1C NASLOVNA STRAN NAČRTA
2 Načrt s področja gradbeništva
2.1 Načrt temeljenja drogov razsvetljave

PODATKI O GRADNJI	
naziv gradnje	**IZVEDBA RAZSVETLJAVE IN VZDRŽEVALNIH DEL NA NOGOMETNEM STADIONU V AJDOVŠČINI**
kratek opis gradnje	**na obodu glavnega nogometnega igrišča se postavi 8 reflektorskih drogov z ustreznimi temelji, 7 drogov je višine 22 m, en reflektorski drog pa višine 19,24 m merjeno od absolutne nadmorske višine 111.12 m.n.m., na katere se montira 96 reflektorjev za razsvetljavo moči 1200W in svetlobnim tokom 216000lum, 5000°K, IP65, IK09.**
VRSTE GRADNJE	**novogradnja-prizidava**
PODATKI O PROJEKTNI DOKUMENTACIJI	
vrsta dokumentacije	**PZI (projektna dokumentacija za izvedbo gradnje**
številka projekta	**2023-1/12**
PODATKI O NAČRTU	
strokovno področje načrta	**2 Načrt s področja gradbeništva**
naziv načrta	**2.1 Načrt temeljenja drogov razsvetljave**
številka načrta	**116/23**
datum izdelave	**05.2024**
datum spremembe	
PODATKI O PROJEKTANTU NAČRTA	
projektant načrta (naziv družbe)	**CORUS INŽENIRJI d.o.o.**
naslov	**C. IV prekomorske 30a, 5270 Ajdovščina**
odgovorna oseba projektanta načrta	**MATEJ KOSOVEL**
podpis odgovorne osebe projektanta načrta	corus inženirji
PODATKI O IZDELOVALCU NAČRTA	
ime in priimek pooblaščenega inženirja	**MATEJ KOSOVEL, univ.dipl.inž.grad.**
identifikacijska številka	**IZS G-2341 PI**
podpis pooblaščenega inženirja	MATEJ KOSOVEL univ.dipl.inž.grad. IZS G-2341

2C IZJAVA PROJEKTANTA NAČRTA IN POOBLAŠČENEGA STROKOVNJAKA, KI JE IZDELAL NAČRT V PZI IN PID

PROJEKTANT NAČRTA	
projektant načrta (naziv družbe)	**CORUS INŽENIRJI d.o.o.**
naslov	**C. IV prekomorske 30a, 5270 Ajdovščina**
odgovorna oseba projektanta načrta	**MATEJ KOSOVEL**

IN POOBLAŠČENI STROKOVNJAK, KI JE IZDELAL NAČRT	
ime in priimek pooblaščenega inženirja	**MATEJ KOSOVEL, univ.dipl.inž.grad.**

IZJAVLJAVA:

DA NAČRT

vrsta dokumentacije	**PZI (projektna dokumentacija za izvedbo gradnje**
strokovno področje načrta	**2 Načrt s področja gradbeništva**
naziv načrta	**2.1 Načrt temeljenja drogov razsvetljave**
številka načrta	**116/23**
datum izdelave	**05.2024**
datum spremembe	

upošteva relevantne predpise in druge normativne dokumente ter da so upoštevane ustrezne bistvene in druge zahteve.

PODATKI O PROJEKTANTU NAČRTA	
projektant načrta (naziv družbe)	**CORUS INŽENIRJI d.o.o.**
naslov	**C. IV prekomorske 30a, 5270 Ajdovščina**
odgovorna oseba projektanta načrta	**MATEJ KOSOVEL**
podpis odgovorne osebe projektanta načrta	corus inženirji

PODATKI O IZDELOVALCU NAČRTA	
ime in priimek pooblaščenega inženirja	**MATEJ KOSOVEL, univ.dipl.inž.grad.**
identifikacijska številka	**IZS G-2341 PI**
podpis pooblaščenega inženirja	MATEJ KOSOVEL univ.dipl.inž.grad. IZS G-2341

PRILOGA 3A

3A KAZALO VSEBINE NAČRTA

T.1.1 TEHNIČNO POROČILO

1 SPLOŠNO

Občina Ajdovščina želi izvesti razsvetljavo nogometnega igrišča na mestnem stadionu v Ajdovščini. V ta namen bo potrebno postaviti osem (8) reflektorskih drogov. Na vsakem drogu bo montirano dvanajst (12) reflektorjev. Reflektorski drogovi so različnih višin, ki so navedene v spodnji tabeli:

oznaka reflektorja	nadmorska višina vpetja reflektorskega droga v vrh temelja m.n.m.	maksimalna nadmorska višina reflektorskega droga m.n.m	maksimalna skupna višina reflektorskega droga (m)
1	111,12	133,12	**22,00**
2	111,12	133,12	**22,00**
3	111,12	133,12	**22,00**
4	111,12	133,12	**22,00**
5	111,12	133,12	**22,00**
6	111,12	130,36	**19,20**
7	114,60	133,12	**18,50**
8	114,60	133,12	**18,50**

Drogovi so izdelek zato je dimenzioniranje le teh izvedlo podjetje proizvajalca Abacus Lighting ltd iz Velike Britanije. Vzdolž daljše stranice so na obeh straneh razporejeni po štirje reflektorji. Vogalni drogovi se montirajo na obstoječe temelje, katere je potrebno delno rekonstruirati, vmesni pa na nove temelje.

2 OSNOVE ZA PROJEKTIRANJE

Osnove za projektiranje:

- Načrt s področja gradbeništva faze DGD št.: 2023-1/12 (Arti inženiring d.o.o, december 2023)
- GG elaborat št.:006/24 (corus inženirji d.o.o., januar 2024)

2.1 STANDARDI, PRAVILNIKI IN NAVODILA

Upoštevani standardi in pravilniki pri projektiranju objektov:

PODROČJE	STANDARD
osnove projektiranja	SIST EN 1990: 2004
upoštevane obtežbe	SIST EN 1991-1-1:2004, SIST EN 1991-1-1:2004/A101:2005
	SIST EN 1991-1-4:2005, SIST EN 1991-1-4:2005/oA10:2007
betonske konstrukcije	SIST EN 1992-1-1:2005, SIST EN 1992-1-1:2005/A101:2006
jeklene konstrukcije – zaslon	SIST EN 1993-1-1:2005, SIST EN 1993-1-1:2005/A101:2006
temeljenje	SIST EN 1997-1:2005, SIST EN 1997-1:2005/AC:2009
materiali	Beton: SIST EN 206, SIST EN 1026, SIST EN 12620,
	Armatura: SIST EN 10080
	Izvajanje jeklenih konstrukcij: SIST EN 1090

2.2 GEOLOŠKO GEOMEHANSKI ELABORAT – POVZETEK

Na lokaciji objekta so bile izvedene terenske raziskave na podlagi katerih je izdelan GG elaborat (št. 006/24, corus inženirji d.o.o., januar 2024). Objekt bo pretežno temeljen v zaglinjenih do zameljenih prodih in gruščih kjer se mestoma lahko pojavljajo tudi žepi gline ali meljev. V računu so bile privzete karakteristike temeljnih tal iz preglednice 1.

	prostor. teža	**enoosna tlačna trdnost**	**nedrenirana strižna trdnost**	**kohezija**	**strižni kot**	**Modul elastičnosti**
Material	γ	q_u	c_u	c	ϕ	E
	[kN/m3]	[kPa]	[kPa]	[kPa]	[°]	[kPa]
GrP – nasip	20,1	-	-	0	31,0	16.000
CIL – aluvialne gline	18,3	350	175	2,0	27,0	6.500
GrP-siGr – zaglinjeni do zameljeni prodi	19,0	-	-	1	33,0	20.000
flišna podlaga	22,0	-	-	30	35	100.000

Preglednica 1: Karakteristične vrednosti geomehanskih parametrov

Na lokaciji objekta se talna voda ne dvigne do nivoja temeljenja.

3 ZASNOVA KONSTRUKCIJE

Drogovi so izdelek zato je dimenzioniranje le teh izvedlo podjetje proizvajalca Abacus Lighting ltd iz Velike Britanije. Za dimenzioniranje plitvih AB točkovnih temeljev drogov so bile privzete reakcije drogov na vpetju katere je določil proizvajalec.

3.1 TEMELJENJE DROGOV ZA RAZSVETLJAVO

Drogovi za razsvetljavo so temeljeni plitvo na točkovnih AB temeljih.

Vogalni točkovni temelji TT1 (so že izvedeni po načrtu (št.: 3947/2010, Primorje d.d., avgust 2010) z dimenzijo temeljne stope 470/470/80cm ter temeljnim nastavkom 150/150/185cm. V načrtu predpisani materiali so beton C30/37 (XC4, Xf3, PV II) ter armatura (B500). Temelji niso pravilno orientirani zato bo potrebno temeljne nastavke rekonstruirati na zarotirano pozicijo. Obstoječe nastavke bo potrebno porušiti nato pa izvesti nove temeljne nastavke skladno z detajli prikazanimi v risbah. Posebno pozornost je potrebno posvetiti izvedbi kemičnih sider na temeljih TT1 ter natančno slediti predpisanemu postopku vgradnje.

Ob glavni tribuni je potrebno zgraditi nova točkovna temelja TT2 katerih dimenzija temeljne stope znaša 450/450/80cm dimenzija temeljnega nastavka pa 150/150/140cm.

Ob pomožni tribuni je potrebno zgraditi nova točkovna temelja TT3 katerih dimenzija temeljne stope znaša 450/255/80cm dimenzija temeljnega nastavka pa 150/150/70cm. Nove temelje je potrebno monolitno povezati z obstoječimi temelji tribunskih nosilcev skladno z detajli prikazanimi v risbah.

V vse temeljne nastavke je potrebno natančno vgraditi sidrni modul za montažo drogov. Sidri modul predstavljajo navojne palice 16xM20 (8.8) dolžine 150cm.

Pod novimi temelji je potrebno izvesti zbitost planuma do nivoja min.100 MPa (Ev2).

3.2 MATERIALI

Vsa betonska dela se izvajajo z betonom C 30/37, XC4, XD3, XF3, PV-II, Dmax 32 ter armirajo z varivim armaturnim jeklom B500A. Konstrukcije se sidra v temelje z vroče cinkanimi navojnimi palicami kvalitete 8.8.

4 ZAŠČITA GRADBENE JAME

Gradbena jama se varuje s stabilnimi nakloni izkopa 1:1, kjer to ni možno je potrebno gradbeno jamo varovati z geotehničnimi podpornimi konstrukcijami za katere je potrebno pred izvedbo izdelati načrt.

5 ZAKLJUČEK

Izvajalec je pred začetkom izvajanja del dolžan izdelati Tehnološki elaborat za izvedbo konstrukcij. Iz elaborata mora biti razvidna tehnologija izvedbe in faznost del. Navedeni morajo biti proizvajalci ključnih materialov za zagotavljanje trajnosti in stabilnosti konstrukcij, priloženi pa morajo biti ustrezni certifikati. Del elaborata mora biti tudi program notranje kontrole kakovosti.

Za čas gradnje mora biti imenovan nadzornik nad gradnjo.

Izkop gradbene jame mora pregledati strokovnjak geomehanik kateri ugotovi ustreznost izbranih predpostavk. V primeru, da so razmere slabše od predpostavljenih je potrebno obvestiti odgovornega projektanta gradbeništva, ki bo podal ustrezne rešitve

T.1.2 STATIČNA ANALIZA KONSTRUKCIJ

1 DIMENZIONIRANJE TEMELJEV DROGOV ZA RAZSVETLJAVO

1.1 OBTEŽBE

Konstrukcija je bila preverjena na vse predpisane obtežbe standardov

- SIST EN 1991-1-1:2004, SIST EN 1991-1-1:2004/A101:2005– določitev stalne obtežbe
- SIST EN 1991-1-4:2005, SIST EN 1991-1-4:2005/oA10:2007– določitev vetrne obtežbe

a Teže izbranih materialov

prostorninska teža betona γ_c=25 kN/m^3
prostorninska teža jekla γ_z=78.5 kN/m^3

b Varnostni faktorji za dimenzioniranje

MSN: γ_Q=1.50, γ_G=1.35
MSU: γ_Q=1.00, γ_G=1.00

1.2 HORIZONTALNE OBTEŽBE

1.2.1 VETRNA OBTEŽBA POSREDIVANA IZVAJALCU ZA IZRAČUN DROGA

Obtežba vetra CONA 3: q_b=0,56kN/m^2

- Ref. hitrost vetra: 30 m/s
- Kat terena: I. kategorija
- Višina objekta 22,00m

Tlak konične hitrosti: qp(z)=1,98kN/m^2

1.2.2 OBTEŽBA PRIVZETA ZA IZRAČUN TEMELJEV

V spodnji tabeli je prikazana obtežba na temelj privzeta v računu temeljev.

Summary of Mast Calculations

Abacus
Leaders in lighting

Project	4064179	Date	15/04/2024
Client		Engineer	MN
Mast ref.	PNE/22-5.2/A4714	Calc. No.	D6648c1

Design and Loading Parameters

Overall mast height	=	22.000	m
Wind gust speed @ 10m	=	41.5	m/s
	=	149	kph

Design code	=	EN40
Wind load factor	=	1.20
Material factor	=	1.15

Calculation Summary

Point / Element	Height Above Ground (m)	Factored Moment (KNm)	Ultimate Capacity (KNm)	Utilisation %	Deflection & Rotation: Lateral (mm)	Rotation (degrees)	Vertical (mm)
0	22.000				1429	6.2	0
1	21.918	0.7	116	1%	1420	6.2	0
2	21.405	5.1	116	4%	1365	6.2	0
3	20.893	9.5	116	8%	1309	6.2	0
4	20.380	14.1	116	12%	1254	6.2	0
5	19.380	23.2	154	15%	1146	6.1	0
6	18.380	32.6	154	21%	1041	6.0	0
7	17.380	42.4	154	28%	938	5.9	0
8	16.380	52.5	154	34%	839	5.7	0
9	15.393	62.8	197	32%	744	5.5	0
10	14.405	73.5	197	37%	655	5.2	0
11	13.418	84.4	197	43%	571	4.9	0
12	12.430	95.7	197	49%	491	4.6	0
13	11.480	106.8	250	43%	420	4.3	0
14	10.530	118.2	250	47%	355	3.9	0
15	9.580	129.9	250	52%	296	3.6	0
16	8.630	141.9	250	57%	242	3.3	0
17	7.693	153.9	344	45%	194	2.9	0
18	6.755	166.3	344	48%	153	2.5	0
19	5.818	178.8	344	52%	117	2.2	0
20	4.880	191.7	344	56%	85	1.9	0
21	3.668	208.6	430	49%	51	1.6	0
22	2.455	225.9	430	53%	26	1.2	0
23	1.243	243.6	430	57%	9	0.8	0
24	0.030	261.6	430	61%	0	0.4	0
25	0.000	262.0	897	29%	0	0.0	0

Mast strength	61%	vs. limit of	100%	Therefore OK
Deflection limit	71%	vs. limit of	100%	Therefore OK
Flange plate strength	0%	vs. limit of	100%	Therefore OK
Foundation bolt strength	0%	vs. limit of	100%	Therefore OK

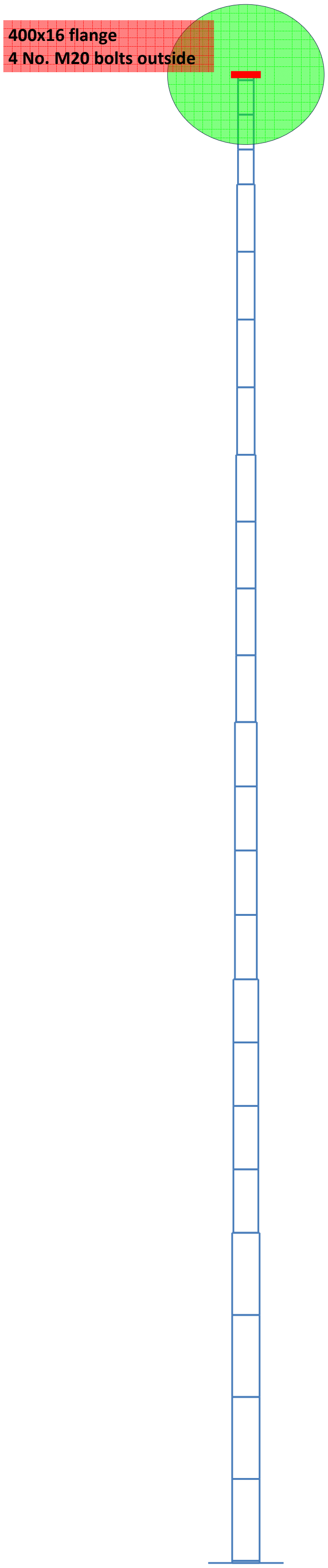
1.3 IZPISKI IZRAČUNOV

- Dimenzioniranje droga Abacus Lighting ltd
- Dimenzioniranje sidrišča droga
- Dimenzioniranje kemičnih sider za rekonstrukcijo nastavka temelja
- Dimenzioniranje točkovnih temeljev

Summary of Mast Construction

Abacus
Leaders in lighting

Project	4064179	Date	15/04/2024
Client		Engineer	MN
Mast ref.	PNE/22-5.2/A4714	Calc. No.	D6648c1



Unfactored foundation loads:
Overturning moment = 217kNm
Shear = 15kN
Vertical load = 15kN

Shaft summary:

Element	Len.	AF b	AF t	t	Grd.	N	kg
Shaft5	1.62	202	202	25.0	170	0	66
Shaft4	4.00	229	229	25.0	170	0	174
Shaft3	3.95	256	256	25.0	170	0	194
Shaft2	3.80	285	285	25.0	170	0	210
Shaft1	3.75	330	330	25.0	170	0	243
Base	4.88	366	366	25.0	355	0	354

Total shaft weight (including flanges) = 1242

Total mast weight (including ancillaries) = 1548

Headload summary:

Headframe type: SB10

10 No. Customer specified flood lights

25kg / 0.25m2 EA.

Summary of Mast Calculations

Abacus Leaders in lighting

Project	4064179	Date	15/04/2024
Client		Engineer	MN
Mast ref.	PNE/22-5.2/A4714	Calc. No.	D6648c1

Design and Loading Parameters

Overall mast height	=	22.000 m

Design code	=	EN40

Wind gust speed @ 10m	=	41.5 m/s
	=	149 kph

Wind load factor	=	1.20
Material factor	=	1.15

Calculation Summary

	Height Above Ground	Factored Moment	Ultimate Capacity	Utilisation	Deflection & Rotation		
					Lateral	Rotation	Vertical
Point / Element	(m)	(KNm)	(KNm)	%	(mm)	(degrees)	(mm)
0	22.000				1429	6.2	0
1	21.918	0.7	116	1%	1420	6.2	0
2	21.405	5.1	116	4%	1365	6.2	0
3	20.893	9.5	116	8%	1309	6.2	0
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12	12.430	95.7	197	49%	491	4.6	0
13	11.480	106.8	250	43%	420	4.3	0
14	10.530	118.2	250	47%	355	3.9	0
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22	2.455	225.9	430	53%	26	1.2	0
23	1.243	243.6	430	57%	9	0.8	0
24	0.030	261.6	430	61%	0	0.4	0
25	0.000	262.0	897	29%	0	0.0	0

Mast strength	61%	vs. limit of	100%	Therefore OK
Deflection limit	71%	vs. limit of	100%	Therefore OK
Flange plate strength	0%	vs. limit of	100%	Therefore OK
Foundation bolt strength	0%	vs. limit of	100%	Therefore OK

Abacus
Leaders in lighting

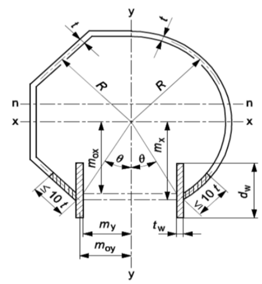
Table i1

ver: 5.7

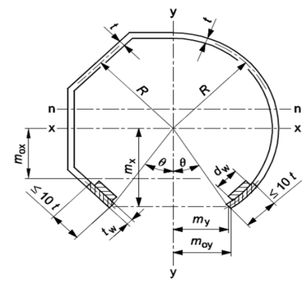
Date	15/04/2024	Design to	EN40
Client			
Project	4064179		
Mast ref.	PNE/22-5.2/A4714		
Calc. No.	D6648c1		
Engineer	MN	Checked by	
Elements	25 (maximum 25)	Material Young's modulus	70000 MPa
		Material modulus of rigidity	26600 MPa
Top D	mm A/F	Material density	2710 kg/m3
Base D	mm A/F		
Height	22.000 m		
Weight	1237 kg		

Basic Geometry																	True	Element
Point	Element	Note	Length	From top	From base	Dtaper	Dactual	Duse,b	Duse,t	N	t	t	Material	Taper	Incline	Offset	Length	Mass
			(m)	(m)	(m)	(mm)	(mm)	(mm)	(mm)		(mm)	(mm)		(y/n/dim)	(degs)	(mm)	(m)	(kg)
0				0.000	22.000	0	202	202		0	25.0	25.0	170			0		
1	1		0.083	0.083	21.918	0	202	202	202	0	25.0	25.0	170	N		0	0.083	3.1
2	2		0.513	0.595	21.405	0	202	202	202	0	25.0	25.0	170	N		0	0.513	19.3
3	3		0.513	1.108	20.893	0	202	202	202	0	25.0	25.0	170	N		0	0.513	19.3
4	4	#Shaft5	0.513	1.620	20.380	0	202	202	202	0	25.0	25.0	170	N		0	0.513	19.3
5	5		1.000	2.620	19.380	0	229	229	229	0	25.0	25.0	170	N		0	1.000	43.4
6	6		1.000	3.620	18.380	0	229	229	229	0	25.0	25.0	170	N		0	1.000	43.4
7	7		1.000	4.620	17.380	0	229	229	229	0	25.0	25.0	170	N		0	1.000	43.4
8	8	#Shaft4	1.000	5.620	16.380	0	229	229	229	0	25.0	25.0	170	N		0	1.000	43.4
9	9		0.988	6.608	15.393	0	256	256	256	0	25.0	25.0	170	N		0	0.988	48.6
10	10		0.988	7.595	14.405	0	256	256	256	0	25.0	25.0	170	N		0	0.988	48.6
11	11		0.988	8.583	13.418	0	256	256	256	0	25.0	25.0	170	N		0	0.988	48.6
12	12	#Shaft3	0.988	9.570	12.430	0	256	256	256	0	25.0	25.0	170	N		0	0.988	48.6
13	13		0.950	10.520	11.480	0	285	285	285	0	25.0	25.0	170	N		0	0.950	52.6
14	14		0.950	11.470	10.530	0	285	285	285	0	25.0	25.0	170	N		0	0.950	52.6
15	15		0.950	12.420	9.580	0	285	285	285	0	25.0	25.0	170	N		0	0.950	52.6
16	16	#Shaft2	0.950	13.370	8.630	0	285	285	285	0	25.0	25.0	170	N		0	0.950	52.6
17	17		0.938	14.308	7.693	0	330	330	330	0	25.0	25.0	170	N		0	0.938	60.9
18	18		0.938	15.245	6.755	0	330	330	330	0	25.0	25.0	170	N		0	0.938	60.9
19	19		0.938	16.183	5.818	0	330	330	330	0	25.0	25.0	170	N		0	0.938	60.9
20	20	#Shaft1	0.938	17.120	4.880	0	330	330	330	0	25.0	25.0	170	N		0	0.938	60.9
21	21		1.213	18.333	3.668	0	366	366	366	0	25.0	25.0	170	N		0	1.213	88.0
22	22		1.213	19.545	2.455	0	366	366	366	0	25.0	25.0	170	N		0	1.213	88.0
23	23		1.213	20.758	1.243	0	366	366	366	0	25.0	25.0	170	N		0	1.213	88.0
24	24		1.213	21.970	0.030	0	366	366	366	0	25.0	25.0	170	N		0	1.213	88.0
25	25	#Base	0.030	22.000	0.000	0	366	366	366	0	25.0	25.0	355	N		0	0.030	2.2

Table i2



Type 1 reinforcement



Type 4 reinforcement

Openings and Reinforcement

Element	Type	Width	r (N)	R-Type	dw	tw	x	Overlap	Moment
		(mm)	(mm)	(0, 1 or 4)	(mm)	(mm)	(mm)	factor	factor
1									1.000
2									1.000
3									1.000
4									1.000
5									1.000
6									1.000
7									1.000
8									1.000
9									1.000
10									1.000
11									1.000
12									1.000
13									1.000
14									1.000
15									1.000
16									1.000
17									1.000
18									1.000
19									1.000
20									1.000
21									1.000
22									1.000
23									1.000
24									1.000
25									1.000

Table i3

Dynamic factor;
γf dyn = 1.05

Hinge height;
0.000 m

Ram top;
0.000 m

Ram base;
0.000 m

Hinge

Point	Hinge
	(Rt,H,Rb)
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	

Abacus
Leaders in lighting

Table i4

Note: Alpha angle is clockwise from x-axis

Utilisation summary;

Mast	60.9%
Flange	0.0%
Counterbalance	0.0%

Max deflection @ max wind speed = Height x 65

Linear ancillaries:

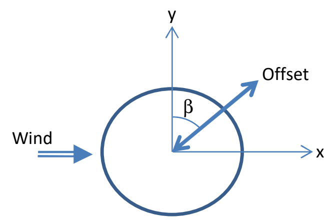
Internal cable weight = 0.0 kg/m
Ladder weight = kg/m
Ladder effective wind area = m2/m

Ancillaries

Point	Height	Label	Area (x)	Area (y)	Cf	Mass	Total	Alpha	Offset A	Offset M	Deflection Limits	
	(m)		(m2	(m2)		(kg)	(kg)	(deg)	(m)	(m)	(degs)	(mm)
0	22.000		3.373		1.000	300	310.7	0	0.000	0.000		2000
1	21.918						0.0					
2	21.405						0.0					
3	20.893						0.0					
4	20.380						0.0					
5	19.380						0.0					
6	18.380						0.0					
7	17.380						0.0					
8	16.380						0.0					
9	15.393						0.0					
10	14.405						0.0					
11	13.418						0.0					
12	12.430						0.0					
13	11.480						0.0					
14	10.530						0.0					
15	9.580						0.0					
16	8.630						0.0					
17	7.693						0.0					
18	6.755						0.0					
19	5.818						0.0					
20	4.880						0.0					
21	3.668						0.0					
22	2.455						0.0					
23	1.243						0.0					
24	0.030						0.0					
25	0.000						0.0					

Table i5

Note: Direct loading NOT included in natural frequncy calculation.
Enter loading with 90 degree beta angle to be additive to wind loads.



