

elektronski potpis projektanta	elektronski potpis revidenta
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INVESTITOR¹

Opština Bar

OBJEKAT²

Saobraćajnica sa pratećom infrastrukturom, dio koji se nalazi između zona "A" i "B" sa jedne strane i zone "Aa" sa druge strane, u zahvatu DUP-a "Ilino", Bar

LOKACIJA³

Katastarske parcele 4813/5; 4814/10; 4755/2; 4733/5; 4782/4; 4782/3; 4734/3; 4735/2; 4781/2; 4780/2; 4736/2; 4799/2; 4758/2; 4742/3; 4743/7; 4749/2; 4760/2; 4750/2; 4757/2; 4754/2; 4756/2; 4755/4; 4154/9; 4158/4; K.O. Novi Bar

DIO TEHNIČKE
DOKUMENTACIJE⁴

Sveska 2.2-Konstrukcija

PROJEKTANT⁵

“URBI PRO” d.o.o. Podgorica

ODGOVORNO LICE⁶ /

Dušan Džudović, dipl. inž. arh.

ODGOVORNI INŽENJER⁷ /

Jovana Perović, dipl. inž. građ.

SARADNICI NA
PROJEKTU⁸

Mirko Jušković bsc. građ.
Marko Šoć dipl. inž. građ.

¹ Naziv/ime investitora

² Naziv projektovanog objekta

³ Mjesto građenja, planski dokument, urbanistička parcela, katastarska parcela

⁴ Arhitektonski projekat, građevinski projekat, elektrotehnički projekat odnosno mašinski projekat (ako je u pitanju naslovna strana dijela tehnički dokumentacije)

⁵ Naziv privrednog društva, pravnog lica odnosno preduzetnika koji je izradio dio tehničke dokumentacije

⁶ Ime odgovornog lica u privrednom društvu, pravnom licu odnosno ime i prezime preduzetnika

⁷ Ime i prezime odgovornog inženjera

⁸ Ime i prezime saradnika na izradi dijela tehnički dokumentacije

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- 1-01 Plan pozicija potpornih zidova
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TEKSTUALNA DOKUMENTACIJA

TEHNIČKI IZVJEŠTAJ

Lokacija: Novi Bar - Katastarske parcele 4813/5; 4814/10; 4755/2; 4733/5; 4782/4; 4782/3; 4734/3; 4735/2; 4781/2; 4780/2; 4736/2; 4799/2; 4758/2; 4742/3; 4743/7; 4749/2; 4760/2; 4750/2; 4757/2; 4754/2; 4756/2; 4755/4; 4154/9; 4158/4; K.O.

Objekat: Saobraćajnica sa pratećom infrastrukturom, dio koji se nalazi između zona "A" i "B" sa jedne strane i zone "Aa" sa druge strane, u zahvatu DUP-a "Ilino", Bar

Investitor: Opština Bar

1. UVOD

Glavni projekat konstrukcije potpornih zidova urađen je na osnovu: projekta saobraćaja, geodetskih podloga, geotehničkog elaborata, hidrotehnike i drugih instalacija koji su povezani glavnim projektom.

Takođe, projekat konstrukcije urađen je poštujući projektni zadatak, kao i odgovarajuće tehničke propise i standarde, a s obzirom na namjenu, lokaciju i položaj objekta. Dokazana je statička sigurnost konstrukcije svih objekata, kao i prostorna stabilnost.

2. OPŠTI PODACI

Lokacija na kojoj je planirana izgradnja potpornih zidova je u Baru. Morfološki posmatrano teren je ravničarskog karaktera.

Za potrebe saobraćajnice nije rađen Geotehnički elaborat. Na osnovu elaborata koji je urađen u neposrednoj blizini, može se zaključiti da su registrovane sljedeće geotehničke sredine:

Sredina 1 – crvenica sa sitnom i krupnom krečnjačkom drobinom (tr) – izgrađuje gornje djelove terena, debljine do 2,0m. Predstavlja slabovezanu, heterogenu, slabo zbijenu sredinu (na inženjerskogeološkom profilu terena je označena sa 1, prilog br.4.0). F

Sredina 2 – prašinasta i pjeskovita drobina i sitni komadi sa laporovitom glinom flišnog porijekla, komadima pješčara i krečnjaka (dl) – pripada inženjerskogeološkoj grupi slabo vezanih stijena. U genetskom smislu pripadaju deluvijalnim sedimentima. Pojavljuje se u slojevima debljine do 3,0m.

Sredina 3 – Eluvijalna prašinasta i laporovita glina sa uklopcima laporaca i pješčara (el) – Čine ih sivomaslinaste i tamnosive laporovite gline i glinoviti lapori sa očuvanom primarnom teksturom i sa jasno uočljivom primarnom teksturom, a sama drobina je u različitim međusobnim razmjerama. Nalaze u gornjoj zoni flišnog kompleksa debljine 1,0m do 2,0m. U suvom stanju, ova sredina je dobrih fizičkomehaničkih karakteristika, dok pod uticajem vode i vlage, dolazi do pogoršanja otporno-deformabilnih svojstava, te prelazi u stanje mekih, stišljivih, slabo nosivih glina.

Sredina 4 – Flišni sediment srednje eocenske starosti (fliš) – Predstavljaju vezane, slabookamenjene do okamenjene stijene sastavljene od glinaca, laporaca i pješčara, listastih, tankoslojevitih do slojevitih, sive do sivoplavičaste boje. Granica između svijžeg fliša i eluvijuma je postupna i nepravilna. Kompleks je ubran i ispucao, u površinskoj zoni fizičko-hemijski izmijenjen i pretvoren u gline sa drobinom, smeđe do braon boje. Pri opterećenju se ponašaja kao kruta elastična sredina. Stijena je suva, kompaktna, svjetlosive boje, bušenjem usitnjena u komade, sa vrlo kratkim intervalima bušenja.

Zbog racionalnosti, izvršeno je fundiranje na dubini od 1,0 do 1,5 m u odnosu na kotu terena. Kako na ovoj dubini se nalazi geotehnička sredina 2, koja nije pogodna za gradnju, potporni zidovi moraju se izvoditi uz potpunu zamjenu tla, sa minimalnom debljinom zamjene od 1,0 m, u četiri sloja po 0.25m. Zamjenu podtla izvršiti dobro granuliranim, čistim drobljenim krečnjačkim ili prirodnim šljunkovito-pjeskovitim materijalom granulacije 0-50 mm uz maksimalno učešće glinovite komponente do 3%. Tampon je neophodno uvaljati (zbiti) do modula $M_s = 50.000 \text{ kN/m}^2$ u slojevima od po 25 cm;

- Zbijenost tampona provjeravati opitom kružnom pločom na dovoljnom broju mjernih mjesta i uraditi Izvještaj o izvedenim ispitivanjima;
- Iskope izvoditi po mogućnosti u sušnom periodu zbog priliva voda i planirati mjere zaštite iskopa po potrebi;
- Tokom izvođenja zemljanih radova može se očekivati da će doći do prodora podzemne vode zbog njenog visokog nivoa, tj. vodozasićenje iskopa odmah nakon zasijecanja tla pa je potrebno u dijelu terena iskopati drenažni šaht iz koga bi se muljnom pumpom voda izbacala do najbližeg vodosabirnika ili kanala;
- Kosine iskopa prilikom zasjecanja raditi i nagibu 2:1;
- OBAVEZNO je prisustvo inženjera geotehnike pri izvođenju iskopa kako bi se precizno definisale inženjerskogeološke sredine na otvorenom profilu zasjeka i pravovremeno riješili eventualni problema.

3. DISPOZICIONO RJEŠENJE I USVOJENI KONSTRUKTIVNI SISTEM

Dispoziciono rješenje i upotreba osnovnih materijala za konstrukciju usvojeni su u skladu sa projektnim zadatkom, funkcijom, lokalnim uslovima, projektom saobraćaja.

Projektovani su potporni zidovi kao konzole. Kota krune zida definisana je projektom saobraćajnice. Potporni zidovi su promjenljive visine krune zida.

Usvojeno je 3 različita poprečna presjeka potpornih zidova, što je uslovljeno različitim visinskim kotama krune zida i nagibom terena.

Usvojeni tip konstrukcije zadovoljava sve uslove tražene seizmičkim propisima.

4. OPIS MODELIRANJA I PRORAČUNA

- Proračunski model je urađen kao 2D model pomoću u programskom paketu GEO 5 (Geo Structural Analysis – Cantilever wall).

-Projektant konstrukcije je vrijednost dozvoljenog centričnog napona u tlu usvojio od 150 kN/m^2 i sljedeće parametre zasipa i temeljnog tla:

- $\gamma=20.0 \text{ kN/m}^3$
- $\varphi=30^\circ$
- $c_1=0 \text{ kN/m}^2, c_2=5 \text{ kN/m}^2$
- $M_s=10\,000 \text{ kN/m}^2$
- Zaštitni sloj za $a_0=4 \text{ cm}$
- $\delta=(1/3-2/3) \varphi_{ef}=20^\circ$

Po ovim parametrima izvršen je proračun zidova u programskom paketu GEO 5, po važećim evropskim propisima i standardu EC7, pri čemu je korišten projektni pristup 2.

Kontrola naprezanja u kontaktnoj površini sprovedena je za najnepovoljniju kombinaciju eksploatacionih opterećenja, a cilj je obezbijediti da maksimalna **naprezanja ne prevazilaze dopuštene napone u tlu, a da pri tome budu zadovoljeni propisima faktori sigurnosti na preturanje i klizanje**. Pri tome, u prenosu opterećenja na tlo može učestvovati samo onaj dio kontaktne površine koji je pritisnut (na spoju temelj – tlo se ne prenose naponi zatezanja). Izuzetno, za pojedine kombinacije (seizmička), dopušta se prekoračenje dopuštenih napona u ograničenom procentu (20%) na ivicama kontaktne površine.

Obavezno je izvesti predviđene drenaže i barbakane potpornih zidova.

Svi zidovi projektovani su uzimajući u obzir zemlju sa obje strane zida, odnosno cijelu visinu dubine fundiranja sa jedne strane (80-100cm) i cijelo opterećenje zemljom sa druge kritičnije strane.

U proračunskom modelu konstrukcije su unešena sledeća opterećenja:

Stalno – sopstvena težina elemenata konstruktivnog sistema i sva ostala opterećenja stalnog karaktera, uključujući i tlo (aktivni i pasivni pritisak)

Saobraćajno opterećenje - usvojeno $33,3 \text{ kN/m}^2$

Seizmičko opterećenje

Seizmičko opterećenje je odrađeno po formuli:

$$F_y = \Sigma G \cdot k_h$$

$$K_h = a_{\max} \cdot S/r$$

$$K_v = 0,33 \text{ za slučaj } K_h \leq 0,6$$

Usvojeni povratni period referentnog zemljotresa od 475 godina usvojeno je horizontalno ubrzanje tla za zadatu lokaciju je $a_{gr} = 0,371 \text{ g}$ i temeljno tlo tipa C ($S=1.15$)

Faktor **r** usvaja se zavisno od tipa potporne konstrukcije. Za zidove koji nisu visočiji od 10 m usvaja se da je seizmički koeficijent konstantan po visini. Usvojen je $r=2$, za slobodne masivne zidove, gdje je prihvatljivo pomjeranje do $d_r = 300 \alpha \cdot S$ (mm), prema EN 1998-5 (7.3.2.2.)

$$K_h = 0.371 \cdot 1.15 / 2$$

$$K_h = 0,213$$

Prilikom dimenzionisanja elemenata konstrukcije koje je vršeno po teoriji graničnih stanja korišćeni su adekvatni parcijalni koeficijenti sigurnosti.

Kao opšti zaključak se navodi da usvojene dimenzije konstruktivnih elemenata kao i usvojena armatura AB elemenata obezbjeđuju potrebnu sigurnost, stabilnost i duktilnost konstrukcije.

5. KVALITET MATERIJALA ZA KONSTRUKCIJU OBJEKTA

- Za cjelokupnu konstrukciju: C25/30 fck=25.00 MPa
- Za armaturu: B500B i MAR 500/560 fyk=500.00MPa

6. PRIMJENJENI PROPISI

- EN 1991-1-1, EN 1991-1-3
- EN 1992-1-1
- EN 1998-1, EN 1998-5
- MEST EN 1990
- MEST EN 1997-1

7. OPŠTE SMJERNICE ZA IZVOĐENJE

- Zidove treba izvoditi u kampadama uz potpun završetak kampade (zida, drenažnog sloja i nasipa) prije otpočinjanja radova na sljedećoj kampadi. Iskop za izradu potporne konstrukcije se ne smije ostaviti da stoji dugo otvoren. Preporuka je da se od izvođenja iskopa u roku od 7- 10 dana izvede potporna konstrukcija i izvrši zatrpavanje preostalog profila do projektom predviđenih kota. Napredovanje iskopa u podužnom pravcu ograničiti na dužinu jednaku dužini 1 -1.5 kampade. U suprotnom preduzeti dodatne mjere u cilju obezbjeđivanja stabilnosti iskopa, odobrene od strane nadzora. Na izvođenju se u svemu/pridržavati važećeg Zakona o zaštiti na radu.
- **Zidovi u usijeku** - U svim zidovima izvesti barbakane prečnika Ø100mm. Barbakane izvesti u jednom redu, na međusobnom horizontalnom razmaku od 200cm. Sve barbakane izvesti sa padom od 2% prema vanjskoj strani zida.
- **Zidovi u nasipu** - Vertikalni i horizontalni razmak između barbakana je 200cm (horizontalni razmak) i 100cm (vertikalni razmak). Iza prvog reda barbakana u drenažnom materijalu iza zida položiti perforiranu drenažnu cijev PP-ID150-SNB (otvor perforacija da nije manji od 100cm²/m) sa izvodima u barbakane od cijevi PVC-DN125. Sve barbakane izvesti sa padom od 2% prema vanjskoj strani zida.
Ukoliko je visina zida veća od 4.0 m barbakane izvesti u tri reda.
Ukoliko je visina zida od 2.5 do 4.0 m barbakane izvesti u dva reda.
Ukoliko je visina zida 2.0m barbakane izvesti u jednom redu.
- Zemljane radove vršiti kontrolisano, kako se ne bi poremetila stabilnost zidova iskopa i time ugrozila stabilnost terena i objekata u blizini,
- Za objekte predvidjeti adekvatne drenaže

U toku izvođenja radova na temeljnom iskopu obavezan je geotehnički nadzor radi eventualnih nepredviđenih okolnosti koja diktiraju složena svojstva geološke sredine.

U Podgorici,
Januar, 2024. godine

Odgovorni inženjer:
Jovana Perović, spec.sci.građ.

2.2. OPŠTI TEHNIČKI I TEHNOLOŠKI USLOVI ZA IZRADU KONSTRUKCIJE OBJEKTA

Da bi se postigla potpuna sigurnost rada i stabilnost konstrukcije, moraju se sagledati sledeći problemi i opasnosti, analizirati uslove za njihovo otklanjanje i sprovesti odgovarajuće mere.

OPŠTI USLOVI ZA IZVOĐENJE RADOVA

Izvođenje svih radova mora biti stručno i precizno, prema planovima, opisima i detaljima projekta, po tehničkim propisima, primjenom Eurocode (MEST EN) i po potrebnim uputstvima projektanta.

Radove mogu izvoditi samo stručna lica sa potrebnom spremom i atestima, kao i preduzeća registrovana za te vrste radova i sa odgovarajućim licencama.

Svi materijali, polufabrikati i gotovi proizvodi, moraju odgovarati propisima MEST-a.

Svi materijali za koje po MEST-u mora da se garantuje kvalitet, moraju biti atestirani ili ispitani, da bi se dokazao potreban kvalitet. Ukoliko je izvođač ugradio materijal koji nema odgovarajući atest, ili se ispitivanjem dokaže kvalitet niži od potrebnog, izvođač je dužan da ga ukloni i zamijeni odgovarajućim, na svoju štetu.

Svu odgovornost za kvalitet materijala, u skladištima, na objektu i u toku ugradnje, pa sve do predaje objekta na korišćenje investitoru, snosi izvođač.

U izvođenju radova izvođač je dužan da sprovodi higijensko tehničke mjere zaštite u skladu sa važećim propisima. Ove mjere moraju biti obuhvaćene cijenom radova.

Nakon izvršenih radova izvođač je dužan da ukloni sve otpadne materijale i viškove materijala. Uklanjanje i odvoženje otpadnog materijala mora biti obuhvaćeno ponudom i ugovorom.

Obračun izvršenih i primljenih radova obavlja se prema ugovoru uz odobrenje nadzornog organa. Ukoliko izvođač odstupa od ugovorenih radova bez saglasnosti projektanta, sam snosi sve posledice koje iz toga proizilaze.

Opšti uslovi važe za sve radove koji su navedeni u predmjeru radova, kao i za radove koji se urade na predlog i uz saglasnost nadzornog organa i projektanta.

U konkretnom objektu su korišćeni sljedeći kvaliteti materijala:

- AB konstrukcija C25/30
- B 500B; MAR 500/560;
- Čelična konstrukcija S 235
- Kalitet elektroda za elekto lučko zavarivanje prema MEST-u.

USLOVI ZA IZVOĐENJE BETONSKIH I ARMIRANO BETONSKIH RADOVA

Betonski radovi se izvode prema projektu konstrukcije i projektu betona. U sastavu projekta betona se nalaze sl. uputstva, potvrde i dokaznice:

- Sastav betonskih mješavina, količine i tehničke uslove za projektovanje klase betona
- Plan betoniranja, organizacije i opreme
- Način transporta i ugrađivanja betonske mješavine
- Način njegovanja građenog betona
- Program kontrolnih ispitivanja sastojaka betona
- Program kontrole betona, uzimanja uzoraka i ispitivanje betonske mješavine po partijama
- Plan montaže elemenata, projekat skele i projekat oplata (kod složene oplata).

Sa betoniranjem se može otpočeti tek kada je izvršen pregled preduzetih mjera iz projekta betona, kada su pregledane i primljene podloge, skele, oplata i armature.

Skele i oplata

Skele i oplata moraju biti izvedene tako da preuzmu opterećenje i uticaje u toku izvođenja radova, bez štetnih slijeganja i deformacija, sa obezbjeđenjem tačnosti predviđene projektom konstrukcije.

Oplata mora biti takva da ne dozvoljava gubitak sastojaka betona za vrijeme betoniranja i sazrijevanja betona. Ona mora biti lako demontažna. Unutrašnje stranice moraju biti čiste i ravne, premazane sredstvima za onemogućavanje prijanjanja betona. Premaz za oplatu ne smije biti štetan za beton, armaturu i vezu betona sa armaturom, kao i za materijale koji se naknadno nanose na beton. Ne smije da mijenja boju površine betona koja je vidna.

Oplata se skida bez potresa i udara, kada je beton dovoljno očvrstnuo. Čvrstoća betona prilikom skidanja oplata mora biti:

- 30 % klase betona za stubove, zidove i vertikalne ivice greda
- 70 % klase betona kod ploča i donjih dijelova oplata greda
- 100 % klase betona ukoliko je betonski element opterećen u trenutku skidanja oplata.

Za nosive elemente, kod kojih je noseća dužina veća od 6.0 m, oplata se postavlja sa nadvišenjem od 1/1000 noseće dužine.

Armatura

Transport, skladištenje i ugradnja armature mora biti takva, da ne dolazi do oštećenja, zamašćenja, zaprljavanja i dodatne korozije armaturnih profila. Takođe, se moraju sačuvati oznake za način ugradnje.

Armatura se savija u hladnom stanju a nastavlja na način predviđen projektom. Ukoliko je nastavljanje zavarivanjem, ono se sprovodi u svemu prema MEST-u. Zavarivanje gorionikom i kovanjem je zabranjeno. Provjera zavarljivosti se sprovodi na epruvetama.

Radi osiguranja projektovanog položaja, armatura se fiksira potrebnim brojem podmetača i graničnika odgovarajućeg tipa.

- Naknadni proračun konstrukcije sa postignutim kvalitetom betona
- Smanjenje dopuštenog opterećenja, ako je moguće
- Sanacija konstrukcije

NUMERIČKA DOKUMENTACIJA

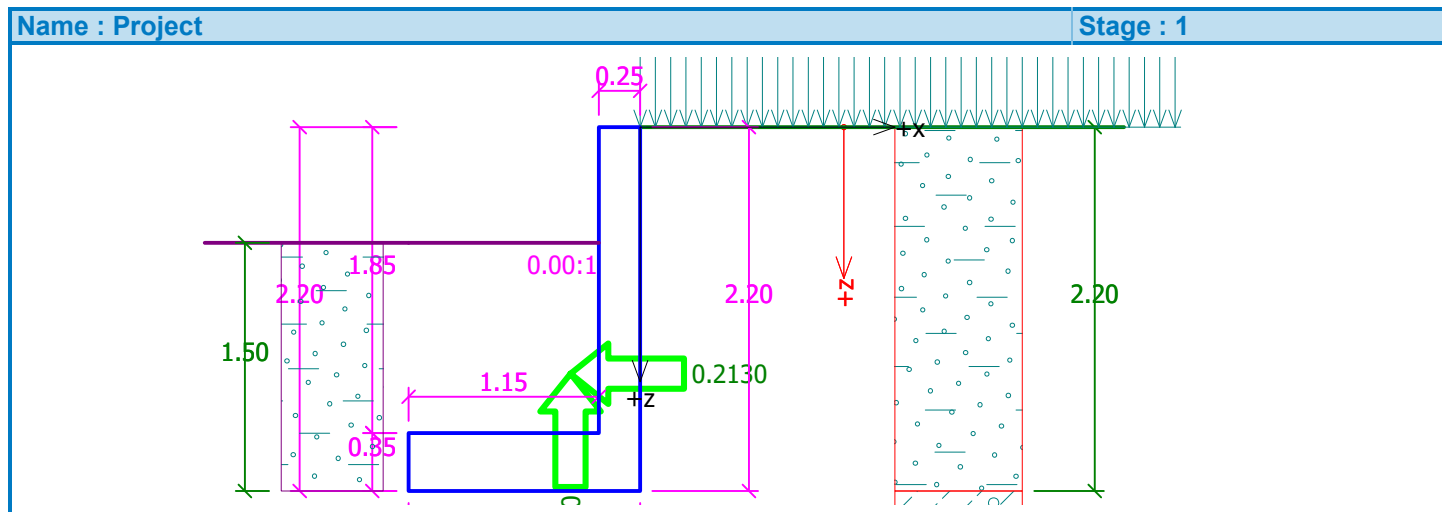
Cantilever wall analysis

Input data

Project

Task : Potporni zid PZ - tip 1 u zasipu

Date : 2/2/2024



Settings

Standard - EN 1997 - DA2

Materials and standards

Concrete structures : EN 1992-1-1 (EC2)

Coefficients EN 1992-1-1 : standard

Wall analysis

Active earth pressure calculation : Coulomb

Passive earth pressure calculation : Caquot-Kerisel

Earthquake analysis : Mononobe-Okabe

Shape of earth wedge : Calculate as skew

Base key : The base key is considered as inclined footing bottom

Verification methodology : according to EN 1997

Design approach : 2 - reduction of actions and resistances

Partial factors on actions (A)			
Permanent design situation			
		Unfavourable	Favourable
Permanent actions :	$\gamma_G =$	1.35 [-]	1.00 [-]
Variable actions :	$\gamma_Q =$	1.50 [-]	0.00 [-]
Water load :	$\gamma_w =$	1.35 [-]	

Partial factors for resistances (R)			
Permanent design situation			
Partial factor on overturning :	$\gamma_{Re} =$	1.40 [-]	
Partial factor on sliding resistance :	$\gamma_{Rh} =$	1.10 [-]	
Partial factor on bearing capacity :	$\gamma_{Rv} =$	1.40 [-]	

Partial factors for variable actions

Permanent design situation

Factor for combination value :	$\psi_0 =$	0.70	[-]
Factor for frequent value :	$\psi_1 =$	0.50	[-]
Factor for quasi-permanent value :	$\psi_2 =$	0.30	[-]

Material of structure

Unit weight $\gamma = 25.00 \text{ kN/m}^3$

Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete : C 25/30

Cylinder compressive strength

 $f_{ck} = 25.00 \text{ MPa}$

Tensile strength

 $f_{ct} = 2.60 \text{ MPa}$

Longitudinal steel : B500

Yield strength

 $f_{yk} = 500.00 \text{ MPa}$

Geometry of structure

No.	Coordinate X [m]	Depth Z [m]
1	0.00	0.00
2	0.00	1.85
3	0.00	2.20
4	-1.40	2.20
5	-1.40	1.85
6	-0.25	1.85
7	-0.25	0.00

The origin [0,0] is located at the most upper right point of the wall.

