Naročnik:		Občina Cirkulane Cirkulane 58 2282 Cirkulane
Naziv projekta:		Sanacija JP 603081 – Gruškovec 110
Vrsta gradnje:		sanacija
Vrsta dokumentacije:		izvedbeni načrt
Številka projekta:		26 9 1311
Podatki o Načrtu		
Strokovno področje načrta:		načrt iz področja geotehnologije
Naziv načrta:		Geološko geotehnično poročilo z načrtom sanacije
Številka načrta:		GG 26 9 1311
Podatki o izdelovalcu načrta:		
Ime in priimek pooblaščenega inženirja		PI mag Janez Mayer, u.d.i.r.g.
Podatki o projektantu:		
Projektant:		PNV inženiring d.o.o. Špičnik 47, 2201 Kungota
Odgovorna oseba		Tomaž Mayer, d.i.g.(UN)
Datum izdelave:		november 2026

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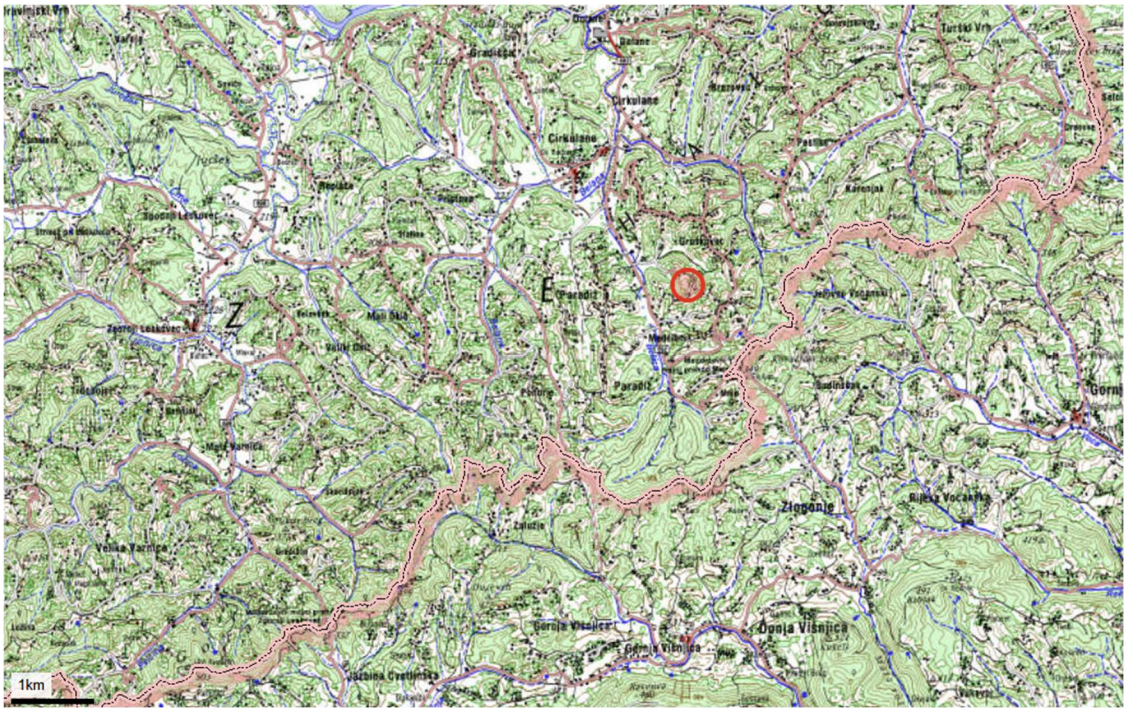
G.7 Detajli ceste

T. TEHNIČNI DEL

T.1. SPLOŠNO

Naročnik geološko geomehanskih meritev želi na lokalni cesti, na parceli št. 808/1 k.o. 475 Gruškovec, v bližini objekta Gruškovec 111 pridobiti informacije o prisotnih materialih in njihovih globinah za potrebe stabilizacije brežine.

Osnova za izdelavo tega poročila je terenska prospekcija območja, predhodne raziskave na obravnavanem območju, geodetski posnetek in izvedene terenske meritve ter interpretacija pridobljenih podatkov.



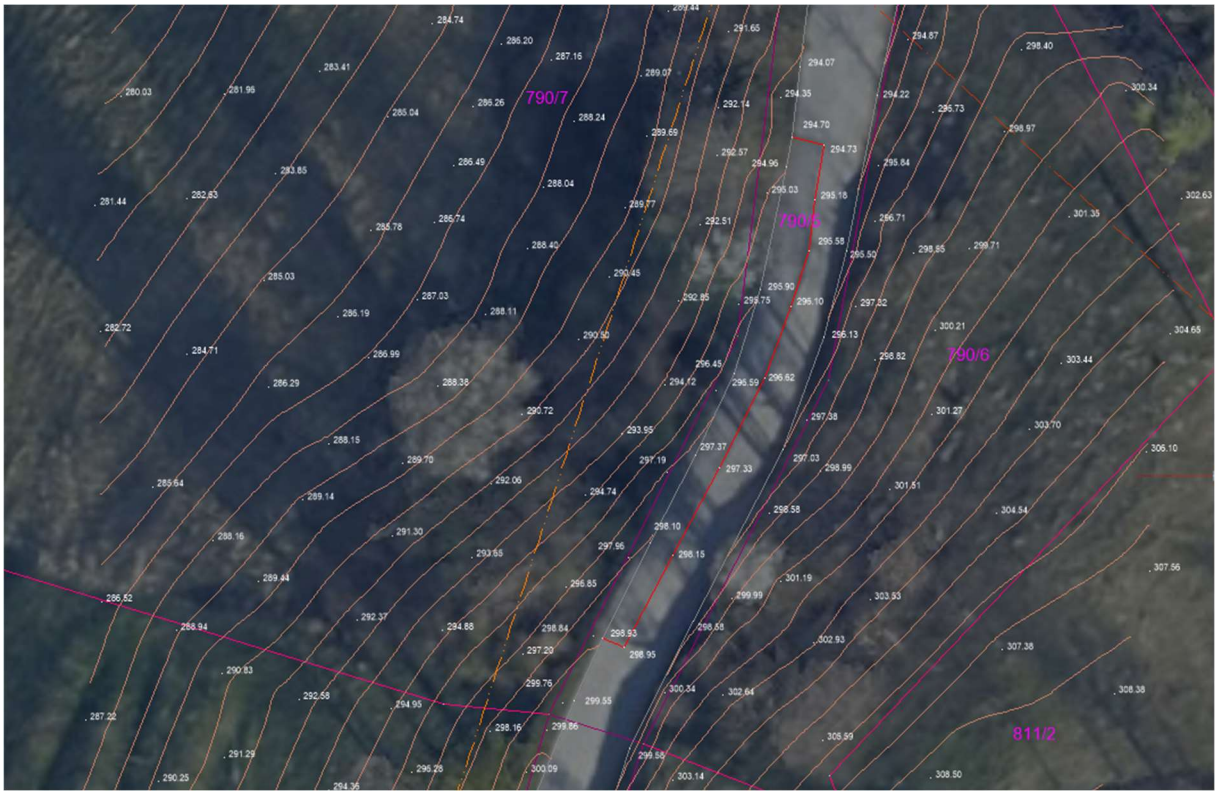
Slika 1: Makrolokacija



Slika 2: Mikrolokacija

T.1.1. Opis plazu

Pod lokalno cesto se je sprožil usad širine cca. 30m in širine cca. 15m. Usedla se je večja gmota razmočenega glinenega materiala zaradi povečane količine vode v materialu. Zaradi usada so vidne vzdolžne razpoke v lokalni cesti, na določenih območjih pa se lahko vidi tudi odlomljene kose asfalta, kljub temu, da je osek asfalta ob brežini že bil saniran in ponovno asfaltiran. Obstoječe vozišče ima muldo na notranji strani ceste, katera vodi vodo v betonske jaške, od koder se jo pod voziščem skozi prepustno cev spušča po brežini. Jaški so v slabem stanju, eden celo popolnoma polomljen.



Slika 3: Situacija obravnavane lokacije



Slika 4: Slika iz terena

T.2. TERENSKE PREISKAVE

T.2.1. Lokacije in število raziskav

Lokacije raziskav so bile zasnovane glede na lokacije objektov in infrastrukturnih vodov, konfiguracijo terena ter dostopnost. Izvedli smo 6 DPH meritev ter eno strukturno vrtino. Terenske preiskave so bile izvedene septembra 2026.

T.2.2. Dinamični penetrometer

Geološko sestavo in mehansko-fizikalne lastnosti temeljnih tal glede na odpornost smo ugotavljali z meritvami z dinamičnim penetrometrom DPH.

Izvedba penetracijskega sondiranja terena nam omogoča pridobiti informacije o odpornostnih karakteristikah materialov ter določitvi slojev glede na odpornost.

Rezultate meritev smo pretvorili na standardni penetracijski preizkus SPT.

Rezultati meritev in interpretacija merjenih rezultatov so prikazani med prilogami.

T.2.3. Strukturna vrtina

V sklopu raziskav smo izvedli strukturno vrtino premera 80mm do globine 2,9 m. Lokacija odvzema vrtine je označena na prilogi G1. Povzetek vrtine se nahaja v spodnji preglednici.

Jedro 1

Globina (cm)	Opis vzorca
0-110	Umetno prodnato-peščeno nasutje
110-270	Peščena glina
270-290	Prehod v lapor

Tabela 1: Popis vrtine 1



Slika 5: Strukturna vrtina - 0-290cm

T.3. GEOLOŠKO-GEOGRAFSKI OPISI

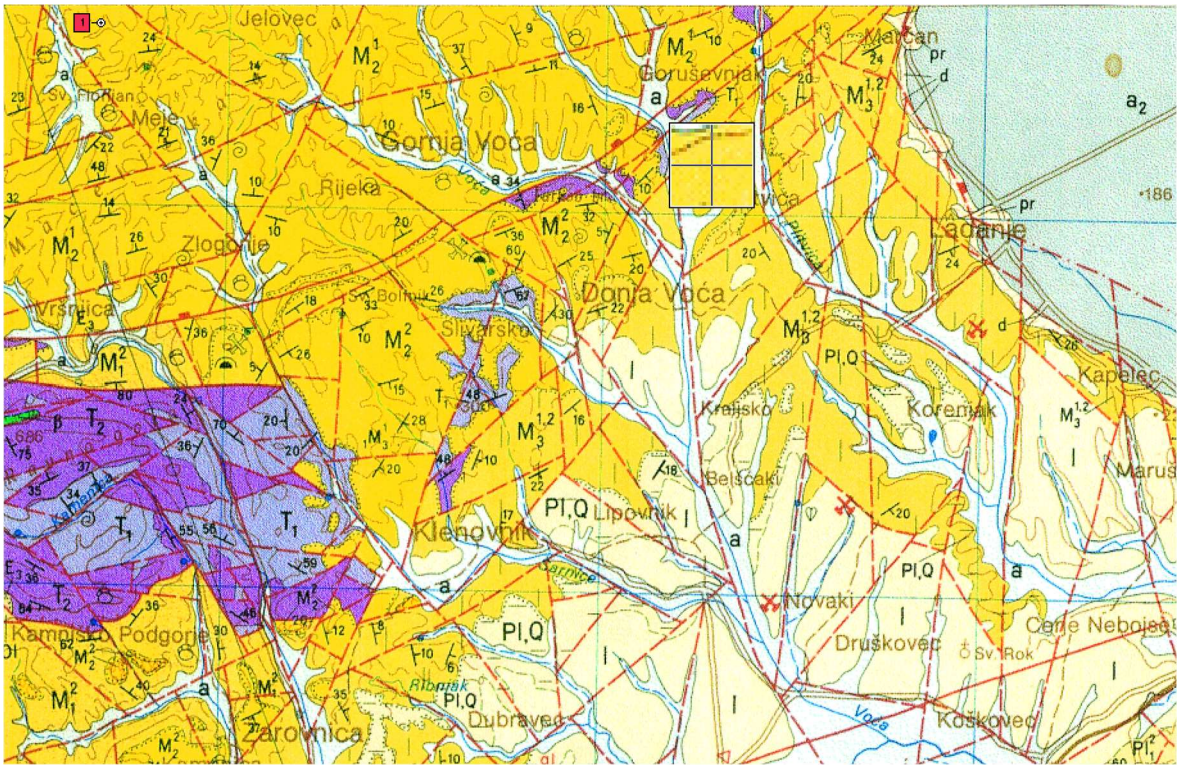
Obravnavana lokacija je prikazana na geološki karti Slovenije – List Rogatec in označena s številko 1.

V geotektonskem smislu leži v geotektonski enoti Južne Karavanke in pripada podenoti Haloška antiklinala.

Haloška antiklinala (b) (imenovana po Halozah) je sestavljena prevladujoče iz plasti helvetijske starosti. Ozemlje Haloz je tudi tektonsko razsekano in nagubano. Slemenitev plasti je pretežno ZJZ-VSV. V vzhodnem delu so vidne še manjše antiklinalne in sinklinalne strukture. V Halozah ni jasno vidna antiklinalna struktura, glede na celotno zgradbo Haloz in sosednjega ozemlja, zato sklepamo na antiklinalno zgradbo.

Lokacija leži na podlagi iz Pmateriala kot je pesek, peščenjak, konglomerat, lapor, breča (helvetijska stopnja) na karti označenega z M2/1

Obravnavana lokacija leži v severno od Donačkega preloma. Prelomi so označeni na geološki karti z rdečo črto



Slika 6: Izsek iz geološke karte

Rec	OPIS_SIF	STAROST
1	Pesek, peščenjak, konglomerat, lapor, breča (helvet)	M2/1

T.4. POGOJI ZA PROJEKTIRANJE IN GRADNJO

T.4.1. Zemeljski sloji

Kamnito nasutje obstoječe VK (saGr):

Kamnito nasutje predstavlja peščen prod velikosti do ≈ D125.

Pričakovana kategorija izkopa: III. (vezljiva in nevezljiva zrnata zemljina)

Meljasto-peščena glina (siCl, saCl)

Melj in glina sta zemljini sestavljeni predvsem iz drobnozrnatih mineralov, pri tem so frakcije gline manjše kot pri melju. Melj načeloma ne nabreka, je slabo lepljiv in ni plastičen, medtem ko glina nabreka, je lepljiva, plastična ter dobro zadržuje vodo. V našem primeru sta pretežno rjave do sive barve in vsebujeta precej peska.

Pričakovana kategorija izkopa: III. (vezljiva in nevezljiva zrnata zemljina)

Lapor

Material je dovolj nosilen in se smatra kot nosilna podlaga. Materiali niso zmrzlinsko odporni.

Pričakovana kategorija izkopa: IV. - V (mehka do trda kamnina)

T.4.2. Karakteristike zemeljskih slojev

Pri projektiranju naj se upošteva karakteristike zemeljskih slojev podane v tabeli 1. Karakteristike zemeljskih materialov so pridobljene s terenskimi raziskavami ali pa so izkustveno ocenjene.

Sloj	Kohezija c (kPa)	Strižni kot ϕ (º)	Prostorninska teža γ (kN/m^3)	Modul elastičnosti E (MPa)
Kamnito nasutje (peščen prod)	0-5	25-35	20	40 – 60
Meljasto-peščena glina srednje/težko gn. kons.	0-10	20 – 27	19	10 – 20
Lapor	10-30	30-40	21	50-100

Tabela 2: Karakteristike zemeljskih slojev

T.4.1. Podzemna in meteorna voda

Konkretni podatki o gibanju nivoja podzemnih vod na tem območju nam niso na voljo, ker ni na voljo opazovalnih objektov. Med izvajanjem meritev nismo zaznali povečane vlažnosti zemljine. Ob daljšem in bolj intenzivnem deževju se lahko pričakuje dvig podtalne vode.

T.4.2. Vodoprepustnost in ponikanje

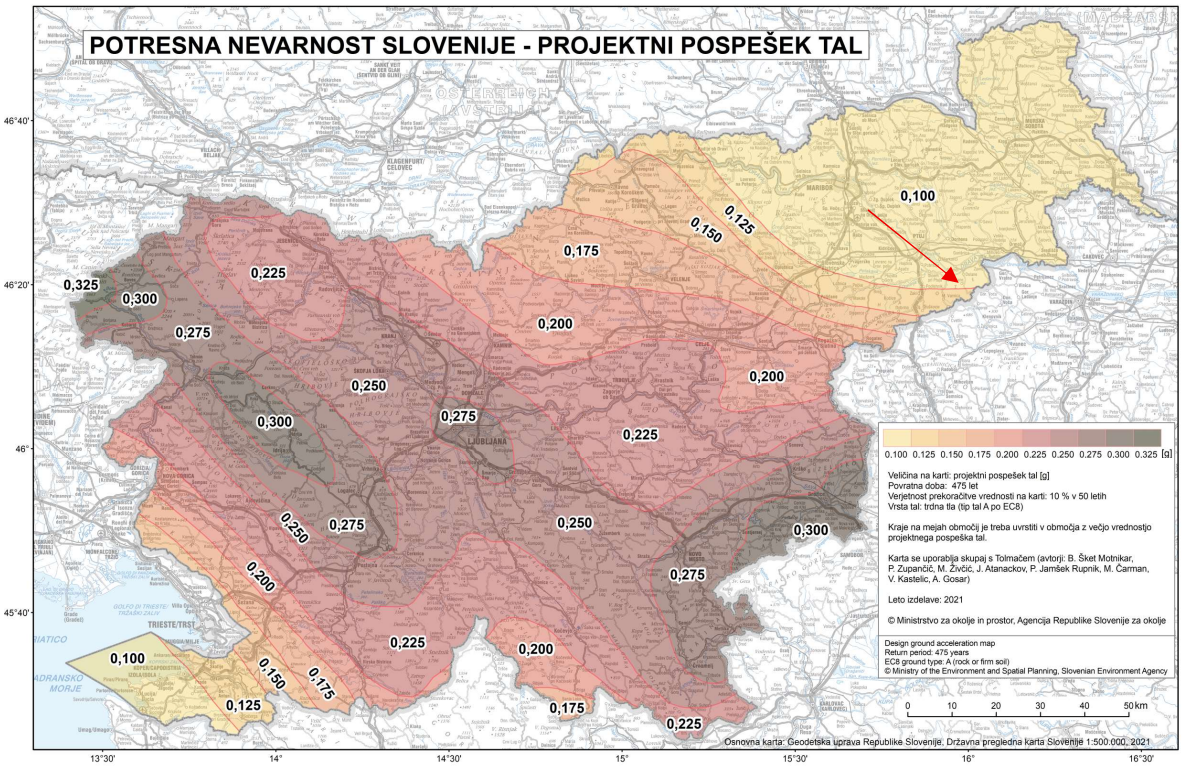
Na podlagi znanih podatkov in meritev na ocenjujemo faktor vodoprepustnosti v glineni podlagi k=1x10^{-7} m/s. Materiali nad nepodajno podlago niso primerni za ponikanje. Priporočamo izdelavo zadrževalnika ali izpust v javno meteorno kanalizacijo ali v površinski odvodnik.

T.4.3. Seizmičnost terena

Podatke o seizmičnosti terena smo povzeli po karti »POTRESNA NEVARNOST SLOVENIJE – PROJEKTNI POSPEŠEK TAL« za povratno dobo 475 let, ki je od leta 2008 obvezna za uporabo pri projektiranju skladno s predpisi EUROCODE.

Projektni pospešek tal: 0,125 g

Tip tal: A – Skala ali druga skali podobna geološka formacija, na kateri je največ 5m slabšega površinskega materiala



Slika 6: Karta projektnega pospeška tal s povratno dobo 475 let

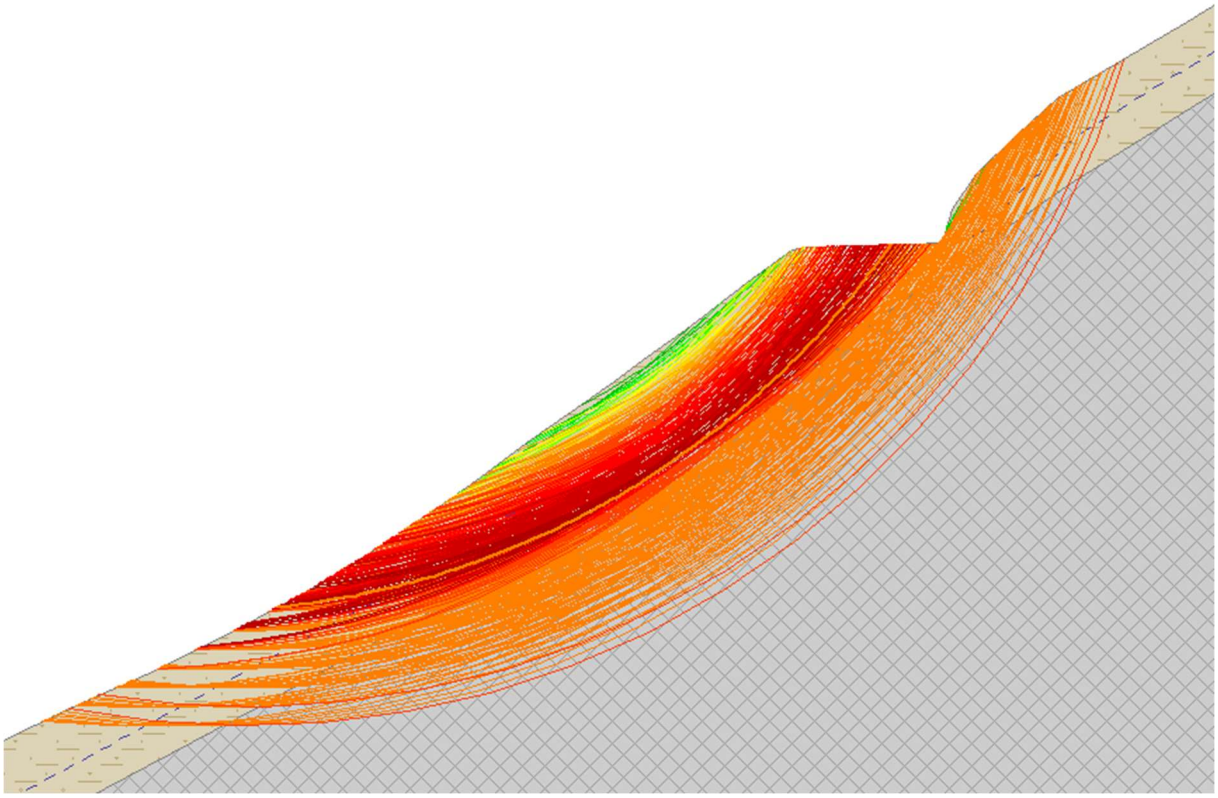
T.5. POVRATNE ANALIZE

V sklopu določitev trdnosti zemljine smo poleg interpretacij meritev izvedli tudi povratne analize. Le te smo izvedli na enem karakterističnem prerezu, ki izkazujejo najslabše karakteristike materialov. Le to smo izvedli na profilu P3.

Podrobni rezultati so prikazani v računskem delu med prilogami.

S povratno analizo smo preverili izvrednotenje geomehanskih karakteristik pridobljenih s preiskavami.

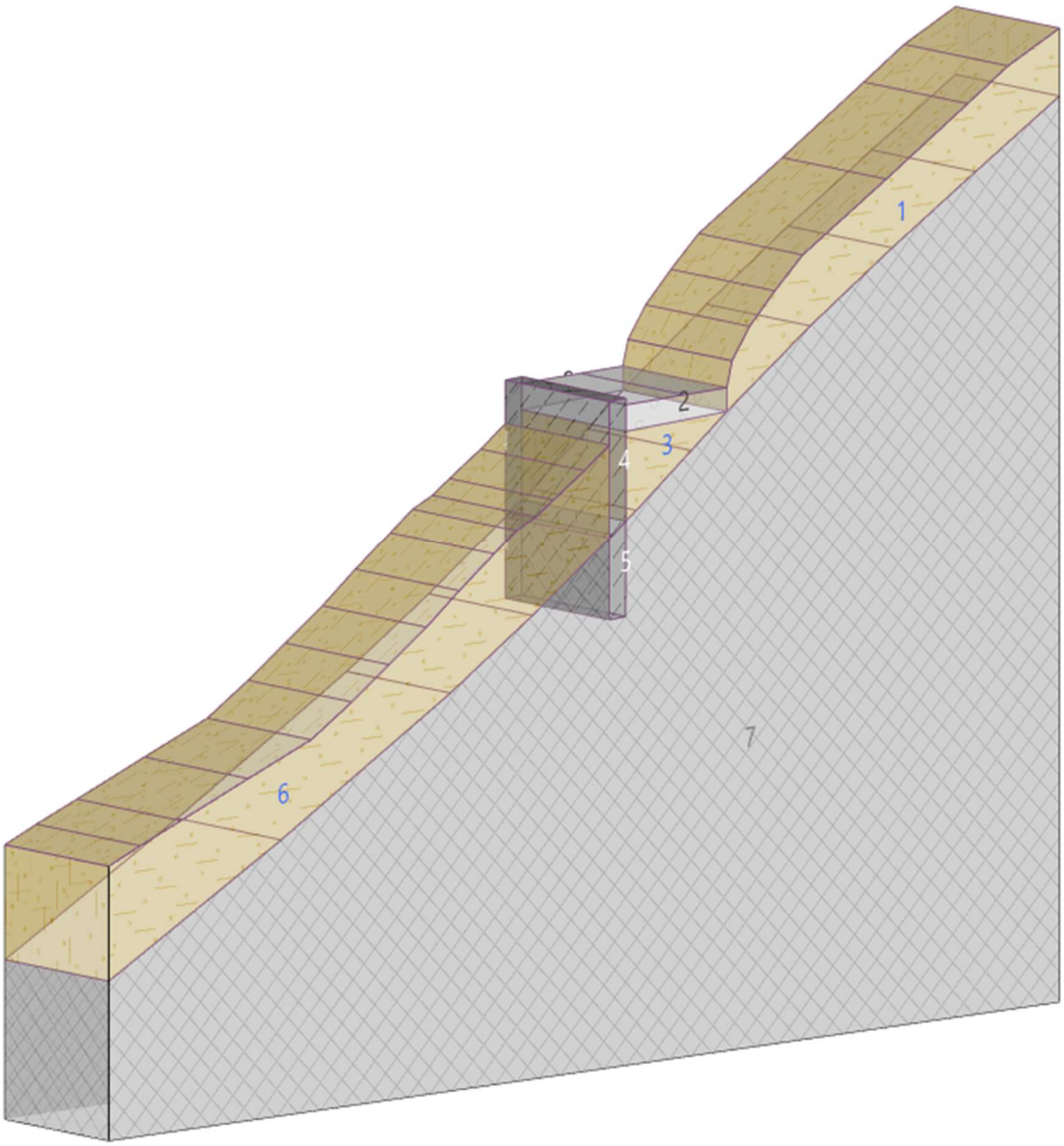
Preračunano je, da je kot notranjega trenja peščene gline 25 ter kohezija 6 kPa. Ti rezultati so bili upoštevani v analizah stabilnosti ter dimenzioniranju zidu.



Slika 7: Kritična porušnica na P3

T.6. ANALIZA STABILNOSTI

V analizi smo obravnavali prečni profil P3.



Slika 8: Geometrija geološkega prečnega profila P3 uporabljanega v analizah

T.6.1. Analiza v P3

Uporabljene karakteristike materialov v analizah:

Tampon:

C = 1 kPa - kohezija
φ = 35° - strižni kot
γ = 20 kN/m^3 - prostorninska teža

Peščena glina:

C = 6 kPa - kohezija
φ = 25° - strižni kot
γ = 19 kN/m^3 - prostorninska teža

Lapor:

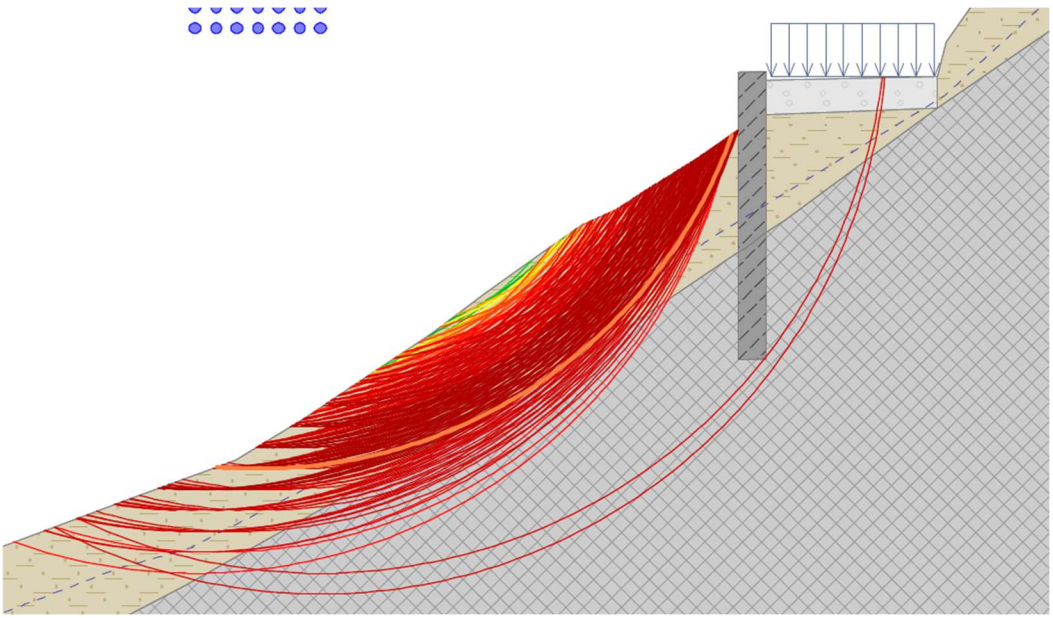
C = 15 kPa - kohezija
φ = 34° - strižni kot
γ = 21 kN/m^3 - prostorninska teža

T.6.2. Rezultati analize stabilnosti

Analizo smo izvedli z analitično metodo po Janbuju z Mohr – Coulombovim modelom. V analizah smo upoštevali geometrijo obravnavanega profila, obtežbo prometa in dodali smo vodo, ki jo lahko pričakujemo ob daljših nalivih. V analizi so upoštevani varnostni faktorji po EC.

Podrobni rezultati so podani v poglavju R.

FAZA	Varnostni faktor
1	1,30
2	1,25
3	1,25



Slika 9: Prikaz porušnice na P3

Iz rezultatov je razvidno, da je stanje po sanaciji zadoščeno faktorju varnosti 1,25.

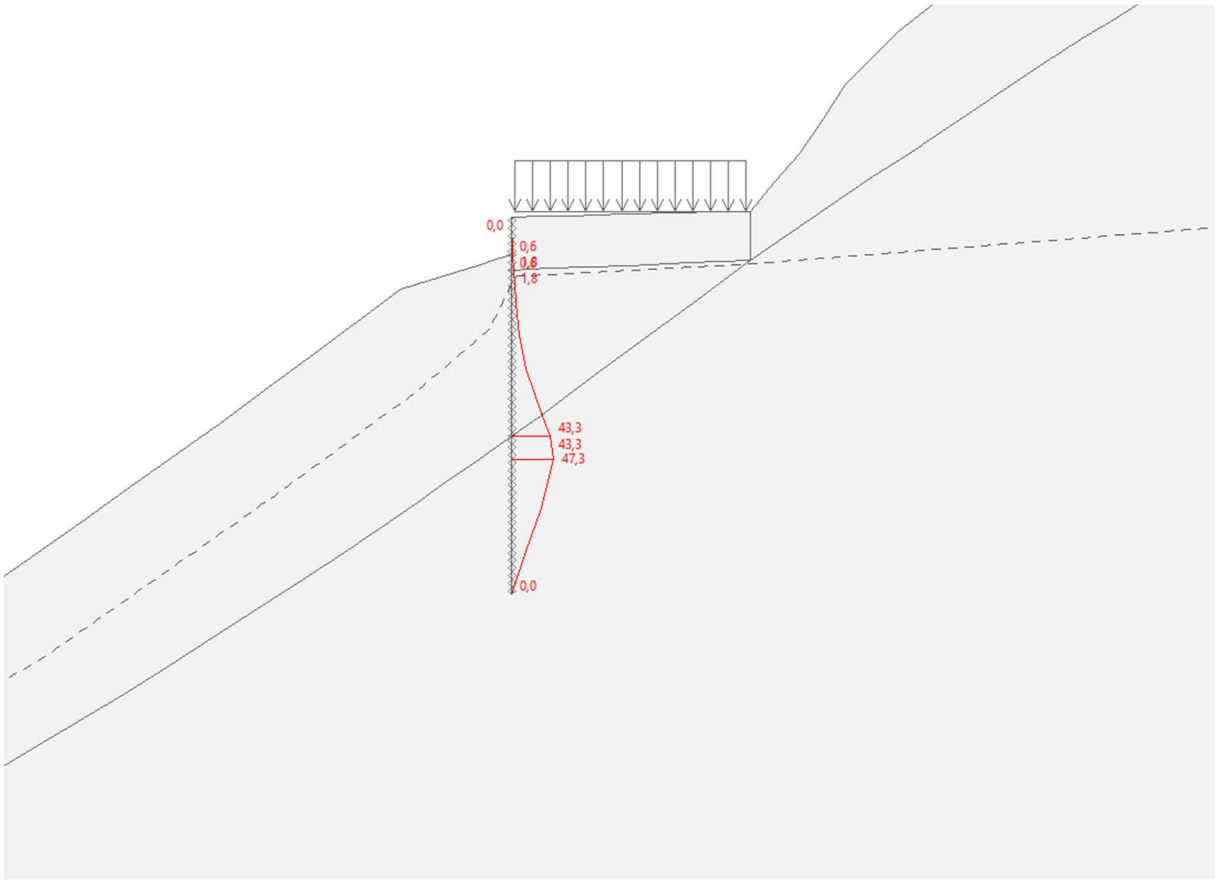
T.7. PRERAČUN IN DIMENZIONIRANJE

Na podlagi GG preiskav ter geodetskega posnetka smo lahko določili tip sanacije, kateri je najbolj smotrn. Kot najbolj smotrn tip sanacije smatramo izdelavo uvrtanih AB pilotov. Za dokaz stabilnosti smo izvedli stabilnostno analizo, kjer smo upoštevali materialne karakteristike preračunane iz DPH meritev ter povratne analize. Te karakteristike so podcenjene, saj ne upoštevamo povečanje kohezivnosti materiala ob bistveno zmanjšani prisotnosti podtalne vode.

Za sanacijo je predvidena pilotna stena iz uvrtanih armiranobetonskih pilotov premera 0,50 m Izračun je bil izveden v programu GEO5 FEM po metodi končnih elementov. Zemljine in hribinska podlaga so modelirane z modelom Modified Mohr–Coulomb v dreniranih pogojih. V izračunu je uporabljen prerez P3.

Uporabljen je projektni pristop PP2, kjer geotehnične lastnosti materialov ostanejo nespremenjene, faktorirajo pa se le vplivi oz. notranje statične količine.

Rezultati preračuna in dimenzioniranja pilotov so prikazani med prilogami –R.računski del.



Slika 10: Geometrija geološkega prečnega profila P3 uporabljanega v analizah

T.8. PREDLOG IZVEDBE in TEHNOLOGIJA DEL

T.8.1. Predlog izvedbe in opis sanacije – pilotna stena

Pripravljalna dela

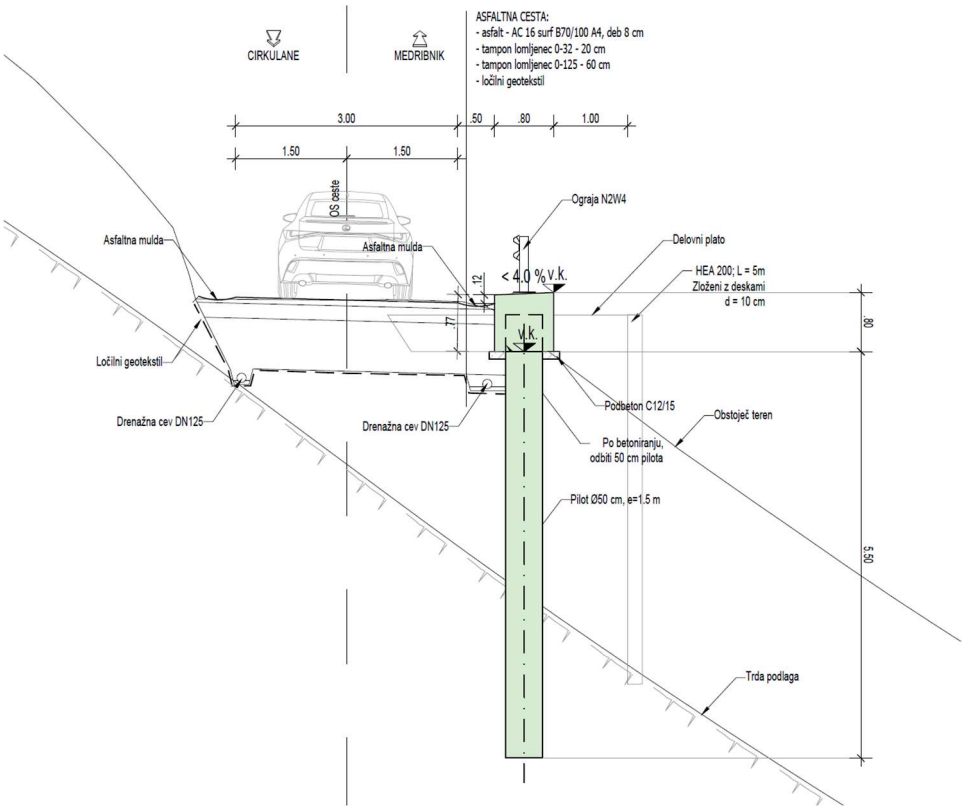
Pred pričetkom del je potrebo očistiti območje gradbišča ter pripraviti delovni plato. Delovni plato mora biti 50cm višje od spodnje kote grede, ki je označena na grafikah. Na spodnji strani pilotne stene bo potrebno izdelati varovanje delovnega platoja. Predvideno je varovanje z zabimi HEA 200 profili, dolžine 5 m in založenimi s plohi debeline 10cm. Širina platoja naj se prilagodi, glede na izbrano tehnologijo dela. Nasutje za plato naj se izdela iz tamponskega drobljenca, ki se kasneje, ob potrditvi nadzornika, lahko uporabi v cesti.

Pilotna stena

Kot najbolj ustrezen tip sanacije je bila izbrana sanacija s pilotno steno. Predvideni so piloti premera 50 cm na osnem razmaku 1,5 m. Piloti so dolžine 5,5 m. V hribinsko podlago morajo biti vpeti najmanj 3d. V kolikor bo potrebno in to presodi geotehnični nadzornik, je potrebno pilote prilagoditi geološkim razmeram na terenu. Piloti morajo biti zabetonirani 50cm višje od spodnjega roba grede. Po izdelavi pilotov se lahko pristopi k znižanju delovnega platoja in odbijanju glav pilotov v višini 50cm. Šele za tem se lahko pristopi k izdelavi grede.

Geotehnična sidra

Geotehnična sidra niso predvidena.



Slika 11: KPP pilotne stene

T.9. NASIPI

Morebitni novi nasipi na območju cestišča naj se izvajajo v zemljinah v naklonu največ 1:2, v primeru kamnitega nasutja (drobljenec) pa v naklonu največ 1:1.5.

Večjih nasipov ni predvidenih.

T.10. ODVODNJAVANJE

Odvodnjavanje obstoječega vozišča je urejeno z muldo, od koder se voda odvaja v jaške ter nato po prepustih na brežino. Jaški so v slabem stanju, brežina pa pri iztokih prepustov sprana in namočena.

V sklopu sanacije je po celotni dolžini nove pilotne stene predvidena mulda, po kateri se bo padavinska voda odvajala v armiranobetonski revizijski jašek premera 100 cm in globine 3 m. V isti jašek bo speljana tudi drenažna cev za pilotno steno. Iz jaška se bo voda po trdostenski cevi DN 200 odvajala približno 20 m navzdol po brežini do urejenega iztoka tako, da ne bo povzročala nadaljnjega spiranja brežine ali zmanjševala njene stabilnosti. Vzdolžni naklon odvodne cevi naj ne presega 5 %.

Na notranji strani ceste je predvidena mulda za prestrezanje vode z brežine po celotni dolžini obravnavanega odseka ceste. Voda se bo iz mulde odvajala dva AB jaška premera 100 cm in globine 1,5 m. Jaška naj se obdelata s kamnito oblogo. Pod muldo je predvidena drenažna cev DN 125, ki se prav tako priključi na naveden jašek.

Pod voziščem se izvedeta novi prepustni cevi premera 50 cm. Cevi se spelje od jaškov (med piloti) do urejenega in tlakovanega iztoka, s čimer se prepreči erozijsko spiranje brežine. Vzdolžni naklon cevi naj ne presega 2 %.

Vse elemente odvodnjavanja je potrebno za ustrezno opravljanje njihovih funkcij, redno vzdrževati in čistiti.

Konstrukcijski detajli peskolovov, prepusta, tlakovanja iztokov ter izvedbe drenaže so prikazani v grafičnih prilogah.

T.11. PODPORNE KONSTRUKCIJE

Podporne konstrukcije so stabilnostno in statično preračunane ter sprojektirane skladno s specifikacijami TSC in standardi Evrokod.

Pri projektiranju podpornih konstrukcij so upoštevane karakteristike zemljin, globine posameznih slojev zemljin, nivoje talne vode ter ostale podatke iz pričujočega geološko-geomehanskega poročila.

T.12. VOZIŠČNE KONSTRUKCIJE

T.12.1. Uporabljeni standardi in literatura

- TSC 06.520: 2009 Projektiranje, Dimenzioniranje novih asfaltnih voziščnih konstrukcij, DRSC
- TSC 06.512: 2003 Projektiranje, Klimatski in hidrološki pogoji
- TSC 06.100: 2003 Kamnita posteljica in povozni plato
- TSC 06.200: 2003 Nevezane nosilne in obrabne plasti
- TSC 06.300: 2009 Smernice in tehnični pogoji za graditev asfaltnih plasti
- TSC 06.330: 2003 Vezane spodnje nosilne plasti z bitumenskimi vezivi
- TSC 06.416: 2003 Vezane asfaltne obrabne in zaporne plasti – tankoplastne prevleke
- SIST EN 13108, 1-8: 2003 Bitumenske zmesi - Specifikacije materialov - 1. do 8. del
- SIST 1038, 1-8: 2006 Bituminizirane zmesi – Specifikacije materialov - 1. do 8. del
- SIST EN 13043: 2002 Agregati za bituminizirane zmesi in površinske prevleke za ceste, letališča in druge prometne površine
- SIST 1035: Bitumen in bitumenska veziva

T.12.2. Obstoječe stanje voziščne konstrukcije

Povzetek iz geološko-geomehanskega elaborata:

Obstoječe cestišče JP 603081 na obravnavanem odseku pri naslovu Gruškovec 110 je v dotrajanem stanju. Na vozišču so vidne razpoke, manjše kolesnice, ter večja posedanja ob robovih. Ponekod se ob robovih asfalt lomi in odpada od voziščne konstrukcije.

Sestava obstoječe VK:

≈ 5 cm asfaltni sloj

≈ 95 cm Nasut peščen prod (saGr)

Raščen teren predstavlja peščena glina (saCl).

Glede na videno na terenu menimo, da je obstoječe kamnito nasutje (peščen prod) ni ustrezen za ponovno uporabo v novi voziščni konstrukciji (posteljici).

T.12.3. GEOLOŠKO-GEOTEHNIČNI PODATKI

T.12.3.1. Sestava in nosilnost planuma temeljnih tal

Povzetek iz geološko-geomehanskega elaborata:

Rezultati so pridobljeni na podlagi SPT rezultatov, prikazanih v geomehanskem elaboratu. Privzeli smo najbolj neugoden rezultat NSPT preizkusov.

Mesto meritve	Globina (cm)	NSPT	CBR ≈ (%)	Material
DPH 1	100	6	3	Peščena glina

Pri dimenzioniranju vozišče konstrukcije naj se upošteva vrednost CBR ≈ 3 %

T.12.3.2. Klimatski in hidrološki pogoji

Maksimalna globina prodiranja mraza h_m na tem območju znaša ≈ 70 cm (povzeto po karti globin prodiranja mraza na področju Republike Slovenije).

Temeljna tla sestavljajo materiali, kateri se uvrščajo v razred neodpornih proti učinkom zmrzovanja in odtajevanja, saj se v temeljnih tleh nahajajo gline.

Hidrološke pogoje glede na lego trase ter ureditve odvodnjavanja obravnavamo kot neugodne.

Potrebna debelina vozišče konstrukcije $h_{min} = 0.8 \cdot h_m = 0.8 \cdot 70 = 56$ cm.

T.12.4. PROMETNE OBREMENITVE

T.12.4.1. Prometna obremenitev – javna pot

Za obravnavano cesto, podatkov o štetju prometa ni bilo mogoče pridobiti. Zaradi tega smo prometno obremenitev ocenili na zelo lahko do lahko, glede na lokacijo in tip cestišča.

Za prometno obremenitev tako upoštevamo naslednje:

$T_{20} = 2 \cdot 10^5$ do $6 \cdot 10^5$ (Zelo lahka do lahka prometna obremenitev)

T.12.5. DIMENZIONIRANJE VOZIŠČNE KONSTRUKCIJE

T.12.5.1. Osnove

Dimenzioniranje je izvedeno na podlagi geološko-geotehničnih pogojev in določene prometne obremenitve. Dimenzioniranje vozišče konstrukcije je izvedeno skladno s Tehničnimi specifikacijami za javne ceste Republike Slovenije.

T.12.6. Minimalne debeline plasti in potrebni debelinski indeks

Za obravnavani odsek je bila določena zelo lahka do lahka prometna obremenitev, $T_{20} = 2 \cdot 10^5$ do $6 \cdot 10^5$ prehodov NOO 100 kN.

Na osnovi izračunane prometne obremenitve in predvidene nosilnosti posteljice (CBR 15 %) je potrebna vozišča konstrukcija iz plasti:

- 8 cm plasti bituminiziranih zmesi (TSC 06.520 : 2009 – tabela 9)
- 20 cm plasti nevezane nosilne plasti kamnitih zrn (TSC 06.520 : 2009 – tabela 9)

Debelinski indeks potrebne vozišče konstrukcije znaša:

$D_{pot} = a_k \cdot d_k + a_{sn} \cdot d_{sn} = 8 \cdot 0.38 + 20 \cdot 0.14$

$D_{pot} = 5{,}84$

a) Nova voziščna konstrukcija

Zaradi zagotovitve zmrzlinske odpornosti voziščne konstrukcije in dodatne izboljšave nosilnosti (CBR iz 3 % na 15 %) je predvidena vgradnja najmanj 60 cm debele plasti zmrzlinsko odpornega kamnitega materiala (posteljice) kar z nevezano nosilno plastjo (20 cm) in slojem bitumenskih zmesi (8 cm) nanese na 93 cm in tako presega potrebnih 56 cm.

Dimenzioniranje voziščne konstrukcije je izvedeno na podlagi prometne obremenitve in nosilnosti temeljnih tal:

Sloj	**d_i (cm)**	**a_i**	**$a_i \cdot d_i$**
Bitumenski beton BB - obrabna plast	8	0.42	3.36
Nevezana nosilna plast D	20	0.14	2.80
Zmrzlinsko odporna kamnita posteljica D, P	60	-	-
Skupaj:	**93**		**6.16**

D_{dej} = 6.16 ≥ D_{pot} = 5,84 pogoj je izpolnjen

h_{dej} = 88 cm ≥ h_{min}= 56 cm pogoj je izpolnjen

T.12.7. Predvidene nove voziščne konstrukcije

T.12.7.1. JP 603081

Predvidene plasti nove voziščne konstrukcije:

- Vgradnja ločilnega geotekstila
- Zmrzlinsko odporna posteljica kamnitega drobljenca ali prodca D125 60 cm
- Nevezana nosilna plast kamnitega drobljenca D32 20 cm
- Obrabna plast bituminizirane zmesi AC 16 surf B 70/100, A4 8 cm

T.12.8. IZVEDBA IN KVALITETA MATERIALOV

T.12.8.1. Planum temeljnih tal

Na planum se naj vgradi ločilni geotekstil.

Na planumu temeljnih tal mora biti zagotovljena nosilnost Evd > 10 MPa, Ev2 > 20 MPa.

V kolikor pogoj ni izpolnjen, se naj na območju predvidi lokalna poglobitev terena do globine, kjer je pogoju zadoščeno.

T.12.8.2. Kamnita posteljica

Za kamnito posteljico se vgradi kamniti drobljenec ali prodec D125.

Zgoščenost v kamnito posteljico vgrajene zmesi zrn mora znašati v povprečju najmanj 97% glede na največjo gostoto zmesi zrn po modificiranem postopku po Proctorju. Spodnja mejna vrednost zgoščenosti lahko od povprečja odstopa največ 3%. Na planumu kamnite posteljice mora biti zagotovljena nosilnost E_{vd} > 40 MPa, E_{v2} > 80 MPa.

T.12.8.3. Nevezana nosilna plast

Za nevezano nosilno plast se vgradi kamniti drobljenec D32.

Zgoščenost v nevezano nosilno plast vgrajene zmesi zrn mora znašati v povprečju najmanj 97% glede na največjo gostoto zmesi zrn po modificiranem postopku po Proctorju. Spodnja mejna vrednost zgoščenosti lahko od povprečja odstopa največ 3%. Na planumu nevezane nosilne plasti mora biti zagotovljena nosilnost E_{vd} > 45 MPa, E_{v2} > 100 MPa.

T.12.8.4. Vezane nosilne plasti

Kvaliteta vgrajenih asfaltnih slojev naj ustreza standardu TSC 06.416 : 2003 za obrabne sloje in TSC 06.330 : 2003 za spodnje nosilne sloje.

T.13. OPOZORILA

Drugačne razmere pri izvedbi izkopov, ki opisu v tem poročilu ne bi bile ustrezne, je potrebno ponovno pregledati, ugotoviti stanje in nosilnost temeljnih tal v delu, kjer jih predstavlja drugačen material od prognoziranega. Obtežni primer v izračunih je informativne narave. Za preračun dejanskega temeljenja je potrebno izdelati preračun temeljenja na podlagi dejanskih obtežb in reakcij objekta na temeljna tla. Vsa zemeljska dela se morajo izvajati v suhem vremenu. V primeru globljih in nenosilnih con pa je potreben ponoven ogled in odločitev o pripravi temeljnih tal, oziroma preračunu temeljenja. Varovanje gradbene jame mora biti izvedeno pod nadzorom geomehanika. Pri vrtanju pilotov mora biti prisoten geomehanik, ki potrdi prognozo v projektu.

Maribor, 4.11.2026 Sestavil:

Tomaž Mayer, dipl. inž. grad. (UN)

T.14. POPIS DEL

POPIS DEL

plaz PS1 Gruškovec

Št.	Šifra	OPIS DELA	Enota	Količina
	1.0	**PREDDELA**		
1		Obnovitev in zavarovanje zakoličene trase	km	0,90
2		Zakoličba pilotov	kom	35,00
3		Zakoličba pilotne grede in roba ceste	kos	1,00
4		Čiščenje terena	kpl	1,00
		opomba: posek drves ter čiščenje zaraščenega terena		
5		Ureditev začasne zapore ceste	kpl	1,00
	1.0	**PREDDELA SKUPAJ:**		
	2.0	**PILOTNA STENA**		
1		Strojni izkopi v zemljini III. in IV. kategorije, z upoštevanjem varovanja izkopa (45°) - priprava platoja	m3	29,00
2		Dobava in vgradnja ter odstranitev zabitih HEA200 profilov na razmaku max 1m z založenimi plohi debeline 10cm za začasno varovanje gradbene jame. Dolžina varovanja čez celotno dolžino pilotne stene - predvidena dolžina varovanja je 60m	m'	60,00
3		Dobava in vgradnja utrjenega nasutja TD 0-128 za izdelavo delovnega platoja	m3	138,00

4		Transport in priprava vrtalne garniture	kpl	1,00
5		Nakladanje in prevoz na deponijo - material za delovni plato	m3	130,00
6		Vrtanje za potrebe vgradnje AB pilotov fi 500mm, 35*5.5m	m'	210,00
7		Dobava in vgradnja betona za pilote C30/37, XD1, XF1, PV-II, dmax=32. S4, VB0	m3	45,25
8		Dobava in vgradnja armaturnih košev B500B pilotov	kg	8.928,89
9		odbijanje glave pilota višine 50 cm	kom	35,00
10		Dobava in vgradnja dvostranskega opaža za gredo in AB zid. Upoštevane prosta in zasuta stran ter bočne stranice	m2	85,00
11		Dobava in vgradnja armature B500B za gredo	kg	4.750,00
12		Dobava in vgradnja betona C30/37, XD1, XF2, PV-II, Dmax=32, S4, VB3 za gredo	m3	35,50
13		Dobava in vgradnja podbetona C12/15	m3	9,00
15		Vgradnja in izdelava dilatacijskega stika na pilotni gredi, debeline 2 cm. Uporaba trajno elastičnega kita	kpl	3,00
16		Ograja objekta Pilotne stene N2W4	m	89,00

		opomba: Upoštevano 16.0 m pred in 12.0 m za objektom ter 4.0 m prehoda na vsaki strani		
17		Tlakovanje v kamni v betonu 3 metre pred in za objektom ter tlakovanje iztkov	m3	25,00
	2.0	**PILOTNA STENA SKUPAJ :**		

	4.0	**ODVODNJEVANJE**		
1		Dobava in vgradnja PVC cevi DN500 za cevni prepust pod cesto. Vgradnja 1.5m AB jaška DN1000 na vtoku, z urejeno vtočno muldo in pokrovom, ter tlakovanje na iztoku cevi	kpl	2,00
2		Dobava in vgradnja AB jaška DN 1000, L=3.0m	kpl	1,00
3		izvedba drenaže za pilotno gredo Ø125 mm - na betonski muldi	m	53,00
4		Obdelava AB jaškov L=1,5m s kamnito oblogo	kpl	2,00
	4.0	**ODVODNJEVANJE SKUPAJ:**		

	5.0	**ZAKLJUČNA DELA**		
1		Izravnava in urejanje poškodovanih površin, humuziranje in zatravitev ter ureditev obstoječih naklonov brežin	m2	500,00
	5.0	**ZAKLJUČNA DELA SKUPAJ**		

	6.0	**CESTA**		
1		Odstranitev asfaltnega sloja	m2	305,00

2		strojni izkop obstoječe ceste 90cm z nakladanjem in odvozom na trajno deponijo v oddaljenosti 20 km	m3	320,00
3		dobava in vgrajevanje tamponskega drobljenca (deb 0-32) v skupni debelini 20 do 30cm cm, strojno raztiranje tampona, planiranje do točnosti +/- 1 cm, valjanje in utrjevanje do zbitosti EV2>100 MPa skupaj s prevozom - tampon v zbitem stanju. (odpornost proti drobljenju po metodi (LA) mora biti manjša od 30% pred oz po vgradnji), zamenjava tampona	m3	85,00
4		dobava in vgrajevanje tamponskega drobljenca (deb 0-125) v skupni debelini do 60cm cm, strojno raztiranje tampona, planiranje do točnosti +/- 1 cm, valjanje in utrjevanje do zbitosti EV2>80 MPa skupaj s prevozom - tampon v zbitem stanju. (odpornost proti drobljenju po metodi (LA) mora biti manjša od 30% pred oz po vgradnji), zamenjava tampona	m3	200,00
5		dobava in vgradnja ločilnega geotekstila. brez upoštevanja preklopov	m2	450,00
6		strojno planiranje z grederjem in utrjevanje spodnjega ustroja - priprava za asfaltiranje	m2	330,00

7		asfalt - AC 16 surf B70/100 A4, deb 8 cm	m2	330,00
8		Izvedba cestne drenaže Ø125 mm (raudrill) - na betonski muldi	m	90,00
9		Dodatek za izvedbo asfaltne mudle	m	145,00
	6.0	**CESTA SKUPAJ:**		

	7.0	**TUJE STORITVE**		
1		Geomehanski nadzor	ur	20,00
2		Projektantski nadzor	ur	20,00
3		Izdelava PID	kom	1
	7.0	**TUJE STORITVE SKUPAJ:**		

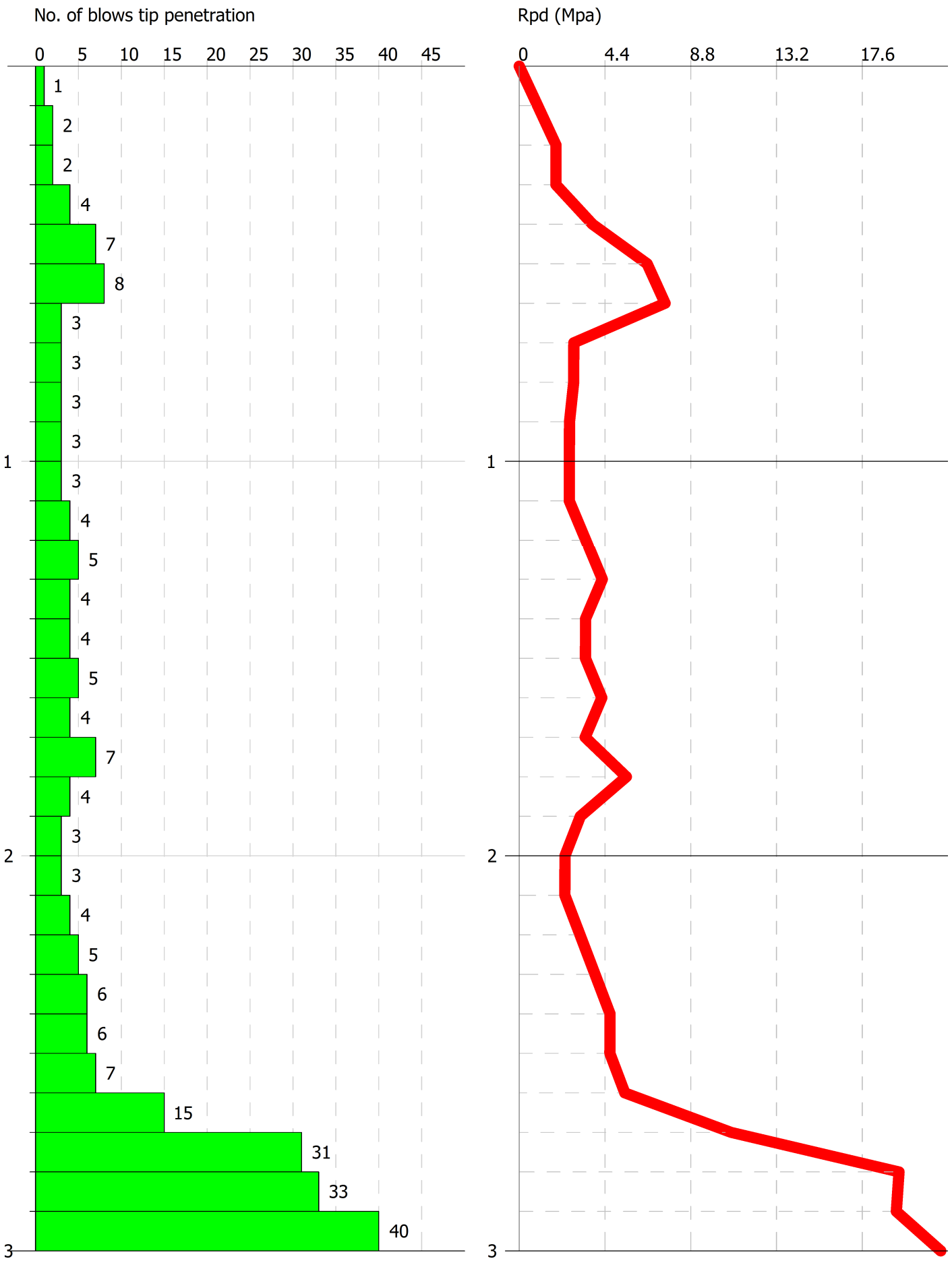
T.15. REZULTATI MERITEV

DYNAMIC PENETRATION TEST DPH 1
Equipment used... DPH

Customer: Obcina Cirkulane
Description: Plaz Gruškovec
Location: Gruškovec

20. 09. 2026

Scale 1:14



ESTIMATE TEST GEOTECHNICAL PARAMETERS DPH 1

COHESIVE SOILS

Undrained cohesion

Description	NSPT	Layer depth (m)	Correlation	Cu (KPa)
Layer (1) Layer	9.42	0.00-2.70	Terzaghi-Peck	62.37
Layer (2) Layer	70.52	2.70-3.00	Terzaghi-Peck	466.80

Qc (CPT Cone resistance)

Description	NSPT	Layer depth (m)	Correlation	Qc (Mpa)
Layer (1) Layer	9.42	0.00-2.70	Robertson (1983)	1.85
Layer (2) Layer	70.52	2.70-3.00	Robertson (1983)	13.83

Oedometric module

Description	NSPT	Layer depth (m)	Correlation	Eed (Mpa)
Layer (1) Layer	9.42	0.00-2.70	Trofimenkov (1974), Mitchell e Gardner	9.60
Layer (2) Layer	70.52	2.70-3.00	Trofimenkov (1974), Mitchell e Gardner	70.71

Young's modulus

Description	NSPT	Layer depth (m)	Correlation	Ey (Mpa)
Layer (1) Layer	9.42	0.00-2.70	Apollonia	9.24
Layer (2) Layer	70.52	2.70-3.00	Apollonia	69.16

AGI Classification (Assoc. It. Geolog.)

