



<u>PROJEKTO PAVADINIMAS:</u>	Kultūros paskirties pastato, Gedimino g. 69, Kaišiadorys, statybos projektas
<u>ADRESAS:</u>	Gedimino g. 69, Kaišiadorys
<u>SKLYPO KADASTRINIS NR.:</u>	4918/0042:14
<u>UŽSAKOVAS:</u>	Kaišiadorių rajono savivaldybė
<u>STATYTOJAS:</u>	Kaišiadorių rajono savivaldybė
<u>STATINIO KATEGORIJA:</u>	Ypatingasis statinys
<u>STATYBOS RŪŠIS:</u>	Nauja statyba
<u>STATINIO NAUDOJIMO PASKIRTIS:</u>	Kultūros paskirties pastatas
<u>PROJEKTO RENGIMO ETAPAS:</u>	Techninis projektas
<u>PROJEKTO DALIS</u>	Konstrukcijų. Sprendinių detalieji skaičiavimai
<u>LAIDA</u>	0
<u>PROJEKTO NUMERIS:</u>	IN2329-01-TP-SK-S

Direktorius

AV.

Parašas

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PV

Parašas

Jolanta Stefanovič A Nr. 2232

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Mindaugas Zabinas KA Nr. 37460

Proj.

Parašas

Margarita Čekalina KA Nr. 40628

Proj.

Parašas

Kipras Dankevičius BD Nr. 030232

2024 m.



PROJEKTO SUĖTIES ŽINIARAŠTIS				
Eil. Nr.	Bylos (segtuvo) žymuo	Laida	Pavadinimas	Pastabos
1.	BD	0	Bendroji	
2.	SP	0	Sklypo sutvarkymo (sklypo planas)	
3.	SA	0	Architektūrinė (statinio architektūra)	
4.	SK	0	Konstruktinė (statinio konstrukcijos)	
5.	SK-S	0	Konstruktinė. Sprendinių detalieji skaičiavimai	
6.	LVN	0	Lauko vandentiekio ir nuotekų šalinimo	
7.	VN	0	Vandentiekio ir nuotekų šalinimo	
8.	ŠVOK	0	Šildymo, vėdinimo ir oro kondicionavimo	
9.	E	0	Elektrotechnikos	
10.	ER	0	Elektroninių ryšių (telekomunikacijų)	
11.	AS	0	Apsauginės signalizacijos	
12.	GSS	0	Gaisro aptikimo ir signalizacijos	
13.	PVA	0	Procesų valdymo ir automatizacijos	
14.	ŠT	0	Šilumos gamybos ir tiekimo	
15.	GS	0	Gaisrinės saugos	
16.	SO	0	Pasirengimo statybai ir statybos darbų organizavimo	
17.	KS	0	Statybos skaičiuojamosios kainos nustatymo	

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	2	116	0

PROJEKTO DALIES BYLŲ (SEGTUVŲ) SUDĖTIES ŽINIARAŠTIS				
Eil. Nr.	Bylos (segtuvo) žymuo	Laida	Pavadinimas	Pastabos
1.	IN2329-01-TP-SK	0	Konstrukcijų (statinio konstrukcijos)	
3.	IN2329-01-TP-SK-S	0	Konstrukcijų. Sprendinių detalieji skaičiavimai	

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	3	116	0

1. KONSTRUKCIJŲ SKAIČIAVIMAS

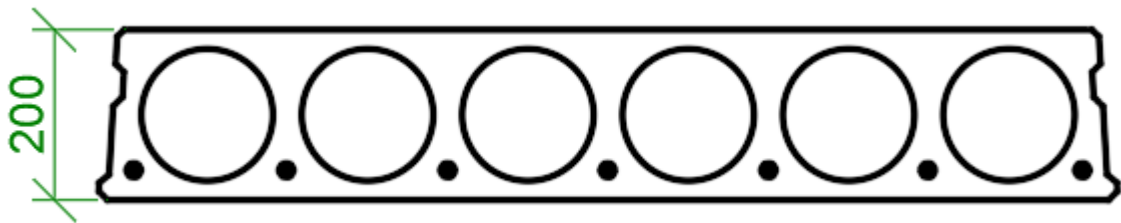
Laikančių konstrukcijų skaičiavimai atlikti baigtinių elementų skaičiavimo programa Autodesk Robot Structural Analysis Professional 2023.

1.1. Surenkamų perdangos plokščių projektavimas

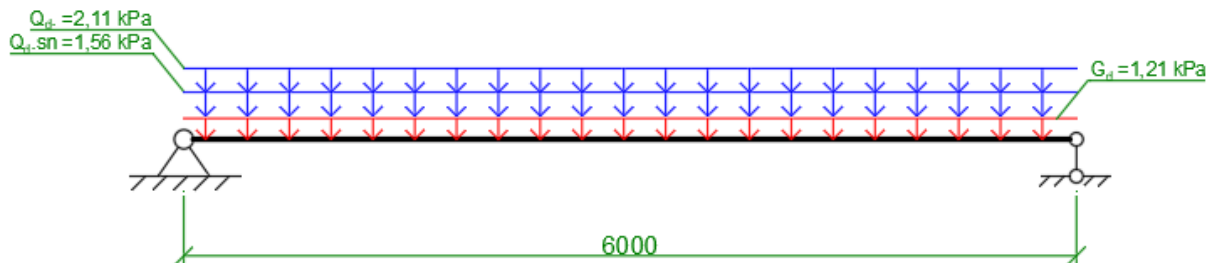
Projektuojamos standartinės įtempto gelžbetonio kiaurymėtos perdangos plokštės.

Perdangų armavimą pagal Projekto brėžiniuose pateiktas atrėmimo ir apkrovų schemas konstruoja gamintojas.

Perdangos tarp ašių C-D ir 1-2:



Skaičiuojamoji schema:

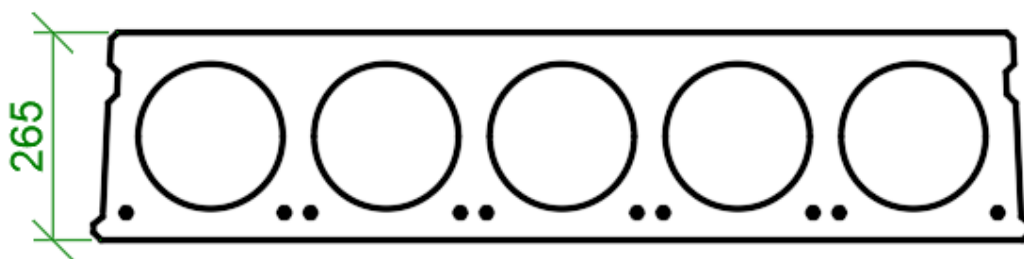


Perdangos plokščių aukštis nustatomas pagal gamintojų apkrovų lenteles.

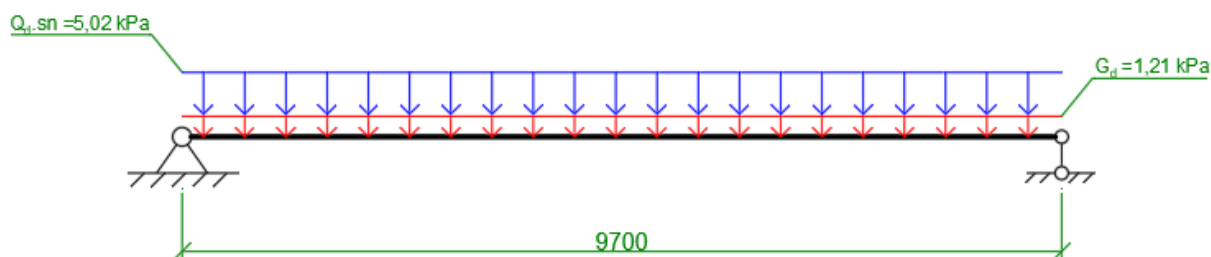
Pagal pateiktą apkrovimo schemą perdangos armavimo skaičiavimus atlieka gamintojas.

Perdangos tarp ašių A-B ir 2-3:

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	4	116	0



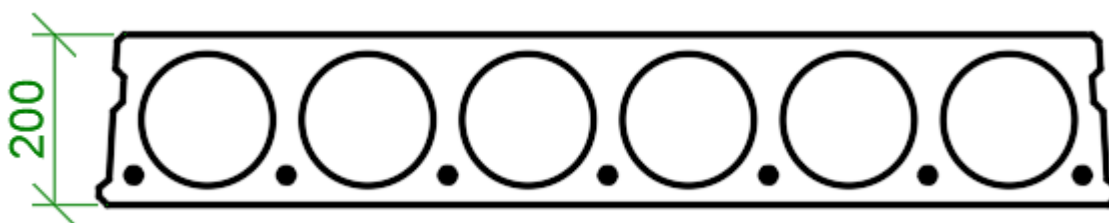
Skaičiuojamoji schema:



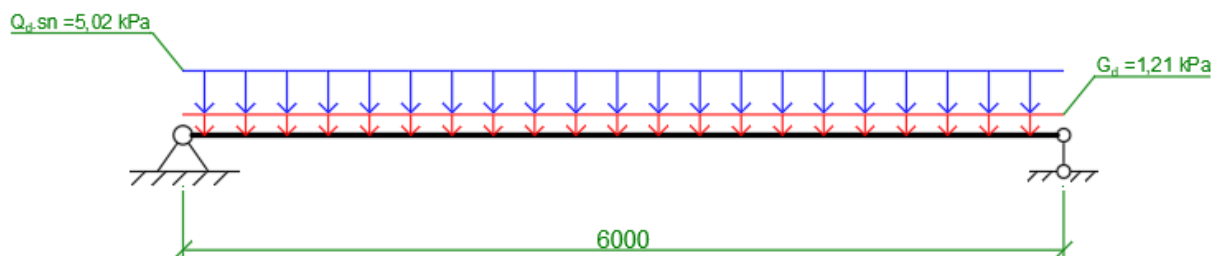
Perdangos plokščių aukštis nustatomas pagal gamintojų apkrovų lenteles.

Pagal pateiktą apkrovimo schemą perdangos armavimo skaičiavimus atlieka gamintojas.

Perdangos tarp ašių A-B ir 1-2:



Skaičiuojamoji schema:

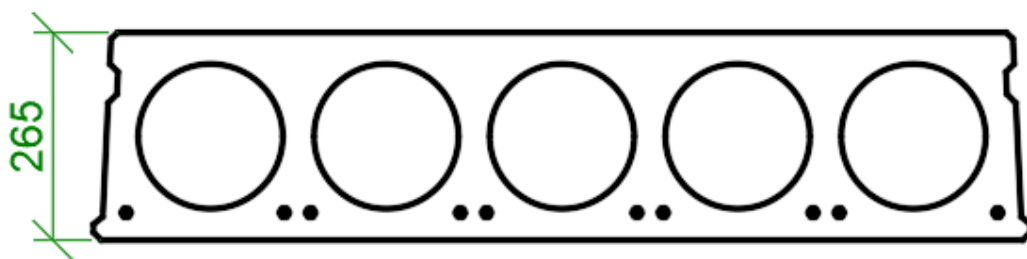


Perdangos plokščių aukštis nustatomas pagal gamintojų apkrovų lenteles.

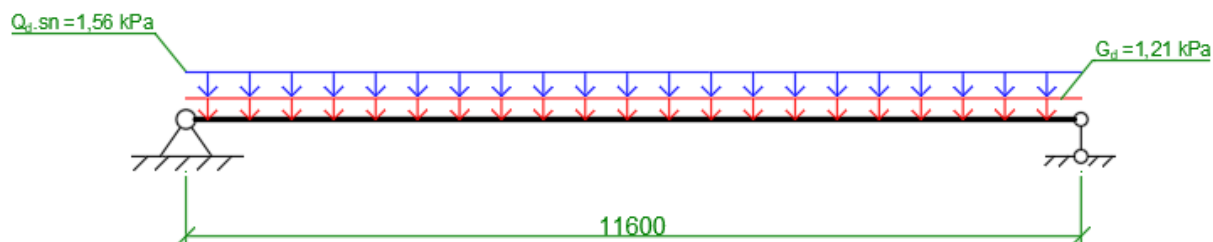
Pagal pateiktą apkrovimo schemą perdangos armavimo skaičiavimus atlieka gamintojas.

Perdangos tarp ašių C-D ir 2-3:

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	5	116	0



Skaičiuojamoji schema:



Perdangos plokščių aukštis nustatomas pagal gamintojų apkrovų lenteles.

Pagal pateiktą apkrovimo schemą perdangos armavimo skaičiavimus atlieka gamintojas.

1.2. Monolitinės sąramos projektavimas ant C ašies

Projektuojama monolitinė sąrama ant C ašies.

Betonas: C25/30;

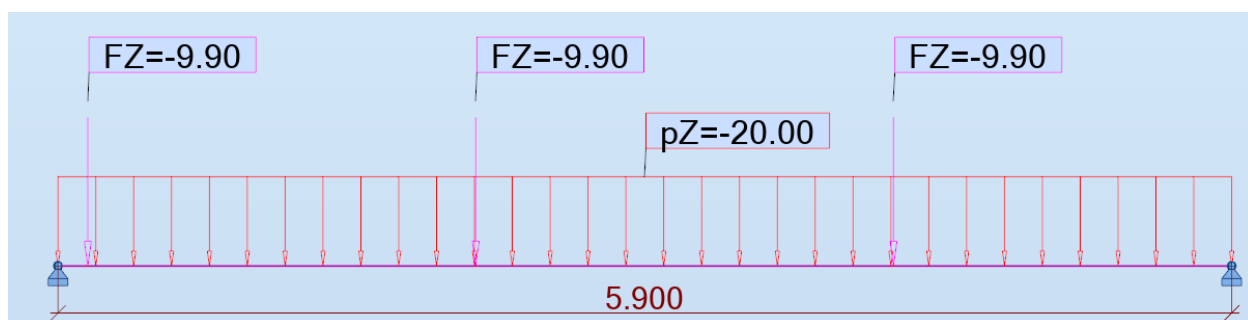
Aplinkos klasė XC1;

Sąrama remiasi ant mūrinės sienos lanksčiai.

Apsauginis betono sluoksnis: ne mažiau kaip armatūros skersmuo ir ne mažiau nei 30 mm iki pagrindinės armatūros krašto. Sąramos ugniaatsparumas R60.

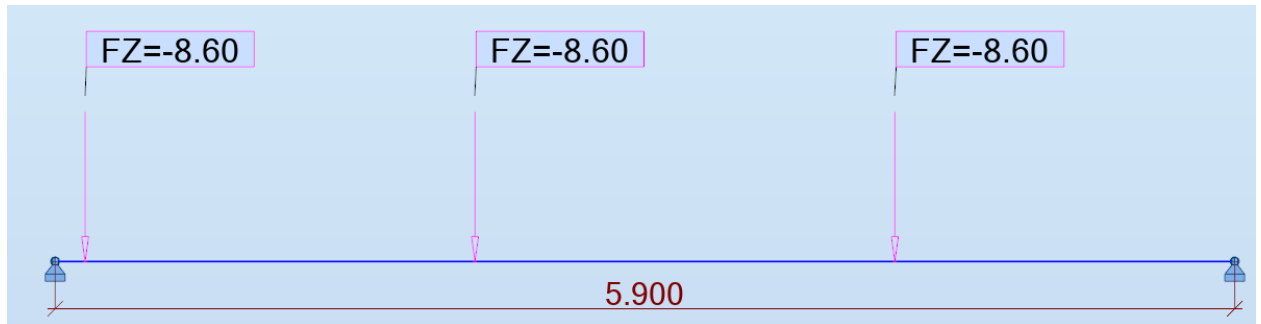
Skaičiuojamoji schema su veikiančiomis apkrovomis:

Nuolatinės apkrovos:

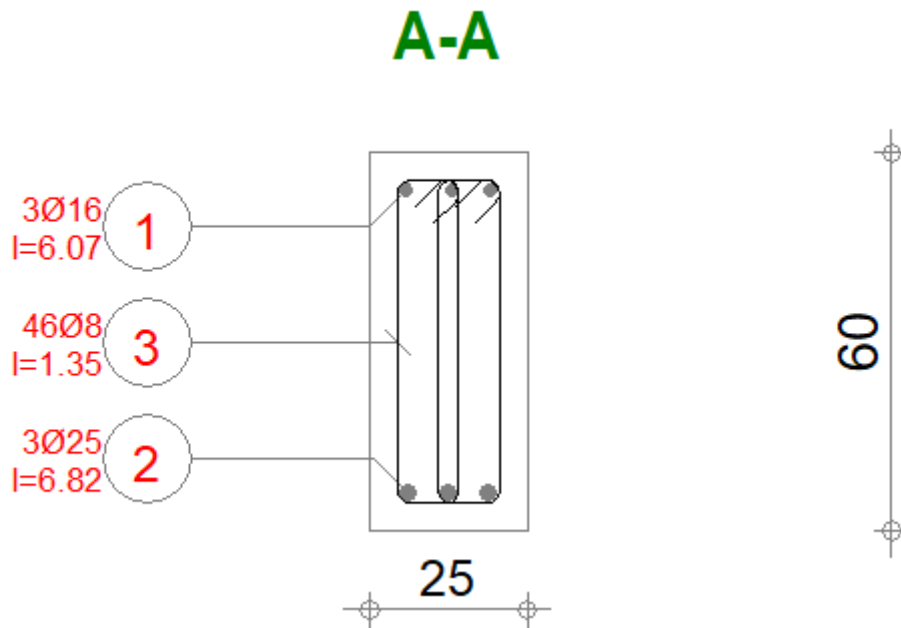


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	6	116	0

Sniego apkrovos:



Reikalingas armavimas:



1 Level:

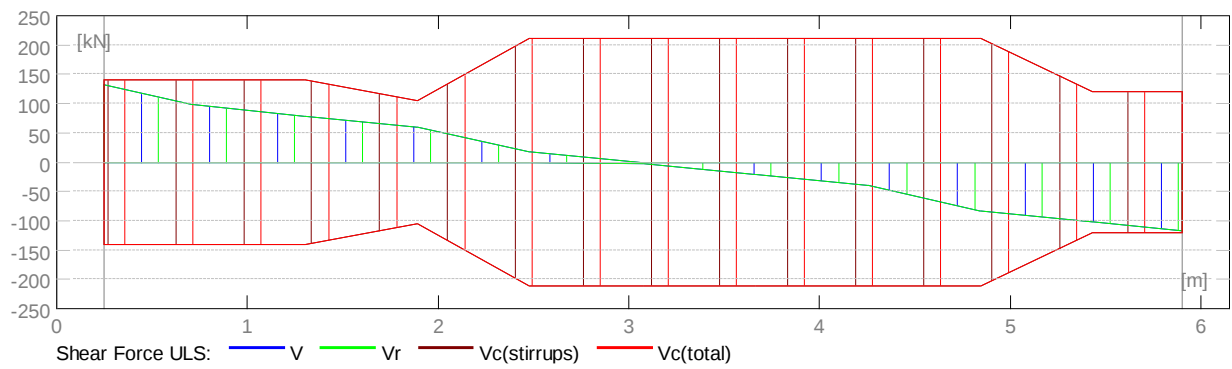
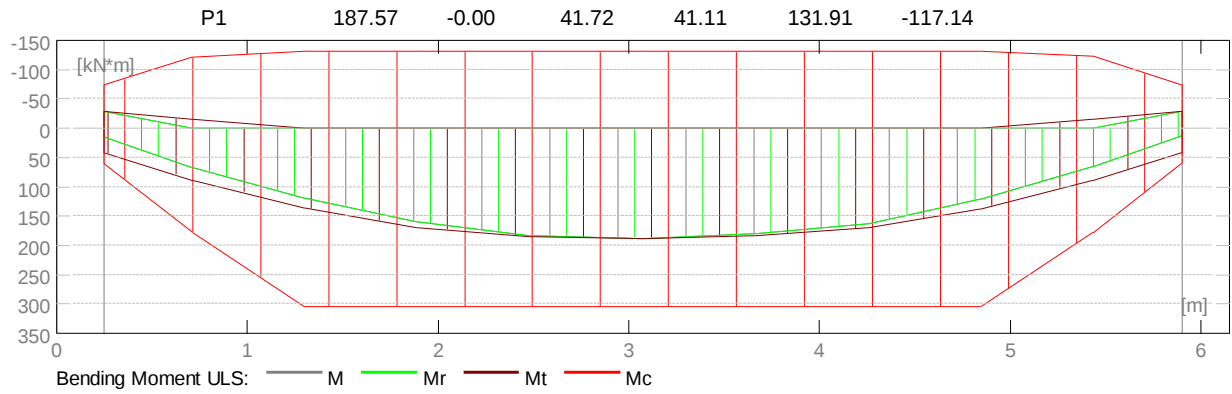
- Name : ---
- Reference level : ---
- Maximum cracking : 0.30 (mm)
- Exposure : XC1
- Concrete creep coefficient : ϕ_{π} = No results
- Cement class : N
- Concrete age (loading moment) : 28 (days)
- Concrete age : 50 (years)
- Concrete age after erecting a structure : 365 (years)
- Structure class : S4
- Fire resistance class : no requirements
- FFB Recommendations 7.4.3(7) : No results

2 Beam: Beam1 identical elements: 1

Number of

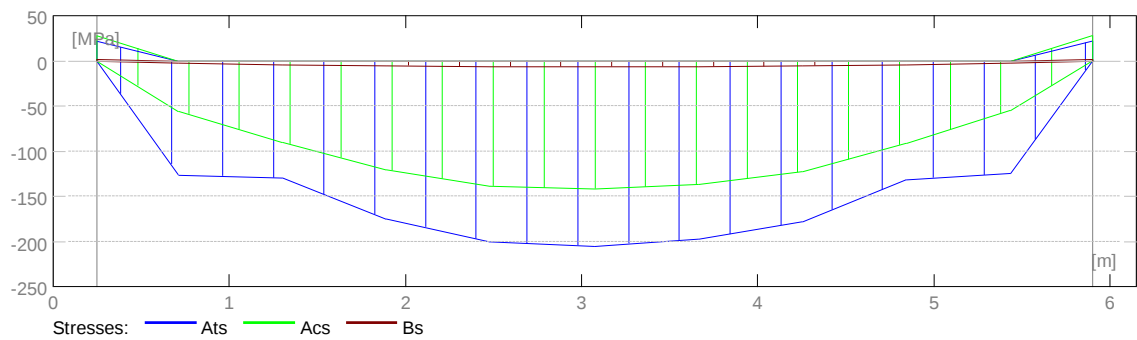
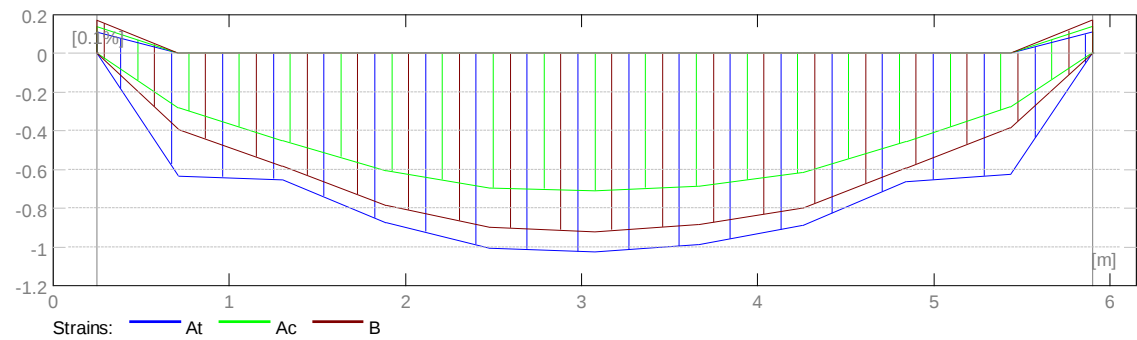
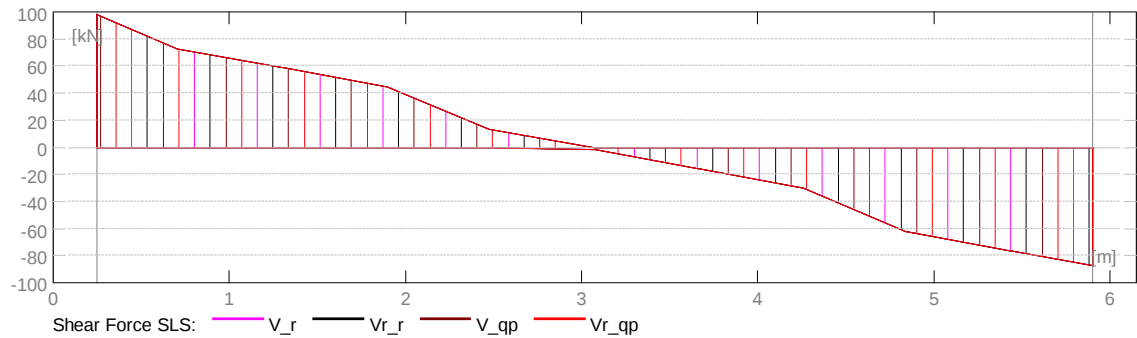
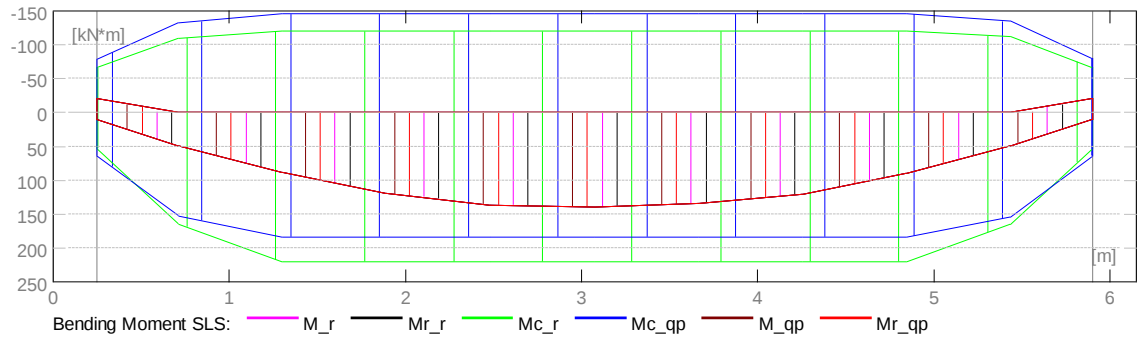
IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	7	116	0

Span	Mt max. (kN*m)	Mt min. (kN*m)	MI (kN*m)	Mr (kN*m)	Ql (kN)	Qr (kN)			
IN2329-01-TP-SK-S							Lapas	Lapu	Laida
							8	116	0



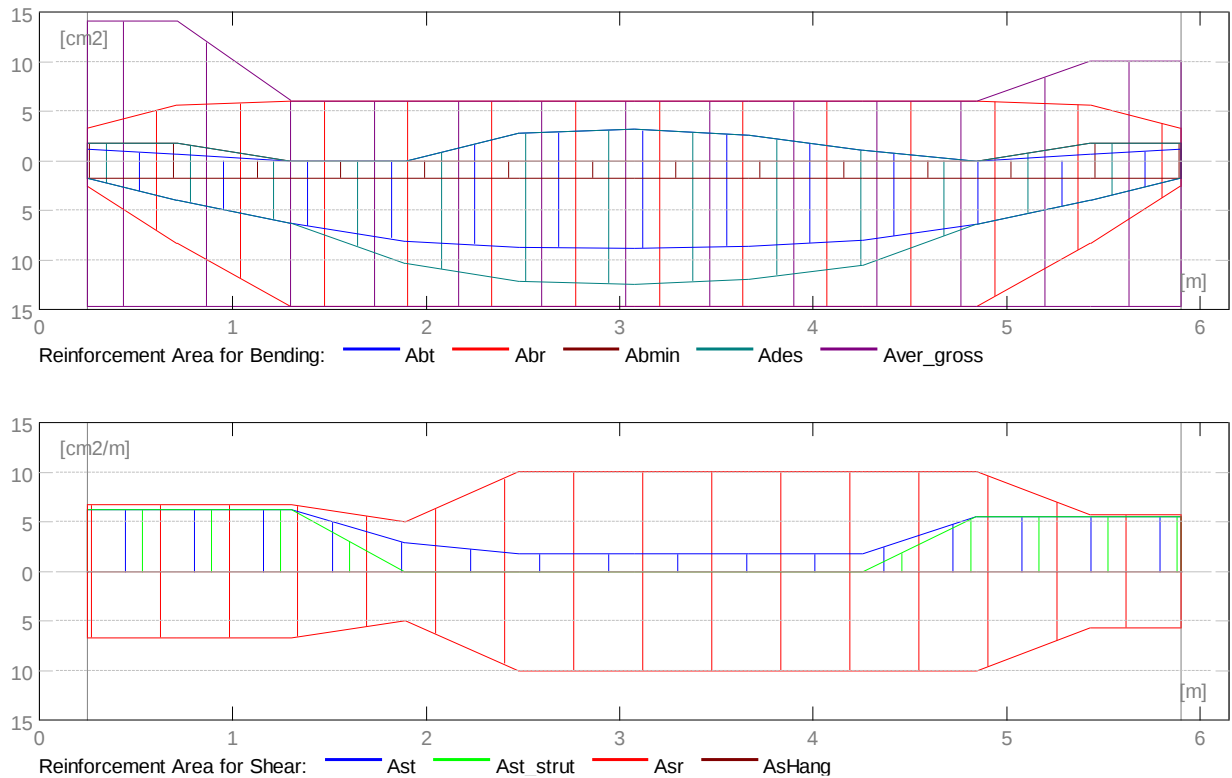
2.4.2 Internal forces in SLS

Span	Mt max. (kN*m)	Mt min. (kN*m)	Ml (kN*m)	Mr (kN*m)	Ql (kN)	Qr (kN)
P1	139.57	0.00	-20.94	-20.94	98.25	-87.12



2.4.3 Required reinforcement area

Span	Span (cm ²)		Left support (cm ²)		Right support (cm ²)	
	bottom	top	bottom	top	bottom	top
P1	8.82	3.16	1.78	1.19	1.75	1.19



2.4.4 Deflection and cracking

wt(QP) Total due to quasi-permanent combination

wt(QP)dop Allowable due to quasi-permanent combination

Dwt(QP) Deflection increment from the quasi-permanent load combination after erecting a structure.

Dwt(QP)dop Admissible deflection increment from the quasi-permanent load combination after erecting a structure.

wk - width of perpendicular cracks

Span	wt(QP) (cm)	wt(QP)dop (cm)	Dwt(QP) (cm)	Dwt(QP)dop (cm)	wk (mm)
P1	1.30	2.36	0.21	0.00	0.2

2.5 Theoretical results - detailed results:

2.5.1 P1 : Span from 0.250 to 5.900 (m)

Abscissa (m)	ULS		SLS		A bottom (cm²)	A top (cm²)	A compressive (cm²)
	M max. (kN*m)	M min. (kN*m)	M max. (kN*m)	M min. (kN*m)			
0.250	41.72	-28.14	10.54	-20.94	1.78	1.19	0.00
0.715	88.34	-14.70	49.77	0.00	3.98	0.63	0.00
1.305	135.83	-0.00	88.51	0.00	6.32	0.00	0.00
1.895	169.57	-0.00	119.02	0.00	8.10	0.00	0.00
2.485	185.10	-0.00	136.47	0.00	8.70	2.80	2.80
3.075	187.57	-0.00	139.57	0.00	8.82	3.16	3.16
3.665	183.51	-0.00	134.43	0.00	8.64	2.57	2.57
4.255	170.05	-0.00	121.05	0.00	8.03	1.03	1.03
4.845	137.96	-0.00	89.81	0.00	6.43	0.00	0.00
5.435	88.47	-14.70	49.03	0.00	3.99	0.63	0.00
5.900	41.11	-28.14	10.39	-20.94	1.75	1.19	0.00

ULS SLS

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	11	116	0

Abscissa (m)	V max. (kN)	V max. (kN)	afp (mm)
0.250	131.91	98.25	0.0
0.715	97.70	72.66	0.1
1.305	78.84	58.69	0.1
1.895	59.98	44.72	0.2
2.485	17.61	13.05	0.2
3.075	-2.29	-1.72	0.2
3.665	-21.15	-15.70	0.2
4.255	-40.01	-29.67	0.2
4.845	-83.42	-62.14	0.1
5.435	-102.28	-76.11	0.1
5.900	-117.14	-87.12	0.0

2.6 Reinforcement:

2.6.1 P1 : Span from 0.250 to 5.900 (m)

Longitudinal reinforcement:

- bottom (B500B)
 - 3 $\phi 25$ $l = 6.820$ from 0.040 to 6.110
- support (B500B)
 - 3 $\phi 16$ $l = 6.070$ from 0.040 to 6.110
 - 2 $\phi 16$ $l = 2.335$ from 0.056 to 0.056

Transversal reinforcement:

- main (B500B)
 - stirrups 46 $\phi 8$ $l = 1.347$
 $e = 1*0.095 + 4*0.300 + 1*0.400 + 15*0.200 + 2*0.350$ (m)

3 Material survey:

- Concrete volume = 0.923 (m3)
- Formwork = 9.093 (m2)
- Steel B500B
 - Total weight = 139.46 (kG)
 - Density = 151.18 (kG/m3)
 - Average diameter = 13.0 (mm)
 - Survey according to diameters:

Diameter (mm)	Length (m)	Weight (kG)	Number (No.)	Total weight (kG)
8	1.347	0.53	46	24.47
16	2.335	3.69	2	7.37
16	6.070	9.58	3	28.75
25	6.820	26.29	3	78.87

Išvada: sąlyga tenkinama

1.3. Monolitinės sąramos projektavimas ant 2 ašies žemesnėje pastato dalyje

Projektuojama monolitinė sąrama ant 2 ašies žemesnėje pastato dalyje.

Betonas: C25/30;

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	12	116	0

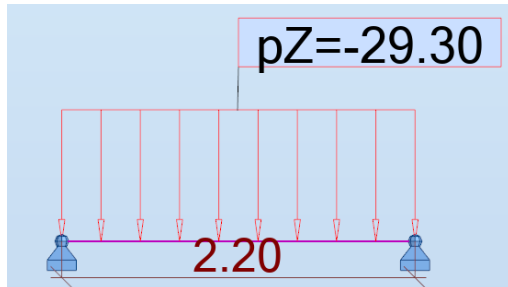
Aplinkos klasė XC1;

Sąrama remiasi ant mūrinės sienos lanksčiai.

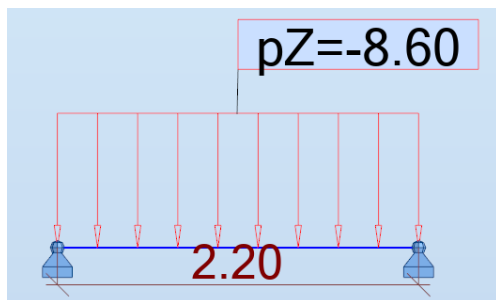
Apsauginis betono sluoksnis: ne mažiau kaip armatūros skersmuo ir ne mažiau nei 30 mm iki pagrindinės armatūros krašto. Sąramos ugniaatsparumas R60.