Wall section area = 0.95 m^2 .

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m ³]	γ_{su} [kN/m ³]	δ [°]
1	nasip		30.00	0.00	20.00	10.00	20.00
2	temeljno tlo		30.00	5.00	20.00	10.00	20.00

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

nasip

Unit weight :

 $\gamma = 20.00 \text{ kN/m}^3$

Stress-state :

effective

Angle of internal friction :

 $\varphi_{ef} = 30.00^\circ$

Cohesion of soil :

 $c_{ef} = 0.00 \text{ kPa}$

Angle of friction struc.-soil :

 $\delta = 20.00^\circ$

Soil :

cohesionless

Saturated unit weight :

 $\gamma_{sat} = 20.00 \text{ kN/m}^3$

temeljno tlo

Unit weight : $\gamma = 20.00 \text{ kN/m}^3$
 Stress-state : effective
 Angle of internal friction : $\varphi_{ef} = 30.00^\circ$
 Cohesion of soil : $c_{ef} = 5.00 \text{ kPa}$
 Angle of friction struc.-soil : $\delta = 20.00^\circ$
 Soil : cohesionless
 Saturated unit weight : $\gamma_{sat} = 20.00 \text{ kN/m}^3$

Geological profile and assigned soils

No.	Layer [m]	Assigned soil	Pattern
1	2.20	nasip	
2	-	temeljno tlo	

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1 [kN/m ²]	Mag.2 [kN/m ²]	Ord.x x [m]	Length l [m]	Depth z [m]
	new	change						
1	YES		permanent	33.30				on terrain

No.	Name
1	saobraćajno opterećenje

Resistance on front face of the structure

Resistance on front face of the structure: passive

Soil on front face of the structure - nasip

Angle of friction struc.-soil $\delta = 0.00^\circ$

Soil thickness in front of structure $h = 1.50 \text{ m}$

Terrain in front of structure is flat.

Earthquake

Horizontal seismic coefficient $k_h = 0.2130$

Vertical seismic coefficient $k_v = 0.3300$

Coeff. to compute point of application $k.H = 0.66$

Water below the GWT is restricted.

Settings of the stage of construction

Design situation : permanent

The wall is free to move. Active earth pressure is therefore assumed.

Verification No. 1**Forces acting on construction**

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Weight - wall	0.00	-0.71	23.81	0.98	1.000	1.000	1.350
Earthq.- constr.	5.07	-0.71	-7.86	0.98	1.000	1.000	1.000
FF resistance	-67.37	-0.50	0.04	0.57	1.000	1.000	1.350
Earthq.- face	0.00	-1.50	-2.69	1.15	1.000	1.000	1.000
Active pressure	13.52	-0.73	4.92	1.40	1.350	1.350	1.350
Earthq.- act.pressure	9.14	-1.45	3.33	1.40	1.000	1.000	1.000
saobraćajno opterećenje	20.47	-1.10	7.45	1.40	1.350	1.350	1.350

Verification of complete wall**Check for overturning stability**Resisting moment $M_{res} = 28.99$ kNm/mOverturning moment $M_{ovr} = 26.95$ kNm/m**Wall for overturning is SATISFACTORY****Check for slip**Resisting horizontal force $H_{res} = 17.49$ kN/mActive horizontal force $H_{act} = -7.27$ kN/m**Wall for slip is SATISFACTORY****Overall check - WALL is SATISFACTORY**

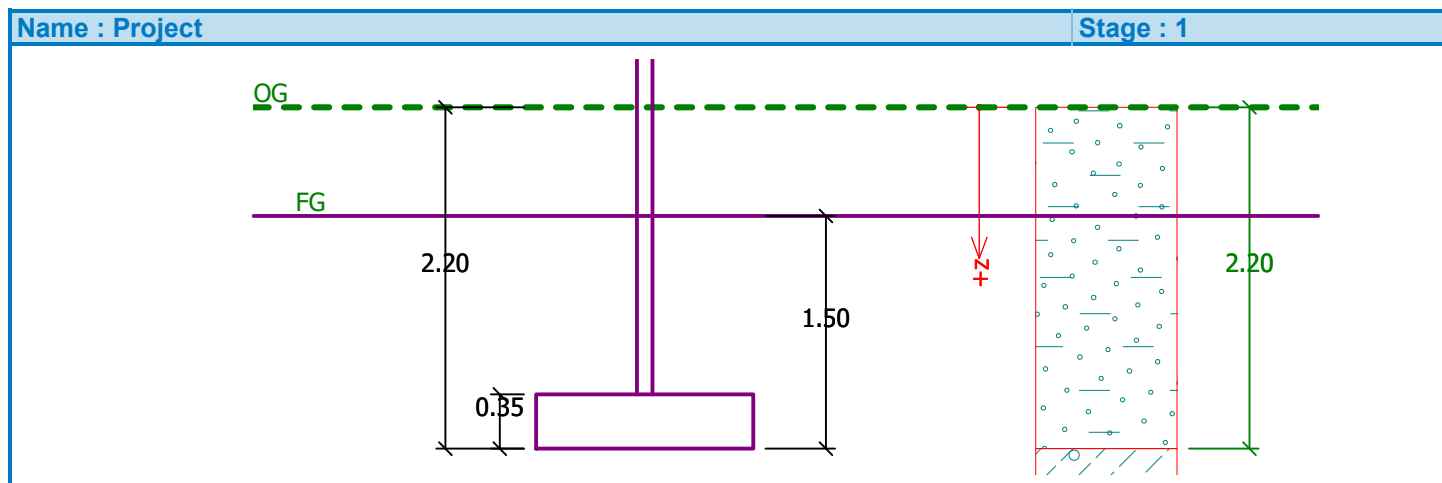
Maximum stress in footing bottom : 29.77 kPa

Bearing capacity of foundation soil**Forces acting at the centre of the footing bottom**

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]	Eccentricity [m]	Stress [kPa]
1	-4.43	41.68	-30.85	0.00	29.77
2	9.69	33.33	-7.27	0.29	40.72

Spread footing verification

Input data



Settings

Standard - EN 1997 - DA2

Materials and standards

Concrete structures : EN 1992-1-1 (EC2)

Coefficients EN 1992-1-1 : standard

Settlement

Analysis method : Analysis using oedometric modulus

Restriction of influence zone : by percentage of Sigma, Or

Coeff. of restriction of influence zone : 10.0 [%]

Spread Footing

Analysis for drained conditions : EC 7-1 (EN 1997-1:2003)

Verification methodology : according to EN 1997

Design approach : 2 - reduction of actions and resistances

Partial factors on actions (A)			
Permanent design situation			
		Unfavourable	Favourable
Permanent actions :	$\gamma_G =$	1.35 [-]	1.00 [-]

Partial factors for resistances (R)			
Permanent design situation			
Partial factor on vertical bearing capacity :	$\gamma_{Rvs} =$	1.40 [-]	
Partial factor on sliding resistance :	$\gamma_{Rhs} =$	1.10 [-]	

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m ³]	γ_{su} [kN/m ³]	δ [°]
1	nasip		30.00	0.00	20.00	10.00	20.00
2	temeljno tlo		30.00	5.00	20.00	10.00	20.00

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters**nasip**

Unit weight :	γ	=	20.00 kN/m ³
Angle of internal friction :	φ_{ef}	=	30.00 °
Cohesion of soil :	c_{ef}	=	0.00 kPa
Deformation modulus :	E_{def}	=	1.37 MPa
Poisson's ratio :	ν	=	0.33
Saturated unit weight :	γ_{sat}	=	20.00 kN/m ³

temeljno tlo

Unit weight :	γ	=	20.00 kN/m ³
Angle of internal friction :	φ_{ef}	=	30.00 °
Cohesion of soil :	c_{ef}	=	5.00 kPa
Deformation modulus :	E_{def}	=	6.74 MPa
Poisson's ratio :	ν	=	0.33
Saturated unit weight :	γ_{sat}	=	20.00 kN/m ³

Foundation**Foundation type: strip footing**

Depth from original ground surface	h_z	=	2.20 m
Depth of footing bottom	d	=	1.50 m
Foundation thickness	t	=	0.35 m
Incl. of finished grade	s_1	=	0.00 °
Incl. of footing bottom	s_2	=	0.00 °

Unit weight of soil above foundation = 20.00 kN/m³

Geometry of structure**Foundation type: strip footing**

Overall strip footing length	=	3.05 m
Strip footing width (x)	=	1.40 m
Column width in the direction of x	=	0.10 m
Volume of strip footing	=	0.49 m ³ /m

Inserted loading is considered per unit length of continuous footing span.

Material of structure

Unit weight γ = 25.00 kN/m³

Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete : C 25/30

Cylinder compressive strength	f_{ck}	=	25.00 MPa
Tensile strength	f_{ct}	=	2.60 MPa
Elasticity modulus	E_{cm}	=	31000.00 MPa

Longitudinal steel : B500

Yield strength	f_{yk}	=	500.00 MPa
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Transverse steel: B500

Yield strength	f_{yk}	=	500.00 MPa
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Geological profile and assigned soils

No.	Layer [m]	Assigned soil	Pattern
1	2.20	nasip	
2	-	temeljno tlo	

Load

No.	Load new	Load change	Name	Type	N [kN/m]	M _y [kNm/m]	H _x [kN/m]
1	YES		LC 1	Service	-0.47	0.00	0.00
2	YES		LC 2	Design	-0.47	0.00	0.00
3	YES		LC 3	Service	-8.82	9.69	0.00
4	YES		LC 4	Design	-8.82	9.69	0.00

Global settings

Analysis type : analysis for drained conditions

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Load case verification

Name	Self w. in favor	e _x [m]	e _y [m]	σ [kPa]	R _d [kPa]	Utilization [%]	Is satisfied
LC 2	Yes	0.00	0.00	29.77	791.89	3.76	Yes
LC 2	No	0.00	0.00	40.31	791.89	5.09	Yes
LC 4	Yes	-0.29	0.00	40.72	678.20	6.00	Yes
LC 4	No	-0.20	0.00	48.23	714.10	6.75	Yes

Analysis carried out with automatic selection of the most unfavourable load cases.

Computed self weight of strip foundation $G = 16.54 \text{ kN/m}$

Computed weight of overburden $Z = 40.36 \text{ kN/m}$

Vertical bearing capacity check

Shape of contact stress : rectangle

Most severe load case No. 4. (LC 4)

Parameters of slip surface below foundation:

Depth of slip surface $z_{sp} = 2.22 \text{ m}$

Length of slip surface $l_{sp} = 6.71 \text{ m}$

Design bearing capacity of found.soil $R_d = 714.10 \text{ kPa}$

Extreme contact stress $\sigma = 48.23 \text{ kPa}$

Bearing capacity in the vertical direction is SATISFACTORY

Horizontal bearing capacity check

Most severe load case No. 2. (LC 2)

Earth resistance: not considered

Friction angle foundation-footing bottom $\psi = 30.00^\circ$

Cohesion foundation-footing bottom $a = 5.00 \text{ kPa}$

Horizontal bearing capacity $R_{dh} = 21.88 \text{ kN}$

Extreme horizontal force $H = 0.00 \text{ kN}$

Bearing capacity in the horizontal direction is SATISFACTORY

Bearing capacity of foundation is SATISFACTORY

Verification No. 1

Settlement and rotation of foundation - input data

Analysis carried out with automatic selection of the most unfavourable load cases.

Analysis carried out with accounting for coefficient κ_1 (influence of foundation depth).

Stress at the footing bottom considered from the finished grade.

Computed self weight of strip foundation $G = 12.25 \text{ kN/m}$

Computed weight of overburden $Z = 29.90 \text{ kN/m}$

Settlement of mid point of longitudinal edge $= 0.0 \text{ mm}$

Settlement of mid point of transverse edge 1 $= 0.0 \text{ mm}$

Settlement of mid point of transverse edge 2 $= 0.0 \text{ mm}$

(1-max.compressed edge; 2-min.compressed edge)

Settlement and rotation of foundation - results

Foundation stiffness:

Computed weighted average modulus of deformation $E_{def} = 6.74 \text{ MPa}$

Foundation in the longitudinal direction is rigid ($k=71.87$)

Foundation in the direction of width is rigid ($k=197.20$)

Overall settlement and rotation of foundation:

Foundation settlement $= 0.0 \text{ mm}$

Depth of influence zone $= 0.01 \text{ m}$

Rotation in direction of width $= 0.391 \text{ (tan}^\circ\text{1000)}$

Dimensioning No. 1

Analysis carried out with automatic selection of the most unfavourable load cases.

Verification of longitudinal reinforcement of foundation in the direction of x

Bar diameter $= 12.0 \text{ mm}$

Number of bars $= 6$

Reinforcement cover $= 40.0 \text{ mm}$

Cross-section width $= 1.00 \text{ m}$

Cross-section depth $= 0.35 \text{ m}$

Reinforcement ratio $\rho = 0.22 \% > 0.14 \% = \rho_{min}$

Position of neutral axis $x = 0.02 \text{ m} < 0.19 \text{ m} = x_{max}$

Ultimate moment $M_{Rd} = 87.08 \text{ kNm} > 6.22 \text{ kNm} = M_{Ed}$

Cross-section is SATISFACTORY.

Spread footing for punching shear failure check

Column normal force = -8.82 kN

Compression chord adjacent to the column

Force transmitted into found. soil	= -0.63 kN
Force transmitted by shear strength of SRC	= -8.19 kN
Considered column perimeter	$u_0 = 0.91 \text{ m}$
Shear resistance at the column perimeter	$v_{Ed,max} = 0.35 \text{ MPa}$
Resist. of the compr. chord adjacent to the column	$v_{Rd,max} = 4.50 \text{ MPa}$

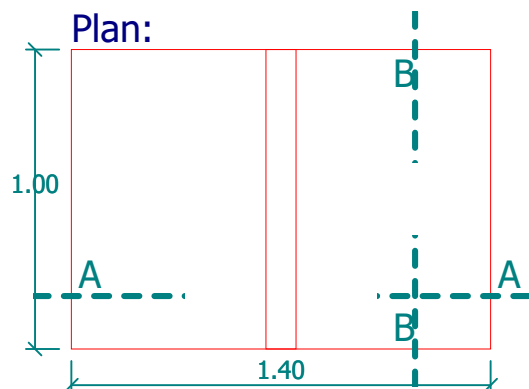
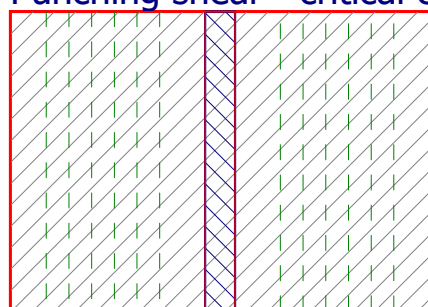
Critical section without shear reinforcement

Force transmitted into found. soil	= -5.40 kN
Force transmitted by shear strength of SRC	= -3.42 kN
Distance of section from the column	= 0.38 m
Section perimeter	$u_{cr} = 2.00 \text{ m}$
Shear stress at section	$v_{Ed} = 0.02 \text{ MPa}$
Shear resistance of section without shear reinforcement	$v_{Rd,c} = 0.68 \text{ MPa}$

 $v_{Ed} < v_{Rd,c} \Rightarrow$ Reinforcement is not required**Spread footing for punching shear is SATISFACTORY**

Name : Dimensioning

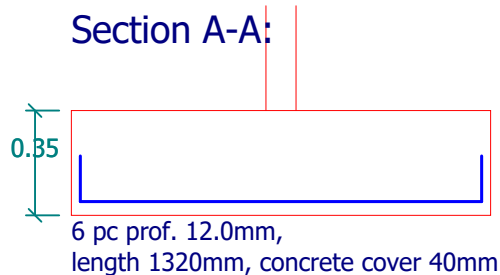
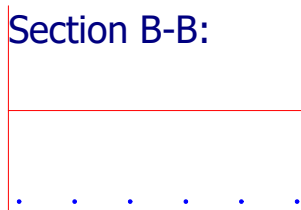
Stage : 1; Dimensioning : 1

Plan:**Punching shear - critical cross-section:**

Loading area
transmitted by RC through shear
area: 1.00E-01m²

critical cross-section
length: 2.00m

checked cross-sections

Section A-A:**Section B-B:**

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. moment	Coeff. norm.force	Coeff. shear for.
Weight - wall	0.00	-0.92	11.55	0.12	1.000	1.350	1.000
Earthq.- constr.	2.46	-0.92	-3.81	0.12	1.000	1.000	1.000
FF resistance	-39.57	-0.38	0.00	0.00	1.000	1.000	1.000
Earthq.- face	0.00	-1.15	0.00	0.00	1.000	1.000	1.000
Pressure at rest	17.09	-0.62	0.00	0.25	1.350	1.000	1.350
Earthquake - pressure at rest	9.76	-0.92	0.00	0.25	1.000	1.000	1.000
saobraćajno opterećenje	30.78	-0.92	0.00	0.25	1.350	1.000	1.350

Wall stem check

Reinforcement and dimensions of the cross-section

Bar diameter = 10.0 mm

Number of bars = 8

Reinforcement cover = 40.0 mm

Cross-section width = 1.00 m

Cross-section depth = 0.25 m

Reinforcement ratio ρ = 0.31 % > 0.14 % = ρ_{min}

Position of neutral axis x = 0.02 m < 0.13 m = x_{max}

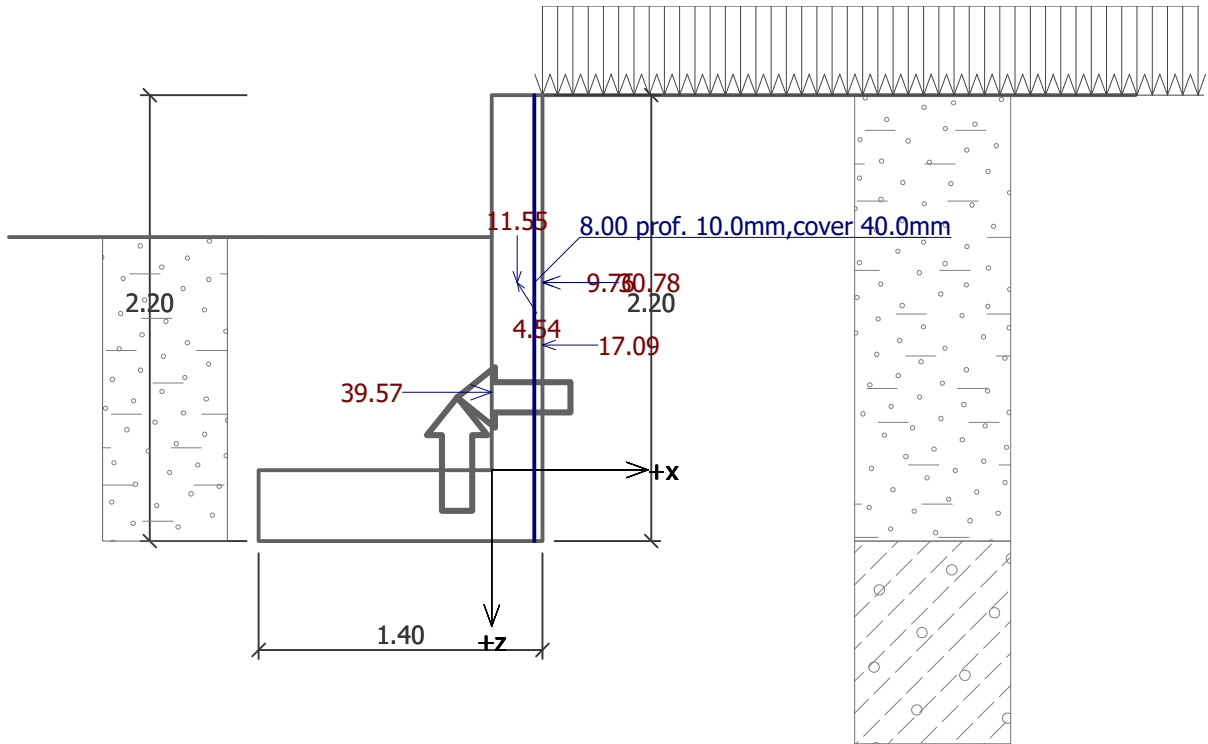
Ultimate shear force V_{Rd} = 100.54 kN > 37.28 kN = V_{Ed}

Ultimate moment M_{Rd} = 53.76 kNm > 48.77 kNm = M_{Ed}

Cross-section is SATISFACTORY.