Description	NSPT	Layer depth (m)	Correlation	Classification
Layer (1) Layer	9.42	0.00-2.70	A.G.I. (1977)	CONSISTENTE
Layer (2) Layer	70.52	2.70-3.00	A.G.I. (1977)	ESTREM. CONSISTENTE

Unit weight

Description	NSPT	Layer depth (m)	Correlation	Unit weight (KN/m³)
Layer (1) Layer	9.42	0.00-2.70	Meyerhof	19.12
Layer (2) Layer	70.52	2.70-3.00	Meyerhof	24.52

Saturated unit weight

Description	NSPT	Layer depth (m)	Correlation	Saturated unit weight (KN/m³)	
Layer (1) Layer	9.42	0.00-2.70	Meyerhof	20.99	
Layer (2) Layer	70.52	2.70-3.00	Meyerhof	24.52	

Shear wave velocity

Description	NSPT	Layer depth (m)	Correlation	Shear wave velocity (m/s)
Layer (1) Layer	9.42	0.00-2.70	Ohta & Goto (1978) Low plasticity clays and silty clays	106.85
Layer (2) Layer	70.52	2.70-3.00	Ohta & Goto (1978) Low plasticity clays and silty clays	174.85

COHESIONLESS SOILS

Relative density

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Relative density (%)
Layer (1) Layer	9.42	0.00-2.70	9.42	Meyerhof 1957	77.04
Layer (2) Layer	70.52	2.70-3.00	70.52	Meyerhof 1957	100

Shear resistance angle

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Angle of friction (°)
Layer (1) Layer	9.42	0.00-2.70	9.42	Meyerhof (1956)	22.69
Layer (2) Layer	70.52	2.70-3.00	70.52	Meyerhof (1956)	40.15

Young's modulus

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Young's modulus (Mpa)
Layer (1) Layer	9.42	0.00-2.70	9.42	Bowles (1982) Sabbia Media	---
Layer (2) Layer	70.52	2.70-3.00	70.52	Bowles (1982) Sabbia Media	41.93

Oedometric module

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Oedometric module (Mpa)
Layer (1) Layer	9.42	0.00-2.70	9.42	Begemann 1974 (Ghiaia con sabbia)	4.59
Layer (2) Layer	70.52	2.70-3.00	70.52	Begemann 1974 (Ghiaia con sabbia)	16.90

AGI Classification (Assoc. It. Geolog.)

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	AGI Classification (Assoc. It. Geolog.)
Layer (1) Layer	9.42	0.00-2.70	9.42	Classification A.G.I	SLIGHTLY THICKENED
Layer (2) Layer	70.52	2.70-3.00	70.52	Classification A.G.I	VERY THICKENED

Unit weight

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Unit Weight (KN/m³)
Layer (1) Layer	9.42	0.00-2.70	9.42	Terzaghi-Peck 1948	14.42
Layer (2) Layer	70.52	2.70-3.00	70.52	Terzaghi-Peck 1948	19.06

Saturated unit weight

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Saturated weight (KN/m³)
Layer (1) Layer	9.42	0.00-2.70	9.42	Terzaghi-Peck 1948	18.78
Layer (2) Layer	70.52	2.70-3.00	70.52	Terzaghi-Peck 1948	21.64

Poisson's modulus

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Poisson
Layer (1) Layer	9.42	0.00-2.70	9.42	(A.G.I.)	0.34
Layer (2) Layer	70.52	2.70-3.00	70.52	(A.G.I.)	0.21

Dynamic shear modulus

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	G (Mpa)
Layer (1) Layer	9.42	0.00-2.70	9.42	Ohsaki (Sabbie pulite)	52.49
Layer (2) Layer	70.52	2.70-3.00	70.52	Ohsaki (Sabbie pulite)	348.22

Shear wave velocity

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Shear wave velocity (m/s)
Layer (1) Layer	9.42	0.00-2.70	9.42	Ohta & Goto (1978) Silts	106.85
Layer (2) Layer	70.52	2.70-3.00	70.52	Ohta & Goto (1978) Silts	174.85

Coefficient of earth pressure at rest K0=SigmaH/P0

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	K0
Layer (1) Layer	9.42	0.00-2.70	9.42	Navfac 1971-1982	1.98
Layer (2) Layer	70.52	2.70-3.00	70.52	Navfac 1971-1982	11.93

Qc (CPT Cone resistance)

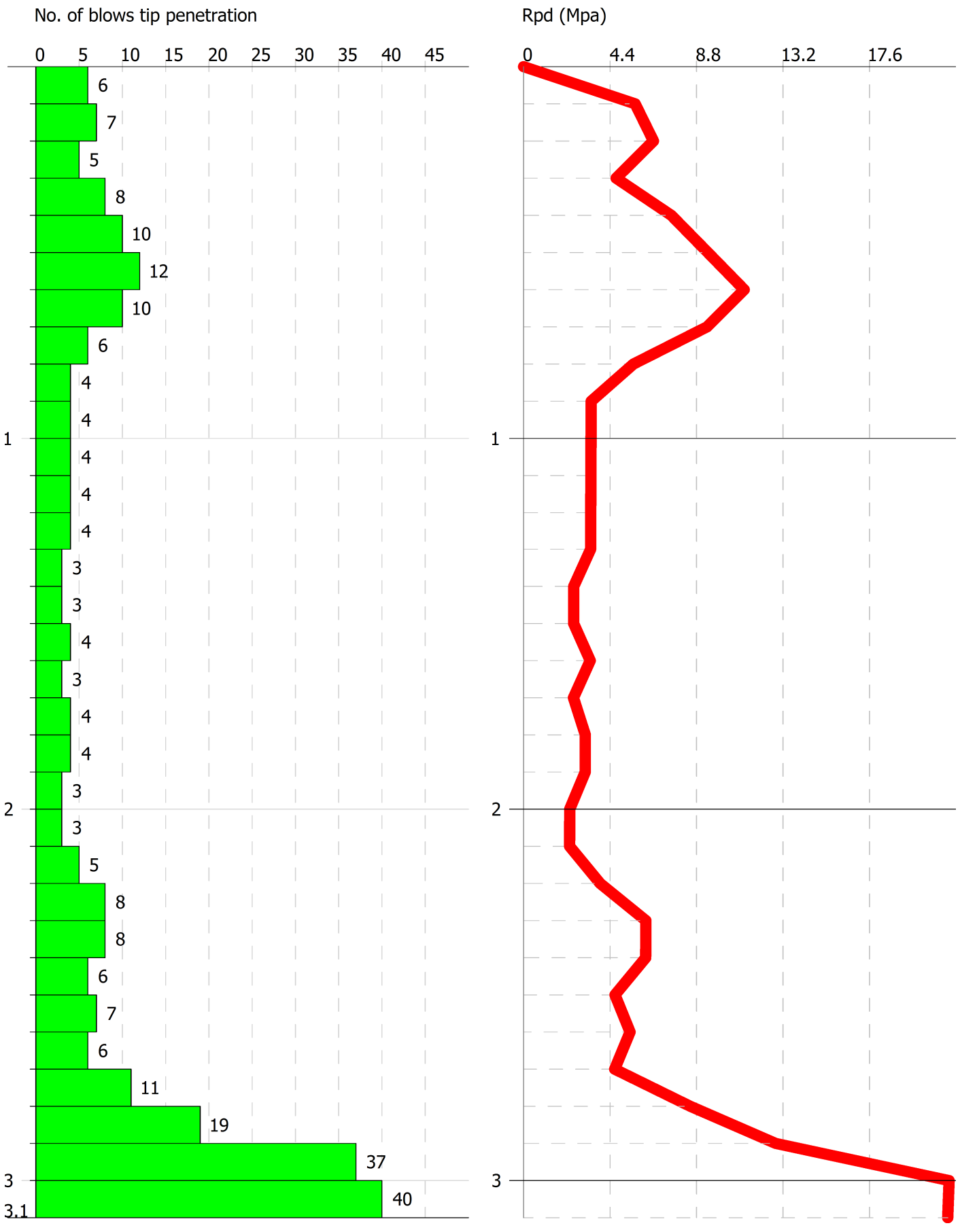
Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Qc (Mpa)
Layer (1) Layer	9.42	0.00-2.70	9.42	Robertson 1983	1.85
Layer (2) Layer	70.52	2.70-3.00	70.52	Robertson 1983	13.83

DYNAMIC PENETRATION TEST DPH 2
Equipment used... DPH

Customer: Obcina Cirkulane
Description: Plaz Gruškovec
Location: Gruškovec

20. 09. 2026

Scale 1:15



ESTIMATE TEST GEOTECHNICAL PARAMETERS DPH 2

COHESIVE SOILS

Undrained cohesion

Description	NSPT	Layer depth (m)	Correlation	Cu (KPa)
Layer (1) Layer	12.69	0.00-2.90	Terzaghi-Peck	84.04
Layer (2) Layer	78.31	2.90-3.10	Terzaghi-Peck	518.38

Qc (CPT Cone resistance)

Description	NSPT	Layer depth (m)	Correlation	Qc (Mpa)
Layer (1) Layer	12.69	0.00-2.90	Robertson (1983)	2.49
Layer (2) Layer	78.31	2.90-3.10	Robertson (1983)	15.36

Oedometric module

Description	NSPT	Layer depth (m)	Correlation	Eed (Mpa)
Layer (1) Layer	12.69	0.00-2.90	Trofimenkov (1974), Mitchell e Gardner	12.87
Layer (2) Layer	78.31	2.90-3.10	Trofimenkov (1974), Mitchell e Gardner	78.50

Young's modulus

Description	NSPT	Layer depth (m)	Correlation	Ey (Mpa)
Layer (1) Layer	12.69	0.00-2.90	Apollonia	12.44
Layer (2) Layer	78.31	2.90-3.10	Apollonia	76.80

AGI Classification (Assoc. It. Geolog.)

Description	NSPT	Layer depth (m)	Correlation	Classification
Layer (1) Layer	12.69	0.00-2.90	A.G.I. (1977)	CONSISTENTE
Layer (2) Layer	78.31	2.90-3.10	A.G.I. (1977)	ESTREM. CONSISTENTE

Unit weight

Description	NSPT	Layer depth (m)	Correlation	Unit weight (KN/m³)
Layer (1) Layer	12.69	0.00-2.90	Meyerhof	19.91
Layer (2) Layer	78.31	2.90-3.10	Meyerhof	24.52

Saturated unit weight

Description	NSPT	Layer depth (m)	Correlation	Saturated unit weight (KN/m³)	
Layer (1) Layer	12.69	0.00-2.90	Meyerhof	21.87	
Layer (2) Layer	78.31	2.90-3.10	Meyerhof	24.52	

Shear wave velocity

Description	NSPT	Layer depth (m)	Correlation	Shear wave velocity (m/s)
Layer (1) Layer	12.69	0.00-2.90	Ohta & Goto (1978) Low plasticity clays and silty clays	114.07
Layer (2) Layer	78.31	2.90-3.10	Ohta & Goto (1978) Low plasticity clays and silty clays	179.82

COHESIONLESS SOILS

Relative density

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Relative density (%)
Layer (1) Layer	12.69	0.00-2.90	12.69	Meyerhof 1957	89.41
Layer (2) Layer	78.31	2.90-3.10	78.31	Meyerhof 1957	100

Shear resistance angle

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Angle of friction (°)
Layer (1) Layer	12.69	0.00-2.90	12.69	Meyerhof (1956)	23.63
Layer (2) Layer	78.31	2.90-3.10	78.31	Meyerhof (1956)	42.37

Young's modulus

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Young's modulus (Mpa)
Layer (1) Layer	12.69	0.00-2.90	12.69	Bowles (1982) Sabbia Media	13.58
Layer (2) Layer	78.31	2.90-3.10	78.31	Bowles (1982) Sabbia Media	45.75

Oedometric module

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Oedometric module (Mpa)
Layer (1) Layer	12.69	0.00-2.90	12.69	Begemann 1974 (Ghiaia con sabbia)	5.25
Layer (2) Layer	78.31	2.90-3.10	78.31	Begemann 1974 (Ghiaia con sabbia)	18.47

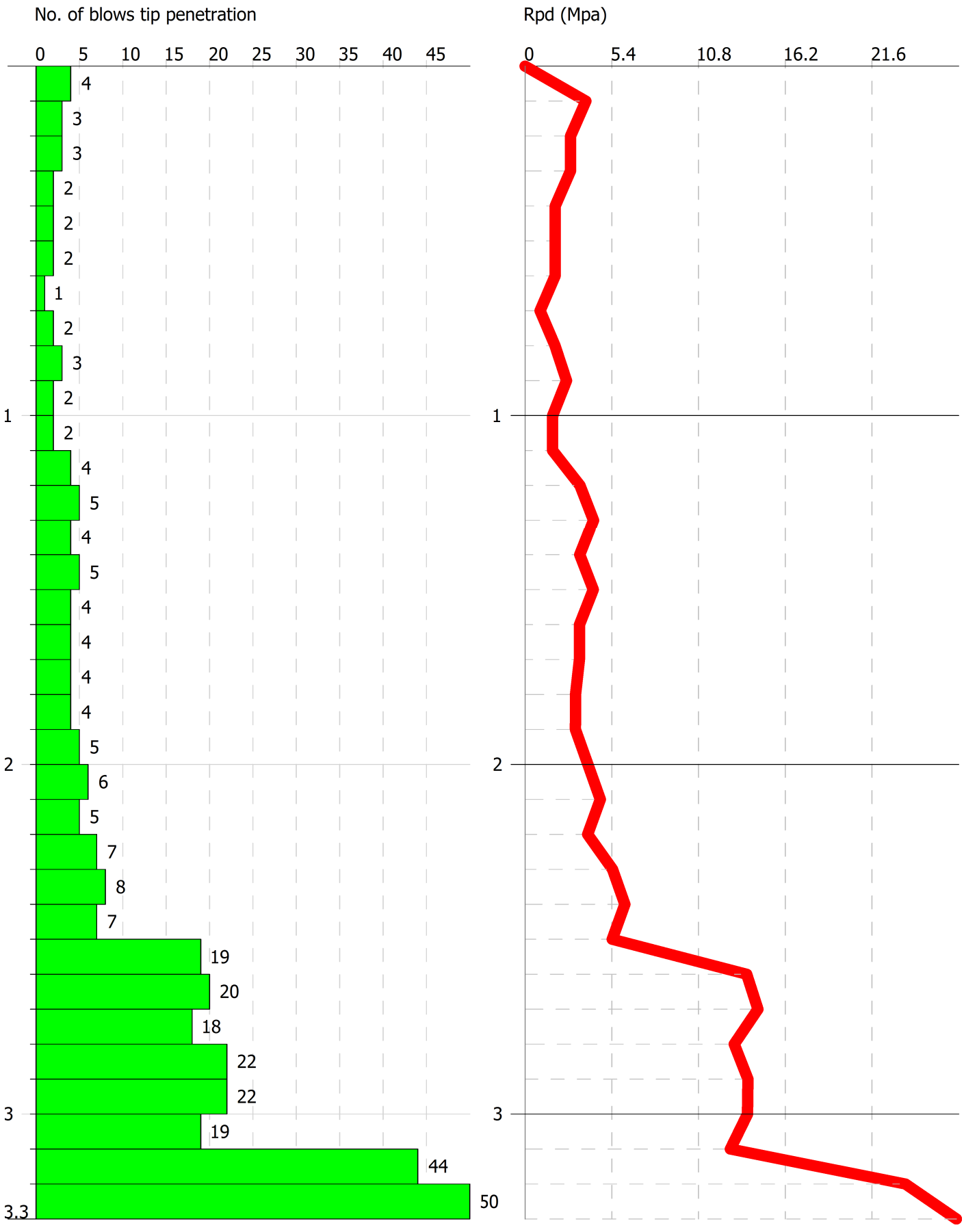
AGI Classification (Assoc. It. Geolog.)
Description

DYNAMIC PENETRATION TEST DPH 3
Equipment used... DPH

Customer: Obcina Cirkulane
Description: Plaz Gruškovec
Location: Gruškovec

20. 09. 2026

Scale 1:16



ESTIMATE TEST GEOTECHNICAL PARAMETERS DPH 3

COHESIVE SOILS

Undrained cohesion

Description	NSPT	Layer depth (m)	Correlation	Cu (KPa)
Layer (1) Layer	14.30	0.00-3.10	Terzaghi-Peck	94.63
Layer (2) Layer	95.60	3.10-3.30	Terzaghi-Peck	632.82

Qc (CPT Cone resistance)

Description	NSPT	Layer depth (m)	Correlation	Qc (Mpa)
Layer (1) Layer	14.30	0.00-3.10	Robertson (1983)	2.80
Layer (2) Layer	95.60	3.10-3.30	Robertson (1983)	18.75

Oedometric module

Description	NSPT	Layer depth (m)	Correlation	Eed (Mpa)
Layer (1) Layer	14.30	0.00-3.10	Trofimenkov (1974), Mitchell e Gardner	14.48
Layer (2) Layer	95.60	3.10-3.30	Trofimenkov (1974), Mitchell e Gardner	95.80

Young's modulus

Description	NSPT	Layer depth (m)	Correlation	Ey (Mpa)
Layer (1) Layer	14.30	0.00-3.10	Apollonia	14.02
Layer (2) Layer	95.60	3.10-3.30	Apollonia	93.75

AGI Classification (Assoc. It. Geolog.)

Description	NSPT	Layer depth (m)	Correlation	Classification
Layer (1) Layer	14.30	0.00-3.10	A.G.I. (1977)	CONSISTENTE
Layer (2) Layer	95.60	3.10-3.30	A.G.I. (1977)	ESTREM. CONSISTENTE

Unit weight

Description	NSPT	Layer depth (m)	Correlation	Unit weight (KN/m³)
Layer (1) Layer	14.30	0.00-3.10	Meyerhof	20.20
Layer (2) Layer	95.60	3.10-3.30	Meyerhof	24.52

Saturated unit weight

Description	NSPT	Layer depth (m)	Correlation	Saturated unit weight (KN/m³)	
Layer (1) Layer	14.30	0.00-3.10	Meyerhof	22.26	
Layer (2) Layer	95.60	3.10-3.30	Meyerhof	24.52	

Shear wave velocity

Description	NSPT	Layer depth (m)	Correlation	Shear wave velocity (m/s)
Layer (1) Layer	14.30	0.00-3.10	Ohta & Goto (1978) Low plasticity clays and silty clays	117.96
Layer (2) Layer	95.60	3.10-3.30	Ohta & Goto (1978) Low plasticity clays and silty clays	188.47

COHESIONLESS SOILS

Relative density

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Relative density (%)
Layer (1) Layer	14.30	0.00-3.10	14.30	Meyerhof 1957	94.92
Layer (2) Layer	95.60	3.10-3.30	95.60	Meyerhof 1957	100

Shear resistance angle

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Angle of friction (°)
Layer (1) Layer	14.30	0.00-3.10	14.30	Meyerhof (1956)	24.09
Layer (2) Layer	95.60	3.10-3.30	95.60	Meyerhof (1956)	47.31

Young's modulus

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Young's modulus (Mpa)
Layer (1) Layer	14.30	0.00-3.10	14.30	Bowles (1982) Sabbia Media	14.37
Layer (2) Layer	95.60	3.10-3.30	95.60	Bowles (1982) Sabbia Media	54.23

Oedometric module

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Oedometric module (Mpa)
Layer (1) Layer	14.30	0.00-3.10	14.30	Begemann 1974 (Ghiaia con sabbia)	5.57
Layer (2) Layer	95.60	3.10-3.30	95.60	Begemann 1974 (Ghiaia con sabbia)	21.95

AGI Classification (Assoc. It. Geolog.)

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	AGI Classification (Assoc. It. Geolog.)
Layer (1) Layer	14.30	0.00-3.10	14.30	Classification A.G.I	MODERATELY THICKENED
Layer (2) Layer	95.60	3.10-3.30	95.60	Classification A.G.I	VERY THICKENED

Unit weight

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Unit Weight (KN/m³)
Layer (1) Layer	14.30	0.00-3.10	14.30	Terzaghi-Peck 1948	15.01
Layer (2) Layer	95.60	3.10-3.30	95.60	Terzaghi-Peck 1948	19.24

Saturated unit weight

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Saturated weight (KN/m³)
Layer (1) Layer	14.30	0.00-3.10	14.30	Terzaghi-Peck 1948	19.15
Layer (2)	95.60	3.10-3.30	95.60	Terzaghi-Peck	21.74

Layer				1948	

Poisson's modulus

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Poisson
Layer (1) Layer	14.30	0.00-3.10	14.30	(A.G.I.)	0.33
Layer (2) Layer	95.60	3.10-3.30	95.60	(A.G.I.)	0.16

Dynamic shear modulus

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	G (Mpa)
Layer (1) Layer	14.30	0.00-3.10	14.30	Ohsaki (Sabbie pulite)	77.70
Layer (2) Layer	95.60	3.10-3.30	95.60	Ohsaki (Sabbie pulite)	463.52

Shear wave velocity

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Shear wave velocity (m/s)
Layer (1) Layer	14.30	0.00-3.10	14.30	Ohta & Goto (1978) Silts	117.96
Layer (2) Layer	95.60	3.10-3.30	95.60	Ohta & Goto (1978) Silts	188.47

Coefficient of earth pressure at rest K0=SigmaH/P0

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	K0
Layer (1) Layer	14.30	0.00-3.10	14.30	Navfac 1971-1982	2.99
Layer (2) Layer	95.60	3.10-3.30	95.60	Navfac 1971-1982	11.93

Qc (CPT Cone resistance)

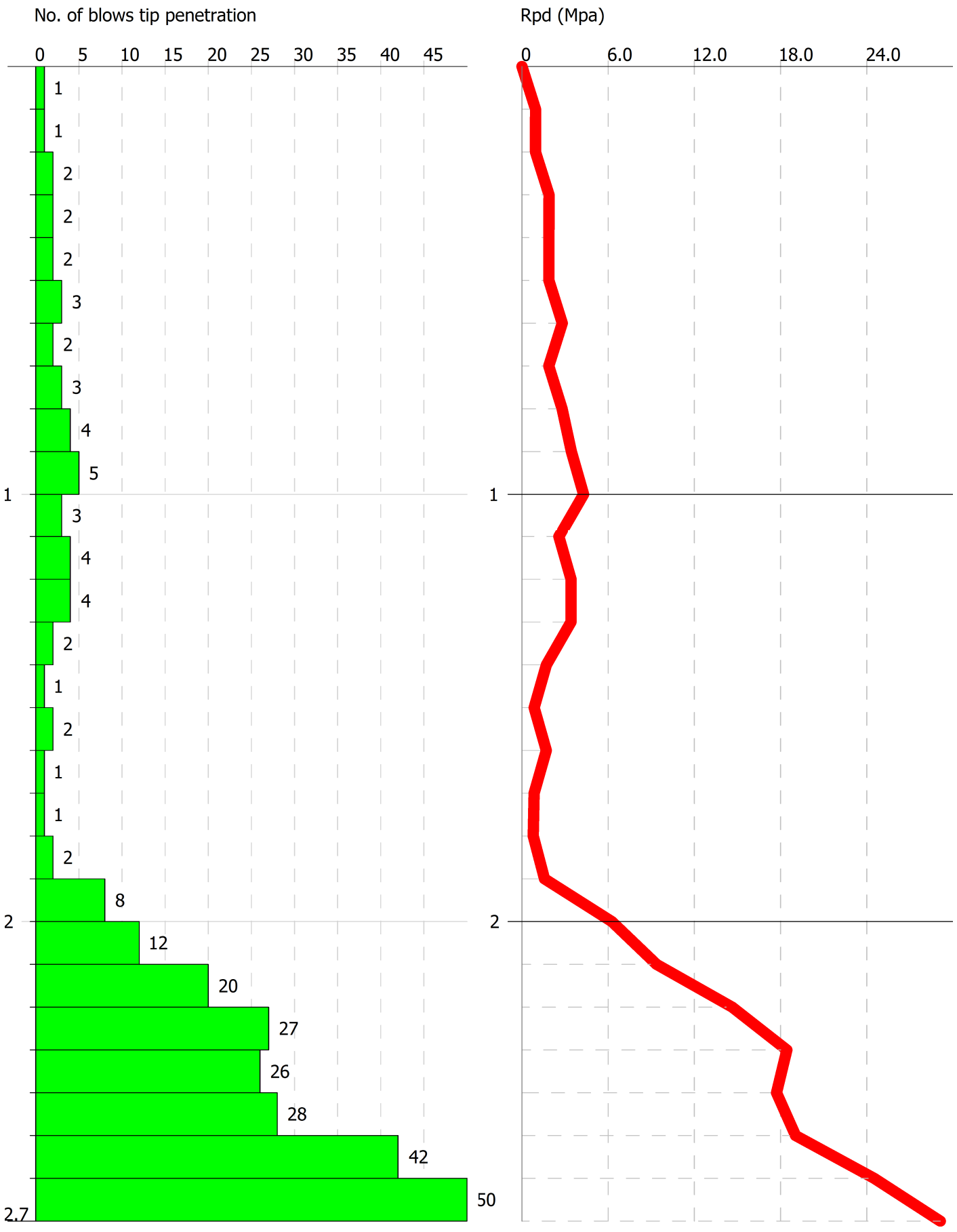
Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Qc (Mpa)
Layer (1) Layer	14.30	0.00-3.10	14.30	Robertson 1983	2.80
Layer (2) Layer	95.60	3.10-3.30	95.60	Robertson 1983	18.75

DYNAMIC PENETRATION TEST DPH 4
Equipment used... DPH

Customer: Obcina Cirkulane
Description: Plaz Gruškovec
Location: Gruškovec

20. 09. 2026

Scale 1:13



ESTIMATE TEST GEOTECHNICAL PARAMETERS DPH 4

COHESIVE SOILS

Undrained cohesion

Description	NSPT	Layer depth (m)	Correlation	Cu (KPa)
Layer (1) Layer	7.85	0.00-2.20	Terzaghi-Peck	48.15
Layer (2) Layer	70.38	2.20-2.70	Terzaghi-Peck	465.91

Qc (CPT Cone resistance)

Description	NSPT	Layer depth (m)	Correlation	Qc (Mpa)
Layer (1) Layer	7.85	0.00-2.20	Robertson (1983)	1.54
Layer (2) Layer	70.38	2.20-2.70	Robertson (1983)	13.80

Oedometric module

Description	NSPT	Layer depth (m)	Correlation	Eed (Mpa)
Layer (1) Layer	7.85	0.00-2.20	Trofimenkov (1974), Mitchell e Gardner	8.03
Layer (2) Layer	70.38	2.20-2.70	Trofimenkov (1974), Mitchell e Gardner	70.57

Young's modulus

Description	NSPT	Layer depth (m)	Correlation	Ey (Mpa)
Layer (1) Layer	7.85	0.00-2.20	Apollonia	7.70
Layer (2) Layer	70.38	2.20-2.70	Apollonia	69.02

AGI Classification (Assoc. It. Geolog.)

Description	NSPT	Layer depth (m)	Correlation	Classification
Layer (1) Layer	7.85	0.00-2.20	A.G.I. (1977)	MODERAT. CONSISTENTE
Layer (2) Layer	70.38	2.20-2.70	A.G.I. (1977)	ESTREM. CONSISTENTE

Unit weight

Description	NSPT	Layer depth (m)	Correlation	Unit weight (KN/m³)
Layer (1) Layer	7.85	0.00-2.20	Meyerhof	18.53
Layer (2) Layer	70.38	2.20-2.70	Meyerhof	24.52

Saturated unit weight

Description	NSPT	Layer depth (m)	Correlation	Saturated unit weight (KN/m³)	
Layer (1) Layer	7.85	0.00-2.20	Meyerhof	18.63	
Layer (2) Layer	70.38	2.20-2.70	Meyerhof	24.52	

Shear wave velocity

Description	NSPT	Layer depth (m)	Correlation	Shear wave velocity (m/s)
Layer (1) Layer	7.85	0.00-2.20	Ohta & Goto (1978) Low plasticity clays and silty clays	99.52
Layer (2) Layer	70.38	2.20-2.70	Ohta & Goto (1978) Low plasticity clays and silty clays	169.76

COHESIONLESS SOILS

Relative density

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Relative density (%)
Layer (1) Layer	7.85	0.00-2.20	7.85	Meyerhof 1957	70.32
Layer (2) Layer	70.38	2.20-2.70	70.38	Meyerhof 1957	100

Shear resistance angle

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Angle of friction (°)
Layer (1) Layer	7.85	0.00-2.20	7.85	Meyerhof (1956)	22.24
Layer (2) Layer	70.38	2.20-2.70	70.38	Meyerhof (1956)	40.11

Young's modulus

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Young's modulus (Mpa)
Layer (1) Layer	7.85	0.00-2.20	7.85	Bowles (1982) Sabbia Media	---
Layer (2) Layer	70.38	2.20-2.70	70.38	Bowles (1982) Sabbia Media	41.86

Oedometric module

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Oedometric module (Mpa)
Layer (1) Layer	7.85	0.00-2.20	7.85	Begemann 1974 (Ghiaia con sabbia)	4.27
Layer (2) Layer	70.38	2.20-2.70	70.38	Begemann 1974 (Ghiaia con sabbia)	16.87

AGI Classification (Assoc. It. Geolog.)

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	AGI Classification (Assoc. It. Geolog.)
Layer (1) Layer	7.85	0.00-2.20	7.85	Classification A.G.I	SLIGHTLY THICKENED
Layer (2) Layer	70.38	2.20-2.70	70.38	Classification A.G.I	VERY THICKENED

Unit weight

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Unit Weight (KN/m³)
Layer (1) Layer	7.85	0.00-2.20	7.85	Terzaghi-Peck 1948	14.22
Layer (2) Layer	70.38	2.20-2.70	70.38	Terzaghi-Peck 1948	19.06

Saturated unit weight

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Saturated weight (KN/m³)
Layer (1) Layer	7.85	0.00-2.20	7.85	Terzaghi-Peck 1948	18.66
Layer (2) Layer	70.38	2.20-2.70	70.38	Terzaghi-Peck 1948	21.64

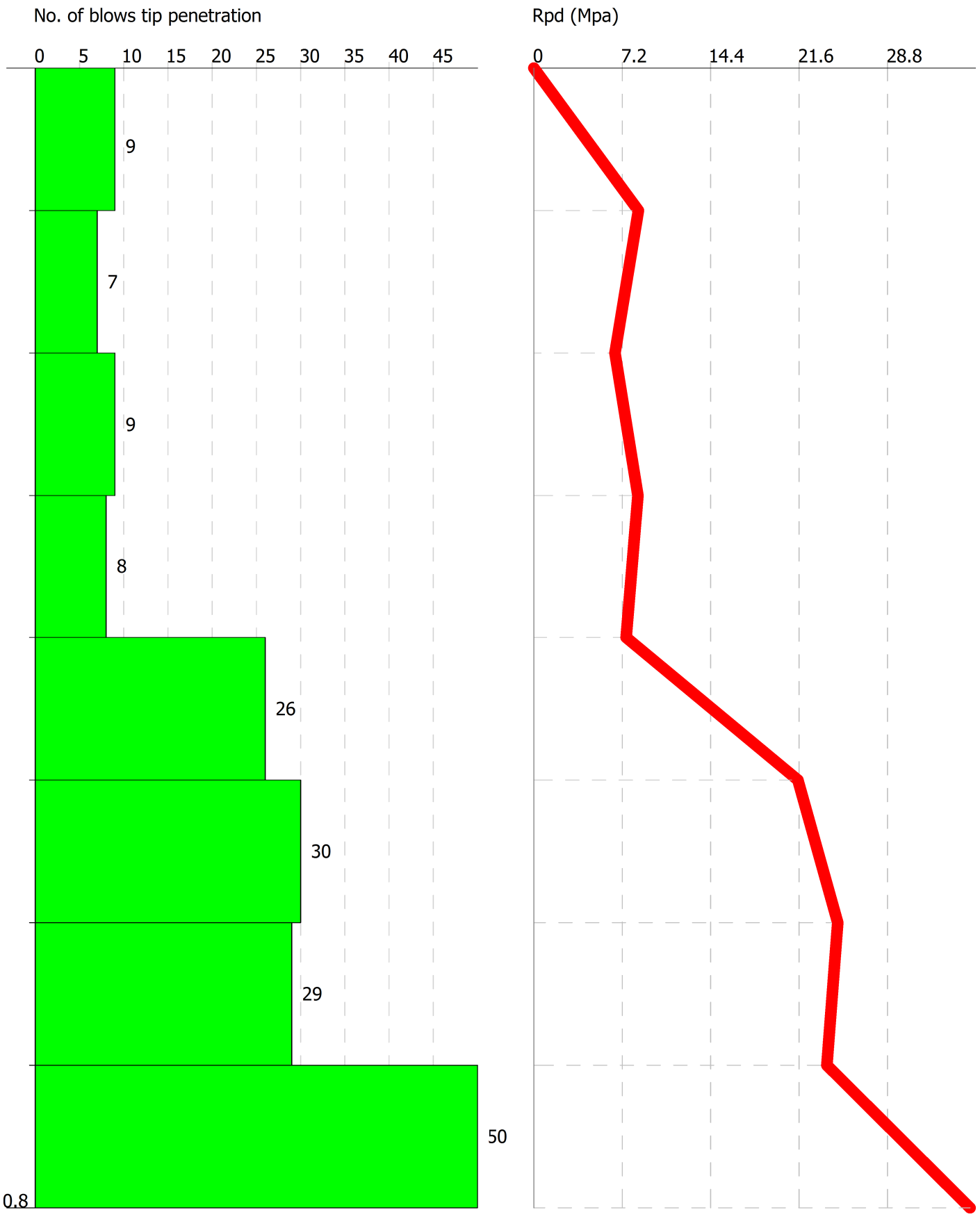
Poisson's modulus
Description

DYNAMIC PENETRATION TEST DPH 5
Equipment used... DPH

Customer: Obcina Cirkulane
Description: Plaz Gruškovec
Location: Gruškovec

20. 09. 2026

Scale 1:4



ESTIMATE TEST GEOTECHNICAL PARAMETERS DPH 5

COHESIVE SOILS

Undrained cohesion

Description	NSPT	Layer depth (m)	Correlation	Cu (KPa)
Layer (1) Layer	16.78	0.00-0.40	Terzaghi-Peck	111.11
Layer (2) Layer	68.65	0.40-0.80	Terzaghi-Peck	454.44

Qc (CPT Cone resistance)

Description	NSPT	Layer depth (m)	Correlation	Qc (Mpa)
Layer (1) Layer	16.78	0.00-0.40	Robertson (1983)	3.29
Layer (2) Layer	68.65	0.40-0.80	Robertson (1983)	13.46

Oedometric module

Description	NSPT	Layer depth (m)	Correlation	Eed (Mpa)
Layer (1) Layer	16.78	0.00-0.40	Trofimenkov (1974), Mitchell e Gardner	16.96
Layer (2) Layer	68.65	0.40-0.80	Trofimenkov (1974), Mitchell e Gardner	68.84

Young's modulus

Description	NSPT	Layer depth (m)	Correlation	Ey (Mpa)
Layer (1) Layer	16.78	0.00-0.40	Apollonia	16.46
Layer (2) Layer	68.65	0.40-0.80	Apollonia	67.32

AGI Classification (Assoc. It. Geolog.)

Description	NSPT	Layer depth (m)	Correlation	Classification
Layer (1) Layer	16.78	0.00-0.40	A.G.I. (1977)	MOLTO CONSISTENTE
Layer (2) Layer	68.65	0.40-0.80	A.G.I. (1977)	ESTREM. CONSISTENTE

Unit weight

Description	NSPT	Layer depth (m)	Correlation	Unit weight (KN/m³)
Layer (1) Layer	16.78	0.00-0.40	Meyerhof	20.40
Layer (2) Layer	68.65	0.40-0.80	Meyerhof	24.52

Saturated unit weight

Description	NSPT	Layer depth (m)	Correlation	Saturated unit weight (KN/m³)	
Layer (1) Layer	16.78	0.00-0.40	Meyerhof	22.46	
Layer (2) Layer	68.65	0.40-0.80	Meyerhof	24.52	

Shear wave velocity

Description	NSPT	Layer depth (m)	Correlation	Shear wave velocity (m/s)
Layer (1) Layer	16.78	0.00-0.40	Ohta & Goto (1978) Low plasticity clays and silty clays	81.68
Layer (2) Layer	68.65	0.40-0.80	Ohta & Goto (1978) Low plasticity clays and silty clays	128.84

COHESIONLESS SOILS

Relative density

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Relative density (%)
Layer (1) Layer	16.78	0.00-0.40	16.78	Meyerhof 1957	100
Layer (2) Layer	68.65	0.40-0.80	68.65	Meyerhof 1957	100

Shear resistance angle

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Angle of friction (°)
Layer (1) Layer	16.78	0.00-0.40	16.78	Meyerhof (1956)	24.79
Layer (2) Layer	68.65	0.40-0.80	68.65	Meyerhof (1956)	39.61

Young's modulus

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Young's modulus (Mpa)
Layer (1) Layer	16.78	0.00-0.40	16.78	Bowles (1982) Sabbia Media	15.58
Layer (2) Layer	68.65	0.40-0.80	68.65	Bowles (1982) Sabbia Media	41.02

Oedometric module

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Oedometric module (Mpa)
Layer (1) Layer	16.78	0.00-0.40	16.78	Begemann 1974 (Ghiaia con sabbia)	6.07
Layer (2) Layer	68.65	0.40-0.80	68.65	Begemann 1974 (Ghiaia con sabbia)	16.52

AGI Classification (Assoc. It. Geolog.)

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	AGI Classification (Assoc. It. Geolog.)
Layer (1) Layer	16.78	0.00-0.40	16.78	Classification A.G.I	MODERATELY THICKENED
Layer (2) Layer	68.65	0.40-0.80	68.65	Classification A.G.I	VERY THICKENED

Unit weight

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Unit Weight (KN/m³)
Layer (1) Layer	16.78	0.00-0.40	16.78	Terzaghi-Peck 1948	15.29
Layer (2) Layer	68.65	0.40-0.80	68.65	Terzaghi-Peck 1948	19.01

Saturated unit weight

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Saturated weight (KN/m³)
Layer (1) Layer	16.78	0.00-0.40	16.78	Terzaghi-Peck 1948	19.33
Layer (2)	68.65	0.40-0.80	68.65	Terzaghi-Peck	21.61

Layer				1948	

Poisson's modulus

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Poisson
Layer (1) Layer	16.78	0.00-0.40	16.78	(A.G.I.)	0.32
Layer (2) Layer	68.65	0.40-0.80	68.65	(A.G.I.)	0.21

Dynamic shear modulus

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	G (Mpa)
Layer (1) Layer	16.78	0.00-0.40	16.78	Ohsaki (Sabbie pulite)	90.31
Layer (2) Layer	68.65	0.40-0.80	68.65	Ohsaki (Sabbie pulite)	339.53

Shear wave velocity

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Shear wave velocity (m/s)
Layer (1) Layer	16.78	0.00-0.40	16.78	Ohta & Goto (1978) Silts	81.68
Layer (2) Layer	68.65	0.40-0.80	68.65	Ohta & Goto (1978) Silts	128.84

Coefficient of earth pressure at rest K0=SigmaH/P0

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	K0
Layer (1) Layer	16.78	0.00-0.40	16.78	Navfac 1971-1982	3.46
Layer (2) Layer	68.65	0.40-0.80	68.65	Navfac 1971-1982	11.93

Qc (CPT Cone resistance)

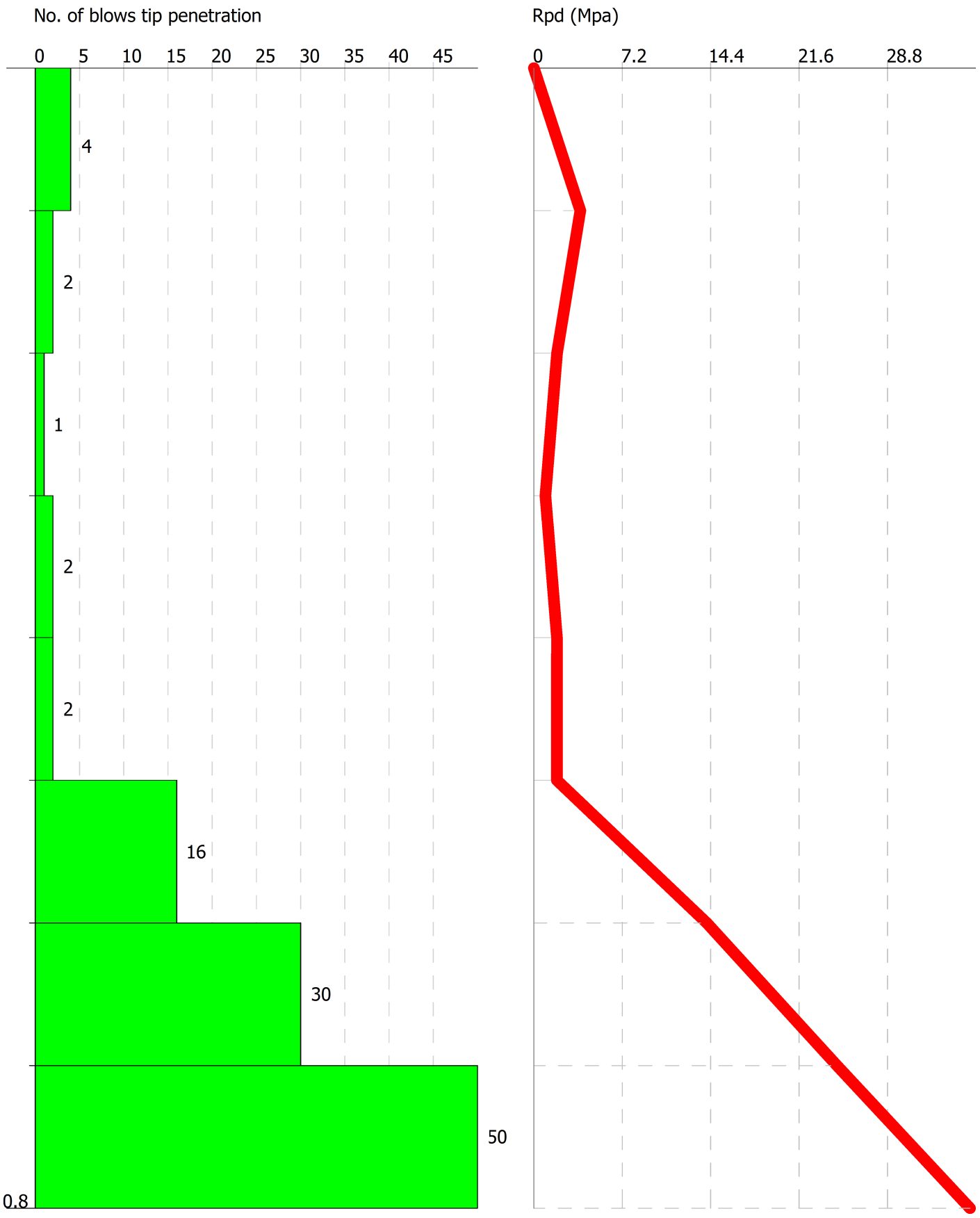
Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Qc (Mpa)
Layer (1) Layer	16.78	0.00-0.40	16.78	Robertson 1983	3.29
Layer (2) Layer	68.65	0.40-0.80	68.65	Robertson 1983	13.46

DYNAMIC PENETRATION TEST DPH 6
Equipment used... DPH

Customer: Obcina Cirkulane
Description: Plaz Gruškovec
Location: Gruškovec

20. 09. 2026

Scale 1:4



ESTIMATE TEST GEOTECHNICAL PARAMETERS DPH 6

COHESIVE SOILS

Undrained cohesion

Description	NSPT	Layer depth (m)	Correlation	Cu (KPa)
Layer (1) Layer	9.15	0.00-0.60	Terzaghi-Peck	60.61
Layer (2) Layer	81.36	0.60-0.80	Terzaghi-Peck	538.58

Qc (CPT Cone resistance)

Description	NSPT	Layer depth (m)	Correlation	Qc (Mpa)
Layer (1) Layer	9.15	0.00-0.60	Robertson (1983)	1.79
Layer (2) Layer	81.36	0.60-0.80	Robertson (1983)	15.96

Oedometric module

Description	NSPT	Layer depth (m)	Correlation	Eed (Mpa)
Layer (1) Layer	9.15	0.00-0.60	Trofimenkov (1974), Mitchell e Gardner	9.33
Layer (2) Layer	81.36	0.60-0.80	Trofimenkov (1974), Mitchell e Gardner	81.55

Young's modulus

Description	NSPT	Layer depth (m)	Correlation	Ey (Mpa)
Layer (1) Layer	9.15	0.00-0.60	Apollonia	8.97
Layer (2) Layer	81.36	0.60-0.80	Apollonia	79.79

AGI Classification (Assoc. It. Geolog.)

Description	NSPT	Layer depth (m)	Correlation	Classification
Layer (1) Layer	9.15	0.00-0.60	A.G.I. (1977)	CONSISTENTE
Layer (2) Layer	81.36	0.60-0.80	A.G.I. (1977)	ESTREM. CONSISTENTE

Unit weight

Description	NSPT	Layer depth (m)	Correlation	Unit weight (KN/m³)
Layer (1) Layer	9.15	0.00-0.60	Meyerhof	19.02
Layer (2) Layer	81.36	0.60-0.80	Meyerhof	24.52

Saturated unit weight

Description	NSPT	Layer depth (m)	Correlation	Saturated unit weight (KN/m³)	
Layer (1) Layer	9.15	0.00-0.60	Meyerhof	20.89	
Layer (2) Layer	81.36	0.60-0.80	Meyerhof	24.52	

Shear wave velocity

Description	NSPT	Layer depth (m)	Correlation	Shear wave velocity (m/s)
Layer (1) Layer	9.15	0.00-0.60	Ohta & Goto (1978) Low plasticity clays and silty clays	79.53
Layer (2) Layer	81.36	0.60-0.80	Ohta & Goto (1978) Low plasticity clays and silty clays	136.69

COHESIONLESS SOILS

Relative density

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Relative density (%)
Layer (1) Layer	9.15	0.00-0.60	9.15	Meyerhof 1957	75.92
Layer (2) Layer	81.36	0.60-0.80	81.36	Meyerhof 1957	100

Shear resistance angle

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Angle of friction (°)
Layer (1) Layer	9.15	0.00-0.60	9.15	Meyerhof (1956)	22.61
Layer (2) Layer	81.36	0.60-0.80	81.36	Meyerhof (1956)	43.25

Young's modulus

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Young's modulus (Mpa)
Layer (1) Layer	9.15	0.00-0.60	9.15	Bowles (1982) Sabbia Media	---
Layer (2) Layer	81.36	0.60-0.80	81.36	Bowles (1982) Sabbia Media	47.25

Oedometric module

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Oedometric module (Mpa)
Layer (1) Layer	9.15	0.00-0.60	9.15	Begemann 1974 (Ghiaia con sabbia)	4.54
Layer (2) Layer	81.36	0.60-0.80	81.36	Begemann 1974 (Ghiaia con sabbia)	19.08

AGI Classification (Assoc. It. Geolog.)

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	AGI Classification (Assoc. It. Geolog.)
Layer (1) Layer	9.15	0.00-0.60	9.15	Classification A.G.I	SLIGHTLY THICKENED
Layer (2) Layer	81.36	0.60-0.80	81.36	Classification A.G.I	VERY THICKENED

Unit weight

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Unit Weight (KN/m³)
Layer (1) Layer	9.15	0.00-0.60	9.15	Terzaghi-Peck 1948	14.38
Layer (2) Layer	81.36	0.60-0.80	81.36	Terzaghi-Peck 1948	19.26

Saturated unit weight

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Saturated weight (KN/m³)
Layer (1) Layer	9.15	0.00-0.60	9.15	Terzaghi-Peck 1948	18.76
Layer (2) Layer	81.36	0.60-0.80	81.36	Terzaghi-Peck 1948	21.76

Poisson's modulus

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Poisson
Layer (1) Layer	9.15	0.00-0.60	9.15	(A.G.I.)	0.34
Layer (2) Layer	81.36	0.60-0.80	81.36	(A.G.I.)	0.19

Dynamic shear modulus

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	G (Mpa)
Layer (1) Layer	9.15	0.00-0.60	9.15	Ohsaki (Sabbie pulite)	51.07
Layer (2) Layer	81.36	0.60-0.80	81.36	Ohsaki (Sabbie pulite)	398.31

Shear wave velocity

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Shear wave velocity (m/s)
Layer (1) Layer	9.15	0.00-0.60	9.15	Ohta & Goto (1978) Silts	79.53
Layer (2) Layer	81.36	0.60-0.80	81.36	Ohta & Goto (1978) Silts	136.69

Coefficient of earth pressure at rest K0=SigmaH/P0

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	K0
Layer (1) Layer	9.15	0.00-0.60	9.15	Navfac 1971-1982	1.92
Layer (2) Layer	81.36	0.60-0.80	81.36	Navfac 1971-1982	11.93

Qc (CPT Cone resistance)

Description	NSPT	Layer depth (m)	N. Calculation	Correlation	Qc (Mpa)
Layer (1) Layer	9.15	0.00-0.60	9.15	Robertson 1983	1.79
Layer (2) Layer	81.36	0.60-0.80	81.36	Robertson 1983	15.96

T.16. VRTINA V-1

GEOTEHNIČNI PROFIL VRTINE V-1

0 m - 2,9 m

		GLOBINA:	2,9 m	VRTALNI STROJ:	GeoExplorer
		NIVO VODE:		DATUM VRTANJA:	15.9.2026
NAROČNIK:	Občina Cirkulane	KOTA TERENA:	296,40 m n.v.	OBDELAL:	Gašper Mohorko, u.d.g.i.
				PREGLEDAL:	Tomaž Mayer, u.d.i.g.
OBJEKT:	Plaz Gruškovec	E:	577949.929	MERILO:	1:50
LOKACIJA:	parc. št. 790/5 k.o. 475 Gruškovec	N:	132917.886	LIST:	1/1

Metoda vrtanja	Globina (m)	LITOLOŠKI STOLPEC	AC KLASIFIKACIJA	LITOLOŠKI OPIS	RQD	RAZPOKE	SPT	PRESIOMETER	VZOREC	OPOMBE	NIVO VODE
	1.10		clGr	UMETNO PRODNATO NASUTJE							
	2.70		saCl	PEŠČENA GLINA							
	2.90			PREHOD V LAPOR							

T.17. POVRATNE ANALIZE

T.17.1. Povratna analiza na profilu P3

Slope stability analysis

Input data (Construction stage 1)

Project

Project : Analiza stabilnosti
Part : Profil 3
Description : Plaz Gruškovec
Customer : Občina Cirkulane
Author : Tomaž Mayer d.i.g. (UN)
Date : 4. 11. 2026
Project number : 26 9 1311

Settings

(input for current task)

Stability analysis

Verification methodology : Safety factors (ASD)
Earthquake analysis : Standard

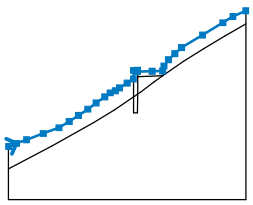
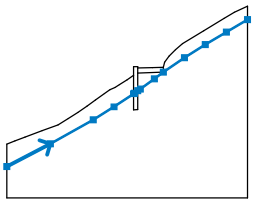
Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1,25	[–]

Anchors

Verification methodology : Safety factors (ASD)

Safety factors			
Safety factor for steel strength :	SF_t =	1,50	[–]
Safety factor for pull out resistance (soil) :	SF_e =	1,50	[–]
Safety factor for pull out resistance (grouting) :	SF_c =	1,50	[–]

Interface

Number	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
1		0,00	3,60	1,27	4,10	2,91	4,70
		5,63	5,71	8,17	6,64	9,82	7,64
		11,32	8,64	12,83	9,64	14,16	10,64
		15,57	11,64	16,47	12,28	17,27	12,63
		17,96	13,08	19,22	13,86	20,22	14,55
		20,22	15,92	20,89	15,95	20,89	15,74
		23,25	15,79	24,97	15,82	25,18	16,64
		25,89	17,64	26,91	18,64	28,03	19,64
		31,41	21,64	34,70	23,64	36,33	24,64
		38,41	25,59				
2		0,00	0,00	6,96	3,64	13,80	7,47
		17,12	9,53	20,22	11,62	20,37	11,71
		20,89	12,09	21,32	12,38	23,53	14,01
		24,97	15,07	28,34	17,38	31,65	19,46
		35,02	21,47	38,41	23,46		

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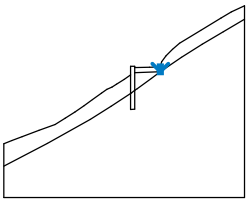
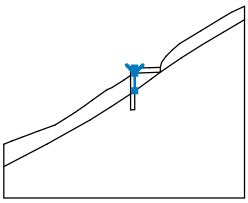
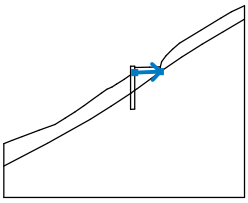
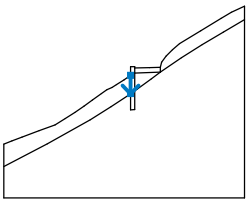
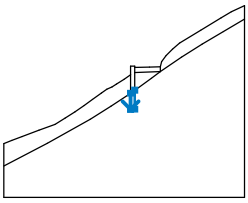
Number	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
3		24,97	15,82	24,97	15,07		
4		20,89	15,74	20,89	14,91	20,89	12,09
5		20,89	14,91	24,97	15,07		
6		20,22	14,55	20,22	11,62		
7		20,22 20,89	11,62 12,09	20,22	9,04	20,88	9,07

Soil parameters - effective stress state

Number	Pattern	Soil name	γ [kN/m³]	φ_{ef} [°]	c_{ef} [kPa]
1		Tampon	20,00	35,00	1,00
2		Peščena glina	19,00	25,00	6,00
3		Lapor	21,00	34,00	15,00

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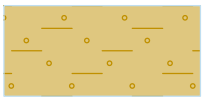
Soil parameters - uplift

Number	Pattern	Soil name	γ_{sat} [kN/m3]	γ_s [kN/m3]	n [-]
1		Tampon	20,50		
2		Peščena glina	19,50		
3		Lapor	21,00		

Soil parameters

Tampon

Basic data
Unit weight : $\gamma = 20,00$ [kN/m3]
Shear strength : Mohr-Coulomb
Stress-state : effective
Internal friction angle : $\varphi_{ef} = 35,00$ [°]
Cohesion : $c_{ef} = 1,00$ [kPa]

Uplift pressure
Uplift calculation : standard
Unit weight of saturated soil : $\gamma_{sat} = 20,50$ [kN/m3]

Foliation
Soil foliation : not consider

View
Sample : 

Peščena glina

Basic data
Unit weight : $\gamma = 19,00$ [kN/m3]
Shear strength : Mohr-Coulomb
Stress-state : effective
Internal friction angle : $\varphi_{ef} = 25,00$ [°]
Cohesion : $c_{ef} = 6,00$ [kPa]

Uplift pressure
Uplift calculation : standard
Unit weight of saturated soil : $\gamma_{sat} = 19,50$ [kN/m3]

Foliation
Soil foliation : not consider

View
Sample : 

Lapor

Basic data
Unit weight : $\gamma = 21,00$ [kN/m3]

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Shear strength : Mohr-Coulomb
Stress-state : effective
Internal friction angle : φ_{ef} = 34,00 [°]
Cohesion : c_{ef} = 15,00 [kPa]

Uplift pressure
Uplift calculation : standard
Unit weight of saturated soil : γ_{sat} = 21,00 [kN/m^3]

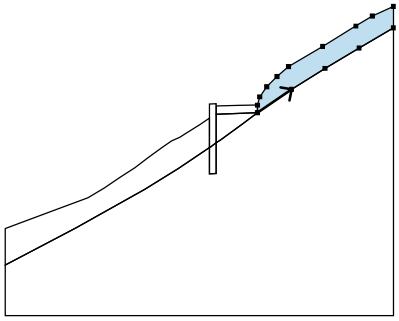
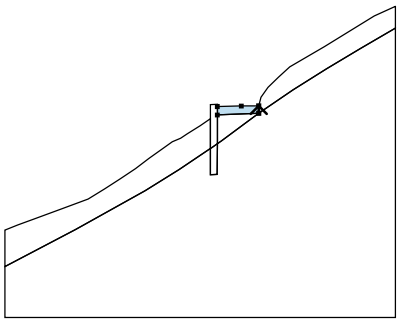
Foliation
Soil foliation : not consider

View
Sample :

Rigid Bodies

Number	Sample	Soil name	γ [kN/m^3]
1		Pilot	25,00

Assigning and surfaces

Number	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
1		24,97	15,07	28,34	17,38	Peščena glina
		31,65	19,46	35,02	21,47	
		38,41	23,46	38,41	25,59	
		36,33	24,64	34,70	23,64	
		31,41	21,64	28,03	19,64	
		26,91	18,64	25,89	17,64	
		25,18	16,64	24,97	15,82	
2		24,97	15,07	24,97	15,82	Tampon
		23,25	15,79	20,89	15,74	
		20,89	14,91			

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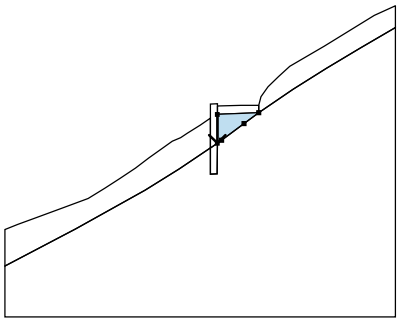
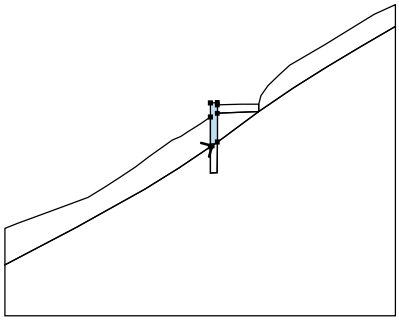
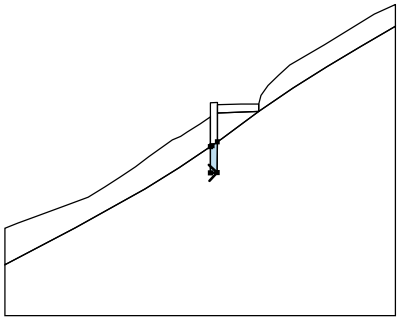
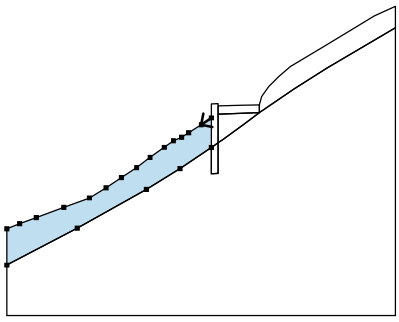
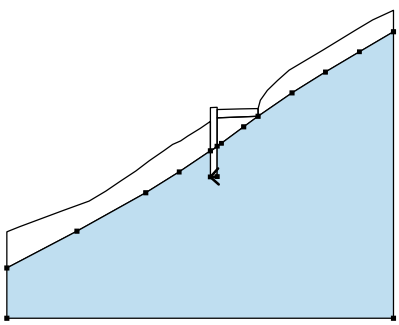
Number	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
3		20,89	14,91	20,89	12,09	Peščena glina
		21,32	12,38	23,53	14,01	
		24,97	15,07			
4		20,22	11,62	20,37	11,71	Pilot
		20,89	12,09	20,89	14,91	
		20,89	15,74	20,89	15,95	
		20,22	15,92	20,22	14,55	
5		20,22	9,04	20,88	9,07	Pilot
		20,89	12,09	20,37	11,71	
		20,22	11,62			
6		20,22	14,55	19,22	13,86	Peščena glina
		17,96	13,08	17,27	12,63	
		16,47	12,28	15,57	11,64	
		14,16	10,64	12,83	9,64	
		11,32	8,64	9,82	7,64	
		8,17	6,64	5,63	5,71	
		2,91	4,70	1,27	4,10	
		0,00	3,60	0,00	0,00	
		6,96	3,64	13,80	7,47	
		17,12	9,53	20,22	11,62	
7		20,88	9,07	20,22	9,04	Lapor
		20,22	11,62	17,12	9,53	
		13,80	7,47	6,96	3,64	
		0,00	0,00	0,00	-5,00	
		38,41	-5,00	38,41	23,46	
		35,02	21,47	31,65	19,46	
		28,34	17,38	24,97	15,07	
		23,53	14,01	21,32	12,38	
		20,89	12,09			

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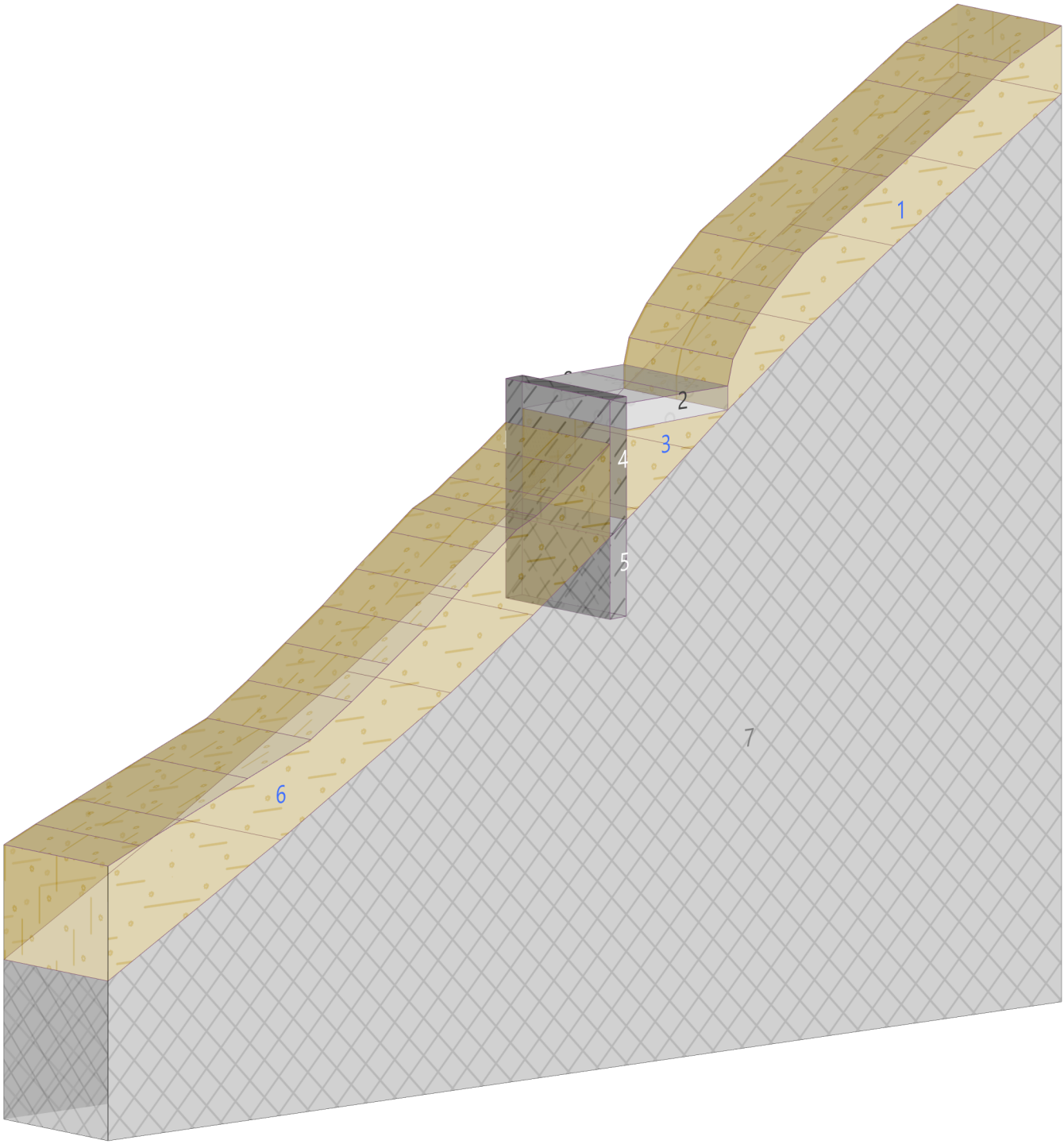
Name : Soils and assignment

Stage : 1



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Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Construction stage 1)

Analysis 1 (stage 1)

Circular slip surface

Slip surface parameters							
Center :	x =	8,80	[m]	Angles :	α_1 =	-3,76	[°]
	z =	18,44	[m]		α_2 =	69,97	[°]
Radius :	R =	11,88	[m]				
Slip surface after grid search.							