Skaičiuojamoji schema su veikiančiomis apkrovomis:

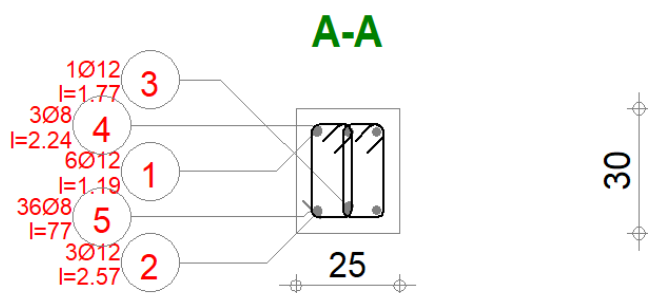
Nuolatinės apkrovos:



Sniego apkrovos:



Reikalingas armavimas:



1 Level:

- Name : ---
- Reference level : ---
- Maximum cracking : 0.30 (mm)
- Exposure : XC1
- Concrete creep coefficient : ϕ_{π} = No results

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	13	116	0

- Cement class : N
- Concrete age (loading moment) : 28 (days)
- Concrete age : 50 (years)
- Concrete age after erecting a structure : 365 (years)
- Structure class : S4
- Fire resistance class : no requirements
- FFB Recommendations 7.4.3(7) : No results

2 Beam: Beam1 identical elements: 1

Number of

2.1 Material properties:

- Concrete : C25/30 $f_{ck} = 25.00$ (MPa)
Rectangular stress distribution [3.1.7(3)]
Density : 2501.36 (kG/m³)
Aggregate size : 20.0 (mm)
- Longitudinal reinforcement: : B500B $f_{yk} = 500.00$ (MPa)
Horizontal branch of the stress-strain
diagram
Ductility class : B
- Transversal reinforcement: : B500B $f_{yk} = 500.00$ (MPa)
Horizontal branch of the stress-strain
diagram
Ductility class : B
- Additional reinforcement: : B500B $f_{yk} = 500.00$ (MPa)
Horizontal branch of the stress-strain
diagram

2.2 Geometry:

2.2.1	Span	Position	L supp. (m)	L (m)	R supp. (m)
	P1	Span 0.25	1.95	0.25	
	Span length: $L_0 = 2.20$ (m)				
	Section from 0.00 to 1.95 (m)				
	25.0 x 30.0 (cm)				
	without left slab				
	without right slab				

2.3 Calculation options:

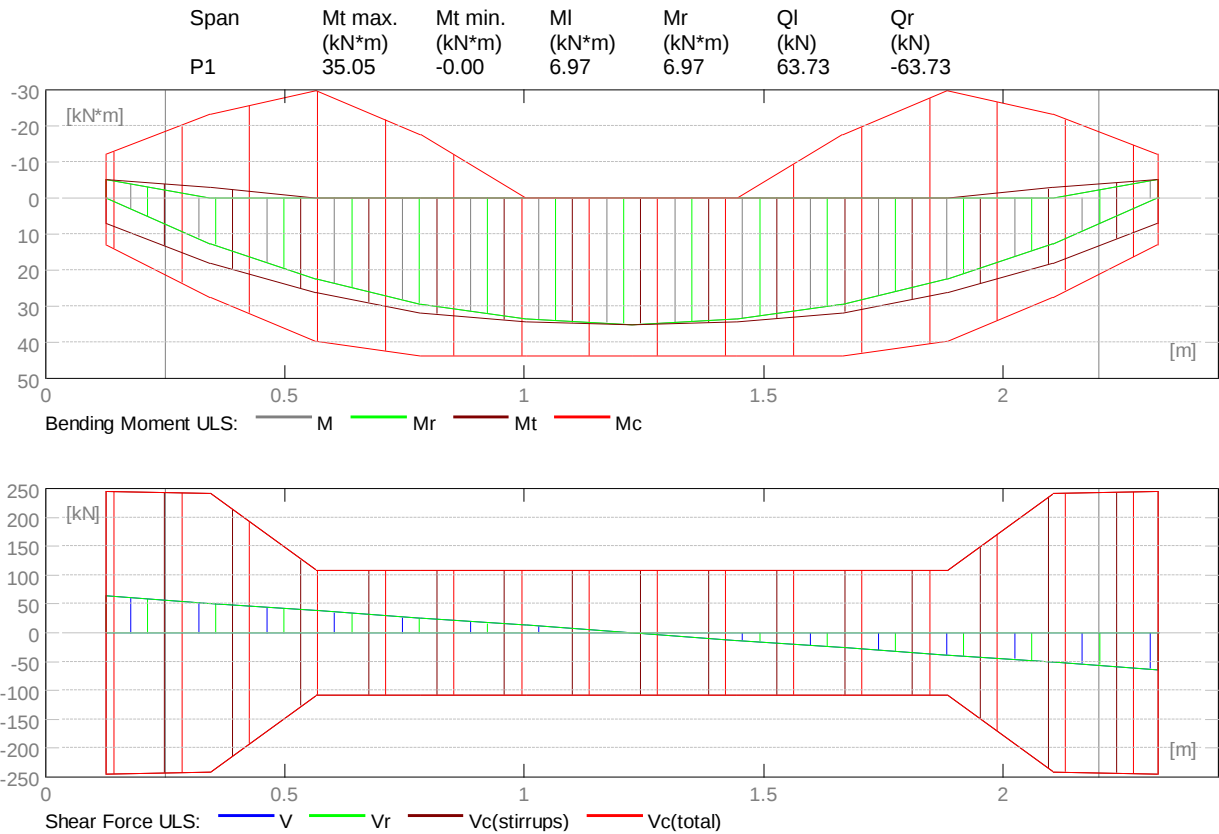
- Regulation of combinations : EN 1990:2002
- Calculations according to : EN 1992-1-1:2004/A1:2014
- Seismic dispositions : No requirements
- Precast beam : no
- Cover : bottom $c = 3.4$ (cm)
: side $c_1 = 3.4$ (cm)
: top $c_2 = 3.4$ (cm)
- Cover deviations : $C_{dev} = 1.0$ (cm), $C_{dur} = 0.0$ (cm)

	Lapas	Lapų	Laida
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- Coefficient $\beta_2 = 0.50$: long-term or cyclic load
- Method of shear calculations : strut inclination

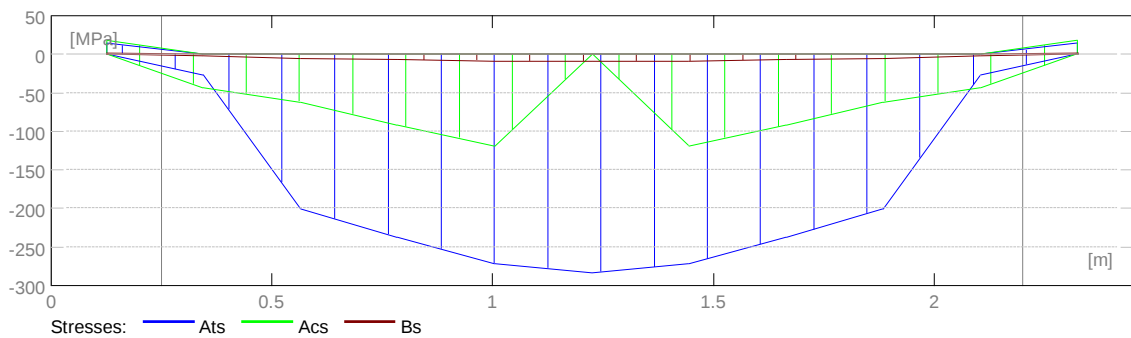
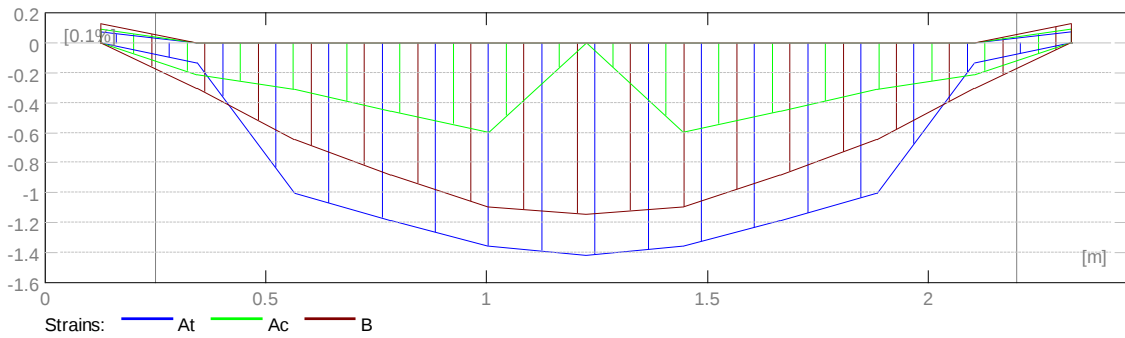
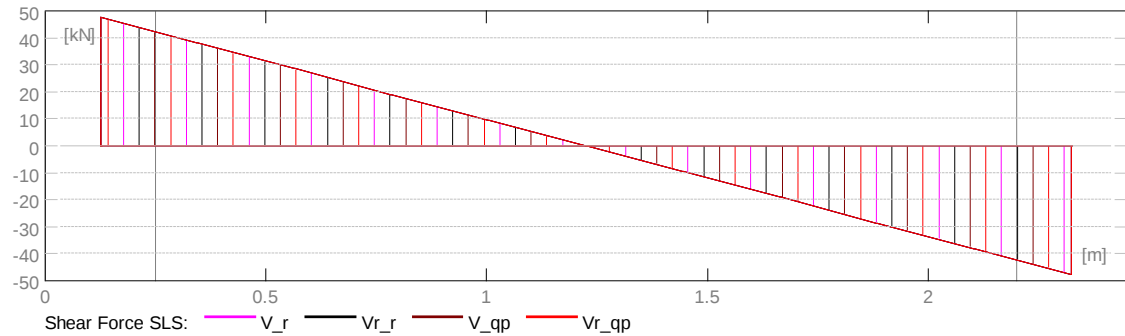
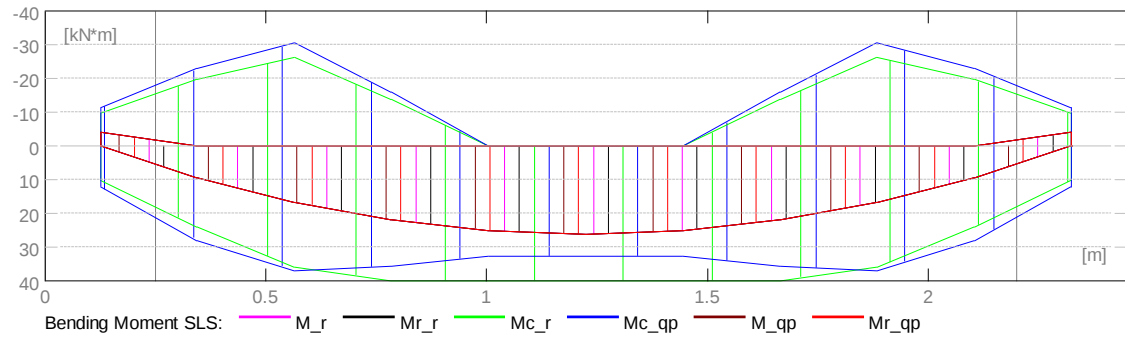
2.4 Calculation results:

2.4.1 Internal forces in ULS



2.4.2 Internal forces in SLS

Span	Mt max. (kN*m)	Mt min. (kN*m)	MI (kN*m)	Mr (kN*m)	Ql (kN)	Qr (kN)
P1	26.19	0.00	-3.93	-3.93	47.63	-47.63

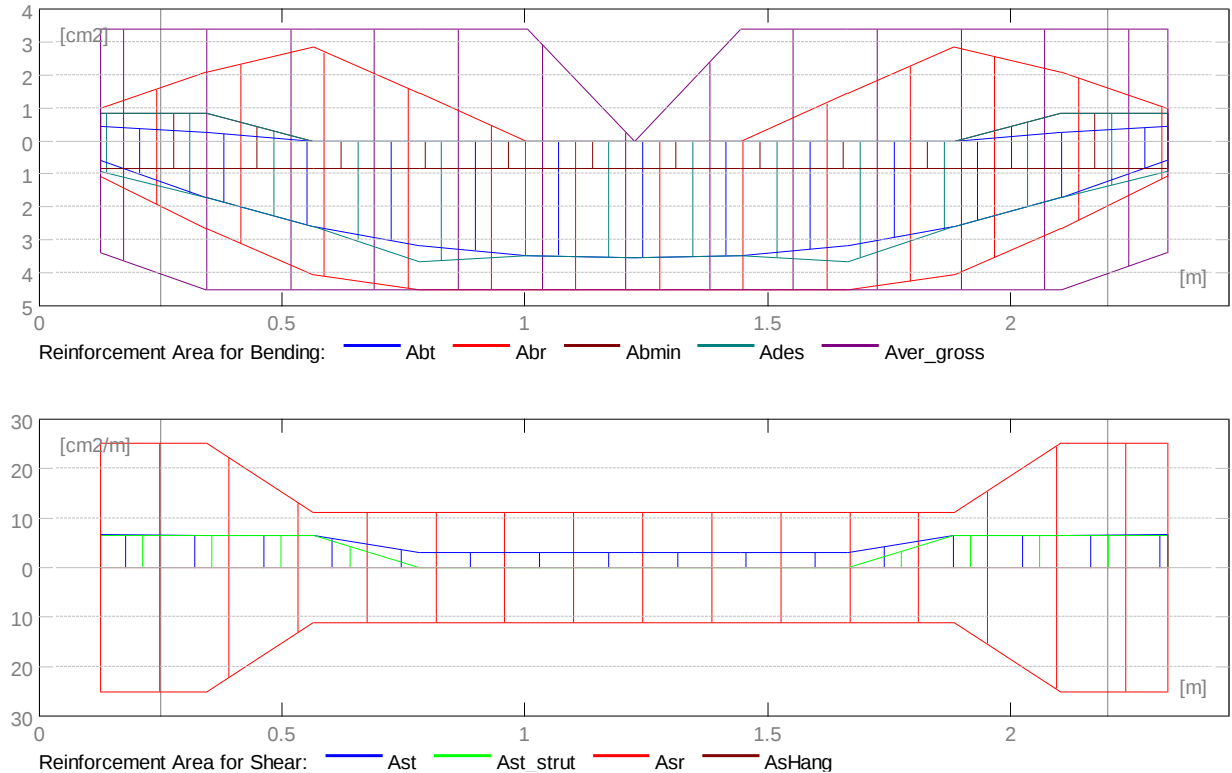


2.4.3 Required reinforcement area

Span	Span (cm ²)		Left support (cm ²)		Right support (cm ²)	
	bottom	top	bottom	top	bottom	top
P1	3.54	0.00	0.58	0.44	0.58	0.44

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Lapas	Lapų	Laida
16	116	0



2.4.4 Deflection and cracking

wt(QP) Total due to quasi-permanent combination

wt(QP)dop Allowable due to quasi-permanent combination

Dwt(QP) Deflection increment from the quasi-permanent load combination after erecting a structure.

Dwt(QP)dop Admissible deflection increment from the quasi-permanent load combination after erecting a structure.

wk - width of perpendicular cracks

Span	wt(QP) (cm)	wt(QP)dop (cm)	Dwt(QP) (cm)	Dwt(QP)dop (cm)	wk (mm)
P1	0.5	0.9	0.1	0.0	0.3

2.5 Theoretical results - detailed results:

2.5.1 P1 : Span from 0.25 to 2.20 (m)

Abscissa (m)	ULS		SLS		A bottom (cm²)	A top (cm²)
	M max. (kN*m)	M min. (kN*m)	M max. (kN*m)	M min. (kN*m)		
0.13	6.97	-5.26	0.00	-3.93	0.58	0.44
0.35	18.04	-2.90	9.43	0.00	1.71	0.27
0.57	26.30	-0.00	16.76	0.00	2.60	0.00
0.79	31.76	-0.00	22.00	0.00	3.18	0.00
1.01	34.42	-0.00	25.15	0.00	3.47	0.00
1.23	35.05	0.00	26.19	0.00	3.54	0.00
1.45	34.42	-0.00	25.15	0.00	3.47	0.00
1.67	31.76	-0.00	22.00	0.00	3.18	0.00
1.89	26.30	-0.00	16.76	0.00	2.60	0.00
2.11	18.04	-2.90	9.43	0.00	1.71	0.27
2.33	6.97	-5.26	0.00	-3.93	0.58	0.44

ULS SLS

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	17	116	0

Abscissa (m)	V max. (kN)	V max. (kN)	afp (mm)
0.13	63.73	47.63	0.0
0.35	50.98	38.10	0.0
0.57	38.24	28.58	0.2
0.79	25.49	19.05	0.2
1.01	12.75	9.53	0.3
1.23	0.00	0.00	0.3
1.45	-12.75	-9.53	0.3
1.67	-25.49	-19.05	0.2
1.89	-38.24	-28.58	0.2
2.11	-50.98	-38.10	0.0
2.33	-63.73	-47.63	0.0

2.6 Reinforcement:

2.6.1 P1 : Span from 0.25 to 2.20 (m)

Longitudinal reinforcement:

- bottom (B500B)
 - 3 $\phi 12$ $l = 2.57$ from 0.03 to 2.42
 - 1 $\phi 12$ $l = 1.77$ from 0.34 to 2.11
- assembling (top) (B500B)
 - 3 $\phi 8$ $l = 2.24$ from 0.10 to 2.35
- support (B500B)
 - 3 $\phi 12$ $l = 1.19$ from 0.03 to 1.01
 - 3 $\phi 12$ $l = 1.19$ from 1.44 to 2.42

Transversal reinforcement:

- main (B500B)
 - 36 $\phi 8$ $l = 0.77$
 - $e = 1 \cdot 0.17 + 1 \cdot 0.10 + 3 \cdot 0.08 + 9 \cdot 0.18 + 3 \cdot 0.08 + 1 \cdot 0.10$ (m)

3 Material survey:

- Concrete volume = 0.18 (m3)
- Formwork = 2.11 (m2)
- Steel B500B
 - Total weight = 28.38 (kG)
 - Density = 154.43 (kG/m3)
 - Average diameter = 9.3 (mm)
 - Survey according to diameters:

Diameter (mm)	Length (m)	Weight (kG)	Number (No.)	Total weight (kG)
8	0.77	0.30	36	10.95
8	2.24	0.88	3	2.65
12	1.19	1.06	6	6.35
12	1.77	1.57	1	1.57
12	2.57	2.28	3	6.85

Išvada: sąlyga tenkinama

1.4. Monolitinės sąramos projektavimas ant 2 ašies aukštesnėje pastato dalyje

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	18	116	0

Projektuojama monolitinė sàrama ant 2 ašies aukštesnėje pastato dalyje.

Betonas: C25/30;

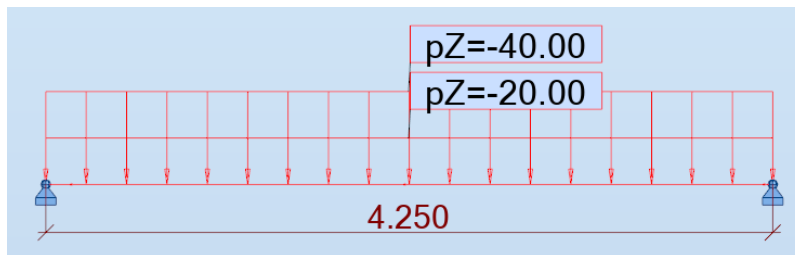
Aplinkos klasė XC1;

Sàrama remiasi ant mūrinės sienos lanksčiai.

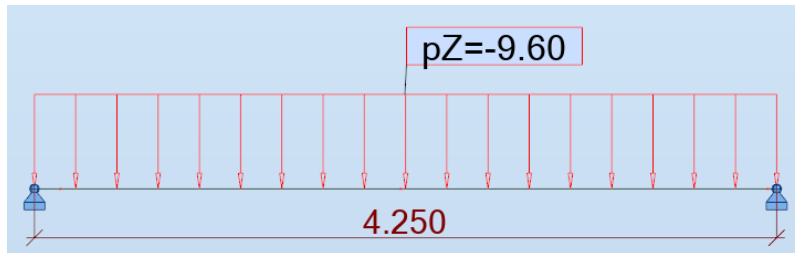
Apsauginis betono sluoksnis: ne mažiau kaip armatūros skersmuo ir ne mažiau nei 30 mm iki pagrindinės armatūros krašto. Sàramos ugniaatsparumas R60.

Skaičiuojamoji schema su veikiančiomis apkrovomis:

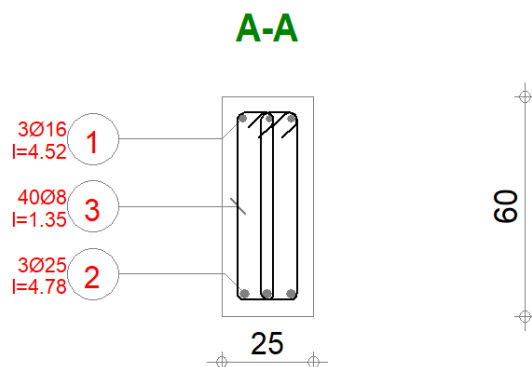
Nuolatinės apkrovos:



Sniego apkrovos:



Reikalingas armavimas:



1 Level:

- Name : ---
- Reference level : ---
- Maximum cracking : 0.30 (mm)
- Exposure : XC1
- Concrete creep coefficient : $\varphi_{\pi} = 2.81$

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	19	116	0

- Cement class : N
- Concrete age (loading moment) : 28 (days)
- Concrete age : 50 (years)
- Concrete age after erecting a structure : 365 (years)
- Structure class : S4
- Fire resistance class : no requirements
- FFB Recommendations 7.4.3(7) : 0.00

2 Beam: Beam1 identical elements: 1

Number of

2.1 Material properties:

- Concrete : C25/30 $f_{ck} = 25.00$ (MPa)
Rectangular stress distribution [3.1.7(3)]
Density : 2501.36 (kG/m³)
Aggregate size : 20.0 (mm)
- Longitudinal reinforcement: : B500B $f_{yk} = 500.00$ (MPa)
Horizontal branch of the stress-strain
diagram
Ductility class : B
- Transversal reinforcement: : B500B $f_{yk} = 500.00$ (MPa)
Horizontal branch of the stress-strain
diagram
Ductility class : B
- Additional reinforcement: : B500B $f_{yk} = 500.00$ (MPa)
Horizontal branch of the stress-strain
diagram
- Modified partial coefficients:
 $\alpha_{cc} = 0.9$ 1992-1-1 3.1.6 (1)P

2.2 Geometry:

2.2.1	Span	Position	L supp. (m)	L (m)	R supp. (m)
	P1	Span 0.350	3.900	0.350	
	Span length: $L_0 = 4.250$ (m)				
	Section from 0.000 to 3.900 (m)				
	25.0 x 60.0 (cm)				
	without left slab				
	without right slab				

2.3 Calculation options:

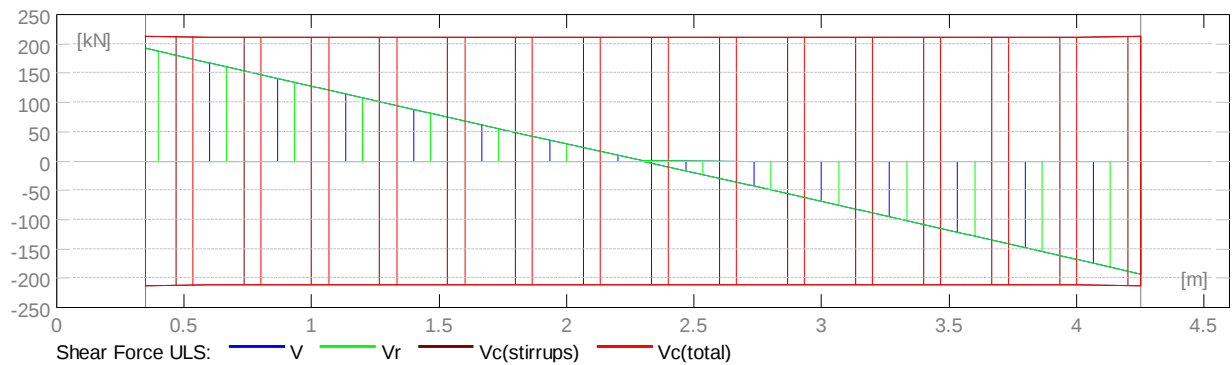
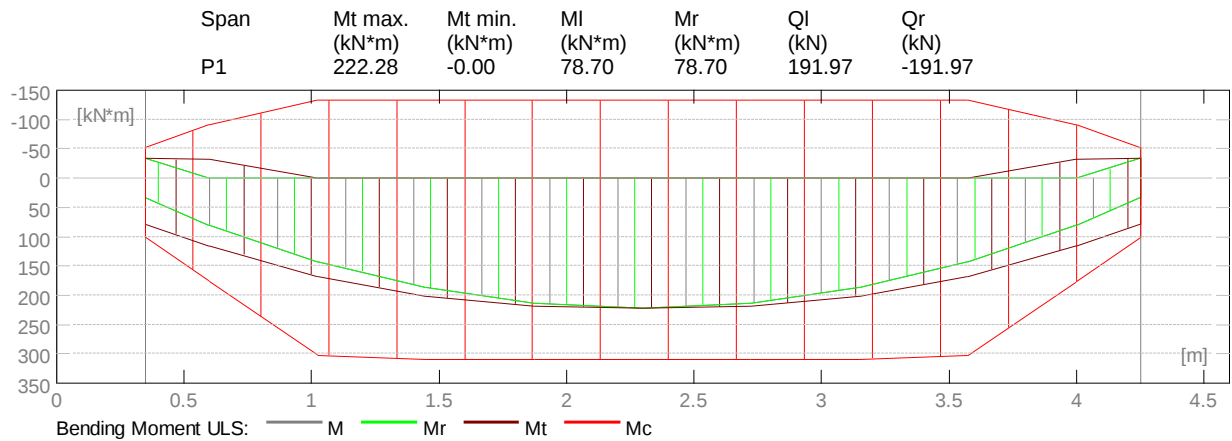
- Regulation of combinations : EN 1990:2002
- Calculations according to : EN 1992-1-1:2004/A1:2014
- Seismic dispositions : No requirements
- Precast beam : no

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	20	116	0

- Cover : bottom $c = 4.0$ (cm)
: side $c1 = 4.0$ (cm)
: top $c2 = 4.0$ (cm)
- Cover deviations : $Cdev = 1.0$ (cm), $Cdur = 0.0$ (cm)
- Coefficient $\beta_2 = 0.50$: long-term or cyclic load
- Method of shear calculations : strut inclination

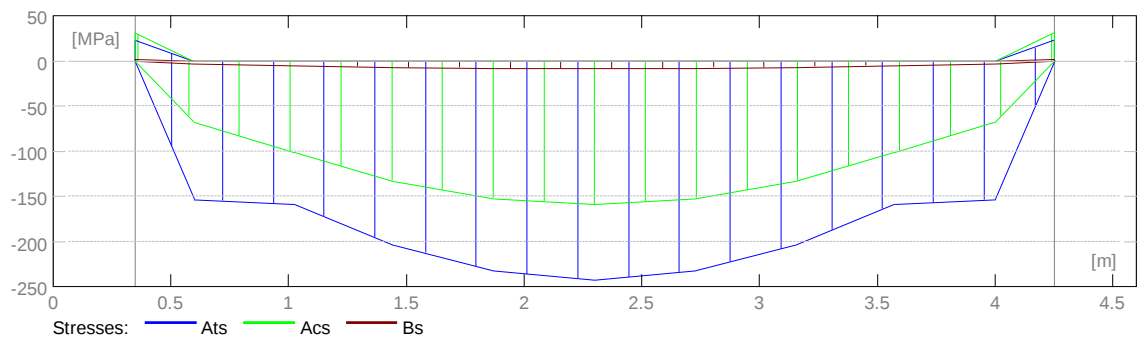
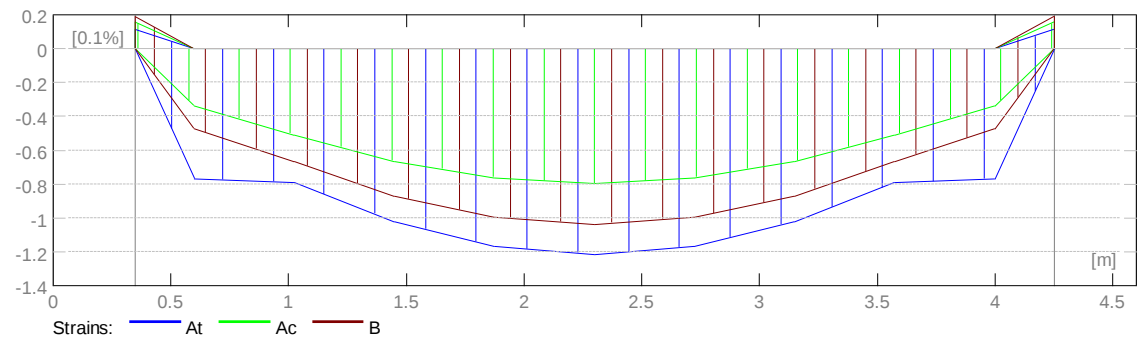
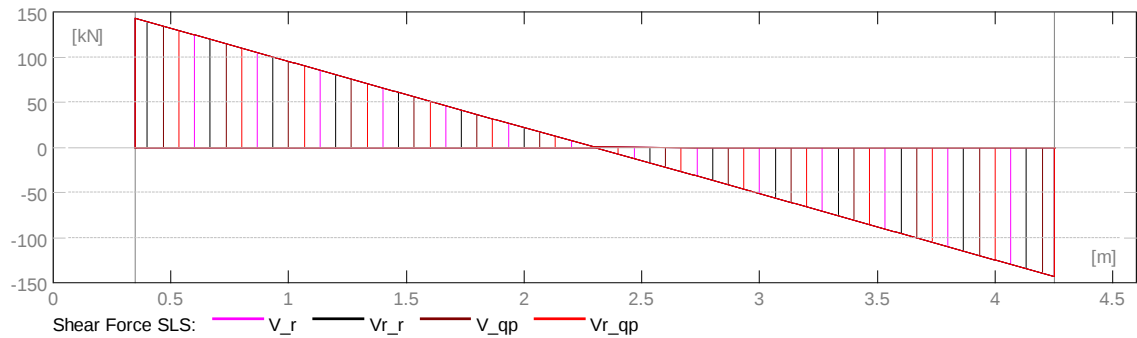
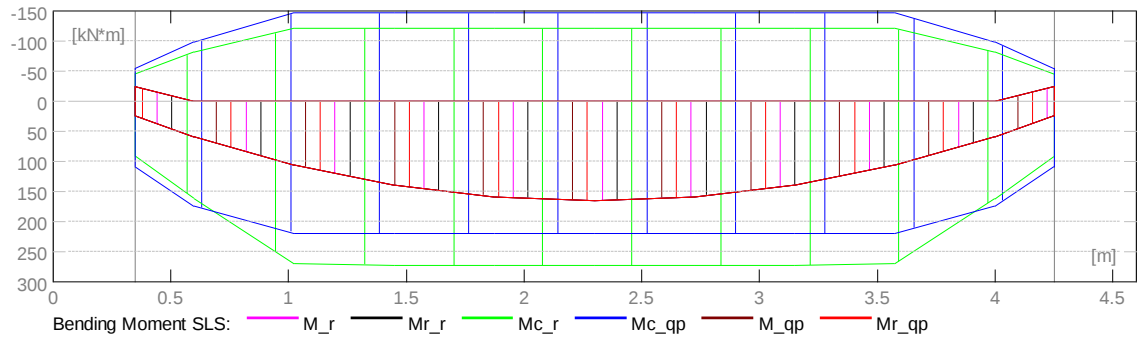
2.4 Calculation results:

2.4.1 Internal forces in ULS



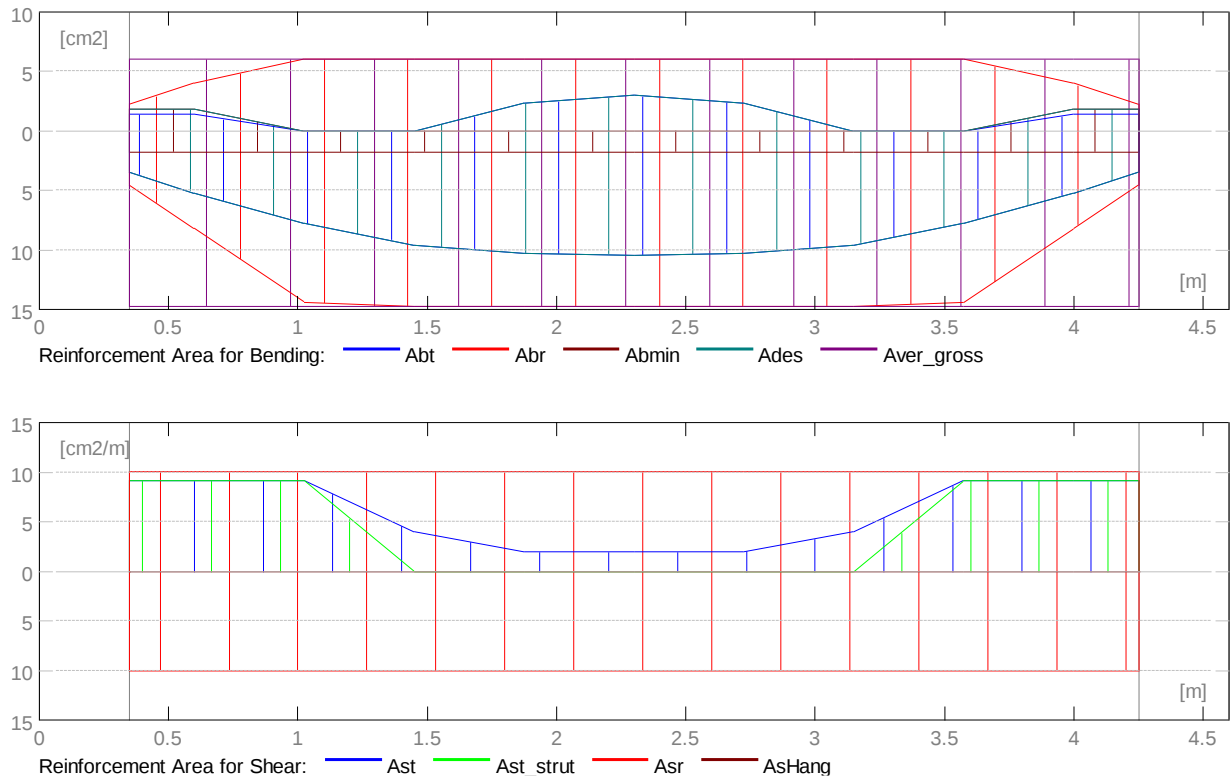
2.4.2 Internal forces in SLS

Span	Mt max. (kN*m)	Mt min. (kN*m)	MI (kN*m)	Mr (kN*m)	Ql (kN)	Qr (kN)
P1	165.45	0.00	-24.82	-24.82	142.90	-142.90



2.4.3 Required reinforcement area

Span	Span (cm ²)		Left support (cm ²)		Right support (cm ²)	
	bottom	top	bottom	top	bottom	top
P1	10.44	3.00	3.48	1.44	3.48	1.44



2.4.4 Deflection and cracking

wt(QP) Total due to quasi-permanent combination

wt(QP)dop Allowable due to quasi-permanent combination

Dwt(QP) Deflection increment from the quasi-permanent load combination after erecting a structure.

Dwt(QP)dop Admissible deflection increment from the quasi-permanent load combination after erecting a structure.

wk - width of perpendicular cracks

Span	wt(QP) (cm)	wt(QP)dop (cm)	Dwt(QP) (cm)	Dwt(QP)dop (cm)	wk (mm)
P1	0.77	1.70	0.13	0.85	0.3

2.5 Theoretical results - detailed results:

2.5.1 P1 : Span from 0.350 to 4.250 (m)

Abscissa (m)	ULS		SLS		A bottom (cm²)	A top (cm²)	A compressive (cm²)
	M max. (kN*m)	M min. (kN*m)	M max. (kN*m)	M min. (kN*m)			
0.350	78.70	-33.34	24.53	-24.82	3.48	1.44	0.00
0.600	115.60	-32.41	59.56	0.00	5.22	1.40	0.00
1.025	167.67	-0.00	105.89	0.00	7.79	0.00	0.00
1.450	201.96	-0.00	138.98	0.00	9.59	0.00	0.00
1.875	218.47	-0.00	158.83	0.00	10.28	2.32	2.32
2.300	222.28	0.00	165.45	0.00	10.44	3.00	3.00
2.725	218.47	-0.00	158.83	0.00	10.28	2.32	2.32
3.150	201.96	-0.00	138.98	0.00	9.59	0.00	0.00
3.575	167.67	-0.00	105.89	0.00	7.79	0.00	0.00
4.000	115.60	-32.41	59.56	0.00	5.22	1.40	0.00
4.250	78.70	-33.34	24.53	-24.82	3.48	1.44	0.00

ULS SLS

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	23	116	0

Abscissa (m)	V max. (kN)	V max. (kN)	afp (mm)
0.350	191.97	142.90	0.0
0.600	167.36	124.58	0.2
1.025	125.52	93.43	0.2
1.450	83.68	62.29	0.2
1.875	41.84	31.14	0.3
2.300	0.00	0.00	0.3
2.725	-41.84	-31.14	0.3
3.150	-83.68	-62.29	0.2
3.575	-125.52	-93.43	0.2
4.000	-167.36	-124.58	0.2
4.250	-191.97	-142.90	0.0

2.6 Reinforcement:

2.6.1 P1 : Span from 0.350 to 4.250 (m)

Longitudinal reinforcement:

- bottom (B500B)
 - 3 $\phi 25$ $l = 4.520$ from 0.040 to 4.560
- support (B500B)
 - 3 $\phi 16$ $l = 4.520$ from 0.040 to 4.560

Transversal reinforcement:

- main (B500B)
 - stirrups 38 $\phi 8$ $l = 1.347$
 $e = 1*0.175 + 18*0.200$ (m)

3 Material survey:

- Concrete volume = 0.690 (m³)
- Formwork = 6.795 (m²)
- Steel B500B
 - Total weight = 93.89 (kG)
 - Density = 136.07 (kG/m³)
 - Average diameter = 12.3 (mm)
 - Survey according to diameters:

Diameter (mm)	Length (m)	Weight (kG)	Number (No.)	Total weight (kG)
8	1.347	0.53	38	20.21
16	4.520	7.14	3	21.41
25	4.520	17.42	3	52.27

Išvada: sąlyga tenkinama

1.5. Sijinės monolitinės perdangos plokštės projektavimas tarp ašių D-E

Projektuojamos monolitinės g/b perdangos.

Betonas: C30/37;

Aplinkos klasė XC1;

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	24	116	0

Perdanga iš keturių kraštų remiasi lanksčiai ant mūrinių sienų. Iš vienos pusės išsikiša gembinė dalis, kuri galuose remiasi į GB kolonas. Kolonos su perdanga jungiasi standžiai.

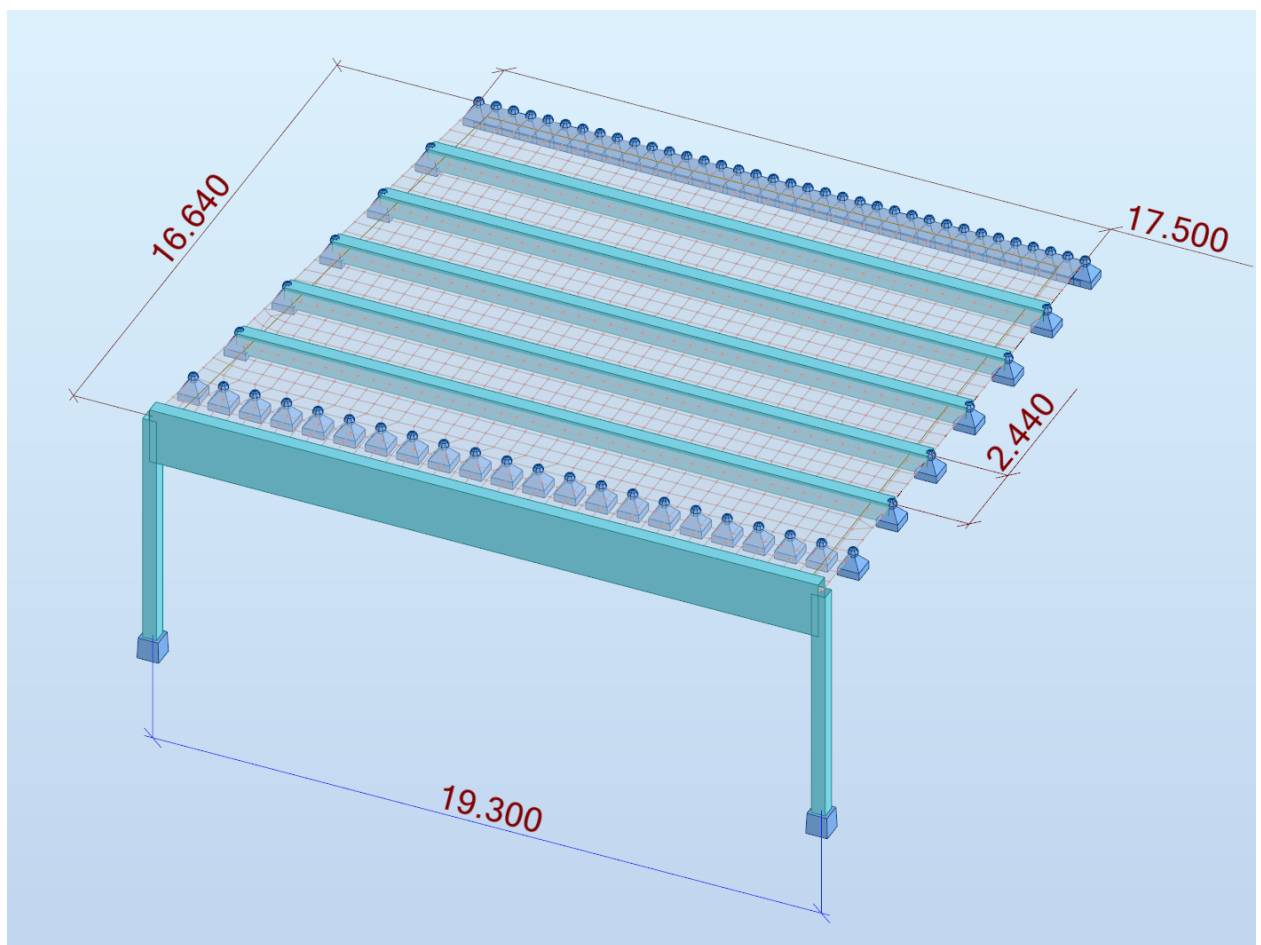
Apsauginis betono sluoksnis: ne mažiau kaip armatūros skersmuo ir ne mažiau nei 30 mm iki pagrindinės armatūros krašto. Perdangos ugniaatsparumas R20, kolonų ugniaatsparumas R60.

Projektuojamos perdangos lentynos storis: 180mm;

Projektuojamos perdangos sijos skerspjūvis (bxh): 400x600mm;

Projektuojamos kolonos skerspjūvis: 400x400mm.

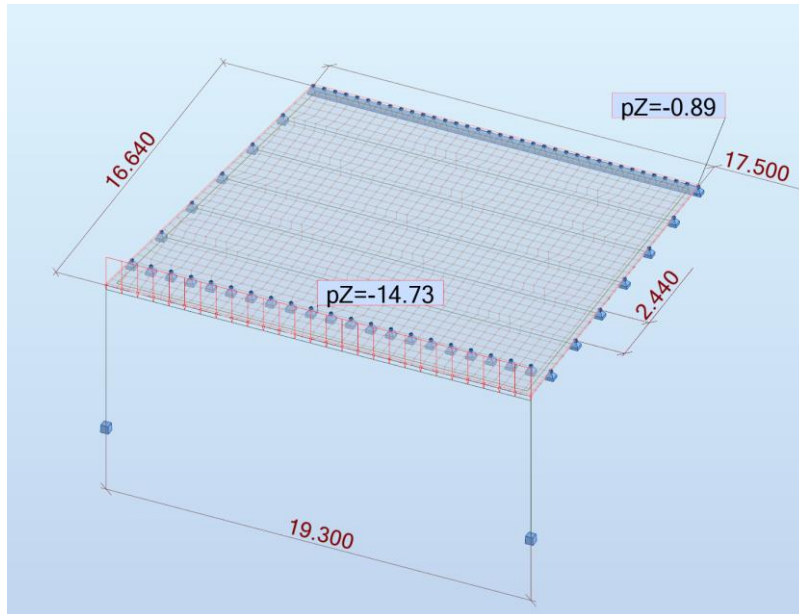
Skaičiuojamoji schema:



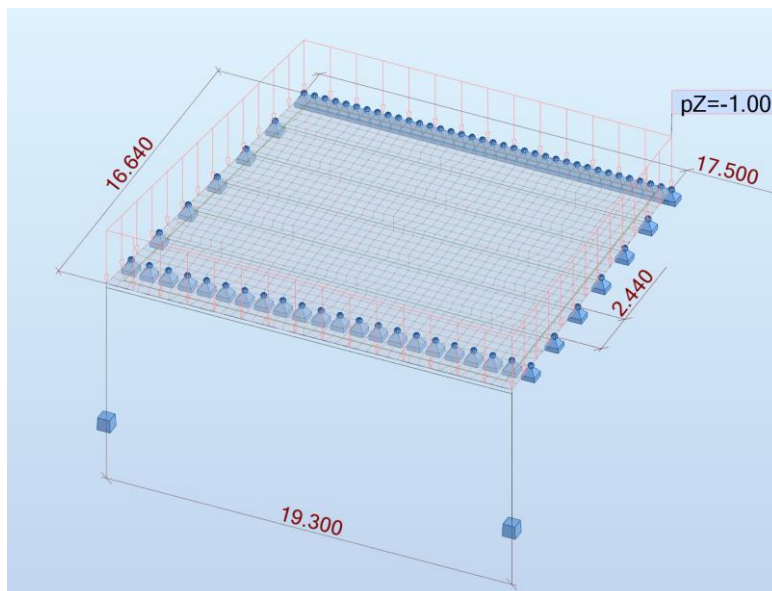
Veikiančios apkrovos.