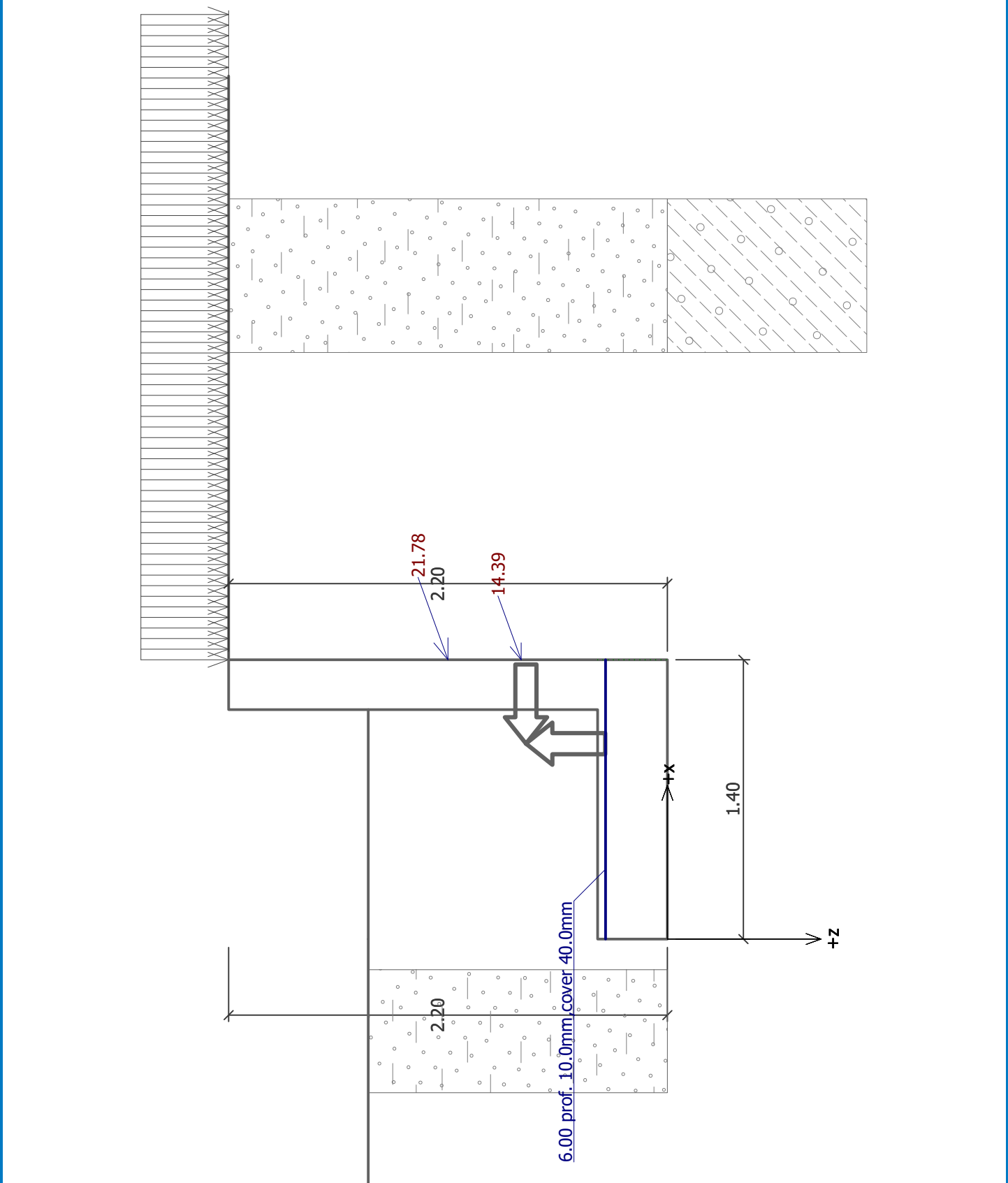
Name : Dimensioning

Stage : 1; Dimensioning : 1



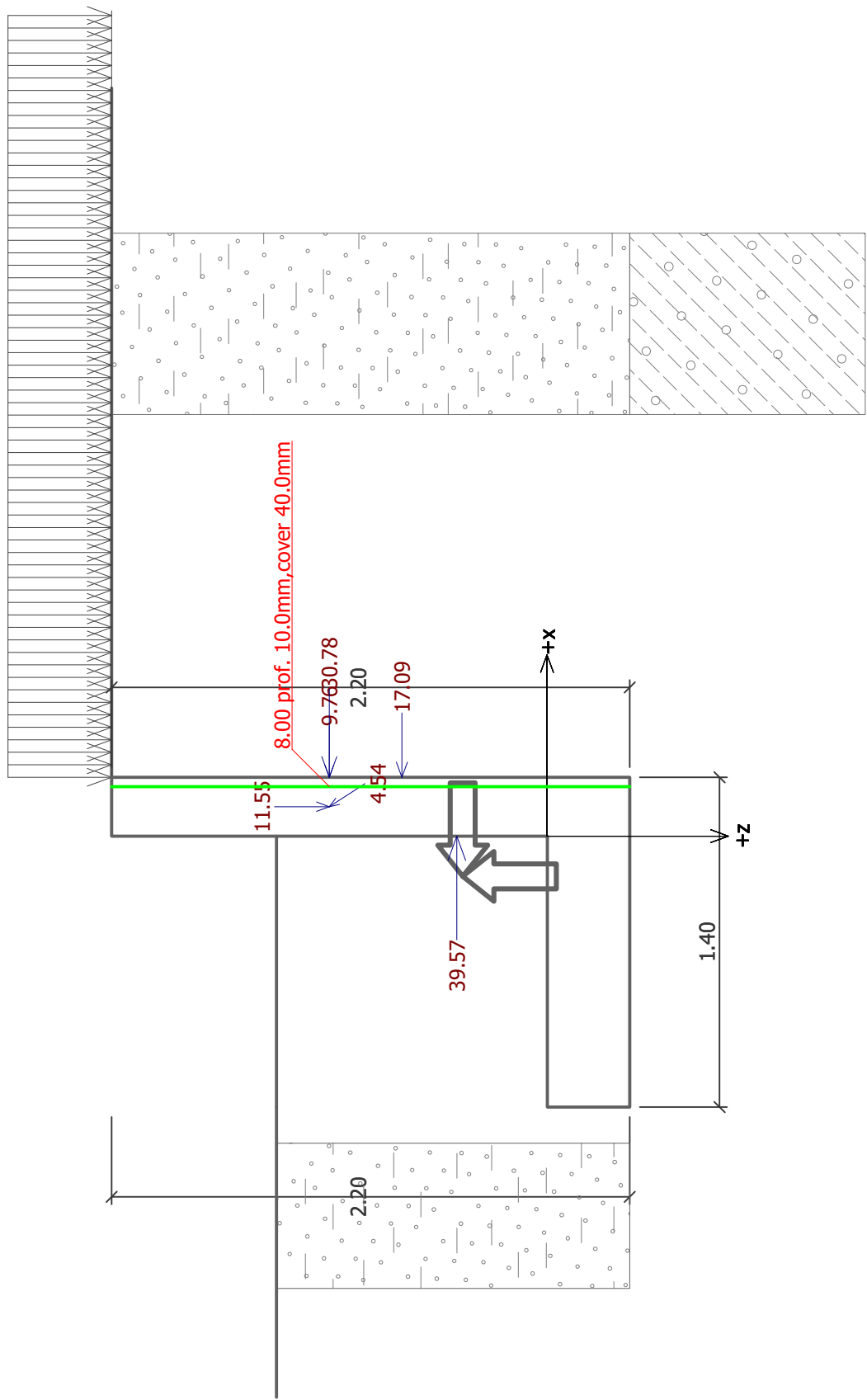
Name : Dimensioning

Stage - analysis : 1 - 1



Name : Dimensioning

Stage - analysis : 1 - 1



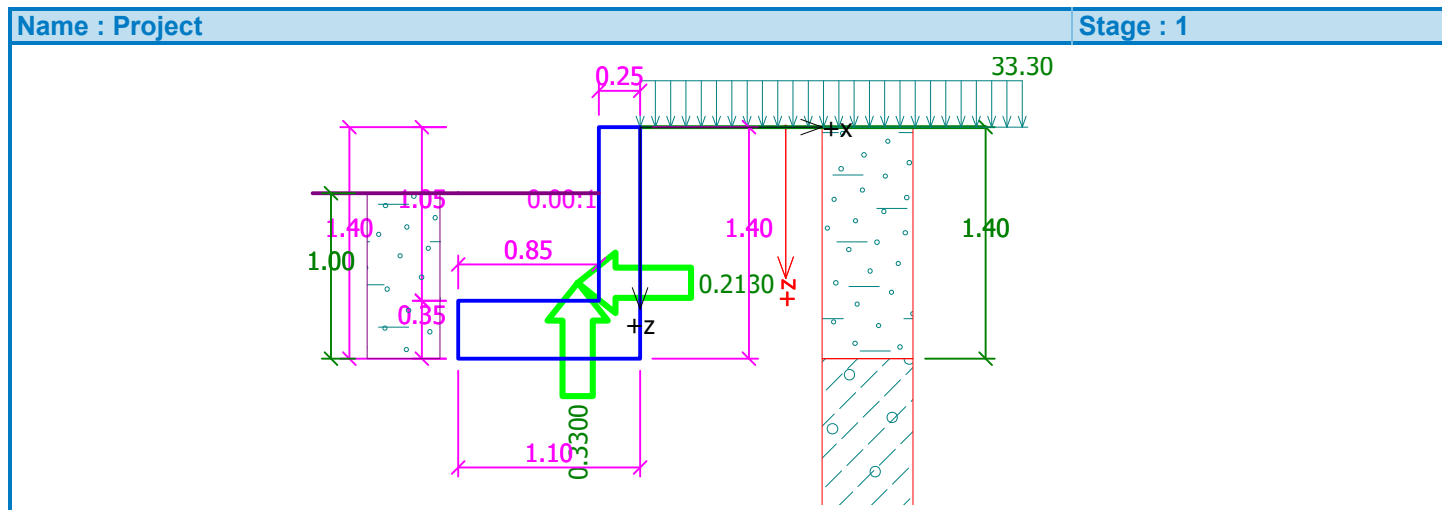
Cantilever wall analysis

Input data

Project

Task : Potporni zid PZ - tip 2 u zasipu

Date : 2/2/2024



Settings

Standard - EN 1997 - DA2

Materials and standards

Concrete structures : EN 1992-1-1 (EC2)

Coefficients EN 1992-1-1 : standard

Wall analysis

Active earth pressure calculation : Coulomb

Passive earth pressure calculation : Caquot-Kerisel

Earthquake analysis : Mononobe-Okabe

Shape of earth wedge : Calculate as skew

Base key : The base key is considered as inclined footing bottom

Verification methodology : according to EN 1997

Design approach : 2 - reduction of actions and resistances

Partial factors on actions (A)			
Permanent design situation			
		Unfavourable	Favourable
Permanent actions :	$\gamma_G =$	1.35 [-]	1.00 [-]
Variable actions :	$\gamma_Q =$	1.50 [-]	0.00 [-]
Water load :	$\gamma_w =$	1.35 [-]	

Partial factors for resistances (R)			
Permanent design situation			
Partial factor on overturning :	$\gamma_{Re} =$	1.40 [-]	
Partial factor on sliding resistance :	$\gamma_{Rh} =$	1.10 [-]	
Partial factor on bearing capacity :	$\gamma_{Rv} =$	1.40 [-]	

Partial factors for variable actions

Permanent design situation

Factor for combination value :	$\psi_0 =$	0.70	[-]
Factor for frequent value :	$\psi_1 =$	0.50	[-]
Factor for quasi-permanent value :	$\psi_2 =$	0.30	[-]

Material of structure

Unit weight $\gamma = 25.00 \text{ kN/m}^3$

Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete : C 25/30

Cylinder compressive strength

 $f_{ck} = 25.00 \text{ MPa}$

Tensile strength

 $f_{ct} = 2.60 \text{ MPa}$

Longitudinal steel : B500

Yield strength

 $f_{yk} = 500.00 \text{ MPa}$

Geometry of structure

No.	Coordinate X [m]	Depth Z [m]
1	0.00	0.00
2	0.00	1.05
3	0.00	1.40
4	-1.10	1.40
5	-1.10	1.05
6	-0.25	1.05
7	-0.25	0.00

The origin [0,0] is located at the most upper right point of the wall.

Wall section area = 0.65 m^2 .

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m ³]	γ_{su} [kN/m ³]	δ [°]
1	nasip		30.00	0.00	20.00	10.00	20.00
2	temeljno tlo		30.00	5.00	20.00	10.00	20.00

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

nasip

Unit weight :

 $\gamma = 20.00 \text{ kN/m}^3$

Stress-state :

effective

Angle of internal friction :

 $\varphi_{ef} = 30.00^\circ$

Cohesion of soil :

 $c_{ef} = 0.00 \text{ kPa}$

Angle of friction struc.-soil :

 $\delta = 20.00^\circ$

Soil :

cohesionless

Saturated unit weight :

 $\gamma_{sat} = 20.00 \text{ kN/m}^3$

temeljno tlo

Unit weight : $\gamma = 20.00 \text{ kN/m}^3$
 Stress-state : effective
 Angle of internal friction : $\varphi_{\text{ef}} = 30.00^\circ$
 Cohesion of soil : $c_{\text{ef}} = 5.00 \text{ kPa}$
 Angle of friction struc.-soil : $\delta = 20.00^\circ$
 Soil : cohesionless
 Saturated unit weight : $\gamma_{\text{sat}} = 20.00 \text{ kN/m}^3$

Geological profile and assigned soils

No.	Layer [m]	Assigned soil	Pattern
1	1.40	nasip	
2	-	temeljno tlo	

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1 [kN/m ²]	Mag.2 [kN/m ²]	Ord.x x [m]	Length l [m]	Depth z [m]
	new	change						
1	YES		permanent	33.30				on terrain

No.	Name
1	saobraćajno opterećenje

Resistance on front face of the structure

Resistance on front face of the structure: passive

Soil on front face of the structure - nasip

Angle of friction struc.-soil $\delta = 0.00^\circ$

Soil thickness in front of structure $h = 1.00 \text{ m}$

Terrain in front of structure is flat.

Earthquake

Horizontal seismic coefficient $k_h = 0.2130$

Vertical seismic coefficient $k_v = 0.3300$

Coeff. to compute point of application $k.H = 0.66$

Water below the GWT is restricted.

Settings of the stage of construction

Design situation : permanent

The wall is free to move. Active earth pressure is therefore assumed.

Verification No. 1**Forces acting on construction**

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Weight - wall	0.00	-0.46	16.19	0.72	1.000	1.000	1.350
Earthq.- constr.	3.45	-0.46	-5.34	0.72	1.000	1.000	1.000
FF resistance	-29.93	-0.33	0.02	0.42	1.000	1.000	1.350
Earthq.- face	0.00	-1.00	-1.96	0.85	1.000	1.000	1.000
Active pressure	5.48	-0.47	1.99	1.10	1.350	1.350	1.350
Earthq.- act.pressure	3.70	-0.92	1.35	1.10	1.000	1.000	1.000
saobraćajno opterećenje	13.02	-0.70	4.74	1.10	1.350	1.350	1.350

Verification of complete wall**Check for overturning stability**Resisting moment $M_{res} = 12.61$ kNm/mOverturning moment $M_{ovr} = 10.78$ kNm/m**Wall for overturning is SATISFACTORY****Check for slip**Resisting horizontal force $H_{res} = 10.16$ kN/mActive horizontal force $H_{act} = 2.19$ kN/m**Wall for slip is SATISFACTORY****Overall check - WALL is SATISFACTORY**

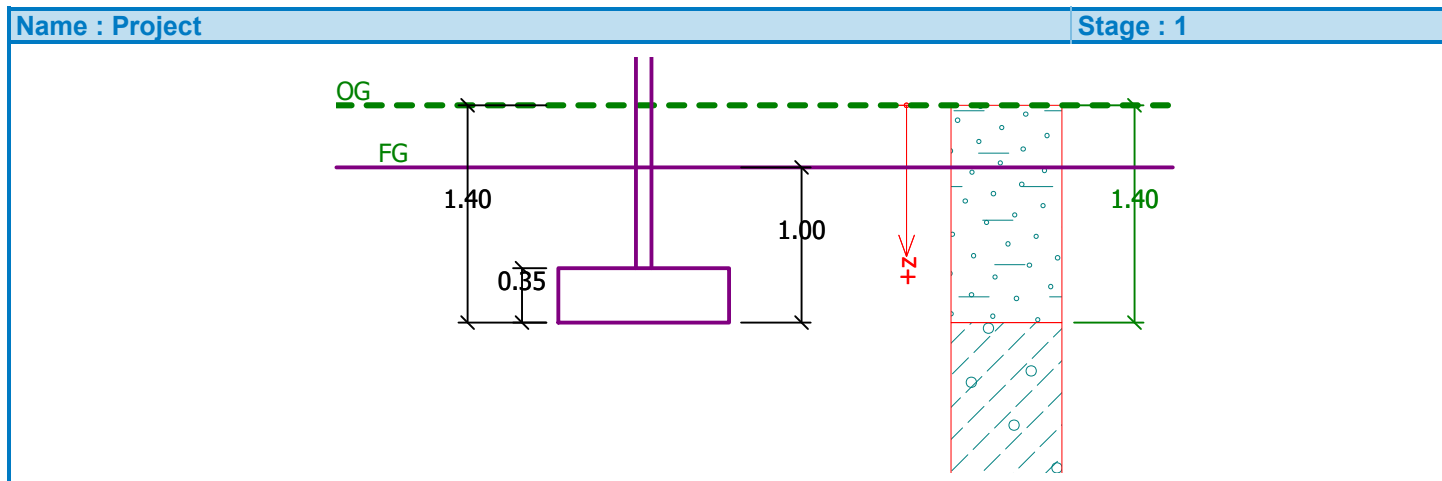
Maximum stress in footing bottom : 22.75 kPa

Bearing capacity of foundation soil**Forces acting at the centre of the footing bottom**

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]	Eccentricity [m]	Stress [kPa]
1	-0.70	25.02	-8.28	0.00	22.75
2	3.76	19.35	2.19	0.19	27.22

Spread footing verification

Input data



Settings

Standard - EN 1997 - DA2

Materials and standards

Concrete structures : EN 1992-1-1 (EC2)

Coefficients EN 1992-1-1 : standard

Settlement

Analysis method : Analysis using oedometric modulus

Restriction of influence zone : by percentage of Sigma, Or

Coeff. of restriction of influence zone : 10.0 [%]

Spread Footing

Analysis for drained conditions : EC 7-1 (EN 1997-1:2003)

Verification methodology : according to EN 1997

Design approach : 2 - reduction of actions and resistances

Partial factors on actions (A)			
Permanent design situation			
		Unfavourable	Favourable
Permanent actions :	$\gamma_G =$	1.35 [-]	1.00 [-]

Partial factors for resistances (R)			
Permanent design situation			
Partial factor on vertical bearing capacity :	$\gamma_{Rvs} =$	1.40 [-]	
Partial factor on sliding resistance :	$\gamma_{Rhs} =$	1.10 [-]	

Basic soil parameters

No.	Name	Pattern	ϕ_{ef} [°]	c_{ef} [kPa]	γ [kN/m ³]	γ_{su} [kN/m ³]	δ [°]
1	nasip		30.00	0.00	20.00	10.00	20.00
2	temeljno tlo		30.00	5.00	20.00	10.00	20.00

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters**nasip**

Unit weight :	γ	=	20.00 kN/m ³
Angle of internal friction :	φ_{ef}	=	30.00 °
Cohesion of soil :	c_{ef}	=	0.00 kPa
Deformation modulus :	E_{def}	=	1.37 MPa
Poisson's ratio :	ν	=	0.33
Saturated unit weight :	γ_{sat}	=	20.00 kN/m ³

temeljno tlo

Unit weight :	γ	=	20.00 kN/m ³
Angle of internal friction :	φ_{ef}	=	30.00 °
Cohesion of soil :	c_{ef}	=	5.00 kPa
Deformation modulus :	E_{def}	=	6.74 MPa
Poisson's ratio :	ν	=	0.33
Saturated unit weight :	γ_{sat}	=	20.00 kN/m ³

Foundation**Foundation type: strip footing**

Depth from original ground surface	h_z	=	1.40 m
Depth of footing bottom	d	=	1.00 m
Foundation thickness	t	=	0.35 m
Incl. of finished grade	s_1	=	0.00 °
Incl. of footing bottom	s_2	=	0.00 °

Unit weight of soil above foundation = 20.00 kN/m³

Geometry of structure**Foundation type: strip footing**

Overall strip footing length	=	3.05 m
Strip footing width (x)	=	1.10 m
Column width in the direction of x	=	0.10 m
Volume of strip footing	=	0.39 m ³ /m

Inserted loading is considered per unit length of continuous footing span.

Material of structure

Unit weight γ = 25.00 kN/m³

Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete : C 25/30

Cylinder compressive strength	f_{ck}	=	25.00 MPa
Tensile strength	f_{ct}	=	2.60 MPa
Elasticity modulus	E_{cm}	=	31000.00 MPa

Longitudinal steel : B500

Yield strength	f_{yk}	=	500.00 MPa
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Transverse steel: B500

Yield strength	f_{yk}	=	500.00 MPa
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Geological profile and assigned soils

No.	Layer [m]	Assigned soil	Pattern
1	1.40	nasip	
2	-	temeljno tlo	

Load

No.	Load new	Load change	Name	Type	N [kN/m]	M _y [kNm/m]	H _x [kN/m]
1	YES		LC 1	Service	2.40	0.00	0.00
2	YES		LC 2	Design	2.40	0.00	0.00
3	YES		LC 3	Service	-3.28	3.00	-2.19
4	YES		LC 4	Design	-3.28	3.00	-2.19

Global settings

Analysis type : analysis for drained conditions

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Load case verification

Name	Self w. in favor	e _x [m]	e _y [m]	σ [kPa]	R _d [kPa]	Utilization [%]	Is satisfied
LC 2	Yes	0.00	0.00	22.75	579.27	3.93	Yes
LC 2	No	0.00	0.00	29.95	579.27	5.17	Yes
LC 4	Yes	-0.19	0.00	27.22	434.27	6.27	Yes
LC 4	No	-0.14	0.00	33.09	472.17	7.01	Yes

Analysis carried out with automatic selection of the most unfavourable load cases.

Computed self weight of strip foundation $G = 12.99$ kN/m

Computed weight of overburden $Z = 17.55$ kN/m

Vertical bearing capacity check

Shape of contact stress : rectangle

Most severe load case No. 4. (LC 4)

Parameters of slip surface below foundation:

Depth of slip surface $z_{sp} = 1.74$ m

Length of slip surface $l_{sp} = 5.27$ m

Design bearing capacity of found.soil $R_d = 472.17$ kPa

Extreme contact stress $\sigma = 33.09$ kPa

Bearing capacity in the vertical direction is SATISFACTORY

Horizontal bearing capacity check

Most severe load case No. 4. (LC 4)

Earth resistance: not considered

Friction angle foundation-footing bottom $\psi = 30.00^\circ$

Cohesion foundation-footing bottom $a = 5.00 \text{ kPa}$

Horizontal bearing capacity $R_{dh} = 10.16 \text{ kN}$

Extreme horizontal force $H = 2.19 \text{ kN}$

Bearing capacity in the horizontal direction is SATISFACTORY

Bearing capacity of foundation is SATISFACTORY

Verification No. 1

Settlement and rotation of foundation - input data

Analysis carried out with automatic selection of the most unfavourable load cases.

Analysis carried out with accounting for coefficient κ_1 (influence of foundation depth).

Stress at the footing bottom considered from the finished grade.

Computed self weight of strip foundation $G = 9.63 \text{ kN/m}$

Computed weight of overburden $Z = 13.00 \text{ kN/m}$

Settlement of mid point of longitudinal edge $= 0.0 \text{ mm}$

Settlement of mid point of transverse edge 1 $= 0.0 \text{ mm}$

Settlement of mid point of transverse edge 2 $= 0.0 \text{ mm}$

(1-max.compressed edge; 2-min.compressed edge)

Settlement and rotation of foundation - results

Foundation stiffness:

Computed weighted average modulus of deformation $E_{def} = 6.74 \text{ MPa}$

Foundation in the longitudinal direction is rigid ($k=148.16$)

Foundation in the direction of width is rigid ($k=197.20$)

Overall settlement and rotation of foundation:

Foundation settlement $= 0.0 \text{ mm}$

Depth of influence zone $= 0.01 \text{ m}$

Rotation in direction of width $= 0.267 \text{ (tan}^\circ \cdot 1000)$

Dimensioning No. 1

Analysis carried out with automatic selection of the most unfavourable load cases.

Verification of longitudinal reinforcement of foundation in the direction of x

Bar diameter $= 10.0 \text{ mm}$

Number of bars $= 7$

Reinforcement cover $= 40.0 \text{ mm}$

Cross-section width $= 1.00 \text{ m}$

Cross-section depth $= 0.35 \text{ m}$

Reinforcement ratio $\rho = 0.18 \% > 0.14 \% = \rho_{min}$

Position of neutral axis $x = 0.02 \text{ m} < 0.19 \text{ m} = x_{max}$

Ultimate moment $M_{Rd} = 71.19 \text{ kNm} > 2.03 \text{ kNm} = M_{Ed}$

Cross-section is SATISFACTORY.