Total weight of soil above the slip surface: 434,37 kN/m

Slope stability verification (Bishop)

Sum of active forces : F_a = 212,08 kN/m

Sum of passive forces : F_p = 275,47 kN/m

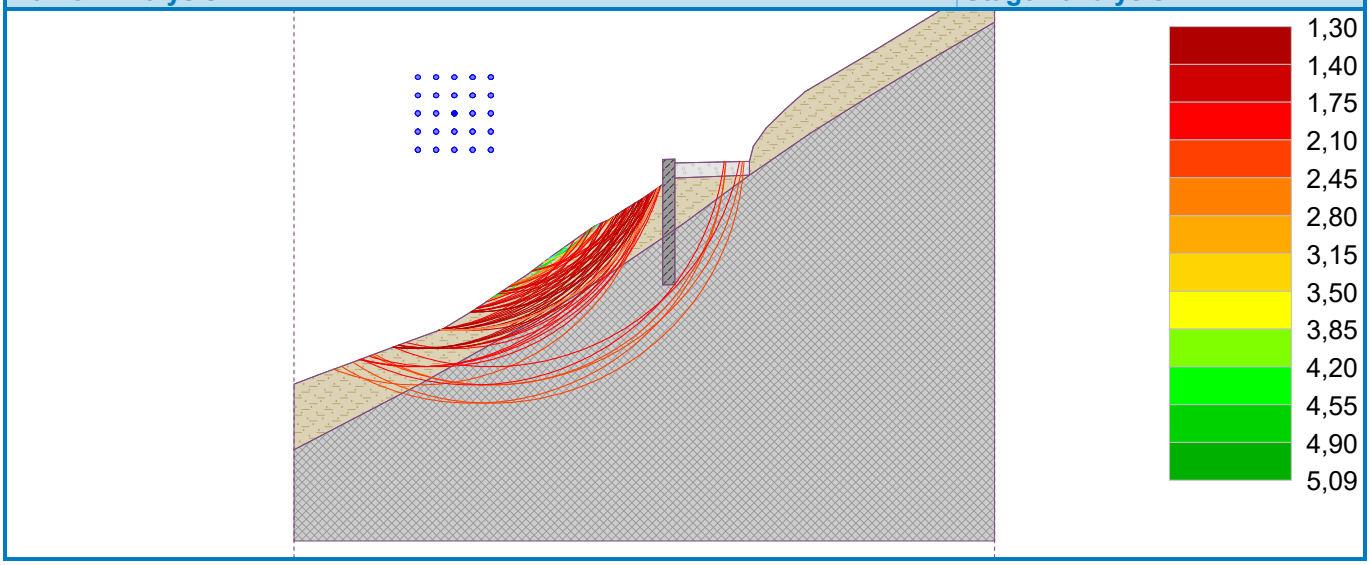
Sliding moment : M_a = 2519,56 kNm/m

Resisting moment : M_p = 3272,55 kNm/m

Factor of safety = 1,30 ≥ 1,25

Slope stability ACCEPTABLE

Name : Analysis	Stage - analysis : 1 - 1



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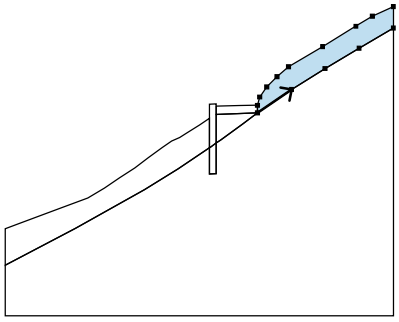
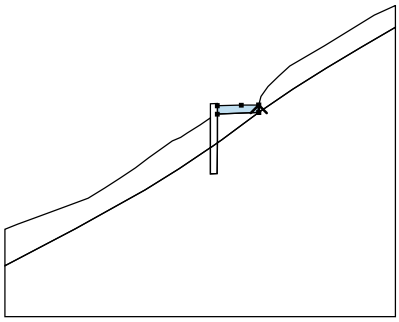
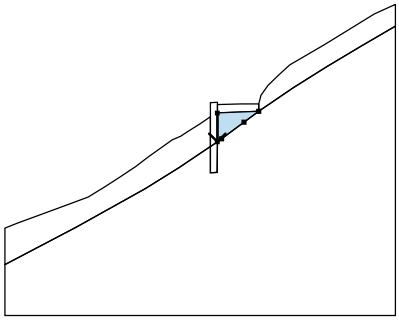
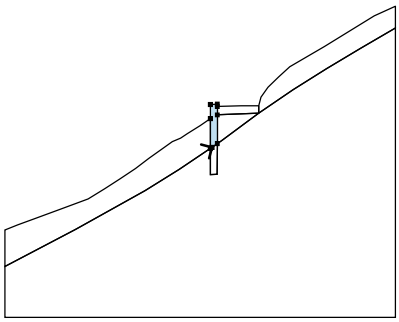
Input data (Construction stage 2)

Assigning and surfaces

Number	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
1		24,97	15,07	28,34	17,38	Peščena glina
		31,65	19,46	35,02	21,47	
		38,41	23,46	38,41	25,59	
		36,33	24,64	34,70	23,64	
		31,41	21,64	28,03	19,64	
		26,91	18,64	25,89	17,64	
		25,18	16,64	24,97	15,82	
2		24,97	15,07	24,97	15,82	Tampon
		23,25	15,79	20,89	15,74	
		20,89	14,91			
3		20,89	14,91	20,89	12,09	Peščena glina
		21,32	12,38	23,53	14,01	
		24,97	15,07			
4		20,22	11,62	20,37	11,71	Pilot
		20,89	12,09	20,89	14,91	
		20,89	15,74	20,89	15,95	
		20,22	15,92	20,22	14,55	

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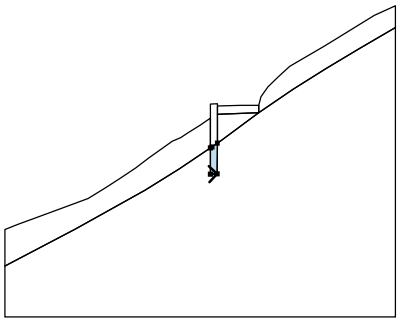
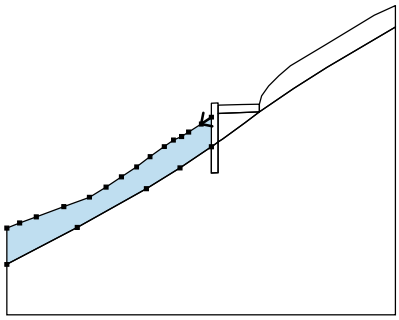
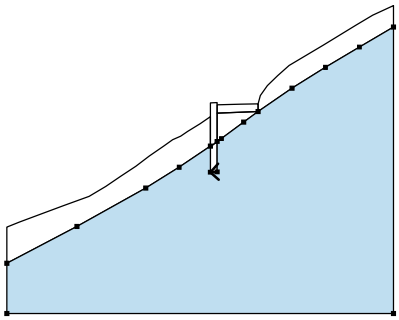
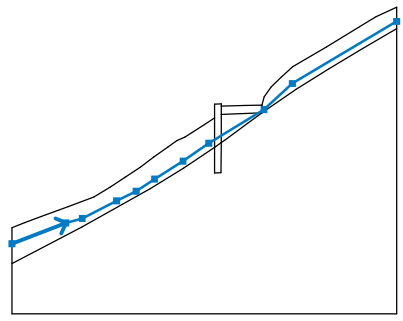
Number	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
5		20,22	9,04	20,88	9,07	Pilot
		20,89	12,09	20,37	11,71	
		20,22	11,62			
6		20,22	14,55	19,22	13,86	Peščena glina
		17,96	13,08	17,27	12,63	
		16,47	12,28	15,57	11,64	
		14,16	10,64	12,83	9,64	
		11,32	8,64	9,82	7,64	
		8,17	6,64	5,63	5,71	
		2,91	4,70	1,27	4,10	
		0,00	3,60	0,00	0,00	
		6,96	3,64	13,80	7,47	
		17,12	9,53	20,22	11,62	
7		20,88	9,07	20,22	9,04	Lapor
		20,22	11,62	17,12	9,53	
		13,80	7,47	6,96	3,64	
		0,00	0,00	0,00	-5,00	
		38,41	-5,00	38,41	23,46	
		35,02	21,47	31,65	19,46	
		28,34	17,38	24,97	15,07	
		23,53	14,01	21,32	12,38	
		20,89	12,09			

Water

Water type : GWT

Number	GWT location	Coordinates of GWT points [m]					
		x	z	x	z	x	z
1099981523		0,00	1,98	5,39	4,06	7,02	4,51
		10,44	6,26	12,39	7,22	14,24	8,45
		17,08	10,24	19,66	12,02	25,16	15,37
		27,98	17,98	38,41	24,18		

Tensile crack

Tensile crack not input.

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Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Construction stage 2)

Analysis 1 (stage 2)

Circular slip surface

Slip surface parameters							
Center :	x =	9,01	[m]	Angles :	α_1 =	-3,35	[°]
	z =	18,53	[m]		α_2 =	69,94	[°]
Radius :	R =	11,82	[m]				
Slip surface after grid search.							

Total weight of soil above the slip surface: 428,96 kN/m

Slope stability verification (Bishop)

Sum of active forces : F_a = 209,61 kN/m

Sum of passive forces : F_p = 263,14 kN/m

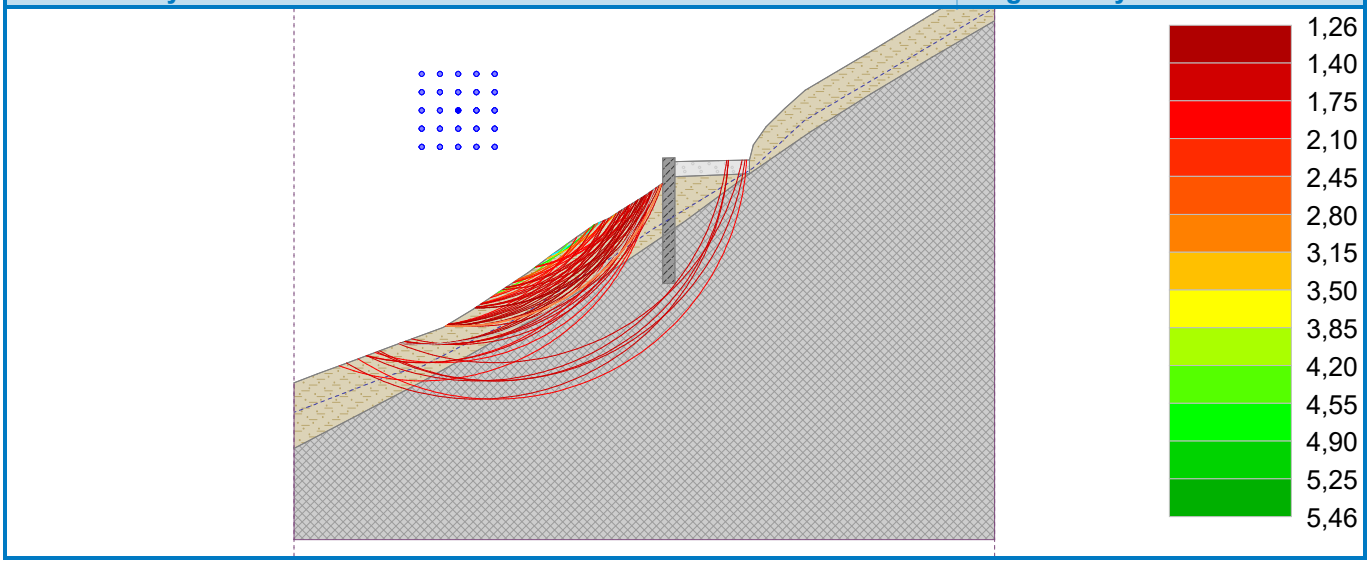
Sliding moment : M_a = 2477,55 kNm/m

Resisting moment : M_p = 3110,34 kNm/m

Factor of safety = 1,26 ≥ 1,25

Slope stability ACCEPTABLE

Name : Analysis	Stage - analysis : 2 - 1



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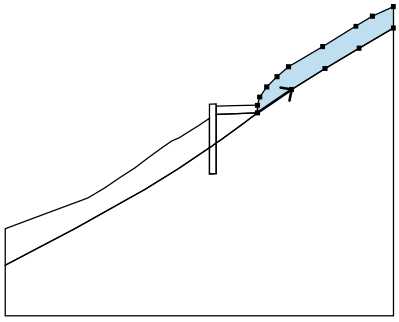
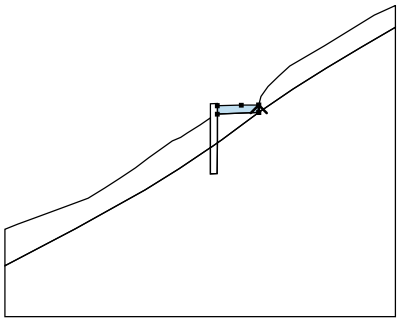
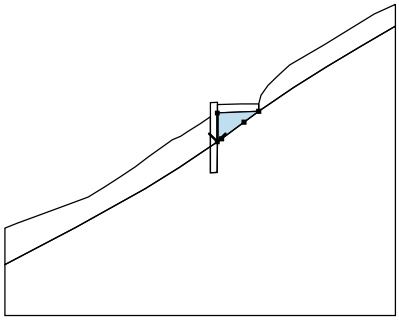
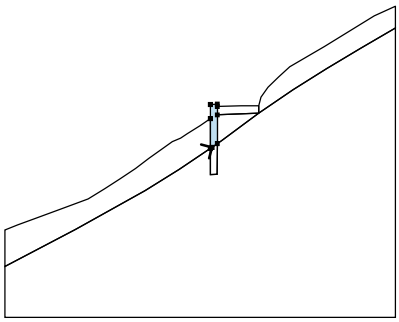
Input data (Construction stage 3)

Assigning and surfaces

Number	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
1		24,97	15,07	28,34	17,38	Peščena glina
		31,65	19,46	35,02	21,47	
		38,41	23,46	38,41	25,59	
		36,33	24,64	34,70	23,64	
		31,41	21,64	28,03	19,64	
		26,91	18,64	25,89	17,64	
		25,18	16,64	24,97	15,82	
2		24,97	15,07	24,97	15,82	Tampon
		23,25	15,79	20,89	15,74	
		20,89	14,91			
3		20,89	14,91	20,89	12,09	Peščena glina
		21,32	12,38	23,53	14,01	
		24,97	15,07			
4		20,22	11,62	20,37	11,71	Pilot
		20,89	12,09	20,89	14,91	
		20,89	15,74	20,89	15,95	
		20,22	15,92	20,22	14,55	

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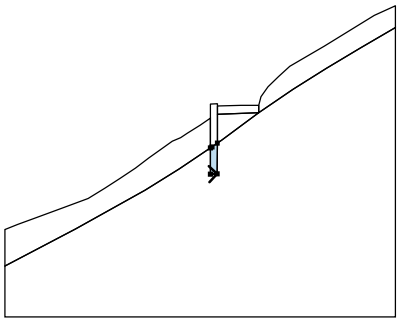
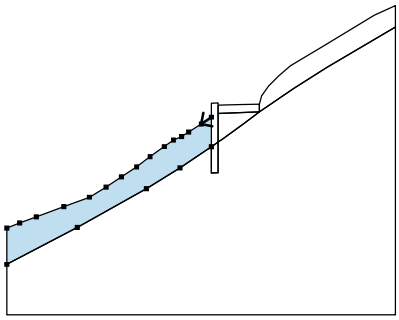
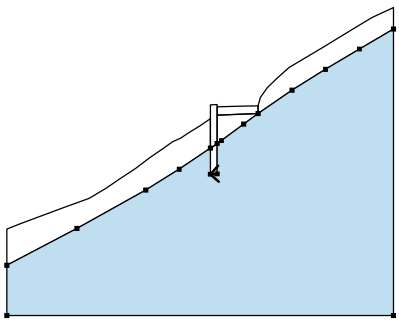
Number	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
5		20,22	9,04	20,88	9,07	Pilot
		20,89	12,09	20,37	11,71	
		20,22	11,62			
6		20,22	14,55	19,22	13,86	Peščena glina
		17,96	13,08	17,27	12,63	
		16,47	12,28	15,57	11,64	
		14,16	10,64	12,83	9,64	
		11,32	8,64	9,82	7,64	
		8,17	6,64	5,63	5,71	
		2,91	4,70	1,27	4,10	
		0,00	3,60	0,00	0,00	
		6,96	3,64	13,80	7,47	
		17,12	9,53	20,22	11,62	
7		20,88	9,07	20,22	9,04	Lapor
		20,22	11,62	17,12	9,53	
		13,80	7,47	6,96	3,64	
		0,00	0,00	0,00	-5,00	
		38,41	-5,00	38,41	23,46	
		35,02	21,47	31,65	19,46	
		28,34	17,38	24,97	15,07	
		23,53	14,01	21,32	12,38	
		20,89	12,09			

Surcharge

Number	Surcharge		Type	Type of action	Location	Origin	Length	Width	Slope	Magnitude			
	new	change			z [m]	x [m]	l [m]	b [m]	α [°]	q, q_1, f, F, x	q_2, z		unit
1	Yes		strip	permanent	on terrain	x = 21,00	l = 3,90		0,00	16,00			kN/m^2

Surcharges

Number	Name
1	Promet

Water

Water type : GWT

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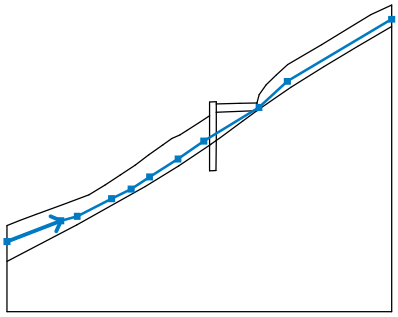
Number	GWT location	Coordinates of GWT points [m]					
		x	z	x	z	x	z
1099981523		0,00	1,98	5,39	4,06	7,02	4,51
		10,44	6,26	12,39	7,22	14,24	8,45
		17,08	10,24	19,66	12,02	25,16	15,37
		27,98	17,98	38,41	24,18		

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Construction stage 3)

Analysis 1 (stage 3)

Circular slip surface

Slip surface parameters							
Center :	x =	8,72	[m]	Angles :	α_1 =	-4,70	[°]
	z =	18,48	[m]		α_2 =	70,40	[°]
Radius :	R =	12,04	[m]				
Slip surface after grid search.							

Total weight of soil above the slip surface: 461,75 kN/m

Slope stability verification (Bishop)

Sum of active forces : F_a = 224,54 kN/m

Sum of passive forces : F_p = 279,76 kN/m

Sliding moment : M_a = 2703,51 kNm/m

Resisting moment : M_p = 3368,30 kNm/m

Factor of safety = 1,25 ≥ 1,25

Slope stability ACCEPTABLE

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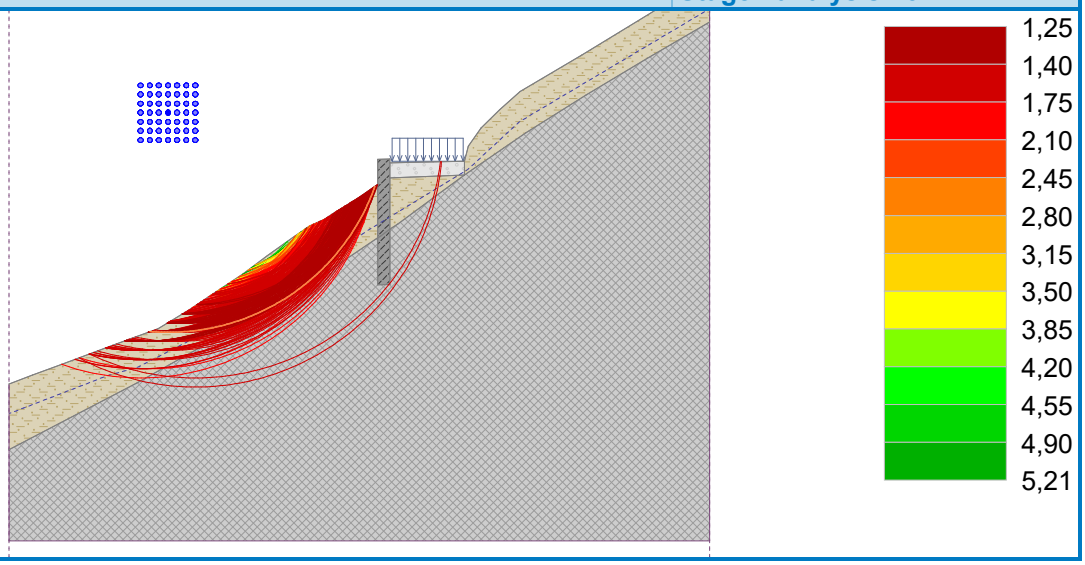
Name : Analysis	Stage - analysis : 3 - 1



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T.18. ANALIZA STABILNOSTI

T.18.1. Analiza stabilnosti na profilu P3

Slope stability analysis

Input data (Construction stage 1)

Project

Project : Povratna analiza
Part : Profil 3
Description : Usad Gruškovec
Customer : Občina Cirkulane
Author : Tomaž Mayer d.i.g. (UN)
Date : 9. 11. 2026
Project number : 26 9 1311

Settings

Standard - no reduction of parameters

Stability analysis

Verification methodology : Limit states (LSD)
Earthquake analysis : Standard

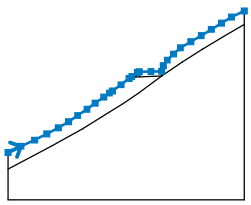
Reduction coeff. of soil parameters			
Permanent design situation			
Reduction coeff. of internal friction :	$\gamma_{m\varphi}$ =	1,00	[–]
Reduction coeff. of cohesion :	γ_{mc} =	1,00	[–]
Reduction coeff. of overall stability of construction :	γ_s =	1,00	[–]

Anchors

Verification methodology : Limit states (LSD)

Reduction coefficients			
Reduction. coeff of steel strength :	γ_s =	1,00	[–]
Reduction coefficient of pull out resistance (soil) :	γ_e =	1,00	[–]
Reduction coefficient of pull out resistance (grouting) :	γ_c =	1,00	[–]

Interface

Number	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
1		0,00	2,64	2,08	3,64	4,33	4,64
		6,31	5,64	8,17	6,64	9,82	7,64
		11,32	8,64	12,83	9,64	14,16	10,64
		15,57	11,64	16,47	12,28	16,97	12,64
		18,36	13,64	19,66	14,64	20,11	14,97
		21,04	15,64	21,35	15,73	23,24	15,78
		24,97	15,82	25,23	16,73	25,89	17,64
		26,91	18,64	28,03	19,64	29,71	20,64
		31,41	21,64	33,05	22,64	34,70	23,64
		36,33	24,64	38,41	25,64		

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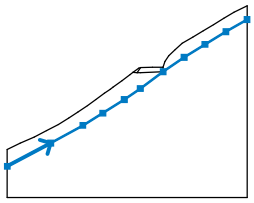
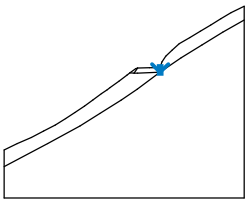
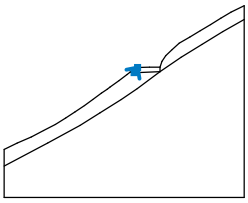
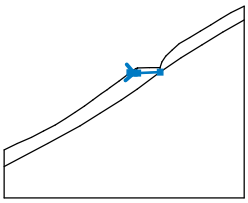
Number	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
2		0,00	-0,07	6,96	3,64	12,11	6,49
		15,31	8,44	18,76	10,60	21,32	12,38
		24,97	15,07	28,34	17,38	31,65	19,46
		35,02	21,47	38,41	23,44		
3		24,97	15,82	24,97	15,07		
4		20,78	14,91	21,35	15,73		
5		20,11	14,97	20,78	14,91	21,35	14,93
		24,97	15,07				

Soil parameters - effective stress state

Number	Pattern	Soil name	γ [kN/m³]	φef [°]	cef [kPa]
1		Tampon	20,00	35,00	1,00
2		Peščena glina	19,00	25,00	6,00
3		Lapor	21,00	34,00	15,00

Soil parameters - uplift

Number	Pattern	Soil name	γsat [kN/m³]	γs [kN/m³]	n [-]
1		Tampon	21,00		

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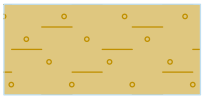
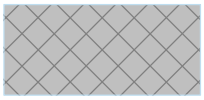
Number	Pattern	Soil name	γ_{sat} [kN/m3]	γ_s [kN/m3]	n [-]
2		Peščena glina	19,50		
3		Lapor	21,00		

Soil parameters

Tampon

Basic data
Unit weight : γ = 20,00 [kN/m3]
Shear strength : Mohr-Coulomb
Stress-state : effective
Internal friction angle : φ_{ef} = 35,00 [°]
Cohesion : c_{ef} = 1,00 [kPa]

Uplift pressure
Uplift calculation : standard
Unit weight of saturated soil : γ_{sat} = 21,00 [kN/m3]

Foliation
Soil foliation : not consider

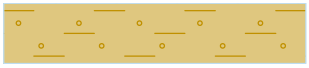
View
Sample : 

Peščena glina

Basic data
Unit weight : γ = 19,00 [kN/m3]
Shear strength : Mohr-Coulomb
Stress-state : effective
Internal friction angle : φ_{ef} = 25,00 [°]
Cohesion : c_{ef} = 6,00 [kPa]

Uplift pressure
Uplift calculation : standard
Unit weight of saturated soil : γ_{sat} = 19,50 [kN/m3]

Foliation
Soil foliation : not consider

View
Sample : 

Lapor

Basic data
Unit weight : γ = 21,00 [kN/m3]
Shear strength : Mohr-Coulomb
Stress-state : effective
Internal friction angle : φ_{ef} = 34,00 [°]
Cohesion : c_{ef} = 15,00 [kPa]

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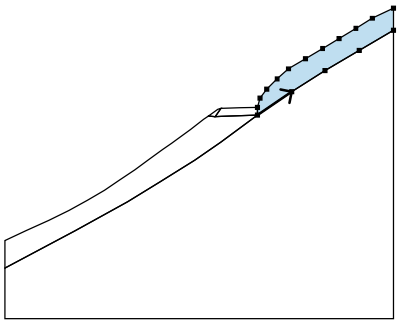
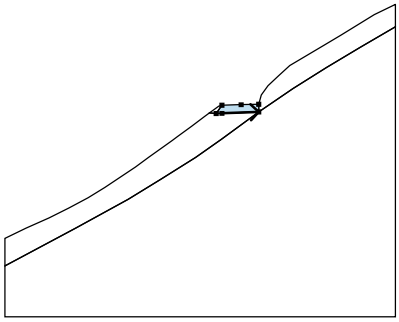
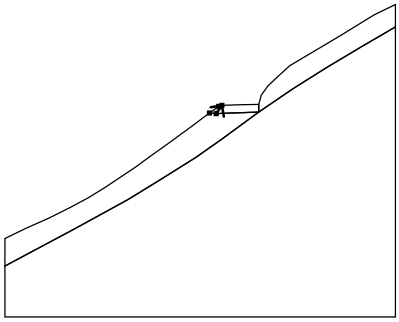
Uplift pressure
Uplift calculation : standard
Unit weight of saturated soil : γ_{sat} = 21,00 [kN/m^3]

Foliation
Soil foliation : not consider

View
Sample :

Assigning and surfaces

Number	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
1		24,97	15,07	28,34	17,38	Peščena glina
		31,65	19,46	35,02	21,47	
		38,41	23,44	38,41	25,64	
		36,33	24,64	34,70	23,64	
		33,05	22,64	31,41	21,64	
		29,71	20,64	28,03	19,64	
		26,91	18,64	25,89	17,64	
		25,23	16,73	24,97	15,82	
2		21,35	14,93	24,97	15,07	Tampon
		24,97	15,82	23,24	15,78	
		21,35	15,73	20,78	14,91	
3		20,78	14,91	21,35	15,73	Peščena glina
		21,04	15,64	20,11	14,97	

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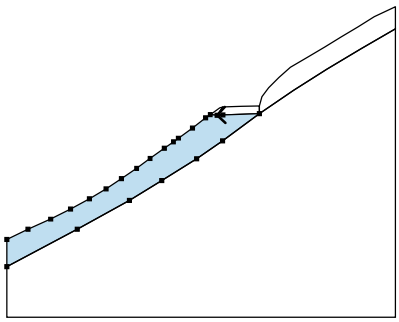
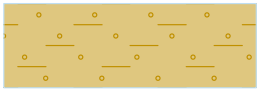
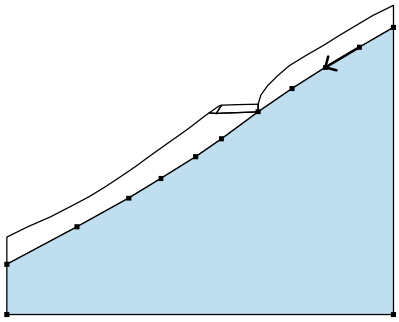
Number	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
4		21,35	14,93	20,78	14,91	Peščena glina
		20,11	14,97	19,66	14,64	
		18,36	13,64	16,97	12,64	
		16,47	12,28	15,57	11,64	
		14,16	10,64	12,83	9,64	
		11,32	8,64	9,82	7,64	
		8,17	6,64	6,31	5,64	
		4,33	4,64	2,08	3,64	
		0,00	2,64	0,00	-0,07	
		6,96	3,64	12,11	6,49	
		15,31	8,44	18,76	10,60	
		21,32	12,38	24,97	15,07	
5		35,02	21,47	31,65	19,46	Lapor
		28,34	17,38	24,97	15,07	
		21,32	12,38	18,76	10,60	
		15,31	8,44	12,11	6,49	
		6,96	3,64	0,00	-0,07	
		0,00	-5,07	38,41	-5,07	
		38,41	23,44			

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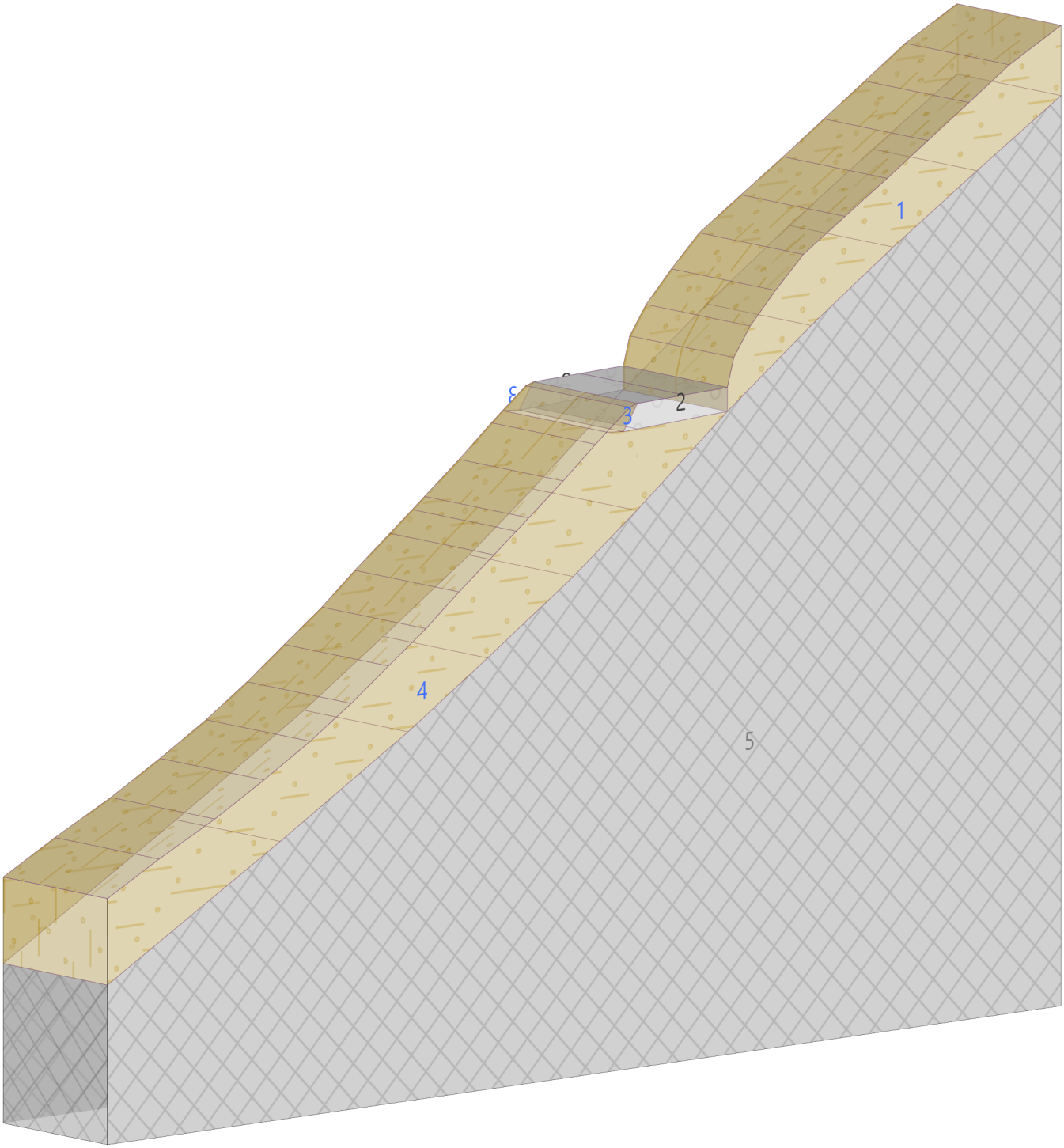
Name : Soils and assignment

Stage : 1



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Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Construction stage 1)

Analysis 1 (stage 1)

Circular slip surface

Slip surface parameters							
Center :	x =	4,63	[m]	Angles :	α_1 =	4,81	[°]
	z =	27,14	[m]		α_2 =	58,09	[°]
Radius :	R =	21,51	[m]				
Slip surface after grid search.							

Total weight of soil above the slip surface: 651,75 kN/m

Slope stability verification (Bishop)

Sum of active forces : F_a = 338,29 kN/m

Sum of passive forces : F_p = 385,28 kN/m

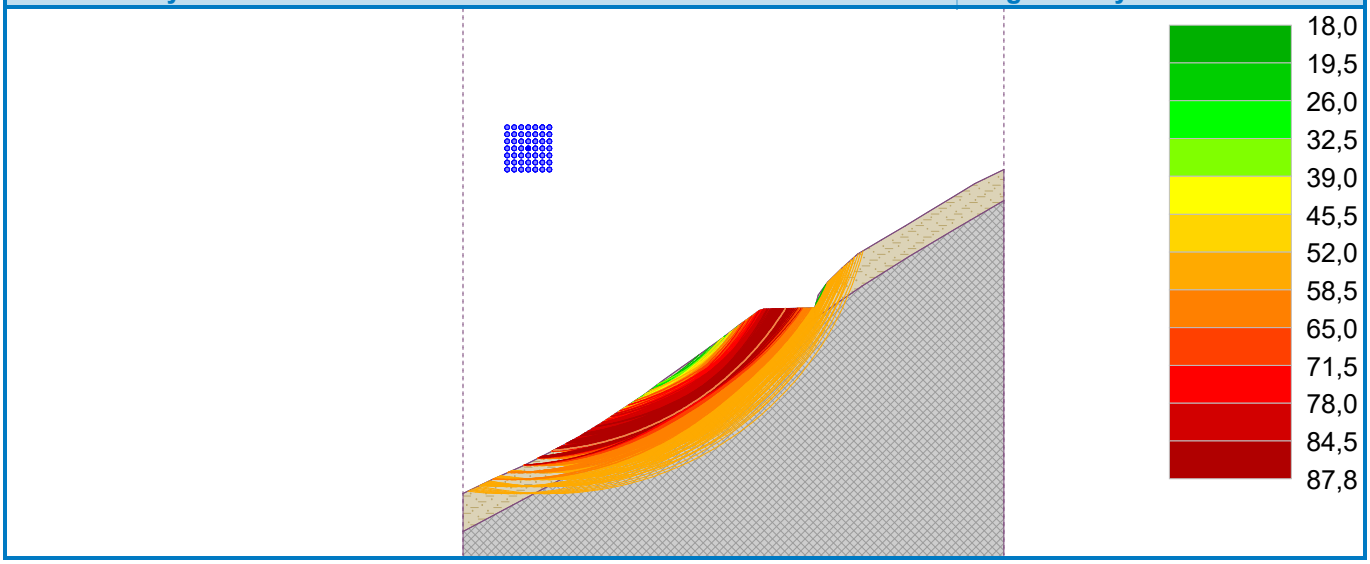
Sliding moment : M_a = 7276,62 kNm/m

Resisting moment : M_p = 8287,46 kNm/m

Utilization : 87,8 %

Slope stability ACCEPTABLE

Name : Analysis	Stage - analysis : 1 - 1



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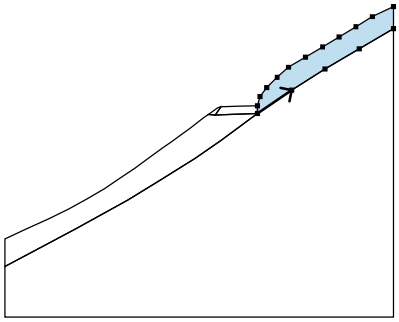
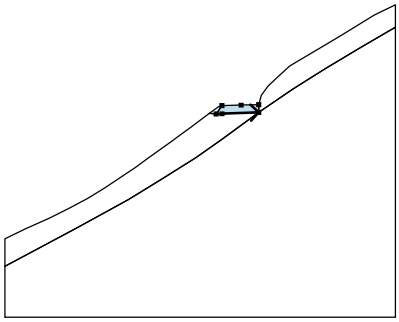
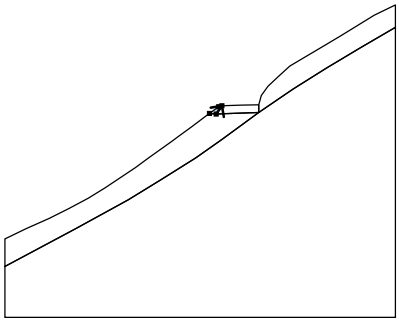
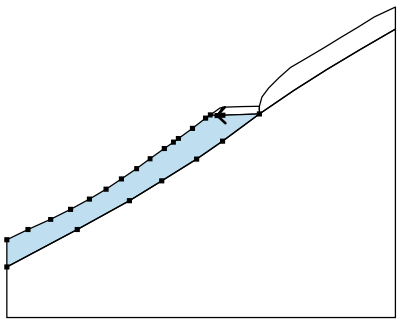
Input data (Construction stage 2)

Assigning and surfaces

Number	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
1		24,97	15,07	28,34	17,38	Peščena glina
		31,65	19,46	35,02	21,47	
		38,41	23,44	38,41	25,64	
		36,33	24,64	34,70	23,64	
		33,05	22,64	31,41	21,64	
		29,71	20,64	28,03	19,64	
		26,91	18,64	25,89	17,64	
		25,23	16,73	24,97	15,82	
2		21,35	14,93	24,97	15,07	Tampon
		24,97	15,82	23,24	15,78	
		21,35	15,73	20,78	14,91	
3		20,78	14,91	21,35	15,73	Peščena glina
		21,04	15,64	20,11	14,97	
4		21,35	14,93	20,78	14,91	Peščena glina
		20,11	14,97	19,66	14,64	
		18,36	13,64	16,97	12,64	
		16,47	12,28	15,57	11,64	
		14,16	10,64	12,83	9,64	
		11,32	8,64	9,82	7,64	
		8,17	6,64	6,31	5,64	
		4,33	4,64	2,08	3,64	
		0,00	2,64	0,00	-0,07	
		6,96	3,64	12,11	6,49	
		15,31	8,44	18,76	10,60	
		21,32	12,38	24,97	15,07	

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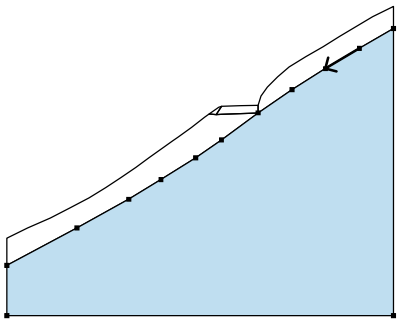
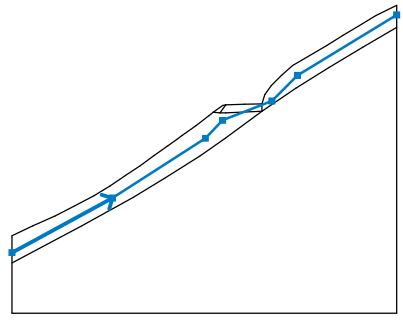
Number	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
5		35,02	21,47	31,65	19,46	Lapor
		28,34	17,38	24,97	15,07	
		21,32	12,38	18,76	10,60	
		15,31	8,44	12,11	6,49	
		6,96	3,64	0,00	-0,07	
		0,00	-5,07	38,41	-5,07	
		38,41	23,44			

Water

Water type : GWT

Number	GWT location	Coordinates of GWT points [m]					
		x	z	x	z	x	z
1099981523		0,00	0,97	10,05	6,41	19,32	12,38
		21,03	14,17	25,95	16,09	28,51	18,65
		38,41	24,70				

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Construction stage 2)

Analysis 1 (stage 2)

Circular slip surface

Slip surface parameters							
Center :	x =	5,13	[m]	Angles :	α_1 =	5,90	[°]
	z =	28,64	[m]		α_2 =	55,19	[°]
Radius :	R =	22,51	[m]				
Slip surface after grid search.							

Total weight of soil above the slip surface: 660,79 kN/m

Slope stability verification (Bishop)

Sum of active forces : F_a = 337,67 kN/m

Sum of passive forces : F_p = 338,21 kN/m

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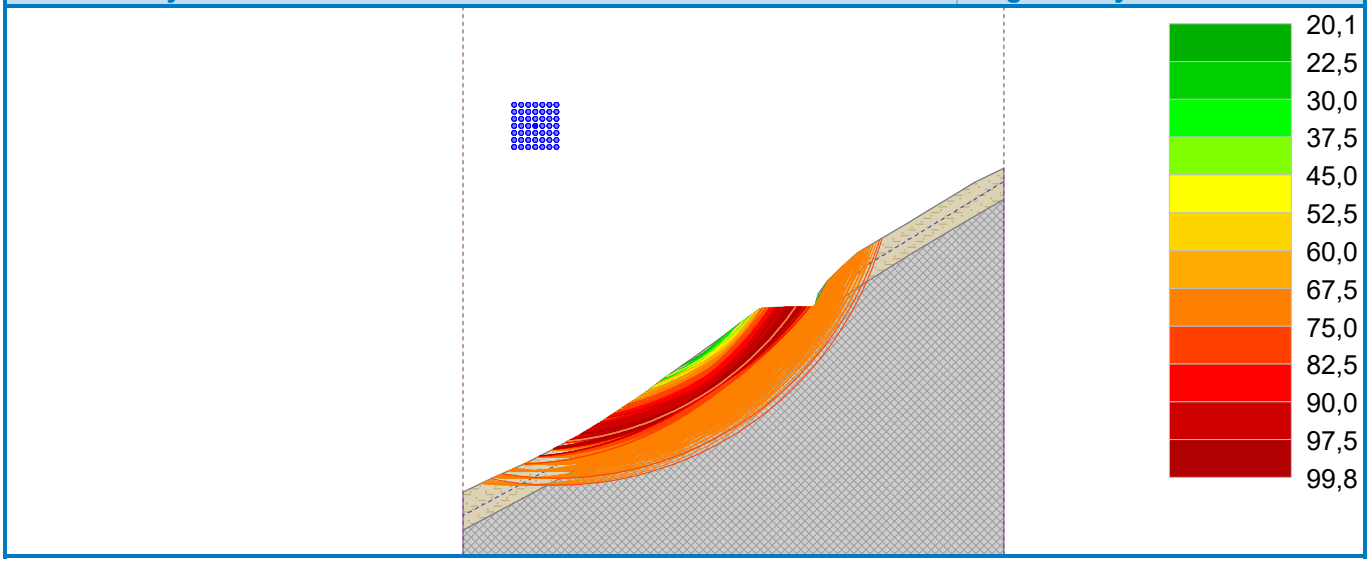
Sliding moment : M_a = 7601,00 kNm/m
Resisting moment : M_p = 7613,13 kNm/m
Utilization : 99,8 %

Slope stability ACCEPTABLE

Name : Analysis	Stage - analysis : 2 - 1



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T.19. PRERAČUN IN DIMENZIONIRANJE PODPORNEGA UKREPA

T.19.1. Preračun sanacije na profilu P3

Analysis using finite element method

Topology

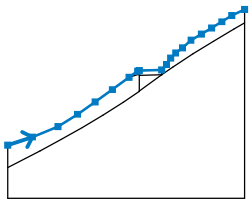
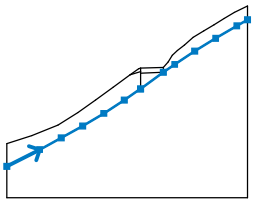
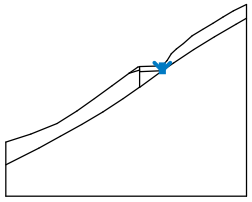
Project

Project : Dimenzioniranje pilotne stene
Part : Profil 3
Description : Plaz Gruškovec
Customer : Občina Cirkulane
Author : Tomaž Mayer d.i.g. (UN)
Date : 3. 11. 2026
Project number : 26 9 1311

Global settings

Task geometry :	Plane strain
Analysis type :	Stress analysis
Tunnels :	no
Allow to input water as the result of steady state water flow analysis :	no
Allow dynamic analysis of earthquake :	no
Concrete structures :	EN 1992-1-1 (EC2)
Calculation of geostatic stress (1st stage) :	Geostatic stress
Advanced mesh generating parameters :	no
Advanced soil parameters :	no
Detailed results :	no

Interface

Number	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
1		0,00	3,65	3,99	4,96	8,17	6,64
		11,32	8,64	14,16	10,64	16,97	12,64
		19,66	14,64	21,04	15,64	21,35	15,73
		24,97	15,82	25,73	16,70	26,42	17,75
		27,22	18,56	28,33	19,42	29,71	20,64
		31,41	21,64	33,05	22,64	34,70	23,64
		36,33	24,64	38,41	25,64		
2		0,00	0,03	5,23	2,72	8,69	4,57
		12,11	6,49	15,47	8,49	18,76	10,60
		21,32	12,38	21,35	12,40	24,97	15,07
		26,79	16,31	29,99	18,43	33,33	20,47
		36,71	22,46	38,41	23,44		
3		24,97	15,82	24,97	15,07		

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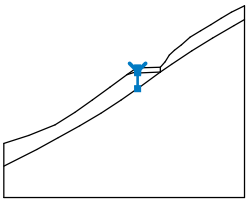
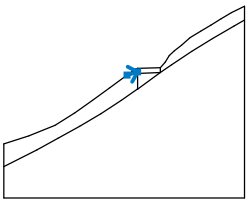
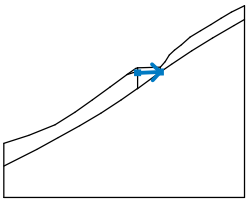
Number	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
4		21,35	15,73	21,35	15,16	21,35	14,93
		21,35	12,40				
5		19,66	14,64	21,35	15,16		
6		21,35	14,93	24,97	15,07		

Soil parameters - basic data, uplift

Number	Pattern	Soil name Material model	Type of soil	γ [kN/m³]	ν [-]	e_{in} [-]	γ_{sat} [kN/m³]
1		Tampon Mohr-Coulomb	drained	20,00	0,30	1,000	20,50
2		Peščena glina Mohr-Coulomb	drained	19,00	0,30	1,000	19,50
3		Lapor Mohr-Coulomb	drained	21,00	0,30	1,000	21,00

Soil parameters - data according to model - part 1/2

Number	Pattern	Soil name Material model	E_{ref} [MPa]	$E_{ur,ref}$ [MPa]
1		Tampon Mohr-Coulomb	40,00	80,00
2		Peščena glina Mohr-Coulomb	20,00	40,00
3		Lapor Mohr-Coulomb	100,00	200,00

Soil parameters - data according to model - part 2/2

Number	Pattern	Soil name Material model	φ_{ef} [°]	c_{ef} [kPa]	ψ [°]
1		Tampon Mohr-Coulomb	35,00	1,00	0,00
2		Peščena glina Mohr-Coulomb	25,00	6,00	0,00

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Number	Pattern	Soil name Material model	φ_{ef} [°]	c_{ef} [kPa]	ψ [°]
3		Lapor Mohr-Coulomb	34,00	15,00	0,00

Soil parameters

Tampon

Material model
Material model type : Basic elasto-plastic models
Material model : Mohr-Coulomb

Basic data
Unit weight : $\gamma = 20,00$ [kN/m^3]
Poisson's ratio : $\nu = 0,30$ [-]
Initial void ratio : $e_{in} = 1,000$ [-]
Type of soil : drained

Uplift pressure
Uplift calculation : standard
Unit weight of saturated soil : $\gamma_{sat} = 20,50$ [kN/m^3]

Mohr-Coulomb model
Elastic modulus : E = 40,00 [MPa]
Unload / reload modulus : $E_{ur} = 80,00$ [MPa]
Modulus : constant
Internal friction angle : $\varphi_{ef} = 35,00$ [°]
Cohesion : $c_{ef} = 1,00$ [kPa]
Dilatancy angle : $\psi = 0,00$ [°]
Dilatancy cut-off : no
Tension cut-off : not consider

View
Sample :



Peščena glina

Material model
Material model type : Basic elasto-plastic models
Material model : Mohr-Coulomb

Basic data
Unit weight : $\gamma = 19,00$ [kN/m^3]
Poisson's ratio : $\nu = 0,30$ [-]
Initial void ratio : $e_{in} = 1,000$ [-]
Type of soil : drained

Uplift pressure
Uplift calculation : standard
Unit weight of saturated soil : $\gamma_{sat} = 19,50$ [kN/m^3]

Mohr-Coulomb model
Elastic modulus : E = 20,00 [MPa]
Unload / reload modulus : $E_{ur} = 40,00$ [MPa]
Modulus : constant
Internal friction angle : $\varphi_{ef} = 25,00$ [°]
Cohesion : $c_{ef} = 6,00$ [kPa]
Dilatancy angle : $\psi = 0,00$ [°]
Dilatancy cut-off : no

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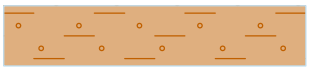
Tension cut-off : not consider

View

Sample : 

Lapor

Material model

Material model type : Basic elasto-plastic models
Material model : Mohr-Coulomb

Basic data

Unit weight : $\gamma = 21{,}00$ [kN/m^3]
Poisson's ratio : $\nu = 0{,}30$ [-]
Initial void ratio : $e_{in} = 1{,}000$ [-]
Type of soil : drained

Uplift pressure

Uplift calculation : standard
Unit weight of saturated soil : $\gamma_{sat} = 21{,}00$ [kN/m^3]

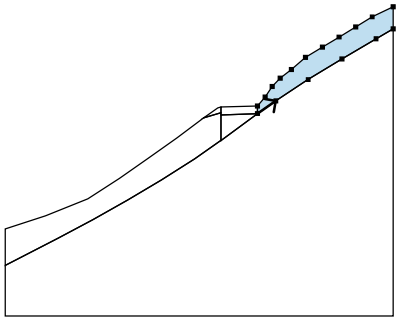
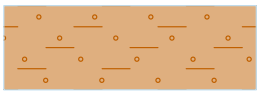
Mohr-Coulomb model

Elastic modulus : $E = 100{,}00$ [MPa]
Unload / reload modulus : $E_{ur} = 200{,}00$ [MPa]
Modulus : constant
Internal friction angle : $\varphi_{ef} = 34{,}00$ [°]
Cohesion : $c_{ef} = 15{,}00$ [kPa]
Dilatancy angle : $\psi = 0{,}00$ [°]
Dilatancy cut-off : no
Tension cut-off : not consider

View

Sample : 

Assigning and surfaces

Number	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
1		24,97	15,07	26,79	16,31	Peščena glina 
		29,99	18,43	33,33	20,47	
		36,71	22,46	38,41	23,44	
		38,41	25,64	36,33	24,64	
		34,70	23,64	33,05	22,64	
		31,41	21,64	29,71	20,64	
		28,33	19,42	27,22	18,56	
		26,42	17,75	25,73	16,70	
		24,97	15,82			

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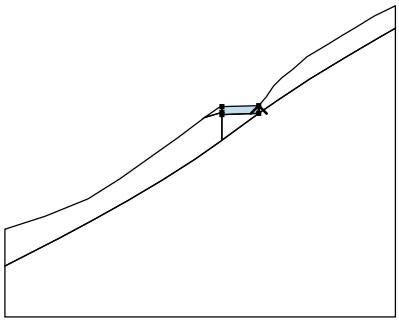
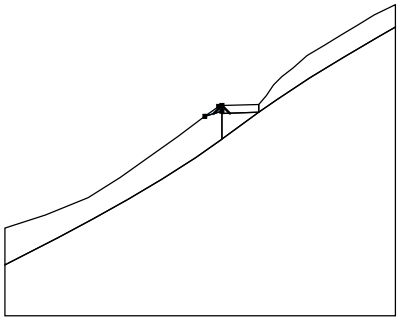
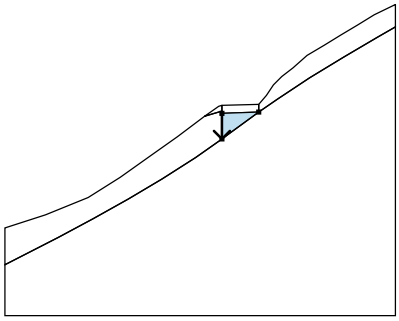
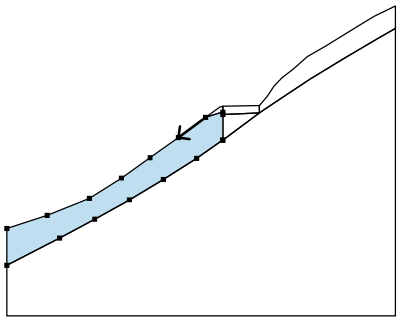
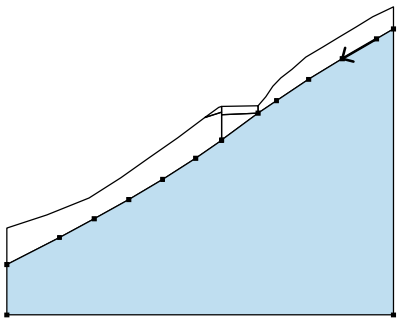
Number	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
2		24,97	15,07	24,97	15,82	Tampon
		21,35	15,73	21,35	15,16	
		21,35	14,93			
3		21,35	15,16	21,35	15,73	Peščena glina
		21,04	15,64	19,66	14,64	
4		21,35	14,93	21,35	12,40	Peščena glina
		24,97	15,07			
5		19,66	14,64	16,97	12,64	Peščena glina
		14,16	10,64	11,32	8,64	
		8,17	6,64	3,99	4,96	
		0,00	3,65	0,00	0,03	
		5,23	2,72	8,69	4,57	
		12,11	6,49	15,47	8,49	
		18,76	10,60	21,32	12,38	
		21,35	12,40	21,35	14,93	
		21,35	15,16			
6		36,71	22,46	33,33	20,47	Lapor
		29,99	18,43	26,79	16,31	
		24,97	15,07	21,35	12,40	
		21,32	12,38	18,76	10,60	
		15,47	8,49	12,11	6,49	
		8,69	4,57	5,23	2,72	
		0,00	0,03	0,00	-4,97	
		38,41	-4,97	38,41	23,44	

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Free points

Number	Location x [m]	Location z [m]	Number	Location x [m]	Location z [m]	Number	Location x [m]	Location z [m]	Number	Location x [m]	Location z [m]
1	21,35	10,00									

Free lines

Number	Type of line	Mode of input	Lines topology
1	segment		Origin (21,35; 12,40) [m] , end (21,35; 10,00) [m]

Free mesh refinements

Number	Refinement type	Mode of input	Refinement topology	Radius r [m]	Length l [m]
1	around abscissa		Origin (21,34; 15,68) [m] , end (21,39; 10,89) [m]	1,50	0,50

Mesh generation

Mesh generation parameters

Element edge length : 1,50 [m]
Mesh smoothing : yes
Generate multinode elements : yes

Mesh generation result

Finite element mesh was successfully generated.
Number of nodes 2129
Number of elements 1253 (region 721, beam 133, interface 399)

Warning
[W085] Mesh points (21,35; 12,40) and (21,32; 12,38) are found too close to each other.
[W086] Mesh point (21,32; 12,38) is found too close to line LI{(21,35; 12,40) .. (21,35; 10,00)}.