Direct Loading (N or Nm, unfactored)						
Point	**Label**	**Shear (Y)**	**Offset**	**Vertical (Z)**	**Beta**	**γf**
		(N)	**(m)**	**(N)**	**(deg)**	
0						
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						

Table i6
Ice:
Radial ice thickness = mm
Ice density = kg/m3

Table i7		
Effective stiffness	=	6652 N/m
Total equivilent mass	=	556 kg
Frequency	=	0.550 Hz
Period	=	1.817 seconds

Table i8

Harmonic ocillation can occur in conditions only when the following parameters are co-existent;

- Strouhal number is equal to 0.2
- Reynolds number is greater than 40 and less than 200000
- Cross wind energy input is sufficient to give negative net damping
- Vcrit is above 10m/s and below maximum design wind speed

Risk summary: Unlikely to be at risk

Ice Loading

Point	Element	Diameter (m)	Area (m2)	Mass (kg)
0	0	0.202	0.000	
1	1	0.202	0.000	0.0
2	2	0.202	0.000	0.0
3	3	0.202	0.000	0.0
4	4	0.202	0.000	0.0
5	5	0.229	0.000	0.0
6	6	0.229	0.000	0.0
7	7	0.229	0.000	0.0
8	8	0.229	0.000	0.0
9	9	0.256	0.000	0.0
10	10	0.256	0.000	0.0
11	11	0.256	0.000	0.0
12	12	0.256	0.000	0.0
13	13	0.285	0.000	0.0
14	14	0.285	0.000	0.0
15	15	0.285	0.000	0.0
16	16	0.285	0.000	0.0
17	17	0.330	0.000	0.0
18	18	0.330	0.000	0.0
19	19	0.330	0.000	0.0
20	20	0.330	0.000	0.0
21	21	0.366	0.000	0.0
22	22	0.366	0.000	0.0
23	23	0.366	0.000	0.0
24	24	0.366	0.000	0.0
25	25	0.366	0.000	0.0

Natural Frequency Calculation

Element	L (m)	Iav E^5	L^3/I	Mass (kg)	Eqiv. M (kg)
0				312.2	312.2
1	0.083	8.1	0.0	11.2	11.1
2	0.513	8.1	0.0	19.3	17.8
3	0.513	8.1	0.1	19.3	16.5
4	0.513	8.1	0.4	31.4	24.9
5	1.000	11.8	1.2	43.4	29.7
6	1.000	11.8	2.5	43.4	25.3
7	1.000	11.8	4.3	43.4	21.4
8	1.000	11.8	6.7	46.0	19.0
9	0.988	16.5	6.7	48.6	16.6
10	0.988	16.5	9.1	48.6	13.6
11	0.988	16.5	11.8	48.6	11.0
12	0.988	16.5	14.8	50.6	9.1
13	0.950	22.7	12.7	52.6	7.5
14	0.950	22.7	15.2	52.6	5.8
15	0.950	22.7	17.9	52.6	4.3
16	0.950	22.7	20.9	56.7	3.4
17	0.938	35.3	15.3	60.9	2.6
18	0.938	35.3	17.4	60.9	1.8
19	0.938	35.3	19.7	60.9	1.1
20	0.938	35.3	22.1	74.4	0.8
21	1.213	48.1	23.8	88.0	0.4
22	1.213	48.1	27.1	88.0	0.1
23	1.213	48.1	30.7	88.0	0.0
24	1.213	48.1	34.5	45.1	0.0
25	0.030	48.1	0.9	1.1	0.0

Vortex Induced Vibration Assessment

Point	Diameter	Vmax	1st mode		
	(m)	(m/s)	Vcrit	Re	Risk
0	0.202	50.9	0.56	7691	No
1	0.202	50.8	0.56	7691	No
2	0.202	50.7	0.56	7691	No
3	0.202	50.6	0.56	7691	No
4	0.202	50.4	0.56	7691	No
5	0.229	50.1	0.63	9885	No
6	0.229	49.8	0.63	9885	No
7	0.229	49.4	0.63	9885	No
8	0.229	49.1	0.63	9885	No
9	0.256	48.7	0.70	12353	No
10	0.256	48.3	0.70	12353	No
11	0.256	47.8	0.70	12353	No
12	0.256	47.4	0.70	12353	No
13	0.285	46.9	0.78	15310	No
14	0.285	46.3	0.78	15310	No
15	0.285	45.7	0.78	15310	No
16	0.285	45.1	0.78	15310	No
17	0.330	44.4	0.91	20526	No
18	0.330	43.6	0.91	20526	No
19	0.330	42.6	0.91	20526	No
20	0.330	41.5	0.91	20526	No
21	0.366	40.3	1.01	25249	No
22	0.366	40.3	1.01	25249	No
23	0.366	40.3	1.01	25249	No
24	0.366	40.3	1.01	25249	No
25	0.366	40.3	1.01	25249	No

Table e1

From BE EN 1991-1-4 NA, 10 minute mean wind speed,	vref0 =	30.0	m/s
	(equivalent 3-second gust speed) =	41.5	m/s
Air density,	ρ =	1.23	kg/m3
Kinematic viscosity of air,	ν =	1.51E-05	m2/s
Site altitude (to base of topographic feature if f<>1.0),	a =		m
Topography and direction factor product (required for Rwf run also),	f =	1.00	
Terrain category (0 to 4) (required for Rwf run also) (leave blank to use PD6547 defaults),	=	2	
Base elevation (if installed on building or bridge etc.),	=		m
Altitude factor (= 1 + a / 1000),	Calt =	1.000	
Basic reference wind velocity (= vref0 x Calt),	vref =	30.0	m/s
Wind return period	1 / p =	25	years
Annual probability factor,	Cs =	0.960	
Rationalised wind loading factor (overrules specific wind speed if present),	Rwf =		Pa
Reference wind pressure,	q(10) =	510	Pa
	BS 5649-6 K-Factor =	3.23	

δ = 0.780 β = 1.729

z0 = 0.05 zmin = 4 kr = 0.19

Table e2

Material partial safety factor,	γm =	1.15
Partial load factor,	γf wind =	1.20
	γf dead =	1.20
	γf ice =	1.20
	γf hinge =	1.60

EN40:

Class	γf wind	γf dead
A	1.4	1.2
B	1.2	1.2

Wind Loading on Elements (unfactored, omni-directional)

Element	z	Cr(z)	Ce(z)	q(z)	V	D	Re	r	r/D	c	Ac	Fc
1	21.959	1.156	2.874	1975	50.9	0.202	6.80E+05	0.075	0.371	0.547	0.017	18
2	21.661	1.154	2.865	1969	50.8	0.202	6.79E+05	0.075	0.371	0.547	0.104	111
3	21.149	1.149	2.848	1958	50.6	0.202	6.77E+05	0.075	0.371	0.546	0.104	111
4	20.636	1.144	2.831	1946	50.5	0.202	6.75E+05	0.075	0.371	0.546	0.104	110
5	19.880	1.137	2.806	1928	50.3	0.229	7.62E+05	0.075	0.328	0.560	0.229	247
6	18.880	1.127	2.771	1904	49.9	0.229	7.57E+05	0.075	0.328	0.560	0.229	244
7	17.880	1.117	2.734	1879	49.6	0.229	7.52E+05	0.075	0.328	0.559	0.229	240
8	16.880	1.106	2.695	1852	49.2	0.229	7.47E+05	0.075	0.328	0.558	0.229	237
9	15.886	1.095	2.654	1824	48.9	0.256	8.29E+05	0.075	0.293	0.571	0.253	264
10	14.899	1.082	2.611	1795	48.5	0.256	8.22E+05	0.075	0.293	0.570	0.253	259
11	13.911	1.069	2.566	1764	48.1	0.256	8.15E+05	0.075	0.293	0.569	0.253	254
12	12.924	1.055	2.518	1730	47.6	0.256	8.07E+05	0.075	0.293	0.568	0.253	248
13	11.955	1.041	2.467	1695	47.1	0.285	8.89E+05	0.075	0.263	0.582	0.271	267
14	11.005	1.025	2.413	1659	46.6	0.285	8.80E+05	0.075	0.263	0.580	0.271	260
15	10.055	1.008	2.356	1619	46.0	0.285	8.69E+05	0.075	0.263	0.578	0.271	253
16	9.105	0.989	2.293	1576	45.4	0.285	8.57E+05	0.075	0.263	0.576	0.271	246
17	8.161	0.968	2.225	1529	44.7	0.330	9.78E+05	0.075	0.227	0.596	0.309	282
18	7.224	0.945	2.150	1477	44.0	0.330	9.61E+05	0.075	0.227	0.594	0.309	271
19	6.286	0.918	2.065	1419	43.1	0.330	9.42E+05	0.075	0.227	0.590	0.309	259
20	5.349	0.888	1.969	1353	42.1	0.330	9.20E+05	0.075	0.227	0.587	0.309	246
21	4.274	0.845	1.838	1263	40.7	0.366	9.86E+05	0.075	0.205	0.598	0.444	335
22	3.061	0.833	1.801	1237	40.3	0.366	9.76E+05	0.075	0.205	0.596	0.444	327
23	1.849	0.833	1.801	1237	40.3	0.366	9.76E+05	0.075	0.205	0.596	0.444	327
24	0.636	0.833	1.801	1237	40.3	0.366	9.76E+05	0.075	0.205	0.596	0.444	327
25	0.015	0.833	1.801	1237	40.3	0.366	9.76E+05	0.075	0.205	0.596	0.011	8

Wind Loading on Ancillaries (unfactored, omni-directional)

Point	z	Cr(z)	Ce(z)	q(z)	V	Fl
0	22.000	1.156	2.876	1976	50.9	6666
1	21.918	1.156	2.873	1975	50.8	0
2	21.405	1.151	2.857	1963	50.7	0
3	20.893	1.147	2.840	1952	50.6	0
4	20.380	1.142	2.823	1940	50.4	0
5	19.380	1.132	2.788	1916	50.1	0
6	18.380	1.122	2.752	1892	49.8	0
7	17.380	1.112	2.714	1866	49.4	0
8	16.380	1.100	2.675	1838	49.1	0
9	15.393	1.089	2.633	1810	48.7	0
10	14.405	1.076	2.589	1779	48.3	0
11	13.418	1.063	2.542	1747	47.8	0
12	12.430	1.048	2.492	1713	47.4	0
13	11.480	1.033	2.441	1677	46.9	0
14	10.530	1.016	2.385	1639	46.3	0
15	9.580	0.999	2.325	1598	45.7	0
16	8.630	0.979	2.259	1553	45.1	0
17	7.693	0.957	2.188	1504	44.4	0
18	6.755	0.932	2.109	1449	43.6	0
19	5.818	0.904	2.019	1387	42.6	0
20	4.880	0.870	1.915	1316	41.5	0
21	3.668	0.833	1.801	1237	40.3	0
22	2.455	0.833	1.801	1237	40.3	0
23	1.243	0.833	1.801	1237	40.3	0
24	0.030	0.833	1.801	1237	40.3	0
25	0.000	0.833	1.801	1237	40.3	0

Table e3

Unfactored forces for foundation design:

		Wind	Hinge	Max
Total moment at ground level	=	216.612	0.000	216.612 kNm
Total shear at ground level	=	12.419	-	12.419 kN
Total vertical load at ground level	=	15.181	-	15.181 kN

Factored forces for baseplate design:

		Wind	Hinge	Max
Total moment at ground level	=	262.008	0.000	262.008 kNm
Total shear at ground level	=	14.903	-	14.903 kN
Total vertical load at ground level	=	18.217	-	18.217 kN

Serviceability summary:

SLS deflection at masthead	=	1429 mm
SLS rotation at mast head	=	6.21 degrees
ULS deflection as masthead	=	1715 mm
Fundemental frequency	=	0.550 Hz

SLS Mast Analysis

Point	h	Fwind	Fx	Fy	Fz	Mwind	Mx	My	Mz
	(m)	(N)	(N)	(N)	(N)	(Nm)	(Nm)	(Nm)	(Nm)
0	22.000	6666	0	0	3048	0	0	0	0
1	21.918	6684	0	0	3078	551	0	0	0
2	21.405	6796	0	0	3268	4005	0	0	0
3	20.893	6906	0	0	3457	7516	0	0	0
4	20.380	7016	0	0	3647	11084	0	0	0
5	19.380	7264	0	0	4073	18224	0	0	0
6	18.380	7508	0	0	4498	25609	0	0	0
7	17.380	7748	0	0	4924	33237	0	0	0
8	16.380	7985	0	0	5350	41104	0	0	0
9	15.393	8248	0	0	5827	49119	0	0	0
10	14.405	8507	0	0	6303	57391	0	0	0
11	13.418	8761	0	0	6779	65917	0	0	0
12	12.430	9009	0	0	7256	74691	0	0	0
13	11.480	9276	0	0	7771	83376	0	0	0
14	10.530	9536	0	0	8287	92312	0	0	0
15	9.580	9790	0	0	8803	101492	0	0	0
16	8.630	10036	0	0	9319	110910	0	0	0
17	7.693	10318	0	0	9916	120450	0	0	0
18	6.755	10589	0	0	10513	130250	0	0	0
19	5.818	10848	0	0	11110	140299	0	0	0
20	4.880	11094	0	0	11707	150585	0	0	0
21	3.668	11429	0	0	12570	164239	0	0	0
22	2.455	11756	0	0	13433	178295	0	0	0
23	1.243	12084	0	0	14297	192748	0	0	0
24	0.030	12411	0	0	15160	207598	0	0	0
25	0.000	12419	0	0	15181	207971	0	0	0

Table e4

ULS Mast Analysis

Point	h	Fwind	Fx	Fy	Fz	Mwind	Mx	My	Mz
	(m)	(N)	(N)	(N)	(N)	(Nm)	(Nm)	(Nm)	(Nm)
0	22.000	7999	0	0	3657	0	0	0	0
1	21.918	8021	0	0	3694	661	0	0	0
2	21.405	8155	0	0	3921	4806	0	0	0
3	20.893	8288	0	0	4149	9019	0	0	0
4	20.380	8420	0	0	4376	13300	0	0	0
5	19.380	8716	0	0	4887	21868	0	0	0
6	18.380	9009	0	0	5398	30731	0	0	0
7	17.380	9298	0	0	5909	39885	0	0	0
8	16.380	9582	0	0	6420	49324	0	0	0
9	15.393	9898	0	0	6992	58942	0	0	0
10	14.405	10208	0	0	7564	68870	0	0	0
11	13.418	10513	0	0	8135	79101	0	0	0
12	12.430	10811	0	0	8707	89629	0	0	0
13	11.480	11131	0	0	9326	100052	0	0	0
14	10.530	11444	0	0	9944	110775	0	0	0
15	9.580	11748	0	0	10563	121791	0	0	0
16	8.630	12043	0	0	11182	133091	0	0	0
17	7.693	12381	0	0	11899	144540	0	0	0
18	6.755	12707	0	0	12615	156300	0	0	0
19	5.818	13018	0	0	13332	168359	0	0	0
20	4.880	13313	0	0	14048	180702	0	0	0
21	3.668	13715	0	0	15084	197087	0	0	0
22	2.455	14108	0	0	16120	213954	0	0	0
23	1.243	14500	0	0	17156	231298	0	0	0
24	0.030	14893	0	0	18192	249118	0	0	0
25	0.000	14903	0	0	18217	249565	0	0	0

Table e5

SLS Deflection Calculation (principal moment)																
Point	Element	Length	I	J	EI	Mp1 SLS	M/EI	θ	Σθ	K	α	Σα	δ	Σδ	Σδinc
		(mm)	(mm4)	(mm4)	(Nmm2)	(Nm)		(rads)	(rads)	(mm4)	(rads)	(rads)	(mm)	(mm)	(mm)
0			80919651.33	108880395	5.66E+12	0	0.00E+00	0.000	0.103			0.0000		1359	1359
1	1	82.5	80919651.33	108880395	5.66E+12	551	9.72E-08	0.000	0.103	111052489	0.00E+00	0.0000	8	1350	1350
2	2	512.5	80919651.33	108880395	5.66E+12	4005	7.07E-07	0.000	0.103	111052489	0.00E+00	0.0000	53	1297	1297
3	3	512.5	80919651.33	108880395	5.66E+12	7516	1.33E-06	0.000	0.103	111052489	0.00E+00	0.0000	53	1245	1245
4	4	512.5	80919651.33	108880395	5.66E+12	11084	1.96E-06	0.001	0.103	111052489	0.00E+00	0.0000	53	1192	1192
5	5	1000	117897973.8	166694163	8.25E+12	18224	2.21E-06	0.002	0.102	169197584	0.00E+00	0.0000	102	1090	1090
6	6	1000	117897973.8	166694163	8.25E+12	25609	3.10E-06	0.002	0.100	169197584	0.00E+00	0.0000	100	990	990
7	7	1000	117897973.8	166694163	8.25E+12	33237	4.03E-06	0.003	0.098	169197584	0.00E+00	0.0000	98	893	893
8	8	1000	117897973.8	166694163	8.25E+12	41104	4.98E-06	0.004	0.095	169197584	0.00E+00	0.0000	95	798	798
9	9	987.5	164709932.9	242028121	1.15E+13	49119	4.26E-06	0.005	0.091	244862867	0.00E+00	0.0000	89	708	708
10	10	987.5	164709932.9	242028121	1.15E+13	57391	4.98E-06	0.004	0.086	244862867	0.00E+00	0.0000	85	624	624
11	11	987.5	164709932.9	242028121	1.15E+13	65917	5.72E-06	0.005	0.081	244862867	0.00E+00	0.0000	80	543	543
12	12	987.5	164709932.9	242028121	1.15E+13	74691	6.48E-06	0.006	0.077	244862867	0.00E+00	0.0000	76	468	468
13	13	950	227266003.3	345103953	1.59E+13	83376	5.24E-06	0.006	0.071	348294561	0.00E+00	0.0000	67	400	400
14	14	950	227266003.3	345103953	1.59E+13	92312	5.80E-06	0.005	0.065	348294561	0.00E+00	0.0000	62	339	339
15	15	950	227266003.3	345103953	1.59E+13	101492	6.38E-06	0.006	0.060	348294561	0.00E+00	0.0000	57	282	282
16	16	950	227266003.3	345103953	1.59E+13	110910	6.97E-06	0.006	0.054	348294561	0.00E+00	0.0000	52	230	230
17	17	937.5	352810672.5	557095189	2.47E+13	120450	4.88E-06	0.007	0.048	560837986	0.00E+00	0.0000	45	185	185
18	18	937.5	352810672.5	557095189	2.47E+13	130250	5.27E-06	0.005	0.042	560837986	0.00E+00	0.0000	39	146	146
19	19	937.5	352810672.5	557095189	2.47E+13	140299	5.68E-06	0.005	0.037	560837986	0.00E+00	0.0000	35	111	111
20	20	937.5	352810672.5	557095189	2.47E+13	150585	6.10E-06	0.005	0.032	560837986	0.00E+00	0.0000	30	81	81
21	21	1212.5	481330243.5	778561685	3.37E+13	164239	4.87E-06	0.007	0.027	782746221	0.00E+00	0.0000	33	49	49
22	22	1212.5	481330243.5	778561685	3.37E+13	178295	5.29E-06	0.006	0.019	782746221	0.00E+00	0.0000	24	25	25
23	23	1212.5	481330243.5	778561685	3.37E+13	192748	5.72E-06	0.006	0.014	782746221	0.00E+00	0.0000	16	9	9
24	24	1212.5	481330243.5	778561685	3.37E+13	207598	6.16E-06	0.007	0.007	782746221	0.00E+00	0.0000	9	0	0
25	25	30	481330243.5	778561685	3.37E+13	207971	6.17E-06	0.000	0.000	782746221	0.00E+00	0.0000	0	0	0