Nuolatinės apkrovos:

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	25	116	0

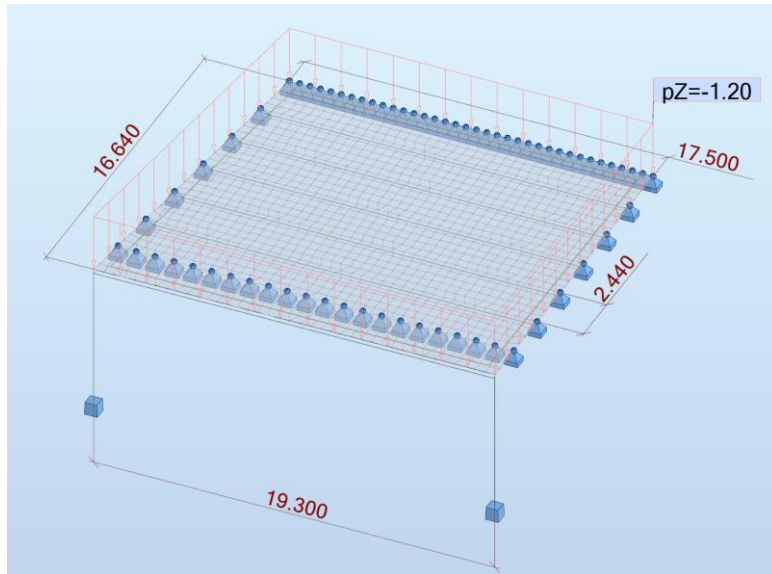


Naudojimo apkrova:

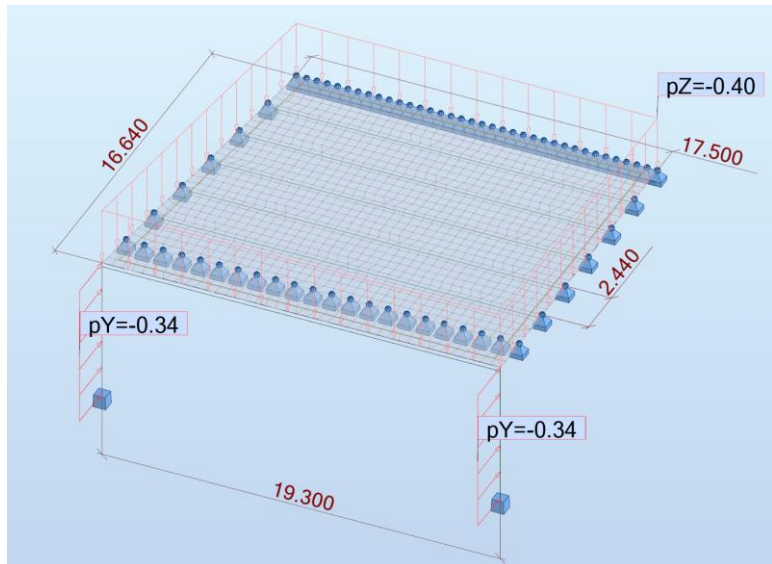


Sniego apkrova:

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	26	116	0



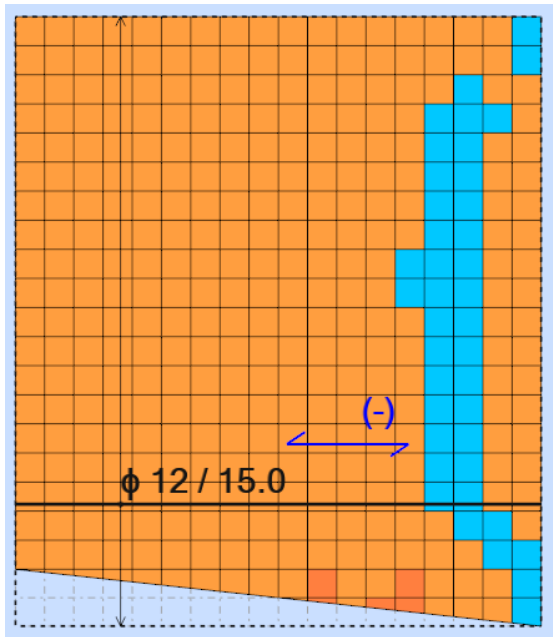
Vėjo apkrovos:



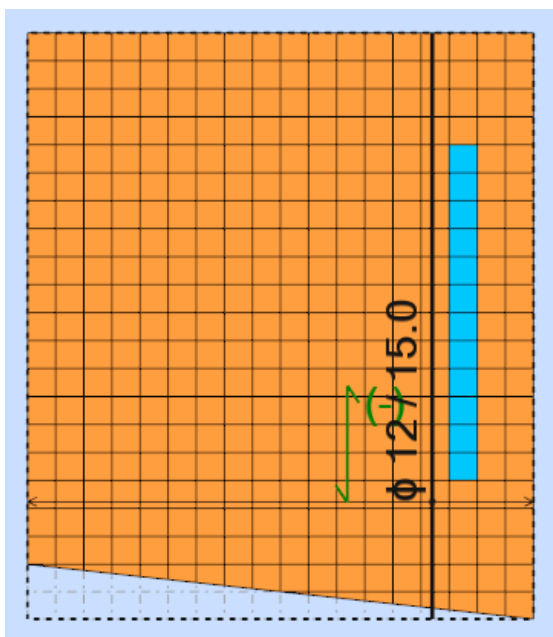
Reikalingas lentynos armavimas.

Apatinis armavimas X kryptimi:

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	27	116	0

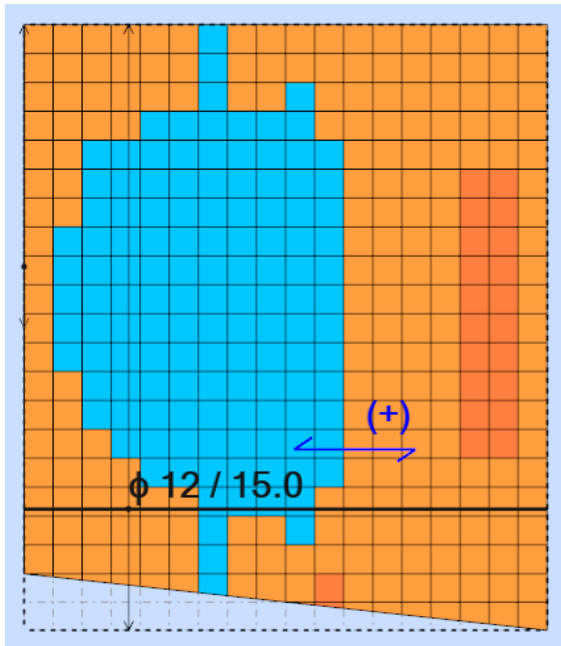


Apatinis armavimas Y kryptimi:

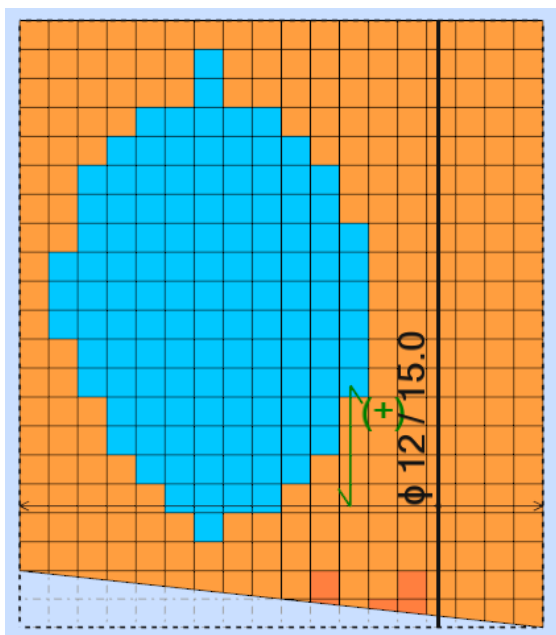


Viršutinis armavimas X kryptimi:

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	28	116	0



Viršutinis armavimas Y kryptimi:



1. Slab: Slab1 - Panel no. 1

1.1. Reinforcement:

- Type : Perdanga
- Main reinforcement direction : 0°
- Main reinforcement grade : B500B; Characteristic strength = 500.00 MPa
Horizontal branch of the stress-strain diagram
- Ductility class : B
- Bar diameters bottom d1 = 1.2 (cm) d2 = 1.2 (cm)
top d1 = 1.2 (cm) d2 = 1.2 (cm)

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	29	116	0

- Cover bottom $c_1 = 3.0$ (cm)
top $c_2 = 3.0$ (cm)
- Cover deviations $C_{dev} = 1.0$ (cm), $C_{dur} = 0.0$ (cm)

1.2. Concrete

- Class : C30/37; Characteristic strength = 30.00 MPa
Rectangular stress distribution [3.1.7(3)]
- Density : 2501.36 (kG/m³)
 - Concrete creep coefficient : 1.40
 - Cement class : N

1.3. Hypothesis

- Calculations according to : EN 1992-1-1:2004/A1:2014
- Method of reinforcement area calculations : analytical
- Allowable cracking width :
- upper layer : 0.30 (mm)
- lower layer : 0.30 (mm)
- Allowable deflection : 7.70 (cm)
- Verification of punching : yes
- Exposure :
- upper layer : XC1
- lower layer : XC1
- Calculation type : simple bending
- Structure class : S4

Modified partial coefficients:

$$a_{cc} = 0.9 \quad 1992-1-1 \text{ 3.1.6 (1)P}$$

1.4. Slab geometry

Thickness 0.180 (m)

Contour:

edge	beginning		end		length
	x1	y1	x2	y2	(m)
1	0.000	17.500	16.640	17.500	16.640
2	16.640	17.500	16.640	-1.800	19.300
3	16.640	-1.800	0.000	0.000	16.737
4	0.000	0.000	0.000	17.500	17.500

Support:

n°	Name	dimensions (m)	coordinates		edge
			x	y	
3	linear	19.300 / 0.400	16.640	7.850	—
3	point	0.400 / 0.400	16.640	17.500	—
4	point	0.400 / 0.400	16.640	-1.800	—
6	linear	17.763 / 0.400	2.440	8.618	—
7	linear	18.027 / 0.400	4.880	8.487	—
8	linear	18.290 / 0.400	7.320	8.355	—
9	linear	18.553 / 0.400	9.760	8.223	—
10	linear	18.817 / 0.400	12.200	8.092	—

* - head present

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	30	116	0

1.5. Calculation results:

1.5.1. Maximum moments + reinforcement for bending

	Ax(+)	Ax(-)	Ay(+)	Ay(-)
Provided reinforcement (cm ² /m):	7.54	7.54	7.54	7.54
Modified required reinforcement (cm ² /m):	6.13	6.06	6.21	4.52
Original required reinforcement (cm ² /m):	6.13	6.06	6.21	4.52
Coordinates (m):	14.640;9.323	12.200;-1.317	9.760;-1.053	3.416;-0.369

1.5.2. Maximum moments + reinforcement for bending

	Ax(+)	Ax(-)	Ay(+)	Ay(-)
Symbol: required area/provided area				
Ax(+) (cm ² /m)	6.13/7.54	4.52/7.54	5.04/7.54	0.15/7.54
Ax(-) (cm ² /m)	0.00/7.54	6.06/7.54	5.79/7.54	4.52/7.54
Ay(+) (cm ² /m)	4.52/7.54	5.58/7.54	6.21/7.54	0.66/7.54
Ay(-) (cm ² /m)	0.00/7.54	4.52/7.54	4.52/7.54	4.52/7.54
SLS				
Mxx (kN*m/m)	25.35	-3.84	-1.34	-3.42
Myy (kN*m/m)	6.99	4.02	5.05	-0.61
Mxy (kN*m/m)	-0.27	-19.54	-20.82	3.56
Nxx (kN/m)	-9.13	32.89	80.58	-15.45
Nyy (kN/m)	-6.33	31.88	61.18	-1.80
Nxy (kN/m)	-5.94	6.68	10.22	1.56
ULS				
Mxx (kN*m/m)	33.68	-5.07	-1.78	-4.52
Myy (kN*m/m)	9.28	5.29	6.66	-0.81
Mxy (kN*m/m)	-0.36	-25.72	-27.50	4.68
Nxx (kN/m)	-12.21	43.31	106.02	-20.36
Nyy (kN/m)	-8.54	41.84	80.47	-2.37
Nxy (kN/m)	-8.02	8.70	13.46	2.06
Coordinates (m)	14.640;9.323	12.200;-1.317	9.760;-1.053	3.416;-0.369
Coordinates* (m)	8.177;14.640;0.000 18.817;12.200;0.000 18.553;9.760;0.000 17.869;3.416;0.000			
	* - Coordinates in the structure global coordinate system			

1.5.4. Deflection

|f(+)| = 0.03 (cm) <= fdop(+) = 7.70 (cm)
|f(-)| = 2.70 (cm) <= fdop(-) = 7.70 (cm)

1.5.5. Cracking

upper layer

ax = 0.20 (mm) <= adop = 0.30 (mm)

ay = 0.00 (mm) <= adop = 0.30 (mm)

lower layer

ax = 0.00 (mm) <= adop = 0.30 (mm)

ay = 0.00 (mm) <= adop = 0.30 (mm)

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	31	116	0

3. Results - detailing

List of solutions:

Reinforcement: bars

Solution no.	Reinforcement range Diameter / Weight	Total weight (kG)
1	-	7250.85

Results for the solution no. 1

Reinforcement zones

Bottom reinforcement

Name	coordinates Ar				Provided reinforcement At	
	x1	y1	x2	y2	φ (mm) / (cm)	(cm2/m)
1/1- Ax Main	0.000	-1.800	16.640	17.500	12.0 / 15.0	6.06 <
	7.54					
1/2- Ay Perpendicular	0.000	-1.800	16.640	17.500	12.0 / 15.0	4.52 <
	7.54					

Top reinforcement

Name	coordinates Ar				Provided reinforcement At	
	x1	y1	x2	y2	φ (mm) / (cm)	(cm2/m)
1/3+ Ax Main	0.000	-1.800	16.640	17.500	12.0 / 15.0	6.13 <
	7.54					
1/4+ Ay Perpendicular	0.000	-1.800	16.640	17.500	12.0 / 15.0	6.21 <
	7.54					
1/5+ Ax Main	0.000	7.850	0.000	17.500	6.0 / 40.0	0.00 <
	0.71					

4. Material survey

- Concrete volume = 55.112 (m3)
- Formwork = 306.176 (m2)
- Slab circumference = 70.177 (m)
- Area of openings = 0.000 (m2)

- Steel B500B
- Total weight = 7405.06 (kG)
- Density = 134.37 (kG/m3)
- Average diameter = 12.0 (mm)
- Survey according to diameters:

Diameter	Length (m)	Number of identical elements:
12	0.402	2
12	1.789	2
12	3.176	2
12	4.562	2
12	5.949	2
12	6.651	4
12	7.336	6

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	32	116	0



12	8.038	4
12	8.500	468
12	8.722	2
12	8.934	8
12	8.950	8
12	8.966	8
12	8.982	8
12	8.999	8
12	9.015	8
12	9.031	8
12	9.047	8
12	9.064	8
12	9.080	8
12	9.096	8
12	9.112	8
12	9.128	8
12	9.145	8
12	9.161	8
12	9.177	8
12	9.193	8
12	9.210	8
12	9.226	8
12	9.242	8
12	9.258	8
12	9.275	8
12	9.291	8
12	9.307	8
12	9.323	8
12	9.339	8
12	9.356	8
12	9.372	8
12	9.388	8
12	9.404	8
12	9.421	8
12	9.437	8
12	9.453	8
12	9.469	8
12	9.485	8
12	9.502	8
12	9.518	8
12	9.534	8
12	9.550	8
12	9.567	8
12	9.583	8
12	9.599	8
12	9.615	8
12	9.632	8
12	9.648	8
12	9.664	8
12	9.680	8
12	9.696	8
12	9.713	8
12	9.729	8
12	9.745	8
12	9.761	8
12	9.778	8
12	9.794	8
12	9.810	8

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	33	116	0

12	9.826	4
12	10.109	2
12	11.496	2

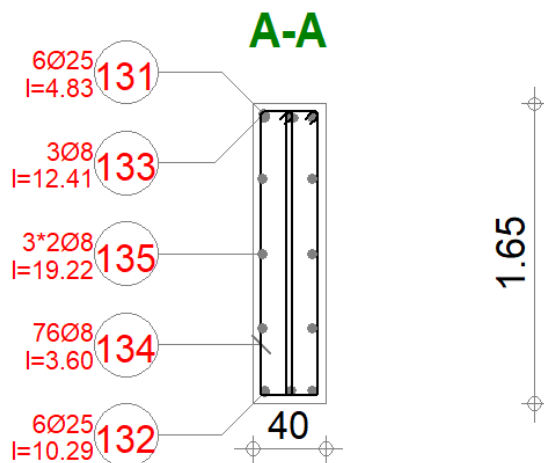
Išvada: laikomoji galia pakankama

Perdangos sijos virš aliuminio stiklo fasado reikalingas armavimas.

Sijos ilgis 19,30m.

Leistinas įlinkis - įlinkis virš lango $L/200=1,8/200=9\text{mm}$, kur L-vienos virtinos segmento tarpatramis.

Reikalingas armavimas:



1 Level:

- Name : ---
- Reference level : ---
- Maximum cracking : 0.30 (mm)
- Exposure : XC1
- Concrete creep coefficient : $\varphi_{\pi} = 2.27$
- Cement class : N
- Concrete age (loading moment) : 28 (days)
- Concrete age : 50 (years)
- Concrete age after erecting a structure : 365 (years)
- Structure class : S4
- Fire resistance class : no requirements
- FFB Recommendations 7.4.3(7) : 0.00

2 Beam: Beam11 identical elements: 1

Number of

2.1 Material properties:

- Concrete : C30/37 $f_{ck} = 30.00 \text{ (MPa)}$

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	34	116	0

- Density : Rectangular stress distribution [3.1.7(3)]
2501.36 (kG/m³)
- Aggregate size : 20.0 (mm)
- Longitudinal reinforcement: : B500B $f_{yk} = 500.00$ (MPa)
Horizontal branch of the stress-strain
diagram
- Transversal reinforcement: : Ductility class : B
B500B $f_{yk} = 500.00$ (MPa)
Horizontal branch of the stress-strain
diagram
- Additional reinforcement: : Ductility class : B
 $f_{yk} = 0.00$ (MPa)
Horizontal branch of the stress-strain
diagram
- Modified partial coefficients:
 $\alpha_{cc} = 0.9$ 1992-1-1 3.1.6 (1)P

2.2 Geometry:

2.2.1	Span	Position	L supp. (m)	L (m)	R supp. (m)
	P1	Span 0.450	18.850	0.450	
	Span length: $L_0 = 19.300$ (m)				
	Section from 0.000 to 18.850 (m)				
	40.0 x 165.0 (cm)				
	without left slab				
	without right slab				

2.3 Calculation options:

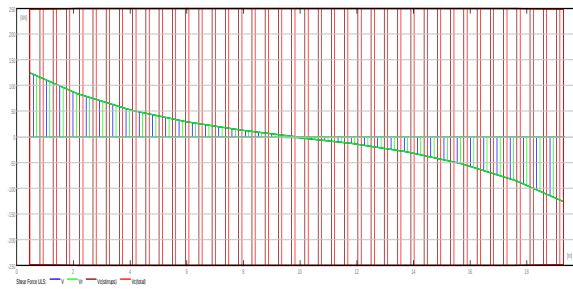
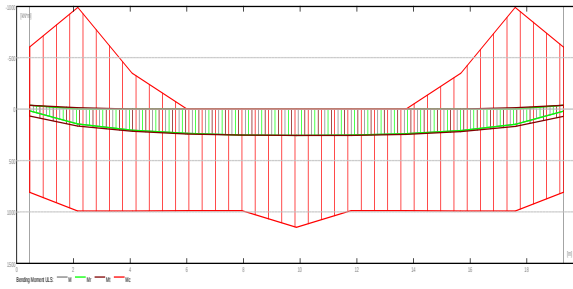
- Regulation of combinations : EN 1990:2002
- Calculations according to : EN 1992-1-1:2004/A1:2014
- Seismic dispositions : No requirements
- Precast beam : no
- Cover : bottom $c = 4.0$ (cm)
: side $c_1 = 4.0$ (cm)
: top $c_2 = 4.0$ (cm)
- Cover deviations : $C_{dev} = 1.0$ (cm), $C_{dur} = 0.0$ (cm)
- Coefficient $\beta_2 = 0.50$: long-term or cyclic load
- Method of shear calculations : strut inclination

2.4 Calculation results:

2.4.1 Internal forces in ULS

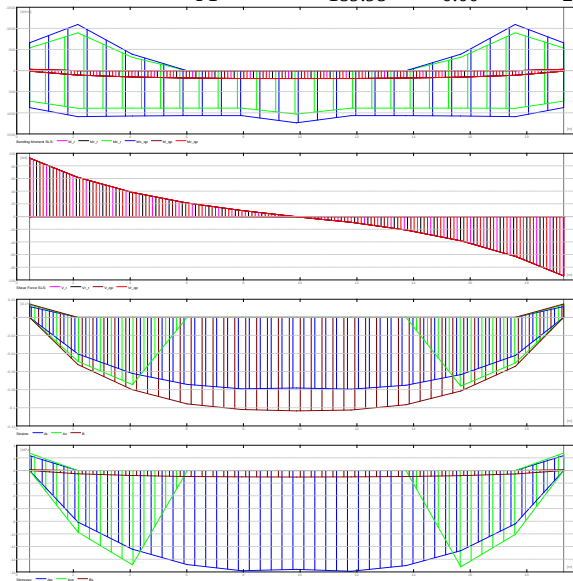
Span	Mt max. (kN*m)	Mt min. (kN*m)	MI (kN*m)	Mr (kN*m)	QI (kN)	Qr (kN)
P1	256.47	-0.00	65.89	68.47	124.93	-126.10

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	35	116	0



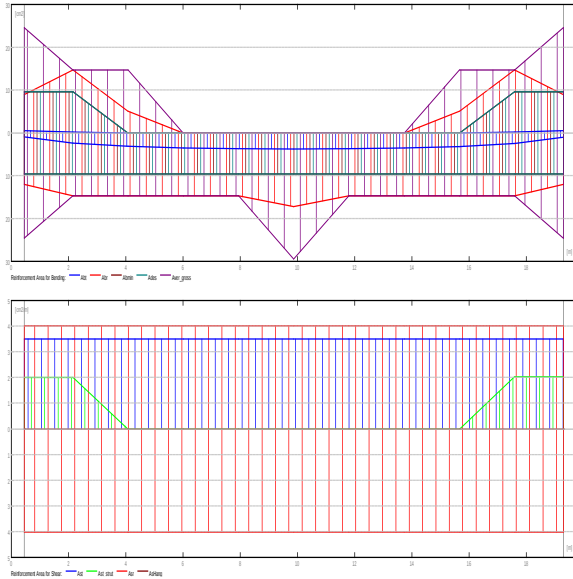
2.4.2 Internal forces in SLS

Span	Mt max. (kN*m)	Mt min. (kN*m)	Ml (kN*m)	Mr (kN*m)	Ql (kN)	Qr (kN)
P1	189.98	0.00	-28.50	-28.50	92.54	-93.41



2.4.3 Required reinforcement area

Span	Span (cm ²)		Left support (cm ²)		Right support (cm ²)	
	bottom	top	bottom	top	bottom	top
P1	3.74	0.00	0.94	0.55	0.98	0.55



2.4 Deflection and cracking

wt(QP) Total due to quasi-permanent combination

wt(QP)dop Allowable due to quasi-permanent combination

Dwt(QP) Deflection increment from the quasi-permanent load combination after erecting a structure.

Dwt(QP)dop Admissible deflection increment from the quasi-permanent load combination after erecting a structure.

wk - width of perpendicular cracks

Span	wt(QP) (cm)	wt(QP)dop (cm)	Dwt(QP) (cm)	Dwt(QP)dop (cm)	wk (mm)
P1	0.48	0.9	0.09	0.9	0.0

2.5 Theoretical results - detailed results:

2.5.1 P1 : Span from 0.450 to 19.300 (m)

Abscissa (m)	ULS		SLS		A bottom (cm ²)	A top (cm ²)
	M max. (kN*m)	M min. (kN*m)	M max. (kN*m)	M min. (kN*m)		
0.450	65.89	-38.47	12.29	-28.50	0.94	0.55
2.155	163.78	-15.08	105.46	0.00	2.38	0.22
4.085	215.15	-0.00	151.27	0.00	3.13	0.00
6.015	241.22	-0.00	174.68	0.00	3.51	0.00
7.945	253.18	-0.00	186.25	0.00	3.69	0.00
9.875	256.47	-0.00	189.98	0.00	3.74	0.00
11.805	253.93	-0.00	187.10	0.00	3.70	0.00
13.735	243.31	-0.00	176.59	0.00	3.54	0.00
15.665	218.81	-0.00	154.40	0.00	3.18	0.00
17.595	168.88	-15.08	109.58	0.00	2.45	0.22
19.300	68.47	-38.47	12.77	-28.50	0.98	0.55

Abscissa (m)	ULS		afp (mm)
	V max. (kN)	V max. (kN)	
0.450	124.93	92.54	0.0
2.155	83.76	62.05	0.0
4.085	51.56	38.19	0.0
6.015	29.09	21.55	0.0
7.945	12.96	9.60	0.0
9.875	-0.71	-0.53	0.0

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	37	116	0

11.805	-12.18	-9.02	0.0
13.735	-28.69	-21.25	0.0
15.665	-51.53	-38.17	0.0
17.595	-84.59	-62.66	0.0
19.300	-126.10	-93.41	0.0

2.6 Reinforcement:

2.6.1 P1 : Span from 0.450 to 19.300 (m)

Longitudinal reinforcement:

- bottom (B500B)
 - 3 ϕ 25 $l = 10.288$ from 0.040 to 10.328
 - 3 ϕ 25 $l = 10.288$ from 9.422 to 19.710
 - 2 ϕ 25 $l = 0.906$ from 0.053 to 0.958
 - 2 ϕ 25 $l = 0.906$ from 19.698 to 18.792
- assembling (top) (B500B)
 - 3 ϕ 8 $l = 12.408$ from 3.671 to 16.079
- support (B500B)
 - 3 ϕ 25 $l = 4.834$ from 0.040 to 4.473
 - 3 ϕ 25 $l = 4.834$ from 15.277 to 19.710
 - 2 ϕ 25 $l = 1.294$ from 0.053 to 1.346
 - 2 ϕ 25 $l = 1.294$ from 19.698 to 18.404

Surface reinforcement (B500B):

- 6 ϕ 8 $l = 19.220$ from 0.265 to 19.485
- pins 3 ϕ 8 $l = 0.478$
- $e = 1*9.425$ (m)

Transversal reinforcement:

- main (B500B)
 - stirrups 76 ϕ 8 $l = 3.597$
 - $e = 1*0.175 + 37*0.500$ (m)
 - 6 ϕ 8 $l = 19.220$
 - $e = 1*-0.185$ (m)
- pins 6 ϕ 8 $l = 19.220$
- $e = 1*-0.185$ (m)

3 Material survey:

- Concrete volume = 13.035 (m3)
- Formwork = 74.035 (m2)
- Steel B500B
 - Total weight = 552.36 (kG)
 - Density = 42.38 (kG/m3)
 - Average diameter = 11.2 (mm)
 - Survey according to diameters:

Diameter (mm)	Length (m)	Weight (kG)	Number (No.)	Total weight (kG)
8	0.478	0.19	3	0.57
8	3.597	1.42	76	107.92
8	12.408	4.90	3	14.69
8	19.220	7.59	6	45.52
25	0.906	3.49	4	13.97
25	1.294	4.99	4	19.95
25	4.834	18.63	6	111.81
25	10.288	39.66	6	237.94

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	38	116	0

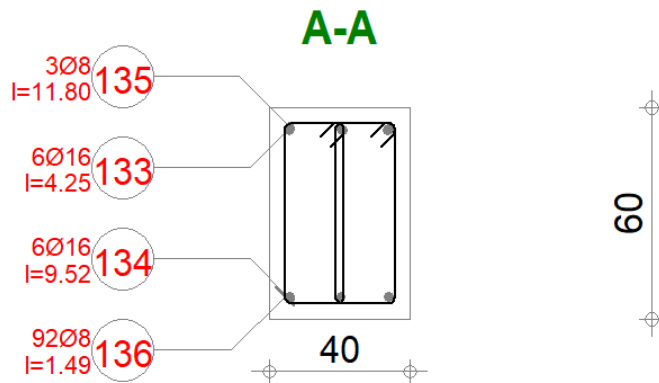
Išvada: laikomoji galia pakankama

Pagrindinės perdangos sijos reikalingas armavimas.

Sijos ilgis 17,76-18,82m.

Leistinas įlinkis - $L/200=17,76/250=71\text{mm}$, kur L-sijos tarpatramis.

Reikalingas armavimas:



1 Level:

- Name : ---
- Reference level : ---
- Maximum cracking : 0.30 (mm)
- Exposure : XC1
- Concrete creep coefficient : $\phi_{\pi} = 2.38$
- Cement class : N
- Concrete age (loading moment) : 28 (days)
- Concrete age : 50 (years)
- Concrete age after erecting a structure : 365 (years)
- Structure class : S4
- Fire resistance class : no requirements
- FFB Recommendations 7.4.3(7) : 0.00

2 Beam: Beam5 identical elements: 1

Number of

2.1 Material properties:

- Concrete : C30/37 $f_{ck} = 30.00$ (MPa)
Rectangular stress distribution [3.1.7(3)]
- Density : 2501.36 (kG/m³)
- Aggregate size : 20.0 (mm)
- Longitudinal reinforcement: : B500B $f_{yk} = 500.00$ (MPa)
Horizontal branch of the stress-strain diagram
- Transversal reinforcement: : B500B $f_{yk} = 500.00$ (MPa)
Horizontal branch of the stress-strain diagram

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	39	116	0

diagram

- Additional reinforcement: :

Ductility class : B

$f_{yk} = 0.00$ (MPa)

Horizontal branch of the stress-strain

diagram

- Modified partial coefficients:
 $\alpha_{cc} = 0.9$ 1992-1-1 3.1.6 (1)P

2.2 Geometry:

2.2.1	Span	Position	L supp. (m)	L (m)	R supp. (m)
	P1	Span 0.250	18.040	0.250	
	Span length: $L_0 = 18.290$ (m)				
	Section from 0.000 to 18.040 (m)				
	40.0 x 60.0 (cm)				
	without left slab				
	without right slab				

2.3 Calculation options:

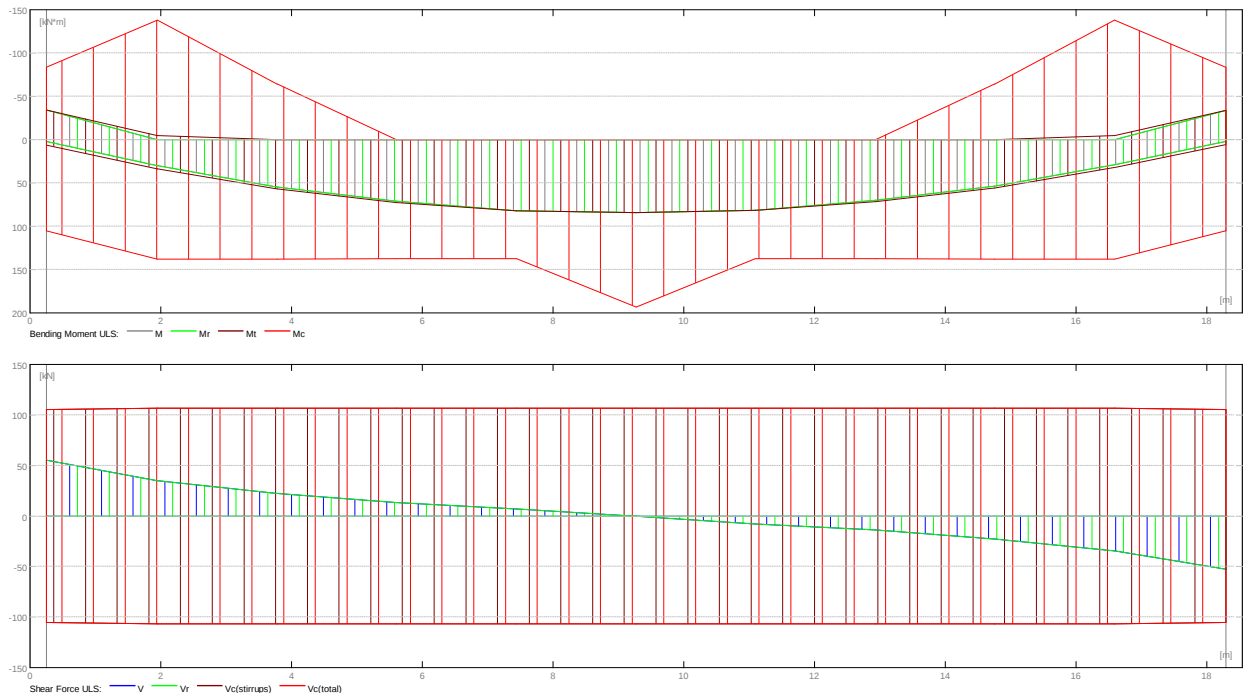
- Regulation of combinations : EN 1990:2002
- Calculations according to : EN 1992-1-1:2004/A1:2014
- Seismic dispositions : No requirements
- Precast beam : no
- Cover : bottom $c = 4.0$ (cm)
: side $c_1 = 4.0$ (cm)
: top $c_2 = 4.0$ (cm)
- Cover deviations : $C_{dev} = 1.0$ (cm), $C_{dur} = 0.0$ (cm)
- Coefficient $\beta_2 = 0.50$: long-term or cyclic load
- Method of shear calculations : strut inclination

2.4 Calculation results:

2.4.1 Internal forces in ULS

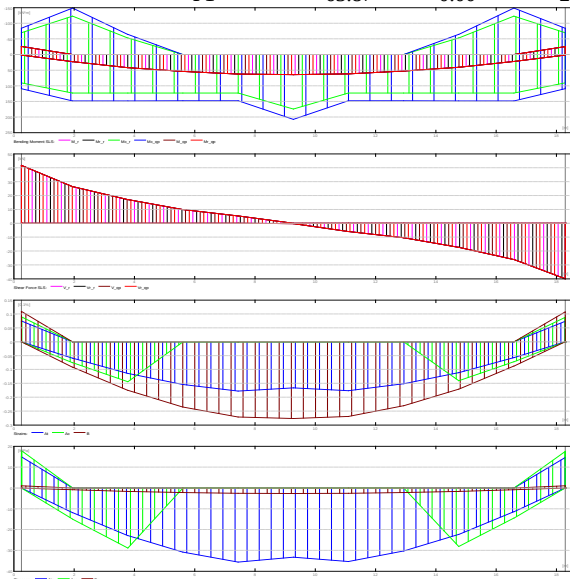
Span	Mt max. (kN*m)	Mt min. (kN*m)	MI (kN*m)	Mr (kN*m)	QI (kN)	Qr (kN)
P1	84.11	-0.00	-34.47	-33.86	55.04	-52.57

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	40	116	0



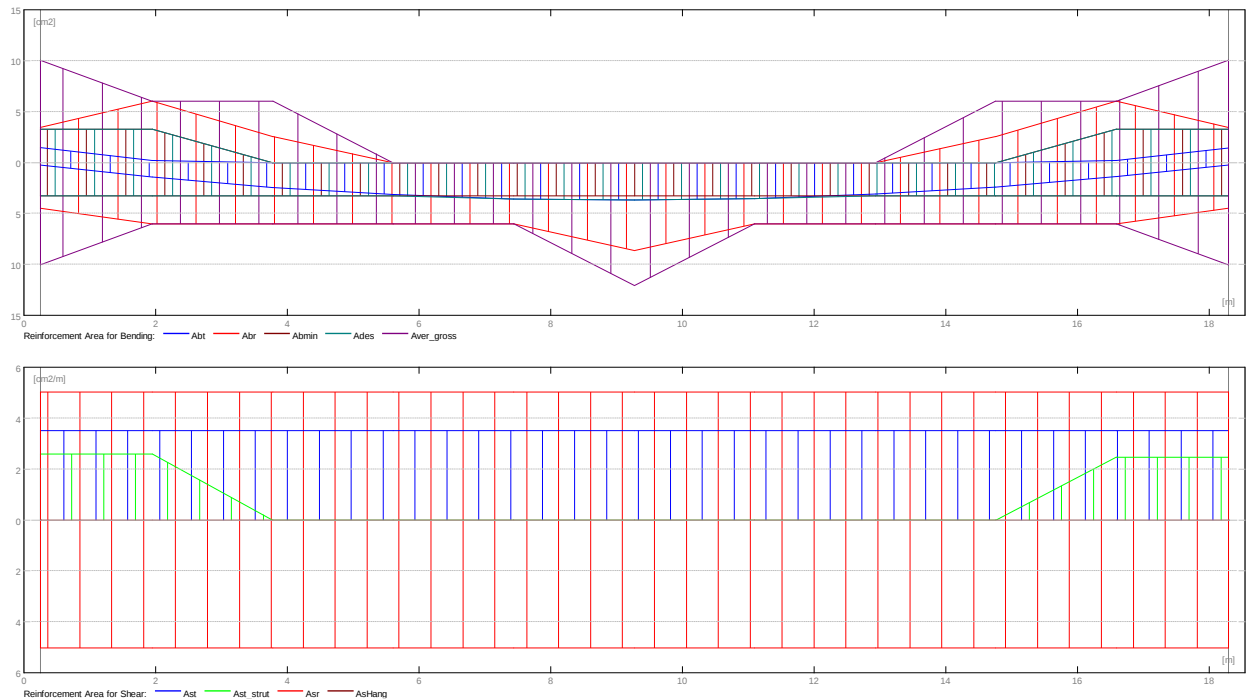
2.4.2 Internal forces in SLS

Span	Mt max. (kN*m)	Mt min. (kN*m)	Ml (kN*m)	Mr (kN*m)	Ql (kN)	Qr (kN)
P1	63.87	0.00	-26.17	-25.71	41.76	-39.90



2.4.3 Required reinforcement area

Span	Span (cm2)		Left support (cm2)		Right support (cm2)	
	bottom	top	bottom	top	bottom	top
P1	3.66	0.00	0.25	1.46	0.24	1.43



2.4.4 Deflection and cracking

wt(QP) Total due to quasi-permanent combination

wt(QP)dop Allowable due to quasi-permanent combination

Dwt(QP) Deflection increment from the quasi-permanent load combination after erecting a structure.

Dwt(QP)dop Admissible deflection increment from the quasi-permanent load combination after erecting a structure.

wk - width of perpendicular cracks

Span	wt(QP) (cm)	wt(QP)dop (cm)	Dwt(QP) (cm)	Dwt(QP)dop (cm)	wk (mm)
P1	2.42	7.11	1.59	3.66	0.0

2.5 Theoretical results - detailed results:

2.5.1 P1 : Span from 0.250 to 18.290 (m)

Abscissa (m)	ULS		SLS		A bottom (cm ²)	A top (cm ²)
	M max. (kN*m)	M min. (kN*m)	M max. (kN*m)	M min. (kN*m)		
0.250	6.06	-34.47	1.56	-26.17	0.25	1.46
1.954	33.43	-4.92	22.86	0.00	1.42	0.21
3.783	57.10	-0.00	41.71	0.00	2.47	0.00
5.612	72.53	-0.00	53.96	0.00	3.14	0.00
7.441	82.28	-0.00	62.26	0.00	3.58	0.00
9.270	84.11	-0.00	63.87	0.00	3.66	0.00
11.099	81.77	-0.00	61.82	0.00	3.55	0.00
12.928	71.34	-0.00	53.00	0.00	3.09	0.00
14.757	55.80	-0.00	40.74	0.00	2.41	0.00
16.586	32.17	-4.83	21.92	0.00	1.36	0.20
18.290	5.81	-33.86	1.50	-25.71	0.24	1.43

Abscissa (m)	ULS		SLS
	V max. (kN)	V max. (kN)	afp (mm)
0.250	55.04	41.76	0.0

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Lapas	Lapų	Laida
42	116	0

1.954	34.80	26.42	0.0
3.783	22.53	17.11	0.0
5.612	13.13	9.97	0.0
7.441	7.08	5.38	0.0
9.270	-0.22	-0.16	0.0
11.099	-7.82	-5.94	0.0
12.928	-13.73	-10.43	0.0
14.757	-22.79	-17.31	0.0
16.586	-34.38	-26.10	0.0
18.290	-52.57	-39.90	0.0

2.6 Reinforcement:

2.6.1 P1 : Span from 0.250 to 18.290 (m)

Longitudinal reinforcement:

- bottom (B500B)
 - 3 $\phi 16$ $l = 9.520$ from 0.040 to 9.560
 - 3 $\phi 16$ $l = 9.520$ from 8.980 to 18.500
 - 2 $\phi 16$ $l = 0.580$ from 0.048 to 0.628
 - 2 $\phi 16$ $l = 0.580$ from 18.492 to 17.912
- assembling (top) (B500B)
 - 3 $\phi 8$ $l = 11.802$ from 3.369 to 15.171
- support (B500B)
 - 3 $\phi 16$ $l = 4.255$ from 0.040 to 4.031
 - 3 $\phi 16$ $l = 4.255$ from 14.509 to 18.500
 - 2 $\phi 16$ $l = 0.828$ from 0.048 to 0.876
 - 2 $\phi 16$ $l = 0.828$ from 18.492 to 17.664

Transversal reinforcement:

- main (B500B)
 - stirrups 92 $\phi 8$ $l = 1.488$
 $e = 1 \cdot 0.020 + 45 \cdot 0.400$ (m)

3 Material survey:

- Concrete volume = 4.450 (m3)
- Formwork = 29.944 (m2)
- Steel B500B
 - Total weight = 207.41 (kG)
 - Density = 46.61 (kG/m3)
 - Average diameter = 10.7 (mm)
 - Survey according to diameters:

Diameter (mm)	Length (m)	Weight (kG)	Number (No.)	Total weight (kG)
8	1.488	0.59	92	54.05
8	11.802	4.66	3	13.98
16	0.580	0.92	4	3.66
16	0.828	1.31	4	5.23
16	4.255	6.72	6	40.31
16	9.520	15.03	6	90.18

Išvada: laikomoji galia pakankama

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	43	116	0

Kolonų reikalingas armavimas.