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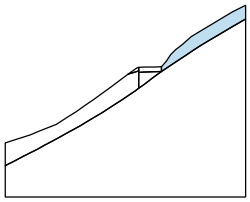
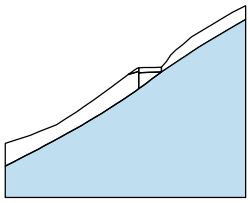
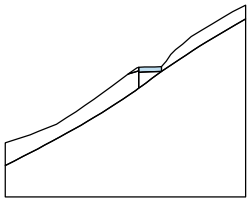
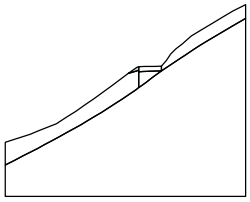
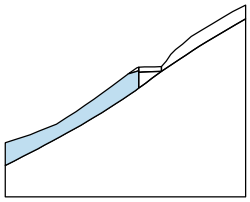
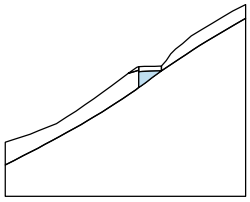
Input data (Construction stage 1)

Assignment and activation

Number	Region	Active / inactive	Assigned soil
1		Active	Peščena glina
2		Active	Lapor
3		Active	Tampon
4		Active	Peščena glina
5		Active	Peščena glina
6		Active	Peščena glina

Line supports

Number	Location	Support	
		Direction X	Direction Z
A1	Mesh line No. 41	fixed	free
A2	Mesh line No. 33	fixed	free
A3	Mesh line No. 43	fixed	free
A1 up to A5 - automatically generated line supports along model edges			

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Number	Location	Support	
		Direction X	Direction Z
A4	Mesh line No. 6	fixed	free
A5	Mesh line No. 42	fixed	fixed
A1 up to A5 - automatically generated line supports along model edges			

Water

Water type : No water

Analysis settings

Stress

Method :	Newton - Raphson
Stiffness matrix change :	after each iteration
Max. number of iterations for one calc. step :	100
Initial calculation step :	0,1000
Displacement error :	0,0100
Imbalanced forces error :	0,0100
Energy error :	0,0100
Respect material interfaces :	no

Plasticity

Return mapping error :	0,00100
Max. number of iterations for one plast. step :	20

Newton - Raphson

Relaxation factor of calculation step :	2,00
Maximum number of relaxations of calculation step :	2
Min. number of iterations for one calc. step :	1

Line search

Solution method :	iterate no
Line search limit - minimum :	0,100
Line search limit - maximum :	1,000

Results (Construction stage 1)

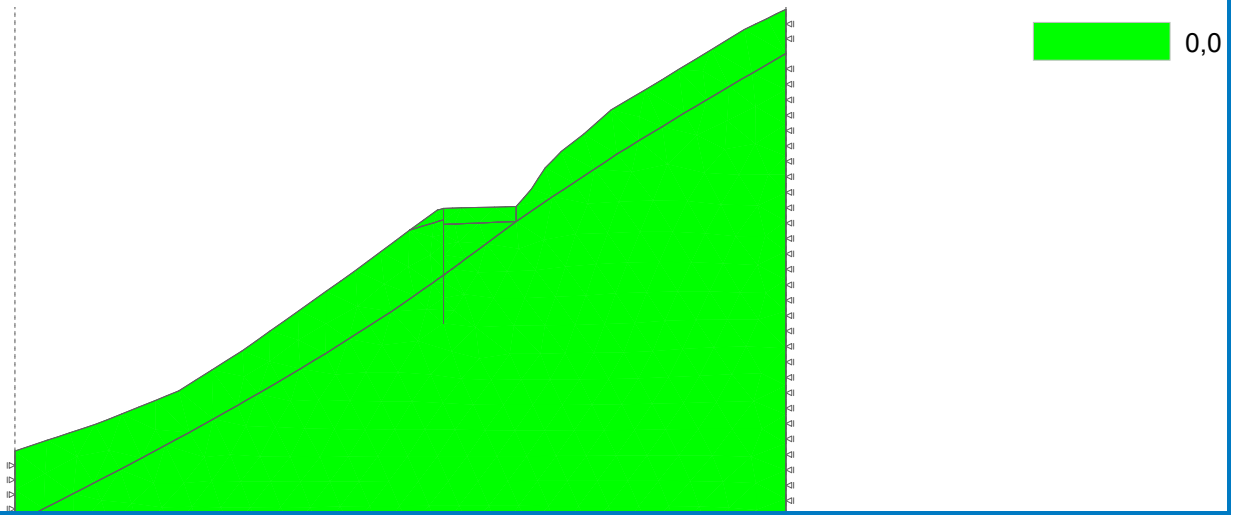
Stress analysis was successfully completed.

Analysis settings : standard

Attained loading = 100,00 %

Name : Analysis	Stage : 1

Results : overall; variable : Displacement d_x; range : <0,0; 0,0> mm



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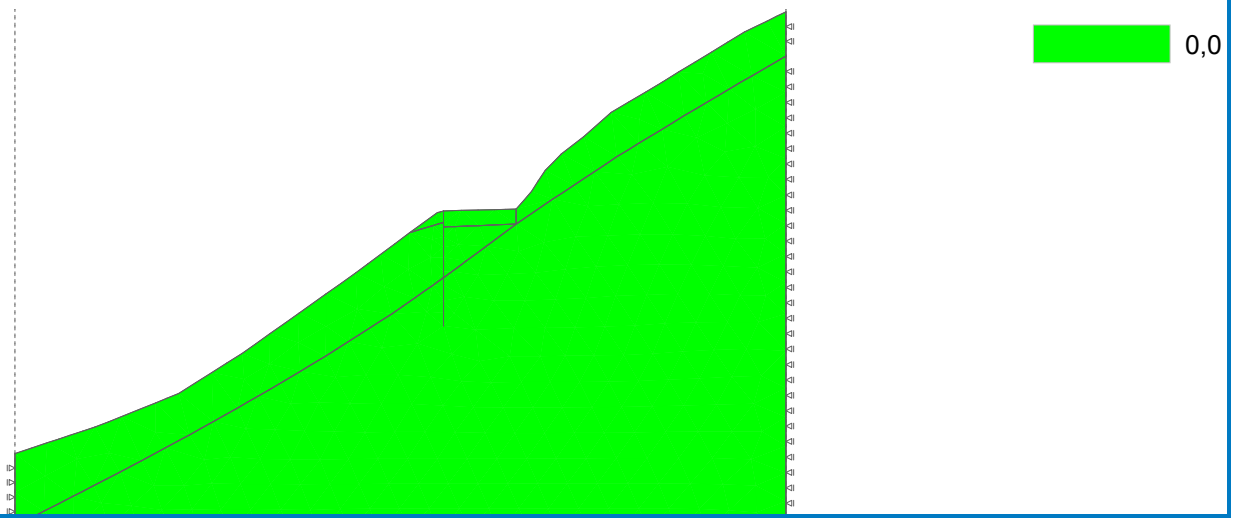
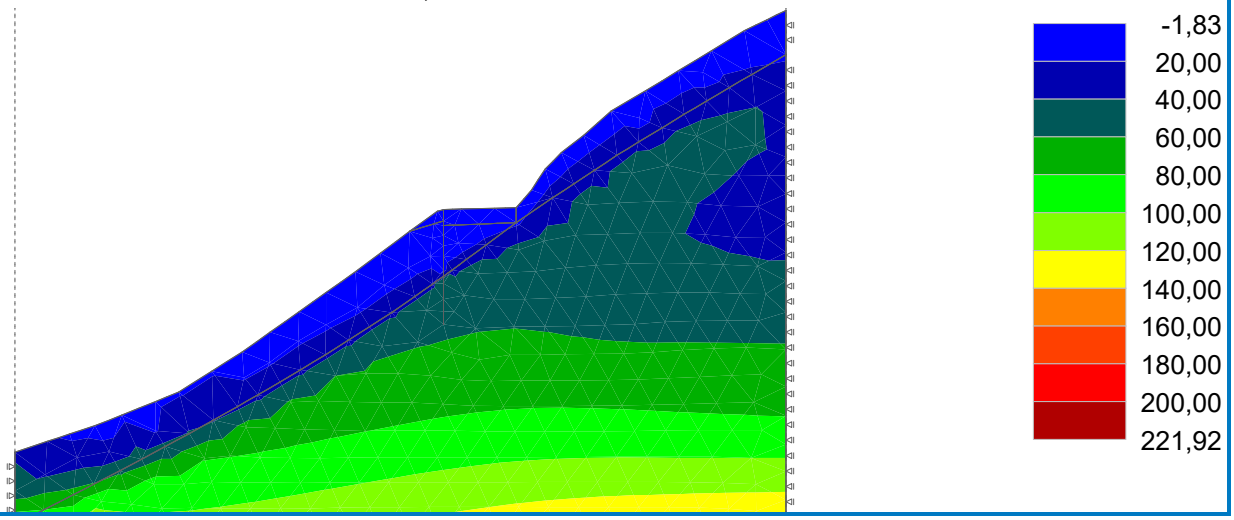
Name : Analysis	Stage : 1

Results : overall; variable : Displacement d_z; range : <0,0; 0,0> mm



Name : Analysis	Stage : 1

Results : overall; variable : Effective stress $\sigma_{x,\,eff}$; range : <-1,83; 221,92> kPa



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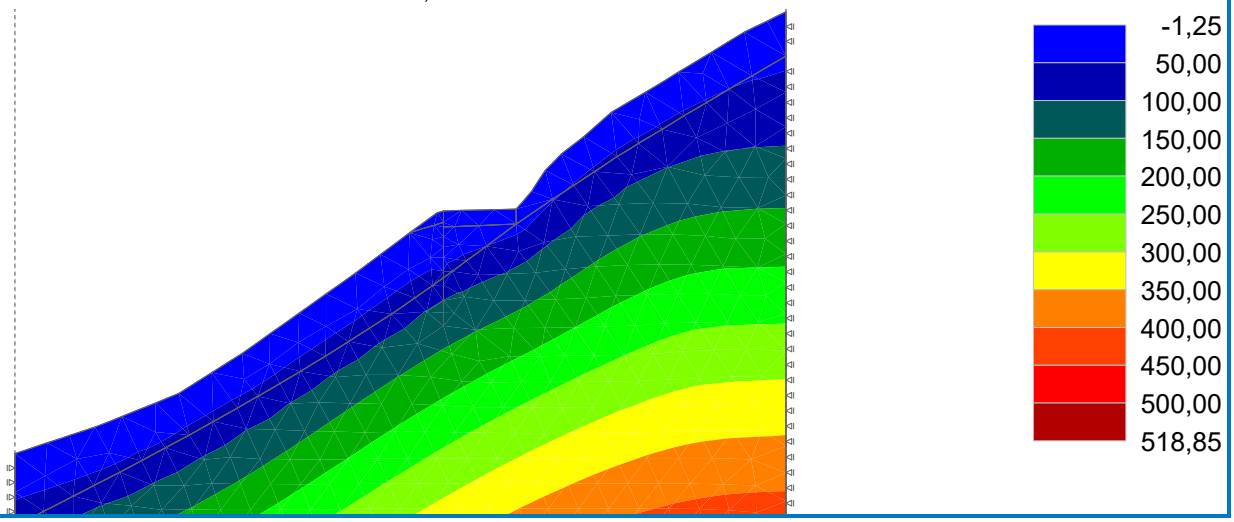
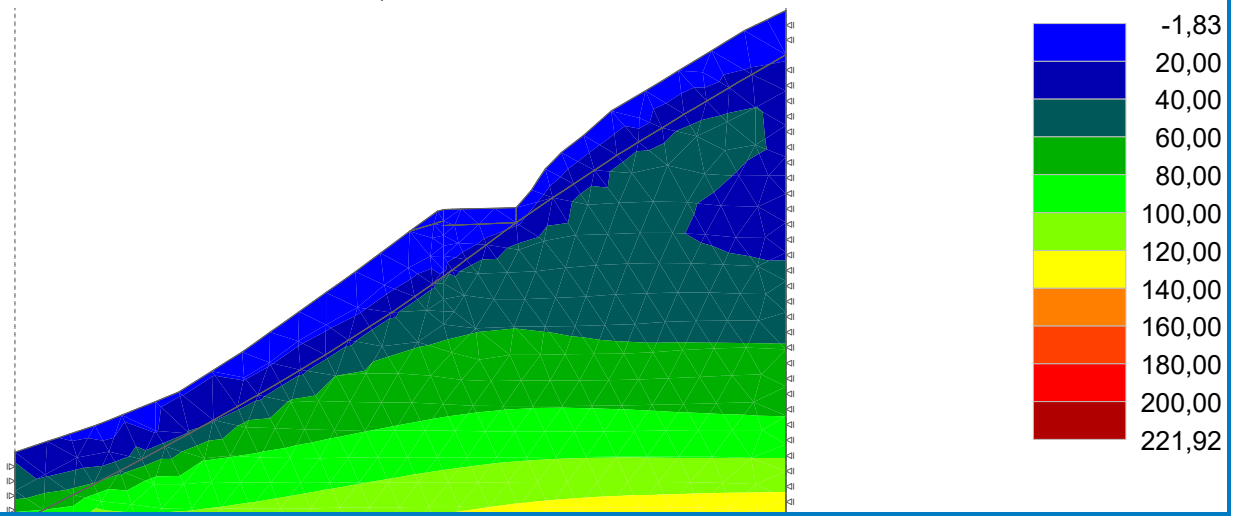
Name : Analysis	Stage : 1

Results : overall; variable : Effective stress $\sigma_{z,\,eff}$; range : <-1,25; 518,85> kPa



Name : Analysis	Stage : 1

Results : overall; variable : Total stress $\sigma_{x,\,tot}$; range : <-1,83; 221,92> kPa



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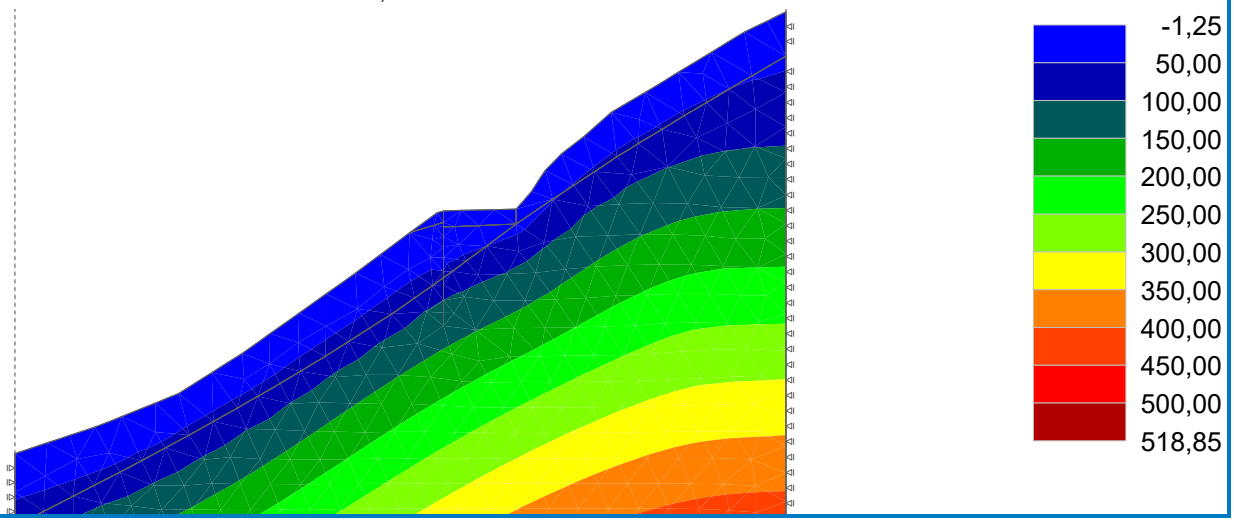
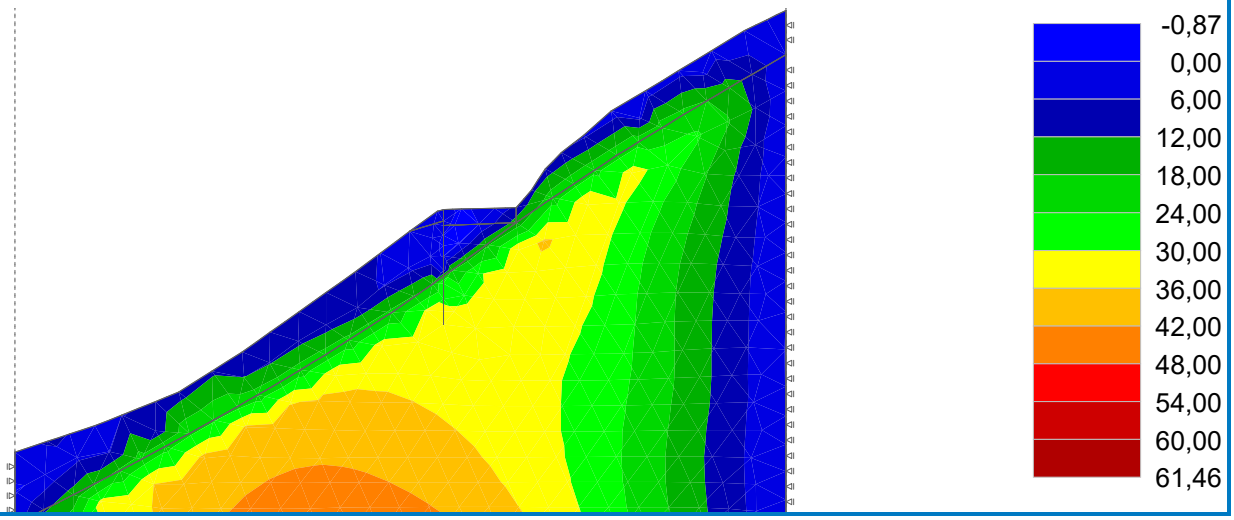
Name : Analysis	Stage : 1

Results : overall; variable : Total stress $\sigma_{z,\,tot}$; range : <-1,25; 518,85> kPa



Name : Analysis	Stage : 1

Results : overall; variable : Shear stress τ_{xz}; range : <-0,87; 61,46> kPa



Extremes

Stress (extremes)

Variable	Location		Min	Location		Max
	x [m]	z [m]		x [m]	z [m]	
Total stress $\sigma_{z,\,tot}$ [kPa]	29,71	20,64	-1,25	38,41	-4,97	518,85
Effective stress $\sigma_{z,\,eff}$ [kPa]	29,71	20,64	-1,25	38,41	-4,97	518,85
Total stress $\sigma_{x,\,tot}$ [kPa]	38,41	25,64	-1,83	38,41	-4,97	221,92
Effective stress $\sigma_{x,\,eff}$ [kPa]	38,41	25,64	-1,83	38,41	-4,97	221,92
Shear stress τ_{xz} [kPa]	0,00	1,71	-0,87	16,25	-4,97	61,46

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Strain (extremes)

Variable	Location		Min	Location		Max
	x [m]	z [m]		x [m]	z [m]	
Equivalent deviatoric strain E_d [%]	38,41	25,64	0,01	21,35	12,71	0,70
Plastic equivalent deviatoric strain $E_{d, pl}$ [%]	36,33	24,64	0,00	17,67	9,90	0,47

Mobilization degree (extremes)

Variable	Location		Min	Location		Max
	x [m]	z [m]		x [m]	z [m]	
Mobilized shear strength [%]	37,46	25,18	14,66	38,41	8,75	100,07

Pore pressures (extremes)

Variable	Location		Max
	x [m]	z [m]	
Total pore pressure u_{tot} [kPa]	24,97	15,82	0,00

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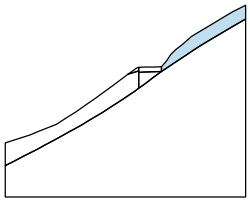
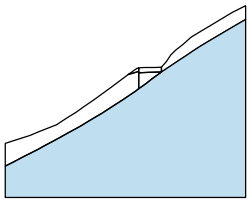
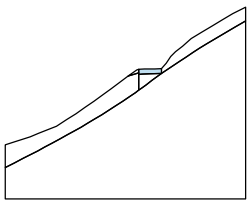
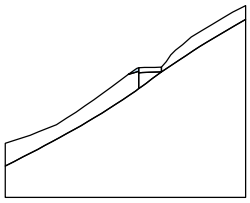
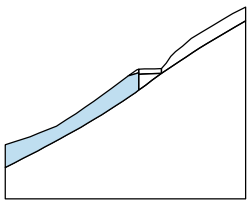
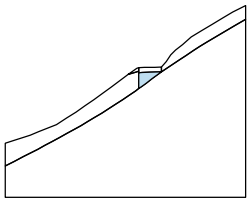
Input data (Construction stage 2)

Assignment and activation

Number	Region	Active / inactive	Assigned soil
1		Active	Peščena glina
2		Active	Lapor
3		Active	Tampon
4		Active	Peščena glina
5		Active	Peščena glina
6		Active	Peščena glina

Beams

Number	Beam		Location	Support [m]		Include self weight	Fictitious beam	Cross-section	Material	Contacts	
	new	modified		Start pt.	End pt.					left	right
1	Yes		Mesh line No. 19	⊢	⊢	Yes	No	●●● D = 0,50 m; a = 1,50 m	C 30/37	(not input)	(not input)

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Number	Beam		Location	Support [m]		Include self weight	Fictitious beam	Cross-section	Material	Contacts	
	new	modified		Start pt.	End pt.					left	right
2	Yes		Mesh line No. 20	⊢	⊢	Yes	No	●●● D = 0,50 m; a = 1,50 m	C 30/37	(not input)	(not input)
3	Yes		Mesh line No. 25	⊢	⊢	Yes	No	●●● D = 0,50 m; a = 1,50 m	C 30/37	(not input)	(not input)
4	Yes		Mesh line No. 44	⊢	⊢	Yes	No	●●● D = 0,50 m; a = 1,50 m	C 30/37	(not input)	(not input)

Number	Cross-section		Material	
	I_y [m⁴/m]	A [m²/m]	E [MPa]	G [MPa]
1	2,05E-03	1,31E-01	33000,00	13750,00
2	2,05E-03	1,31E-01	33000,00	13750,00
3	2,05E-03	1,31E-01	33000,00	13750,00
4	2,05E-03	1,31E-01	33000,00	13750,00

Line supports

Number	Line support		Location	Support	
	new	modified		Direction X	Direction Z
A1	Yes		Mesh line No. 41	fixed	free
A2	Yes		Mesh line No. 33	fixed	free
A3	Yes		Mesh line No. 43	fixed	free
A4	Yes		Mesh line No. 6	fixed	free
A5	Yes		Mesh line No. 42	fixed	fixed
A1 up to A5 - automatically generated line supports along model edges					

Water

Water type : No water

Analysis settings

Stress

Method :	Newton - Raphson
Stiffness matrix change :	after each iteration
Max. number of iterations for one calc. step :	100
Initial calculation step :	0,1000
Displacement error :	0,0100
Imbalanced forces error :	0,0100
Energy error :	0,0100
Respect material interfaces :	no

Plasticity

Return mapping error :	0,00100
Max. number of iterations for one plast. step :	20

Newton - Raphson

Relaxation factor of calculation step :	2,00
Maximum number of relaxations of calculation step :	2
Min. number of iterations for one calc. step :	1

Line search

Solution method :	iterate no

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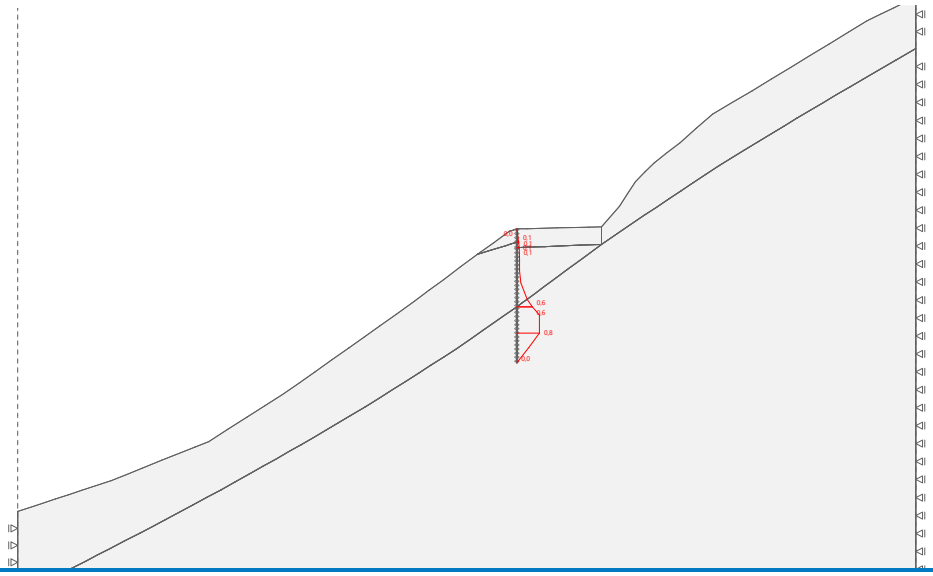
Line search limit - minimum :	0,100
Line search limit - maximum :	1,000

Results (Construction stage 2)

Stress analysis was successfully completed.
Analysis settings : standard
Attained loading = 100,00 %

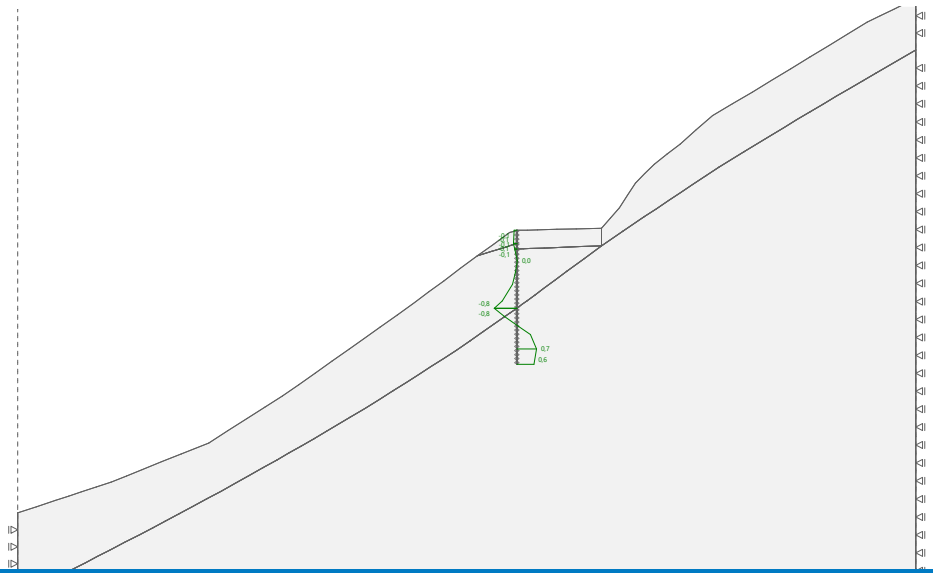
Name : Analysis	Stage : 2

M [kNm/m]



Name : Analysis	Stage : 2

Q [kN/m]



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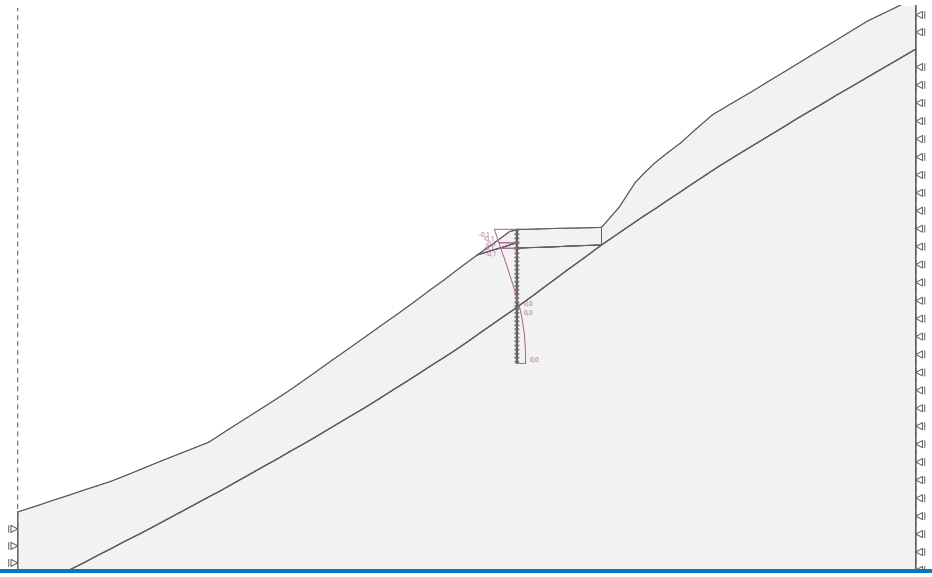
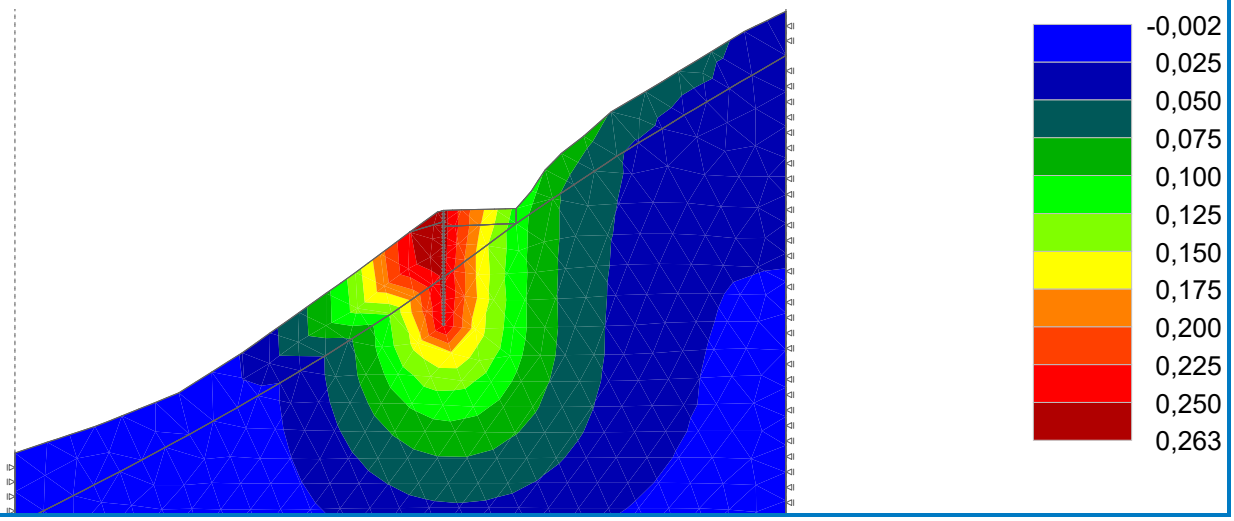
Name : Analysis	Stage : 2

D [mm]



Name : Analysis	Stage : 2

Results : overall; variable : Displacement d $_z$; range : <0,0; 0,3> mm



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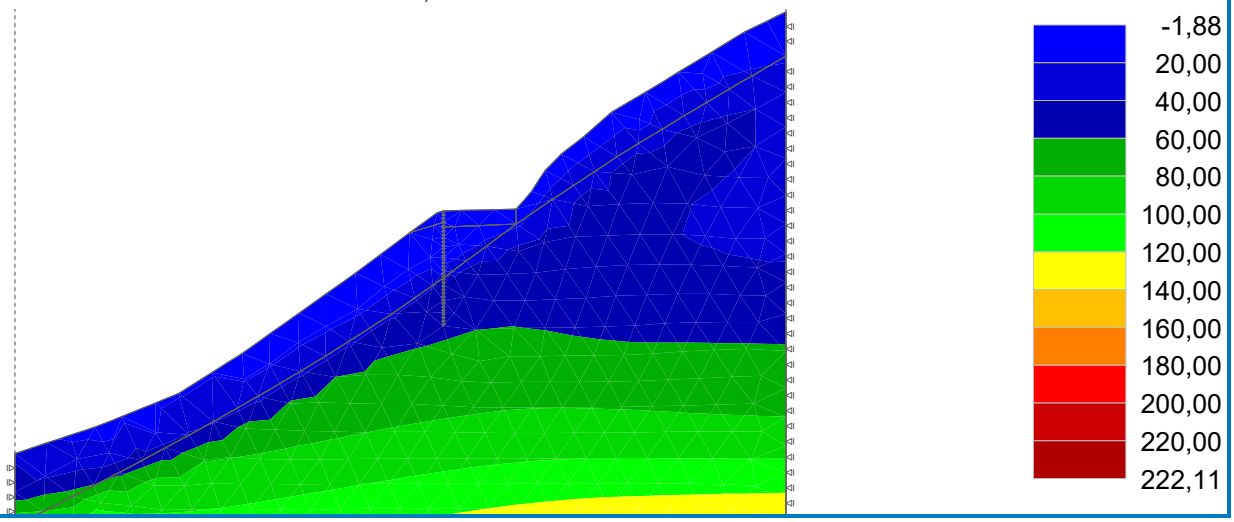
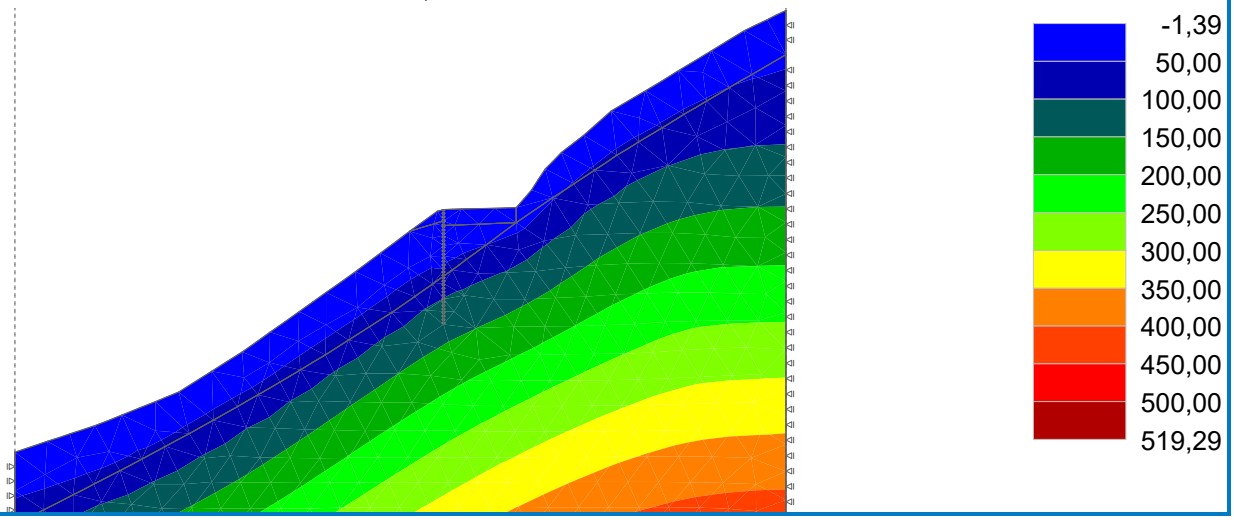
Name : Analysis	Stage : 2

Results : overall; variable : Effective stress $\sigma_{x,\,eff}$; range : <-1,88; 222,11> kPa



Name : Analysis	Stage : 2

Results : overall; variable : Effective stress $\sigma_{z,\,eff}$; range : <-1,39; 519,29> kPa



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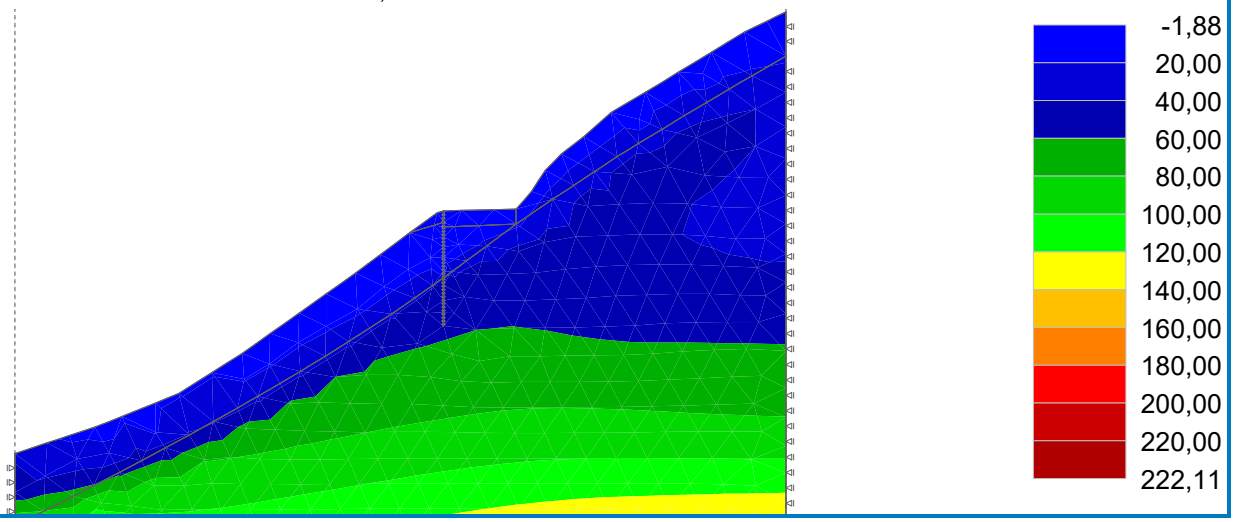
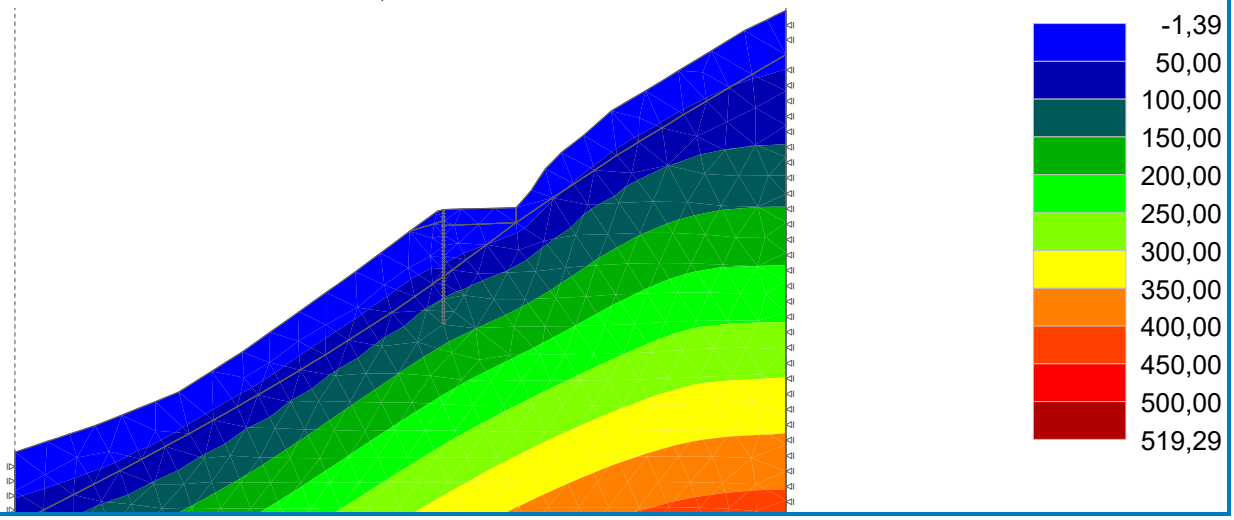
Name : Analysis	Stage : 2

Results : overall; variable : Total stress $\sigma_{x,\,tot}$; range : <-1,88; 222,11> kPa



Name : Analysis	Stage : 2

Results : overall; variable : Total stress $\sigma_{z,\,tot}$; range : <-1,39; 519,29> kPa



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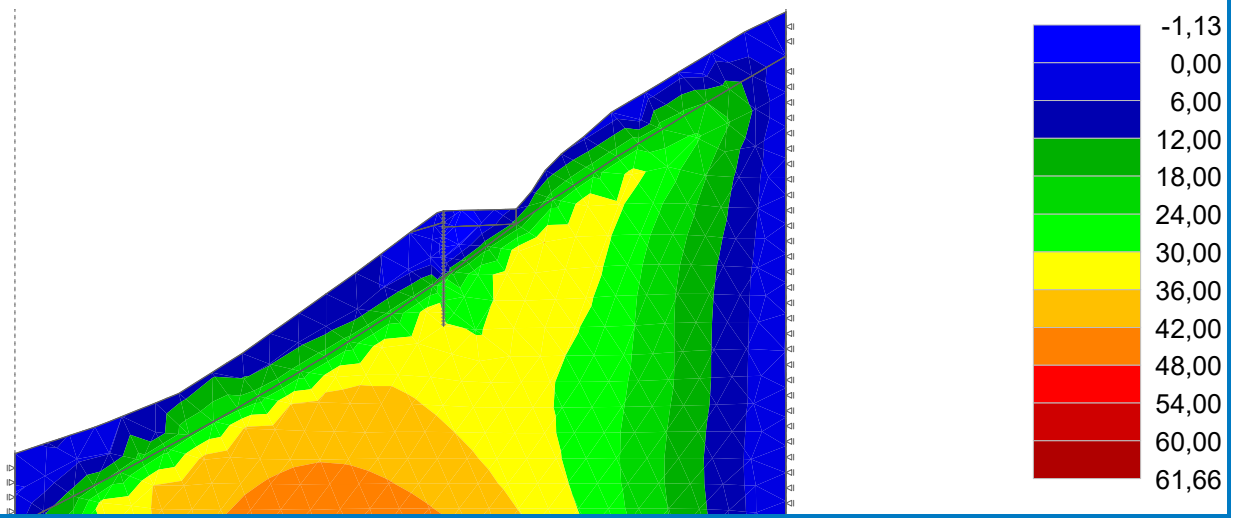
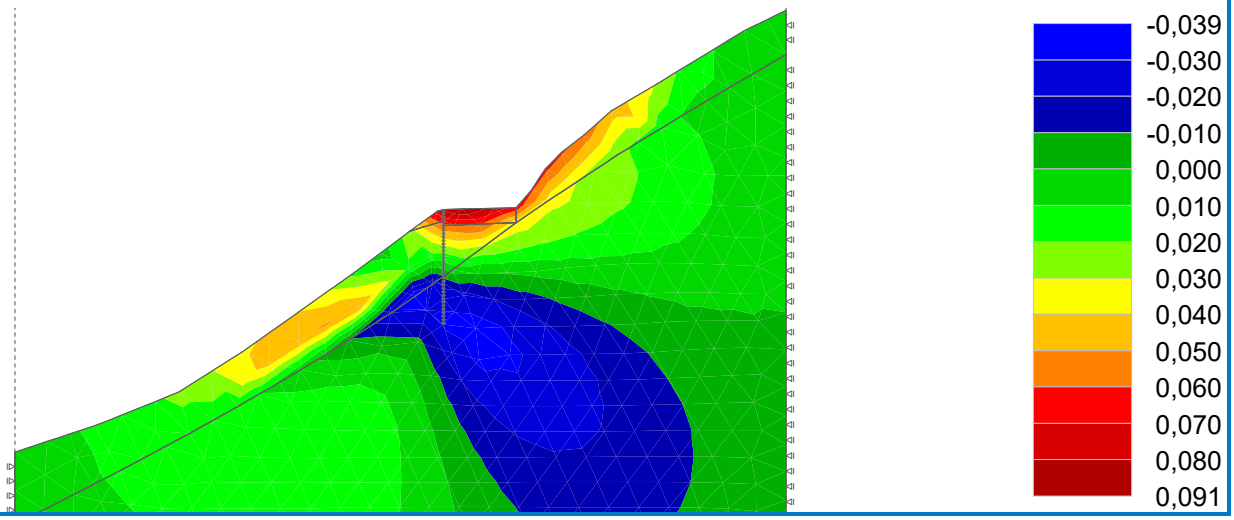
Name : Analysis	Stage : 2

Results : overall; variable : Shear stress τ_{xz}; range : <-1,13; 61,66> kPa



Name : Analysis	Stage : 2

Results : overall; variable : Displacement d_x; range : <0,0; 0,1> mm



Extremes

Displacements (extremes)

Variable	Location		Min	Location		Max
	x [m]	z [m]		x [m]	z [m]	
Displacements x [mm]	19,91	11,40	0,0	22,24	15,75	0,1
Displacements z [mm]	0,00	3,65	0,0	20,70	13,40	0,3

Stress (extremes)

Variable	Location		Min	Location		Max
	x [m]	z [m]		x [m]	z [m]	
Total stress $\sigma_{z, tot}$ [kPa]	29,71	20,64	-1,39	38,41	-4,97	519,29
Effective stress $\sigma_{z, eff}$ [kPa]	29,71	20,64	-1,39	38,41	-4,97	519,29
Total stress $\sigma_{x, tot}$ [kPa]	38,41	25,64	-1,88	38,41	-4,97	222,11

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Variable	Location x [m]	Location z [m]	Min	Location x [m]	Location z [m]	Max
Effective stress $\sigma_{x,\,eff}$ [kPa]	38,41	25,64	-1,88	38,41	-4,97	222,11
Shear stress τ_{xz} [kPa]	22,10	14,05	-1,13	16,25	-4,97	61,66

Strain (extremes)

Variable	Location x [m]	Location z [m]	Min	Location x [m]	Location z [m]	Max
Equivalent deviatoric strain E_d [%]	38,41	25,64	0,01	21,35	12,71	0,70
Plastic equivalent deviatoric strain $E_{d,\,pl}$ [%]	36,33	24,64	0,00	17,67	9,90	0,48

Mobilization degree (extremes)

Variable	Location x [m]	Location z [m]	Min	Location x [m]	Location z [m]	Max
Mobilized shear strength [%]	37,46	25,18	14,92	38,41	12,17	100,04

Pore pressures (extremes)

Variable	Location x [m]	Location z [m]	Max
Total pore pressure u_{tot} [kPa]	24,97	15,82	0,00

Distributions on beams (extremes)

Number	Coordinates x [m]	Coordinates z [m]	D [mm]	N [kN/m]	M [kNm/m]	Q [kN/m]
1	21,35	15,73	**-0,1**	**0,1**	**0,0**	**-0,1**
	21,35	15,16	**-0,1**	**-1,5**	**0,1**	**-0,1**
2	21,35	15,16	**-0,1**	**-1,5**	**0,1**	**-0,1**
	21,35	14,93	**-0,1**	**-2,2**	**0,1**	**-0,1**
3	21,35	14,93	**-0,1**	**-2,2**	**0,1**	-0,1
	21,35	14,43	0,0	-3,6	0,1	**0,0**
	21,35	12,40	**0,0**	**-8,2**	**0,6**	**-0,8**
4	21,35	12,40	**0,0**	**-8,2**	0,6	**-0,8**
	21,35	11,27	0,0	-7,3	**0,8**	0,5
	21,35	10,66	0,0	-6,5	0,4	**0,7**
	21,35	10,00	**0,0**	**-5,7**	**0,0**	0,6

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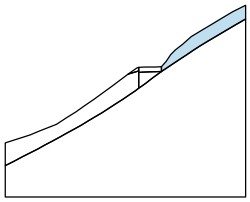
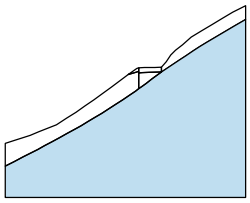
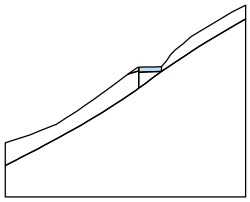
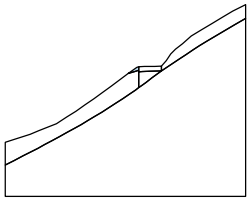
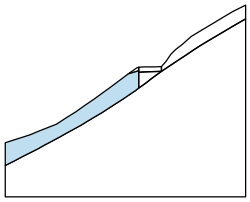
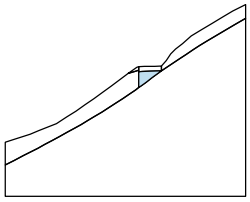
Input data (Construction stage 3)

Assignment and activation

Number	Region	Active / inactive	Assigned soil
1		Active	Peščena glina
2		Active	Lapor
3		Active	Tampon
4		Inactive	
5		Active	Peščena glina
6		Active	Peščena glina

Beams

Number	Beam		Location	Support [m]		Include self weight	Fictitious beam	Cross-section	Material	Contacts	
	new	modified		Start pt.	End pt.					left	right
1	No	No	Mesh line No. 19	⊢	⊢	Yes	No	without modification	without modification	(not input)	(not input)

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Number	Beam		Location	Support [m]		Include self weight	Fictitious beam	Cross-section	Material	Contacts	
	new	modified		Start pt.	End pt.					left	right
2	No	No	Mesh line No. 20	⊢	⊢	Yes	No	without modification	without modification	(not input)	(not input)
3	No	No	Mesh line No. 25	⊢	⊢	Yes	No	without modification	without modification	(not input)	(not input)
4	No	No	Mesh line No. 44	⊢	⊢	Yes	No	without modification	without modification	(not input)	(not input)

Number	Cross-section		Material	
	I_y [m⁴/m]	A [m²/m]	E [MPa]	G [MPa]
1	2,05E-03	1,31E-01	33000,00	13750,00
2	2,05E-03	1,31E-01	33000,00	13750,00
3	2,05E-03	1,31E-01	33000,00	13750,00
4	2,05E-03	1,31E-01	33000,00	13750,00

Line supports

Number	Line support		Location	Support	
	new	modified		Direction X	Direction Z
A1	Yes		Mesh line No. 41	fixed	free
A2	Yes		Mesh line No. 33	fixed	free
A3	Yes		Mesh line No. 43	fixed	free
A4	Yes		Mesh line No. 6	fixed	free
A5	Yes		Mesh line No. 42	fixed	fixed
A1 up to A5 - automatically generated line supports along model edges					

Water

Water type : No water

Analysis settings

Stress

Method :	Newton - Raphson
Stiffness matrix change :	after each iteration
Max. number of iterations for one calc. step :	100
Initial calculation step :	0,1000
Displacement error :	0,0100
Imbalanced forces error :	0,0100
Energy error :	0,0100
Respect material interfaces :	no

Plasticity

Return mapping error :	0,00100
Max. number of iterations for one plast. step :	20

Newton - Raphson

Relaxation factor of calculation step :	2,00
Maximum number of relaxations of calculation step :	2
Min. number of iterations for one calc. step :	1

Line search

Solution method :	iterate no

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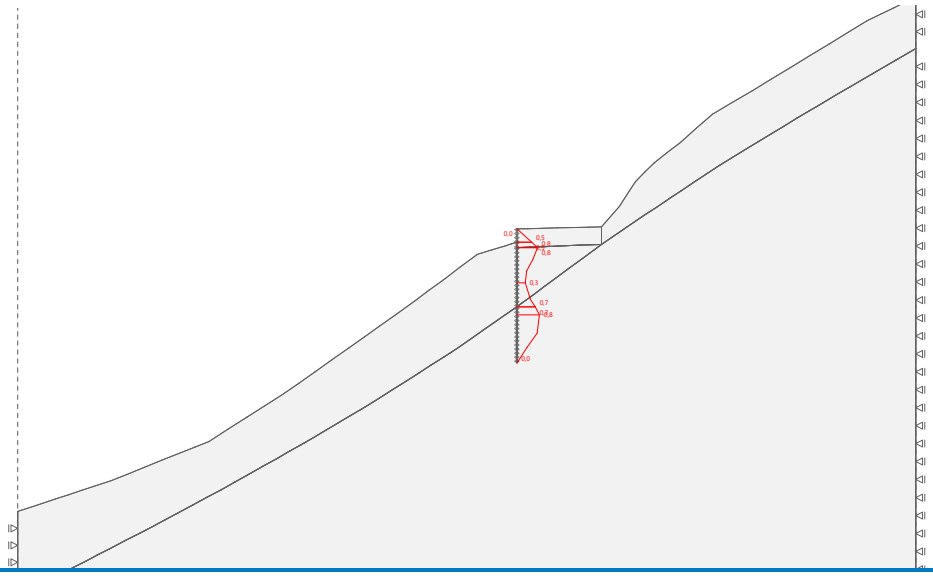
Line search limit - minimum :	0,100
Line search limit - maximum :	1,000

Results (Construction stage 3)

Stress analysis was successfully completed.
Analysis settings : standard
Attained loading = 100,00 %

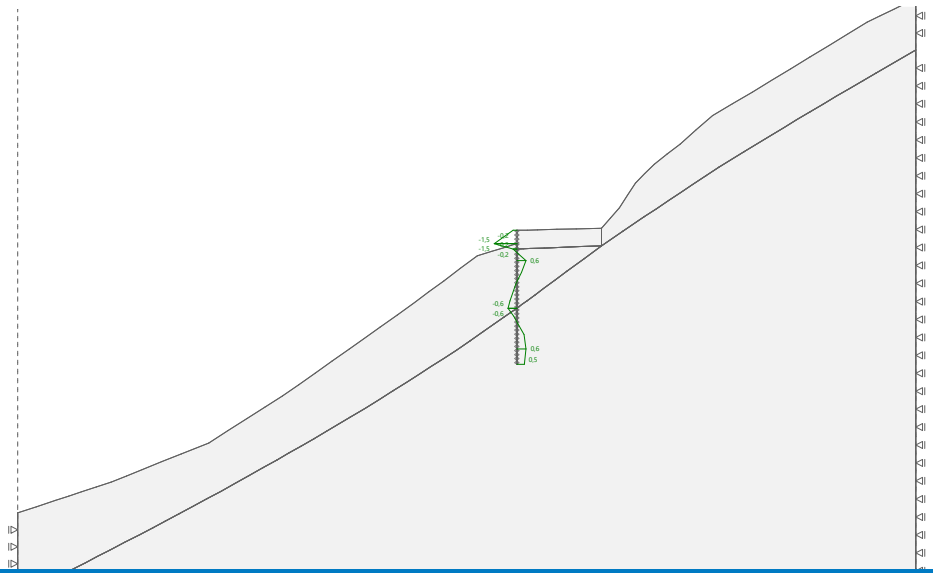
Name : Analysis	Stage : 3

M [kNm/m]



Name : Analysis	Stage : 3

Q [kN/m]



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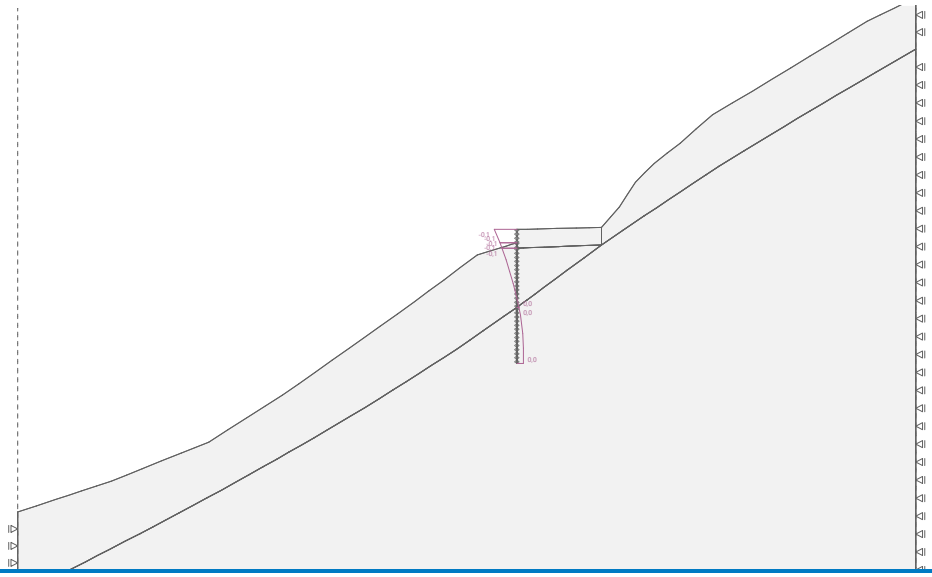
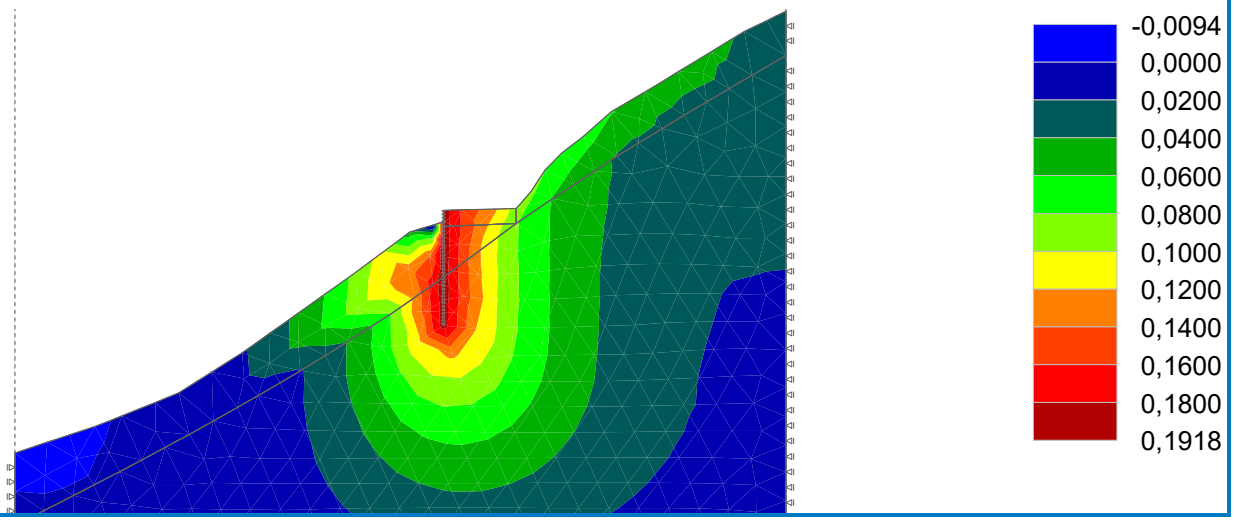
Name : Analysis	Stage : 3