Spread footing for punching shear failure check

Column normal force = -3.28 kN

Compression chord adjacent to the column

Force transmitted into found. soil	= -0.30 kN
Force transmitted by shear strength of SRC	= -2.98 kN
Considered column perimeter	$u_0 = 0.91 \text{ m}$
Shear resistance at the column perimeter	$v_{Ed,max} = 0.11 \text{ MPa}$
Resist. of the compr. chord adjacent to the column	$v_{Rd,max} = 4.50 \text{ MPa}$

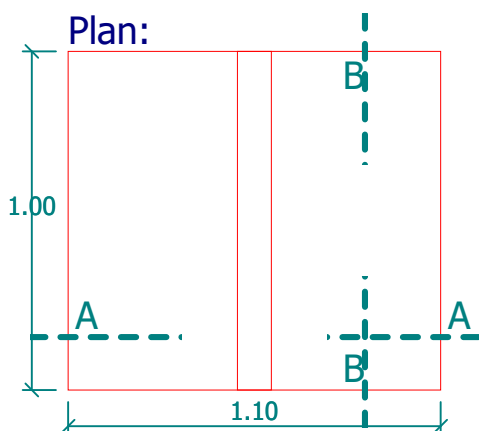
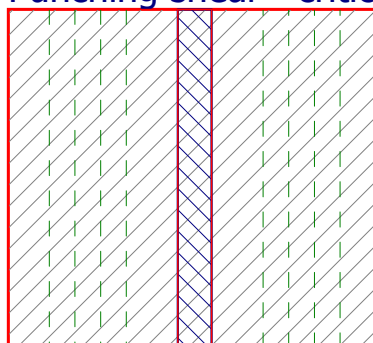
Critical section without shear reinforcement

Force transmitted into found. soil	= -2.11 kN
Force transmitted by shear strength of SRC	= -1.17 kN
Distance of section from the column	= 0.30 m
Section perimeter	$u_{cr} = 2.00 \text{ m}$
Shear stress at section	$v_{Ed} = 0.01 \text{ MPa}$
Shear resistance of section without shear reinforcement	$v_{Rd,c} = 0.85 \text{ MPa}$

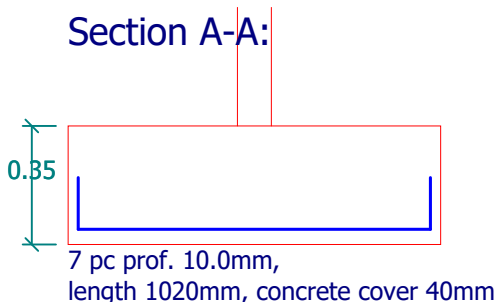
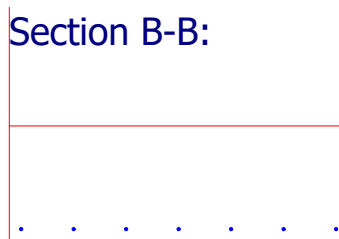
 $v_{Ed} < v_{Rd,c} \Rightarrow$ Reinforcement is not required**Spread footing for punching shear is SATISFACTORY**

Name : Dimensioning

Stage : 1; Dimensioning : 1

**Punching shear - critical cross-section:**

 Loading area transmitted by RC through shear area: $1.00E-01\text{m}^2$
 critical cross-section length: 2.00m
 checked cross-sections



Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. moment	Coeff. norm.force	Coeff. shear for.
Weight - wall	0.00	-0.52	6.55	0.12	1.000	1.350	1.000
Earthq.- constr.	1.40	-0.52	-2.16	0.12	1.000	1.000	1.000
FF resistance	-12.62	-0.22	0.00	0.00	1.000	1.000	1.000
Earthq.- face	0.00	-0.65	0.00	0.00	1.000	1.000	1.000
Pressure at rest	5.50	-0.35	0.00	0.25	1.350	1.000	1.350
Earthquake - pressure at rest	3.14	-0.52	0.00	0.25	1.000	1.000	1.000
saobraćajno opterećenje	17.46	-0.52	0.00	0.25	1.350	1.000	1.350

Wall stem check

Reinforcement and dimensions of the cross-section

Bar diameter = 10.0 mm

Number of bars = 6

Reinforcement cover = 40.0 mm

Cross-section width = 1.00 m

Cross-section depth = 0.25 m

Reinforcement ratio ρ = 0.23 % > 0.14 % = ρ_{min}

Position of neutral axis x = 0.02 m < 0.13 m = x_{max}

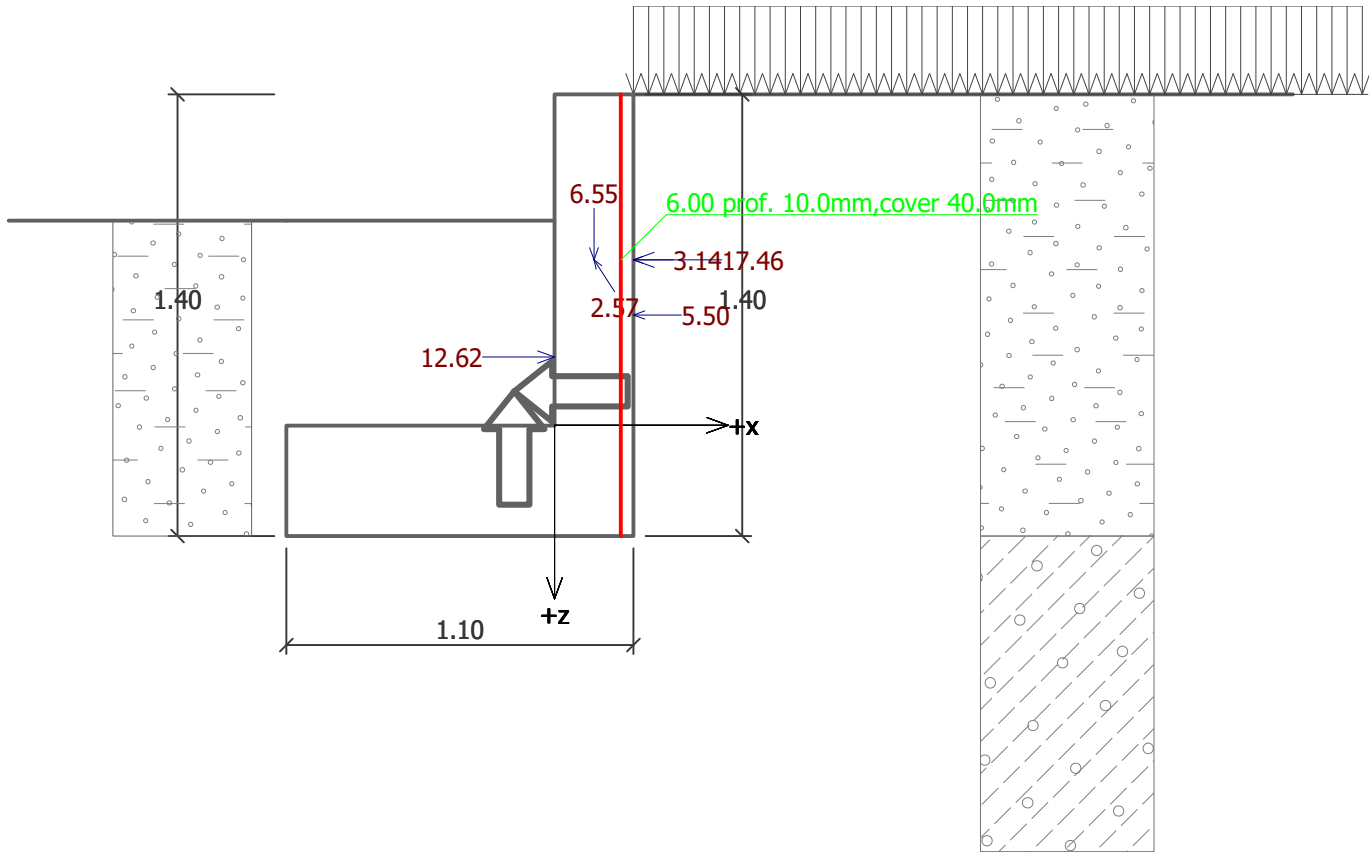
Ultimate shear force V_{Rd} = 100.54 kN > 22.91 kN = V_{Ed}

Ultimate moment M_{Rd} = 40.74 kNm > 14.61 kNm = M_{Ed}

Cross-section is SATISFACTORY.

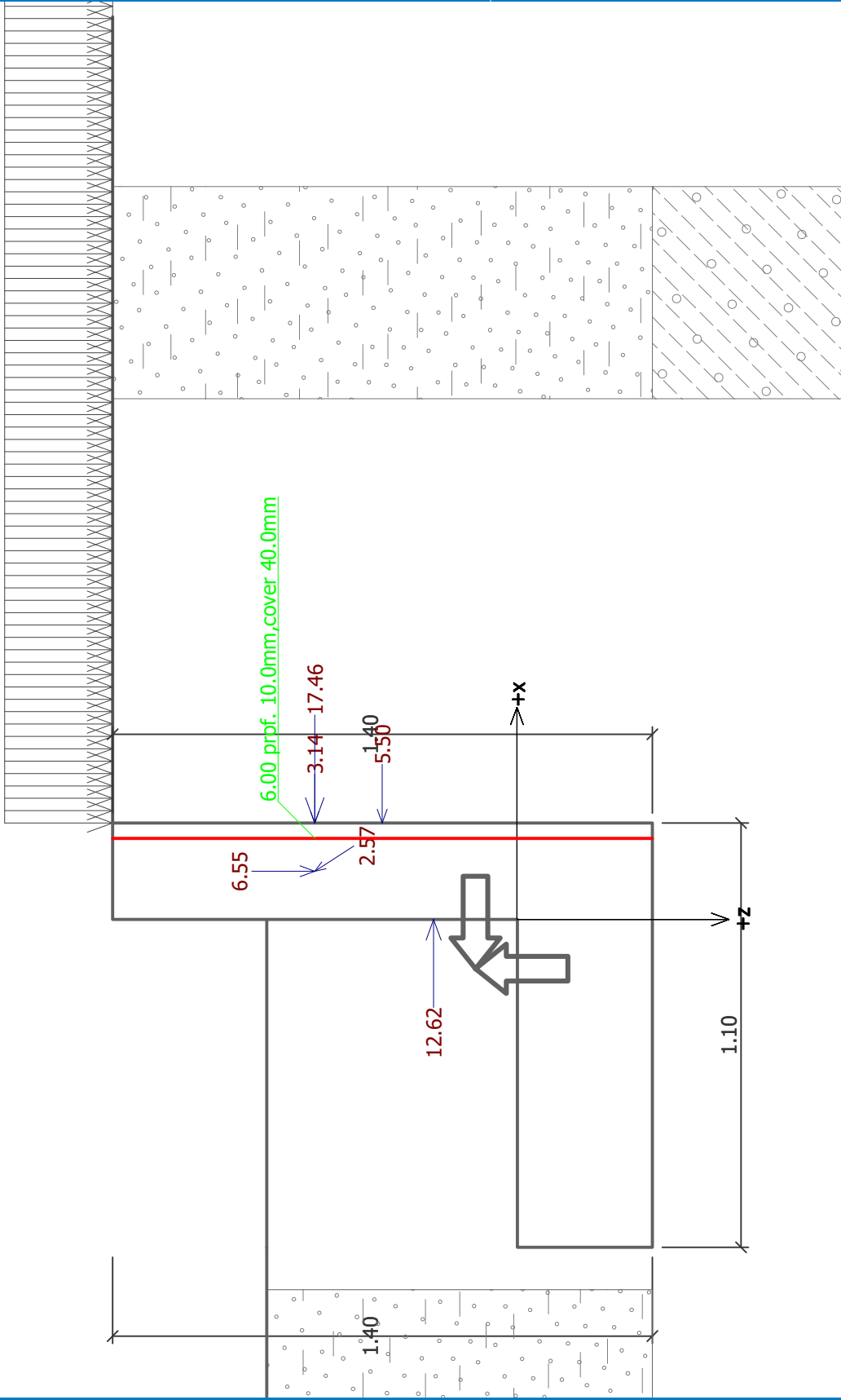
Name : Dimensioning

Stage : 1; Dimensioning : 1



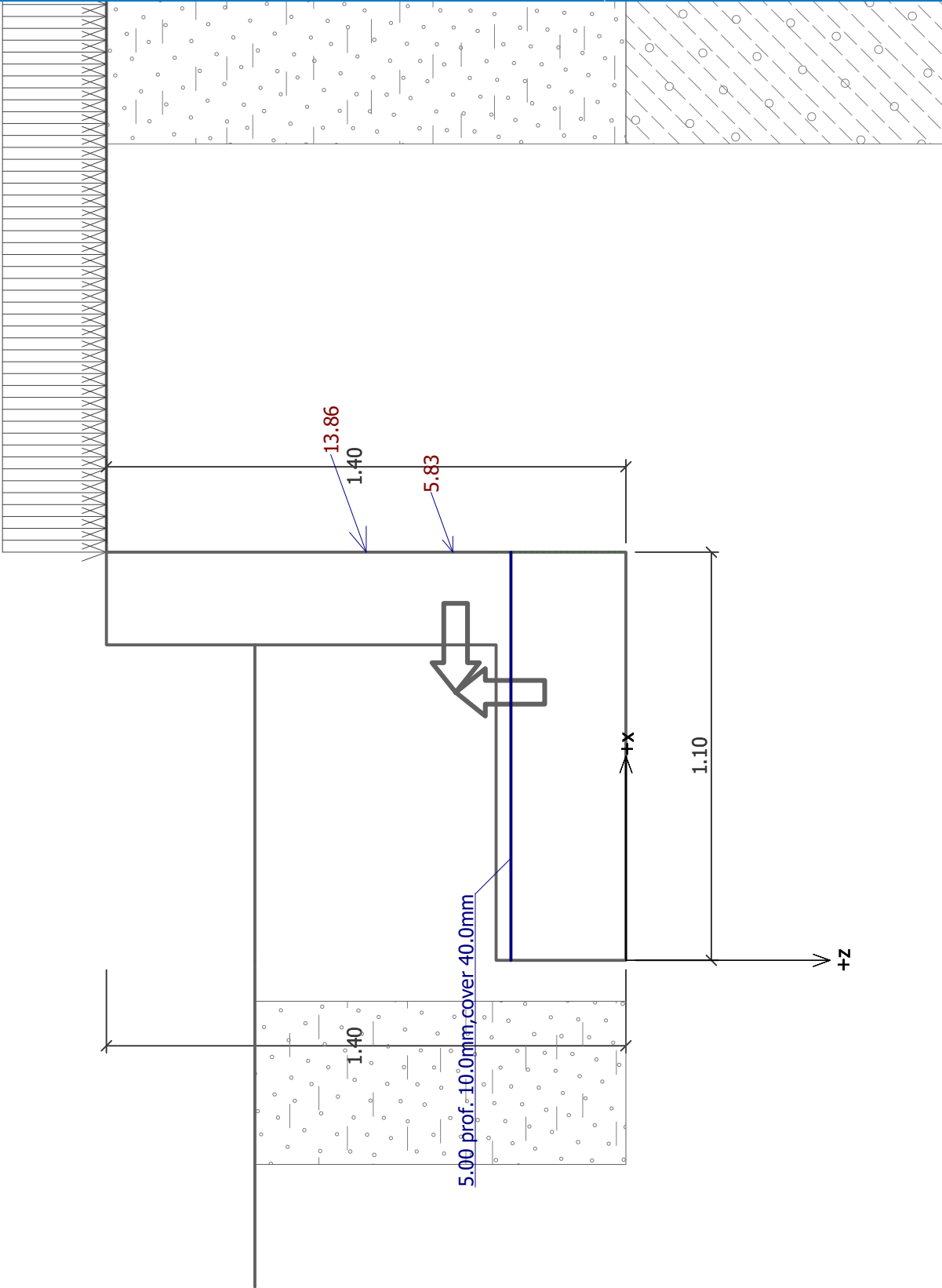
Name : Dimensioning

Stage - analysis : 1 - 1



Name : Dimensioning

Stage - analysis : 1 - 1

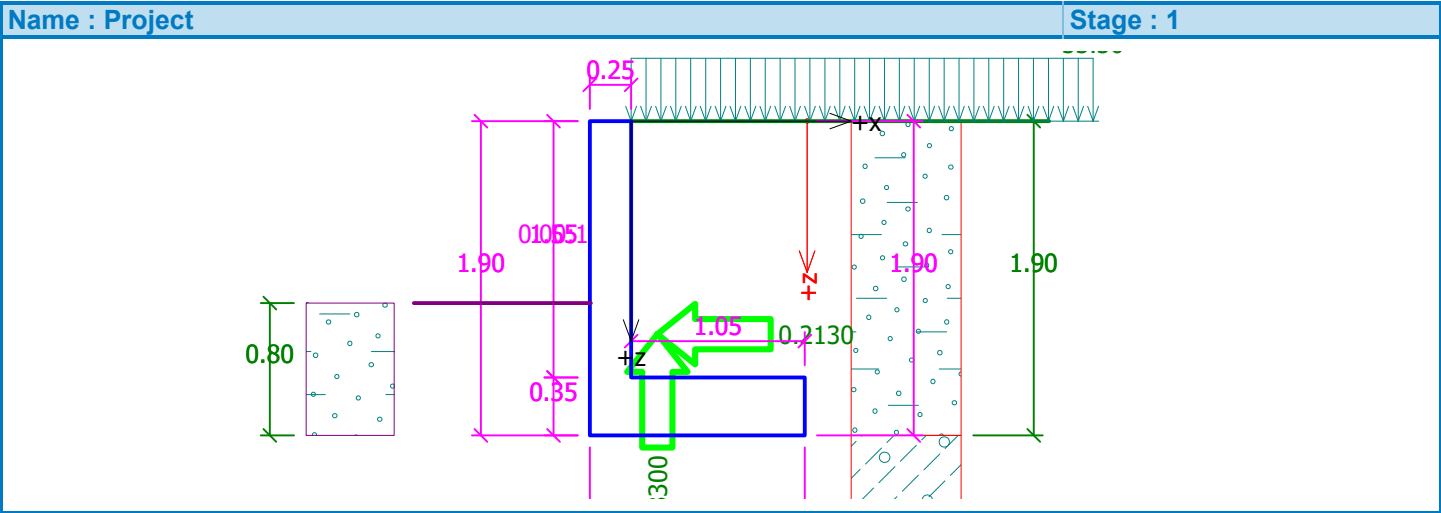


Cantilever wall analysis

Input data

Project

Task : Potporni zid PZ 1- Ulica Bar
Date : 2/2/2024



Settings

Standard - EN 1997 - DA2

Materials and standards

Concrete structures : EN 1992-1-1 (EC2)
Coefficients EN 1992-1-1 : standard

Wall analysis

Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Caquot-Kerisel
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Base key : The base key is considered as inclined footing bottom
Verification methodology : according to EN 1997
Design approach : 2 - reduction of actions and resistances

Partial factors on actions (A)			
Permanent design situation			
		Unfavourable	Favourable
Permanent actions :	$\gamma_G =$	1.35 [-]	1.00 [-]
Variable actions :	$\gamma_Q =$	1.50 [-]	0.00 [-]
Water load :	$\gamma_w =$	1.35 [-]	

Partial factors for resistances (R)			
Permanent design situation			
Partial factor on overturning :	$\gamma_{Re} =$	1.40 [-]	
Partial factor on sliding resistance :	$\gamma_{Rh} =$	1.10 [-]	
Partial factor on bearing capacity :	$\gamma_{Rv} =$	1.40 [-]	

Partial factors for variable actions

Permanent design situation

Factor for combination value :	$\psi_0 =$	0.70	[-]
Factor for frequent value :	$\psi_1 =$	0.50	[-]
Factor for quasi-permanent value :	$\psi_2 =$	0.30	[-]

Material of structure

Unit weight $\gamma = 25.00 \text{ kN/m}^3$

Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete : C 25/30

Cylinder compressive strength

 $f_{ck} = 25.00 \text{ MPa}$

Tensile strength

 $f_{ct} = 2.60 \text{ MPa}$

Longitudinal steel : B500

Yield strength

 $f_{yk} = 500.00 \text{ MPa}$

Geometry of structure

No.	Coordinate X [m]	Depth Z [m]
1	0.00	0.00
2	0.00	1.55
3	1.05	1.55
4	1.05	1.90
5	-0.25	1.90
6	-0.25	1.55
7	-0.25	0.00

The origin [0,0] is located at the most upper right point of the wall.

Wall section area = 0.84 m^2 .

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m ³]	γ_{su} [kN/m ³]	δ [°]
1	nasip		30.00	0.00	20.00	10.00	20.00
2	temeljno tlo		30.00	5.00	20.00	10.00	20.00

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

nasip

Unit weight :

 $\gamma = 20.00 \text{ kN/m}^3$

Stress-state :

effective

Angle of internal friction :

 $\varphi_{ef} = 30.00^\circ$

Cohesion of soil :

 $c_{ef} = 0.00 \text{ kPa}$

Angle of friction struc.-soil :

 $\delta = 20.00^\circ$

Soil :

cohesionless

Saturated unit weight :

 $\gamma_{sat} = 20.00 \text{ kN/m}^3$

temeljno tlo

Unit weight : $\gamma = 20.00 \text{ kN/m}^3$
 Stress-state : effective
 Angle of internal friction : $\varphi_{\text{ef}} = 30.00^\circ$
 Cohesion of soil : $c_{\text{ef}} = 5.00 \text{ kPa}$
 Angle of friction struc.-soil : $\delta = 20.00^\circ$
 Soil : cohesionless
 Saturated unit weight : $\gamma_{\text{sat}} = 20.00 \text{ kN/m}^3$

Geological profile and assigned soils

No.	Layer [m]	Assigned soil	Pattern
1	1.90	nasip	
2	-	temeljno tlo	

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1 [kN/m ²]	Mag.2 [kN/m ²]	Ord.x x [m]	Length l [m]	Depth z [m]
	new	change						
1	YES		permanent	33.30				on terrain

No.	Name
1	saobraćajno opterećenje

Resistance on front face of the structure

Resistance on front face of the structure: passive

Soil on front face of the structure - nasip

Angle of friction struc.-soil $\delta = 0.00^\circ$

Soil thickness in front of structure $h = 0.80 \text{ m}$

Terrain in front of structure is flat.

Earthquake

Horizontal seismic coefficient $k_h = 0.2130$

Vertical seismic coefficient $k_v = 0.3300$

Coeff. to compute point of application $k.H = 0.66$

Water below the GWT is restricted.

Settings of the stage of construction

Design situation : permanent

The wall is free to move. Active earth pressure is therefore assumed.

Verification No. 1**Forces acting on construction**

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Weight - wall	0.00	-0.61	21.06	0.41	1.000	1.000	1.350
Earthq.- constr.	4.49	-0.61	-6.95	0.41	1.000	1.000	1.000
FF resistance	-19.19	-0.27	0.00	0.00	1.000	1.000	1.000
Earthq.- face	0.00	-0.80	0.00	0.00	1.000	1.000	1.000
Weight - earth wedge	0.00	-0.93	18.68	0.61	1.000	1.000	1.350
Earthquake - soil wedge	3.98	-0.93	-6.16	0.61	1.000	1.000	1.000
Active pressure	11.38	-0.66	15.10	1.03	1.350	1.350	1.350
Earthq.- act.pressure	9.77	-1.25	16.61	0.78	1.000	1.000	1.000
saobraćajno opterećenje	20.46	-0.97	30.98	0.87	1.350	1.350	1.350
saobraćajno opterećenje	0.00	-1.90	5.16	0.33	1.000	1.000	1.350

Verification of complete wall**Check for overturning stability**Resisting moment $M_{res} = 60.90$ kNm/mOverturning moment $M_{ovr} = 50.63$ kNm/m**Wall for overturning is SATISFACTORY****Check for slip**Resisting horizontal force $H_{res} = 58.06$ kN/mActive horizontal force $H_{act} = 42.04$ kN/m**Wall for slip is SATISFACTORY****Overall check - WALL is SATISFACTORY**

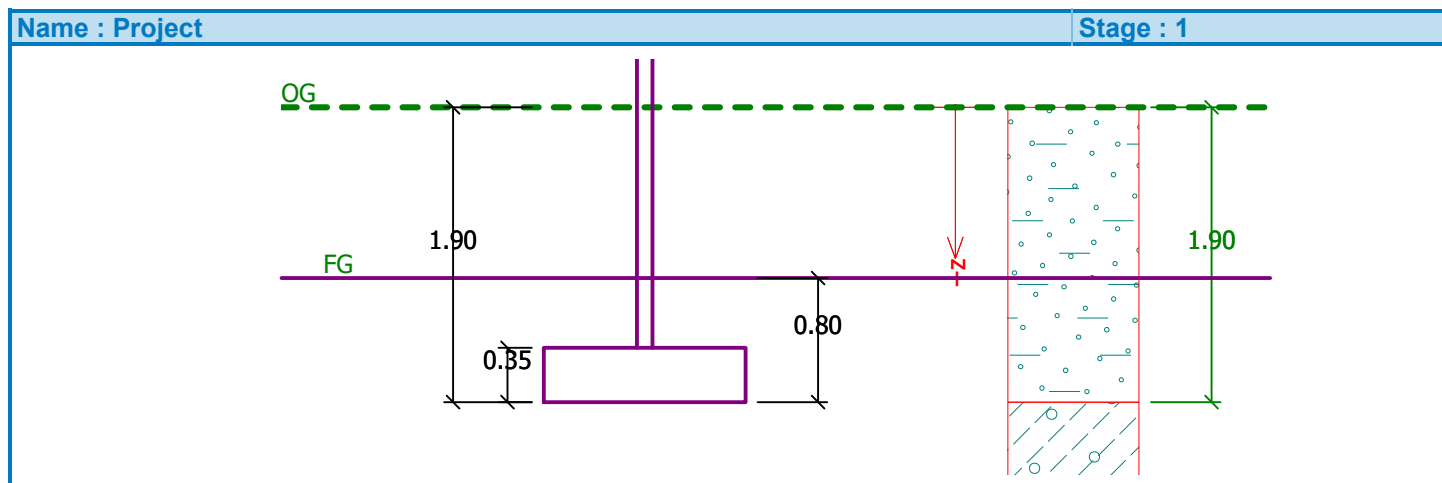
Maximum stress in footing bottom : 189.10 kPa

Bearing capacity of foundation soil**Forces acting at the centre of the footing bottom**

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]	Eccentricity [m]	Stress [kPa]
1	39.92	126.33	42.04	0.32	189.10
2	37.27	110.61	42.04	0.34	176.66

Spread footing verification

Input data



Settings

Standard - EN 1997 - DA2

Materials and standards

Concrete structures : EN 1992-1-1 (EC2)

Coefficients EN 1992-1-1 : standard

Settlement

Analysis method : Analysis using oedometric modulus

Restriction of influence zone : by percentage of Sigma, Or

Coeff. of restriction of influence zone : 10.0 [%]

Spread Footing

Analysis for drained conditions : EC 7-1 (EN 1997-1:2003)

Verification methodology : according to EN 1997

Design approach : 2 - reduction of actions and resistances

Partial factors on actions (A)			
Permanent design situation			
		Unfavourable	Favourable
Permanent actions :	$\gamma_G =$	1.35 [-]	1.00 [-]

Partial factors for resistances (R)			
Permanent design situation			
Partial factor on vertical bearing capacity :	$\gamma_{Rvs} =$	1.40 [-]	
Partial factor on sliding resistance :	$\gamma_{Rhs} =$	1.10 [-]	

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m ³]	γ_{su} [kN/m ³]	δ [°]
1	nasip		30.00	0.00	20.00	10.00	20.00
2	temeljno tlo		30.00	5.00	20.00	10.00	20.00

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters**nasip**

Unit weight :	γ	=	20.00 kN/m ³
Angle of internal friction :	φ_{ef}	=	30.00 °
Cohesion of soil :	c_{ef}	=	0.00 kPa
Deformation modulus :	E_{def}	=	1.37 MPa
Poisson's ratio :	ν	=	0.33
Saturated unit weight :	γ_{sat}	=	20.00 kN/m ³

temeljno tlo

Unit weight :	γ	=	20.00 kN/m ³
Angle of internal friction :	φ_{ef}	=	30.00 °
Cohesion of soil :	c_{ef}	=	5.00 kPa
Deformation modulus :	E_{def}	=	6.74 MPa
Poisson's ratio :	ν	=	0.33
Saturated unit weight :	γ_{sat}	=	20.00 kN/m ³

Foundation**Foundation type: strip footing**

Depth from original ground surface	h_z	=	1.90 m
Depth of footing bottom	d	=	0.80 m
Foundation thickness	t	=	0.35 m
Incl. of finished grade	s_1	=	0.00 °
Incl. of footing bottom	s_2	=	0.00 °

Unit weight of soil above foundation = 20.00 kN/m³

Geometry of structure**Foundation type: strip footing**

Overall strip footing length	=	3.05 m
Strip footing width (x)	=	1.30 m
Column width in the direction of x	=	0.10 m
Volume of strip footing	=	0.46 m ³ /m

Inserted loading is considered per unit length of continuous footing span.