Table e6

ULS Deflection Calculation (principal moment)								
Point	Element	Mp1 ULS	M/EI	θ	Σθ	δ	Σδ	Σδinc
		(Nm)		(rads)	(rads)	(mm)	(mm)	(mm)
0		0	0.00E+00	0.000	0.124		1630	1630
1	1	661	1.17E-07	0.000	0.124	10	1620	1620
2	2	4806	8.48E-07	0.000	0.124	63	1557	1557
3	3	9019	1.59E-06	0.000	0.124	63	1494	1494
4	4	13300	2.35E-06	0.001	0.123	63	1431	1431
5	5	21868	2.65E-06	0.002	0.122	122	1308	1308
6	6	30731	3.72E-06	0.003	0.120	120	1188	1188
7	7	39885	4.83E-06	0.004	0.117	117	1071	1071
8	8	49324	5.98E-06	0.005	0.114	114	957	957
9	9	58942	5.11E-06	0.006	0.109	107	850	850
10	10	68870	5.97E-06	0.005	0.103	102	749	749
11	11	79101	6.86E-06	0.006	0.098	97	652	652
12	12	89629	7.77E-06	0.007	0.092	91	561	561
13	13	100052	6.29E-06	0.007	0.085	81	480	480
14	14	110775	6.96E-06	0.006	0.078	74	407	407
15	15	121791	7.66E-06	0.007	0.072	68	338	338
16	16	133091	8.37E-06	0.007	0.065	62	276	276
17	17	144540	5.85E-06	0.008	0.058	54	222	222
18	18	156300	6.33E-06	0.005	0.050	47	175	175
19	19	168359	6.82E-06	0.006	0.045	42	134	134
20	20	180702	7.32E-06	0.006	0.039	36	97	97
21	21	197087	5.85E-06	0.009	0.032	39	58	58
22	22	213954	6.35E-06	0.007	0.023	28	30	30
23	23	231298	6.86E-06	0.008	0.016	20	10	10
24	24	249118	7.39E-06	0.008	0.009	10	0	0
25	25	249565	7.41E-06	0.000	0.000	0	0	0

Table e7

Secondary Moments			
SLS PΔ	ULS PΔ	Mp SLS	Mp ULS
(Nm)	(Nm)	(Nm)	(Nm)
0	0	0	0
26	37	577	698
188	271	4193	5077
361	520	7877	9539
543	781	11626	14082
914	1316	19138	23185
1321	1903	26931	32634
1761	2536	34998	42420
2227	3207	43331	52531
2706	3896	51824	62839
3199	4606	60590	73476
3706	5337	69623	84437
4219	6075	78910	95704
4707	6779	88084	106831
5186	7467	97498	118242
5656	8145	107149	129936
6110	8799	117020	141890
6532	9405	126982	153946
6919	9963	137169	166264
7285	10490	147584	178849
7620	10973	158205	191674
8001	11521	172240	208608
8297	11948	186593	225903
8518	12266	201266	243564
8641	12443	216239	261561
8641	12443	216612	262008

Table e8

Maximum deflection ratios against input limits;

Deflection = 71%
Rotation = 0%

SLS Deflection Calculation (secondary moment)										
Point	Element	SLS Fp	SLS Mp	M/EI	θ	Σθ	δ	Σδ	Height/	Over limit
		(N)	(Nm)		(rads)	(rads)	(mm)	(mm)		Mins / yr
0		0	0	0.00E+00	0.000	0.108		1429	15.4	0
1	1	6684	577	1.02E-07	0.000	0.108	9	1420	15.4	0
2	2	6796	4193	7.40E-07	0.000	0.108	56	1365	15.7	0
3	3	6906	7877	1.39E-06	0.000	0.108	56	1309	16.0	0
4	4	7016	11626	2.05E-06	0.001	0.108	55	1254	16.3	0
5	5	7264	19138	2.32E-06	0.002	0.107	107	1146	16.9	0
6	6	7508	26931	3.26E-06	0.002	0.105	105	1041	17.7	0
7	7	7748	34998	4.24E-06	0.003	0.103	103	938	18.5	0
8	8	7985	43331	5.25E-06	0.004	0.100	100	839	19.5	0
9	9	8248	51824	4.49E-06	0.005	0.095	94	744	20.7	0
10	10	8507	60590	5.26E-06	0.004	0.090	89	655	22.0	0
11	11	8761	69623	6.04E-06	0.005	0.086	85	571	23.5	0
12	12	9009	78910	6.84E-06	0.006	0.081	80	491	25.3	0
13	13	9276	88084	5.54E-06	0.007	0.075	71	420	27.3	0
14	14	9536	97498	6.13E-06	0.005	0.068	65	355	29.6	0
15	15	9790	107149	6.74E-06	0.006	0.063	60	296	32.4	0
16	16	10036	117020	7.36E-06	0.006	0.057	54	242	35.7	0
17	17	10318	126982	5.14E-06	0.007	0.051	47	194	39.6	0
18	18	10589	137169	5.55E-06	0.005	0.044	41	153	44.1	0
19	19	10848	147584	5.98E-06	0.005	0.039	36	117	49.9	0
20	20	11094	158205	6.41E-06	0.006	0.034	32	85	57.5	0
21	21	11429	172240	5.11E-06	0.008	0.028	34	51	72.1	0
22	22	11756	186593	5.54E-06	0.006	0.020	25	26	93.8	0
23	23	12084	201266	5.97E-06	0.007	0.014	17	9	137.7	0
24	24	12411	216239	6.42E-06	0.007	0.007	9	0	5193.8	0
25	25	12419	216612	6.43E-06	0.000	0.000	0	0	0	0

Table e9

Column Design Check (non-directional, openings not considered)											
Point	Mp	t	fy	R	ε	ϕ1	ϕ2	Zp	Mup	Tu	F of S
	(Nm)	(mm)	(Mpa)	(mm)				(mm3)	(Nm)	(Nm)	
0	0	25.0	170	89	0.174	1.000	1.000	783225	115781	90934	0.000
1	698	25.0	170	89	0.174	1.000	1.000	783225	115781	90934	0.006
2	5077	25.0	170	89	0.174	1.000	1.000	783225	115781	90934	0.044
3	9539	25.0	170	89	0.174	1.000	1.000	783225	115781	90934	0.082
4	14082	25.0	170	89	0.174	1.000	1.000	783225	115781	90934	0.122
5	23185	25.0	170	102	0.201	1.000	1.000	1040400	153798	120793	0.151
6	32634	25.0	170	102	0.201	1.000	1.000	1040400	153798	120793	0.212
7	42420	25.0	170	102	0.201	1.000	1.000	1040400	153798	120793	0.276
8	52531	25.0	170	102	0.201	1.000	1.000	1040400	153798	120793	0.342
9	62839	25.0	170	116	0.228	1.000	1.000	1334025	197204	154883	0.319
10	73476	25.0	170	116	0.228	1.000	1.000	1334025	197204	154883	0.373
11	84437	25.0	170	116	0.228	1.000	1.000	1334025	197204	154883	0.428
12	95704	25.0	170	116	0.228	1.000	1.000	1334025	197204	154883	0.485
13	106831	25.0	170	130	0.256	1.000	1.000	1690000	249826	196213	0.428
14	118242	25.0	170	130	0.256	1.000	1.000	1690000	249826	196213	0.473
15	129936	25.0	170	130	0.256	1.000	1.000	1690000	249826	196213	0.520
16	141890	25.0	170	130	0.256	1.000	1.000	1690000	249826	196213	0.568
17	153946	25.0	170	153	0.301	1.000	1.000	2325625	343788	270010	0.448
18	166264	25.0	170	153	0.301	1.000	1.000	2325625	343788	270010	0.484
19	178849	25.0	170	153	0.301	1.000	1.000	2325625	343788	270010	0.520
20	191674	25.0	170	153	0.301	1.000	1.000	2325625	343788	270010	0.558
21	208608	25.0	170	171	0.336	1.000	1.000	2907025	429734	337512	0.485
22	225903	25.0	170	171	0.336	1.000	1.000	2907025	429734	337512	0.526
23	243564	25.0	170	171	0.336	1.000	1.000	2907025	429734	337512	0.567
24	261561	25.0	170	171	0.336	1.000	1.000	2907025	429734	337512	0.609
25	262008	25.0	355	171	0.486	1.000	1.000	2907025	897386	704805	0.292

Table e10

Opening Check (directional)						
Element	Mp	Mux	Muy	Tu	F of S x	F of S y
	(Nm)	(Nm)	(Nm)	(Nm)		
1	698	N/A	N/A	N/A	0.000	0.000
2	5077	N/A	N/A	N/A	0.000	0.000
3	9539	N/A	N/A	N/A	0.000	0.000
4	14082	N/A	N/A	N/A	0.000	0.000
5	23185	N/A	N/A	N/A	0.000	0.000
6	32634	N/A	N/A	N/A	0.000	0.000
7	42420	N/A	N/A	N/A	0.000	0.000
8	52531	N/A	N/A	N/A	0.000	0.000
9	62839	N/A	N/A	N/A	0.000	0.000
10	73476	N/A	N/A	N/A	0.000	0.000
11	84437	N/A	N/A	N/A	0.000	0.000
12	95704	N/A	N/A	N/A	0.000	0.000
13	106831	N/A	N/A	N/A	0.000	0.000
14	118242	N/A	N/A	N/A	0.000	0.000
15	129936	N/A	N/A	N/A	0.000	0.000
16	141890	N/A	N/A	N/A	0.000	0.000
17	153946	N/A	N/A	N/A	0.000	0.000
18	166264	N/A	N/A	N/A	0.000	0.000
19	178849	N/A	N/A	N/A	0.000	0.000
20	191674	N/A	N/A	N/A	0.000	0.000
21	208608	N/A	N/A	N/A	0.000	0.000
22	225903	N/A	N/A	N/A	0.000	0.000
23	243564	N/A	N/A	N/A	0.000	0.000
24	261561	N/A	N/A	N/A	0.000	0.000
25	262008	N/A	N/A	N/A	0.000	0.000

Table e11

Table e12

Maximum utilisation = 0.609

Maximum deflection utilisation = 0.715

Table e13

Design life, L = years
Frequency of vibration, Nf = 0.550 Hz
Effective frequency, Nfe = 0.000 Hz
Number of cycles, n1 = 0.00E+00
Dynamic resposnse factor, β = 1.729
Cstat = 0.560

Hinge Point Analysis

Point	Element	L	Wp	We	Mh	M*	F of S
		(m)	(N)	(N)	(Nm)	(Nm)	
0			5120		0		
1	1	0.083	0	51	0	115781	0.000
2	2	0.513	0	318	0	115781	0.000
3	3	0.513	0	318	0	115781	0.000
4	4	0.513	0	318	0	115781	0.000
5	5	1.000	0	716	0	153798	0.000
6	6	1.000	0	716	0	153798	0.000
7	7	1.000	0	716	0	153798	0.000
8	8	1.000	0	716	0	153798	0.000
9	9	0.988	0	800	0	197204	0.000
10	10	0.988	0	800	0	197204	0.000
11	11	0.988	0	800	0	197204	0.000
12	12	0.988	0	800	0	197204	0.000
13	13	0.950	0	866	0	249826	0.000
14	14	0.950	0	866	0	249826	0.000
15	15	0.950	0	866	0	249826	0.000
16	16	0.950	0	866	0	249826	0.000
17	17	0.938	0	1003	0	343788	0.000
18	18	0.938	0	1003	0	343788	0.000
19	19	0.938	0	1003	0	343788	0.000
20	20	0.938	0	1003	0	343788	0.000
21	21	1.213	0	1450	0	429734	0.000
22	22	1.213	0	1450	0	429734	0.000
23	23	1.213	0	1450	0	429734	0.000
24	24	1.213	0	1450	0	429734	0.000
25	25	0.030	0	36	0	897386	0.000

Mast Utilisation Summary

Point	Shaft	Opening	Hinged	Max
Max	0.609	0.000	0.000	0.609
0	0.000	0.000	0.000	0.000
1	0.006	0.000	0.000	0.006
2	0.044	0.000	0.000	0.044
3	0.082	0.000	0.000	0.082
4	0.122	0.000	0.000	0.122
5	0.151	0.000	0.000	0.151
6	0.212	0.000	0.000	0.212
7	0.276	0.000	0.000	0.276
8	0.342	0.000	0.000	0.342
9	0.319	0.000	0.000	0.319
10	0.373	0.000	0.000	0.373
11	0.428	0.000	0.000	0.428
12	0.485	0.000	0.000	0.485
13	0.428	0.000	0.000	0.428
14	0.473	0.000	0.000	0.473
15	0.520	0.000	0.000	0.520
16	0.568	0.000	0.000	0.568
17	0.448	0.000	0.000	0.448
18	0.484	0.000	0.000	0.484
19	0.520	0.000	0.000	0.520
20	0.558	0.000	0.000	0.558
21	0.485	0.000	0.000	0.485
22	0.526	0.000	0.000	0.526
23	0.567	0.000	0.000	0.567
24	0.609	0.000	0.000	0.609
25	0.292	0.000	0.000	0.292

Fatigue - BD94/17

Point	Detail	σs	Cvs	σr	σrlim	F of S
		(MPa)		(MPa)	(MPa)	
		0.0	1.20	0.0	0.0	0.000
1		0.7	1.20	0.2	0.0	0.000
2		5.4	1.20	1.2	0.0	0.000
3		10.1	1.20	2.3	0.0	0.000
4		14.8	1.20	3.4	0.0	0.000
5		18.4	1.20	4.2	0.0	0.000
6		25.9	1.20	5.8	0.0	0.000
7		33.6	1.20	7.6	0.0	0.000
8		41.6	1.20	9.4	0.0	0.000
9		38.8	1.20	8.8	0.0	0.000
10		45.4	1.20	10.3	0.0	0.000
11		52.2	1.20	11.8	0.0	0.000
12		59.2	1.20	13.4	0.0	0.000
13		52.1	1.20	11.8	0.0	0.000
14		57.7	1.20	13.0	0.0	0.000
15		63.4	1.20	14.3	0.0	0.000
16		69.2	1.20	15.6	0.0	0.000
17		54.6	1.20	12.3	0.0	0.000
18		59.0	1.20	13.3	0.0	0.000
19		63.5	1.20	14.3	0.0	0.000
20		68.0	1.20	15.4	0.0	0.000
21		59.2	1.20	13.4	0.0	0.000
22		64.2	1.20	14.5	0.0	0.000
23		69.2	1.20	15.6	0.0	0.000
24		74.4	1.20	16.8	0.0	0.000
25		74.5	1.20	16.8	0.0	0.000

Project data

Project name	stadion Ajdovščina
Project number	116/23
Author	corus inženirji d.o.o.
Description	
Date	6/20/2024
Code	EN

Material

Steel	S 355
Concrete	C30/37

Project item STEBER REFLEKTORJA

Design

Name	STEBER REFLEKTORJA
Description	sidranje stebra
Analysis	Stress, strain/ loads in equilibrium

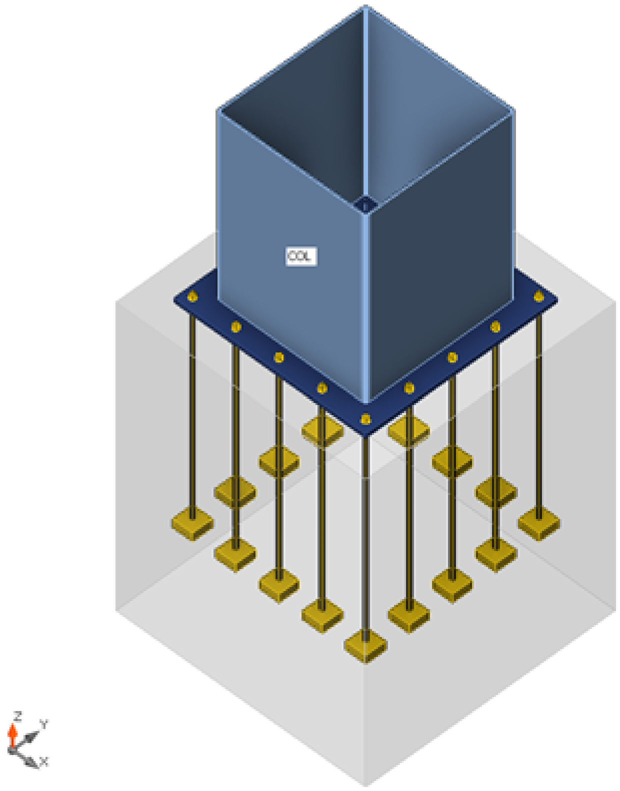
Members

Geometry

Name	Cross-section	β – Direction [°]	γ - Pitch [°]	α - Rotation [°]	Offset ex [mm]	Offset ey [mm]	Offset ez [mm]
COL	2 - RHS900x900	0.0	90.0	0.0	0	0	0

Supports and forces

Name	Support	Forces in	X [mm]
COL / end		Node	0



Cross-sections

Name	Material
2 - RHS900x900	S 355

Anchors

Name	Diameter [mm]	f_y [MPa]	f_u [MPa]	Gross area [mm^2]
M20 8.8	20	640.0	800.0	314

Load effects (forces in equilibrium)

Name	Member	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
LE1	COL / End	-15.0	0.0	-12.0	0.0	262.0	0.0

Unbalanced forces

Name	X [kN]	Y [kN]	Z [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
LE1	12.0	0.0	-15.0	0.0	262.0	0.0

Foundation block

Item	Value	Unit
CB 1		
Dimensions	1500 x 1500	mm
Depth	1850	mm
Anchor	M20 8.8	
Anchoring length	1300	mm
Shear force transfer	Friction	

Check

Summary

Name	Value	Check status
Analysis	100.0%	OK
Plates	0.0 < 5.0%	OK
Loc. deformation	0.0 < 3%	OK
Anchors	53.4 < 100%	OK
Welds	0.0 < 100%	OK
Concrete block	9.7 < 100%	OK
Shear	12.0 < 100%	OK
Buckling	6.64	

Plates

Name	t_p [mm]	Loads	σ_{Ed} [MPa]	ε_{Pl} [%]	$\sigma_{c,Ed}$ [MPa]	Status
COL	10.0	LE1	195.8	0.0	0.0	OK
BP1	25.0	LE1	162.2	0.0	0.0	OK

Design data

Material	f_y [MPa]	ε_{lim} [%]
S 355	355.0	5.0

Symbol explanation

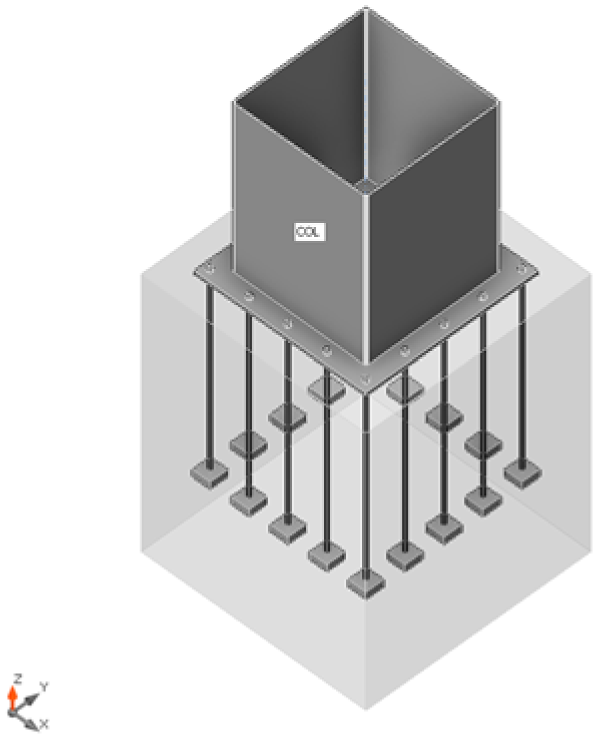
t_p	Plate thickness
σ_{Ed}	Equivalent stress
ε_{Pl}	Plastic strain
$\sigma_{c,Ed}$	Contact stress
f_y	Yield strength
ε_{lim}	Limit of plastic strain

Loc. deformation

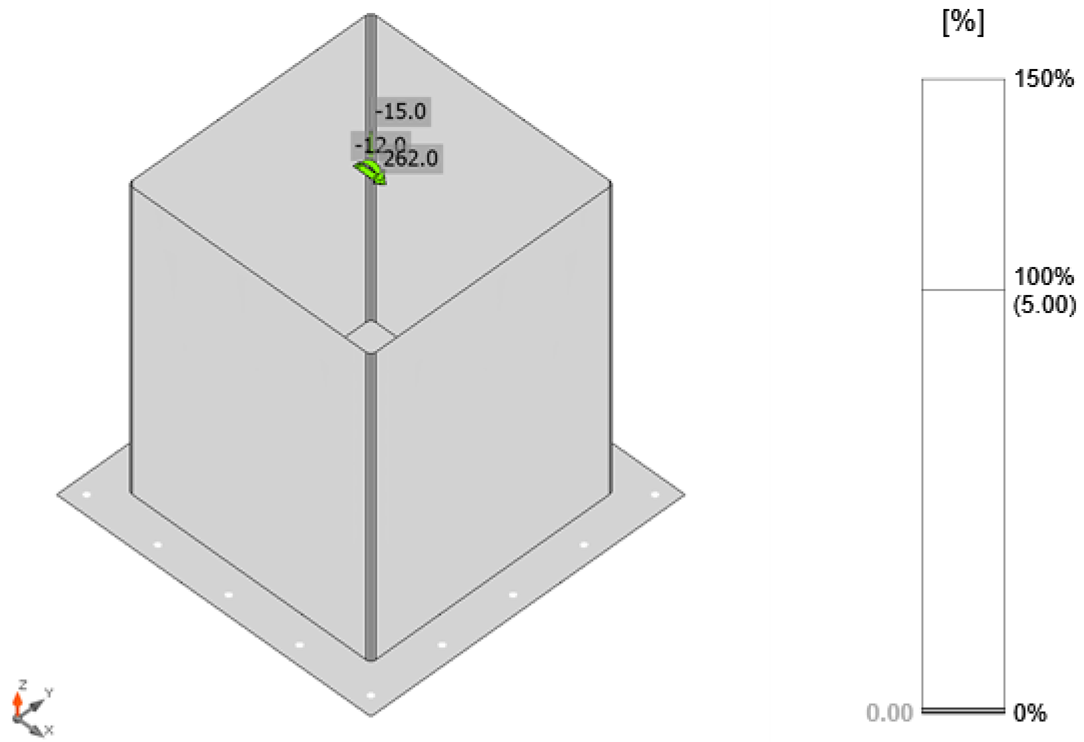
Name	d_0 [mm]	Loads	δ [mm]	δ_{lim} [mm]	δ/d_0 [%]	Check status
COL	900	LE1	0	27	0.0	OK