D [mm]



Name : Analysis	Stage : 3

Results : overall; variable : Displacement d_z; range : <0,0; 0,2> mm



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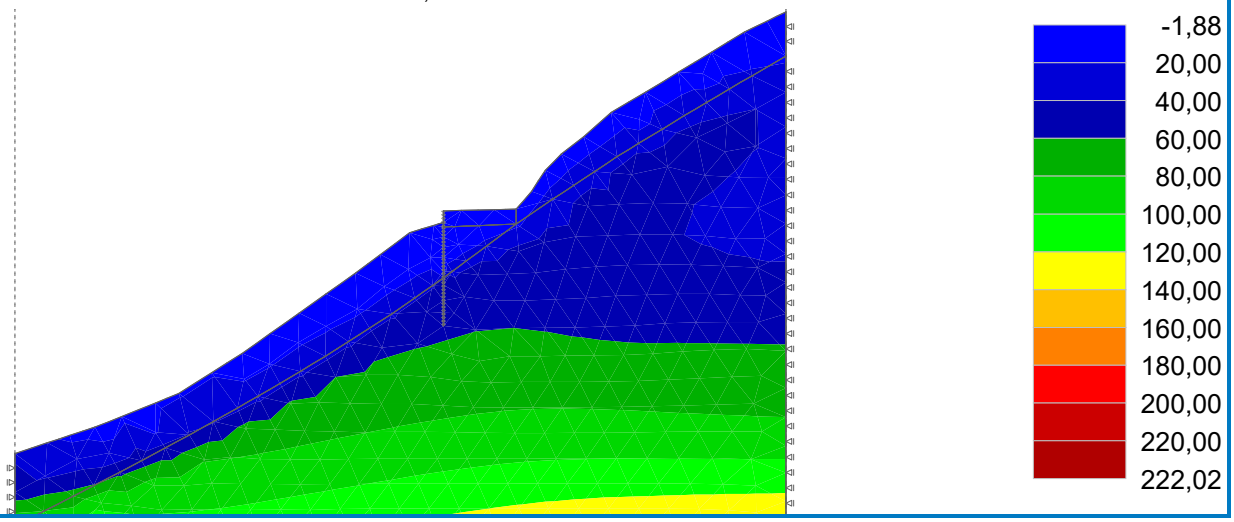
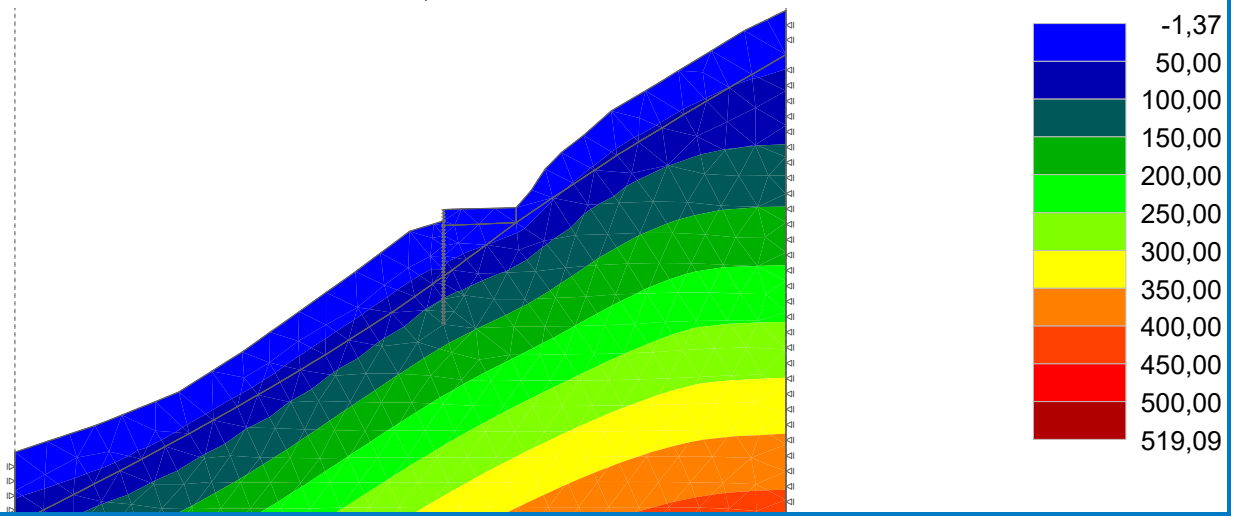
Name : Analysis	Stage : 3

Results : overall; variable : Effective stress $\sigma_{x,\,eff}$; range : <-1,88; 222,02> kPa



Name : Analysis	Stage : 3

Results : overall; variable : Effective stress $\sigma_{z,\,eff}$; range : <-1,37; 519,09> kPa



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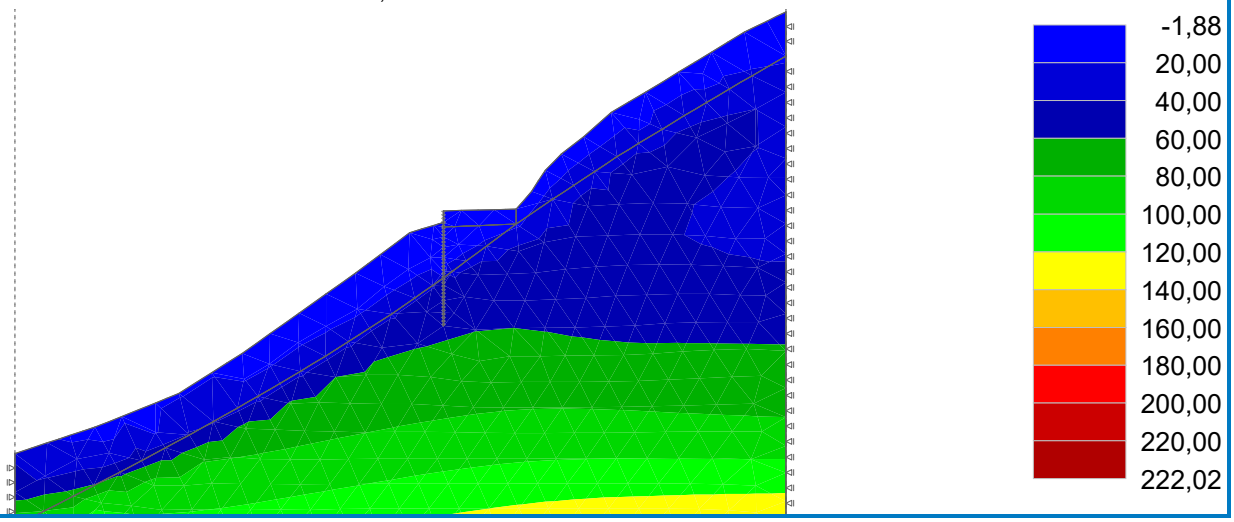
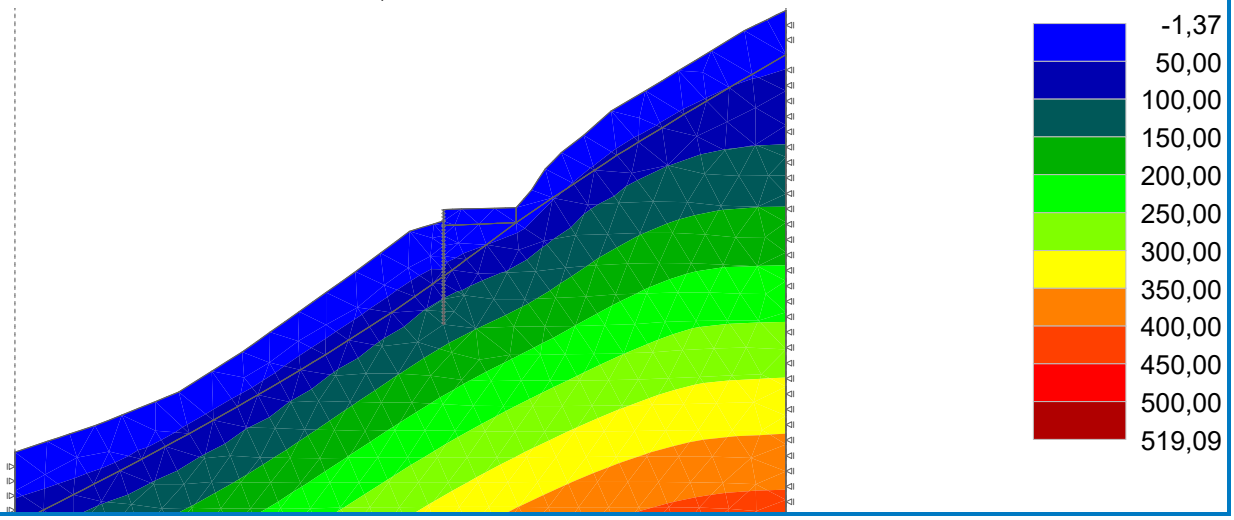
Name : Analysis	Stage : 3

Results : overall; variable : Total stress $\sigma_{x,\,tot}$; range : <-1,88; 222,02> kPa



Name : Analysis	Stage : 3

Results : overall; variable : Total stress $\sigma_{z,\,tot}$; range : <-1,37; 519,09> kPa



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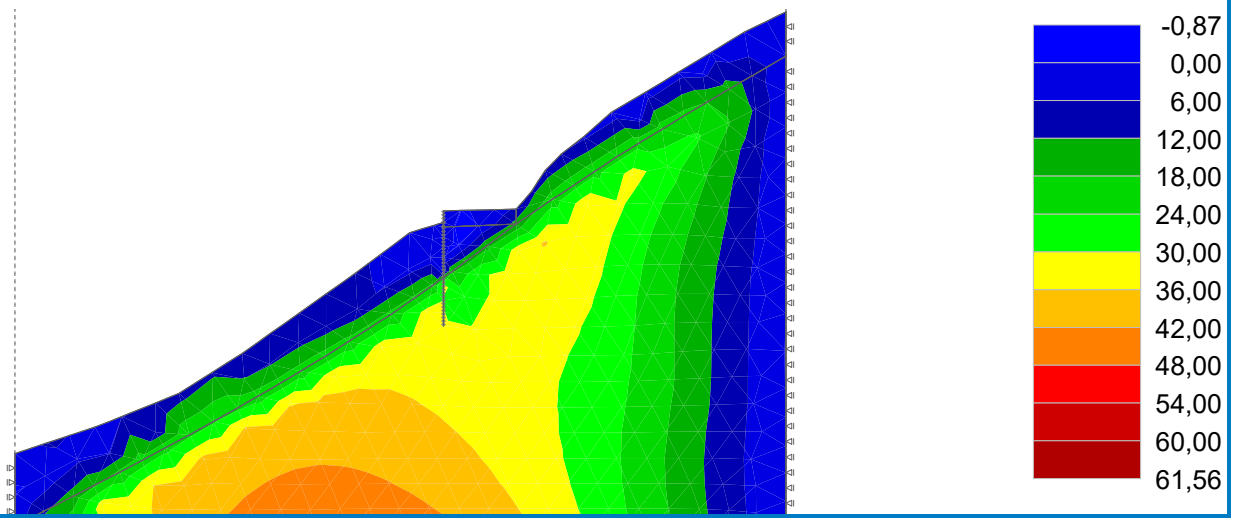
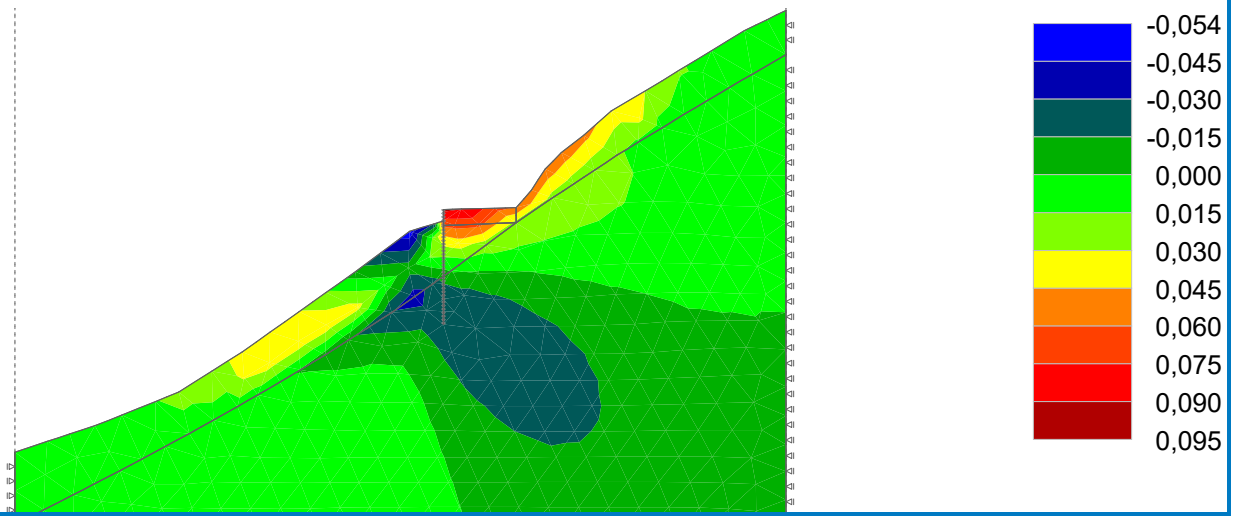
Name : Analysis	Stage : 3

Results : overall; variable : Shear stress τ_{xz}; range : <-0,87; 61,56> kPa



Name : Analysis	Stage : 3

Results : overall; variable : Displacement d_x; range : <-0,1; 0,1> mm



Extremes

Displacements (extremes)

Variable	Location		Min	Location		Max
	x [m]	z [m]		x [m]	z [m]	
Displacements x [mm]	19,66	14,64	-0,1	21,35	15,73	0,1
Displacements z [mm]	20,87	15,01	0,0	21,35	15,73	0,2

Stress (extremes)

Variable	Location		Min	Location		Max
	x [m]	z [m]		x [m]	z [m]	
Total stress $\sigma_{z,\,tot}$ [kPa]	29,71	20,64	-1,37	38,41	-4,97	519,09
Effective stress $\sigma_{z,\,eff}$ [kPa]	29,71	20,64	-1,37	38,41	-4,97	519,09
Total stress $\sigma_{x,\,tot}$ [kPa]	38,41	25,64	-1,88	38,41	-4,97	222,02

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Variable	Location x [m]	Location z [m]	Min	Location x [m]	Location z [m]	Max
Effective stress $\sigma_{x,\,eff}$ [kPa]	38,41	25,64	-1,88	38,41	-4,97	222,02
Shear stress τ_{xz} [kPa]	0,00	1,71	-0,87	16,25	-4,97	61,56

Strain (extremes)

Variable	Location x [m]	Location z [m]	Min	Location x [m]	Location z [m]	Max
Equivalent deviatoric strain E_d [%]	38,41	25,64	0,01	21,35	12,71	0,70
Plastic equivalent deviatoric strain $E_{d,\,pl}$ [%]	36,33	24,64	0,00	17,67	9,90	0,48

Mobilization degree (extremes)

Variable	Location x [m]	Location z [m]	Min	Location x [m]	Location z [m]	Max
Mobilized shear strength [%]	37,46	25,18	14,90	38,41	12,17	100,01

Pore pressures (extremes)

Variable	Location x [m]	Location z [m]	Max
Total pore pressure u_{tot} [kPa]	24,97	15,82	0,00

Distributions on beams (extremes)

Number	Coordinates x [m]	Coordinates z [m]	D [mm]	N [kN/m]	M [kNm/m]	Q [kN/m]
1	21,35	15,73	**-0,1**	**-0,2**	**0,0**	**-0,2**
	21,35	15,16	**-0,1**	**-1,4**	**0,5**	**-1,5**
2	21,35	15,16	**-0,1**	**-1,4**	**0,5**	**-1,5**
	21,35	14,93	**-0,1**	**-1,0**	**0,8**	**-0,2**
3	21,35	14,93	**-0,1**	-1,0	**0,8**	-0,2
	21,35	14,43	0,0	-0,7	0,6	**0,6**
	21,35	13,93	0,0	**-0,7**	0,4	0,3
	21,35	13,42	0,0	-1,4	**0,3**	-0,1
	21,35	12,40	**0,0**	**-3,2**	0,7	**-0,6**
4	21,35	12,40	**0,0**	-3,2	0,7	**-0,6**
	21,35	12,05	0,0	**-3,1**	**0,8**	-0,2
	21,35	10,66	0,0	-3,2	0,4	**0,6**
	21,35	10,00	**0,0**	**-3,3**	**0,0**	0,5

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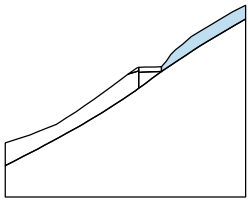
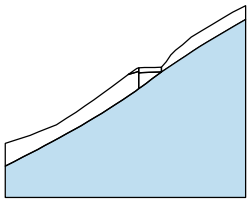
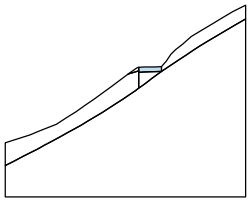
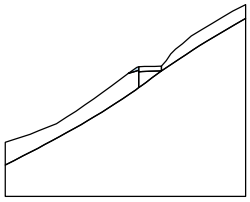
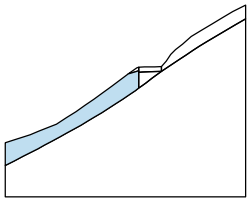
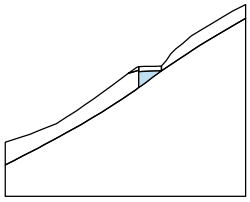
Input data (Construction stage 4)

Assignment and activation

Number	Region	Active / inactive	Assigned soil
1		Active	Peščena glina
2		Active	Lapor
3		Active	Tampon
4		Inactive	
5		Active	Peščena glina
6		Active	Peščena glina

Beams

Number	Beam		Location	Support [m]		Include self weight	Fictitious beam	Cross-section	Material	Contacts	
	new	modified		Start pt.	End pt.					left	right
1	No	No	Mesh line No. 19	⊢	⊢	Yes	No	without modification	without modification	(not input)	(not input)

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Number	Beam		Location	Support [m]		Include self weight	Fictitious beam	Cross-section	Material	Contacts	
	new	modified		Start pt.	End pt.					left	right
2	No	No	Mesh line No. 20	⊢	⊢	Yes	No	without modification	without modification	(not input)	(not input)
3	No	No	Mesh line No. 25	⊢	⊢	Yes	No	without modification	without modification	(not input)	(not input)
4	No	No	Mesh line No. 44	⊢	⊢	Yes	No	without modification	without modification	(not input)	(not input)

Number	Cross-section		Material	
	I_y [m⁴/m]	A [m²/m]	E [MPa]	G [MPa]
1	2,05E-03	1,31E-01	33000,00	13750,00
2	2,05E-03	1,31E-01	33000,00	13750,00
3	2,05E-03	1,31E-01	33000,00	13750,00
4	2,05E-03	1,31E-01	33000,00	13750,00

Line supports

Number	Line support		Location	Support	
	new	modified		Direction X	Direction Z
A1	Yes		Mesh line No. 41	fixed	free
A2	Yes		Mesh line No. 33	fixed	free
A3	Yes		Mesh line No. 43	fixed	free
A4	Yes		Mesh line No. 6	fixed	free
A5	Yes		Mesh line No. 42	fixed	fixed
A1 up to A5 - automatically generated line supports along model edges					

Surcharge

Number	Surcharge		Type	Location / Point 1	Origin / Point 1	Length / Point 2	Width / Point 2	Slope	Magnitude		
	new	change		z [m] / x_1 [m]	x [m] / z_1 [m]	l [m] / x_2 [m]	b [m] / z_2 [m]	α [°]	q, q_1, f, F	q_2	unit
1	Yes		strip	on terrain	x = 21,40	l = 3,50		0,00	16,00		kN/m²

Surcharges

Number	Name
1	Promet

Water

Water type : No water

Analysis settings

Stress

Method :	Newton - Raphson
Stiffness matrix change :	after each iteration
Max. number of iterations for one calc. step :	100
Initial calculation step :	0,1000

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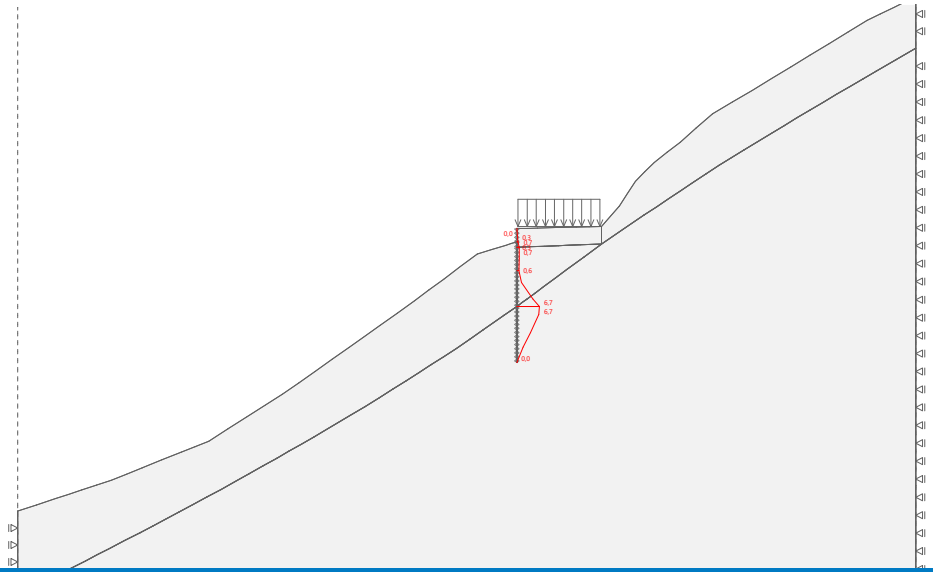
Displacement error :	0,0100
Imbalanced forces error :	0,0100
Energy error :	0,0100
Respect material interfaces :	no
Plasticity	
Return mapping error :	0,00100
Max. number of iterations for one plast. step :	20
Newton - Raphson	
Relaxation factor of calculation step :	2,00
Maximum number of relaxations of calculation step :	2
Min. number of iterations for one calc. step :	1
Line search	
Solution method :	iterate no
Line search limit - minimum :	0,100
Line search limit - maximum :	1,000

Results (Construction stage 4)

Stress analysis was successfully completed.
Analysis settings : standard
Attained loading = 100,00 %

Name : Analysis	Stage : 4

M [kNm/m]



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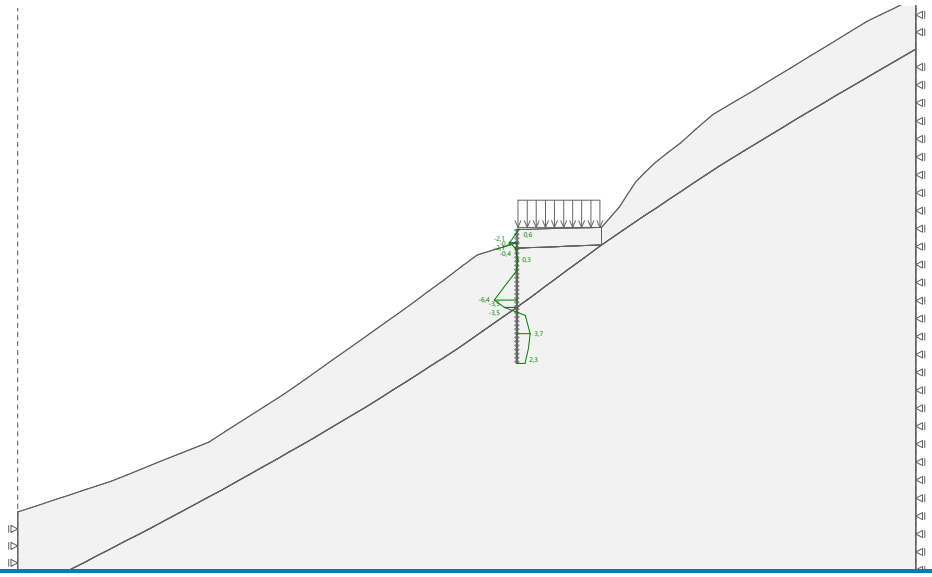
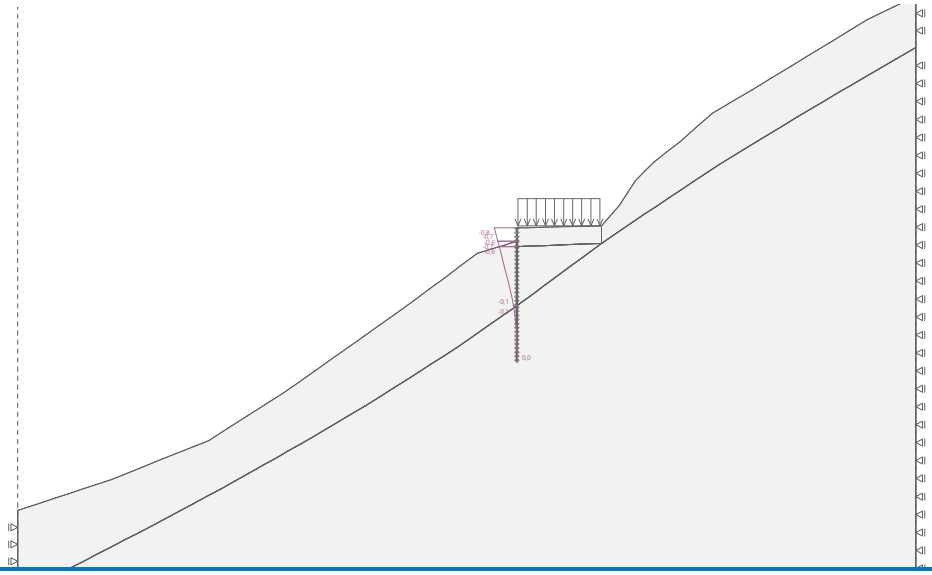
Name : Analysis **Stage : 4**

Q [kN/m]



Name : Analysis **Stage : 4**

D [mm]



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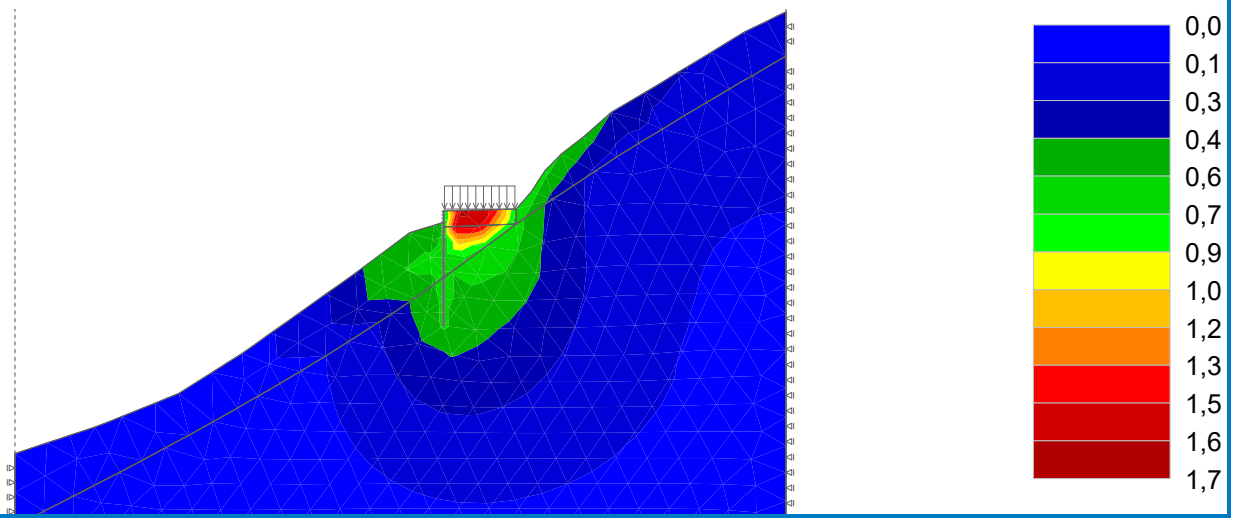
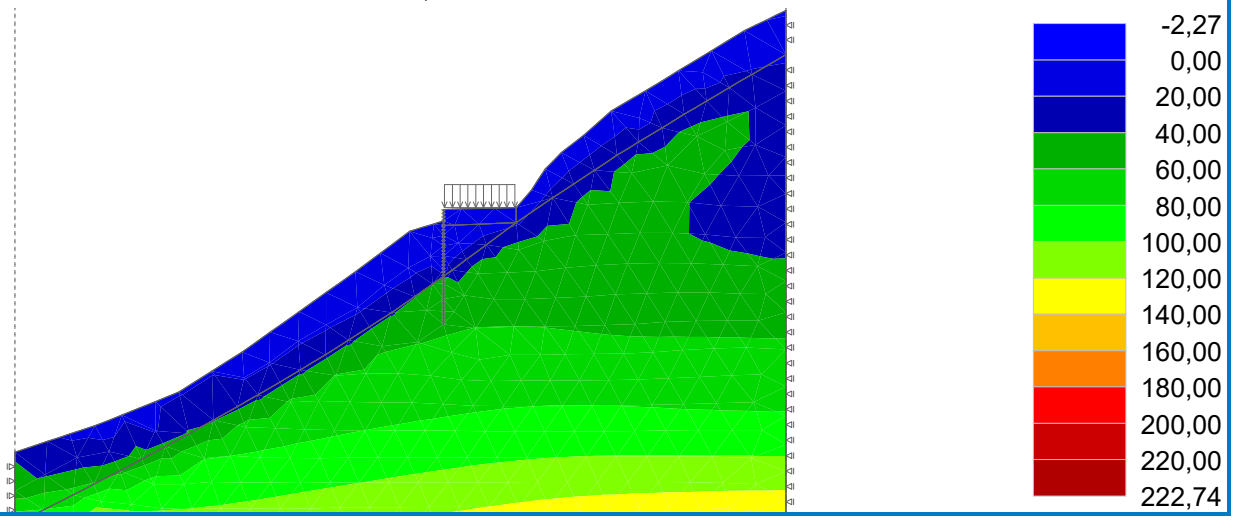
Name : Analysis	Stage : 4

Results : overall; variable : Displacement d_z; range : <0,0; 1,7> mm



Name : Analysis	Stage : 4

Results : overall; variable : Effective stress $\sigma_{x,\,eff}$; range : <-2,27; 222,74> kPa



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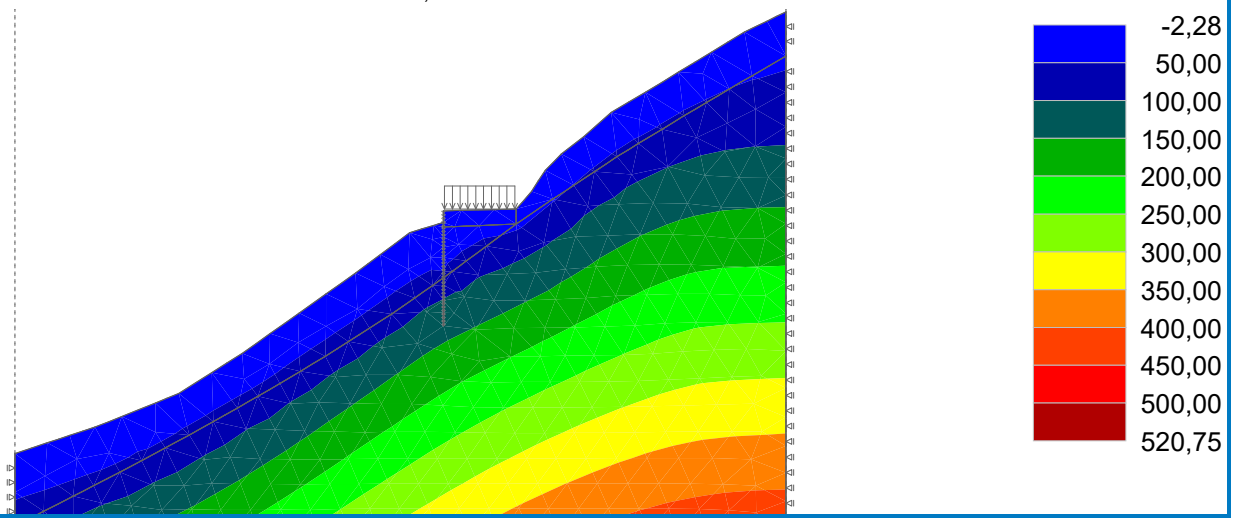
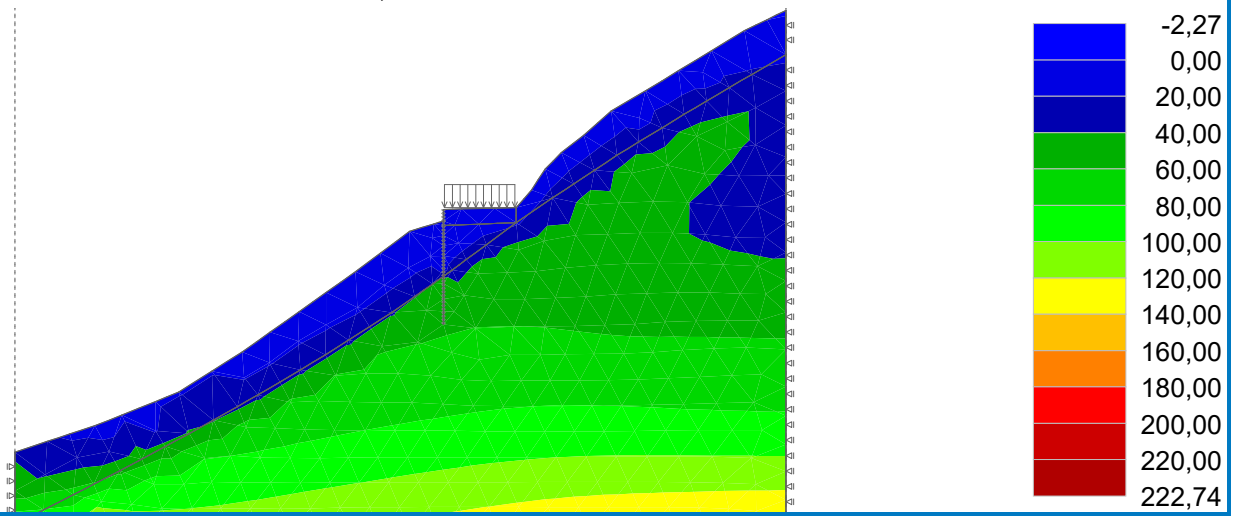
Name : Analysis	Stage : 4

Results : overall; variable : Effective stress $\sigma_{z,\,eff}$; range : <-2,28; 520,75> kPa



Name : Analysis	Stage : 4

Results : overall; variable : Total stress $\sigma_{x,\,tot}$; range : <-2,27; 222,74> kPa



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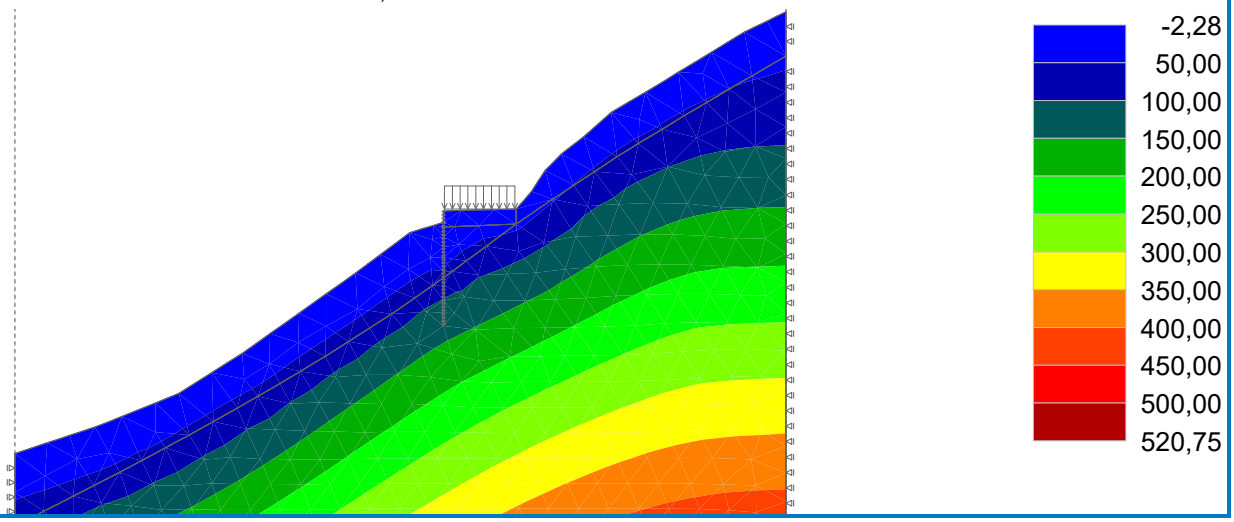
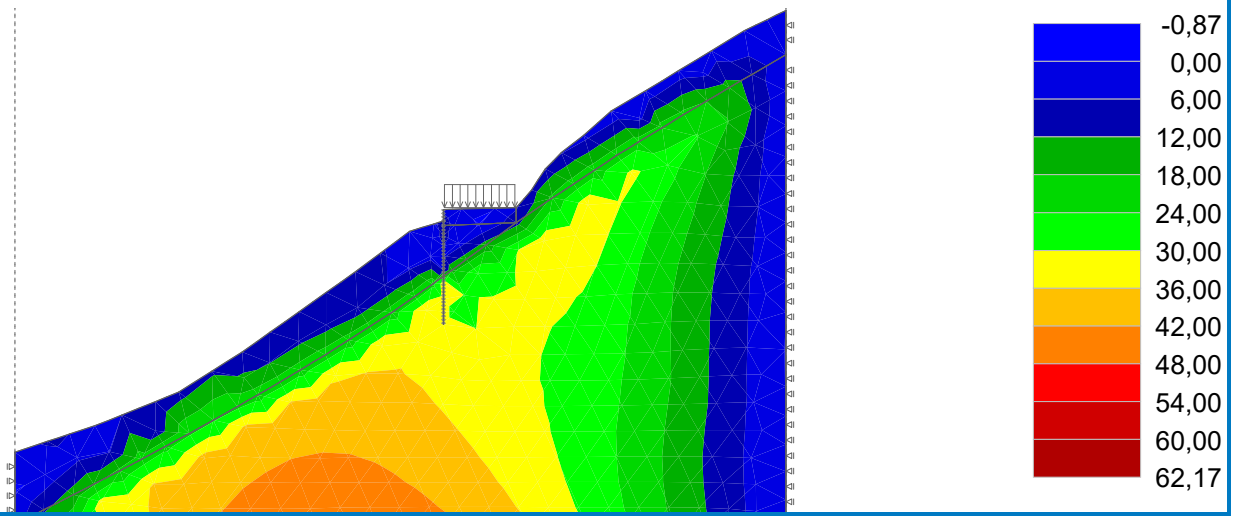
Name : Analysis	Stage : 4

Results : overall; variable : Total stress $\sigma_{z,\,tot}$; range : <-2,28; 520,75> kPa



Name : Analysis	Stage : 4

Results : overall; variable : Shear stress τ_{xz}; range : <-0,87; 62,17> kPa



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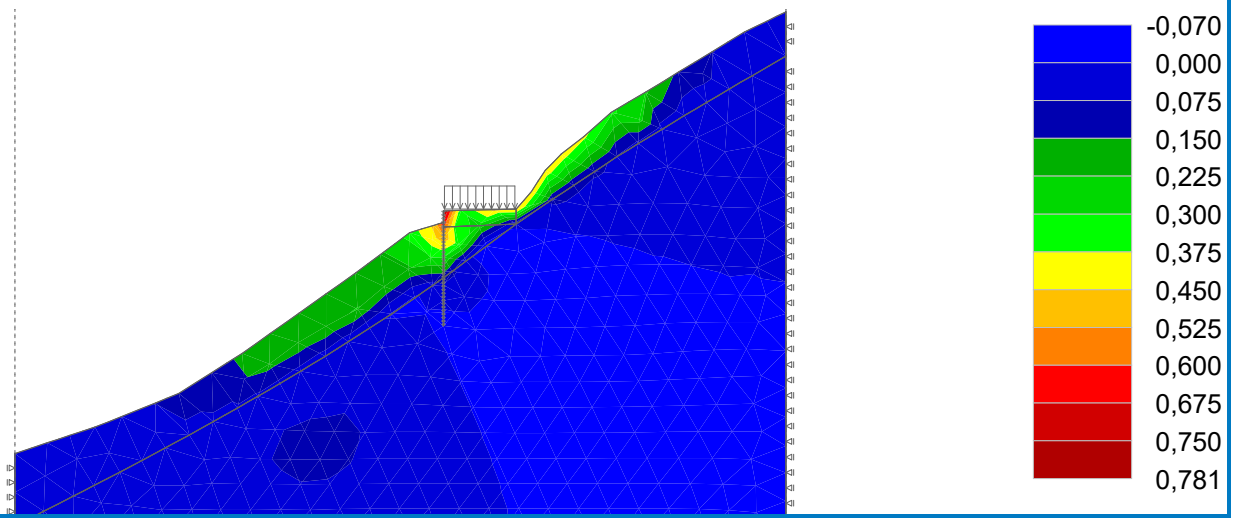
Name : Analysis	Stage : 4

Results : overall; variable : Displacement d $_x$; range : <-0,1; 0,8> mm



Extremes

Displacements (extremes)

Variable	Location x [m]	Location z [m]	Min	Location x [m]	Location z [m]	Max
Displacements x [mm]	25,10	13,72	-0,1	21,35	15,73	0,8
Displacements z [mm]	0,00	3,65	0,0	22,24	15,75	1,7

Stress (extremes)

Variable	Location x [m]	Location z [m]	Min	Location x [m]	Location z [m]	Max
Total stress $\sigma_{z,\,tot}$ [kPa]	29,71	20,64	-2,28	38,41	-4,97	520,75
Effective stress $\sigma_{z,\,eff}$ [kPa]	29,71	20,64	-2,28	38,41	-4,97	520,75
Total stress $\sigma_{x,\,tot}$ [kPa]	38,41	25,64	-2,27	38,41	-4,97	222,74
Effective stress $\sigma_{x,\,eff}$ [kPa]	38,41	25,64	-2,27	38,41	-4,97	222,74
Shear stress τ_{xz} [kPa]	0,00	1,71	-0,87	16,25	-4,97	62,17

Strain (extremes)

Variable	Location x [m]	Location z [m]	Min	Location x [m]	Location z [m]	Max
Equivalent deviatoric strain E_d [%]	38,41	25,64	0,01	21,35	12,71	0,71
Plastic equivalent deviatoric strain $E_{d,\,pl}$ [%]	36,33	24,64	0,00	17,67	9,90	0,49

Mobilization degree (extremes)

Variable	Location x [m]	Location z [m]	Min	Location x [m]	Location z [m]	Max
Mobilized shear strength [%]	37,46	25,18	17,95	23,12	15,00	100,28

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Pore pressures (extremes)

Variable	Location		Max
	x [m]	z [m]	
Total pore pressure u_{tot} [kPa]	24,97	15,82	0,00

Distributions on beams (extremes)

Number	Coordinates		D	N	M	Q
	x [m]	z [m]	[mm]	[kN/m]	[kNm/m]	[kN/m]
1	21,35	15,73	**-0,8**	**-0,3**	**0,0**	**0,6**
	21,35	15,16	**-0,7**	**-6,0**	**0,3**	**-2,1**
2	21,35	15,16	**-0,7**	**-6,0**	**0,3**	**-2,1**
	21,35	14,93	**-0,6**	**-5,2**	**0,7**	**-0,4**
3	21,35	14,93	**-0,6**	**-5,2**	0,7	-0,4
	21,35	14,43	-0,5	-8,3	0,6	**0,3**
	21,35	13,93	-0,4	-11,4	**0,6**	-0,2
	21,35	12,71	-0,2	-20,3	4,8	**-6,4**
	21,35	12,40	**-0,1**	**-21,2**	**6,7**	-3,5
4	21,35	12,40	**-0,1**	**-21,2**	**6,7**	**-3,5**
	21,35	11,27	0,0	-16,3	4,0	**3,7**
	21,35	10,00	**0,0**	**-11,2**	**0,0**	2,3

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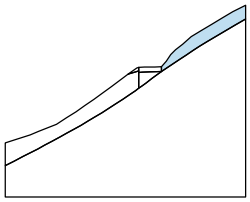
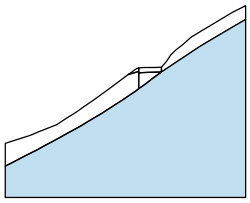
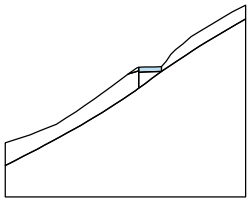
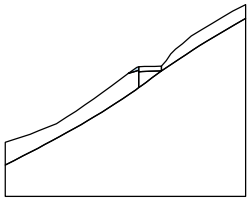
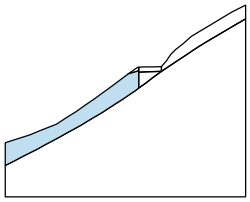
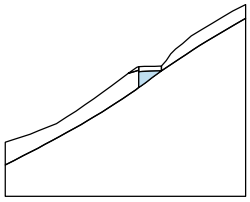
Input data (Construction stage 5)

Assignment and activation

Number	Region	Active / inactive	Assigned soil
1		Active	Peščena glina
2		Active	Lapor
3		Active	Tampon
4		Inactive	
5		Active	Peščena glina
6		Active	Peščena glina

Beams

Number	Beam		Location	Support [m]		Include self weight	Fictitious beam	Cross-section	Material	Contacts	
	new	modified		Start pt.	End pt.					left	right
1	No	No	Mesh line No. 19	⊢	⊢	Yes	No	without modification	without modification	(not input)	(not input)

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Number	Beam		Location	Support [m]		Include self weight	Fictitious beam	Cross-section	Material	Contacts	
	new	modified		Start pt.	End pt.					left	right
2	No	No	Mesh line No. 20	⊢	⊢	Yes	No	without modification	without modification	(not input)	(not input)
3	No	No	Mesh line No. 25	⊢	⊢	Yes	No	without modification	without modification	(not input)	(not input)
4	No	No	Mesh line No. 44	⊢	⊢	Yes	No	without modification	without modification	(not input)	(not input)

Number	Cross-section		Material	
	I_y [m⁴/m]	A [m²/m]	E [MPa]	G [MPa]
1	2,05E-03	1,31E-01	33000,00	13750,00
2	2,05E-03	1,31E-01	33000,00	13750,00
3	2,05E-03	1,31E-01	33000,00	13750,00
4	2,05E-03	1,31E-01	33000,00	13750,00

Line supports

Number	Line support		Location	Support	
	new	modified		Direction X	Direction Z
A1	Yes		Mesh line No. 41	fixed	free
A2	Yes		Mesh line No. 33	fixed	free
A3	Yes		Mesh line No. 43	fixed	free
A4	Yes		Mesh line No. 6	fixed	free
A5	Yes		Mesh line No. 42	fixed	fixed
A1 up to A5 - automatically generated line supports along model edges					

Surcharge

Number	Surcharge		Type	Location / Point 1	Origin / Point 1	Length / Point 2	Width / Point 2	Slope	Magnitude		
	new	change		z [m] / x_1 [m]	x [m] / z_1 [m]	l [m] / x_2 [m]	b [m] / z_2 [m]	α [°]	q, q_1, f, F	q_2	unit
1	No	No	strip	on terrain	x = 21,40	l = 3,50		0,00	16,00		kN/m²

Surcharges

Number	Name
1	Promet

Water

Water type : GWT

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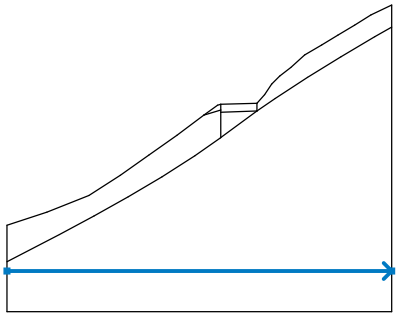
Number	GWT location	Coordinates of GWT points [m]					
		x	z	x	z	x	z
1099981523		0,00	-0,90	38,41	-0,90		

Analysis settings

Stress

Method :	Newton - Raphson
Stiffness matrix change :	after each iteration
Max. number of iterations for one calc. step :	100
Initial calculation step :	0,1000
Displacement error :	0,0100
Imbalanced forces error :	0,0100
Energy error :	0,0100
Respect material interfaces :	no

Plasticity

Return mapping error :	0,00100
Max. number of iterations for one plast. step :	20

Newton - Raphson

Relaxation factor of calculation step :	2,00
Maximum number of relaxations of calculation step :	2
Min. number of iterations for one calc. step :	1

Line search

Solution method :	iterate no
Line search limit - minimum :	0,100
Line search limit - maximum :	1,000

Results (Construction stage 5)

Stress analysis was successfully completed.
Analysis settings : standard
Attained loading = 100,00 %

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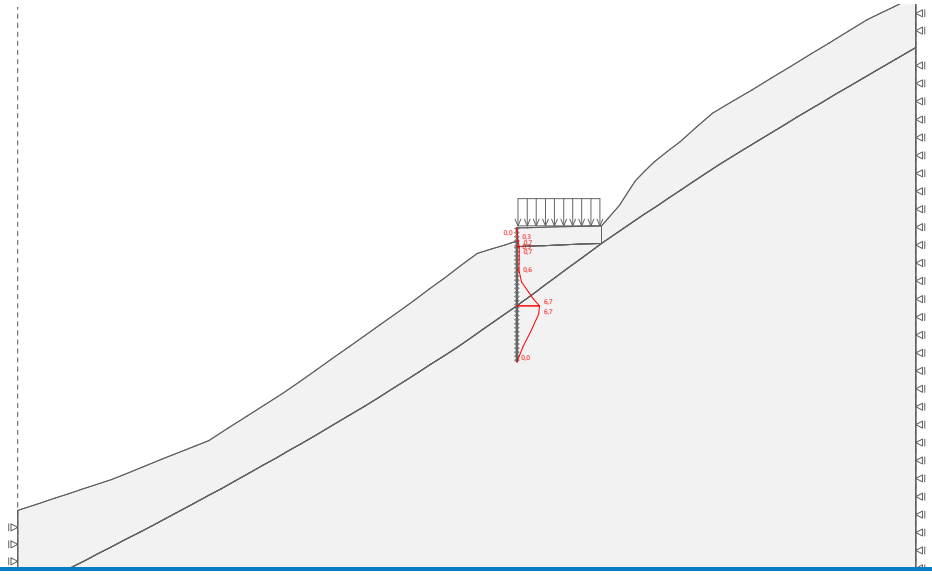
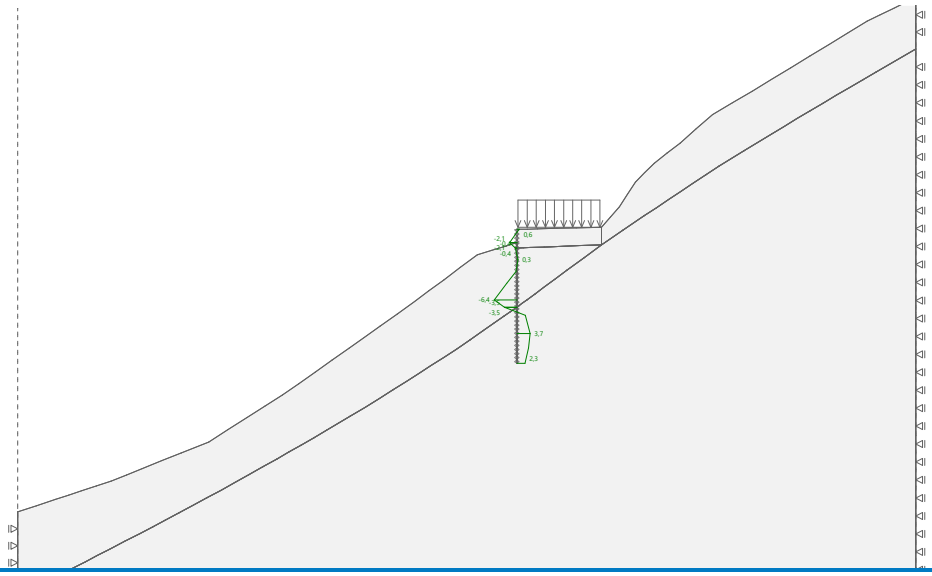
Name : Analysis	Stage : 5

M [kNm/m]



Name : Analysis	Stage : 5

Q [kN/m]



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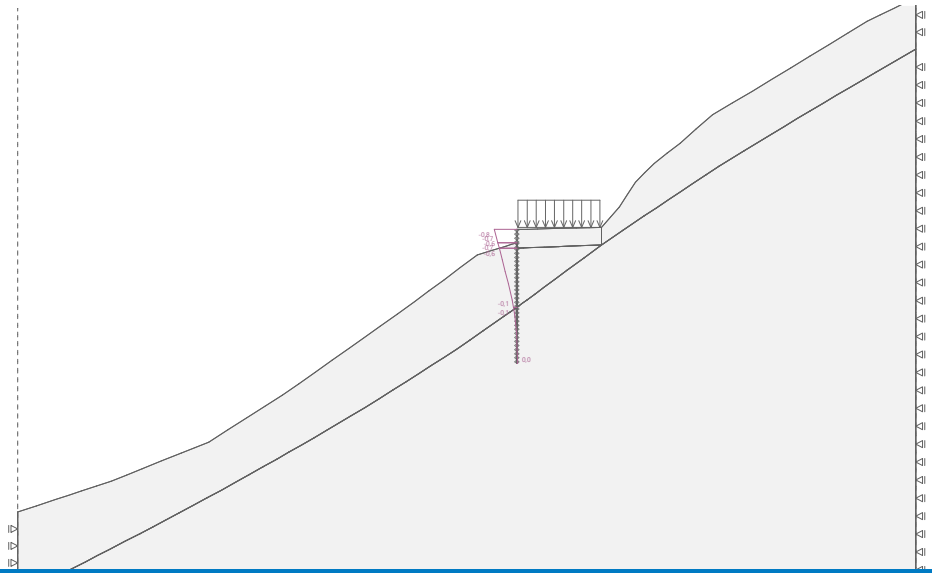
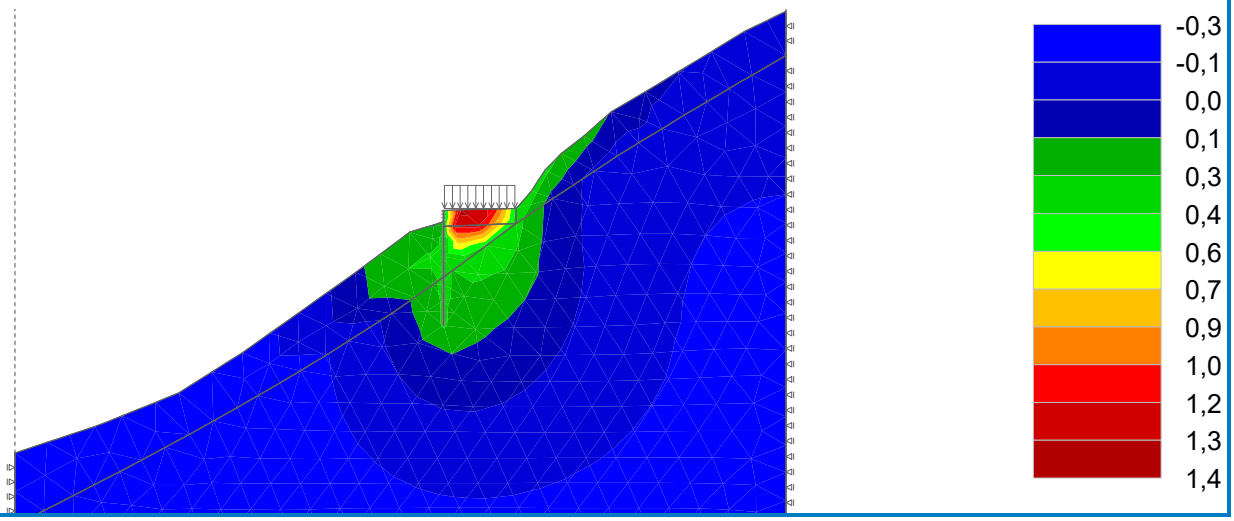
Name : Analysis	Stage : 5

D [mm]