Material of structure

Unit weight γ = 25.00 kN/m³

Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete : C 25/30

Cylinder compressive strength	f_{ck}	=	25.00 MPa
Tensile strength	f_{ct}	=	2.60 MPa
Elasticity modulus	E_{cm}	=	31000.00 MPa

Longitudinal steel : B500

Yield strength	f_{yk}	=	500.00 MPa
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Transverse steel: B500

Yield strength	f_{yk}	=	500.00 MPa
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Geological profile and assigned soils

No.	Layer [m]	Assigned soil	Pattern
1	1.90	nasip	
2	-	temeljno tlo	

Load

No.	Load new	Load change	Name	Type	N [kN/m]	M _y [kNm/m]	H _x [kN/m]
1	YES		LC 1	Service	104.16	25.20	-42.04
2	YES		LC 2	Design	104.16	25.20	-42.04
3	YES		LC 3	Service	88.44	22.56	-42.04
4	YES		LC 4	Design	88.44	22.56	-42.04

Global settings

Analysis type : analysis for drained conditions

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Load case verification

Name	Self w. in favor	e _x [m]	e _y [m]	σ [kPa]	R _d [kPa]	Utilization [%]	Is satisfied
LC 2	Yes	-0.32	0.00	189.10	223.61	84.57	Yes
LC 2	No	-0.30	0.00	190.30	238.32	79.85	Yes
LC 4	Yes	-0.34	0.00	176.66	194.69	90.74	Yes
LC 4	No	-0.31	0.00	176.60	212.22	83.22	Yes

Analysis carried out with automatic selection of the most unfavourable load cases.

Computed self weight of strip foundation $G = 11.38 \text{ kN/m}$

Computed weight of overburden $Z = 10.80 \text{ kN/m}$

Vertical bearing capacity check

Shape of contact stress : rectangle

Most severe load case No. 4. (LC 4)

Parameters of slip surface below foundation:

Depth of slip surface $z_{sp} = 2.06 \text{ m}$

Length of slip surface $l_{sp} = 6.23 \text{ m}$

Design bearing capacity of found.soil $R_d = 194.69 \text{ kPa}$

Extreme contact stress $\sigma = 176.66 \text{ kPa}$

Bearing capacity in the vertical direction is SATISFACTORY

Horizontal bearing capacity check

Most severe load case No. 4. (LC 4)

Earth resistance: not considered

Friction angle foundation-footing bottom $\psi = 30.00^\circ$

Cohesion foundation-footing bottom $a = 5.00 \text{ kPa}$

Horizontal bearing capacity $R_{dh} = 58.06 \text{ kN}$

Extreme horizontal force $H = 42.04 \text{ kN}$

Bearing capacity in the horizontal direction is SATISFACTORY

Bearing capacity of foundation is SATISFACTORY

Verification No. 1

Settlement and rotation of foundation - input data

Analysis carried out with automatic selection of the most unfavourable load cases.

Analysis carried out with accounting for coefficient κ_1 (influence of foundation depth).

Stress at the footing bottom considered from the finished grade.

Computed self weight of strip foundation $G = 11.38 \text{ kN/m}$

Computed weight of overburden $Z = 10.80 \text{ kN/m}$

Settlement of mid point of longitudinal edge $= 6.2 \text{ mm}$

Settlement of mid point of transverse edge 1 $= 11.8 \text{ mm}$

Settlement of mid point of transverse edge 2 $= 5.4 \text{ mm}$

(1-max.compressed edge; 2-min.compressed edge)

Settlement and rotation of foundation - results

Foundation stiffness:

Computed weighted average modulus of deformation $E_{def} = 6.74 \text{ MPa}$

Foundation in the longitudinal direction is rigid ($k=89.76$)

Foundation in the direction of width is rigid ($k=197.20$)

Overall settlement and rotation of foundation:

Foundation settlement $= 8.5 \text{ mm}$

Depth of influence zone $= 2.93 \text{ m}$

Rotation in direction of width $= 4.914 \text{ (tan}^\circ \cdot 1000)$

Dimensioning No. 1

Analysis carried out with automatic selection of the most unfavourable load cases.

Verification of longitudinal reinforcement of foundation in the direction of x

Bar diameter $= 10.0 \text{ mm}$

Number of bars $= 7$

Reinforcement cover $= 40.0 \text{ mm}$

Cross-section width $= 1.00 \text{ m}$

Cross-section depth $= 0.35 \text{ m}$

Reinforcement ratio $\rho = 0.18 \% > 0.14 \% = \rho_{min}$

Position of neutral axis $x = 0.02 \text{ m} < 0.19 \text{ m} = x_{max}$

Ultimate moment $M_{Rd} = 71.19 \text{ kNm} > 34.51 \text{ kNm} = M_{Ed}$

Cross-section is SATISFACTORY.

Spread footing for punching shear failure check

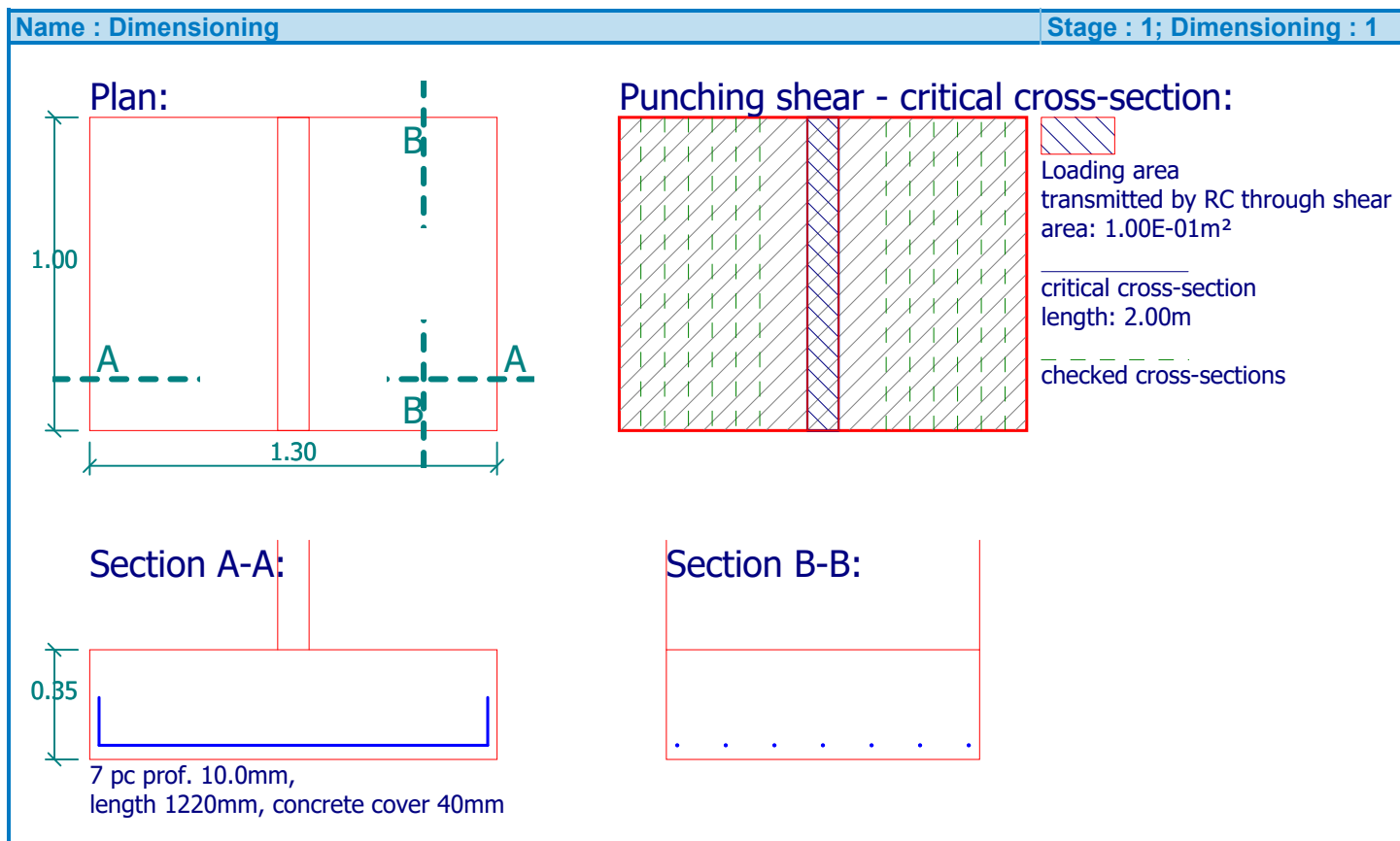
Column normal force = 104.16 kN

Compression chord adjacent to the column

Force transmitted into found. soil	=	8.01 kN
Force transmitted by shear strength of SRC	=	96.14 kN
Considered column perimeter	u_0	= 0.91 m
Shear resistance at the column perimeter	$v_{Ed,max}$	= 1.17 MPa
Resist. of the compr. chord adjacent to the column	$v_{Rd,max}$	= 4.50 MPa

Critical section without shear reinforcement

Force transmitted into found. soil	=	56.65 kN
Force transmitted by shear strength of SRC	=	47.51 kN
Distance of section from the column	=	0.30 m
Section perimeter	u_{cr}	= 2.00 m
Shear stress at section	v_{Ed}	= 0.13 MPa
Shear resistance of section without shear reinforcement	$v_{Rd,c}$	= 0.85 MPa

 $v_{Ed} < v_{Rd,c} \Rightarrow$ Reinforcement is not required**Spread footing for punching shear is SATISFACTORY**

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Design coefficient
Weight - wall	0.00	-0.17	9.19	0.78	1.350
Weight - earth wedge	0.00	-0.93	18.68	0.61	1.350
Active pressure	11.38	-0.66	15.10	1.03	1.350
saobraćajno opterećenje	20.46	-0.97	30.98	0.87	1.350
Contact tractions	0.00	0.00	-71.16	0.50	1.000
Gravity surch. 1	0.00	-1.90	5.16	0.33	1.350

Back wall jump check

Reinforcement and dimensions of the cross-section

Bar diameter = 10.0 mm

Number of bars = 7

Reinforcement cover = 40.0 mm

Cross-section width = 1.00 m

Cross-section depth = 0.35 m

Reinforcement ratio ρ = 0.18 % > 0.14 % = ρ_{min}

Position of neutral axis x = 0.02 m < 0.19 m = x_{max}

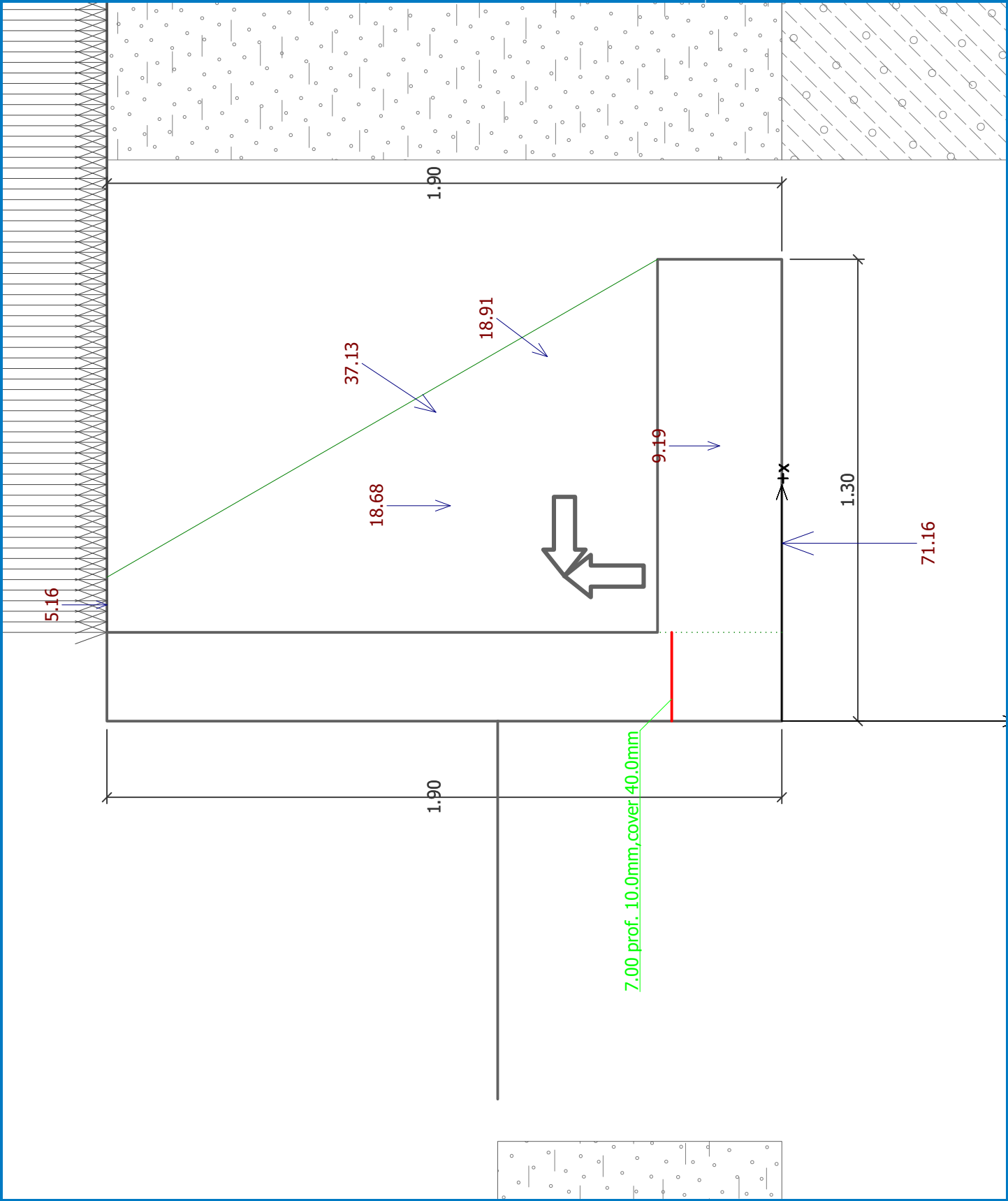
Ultimate shear force V_{Rd} = 129.95 kN > 35.64 kN = V_{Ed}

Ultimate moment M_{Rd} = 71.19 kNm > 39.94 kNm = M_{Ed}

Cross-section is SATISFACTORY.

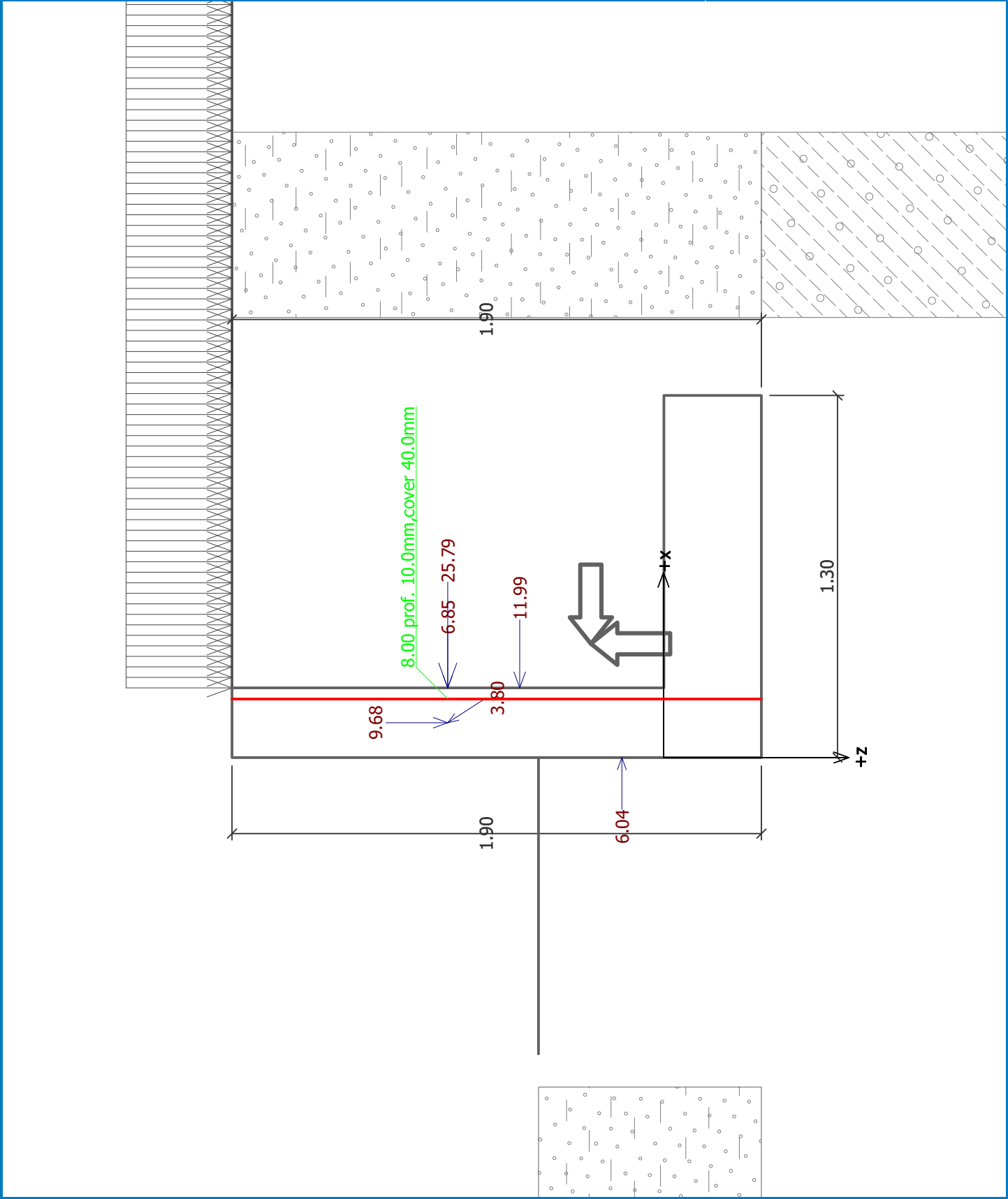
Name : Dimensioning

Stage - analysis : 1 - 1



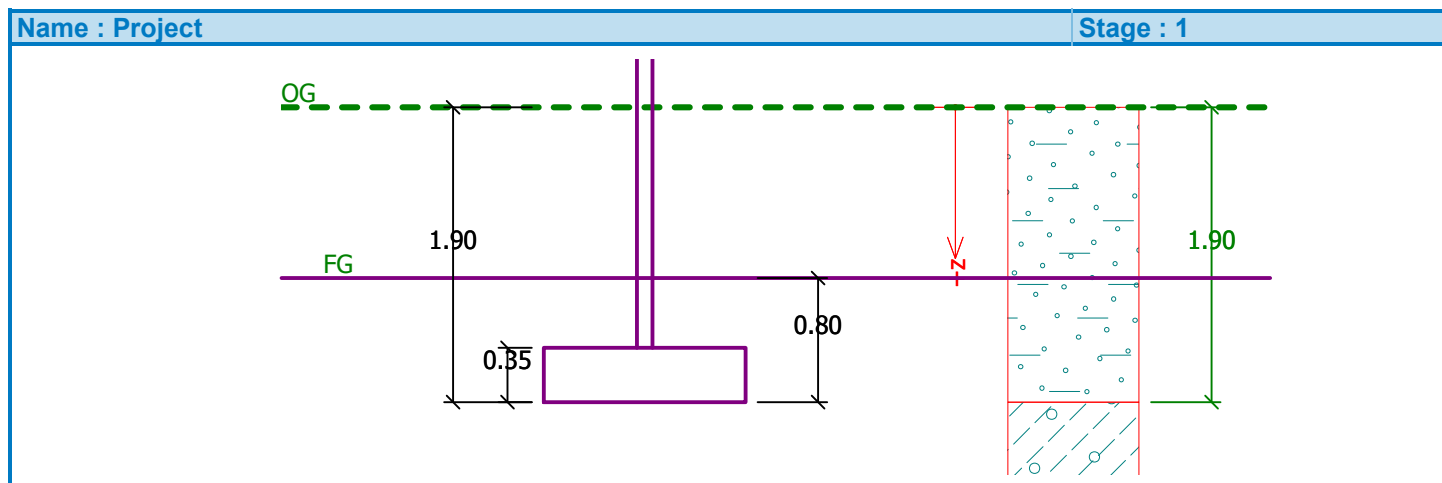
Name : Dimensioning

Stage - analysis : 1 - 1



Spread footing verification

Input data



Settings

Standard - EN 1997 - DA2

Materials and standards

Concrete structures : EN 1992-1-1 (EC2)

Coefficients EN 1992-1-1 : standard

Settlement

Analysis method : Analysis using oedometric modulus

Restriction of influence zone : by percentage of Sigma, Or

Coeff. of restriction of influence zone : 10.0 [%]

Spread Footing

Analysis for drained conditions : EC 7-1 (EN 1997-1:2003)

Verification methodology : according to EN 1997

Design approach : 2 - reduction of actions and resistances

Partial factors on actions (A)			
Permanent design situation			
		Unfavourable	Favourable
Permanent actions :	$\gamma_G =$	1.35 [-]	1.00 [-]

Partial factors for resistances (R)			
Permanent design situation			
Partial factor on vertical bearing capacity :	$\gamma_{Rvs} =$	1.40 [-]	
Partial factor on sliding resistance :	$\gamma_{Rhs} =$	1.10 [-]	

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m ³]	γ_{su} [kN/m ³]	δ [°]
1	nasip		30.00	0.00	20.00	10.00	20.00
2	temeljno tlo		30.00	5.00	20.00	10.00	20.00

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters**nasip**

Unit weight :	γ	=	20.00 kN/m ³
Angle of internal friction :	φ_{ef}	=	30.00 °
Cohesion of soil :	c_{ef}	=	0.00 kPa
Deformation modulus :	E_{def}	=	1.37 MPa
Poisson's ratio :	ν	=	0.33
Saturated unit weight :	γ_{sat}	=	20.00 kN/m ³

temeljno tlo

Unit weight :	γ	=	20.00 kN/m ³
Angle of internal friction :	φ_{ef}	=	30.00 °
Cohesion of soil :	c_{ef}	=	5.00 kPa
Deformation modulus :	E_{def}	=	6.74 MPa
Poisson's ratio :	ν	=	0.33
Saturated unit weight :	γ_{sat}	=	20.00 kN/m ³

Foundation**Foundation type: strip footing**

Depth from original ground surface	h_z	=	1.90 m
Depth of footing bottom	d	=	0.80 m
Foundation thickness	t	=	0.35 m
Incl. of finished grade	s_1	=	0.00 °
Incl. of footing bottom	s_2	=	0.00 °

Unit weight of soil above foundation = 20.00 kN/m³

Geometry of structure**Foundation type: strip footing**

Overall strip footing length	=	3.05 m
Strip footing width (x)	=	1.30 m
Column width in the direction of x	=	0.10 m
Volume of strip footing	=	0.46 m ³ /m

Inserted loading is considered per unit length of continuous footing span.