Kolonos geometrinis ilgis 7,0m.

Skaičiuojamieji ilgiai:

Member: Kolona

Buckling with respect to Y axis

Member length l_y

☐ at support faces

☐ in axes

☐ real m

☒ coeff. * L_0

Buckling length coefficient

Ky: 

Buckling with respect to Z axis

Member length l_z

☐ at support faces

☐ in axes

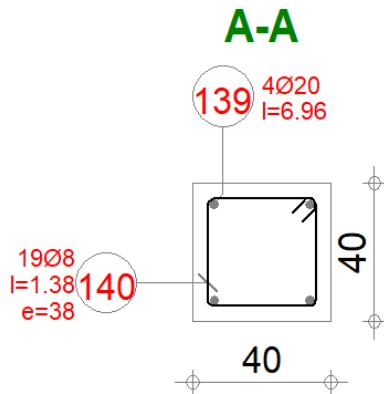
☐ real m

☒ coeff. * L_0

Buckling length coefficient

Kz: 

Reikalingas armavimas:



1 Level:

- Name :
- Reference level : -7.000 (m)
- Concrete creep coefficient : $\varphi_p = 2.47$
- Cement class : N
- Environment class : XC1
- Structure class : S4

2 Column: Column20..21

Number of identical elements: 2

2.1 Material properties:

- Concrete : C30/37 $f_{ck} = 30.00$ (MPa)
- Unit weight : 2501.36 (kG/m3)
- Aggregate size : 20.0 (mm)
- Longitudinal reinforcement: B500B $f_{yk} = 500.00$ (MPa)
- Ductility class : B
- Transversal reinforcement: B500B $f_{yk} = 500.00$ (MPa)
- Modified partial coefficients: $\alpha_{cc} = 0.9$ 1992-1-1 3.1.6 (1)P

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	44	116	0

2.2 Geometry:

2.2.1	Rectangular	40.0 x 40.0 (cm)
2.2.2	Height: L	= 7.000 (m)
2.2.3	Slab thickness	= 0.000 (m)
2.2.4	Beam height	= 0.000 (m)
2.2.5	Cover	= 4.0 (cm)

2.3 Calculation options:

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

2.4 Calculation results:

Safety factors $R_d/E_d = 4.36 > 1.0$

2.4.1 ULS/ALS Analysis

Design combination: ULS/3=1*1.35 (C)

Combination type: ULS

Internal forces:

$N_{sd} = 136.14$ (kN) $M_{sdy} = -5.98$ (kN*m) $M_{sdz} = 8.72$ (kN*m)

Design forces:

Cross-section in the middle of the column

$N = 136.14$ (kN) $N^*etotz = -5.98$ (kN*m) $N^*etoty = 10.73$ (kN*m)

Eccentricity:

		e_z (My/N) (cm)	e_y (Mz/N) (cm)
Initial	e_0 :	-4.4	6.4
Imperfection	e_i :	0.0	1.5
I order ($e_0 + e_i$)	e_{0Ed} :	-4.4	7.9
Minimal	e_{Edmin} :	2.0	2.0
Total	e_{Ed} :	-4.4	7.9

2.4.1.1. Detailed analysis-Direction Y:

2.4.1.1.1 Slenderness analysis

Non-sway structure

L (m)	L_0 (m)	λ	λ_{lim}	
8.750	8.750	75.78	157.43	Short column

2.4.1.1.2 Buckling analysis

$M_A = -14.62$ (kN*m) $M_B = 6.98$ (kN*m) $M_C = -5.98$ (kN*m)

Case: Cross-section in the middle of the column, Slenderness not taken into account

$M_0 = \max(|M_{0e}|, |M_{0emin}|) = -5.98$ (kN*m)

$M_{0e} = 0.6*M_0 + 0.4*M_1 = -5.98$ (kN*m)

$M_{0emin} = 0.4*M_0 = -5.85$ (kN*m)

$M_1 = \min(|M_A|, |M_B|)$

	Lapas	Lapų	Laida
IN2329-01-TP-SK-S	45	116	0

$$M02 = \max(|MA|; |MB|)$$

$$|MA| > |MB| \Rightarrow M01 = MB, M02 = MA$$

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

$$M_a = N \cdot e_i = 0.00 \text{ (kN}\cdot\text{m)}$$

$$M_{Edmin} = 2.72 \text{ (kN}\cdot\text{m)}$$

$$M_{0Ed} = \max(M_{Edmin}, M_0 + M_a) = -5.98 \text{ (kN}\cdot\text{m)}$$

2.4.1.2. Detailed analysis-Direction Z:

2.4.1.2.1 Slenderness analysis

Non-sway structure

L (m)	Lo (m)	λ	λ_{lim}	
8.750	8.750	75.78	158.34	Short column

2.4.1.2.2 Buckling analysis

$$MA = 21.59 \text{ (kN}\cdot\text{m)} \quad MB = -10.58 \text{ (kN}\cdot\text{m)} \quad MC = 8.72 \text{ (kN}\cdot\text{m)}$$

Case: Cross-section in the middle of the column, Slenderness not taken into account

$$M_0 M_0 = \max(|M_{0e}|, |M_{0emin}|) = 8.72 \text{ (kN}\cdot\text{m)}$$

$$M_{0e} = 0.6 \cdot M_{02} + 0.4 \cdot M_{01} = 8.72 \text{ (kN}\cdot\text{m)}$$

$$M_{0emin} = 0.4 \cdot M_{02} = 8.63 \text{ (kN}\cdot\text{m)}$$

$$M_{01} = \min(|MA|; |MB|)$$

$$M_{02} = \max(|MA|; |MB|)$$

$$|MA| > |MB| \Rightarrow M_{01} = MB, M_{02} = MA$$

$$e_i = \theta_1 \cdot l_0 / 2 = 1.5 \text{ (cm)}$$

$$\theta_1 = \theta_0 \cdot \alpha_h \cdot \alpha_m = 0.00$$

$$\theta_0 = 0.01$$

$$\alpha_h = 0.68$$

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

$$m = 1.00$$

$$M_a = N \cdot e_i = 2.01 \text{ (kN}\cdot\text{m)}$$

$$M_{Edmin} = 2.72 \text{ (kN}\cdot\text{m)}$$

$$M_{0Ed} = \max(M_{Edmin}, M_0 + M_a) = 10.73 \text{ (kN}\cdot\text{m)}$$

2.4.2 Reinforcement:

$$\text{Real (provided) area} \quad A_{sr} = 12.57 \text{ (cm}^2\text{)}$$

$$\text{Ratio:} \quad \rho = 0.79 \%$$

2.5 Reinforcement:

Main bars (B500B):

- 4 $\phi 20$ l = 6.960 (m)

Transversal reinforcement: (B500B):

$$\text{stirrups:} \quad 19 \phi 8 \quad l = 1.376 \text{ (m)}$$

3 Material survey:

- Concrete volume = 2.240 (m³)
- Formwork = 22.400 (m²)
- Steel B500B
 - Total weight = 158.01 (kG)
 - Density = 70.54 (kG/m³)
 - Average diameter = 14.2 (mm)

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	46	116	0

- Reinforcement survey:

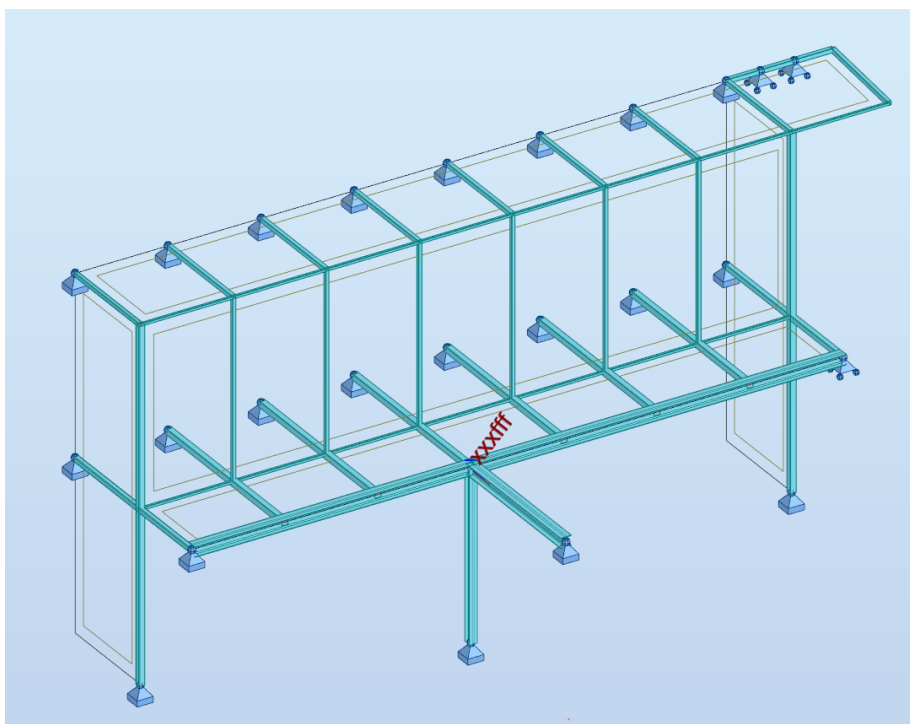
Diameter	Length (m)	Weight (kG)	Number (No.)	Total weight (kG)
8	1.376	0.54	38	20.65
20	6.960	17.17	8	137.36

Išvada : laikomoji galia pakankama

1.6. Užstiklinto medinio rėmo tarp ašių B ir C skaičiavimas

Skaičiuojamas plieninis užstiklintas rėmas su peraukštėjimu, apjungiantis dvi pastato dalis. Rėmą sudaro plieninė kolona ir apatinės sijos dvitėjinio skerspjūvio, plieninės sijos ir kolonos dėžinio skerspjūvio, plieno klasė S355J2H. Visos kolonos su pamatu jungiamos lanksčiai, visos sijos tarpusavyje ir su peraukštėjimo kolonomis jungiamos standžiai. Visų plieninių konstrukcijų atsparumas ugniai R60, galinio rėmo prie ugniasienės atsparumas ugniai R180, ugniasienės rėmo elementų sienelė 10mm storio. Atsparumas ugniai užtikrinamas priešgaisrinio dažymo.

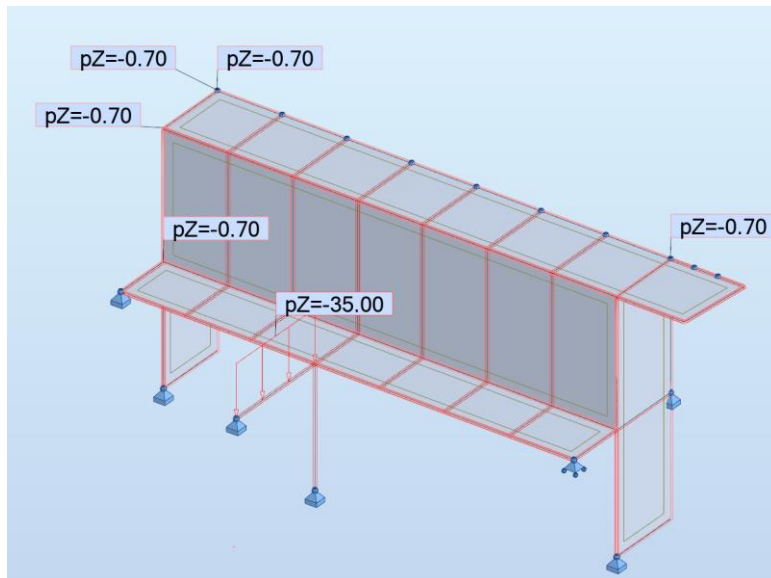
Skaičiuojamoji schema:



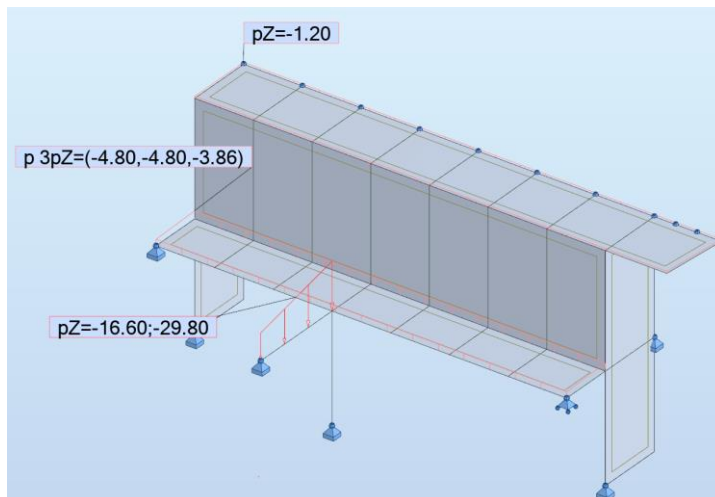
Veikiančios charakteristinės apkrovos.

Nuolatinės apkrovos:

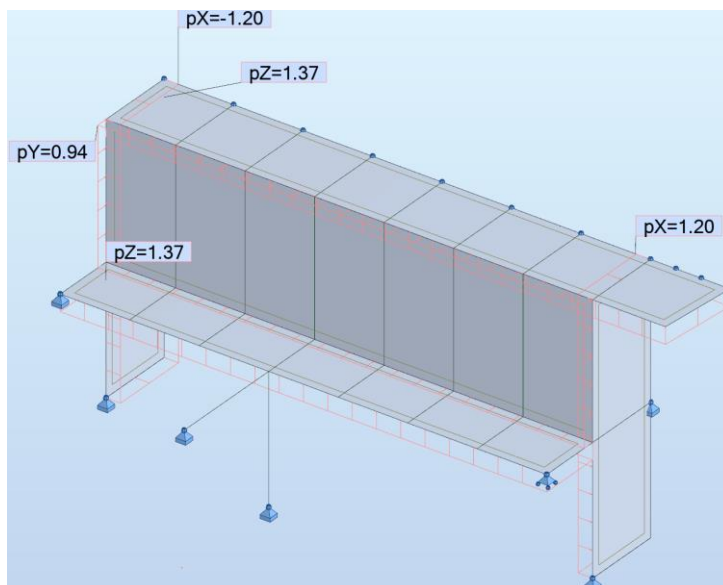
IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	47	116	0



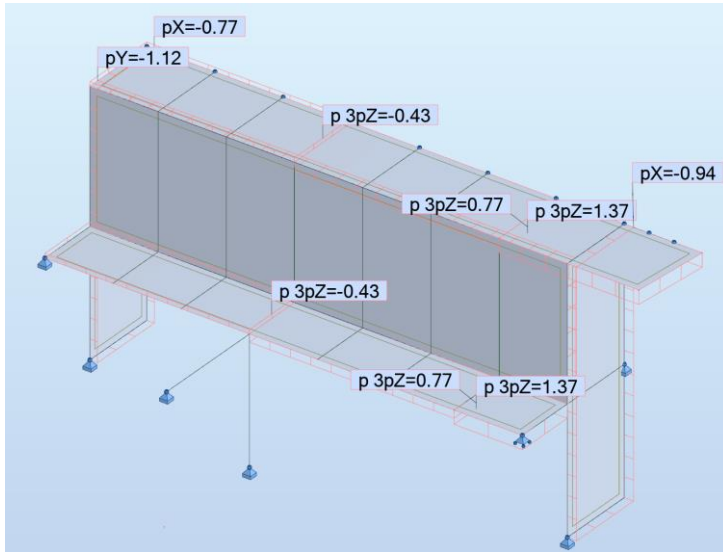
Sniego apkrovos:



Vėjas 1:



Vėjas 2:



Žemesnio lygio išilginės sijos projektavimas

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

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 28 sijos 1_28
m

POINT: 1

COORDINATE: x = 0.00 L = 0.00

LOADS:

Governing Load Case: 15 ULS/11=1*1.35 + 2*1.30 1*1.35+2*1.30

MATERIAL:

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



SECTION PARAMETERS: HEA 300

h=29.0 cm	gM0=1.00	gM1=1.00	
b=30.0 cm	Ay=94.85 cm ²	Az=37.28 cm ²	Ax=112.53 cm ²
tw=0.9 cm	Iy=18263.50 cm ⁴	Iz=6309.56 cm ⁴	Ix=75.30 cm ⁴
tf=1.4 cm	Wely=1259.55 cm ³	Welz=420.64 cm ³	

INTERNAL FORCES AND CAPACITIES:

N,Ed = 0.45 kN	My,Ed = -97.90 kN*m	Mz,Ed = 0.12 kN*m	Vy,Ed = 0.11 kN
Nc,Rd = 3994.74 kN	My,Ed,max = -97.90 kN*m		Mz,Ed,max = 0.12 kN*m
	Vy,T,Rd = 1942.38 kN		
Nb,Rd = 1298.64 kN	My,c,Rd = 447.14 kN*m	Mz,c,Rd = 149.33 kN*m	Vz,Ed = 60.02 kN
			Vz,T,Rd = 763.66 kN
	Mb,Rd = 287.72 kN*m		Tt,Ed = 0.02 kN*m
			Class of section = 3



LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 358.13 kN*m	Curve,LT - b	XLT = 0.63
Lcr,low=8.40 m	Lam_LT = 1.12	fi,LT = 1.09	XLT,mod = 0.64

BUCKLING PARAMETERS:

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	49	116	0



About y axis:

Ly = 8.40 m Lam_y = 0.86
Lcr,y = 8.40 m Xy = 0.68
Lamy = 65.94 kzy = 1.00



About z axis:

Lz = 8.40 m Lam_z = 1.47
Lcr,z = 8.40 m Xz = 0.33
Lamz = 112.18 kzz = 1.00

VERIFICATION FORMULAS:

Section strength check:

$$N_{Ed}/N_{c,Rd} + M_{y,Ed}/M_{y,c,Rd} + M_{z,Ed}/M_{z,c,Rd} = 0.22 < 1.00 \quad (6.2.1(7))$$

$$\sqrt{(\sigma_{x,Ed})^2 + 3 \cdot (\tau_{xy,Ed})^2} / (f_y / g_{M0}) = 0.22 < 1.00 \quad (6.2.1(5))$$

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

$$V_{z,Ed}/V_{z,T,Rd} = 0.08 < 1.00 \quad (6.2.6-7)$$

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

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

Global stability check of member:

$$\lambda_{b,y} = 65.94 < \lambda_{b,max} = 150.00 \quad \lambda_{b,z} = 112.18 < \lambda_{b,max} = 150.00 \quad \text{STABLE}$$

$$M_{y,Ed,max}/M_{b,Rd} = 0.34 < 1.00 \quad (6.3.2.1(1))$$

$$N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.34 < 1.00 \quad (6.3.3(4))$$

$$N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.34 < 1.00 \quad (6.3.3(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/150.00 = 5.6 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 28 \text{ SLS:CHR}/8 = 1 \cdot 1.00 + 4 \cdot 0.60 + 2 \cdot 1.00 \quad (1+2) \cdot 1.00 + 4 \cdot 0.60$$

$$u_z = 0.8 \text{ cm} < u_{z,max} = L/150.00 = 5.6 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 28 \text{ SLS:CHR}/8 = 1 \cdot 1.00 + 4 \cdot 0.60 + 2 \cdot 1.00 \quad (1+2) \cdot 1.00 + 4 \cdot 0.60$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

Išvada: laikomoji galia pakankama ir įlinkis neviršija ribinio

Viršutinės skersinės sijos projektavimas

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

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 9 Sijos_9

POINT: 2

COORDINATE: x = 0.50 L = 1.20

m

LOADS:

$$\text{Governing Load Case: } 8 \text{ ULS}/4 = 1 \cdot 1.35 + 4 \cdot 1.30 + 2 \cdot 0.91 \quad 1 \cdot 1.35 + 4 \cdot 1.30 + 2 \cdot 0.91$$

MATERIAL:

S 355 (S 355) fy = 355.00 MPa



SECTION PARAMETERS: RECT 150x100x4

h=15.0 cm

gM0=1.00

gM1=1.00

b=10.0 cm

Ay=7.58 cm²

Az=11.37 cm²

Ax=18.95 cm²

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	50	116	0

tw=0.4 cm Iy=594.60 cm⁴ Iz=318.57 cm⁴ Ix=650.45 cm⁴
tf=0.4 cm Wply=95.67 cm³ Wplz=72.50 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = -6.06 kN My,Ed = 5.96 kN*m Mz,Ed = 0.46 kN*m Vy,Ed = 0.38 kN
Nt,Rd = 672.73 kN My,pl,Rd = 33.96 kN*m Mz,pl,Rd = 25.74 kN*m Vy,c,Rd = 155.36 kN
My,c,Rd = 33.96 kN*m Mz,c,Rd = 25.74 kN*m Vz,Ed = -1.58 kN
MN,y,Rd = 33.96 kN*m MN,z,Rd = 25.74 kN*m Vz,c,Rd = 233.04 kN
Mb,Rd = 33.96 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00 Mcr = 835.04 kN*m Curve,LT - d XLT = 1.00
Lcr,upp=2.40 m Lam_LT = 0.20 fi,LT = 0.44 XLT,mod = 1.00

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nt,Rd = 0.01 < 1.00 (6.2.3.(1))
My,Ed/MN,y,Rd = 0.18 < 1.00 (6.2.9.1.(2))
Mz,Ed/MN,z,Rd = 0.02 < 1.00 (6.2.9.1.(2))
(My,Ed/MN,y,Rd)^{1.66} + (Mz,Ed/MN,z,Rd)^{1.66} = 0.06 < 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/Mb,Rd = 0.18 < 1.00 (6.3.2.1.(1))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

uy = 0.0 cm < uy max = L/150.00 = 1.6 cm Verified
Governing Load Case: 28 SLS:CHR/8=1*1.00 + 4*0.60 + 2*1.00 (1+2)*1.00+4*0.60
uz = 0.2 cm < uz max = L/150.00 = 1.6 cm Verified
Governing Load Case: 28 SLS:CHR/8=1*1.00 + 4*0.60 + 2*1.00 (1+2)*1.00+4*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

Išvada: laikomoji galia pakankama ir įlinkis neviršija ribinio

Viršutinės gembinės sijos projektavimas

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

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 57 ryšiai_57
m

POINT: 1

COORDINATE: x = 0.00 L = 0.00

LOADS:

Governing Load Case: 15 ULS/11=1*1.35 + 2*1.30 1*1.35+2*1.30

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	51	116	0

MATERIAL:

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



SECTION PARAMETERS: RECT 200x100x5

h=20.0 cm	gM0=1.00	gM1=1.00	
b=10.0 cm	Ay=9.45 cm ²	Az=18.91 cm ²	Ax=28.36 cm ²
tw=0.5 cm	Iy=1459.25 cm ⁴	Iz=496.94 cm ⁴	Ix=1185.78 cm ⁴
tf=0.5 cm	Wply=181.37 cm ³	Wplz=112.09 cm ³	

INTERNAL FORCES AND CAPACITIES:

N,Ed = 0.02 kN	My,Ed = -6.70 kN*m	Mz,Ed = -0.12 kN*m	Vy,Ed = -0.04 kN
Nc,Rd = 1006.78 kN	My,Ed,max = -6.70 kN*m	Mz,Ed,max = -0.12 kN*m	Vy,T,Rd = 183.62 kN
Nb,Rd = 873.09 kN	My,c,Rd = 64.39 kN*m	Mz,c,Rd = 39.79 kN*m	Vz,Ed = 3.51 kN
	MN,y,Rd = 64.39 kN*m	MN,z,Rd = 39.79 kN*m	Vz,T,Rd = 367.25 kN
	Mb,Rd = 64.39 kN*m		Tt,Ed = -1.99 kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00	Mcr = 1577.04 kN*m	Curve,LT - d	XLT = 1.00
Lcr,low=2.10 m	Lam_LT = 0.20	fi,LT = 0.44	XLT,mod = 1.00

BUCKLING PARAMETERS:



About y axis:

Ly = 2.10 m	Lam_y = 0.38
Lcr,y = 2.10 m	Xy = 0.96
Lamy = 29.28	kyy = 1.00



About z axis:

Lz = 2.10 m	Lam_z = 0.66
Lcr,z = 2.10 m	Xz = 0.87
Lamz = 50.17	kyz = 0.57

VERIFICATION FORMULAS:

Section strength check:

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

$$My,Ed/MN,y,Rd = 0.10 < 1.00 \quad (6.2.9.1.(2))$$

$$Mz,Ed/MN,z,Rd = 0.00 < 1.00 \quad (6.2.9.1.(2))$$

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

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

$$Vz,Ed/Vz,T,Rd = 0.01 < 1.00 \quad (6.2.6-7)$$

$$\tau_{ty,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.05 < 1.00 \quad (6.2.6)$$

$$\tau_{tz,Ed}/(f_y/(\sqrt{3} \cdot gM0)) = 0.05 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$\lambda_{y,y} = 29.28 < \lambda_{y,max} = 150.00 \quad \lambda_{y,z} = 50.17 < \lambda_{y,max} = 150.00 \quad \text{STABLE}$$

$$My,Ed,max/Mb,Rd = 0.10 < 1.00 \quad (6.3.2.1.(1))$$

$$N,Ed/(Xy \cdot N,Rk/gM1) + kyy \cdot My,Ed,max/(XLT \cdot My,Rk/gM1) + kyz \cdot Mz,Ed,max/(Mz,Rk/gM1) = 0.11 < 1.00 \quad (6.3.3.(4))$$

$$N,Ed/(Xz \cdot N,Rk/gM1) + kzy \cdot My,Ed,max/(XLT \cdot My,Rk/gM1) + kzz \cdot Mz,Ed,max/(Mz,Rk/gM1) = 0.07 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/150.00 = 1.5 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 28 \text{ SLS:CHR}/8=1 \cdot 1.00 + 4 \cdot 0.60 + 2 \cdot 1.00 \quad (1+2) \cdot 1.00 + 4 \cdot 0.60$$

$$u_z = 0.0 \text{ cm} < u_{z,max} = L/150.00 = 1.5 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 28 \text{ SLS:CHR}/8=1 \cdot 1.00 + 4 \cdot 0.60 + 2 \cdot 1.00 \quad (1+2) \cdot 1.00 + 4 \cdot 0.60$$



Displacements (GLOBAL SYSTEM): Not analyzed

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	52	116	0

Section OK !!!

Išvada: laikomoji galia pakankama ir įlinkis neviršija ribinio

Ryšių tarp sijų projektavimas

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

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 56 ryšiai_56

POINT: 3

COORDINATE: x = 1.00 L = 2.10

m

LOADS:

Governing Load Case: 15 ULS/11=1*1.35 + 2*1.30 1*1.35+2*1.30

MATERIAL:

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



SECTION PARAMETERS: SQUA 60x60x4

h=6.0 cm

gM0=1.00

gM1=1.00

b=6.0 cm

Ay=4.27 cm²

Az=4.27 cm²

Ax=8.55 cm²

tw=0.4 cm

Iy=43.55 cm⁴

Iz=43.55 cm⁴

Ix=70.72 cm⁴

tf=0.4 cm

Wply=17.64 cm³

Wplz=17.64 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = -0.76 kN

My,Ed = -2.06 kN*m

Mz,Ed = -0.15 kN*m

Vy,Ed = 0.14 kN

Nt,Rd = 303.45 kN

My,pl,Rd = 6.26 kN*m

Mz,pl,Rd = 6.26 kN*m

Vy,T,Rd = 86.00 kN

My,c,Rd = 6.26 kN*m

Mz,c,Rd = 6.26 kN*m

Vz,Ed = -1.72 kN

MN,y,Rd = 6.26 kN*m

MN,z,Rd = 6.26 kN*m

Vz,T,Rd = 86.00 kN

Mb,Rd = 6.26 kN*m

Tt,Ed = 0.09 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

Mcr = 119.25 kN*m

Curve,LT - d

XLT = 1.00

Lcr,low=2.10 m

Lam_LT = 0.23

fi,LT = 0.45

XLT,mod = 1.00

BUCKLING PARAMETERS:



About y axis:



About z axis:

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{t,Rd} = 0.00 < 1.00$ (6.2.3.(1))

$M_{y,Ed}/M_{N,y,Rd} = 0.33 < 1.00$ (6.2.9.1.(2))

$M_{z,Ed}/M_{N,z,Rd} = 0.02 < 1.00$ (6.2.9.1.(2))

$(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.16 < 1.00$ (6.2.9.1.(6))

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

$V_{z,Ed}/V_{z,T,Rd} = 0.02 < 1.00$ (6.2.6-7)

$\tau_{ty,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.02 < 1.00$ (6.2.6)

$\tau_{tz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) = 0.02 < 1.00$ (6.2.6)

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	53	116	0

Global stability check of member:

$M_{y,Ed}/M_{b,Rd} = 0.33 < 1.00$ (6.3.2.1.(1))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y \max} = L/150.00 = 1.4 \text{ cm}$

Verified

Governing Load Case: 28 SLS:CHR/8=1*1.00 + 4*0.60 + 2*1.00 (1+2)*1.00+4*0.60

$u_z = 0.1 \text{ cm} < u_{z \max} = L/150.00 = 1.4 \text{ cm}$

Verified

Governing Load Case: 28 SLS:CHR/8=1*1.00 + 4*0.60 + 2*1.00 (1+2)*1.00+4*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

Išvada: laikomoji galia pakankama ir įlinkis neviršija ribinio

Žemesnio lygio skersinė vidurinė sija

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

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 8 žemesnio lygio sijos_8

POINT: 3 **COORDINATE:** x =

0.44 L = 1.90 m

LOADS:

Governing Load Case: 17 ULS/13=1*1.35 + 4*0.78 + 2*1.30 1*1.35+4*0.78+2*1.30

MATERIAL:

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



SECTION PARAMETERS: RECT 250x150x5

h=25.0 cm

gM0=1.00

gM1=1.00

b=15.0 cm

Ay=14.38 cm²

Az=23.97 cm²

Ax=38.36 cm²

tw=0.5 cm

Iy=3304.18 cm⁴

Iz=1507.95 cm⁴

Ix=3239.21 cm⁴

tf=0.5 cm

Wply=319.76 cm³

Wplz=225.48 cm³

INTERNAL FORCES AND CAPACITIES:

N_{Ed} = 0.25 kN

M_{y,Ed} = 32.85 kN*m

M_{z,Ed} = 1.34 kN*m

V_{y,Ed} = -1.59 kN

N_{c,Rd} = 1361.78 kN

M_{y,Ed,max} = 32.85 kN*m

M_{z,Ed,max} = -1.68 kN*m

V_{y,T,Rd} = 294.69 kN

N_{b,Rd} = 1258.25 kN

M_{y,c,Rd} = 113.51 kN*m

M_{z,c,Rd} = 80.05 kN*m

V_{z,Ed} = 2.77 kN

M_{N,y,Rd} = 113.51 kN*m

M_{N,z,Rd} = 80.05 kN*m

V_{z,T,Rd} = 491.15 kN

M_{b,Rd} = 113.51 kN*m

T_{t,Ed} = 0.04 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

M_{cr} = 3929.21 kN*m

Curve,LT - d

XLT = 1.00

L_{cr,upp}=2.40 m

L_{am,LT} = 0.17

f_{i,LT} = 0.42

XLT,mod = 1.00

BUCKLING PARAMETERS:



About y axis:

L_y = 2.40 m

L_{am,y} = 0.34



About z axis:

L_z = 2.40 m

L_{am,z} = 0.50

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	54	116	0

Lcr,y = 2.40 m
Lamy = 25.86

Xy = 0.97
kyy = 1.00

Lcr,z = 2.40 m
Lamz = 38.28

Xz = 0.92
kyz = 0.58

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.00 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{N,y,Rd} = 0.29 < 1.00$ (6.2.9.1.(2))
 $M_{z,Ed}/M_{N,z,Rd} = 0.02 < 1.00$ (6.2.9.1.(2))
 $(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.13 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,T,Rd} = 0.01 < 1.00$ (6.2.6-7)
 $V_{z,Ed}/V_{z,T,Rd} = 0.01 < 1.00$ (6.2.6-7)
 $\tau_{xy,Ed}/(\tau_{xy}/(\sqrt{3}) \cdot g_{M0}) = 0.00 < 1.00$ (6.2.6)
 $\tau_{xz,Ed}/(\tau_{xz}/(\sqrt{3}) \cdot g_{M0}) = 0.00 < 1.00$ (6.2.6)

Global stability check of member:

$\lambda_{y,Ed} = 25.86 < \lambda_{y,max} = 150.00$ $\lambda_{z,Ed} = 38.28 < \lambda_{z,max} = 150.00$ STABLE
 $M_{y,Ed,max}/M_{b,Rd} = 0.29 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.30 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) = 0.20 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/150.00 = 2.9 \text{ cm}$ Verified
Governing Load Case: 28 SLS:CHR/8=1*1.00 + 4*0.60 + 2*1.00 (1+2)*1.00+4*0.60
 $u_z = 0.6 \text{ cm} < u_{z,max} = L/150.00 = 2.9 \text{ cm}$ Verified
Governing Load Case: 28 SLS:CHR/8=1*1.00 + 4*0.60 + 2*1.00 (1+2)*1.00+4*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

Išvada: laikomoji galia pakankama ir įlinkis neviršija ribinio

Žemesnio lygio skersinė kraštinė sija

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

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 36

POINT: 1

COORDINATE: x = 0.00 L = 0.00

m

LOADS:

Governing Load Case: 6 ULS/2=1*1.35 + 3*1.30 + 2*0.91 1*1.35+3*1.30+2*0.91

MATERIAL:

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



SECTION PARAMETERS: SQUA 120x120x4

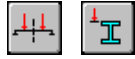
$h = 12.0 \text{ cm}$ $g_{M0} = 1.00$ $g_{M1} = 1.00$
 $b = 12.0 \text{ cm}$ $A_y = 9.07 \text{ cm}^2$ $A_z = 9.07 \text{ cm}^2$ $A_x = 18.15 \text{ cm}^2$
 $t_w = 0.4 \text{ cm}$ $I_y = 402.28 \text{ cm}^4$ $I_z = 402.28 \text{ cm}^4$ $I_x = 625.35 \text{ cm}^4$
 $t_f = 0.4 \text{ cm}$ $W_{ply} = 78.33 \text{ cm}^3$ $W_{plz} = 78.33 \text{ cm}^3$

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	55	116	0

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 2.67 \text{ kN}$	$M_{y,Ed} = -3.04 \text{ kN}\cdot\text{m}$	$M_{z,Ed} = 3.95 \text{ kN}\cdot\text{m}$	$V_{y,Ed} = 12.64 \text{ kN}$
$N_{c,Rd} = 644.25 \text{ kN}$	$M_{y,Ed,max} = -3.04 \text{ kN}\cdot\text{m}$	$M_{z,Ed,max} = -4.77 \text{ kN}\cdot\text{m}$	$V_{y,c,Rd} = 185.98 \text{ kN}$
$N_{b,Rd} = 555.76 \text{ kN}$	$M_{y,c,Rd} = 27.81 \text{ kN}\cdot\text{m}$	$M_{z,c,Rd} = 27.81 \text{ kN}\cdot\text{m}$	$V_{z,Ed} = 8.16 \text{ kN}$
	$MN_{y,Rd} = 27.81 \text{ kN}\cdot\text{m}$	$MN_{z,Rd} = 27.81 \text{ kN}\cdot\text{m}$	$V_{z,c,Rd} = 185.98 \text{ kN}$
	$M_{b,Rd} = 27.81 \text{ kN}\cdot\text{m}$		

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 923.85 \text{ kN}\cdot\text{m}$	Curve,LT - d	$XLT = 1.00$
$L_{cr,low} = 2.40 \text{ m}$	$\lambda_{m,LT} = 0.17$	$\phi_{LT} = 0.43$	$XLT,mod = 1.00$

BUCKLING PARAMETERS:



About y axis:

$L_y = 2.40 \text{ m}$	$\lambda_{m,y} = 0.67$
$L_{cr,y} = 2.40 \text{ m}$	$\chi_y = 0.86$
$\lambda_{my} = 50.98$	$\phi_{zy} = 0.60$



About z axis:

$L_z = 2.40 \text{ m}$	$\lambda_{m,z} = 0.67$
$L_{cr,z} = 2.40 \text{ m}$	$\chi_z = 0.86$
$\lambda_{mz} = 50.98$	$\phi_{zz} = 1.00$

VERIFICATION FORMULAS:

Section strength check:

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

$$M_{y,Ed}/M_{N,y,Rd} = 0.11 < 1.00 \quad (6.2.9.1.(2))$$

$$M_{z,Ed}/M_{N,z,Rd} = 0.14 < 1.00 \quad (6.2.9.1.(2))$$

$$(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.06 < 1.00 \quad (6.2.9.1.(6))$$

$$V_{y,Ed}/V_{y,c,Rd} = 0.07 < 1.00 \quad (6.2.6.(1))$$

$$V_{z,Ed}/V_{z,c,Rd} = 0.04 < 1.00 \quad (6.2.6.(1))$$

Global stability check of member:

$$\lambda_{m,y} = 50.98 < \lambda_{m,max} = 150.00 \quad \lambda_{m,z} = 50.98 < \lambda_{m,max} = 150.00 \quad \text{STABLE}$$

$$M_{y,Ed,max}/M_{b,Rd} = 0.11 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(\chi_y N_{Rk}/gM1) + \phi_{zy} M_{y,Ed,max}/(XLT M_{y,Rk}/gM1) + \phi_{zz} M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.22 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(\chi_z N_{Rk}/gM1) + \phi_{zy} M_{y,Ed,max}/(XLT M_{y,Rk}/gM1) + \phi_{zz} M_{z,Ed,max}/(M_{z,Rk}/gM1) = 0.24 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.1 \text{ cm} < u_{y,max} = L/150.00 = 1.6 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 28 SLS:CHR/8=1*1.00 + 4*0.60 + 2*1.00 (1+2)*1.00+4*0.60

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/150.00 = 1.6 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 30 SLS:QPR/10=1*1.00 1*1.00



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

Išvada: laikomoji galia pakankama ir įlinkis neviršija ribinio

Plieninių peraukštėjimo kolonų projektavimas

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

ANALYSIS TYPE: Member Verification

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	56	116	0

CODE GROUP:

MEMBER: 6 peraukštėjimo kolonos_6
0.00 L = 0.00 m

POINT: 1 COORDINATE: x =

LOADS:

Governing Load Case: 8 ULS/4=1*1.35 + 4*1.30 + 2*0.91 1*1.35+4*1.30+2*0.91

MATERIAL:

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



SECTION PARAMETERS: SQUA 80x80x4

h=8.0 cm	gM0=1.00	gM1=1.00	
b=8.0 cm	Ay=5.87 cm ²	Az=5.87 cm ²	Ax=11.75 cm ²
tw=0.4 cm	Iy=111.04 cm ⁴	Iz=111.04 cm ⁴	Ix=176.24 cm ⁴
tf=0.4 cm	Wply=33.07 cm ³	Wplz=33.07 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = 13.02 kN	My _{Ed} = 4.31 kN*m	Mz _{Ed} = -0.74 kN*m	Vy _{Ed} = -0.38 kN
N _{c,Rd} = 417.05 kN	My _{Ed,max} = 4.31 kN*m	Mz _{Ed,max} = 0.80 kN*m	Vy _{T,Rd} = 119.51 kN
N _{b,Rd} = 121.79 kN	My _{c,Rd} = 11.74 kN*m	Mz _{c,Rd} = 11.74 kN*m	Vz _{Ed} = -6.32 kN
	MN _{y,Rd} = 11.74 kN*m	MN _{z,Rd} = 11.74 kN*m	Vz _{T,Rd} = 119.51 kN
	Mb _{Rd} = 11.74 kN*m		Tt _{Ed} = 0.07 kN*m
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00	M _{cr} = 157.09 kN*m	Curve,LT - d	XLT = 1.00
L _{cr,upp} =4.05 m	L _{am,LT} = 0.27	fi,LT = 0.48	XLT,mod = 1.00

BUCKLING PARAMETERS:



About y axis:

Ly = 4.05 m	L _{am,y} = 1.72
L _{cr,y} = 4.05 m	Xy = 0.29
L _{amy} = 131.73	ky _y = 1.06



About z axis:

Lz = 4.05 m	L _{am,z} = 1.72
L _{cr,z} = 4.05 m	Xz = 0.29
L _{amz} = 131.73	ky _z = 0.68

VERIFICATION FORMULAS:

Section strength check:

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

$$M_{y,Ed}/M_{N,y,Rd} = 0.37 < 1.00 \quad (6.2.9.1.(2))$$

$$M_{z,Ed}/M_{N,z,Rd} = 0.06 < 1.00 \quad (6.2.9.1.(2))$$

$$(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.20 < 1.00 \quad (6.2.9.1.(6))$$

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

$$V_{z,Ed}/V_{z,T,Rd} = 0.05 < 1.00 \quad (6.2.6-7)$$

$$\tau_{ty,Ed}/(f_y/(\sqrt{3})gM_0) = 0.01 < 1.00 \quad (6.2.6)$$

$$\tau_{tz,Ed}/(f_y/(\sqrt{3})gM_0) = 0.01 < 1.00 \quad (6.2.6)$$

Global stability check of member:

$$\lambda_{b,y} = 131.73 < \lambda_{b,max} = 150.00 \quad \lambda_{b,z} = 131.73 < \lambda_{b,max} = 150.00 \quad \text{STABLE}$$

$$M_{y,Ed,max}/M_{b,Rd} = 0.37 < 1.00 \quad (6.3.2.1.(1))$$

$$N_{Ed}/(X_y N_{Rk}/gM_1) + k_{yy} M_{y,Ed,max}/(XLT M_{y,Rk}/gM_1) + k_{yz} M_{z,Ed,max}/(M_{z,Rk}/gM_1) = 0.54 < 1.00 \quad (6.3.3.(4))$$

$$N_{Ed}/(X_z N_{Rk}/gM_1) + k_{zy} M_{y,Ed,max}/(XLT M_{y,Rk}/gM_1) + k_{zz} M_{z,Ed,max}/(M_{z,Rk}/gM_1) = 0.43 < 1.00 \quad (6.3.3.(4))$$

LIMIT DISPLACEMENTS

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	57	116	0



Deflections (LOCAL SYSTEM):

$u_y = 0.1 \text{ cm} < u_{y \text{ max}} = L/150.00 = 2.7 \text{ cm}$

Verified

Governing Load Case: 28 SLS:CHR/8=1*1.00 + 4*0.60 + 2*1.00 (1+2)*1.00+4*0.60

$u_z = 0.5 \text{ cm} < u_{z \text{ max}} = L/150.00 = 2.7 \text{ cm}$

Verified

Governing Load Case: 28 SLS:CHR/8=1*1.00 + 4*0.60 + 2*1.00 (1+2)*1.00+4*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

Išvada: laikomoji galia pakankama ir horizontalusis poslinkis neviršija ribinio

Kampinių ilgų kolonų projektavimas

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

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 33

POINT: 1

COORDINATE: x = 0.49 L = 3.85

m

LOADS:

Governing Load Case: 15 ULS/11=1*1.35 + 2*1.30 1*1.35+2*1.30

MATERIAL:

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



SECTION PARAMETERS: SQUA 140x140x4

h=14.0 cm

gM0=1.00

gM1=1.00

b=14.0 cm

Ay=10.67 cm²

Az=10.67 cm²

Ax=21.35 cm²

tw=0.4 cm

Iy=651.62 cm⁴

Iz=651.62 cm⁴

Ix=1007.34 cm⁴

tf=0.4 cm

Wply=108.15 cm³

Wplz=108.15 cm³

INTERNAL FORCES AND CAPACITIES:

N,Ed = 20.91 kN

My,Ed = -0.27 kN*m

Mz,Ed = 0.79 kN*m

Vy,Ed = 0.57 kN

Nc,Rd = 757.85 kN

My,Ed,max = -3.81 kN*m

Mz,Ed,max = -1.51 kN*m

Vy,T,Rd = 217.90 kN

Nb,Rd = 525.82 kN

My,c,Rd = 38.39 kN*m

Mz,c,Rd = 38.39 kN*m

Vz,Ed = -0.87 kN

MN,y,Rd = 38.39 kN*m

MN,z,Rd = 38.39 kN*m

Vz,T,Rd = 217.90 kN

Mb,Rd = 38.39 kN*m

Tt,Ed = -0.12 kN*m

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00

Mcr = 897.06 kN*m

Curve,LT - d

XLT = 1.00

Lcr,low=4.05 m

Lam_LT = 0.21

fi,LT = 0.44

XLT,mod = 1.00

BUCKLING PARAMETERS:



About y axis:

Ly = 4.05 m

Lam_y = 0.96

Lcr,y = 4.05 m

Xy = 0.69

Lamy = 73.31

kyy = 1.02



About z axis:

Lz = 4.05 m

Lam_z = 0.96

Lcr,z = 4.05 m

Xz = 0.69

Lamz = 73.31

kyz = 0.62

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Lapas	Lapų	Laida
58	116	0

VERIFICATION FORMULAS:

Section strength check:

$$\begin{aligned} N_{Ed}/N_{c,Rd} &= 0.03 < 1.00 \quad (6.2.4.(1)) \\ M_{y,Ed}/M_{N,y,Rd} &= 0.01 < 1.00 \quad (6.2.9.1.(2)) \\ M_{z,Ed}/M_{N,z,Rd} &= 0.02 < 1.00 \quad (6.2.9.1.(2)) \\ (M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} &= 0.00 < 1.00 \quad (6.2.9.1.(6)) \\ V_{y,Ed}/V_{y,T,Rd} &= 0.00 < 1.00 \quad (6.2.6-7) \\ V_{z,Ed}/V_{z,T,Rd} &= 0.00 < 1.00 \quad (6.2.6-7) \\ \tau_{xy,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) &= 0.00 < 1.00 \quad (6.2.6) \\ \tau_{xz,Ed}/(f_y/(\sqrt{3} \cdot g_{M0})) &= 0.00 < 1.00 \quad (6.2.6) \end{aligned}$$

Global stability check of member:

$$\begin{aligned} \lambda_{y,Ed} &= 73.31 < \lambda_{y,max} = 120.00 \quad \lambda_{z,Ed} = 73.31 < \lambda_{z,max} = 120.00 \quad \text{STABLE} \\ M_{y,Ed,max}/M_{b,Rd} &= 0.10 < 1.00 \quad (6.3.2.1.(1)) \\ N_{Ed}/(X_y \cdot N_{Rk}/g_{M1}) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/g_{M1}) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) &= 0.17 < 1.00 \quad (6.3.3.(4)) \\ N_{Ed}/(X_z \cdot N_{Rk}/g_{M1}) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/g_{M1}) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/g_{M1}) &= 0.14 < 1.00 \quad (6.3.3.(4)) \end{aligned}$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$\begin{aligned} u_y &= 0.1 \text{ cm} < u_{y,max} = L/150.00 = 5.3 \text{ cm} \quad \text{Verified} \\ \text{Governing Load Case: } 28 \text{ SLS:CHR/8} &= 1 \cdot 1.00 + 4 \cdot 0.60 + 2 \cdot 1.00 \quad (1+2) \cdot 1.00 + 4 \cdot 0.60 \\ u_z &= 0.2 \text{ cm} < u_{z,max} = L/150.00 = 5.3 \text{ cm} \quad \text{Verified} \\ \text{Governing Load Case: } 29 \text{ SLS:QPR/9} &= 1 \cdot 1.00 + 2 \cdot 0.20 \quad 1 \cdot 1.00 + 2 \cdot 0.20 \end{aligned}$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

Išvada: laikomoji galia pakankama ir horizontalusis poslinkis neviršija ribinio

Plieninės vidurinės kolonos projektavimas

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

ANALYSIS TYPE: [Member Verification](#)

CODE GROUP:

MEMBER: 3 Kolona_3
m

POINT: 2

COORDINATE: x = 0.50 L = 1.93

LOADS:

Governing Load Case: 15 ULS/11=1*1.35 + 2*1.30 1*1.35+2*1.30

MATERIAL:

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



SECTION PARAMETERS: HEA 180

$$\begin{aligned} h &= 17.1 \text{ cm} & g_{M0} &= 1.00 & g_{M1} &= 1.00 \\ b &= 18.0 \text{ cm} & A_y &= 37.93 \text{ cm}^2 & A_z &= 14.47 \text{ cm}^2 & A_x &= 45.25 \text{ cm}^2 \\ t_w &= 0.6 \text{ cm} & I_y &= 2510.29 \text{ cm}^4 & I_z &= 924.60 \text{ cm}^4 & I_x &= 14.20 \text{ cm}^4 \\ t_f &= 0.9 \text{ cm} & W_{ply} &= 324.88 \text{ cm}^3 & W_{plz} &= 156.50 \text{ cm}^3 \end{aligned}$$

INTERNAL FORCES AND CAPACITIES:

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	59	116	0

$N_{Ed} = 284.30 \text{ kN}$
 $N_{c,Rd} = 1606.42 \text{ kN}$
 $N_{b,Rd} = 425.35 \text{ kN}$
 $M_{y,Ed} = -6.62 \text{ kN}\cdot\text{m}$
 $M_{y,Ed,max} = -13.25 \text{ kN}\cdot\text{m}$
 $M_{y,c,Rd} = 777.44 \text{ kN}$
 $M_{y,c,Rd} = 115.33 \text{ kN}\cdot\text{m}$
 $M_{N,y,Rd} = 108.12 \text{ kN}\cdot\text{m}$
 $M_{z,Ed} = 1.29 \text{ kN}\cdot\text{m}$
 $M_{z,Ed,max} = 2.58 \text{ kN}\cdot\text{m}$
 $M_{z,c,Rd} = 55.56 \text{ kN}\cdot\text{m}$
 $M_{N,z,Rd} = 55.56 \text{ kN}\cdot\text{m}$
 $V_{y,Ed} = -0.67 \text{ kN}$
 $M_{z,Ed,max} = 2.58 \text{ kN}\cdot\text{m}$
 $V_{z,Ed} = -3.44 \text{ kN}$
 $V_{z,c,Rd} = 296.60 \text{ kN}$
 Class of section = 2



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

$L_y = 3.85 \text{ m}$
 $L_{cr,y} = 5.78 \text{ m}$
 $\lambda_{my} = 77.54$
 $\lambda_{my} = 1.01$
 $\chi_y = 0.59$
 $\phi_{ky} = 0.36$



About z axis:

$L_z = 3.85 \text{ m}$
 $L_{cr,z} = 5.78 \text{ m}$
 $\lambda_{mz} = 127.76$
 $\lambda_{mz} = 1.67$
 $\chi_z = 0.26$
 $\phi_{kz} = 0.88$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.18 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{N,y,Rd} = 0.06 < 1.00$ (6.2.9.1.(2))
 $M_{z,Ed}/M_{N,z,Rd} = 0.02 < 1.00$ (6.2.9.1.(2))
 $(M_{y,Ed}/M_{N,y,Rd})^{2.00} + (M_{z,Ed}/M_{N,z,Rd})^{1.00} = 0.03 < 1.00$ (6.2.9.1.(6))
 $V_{y,Ed}/V_{y,c,Rd} = 0.00 < 1.00$ (6.2.6.(1))
 $V_{z,Ed}/V_{z,c,Rd} = 0.01 < 1.00$ (6.2.6.(1))

Global stability check of member:

$\lambda_{my} = 77.54 < \lambda_{my,max} = 144.00$ $\lambda_{mz} = 127.76 < \lambda_{mz,max} = 144.00$ STABLE
 $N_{Ed}/(\chi_y N_{Rk}/\gamma_{M1}) + \phi_{ky} M_{y,Ed,max}/(XLT M_{y,Rk}/\gamma_{M1}) + \phi_{kz} M_{z,Ed,max}/(M_{z,Rk}/\gamma_{M1}) = 0.45 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(\chi_z N_{Rk}/\gamma_{M1}) + \phi_{ky} M_{y,Ed,max}/(XLT M_{y,Rk}/\gamma_{M1}) + \phi_{kz} M_{z,Ed,max}/(M_{z,Rk}/\gamma_{M1}) = 0.75 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$v_x = 0.0 \text{ cm} < v_{x,max} = L/150.00 = 2.6 \text{ cm}$ Verified
Governing Load Case: 28 SLS:CHR/8=1*1.00 + 4*0.60 + 2*1.00 (1+2)*1.00+4*0.60
 $v_y = 0.0 \text{ cm} < v_{y,max} = L/150.00 = 2.6 \text{ cm}$ Verified
Governing Load Case: 29 SLS:QPR/9=1*1.00 + 2*0.20 1*1.00+2*0.20

Section OK !!!

Išvada: laikomoji galia pakankama

Plieninės sijos perdangoms atremti projektavimas

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

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 47 Sijos_47

POINT: 2

COORDINATE: x = 0.50 L = 1.75

m

LOADS:

Governing Load Case: 17 ULS/13=1*1.35 + 4*0.78 + 2*1.30 1*1.35+4*0.78+2*1.30

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	60	116	0

MATERIAL:

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



SECTION PARAMETERS: HEA 240

$h=23.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=24.0 \text{ cm}$	$A_y=64.54 \text{ cm}^2$	$A_z=25.18 \text{ cm}^2$	$A_x=76.84 \text{ cm}^2$
$t_w=0.8 \text{ cm}$	$I_y=7763.18 \text{ cm}^4$	$I_z=2768.81 \text{ cm}^4$	$I_x=38.20 \text{ cm}^4$
$t_f=1.2 \text{ cm}$	$W_{ply}=744.68 \text{ cm}^3$	$W_{plz}=351.70 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 1.38 \text{ kN}$	$M_{y,Ed} = 119.76 \text{ kN}\cdot\text{m}$	
$N_{c,Rd} = 2727.66 \text{ kN}$	$M_{y,Ed,max} = 119.76 \text{ kN}\cdot\text{m}$	
$N_{b,Rd} = 1869.41 \text{ kN}$	$M_{y,c,Rd} = 264.36 \text{ kN}\cdot\text{m}$	$V_{z,Ed} = 2.50 \text{ kN}$
	$M_{N,y,Rd} = 264.36 \text{ kN}\cdot\text{m}$	$V_{z,c,Rd} = 516.00 \text{ kN}$
	$M_{b,Rd} = 232.50 \text{ kN}\cdot\text{m}$	
		Class of section = 2



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 493.18 \text{ kN}\cdot\text{m}$	Curve,LT - b	$X_{LT} = 0.85$
$L_{cr,upp}=3.50 \text{ m}$	$\lambda_{m_LT} = 0.73$	$\phi_{i,LT} = 0.76$	$X_{LT,mod} = 0.88$

BUCKLING PARAMETERS:



About y axis:

$L_y = 3.50 \text{ m}$	$\lambda_{m_y} = 0.46$
$L_{cr,y} = 3.50 \text{ m}$	$X_y = 0.90$
$\lambda_{my} = 34.82$	$k_{yy} = 1.00$



About z axis:

$L_z = 3.50 \text{ m}$	$\lambda_{m_z} = 0.76$
$L_{cr,z} = 3.50 \text{ m}$	$X_z = 0.69$
$\lambda_{mz} = 58.30$	$k_{zy} = 0.51$

VERIFICATION FORMULAS:

Section strength check:

$N_{Ed}/N_{c,Rd} = 0.00 < 1.00$ (6.2.4.(1))
 $M_{y,Ed}/M_{y,c,Rd} = 0.45 < 1.00$ (6.2.5.(1))
 $V_{z,Ed}/V_{z,c,Rd} = 0.00 < 1.00$ (6.2.6.(1))

Global stability check of member:

$\lambda_{m,y} = 34.82 < \lambda_{m,max} = 150.00$ $\lambda_{m,z} = 58.30 < \lambda_{m,max} = 150.00$ STABLE
 $M_{y,Ed,max}/M_{b,Rd} = 0.52 < 1.00$ (6.3.2.1.(1))
 $N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{Rk}/gM1) = 0.52 < 1.00$ (6.3.3.(4))
 $N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(X_{LT} \cdot M_{Rk}/gM1) = 0.27 < 1.00$ (6.3.3.(4))

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$u_y = 0.0 \text{ cm} < u_{y,max} = L/150.00 = 2.3 \text{ cm}$ Verified
Governing Load Case: 28 SLS:CHR/8=1*1.00 + 4*0.60 + 2*1.00 (1+2)*1.00+4*0.60
 $u_z = 0.7 \text{ cm} < u_{z,max} = L/150.00 = 2.3 \text{ cm}$ Verified
Governing Load Case: 28 SLS:CHR/8=1*1.00 + 4*0.60 + 2*1.00 (1+2)*1.00+4*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

Išvada: laikomoji galia pakankama

1.6.1. Rėmo mazgų projektavimas

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	61	116	0

Plieninės kolonos su plienine sija mazgo skaičiavimas



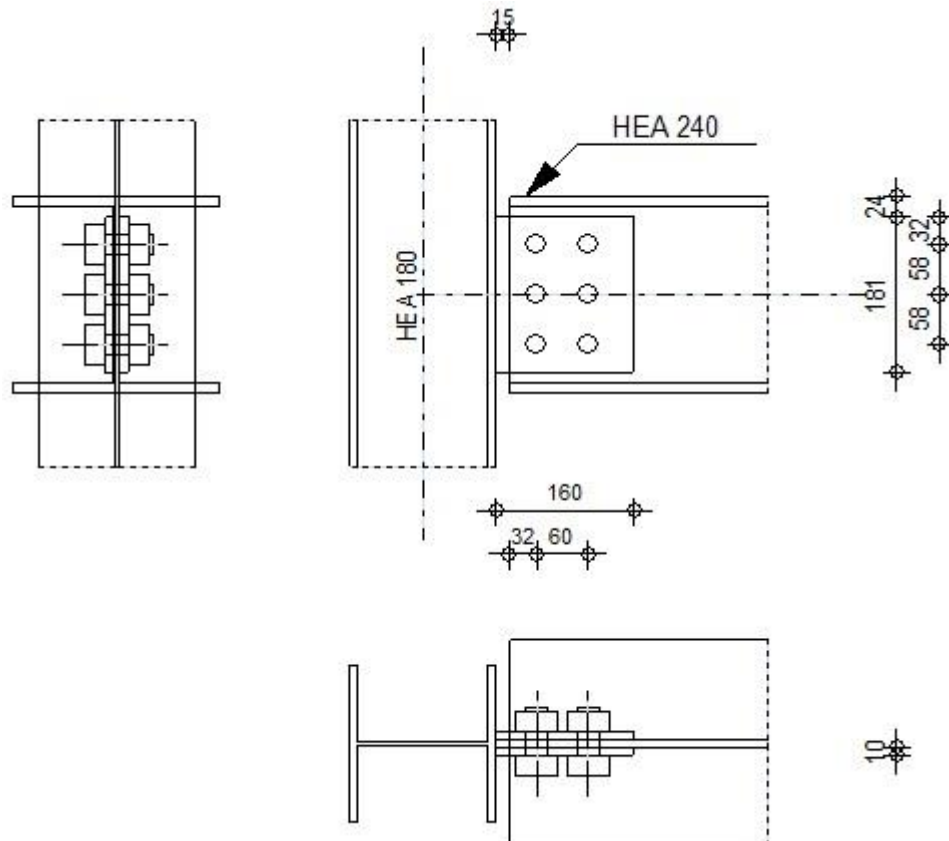
Robot Structural Analysis Professional 2023

Calculation of the beam-column (flange) connection

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



Ratio
0.91



GENERAL

Connection no.: 1
Connection name: Beam-column (flange)
Structure node: 18
Structure members: 3, 47

GEOMETRY

COLUMN

Section: HEA 180
Member no.: 3
 $\alpha = -90.0$ [Deg] Inclination angle
 $h_c = 171$ [mm] Height of column section
 $b_{fc} = 180$ [mm] Width of column section
 $t_{wc} = 6$ [mm] Thickness of the web of column section
 $t_{fc} = 10$ [mm] Thickness of the flange of column section

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	62	116	0



Section: HEA 180
 $r_c = 15$ [mm] Radius of column section fillet
 $A_c = 45.25$ [cm²] Cross-sectional area of a column
 $I_{yc} = 2510.29$ [cm⁴] Moment of inertia of the column section
Material: S 355
 $f_{yc} = 355.00$ [MPa] Design resistance
 $f_{uc} = 470.00$ [MPa] Tensile resistance

BEAM

Section: HEA 240
Member no.: 47
 $\alpha = 0.0$ [Deg] Inclination angle
 $h_b = 230$ [mm] Height of beam section
 $b_b = 240$ [mm] Width of beam section
 $t_{wb} = 8$ [mm] Thickness of the web of beam section
 $t_{fb} = 12$ [mm] Thickness of the flange of beam section
 $r_b = 21$ [mm] Radius of beam section fillet
 $A_b = 76.84$ [cm²] Cross-sectional area of a beam
 $I_{yb} = 7763.18$ [cm⁴] Moment of inertia of the beam section
Material: S 355
 $f_{yb} = 355.00$ [MPa] Design resistance
 $f_{ub} = 470.00$ [MPa] Tensile resistance

PLATE

Type: bilateral
 $l_p = 160$ [mm] Plate length
 $h_p = 181$ [mm] Plate height
 $t_p = 10$ [mm] Plate thickness
Material: S 355
 $f_{yp} = 355.00$ [MPa] Design resistance
 $f_{up} = 470.00$ [MPa] Tensile resistance

BOLTS

BOLTS CONNECTING BEAM WITH PLATE

The shear plane passes through the UNTHREADED portion of the bolt.

Class = 8.8 Bolt class
 $d = 24$ [mm] Bolt diameter
 $d_0 = 26$ [mm] Bolt opening diameter
 $A_s = 3.53$ [cm²] Effective section area of a bolt
 $A_v = 4.52$ [cm²] Area of bolt section
 $f_{ub} = 800.00$ [MPa] Tensile resistance
 $k = 2$ Number of bolt columns
 $w = 3$ Number of bolt rows
 $e_1 = 32$ [mm] Level of first bolt
 $p_2 = 60$ [mm] Horizontal spacing
 $p_1 = 58$ [mm] Vertical spacing

WELDS

$a_{cp} = 7$ [mm] Fillet welds connecting plate with column

MATERIAL FACTORS

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	63	116	0



$\gamma_{M0} =$	1.00	Partial safety factor	[2.2]
$\gamma_{M2} =$	1.25	Partial safety factor	[2.2]

LOADS

Case: 17: ULS/13=1*1.35 + 4*0.78 + 2*1.30 1*1.35+4*0.78+2*1.30

$N_{b,Ed} =$	-1.38	[kN]	Axial force
$V_{b,Ed} =$	141.87	[kN]	Shear force
$M_{b,Ed} =$	0.00	[kN*m]	Bending moment

RESULTS

BOLTS CONNECTING BEAM WITH PLATE

BOLT CAPACITIES

$F_{v,Rd} = 347.44$ [kN] Shear bolt resistance in the unthreaded portion of a bolt $F_{v,Rd} = 0.6 \cdot f_{ub} \cdot A_v \cdot m / \gamma_{M2}$

Bolt bearing on the beam

Direction x

$k_{1x} = 1.42$ Coefficient for calculation of $F_{b,Rd}$ $k_{1x} = \min[2.8 \cdot (e_1/d_0) - 1.7, 1.4 \cdot (p_1/d_0) - 1.7, 2.5]$

$k_{1x} > 0.0$ $1.42 > 0.00$ verified

$\alpha_{bx} = 0.41$ Coefficient for calculation of $F_{b,Rd}$ $\alpha_{bx} = \min[e_2/(3 \cdot d_0), p_2/(3 \cdot d_0) - 0.25, f_{ub}/f_u, 1]$

$\alpha_{bx} > 0.0$ $0.41 > 0.00$ verified

$F_{b,Rd1x} = 39.51$ [kN] Bearing resistance of a single bolt $F_{b,Rd1x} = k_{1x} \cdot \alpha_{bx} \cdot f_u \cdot d \cdot t_i / \gamma_{M2}$

Direction z

$k_{1z} = 1.53$ Coefficient for calculation of $F_{b,Rd}$ $k_{1z} = \min[2.8 \cdot (e_2/d_0) - 1.7, 1.4 \cdot (p_2/d_0) - 1.7, 2.5]$

$k_{1z} > 0.0$ $1.53 > 0.00$ verified

$\alpha_{bz} = 0.49$ Coefficient for calculation of $F_{b,Rd}$ $\alpha_{bz} = \min[e_1/(3 \cdot d_0), p_1/(3 \cdot d_0) - 0.25, f_{ub}/f_u, 1]$

$\alpha_{bz} > 0.0$ $0.49 > 0.00$ verified

$F_{b,Rd1z} = 51.14$ [kN] Bearing resistance of a single bolt $F_{b,Rd1z} = k_{1z} \cdot \alpha_{bz} \cdot f_u \cdot d \cdot t_i / \gamma_{M2}$

Bolt bearing on the plate

Direction x

$k_{1x} = 1.42$ Coefficient for calculation of $F_{b,Rd}$ $k_{1x} = \min[2.8 \cdot (e_1/d_0) - 1.7, 1.4 \cdot (p_1/d_0) - 1.7, 2.5]$

$k_{1x} > 0.0$ $1.42 > 0.00$ verified

$\alpha_{bx} = 0.52$ Coefficient for calculation of $F_{b,Rd}$ $\alpha_{bx} = \min[e_2/(3 \cdot d_0), p_2/(3 \cdot d_0) - 0.25, f_{ub}/f_u, 1]$

$\alpha_{bx} > 0.0$ $0.52 > 0.00$ verified

$F_{b,Rd2x} = 133.36$ [kN] Bearing resistance of a single bolt $F_{b,Rd2x} = k_{1x} \cdot \alpha_{bx} \cdot f_u \cdot d \cdot t_i / \gamma_{M2}$

Direction z

$k_{1z} = 1.53$ Coefficient for calculation of $F_{b,Rd}$ $k_{1z} = \min[2.8 \cdot (e_2/d_0) - 1.7, 1.4 \cdot (p_2/d_0) - 1.7, 2.5]$

$k_{1z} > 0.0$ $1.53 > 0.00$ verified

$\alpha_{bz} = 0.42$ Coefficient for calculation of $F_{b,Rd}$ $\alpha_{bz} = \min[e_1/(3 \cdot d_0), p_1/(3 \cdot d_0) - 0.25, f_{ub}/f_u, 1]$

$\alpha_{bz} > 0.0$ $0.42 > 0.00$ verified

$F_{b,Rd2z} = 115.11$ [kN] Bearing resistance of a single bolt $F_{b,Rd2z} = k_{1z} \cdot \alpha_{bz} \cdot f_u \cdot d \cdot t_i / \gamma_{M2}$

FORCES ACTING ON BOLTS IN THE PLATE - BEAM CONNECTION

Bolt shear

$e = 82$ [mm] Distance between centroid of a bolt group and center of column flange

$M_0 = 11.6$ [kN*m] Real bending moment $M_0 = M_{b,Ed} + V_{b,Ed} \cdot e$

$F_{Nx} = 0.23$ [kN] Component force in a bolt due to influence of the longitudinal force $F_{Nx} = |N_{b,Ed}|/n$

$F_{Vz} = 23.6$ [kN] Component force in a bolt due to influence of the shear force $F_{Vz} = |V_{b,Ed}|/n$

$F_{Mx} = 35.6$ [kN] Component force in a bolt due to influence of the moment on the x direction $F_{Mx} = |M_0| \cdot z_i / \sum (x_i^2 + z_i^2)$

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	64	116	0

**Bolt shear**

$e =$	82 [mm]	Distance between centroid of a bolt group and center of column flange	
$F_{Mz} =$	18.45 [kN]	Component force in a bolt due to influence of the moment on the z direction	$F_{Mz} = M_0 \cdot x_i / \sum (x_i^2 + z_i^2)$
$F_{x,Ed} =$	35.91 [kN]	Design total force in a bolt on the direction x	$F_{x,Ed} = F_{Nx} + F_{Mx}$
$F_{z,Ed} =$	42.10 [kN]	Design total force in a bolt on the direction z	$F_{z,Ed} = F_{Vz} + F_{Mz}$
$F_{Ed} =$	55.33 [kN]	Resultant shear force in a bolt	$F_{Ed} = \sqrt{F_{x,Ed}^2 + F_{z,Ed}^2}$
$F_{Rdx} =$	39.51 [kN]	Effective design capacity of a bolt on the direction x	$F_{Rdx} = \min(F_{bRd1x}, F_{bRd2x})$
$F_{Rdz} =$	51.14 [kN]	Effective design capacity of a bolt on the direction z	$F_{Rdz} = \min(F_{bRd1z}, F_{bRd2z})$
$ F_{x,Ed} \leq F_{Rdx}$	35.91 < 39.51	verified	(0.91)
$ F_{z,Ed} \leq F_{Rdz}$	42.10 < 51.14	verified	(0.82)
$F_{Ed} \leq F_{v,Rd}$	55.33 < 347.44	verified	(0.16)

VERIFICATION OF THE SECTION DUE TO BLOCK TEARING (SHEAR FORCE)**PLATE**

$A_{nt} =$	6.80 [cm ²]	Net area of the section in tension	
$A_{nv} =$	8.35 [cm ²]	Area of the section in shear	
$V_{effRd} =$	298.98 [kN]	Design capacity of a section weakened by openings	$V_{effRd} = 0.5 \cdot f_u \cdot A_{nt} / \gamma_{M2} + (1/\sqrt{3}) \cdot f_y \cdot A_{nv} / \gamma_{M0}$
$ 0.5 \cdot V_{b,Ed} \leq V_{effRd}$	70.94 < 298.98	verified	(0.24)

BEAM

$A_{nt} =$	3.97 [cm ²]	Net area of the section in tension	
$A_{nv} =$	8.10 [cm ²]	Area of the section in shear	
$V_{effRd} =$	240.75 [kN]	Design capacity of a section weakened by openings	$V_{effRd} = 0.5 \cdot f_u \cdot A_{nt} / \gamma_{M2} + (1/\sqrt{3}) \cdot f_y \cdot A_{nv} / \gamma_{M0}$
$ V_{b,Ed} \leq V_{effRd}$	141.87 < 240.75	verified	(0.59)

VERIFICATION OF A PLATE WEAKENED BY OPENINGS

$A_t =$	9.02 [cm ²]	Area of tension zone of the gross section	
$A_{t,net} =$	6.42 [cm ²]	Net area of the section in tension	
$0.9 \cdot (A_{t,net} / A_t) \geq (f_y \cdot \gamma_{M2}) / (f_u \cdot \gamma_{M0})$	0.64 < 0.94		
$W_{net} =$	48.35 [cm ³]	Elastic section modulus	
$M_{c,Rdnet} =$	17.17 [kN*m]	Design resistance of the section for bending	$M_{c,Rdnet} = W_{net} \cdot f_{yp} / \gamma_{M0}$
$ M_0 \leq M_{c,Rdnet}$	5.80 < 17.17	verified	(0.34)
$A_v =$	18.10 [cm ²]	Effective section area for shear	$A_v = h_p \cdot t_p$
$A_{v,net} =$	10.30 [cm ²]	Net area of a section effective for shear	$A_{v,net} = A_v - n_v \cdot d_0$
$V_{pl,Rd} =$	211.11 [kN]	Design plastic resistance for shear	$V_{pl,Rd} = (A_{v,net} \cdot f_y) / (\sqrt{3} \cdot \gamma_{M0})$
$ 0.5 \cdot V_{b,Ed} \leq V_{pl,Rd}$	70.94 < 211.11	verified	(0.34)

VERIFICATION OF A BEAM SECTION WEAKENED BY OPENINGS

$A_t =$	8.59 [cm ²]	Area of tension zone of the gross section	
$A_{t,net} =$	4.69 [cm ²]	Net area of the section in tension	
$0.9 \cdot (A_{t,net} / A_t) \geq (f_y \cdot \gamma_{M2}) / (f_u \cdot \gamma_{M0})$	0.49 < 0.94		
$W_{net} =$	58.49 [cm ³]	Elastic section modulus	
$M_{c,Rdnet} =$	20.76 [kN*m]	Design resistance of the section for bending	$M_{c,Rdnet} = W_{net} \cdot f_{yp} / \gamma_{M0}$
$ M_0 \leq M_{c,Rdnet}$	11.60 < 20.76	verified	(0.56)
$A_v =$	17.25 [cm ²]	Effective section area for shear	
$A_{v,net} =$	11.40 [cm ²]	Net area of a section effective for shear	$A_{v,net} = A_v - n_v \cdot d_0$

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	65	116	0



$A_v =$	17.25	[cm ²]	Effective section area for shear	
$V_{pl,Rd} =$	233.65	[kN]	Design plastic resistance for shear	$V_{pl,Rd} = (A_{v,net} * f_y) / (\sqrt{3} * \gamma_{M0})$
$V_{b,Ed} \leq V_{pl,Rd}$	141.87	<	233.65	verified (0.61)

WELD RESISTANCE

FILLET WELDS CONNECTING PLATE WITH COLUMN

$A_w =$	12.67	[cm ²]	Weld area	$A_w = h_p * a_{gp}$
$\sigma =$	142.36	[MPa]	Normal stress in a weld	$\sigma = 0.5 * [N_{b,Ed} / A_s + M_o / W_{yw}]$
$\sigma_{\perp} =$	100.66	[MPa]	Normal perpendicular stress in the weld	$\sigma_{\perp} = \sigma / \sqrt{2}$
$ \sigma_{\perp} \leq 0.9 * f_{u2} / \gamma_{M2}$	100.66	<	338.40	verified (0.30)
$\tau_{\perp} =$	100.66	[MPa]	Perpendicular tangent stress	$\tau_{\perp} = \sigma_{\perp}$
$\tau_{\parallel} =$	55.99	[MPa]	Parallel tangent stress	$\tau_{\parallel} = 0.25 * V_{b,Ed} / A_w$
$\beta_w =$	0.90		Correlation coefficient	[Table 4.1]
$\sqrt{[\sigma_{\perp}^2 + 3 * (\tau_{\parallel}^2 + \tau_{\perp}^2)]} \leq f_{u2} / (\beta_w * \gamma_{M2})$	223.46	<	417.78	verified (0.53)

REMARKS

Distance between plate horizontal edge and beam upper flange is too small
Length of plate connecting the beam is too large

25 [mm] < 33 [mm]
181 [mm] > 164 [mm]

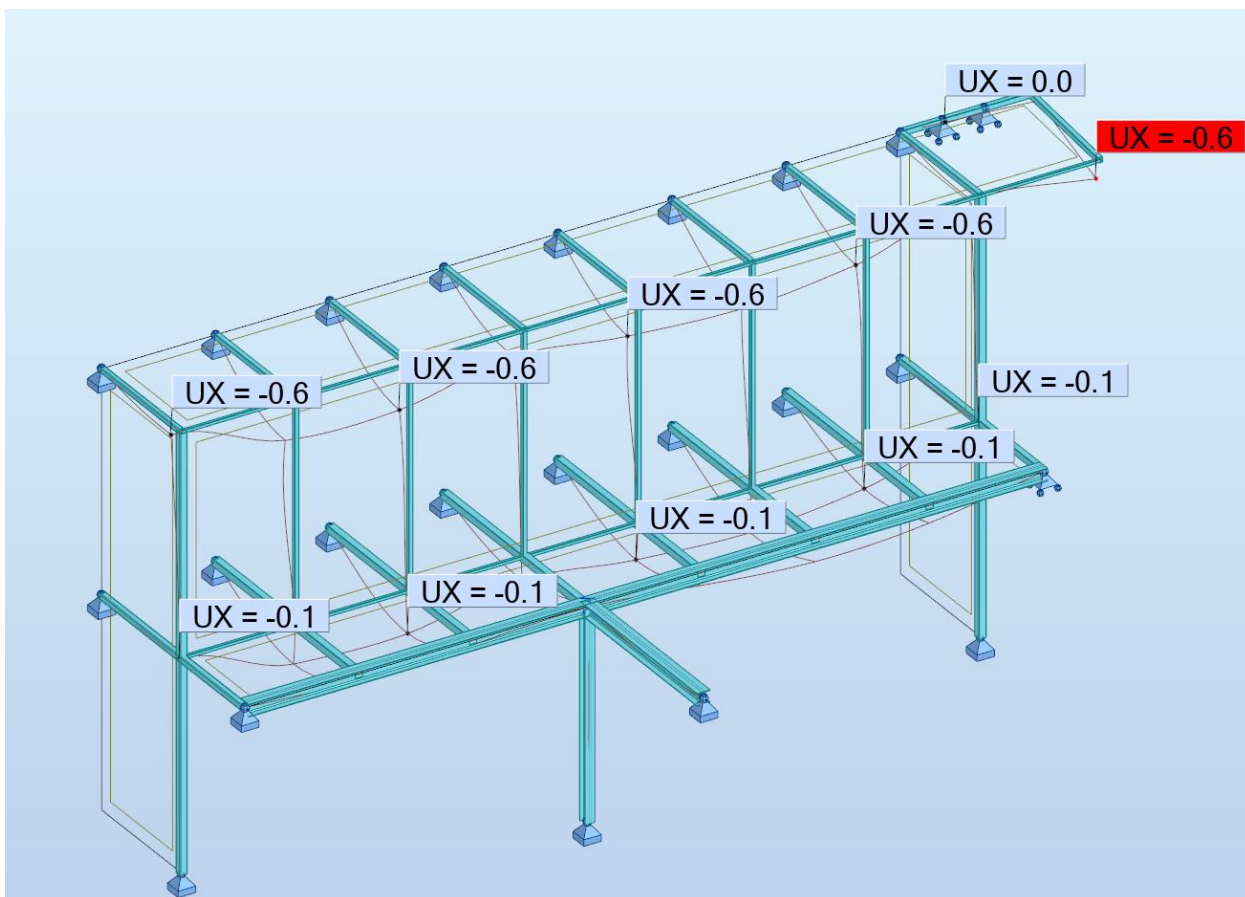
Connection conforms to the code	Ratio	0.91
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Išvada: laikomoji galia pakankama

1.6.2. Užstiklinto medinio rėmo tinkamumo ribinis būvis

Tikrinamas stogelio horizontalus poslinkis:

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	66	116	0

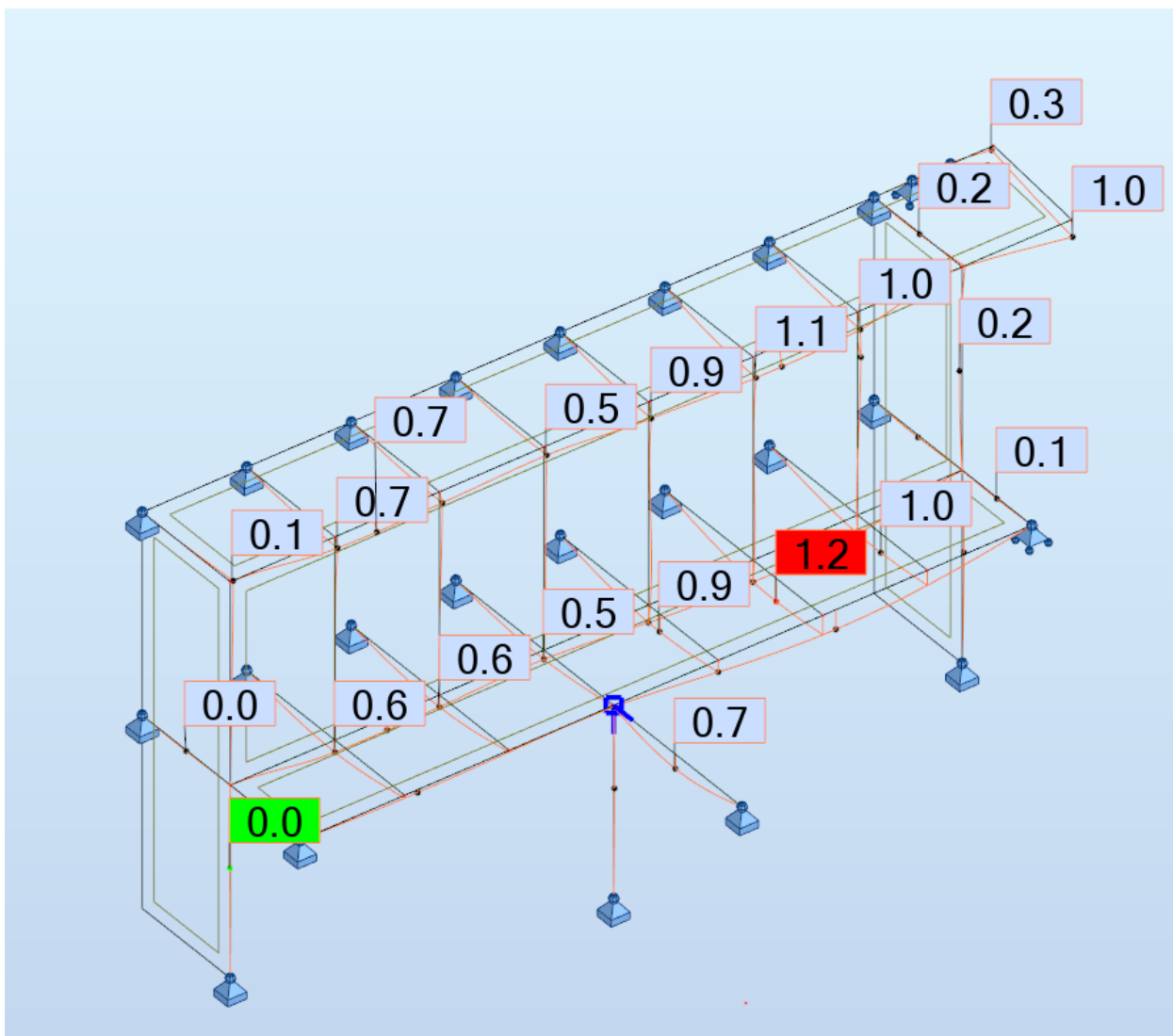


$$u_x = 0,6cm \leq L/700 = 7,9/700 = 1,1cm.$$

Išvada: sąlyga tenkinama

Tikrinamas sijų vertikalus įlinkis:

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	67	116	0



Plieninės sijos perdangoms atremti vertikalus įlinkis:

$$u_z = 0,7cm \leq L/150 = 3,5/150 = 2,3cm.$$

Stiklintos dalies gėminės sijos vertikalus įlinkis:

$$u_z = 1,0cm \leq L/200 = 2,2/200 = 1,1cm.$$

Stiklintos dalies viršutinės sijos vertikalus įlinkis:

$$u_z = 1,1cm \leq L/200 = 2,4/200 = 1,2cm.$$

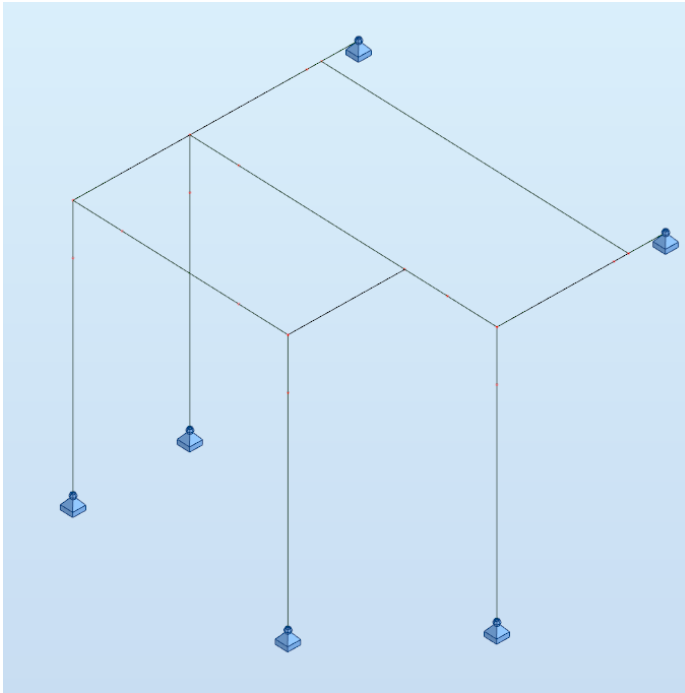
Išvada: sąlyga tenkinama

1.7. Metalinio stogelio tarp ašių B-C už 1 ašies skaičiavimas

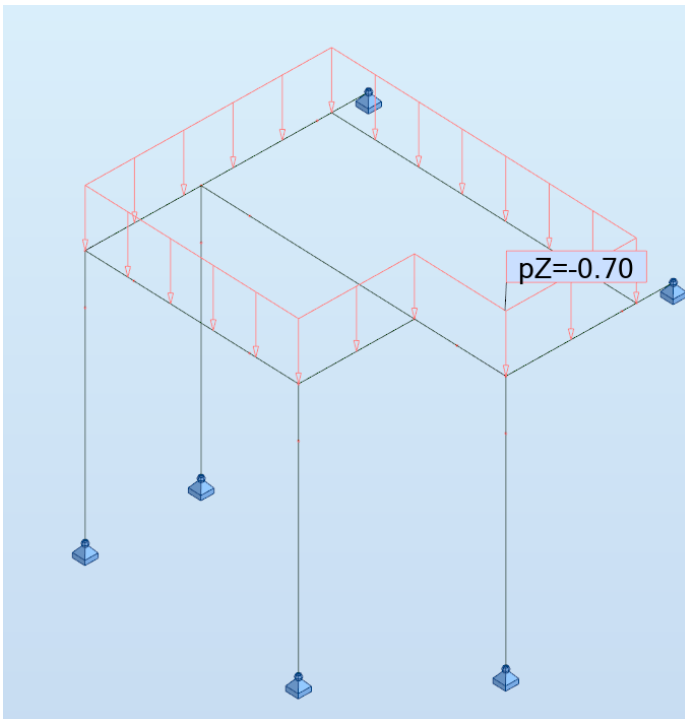
Skaičiuojamas išorinis metalinis stogelis. Laikančios kolonos ir sijos iš dėžinių skerspjūvių, plieno klasė S355J2H. Plieninės kolonos prie pamato jungiamos lanksčiai. Sijos su kolonomis jungiamos standžiai.

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	68	116	0

Stogelio skaičiuotinė schema:

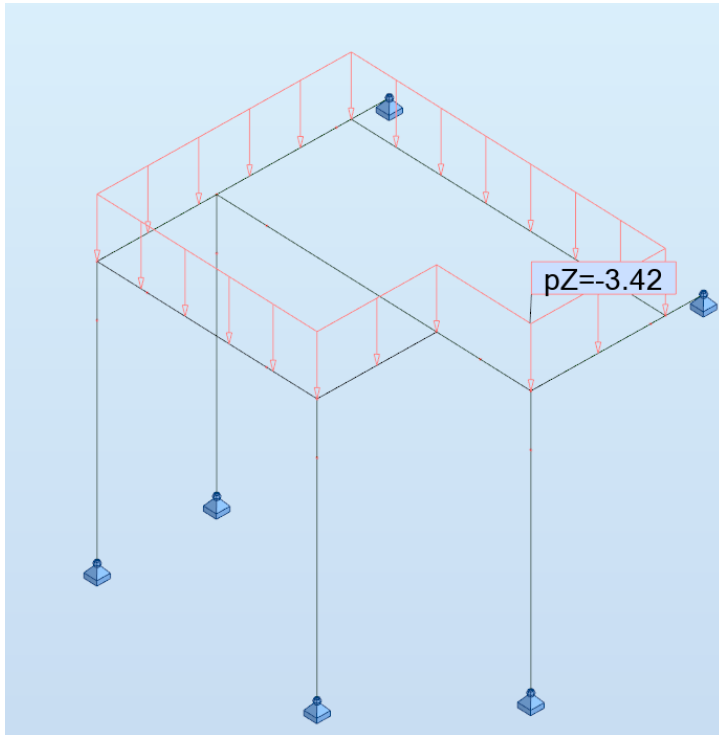


Nuolatinė apkrova:

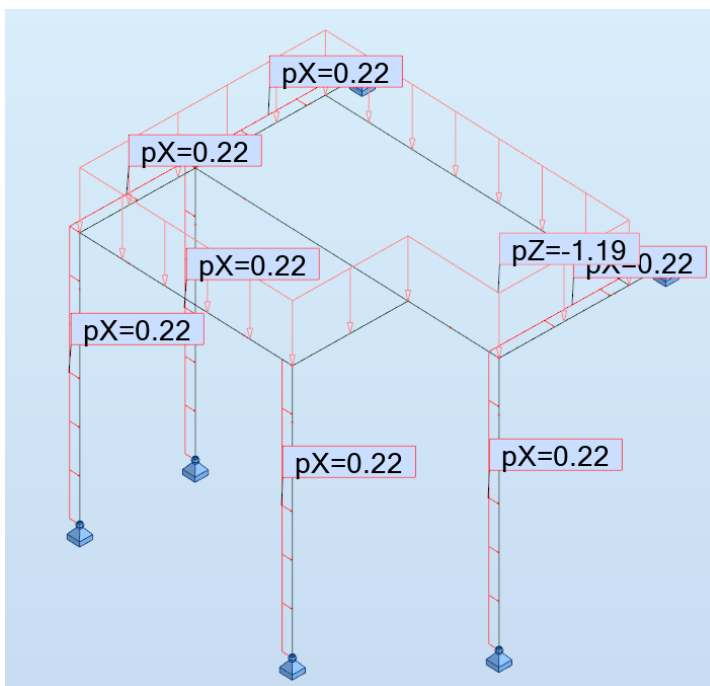


IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	69	116	0

Sniego apkrova:

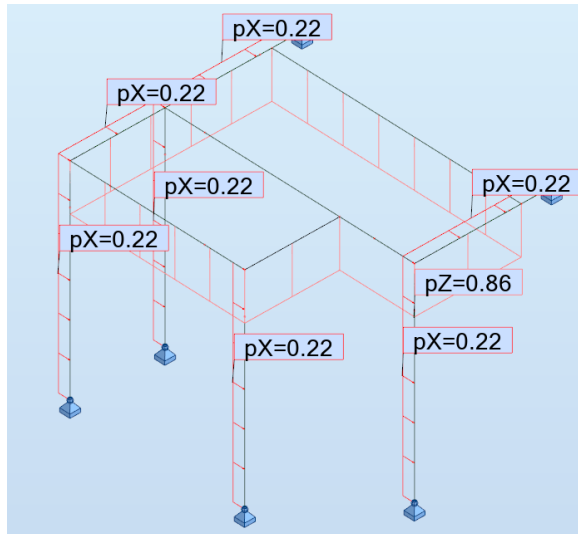


Vėjo apkrova slegianti stogelį:



Vėjo apkrova traukianti stogelį:

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	70	116	0



Stogelio kolonos projektavimas

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

CODE GROUP:

MEMBER: 7 Kolona_7
m

POINT: 3

COORDINATE: x = 1.00 L = 4.10

LOADS:

Governing Load Case: 16 ULS/11=1*1.35 + 4*0.78 + 2*1.30 1*1.35+4*0.78+2*1.30

MATERIAL:

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



SECTION PARAMETERS: SQUA 140x140x4

h=14.0 cm	gM0=1.00	gM1=1.00	
b=14.0 cm	Ay=10.67 cm ²	Az=10.67 cm ²	Ax=21.35 cm ²
tw=0.4 cm	Iy=651.62 cm ⁴	Iz=651.62 cm ⁴	Ix=1007.34 cm ⁴
tf=0.4 cm	Wply=108.15 cm ³	Wplz=108.15 cm ³	

INTERNAL FORCES AND CAPACITIES:

N _{Ed} = 33.94 kN	My _{Ed} = -8.19 kN*m	Mz _{Ed} = -0.58 kN*m	Vy _{Ed} = 0.14 kN
N _{c,Rd} = 757.85 kN	My _{Ed,max} = -8.19 kN*m	Mz _{Ed,max} = -0.58 kN*m	Vy _{c,Rd} = 218.77 kN
Nb _{Rd} = 178.25 kN	My _{c,Rd} = 38.39 kN*m	Mz _{c,Rd} = 38.39 kN*m	Vz _{Ed} = -2.35 kN
	MN _{y,Rd} = 38.39 kN*m	MN _{z,Rd} = 38.39 kN*m	Vz _{c,Rd} = 218.77 kN
			Class of section = 1



LATERAL BUCKLING PARAMETERS:

BUCKLING PARAMETERS:



About y axis:

Ly = 4.10 m	Lam _y = 1.94
Lcr,y = 8.20 m	Xy = 0.24
Lamy = 148.42	kyy = 0.82



About z axis:

Lz = 4.10 m	Lam _z = 1.94
Lcr,z = 8.20 m	Xz = 0.24
Lamz = 148.42	kyz = 0.53

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Lapas	Lapų	Laida
71	116	0

VERIFICATION FORMULAS:

Section strength check:

$$\begin{aligned} N_{Ed}/N_{c,Rd} &= 0.04 < 1.00 \quad (6.2.4.(1)) \\ M_{y,Ed}/M_{N,y,Rd} &= 0.21 < 1.00 \quad (6.2.9.1.(2)) \\ M_{z,Ed}/M_{N,z,Rd} &= 0.02 < 1.00 \quad (6.2.9.1.(2)) \\ (M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} &= 0.08 < 1.00 \quad (6.2.9.1.(6)) \\ V_{y,Ed}/V_{y,c,Rd} &= 0.00 < 1.00 \quad (6.2.6.(1)) \\ V_{z,Ed}/V_{z,c,Rd} &= 0.01 < 1.00 \quad (6.2.6.(1)) \end{aligned}$$

Global stability check of member:

$$\begin{aligned} \Lambda_{y} &= 148.42 < \Lambda_{max} = 150.00 \quad \Lambda_{z} = 148.42 < \Lambda_{max} = 150.00 \quad \text{STABLE} \\ N_{Ed}/(X_y \cdot N_{Rk}/gM1) + k_{yy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{yz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) &= 0.37 < 1.00 \quad (6.3.3.(4)) \\ N_{Ed}/(X_z \cdot N_{Rk}/gM1) + k_{zy} \cdot M_{y,Ed,max}/(XLT \cdot M_{y,Rk}/gM1) + k_{zz} \cdot M_{z,Ed,max}/(M_{z,Rk}/gM1) &= 0.32 < 1.00 \quad (6.3.3.(4)) \end{aligned}$$

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM): Not analyzed



Displacements (GLOBAL SYSTEM):

$$v_x = 0.4 \text{ cm} < v_{x,max} = L/150.00 = 2.7 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 32 SLS:CHR/5=1*1.00 + 5*1.00 (1+5)*1.00

$$v_y = 0.0 \text{ cm} < v_{y,max} = L/150.00 = 2.7 \text{ cm} \quad \text{Verified}$$

Governing Load Case: 32 SLS:CHR/5=1*1.00 + 5*1.00 (1+5)*1.00

Section OK !!!

Išvada: sąlyga tenkinama

Pagrindinės stogelio sijos projektavimas

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

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 9 Sija_9

POINT: 2

COORDINATE: x = 0.43 L = 2.15

m

LOADS:

Governing Load Case: 16 ULS/11=1*1.35 + 4*0.78 + 2*1.30 1*1.35+4*0.78+2*1.30

MATERIAL:

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



SECTION PARAMETERS: RECT 200x100x5

h=20.0 cm	gM0=1.00	gM1=1.00	
b=10.0 cm	Ay=9.45 cm ²	Az=18.91 cm ²	Ax=28.36 cm ²
tw=0.5 cm	Iy=1459.25 cm ⁴	Iz=496.94 cm ⁴	Ix=1185.78 cm ⁴
tf=0.5 cm	Wply=181.37 cm ³	Wplz=112.09 cm ³	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 1.87 \text{ kN}$	$M_{y,Ed} = 20.35 \text{ kN*m}$	$M_{z,Ed} = 0.16 \text{ kN*m}$	$V_{y,Ed} = 0.17 \text{ kN}$
$N_{c,Rd} = 1006.78 \text{ kN}$	$M_{y,Ed,max} = 20.35 \text{ kN*m}$	$M_{z,Ed,max} = -1.55 \text{ kN*m}$	$V_{y,T,Rd} = 185.65 \text{ kN}$
$N_{b,Rd} = 349.32 \text{ kN}$	$M_{y,c,Rd} = 64.39 \text{ kN*m}$	$M_{z,c,Rd} = 39.79 \text{ kN*m}$	$V_{z,Ed} = 1.27 \text{ kN}$
	$M_{N,y,Rd} = 64.39 \text{ kN*m}$	$M_{N,z,Rd} = 39.79 \text{ kN*m}$	$V_{z,T,Rd} = 371.30 \text{ kN}$
	$M_{b,Rd} = 64.39 \text{ kN*m}$		$T_{t,Ed} = 1.59 \text{ kN*m}$

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	72	116	0

Class of section = 1



LATERAL BUCKLING PARAMETERS:

z = 1.00 Mcr = 722.97 kN*m Curve,LT - d XLT = 1.00
Lcr,upp=5.00 m Lam_LT = 0.30 fi,LT = 0.49 XLT,mod = 1.00

BUCKLING PARAMETERS:



About y axis:

Ly = 5.00 m Lam_y = 0.91
Lcr,y = 5.00 m Xy = 0.73
Lamy = 69.70 kyy = 0.94



About z axis:

Lz = 5.00 m Lam_z = 1.56
Lcr,z = 5.00 m Xz = 0.35
Lamz = 119.45 kyz = 0.41

VERIFICATION FORMULAS:

Section strength check:

N,Ed/Nc,Rd = 0.00 < 1.00 (6.2.4.(1))
My,Ed/MN,y,Rd = 0.32 < 1.00 (6.2.9.1.(2))
Mz,Ed/MN,z,Rd = 0.00 < 1.00 (6.2.9.1.(2))
(My,Ed/MN,y,Rd)^1.66 + (Mz,Ed/MN,z,Rd)^1.66 = 0.15 < 1.00 (6.2.9.1.(6))
Vy,Ed/Vy,T,Rd = 0.00 < 1.00 (6.2.6-7)
Vz,Ed/Vz,T,Rd = 0.00 < 1.00 (6.2.6-7)
Tau,ty,Ed/(fy/(sqrt(3)*gM0)) = 0.04 < 1.00 (6.2.6)
Tau,tz,Ed/(fy/(sqrt(3)*gM0)) = 0.04 < 1.00 (6.2.6)

Global stability check of member:

Lambda,y = 69.70 < Lambda,max = 150.00 Lambda,z = 119.45 < Lambda,max = 150.00 STABLE
My,Ed,max/Mb,Rd = 0.32 < 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) = 0.32 < 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) = 0.22 < 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: 32 SLS:CHR/5=1*1.00 + 5*1.00 (1+5)*1.00

uz = 1.2 cm < uz max = L/200.00 = 2.5 cm Verified

Governing Load Case: 33 SLS:CHR/6=1*1.00 + 4*0.60 + 2*1.00 (1+2)*1.00+4*0.60



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

Išvada: sąlyga tenkinama

Šoninių stogelio sijų projektavimas

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

ANALYSIS TYPE: Member Verification

CODE GROUP:

MEMBER: 10 Sija1_10
m

POINT: 1

COORDINATE: x = 0.78 L = 2.02

LOADS:

Governing Load Case: 16 ULS/11=1*1.35 + 4*0.78 + 2*1.30 1*1.35+4*0.78+2*1.30

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	73	116	0

MATERIAL:

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



SECTION PARAMETERS: RECT 200x100x5

$h=20.0 \text{ cm}$	$gM0=1.00$	$gM1=1.00$	
$b=10.0 \text{ cm}$	$A_y=9.45 \text{ cm}^2$	$A_z=18.91 \text{ cm}^2$	$A_x=28.36 \text{ cm}^2$
$t_w=0.5 \text{ cm}$	$I_y=1459.25 \text{ cm}^4$	$I_z=496.94 \text{ cm}^4$	$I_x=1185.78 \text{ cm}^4$
$t_f=0.5 \text{ cm}$	$W_{ply}=181.37 \text{ cm}^3$	$W_{plz}=112.09 \text{ cm}^3$	

INTERNAL FORCES AND CAPACITIES:

$N_{Ed} = 2.61 \text{ kN}$	$M_{y,Ed} = 7.52 \text{ kN*m}$	$M_{z,Ed} = -0.56 \text{ kN*m}$	$V_{y,Ed} = -0.92 \text{ kN}$
$N_{c,Rd} = 1006.78 \text{ kN}$	$M_{y,Ed,max} = 7.52 \text{ kN*m}$	$M_{z,Ed,max} = -1.55 \text{ kN*m}$	$V_{y,c,Rd} = 193.75 \text{ kN}$
$N_{b,Rd} = 793.60 \text{ kN}$	$M_{y,c,Rd} = 64.39 \text{ kN*m}$	$M_{z,c,Rd} = 39.79 \text{ kN*m}$	$V_{z,Ed} = -13.08 \text{ kN}$
	$MN_{y,Rd} = 64.39 \text{ kN*m}$	$MN_{z,Rd} = 39.79 \text{ kN*m}$	$V_{z,c,Rd} = 387.51 \text{ kN}$
	$M_{b,Rd} = 64.39 \text{ kN*m}$		

Class of section = 1



LATERAL BUCKLING PARAMETERS:

$z = 1.00$	$M_{cr} = 2271.92 \text{ kN*m}$	Curve,LT - d	$XLT = 1.00$
$L_{cr,upp}=2.60 \text{ m}$	$Lam_{LT} = 0.17$	$f_{i,LT} = 0.42$	$XLT_{mod} = 1.00$

BUCKLING PARAMETERS:



About y axis:

$L_y = 2.60 \text{ m}$	$Lam_y = 0.47$
$L_{cr,y} = 2.60 \text{ m}$	$X_y = 0.93$
$Lam_y = 36.25$	$k_{yy} = 0.79$



About z axis:

$L_z = 2.60 \text{ m}$	$Lam_z = 0.81$
$L_{cr,z} = 2.60 \text{ m}$	$X_z = 0.79$
$Lam_z = 62.11$	$k_{yz} = 0.45$

VERIFICATION FORMULAS:

Section strength check:

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

$$M_{y,Ed}/M_{N,y,Rd} = 0.12 < 1.00 \quad (6.2.9.1.(2))$$

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

$$(M_{y,Ed}/M_{N,y,Rd})^{1.66} + (M_{z,Ed}/M_{N,z,Rd})^{1.66} = 0.03 < 1.00 \quad (6.2.9.1.(6))$$

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

$$V_{z,Ed}/V_{z,c,Rd} = 0.03 < 1.00 \quad (6.2.6.(1))$$

Global stability check of member:

$$\Lambda_{y} = 36.25 < \Lambda_{y,max} = 150.00 \quad \Lambda_{z} = 62.11 < \Lambda_{z,max} = 150.00 \quad \text{STABLE}$$

$$M_{y,Ed,max}/M_{b,Rd} = 0.12 < 1.00 \quad (6.3.2.1.(1))$$

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

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

LIMIT DISPLACEMENTS



Deflections (LOCAL SYSTEM):

$$u_y = 0.0 \text{ cm} < u_{y,max} = L/150.00 = 1.7 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 28 \text{ SLS:CHR/1}=1*1.00 + 4*1.00 + 2*0.50 \quad (1+4)*1.00+2*0.50$$

$$u_z = 0.1 \text{ cm} < u_{z,max} = L/150.00 = 1.7 \text{ cm} \quad \text{Verified}$$

$$\text{Governing Load Case: } 33 \text{ SLS:CHR/6}=1*1.00 + 4*0.60 + 2*1.00 \quad (1+2)*1.00+4*0.60$$



Displacements (GLOBAL SYSTEM): Not analyzed

Section OK !!!

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	74	116	0

Išvada: sąlyga tenkinama

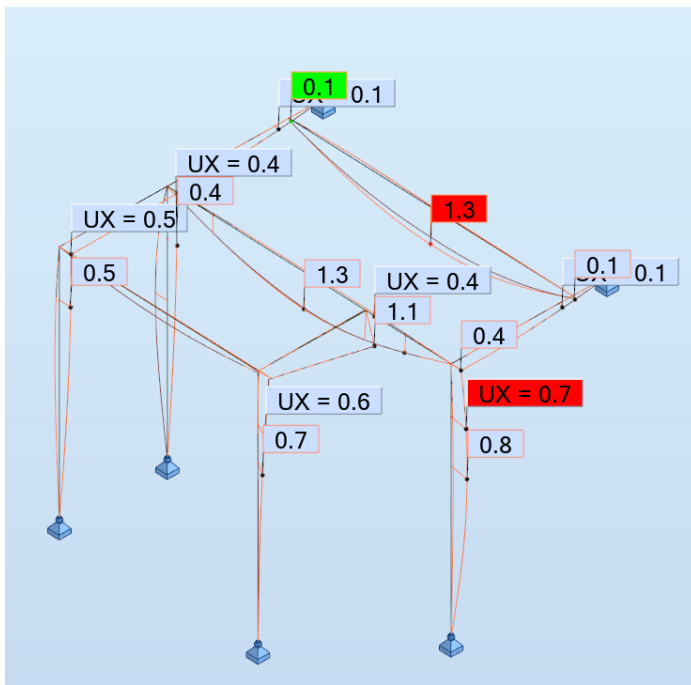
1.7.1. Medinio stogelio Mazgų skaičiavimas

Kolonos bazės skaičiavimas

Skaičiuojamas mazgo metalinių konstrukcijų laikomoji galia ir standumas, kuris panaudojamas bendrame modelyje, kad įvertinti mazgo dalinį standumą.

1.7.2. Metalinio stogelio tinkamumo ribinis būvis

Tikrinamas stogelio kolonos viršutinio taško horizontalus poslinkis:

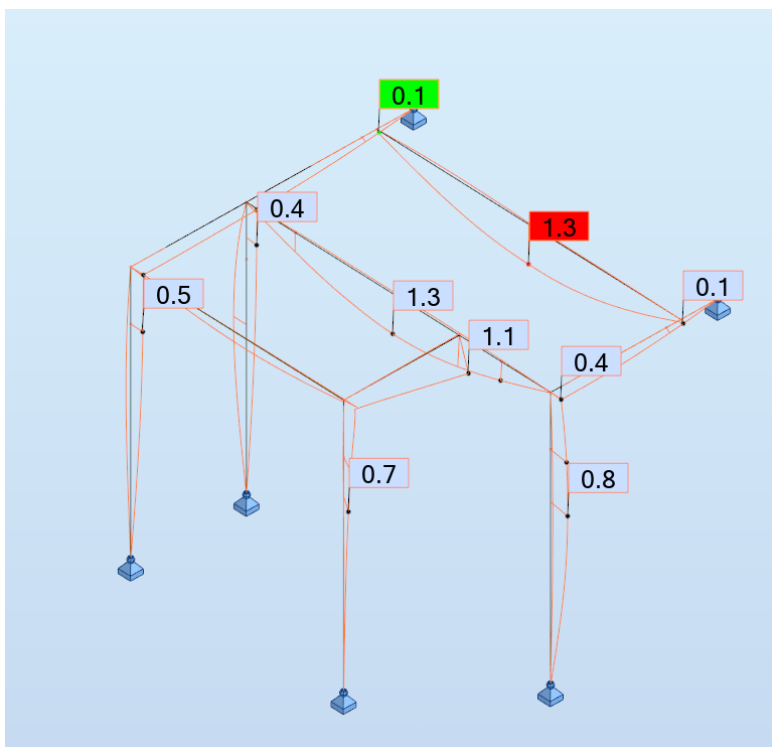


$$u_x = 0,4cm \leq L/700 = 4,1/700 = 0,6cm.$$

Išvada: sąlyga tenkinama

Tikrinamas sijų vertikalus įlinkis:

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	75	116	0



$$u_z = 1,3cm \leq L/200 = 5,5/200 = 2,8cm.$$

Išvada: sąlyga tenkinama

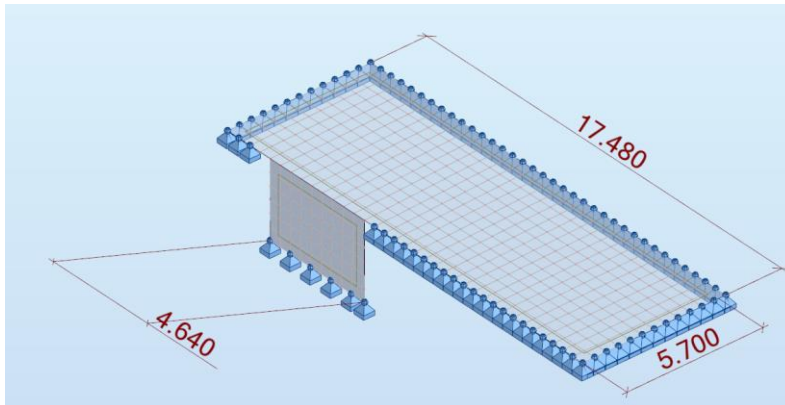
1.8. Priedangos skaičiavimas

Pastato rūšys projektuojamas kaip priedanga. Polių siena iš 500mm polių su 50mm tarpu tarp polių ir monolitinė perdanga 350mm storio, sujungta su polių siena lanksčiai. Polių sienos polių stabilumas montavimo stadijoje skaičiuojamas kaip liaunos atraminės sienos, kad momentas nuo aktyvaus grunto slėgio neviršytų momento nuo pasyvaus grunto slėgio. Eksploatavimo stadijoje polių siena suvaržyta perdanga iš viršaus, ir grindimis ant grunto žemiau. Skaičiuojant armavimą grunto trintis skaičiuojamojoje schemoje nevertinama. Polių sienos betonas C30/37 XC2 W8, armatūra S500. Priedangos perdangos betonas C30/37 XC1, armatūra S500. Priedangos sienos ir perdangos atsparumas ugniai R180.

1.8.1. Priedangos perdangos skaičiavimas

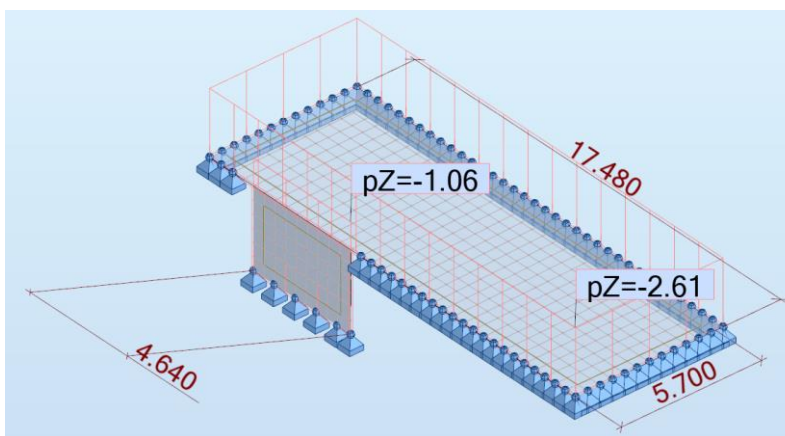
Priedangos perdanga atremta lanksčiai ant polių sienos iš keturių pusių. Skaičiuojamoji schema:

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	76	116	0

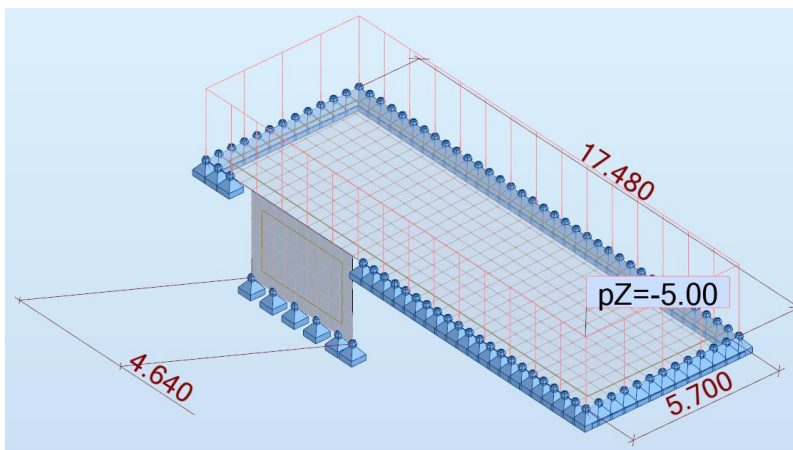


Veikiančios charakteristinės apkrovos.

Nuolatinės apkrovos:

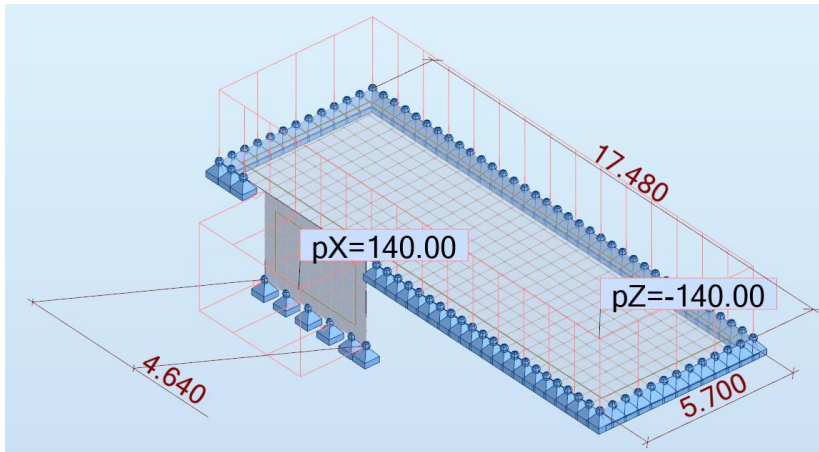


Naudojamo apkrovos:



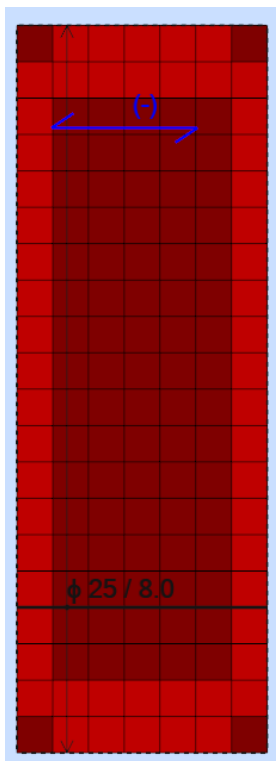
Ypatingųjų poveikių apkrovos (virš priedangos perdangos esančių statinio aukštų konstrukcijų griūties sukeltos dinaminės apkrovos ir sprogimo bangos sukelta vibracija):

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	77	116	0



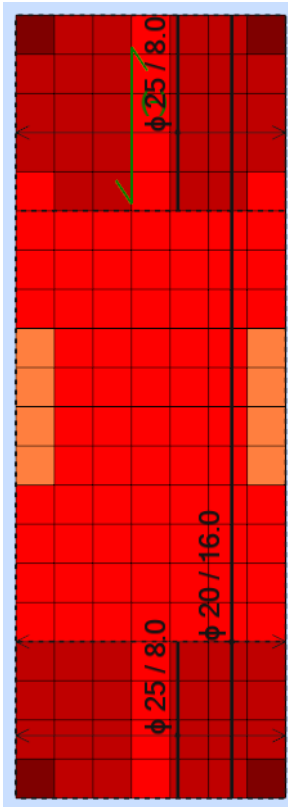
Reikalingas perdangos armavimas.

Apatinis armavimas X kryptimi:

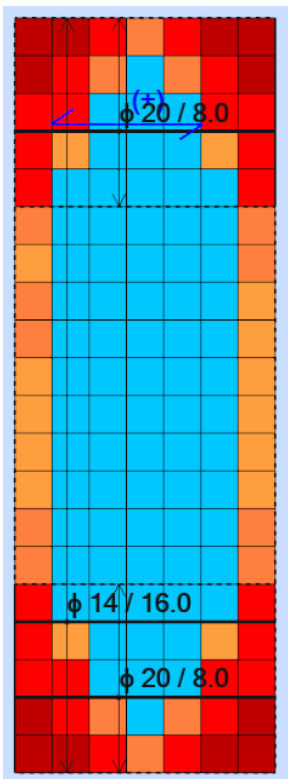


Apatinis armavimas Y kryptimi:

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	78	116	0

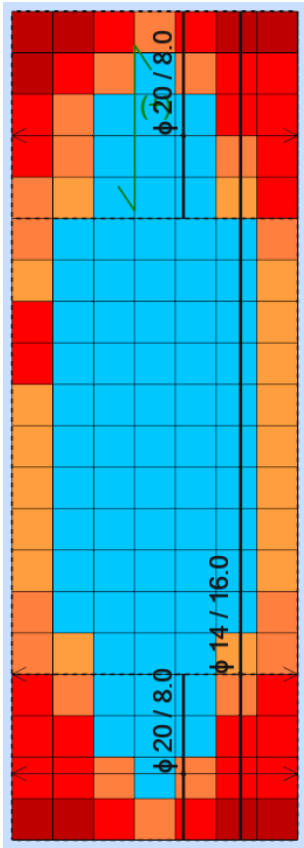


Viršutinis armavimas X kryptimi:



Viršutinis armavimas Y kryptimi:

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	79	116	0



1. Slab: Slab1 - Panel no. 1

1.1. Reinforcement:

- Type : Perdanga
- Main reinforcement direction : 0°
- Main reinforcement grade : B500B; Characteristic strength = 500.00 MPa
Horizontal branch of the stress-strain diagram
- Ductility class : B
- Bar diameters bottom d1 = 1.2 (cm) d2 = 1.2 (cm)
top d1 = 1.2 (cm) d2 = 1.2 (cm)
- Cover bottom c1 = 4.5 (cm)
top c2 = 4.5 (cm)
- Cover deviations Cdev = 1.0(cm), Cdur = 0.0(cm)

1.2. Concrete

- Class : C30/37; Characteristic strength = 30.00 MPa
Rectangular stress distribution [3.1.7(3)]
- Density : 2501.36 (kG/m3)
- Concrete creep coefficient : 1.33
- Cement class : N

1.3. Hypothesis

- Calculations according to : EN 1992-1-1:2004/A1:2014
- Method of reinforcement area calculations : analytical

	Lapas	Lapų	Laida
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- Allowable cracking width
 - upper layer : 0.30 (mm)
 - lower layer : 0.30 (mm)
 - Allowable deflection : 3.80 (cm)
 - Verification of punching : no
 - Exposure
 - upper layer : XC1
 - lower layer : XC1
 - Calculation type : simple bending
 - Structure class : S4
- Modified partial coefficients:
 $a_{cc} = 0.9$ 1992-1-1 3.1.6 (1)P

1.4. Slab geometry

Thickness 0.350 (m)

Contour:

edge	beginning		end		length
	x1	y1	x2	y2	(m)
1	0.000	-17.480	6.000	-17.480	6.000
2	6.000	-17.480	6.000	0.000	17.480
3	6.000	0.000	0.000	0.000	6.000
4	0.000	0.000	0.000	-17.480	17.480

Support:

n°	Name	dimensions (m)	coordinates		edge
			x	y	
0	linear	4.640 / 0.300	0.000	-4.420	—
* - head present					

1.5. Calculation results:

1.5.1. Maximum moments + reinforcement for bending

	Ax(+)	Ax(-)	Ay(+)	Ay(-)
Provided reinforcement (cm2/m):	28.37	61.36	34.39	66.27
Modified required reinforcement (cm2/m):	25.04	59.02	25.73	46.11
Original required reinforcement (cm2/m):	25.04	59.02	25.73	46.11
Coordinates (m):	0.000;-0.555 0.000;0.000	3.000;-8.592	0.000;-1.110	

1.5.2. Maximum moments + reinforcement for bending

	Ax(+)	Ax(-)	Ay(+)	Ay(-)
Symbol: required area/provided area				
Ax(+) (cm2/m)	25.04/28.37	0.00/9.62	20.88/28.37	
Ax(-) (cm2/m)	27.88/61.36	59.02/61.36	27.88/61.36	
	45.91/61.36			

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	81	116	0



Ay(+) (cm ² /m)	25.73/34.39	0.00/10.54	25.73/34.39	
Ay(-) (cm ² /m)	23.04/34.39	12.38/22.44	21.39/66.27	
	20.02/66.27			
	46.11/66.27			
SLS				
Mxx (kN*m/m)	4.44	-68.92	4.65	-27.62
Myy (kN*m/m)	0.05	-17.02	14.39	-30.49
Mxy (kN*m/m)	-27.57	-0.06	-22.85	-27.19
Nxx (kN/m)	0.48	0.01	1.31	0.23
Nyy (kN/m)	-0.43	0.25	-7.79	-0.17
Nxy (kN/m)	2.71	-0.11	3.08	0.74
ULS				
Mxx (kN*m/m)	5.93	-91.98	6.21	-36.87
Myy (kN*m/m)	0.06	-22.71	19.23	-40.69
Mxy (kN*m/m)	-36.80	-0.08	-30.49	-36.29
Nxx (kN/m)	0.64	0.02	1.75	0.31
Nyy (kN/m)	-0.57	0.33	-10.40	-0.23
Nxy (kN/m)	3.62	-0.15	4.12	0.99
ULS - accid. comb.				
Mxx (kN*m/m)	43.52	-658.21	41.21	-263.55
Myy (kN*m/m)	1.56	-162.74	124.29	-290.52
Mxy (kN*m/m)	-261.76	-0.50	-219.05	-259.06
Nxx (kN/m)	32.74	-6.83	178.43	1.66
Nyy (kN/m)	12.57	-18.69	100.65	-1.22
Nxy (kN/m)	-4.75	16.52	-61.69	8.00
Coordinates (m)	0.000;-0.555	3.000;-8.592	0.000;-1.110	
Coordinates* (m)	0.000;0.000	0.000;16.925;0.000	3.000;8.888;0.000	0.000;16.370;0.000
	0.000;17.480;0.000			
* - Coordinates in the structure global coordinate system				

1.5.4. Deflection

|f(+)| = 0.00 (cm) <= fdop(+) = 3.80 (cm)
|f(-)| = 0.46 (cm) <= fdop(-) = 3.80 (cm)

1.5.5. Cracking

upper layer

ax = 0.00 (mm) <= adop = 0.30 (mm)

ay = 0.00 (mm) <= adop = 0.30 (mm)

lower layer

ax = 0.03 (mm) <= adop = 0.30 (mm)

ay = 0.00 (mm) <= adop = 0.30 (mm)

3. Results - detailing

List of solutions:

Reinforcement: bars

Solution no.