Symbol explanation

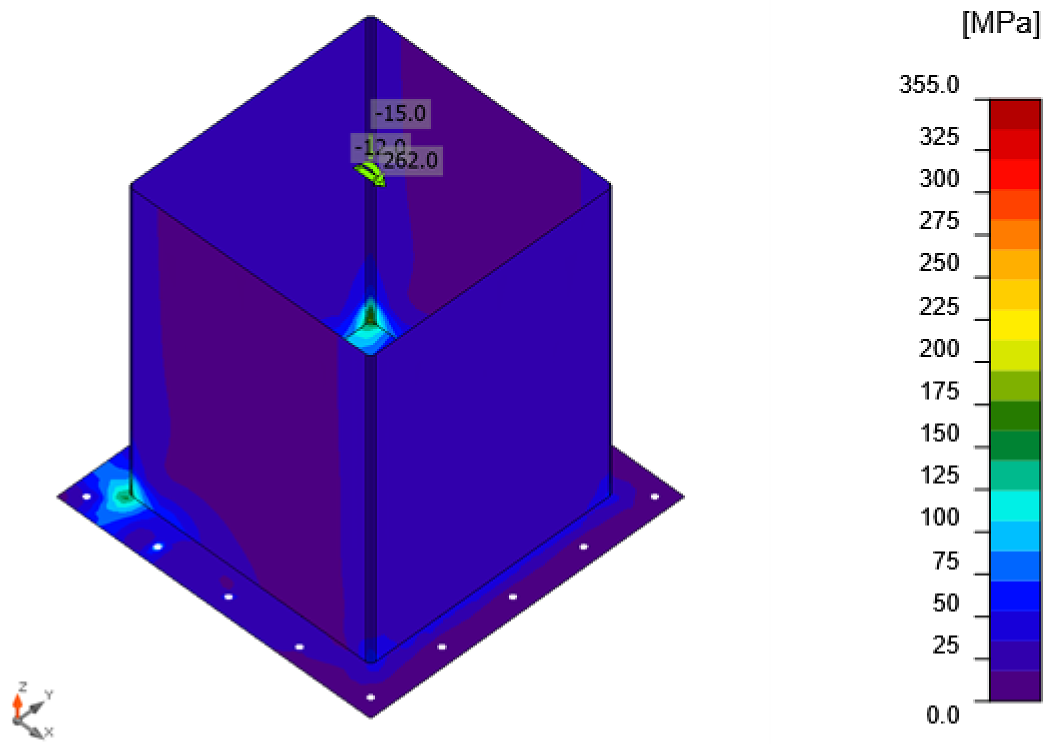
d_0	Cross-section size
δ	Local cross-section deformation
δ_{lim}	Allowed deformation



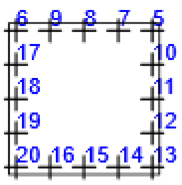
Overall check, LE1



Strain check, LE1



Equivalent stress, LE1

Shape	Item	Loads	N_{Ed} [kN]	V_{Ed} [kN]	$N_{Rd,p}$ [kN]	$N_{Rd,cb}$ [kN]	Ut_t [%]	Ut_s [%]	Ut_{ts} [%]	Detailing	Status
	A5	LE1	32.4	0.0	2465.0	2650.4	29.2	0.0	8.5	OK	OK
	A6	LE1	32.5	0.0	2465.0	2650.4	29.3	0.0	8.6	OK	OK
	A7	LE1	59.3	0.0	2465.0	2650.4	53.4	0.0	28.5	OK	OK
	A8	LE1	49.7	0.0	2465.0	2650.4	44.8	0.0	20.1	OK	OK
	A9	LE1	59.3	0.0	2465.0	2650.4	53.4	0.0	28.5	OK	OK
	A10	LE1	41.7	0.0	2465.0	1743.9	37.6	0.0	14.1	OK	OK
	A11	LE1	16.8	0.0	2465.0	1743.9	15.1	0.0	2.3	OK	OK
	A12	LE1	1.8	0.0	2465.0	1743.9	5.3	0.0	1.2	OK	OK
	A13	LE1	0.0	0.0	2465.0	-	0.0	0.0	0.0	OK	OK
	A14	LE1	0.0	0.0	2465.0	-	0.0	0.0	0.0	OK	OK
	A15	LE1	0.0	0.0	2465.0	-	0.0	0.0	0.0	OK	OK
	A16	LE1	0.0	0.0	2465.0	-	0.0	0.0	0.0	OK	OK
	A17	LE1	41.9	0.0	2465.0	1741.7	37.7	0.0	14.2	OK	OK
	A18	LE1	16.8	0.0	2465.0	1741.7	15.1	0.0	2.3	OK	OK
	A19	LE1	1.8	0.0	2465.0	1741.7	5.3	0.0	1.2	OK	OK
	A20	LE1	0.0	0.0	2465.0	-	0.0	0.0	0.0	OK	OK

Design data

Grade	$N_{Rd,s}$ [kN]	$V_{Rd,s}$ [kN]
M20 8.8 - 1	111.1	78.4

Symbol explanation

N_{Ed}	Tension force
V_{Ed}	Resultant of bolt shear forces Vy and Vz in shear planes
$N_{Rd,p}$	Design resistance in case of pull-out failure - EN 1992-4 – 7.2.1.5
$N_{Rd,cb}$	Design resistance in case of concrete blow-out failure - EN 1992-4 – 7.2.1.8
Ut_t	Utilization in tension
Ut_s	Utilization in shear
Ut_{ts}	Utilization in tension and shear
$N_{Rd,s}$	Design tensile resistance of a fastener in case of steel failure - EN 1992-4 – 7.2.1.3
$V_{Rd,s}$	Design shear resistance of a fastener in case of steel failure - EN 1992-4 – 7.2.2.3.1

Welds

Item	Edge	T_w [mm]	L [mm]	Loads	$\sigma_{w,Ed}$ [MPa]	ε_{Pl} [%]	$\sigma_{\perp}$ [MPa]	$\tau_{\perp}$ [MPa]	$\tau_{\parallel}$ [MPa]	Ut [%]	Ut_c [%]	Detailing	Status
BP1	COL-w 1	-	4393	-	-	-	-	-	-	-	-	OK	OK

Design data

Material	f_u [MPa]	β_w [-]	$\sigma_{w,Rd}$ [MPa]	0.9 σ [MPa]
S 355	0.0	-	-	-

Symbol explanation

T_w	Throat thickness a
L	Length
$\sigma_{w,Ed}$	Equivalent stress
ε_{Pl}	Strain
$\sigma_{\perp}$	Perpendicular stress
$\tau_{\perp}$	Shear stress perpendicular to weld axis
$\tau_{\|\|}$	Shear stress parallel to weld axis
Ut	Utilization
Ut_c	Weld capacity estimation
f_u	Ultimate strength of weld
β_w	Correlation factor EN 1993-1-8 – Tab. 4.1
$\sigma_{w,Rd}$	Equivalent stress resistance
0.9 σ	Perpendicular stress resistance: 0.9*fu/γM2

Item	Loads	c [mm]	A_{eff} [mm^2]	σ [MPa]	k_j [-]	f_{jd} [MPa]	Ut [%]	Status
CB 1	LE1	43	104872	3.8	2.92	39.1	9.7	OK

Symbol explanation

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

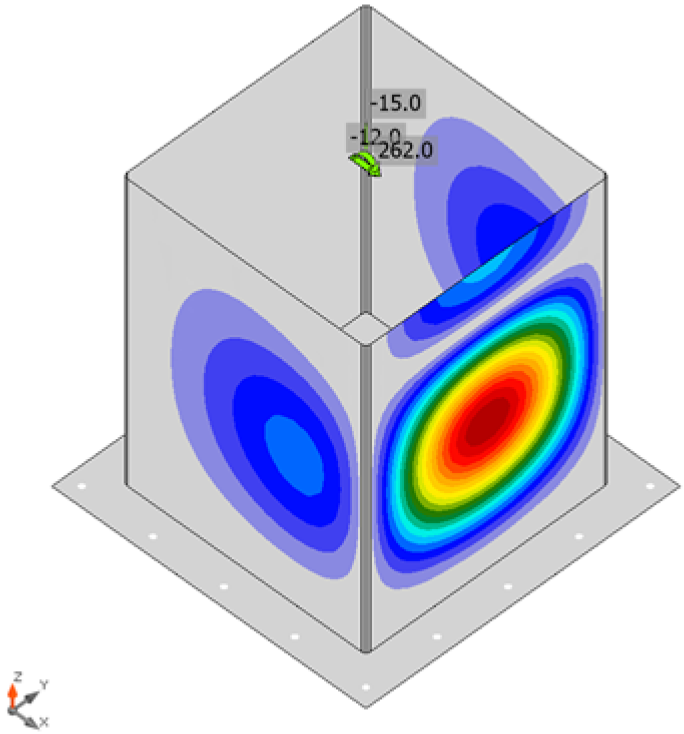
Name	Loads	V_y [kN]	V_z [kN]	$V_{Rd,y}$ [kN]	$V_{Rd,z}$ [kN]	U_t [%]	Status
BP1	LE1	0.0	-12.0	99.8	99.8	12.0	OK

Symbol explanation

V_y	Shear force in base plate Vy
V_z	Shear force in base plate Vz
$V_{Rd,y}$	Shear resistance
$V_{Rd,z}$	Shear resistance
U_t	Utilization

Buckling

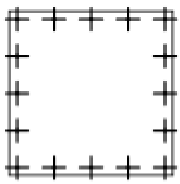
Loads	Shape	Factor [-]
LE1	1	6.64
	2	7.17
	3	11.49
	4	14.98
	5	18.98
	6	19.57



First buckling mode shape, LE1

Bill of material

Manufacturing operations

Name	Plates [mm]	Shape	Nr.	Welds Throat thickness [mm]	Length [mm]	Bolts	Nr.
BP1	P25.0x1150.0-1150.0 (S 355)		1	Butt: 10.0	3533.2	M20 8.8	16

Welds

Type	Material	Throat thickness [mm]	Leg size [mm]	Length [mm]
Butt	S 355	-	-	3533.2

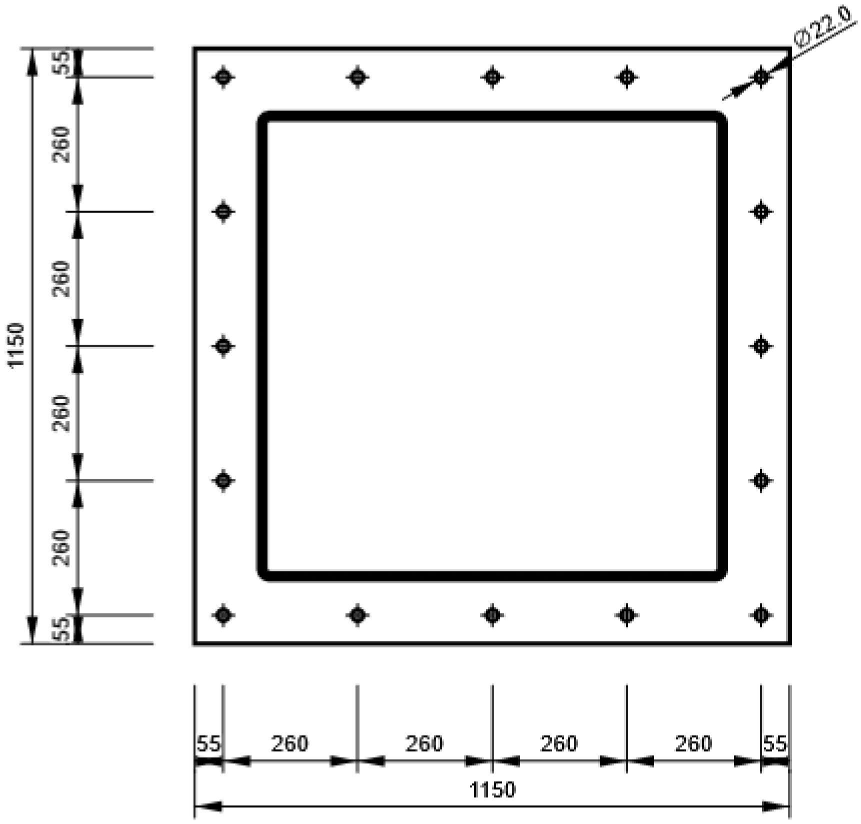
Anchors

Name	Length [mm]	Drill length [mm]	Count
M20 8.8	1325	1300	16

Drawing

BP1

P25.0x1150-1150 (S 355)



Code settings

Item	Value	Unit	Reference
Safety factor γ_{M0}	1.00	-	EN 1993-1-1: 6.1
Safety factor γ_{M1}	1.00	-	EN 1993-1-1: 6.1
Safety factor γ_{M2}	1.25	-	EN 1993-1-1: 6.1
Safety factor γ_{M3}	1.25	-	EN 1993-1-8: 2.2
Safety factor γ_{C}	1.50	-	EN 1992-1-1: 2.4.2.4
Safety factor γ_{Inst}	1.20	-	EN 1992-4: Table 4.1
Joint coefficient βj	0.67	-	EN 1993-1-8: 6.2.5
Effective area - influence of mesh size	0.10	-	
Friction coefficient - concrete	0.25	-	EN 1993-1-8
Friction coefficient in slip-resistance	0.30	-	EN 1993-1-8 tab 3.7
Limit plastic strain	0.05	-	EN 1993-1-5
Detailing	Yes		
Distance between bolts [d]	2.20	-	EN 1993-1-8: tab 3.3
Distance between bolts and edge [d]	1.20	-	EN 1993-1-8: tab 3.3
Concrete breakout resistance check	None		EN 1992-4: 7.2.1.4 and 7.2.2.5
Use calculated αb in bearing check.	Yes		EN 1993-1-8: tab 3.4
Cracked concrete	No		EN 1992-4
Local deformation check	Yes		CIDECT DG 1, 3 - 1.1
Local deformation limit	0.03	-	CIDECT DG 1, 3 - 1.1
Geometrical nonlinearity (GMNA)	Yes		Analysis with large deformations for hollow section joints
Braced system	No		EN 1993-1-8: 5.2.2.5

Company:		Page:	1
Address:		Specifier:	
Phone | Fax:	|	E-Mail:	
Design:	Rebar - Jul 9, 2024	Date:	10. 07. 2024
Rebar aplikacija:			

Specifier's comments:

1. Input data

General

Design method	EOTA TR069
Consider the effect of ΔF_{td}	no
Verification of interface shear	no
Consider compression reinforcement for CSD	yes
Application type	Column to slab
Continuous in X	no
Loading type	Static
Design for yield	no
Design working life	50 years

Product

Mortar	**HIT-HY 200-R V3**
Item number	2262133 HIT-HY 200-R V3 (adhesive)
European Technical Assessment	ETA-19/0665
Issued	29. 06. 2023
Installation	Hammer drilling (HD), Installation Condition: Dry Concrete
Drilling direction	Drilling aid is used (this improves the angle of drilling)

Material and Geometry

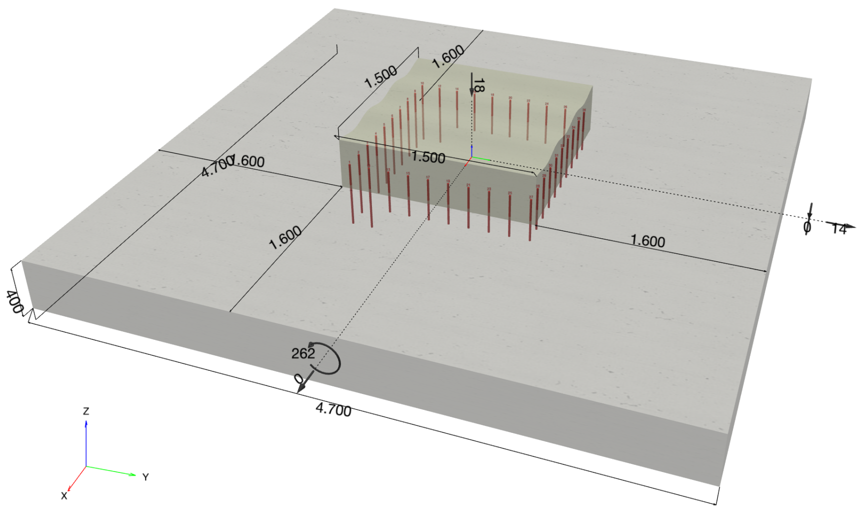
Existing concrete	Cracked concrete, C30/37, f_{ck} = 30 N/mm²
New concrete	Cracked concrete, C30/37, f_{ck} = 30 N/mm²
Joint roughness	Rough
Interface between new and old concrete	Rectangular cross section, width = 1.500 mm, height = 1.500 mm
Length of existing concrete	400 mm
Temperature	During installation: from 5°C to 20°C; During service: 20 °C / 20 °C (short / long term)
Concrete reinforcement	Wide, For Φ > 10, spacing ≥ 150mm and for Φ ≤ 10, spacing ≥ 100mm

Post installed rebar

	Diameter	Coordinate X	Coordinate Y	Bond	f_{yk}	Drilling length (l_v)
1	16mm	-702 mm	702 mm	Good	500,00 N/mm^2	343 mm
2	16mm	-546 mm	702 mm	Good	500,00 N/mm^2	343 mm
3	16mm	-390 mm	702 mm	Good	500,00 N/mm^2	343 mm
4	16mm	-234 mm	702 mm	Good	500,00 N/mm^2	343 mm
5	16mm	-78 mm	702 mm	Good	500,00 N/mm^2	343 mm
6	16mm	78 mm	702 mm	Good	500,00 N/mm^2	343 mm
7	16mm	234 mm	702 mm	Good	500,00 N/mm^2	343 mm
8	16mm	390 mm	702 mm	Good	500,00 N/mm^2	343 mm
9	16mm	546 mm	702 mm	Good	500,00 N/mm^2	343 mm
10	16mm	702 mm	702 mm	Good	500,00 N/mm^2	343 mm
11	16mm	-702 mm	546 mm	Good	500,00 N/mm^2	343 mm
12	16mm	702 mm	546 mm	Good	500,00 N/mm^2	343 mm
13	16mm	-702 mm	390 mm	Good	500,00 N/mm^2	172 mm
14	16mm	702 mm	390 mm	Good	500,00 N/mm^2	172 mm
15	16mm	-702 mm	234 mm	Good	500,00 N/mm^2	172 mm
16	16mm	702 mm	234 mm	Good	500,00 N/mm^2	172 mm
17	16mm	-702 mm	78 mm	Good	500,00 N/mm^2	172 mm
18	16mm	702 mm	78 mm	Good	500,00 N/mm^2	172 mm
19	16mm	-702 mm	-78 mm	Good	500,00 N/mm^2	172 mm
20	16mm	702 mm	-78 mm	Good	500,00 N/mm^2	172 mm
21	16mm	-702 mm	-234 mm	Good	500,00 N/mm^2	172 mm
22	16mm	702 mm	-234 mm	Good	500,00 N/mm^2	172 mm
23	16mm	-702 mm	-390 mm	Good	500,00 N/mm^2	172 mm
24	16mm	702 mm	-390 mm	Good	500,00 N/mm^2	172 mm
25	16mm	-702 mm	-546 mm	Good	500,00 N/mm^2	172 mm
26	16mm	702 mm	-546 mm	Good	500,00 N/mm^2	172 mm
27	16mm	-702 mm	-702 mm	Good	500,00 N/mm^2	172 mm
28	16mm	-546 mm	-702 mm	Good	500,00 N/mm^2	172 mm
29	16mm	-390 mm	-702 mm	Good	500,00 N/mm^2	172 mm
30	16mm	-234 mm	-702 mm	Good	500,00 N/mm^2	172 mm
31	16mm	-78 mm	-702 mm	Good	500,00 N/mm^2	172 mm
32	16mm	78 mm	-702 mm	Good	500,00 N/mm^2	172 mm
33	16mm	234 mm	-702 mm	Good	500,00 N/mm^2	172 mm
34	16mm	390 mm	-702 mm	Good	500,00 N/mm^2	172 mm
35	16mm	546 mm	-702 mm	Good	500,00 N/mm^2	172 mm
36	16mm	702 mm	-702 mm	Good	500,00 N/mm^2	172 mm
					Final drilling length (l_v)	**343 mm**

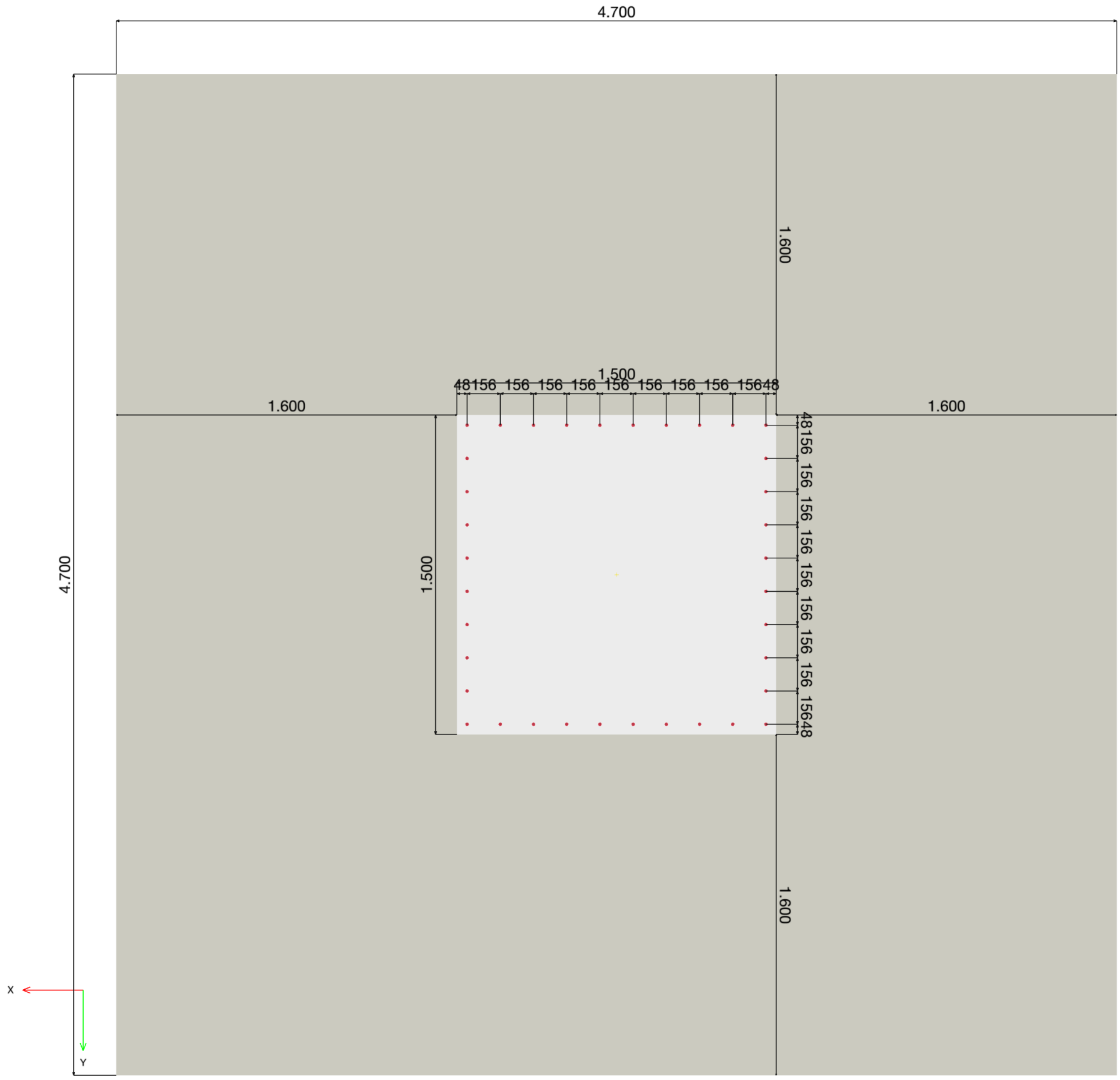
1.1. Geometry & Loading

Geometrical dimensions in [mm]. Loading values in [kN, kNm]