Material of structure

Unit weight γ = 25.00 kN/m³

Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete : C 25/30

Cylinder compressive strength	f_{ck}	=	25.00 MPa
Tensile strength	f_{ct}	=	2.60 MPa
Elasticity modulus	E_{cm}	=	31000.00 MPa

Longitudinal steel : B500

Yield strength	f_{yk}	=	500.00 MPa
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Transverse steel: B500

Yield strength	f_{yk}	=	500.00 MPa
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Geological profile and assigned soils

No.	Layer [m]	Assigned soil	Pattern
1	1.90	nasip	
2	-	temeljno tlo	

Load

No.	Load new	Load change	Name	Type	N [kN/m]	M _y [kNm/m]	H _x [kN/m]
1	YES		LC 1	Service	104.16	25.20	-42.04
2	YES		LC 2	Design	104.16	25.20	-42.04
3	YES		LC 3	Service	88.44	22.56	-42.04
4	YES		LC 4	Design	88.44	22.56	-42.04

Global settings

Analysis type : analysis for drained conditions

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Load case verification

Name	Self w. in favor	e _x [m]	e _y [m]	σ [kPa]	R _d [kPa]	Utilization [%]	Is satisfied
LC 2	Yes	-0.32	0.00	189.10	223.61	84.57	Yes
LC 2	No	-0.30	0.00	190.30	238.32	79.85	Yes
LC 4	Yes	-0.34	0.00	176.66	194.69	90.74	Yes
LC 4	No	-0.31	0.00	176.60	212.22	83.22	Yes

Analysis carried out with automatic selection of the most unfavourable load cases.

Computed self weight of strip foundation $G = 11.38 \text{ kN/m}$

Computed weight of overburden $Z = 10.80 \text{ kN/m}$

Vertical bearing capacity check

Shape of contact stress : rectangle

Most severe load case No. 4. (LC 4)

Parameters of slip surface below foundation:

Depth of slip surface $z_{sp} = 2.06 \text{ m}$

Length of slip surface $l_{sp} = 6.23 \text{ m}$

Design bearing capacity of found.soil $R_d = 194.69 \text{ kPa}$

Extreme contact stress $\sigma = 176.66 \text{ kPa}$

Bearing capacity in the vertical direction is SATISFACTORY

Horizontal bearing capacity check

Most severe load case No. 4. (LC 4)

Earth resistance: not considered

Friction angle foundation-footing bottom $\psi = 30.00^\circ$

Cohesion foundation-footing bottom $a = 5.00 \text{ kPa}$

Horizontal bearing capacity $R_{dh} = 58.06 \text{ kN}$

Extreme horizontal force $H = 42.04 \text{ kN}$

Bearing capacity in the horizontal direction is SATISFACTORY

Bearing capacity of foundation is SATISFACTORY

Verification No. 1

Settlement and rotation of foundation - input data

Analysis carried out with automatic selection of the most unfavourable load cases.

Analysis carried out with accounting for coefficient κ_1 (influence of foundation depth).

Stress at the footing bottom considered from the finished grade.

Computed self weight of strip foundation $G = 11.38 \text{ kN/m}$

Computed weight of overburden $Z = 10.80 \text{ kN/m}$

Settlement of mid point of longitudinal edge $= 6.2 \text{ mm}$

Settlement of mid point of transverse edge 1 $= 11.8 \text{ mm}$

Settlement of mid point of transverse edge 2 $= 5.4 \text{ mm}$

(1-max.compressed edge; 2-min.compressed edge)

Settlement and rotation of foundation - results

Foundation stiffness:

Computed weighted average modulus of deformation $E_{def} = 6.74 \text{ MPa}$

Foundation in the longitudinal direction is rigid ($k=89.76$)

Foundation in the direction of width is rigid ($k=197.20$)

Overall settlement and rotation of foundation:

Foundation settlement $= 8.5 \text{ mm}$

Depth of influence zone $= 2.93 \text{ m}$

Rotation in direction of width $= 4.914 \text{ (tan}^\circ \cdot 1000)$

Dimensioning No. 1

Analysis carried out with automatic selection of the most unfavourable load cases.

Verification of longitudinal reinforcement of foundation in the direction of x

Bar diameter $= 10.0 \text{ mm}$

Number of bars $= 7$

Reinforcement cover $= 40.0 \text{ mm}$

Cross-section width $= 1.00 \text{ m}$

Cross-section depth $= 0.35 \text{ m}$

Reinforcement ratio $\rho = 0.18 \% > 0.14 \% = \rho_{min}$

Position of neutral axis $x = 0.02 \text{ m} < 0.19 \text{ m} = x_{max}$

Ultimate moment $M_{Rd} = 71.19 \text{ kNm} > 34.51 \text{ kNm} = M_{Ed}$

Cross-section is SATISFACTORY.

Spread footing for punching shear failure check

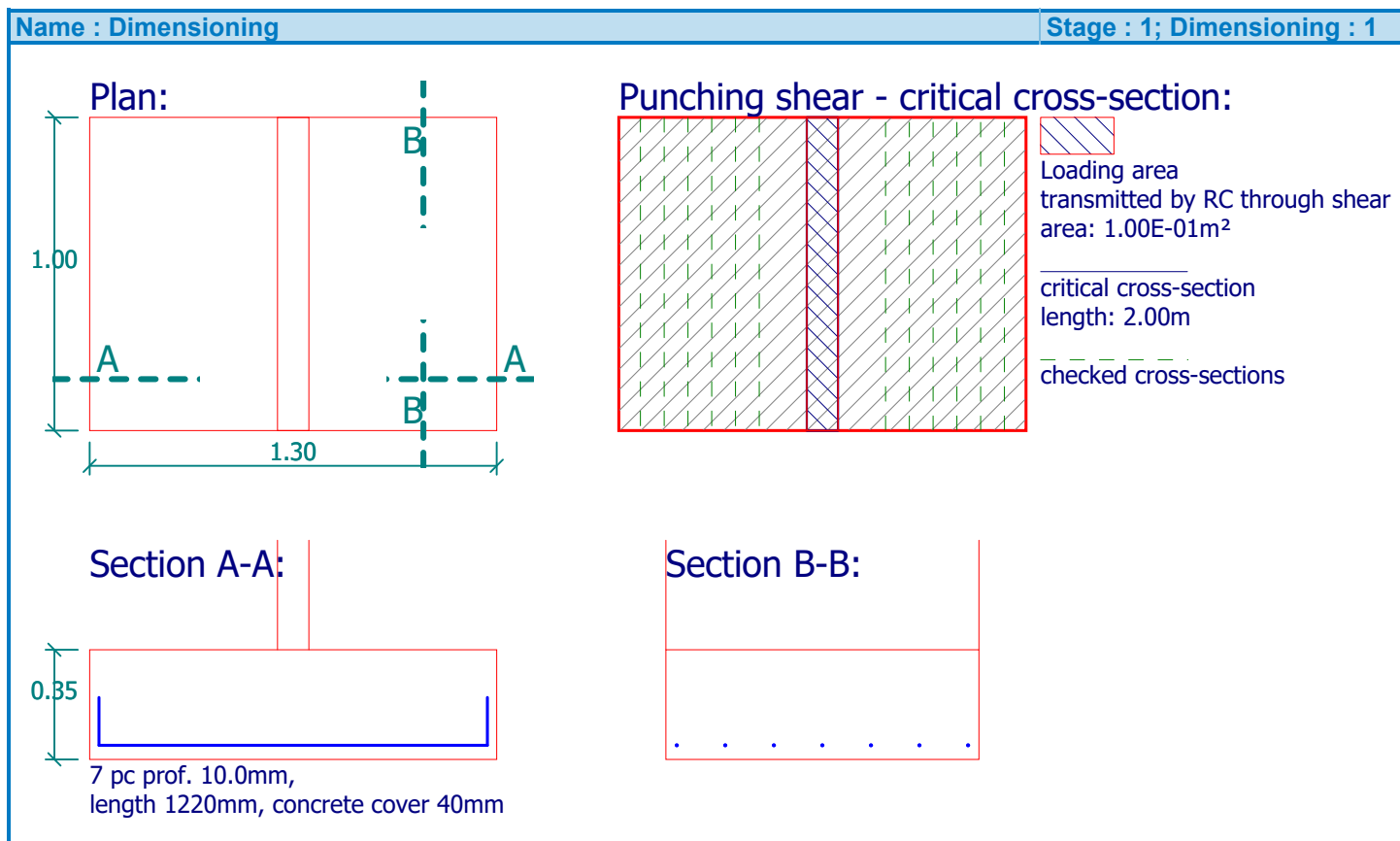
Column normal force = 104.16 kN

Compression chord adjacent to the column

Force transmitted into found. soil	=	8.01 kN
Force transmitted by shear strength of SRC	=	96.14 kN
Considered column perimeter	u_0	= 0.91 m
Shear resistance at the column perimeter	$v_{Ed,max}$	= 1.17 MPa
Resist. of the compr. chord adjacent to the column	$v_{Rd,max}$	= 4.50 MPa

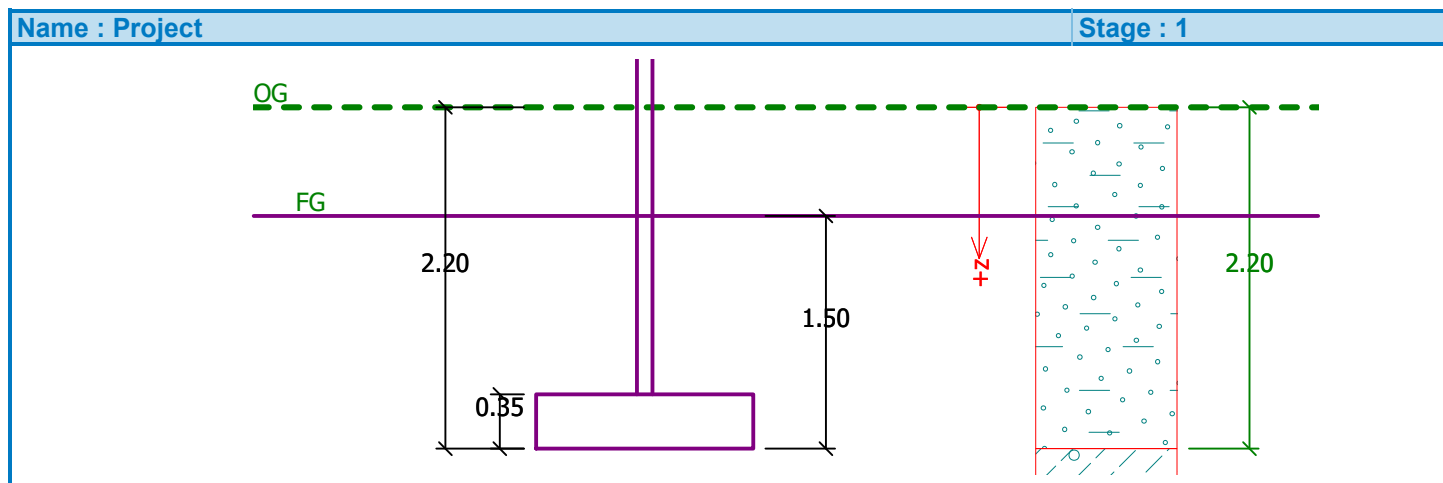
Critical section without shear reinforcement

Force transmitted into found. soil	=	56.65 kN
Force transmitted by shear strength of SRC	=	47.51 kN
Distance of section from the column	=	0.30 m
Section perimeter	u_{cr}	= 2.00 m
Shear stress at section	v_{Ed}	= 0.13 MPa
Shear resistance of section without shear reinforcement	$v_{Rd,c}$	= 0.85 MPa

 $v_{Ed} < v_{Rd,c} \Rightarrow$ Reinforcement is not required**Spread footing for punching shear is SATISFACTORY**

Spread footing verification

Input data



Settings

Standard - EN 1997 - DA2

Materials and standards

Concrete structures : EN 1992-1-1 (EC2)

Coefficients EN 1992-1-1 : standard

Settlement

Analysis method : Analysis using oedometric modulus

Restriction of influence zone : by percentage of Sigma, Or

Coeff. of restriction of influence zone : 10.0 [%]

Spread Footing

Analysis for drained conditions : EC 7-1 (EN 1997-1:2003)

Verification methodology : according to EN 1997

Design approach : 2 - reduction of actions and resistances

Partial factors on actions (A)			
Permanent design situation			
		Unfavourable	Favourable
Permanent actions :	$\gamma_G =$	1.35 [-]	1.00 [-]

Partial factors for resistances (R)			
Permanent design situation			
Partial factor on vertical bearing capacity :	$\gamma_{Rvs} =$	1.40 [-]	
Partial factor on sliding resistance :	$\gamma_{Rhs} =$	1.10 [-]	

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m ³]	γ_{su} [kN/m ³]	δ [°]
1	nasip		30.00	0.00	20.00	10.00	20.00
2	temeljno tlo		30.00	5.00	20.00	10.00	20.00

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters**nasip**

Unit weight :	γ	=	20.00 kN/m ³
Angle of internal friction :	φ_{ef}	=	30.00 °
Cohesion of soil :	c_{ef}	=	0.00 kPa
Deformation modulus :	E_{def}	=	1.37 MPa
Poisson's ratio :	ν	=	0.33
Saturated unit weight :	γ_{sat}	=	20.00 kN/m ³

temeljno tlo

Unit weight :	γ	=	20.00 kN/m ³
Angle of internal friction :	φ_{ef}	=	30.00 °
Cohesion of soil :	c_{ef}	=	5.00 kPa
Deformation modulus :	E_{def}	=	6.74 MPa
Poisson's ratio :	ν	=	0.33
Saturated unit weight :	γ_{sat}	=	20.00 kN/m ³

Foundation**Foundation type: strip footing**

Depth from original ground surface	h_z	=	2.20 m
Depth of footing bottom	d	=	1.50 m
Foundation thickness	t	=	0.35 m
Incl. of finished grade	s_1	=	0.00 °
Incl. of footing bottom	s_2	=	0.00 °

Unit weight of soil above foundation = 20.00 kN/m³

Geometry of structure**Foundation type: strip footing**

Overall strip footing length	=	3.05 m
Strip footing width (x)	=	1.40 m
Column width in the direction of x	=	0.10 m
Volume of strip footing	=	0.49 m ³ /m

Inserted loading is considered per unit length of continuous footing span.

Material of structure

Unit weight γ = 25.00 kN/m³

Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete : C 25/30

Cylinder compressive strength	f_{ck}	=	25.00 MPa
Tensile strength	f_{ct}	=	2.60 MPa
Elasticity modulus	E_{cm}	=	31000.00 MPa

Longitudinal steel : B500

Yield strength	f_{yk}	=	500.00 MPa
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Transverse steel: B500

Yield strength	f_{yk}	=	500.00 MPa
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Geological profile and assigned soils

No.	Layer [m]	Assigned soil	Pattern
1	2.20	nasip	
2	-	temeljno tlo	

Load

No.	Load new	Load change	Name	Type	N [kN/m]	M _y [kNm/m]	H _x [kN/m]
1	YES		LC 1	Service	-0.47	0.00	0.00
2	YES		LC 2	Design	-0.47	0.00	0.00
3	YES		LC 3	Service	-8.82	9.69	0.00
4	YES		LC 4	Design	-8.82	9.69	0.00

Global settings

Analysis type : analysis for drained conditions

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Load case verification

Name	Self w. in favor	e _x [m]	e _y [m]	σ [kPa]	R _d [kPa]	Utilization [%]	Is satisfied
LC 2	Yes	0.00	0.00	29.77	791.89	3.76	Yes
LC 2	No	0.00	0.00	40.31	791.89	5.09	Yes
LC 4	Yes	-0.29	0.00	40.72	678.20	6.00	Yes
LC 4	No	-0.20	0.00	48.23	714.10	6.75	Yes

Analysis carried out with automatic selection of the most unfavourable load cases.

Computed self weight of strip foundation $G = 16.54$ kN/m

Computed weight of overburden $Z = 40.36$ kN/m

Vertical bearing capacity check

Shape of contact stress : rectangle

Most severe load case No. 4. (LC 4)

Parameters of slip surface below foundation:

Depth of slip surface $z_{sp} = 2.22$ m

Length of slip surface $l_{sp} = 6.71$ m

Design bearing capacity of found.soil $R_d = 714.10$ kPa

Extreme contact stress $\sigma = 48.23$ kPa

Bearing capacity in the vertical direction is SATISFACTORY

Horizontal bearing capacity check

Most severe load case No. 2. (LC 2)

Earth resistance: not considered

Friction angle foundation-footing bottom $\psi = 30.00^\circ$

Cohesion foundation-footing bottom $a = 5.00 \text{ kPa}$

Horizontal bearing capacity $R_{dh} = 21.88 \text{ kN}$

Extreme horizontal force $H = 0.00 \text{ kN}$

Bearing capacity in the horizontal direction is SATISFACTORY

Bearing capacity of foundation is SATISFACTORY

Verification No. 1

Settlement and rotation of foundation - input data

Analysis carried out with automatic selection of the most unfavourable load cases.

Analysis carried out with accounting for coefficient κ_1 (influence of foundation depth).

Stress at the footing bottom considered from the finished grade.

Computed self weight of strip foundation $G = 12.25 \text{ kN/m}$

Computed weight of overburden $Z = 29.90 \text{ kN/m}$

Settlement of mid point of longitudinal edge $= 0.0 \text{ mm}$

Settlement of mid point of transverse edge 1 $= 0.0 \text{ mm}$

Settlement of mid point of transverse edge 2 $= 0.0 \text{ mm}$

(1-max.compressed edge; 2-min.compressed edge)

Settlement and rotation of foundation - results

Foundation stiffness:

Computed weighted average modulus of deformation $E_{def} = 6.74 \text{ MPa}$

Foundation in the longitudinal direction is rigid ($k=71.87$)

Foundation in the direction of width is rigid ($k=197.20$)

Overall settlement and rotation of foundation:

Foundation settlement $= 0.0 \text{ mm}$

Depth of influence zone $= 0.01 \text{ m}$

Rotation in direction of width $= 0.391 \text{ (tan}^\circ\text{1000)}$

Dimensioning No. 1

Analysis carried out with automatic selection of the most unfavourable load cases.

Verification of longitudinal reinforcement of foundation in the direction of x

Bar diameter $= 10.0 \text{ mm}$

Number of bars $= 7$

Reinforcement cover $= 40.0 \text{ mm}$

Cross-section width $= 1.00 \text{ m}$

Cross-section depth $= 0.35 \text{ m}$

Reinforcement ratio $\rho = 0.18 \% > 0.14 \% = \rho_{min}$

Position of neutral axis $x = 0.02 \text{ m} < 0.19 \text{ m} = x_{max}$

Ultimate moment $M_{Rd} = 71.19 \text{ kNm} > 6.22 \text{ kNm} = M_{Ed}$

Cross-section is SATISFACTORY.

Spread footing for punching shear failure check

Column normal force = -8.82 kN

Compression chord adjacent to the column

Force transmitted into found. soil	= -0.63 kN
Force transmitted by shear strength of SRC	= -8.19 kN
Considered column perimeter	$u_0 = 0.91 \text{ m}$
Shear resistance at the column perimeter	$v_{Ed,max} = 0.35 \text{ MPa}$
Resist. of the compr. chord adjacent to the column	$v_{Rd,max} = 4.50 \text{ MPa}$

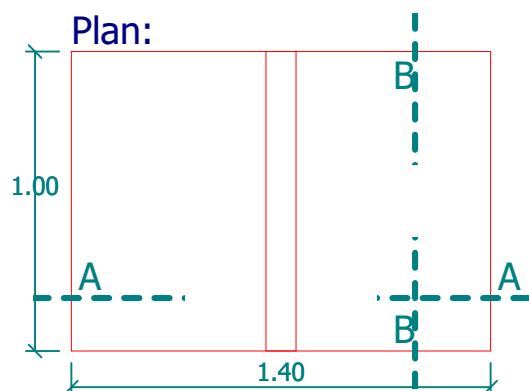
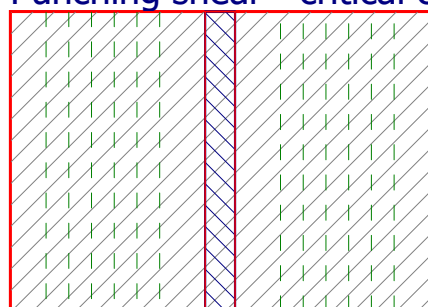
Critical section without shear reinforcement

Force transmitted into found. soil	= -5.41 kN
Force transmitted by shear strength of SRC	= -3.41 kN
Distance of section from the column	= 0.38 m
Section perimeter	$u_{cr} = 2.00 \text{ m}$
Shear stress at section	$v_{Ed} = 0.02 \text{ MPa}$
Shear resistance of section without shear reinforcement	$v_{Rd,c} = 0.68 \text{ MPa}$

 $v_{Ed} < v_{Rd,c} \Rightarrow$ Reinforcement is not required**Spread footing for punching shear is SATISFACTORY**

Name : Dimensioning

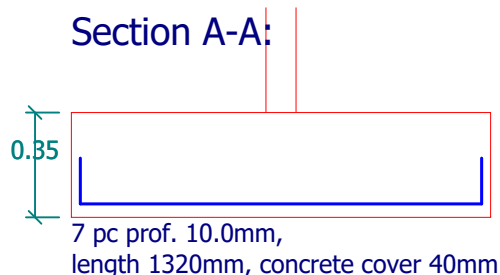
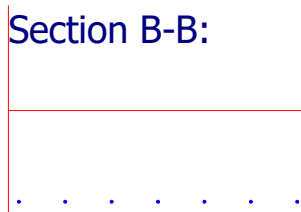
Stage : 1; Dimensioning : 1

Plan:**Punching shear - critical cross-section:**

Loading area
transmitted by RC through shear
area: 1.00E-01m²

critical cross-section
length: 2.00m

checked cross-sections

Section A-A:**Section B-B:**

Spread footing verification

Input data

Name : Project	Stage : 1
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Settings

Standard - EN 1997 - DA2

Materials and standards

Concrete structures : EN 1992-1-1 (EC2)

Coefficients EN 1992-1-1 : standard

Settlement

Analysis method : Analysis using oedometric modulus

Restriction of influence zone : by percentage of Sigma, Or

Coeff. of restriction of influence zone : 10.0 [%]

Spread Footing

Analysis for drained conditions : EC 7-1 (EN 1997-1:2003)

Verification methodology : according to EN 1997

Design approach : 2 - reduction of actions and resistances

Partial factors on actions (A)			
Permanent design situation			
		Unfavourable	Favourable
Permanent actions :	$\gamma_G =$	1.35 [-]	1.00 [-]

Partial factors for resistances (R)			
Permanent design situation			
Partial factor on vertical bearing capacity :	$\gamma_{Rvs} =$	1.40 [-]	
Partial factor on sliding resistance :	$\gamma_{Rhs} =$	1.10 [-]	

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m ³]	γ_{su} [kN/m ³]	δ [°]
1	nasip		30.00	0.00	20.00	10.00	20.00
2	temeljno tlo		30.00	5.00	20.00	10.00	20.00

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters**nasip**

Unit weight :	γ	=	20.00 kN/m ³
Angle of internal friction :	φ_{ef}	=	30.00 °
Cohesion of soil :	c_{ef}	=	0.00 kPa
Deformation modulus :	E_{def}	=	1.37 MPa
Poisson's ratio :	ν	=	0.33
Saturated unit weight :	γ_{sat}	=	20.00 kN/m ³

temeljno tlo

Unit weight :	γ	=	20.00 kN/m ³
Angle of internal friction :	φ_{ef}	=	30.00 °
Cohesion of soil :	c_{ef}	=	5.00 kPa
Deformation modulus :	E_{def}	=	6.74 MPa
Poisson's ratio :	ν	=	0.33
Saturated unit weight :	γ_{sat}	=	20.00 kN/m ³

Foundation**Foundation type: strip footing**

Depth from original ground surface	h_z	=	1.40 m
Depth of footing bottom	d	=	1.00 m
Foundation thickness	t	=	0.35 m
Incl. of finished grade	s_1	=	0.00 °
Incl. of footing bottom	s_2	=	0.00 °

Unit weight of soil above foundation = 20.00 kN/m³

Geometry of structure**Foundation type: strip footing**

Overall strip footing length	=	3.05 m
Strip footing width (x)	=	1.10 m
Column width in the direction of x	=	0.10 m
Volume of strip footing	=	0.39 m ³ /m

Inserted loading is considered per unit length of continuous footing span.