Reinforcement range

Diameter / Weight

Total weight

(kg)

1

-

10928.66

Results for the solution no. 1

Reinforcement zones

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	82	116	0

Bottom reinforcement

Name	coordinates				Provided reinforcement At	
	Ar	x1	y1	x2	y2	φ (mm) / (cm) (cm2/m)
1/1- Ax Main	0.000 61.36	-17.480	6.000	0.000	25.0 / 8.0	59.02 <
1/2- Ay Perpendicular	0.000 19.63	-17.480	6.000	0.000	20.0 / 16.0	18.17 <
1/3-(1/2-) Ay Perpendicular	0.000 46.11	-4.370	6.000	0.000	25.0 / 8.0	25.0 / 8.0
1/4-(1/2-) Ay Perpendicular	0.000 44.06	-17.480	6.000	-13.984	25.0 / 8.0	25.0 / 8.0

Top reinforcement

Name	coordinates				Provided reinforcement At	
	Ar	x1	y1	x2	y2	φ (mm) / (cm) (cm2/m)
1/5+ Ax Main	0.000 9.62	-17.480	6.000	0.000	14.0 / 16.0	8.28 <
1/6+(1/5+) Ax Main	0.000 29.26	-4.370	6.000	0.000	20.0 / 8.0	25.04 <
1/7+(1/5+) Ax Main	0.000 29.26	-17.480	6.000	-13.110	20.0 / 8.0	24.89 <
1/8+ Ay Perpendicular	0.000 9.62	-17.480	6.000	0.000	14.0 / 16.0	9.44 <
1/9+(1/8+) Ay Perpendicular	0.000 25.73	-4.370	6.000	0.000	20.0 / 8.0	20.0 / 8.0
1/10+(1/8+) Ay Perpendicular	0.000 22.04	-17.480	6.000	-13.984	20.0 / 8.0	20.0 / 8.0

4. Material survey

- Concrete volume = 36.708 (m3)
- Formwork = 104.880 (m2)
- Slab circumference = 46.960 (m)
- Area of openings = 0.000 (m2)

- Steel B500B
- Total weight = 11250.80 (kG)
- Density = 306.49 (kG/m3)
- Average diameter = 20.1 (mm)
- Survey according to diameters:

Diameter	Length (m)	Number of identical elements:
14	5.910	109
14	8.945	74
20	4.486	37
20	5.360	37
20	5.910	54
20	9.050	74
25	4.357	37
25	5.231	37

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	83	116	0

25

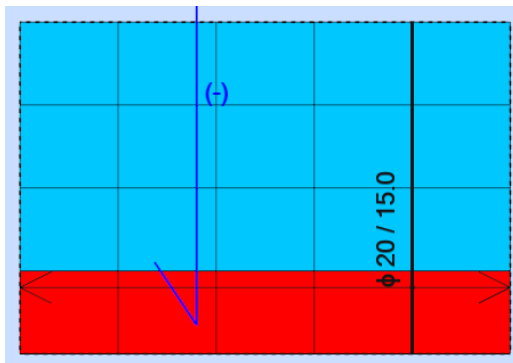
5.910

218

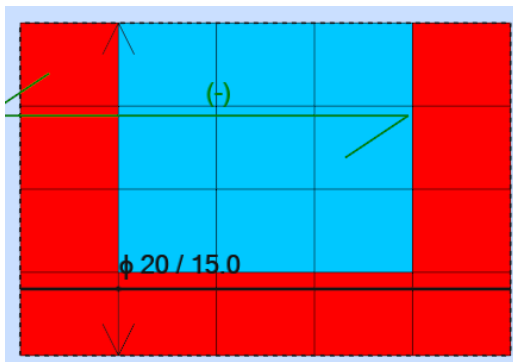
Išvada: sąlyga tenkinama

Monolitinės sienos reikalingas armavimas:

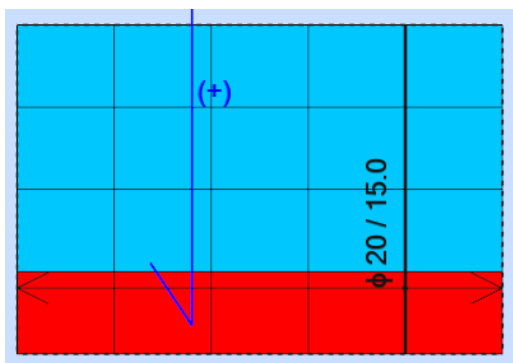
Išorinis tinklas X kryptimi:



Išorinis tinklas Y kryptimi:

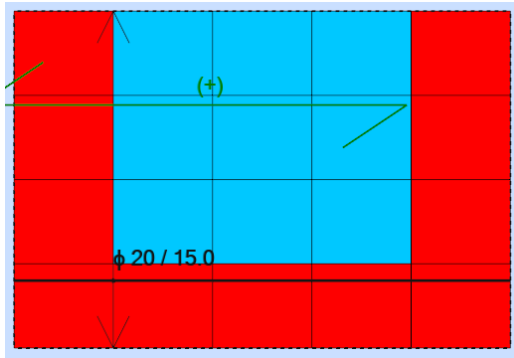


Vidinis tinklas X kryptimi:



Vidinis tinklas Y kryptimi:

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	84	116	0



1. Wall: Slab4 - Panel no. 4

1.1. Reinforcement:

- | | |
|--------------------------------|--|
| • Type | : siena |
| • Main reinforcement direction | : 0° |
| Main reinforcement grade | : B500B; Characteristic strength = 500.00 MPa |
| | Horizontal branch of the stress-strain diagram |
| • Ductility class | : B |
| • Bar diameters | bottom d1 = 1.2 (cm) d2 = 1.2 (cm) |
| | top d1 = 1.2 (cm) d2 = 1.2 (cm) |
| • Cover | bottom c1 = 5.5 (cm) |
| | top c2 = 5.5 (cm) |
| • Cover deviations | Cdev = 1.0(cm), Cdur = 0.0(cm) |

1.2. Concrete

- | | |
|------------------------------|---|
| Class | : C30/37; Characteristic strength = 30.00 MPa
Rectangular stress distribution [3.1.7(3)] |
| • Density | : 2501.36 (kG/m3) |
| • Concrete creep coefficient | : 1.34 |
| • Cement class | : N |

1.3. Hypothesis

- | | |
|---|----------------------------|
| • Calculations according to | : EN 1992-1-1:2004/A1:2014 |
| • Method of reinforcement area calculations | : analytical |
| • Allowable cracking width | |
| - upper layer | : 0.30 (mm) |
| - lower layer | : 0.30 (mm) |
| • Verification of punching | : no |
| • Exposure | |
| - upper layer | : XC2 |
| - lower layer | : XC2 |
| • Calculation type | : compression/tension |
| • Structure class | : S4 |
| Modified partial coefficients: | |
| $a_{cc} = 0.9$ | 1992-1-1 3.1.6 (1)P |

1.4. Slab geometry

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	85	116	0

Thickness 0.300 (m)

Contour:

edge	beginning		end		length
	x1	y1	x2	y2	(m)
1	0.000	3.150	4.640	3.150	4.640
2	4.640	3.150	4.640	0.000	3.150
3	4.640	0.000	0.000	0.000	4.640
4	0.000	0.000	0.000	3.150	3.150

Support:

n°	Name	dimensions (m)	coordinates		edge
			x	y	
0	linear	0.350 / 4.640	2.320	3.150	—
* - head present					

1.5. Calculation results:

1.5.1. Maximum forces + reinforcement

	Ax(+)	Ax(-)	Ay(+)	Ay(-)
Provided reinforcement (cm2/m):	20.94	20.94	20.94	20.94
Modified required reinforcement (cm2/m):	15.54	15.54	15.54	15.54
Original required reinforcement (cm2/m):	15.54	15.54	15.54	15.54
Coordinates (m):	1.140;-0.000 0.000;2.625	1.140;-0.000	0.000;2.625	

1.5.2. Maximum forces + reinforcement

	Ax(+)	Ax(-)	Ay(+)	Ay(-)
Symbol: required area/provided area				
Ax(+) (cm2/m)	15.54/20.94 0.00/20.94	15.54/20.94	0.00/20.94	
Ax(-) (cm2/m)	15.54/20.94 0.00/20.94	15.54/20.94	0.00/20.94	
Ay(+) (cm2/m)	15.54/20.94 15.54/20.94	15.54/20.94	15.54/20.94	
Ay(-) (cm2/m)	15.54/20.94 15.54/20.94	15.54/20.94	15.54/20.94	
SLS				
Mxx (kN*m/m)	-0.00	-0.00	-0.00	-0.00
Myy (kN*m/m)	-0.00	-0.00	-0.00	-0.00
Mxy (kN*m/m)	0.00	0.00	0.00	0.00
Nxx (kN/m)	3.08	3.08	1.59	1.59
Nyy (kN/m)	3.48	3.48	-35.16	-35.16
Nxy (kN/m)	-4.15	-4.15	10.71	10.71
ULS				
Mxx (kN*m/m)	-0.00	-0.00	-0.00	-0.00
Myy (kN*m/m)	-0.00	-0.00	-0.00	-0.00
Mxy (kN*m/m)	0.00	0.00	0.01	0.01

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	86	116	0

Nxx (kN/m)	4.13	4.13	2.15	2.15
Nyy (kN/m)	4.69	4.69	-46.85	-46.85
Nxy (kN/m)	-5.56	-5.56	14.28	14.28
ULS - accid. comb.				
Mxx (kN*m/m)	59.19	59.19	5.18	5.18
Myy (kN*m/m)	18.51	18.51	104.29	104.29
Mxy (kN*m/m)	3.05	3.05	-15.22	-15.22
Nxx (kN/m)	17.69	17.69	-13.37	-13.37
Nyy (kN/m)	10.07	10.07	-365.02	-365.02
Nxy (kN/m)	-30.45	-30.45	109.57	109.57
Coordinates (m)	1.140;-0.000	1.140;-0.000	0.000;2.625	
	0.000;2.625			
Coordinates* (m)	0.000;11.880;-3.1500.000;11.880;-3.1500.000;10.740;-0.525			
	0.000;10.740;-0.525			
	* - Coordinates in the structure global coordinate system			

3. Results - detailing

List of solutions:
Reinforcement: bars
Solution no.

Solution no.	Reinforcement range Diameter / Weight	Total weight (kG)
1	-	961.54

Results for the solution no. 1
Reinforcement zones

Bottom reinforcement
Name

Name	coordinates Ar				Provided reinforcement At	
	x1	y1	x2	y2	φ (mm) / (cm)	(cm2/m)
1/1- Ax Main	4.640	0.000	0.000	3.150	20.0 / 15.0	15.54 <
	20.94					
1/2- Ay Perpendicular	4.640	0.000	0.000	3.150	20.0 / 15.0	15.54 <
	20.94					

Top reinforcement
Name

Name	coordinates Ar				Provided reinforcement At	
	x1	y1	x2	y2	φ (mm) / (cm)	(cm2/m)
1/3+ Ax Main	4.640	0.000	0.000	3.150	20.0 / 15.0	15.54 <
	20.94					
1/4+ Ay Perpendicular	4.640	0.000	0.000	3.150	20.0 / 15.0	15.54 <
	20.94					

4. Material survey

- Concrete volume = 4.385 (m3)
- Formwork = 14.616 (m2)
- Slab circumference = 15.580 (m)
- Area of openings = 0.000 (m2)

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	87	116	0

- Steel B500B
- Total weight = 934.35 (kG)
- Density = 213.09 (kG/m3)
- Average diameter = 20.0 (mm)
- Survey according to diameters:

Diameter	Length (m)	Number of identical elements:
20	3.040	62
20	4.530	42

Išvada: sąlyga tenkinama

1.8.2. Polių sienos skaičiavimas

Polių sienos stabilumas montavimo stadijoje skaičiuojamas kaip atraminės sienos. Įgilinimas ir iškasos gylis nustatomi polių sieną atkasus iki grindų detalės apačios.

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	88	116	0

Grunto vidinis trinties kampas:

$$\varphi := 30 \quad \text{laipsnių}$$

Grunto svorio tankis:

$$\gamma := 18 \quad \frac{\text{kN}}{\text{m}^3}$$

Ilginimas (atkasus iki grindų detalės apačios): Reikiamas atraminės sienutės įgylinimas:

$$d := 4 \quad \text{m} \quad d_{\text{fak}} := 1.2 \cdot d = 4.8 \quad \text{m}$$

Iškasos gylis (atkasus iki grindų detalės apačios):

$$h := 2.52 \quad \text{m}$$

Skaičiuojamas gylis:

$$z := d + h = 6.52 \quad \text{m}$$

Tolygiai išskirstyta aktyvi naudojimo apkrova:

$$p_{a1} := 10 \quad \text{kPa}$$

Tolygiai išskirstyta naudojimo apkrova nuo esamo pastato:

$$p_{a2} := 40.3 \quad \text{kPa}$$

Tolygiai išskirstyta naudojimo apkrovos nuo esamo pastato pradžios gylis:

$$h_{a2} := h - 0.26 = 2.26 \quad \text{m}$$

Grunto sankiba:

$$c := 0$$

Pasyvus grunto slėgis nuo grunto svorio:

$$\sigma_p := \tan^2 \left[45 + \frac{\varphi}{2} \right] \cdot \frac{\pi}{180} \cdot (\gamma \cdot d) - 2 \cdot c \cdot \sqrt{\tan^2 \left[45 + \frac{\varphi}{2} \right] \cdot \frac{\pi}{180}} = 216 \quad \text{kPa}$$

Aktyvus grunto slėgis nuo grunto svorio:

$$\sigma_a := \tan^2 \left[45 - \frac{\varphi}{2} \right] \cdot \frac{\pi}{180} \cdot (\gamma \cdot z) - 2 \cdot c \cdot \sqrt{\tan^2 \left[45 - \frac{\varphi}{2} \right] \cdot \frac{\pi}{180}} = 39.12 \quad \text{kPa}$$

Aktyvus grunto slėgis nuo naudojimo apkrovos:

$$\sigma_{a1} := \tan^2 \left[45 - \frac{\varphi}{2} \right] \cdot \frac{\pi}{180} \cdot (p_{a1}) - 2 \cdot c \cdot \sqrt{\tan^2 \left[45 - \frac{\varphi}{2} \right] \cdot \frac{\pi}{180}} = 3.333 \quad \text{kPa}$$

Aktyvus grunto slėgis nuo naudojimo apkrovos nuo esamo pastato:

$$\sigma_{a2} := \tan^2 \left[45 - \frac{\varphi}{2} \right] \cdot \frac{\pi}{180} \cdot (p_{a2}) - 2 \cdot c \cdot \sqrt{\tan^2 \left[45 - \frac{\varphi}{2} \right] \cdot \frac{\pi}{180}} = 13.433 \quad \text{kPa}$$

Pasyvus grunto slėgio atstojamoji:

$$E_p := \frac{\sigma_p \cdot d}{2} = 432 \quad \text{kN}$$

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	89	116	0

Aktyvaus grunto slėgio atstojamoji:

$$E_a := \frac{\sigma_a \cdot z}{2} + \sigma_{a1} \cdot z + \sigma_{a2} \cdot (z - h_{a2}) = 206.491 \quad \text{kN}$$

Momentas nuo pasyvaus slėgio aplink tašką gylyje z:

$$M_p := \frac{\sigma_p \cdot d}{2} \cdot \frac{d}{3} = 576 \quad \text{kNm}$$

Momentas nuo aktyvaus slėgio aplink tašką gylyje z:

$$M_a := \frac{\sigma_a \cdot z}{2} \cdot \frac{z}{3} + \sigma_{a1} \cdot z \cdot \frac{z}{2} + \sigma_{a2} \cdot (z - h_{a2}) \cdot \frac{(z - h_{a2})}{2} = 469.91 \quad \text{kNm}$$

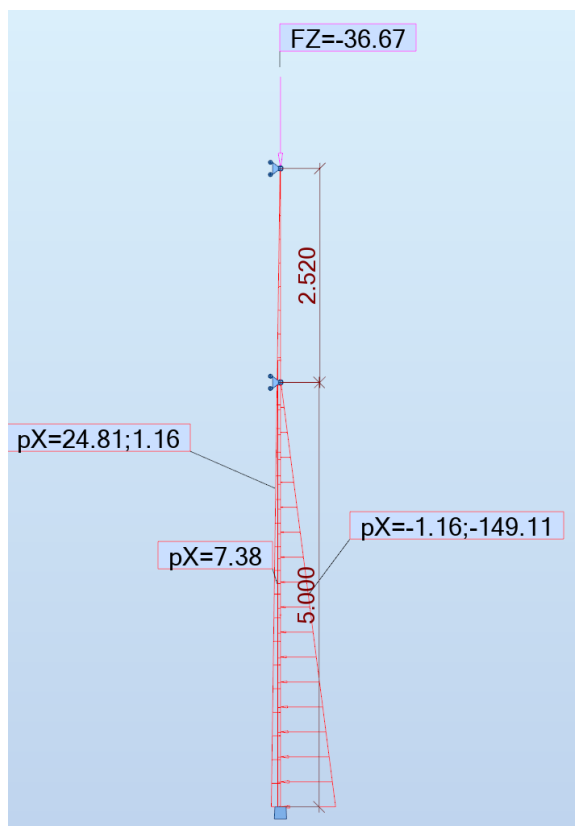
$$\text{Ats} := \text{if}(M_p \geq M_a, \text{"STABILU"}, \text{"NESTABILU"}) = \text{"STABILU"}$$

Išvada: atraminė siena stabili. Polių siena įgilinama 5m nuo grindų detalės apačios.

Skaičiuojama poliaus laikomoji galia.

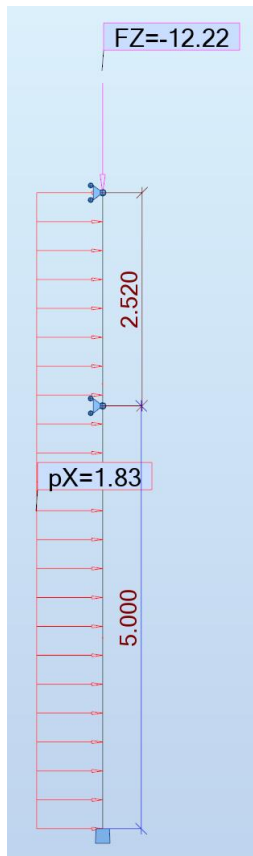
Poliaus skaičiuojamoji schema su veikiančiomis apkrovomis.

Nuolatinės apkrovos:

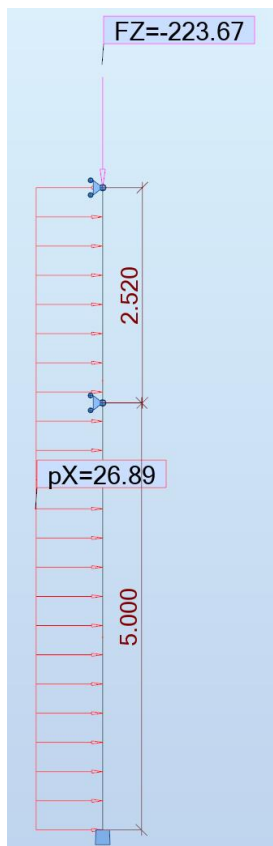


Naudojimo apkrovos:

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	90	116	0

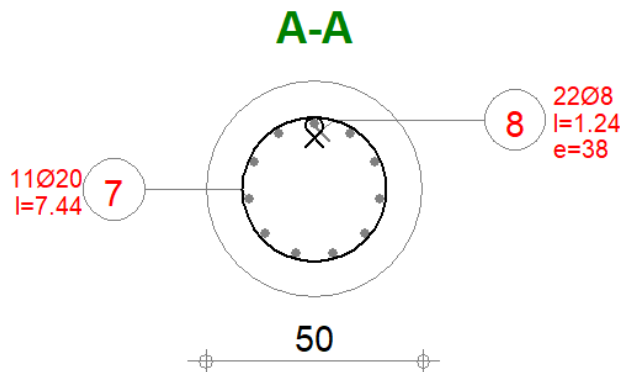


Ypatingojo poveikio apkrovos:



IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	91	116	0

Reikalingas armavimas:



1 Level:

- Name :
- Reference level : 0.000 (m)
- Concrete creep coefficient : $\varphi_p = 2.39$
- Cement class : N
- Environment class : XC2
- Structure class : S4

2 Column: Column1

Number of identical elements: 1

2.1 Material properties:

- Concrete : C30/37 $f_{ck} = 30.00$ (MPa)
- Unit weight : 2501.36 (kg/m³)
- Aggregate size : 20.0 (mm)
- Longitudinal reinforcement: : B500B $f_{yk} = 500.00$ (MPa)
- Ductility class : B
- Transversal reinforcement: : B500B $f_{yk} = 500.00$ (MPa)
- Modified partial coefficients: $\alpha_{cc} = 0.9$ 1992-1-1 3.1.6 (1)P

2.2 Geometry:

- 2.2.1 C
Diameter = 50.0 (cm)
- 2.2.2 Height: L = 7.520 (m)
- 2.2.3 Slab thickness = 0.000 (m)
- 2.2.4 Beam height = 0.000 (m)
- 2.2.5 Cover = 8.0 (cm)

2.3 Calculation options:

- Calculations according to : EN 1992-1-1:2004/A1:2014
- Seismic dispositions : No requirements

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	92	116	0

- Precast column : no
- Pre-design : no
- Slenderness taken into account : yes
- Compression : with bending
- Ties : to slab
- Fire resistance class : No requirements

2.4 Loads:

Case	Nature MzC	Group	γ	N (kN)	MyA (kN*m)	MyB (kN*m)	MyC (kN*m)	MzA (kN*m)	MzB (kN*m)
ULS/1=1*1.35 + 2*1.30	0.00	design(Structural)	0.00	1	1.00	114.29	0.00	-196.97	79.83
ULS/2=1*1.35	0.00	design(Structural)	0.00	1	1.00	98.40	0.00	-202.55	82.62
ULS/3=1*1.00 + 2*1.30	0.00	design(Structural)	0.00	1	1.00	88.78	0.00	-144.46	58.41
ULS/4=1*1.00	0.00	design(Structural)	0.00	1	1.00	72.89	0.00	-150.04	61.20
SLS:CHR/1=1*1.00 + 2*1.00	0.00	Design SLS(CHR)	0.00	1	1.00	85.11	0.00	-145.75	59.05
SLS:CHR/2=1*1.00	0.00	Design SLS(CHR)	0.00	1	1.00	72.89	0.00	-150.04	61.20
SLS:QPR/3=1*1.00 + 2*0.60	0.00	Design SLS(QPR)	0.00	1	1.00	80.22	0.00	-147.46	59.91
SLS:QPR/4=1*1.00	0.00	Design SLS(QPR)	0.00	1	1.00	72.89	0.00	-150.04	61.20
ACC:ACC/1=1*1.00 + 2*0.70 + 3*1.00	0.00	design ACC	1	1.00	305.11	0.00	-84.05	28.18	0.00
ACC:ACC/2=1*1.00 + 3*1.00	0.00	design ACC	1	1.00	296.56	0.00	-87.05	29.68	0.00
ACC:ACC/3=1*1.00	0.00	design ACC	1	1.00	72.89	0.00	-150.04	61.20	0.00

γ - load factor

2.5 Calculation results:

Safety factors $R_d/E_d = 1.11 > 1.0$

2.5.1 ULS/ALS Analysis

Design combination: ULS/2=1*1.35 (B)

Combination type: ULS

Internal forces:

$N_{sd} = 98.40$ (kN) $M_{sdy} = -202.55$ (kN*m) $M_{sdz} = 0.00$ (kN*m)

Design forces:

Lower node

$N = 98.40$ (kN) $N^*etotz = -205.25$ (kN*m) $N^*etoty = 1.97$ (kN*m)

Eccentricity:

		ez (My/N) (cm)	ey (Mz/N) (cm)
Initial	e0:	-205.8	0.0
Imperfection	ei:	2.7	0.0
I order (e0 + ei)	e0Ed:	-203.1	0.0
Minimal	eEdmin:	2.0	2.0
Total	eEd:	-208.6	2.0

2.5.1.1. Detailed analysis-Direction Y:

2.5.1.1.1 Slenderness analysis

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	93	116	0

Non-sway structure

L (m)	Lo (m)	λ	λ_{lim}	
7.520	15.040	120.32	77.23	Slender column

2.5.1.1.2 Buckling analysis

$MA = 0.00 \text{ (kN*m)}$ $MB = -202.55 \text{ (kN*m)}$
 Case: Cross-section at the column end (Lower node), Slenderness not taken into account
 $M_0 = -202.55 \text{ (kN*m)}$
 $ei = \theta_1 * l_0 / 2 = 2.7 \text{ (cm)}$
 $\theta_1 = \theta_0 * \alpha_\eta * \alpha_m = 0.00$
 $\theta_0 = 0.01$
 $\alpha_h = 0.73$
 $\alpha_m = (0.5(1+1/m))^{0.5} = 1.00$
 $m = 1.00$
 $Ma = N * ei = 2.70 \text{ (kN*m)}$
 $ME_{dmin} = 1.97 \text{ (kN*m)}$
 $M_{0Ed} = \max(ME_{dmin}, M_0 + Ma) = -205.25 \text{ (kN*m)}$

2.5.1.2. Detailed analysis-Direction Z:

2.5.1.2.1 Slenderness analysis

Non-sway structure

L (m)	Lo (m)	λ	λ_{lim}	
7.520	15.040	120.32	77.23	Slender column

2.5.1.2.2 Buckling analysis

$MA = 0.00 \text{ (kN*m)}$ $MB = 0.00 \text{ (kN*m)}$
 Case: Cross-section at the column end (Lower node), Slenderness not taken into account
 $M_0 = 0.00 \text{ (kN*m)}$
 $ei = 0.0 \text{ (cm)}$
 $Ma = N * ei = 0.00 \text{ (kN*m)}$
 $ME_{dmin} = 1.97 \text{ (kN*m)}$
 $M_{0Ed} = \max(ME_{dmin}, M_0 + Ma) = 1.97 \text{ (kN*m)}$

2.5.2 Reinforcement:

Real (provided) area $Asr = 34.56 \text{ (cm}^2\text{)}$
 Ratio: $\rho = 1.76 \%$

2.6 Reinforcement:

Main bars (B500B):

- 11 $\phi 20$ $l = 7.440 \text{ (m)}$

Transversal reinforcement: (B500B):

stirrups: 22 $\phi 8$ $l = 1.237 \text{ (m)}$

3 Material survey:

- Concrete volume $= 1.477 \text{ (m}^3\text{)}$
- Formwork $= 11.812 \text{ (m}^2\text{)}$
- Steel B500B
 - Total weight $= 212.64 \text{ (kg)}$

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	94	116	0



- Density = 144.01 (kG/m³)
- Average diameter = 17.0 (mm)
- Reinforcement survey:

Diameter	Length (m)	Weight (kG)	Number (No.)	Total weight (kG)
8	1.237	0.49	22	10.74
20	7.440	18.35	11	201.90

Išvada: sąlyga tenkinama

1.9. Mūrinių sienų skaičiavimas

Tikrinamas aukščiausios ir ilgiausios mūrinės sienos leistinieji aukščiai, storiai ir ilgiai.
Sienos ilgis tarp skersinių sienų 18,81m, sienos aukštis iki perdangos apačios 6,88m.

SIENŲ IR STULPŲ LEISTINIEJIAUKŠČIAI, STORIAI IR ILGIAI pagal EC

Sienos aukštis:

$$h := 6.88 \quad \text{m}$$

Sienos storis:

$$t := 0.25 \quad \text{m}$$

Laisvasis sienos ilgis:

$$l := 18.81 \quad \text{m}$$

Efektyvus sienos storis, kai siena be pilaistrų:

$$t_{ef} := t = 0.25 \quad \text{m}$$

Efektyvus sienos aukštis, kai siena sustandinta dviuose vertikaliuose kraštuose ir GB perdangomis:

$$h_{ef} := \text{if}(l > 30 \cdot t, 0.75 \cdot h, \text{"formulė netinka"}) = 5.16 \quad \text{m}$$

Sienos liaunis:

$$\lambda := \frac{h_{ef}}{t_{ef}} = 20.64$$

$$\text{Ats1} := \text{if}(\lambda > 27, \text{"LIAUNIS BLOGAS"}, \text{"LIAUNIS GERAS"}) = \text{"LIAUNIS GERAS"}$$

Aukščio ir storio santykis:

$$\frac{h}{t} = 27.52$$

Ilgio ir storio santykis:

$$\frac{l}{t} = 75.24$$

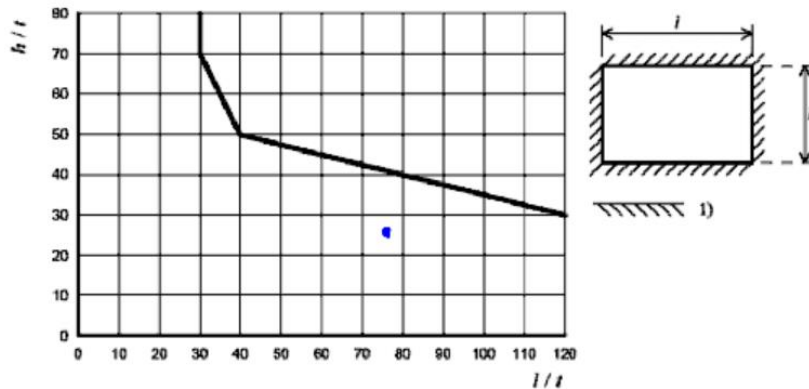
IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	95	116	0

Tinkamumo ribinio būvio sienų aukščio bei ilgio ir storio santykių ribinės reikšmės

(1) Nepaisant sienos atitikimo saugos ribiniam būviui, kurį reikia patikrinti, jos matmenis reikia riboti pagal F.1, F.2 arba F.3 paveikslus, atsižvelgiant į įtvirtinimo sąlygas, parodytas paveiksluose, kai h yra prošvaisinis sienos aukštis, l – sienos ilgis, o t – sienos storis; tuščiaavidurėms sienoms reikia taikyti t_{ef} vietoje t .

(2) Kai sienos yra įtvirtintos viršuje, bet ne galuose, h turi neviršyti $30 t$.

(3) Šis priedas galioja, kai sienos arba vieno tuščiaavidurės sienos sluoksnio storis yra ne mažesnis nei 100 mm.



Iš grafiko nustatyta, kad santykiai tenkinami

Paskaičiuojamas nearmuoto mūro skaičiuojamasis stipris:

NEARMUOTO MŪRO SKAIČIUOJAMASIS STIPRIS

$$\gamma_M = 3$$

$$f_b = 17 \quad \text{MPa}$$

$$f_m = 10 \quad \text{MPa}$$

$$K = 0.45$$

$$f_k = K \cdot f_b^{0.7} \cdot f_m^{0.3} = 6.524 \quad \text{MPa}$$

$$f_d = \frac{f_k}{\gamma_M} = 2.175 \quad \text{MPa}$$

Tikrinama ekscentriškai gniuždoma išorinė armuota mūrinė siena pjūvyje ties pamato padu, kur veikianti ašinė jėga lygi reakcijai į pamatą. Siena armuota tinklais 4/4/50/50 kas ketvirtą eilę. Armatūra S500.

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	96	116	0

Ekscentriškai gniuždoma mūrinė siena

Sienos aukštis

$$l_{\text{sw}} := 6.58 \quad \text{m}$$

Sienos ilgis (atstumas tarp skersinių sienų)

$$l_{0s} := 1 \quad \text{m}$$

Sienos storis

$$h := 0.25 \quad \text{m}$$

$$y := \frac{h}{2} = 0.125 \quad \text{m}$$

Veikianti ašinė jėga

$$N_{\text{ed}} := 131 \quad \text{kN}$$

Veikiantis lenkimo momentas

$$M := 5.90 \quad \text{kNm}$$

Jėgos pridėjimo ekscentricitetas

$$e_0 := \frac{M}{N_{\text{ed}}} = 0.045 \quad \text{m}$$

Skaičiuojamasis elemento aukštis

$$l_0 := l = 6.58 \quad \text{m}$$

Santykis

$$\lambda_h := \frac{l_0}{h} = 26.32$$

Mūro, armuoto tinkleliais, tamprumo charakteristika

$$\alpha_{\text{sk}} := \alpha \cdot \frac{k \cdot f_d}{f_{\text{skm}}} = 604.167$$

Klupumo koeficientas iš 19 lentelės

$$\varphi := 0.36$$

Gniuždomos zonos aukštis

$$h_c := h - 2 \cdot e_0 = 0.16$$

Gniuždomos zonos santykis

$$\lambda_{hc} := \frac{1}{h_c} = 41.145$$

Gniuždomos zonos klupumo koeficientas iš 19 lentelės

$$\varphi_c := 0.17$$

Armatūros charakteristikos

$$f_{yk} := 500 \quad \text{MPa}$$

$$f_{yd} := \frac{f_{yk}}{1.15} = 434.783 \quad \text{MPa}$$

Armatūros d4 skerspjūvio plotas

$$A_{\text{st}} := 0.126 \cdot 10^{-4} \quad \text{m}^2$$

Atstumas tarp tinklų (kas 4 eilę)

$$a_1 := 0.48 \quad \text{m}$$

Tinklelio akis

$$a := 0.05 \quad \text{m}$$

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	97	116	0

Mūro charakteristikos

Mūro tamprumo charakteristika (iš 16 lentelės)

$$\alpha := 750$$

k iš 15 lentelės

$$k := 2$$

Skaičiuojamasis mūro gniuždomasis stipris

$$f_d := 2.175$$

Armavimo koeficientas, kai armuojama tinkleliu

$$\rho_w := \frac{2 \cdot A_{st}}{a \cdot a_1} \cdot 100 = 0.105$$

Mūro, armuoto tinkleliu gniuždomojo stiprio vidutinė reikšmė

$$f_{skm} := k \cdot f_d + \frac{2 \cdot f_{yk} \cdot \rho_w}{100} = 5.4$$

$$\varphi_1 := \frac{\varphi + \varphi_c}{2} = 0.265$$

Elemento skerspjūvio plotas

$$A_s := 1 \cdot I_{0s} = 6.58 \quad \text{m}^2$$

$$A_c := A \cdot \left(1 - \frac{2 \cdot e_0}{s} \right) = 4.007$$

$$e_{0lt} := e_0 = 0.045 \quad \text{m}$$

$$N_{Edlt} := N_{ed} = 131 \quad \text{kN}$$

$$\eta := 0.38 \quad \text{iš 21 lentelės}$$

$$m_{lt} := \text{if} \left[h \geq 300, 1, 1 - \eta \cdot \frac{N_{Edlt}}{N_{ed}} \cdot \left(1 + \frac{1.2 \cdot e_{0lt}}{h} \right) \right] = 0.538$$

$$\omega := 1 + \frac{e_0}{h} = 1.18 \quad \text{iš 20 lentelės}$$

Ekscentriškai gniuždomo armuotojo mūro skaičiuojamasis gniuždomasis stipris

$$f_{skd} := f_d + \frac{2 \cdot \rho_w \cdot f_{yd}}{100} \cdot \left(1 - \frac{2 \cdot e_0}{y} \right) = 2.43 \quad \text{MPa}$$

$$N_{Rd} := m_{lt} \cdot \varphi_1 \cdot f_{skd} \cdot A_c \cdot \omega = 1.638 \quad \text{MN}$$

$$\frac{N_{ed}}{N_{Rd} \cdot 10^3} = 0.08$$

Išvada: išorinės sienos laikomoji galia pakankama

Tikrinama ekscentriškai gniuždoma vidinė armuota mūrinė siena pjūvyje ties pamato padu. Ekscentricitetas atsiranda nuo skirtingai apkrautos iš dviejų pusių sienos. Skaičiavimuose vertinamas skirtingų ašinių jėgų skirtumas. Siena armuota tinklais 4/4/50/50 kas ketvirtą eilę. Armatūra S500.

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	99	116	0

Ekscentriškai gniuždoma mūrinė siena

Sienos aukštis

$$l_w := 6.58 \quad \text{m}$$

Sienos ilgis (atstumas tarp skersinių sienų)

$$l_{0s} := 1 \quad \text{m}$$

Sienos storis

$$h := 0.25 \quad \text{m}$$

$$y := \frac{h}{2} = 0.125 \quad \text{m}$$

Veikianti ašinė jėga

$$N_{ed} := 10.96 \quad \text{kN}$$

Veikiantis lenkimo momentas

$$M := 0.64 \quad \text{kNm}$$

Jėgos pridėjimo ekscentricitetas

$$e_0 := \frac{M}{N_{ed}} = 0.058 \quad \text{m}$$

Skaičiuojamasis elemento aukštis

$$l_0 := 1 = 6.58 \quad \text{m}$$

Santykis

$$\lambda_h := \frac{l_0}{h} = 26.32$$

Mūro, armuoto tinkleliais, tamprumo charakteristika

$$\alpha_{sk} := \alpha \cdot \frac{k \cdot f_d}{f_{skm}} = 604.167$$

Klupumo koeficientas iš 19 lentelės

$$\varphi := 0.36$$

Gniuždomos zonos aukštis

$$h_c := h - 2 \cdot e_0 = 0.133$$

Gniuždomos zonos santykis

$$\lambda_{hc} := \frac{1}{h_c} = 49.395$$

Gniuždomos zonos klupumo koeficientas iš 19 lentelės

$$\varphi_c := 0.10$$

Armatūros charakteristikos

$$f_{yk} := 500 \quad \text{MPa}$$

$$f_{yd} := \frac{f_{yk}}{1.15} = 434.783 \quad \text{MPa}$$

Armatūros d4 skerspjūvio plotas

$$A_{st} := 0.126 \cdot 10^{-4} \quad \text{m}^2$$

Atstumas tarp tinklų (kas 4 eilę)

$$a_1 := 0.48 \quad \text{m}$$

Tinklelio akis

$$a := 0.05 \quad \text{m}$$

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	100	116	0

Mūro charakteristikos

Mūro tamprumo charakteristika (iš 16 lentelės)

$$\alpha := 750$$

k iš 15 lentelės

$$k := 2$$

Skaičiuojamasis mūro gniuždomasis stipris

$$f_d := 2.175$$

Armavimo koeficientas, kai armuojama tinkleliu

$$\rho_w := \frac{2 \cdot A_{st}}{a \cdot a_1} \cdot 100 = 0.105$$

Mūro, armuoto tinkleliu gniuždomojo stiprio vidutinė reikšmė

$$f_{skm} := k \cdot f_d + \frac{2 \cdot f_{yk} \cdot \rho_w}{100} = 5.4$$

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	101	116	0

$$\varphi_1 := \frac{\varphi + \varphi_c}{2} = 0.23$$

Elemento skerspjūvio plotas

$$A_s := h \cdot l_{0s} = 0.25 \quad \text{m}^2$$

$$A_c := A \cdot \left(1 - \frac{2 \cdot e_0}{5} \right) = 0.153$$

$$e_{0lt} := e_0 = 0.058 \quad \text{m}$$

$$N_{Edlt} := N_{ed} = 10.96 \quad \text{kN}$$

$$\eta := 0.38 \quad \text{iš 21 lentelės}$$

$$m_{lt} := \text{if} \left[h \geq 300, 1, 1 - \eta \cdot \frac{N_{Edlt}}{N_{ed}} \cdot \left(1 + \frac{1.2 \cdot e_{0lt}}{h} \right) \right] = 0.513$$

$$\omega := 1 + \frac{e_0}{h} = 1.234 \quad \text{iš 20 lentelės}$$

Ekscentriškai gniuždomo armuotojo mūro skaičiuojamasis gniuždomasis stipris

$$f_{skd} := f_d + \frac{2 \cdot \rho_w \cdot f_{yd}}{100} \cdot \left(1 - \frac{2 \cdot e_0}{y} \right) = 2.235 \quad \text{MPa}$$

$$N_{Rd} := m_{lt} \cdot \varphi_1 \cdot f_{skd} \cdot A_c \cdot \omega = 0.05 \quad \text{MN}$$

$$\frac{N_{ed}}{N_{Rd} \cdot 10^3} = 0.22$$

Išvada: vidinės sienos laikomoji galia nuo pridėjimo ekscentriciteto pakankama

Tikrinama centriškai gniuždoma vidinė armuota mūrinė siena pjūvyje ties pamato padu, kur veikianti ašinė jėga lygi atraminei reakcijai į pamatą. Sieną armuota tinklais 4/4/50/50 kas ketvirtą eilę. Armatūra S500.