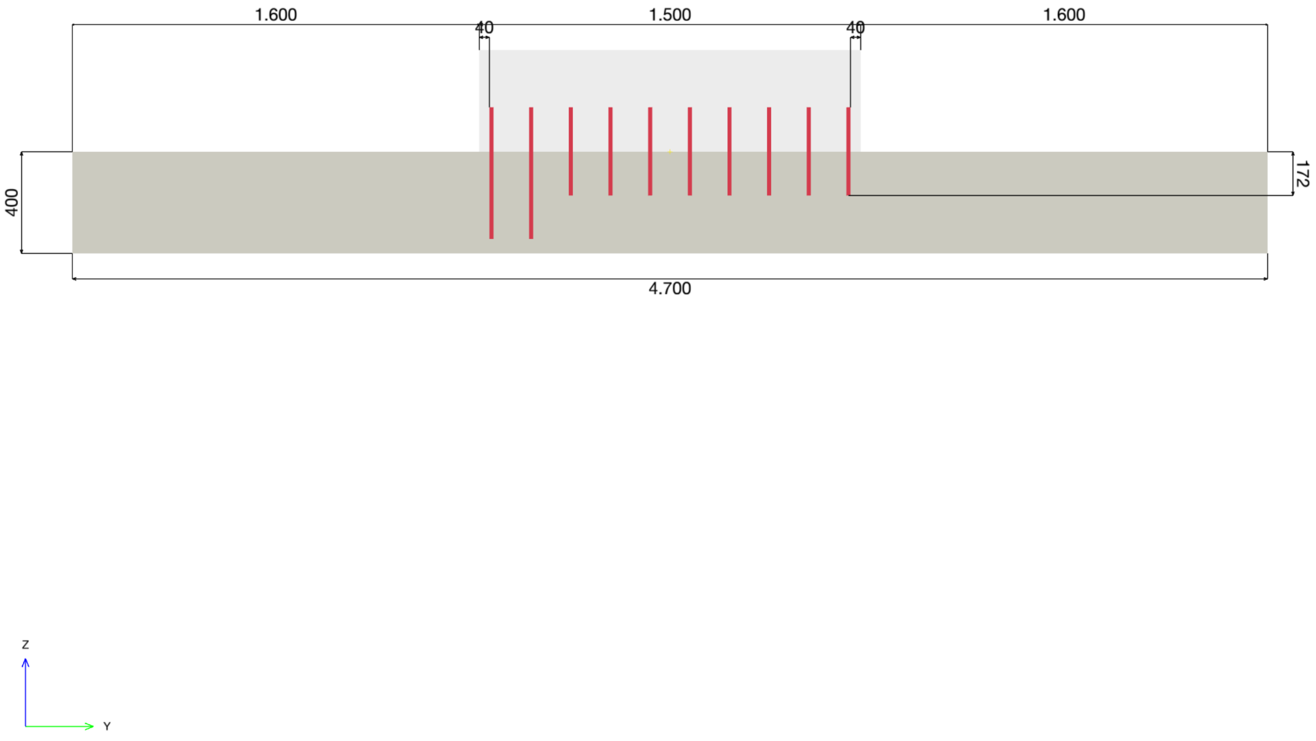
Company:		Page:	4
Address:		Specifier:	
Phone | Fax:	|	E-Mail:	
Design:	Rebar - Jul 9, 2024	Date:	10.07.2024
Rebar aplikacija:			

1.2. Cross section view



Company:		Page:	5
Address:		Specifier:	
Phone | Fax:	|	E-Mail:	
Design:	Rebar - Jul 9, 2024	Date:	10.07.2024
Rebar aplikacija:			

1.3. Side section view



2. Loads

2.1. Load combination and Geometry

LC	Load type	V_x [kN]	V_y [kN]	N [kN]	M_x [kNm]	M_y [kNm]	Design Method	Max drill length l_v [mm]	Max. Utilization [%]
Combination 1	Static	0,000	14,000	-18,000	262,000	0,000	DE NA EOTA TR069	343,104	71

3. Overview of results

3.1. References

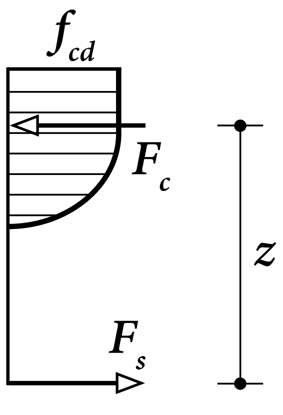
[1] EN 1992-1-1:2011 (01/2011): Eurocode 2: Design of concrete structures - Part 1-1: General rules and rules for buildings
[2] EOTA TR 069, 2019-10 (Amended 2021-06): Design method for anchorage of post-installed reinforcing bars (rebars) with improved bond-splitting behavior as compared to EN 1992-1-1
[3] EN 1992-4:2018 (07/2018): Eurocode 2: Design of concrete structures – Part 4: Design of fastenings for use in concrete
[4] German National Annex to EN 1992-1-1:2011: Nationaler Anhang – National festgelegte Parameter – Eurocode 2: Bemessung und Konstruktion von Stahlbeton- und Spannbetontragwerken – Teil 1-1: Allgemeine Bemessungsregeln und Regeln für den Hochbau

3.2. Cross-section verification

Description	Variable	Value
Post-Installed Rebar diameter	ϕ	16 mm
Reinforcement yield strength, post installed	f_{yk}	500,00 N/mm²
Concrete compressive strength, existing	f_{ck}	30,00 N/mm²
Concrete compressive strength, new	f_{ck}	30,00 N/mm²
Member height	h	1.500 mm
Member width	b	1.500 mm

The determination of the load bearing capacity of the reinforced concrete member is performed assuming the Bernoulli Hypothesis ("plane sections remain plane").

For the (compressed) concrete the following stress-strain relationship (parabola-rectangle diagram) is used.



$$\sigma_c = f_{cd} \cdot \left[1 - \left(1 - \frac{\varepsilon_c}{\varepsilon_{c2}}\right)^n\right] \; for \; 0 \leq \varepsilon_c \leq \varepsilon_{c2}$$ [1] Eq. (3.17)

$$\sigma_c = f_{cd} \; for \; \varepsilon_{c2} \leq \varepsilon_c \leq \varepsilon_{cu2}$$ [1] Eq. (3.18)

$$f_{cd} = \frac{\alpha_{cc} \cdot f_{ck}}{\gamma_c}$$ [1] (3.15)

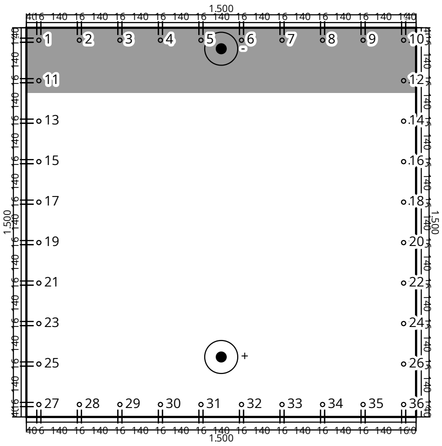
The design stress-strain diagram for reinforcing steel (in tension and compression) is assumed as bi-linear with a horizontal top branch.

f_{yd}	$= \frac{f_{yk}}{\gamma_s}$	design yield stress
ε_{yd}	$= \frac{f_{yd}}{E_s}$	design strain at yielding of steel reinforcement
ε_{ud}		design ultimate strain for steel reinforcement

f_{ck} [N/mm²]	α_{cc} [-]	γ_c [-]	f_{cd} [N/mm²]	ε_{c2} [-]	ε_{cu2} [-]
30,00	0,850	1,500	17,00	0,002	0.0035

f_{yk} [N/mm²]	γ_s [-]	f_{yd} [N/mm²]	E_s [N/mm²]	ε_{yd} [-]	ε_{ud} [-]
500,00	1,150	434,78	200.000,00	0,002	0,020

Rebar arrangement and diameter at the interface; see figure below



Resulting rebar forces

Force (+Tension, -Compression)

Rebar	Tension Force [kN]	Total Force [kN]
1	-2,121	-2,121
2	-2,121	-2,121
3	-2,121	-2,121
4	-2,121	-2,121
5	-2,121	-2,121
6	-2,121	-2,121
7	-2,121	-2,121
8	-2,121	-2,121
9	-2,121	-2,121
10	-2,121	-2,121
11	-0,488	-0,488
12	-0,488	-0,488
13	1,145	1,145
14	1,145	1,145
15	2,779	2,779
16	2,779	2,779
17	4,412	4,412
18	4,412	4,412
19	6,045	6,045
20	6,045	6,045

21	7,679	7,679
22	7,679	7,679
23	9,312	9,312
24	9,312	9,312
25	10,946	10,946
26	10,946	10,946
27	12,579	12,579
28	12,579	12,579
29	12,579	12,579
30	12,579	12,579
31	12,579	12,579
32	12,579	12,579
33	12,579	12,579
34	12,579	12,579
35	12,579	12,579
36	12,579	12,579

max. concrete compressive strain:	0,065 ‰
max. concrete compressive stress:	1,09 N/mm²
resulting tension force in (x/y) = (-0,000/-518,829):	210,425 kN
resulting compression force in (x/y) = (-0,000/669,041):	228,425 kN
inner lever arm z =	1.188 mm

4. Rebar design in tension ([1] Section 8.4 , [2] Section 4 , [4] NCI to section 8.4, 8.7)

4.1. Steel, concrete cone, bond splitting verification and installation length determination

Input

Description	Variable	Value
Characteristic concrete compressive strength, existing	f_{ck}	30,00 N/mm²
Mean concrete tensile strength, existing	f_{ctm}	2,90 N/mm²
Partial material safety factor	γ_c	1,500
Coefficient for long-term effects on the tensile strength	α_{ct}	1,000
Design concrete tensile strength	f_{ctd}	1,35 N/mm²
Concrete state		cracked
Temperature	short/long	20 °C / 20 °C
Drilling		hammer drilled
Installation condition		installation in dry concrete
Installation safety factor	γ_{inst}	1,000
Reinforcement		no reinforcement or reinforcement spacing ≥ 150 mm (any Ø) or ≥ 100 mm (Ø ≤ 10 mm)
Rebar diameter	ϕ	16,000 mm
Transverse pressure	p_{tr}	-0,00 N/mm²

Governing loading situation

The results presented in the following are valid for the governing loading situation:

The design is performed based on the results of the cross-section analysis (incl. additional tension forces due to shear loads)

Installation/Drill length results

$l_v \geq l_{b,min}$

Rebar	ϕ [mm]	$l_{b,min}$ [mm]	l_v [mm]
13	16	172	172
14	16	172	172
15	16	172	172
16	16	172	172
17	16	172	172
18	16	172	172
19	16	172	172
20	16	172	172
21	16	172	172
22	16	172	172
23	16	172	172
24	16	172	172
25	16	172	172

26	16	172	172
27	16	172	172
28	16	172	172
29	16	172	172
30	16	172	172
31	16	172	172
32	16	172	172
33	16	172	172
34	16	172	172
35	16	172	172
36	16	172	172

Verification results overview

Verification	Load N_{Ed} [kN]	Resistance N_{Rd} [kN]	Utilization [%]	Status
Steel failure	12,579	87,418	15	Ok
Concrete cone failure	210,425	296,575	71	Ok
Bond splitting failure	12,579	41,776	31	Ok

Steel verification

$$N_{Ed} \leq N_{Rd,s} = \frac{N_{Rk,s}}{\gamma_{Ms}} = \frac{A_s \cdot f_{yk}}{\gamma_{Ms}}$$ [2] Table (4.1.1)

Rebar	N_{Ed} [kN]	ϕ [mm]	A_s [mm]	γ_{Ms} [-]	$N_{Rd,s}$ [kN]	Utilization [%]	Status
13	1,145	16	201	1,150	87,418	2	Ok
14	1,145	16	201	1,150	87,418	2	Ok
15	2,779	16	201	1,150	87,418	4	Ok
16	2,779	16	201	1,150	87,418	4	Ok
17	4,412	16	201	1,150	87,418	6	Ok
18	4,412	16	201	1,150	87,418	6	Ok
19	6,045	16	201	1,150	87,418	7	Ok
20	6,045	16	201	1,150	87,418	7	Ok
21	7,679	16	201	1,150	87,418	9	Ok
22	7,679	16	201	1,150	87,418	9	Ok
23	9,312	16	201	1,150	87,418	11	Ok
24	9,312	16	201	1,150	87,418	11	Ok
25	10,946	16	201	1,150	87,418	13	Ok
26	10,946	16	201	1,150	87,418	13	Ok
27	12,579	16	201	1,150	87,418	15	Ok
28	12,579	16	201	1,150	87,418	15	Ok
29	12,579	16	201	1,150	87,418	15	Ok
30	12,579	16	201	1,150	87,418	15	Ok
31	12,579	16	201	1,150	87,418	15	Ok
32	12,579	16	201	1,150	87,418	15	Ok
33	12,579	16	201	1,150	87,418	15	Ok
34	12,579	16	201	1,150	87,418	15	Ok
35	12,579	16	201	1,150	87,418	15	Ok
36	12,579	16	201	1,150	87,418	15	Ok

Concrete cone verification

The concrete cone verification considering all rebars in the tension zone.

N_{Ed}	$\leq N_{Rd,c} = \frac{N_{Rk,c}}{\gamma_{M,c}}$	[2] Table (4.1.1)
$N_{Rk,c}$	$= N^0_{Rk,c} \cdot \frac{A_{c,N}}{A^0_{c,N}} \cdot \psi_{s,N} \cdot \psi_{re,N} \cdot \psi_{ec1,N} \cdot \psi_{ec2,N} \cdot \psi_{M,N}$	[2] Eq. (4.3)
$N^0_{Rk,c}$	$= k_1 \cdot \sqrt{f_{ck}} \cdot l_b^{1.5}$	[2] Eq. (4.4)
$A^0_{c,N}$	$= s_{cr,N} \cdot s_{cr,N}$	[2] Eq. (4.5)
$\psi_{s,N}$	$= 0.7 + 0.3\frac{c}{c_{cr,N}} \leq 1.00$	[2] Eq. (4.6)
$\psi_{ec1,N}$	$= \frac{1}{1+\frac{2 \cdot e_{N,1}}{s_{cr,N}}} \leq 1$	[2] Eq. (4.7)
$\psi_{ec2,N}$	$= \frac{1}{1+\frac{2 \cdot e_{N,2}}{s_{cr,N}}} \leq 1$	[2] Eq. (4.7)

$A_{c,N}$ [mm²]	$A^0_{c,N}$ [mm²]	$c_{cr,N}$ [mm]	$s_{cr,N}$ [mm]	f_{ck} [N/mm²]	l_b [mm]
2.117.664	266.256	258	516	30,00	172

l'_b [mm]	c [mm]	$\psi_{s,N}$ [-]	$e_{N,1}$ [mm]	$\psi_{ec1,N}$ [-]
-	1.648	1,000	0	1,000

$e_{N,2}$ [mm]	$\psi_{ec2,N}$ [-]	$\psi_{re,N}$ [-]	z [mm]	$\psi_{M,N}$ [-]
181	0,588	1,000	1.188	1,000

k_1 [-]	$N^0_{Rk,c}$ [kN]	$N_{Rk,c}$ [kN]	γ_{Mc} [-]	$N_{Rd,c}$ [kN]	N_{Ed} [kN]
7,700	95,136	444,863	1,500	296,575	210,425

Group rebar ID
13-36

Bond splitting verification

$N_{Ed} \leq N_{Rd,sp} = \frac{N_{Rk,sp}}{\gamma_{M,c}}$	[2] Table (4.1.1)
$N_{Rk,sp} = \tau_{Rk,sp} \cdot l_b \cdot \phi \cdot \pi$	[2] Eq. (4.10)
$N_{Rk,sp} = \eta_1 \cdot A_k \cdot \left(\frac{f_{ck}}{25}\right)^{sp1} \cdot \left(\frac{25}{\phi}\right)^{sp2} \cdot \left[\left(\frac{c_d}{\phi}\right)^{sp3} \cdot \left(\frac{c_{max}}{c_d}\right)^{sp4} + k_m \cdot k_{tr}\right] \cdot \left(\frac{7 \cdot \phi}{l_b}\right)^{lb1} \cdot \Omega_{p,tr}$	[2] Eq. (4.11a)
$\eta_1 = 1.0$ for good bond conditions	[2] Eq. (8.4.2)
$\tau_{Rk,sp} \leq \tau_{Rk,ucr} \cdot \Omega_{cr} \cdot \psi_{sus}$ for $7 \cdot \phi \leq l_b \leq 20 \cdot \phi$	[2] Eq. (4.11b-2)
$\tau_{Rk,sp} \leq \tau_{Rk,ucr} \cdot \left(\frac{20 \cdot \phi}{l_b}\right)^{lb1} \cdot \Omega_{cr} \cdot \psi_{sus}$ for $l_b > 20 \cdot \phi$	[2] Eq. (4.11c-2)
$c_d = \min\left(\frac{a}{2}, c_1, c\right)$	[2] Section 4.4 (3)
$c_{max} = \max\left(\frac{a}{2}, c\right)$	[2] Section 4.4 (3)
$\frac{c_{max}}{c_d} \leq 3.5$	[2] Section 4.4 (3)
$\Omega_{p,tr} = 1.0$	
$k_m = 0$	[2] Section 4.4 (3)
$k_{tr} = 0$	[2] Section 4.4 (3)
$\psi_{sus} = 1$ for $\alpha_{sus} \leq \psi^0_{sus}$	[2] Eq. (4.14a)
$\psi_{sus} = \psi^0_{sus} + 1 - \alpha_{sus}$ for $\alpha_{sus} > \psi^0_{sus}$	[2] Eq. (4.14b)

$A_k, sp1, sp2, sp3, sp4, lb1, \Omega_{cr}, \tau_{Rk,ucr}, \psi^0_{sus}, \gamma_{inst}$ values from ETA-19/0665

Rebar	$\tau_{Rk,ucr}$ [N/mm²]	Ω_{cr} [-]	ψ^0_{sus} [-]	α_{sus} [-]	ψ_{sus} [-]	η_1 [-]
13	12,50	0,580	0,740	0,500	1,000	1,000
14	12,50	0,580	0,740	0,500	1,000	1,000
15	12,50	0,580	0,740	0,500	1,000	1,000
16	12,50	0,580	0,740	0,500	1,000	1,000
17	12,50	0,580	0,740	0,500	1,000	1,000
18	12,50	0,580	0,740	0,500	1,000	1,000
19	12,50	0,580	0,740	0,500	1,000	1,000
20	12,50	0,580	0,740	0,500	1,000	1,000
21	12,50	0,580	0,740	0,500	1,000	1,000
22	12,50	0,580	0,740	0,500	1,000	1,000
23	12,50	0,580	0,740	0,500	1,000	1,000
24	12,50	0,580	0,740	0,500	1,000	1,000
25	12,50	0,580	0,740	0,500	1,000	1,000
26	12,50	0,580	0,740	0,500	1,000	1,000
27	12,50	0,580	0,740	0,500	1,000	1,000
28	12,50	0,580	0,740	0,500	1,000	1,000
29	12,50	0,580	0,740	0,500	1,000	1,000
30	12,50	0,580	0,740	0,500	1,000	1,000
31	12,50	0,580	0,740	0,500	1,000	1,000
32	12,50	0,580	0,740	0,500	1,000	1,000
33	12,50	0,580	0,740	0,500	1,000	1,000
34	12,50	0,580	0,740	0,500	1,000	1,000
35	12,50	0,580	0,740	0,500	1,000	1,000
36	12,50	0,580	0,740	0,500	1,000	1,000

Company:		Page:	14
Address:		Specifier:	
Phone | Fax:	|	E-Mail:	
Design:	Rebar - Jul 9, 2024	Date:	10.07.2024
Rebar aplikacija:			

Rebar	A_k [-]	f_{ck} [N/mm²]	$sp1$ [-]	$sp2$ [-]	a [mm]	c_1 [mm]	c [mm]	c_d [mm]
13	4,100	30,00	0,310	0,320	140	1.640	1.952	70
14	4,100	30,00	0,310	0,320	140	1.640	1.952	70
15	4,100	30,00	0,310	0,320	140	1.640	2.108	70
16	4,100	30,00	0,310	0,320	140	1.640	2.108	70
17	4,100	30,00	0,310	0,320	140	1.640	2.264	70
18	4,100	30,00	0,310	0,320	140	1.640	2.264	70
19	4,100	30,00	0,310	0,320	140	1.640	2.264	70
20	4,100	30,00	0,310	0,320	140	1.640	2.264	70
21	4,100	30,00	0,310	0,320	140	1.640	2.108	70
22	4,100	30,00	0,310	0,320	140	1.640	2.108	70
23	4,100	30,00	0,310	0,320	140	1.640	1.952	70
24	4,100	30,00	0,310	0,320	140	1.640	1.952	70
25	4,100	30,00	0,310	0,320	140	1.640	1.796	70
26	4,100	30,00	0,310	0,320	140	1.640	1.796	70
27	4,100	30,00	0,310	0,320	140	1.640	1.640	70
28	4,100	30,00	0,310	0,320	140	1.640	1.796	70
29	4,100	30,00	0,310	0,320	140	1.640	1.952	70
30	4,100	30,00	0,310	0,320	140	1.640	2.108	70
31	4,100	30,00	0,310	0,320	140	1.640	2.264	70
32	4,100	30,00	0,310	0,320	140	1.640	2.264	70
33	4,100	30,00	0,310	0,320	140	1.640	2.108	70
34	4,100	30,00	0,310	0,320	140	1.640	1.952	70
35	4,100	30,00	0,310	0,320	140	1.640	1.796	70
36	4,100	30,00	0,310	0,320	140	1.640	1.640	70

Rebar	$sp3$ [-]	c_{max} [mm]	$\frac{c_{max}}{c_d}$ [-]	$sp4$ [-]	$lb1$ [-]	$\tau_{Rk,sp}$ [N/mm²]
13	0,670	-	1,000	0,250	0,450	7,25
14	0,670	-	1,000	0,250	0,450	7,25
15	0,670	-	1,000	0,250	0,450	7,25
16	0,670	-	1,000	0,250	0,450	7,25
17	0,670	-	1,000	0,250	0,450	7,25
18	0,670	-	1,000	0,250	0,450	7,25
19	0,670	-	1,000	0,250	0,450	7,25
20	0,670	-	1,000	0,250	0,450	7,25
21	0,670	-	1,000	0,250	0,450	7,25
22	0,670	-	1,000	0,250	0,450	7,25
23	0,670	-	1,000	0,250	0,450	7,25
24	0,670	-	1,000	0,250	0,450	7,25
25	0,670	-	1,000	0,250	0,450	7,25
26	0,670	-	1,000	0,250	0,450	7,25
27	0,670	-	1,000	0,250	0,450	7,25
28	0,670	-	1,000	0,250	0,450	7,25
29	0,670	-	1,000	0,250	0,450	7,25
30	0,670	-	1,000	0,250	0,450	7,25
31	0,670	-	1,000	0,250	0,450	7,25
32	0,670	-	1,000	0,250	0,450	7,25
33	0,670	-	1,000	0,250	0,450	7,25
34	0,670	-	1,000	0,250	0,450	7,25
35	0,670	-	1,000	0,250	0,450	7,25
36	0,670	-	1,000	0,250	0,450	7,25