Name : Analysis	Stage : 5

Results : overall; variable : Displacement d_z; range : <-0,3; 1,4> mm



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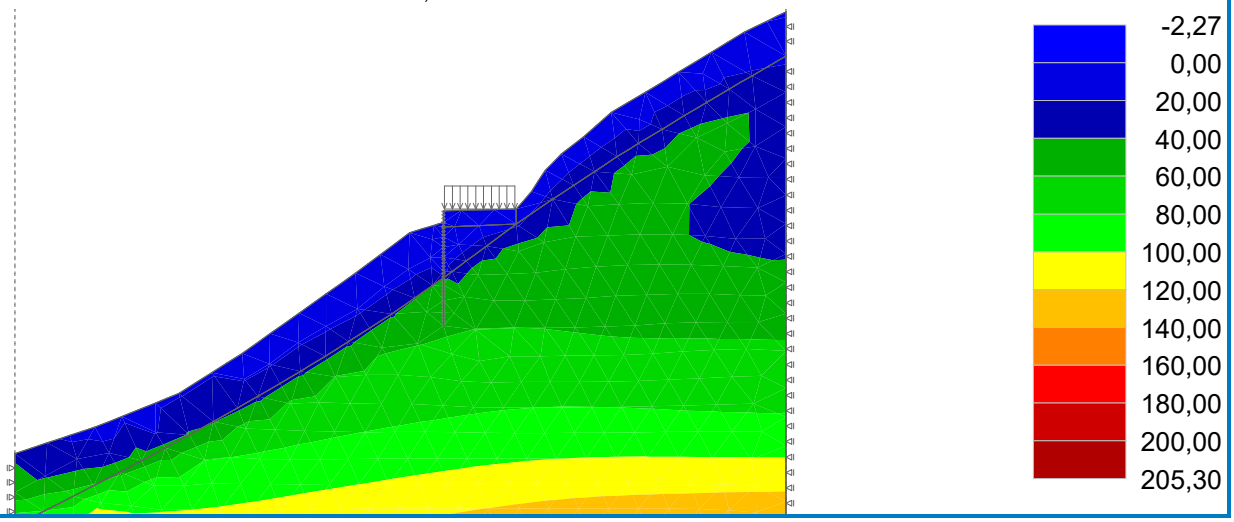
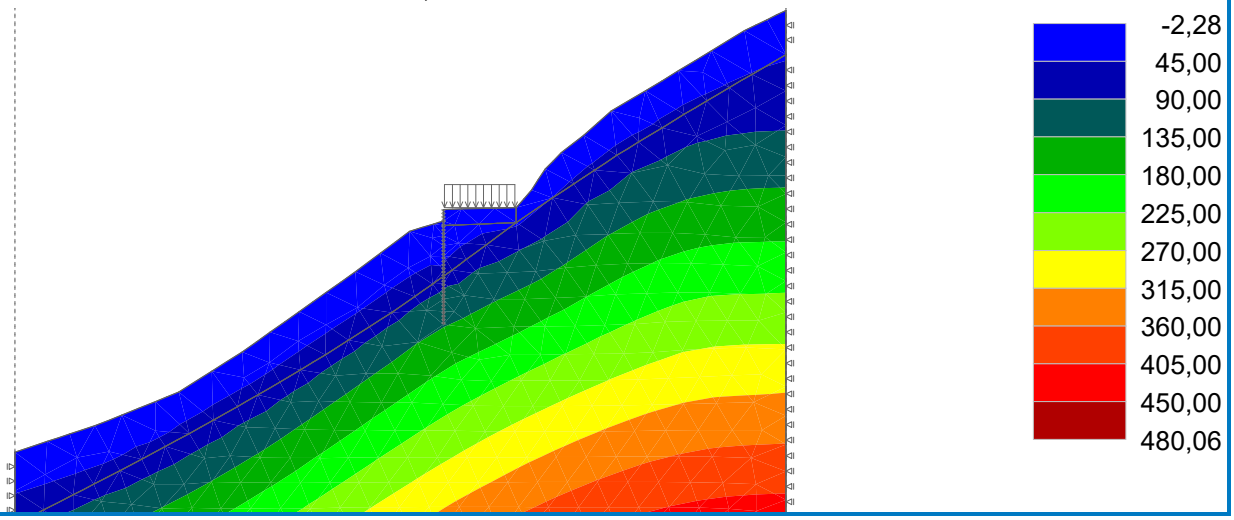
Name : Analysis	Stage : 5

Results : overall; variable : Effective stress $\sigma_{x,\,eff}$; range : <-2,27; 205,30> kPa



Name : Analysis	Stage : 5

Results : overall; variable : Effective stress $\sigma_{z,\,eff}$; range : <-2,28; 480,06> kPa



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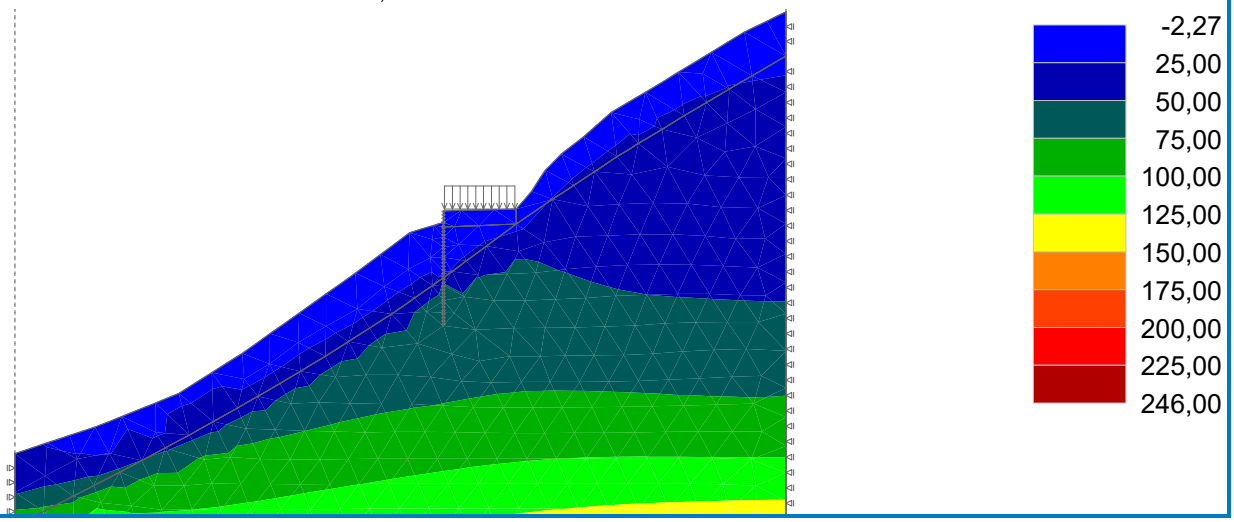
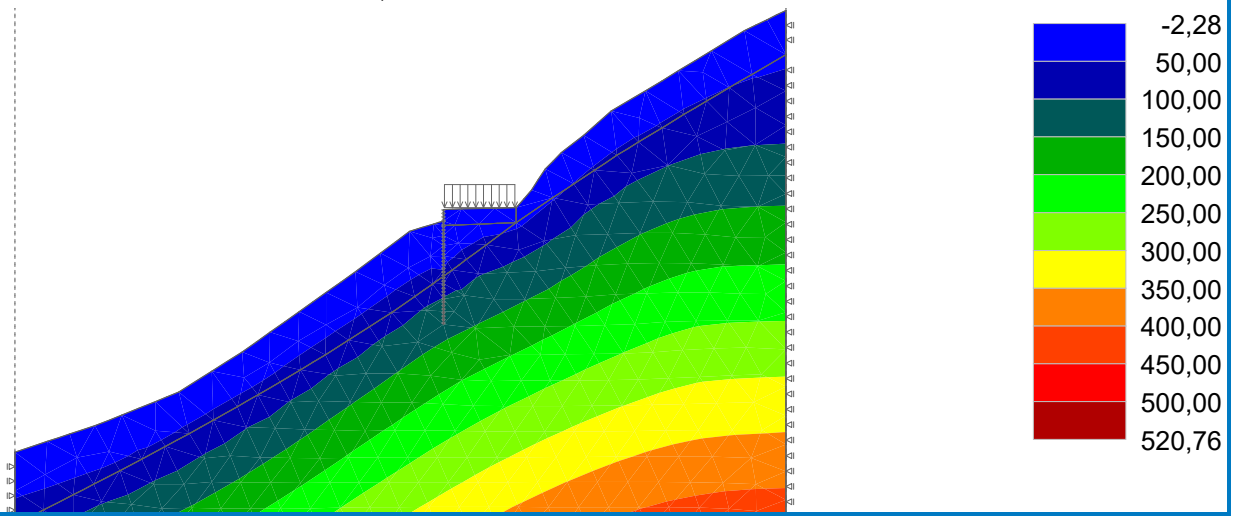
Name : Analysis	Stage : 5

Results : overall; variable : Total stress $\sigma_{x,\,tot}$; range : <-2,27; 246,00> kPa



Name : Analysis	Stage : 5

Results : overall; variable : Total stress $\sigma_{z,\,tot}$; range : <-2,28; 520,76> kPa



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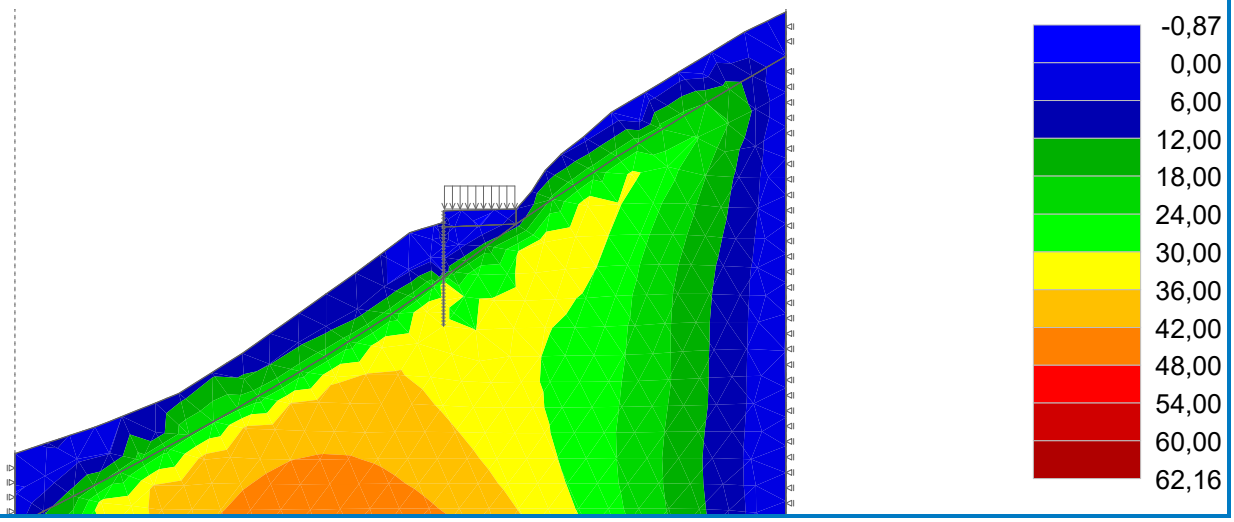
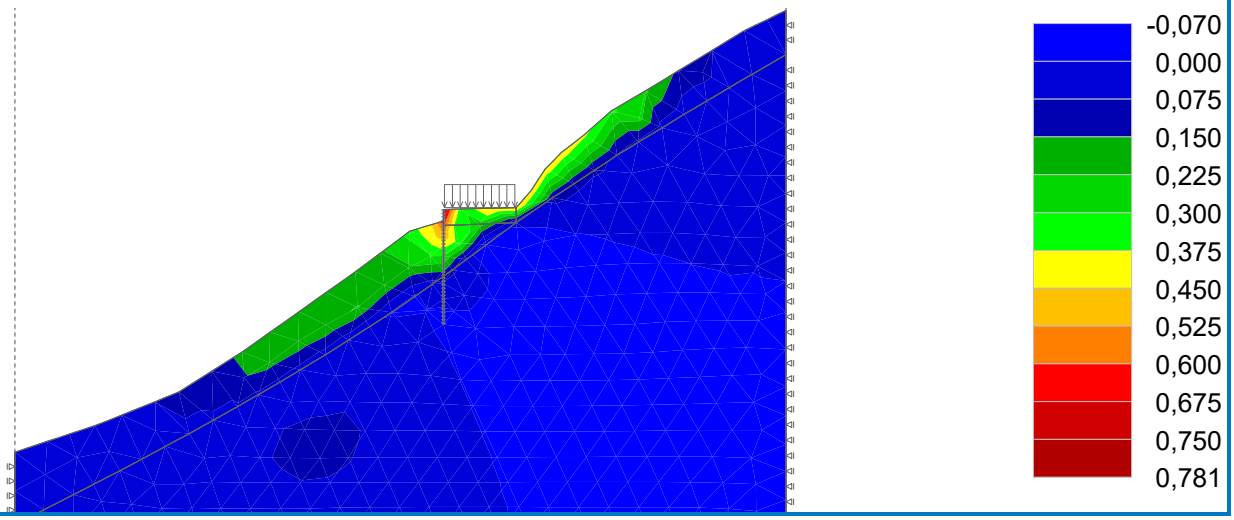
Name : Analysis	Stage : 5

Results : overall; variable : Shear stress τ_{xz}; range : <-0,87; 62,16> kPa



Name : Analysis	Stage : 5

Results : overall; variable : Displacement d_x; range : <-0,1; 0,8> mm



Extremes

Displacements (extremes)

Variable	Location		Min	Location		Max
	x [m]	z [m]		x [m]	z [m]	
Displacements x [mm]	25,10	13,72	-0,1	21,35	15,73	0,8
Displacements z [mm]	0,00	3,65	-0,3	22,24	15,75	1,4

Stress (extremes)

Variable	Location		Min	Location		Max
	x [m]	z [m]		x [m]	z [m]	
Total stress $\sigma_{z,\,tot}$ [kPa]	29,71	20,64	-2,28	38,41	-4,97	520,76
Effective stress $\sigma_{z,\,eff}$ [kPa]	29,71	20,64	-2,28	38,41	-4,97	480,06
Total stress $\sigma_{x,\,tot}$ [kPa]	38,41	25,64	-2,27	38,41	-4,97	246,00

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Variable	Location x [m]	Location z [m]	Min	Location x [m]	Location z [m]	Max
Effective stress $\sigma_{x,\,eff}$ [kPa]	38,41	25,64	-2,27	38,41	-4,97	205,30
Shear stress τ_{xz} [kPa]	0,00	1,71	-0,87	16,25	-4,97	62,16

Strain (extremes)

Variable	Location x [m]	Location z [m]	Min	Location x [m]	Location z [m]	Max
Equivalent deviatoric strain E_d [%]	38,41	25,64	0,01	21,35	12,71	0,71
Plastic equivalent deviatoric strain $E_{d,\,pl}$ [%]	36,33	24,64	0,00	17,67	9,90	0,49

Mobilization degree (extremes)

Variable	Location x [m]	Location z [m]	Min	Location x [m]	Location z [m]	Max
Mobilized shear strength [%]	37,46	25,18	17,95	23,12	15,00	100,28

Pore pressures (extremes)

Variable	Location x [m]	Location z [m]	Max
Total pore pressure u_{tot} [kPa]	0,00	-4,97	40,70

Distributions on beams (extremes)

Number	Coordinates x [m]	Coordinates z [m]	D [mm]	N [kN/m]	M [kNm/m]	Q [kN/m]
1	21,35	15,73	**-0,8**	**-0,3**	**0,0**	**0,6**
	21,35	15,16	**-0,7**	**-6,0**	**0,3**	**-2,1**
2	21,35	15,16	**-0,7**	**-6,0**	**0,3**	**-2,1**
	21,35	14,93	**-0,6**	**-5,2**	**0,7**	**-0,4**
3	21,35	14,93	**-0,6**	**-5,2**	0,7	-0,4
	21,35	14,43	-0,5	-8,3	0,6	**0,3**
	21,35	13,93	-0,4	-11,4	**0,6**	-0,2
	21,35	12,71	-0,2	-20,3	4,8	**-6,4**
	21,35	12,40	**-0,1**	**-21,2**	**6,7**	-3,5
4	21,35	12,40	**-0,1**	**-21,2**	**6,7**	**-3,5**
	21,35	11,27	0,0	-16,3	4,0	**3,7**
	21,35	10,00	**0,0**	**-11,2**	**0,0**	2,3

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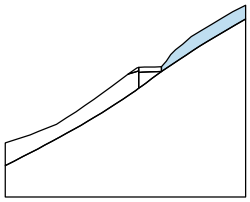
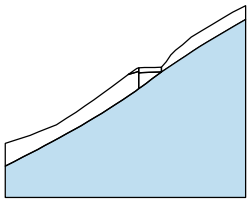
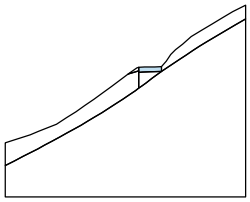
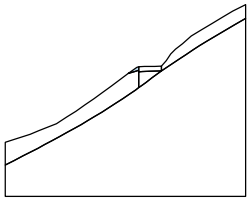
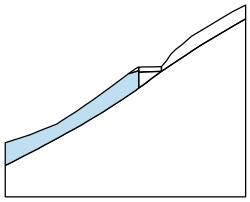
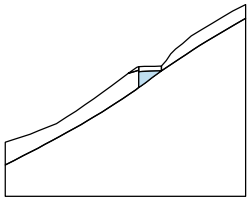
Input data (Construction stage 6)

Assignment and activation

Number	Region	Active / inactive	Assigned soil
1		Active	Peščena glina
2		Active	Lapor
3		Active	Tampon
4		Inactive	
5		Active	Peščena glina
6		Active	Peščena glina

Beams

Number	Beam		Location	Support [m]		Include self weight	Fictitious beam	Cross-section	Material	Contacts	
	new	modified		Start pt.	End pt.					left	right
1	No	No	Mesh line No. 19	⊢	⊢	Yes	No	without modification	without modification	(not input)	(not input)

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Number	Beam		Location	Support [m]		Include self weight	Fictitious beam	Cross-section	Material	Contacts	
	new	modified		Start pt.	End pt.					left	right
2	No	No	Mesh line No. 20	⊢	⊢	Yes	No	without modification	without modification	(not input)	(not input)
3	No	No	Mesh line No. 25	⊢	⊢	Yes	No	without modification	without modification	(not input)	(not input)
4	No	No	Mesh line No. 44	⊢	⊢	Yes	No	without modification	without modification	(not input)	(not input)

Number	Cross-section		Material	
	I_y [m⁴/m]	A [m²/m]	E [MPa]	G [MPa]
1	2,05E-03	1,31E-01	33000,00	13750,00
2	2,05E-03	1,31E-01	33000,00	13750,00
3	2,05E-03	1,31E-01	33000,00	13750,00
4	2,05E-03	1,31E-01	33000,00	13750,00

Line supports

Number	Line support		Location	Support	
	new	modified		Direction X	Direction Z
A1	Yes		Mesh line No. 41	fixed	free
A2	Yes		Mesh line No. 33	fixed	free
A3	Yes		Mesh line No. 43	fixed	free
A4	Yes		Mesh line No. 6	fixed	free
A5	Yes		Mesh line No. 42	fixed	fixed
A1 up to A5 - automatically generated line supports along model edges					

Surcharge

Number	Surcharge		Type	Location / Point 1	Origin / Point 1	Length / Point 2	Width / Point 2	Slope	Magnitude		
	new	change		z [m] / x_1 [m]	x [m] / z_1 [m]	l [m] / x_2 [m]	b [m] / z_2 [m]	α [°]	q, q_1, f, F	q_2	unit
1	No	No	strip	on terrain	x = 21,40	l = 3,50		0,00	16,00		kN/m²

Surcharges

Number	Name
1	Promet

Water

Water type : GWT

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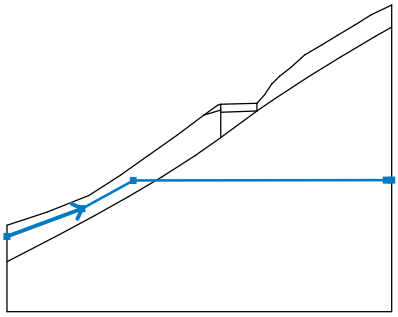
Number	GWT location	Coordinates of GWT points [m]					
		x	z	x	z	x	z
1099981523		0,00	2,55	7,50	5,33	12,61	8,13
		37,87	8,17	38,41	8,17		

Analysis settings

Stress

Method :	Newton - Raphson
Stiffness matrix change :	after each iteration
Max. number of iterations for one calc. step :	100
Initial calculation step :	0,1000
Displacement error :	0,0100
Imbalanced forces error :	0,0100
Energy error :	0,0100
Respect material interfaces :	no

Plasticity

Return mapping error :	0,00100
Max. number of iterations for one plast. step :	20

Newton - Raphson

Relaxation factor of calculation step :	2,00
Maximum number of relaxations of calculation step :	2
Min. number of iterations for one calc. step :	1

Line search

Solution method :	iterate no
Line search limit - minimum :	0,100
Line search limit - maximum :	1,000

Results (Construction stage 6)

Stress analysis was successfully completed.
Analysis settings : standard
Attained loading = 100,00 %

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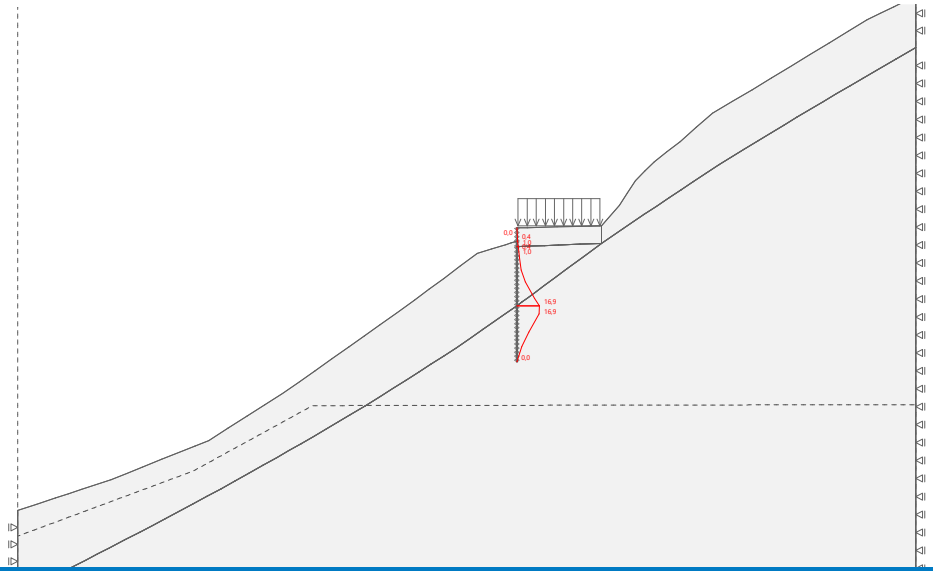
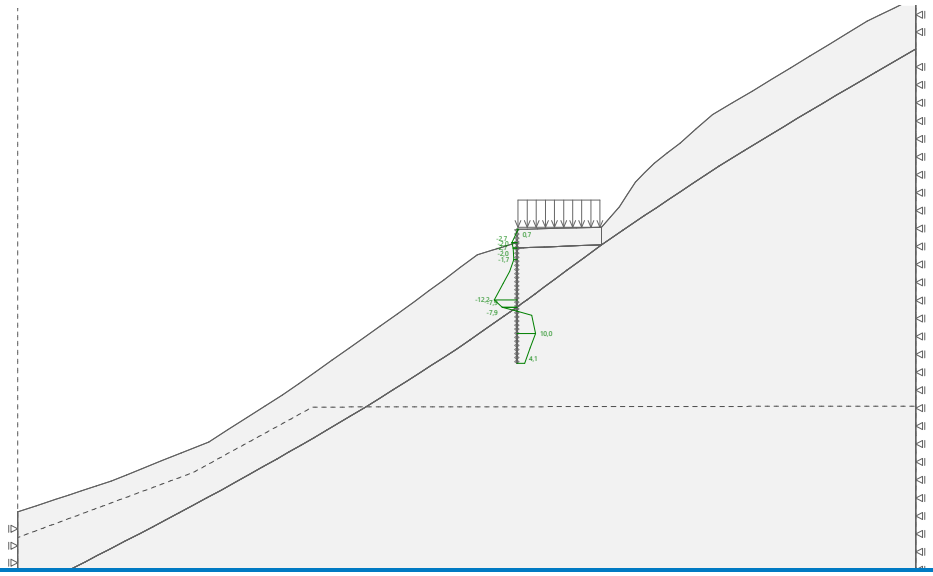
Name : Analysis	Stage : 6

M [kNm/m]



Name : Analysis	Stage : 6

Q [kN/m]



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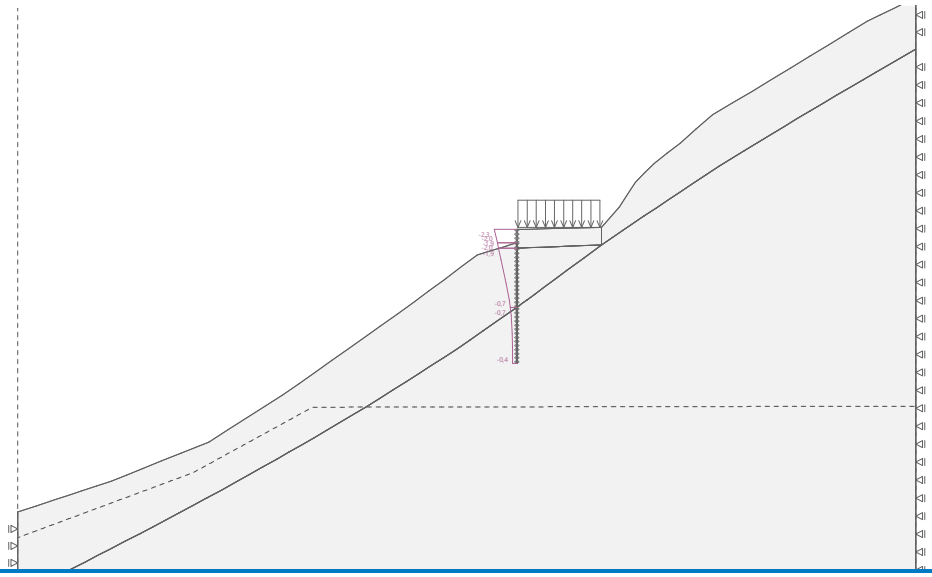
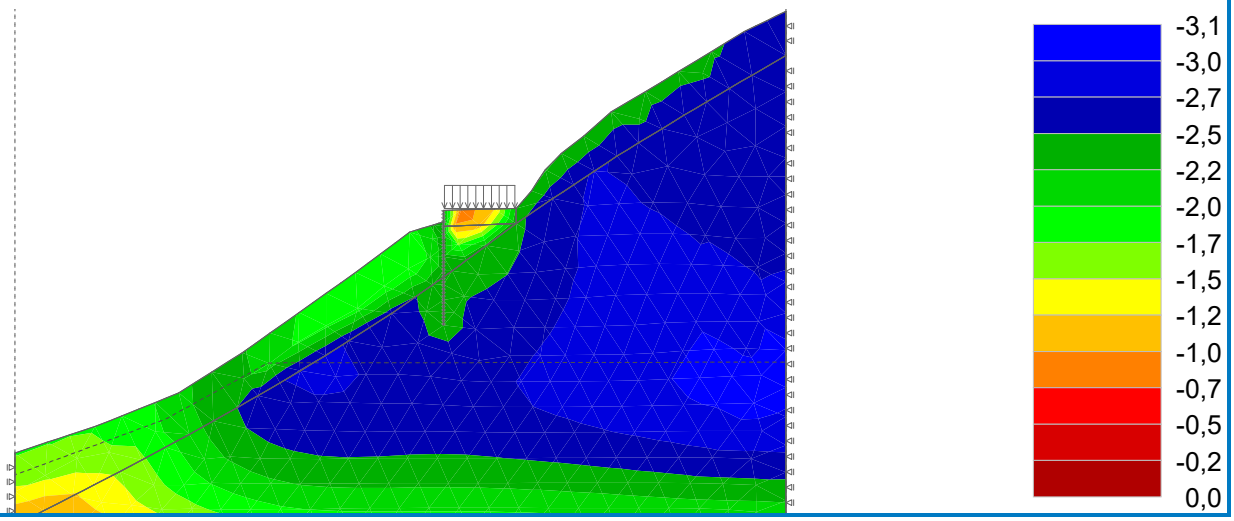
Name : Analysis	Stage : 6

D [mm]



Name : Analysis	Stage : 6

Results : overall; variable : Displacement d_z; range : <-3,1; 0,0> mm



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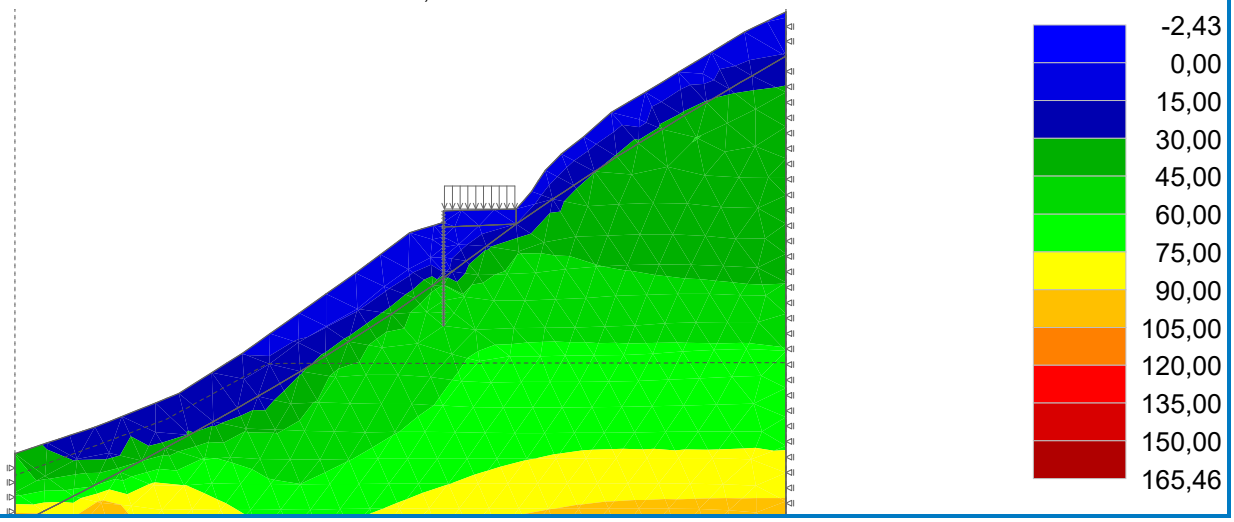
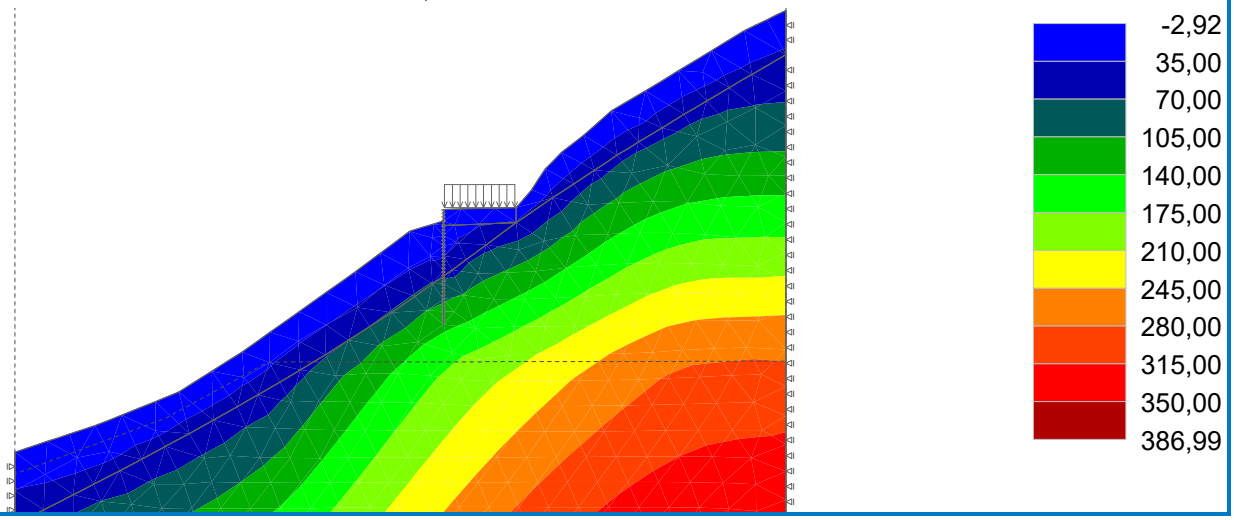
Name : Analysis	Stage : 6

Results : overall; variable : Effective stress $\sigma_{x,\,eff}$; range : <-2,43; 165,46> kPa



Name : Analysis	Stage : 6

Results : overall; variable : Effective stress $\sigma_{z,\,eff}$; range : <-2,92; 386,99> kPa



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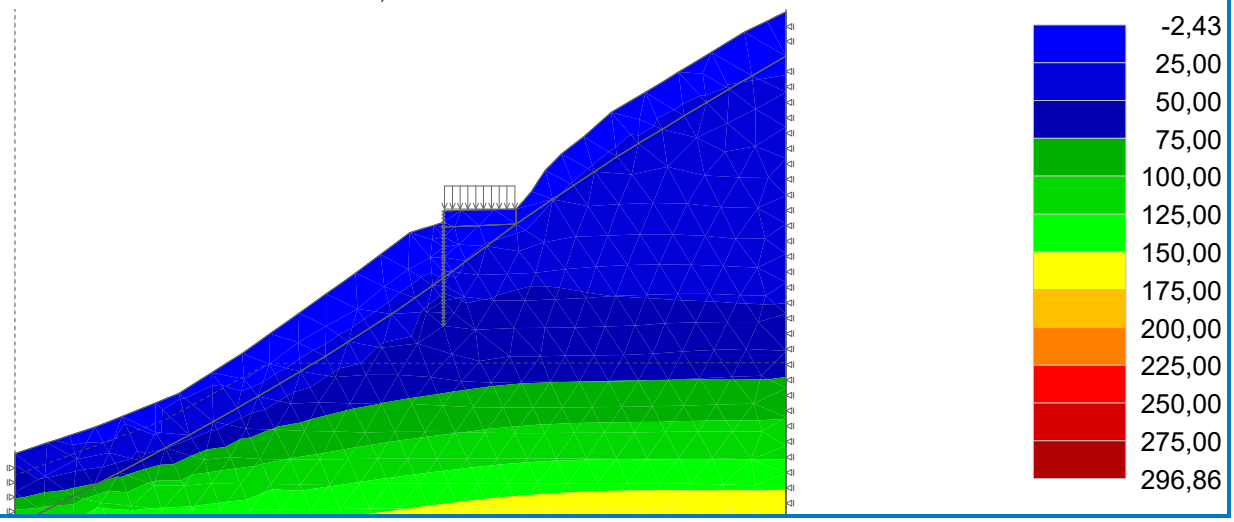
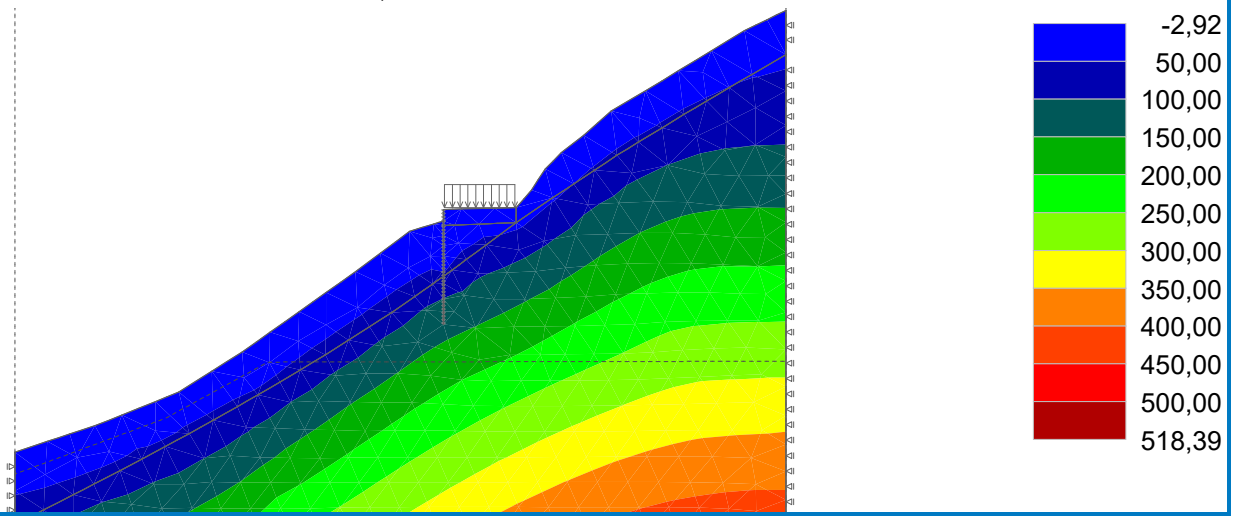
Name : Analysis	Stage : 6

Results : overall; variable : Total stress $\sigma_{x,\,tot}$; range : <-2,43; 296,86> kPa



Name : Analysis	Stage : 6

Results : overall; variable : Total stress $\sigma_{z,\,tot}$; range : <-2,92; 518,39> kPa



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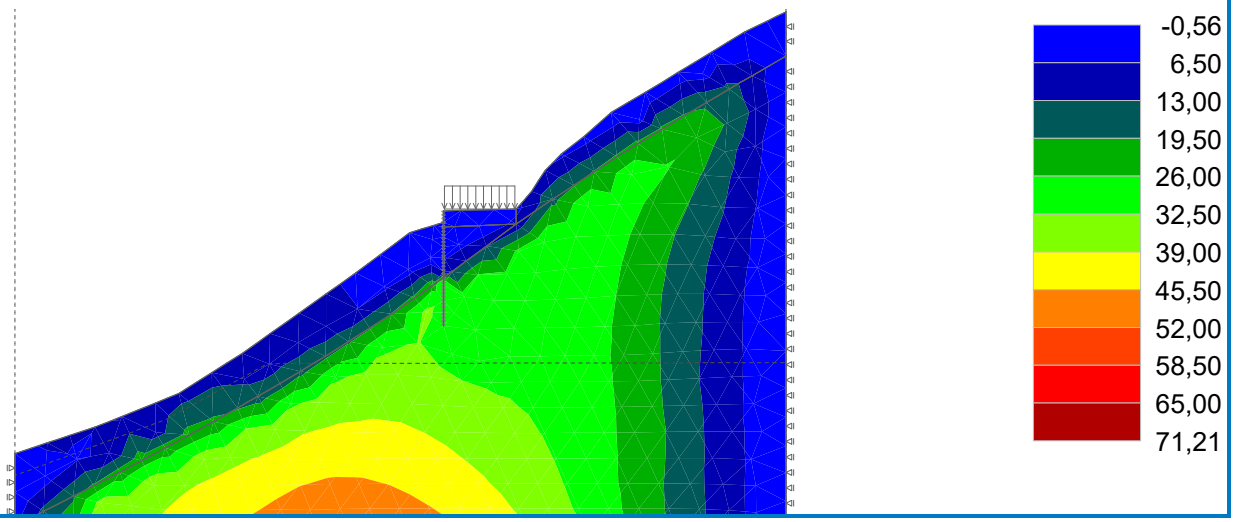
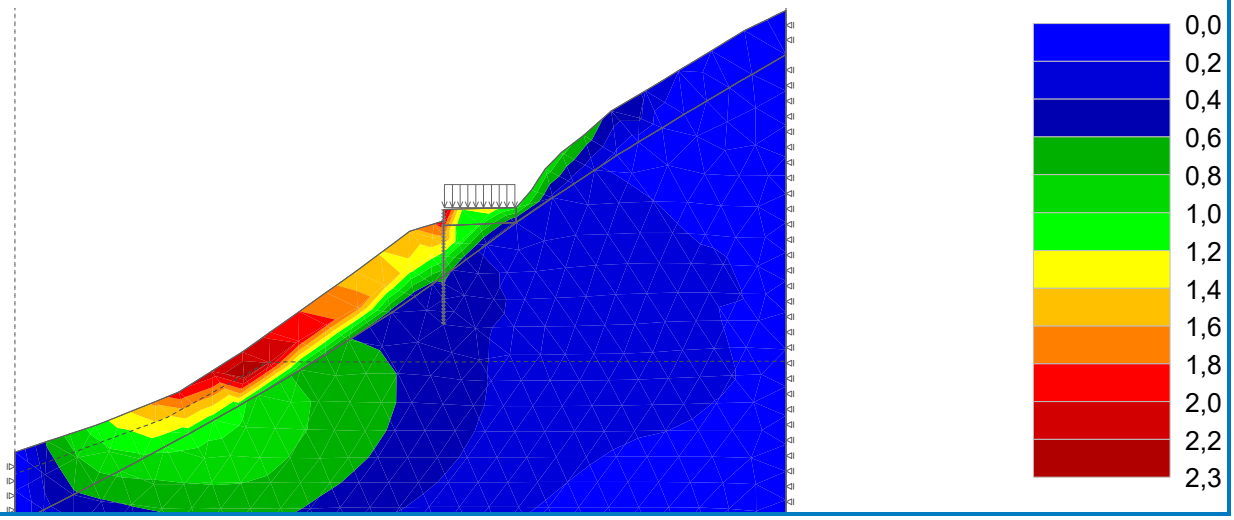
Name : Analysis	Stage : 6

Results : overall; variable : Shear stress τ_{xz}; range : <-0,56; 71,21> kPa



Name : Analysis	Stage : 6

Results : overall; variable : Displacement d_x; range : <0,0; 2,3> mm



Extremes

Displacements (extremes)

Variable	Location		Min	Location		Max
	x [m]	z [m]		x [m]	z [m]	
Displacements x [mm]	38,41	23,44	0,0	21,35	15,73	2,3
Displacements z [mm]	35,71	7,47	-3,1	0,00	-4,97	0,0

Stress (extremes)

Variable	Location		Min	Location		Max
	x [m]	z [m]		x [m]	z [m]	
Total stress $\sigma_{z,\,tot}$ [kPa]	29,71	20,64	-2,92	38,41	-4,97	518,39
Effective stress $\sigma_{z,\,eff}$ [kPa]	29,71	20,64	-2,92	38,41	-4,97	386,99
Total stress $\sigma_{x,\,tot}$ [kPa]	38,41	25,64	-2,43	38,41	-4,97	296,86

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Variable	Location x [m]	Location z [m]	Min	Location x [m]	Location z [m]	Max
Effective stress $\sigma_{x, eff}$ [kPa]	38,41	25,64	-2,43	38,41	-4,97	165,46
Shear stress τ_{xz} [kPa]	23,12	15,00	-0,56	13,30	-4,97	71,21

Strain (extremes)

Variable	Location x [m]	Location z [m]	Min	Location x [m]	Location z [m]	Max
Equivalent deviatoric strain E_d [%]	38,41	25,64	0,02	21,35	15,73	0,82
Plastic equivalent deviatoric strain $E_{d, pl}$ [%]	36,33	24,64	0,00	21,35	15,73	0,79

Mobilization degree (extremes)

Variable	Location x [m]	Location z [m]	Min	Location x [m]	Location z [m]	Max
Mobilized shear strength [%]	36,33	24,64	18,27	23,12	15,00	102,31

Pore pressures (extremes)

Variable	Location x [m]	Location z [m]	Max
Total pore pressure u_{tot} [kPa]	38,41	-4,97	131,40

Distributions on beams (extremes)

Number	Coordinates x [m]	Coordinates z [m]	D [mm]	N [kN/m]	M [kNm/m]	Q [kN/m]
1	21,35	15,73	**-2,3**	**0,7**	**0,0**	**0,7**
	21,35	15,16	**-2,0**	**-6,4**	**0,4**	**-2,7**
2	21,35	15,16	**-2,0**	**-6,4**	**0,4**	**-2,7**
	21,35	14,93	**-1,9**	**-5,8**	**1,0**	**-2,0**
3	21,35	14,93	**-1,9**	**-5,8**	**1,0**	-2,0
	21,35	14,43	-1,6	-11,8	1,8	**-1,7**
	21,35	12,71	-0,8	-31,0	13,3	**-12,2**
	21,35	12,40	**-0,7**	**-31,9**	**16,9**	-7,9
4	21,35	12,40	**-0,7**	**-31,9**	**16,9**	**-7,9**
	21,35	11,27	-0,5	-20,8	8,8	**10,0**
	21,35	10,00	**-0,4**	**-13,7**	**0,0**	4,1

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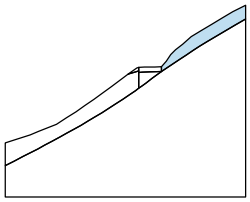
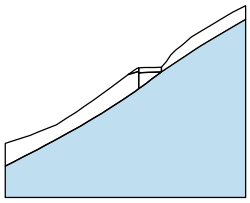
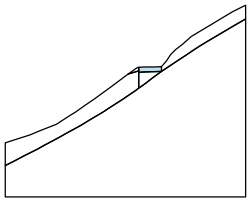
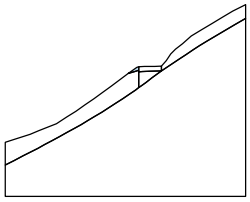
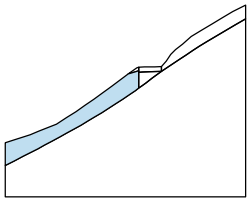
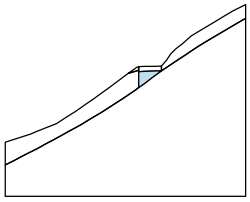
Input data (Construction stage 7)

Assignment and activation

Number	Region	Active / inactive	Assigned soil
1		Active	Peščena glina
2		Active	Lapor
3		Active	Tampon
4		Inactive	
5		Active	Peščena glina
6		Active	Peščena glina

Beams

Number	Beam		Location	Support [m]		Include self weight	Fictitious beam	Cross-section	Material	Contacts	
	new	modified		Start pt.	End pt.					left	right
1	No	No	Mesh line No. 19	⊢	⊢	Yes	No	without modification	without modification	(not input)	(not input)

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Number	Beam		Location	Support [m]		Include self weight	Fictitious beam	Cross-section	Material	Contacts	
	new	modified		Start pt.	End pt.					left	right
2	No	No	Mesh line No. 20	⊢	⊢	Yes	No	without modification	without modification	(not input)	(not input)
3	No	No	Mesh line No. 25	⊢	⊢	Yes	No	without modification	without modification	(not input)	(not input)
4	No	No	Mesh line No. 44	⊢	⊢	Yes	No	without modification	without modification	(not input)	(not input)

Number	Cross-section		Material	
	I_y [m⁴/m]	A [m²/m]	E [MPa]	G [MPa]
1	2,05E-03	1,31E-01	33000,00	13750,00
2	2,05E-03	1,31E-01	33000,00	13750,00
3	2,05E-03	1,31E-01	33000,00	13750,00
4	2,05E-03	1,31E-01	33000,00	13750,00

Line supports

Number	Line support		Location	Support	
	new	modified		Direction X	Direction Z
A1	Yes		Mesh line No. 41	fixed	free
A2	Yes		Mesh line No. 33	fixed	free
A3	Yes		Mesh line No. 43	fixed	free
A4	Yes		Mesh line No. 6	fixed	free
A5	Yes		Mesh line No. 42	fixed	fixed
A1 up to A5 - automatically generated line supports along model edges					

Surcharge

Number	Surcharge		Type	Location / Point 1	Origin / Point 1	Length / Point 2	Width / Point 2	Slope	Magnitude		
	new	change		z [m] / x_1 [m]	x [m] / z_1 [m]	l [m] / x_2 [m]	b [m] / z_2 [m]	α [°]	q, q_1, f, F	q_2	unit
1	No	No	strip	on terrain	x = 21,40	l = 3,50		0,00	16,00		kN/m²

Surcharges

Number	Name
1	Promet

Water

Water type : GWT

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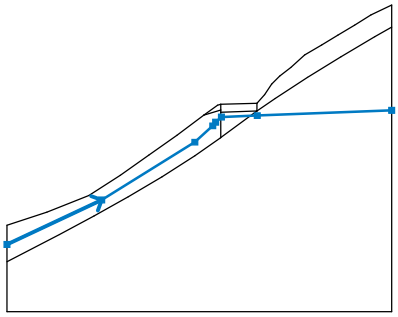
Number	GWT location	Coordinates of GWT points [m]					
		x	z	x	z	x	z
1099981523		0,00	1,73	9,46	6,18	18,76	11,95
		20,54	13,58	20,84	13,94	21,41	14,46
		24,98	14,60	38,41	15,12		

Analysis settings

Stress

Method :	Newton - Raphson
Stiffness matrix change :	after each iteration
Max. number of iterations for one calc. step :	100
Initial calculation step :	0,1000
Displacement error :	0,0100
Imbalanced forces error :	0,0100
Energy error :	0,0100
Respect material interfaces :	no

Plasticity

Return mapping error :	0,00100
Max. number of iterations for one plast. step :	20

Newton - Raphson

Relaxation factor of calculation step :	2,00
Maximum number of relaxations of calculation step :	2
Min. number of iterations for one calc. step :	1

Line search

Solution method :	iterate no
Line search limit - minimum :	0,100
Line search limit - maximum :	1,000

Results (Construction stage 7)

Stress analysis was successfully completed.
Analysis settings : standard
Attained loading = 100,00 %

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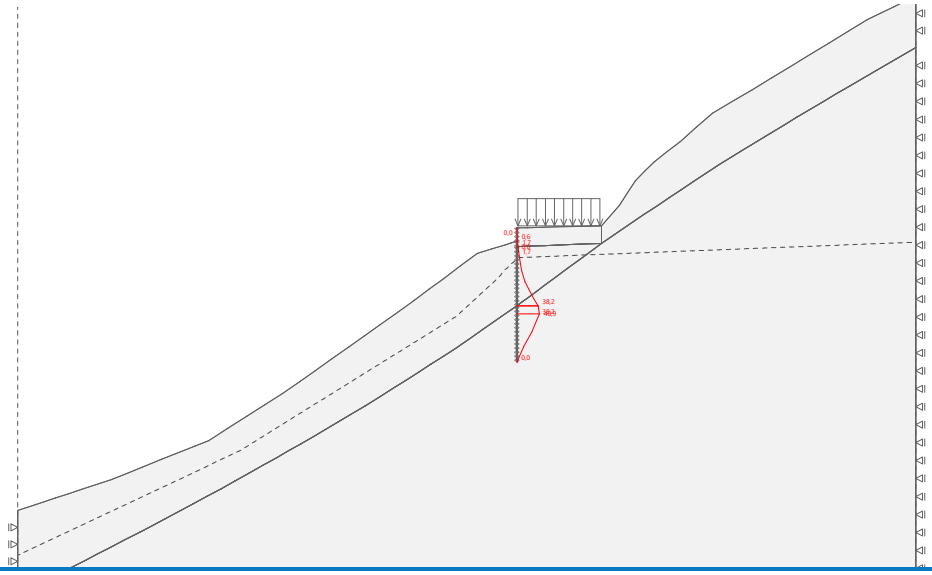
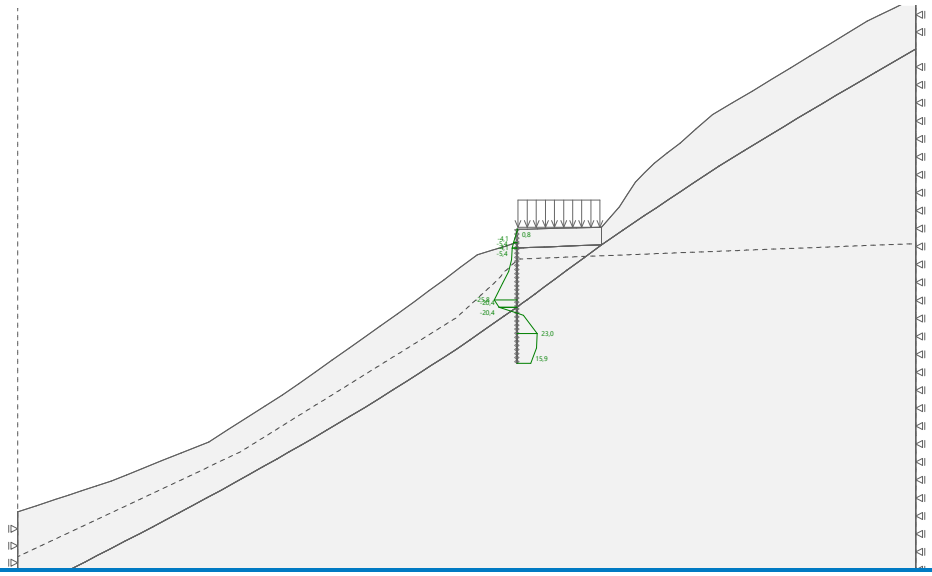
Name : Analysis	Stage : 7

M [kNm/m]



Name : Analysis	Stage : 7

Q [kN/m]



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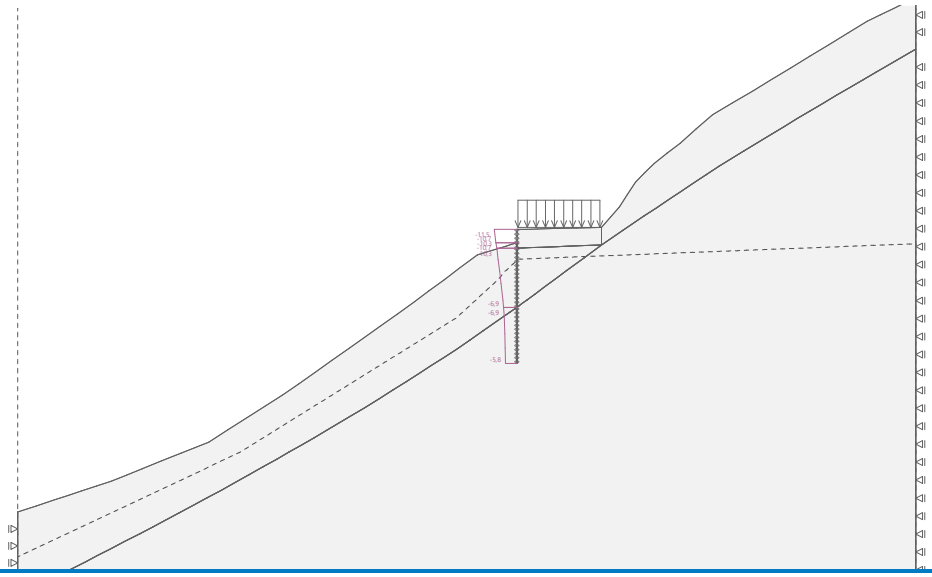
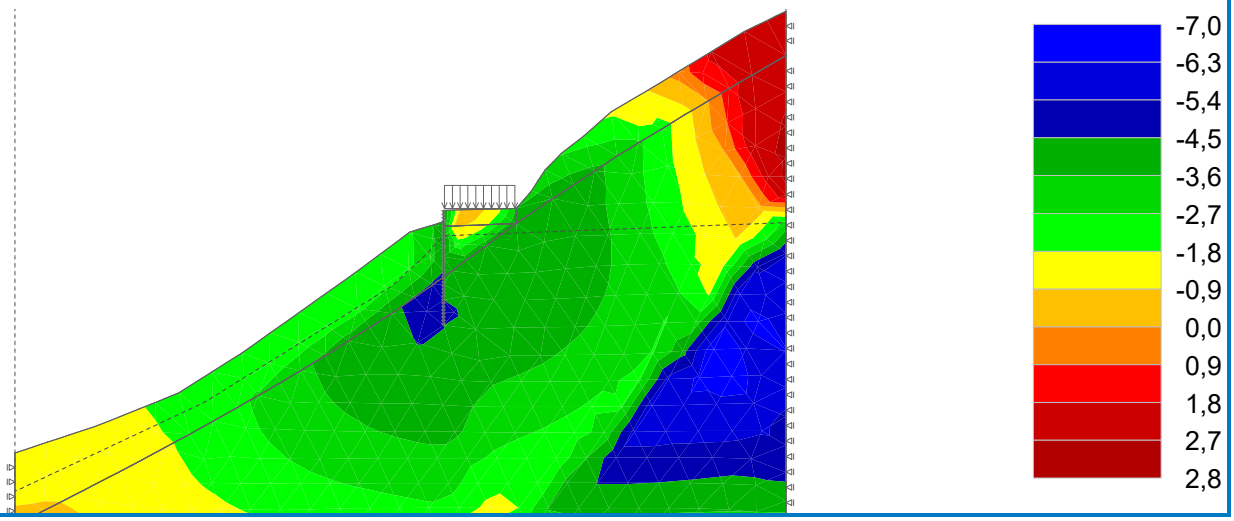
Name : Analysis	Stage : 7

D [mm]



Name : Analysis	Stage : 7

Results : overall; variable : Displacement d_z; range : <-7,0; 2,8> mm



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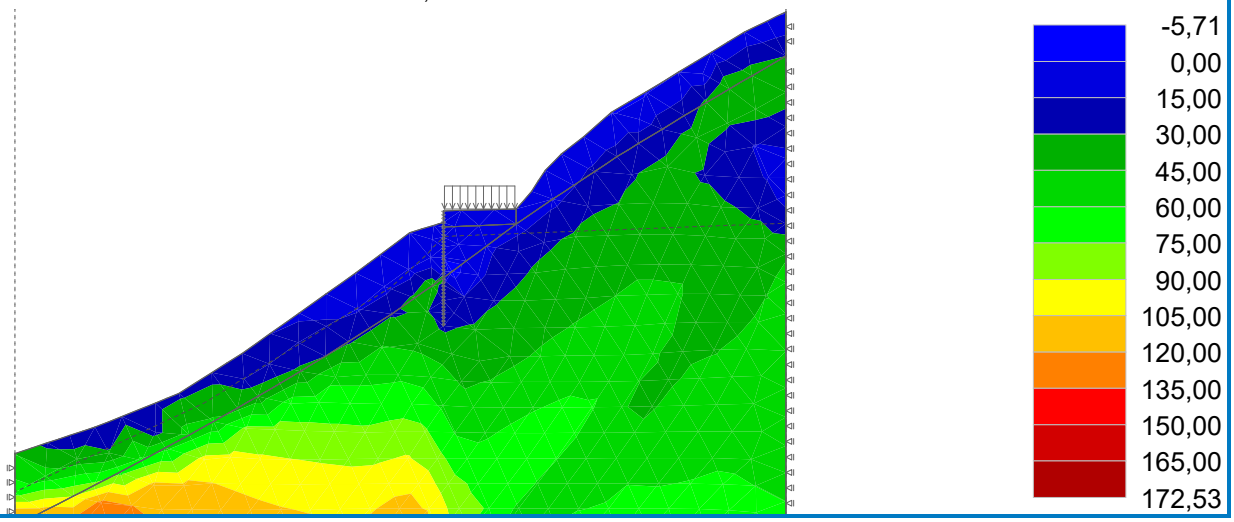
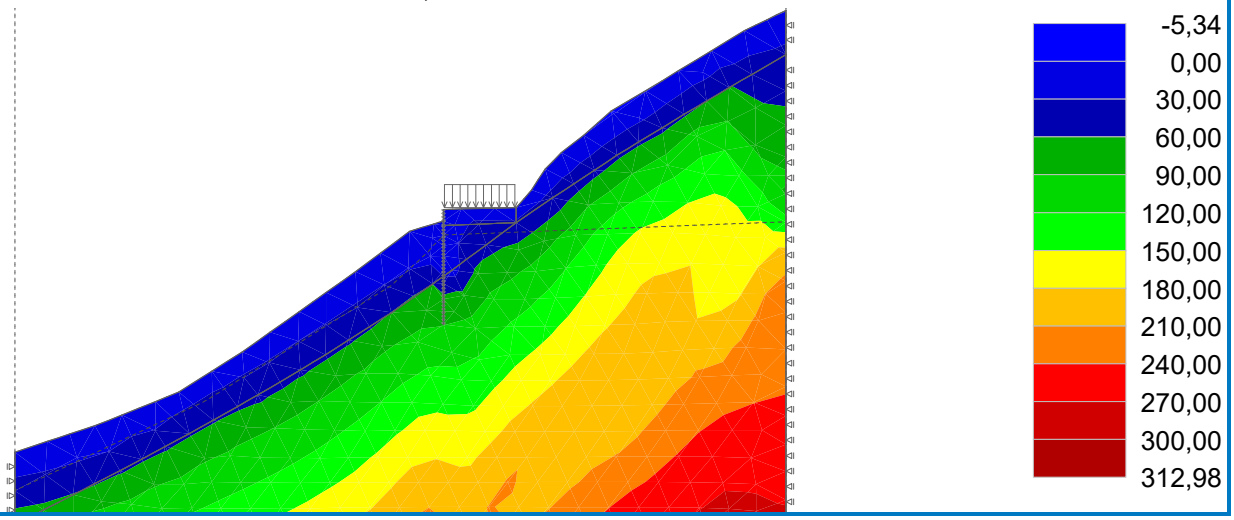
Name : Analysis	Stage : 7

Results : overall; variable : Effective stress $\sigma_{x,\,eff}$; range : <-5,71; 172,53> kPa



Name : Analysis	Stage : 7

Results : overall; variable : Effective stress $\sigma_{z,\,eff}$; range : <-5,34; 312,98> kPa