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	102	116	0

Centriškai gniuždoma mūrinė siena

Sienos aukštis

$$l := 6.58 \quad \text{m}$$

Sienos ilgis

$$l_{0s} := 1 \quad \text{m}$$

Sienos storis

$$h := 0.25 \quad \text{m}$$

$$y := \frac{h}{2} = 0.125 \quad \text{m}$$

Veikianti ašinė jėga

$$N_{ed} := 131 \quad \text{kN}$$

Skaičiuojamasis elemento aukštis

$$l_0 := 1 = 6.58 \quad \text{m}$$

Santykis

$$\lambda_h := \frac{l_0}{h} = 26.32$$

Mūro, amuoto tinkleliais, tamprumo charakteristika

$$\alpha_{sk} := \alpha \cdot \frac{k \cdot f_d}{f_{skm}} = 1.056 \times 10^3$$

Klupumo koeficientas iš 19 lentelės

$$\varphi := 0.52$$

Elemento skerspjūvio plotas

$$A := h \cdot l_{0s} = 0.25 \quad \text{m}^2$$

$$e_{0lt} := 0 \quad \text{m}$$

$$N_{Edlt} := N_{ed} = 131 \quad \text{kN}$$

$$\eta := 0.38 \quad \text{iš 21 lentelės}$$

$$m_{lt} := \text{if} \left[h \geq 300, 1, 1 - \eta \cdot \frac{N_{Edlt}}{N_{ed}} \cdot \left(1 + \frac{1.2 \cdot e_{0lt}}{h} \right) \right] = 0.62$$

Centriškai gniuždomo amuotojo mūro skaičiuojamasis gniuždomasis stipris

$$f_{sd} := f_d + \frac{2 \cdot \rho_w \cdot f_{yd}}{100} = 3.088 \quad \text{MPa}$$

Armatūros charakteristikos

$$f_{yk} := 500 \quad \text{MPa}$$

$$f_{yd} := \frac{f_{yk}}{1.15} = 434.783 \quad \text{MPa}$$

Armatūros d4 skerspjūvio plotas

$$A_{st} := 0.126 \cdot 10^{-4} \quad \text{m}^2$$

Atstumastarp tinklų

$$a_1 := 0.480 \quad \text{m}$$

Tinklelio akis

$$a := 0.05 \quad \text{m}$$

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	103	116	0

Mūro charakteristikos

Mūro tamprumo charakteristika (iš 16 lentelės)

$$\alpha := 750$$

k iš 15 lentelės

$$k := 2$$

Skaičiuojamasis mūro gniuždomasis stipris

$$f_d := 2.175$$

Armavimo koeficientas, kai armuojama tinkleliu

$$\rho_w := \frac{2 \cdot A_{st}}{a \cdot a_1} \cdot 100 = 0.105 \quad \rho_{wmax} := \frac{50 \cdot f_d}{f_{yd}} = 0.25$$

Mūro, armuoto tinkleliu gniuždomojo stiprio vidutinė reikšmė

$$f_{skm} := f_d + \frac{2 \cdot f_{yd} \cdot \rho_w}{100} = 3.088$$

$$N_{Rd} := m_{lt} \cdot \varphi \cdot f_{sd} \cdot A \cdot 10^3 = 248.896 \quad \text{kN}$$

$$\frac{N_{ed}}{N_{Rd}} = 0.526$$

Išvada: centriškai gniuždomos vidinės mūrinės sienos laikomoji galia pakankama

1.10. Pamatų projektavimas

Pamatų sprendinius tikslinti Darbo projekte. Pamatų betonas ne žemesnės klasės nei C25/30, W6, XC2, F100. Armatūra S500. Pamatų atramines reakcijas žiūrėti atraminių reakcijų plane.

Pamatų reakcijos

Reakcijų kryptys pagal globalias koordinačių ašis, pateiktas pamatų išdėstymo schemeje:

Pagal LST EN 1990:2004 STR ir GEO ribiniam būviui apkrovų deriniai sudaromi pagal formulę:

$$\sum_{j \geq 1} \gamma_{G,j} G_{k,j} + \gamma_p P + \gamma_{Q,1} Q_{k,1} + \sum_{i > 1} \gamma_{Q,i} \Psi_{0,i} Q_{k,i};$$

Čia “+” reiškia derinimas su; $G_{k,j}$ ir $Q_{k,j}$ yra nuolatinių ir kintamų apkrovų charakteristinės reikšmės, γ_G ir γ_Q yra daliniai nuolatinių ir kintamųjų poveikių koeficientai, kurie atsižvelgia į įrašų skaičiavimo modelių neapibrėžtumus, skaičiuojamosios schemos neapibrėžtumus, galimas perkrovas ir t.t.; $\Psi_{0,i}$ – kintamojo poveikio derintinės reikšmės koeficientas.

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	104	116	0

Daliniai koeficientai poveikiams (γ_F) ir jų efektams (γ_E):

Poveikis		Žymuo	Apkrovimo grupė	
			A1	A2
Nuolatinis	Nepalankus	γ_G	1,35	1,0
	Palankus		1,0	1,0
Kintamasis	Nepalankus	γ_Q	1,3	1,3
	Palankus		0	0

NA.A.8 lentelė. Daliniai koeficientai (γ_R) ištisinio sraigtinio gręžimo polių (CFA) pagrindo atsparumui

Atsparumas	Simbolis	Apkrovų grupė			
		R1	R2	R3	R4
Polio pado laikomoji galia	γ_b	1,1			1,45
Polio kamieno šoninio paviršiaus laikomoji galia gniuždymui	γ_s	1,0			1,3
Polio pagrindo suminis atsparumas gniuždymui	γ_t	1,1			1,4
Polio laikomoji galia tempimui	γ_{st}	1,25			1,6

A.4 lentelė. Daliniai grunto rodiklių (γ_M) koeficientai

Grunto rodiklis	Simbolis	Apkrovų grupė	
		M1	M2
Vidinės trinties kampo tangentas ^a	$\gamma_{\varphi'}$	1,0	1,25
Efektinioji sankiba	$\gamma_{c'}$	1,0	1,25
Kerpamasis stipris nedrenuojant	γ_{cu}	1,0	1,4
Gniuždomasis stipris nevaržant	γ_{qu}	1,0	1,4
Vienetinis svoris	γ_γ	1,0	1,0

^a Šis koeficientas taikomas kampo tangentui φ' .

1.10.1. Polių po mūrinėmis sienomis projektavimas

Projektuojami juostiniai poliniai pamatai po mūrinėmis sienomis. Poliai 300mm skersmens. Poliai remiami į abs. Alt +76.68 (IGS 10) polių geometrinis ilgis 6,6m. Mažiausias grunto kūginis stipris $q_c=6,1\text{MPa}$; šoninė trintis $f_s=0-180\text{ kPa}$ pagal sluoksnius. Duomenis imami pagal GR. Nr. 3.

Reakcijos po sienomis pateiktos reakcijų plane. Žingsniai tarp polių parenkami pagal veikiančias atramines reakcijas.

Gniuždomo poliaus laikomosios galios skaičiavimas:

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	106	116	0

**Veikiančios įrašos:**

$$N_{Ed,1} := 262 \cdot 10^{-3} = 0.262 \quad \text{MN}$$

$$N_{Ed,2} := 170 \cdot 10^{-3} = 0.17 \quad \text{MN}$$

Daliniai koeficientai:

Daliniai medžiagų patikimumo koef. atvejui M1:

$$\gamma_{fp,1} := 1$$

$$\gamma_{c,1} := 1$$

$$\gamma_{cu,1} := 1$$

$$\gamma_{qu,1} := 1$$

$$\gamma_{\gamma l} := 1$$

Daliniai medžiagų patikimumo koef. atvejui M2:

$$\gamma_{fp,2} := 1.25$$

$$\gamma_{c,2} := 1.25$$

$$\gamma_{cu,2} := 1.4$$

$$\gamma_{qu,2} := 1.4$$

$$\gamma_{\gamma p} := 1$$

Daliniai koeficientai CFA polių pagrindo atsparumui

	R1	R2	R3	R4
Polio pado laikomoji galia	$\gamma_{b1} := 1.1$	$\gamma_{b2} := 1.1$	$\gamma_{b3} := 1.0$	$\gamma_{b4} := 1.45$
Polio kamieno šoninio paviršiaus alikomoji galia gniuždymui	$\gamma_{s1} := 1.0$	$\gamma_{s2} := 1.1$	$\gamma_{s3} := 1.0$	$\gamma_{s4} := 1.30$
Polio pado suminis atsparumas gniuždymui	$\gamma_{t1} := 1.1$	$\gamma_{t2} := 1.1$	$\gamma_{t3} := 1.0$	$\gamma_{t4} := 1.40$
Polio laikomoji galia tempimui	$\gamma_{st1} := 1.25$	$\gamma_{st2} := 1.15$	$\gamma_{st3} := 1.1$	$\gamma_{st4} := 1.60$

$$\alpha_b := 0.5$$

Grunto rodikliai: $\xi_3 := 1.4$

$$\rho := 21 \frac{\text{kN}}{\text{m}^3}$$

$$q_c := 6.1 \quad \text{MPa}$$

$$f_{s1} := 0.1 \quad \text{MPa} \quad f_{s2} := 0.04 \quad \text{MPa} \quad f_{s3} := 0.0 \quad \text{MPa} \quad f_{s4} := 0.18 \quad \text{MPa} \quad f_{s5} := 0.0 \quad \text{MPa} \quad f_{s6} := 0.0 \quad \text{MPa} \quad f_{s7} := 0.0 \quad \text{MPa}$$

Geometriniai rodikliai: $f_{s8} := 0.0 \quad \text{MPa}$

$$h_1 := 1.2 \quad \text{m} \quad h_2 := 0.6 \quad \text{m} \quad h_3 := 3 \quad \text{m} \quad h_4 := 0.78 \quad \text{m} \quad h_5 := 0. \quad \text{m} \quad h_6 := 0 \quad \text{m} \quad h_7 := 0.0 \quad \text{m} \quad h_8 := 0.0 \quad \text{m}$$

$$d := 0.3 \quad \text{m}$$

$$A_p := \frac{\pi \cdot d^2}{4} = 0.071 \quad \text{m}^2$$

$$A_{s1} := \pi \cdot d \cdot h_1 = 1.131 \quad \text{m}^2 \quad A_{s2} := \pi \cdot d \cdot h_2 = 0.565 \quad \text{m}^2 \quad A_{s3} := \pi \cdot d \cdot h_3 = 2.827 \quad \text{m}^2$$

$$A_{s4} := \pi \cdot d \cdot h_4 = 0.735 \quad \text{m}^2 \quad A_{s5} := \pi \cdot d \cdot h_5 = 0 \quad \text{m}^2 \quad A_{s6} := \pi \cdot d \cdot h_6 = 0 \quad \text{m}^2$$

$$A_{s7} := \pi \cdot d \cdot h_7 = 0 \quad \text{m}^2 \quad A_{s8} := \pi \cdot d \cdot h_8 = 0 \quad \text{m}^2$$

Pirmas projektavimo atvejis: A1+M1+R1

$$q_b := \alpha_b \cdot q_c = 3.05 \quad \text{MPa}$$

$$R_b := q_b \cdot A_p = 0.216 \quad \text{MN}$$

$$R_s := f_{s1} \cdot A_{s1} + f_{s2} \cdot A_{s2} + f_{s3} \cdot A_{s3} + f_{s4} \cdot A_{s4} + f_{s5} \cdot A_{s5} + f_{s6} \cdot A_{s6} + f_{s7} \cdot A_{s7} + f_{s8} \cdot A_{s8} = 0.268$$

$$R_{c.cal1} := \frac{R_b}{\gamma_{b1}} + \frac{R_s}{\gamma_{s1}} = 0.464 \quad \text{MN}$$

$$R_{c.k1} := \frac{R_{c.cal1}}{\xi_3} = 0.331 \quad \text{MN}$$

$$R_{c.d1} := \frac{R_{c.k1}}{\gamma_{t1}} = 0.301 \quad \text{MN}$$

$$\frac{N_{Ed.1}}{R_{c.d1}} = 0.87$$

Antras projektavimo atvejis: A2+M1+R4

$$R_{c.cal2} := \frac{R_b}{\gamma_{b4}} + \frac{R_s}{\gamma_{s4}} = 0.355 \quad \text{MN}$$

$$R_{c.k2} := \frac{R_{c.cal2}}{\xi_3} = 0.253 \quad \text{MN}$$

$$R_{c.d2} := \frac{R_{c.k2}}{\gamma_{t4}} = 0.181 \quad \text{MN}$$

$$\frac{N_{Ed.2}}{R_{c.d2}} = 0.939$$

Išvada: sąlyga tenkinama

1.10.2. Polių po kolonomis ant F ašies projektavimas

Projektuojami poliniai pamatai po kolonomis ant F ašies. Poliai 600mm skersmens. Poliai remiami į abs. Alt +76.68 (IGS 10) polių geometrinis ilgis 6,6m. Mažiausias grunto kūginis stipris $q_c=6,1\text{MPa}$; šoninė trintis $f_s=0-180\text{ kPa}$ pagal sluoksnius. Duomenis imami pagal GR. Nr. 3.

Reakcijos po kolonomis pateiktos reakcijų plane.

Gniuždomo poliaus laikomosios galios skaičiavimas:

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	108	116	0

**Veikiančios įrašos:**

$$N_{Ed,1} := 137 \cdot 10^{-3} = 0.137 \quad \text{MN}$$

$$N_{Ed,2} := 101 \cdot 10^{-3} = 0.101 \quad \text{MN}$$

Daliniai koeficientai:

Daliniai medžiagų patikimumo koef. atvejui M1:

$$\gamma_{fp,1} := 1$$

$$\gamma_{c,1} := 1$$

$$\gamma_{cu,1} := 1$$

$$\gamma_{qu,1} := 1$$

$$\gamma_{\gamma_1} := 1$$

Daliniai medžiagų patikimumo koef. atvejui M2:

$$\gamma_{fp,2} := 1.25$$

$$\gamma_{c,2} := 1.25$$

$$\gamma_{cu,2} := 1.4$$

$$\gamma_{qu,2} := 1.4$$

$$\gamma_{\gamma_2} := 1$$

Daliniai koeficientai CFA polių pagrindo atsparumui

	R1	R2	R3	R4
Polio pado laikomoji galia	$\gamma_{b1} := 1.1$	$\gamma_{b2} := 1.1$	$\gamma_{b3} := 1.0$	$\gamma_{b4} := 1.45$
Polio kamieno šoninio paviršiaus alikomoji galia gniuždymui	$\gamma_{s1} := 1.0$	$\gamma_{s2} := 1.1$	$\gamma_{s3} := 1.0$	$\gamma_{s4} := 1.30$
Polio pado suminis atsparumas gniuždymui	$\gamma_{t1} := 1.1$	$\gamma_{t2} := 1.1$	$\gamma_{t3} := 1.0$	$\gamma_{t4} := 1.40$
Polio laikomoji galia tempimui	$\gamma_{st1} := 1.25$	$\gamma_{st2} := 1.15$	$\gamma_{st3} := 1.1$	$\gamma_{st4} := 1.60$

$$\alpha_b := 0.5$$

Grunto rodikliai: $\xi_3 := 1.4$

$$\rho := 21 \frac{\text{kN}}{\text{m}^3}$$

$$q_c := 6.1 \quad \text{MPa}$$

$$f_{s1} := 0.1 \quad \text{MPa} \quad f_{s2} := 0.04 \quad \text{MPa} \quad f_{s3} := 0.0 \quad \text{MPa} \quad f_{s4} := 0.18 \quad \text{MPa} \quad f_{s5} := 0.0 \quad \text{MPa} \quad f_{s6} := 0.0 \quad \text{MPa} \quad f_{s7} := 0.0 \quad \text{MPa}$$

Geometriniai rodikliai: $f_{s8} := 0.0 \quad \text{MPa}$

$$h_1 := 1.2 \quad \text{m} \quad h_2 := 0.6 \quad \text{m} \quad h_3 := 3 \quad \text{m} \quad h_4 := 0.78 \quad \text{m} \quad h_5 := 0. \quad \text{m} \quad h_6 := 0 \quad \text{m} \quad h_7 := 0.0 \quad \text{m} \quad h_8 := 0.0 \quad \text{m}$$
$$d := 0.6 \quad \text{m}$$

$$A_p := \frac{\pi \cdot d^2}{4} = 0.283 \quad \text{m}^2$$

$$A_{s1} := \pi \cdot d \cdot h_1 = 2.262 \quad \text{m}^2 \quad A_{s2} := \pi \cdot d \cdot h_2 = 1.131 \quad \text{m}^2 \quad A_{s3} := \pi \cdot d \cdot h_3 = 5.655 \quad \text{m}^2$$

$$A_{s4} := \pi \cdot d \cdot h_4 = 1.47 \quad \text{m}^2 \quad A_{s5} := \pi \cdot d \cdot h_5 = 0 \quad \text{m}^2 \quad A_{s6} := \pi \cdot d \cdot h_6 = 0 \quad \text{m}^2$$

$$A_{s7} := \pi \cdot d \cdot h_7 = 0 \quad \text{m}^2 \quad A_{s8} := \pi \cdot d \cdot h_8 = 0 \quad \text{m}^2$$

**Pirmas projektavimo atvejis:
A1+M1+R1**

$$q_b := \alpha_b \cdot q_c = 3.05 \quad \text{MPa}$$

$$R_b := q_b \cdot A_p = 0.862 \quad \text{MN}$$

$$R_s := f_{s1} \cdot A_{s1} + f_{s2} \cdot A_{s2} + f_{s3} \cdot A_{s3} + f_{s4} \cdot A_{s4} + f_{s5} \cdot A_{s5} + f_{s6} \cdot A_{s6} + f_{s7} \cdot A_{s7} + f_{s8} \cdot A_{s8} = 0.536$$

$$R_{c,cal1} := \frac{R_b}{\gamma_{b1}} + \frac{R_s}{\gamma_{s1}} = 1.32 \quad \text{MN}$$

$$R_{c,k1} := \frac{R_{c,cal1}}{\xi_3} = 0.943 \quad \text{MN}$$

$$R_{c,d1} := \frac{R_{c,k1}}{\gamma_{t1}} = 0.857 \quad \text{MN}$$

$$\frac{N_{Ed,1}}{R_{c,d1}} = 0.16$$

**Antras projektavimo atvejis:
A2+M1+R4**

$$R_{c,cal2} := \frac{R_b}{\gamma_{b4}} + \frac{R_s}{\gamma_{s4}} = 1.007 \quad \text{MN}$$

$$R_{c,k2} := \frac{R_{c,cal2}}{\xi_3} = 0.719 \quad \text{MN}$$

$$R_{c,d2} := \frac{R_{c,k2}}{\gamma_{t4}} = 0.514 \quad \text{MN}$$

$$\frac{N_{Ed,2}}{R_{c,d2}} = 0.197$$

Išvada: sąlyga tenkinama

Poliaus atsparumo lenkimui tikrinimas:

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	110	116	0

$$q_c := 6100 \text{ kPa} \quad f_{si1} := 100 \text{ kPa} \quad f_{si2} := 40 \quad f_{si3} := 0 \quad f_{si4} := 180 \quad f_{si5} := 0 \quad f_{si6} := 0 \quad f_{si7} := 0 \quad f_{si8} := 0$$

$$N := 132 \text{ kN} \quad h_1 := 1.2 \quad h_2 := 0.6 \quad h_3 := 3 \quad h_4 := 0.78 \quad h_5 := 0.0 \quad h_6 := 0.0 \quad h_7 := 0.0 \quad h_8 := 0.0$$

$$M_d := 13 \text{ kNm}$$

$$Q_d := 7 \text{ kN}$$

Max leistinas nuosėdis:

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

$$s := 0.16 \text{ m}$$

Poliaus geometrinis ilgis:

Grafiko Rsn numeris pagal santyki:

$$h := 6.6 \text{ m}$$

$$n := 100 \cdot \frac{s}{d} = 26.6 \%$$

Pagrindo stiprumas po pamato padu:

iš 6.22, 6.23 grafikų

$$R_{s2} := 0.12 \cdot q_c \cdot 10^{-3} + 0.24 = 0.972 \text{ MPa}$$

$$A_b := 3.14 \cdot \frac{(d^2)}{4} = 0.283$$

Trinties jėga prie pamato šonų:

$$F_f := 3.14 \cdot d \cdot \left(h_1 \cdot \frac{f_{si1}}{3} + h_2 \cdot \frac{f_{si2}}{3} + h_3 \cdot \frac{f_{si3}}{3} + h_4 \cdot \frac{f_{si4}}{3} + h_5 \cdot \frac{f_{si5}}{3} + h_6 \cdot \frac{f_{si6}}{3} + h_7 \cdot \frac{f_{si7}}{3} + h_8 \cdot \frac{f_{si8}}{3} \right) = 178.603 \text{ kN}$$

Slėgis po pamato padu:

$$p := \frac{(N - F_f)}{A_b} = -164.909 \text{ kPa} \quad \text{ne daugiau nei } R_{s2}$$

Pasisukimas ir pasislinkimas

Skaičiuojamasis pamato gylis:

$$d_d := h_1 + h_2 + h_3 + h_4 + h_5 + h_6 + h_7 + h_8 = 5.58 \text{ m}$$

Horizontalios jėgos nuo momento aukštis virš pamato

$$h_m := \frac{M_d}{Q_d} = 1.857$$

Horizontalios jėgos pridėties taško skaičiuojamasis aukštis:

$$h_d := h - d_d + h_m = 2.877 \text{ m}$$

$$\eta := \frac{(1.5 \cdot h_d + 0.5 \cdot d_d)}{1.5 \cdot h_d + d_d} = 0.718 \quad \mu := 0.5$$

kai $F_f < N$:

Pamato posūkiui besipriešinančių jėgų atstojamoji:

$$F_Q := \frac{\left[(N - F_f) \cdot \mu \cdot d_d + 1.5 \cdot F_f \cdot \frac{d}{\pi} \right]}{2 \cdot (1.5 \cdot h_d + d_d)} = -3.984 \text{ kN}$$

$$\text{pamatas} := \text{if} \left[F_Q \geq 0.5 \cdot (\eta + 1) \cdot Q_d, \text{"nepasisuka"}, \text{"pasisuka"} \right] = \text{"pasisuka"}$$

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	111	116	0

Pamato posukio centro gylis nuo skaičiuojamojo pagrindo paviršiaus z_0 :

$$z_0 := \frac{d_d}{1 + \frac{(Q_d \cdot \eta - F_Q)}{Q_d - F_Q}} = 3.065 \quad \text{m}$$

kadangi := if($z_0 < d_d$, "u formule tinka", "netinka") = "u formule tinka"

$$R_{s0.5} := 0.04q_c \cdot 10^{-3} + 0.1 = 0.344$$

Horizontalus pagrindo standumo modulis:

$$u_u := 0.01 \cdot d = 6 \times 10^{-3} \quad \text{m}$$

$$C_h := \frac{R_{s0.5} \cdot 10^3}{0.005d} = 1.147 \times 10^5$$

$$i_u := 0.005 \text{ m}$$

$$u := \left[4Q_d \cdot \frac{(1.5h_d + d_d)}{C_h \cdot d \cdot d_d^2} \right] \cdot \left[1 + \frac{(h - d_d)}{z_0} \right] \cdot \left(1 - \frac{F_Q}{Q_d} \right) = 2.705 \times 10^{-4} \quad \text{m}$$

poslinkis := if($u < u_u$, "poslinkis leistinas", "poslinkis neleistinas") = "poslinkis leistinas"

$$i := \frac{u}{(z_0 + h - d_d)} = 6.621 \times 10^{-5} \quad \text{m}$$

pasisukimas := if($i < i_u$, "pasisukimas leistinas", "pasisukimas neleistinas") = "pasisukimas leistinas"

Gylis kuriame veikia didžiausias lenkimo momentas

Grunto prie pamato šoninio paviršiaus vidutinis stipris:

$$R_f := \frac{F_f}{\pi \cdot d \cdot d_d} = 16.981 \quad \text{kN}$$

Gylis, kuriame veikia didžiausias lenkimo momentas:

$$z_m := z_0 - \sqrt{z_0^2 - \frac{\left(1 - \frac{d^2 \cdot R_f}{2 \cdot Q_d} \right) \cdot d_d^2 \cdot z_0}{2 \cdot (1.5 \cdot h_d + d_d)}} = 0.481 \quad \text{m}$$

Didžiausias polių veikiantis lenkimo momentas:

$$M := Q_d \cdot (h_d + z_m) - \frac{2 \cdot Q_d}{3 \cdot d_d^2 \cdot z_0} \cdot (1.5 \cdot h_d + d_d) \cdot (3 \cdot z_0 - z_m) \cdot z_m^2 - \frac{d^2}{2} \cdot R_f \cdot z_m = 21.061 \text{ kNm}$$

Išvada: sąlyga tenkinama

1.10.3. Polių po priedangos monolitine siena projektavimas

Projektuojami poliniai pamatai po priedangos monolitine siena ant 1 ašies. Poliai 600mm skersmens išdėstyti 1m žingsniu. Poliai remiami į abs. Alt +76.68 (IGS 10) polių geometrinis ilgis 3,10m. Mažiausias grunto kūginis stipris $q_c=6,1\text{MPa}$; šoninė trintis $f_s=0-180 \text{ kPa}$ pagal sluoksnius. Duomenis imami pagal GR. Nr. 3.

Reakcijos po kolonomis pateiktos reakcijų plane. Trečias ypatingų poveikių apkrovų derinys skaičiuojamas kaip M1+R1 projektavimo atvejis.

Gniuždomo poliaus laikomosios galios skaičiavimas:

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	112	116	0

Veikiančios įrašos:

$$N_{Ed,1} := 115 \cdot 10^{-3} = 0.115 \quad \text{MN}$$

$$N_{Ed,2} := 92 \cdot 10^{-3} = 0.092 \quad \text{MN}$$

$$N_{Ed,3} := 621 \cdot 10^{-3} = 0.621 \quad \text{MN}$$

Daliniai koeficientai:

Daliniai medžiagų patikimumo koef. atvejui M1:

$$\gamma_{fp,1} := 1$$

$$\gamma_{c,1} := 1$$

$$\gamma_{sw,1} := 1$$

$$\gamma_{qu,1} := 1$$

$$\gamma_{\gamma,1} := 1$$

Daliniai medžiagų patikimumo koef. atvejui M2:

$$\gamma_{fp,2} := 1.25$$

$$\gamma_{c,2} := 1.25$$

$$\gamma_{sw,2} := 1.4$$

$$\gamma_{qu,2} := 1.4$$

$$\gamma_{\gamma,2} := 1$$

Daliniai koeficientai CFA polių pagrindo atsparumui

	R1	R2	R3	R4
Polio pado laikomoji galia	$\gamma_{b1} := 1.1$	$\gamma_{b2} := 1.1$	$\gamma_{b3} := 1.0$	$\gamma_{b4} := 1.45$
Polio kamieno šoninio paviršiaus alikomoji galia gniuždymui	$\gamma_{s1} := 1.0$	$\gamma_{s2} := 1.1$	$\gamma_{s3} := 1.0$	$\gamma_{s4} := 1.30$
Polio pado suminis atsparumas gniuždymui	$\gamma_{t1} := 1.1$	$\gamma_{t2} := 1.1$	$\gamma_{t3} := 1.0$	$\gamma_{t4} := 1.40$
Polio laikomoji galia tempimui	$\gamma_{st1} := 1.25$	$\gamma_{st2} := 1.15$	$\gamma_{st3} := 1.1$	$\gamma_{st4} := 1.60$

$$\alpha_b := 0.5$$

Grunto rodikliai: $\xi_3 := 1.4$

$$\rho := 21 \frac{\text{kN}}{\text{m}^3}$$

$$q_c := 6.1 \quad \text{MPa}$$

$$f_{s1} := 0.1 \quad \text{MPa} \quad f_{s2} := 0.04 \quad \text{MPa} \quad f_{s3} := 0.0 \quad \text{MPa} \quad f_{s4} := 0.18 \quad \text{MPa} \quad f_{s5} := 0.0 \quad \text{MPa} \quad f_{s6} := 0.0 \quad \text{MPa} \quad f_{s7} := 0.0 \quad \text{MPa}$$

Geometriniai rodikliai: $f_{s8} := 0.0 \quad \text{MPa}$

$$h_1 := 0 \quad \text{m} \quad h_2 := 0.0 \quad \text{m} \quad h_3 := 2.32 \text{m} \quad h_4 := 0.78 \quad \text{m} \quad h_5 := 0. \quad \text{m} \quad h_6 := 0 \quad \text{m} \quad h_7 := 0.0 \quad \text{m} \quad h_8 := 0.0 \quad \text{m}$$

$$d := 0.6 \quad \text{m}$$

$$A_p := \frac{\pi \cdot d^2}{4} = 0.283 \quad \text{m}^2$$

$$A_{s1} := \pi \cdot d \cdot h_1 = 0 \quad \text{m}^2 \quad A_{s2} := \pi \cdot d \cdot h_2 = 0 \quad \text{m}^2 \quad A_{s3} := \pi \cdot d \cdot h_3 = 4.373 \quad \text{m}^2$$

$$A_{s4} := \pi \cdot d \cdot h_4 = 1.47 \quad \text{m}^2 \quad A_{s5} := \pi \cdot d \cdot h_5 = 0 \quad \text{m}^2 \quad A_{s6} := \pi \cdot d \cdot h_6 = 0 \quad \text{m}^2$$

$$A_{s7} := \pi \cdot d \cdot h_7 = 0 \quad \text{m}^2 \quad A_{s8} := \pi \cdot d \cdot h_8 = 0 \quad \text{m}^2$$

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	113	116	0

Pirmas projektavimo atvejis: A1+M1+R1

$$q_b := \alpha_b \cdot q_c = 3.05 \quad \text{MPa}$$

$$R_b := q_b \cdot A_p = 0.862 \quad \text{MN}$$

$$R_s := f_{s1} \cdot A_{s1} + f_{s2} \cdot A_{s2} + f_{s3} \cdot A_{s3} + f_{s4} \cdot A_{s4} + f_{s5} \cdot A_{s5} + f_{s6} \cdot A_{s6} + f_{s7} \cdot A_{s7} + f_{s8} \cdot A_{s8} = 0.265$$

$$R_{c,cal1} := \frac{R_b}{\gamma_{b1}} + \frac{R_s}{\gamma_{s1}} = 1.049 \quad \text{MN}$$

$$R_{c,k1} := \frac{R_{c,cal1}}{\xi_3} = 0.749 \quad \text{MN}$$

$$R_{c,d1} := \frac{R_{c,k1}}{\gamma_{t1}} = 0.681 \quad \text{MN}$$

$$\frac{N_{Ed,1}}{R_{c,d1}} = 0.169$$

Antras projektavimo atvejis: A2+M1+R4

$$R_{c,cal2} := \frac{R_b}{\gamma_{b4}} + \frac{R_s}{\gamma_{s4}} = 0.798 \quad \text{MN}$$

$$R_{c,k2} := \frac{R_{c,cal2}}{\xi_3} = 0.57 \quad \text{MN}$$

$$R_{c,d2} := \frac{R_{c,k2}}{\gamma_{t4}} = 0.407 \quad \text{MN}$$

$$\frac{N_{Ed,2}}{R_{c,d2}} = 0.226$$

Trečias projektavimo atvejis: ACC+M1+R1

$$q_b := \alpha_b \cdot q_c = 3.05 \quad \text{MPa}$$

$$R_b := q_b \cdot A_p = 0.862 \quad \text{MN}$$

$$R_s := f_{s1} \cdot A_{s1} + f_{s2} \cdot A_{s2} + f_{s3} \cdot A_{s3} + f_{s4} \cdot A_{s4} + f_{s5} \cdot A_{s5} + f_{s6} \cdot A_{s6} + f_{s7} \cdot A_{s7} + f_{s8} \cdot A_{s8} = 0.265$$

$$R_{c,cal1} := \frac{R_b}{\gamma_{b1}} + \frac{R_s}{\gamma_{s1}} = 1.049 \quad \text{MN}$$

$$R_{c,k1} := \frac{R_{c,cal1}}{\xi_3} = 0.749 \quad \text{MN}$$

$$R_{c,d1} := \frac{R_{c,k1}}{\gamma_{t1}} = 0.681 \quad \text{MN}$$

$$\frac{N_{Ed,3}}{R_{c,d1}} = 0.912$$

Išvada: laikomoji galia pakankama

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	114	116	0

Lenkiamo poliaus laikomosios galios skaičiavimas, kai polis sujungtas su siena lanksčiai. Lenkiamo poliaus slėgis po pamato padu, poslinkis ir pasisukimas skaičiuojami tik nuo A1 apkrovų derinio (be ypatingųjų poveikių apkrovos):

$$q_c := 6100 \text{ kPa} \quad f_{si1} := 100 \text{ kPa} \quad f_{si2} := 40 \quad f_{si3} := 0 \quad f_{si4} := 180 \quad f_{si5} := 0 \quad f_{si6} := 0 \quad f_{si7} := 0 \quad f_{si8} := 0$$

$$N := 54 \text{ kN} \quad h_1 := 0 \quad h_2 := 0.0 \quad h_3 := 2.32 \quad h_4 := 0.78 \quad h_5 := 0.0 \quad h_6 := 0.0 \quad h_7 := 0.0 \quad h_8 := 0.0$$

$$M_d := 0.01 \text{ kNm}$$

$$Q_d := 30 \text{ kN}$$

Max leistinas nuosėdis:

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

$$s_w := 0.16 \text{ m}$$

Poliaus geometrinis ilgis:

Grafiko Rsn numeris pagal santyki:

$$h := 6.6 \text{ m}$$

$$n := 100 \cdot \frac{s}{d} = 26.6 \%$$

Pagrindo stiprumas po pamato padu:

iš 6.22, 6.23 grafikų

$$R_{s2} := 0.12 \cdot q_c \cdot 10^{-3} + 0.24 = 0.972 \text{ MPa}$$

$$A_b := 3.14 \cdot \frac{d^2}{4} = 0.283$$

Trinties jėga prie pamato šonų:

$$F_f := 3.14 \cdot d \cdot \left(h_1 \cdot \frac{f_{si1}}{3} + h_2 \cdot \frac{f_{si2}}{3} + h_3 \cdot \frac{f_{si3}}{3} + h_4 \cdot \frac{f_{si4}}{3} + h_5 \cdot \frac{f_{si5}}{3} + h_6 \cdot \frac{f_{si6}}{3} + h_7 \cdot \frac{f_{si7}}{3} + h_8 \cdot \frac{f_{si8}}{3} \right) = 88.171 \text{ kN}$$

Slėgis po pamato padu:

$$p := \frac{(N - F_f)}{A_b} = -120.917 \text{ kPa} \quad \text{ne daugiau nei } R_{s2}$$

Pasisukimas ir pasislinkimas

Skaičiuojamasis pamato gylis:

$$d_d := h_1 + h_2 + h_3 + h_4 + h_5 + h_6 + h_7 + h_8 = 3.1 \text{ m}$$

Horizontalios jėgos nuo momento aukštis virš pamato

$$h_m := \frac{M_d}{Q_d} = 3.333 \times 10^{-4}$$

Horizontalios jėgos pridėties taško skaičiuojamasis aukštis:

$$h_d := h - d_d + h_m = 3.5 \text{ m}$$

$$\eta := \frac{(1.5 \cdot h_d + 0.5 \cdot d_d)}{1.5 \cdot h_d + d_d} = 0.814 \quad \mu := 0.5$$

kai $F_f < N$:

Pamato posūkiui besipriešinančių jėgų atstojamoji:

$$F_Q := \frac{\left[(N - F_f) \cdot \mu \cdot d_d + 1.5 \cdot F_f \cdot \frac{d}{\pi} \right]}{2 \cdot (1.5 \cdot h_d + d_d)} = -1.659 \text{ kN}$$

$$\text{pamatas} := \text{if} \left[F_Q \geq 0.5 \cdot (\eta + 1) \cdot Q_d, \text{"nepasisuka"}, \text{"pasisuka"} \right] = \text{"pasisuka"}$$

IN2329-01-TP-SK-S	Lapas	Lapų	Laida
	115	116	0

Pamato posukio centro gylis nuo skaičiuojamojo pagrindo paviršiaus z_0 :

$$z_0 := \frac{d_d}{1 + \frac{(Q_d \cdot \eta - F_Q)}{Q_d - F_Q}} = 1.699 \quad \text{m}$$

kadangi := if($z_0 < d_d$, "u formulė tinka", "netinka") = "u formulė tinka"

$$R_{s0.5} := 0.04q_c \cdot 10^{-3} + 0.1 = 0.344$$

Horizontalus pagrindo standumo modulis:

$$u_u := 0.01 \cdot d = 6 \times 10^{-3} \quad \text{m}$$

$$C_h := \frac{R_{s0.5} \cdot 10^3}{0.005d} = 1.147 \times 10^5$$

$$i_u := 0.005 \text{ m}$$

$$u := \left[4Q_d \cdot \frac{(1.5h_d + d_d)}{C_h \cdot d \cdot d_d^2} \right] \cdot \left[1 + \frac{(h - d_d)}{z_0} \right] \cdot \left(1 - \frac{F_Q}{Q_d} \right) = 4.893 \times 10^{-3} \quad \text{m}$$

poslinkis := if($u < u_u$, "poslinkis leistinas", "poslinkis neleistinas") = "poslinkis leistinas"

$$i := \frac{u}{(z_0 + h - d_d)} = 9.411 \times 10^{-4} \quad \text{m}$$

pasisukimas := if($i < i_u$, "pasisukimas leistinas", "pasisukimas neleistinas") = "pasisukimas leistinas"

Gylis kuriame veikia didžiausias lenkimo momentas

Grunto prie pamato šoninio paviršiaus vidutinis stipris:

$$R_f := \frac{F_f}{\pi \cdot d \cdot d_d} = 15.089 \quad \text{kN}$$

Gylis, kuriame veikia didžiausias lenkimo momentas:

$$z_m := z_0 - \sqrt{z_0^2 - \frac{\left(1 - \frac{d^2 \cdot R_f}{2 \cdot Q_d} \right) \cdot d_d^2 \cdot z_0}{2 \cdot (1.5h_d + d_d)}} = 0.286 \quad \text{m}$$

Didžiausias polių veikiantis lenkimo momentas:

$$M := Q_d \cdot (h_d + z_m) - \frac{2 \cdot Q_d}{3 \cdot d_d^2 \cdot z_0} \cdot (1.5h_d + d_d) \cdot (3 \cdot z_0 - z_m) \cdot z_m^2 - \frac{d^2}{2} \cdot R_f \cdot z_m = 108.781 \text{ kNm}$$

Išvada: sąlygos tenkinamos

1.11. Projekte atliktų skaičiavimų atitiktis projekto rengimo dokumentams, normatyvinių statybos techninių dokumentų reikalavimams

Projekte atliktų skaičiavimų rezultatai atitinka projekto rengimo dokumentų reikalavimus, normatyvinių statybos techninių dokumentų reikalavimus, o konstrukcinių elementų ir jungčių laikomosios galios išnaudojimas neviršija ribinių verčių

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	116	116	0