Rebar	l_b [mm]	ϕ [mm]	$N_{Rk,sp}$ [kN]	γ_{Mc} [-]	$N_{Rd,sp}$ [kN]	N_{Ed} [kN]
13	172	16	62,664	1,500	41,776	1,145
14	172	16	62,664	1,500	41,776	1,145
15	172	16	62,664	1,500	41,776	2,779
16	172	16	62,664	1,500	41,776	2,779
17	172	16	62,664	1,500	41,776	4,412
18	172	16	62,664	1,500	41,776	4,412
19	172	16	62,664	1,500	41,776	6,045
20	172	16	62,664	1,500	41,776	6,045
21	172	16	62,664	1,500	41,776	7,679
22	172	16	62,664	1,500	41,776	7,679
23	172	16	62,664	1,500	41,776	9,312
24	172	16	62,664	1,500	41,776	9,312
25	172	16	62,664	1,500	41,776	10,946
26	172	16	62,664	1,500	41,776	10,946
27	172	16	62,664	1,500	41,776	12,579
28	172	16	62,664	1,500	41,776	12,579
29	172	16	62,664	1,500	41,776	12,579
30	172	16	62,664	1,500	41,776	12,579
31	172	16	62,664	1,500	41,776	12,579
32	172	16	62,664	1,500	41,776	12,579
33	172	16	62,664	1,500	41,776	12,579
34	172	16	62,664	1,500	41,776	12,579
35	172	16	62,664	1,500	41,776	12,579
36	172	16	62,664	1,500	41,776	12,579

Minimum anchorage length acc. to [1]

$l_{b,min}$	$= \alpha_{lb} \cdot \max\left(0.3 \cdot \alpha_1 \cdot \alpha_4 \cdot l_{b,rqd}; 10 \cdot \phi; 100mm\right)$	[1] Eq. (8.6), [4] NCI to section 8.4.4 (1)
σ_{sd}	$= \frac{F_{Ed}}{A_s}$	
for the evaluation of $l_{b,min}$		
σ_{sd}	$= f_{yd} = \frac{f_{yk}}{\gamma_s}$	
$\eta_1 = 1.0$	for good bond conditions	[1] Section 8.4.2 (2), [4] NCI to section 8.4.2
f_{ctd}	$= \frac{\alpha_{ct} \cdot f_{ctk;0.05}}{\gamma_c}$	[1] Eq. (3.16)
$f_{ctk;0.05}$	$= 0.7 \cdot f_{ctm} = 0.7 \cdot 0.3 \cdot f_{ck}^{\left(\frac{2}{3}\right)}$	[1] Table 3.1

Rebar	F_{Ed} [kN]	ϕ [mm]	A_s [mm²]	σ_{sd} [N/mm²]	η_1 [-]	η_2 [-]	f_{ck} [N/mm²]	f_{ctd} [N/mm²]
13	1,145	16	201	5,70	1,000	1,000	37,00	1,35
14	1,145	16	201	5,70	1,000	1,000	37,00	1,35
15	2,779	16	201	13,82	1,000	1,000	37,00	1,35
16	2,779	16	201	13,82	1,000	1,000	37,00	1,35
17	4,412	16	201	21,94	1,000	1,000	37,00	1,35
18	4,412	16	201	21,94	1,000	1,000	37,00	1,35
19	6,045	16	201	30,07	1,000	1,000	37,00	1,35
20	6,045	16	201	30,07	1,000	1,000	37,00	1,35

21	7,679	16	201	38,19	1,000	1,000	37,00	1,35
22	7,679	16	201	38,19	1,000	1,000	37,00	1,35
23	9,312	16	201	46,31	1,000	1,000	37,00	1,35
24	9,312	16	201	46,31	1,000	1,000	37,00	1,35
25	10,946	16	201	54,44	1,000	1,000	37,00	1,35
26	10,946	16	201	54,44	1,000	1,000	37,00	1,35
27	12,579	16	201	62,56	1,000	1,000	37,00	1,35
28	12,579	16	201	62,56	1,000	1,000	37,00	1,35
29	12,579	16	201	62,56	1,000	1,000	37,00	1,35
30	12,579	16	201	62,56	1,000	1,000	37,00	1,35
31	12,579	16	201	62,56	1,000	1,000	37,00	1,35
32	12,579	16	201	62,56	1,000	1,000	37,00	1,35
33	12,579	16	201	62,56	1,000	1,000	37,00	1,35
34	12,579	16	201	62,56	1,000	1,000	37,00	1,35
35	12,579	16	201	62,56	1,000	1,000	37,00	1,35
36	12,579	16	201	62,56	1,000	1,000	37,00	1,35

Rebar	k_b [-]	f_{bd} [N/mm²]	α_{lb} [-]	α_1 [-]	α_4 [-]	$l_{b,rqd}$ [mm]	$l_{b,min}$ [mm]
13	1,000	3,04	1,000	1,000	1,000	572	172
14	1,000	3,04	1,000	1,000	1,000	572	172
15	1,000	3,04	1,000	1,000	1,000	572	172
16	1,000	3,04	1,000	1,000	1,000	572	172
17	1,000	3,04	1,000	1,000	1,000	572	172
18	1,000	3,04	1,000	1,000	1,000	572	172
19	1,000	3,04	1,000	1,000	1,000	572	172
20	1,000	3,04	1,000	1,000	1,000	572	172
21	1,000	3,04	1,000	1,000	1,000	572	172
22	1,000	3,04	1,000	1,000	1,000	572	172
23	1,000	3,04	1,000	1,000	1,000	572	172
24	1,000	3,04	1,000	1,000	1,000	572	172
25	1,000	3,04	1,000	1,000	1,000	572	172
26	1,000	3,04	1,000	1,000	1,000	572	172
27	1,000	3,04	1,000	1,000	1,000	572	172
28	1,000	3,04	1,000	1,000	1,000	572	172
29	1,000	3,04	1,000	1,000	1,000	572	172
30	1,000	3,04	1,000	1,000	1,000	572	172
31	1,000	3,04	1,000	1,000	1,000	572	172
32	1,000	3,04	1,000	1,000	1,000	572	172
33	1,000	3,04	1,000	1,000	1,000	572	172
34	1,000	3,04	1,000	1,000	1,000	572	172
35	1,000	3,04	1,000	1,000	1,000	572	172
36	1,000	3,04	1,000	1,000	1,000	572	172

5. Rebar design in compression ([1] Section 8.4, 8.7, [4] NCI to section 8.4, 8.7)

5.1. Steel verification and anchorage length determination

Input

Description	Variable	Value
Characteristic concrete compressive strength, existing	f_{ck}	30,00 N/mm²
Characteristic concrete tensile strength (5%-fractile), existing	$f_{ctk;0.05}$	2,03 N/mm²
Partial material safety factor	γ_c	1,500
Coefficient for long-term effects on the tensile strength	α_{ct}	1,000
Design concrete tensile strength, existing	f_{ctd}	1,35 N/mm²
Rebar diameter, Post-installed	ϕ	16,000 mm
Reinforcement yield strength	f_{yk}	500,000 N/mm²
Partial material safety factor	γ_s	1,150
Shape of rebar influence ([1] Table 8.2)	α_1	1,000
Concrete cover influence ([1] Table 8.2, [4] NCI to section 8.4.4 (2))	α_2	1,000

Governing loading situation

The results presented in the following are valid for the governing loading situation:

The design is performed based on the results of the cross-section analysis (incl. additional tension forces due to shear loads)

Installation/Drill length results

$$l_v \geq l_{bd}$$

Rebar	ϕ [mm]	l_{bd} [mm]	l_v [mm]
1	16	343	343
2	16	343	343
3	16	343	343
4	16	343	343
5	16	343	343
6	16	343	343
7	16	343	343
8	16	343	343
9	16	343	343
10	16	343	343
11	16	343	343
12	16	343	343

Steel verification

$$F_{Ed} \leq F_{yd} = \frac{A_s \cdot f_{yk}}{\gamma_s}$$

Rebar	F_{Ed} [kN]	ϕ [mm]	γ_s [-]	A_s [mm²]	F_{yd} [kN]	Utilization [%]	Status
Post-Installed 1	-2,121	16	1,150	201	87,418	3	Ok
Post-Installed 2	-2,121	16	1,150	201	87,418	3	Ok
Post-Installed 3	-2,121	16	1,150	201	87,418	3	Ok
Post-Installed 4	-2,121	16	1,150	201	87,418	3	Ok
Post-Installed 5	-2,121	16	1,150	201	87,418	3	Ok
Post-Installed 6	-2,121	16	1,150	201	87,418	3	Ok
Post-Installed 7	-2,121	16	1,150	201	87,418	3	Ok
Post-Installed 8	-2,121	16	1,150	201	87,418	3	Ok
Post-Installed 9	-2,121	16	1,150	201	87,418	3	Ok
Post-Installed 10	-2,121	16	1,150	201	87,418	3	Ok
Post-Installed 11	-0,488	16	1,150	201	87,418	1	Ok
Post-Installed 12	-0,488	16	1,150	201	87,418	1	Ok

Anchorage length

l_b	$= \alpha_1 \cdot \alpha_2 \cdot \alpha_3 \cdot \alpha_4 \cdot \alpha_5 \cdot l_{b,rqd} \geq l_{b,min}$	[1] Eq. (8.4)
$l_{b,rqd}$	$= \frac{\phi}{4} \cdot \frac{\sigma_{sd}}{f_{bd}}$	[1] Eq. (8.3)
σ_{sd}	$= \frac{F_{Ed}}{A_s}$	
for the evaluation of $l_{b,min}$		
σ_{sd}	$= f_{yd} = \frac{f_{yk}}{\gamma_s}$	
f_{bd}	$= 2.25 \cdot \eta_1 \cdot \eta_2 \cdot f_{ctd}$	[1] Eq. (8.2)
η_1	$= 1.0$ for good bond conditions	[1] Section 8.4.2 (2), [4] NCI to section 8.4.2
η_1	$= 0.7$ for all other cases	
η_2	$= 1.0$ for rebars with $\phi \leq 32mm$	[1] Section 8.4.2 (2)
η_2	$= \frac{(132-\phi)}{100}$ for rebars with $\phi > 32mm$	
f_{ctd}	$= \frac{\alpha_{ct} \cdot f_{ctk;0.05}}{\gamma_c}$	[1] Eq. (3.16)
$f_{ctk;0.05}$	$= 0.7 \cdot f_{ctm} = 0.7 \cdot 0.3 \cdot f_{ck}^{\frac{2}{3}}$	[1] Table (3.1)
$l_{b,min}$	$= max\left(0.6 \cdot l_{b,rqd}, 10 \cdot \phi, 100mm\right)$	[1] Eq. (8.7), [4] NCI to section 8.4.4 (1)

Post-installed rebars

In case of post-installed rebars, use $f_{bd,PIR}$ in [1] Eq. (8.3)

$f_{bd,PIR}$	$= k_b \cdot f_{bd}$
k_b	bond efficiency factor from ETA-19/0600
$l_{0,min}$	$= \alpha_{lb} \cdot l_{0,min}$
α_{lb}	amplification factor from ETA-19/0600

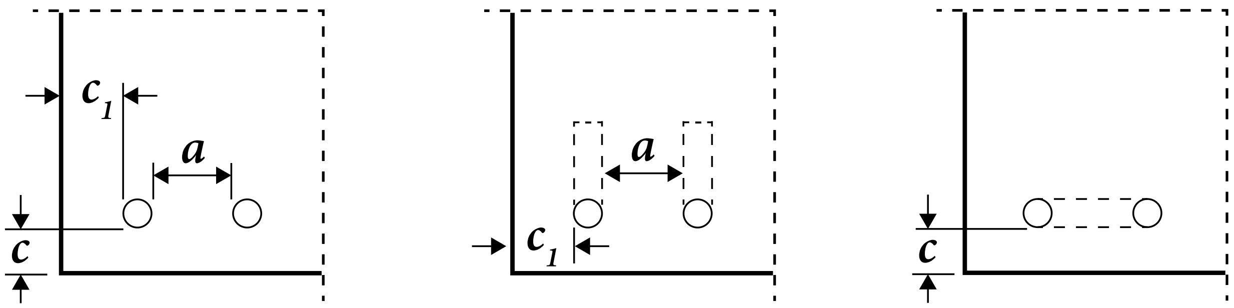
Company:		Page:	19
Address:		Specifier:	
Phone | Fax:	|	E-Mail:	
Design:	Rebar - Jul 9, 2024	Date:	10.07.2024
Rebar aplikacija:			

Influencing factor (α_i) equations

Concrete cover

$\alpha_2 = 1.00$ — [4] NCI to section 8.4.4 (2)

$0.70 \leq \alpha_2 = 1 - 0.15 \cdot \frac{(c_d - \phi)}{\phi} \leq 1.00$ — [1] Table 8.2



Straight bars
$c_d = min\left(\frac{a}{2}, c_1, c\right)$

Bent or hooked bars
$c_d = min\,(c_1, c)$

Looped bars
$c_d = c$

Rebar	F_{Ed} [kN]	ϕ [mm]	A_s [mm²]	σ_{sd} [N/mm²]	η_1 [-]	η_2 [-]	f_{ctd} [N/mm²]
Post-Installed 1	-2,121	16	201	-10,55	1,000	1,000	1,35
Post-Installed 2	-2,121	16	201	-10,55	1,000	1,000	1,35
Post-Installed 3	-2,121	16	201	-10,55	1,000	1,000	1,35
Post-Installed 4	-2,121	16	201	-10,55	1,000	1,000	1,35
Post-Installed 5	-2,121	16	201	-10,55	1,000	1,000	1,35
Post-Installed 6	-2,121	16	201	-10,55	1,000	1,000	1,35
Post-Installed 7	-2,121	16	201	-10,55	1,000	1,000	1,35
Post-Installed 8	-2,121	16	201	-10,55	1,000	1,000	1,35
Post-Installed 9	-2,121	16	201	-10,55	1,000	1,000	1,35
Post-Installed 10	-2,121	16	201	-10,55	1,000	1,000	1,35
Post-Installed 11	-0,488	16	201	-2,43	1,000	1,000	1,35
Post-Installed 12	-0,488	16	201	-2,43	1,000	1,000	1,35

Rebar	k_b [-]	f_{bd} [N/mm²]	$f_{bd,PIR}$ [N/mm²]	α_{lb} [-]	$l_{b,rqd}$ [mm]	$l_{b,min}$ [mm]	α_1 [-]	c_d [mm]
Post-Installed 1	1,000	3,04	3,04	1,000	14	343	1,000	70
Post-Installed 2	1,000	3,04	3,04	1,000	14	343	1,000	70
Post-Installed 3	1,000	3,04	3,04	1,000	14	343	1,000	70
Post-Installed 4	1,000	3,04	3,04	1,000	14	343	1,000	70
Post-Installed 5	1,000	3,04	3,04	1,000	14	343	1,000	70
Post-Installed 6	1,000	3,04	3,04	1,000	14	343	1,000	70
Post-Installed 7	1,000	3,04	3,04	1,000	14	343	1,000	70
Post-Installed 8	1,000	3,04	3,04	1,000	14	343	1,000	70
Post-Installed 9	1,000	3,04	3,04	1,000	14	343	1,000	70

Post-Installed 10	1,000	3,04	3,04	1,000	14	343	1,000	70
Post-Installed 11	1,000	3,04	3,04	1,000	3	343	1,000	70
Post-Installed 12	1,000	3,04	3,04	1,000	3	343	1,000	70

Rebar	α_2 [-]	$\sum A_{st}$ [mm²]	$\sum A_{st,min}$ [mm²]	A_s [mm²]	λ [-]	K [-]	α_3 [-]
Post-Installed 1	1,000	0	0	201	0,000	0,000	1,000
Post-Installed 2	1,000	0	0	201	0,000	0,000	1,000
Post-Installed 3	1,000	0	0	201	0,000	0,000	1,000
Post-Installed 4	1,000	0	0	201	0,000	0,000	1,000
Post-Installed 5	1,000	0	0	201	0,000	0,000	1,000
Post-Installed 6	1,000	0	0	201	0,000	0,000	1,000
Post-Installed 7	1,000	0	0	201	0,000	0,000	1,000
Post-Installed 8	1,000	0	0	201	0,000	0,000	1,000
Post-Installed 9	1,000	0	0	201	0,000	0,000	1,000
Post-Installed 10	1,000	0	0	201	0,000	0,000	1,000
Post-Installed 11	1,000	0	0	201	0,000	0,000	1,000
Post-Installed 12	1,000	0	0	201	0,000	0,000	1,000

Rebar	α_4 [-]	p [N/mm²]	α_5 [-]	$\alpha_{2,3,5}$ [-]	l_{bd} [mm]
Post-Installed 1	1,000	0,00	1,000	1,000	343
Post-Installed 2	1,000	0,00	1,000	1,000	343
Post-Installed 3	1,000	0,00	1,000	1,000	343
Post-Installed 4	1,000	0,00	1,000	1,000	343
Post-Installed 5	1,000	0,00	1,000	1,000	343
Post-Installed 6	1,000	0,00	1,000	1,000	343
Post-Installed 7	1,000	0,00	1,000	1,000	343
Post-Installed 8	1,000	0,00	1,000	1,000	343
Post-Installed 9	1,000	0,00	1,000	1,000	343
Post-Installed 10	1,000	0,00	1,000	1,000	343
Post-Installed 11	1,000	0,00	1,000	1,000	343
Post-Installed 12	1,000	0,00	1,000	1,000	343

6. Sustainability

6.1. CO_2 emissions of Hilti products

Input

Description	Variable	Value
Adhesive CO_2 emissions per mm^3	$e_{adh,A1-A3}$	0,000003638 kg/mm^3 CO_2
Adhesive CO_2 emissions per mm^3	$e_{adh,total}$	0,000005644 kg/mm^3 CO_2
Rebar diameter	ϕ_r	(see Table below)
Drill diameter	$d_{0,r}$	(see Table below)
Drill length	$l_{v,r}$	(see Table below)

Installation/Drill results

Rebar r	ϕ_r [mm]	$d_{0,r}$ [mm]	$l_{v,r}$ [mm]
1	16	20	343
10	16	20	343
11	16	20	343
12	16	20	343
13	16	20	172
14	16	20	172
15	16	20	172
16	16	20	172
17	16	20	172
18	16	20	172
19	16	20	172
2	16	20	343
20	16	20	172
21	16	20	172
22	16	20	172
23	16	20	172
24	16	20	172
25	16	20	172
26	16	20	172
27	16	20	172
28	16	20	172
29	16	20	172
3	16	20	343
30	16	20	172
31	16	20	172
32	16	20	172
33	16	20	172
34	16	20	172
35	16	20	172
36	16	20	172
4	16	20	343
5	16	20	343
6	16	20	343
7	16	20	343

8	16	20	343
9	16	20	343

CO_2 emissions breakdown

Description	Stage	e_{adh} [kg/mm³ CO_2]
Raw material	A1	0,000002614
Transportation to production	A2	0,000000696
Production	A3	0,000000328
Transportation to customer *	A4	0,000000392
Use	B1	0,000000000
End-of-life **	C3 + C4 + D	0,000001614
A1 - A3	A1 + A2 + A3	0,000003638
Total	all	0,000005644

* The value may be different based on the location of consumer and way of transportation.

** This stage includes recycling and reuse of the product at the end-of-life.

Adhesive CO_2 emissions ($E_{adh,A1-A3}$) calculations based on A1 - A3

$$E_{adh,A1-A3} = e_{adh,A1-A3} \cdot V_{adh}$$

Volume of adhesive (V_{adh}) for n rebars:

$$V_{adh} = \sum_{r=1}^{n} l_{v,r} \cdot \left(\left(\frac{\pi \cdot d_{0,r}^2}{4} \right) - \left(\frac{\pi \cdot \phi_r^2}{4} \right) \right)$$

$e_{adh,A1-A3}$ [kg/mm³ CO_2]	V_{adh} [mm³]	$E_{adh,A1-A3}$ [kg CO_2]
0,000003638	932.515,1	3,39

Total Adhesive CO_2 emissions ($E_{adh,total}$) calculations

$$E_{adh,total} = e_{adh,total} \cdot V_{adh}$$

Volume of adhesive (V_{adh}) for n rebars:

$$V_{adh} = \sum_{r=1}^{n} l_{v,r} \cdot \left(\left(\frac{\pi \cdot d_{0,r}^2}{4} \right) - \left(\frac{\pi \cdot \phi_r^2}{4} \right) \right)$$

$e_{adh,total}$ [kg/mm³ CO_2]	V_{adh} [mm³]	$E_{adh,total}$ [kg CO_2]
0,000005644	932.515,1	5,26

7. Warnings

This design exclusively considers the load transfer with post-installed rebars at the interface between new and existing concrete.

Load distribution to the rebars is done assuming that cross sections remain plane after bending.

The joint surfaces for concreting must be roughened at least to such an extent that aggregates protrude.

The accessory list in this report is for the information of the user only. All the relevant installation conditions (drilling, cleaning, setting) must be done in accordance with the relevant ETA and product IFUs.

The increase of bond-splitting resistance due to the possible presence of transverse reinforcement is not taken into account.

If the new structural element is connected to the tension zone of an existing flexural element, and in cases of anchorages shorter than 80% of the thickness of the existing element, the local load transmission to the supports shall be treated carefully. Guidance is provided by EN 1992-4, Annex A.

EOTA TR069 is valid only in joints which are continuous (no L shape joints allowed).

No shear check verification was selected by the user, the verification was not performed in PROFIS Engineering.

Assessment of CO2 emissions associated to Hilti products is based on the three key stages: A1, A2, and A3. A1 corresponds to the CO2 emissions arising from raw material production, while A2 accounts for the CO2 emissions associated with the transportation of raw materials to production site. A3 represents the CO2 emissions generated during the actual production of Hilti products. Total CO2 emissions, including stage A4 (CO2 emissions related to the transportation of products to customers) and EOL stage (CO2 emissions during end-of-life phase of the product, encompassing recycling and reuse), are additionally presented in the Sustainability section of the report.

Life Cycle Assessment (LCA) calculation data is provided to Hilti by FIT Umwelttechnik, a third-party consultant:

- According to ISO 14044 (version current at the time of calculation)
- Calculated with Sphera® LCA for Experts modelling software (version current at the time of calculation)

In the event that no LCA is available, estimates may be provided. Although every effort is made to precisely approximate LCA results, this data is supplied for informational purposes only, without warranty, and may not comply with ISO 14044.

Secondary average data of production processes, raw material emissions etc. was used to calculate the LCA. This data is derived from Sphera® and Ecoinvent® external lifecycle inventory databases (version current at the time of calculation).

Hilti LCA records undergo continuous expansion, renewal and improvement. All data is subject to change without notice.

Interface meets the design criteria!