Material of structure

Unit weight γ = 25.00 kN/m³

Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete : C 25/30

Cylinder compressive strength	f_{ck}	=	25.00 MPa
Tensile strength	f_{ct}	=	2.60 MPa
Elasticity modulus	E_{cm}	=	31000.00 MPa

Longitudinal steel : B500

Yield strength	f_{yk}	=	500.00 MPa
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Transverse steel: B500

Yield strength	f_{yk}	=	500.00 MPa
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Geological profile and assigned soils

No.	Layer [m]	Assigned soil	Pattern
1	1.40	nasip	
2	-	temeljno tlo	

Load

No.	Load new	Load change	Name	Type	N [kN/m]	M _y [kNm/m]	H _x [kN/m]
1	YES		LC 1	Service	2.40	0.00	0.00
2	YES		LC 2	Design	2.40	0.00	0.00
3	YES		LC 3	Service	-3.28	3.00	-2.19
4	YES		LC 4	Design	-3.28	3.00	-2.19

Global settings

Analysis type : analysis for drained conditions

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Load case verification

Name	Self w. in favor	e _x [m]	e _y [m]	σ [kPa]	R _d [kPa]	Utilization [%]	Is satisfied
LC 2	Yes	0.00	0.00	22.75	579.27	3.93	Yes
LC 2	No	0.00	0.00	29.95	579.27	5.17	Yes
LC 4	Yes	-0.19	0.00	27.22	434.27	6.27	Yes
LC 4	No	-0.14	0.00	33.09	472.17	7.01	Yes

Analysis carried out with automatic selection of the most unfavourable load cases.

Computed self weight of strip foundation $G = 12.99$ kN/m

Computed weight of overburden $Z = 17.55$ kN/m

Vertical bearing capacity check

Shape of contact stress : rectangle

Most severe load case No. 4. (LC 4)

Parameters of slip surface below foundation:

Depth of slip surface $z_{sp} = 1.74$ m

Length of slip surface $l_{sp} = 5.27$ m

Design bearing capacity of found.soil $R_d = 472.17$ kPa

Extreme contact stress $\sigma = 33.09$ kPa

Bearing capacity in the vertical direction is SATISFACTORY

Horizontal bearing capacity check

Most severe load case No. 4. (LC 4)

Earth resistance: not considered

Friction angle foundation-footing bottom $\psi = 30.00^\circ$

Cohesion foundation-footing bottom $a = 5.00 \text{ kPa}$

Horizontal bearing capacity $R_{dh} = 10.16 \text{ kN}$

Extreme horizontal force $H = 2.19 \text{ kN}$

Bearing capacity in the horizontal direction is SATISFACTORY

Bearing capacity of foundation is SATISFACTORY

Verification No. 1

Settlement and rotation of foundation - input data

Analysis carried out with automatic selection of the most unfavourable load cases.

Analysis carried out with accounting for coefficient κ_1 (influence of foundation depth).

Stress at the footing bottom considered from the finished grade.

Computed self weight of strip foundation $G = 9.63 \text{ kN/m}$

Computed weight of overburden $Z = 13.00 \text{ kN/m}$

Settlement of mid point of longitudinal edge $= 0.0 \text{ mm}$

Settlement of mid point of transverse edge 1 $= 0.0 \text{ mm}$

Settlement of mid point of transverse edge 2 $= 0.0 \text{ mm}$

(1-max.compressed edge; 2-min.compressed edge)

Settlement and rotation of foundation - results

Foundation stiffness:

Computed weighted average modulus of deformation $E_{def} = 6.74 \text{ MPa}$

Foundation in the longitudinal direction is rigid ($k=148.16$)

Foundation in the direction of width is rigid ($k=197.20$)

Overall settlement and rotation of foundation:

Foundation settlement $= 0.0 \text{ mm}$

Depth of influence zone $= 0.01 \text{ m}$

Rotation in direction of width $= 0.267 \text{ (tan}^\circ\text{1000)}$

Dimensioning No. 1

Analysis carried out with automatic selection of the most unfavourable load cases.

Verification of longitudinal reinforcement of foundation in the direction of x

Bar diameter $= 10.0 \text{ mm}$

Number of bars $= 7$

Reinforcement cover $= 40.0 \text{ mm}$

Cross-section width $= 1.00 \text{ m}$

Cross-section depth $= 0.35 \text{ m}$

Reinforcement ratio $\rho = 0.18 \% > 0.14 \% = \rho_{min}$

Position of neutral axis $x = 0.02 \text{ m} < 0.19 \text{ m} = x_{max}$

Ultimate moment $M_{Rd} = 71.19 \text{ kNm} > 2.03 \text{ kNm} = M_{Ed}$

Cross-section is SATISFACTORY.

Spread footing for punching shear failure check

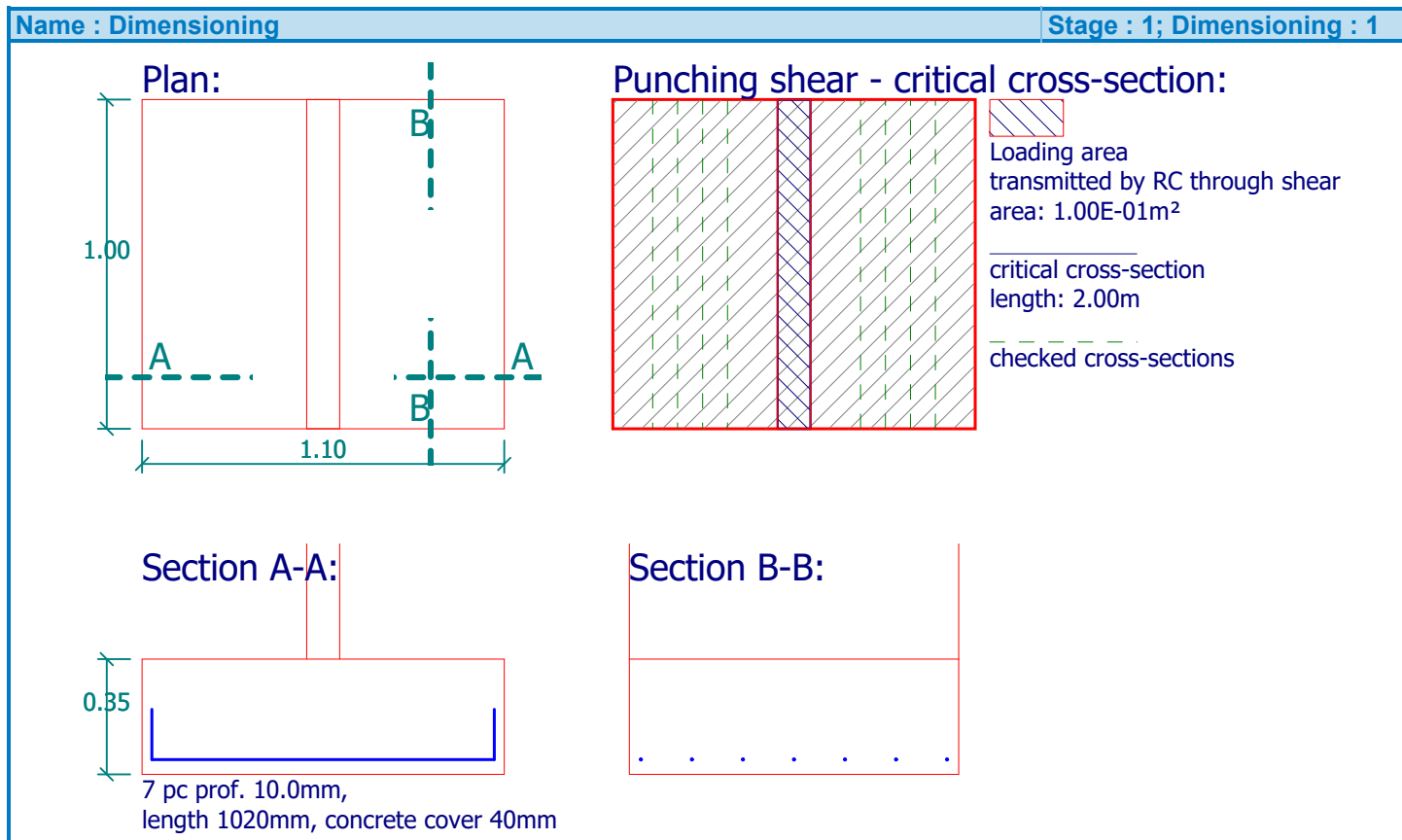
Column normal force = -3.28 kN

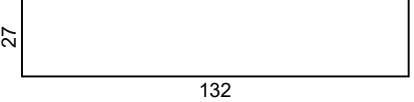
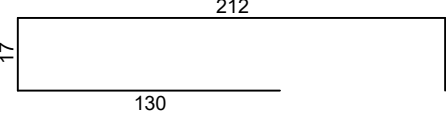
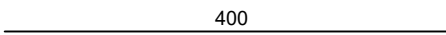
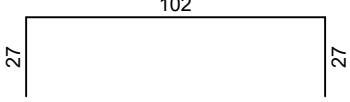
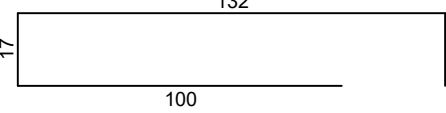
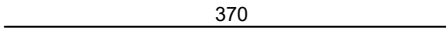
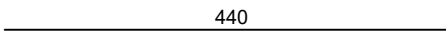
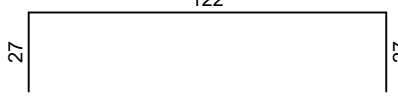
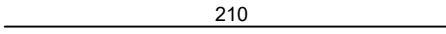
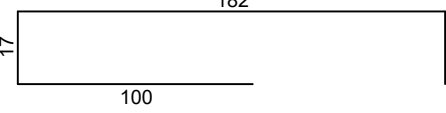
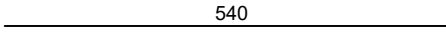
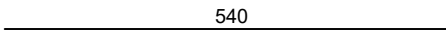
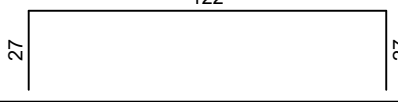
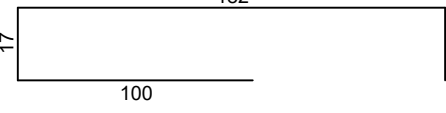
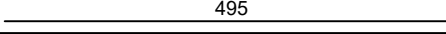
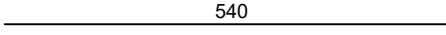
Compression chord adjacent to the column

Force transmitted into found. soil	= -0.30 kN
Force transmitted by shear strength of SRC	= -2.98 kN
Considered column perimeter	$u_0 = 0.91 \text{ m}$
Shear resistance at the column perimeter	$v_{Ed,max} = 0.11 \text{ MPa}$
Resist. of the compr. chord adjacent to the column	$v_{Rd,max} = 4.50 \text{ MPa}$

Critical section without shear reinforcement

Force transmitted into found. soil	= -2.11 kN
Force transmitted by shear strength of SRC	= -1.17 kN
Distance of section from the column	= 0.30 m
Section perimeter	$u_{cr} = 2.00 \text{ m}$
Shear stress at section	$v_{Ed} = 0.01 \text{ MPa}$
Shear resistance of section without shear reinforcement	$v_{Rd,c} = 0.85 \text{ MPa}$

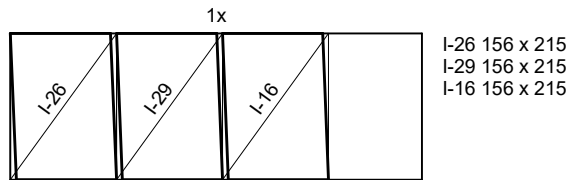
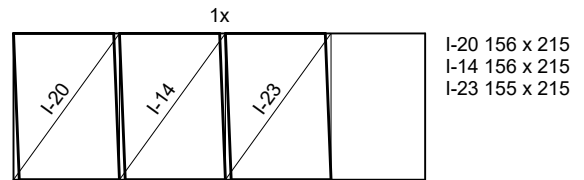
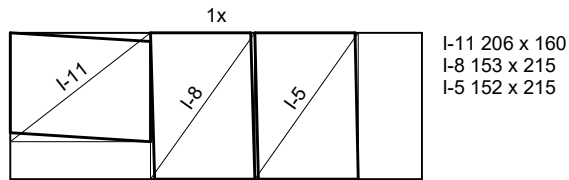
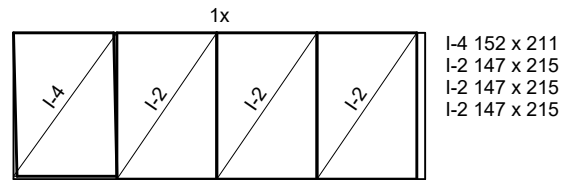
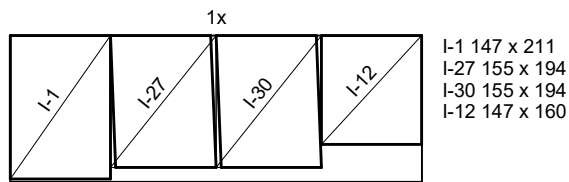
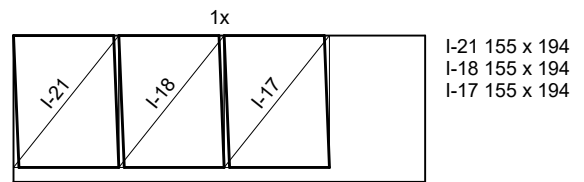
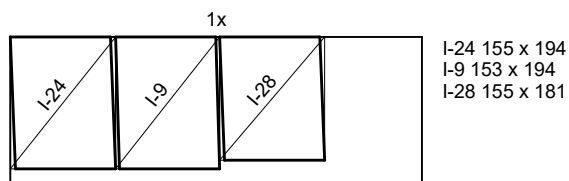
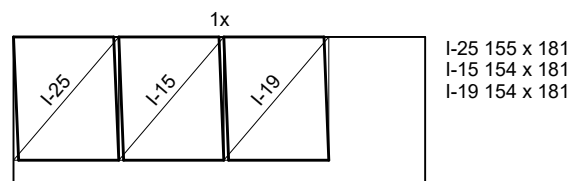
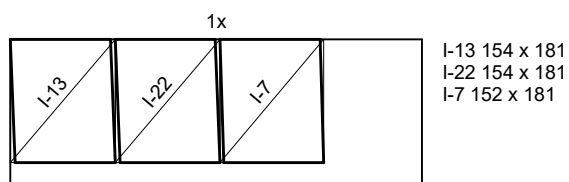
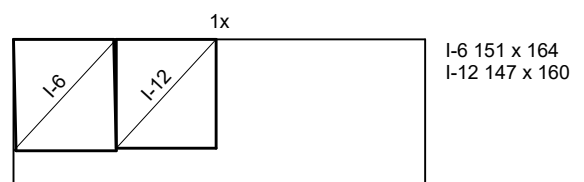
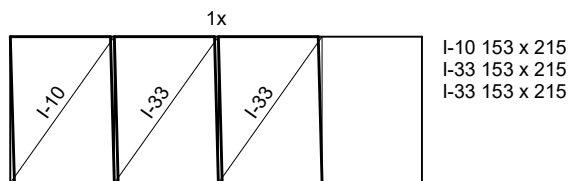
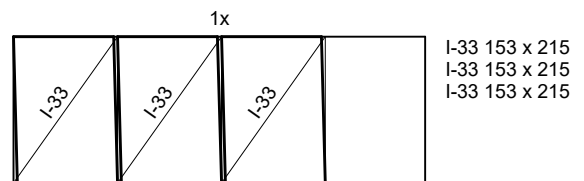
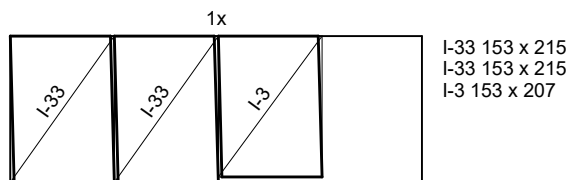
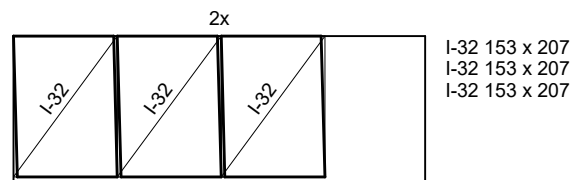
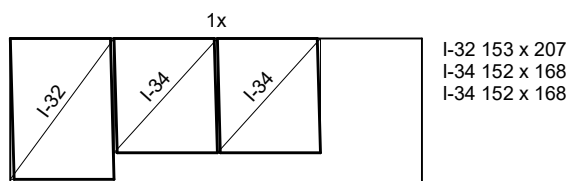
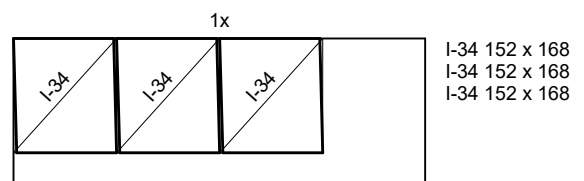
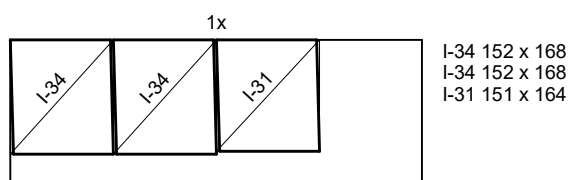
 $v_{Ed} < v_{Rd,c} \Rightarrow$ Reinforcement is not required**Spread footing for punching shear is SATISFACTORY**

Bars - specification						
mark	shape and measures [cm]	Ø	lg [m]	n [pcs.]	lg _n [m]	Remark
Plan armature potpornog zida u zasipu PZ-Tip 1 (1 pcs.)						
1		10	1.86	294	546.84	
2		10	3.76	287	1079.12	
3		10	4.00	52	208.00	
4		10	4.50	312	1404.00	
Plan armature potpornog zida u zasipu PZ-Tip 2 (1 pcs.)						
1		10	1.56	206	321.36	
2		10	2.66	136	361.76	
3		10	3.70	32	118.40	
4		10	4.40	128	563.20	
Plan armature potpornog zida PZ 1 (1 pcs.)						
1		10	1.76	710	1249.60	
2		10	2.10	36	75.60	
3		10	3.16	532	1681.12	
4		10	5.40	108	583.20	
5		10	5.40	252	1360.80	
Plan armature potpornog zida PZ 2 (1 pcs.)						
1		10	1.76	544	957.44	
2		10	3.16	408	1289.28	
3		10	4.95	36	178.20	
4		10	5.40	252	1360.80	

Bars - recapitulation			
Ø [mm]	lgn [m]	Unit weight [kg/m']	Weight [kg]
B500B			
10	13338.72	0.63	8443.41
Total (B500B)			8443.41
Total			8443.41

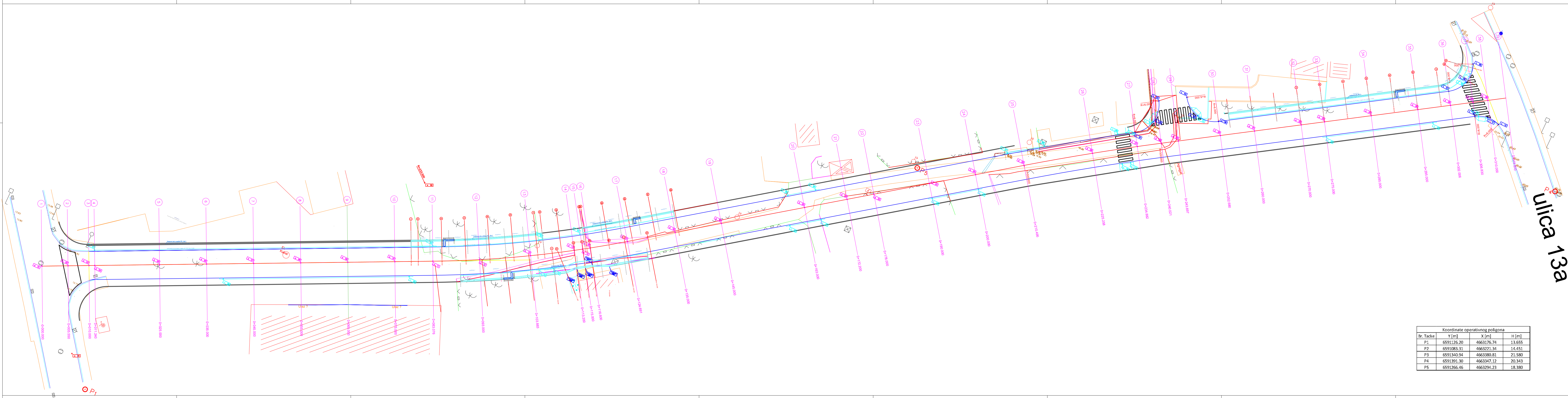
Meshes - specification							
Item	Mesh type	B [cm]	L [cm]	n	Unit weight [kg/m2]	Total weight [kg]	Remark
Plan armature potpornog zida PZ 1 (1 pcs.)							
I-1	Q-257	211	147	1	4.02	12.47	
I-2	Q-257	215	147	3	4.02	38.12	
I-4	Q-257	211	152	1	4.02	12.88	
I-5	Q-257	215	152	1	4.02	13.13	
I-6	Q-257	164	151	1	4.02	9.94	
I-7	Q-257	181	152	1	4.02	11.10	
I-8	Q-257	215	153	1	4.02	13.25	
I-9	Q-257	194	153	1	4.02	11.90	
I-11	Q-257	160	206	1	4.02	13.25	
I-12	Q-257	160	147	2	4.02	18.91	
I-13	Q-257	181	154	1	4.02	11.23	
I-14	Q-257	215	156	1	4.02	13.45	
I-15	Q-257	181	154	1	4.02	11.24	
I-16	Q-257	215	156	1	4.02	13.46	
I-17	Q-257	194	155	1	4.02	12.06	
I-18	Q-257	194	155	1	4.02	12.06	
I-19	Q-257	181	154	1	4.02	11.24	
I-20	Q-257	215	156	1	4.02	13.45	
I-21	Q-257	194	155	1	4.02	12.07	
I-22	Q-257	181	154	1	4.02	11.21	
I-23	Q-257	215	155	1	4.02	13.43	
I-24	Q-257	194	155	1	4.02	12.05	
I-25	Q-257	181	155	1	4.02	11.26	
I-26	Q-257	215	156	1	4.02	13.49	
I-27	Q-257	194	155	1	4.02	12.11	
I-28	Q-257	181	155	1	4.02	11.26	
I-29	Q-257	215	156	1	4.02	13.47	
I-30	Q-257	194	155	1	4.02	12.07	
Total						375.56	
Plan armature potpornog zida PZ 2 (1 pcs.)							
I-3	Q-257	207	153	1	4.02	12.70	
I-10	Q-257	215	153	1	4.02	13.21	
I-31	Q-257	164	151	1	4.02	9.99	
I-32	Q-257	207	153	7	4.02	88.85	
I-33	Q-257	215	153	7	4.02	92.42	
I-34	Q-257	168	152	7	4.02	71.64	
Total						288.80	