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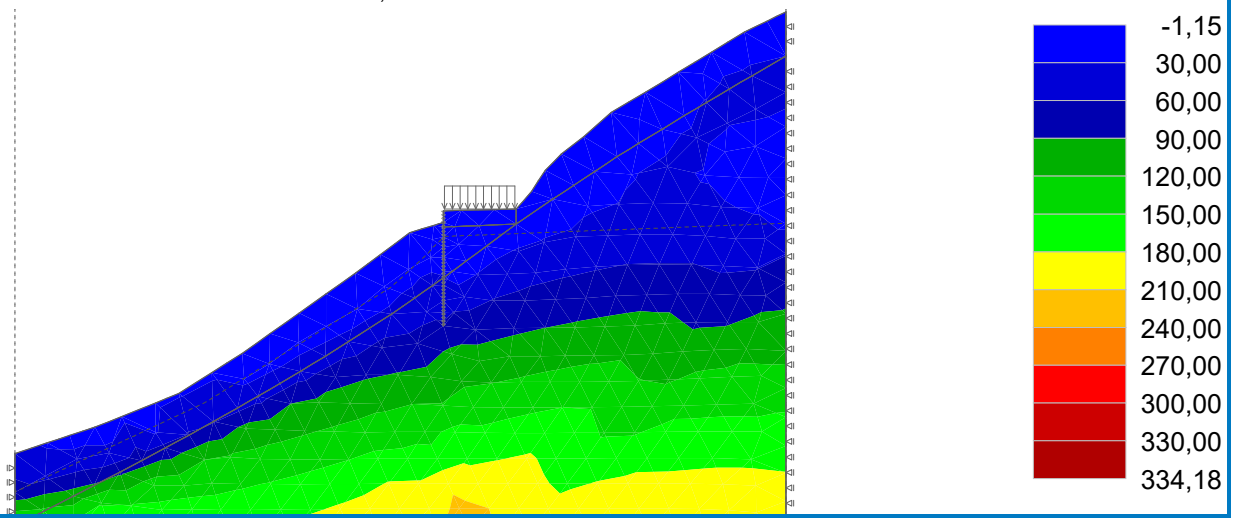
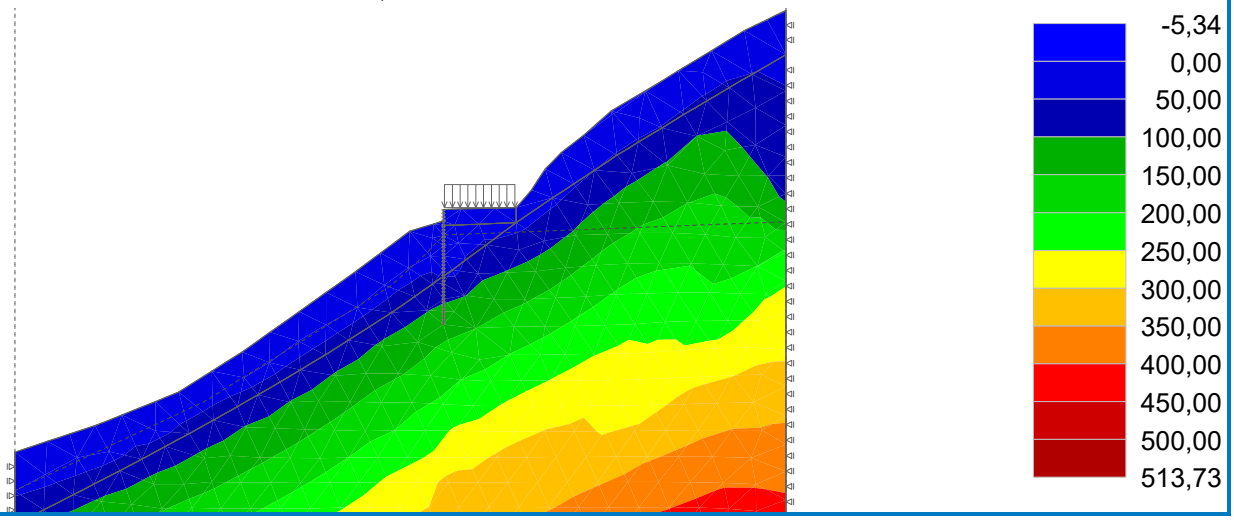
Name : Analysis	Stage : 7

Results : overall; variable : Total stress $\sigma_{x,\,tot}$; range : <-1,15; 334,18> kPa



Name : Analysis	Stage : 7

Results : overall; variable : Total stress $\sigma_{z,\,tot}$; range : <-5,34; 513,73> kPa



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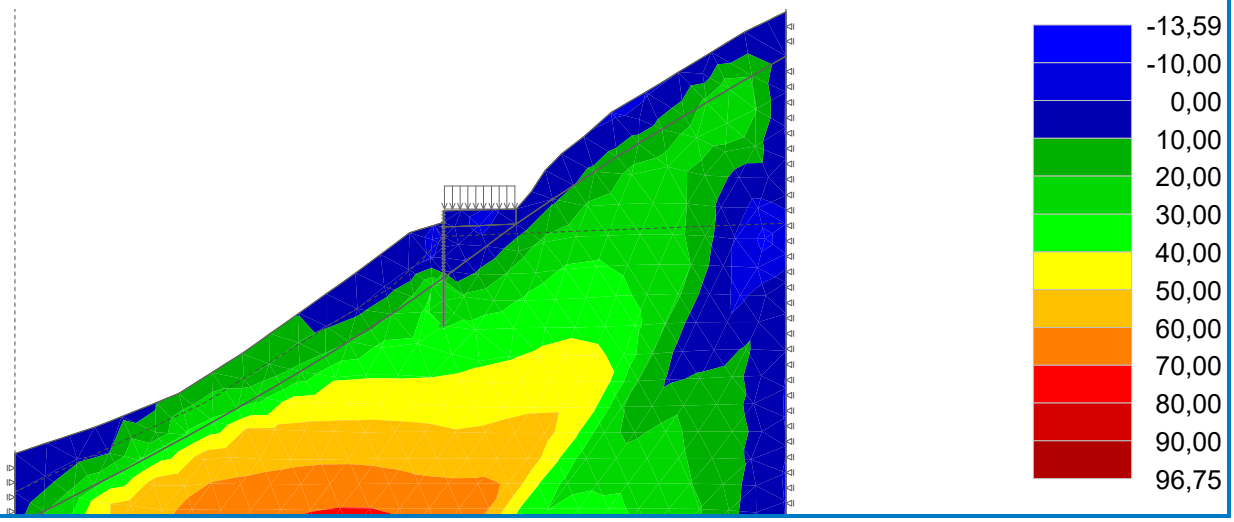
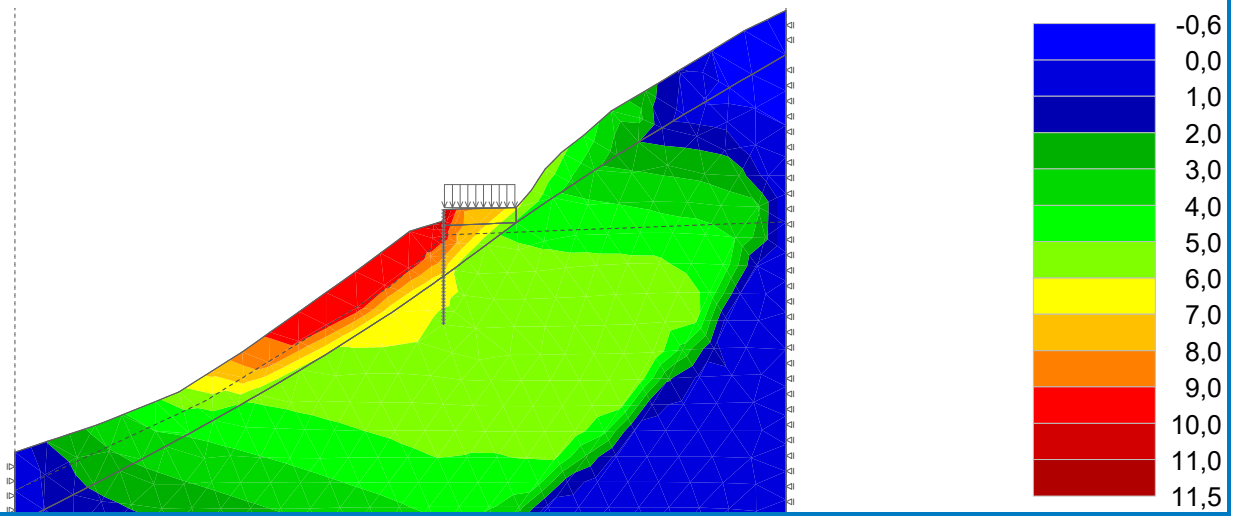
Name : Analysis	Stage : 7

Results : overall; variable : Shear stress τ_{xz}; range : <-13,59; 96,75> kPa



Name : Analysis	Stage : 7

Results : overall; variable : Displacement d_x; range : <-0,6; 11,5> mm



Extremes

Displacements (extremes)

Variable	Location		Min	Location		Max
	x [m]	z [m]		x [m]	z [m]	
Displacements x [mm]	35,58	21,80	-0,6	21,35	15,73	11,5
Displacements z [mm]	34,82	8,81	-7,0	38,41	17,42	2,8

Stress (extremes)

Variable	Location		Min	Location		Max
	x [m]	z [m]		x [m]	z [m]	
Total stress $\sigma_{z,\,tot}$ [kPa]	29,71	20,64	-5,34	38,41	-4,97	513,73
Effective stress $\sigma_{z,\,eff}$ [kPa]	29,71	20,64	-5,34	38,41	-4,97	312,98
Total stress $\sigma_{x,\,tot}$ [kPa]	31,41	21,64	-1,15	38,41	-4,97	334,18

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Variable	Location x [m]	Location z [m]	Min	Location x [m]	Location z [m]	Max
Effective stress $\sigma_{x,\,eff}$ [kPa]	21,77	12,71	-5,71	0,00	-1,23	172,53
Shear stress τ_{xz} [kPa]	37,36	14,35	-13,59	14,77	-4,97	96,75

Strain (extremes)

Variable	Location x [m]	Location z [m]	Min	Location x [m]	Location z [m]	Max
Equivalent deviatoric strain E_d [%]	38,41	25,64	0,01	21,35	15,73	2,46
Plastic equivalent deviatoric strain $E_{d,\,pl}$ [%]	38,41	21,64	0,00	21,35	15,73	2,43

Mobilization degree (extremes)

Variable	Location x [m]	Location z [m]	Min	Location x [m]	Location z [m]	Max
Mobilized shear strength [%]	37,46	25,18	14,82	38,41	8,75	100,35

Pore pressures (extremes)

Variable	Location x [m]	Location z [m]	Max
Total pore pressure u_{tot} [kPa]	38,41	-4,97	200,75

Distributions on beams (extremes)

Number	Coordinates x [m]	Coordinates z [m]	D [mm]	N [kN/m]	M [kNm/m]	Q [kN/m]
1	21,35	15,73	**-11,5**	**1,1**	**0,0**	**0,8**
	21,35	15,16	**-10,7**	**-8,4**	**0,6**	**-4,1**
2	21,35	15,16	**-10,7**	**-8,4**	**0,6**	**-4,1**
	21,35	14,93	**-10,3**	**-8,5**	**1,7**	**-5,4**
3	21,35	14,93	**-10,3**	**-8,5**	**1,7**	**-5,4**
	21,35	12,71	-7,2	**-52,5**	30,4	**-25,8**
	21,35	12,40	**-6,9**	-50,8	**38,2**	-20,4
4	21,35	12,40	**-6,9**	**-50,8**	38,2	**-20,4**
	21,35	12,05	-6,6	-30,6	**40,9**	7,4
	21,35	11,27	-6,1	-12,1	26,9	**23,0**
	21,35	10,00	**-5,8**	**-6,7**	**0,0**	15,9

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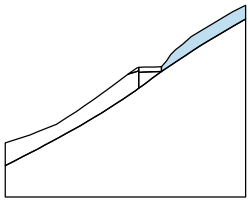
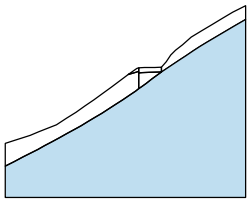
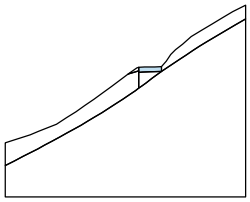
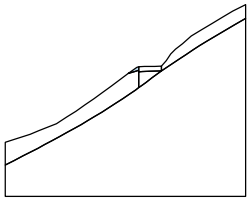
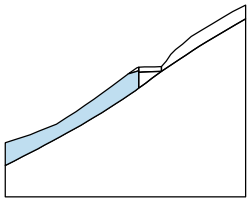
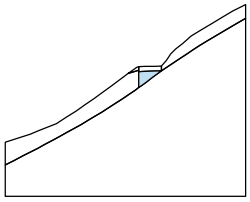
Input data (Construction stage 8)

Assignment and activation

Number	Region	Active / inactive	Assigned soil
1		Active	Peščena glina
2		Active	Lapor
3		Active	Tampon
4		Inactive	
5		Active	Peščena glina
6		Active	Peščena glina

Beams

Number	Beam		Location	Support [m]		Include self weight	Fictitious beam	Cross-section	Material	Contacts	
	new	modified		Start pt.	End pt.					left	right
1	No	No	Mesh line No. 19	⊢	⊢	Yes	No	without modification	without modification	(not input)	(not input)

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Number	Beam		Location	Support [m]		Include self weight	Fictitious beam	Cross-section	Material	Contacts	
	new	modified		Start pt.	End pt.					left	right
2	No	No	Mesh line No. 20	⊢	⊢	Yes	No	without modification	without modification	(not input)	(not input)
3	No	No	Mesh line No. 25	⊢	⊢	Yes	No	without modification	without modification	(not input)	(not input)
4	No	No	Mesh line No. 44	⊢	⊢	Yes	No	without modification	without modification	(not input)	(not input)

Number	Cross-section		Material	
	I_y [m⁴/m]	A [m²/m]	E [MPa]	G [MPa]
1	2,05E-03	1,31E-01	33000,00	13750,00
2	2,05E-03	1,31E-01	33000,00	13750,00
3	2,05E-03	1,31E-01	33000,00	13750,00
4	2,05E-03	1,31E-01	33000,00	13750,00

Line supports

Number	Line support		Location	Support	
	new	modified		Direction X	Direction Z
A1	Yes		Mesh line No. 41	fixed	free
A2	Yes		Mesh line No. 33	fixed	free
A3	Yes		Mesh line No. 43	fixed	free
A4	Yes		Mesh line No. 6	fixed	free
A5	Yes		Mesh line No. 42	fixed	fixed
A1 up to A5 - automatically generated line supports along model edges					

Surcharge

Number	Surcharge		Type	Location / Point 1	Origin / Point 1	Length / Point 2	Width / Point 2	Slope	Magnitude		
	new	change		z [m] / x_1 [m]	x [m] / z_1 [m]	l [m] / x_2 [m]	b [m] / z_2 [m]	α [°]	q, q_1, f, F	q_2	unit
1	No	No	strip	on terrain	x = 21,40	l = 3,50		0,00	16,00		kN/m²

Surcharges

Number	Name
1	Promet

Water

Water type : GWT

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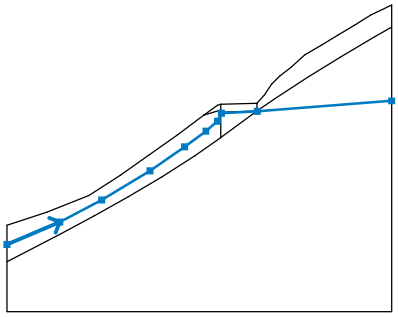
Number	GWT location	Coordinates of GWT points [m]					
		x	z	x	z	x	z
1099981523		0,00	1,73	5,28	3,97	9,46	6,18
		14,29	9,08	17,73	11,49	19,86	13,05
		21,01	14,03	21,40	14,83	24,99	15,02
		38,41	16,07				

Analysis settings

Stress

Method :	Newton - Raphson
Stiffness matrix change :	after each iteration
Max. number of iterations for one calc. step :	100
Initial calculation step :	0,1000
Displacement error :	0,0100
Imbalanced forces error :	0,0100
Energy error :	0,0100
Respect material interfaces :	no

Plasticity

Return mapping error :	0,00100
Max. number of iterations for one plast. step :	20

Newton - Raphson

Relaxation factor of calculation step :	2,00
Maximum number of relaxations of calculation step :	2
Min. number of iterations for one calc. step :	1

Line search

Solution method :	iterate no
Line search limit - minimum :	0,100
Line search limit - maximum :	1,000

Results (Construction stage 8)

Stress analysis was successfully completed.
Analysis settings : standard
Attained loading = 100,00 %

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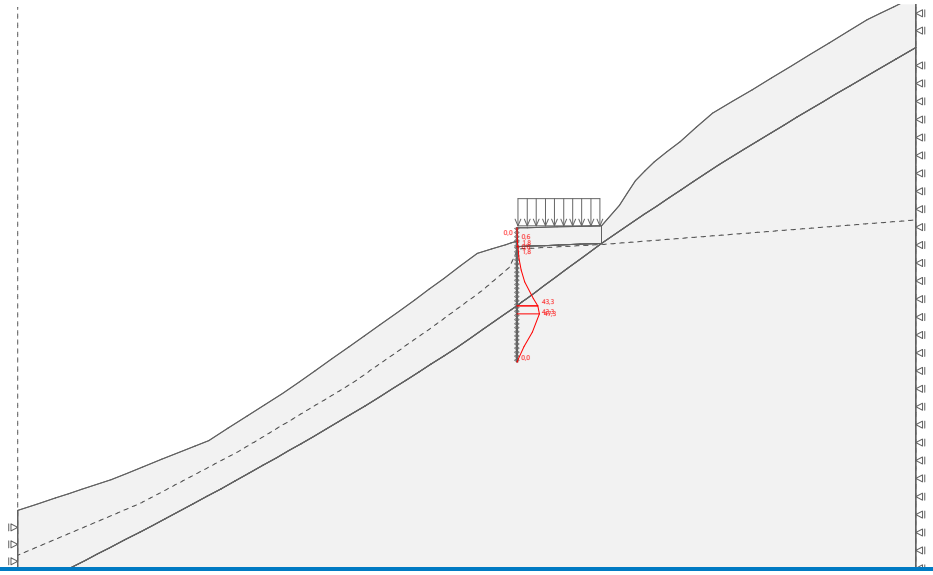
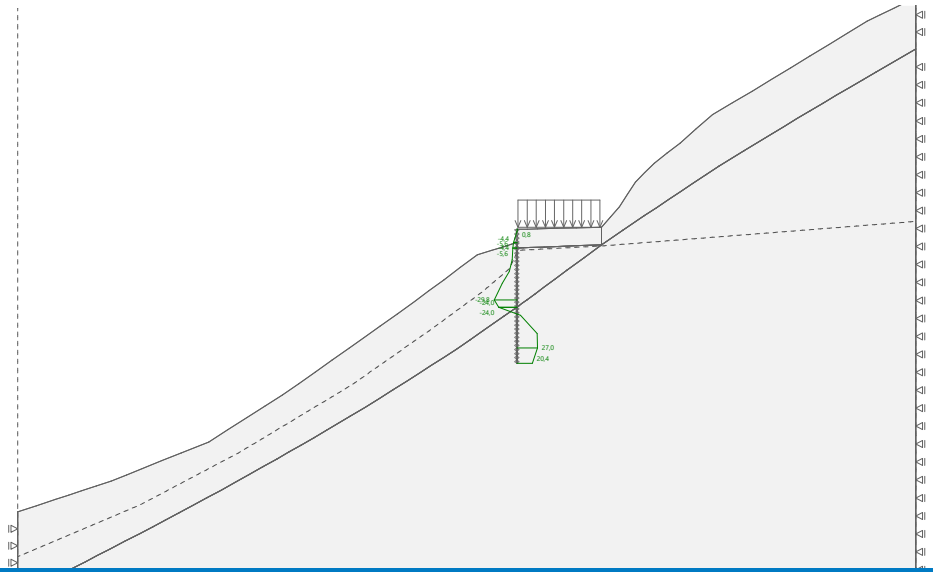
Name : Analysis	Stage : 8

M [kNm/m]



Name : Analysis	Stage : 8

Q [kN/m]



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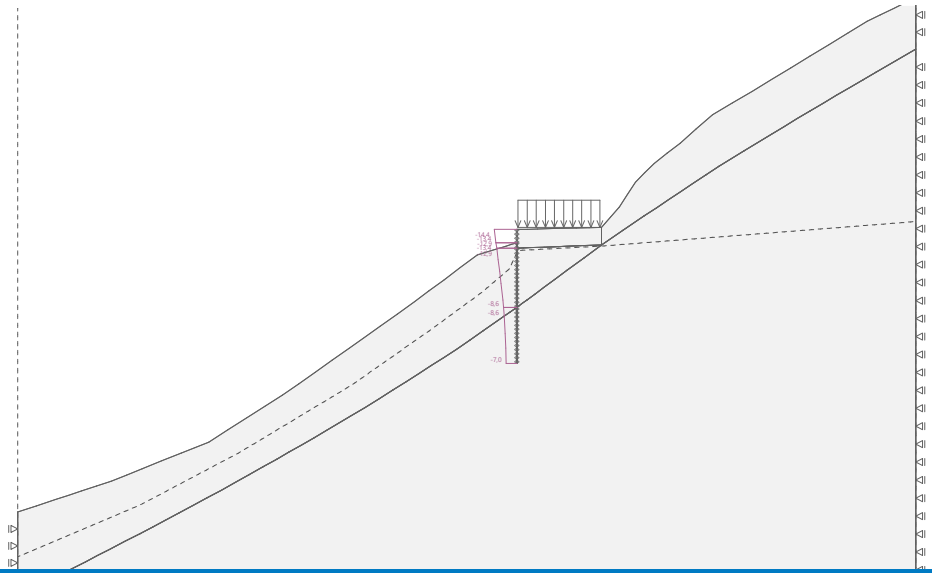
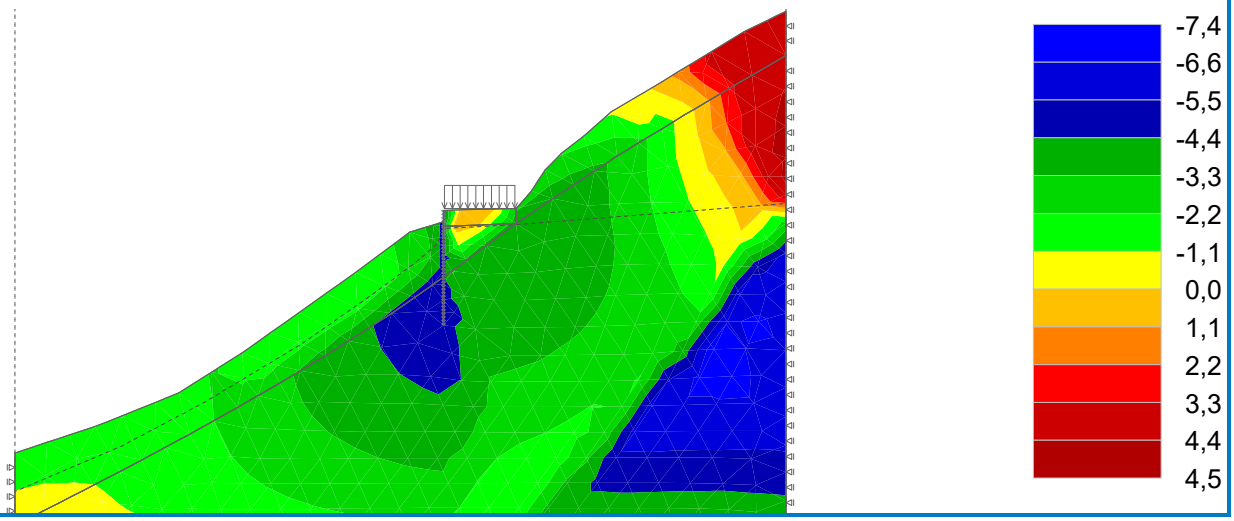
Name : Analysis	Stage : 8

D [mm]



Name : Analysis	Stage : 8

Results : overall; variable : Displacement d $_z$; range : <-7,4; 4,5> mm



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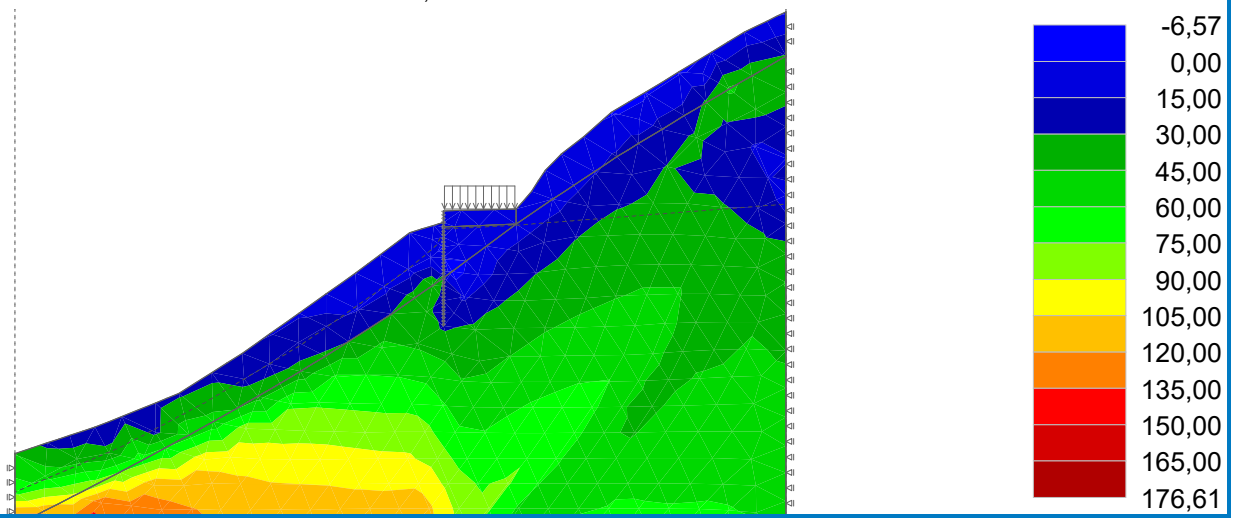
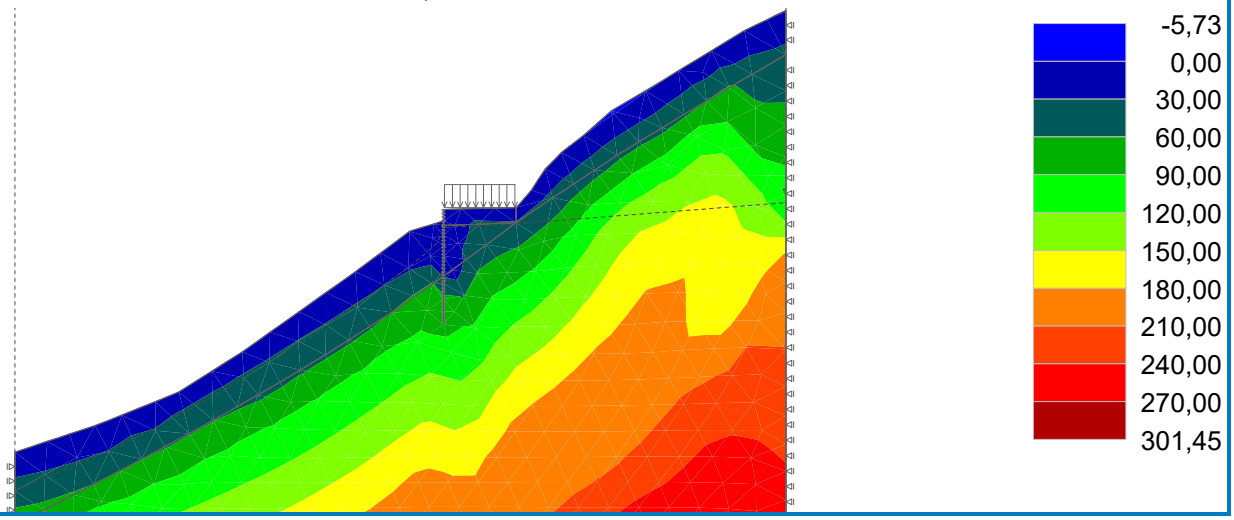
Name : Analysis	Stage : 8

Results : overall; variable : Effective stress $\sigma_{x,\,eff}$; range : <-6,57; 176,61> kPa



Name : Analysis	Stage : 8

Results : overall; variable : Effective stress $\sigma_{z,\,eff}$; range : <-5,73; 301,45> kPa



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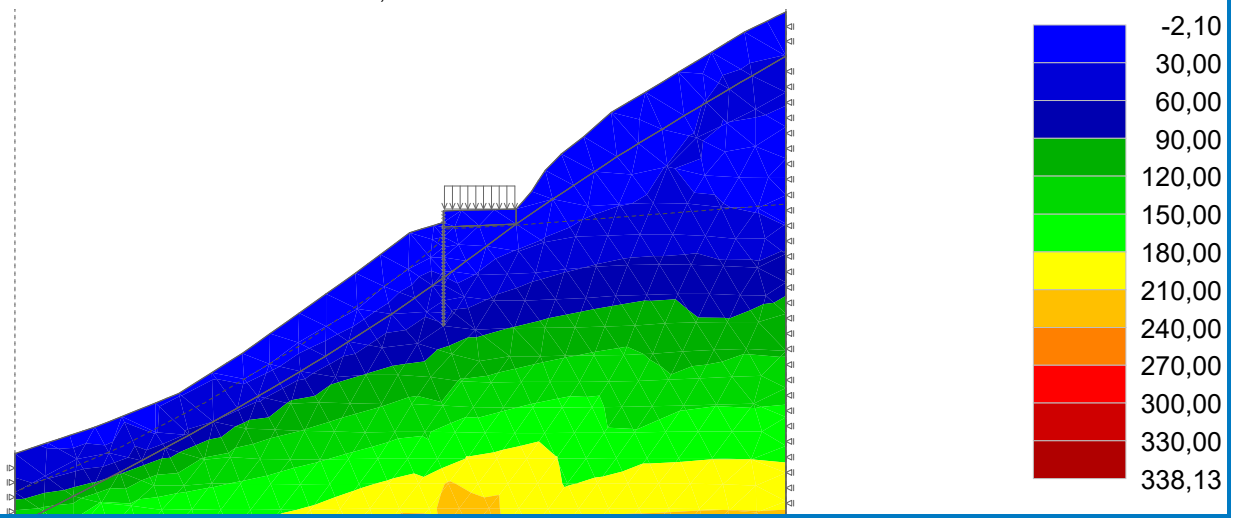
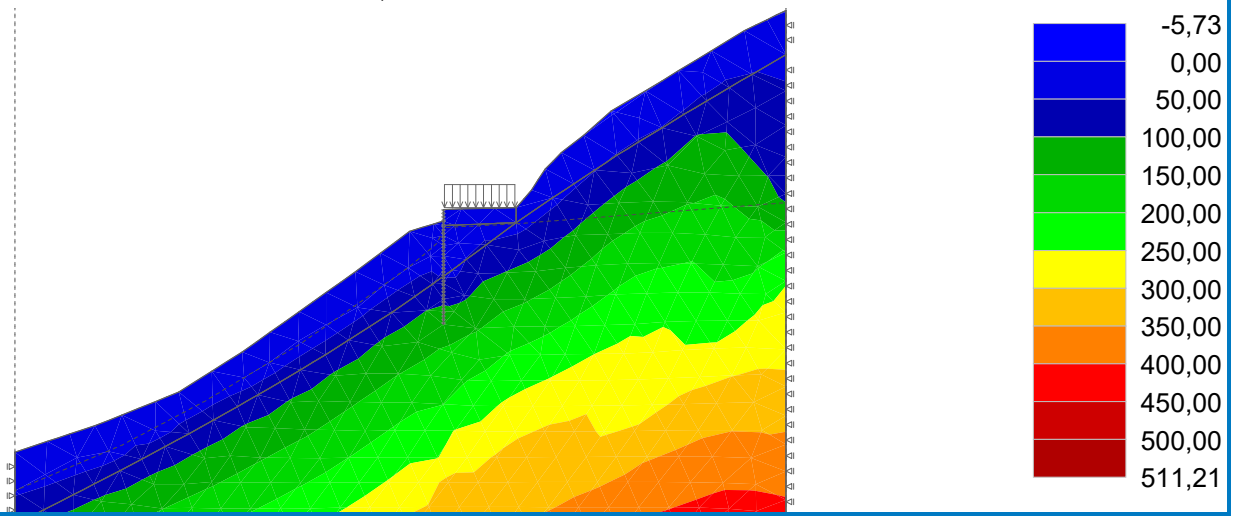
Name : Analysis	Stage : 8

Results : overall; variable : Total stress $\sigma_{x,\,tot}$; range : <-2,10; 338,13> kPa



Name : Analysis	Stage : 8

Results : overall; variable : Total stress $\sigma_{z,\,tot}$; range : <-5,73; 511,21> kPa



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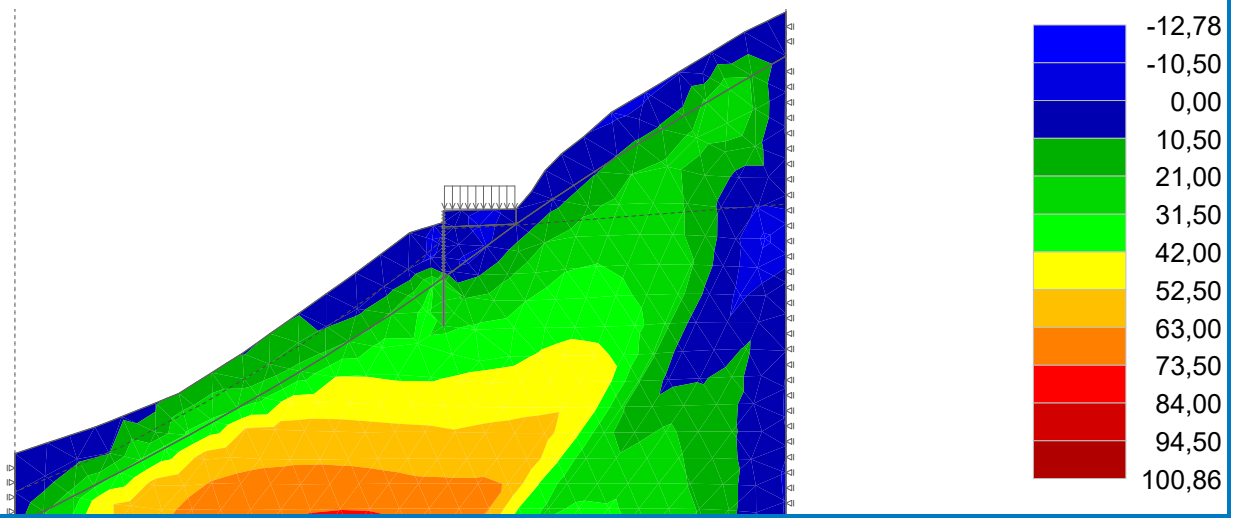
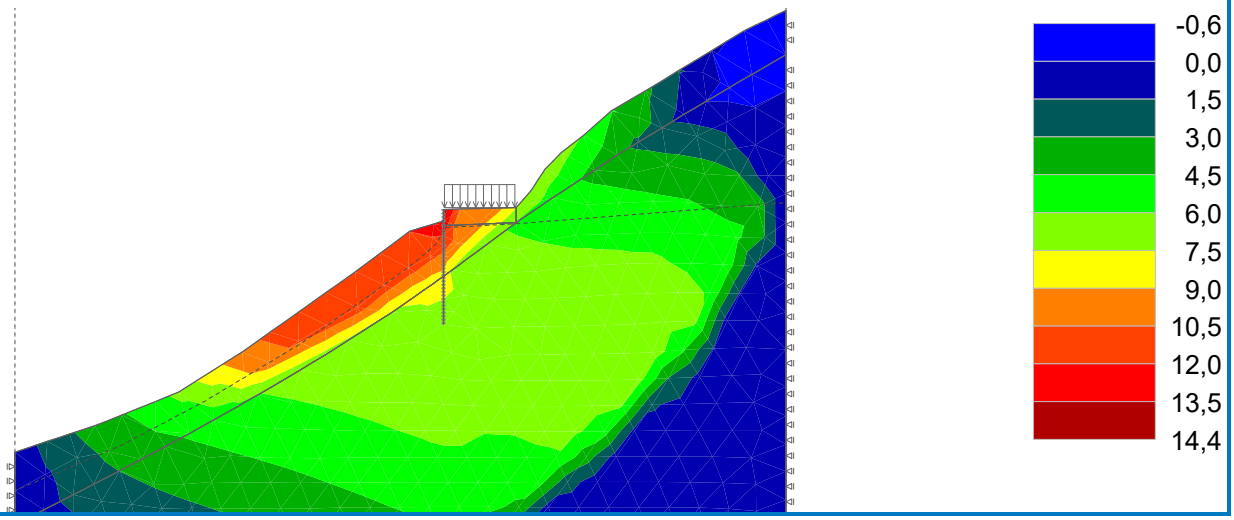
Name : Analysis	Stage : 8

Results : overall; variable : Shear stress τ_{xz}; range : <-12,78; 100,86> kPa



Name : Analysis	Stage : 8

Results : overall; variable : Displacement d_x; range : <-0,6; 14,4> mm



Extremes

Displacements (extremes)

Variable	Location		Min	Location		Max
	x [m]	z [m]		x [m]	z [m]	
Displacements x [mm]	35,58	21,80	-0,6	21,35	15,73	14,4
Displacements z [mm]	34,82	8,81	-7,4	38,41	17,42	4,5

Stress (extremes)

Variable	Location		Min	Location		Max
	x [m]	z [m]		x [m]	z [m]	
Total stress $\sigma_{z, tot}$ [kPa]	29,71	20,64	-5,73	38,41	-4,97	511,21
Effective stress $\sigma_{z, eff}$ [kPa]	29,71	20,64	-5,73	38,41	-4,97	301,45
Total stress $\sigma_{x, tot}$ [kPa]	31,41	21,64	-2,10	38,41	-4,97	338,13

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Variable	Location x [m]	Location z [m]	Min	Location x [m]	Location z [m]	Max
Effective stress $\sigma_{x,\,eff}$ [kPa]	21,77	12,71	-6,57	0,00	-1,23	176,61
Shear stress τ_{xz} [kPa]	37,36	14,35	-12,78	14,77	-4,97	100,86

Strain (extremes)

Variable	Location x [m]	Location z [m]	Min	Location x [m]	Location z [m]	Max
Equivalent deviatoric strain E_d [%]	38,41	25,64	0,01	21,35	15,73	3,22
Plastic equivalent deviatoric strain $E_{d,\,pl}$ [%]	38,41	21,64	0,00	21,35	15,73	3,18

Mobilization degree (extremes)

Variable	Location x [m]	Location z [m]	Min	Location x [m]	Location z [m]	Max
Mobilized shear strength [%]	37,46	25,18	14,49	38,41	8,75	100,16

Pore pressures (extremes)

Variable	Location x [m]	Location z [m]	Max
Total pore pressure u_{tot} [kPa]	38,41	-4,97	209,76

Distributions on beams (extremes)

Number	Coordinates x [m]	Coordinates z [m]	D [mm]	N [kN/m]	M [kNm/m]	Q [kN/m]
1	21,35	15,73	**-14,4**	**0,6**	**0,0**	**0,8**
	21,35	15,16	**-13,4**	**-8,4**	**0,6**	**-4,4**
2	21,35	15,16	**-13,4**	**-8,4**	**0,6**	**-4,4**
	21,35	14,93	**-12,9**	**-9,3**	**1,8**	**-5,6**
3	21,35	14,93	**-12,9**	**-9,3**	**1,8**	**-5,6**
	21,35	12,71	-9,0	**-55,3**	34,4	**-29,8**
	21,35	12,40	**-8,6**	-52,5	**43,3**	-24,0
4	21,35	12,40	**-8,6**	**-52,5**	43,3	**-24,0**
	21,35	12,05	-8,1	-33,8	**47,3**	4,9
	21,35	10,66	-7,2	-5,6	15,2	**27,0**
	21,35	10,00	**-7,0**	**-5,2**	**0,0**	20,4

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T.19.1. Dimenzioniranje pilotov

Project: Dimenzioniranje pilotov

Project number: 26 9 1311

Author: Tomaž Mayer d.i.g. (UN)

IDEA StatiCa®
Calculate yesterday's estimates

Table of contents

1 Project data
2 Sectional checks
2.1 Section S 1
3 List of design members
4 List of reinforced sections
5 List of used materials

1 Project data

Project title	Dimenzioniranje pilotov
Project number	26 9 1311
Description	Plaz Gruškovec
Author	Tomaž Mayer d.i.g. (UN)
Date of creation	13. 11. 2026
Version	25.1.5.1431

National code

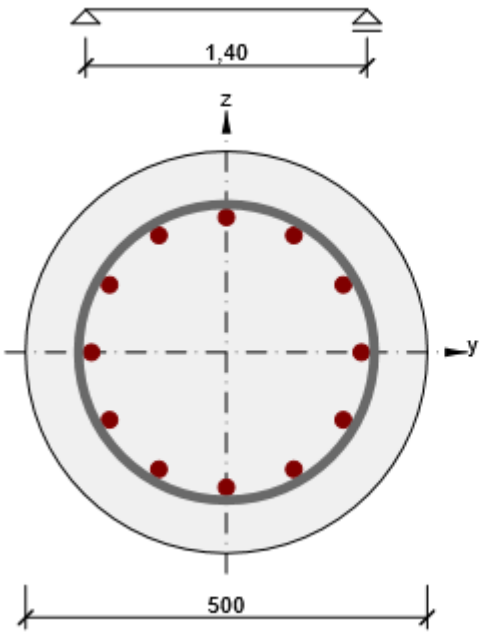
National code	EN 1992-1-1:2014-12
Design working life	50 years

2 Sectional checks

2.1 Section S 1

2.1.1 Extreme S 1 - E 1

Design member	M 1
Reinforced cross-section	R 1



Concrete: C30/37
Age: 28,0 d
Reinforcement: (B 500B)
1ø20 (314mm²), Position 0, 168 mm
2ø20 (628mm²), z = 145 mm
2ø20 (628mm²), z = 84 mm
2ø20 (628mm²), z = 0 mm
2ø20 (628mm²), z = -84 mm
2ø20 (628mm²), z = -145 mm
1ø20 (314mm²), Position 0, -168 mm
Stirrups:
ø12 - 100 mm
Cover:
Uniform cover: 60 mm

2.1.1.1 Load effects - internal forces

Load type	Combination type	N [kN]	V_y [kN]	V_z [kN]	T [kNm]	M_y [kNm]	M_z [kNm]
Total	Fundamental ULS	0,0	0,0	160,0	0,0	120,0	0,0
Total	Characteristic	0,0	0,0	0,0	0,0	75,0	0,0
Total	Quasi-permanent	0,0	0,0	0,0	0,0	75,0	0,0

2.1.1.2 Overall

Governing type of check	N_{Ed} [kN]	$M_{Ed,y}$ [kNm]	$M_{Ed,z}$ [kNm]	V_{Ed} [kN]	T_{Ed} [kNm]	Value [%]	Check
Stress Limitation	0,0	75,0	0,0			95,3	OK

Type of check	N_{Ed} [kN]	$M_{Ed,y}$ [kNm]	$M_{Ed,z}$ [kNm]	V_{Ed} [kN]	T_{Ed} [kNm]	Value [%]	Check
Capacity N-M-M	0,0	120,0	0,0			47,6	OK
Shear	0,0			160,0	0,0	72,4	OK
Torsion					0,0	0,0	OK
Interaction	0,0	120,0	0,0	160,0	0,0	66,9	OK
Stress Limitation	0,0	75,0	0,0			95,3	OK
Crack Width	0,0	75,0	0,0			79,8	OK
Flexural slenderness	0,0	75,0	0,0			12,4	OK

Limit value of the exploitation of the cross-section: 100,0 %

Nonconformity

	Nonconformities
ℹ	Due to the circular shape of stirrups shear resistance of the section was reduced by the factor chi.
⚠	Check of interaction of shear and torsion acc. to 6.3.2 (5) is not satisfactory, therefore it was necessary to check ultimate capacity at interaction of all components of internal forces
⚠	Upper or lower design value of internal forces of one of SLS combinations caused to happen concrete stress higher than concrete tensile strength (section is cracked). Based on code and calculation settings it is assumed that the concrete resists no tension in SLS checks for all combinations of current extreme. The assumptions for SLS checks in other extremes of current section are not influenced.
⚠	The action of concrete in tension is excluded because the cracks appear, see clause 7.1 (2)
ℹ	According EN 1992-1-1 article 7.4.2 check of span/depth is satified. Any other calculation of deflection musn't be done.

2.1.1.3 Capacity N-M-M

Results presented for combination : Fundamental ULS

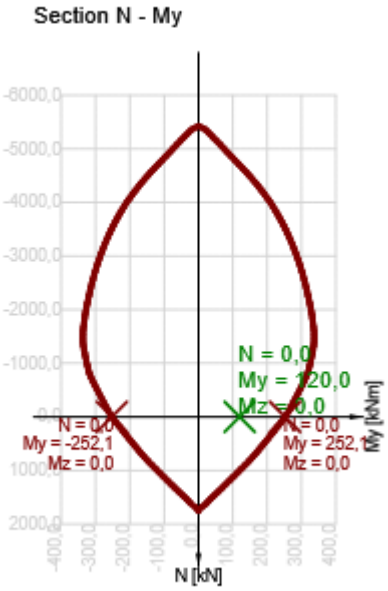
N_{Ed} [kN]	$M_{Ed,y}$ [kNm]	$M_{Ed,z}$ [kNm]	Type	Value [%]	Limit [%]	Check
0,0	120,0	0,0	Nu-Mu-Mu	47,6	100,0	OK

Design resistance of css subjected to bending and axial force

Type	F_{Ed}	F_{Rd1}	F_{Rd2}
N [kN]	0,0	0,0	0,0
M_y [kNm]	120,0	252,1	-252,1
M_z [kNm]	0,0	0,0	0,0

Nonconformity

No nonconformities



Explanation

Symbol	Explanation
N_{Ed}	Design value of the applied axial force caused by permanent and variable external load, and by secondary effects of prestressing
$M_{Ed,y}$	Design value of the applied bending moment around y axis caused by permanent and variable external load, and by secondary effects of prestressing
$M_{Ed,z}$	Design value of the applied bending moment around z axis caused by permanent and variable external load, and by secondary effects of prestressing
Type	Nu-Mu-Mu: Cross-sectional resistance is determined assuming proportional change of all components of acting internal forces (the eccentricity of normal force remains constant) until interaction surface is reached. The change of acting internal forces can be interpreted as the movement along the line connecting the origin of coordinate system (0,0,0) and the point of acting internal forces (NEd, MEdy, MEdz). Two points of intersection of the connecting line and interaction surface, which can be found, represent two sets of forces of resistance. Three resistance forces are determined in each point of intersection by the program: normal force capacity NRd, and capacities in flexure MRdy and MRdz
Value	Utilization of the cross-section or its component (e.g. reinforcement bar) related to the limit value
Limit	Limit value of the exploitation of the cross-section
Check	Result of the check
F_{Ed}	The applied design force caused by external load (without effects of prestressing)
F_{Rd1}	First set of forces of resistance resulting from first point of intersection reached at interaction surface
F_{Rd2}	Second set of forces of resistance resulting from second point of intersection reached at interaction surface

2.1.1.4 Shear

Results presented for combination : Fundamental ULS

V_{Ed} [kN]	N_{Ed} [kN]	V_{Rd} [kN]	Check zone	Clause	Value [%]	Limit [%]	Check
160,0	0,0	221,0	without reduction	6.2.3(3)	72,4	100,0	OK

Design and resistance shear forces

V_{Ed} [kN]	$V_{Rd,c}$ [kN]	$V_{Rd,max}$ [kN]	$V_{Rd,r}$ [kN]	$V_{Rd,s}$ [kN]	V_{Rd} [kN]
160,0	105,5	613,8	680,2	221,0	221,0

Input values and intermediate results of shear design

n_c	a_{sw} [mm^2/m]	A_{sl} [mm^2]	b_w [mm]	d [mm]	z [mm]	θ [°]	α [°]	σ^*_{cp} [MPa]	α_{cw} [-]	χ [-]
2	2262	2827	356	362	287	45,0	90,0	0,0	1,00	0,85

$C_{Rd,c}$ [-]	k [-]	k_1 [-]	ρ_l [-]	σ_{cp} [MPa]	σ_{wd} [MPa]	v_{min} [MPa]	v [-]	v_1 [-]
0,12	1,74	0,15	0,02	0,0	289,6	0,4	0,53	0,60

Nonconformity

	Nonconformities
ⓘ	Due to the circular shape of stirrups shear resistance of the section was reduced by the factor chi.

Explanation

Symbol	Explanation
V_{Ed}	Design value of the applied shear force (with effect of prestressing)
N_{Ed}	Design value of the applied axial force (with effect of prestressing)
V_{Rd}	Final value of the design shear resistance
Check zone	Type of zone in which check is performed
Clause	The number of clause (type of method) used for shear check
Value	Utilization of the cross-section or its component (e.g. reinforcement bar) related to the limit value
Limit	Limit value of the exploitation of the cross-section
Check	Result of the check
$V_{Rd,c}$	The design shear resistance of the member without shear reinforcement
$V_{Rd,max}$	The design value of the maximum shear force which can be sustained by the member, limited by crushing of the compression struts
$V_{Rd,r}$	Limit value of design shear force considered without reduction by Beta factor acc. (6.2.2(6))
$V_{Rd,s}$	Design value of the shear force which can be sustained by the yielding of shear reinforcement
n_c	Number of branches of shear reinforcement
a_{sw}	The cross-sectional area of the shear reinforcement per unit length
A_{sl}	The area of the tensile longitudinal reinforcement
b_w	The width of the cross-section effective for shear.
d	Effective depth of the cross-section
z	The inner lever arm
θ	The angle between the concrete compression strut and the beam axis perpendicular to the shear force
α	The angle between shear reinforcement and the beam axis perpendicular to the shear force
σ^*_{cp}	The mean compressive stress (measured positive) in the concrete due to the design axial force taking account of the reinforcement. σcp* serves for determining αcw (see. EN 1992-1-1, chap. 6.2.3 (3))
α_{cw}	Coefficient taking account of the state of the stress in the compression chord
χ	Reduction factor circular stirrups
$C_{Rd,c}$	Coefficient for calculation the design shear resistance of the member without shear reinforcement
k	Coefficient for calculation the design shear resistance of the member without shear reinforcement
k_1	Coefficient for calculation the design shear resistance of the member without shear reinforcement
ρ_l	Reinforcement ratio of the tensile longitudinal reinforcement
σ_{cp}	The mean compressive stress (measured positive) in the concrete cross-section due to the design axial force. σcp is limited to value 0,2·fcd (EN 1992-1-1 chap. 6.2.2 (1))
σ_{wd}	Design stress of the shear reinforcement, see note 2 of clause 6.2.3 (3)
v_{min}	Coefficient for calculation the design shear resistance of the member without shear reinforcement
v	Concrete strength reduction factor for the calculation of shear resistance
v_1	Concrete strength reduction factor for the calculation of shear resistance

2.1.1.5 Torsion

Results presented for combination : Fundamental ULS

T_{Ed} [kNm]	T_{Rd} [kNm]	Value [%]	Limit [%]	Check
0,0	87,2	0,0	100,0	OK

Design and resistance torsional moments

T_{Ed} [kNm]	$T_{Rd,c}$ [kNm]	$T_{Rd,max}$ [kNm]	$T_{Rd,s}$ [kNm]	$T_{Rd,sl}$ [kNm]	T_{Rd} [kNm]
0,0	39,3	153,4	87,2	275,1	87,2

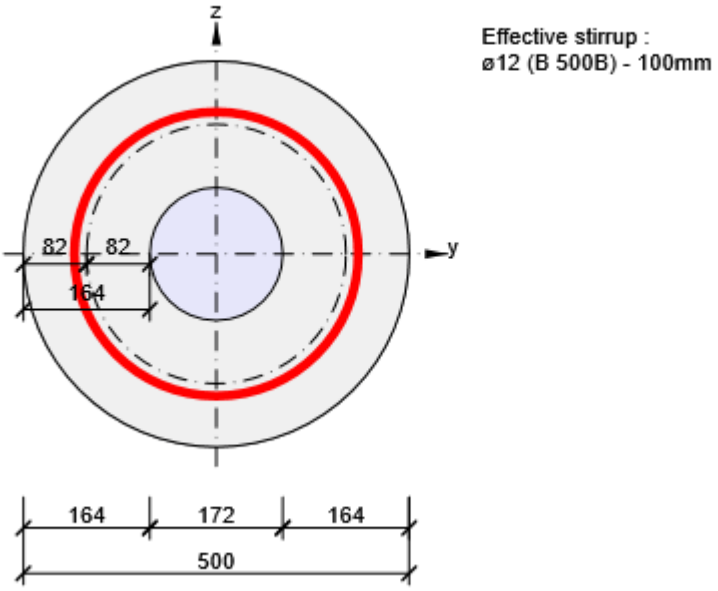
Input values and intermediate results of torsion design

A_k [mm^2]	u_k [mm]	t_{eff} [mm]	a_{sw} [mm^2/m]	A_{sl} [mm^2]	A_{sp} [mm^2]	θ [°]
88638	1056	164	1131	3770	0	45,0

Nonconformity

No nonconformities

Equivalent thin-walled section for torsion check



Effective stirrup :
ø12 (B 500B) - 100mm

Explanation

Symbol	Explanation
T_{Ed}	Design value of the applied torsional moment (with effect of prestressing)
T_{Rd}	Governing design torsional resistance moment
Value	Utilization of the cross-section or its component (e.g. reinforcement bar) related to the limit value
Limit	Limit value of the exploitation of the cross-section
Check	Result of the check
$T_{Rd,c}$	The design torsional cracking moment
$T_{Rd,max}$	The design torsional resistance moment
$T_{Rd,s}$	The design value of the torsional moment, which can be sustained by the yielding of torsion reinforcement
$T_{Rd,sl}$	The design value of the torsional moment, which can be sustained by the yielding of longitudal reinforcement
A_k	The area enclosed by the centre-lines of the connecting walls, including inner hollow areas
u_k	The perimeter of the area Ak
t_{eff}	The effective wall thickness
a_{sw}	Cross-sectional area of the shear reinforcement per unit length used for torsion check
A_{sl}	Area of longitudinal reinforcement inside of the stirrup, which is effective for torsion resistance
A_{sp}	Area of prestressing reinforcement inside of the stirrup, which is effective for torsion resistance
θ	The angle between the concrete compression strut and the beam axis perpendicular to the shear force

2.1.1.6 Interaction

Results presented for combination : Fundamental ULS

N_{Ed} [kN]	M_{Edy} [kNm]	M_{Edz} [kNm]	V_{Ed} [kN]	T_{Ed} [kNm]	Value V+T [%]	Value V+T+M [%]	Value [%]	Limit [%]	Check
0,0	120,0	0,0	160,0	0,0	66,6	66,9	66,9	100,0	OK

Interaction check of shear and torsion (concrete)

$V_{Rd,c}$ [kN]	$T_{Rd,c}$ [kNm]	$V_{Rd,max}$ [kN]	$T_{Rd,max}$ [kNm]	Eq. 6.31 [%]	Eq. 6.29 [%]	Value [%]	Limit [%]	Check
105,5	39,3	613,8	153,4	151,6	26,1	26,1	100,0	OK

Interaction check of shear and torsion (shear reinforcement)

a_{sw} [mm^2/m]	F_{sw} [kN]	$F_{sw,lim}$ [kN]	Value [%]	Limit [%]	Check
1131	327,6	491,7	66,6	100,0	OK

Interaction check of shear, torsion, bending and normal force

F_b [kN]	$\Delta F_{td,s}$ [kN]	$\Delta F_{td,t}$ [kN]	$\Delta\varepsilon_s$ [1e-4]	$\Delta\varepsilon_t$ [1e-4]	Extreme in bar	Value [%]	Limit [%]	Check
350,7	160,0	0,0	1,9	0,0	10	66,9	100,0	OK

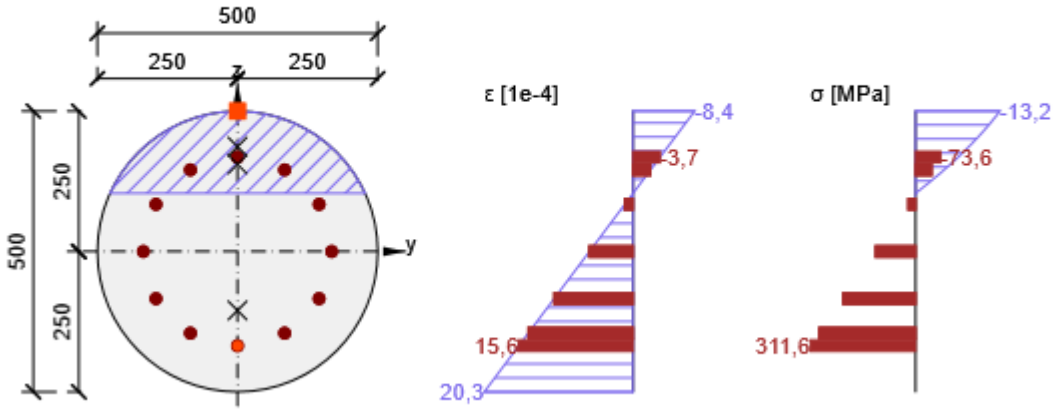
Detailed check of reinforcement

Bar	y_i [mm]	z_i [mm]	$\Delta\varepsilon_{st}$ [1e-4]	ε [1e-4]	ε_{lim} [1e-4]	$\Delta\sigma_{st}$ [MPa]	σ [MPa]	σ_{lim} [MPa]	Value [%]	Check
10	0	-168	1,9	15,6	450,0	38,4	311,6	465,9	66,9	OK

Nonconformity

	Nonconformities
⚠	Check of interaction of shear and torsion acc. to 6.3.2 (5) is not satisfactory, therefore it was necessary to check ultimate capacity at interaction of all components of internal forces

Stress and strain distributions in the cross-section



Explanation

Symbol	Explanation
N_{Ed}	Design value of the applied axial force (with effect of prestressing)
M_{Edy}	Design value of the applied bending moment around y axis (with effect of prestressing)
M_{Edz}	Design value of the applied bending moment around z axis (with effect of prestressing)
V_{Ed}	Design value of the applied shear force (with effect of prestressing)
T_{Ed}	Design value of the applied torsional moment (with effect of prestressing)
Value V+T	Utilization of the cross-section (for interaction of shear and torsion) related to the limit value
Value V+T+M	Utilization of the cross-section (for interaction of shear, torsion and bending) related to the limit value
Value	Utilization of the cross-section or its component (e.g. reinforcement bar) related to the limit value
Limit	Limit value of the exploitation of the cross-section
Check	Result of the check
$V_{Rd,c}$	The design shear resistance of the member without shear reinforcement
$T_{Rd,c}$	The design torsional cracking moment
$V_{Rd,max}$	The design value of the maximum shear force which can be sustained by the member, limited by crushing of the compression struts
$T_{Rd,max}$	The design torsional resistance moment
Eq. 6.31	The value of the exploitation of the cross-section according to equation (6.31) EN 1992-1-1
Eq. 6.29	The value of the exploitation of the cross-section according to equation (6.29) EN 1992-1-1
a_{sw}	The cross-sectional area (per unit length) of the most utilized stirrup leg due to shear and torsion
F_{sw}	Tensile force (per unit length) in the most utilized stirrup leg due to shear and torsion.
$F_{sw,lim}$	Load bearing resistance (per unit length) of the most utilized stirrup length due to shear and torsion (usually Fsw,lim=asw*fywd)
F_b	Resultant force in longitudinal reinforcement due to bending and normal force
$\Delta F_{td,s}$	Additional tensile force in longitudinal reinforcement due to shear calculated as VEd * cotθ. Additional force is applied to the centroid of the area resisting shear.
$\Delta F_{td,t}$	Additional tensile force in longitudinal reinforcement due to torsion
$\Delta\varepsilon_s$	Additional tensile strain in the bar/tendon due to shear
$\Delta\varepsilon_t$	Additional tensile strain in the bar/tendon due to torsion
Extreme in bar	Number of the non-prestressed bar with the extreme value of the check
Bar	Number of reinforcement bar with the extreme value of the check
y_i	y-coordinate of the css component (fibre/bar/tendon...) related to the centroid of css
z_i	z-coordinate of the css component (fibre/bar/tendon...) related to the centroid of css
$\Delta\varepsilon_{st}$	Additional tensile strain in the bar/tendon due to shear and torsion
ε	Strain in the bar/tendon due to shear, torsion and bending
ε_{lim}	Limit value of strain in the bar/tendon
$\Delta\sigma_{st}$	Additional tensile stress in the bar/tendon due to shear and torsion
σ	Stress in the bar/tendon due to shear, torsion and bending
σ_{lim}	Limit value of the stress in the bar/tendon