8. Installation data

Mortar: HIT-HY 200-R V3 + Rebar

Item number: 2262133 HIT-HY 200-R V3 (adhesive)

Reinforcement yield strength f_{yk}: 500,00 N/mm^2

Drilling method: Hammer drilling (HD) (Drilling aid is used)

Hole type: Dry Concrete

Installation temperature: from 5°C to 20°C

Roughness: Rough

Arrangements

Rebar diameter: 16mm

Number of bars: 36

Concrete cover: 40 mm

Drill length, l_v: 343 mm

Drill diameter, d_0: 20 mm

Hole cleaning: Cleaning with the air nozzle

8.1. Maximum working time and minimum curing time [1)]

Temperature in the base material T	Maximum working time t_{work}	Minimum curing time t_{cure}
-10 °C to -5 °C	3 hours	20 hours
-4 °C to 0 °C	1.5 hours	8 hours
1 °C to 5 °C	45 min	4 hours
6 °C to 10 °C	30 min	2.5 hours
11 °C to 20 °C	15 min	1.5 hours
21 °C to 30 °C	9 min	1 hours
31 °C to 40 °C	6 min	1 hours

1) The minimum temperature of the foil pack is +5°C.

9. Remarks; Your cooperation duties

Any and all information and data contained in the Software concern solely the use of Hilti products and are based on the principles, formulas and security regulations in accordance with Hilti's technical directions and operating, mounting and assembly instructions, etc., that must be strictly complied with by the user. All figures contained therein are average figures, and therefore use-specific tests are to be conducted prior to using the relevant Hilti product. The results of the calculations carried out by means of the Software are based essentially on the data you put in. Therefore, you bear the sole responsibility for the absence of errors, the completeness and the relevance of the data to be put in by you. Moreover, you bear sole responsibility for having the results of the calculation checked and cleared by an expert, particularly with regard to compliance with applicable norms and permits, prior to using them for your specific facility. The Software serves only as an aid to interpret norms and permits without any guarantee as to the absence of errors, the correctness and the relevance of the results or suitability for a specific application.

You must take all necessary and reasonable steps to prevent or limit damage caused by the Software. In particular, you must arrange for the regular backup of programs and data and, if applicable, carry out the updates of the Software offered by Hilti on a regular basis. If you do not use the AutoUpdate function of the Software, you must ensure that you are using the current and thus up-to-date version of the Software in each case by carrying out manual updates via the Hilti Website. Hilti will not be liable for consequences, such as the recovery of lost or damaged data or programs, arising from a culpable breach of duty by you.

(temelj je dimenzioniran na nosilnost stebra Mu=897kNm, delovanje obtežbe 45°)

NOSILNOST TEMELJNIH TAL

Vhodni podatki

Materialne karakteristike

IG 2b

c' =	0	kPa
φ' =	33	°
γ' =	19	kN/m^3

Dimenzije temelja

D =	2,60	m pod koto izkopa
B =	4,70	m - v smeri x
L =	4,70	m - v smeri y
T=	0,75	m

Tampon pod temeljem (v m)

d_t =	0,00	m

Obremenitev

P_{Ed} =	833,0	kN, kN/m
$H_{x,Ed}$ =	28,8	kN, kN/m
$H_{y,Ed}$ =	28,8	kN, kN/m
$M_{yy,Ed}$ =	709,0	kNm, kNm/m
$M_{xx,Ed}$ =	709,0	kNm, kNm/m
Q_k =		kN, kN/m

dopustna napetost pod temeljem

q_{dop} =	1.728,4	kPa
(q_{dop} =	703,2	kPa)

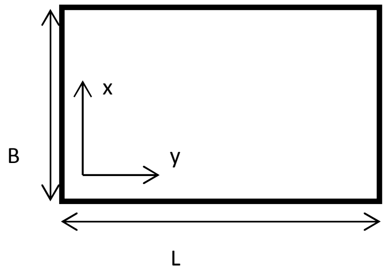
računska napetost pod temeljem

q_d =	92,69	kPa

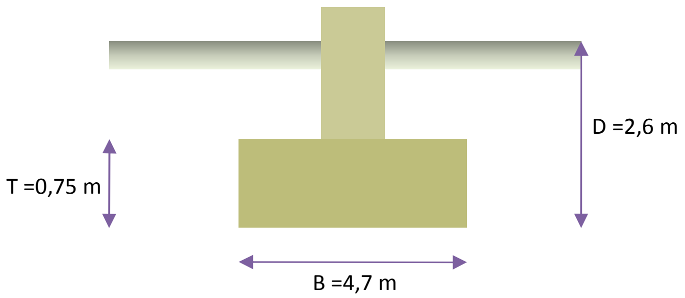
temelj	*414,1875*	m^3
zemljina	*776,4635*	m^3

Izračun (EC7)

q' =	49,40	kPa
N_q =	26,09	
N_c =	38,64	
$N_γ$ =	32,59	
e_x =	0,85	m
e_y =	0,85	m
B' =	3,00	m
L' =	3,00	m
s_q =	1,545	
s_c =	1,566	
$s_γ$ =	0,700	
i_q =	0,928	
i_c =	0,931	
$i_γ$ =	0,882	



računska odpornost temelja:		računska obremenitev temelja:
R_d = 15.533,3 kN	>	V_d = 833,0 kN



moment odpora točka A (EQU)		moment prevrnitve točka A
M_{odpor} = 2.041,7 kN	>	M_{prev} = 897,0 kN

NOSILNOST TEMELJNIH TAL

Vhodni podatki

Materialne karakteristike

IG 2b

c' =	0	kPa
φ' =	33	°
γ' =	19	kN/m^3

Dimenzije temelja

D =	2,20	m pod koto izkopa
B =	4,50	m - v smeri x
L =	4,50	m - v smeri y
T=	0,80	m

Tampon pod temeljem (v m)

d_t =	0,00	m

Obremenitev

P_{Ed} =	586,8	kN, kN/m
$H_{x,Ed}$ =	0,0	kN, kN/m
$H_{y,Ed}$ =	40,8	kN, kN/m
$M_{yy,Ed}$ =	0,0	kNm, kNm/m
$M_{xx,Ed}$ =	986,7	kNm, kNm/m
Q_k =		kN, kN/m

dopustna napetost pod temeljem

q_{dop} =	2.007,4	kPa
(q_{dop} =	507,1	kPa)

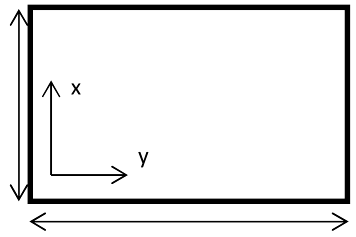
računska napetost pod temeljem

q_d =	114,71	kPa

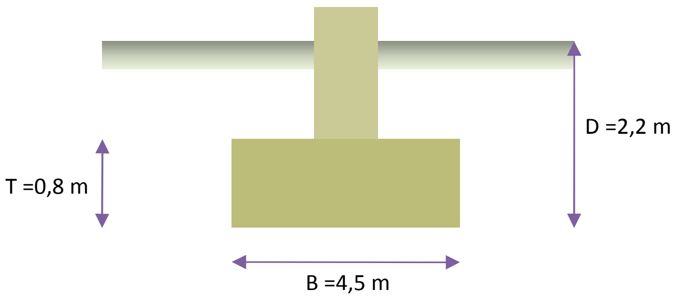
temelj	*405*	m^3
zemljina	*538,65*	m^3

Izračun (EC7)

q' =	41,80	kPa
N_q =	26,09	
N_c =	38,64	
N_γ =	32,59	
e_x =	0,00	m
e_y =	1,68	m
B' =	4,50	m
L' =	1,14	m
s_q =	3,156	
s_c =	3,242	
s_γ =	-0,188	
i_q =	0,879	
i_c =	0,885	
i_γ =	0,817	



računska odpornost temelja:		računska obremenitev temelja:
R_d = 10.268,3 kN	>	V_d = 586,8 kN



moment odpora točka A (EQU)		moment prevrnitve točka A
M_{odpor} = 1.188,2 kN	>	M_{prev} = 986,7 kN

G RISBE

OZNAKA	VSEBINA RISBE	MERILO
G1	prikaz pozicij temeljev	1: 500
G2	opažni načrt temeljev	1: 50,25
G3	Armaturni načrt temeljev	1: 50
	Izvleček armature	

Izvedba razsvetljave in vzdrževalnih del na nogometnem stadionu v Ajdovščini

NAČRT TEMELJEV DROGOV
PRIKAZ POZICIJ TEMELJEV

MATERIALI

	ELEMENT	MATERIAL	ZAŠČITNA PLAST
BETON	podložni beton	C 12/15 X0	/
	temelji	C 30/37, XC4 XD3 XF3, PV-II, Cl0,2 Dmax32	50 mm
ARMATURA	palice, mreže	B 500A	
SIDRA	navojne palice	vroče cinkane, kvaliteta 8.8	
KONSTRUKCIJSKO JEKLO	LED zaslon	S235J2 (cevi), S355J2 (profili)	
KOROZIJSKA ZAŠČITA	LED zaslon	SIST EN ISO 1461	min 55µm (povpr. 70µm)
IZVEDBENI RAZRED	LED zaslon	EXC 2	

naziv projekta: **Izvedba razsvetljave in vzdrževalnih del na nogometnem stadionu v Ajdovščini**

vsebina risbe: 01 PREGLEDNA SITUACIJA
prikaz pozicij temeljev

investitor: Občina Ajdovščina, Cesta 5. maja 6a, 5270 Ajdovščina

projektant: Arti inženiring d.o.o., Ul. Ivana Suliča 6a, 5292 Šempeter pri Gorici

izdelovalec načrta: corus inženirji

vodja projektiranja: ROBERT VRTOVEC, univ.dipl.inž.grad. G-2239 PI

pooblaščeni inženir: MATEJ KOSOVEL, univ.dipl.inž.grad. G-2341 PI

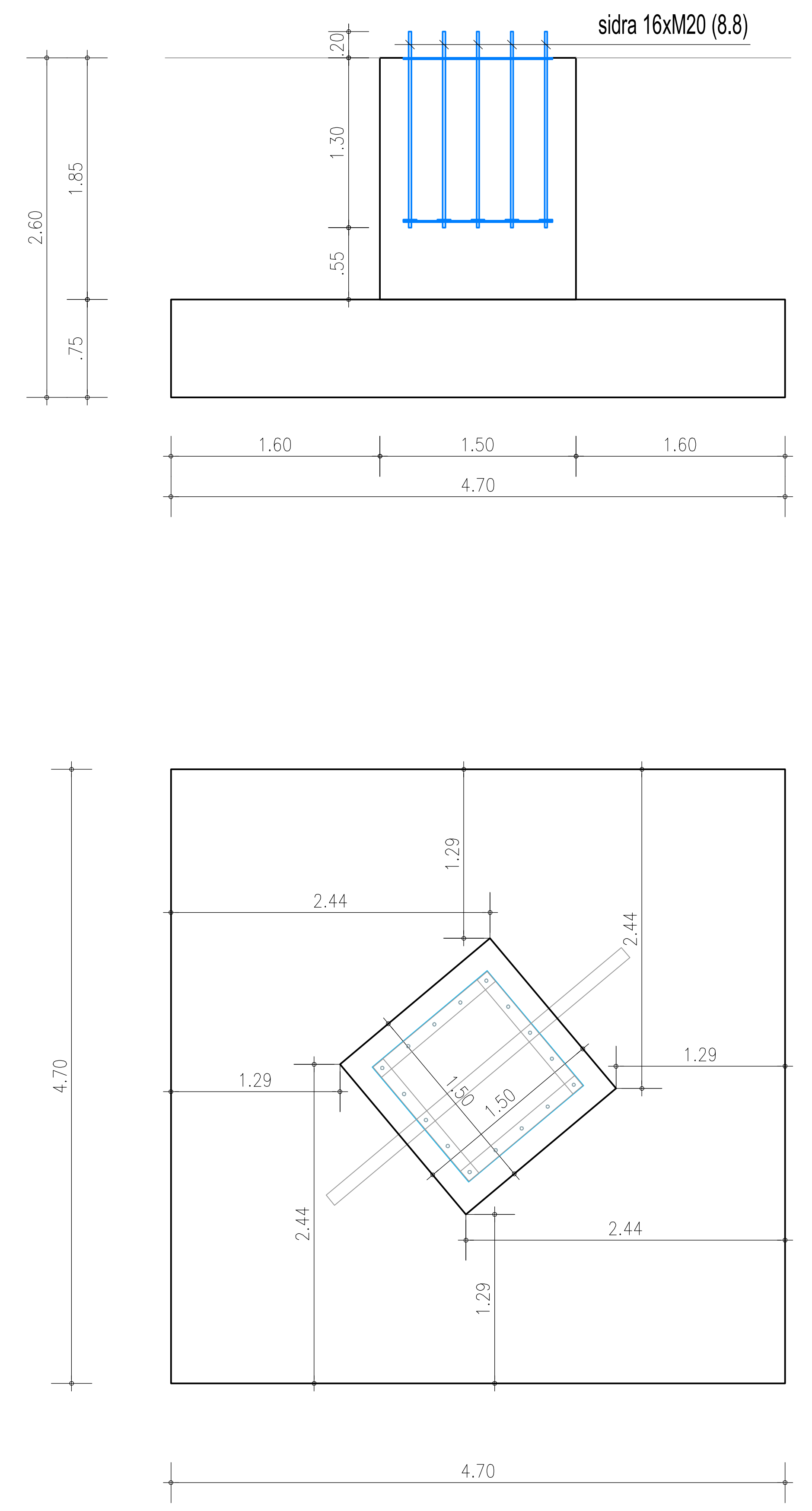
izdelal: MATEJ KOSOVEL, univ.dipl.inž.grad. G-2341 PI

namen dokumentacije: PZI

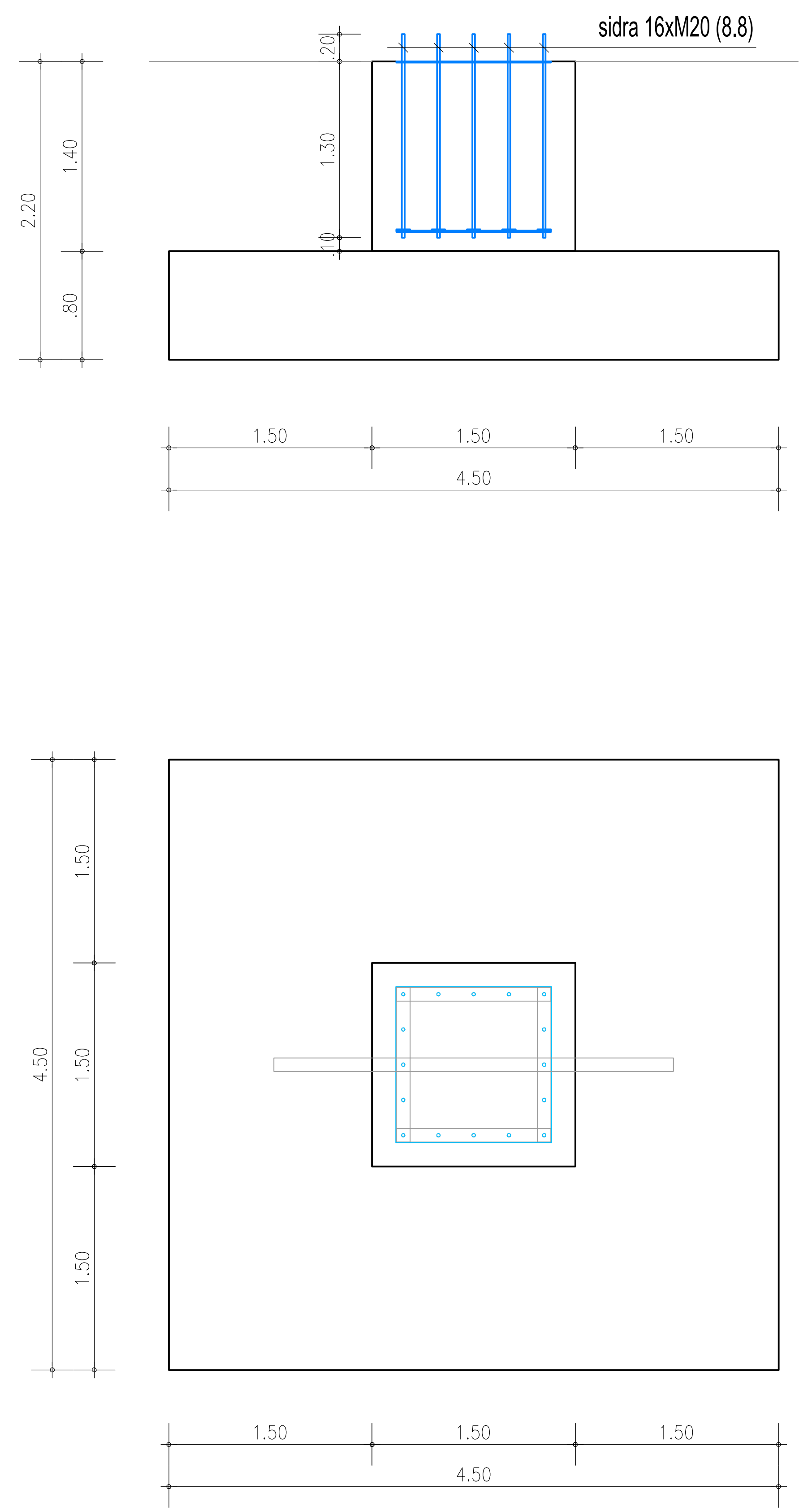
strokovno področje načrta: 2 Načrt gradbeništva
2/1 NAČRT TEMELJEV DROGOV

datum:	št. projekta:	št. načrta:	merilo:	št. risbe:
05.2024	2023-1/12	116/23	1 : 500	G1

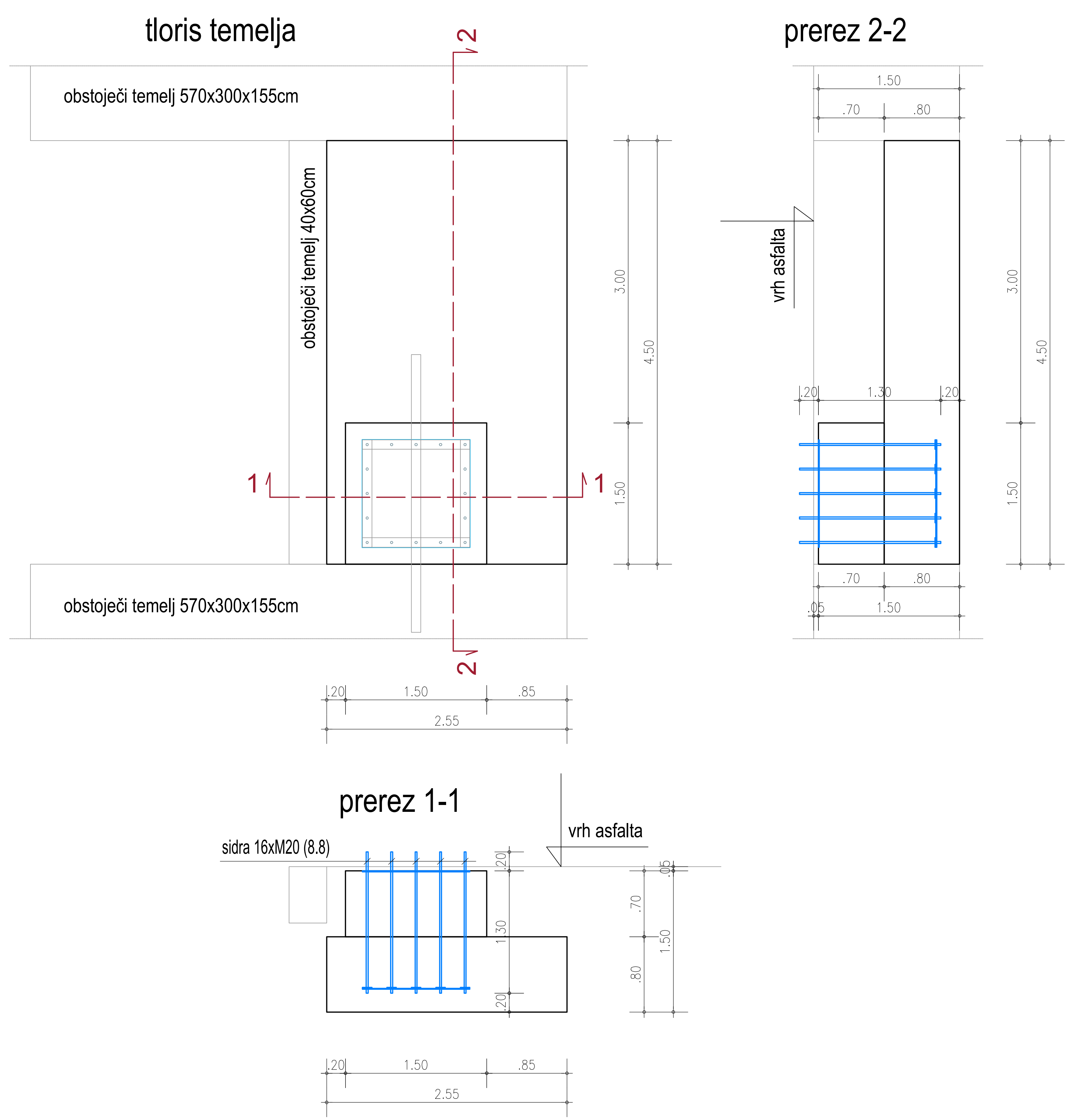
temelj TT1 - rekonstrukcija obstoječega temelja (kom 4)



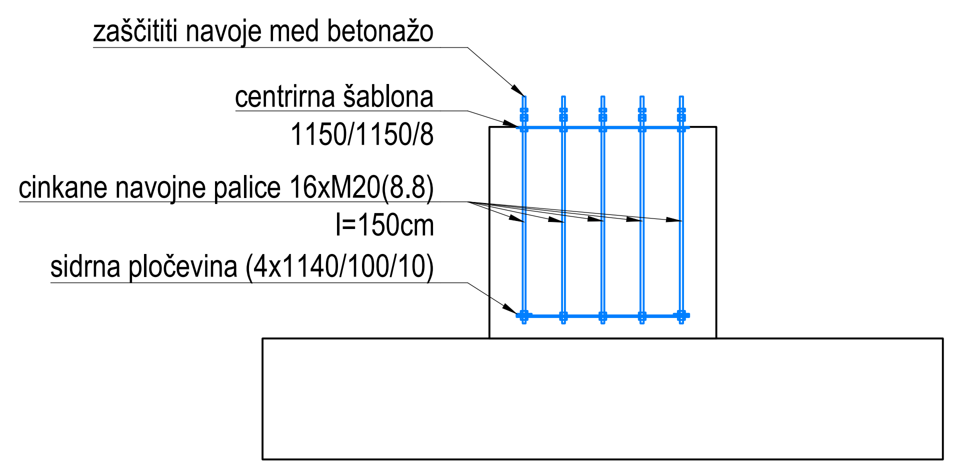
temelj TT2 - novi temelj ob glavni tribuni (kom 2)



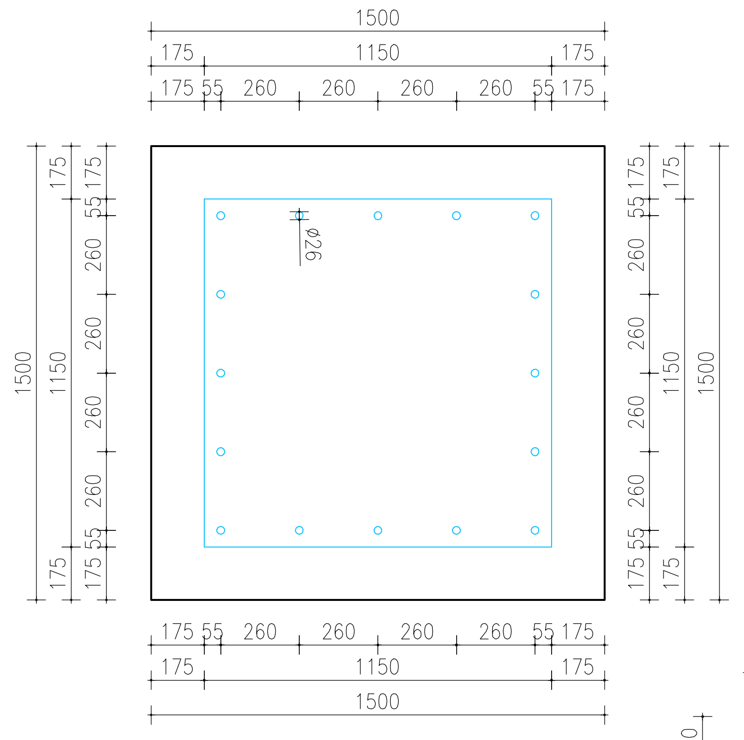
temelj TT3 - novi temelj ob pomožni tribuni (kom 2)



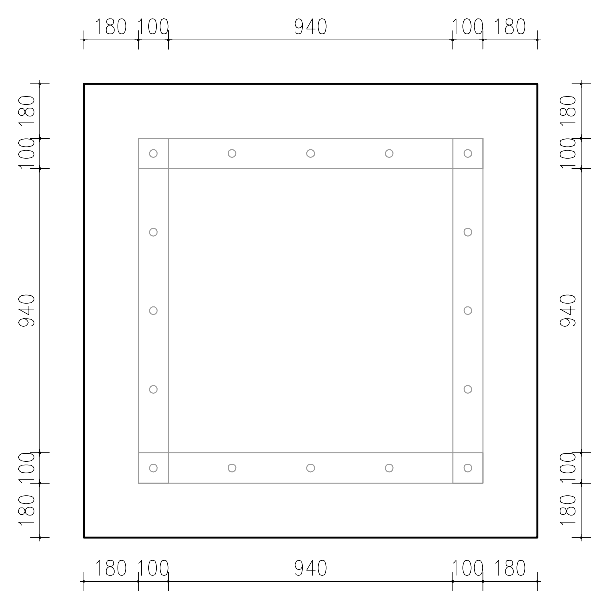
detajl sidranja stebra reflektorja



shema sidra
centrirna šablona, M 1:25



shema sidra
sidrna pločevina, M 1:25



OPOMBA

pred vgradnjo mora shemo sidranja potrditi proizvajalec drogov.