Meshes - recapitulation						
Mesh type	B [cm]	L [cm]	n	Unit weight [kg/m2]	Total weight [kg]	Net installed weight [kg]
Q-257	215	605	18	4.02	941.22	639.56
Total					941.22	639.56



III ARMIRAČKI RADOVI						
1	Nabavka, transport, izvlačenje, ispravljanje, razmjeravanje, obilježavanje, sječenje, savijanje, montaža, vezivanje i ugradnja u svemu prema projektnoj dokumentaciji, statičkom proračunu, detaljima, odnosno planu armature i obezbjeđenje t.j. zaštitu do betoniranja cjelokupne armature.					
	B500B		8.443,41			
	Q257		941,22			
	UKUPNO	kg	9.384,63	1,50		14.076,95
	UKUPNO III - ARMIRAČKI RADOVI:					14.076,95
IV RAZNI RADOVI						
1	Ograda na potpornom zidu: od stacionaže 111.530 do stacionaže 120.804(desna strana) od stacionaže 275.000 do stacionaže 302.010(lijeva strana)	Ograda je metalna konstrukcija, koja se sastoji od elemenata/ rukohvat ø50mm,ispuna ø50mm ukupne visine h=100,0cm. Stubovi se prekodistancera i anker ploče vezuju za ab potporni zid. Završna obrada je grafitna boja za metal uz prethodno nanošenje antikorozivnog premaza.	m	38,00	150,00	5.700,00
	UKUPNO IV - RAZNI RADOVI:					5.700,00
	REKAPITULACIJA GRAĐEVINSKIH I GRAĐEVINSKO-ZANATSKIH RADOVA:					
I	ZEMLJANI RADOVI					14.003,05 €
II	BETONSKI RADOVI					83.166,20 €
III	ARMIRAČKI RADOVI					14.076,95 €
IV	RAZNI RADOVI					5.700,00 €
GRAĐEVINSKI I GRAĐEVINSKO-ZANATSKI RADOVI						111.246,20 €
			PDV			23.361,70 €
			Ukupno sa PDV-om			134.607,90 €

GRAFIČKA DOKUMENTACIJA



L E G E N D A :

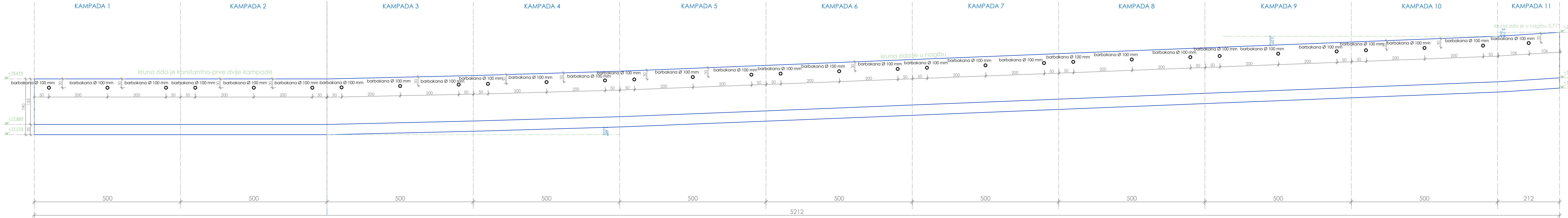
- Stambeni objekat
- Objekat u privredi
- Limeni objekat
- Terasa natkrivena
- Stepenice
- Asfalt
- Beton
- Zid
- Zicana ograda
- Zid kao ograda
- Zicana ograda na zidu
- Sahte
- Slivnik
- Betonski elektro stub
- Trafostanica
- Ormaric za struju
- Ulicna rasvjeta
- Tacka operativnog poligona
- Saobraćajni znakovi
- Hidrant
- Maslina

Koordinate operativnog poligona			
Br. Tacke	Y [m]	X [m]	H [m]
P1	6591126.20	4663176.74	13.655
P2	6591083.31	4663221.34	14.451
P3	6591340.94	4663380.81	21.580
P4	6591391.30	4663347.12	20.343
P5	6591266.46	4663294.23	18.380

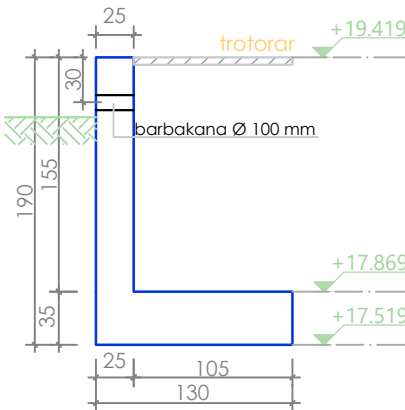
PROJEKTANT:	INVESTITOR:		
"URBI PRO" d.o.o., Podgorica, ul. Radovana Burica 5b, telefon 067/006-012, e-mail: office@urbipro.me PDV: 30/31-14987-7, PIB: 03059847	OPŠTINA BAR		
Objekat: Saniranje i izgradnja sa pratećom infrastrukturom, dio koji se nalazi između zona "A" i "B" sa jedne strane i zone "Aa" sa druge strane, u zahvatu Društva "Tina", Bar	Lokacija: Katastarske parcele 4813/5; 4814/10; 4755/2; 4733/5; 4782/4; 4782/3; 4734/3; 4735/2; 4781/2; 4780/2; 4736/2; 4799/2; 4758/2; 4742/3; 4743/7; 4748/2; 4780/2; 4780/2; 4757/2; 4754/2; 4756/2; 4755/4; 4154/3; 4158/4; K.O. Novi Bar		
Osnovni ishodak: Dusan Dzudovic d.l.a.	GLAVNI PROJEKAT		
Odgovorni inženjer: Jovana Petrović, spec. sci. grad.	Dio tehničke dokumentacije: KONSTRUKCIJA		NAZNAČA: 1:100
Saradnici: Mirko Juković, spec. grad. Marko Šec, dipl. inž. grad.	Prilog: PLAN POZICIJA		Broj stranice: 01
Datum izrade: 1.1.2024.		Broj priloga: 01	
Datum revizije: 1.1.2024.		Broj stranice: 01	

POTPORNI ZID PZ 1

PLAN OPLATE POTPORNIH ZIDOVA



POTPORNI ZID PZ 1



Napomena:
Prilikom izvođenja ovaj crtež posmatrati uporedo sa planovima arhitekture.

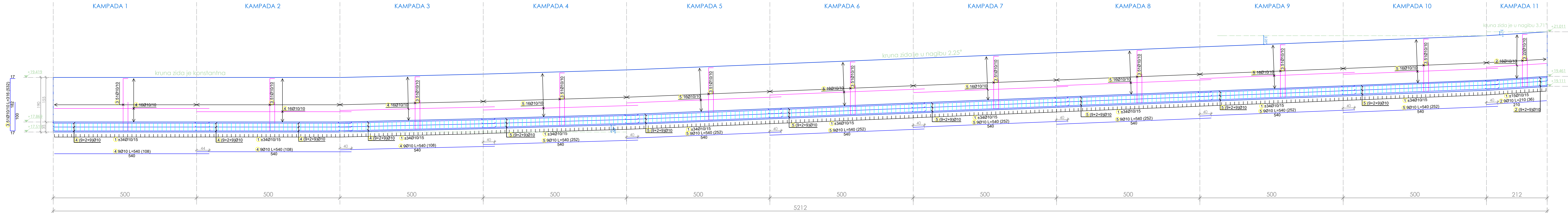
Napomena:
Barbakane postavljati 30cm iznad površine terena.

Napomena:
Kampade izvoditi naizmjenično, parne pa neparne.

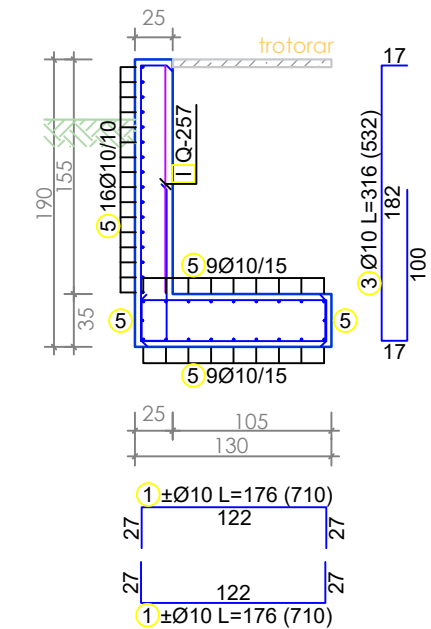
PROJEKTANT:  "URBI.PRO" d.o.o., Podgorica, ul.Radosava Burica bb, telefon 067/006-012, e-mail office@urbipro.me PDV: 30/31-14987-7, PIB: 03059847		INVESTITOR: OPŠTINA BAR	
Objekat: Sagradnja sa pratećom infrastrukturom, dio koji se nalazi između zona "A" i "B" sa jedne strane i zone "Aa" sa druge strane, u zahvatu DUP-a "Ilino", Bar		Lokacija: Katastarske parcele 4813/5; 4814/10; 4755/2; 4733/5; 4782/4; 4782/3; 4734/3; 4735/2; 4781/2; 4780/2; 4736/2; 4799/2; 4758/2; 4742/3; 4743/7; 4749/2; 4760/2; 4750/2; 4757/2; 4754/2; 4756/2; 4755/4; 4154/9; 4158/4; K.O. Novi Bar	
Glavni inženjer: Dušan Džudović d.i.a.		Vrsta tehničke dokumentacije: GLAVNI PROJEKAT	
Odgovorni inženjer: Jovana Perović, spec.sci.grad.		Dio tehničke dokumentacije: KONSTRUKCIJA POTPORNI ZIDOVI PLAN OPLATE	RAZMJERA: 1:50
Saradnici: Mirko Jušković, bsc.grad. Marko Šoć, dipl.inž.grad.		Prilog: POTPORNI ZID PZ 1	Broj priloga: 02 Broj strane: 01
Datum izrade i M.P.: Januar, 2024.		Datum revizije i M.P.:	

POTPORNI ZID PZ 1

PLAN ARMATURE POTPORNIH ZIDOVA



POTPORNI ZID PZ 1



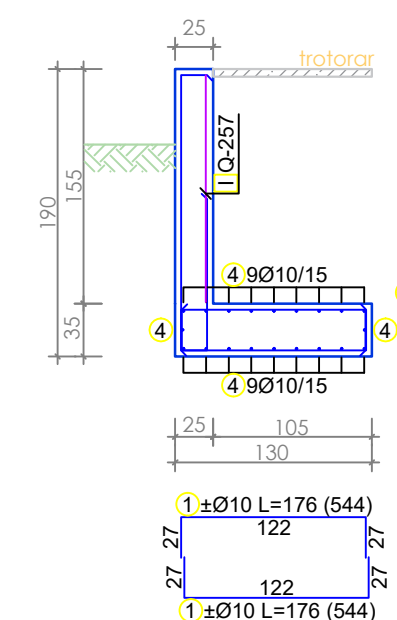
Napomena:
Prilikom izvođenja ovaj crtež posmatrati uporedno sa planovima arhitekture.

Napomena:
Barbakane postavljati 30cm iznad površine terena.

Napomena:
Kampade izvoditi naizmjenično, parne pa neparne.

PROJEKTANT:  "URBI.PRO" d.o.o., Podgorica, ul. Radosava Burica bb, telefon 067/006-012, e-mail office@urbipro.me PDV: 30/31-14987-7, PIB: 03059847		INVESTITOR: OPŠTINA BAR	
Objekat: Sadržajnica sa pratećom infrastrukturom, dio koji se nalazi između zona "A" i "B" sa jedne strane i zone "Aa" sa druge strane, u zahvatu DUP-a "Ilino", Bar		Lokacija: Katastarske parcele 4813/5; 4814/10; 4755/2; 4733/5; 4782/4; 4782/3; 4734/3; 4735/2; 4781/2; 4780/2; 4736/2; 4799/2; 4758/2; 4742/3; 4743/7; 4749/2; 4760/2; 4750/2; 4757/2; 4754/2; 4756/2; 4755/4; 4154/9; 4158/4; K.O. Novi Bar	
Glavni inženjer: Dušan Džudović d.i.a.		Vrsta tehničke dokumentacije: GLAVNI PROJEKAT	
Odgovorni inženjer: Jovana Perović, spec.sci.građ.		Dio tehničke dokumentacije: KONSTRUKCIJA POTPORNI ZIDOVI – PLAN ARMATURE	RAZMJERA: 1:50
Saradnici: Mirko Jušković, bsc.građ. Marko Šoć, dipl.inž.građ.		Prilog: POTPORNI ZID PZ 1	Broj priloga: 03
Datum izrade i M.P.: Januar, 2024.		Datum revizije i M.P.:	
		Broj strane: 01	

PLAN ARMATURE POTPORNIH ZIDOVA



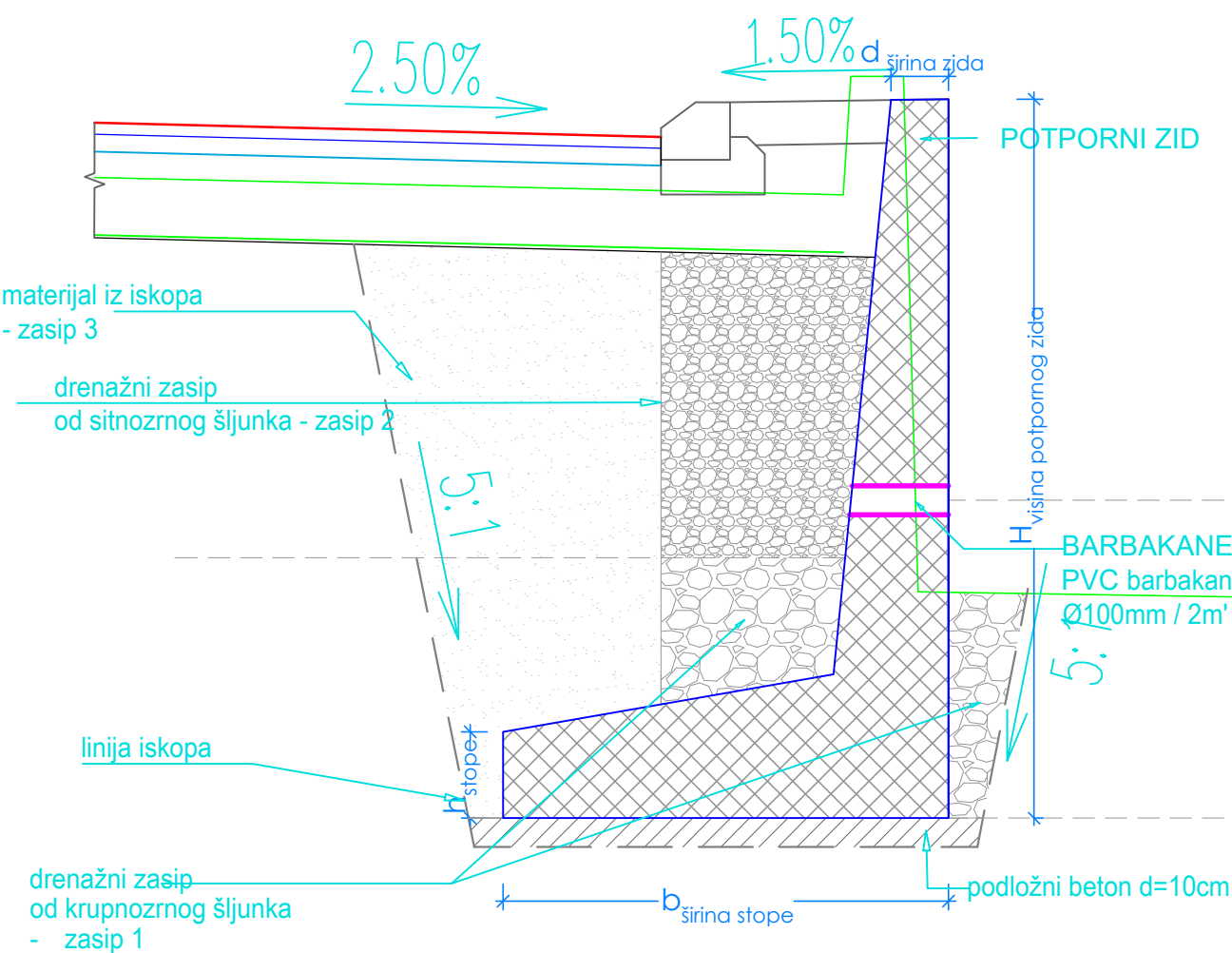
Prilikom izvođenja ovaj crtež posmatrati uporedo sa
planovima arhitekture.

Barbakane postavljati 30cm iznad površine terena.

Kampade izvoditi naizmjenično, parne pa neparne.

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Objekat: Saobraćajnica sa pratećom infrastrukturom, dio koji se nalazi između zona "A" i "B" sa jedne strane i zone "Aa" sa druge strane, u zahvatu DUP-a "Ilino", Bar		Lokacija: Katastarske parcele 4813/5; 4814/10; 4755/2; 4733/5; 4782/4; 4782/3; 4734/3; 4735/2; 4781/2; 4780/2; 4736/2; 4799/2; 4758/2; 4742/3; 4743/7; 4749/2; 4760/2; 4750/2; 4757/2; 4754/2; 4756/2; 4755/4; 4154/9; 4158/4; K.O. Novi Bar	
Glavni inženjer: <div style="text-align: center;">Dušan Džudović d.i.a.</div>		Vrsta tehničke dokumentacije: <div style="text-align: center; font-size: 1.2em; font-weight: bold;">GLAVNI PROJEKAT</div>	
Odgovorni inženjer: <div style="text-align: center;">Jovana Perović, spec.sci.grad.</div>		Dio tehničke dokumentacije: KONSTRUKCIJA POTPORNI ZIDovi + PLAN ARMATURE	RAZMJERA: <div style="text-align: center; font-size: 1.5em; font-weight: bold;">1:50</div>
Saradnici: Miroko Jušković, bsc.grad. Marko Soć, dipl.inž.grad.		Priilo: POTPORNI ZID u zasipu TIP 1 i TIP 2 POTPORNI ZID PZ 2	Broj priloga: <div style="text-align: center; font-size: 1.5em; font-weight: bold;">03</div>
Saradnici: Miroko Jušković, bsc.grad. Marko Soć, dipl.inž.grad.		Priilo: POTPORNI ZID u zasipu TIP 1 i TIP 2 POTPORNI ZID PZ 2	Broj strane: <div style="text-align: center; font-size: 1.5em; font-weight: bold;">02</div>
Datum izrade i M.P. .Januar. 2024		Datum revizije i M.P.	

KARAKTERISTIČNI DETALJ TIPSKOG POTPORNOG ZIDA SA DRENAŽOM



Napomena: Dimenzije potpornog zida prilagoditi dimenzijama potpornih zidova iz projekta. Crtež je prikazan kao primjer sistema drenaže potpornih zidova.

Napomena 1: Iskop za izradu potporne konstrukcije se ne smije ostaviti da stoji dugo otvoren. Preporuka je da se od izvođenja iskopa u roku od 7- 10 dana izvede potporna konstrukcija i izvrši zatrpavanje preostalog profila do projektom predviđenih kota. Napredovanje iskopa u podužnom pravcu ograničiti na dužinu jednaku dužini 1 -1.5 kampade. U suprotnom preduzeti dodatne mjere u cilju obezbjeđivanja stabilnosti iskopa, odobrene od strane nadzora. Na izvođenju se u svemu/pridržavati važećeg Zakona o zaštiti na radu.

Napomena 2: Prije izrade i poručivanja oplata i armature sve dimenzije i broj komada provjeriti na licu mjesta. Eventualne izmjene vršiti uz saglasnost Nadzora i Investitora.

Napomena 3: U potpornom zidu izvesti barbakane PVC-DN100, u skladu sa detaljima datim na grafičkom prilogu za barbakane. Prvi red barbakana postaviti u nivou rječnog dna, a iza ovih barbakana u drenažnom materijalu položiti perforiranu drenažnu cijev PP-ID100-SN8 (otvor perforacija ne manje od 100cm2/m) sa izvodima u barbakane od cijevi PVC-DN100. Iza zida izvesti drenažni materijal- filtarski sloj od šljunka iii tucanika D=64-160mm. Filtarski sloj uviti u netkani geotekstil 600gr/m2. Preklopi kod nastavljanja geotekstila su 10-15cm.

Napomena 4:
Napomene za zidove u usijeku:
U svim zidovima izvesti barbakane prečnika Ø100mm. Barbakane izvesti u jednom redu, na međusobnom horizontalnom razmaku od 200cm. Sve barbakane izvesti sa padom od 2% prema vanjskoj strani zida.
Napomene za zidove u nasipu:
Vertikalni i horizontalni razmak između barbakana je 200cm (horizontalni razmak) i 100cm (vertikalni razmak). Iza prvog reda barbakana u drenažnom materijalu iza zida položiti perforiranu drenažnu cijev PP-ID100-SNB (otvor perforacija da nije manji od 100cm2/m) sa izvodima u barbakane od cijevi PVC-DN100. Sve barbakane izvesti sa padom od 2% prema vanjskoj strani zida.
• Ukoliko je visina zida veća od 4.0 m barbakane izvesti u tri reda.
• Ukoliko je visina zida od 2.5 do 4.0 m barbakane izvesti u dva reda.
• Ukoliko je visina zida 2.0m barbakane izvesti u jednom redu.

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<div>Objekat:</div> <div>Saobraćajnica sa pratećom infrastrukturom, dio koji se nalazi između zona "A" i "B" sa jedne strane i zone "Aa" sa druge strane, u zahvatu DUP-a "Ilino", Bar</div>		<div>Lokacija:</div> <div>Katastarske parcele 4813/5; 4814/10; 4755/2; 4733/5; 4782/4; 4782/3; 4734/3; 4735/2; 4781/2; 4780/2; 4736/2; 4799/2; 4758/2; 4742/3; 4743/7; 4749/2; 4760/2; 4750/2; 4757/2; 4754/2; 4756/2; 4755/4; 4154/9; 4158/4; K.O. Novi Bar</div>			
<div>Glavni inženjer:</div> <div>Dušan Džudović d.i.a.</div>		<div>Vrsta tehničke dokumentacije:</div> <div>GLAVNI PROJEKAT</div>			
<div>Odgovorni inženjer:</div> <div>Jovana Perović, spec.sci.građ.</div>		<div>Dio tehničke dokumentacije:</div> <div>KONSTRUKCIJA POTPORNIH ZIDOVA</div>		<div>RAZMJERA:</div> <div>1:50</div>	
<div>Saradnici:</div> <div>Mirko Jušković, bsc.građ. Marko Šoć, dipl.inž.građ.</div>		<div>Prilog:</div> <div>KARAKTERISTIČNI DETALJ POTPORNOG ZIDA SA DRENAŽOM</div>		<div>Broj priloga:</div> <div>04</div> <div>Broj strane:</div> <div>01</div>	
<div>Datum izrade i M.P.</div> <div>Januar, 2024.</div>		<div>Datum revizije i M.P.</div>			