Izvedba razsvetljave in vzdrževalnih del na nogometnem stadionu v Ajdovščini

NAČRT TEMELJEV DROGOV

OPAŽNI NAČRT TEMELJEV

MATERIALI			
	ELEMENT	MATERIAL	ZAŠČITNA PLAST
BETON	podložni beton	C 12/15 X0	/
	temelji	C 30/37, XC4 XD3 XF3, PV-II, Cl0,2 Dmax32	50 mm
ARMATURA	palice, mreže	B 500A	
SIDRA	navojne palice	vroče cinkane, kvaliteta 8.8	
KONSTRUKCIJSKO JEKLO	LED zaslon	S235J2 (cevi), S355J2 (profili)	
KOROZIJSKA ZAŠČITA	LED zaslon	SIST EN ISO 1461	min 55µm (povpr. 70µm)
IZVEDBENI RAZRED	LED zaslon	EXC 2	

naziv projekta: Izvedba razsvetljave in vzdrževalnih del na nogometnem stadionu v Ajdovščini

vsebina risbe: 61 OPAŽNI NAČRT
opažni načrt temeljev

investitor: Občina Ajdovščina, Cesta 5. maja 6a, 5270 Ajdovščina

projektant: Arti inženiring d.o.o., Ul. Ivana Suliča 6a, 5292 Šempeter pri Gorici

izdelovalec načrta: corus inženirji

vodja projektiranja: ROBERT VRTOVEC, univ.dipl.inž.grad. G-2239 PI

pooblaščeni inženir: MATEJ KOSOVEL, univ.dipl.inž.grad. G-2341 PI

izdelal: MATEJ KOSOVEL, univ.dipl.inž.grad. G-2341 PI

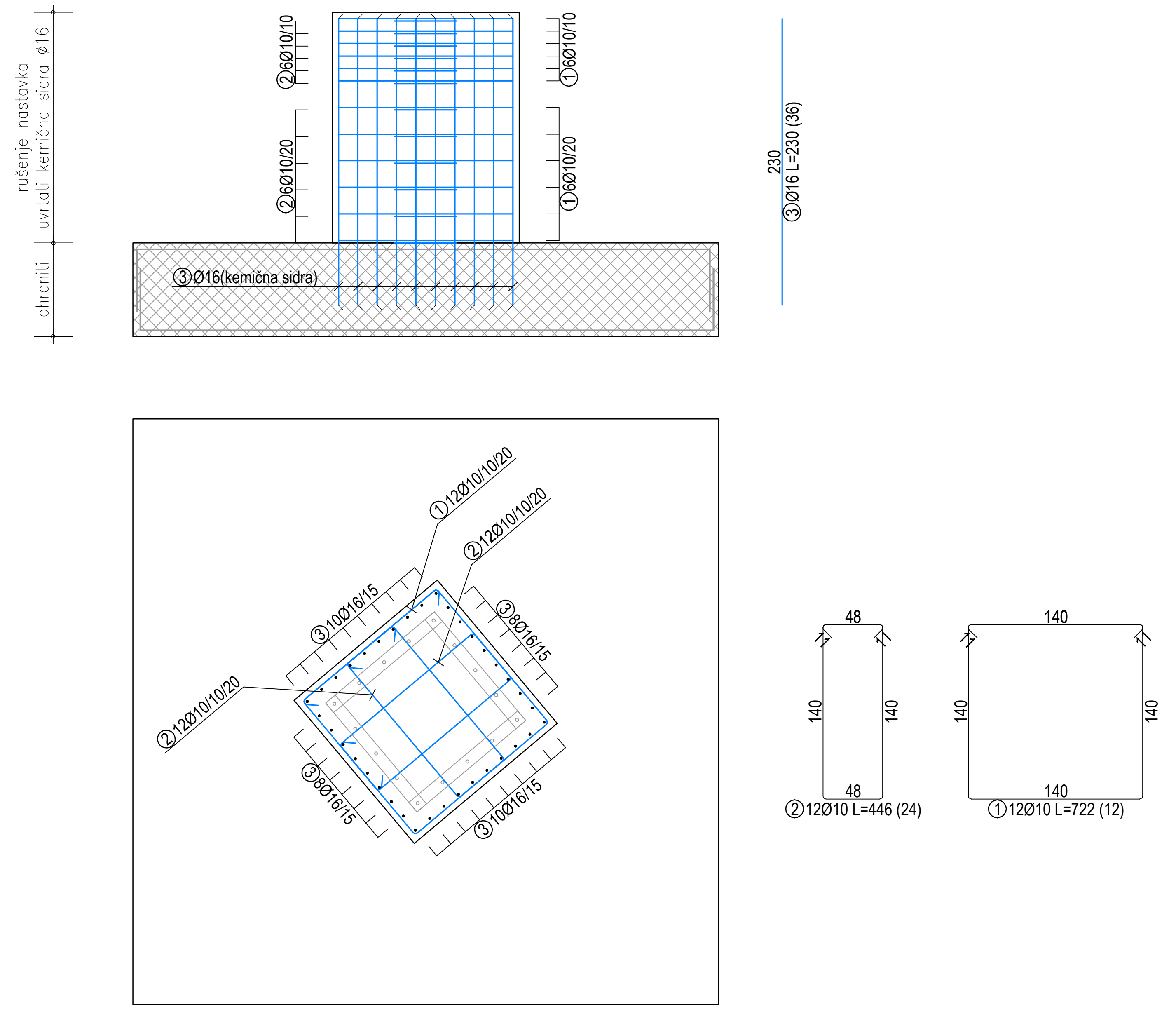
namen dokumentacije: PZI

strokovno področje načrta: 2 Načrt gradbeništva
2/1 NAČRT TEMELJEV DROGOV

datum:	št. projekta:	št. načrta:	merilo:	št. risbe:
05.2024	2023-1/12	116/23	1 : 50, 25	G2

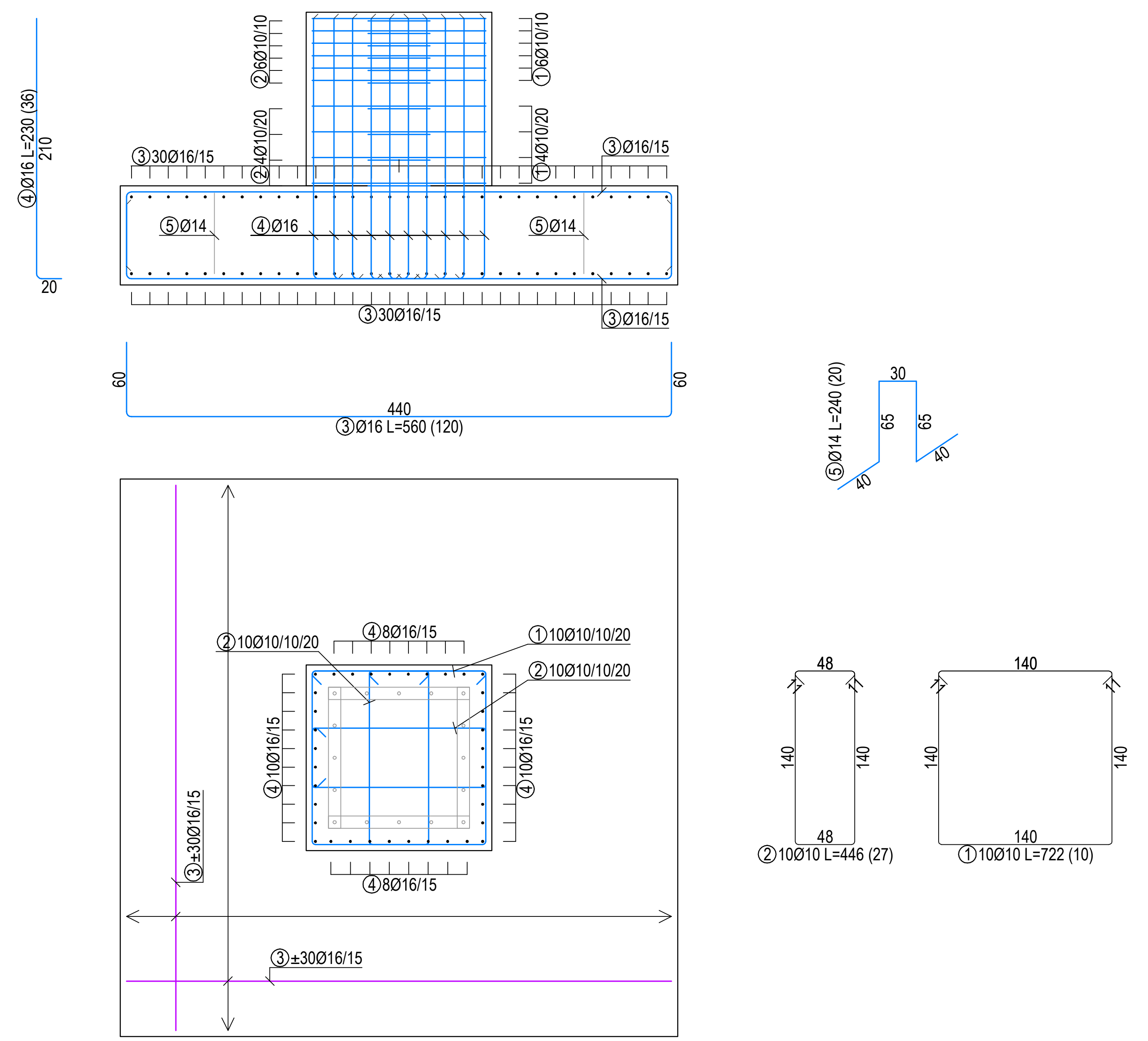
Izvedba razsvetljave in vzdrževalnih del na nogometnem stadionu v Ajdovščini

temelj TT1 -
rekonstrukcija obstoječega temelja (kom 4)

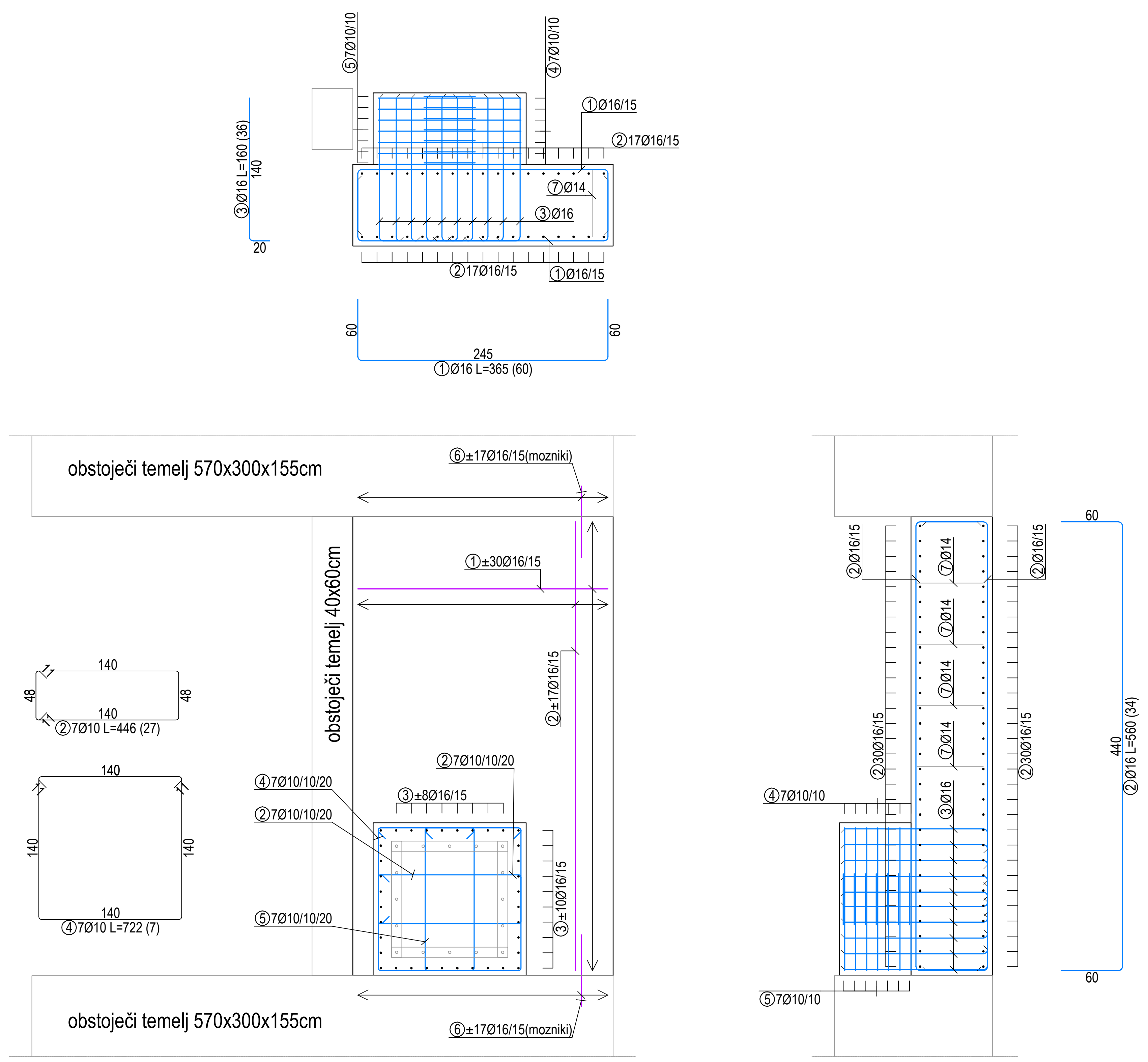


POSTOPEK IZVEDBE:
- odstranitev temeljnega nastavka in krovnega sloja armature pete
- vrtati kemična sidra (hef=50cm), Ø izvrtine znaša 20mm
- razprašiti izvrtino ter vstaviti lepilo HILTI HIT-HY-200
- temelj oprati z vodnim curkom 150-200bar
- kontaktno površino premezati s Cementol Elastosil
- izvedba novega nastavka

temelj TT2 -
novi temelj ob glavni tribuni (kom 2)



temelj TT3 -
novi temelj ob pomožni tribuni (kom 2)



OPOMBA:
- mozniki so kemična sidra katere se vgrajuje z maso HILTI HIT-HY-200

NAČRT TEMELJEV DROGOV
ARMATURNI NAČRT TEMELJEV

MATERIALI			
	ELEMENT	MATERIAL	ZAŠČITNA PLAST
BETON	podložni beton	C 12/15 X0	/
	temelji	C 30/37, XC4 XD3 XF3, PV-II, Cl0,2 Dmax32	50 mm
ARMATURA	palice, mreže	B 500A	
SIDRA	navojne palice	vroče cinkane, kvaliteta 8.8	
KONSTRUKCIJSKO JEKLO	LED zaslon	S235J2 (cevi), S355J2 (profili)	
KOROZIJSKA ZAŠČITA	LED zaslon	SIST EN ISO 1461	min 55μm (povpr. 70μm)
IZVEDBENI RAZRED	LED zaslon	EXC 2	

naziv projekta: Izvedba razsvetljave in vzdrževalnih del na nogometnem stadionu v Ajdovščini

vsebina risbe: 71 ARNATURNI NAČRTI
armaturni načrt temeljev

investitor: Občina Ajdovščina, Cesta 5. maja 6a, 5270 Ajdovščina

projektant: Arti inženiring d.o.o., Ul. Ivana Suliča 6a, 5292 Šempeter pri Gorici

izdelovalec načrta: corus inženirji

vodja projektiranja: ROBERT VRTOVEC, univ.dipl.inž.grad. G-2239 PI

pooblaščeni inženir: MATEJ KOSOVEL, univ.dipl.inž.grad. G-2341 PI

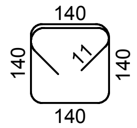
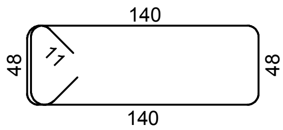
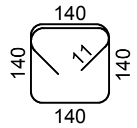
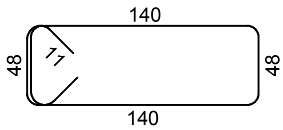
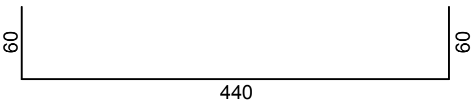
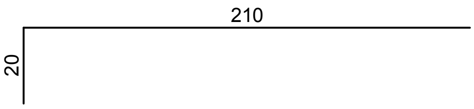
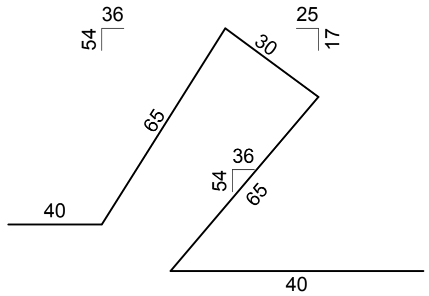
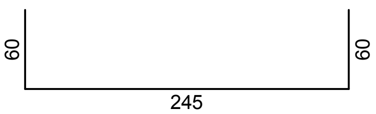
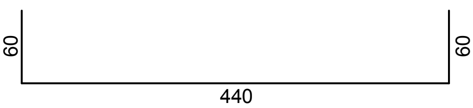
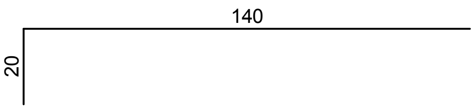
izdelal: MATEJ KOSOVEL, univ.dipl.inž.grad. G-2341 PI

namen dokumentacije: PZI

strokovno področje načrta: 2 Načrt gradbeništva
2/1 NAČRT TEMELJEV DROGOV

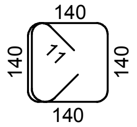
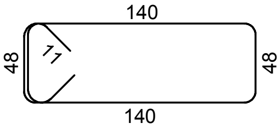
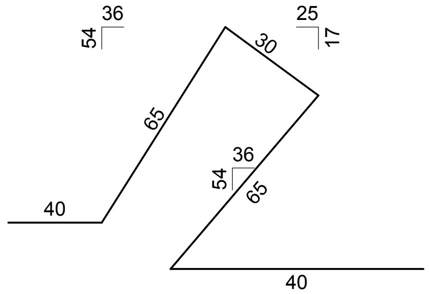
datum:	št. projekta:	št. načrta:	merilo:	št. risbe:
05.2024	2023-1/12	116/23	1 : 50	G3

Palice - specifikacija

ozn	oblika in mere [cm]	Ø	lg [m]	n [kos]	lgn [m]	Opomba
	TT1 - rekonstrukcija obstoječega (4 kos)					
1		10	7.22	48	346.56	
2		10	4.46	96	428.16	
3	230	16	2.30	144	331.20	
	TT2 - ob glavni tribuni (2 kos)					
1		10	7.22	20	144.40	
2		10	4.46	54	240.84	
3		16	5.60	240	1344.00	
4		16	2.30	72	165.60	
5		14	2.40	40	96.00	
	TT3 - ob pomožni tribuni (2 kos)					
1		16	3.65	120	438.00	
2		16	5.60	68	380.80	
3		16	1.60	72	115.20	

OBJEKT: RAZSVETLJAVA STADION AJDOVŠČINA	2/3
KOSOVNICA - TEMELJI	št:116/23

Palice - specifikacija

ozn	oblika in mere [cm]	Ø	lg [m]	n [kos]	lgn [m]	Opomba
4		10	7.22	14	101.08	
5		10	4.46	14	62.44	
6	70	16	0.70	136	95.20	
7		14	2.40	20	48.00	

OBJEKT: RAZSVETLJAVA STADION AJDOVŠČINA	3/3
KOSOVNICA - TEMELJI	št:116/23

Palice - izvleček

Ø [mm]	lgn [m]	Teža enote [kg/m']	Teža [kg]
B 500, Ø <= 12 mm			
10	1323.48	0.64	849.54
Skupaj (B 500, Ø <= 12 mm)			849.54
B 500, Ø > 12 mm			
14	144.00	1.26	181.01
16	2870.00	1.64	4712.25
Skupaj (B 500, Ø > 12 mm)			4893.26
Skupaj			5742.80