2.1.1.7 Stress limitation

Stress limitation - short-term effect

Type of check	Component type	Index	σ [MPa]	σ_{lim} [MPa]	Value [%]	Limit [%]	Check
7.2(3)-Quasi	Concrete fibre	19	-12,9	-13,5	95,3	100,0	OK

Stress limitation - long-term effect

Type of check	Component type	Index	σ [MPa]	σ_{lim} [MPa]	Value [%]	Limit [%]	Check
7.2(3)-Quasi	Concrete fibre	19	-7,6	-13,5	56,3	100,0	OK

Detailed check of concrete - short-term effect

Type of check	Fibre	y_i [mm]	z_i [mm]	N [kN]	M_y [kNm]	M_z [kNm]	σ [MPa]	σ_{lim} [MPa]	Value [%]	Check
7.2(2)-Char	19	0	250	0,0	75,0	0,0	-12,9	-18,0	71,4	OK
7.2(3)-Quasi	19	0	250	0,0	75,0	0,0	-12,9	-13,5	95,3	OK

Detailed check of reinforcement - short-term effect

Type of check	Bar	y_i [mm]	z_i [mm]	N [kN]	M_y [kNm]	M_z [kNm]	σ [MPa]	σ_{lim} [MPa]	Value [%]	Check
7.2(5)-Char	10	0	-168	0,0	75,0	0,0	157,0	400,0	39,2	OK

Detailed check of concrete - long-term effect

Type of check	Fibre	y_i [mm]	z_i [mm]	N [kN]	M_y [kNm]	M_z [kNm]	σ [MPa]	σ_{lim} [MPa]	Value [%]	Check
7.2(2)-Char	19	0	250	0,0	75,0	0,0	-7,6	-18,0	42,2	OK
7.2(3)-Quasi	19	0	250	0,0	75,0	0,0	-7,6	-13,5	56,3	OK

Detailed check of reinforcement - long-term effect

Type of check	Bar	y_i [mm]	z_i [mm]	N [kN]	M_y [kNm]	M_z [kNm]	σ [MPa]	σ_{lim} [MPa]	Value [%]	Check
7.2(5)-Char	10	0	-168	0,0	75,0	0,0	179,4	400,0	44,9	OK

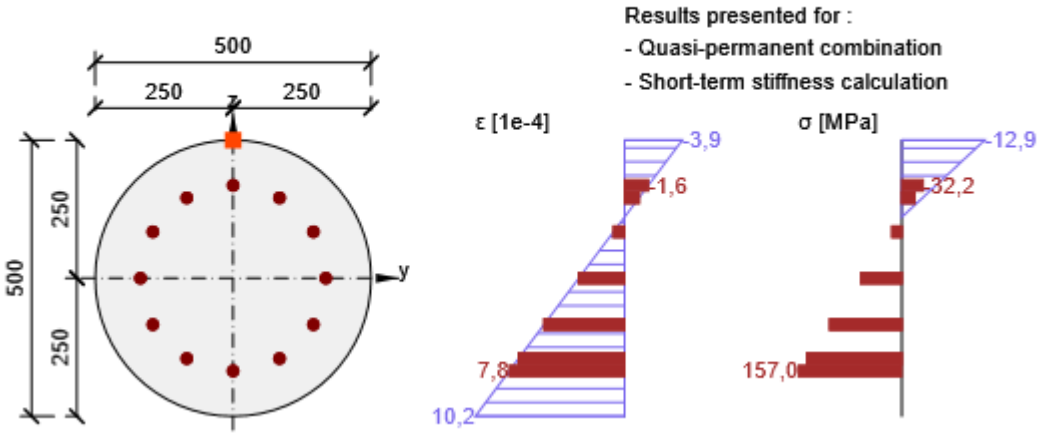
Creep coefficient

Way of assessment	h_0 [mm]	A_c [mm^2]	u [mm]	t [d]	t_0 [d]	t_s [d]	RH [%]	Use γ_{lt}	$\varphi(t,t_0)$ [-]
Automatic	250	196100	1571	18250,0	28,0	7,0	65,0	No	1,92

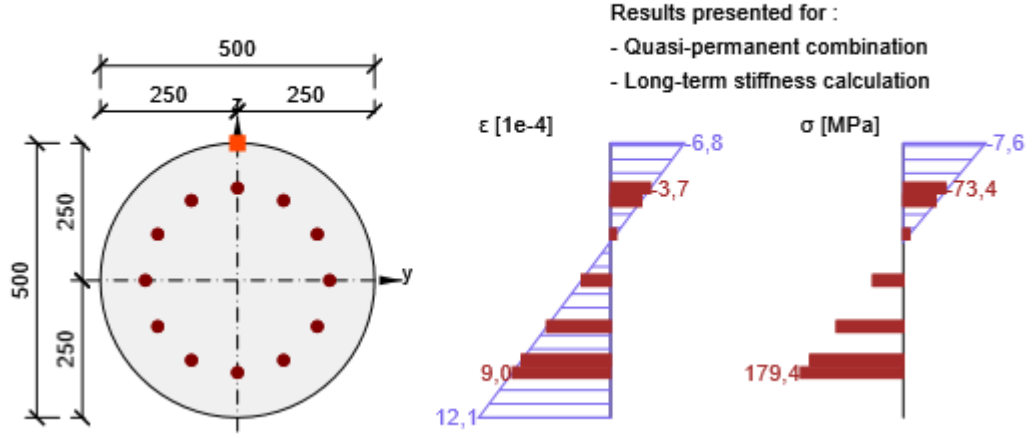
Nonconformity

	Nonconformities
⚠	Upper or lower design value of internal forces of one of SLS combinations caused to happen concrete stress higher than concrete tensile strength (section is cracked). Based on code and calculation settings it is assumed that the concrete resists no tension in SLS checks for all combinations of current extreme. The assumptions for SLS checks in other extremes of current section are not influenced.
⚠	The action of concrete in tension is excluded because the cracks appear, see clause 7.1 (2)

Stress and strain distributions in the cross-section



Stress and strain distributions in the cross-section



Explanation

Symbol	Explanation
Type of check	The number of clause and the type of SLS combination used for the calculation of stress limitation
Component type	Specification of type of css component (concrete fibre/bar/tendon) with extreme value of the check
Index	Number of concrete fibre, reinforcement bar or tendon with the extreme value of the check
σ	Stress in css component (fibre/bar/tendon...) calculated for appropriate SLS combination
σ_{lim}	Limit value of the stress in css component (fibre/bar/tendon...) calculated for appropriate SLS combination
Value	Utilization of the cross-section or its component (e.g. reinforcement bar) related to the limit value
Limit	Limit value of the exploitation of the cross-section
Check	Result of the check
Fibre	Number of concrete fibre with the extreme value of the check
y_i	y-coordinate of the css component (fibre/bar/tendon...) related to the centroid of css
z_i	z-coordinate of the css component (fibre/bar/tendon...) related to the centroid of css
N	Normal force for appropriate SLS combination
M_y	Bending moment around y axis for appropriate SLS combination
M_z	Bending moment around z axis for appropriate SLS combination
Bar	Number of reinforcement bar with the extreme value of the check
h_0	The notional size = 2Ac /u, where Ac is the concrete cross-sectional area and u is the perimeter of that part which is exposed to drying
A_c	The cross-sectional area of the concrete
u	The perimeter of that part which is exposed to drying
t	The age of concrete at the moment considered
t_0	The age of concrete at loading
t_s	The age of the concrete at the beginning of drying shrinkage (or swelling). Normally this is at the end of curing
RH	is the factor to account for relative humidity
Use γ_{lt}	Use long-term delayed strain estimation factor acc. to Annex B, clause B.105 (103)
$\varphi(t,t_0)$	Calculated value of creep coefficient

2.1.1.8 Crack width

Crack width - short-term effect

Combination	N [kN]	M_y [kNm]	M_z [kNm]	w_k [mm]	w_{lim} [mm]	Value [%]	Limit [%]	Check
Quasi	0,0	75,0	0,0	0,177	0,300	59,0	100,0	OK

Crack width - long-term effect

Combination	N [kN]	M_y [kNm]	M_z [kNm]	w_k [mm]	w_{lim} [mm]	Value [%]	Limit [%]	Check
Quasi	0,0	75,0	0,0	0,239	0,300	79,8	100,0	OK

Intermediate results and coefficients for crack width calculation - short-term effect

x [mm]	$h_{c,eff}$ [mm]	d [mm]	$A_{c,eff}$ [mm^2]	$A_{s,eff}$ [mm^2]	$A_{p,eff}$ [mm^2]	$\rho_{p,eff}$ [-]
139	120	403	36276	942	0	0,03

k_t [-]	ε_{sm}-ε_{cm} [1e-4]	k_1 [-]	k_2 [-]	k_3 [-]	k_4 [-]
0,60	4,7	0,80	0,50	3,40	0,43

c [mm]	ε_1 [1e-4]	ε_2 [1e-4]	$s_{r,max}$ [mm]	Φ [mm]	σ_s [MPa]
72	10,2	-3,9	376	20	157,0

Intermediate results and coefficients for crack width calculation - long-term effect

x [mm]	$h_{c,eff}$ [mm]	d [mm]	$A_{c,eff}$ [mm^2]	$A_{s,eff}$ [mm^2]	$A_{p,eff}$ [mm^2]	$\rho_{p,eff}$ [-]
180	107	403	30635	942	0	0,03

k_t [-]	ε_{sm}-ε_{cm} [1e-4]	k_1 [-]	k_2 [-]	k_3 [-]	k_4 [-]
0,40	6,7	0,80	0,50	3,40	0,43

c [mm]	ε_1 [1e-4]	ε_2 [1e-4]	$s_{r,max}$ [mm]	Φ [mm]	σ_s [MPa]
72	12,1	-6,8	355	20	179,4

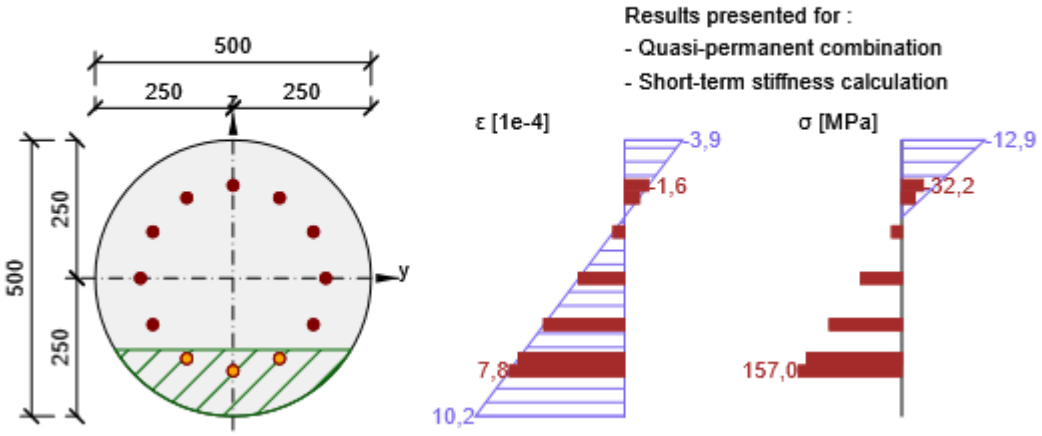
Creep coefficient

Way of assessment	h_0 [mm]	A_c [mm^2]	u [mm]	t [d]	t_0 [d]	t_s [d]	RH [%]	Use γ_{lt}	$\varphi(t,t_0)$ [-]
Automatic	250	196100	1571	18250,0	28,0	7,0	65,0	No	1,92

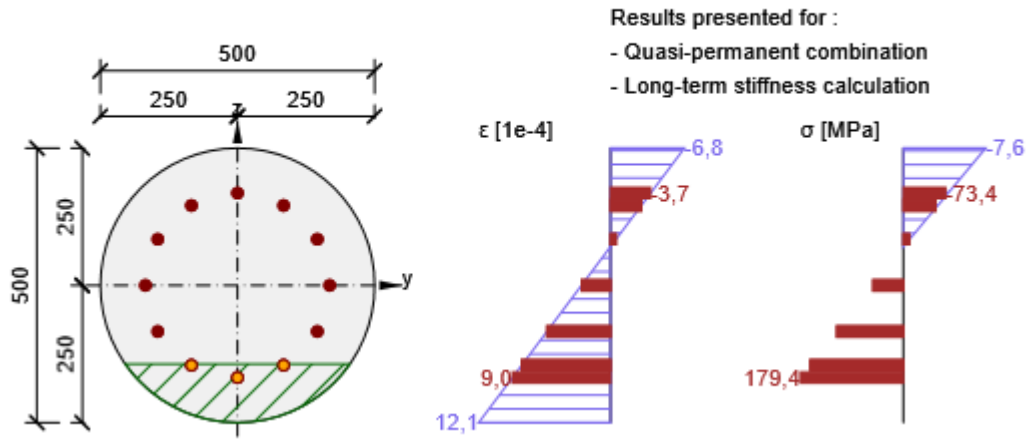
Nonconformity

	Nonconformities
⚠	Upper or lower design value of internal forces of one of SLS combinations caused to happen concrete stress higher than concrete tensile strength (section is cracked). Based on code and calculation settings it is assumed that the concrete resists no tension in SLS checks for all combinations of current extreme. The assumptions for SLS checks in other extremes of current section are not influenced.

Stress and strain distributions in the cross-section



Stress and strain distributions in the cross-section



Explanation

Symbol	Explanation
Combination	Combination used for calculation including rsup or rinf coefficient acc. to 5.10.9
N	Normal force for quasi-permanent combination
M_y	Bending moment around y axis for quasi-permanent combination
M_z	Bending moment around z axis for quasi-permanent combination
w_k	The crack width calculated according to 7.3.4
w_{lim}	Limit value of crack width according to table 7.1N
Value	Utilization of the cross-section or its component (e.g. reinforcement bar) related to the limit value
Limit	Limit value of the exploitation of the cross-section
Check	Result of the check
x	Depth of compression zone (position of neutral axis)
$h_{c,eff}$	Depth of effective tension area of the concrete surrounding the reinforcement or prestressing tendons (7.3.2 (3))
d	Effective depth of the cross-section
$A_{c,eff}$	Effective area of the concrete in tension surrounding the reinforcement or prestressing tendons
$A_{s,eff}$	Effective area of reinforcing steel within effective area of the concrete
$A_{p,eff}$	Effective area of prestressing steel within effective area of the concrete
$\rho_{p,eff}$	Ratio of the effective area of prestressing and reinforcing steel and effective area of the concrete in tension
k_t	Factor dependent on the duration of the load (7.3.4 (2))
k_1	Coefficient which takes account of the bond properties of the bonded reinforcement (7.3.4 (3))
k_2	Coefficient which takes account of the distribution of strain
c	Thickness of concrete cover of main longitudinal reinforcement
ε_1	Greater tensile strain at the boundaries of the section considered, assessed on the basis of a cracked section
ε_2	Lesser tensile strain at the boundaries of the section considered, assessed on the basis of a cracked section
$s_{r,max}$	Maximum final crack spacing
Φ	Diameter of bar or equivalent diameter of bar for more diameters of bars within effective tension area of the concrete
σ_s	Maximum stress in the tension reinforcement assuming a cracked section
h_0	The notional size = 2Ac /u, where Ac is the concrete cross-sectional area and u is the perimeter of that part which is exposed to drying
A_c	The cross-sectional area of the concrete
u	The perimeter of that part which is exposed to drying
t	The age of concrete at the moment considered
t_0	The age of concrete at loading
t_s	The age of the concrete at the beginning of drying shrinkage (or swelling). Normally this is at the end of curing
RH	is the factor to account for relative humidity
Use γ_{lt}	Use long-term delayed strain estimation factor acc. to Annex B, clause B.105 (103)
$\varphi(t,t_0)$	Calculated value of creep coefficient

2.1.1.9 Flexural slenderness

N [kN]	M_y [kNm]	M_z [kNm]	λ [-]	$λ_d$ [-]	Value [%]	Limit [%]	Check
0,0	75,0	0,0	3,97	32,03	12,4	100,0	OK

l_n [mm]	l_{eff} [mm]	d [mm]	K	ρ [%]	$ρ_0$ [%]	ρ' [%]	$σ_s$
1000	1400	353	1	1,1	0,5	0,2	157,0

Nonconformity

	Nonconformities
ℹ	According EN 1992-1-1 article 7.4.2 check of span/depth is satified. Any other calculation of deflection musn't be done.

Explanation

Symbol	Explanation
N	Normal force for quasi-permanent combination
M_y	Bending moment around y axis for quasi-permanent combination
M_z	Bending moment around z axis for quasi-permanent combination
λ	Span to depth ratio
$λ_d$	Limiting span/depth ratio multiplied by correction factors to allow for the type of reinforcement used acc. 7.4.2(2) and other variables
Value	Utilization of the cross-section or its component (e.g. reinforcement bar) related to the limit value
Limit	Limit value of the exploitation of the cross-section
Check	Result of the check
l_n	Clear distance between the faces of the supports
l_{eff}	Effective span of a member
d	Effective depth of the cross-section
K	Factor to take into account the different structural systems
ρ	Required tension reinforcement ratio at mid-span to resist the moment due to the design loads (at support for cantilevers)
$ρ_0$	Reference reinforcement ratio
ρ'	Required compression reinforcement ratio at mid-span to resist the moment due to design loads (at support for cantilevers)
$σ_s$	Tensile steel stress at mid-span (at support for cantilevers) under the design load at SLS

2.1.1.10 Response N-M-M

Results presented for combination : Fundamental ULS

$N_{Ed,tot}$ [kN]	$M_{Ed,ytot}$ [kNm]	$M_{Ed,ztot}$ [kNm]	Concrete fibre	Extreme in bar	Value [%]	Limit [%]	Check
0,0	120,0	0,0	19	10	68,3	100,0	OK

Plane of strain

x [mm]	d [mm]	z [mm]	ε_x [1e-4]	φ_z [1e-4]	φ_y [1e-4]
163	362	287	4,7	0,0	-53,6

Forces in components of cross-section

Component of css	N [kN]	M_y [kNm]	M_z [kNm]	A [mm^2]	y_i [mm]	z_i [mm]
Concrete	-350,7	62,9	0,0	55590	0	179
Reinforcement in tension	417,7	46,7	0,0	2827	0	-112
Reinforcement in compression	-67,0	10,4	0,0	942	0	155
Total	0,0	120,0	0,0			

Detailed check of concrete

Fibre	y_i [mm]	z_i [mm]	ε [1e-4]	ε_{lim} [1e-4]	σ [MPa]	σ_{lim} [MPa]	Value [%]	Check
19	0	250	-8,8	-35,0	-13,7	-20,0	68,3	OK

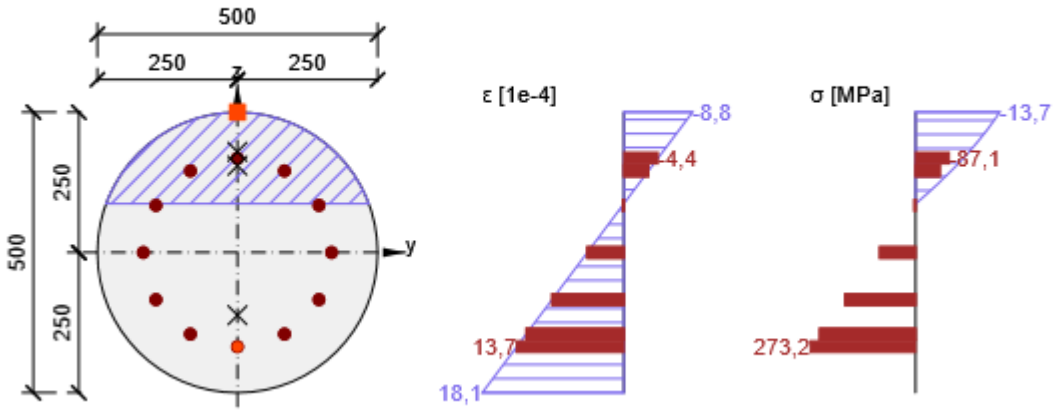
Detailed check of reinforcement

Bar	y_i [mm]	z_i [mm]	ε [1e-4]	ε_{lim} [1e-4]	σ [MPa]	σ_{lim} [MPa]	Value [%]	Check
10	0	-168	13,7	450,0	273,2	465,9	58,6	OK

Nonconformity

No nonconformities

Stress and strain distributions in the cross-section



Explanation

Symbol	Explanation
$N_{Ed,tot}$	Design value of the applied axial force (with effect of prestressing)
$M_{Ed,ytot}$	Design value of the applied bending moment around y axis (with effect of prestressing)
$M_{Ed,ztot}$	Design value of the applied bending moment around z axis (with effect of prestressing)
Concrete fibre	Number of the fibre with the extreme value of the check
Extreme in bar	Number of the non-prestressed bar with the extreme value of the check
Value	Utilization of the cross-section or its component (e.g. reinforcement bar) related to the limit value
Limit	Limit value of the exploitation of the cross-section
Check	Result of the check
x	Depth of compression zone (position of neutral axis)
d	Effective depth of the cross-section
z	The inner lever arm
ε_x	Axial strain
φ_z	Tangent of the angle between 'z' axis and its perpendicular projection into plane of strain (around 'y' axis)
φ_y	Tangent of the angle between 'y' axis and its perpendicular projection into plane of strain (around 'z' axis)
Component of css	Type of component of the css
N	The value of normal force resisted by component of the css
M_y	The value of bending moment around 'y' axis resisted by component of css
M_z	The value of bending moment around 'z' axis resisted by component of css
A	Area of css component (fibre/bar/tendon...)
y_i	y-coordinate of the css component (fibre/bar/tendon...) related to the centroid of css
z_i	z-coordinate of the css component (fibre/bar/tendon...) related to the centroid of css
Fibre	Number of concrete fibre with the extreme value of the check
ε	Strain in current css component (fibre/bar/tendon...) calculated for ULS
ε_{lim}	Limit value of strain in css component (fibre/bar/tendon...)
σ	Stress in css component (fibre/bar/tendon...) calculated for appropriate SLS combination
σ_{lim}	Limit value stress in css component (fibre/bar/tendon...) calculated for appropriate ULS combination
Bar	Number of reinforcement bar with the extreme value of the check

3 List of design members

Design member M 1

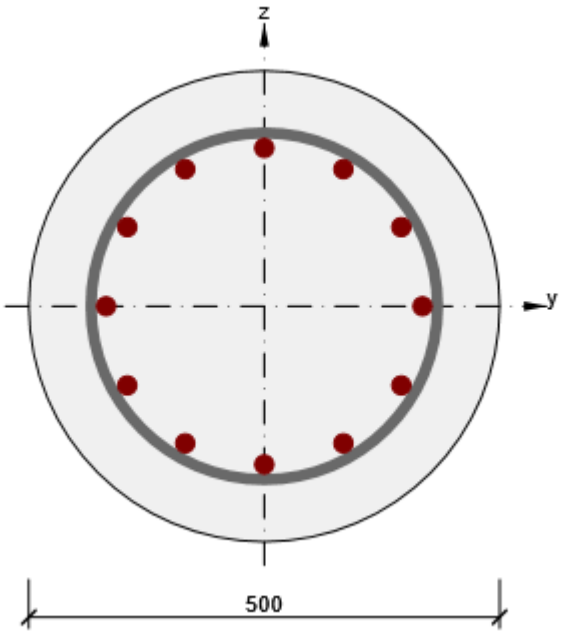
Member type	Beam
Exposure class	XC2, XD3, XF4
Relative humidity	65,0 %
Φ_{inf}	Calculated
Structural member importance	Major

Flexural slenderness data

Clear distance between faces of the supports (5.3.2.2 (1)) m	Width of supporting element (5.3.2.2 (1))		Support condition	
	Left mm	Right mm	Left	Right
1,00	400	400	Non-continuous member	Non-continuous member

4 List of reinforced sections

Reinforced section R 1



Cross-section components

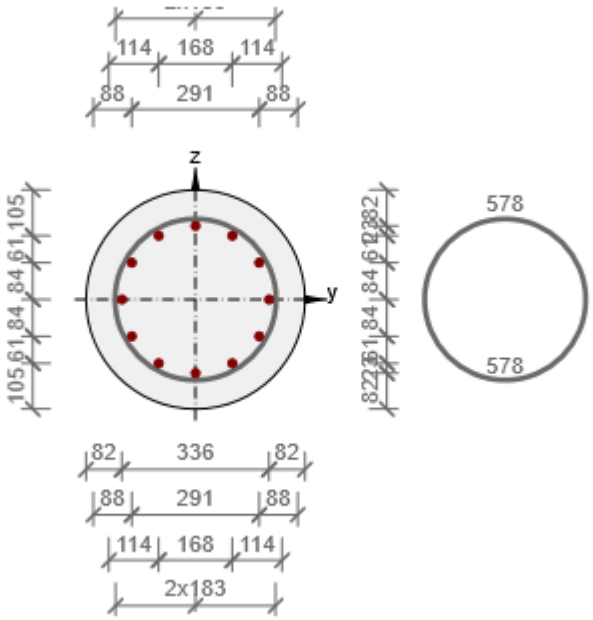
Circular cross-section (Diameter 500mm), Material: C30/37

Cross-section characteristics

A [mm^2]	S_y [mm^3]	S_z [mm^3]	I_y [mm^4]	I_z [mm^4]	C_{gy} [mm]	C_{gz} [mm]	i_y [mm]	i_z [mm]
196100	0	0	3060182512	3060182512	0	0	125	125

Concrete cover related to cross-section edges

Uniform	60 mm



Longitudinal reinforcement [kg/m]	Shear reinforcement [kg/m]	Total mass [kg/m]	Reinforcement / m3 concrete [kg/m^3]
30	10	40	203

Longitudinal reinforcement

Bar	Ø [mm]	Material	Y [mm]	Z [mm]
1	20	B 500B	168	0
2	20	B 500B	145	84
3	20	B 500B	84	145
4	20	B 500B	0	168
5	20	B 500B	-84	145
6	20	B 500B	-145	84
7	20	B 500B	-168	0
8	20	B 500B	-145	-84
9	20	B 500B	-84	-145
10	20	B 500B	0	-168
11	20	B 500B	84	-145
12	20	B 500B	145	-84

Stirrups

Stirrup	Ø [mm]	Material	Distance [mm]	Closed	Shear check	Torsion check	Diameter of mandrel
1	12	B 500B	100	Yes	Yes	Yes	0,00

Stirrup	Vertex	Y [mm]	Z [mm]
1	1	184	0
1	2	175	57
1	3	149	108
1	4	108	149
1	5	57	175
1	6	0	184
1	7	-57	175
1	8	-108	149
1	9	-149	108
1	10	-175	57
1	11	-184	0
1	12	-175	-57
1	13	-149	-108
1	14	-108	-149
1	15	-57	-175
1	16	0	-184
1	17	57	-175
1	18	108	-149
1	19	149	-108
1	20	175	-57
1	21	184	0

5 List of used materials

Concrete

Name	f_{ck} [MPa]	f_{cm} [MPa]	f_{ctm} [MPa]	E_{cm} [MPa]	v [-]	Unit mass [kg/m^3]
C30/37	30,0	38,0	2,9	32836,6	0,20	2500
	ε_{c2} = 20,0 1e-4, ε_{cu2} = 35,0 1e-4, ε_{c3} = 17,5 1e-4, ε_{cu3} = 35,0 1e-4, Exponent - n: 2,00, Aggregate size = 16 mm, Cement class: R (s = 0,20), Diagram type: Parabolic					

Explanation

Symbol	Explanation
f_{ck}	Characteristic compressive cylinder strength of concrete at 28 days
f_{cm}	Mean value of concrete cylinder compressive strength
f_{ctm}	Mean value of axial tensile strength of concrete
E_{cm}	Secant modulus of elasticity of concrete
ε_c	Compressive strain in the concrete at the peak stress fc
ε_{cu}	Ultimate compressive strain in the concrete

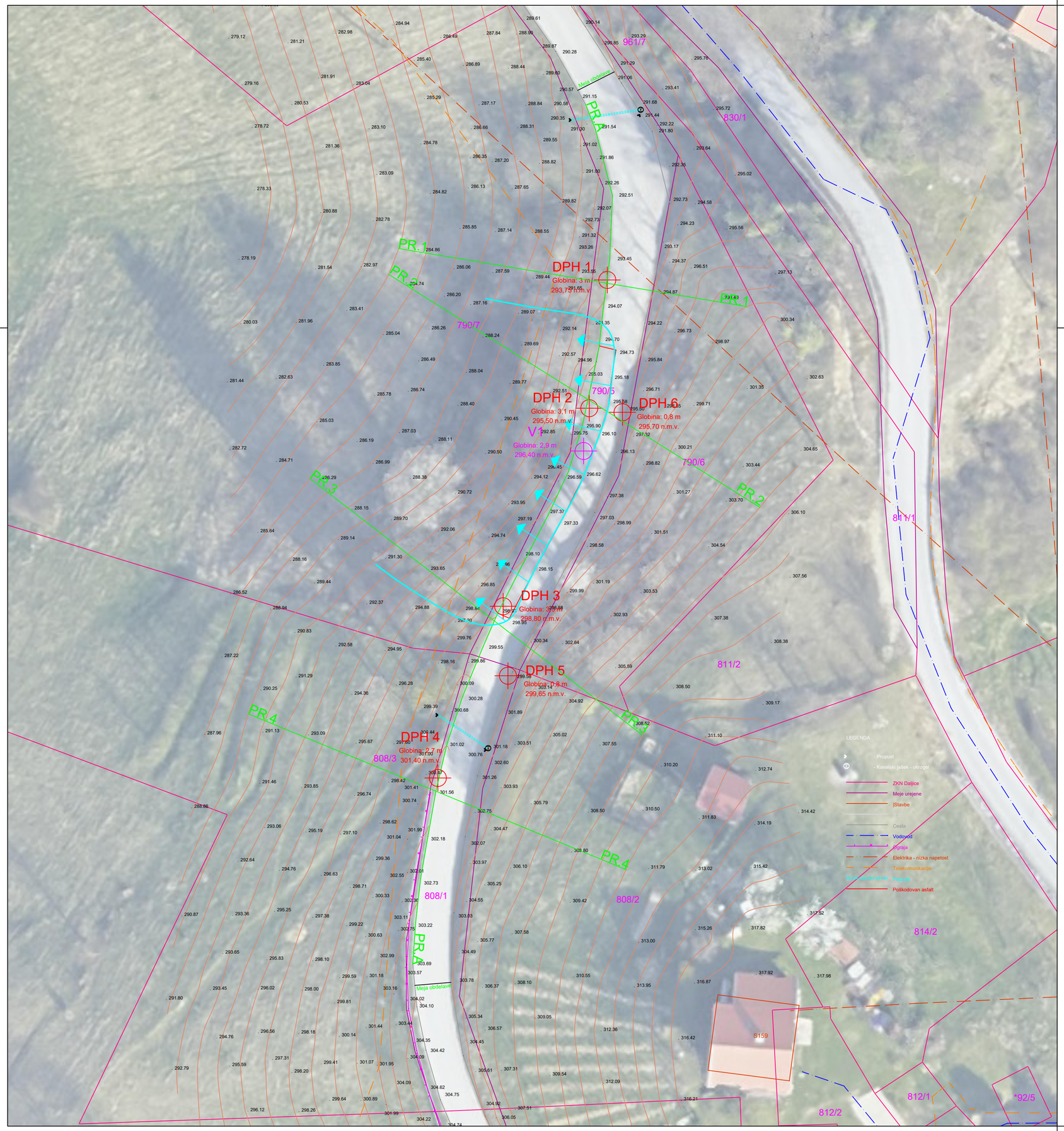
Reinforcement Steel

Name	f_{yk} [MPa]	f_{tk} [MPa]	E [MPa]	v [-]	Unit mass [kg/m^3]
B 500B	500,0	540,0	200000,0	0,20	7850
	f_{tk}/f_{yk} = 1,08, ε_{uk} = 500,0 1e-4, Type: Bars, Bar surface: Ribbed, Class: B, Fabrication: Hot rolled, Diagram type: Bilinear with an inclined top branch				

Explanation

Symbol	Explanation
f_{yk}	Characteristic yield strength of reinforcement
f_{tk}	Characteristic tensile strength of reinforcement
E	Modulus of elasticity of reinforcement steel
ε_{uk}	Characteristic strain of reinforcement or prestressing steel at maximum load

G.GRAFIKE



LEGENDA

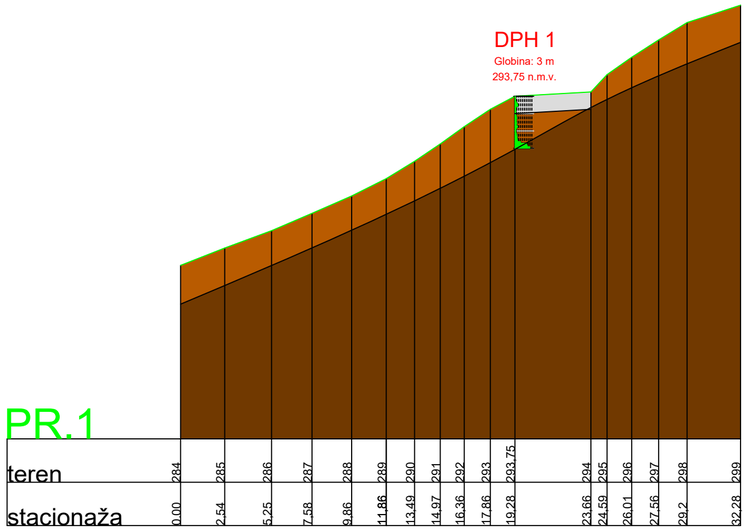
DPH 1 ??? m	Dinamična penetracija		Profil
V-1 ??? m	Geomehanska vrtina		Obod plazu
			Cestišče
			Ograja

Naročnik:	Občina Cirkulane Cirkulane 58 2282 Cirkulane	Projekt:	Sanacija JP 603081 – Gruškovec 110
Izvajalec:	PNV inženiring	Odsek:	
Podizvajalec:		Pododsek:	
		Opis risbe:	Situacija izvedenih meritev
		Del risbe:	

Naziv	Ime in priimek	Ident. št.	Podpis
Odg.vodja proj.:			
Poobl. inženir:	mag. Janez MAYER u.d.i.r.g.	RG-0038	
Projektant 1:	Tomaž MAYER d.i.g.(UN)		
Projektant 2:			

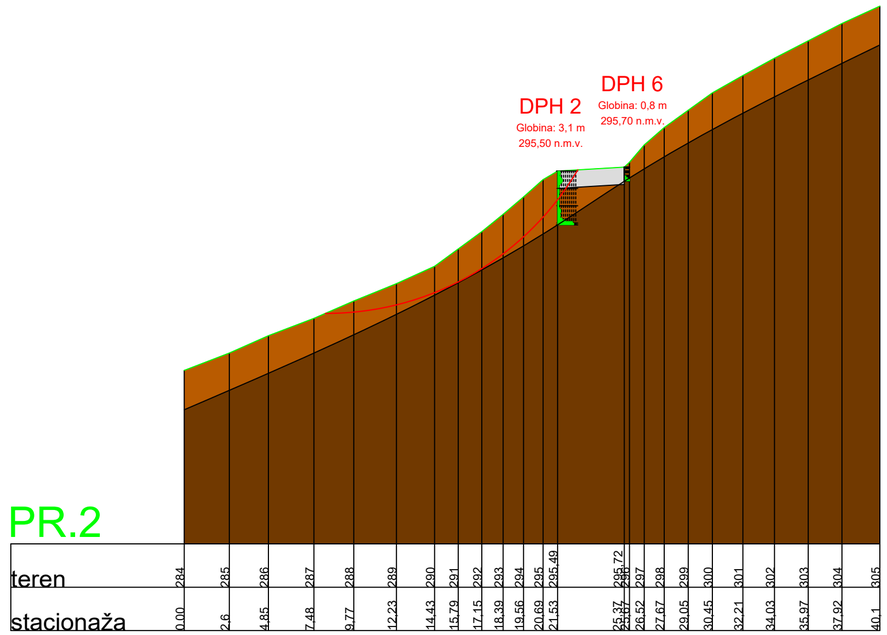
Št. projekta:	26/9/1311	Faza:	PZI
Št. načrta:		Merilo:	1:250
Šifra CC:		Datum:	nov 2026

Št. odseka:	Arhivska št.:	Faza/Objekt:	Šifra risbe:	
Št. priloge:	G.1.1		Avtor risbe:	PNV inženiring d.o.o..
			Ident. št. risbe:	



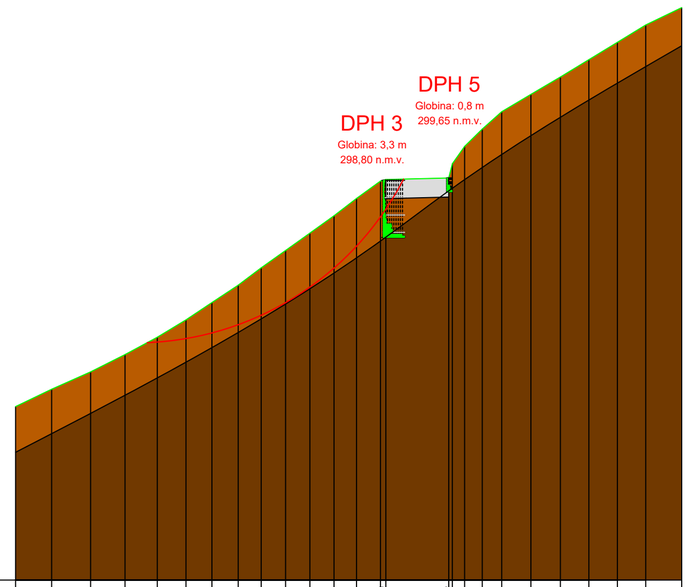
PR.1

teren	284	285	286	287	288	289	290	291	292	293	293,75	294	295	296	297	298	299
stacionaža	0,00	2,54	5,25	7,58	9,86	11,86	13,49	14,97	16,36	17,86	19,28	23,66	24,59	26,01	27,56	29,2	32,28



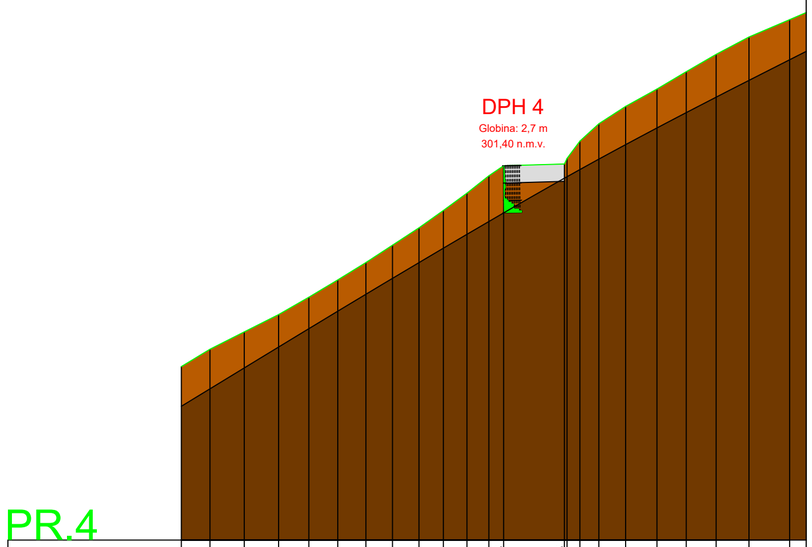
PR.2

teren	284	285	286	287	288	289	290	291	292	293	294	295	295,49	295,72	296	296,52	297	298	299	300	301	302	303	304	305
stacionaža	0,00	2,6	4,85	7,48	9,77	12,23	14,43	15,79	17,15	18,39	19,56	20,69	21,53	25,37	25,87	26,52	27,67	29,05	30,45	32,21	34,03	35,97	37,92	40,1	42,28



PR.3

teren	286	287	288	289	290	291	292	293	294	295	296	297	298	298,08	298,18	299	300	301	302	303	304	305	306	307	308	309
stacionaža	0,00	2,08	4,33	6,31	8,17	9,82	11,32	12,83	14,16	15,57	16,97	18,36	19,66	21,04	21,08	24,97	25,89	26,91	28,03	29,71	31,41	33,05	34,7	36,33	38,41	40,49



PR.4

teren	290	291	292	293	294	295	296	297	298	299	300	301	301,58	302,68	303	304	305	306	307	308	309	310	311	312	313
stacionaža	0,00	1,65	3,63	5,61	7,35	9,02	10,64	12,17	13,7	15,11	16,47	17,73	18,58	22,98	22,98	24,07	25,61	27,42	29,11	30,83	32,73	35,07	37,42	39,76	42,1

LEGENDA

DPH 1
256,97m n.v.

Dinamična penetracija

V-1
372,6 m n.v.
UN 1,6m
CL 2,9m
GW 4,4m
LAPOR

Geomehanska vrtina

Teren

Rob plazu

Porušnica

Umetno prodnato nasutje

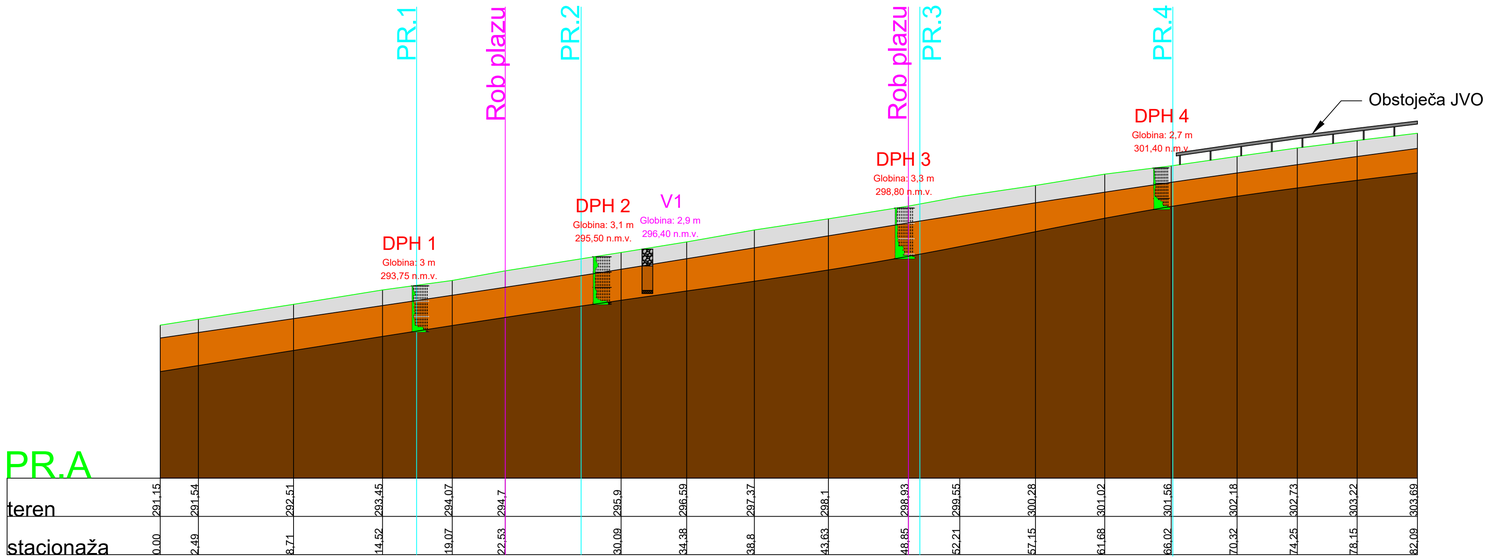
Peščena glina

Lapor

Naročnik:	Občina Cirkulane Cirkulane 58 2282 Cirkulane	Projekt:	Sanacija JP 603081 – Gruškovec 110
Izvajalec:	PNV inženiring	Odsek:	
Podizvajalec:		Pododsek:	
		Opis risbe:	Prečni geološko-geotehnični profili
		Del risbe:	
Št. projekta:	26/9/1311	Faza:	PZI
Št. načrta:		Merilo:	1:250
Šifra CC:		Datum:	nov 2026

Naziv	Ime in priimek	Ident. št.	Podpis
Odg.vodja proj.:			
Pooblj. inženir:	mag. Janez MAYER u.d.i.r.g.	RG-0038	
Projektant 1:	Tomaž MAYER d.i.g.(UN)		
Projektant 2:			

Št. odseka:	Arhivska št.:	Faza/Objekt:	Šifra risbe:	
Št. priloge:	G.1.2		Avtor risbe:	PNV inženiring d.o.o.
			Ident. št. risbe:	



LEGENDA

DPH 1
256,97m n.v.

Dinamična penetracija

V-1
372,8 m n.v.
UN
1,6m
CL
3,0m
GLI
4,4m
LAPOR

Geomehanska vrtina

- Teren
- Rob plazu
- Porušnica
- Umetno prodnato nasutje
- Peščena glina
- Lapor

Naročnik:	Občina Cirkulane Cirkulane 58 2282 Cirkulane	Projekt:	Sanacija JP 603081 – Gruškovec 110
Izvajalec:	PNV inženiring	Odsek:	
Podizvajalec:		Pododsek:	
Naziv	Ime in priimek / Ident. št. / Podpis	Opis risbe:	Vzdolžni geološko-geotehnični profil
Odg.vodja proj.:		Del risbe:	
Poobl. inženir.:	mag. Janez MAYER u.d.i.r.g. / RG-0038	Št. projekta:	26/9/1311
Projektant 1:	Tomaž MAYER d.i.g.(UN)	Faza:	PZI
Projektant 2:		Merilo:	1:200
		Šifra CC:	
		Datum:	nov 2026

Št. odseka:	Arhivska št.:	Faza/Objekt:	Šifra risbe:
Št. priloge:	G.1.3	Avtor risbe:	PNV inženiring d.o.o.
		Ident. št. risbe:	

PREGLEDNA SITUACIJA

M 1:2500



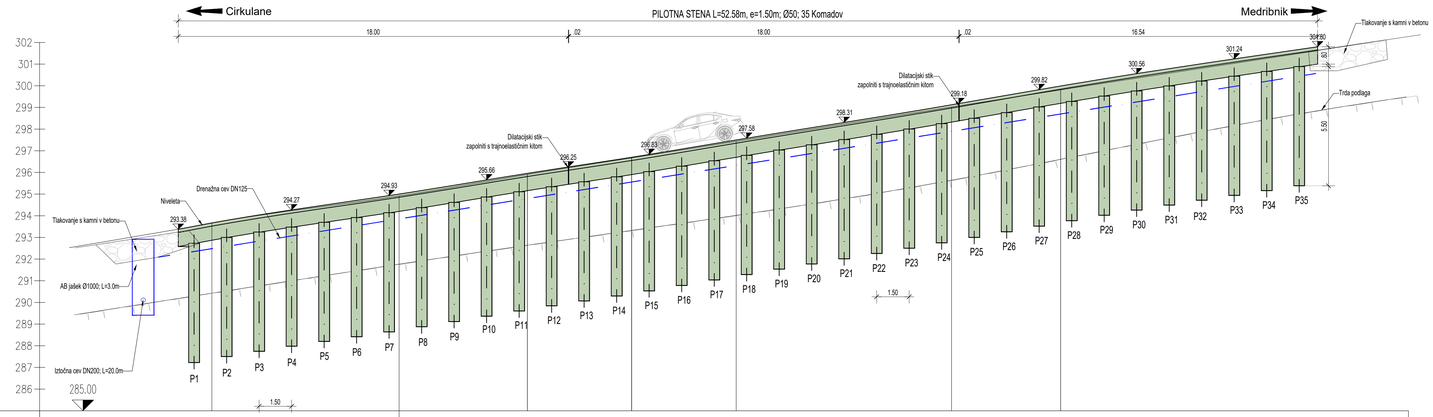
Investitor:	Občina Cirkulane Cirkulane 58 2282 Cirkulane	Naziv gradnje:	Sanacija JP 603081 – Gruškovec 110
Naročnik:		Naziv načrta:	2 Načrt s področja gradbeništva
Projektant načrta:	PNV inženiring, d.o.o. Špičnik 47 2201 Kungota	Opis risbe:	PREGLEDNA SITUACIJA
Naziv	Ime in priimek / Ident. št. / Podpis	Del risbe:	
Odg.vodja proj.:		Št. projekta:	26/9/1311
Pooblj. inženir:	mag. Janez MAYER u.d.i.r.g. / RG-0038	Faza:	PZI
Projektant 1:	Tomaž MAYER d.i.g.(UN)	Št. načrta:	26/9/1311
Projektant 2:		Merilo:	1: 2500
		Šifra CC:	
		Datum:	okt 2026

Št. odseka:	Arhivska št.:	Faza/Objekt:	Šifra risbe:
Št. priloge:	G.2	Avtor risbe:	PNV inženiring, d.o.o.
		Ident. št. risbe:	

V/S=420/841 (0.35 m³)

VZDOLŽNI PREREZ PS1

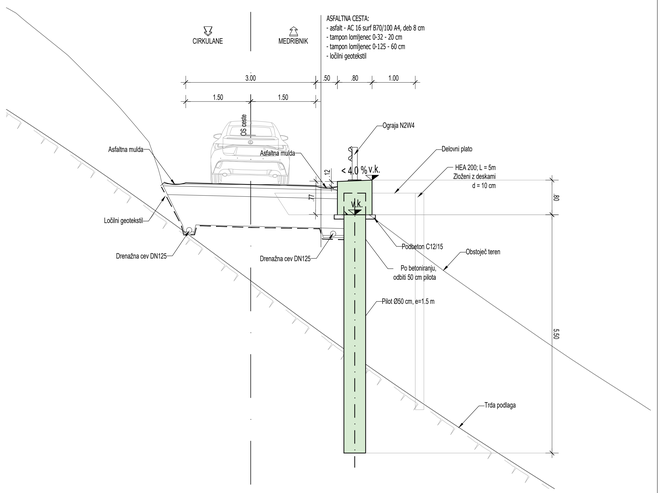
M 1:100



OZNAKE PROFILOV	P4	P5	P6	P7	P8	P9	P10
STACIONAŽE	60.00	69.00	75.00	80.00	85.00	95.00	0000
KOTE TERENA	293.663	294.908	295.909	296.667	297.438	299.021	299.811

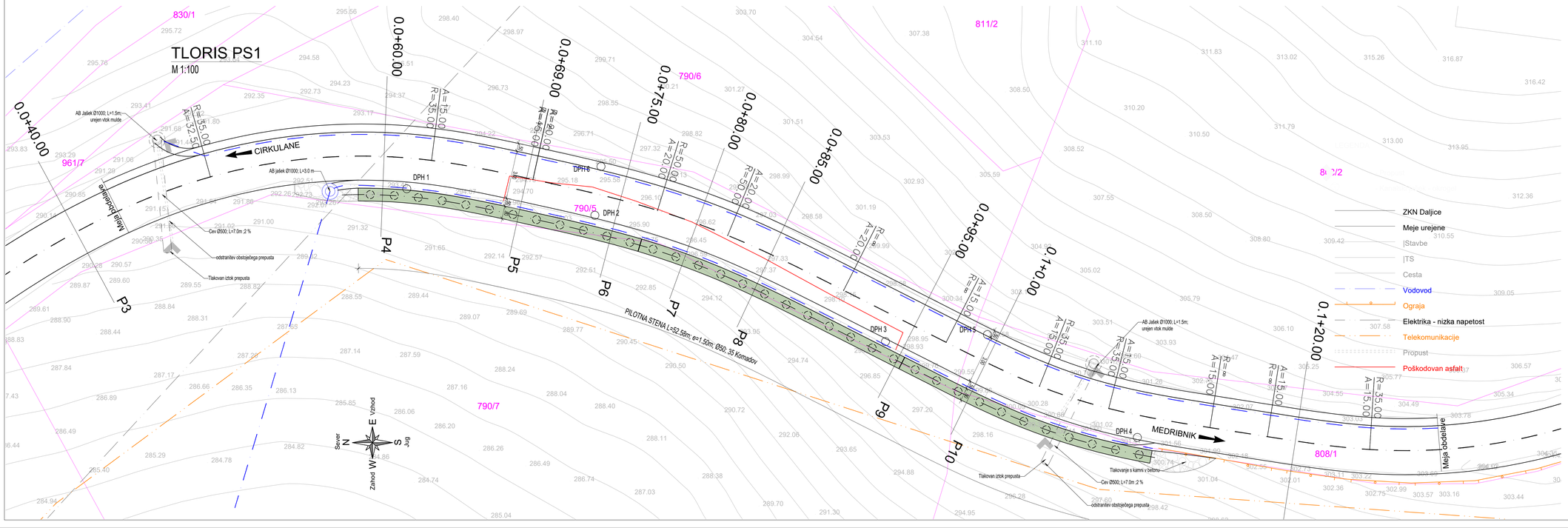
KARAKTERISTIČNI PREČNI PREREZ

M 1:50



TLORIS PS1

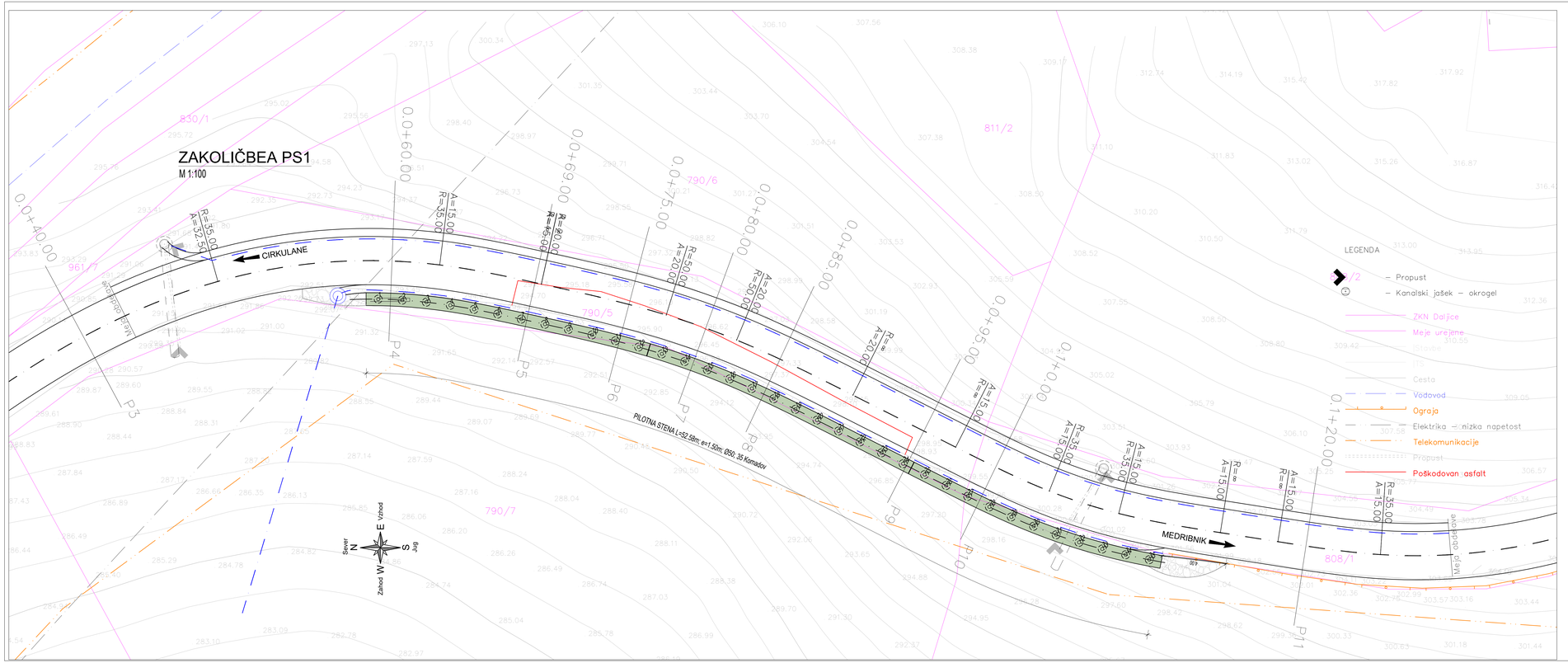
M 1:100



Investitor:	Občina Cirkulane Cirkulane 58 2282 Cirkulane	Naziv gradnje:	Sanacija JP 603081 – Gruškovec 110
Naročnik:		Naziv načrta:	2. Načrt s področja gradbeništva
Projektant načrta: PNV inženiring, d.o.o. Šolska 47 2201 Kungota	PNV inženiring	Opis risbe:	DISPOZICIJA PST
Naziv	Ime in priimek / Ident. št. / Podpis	Del risbe:	
Odg.vodja proj.:		Št. projekta:	26/9/1311
Pooblaščenec:	mag. Janez MAYER u.d.i.g. / IKS-0038	Faza:	PZI
Projektant 1:	Tomaž MAYER d.i.g.(UN)	Št. načrta:	26/9/1311
Projektant 2:		Merilo:	1:100,50
		Šifra CC:	Datum: okt 2026

Št. odseka:	Arhivska št.:	Faza/Objekt:	Šifra risbe:
Št. priloge:	G.3.1		Avtor risbe: PNV inženiring, d.o.o. Ident. št. risbe:

V/Š=594/1189 (0.71 m²)



	Y	X
1	132935.803	577951.738
2	132934.304	577951.680
3	132932.809	577951.553
4	132931.322	577951.356
5	132929.843	577951.104
6	132928.372	577950.813
7	132926.905	577950.499
8	132925.440	577950.178
9	132923.976	577949.851
10	132922.515	577949.512
11	132921.059	577949.151
12	132919.610	577948.761
13	132918.173	577948.333
14	132916.749	577947.859
15	132915.342	577947.341
16	132913.951	577946.778
17	132912.578	577946.175
18	132911.218	577945.542
19	132909.869	577944.885
20	132908.528	577944.214
21	132907.190	577943.536
22	132905.852	577942.858
23	132904.514	577942.180
24	132903.176	577941.501
25	132901.838	577940.823
26	132900.500	577940.145
27	132899.159	577939.472
28	132897.810	577938.817
29	132896.447	577938.192
30	132895.064	577937.611
31	132893.661	577937.081
32	132892.237	577936.609
33	132890.796	577936.195
34	132889.339	577935.839
35	132887.871	577935.533

Investitor: Občina Cirkulane
Cirkulane 58
2282 Cirkulane

Naročnik:

Projektant načrta:
PNV ažerning, d.o.o.
Ptuj 4
2250 Ptuj/Slo

Naziv	Ime in priimek	Ident. št.	Podpis
Odg.vodja proj.:			
Pooblj. inženir:	mag. Janez MAHER u.d.i.g.	IKS-0038	
Projektant 1:	Tomaž MAHER d.i.g.(UN)		
Projektant 2:			

Naziv gradnje: Sanacija JP 603081 – Gruškovec 110

Naziv načrta: II. Načrt s področja gradbeništva

Opis vsebine: ZAKOLIČBENA SITUACIJA

Del. načrta:			
Št. projekta:	26/9/1311	Faza:	PZI
Št. načrta:	26/9/1311	Merilo:	1:100
Datum izd.:		Datum:	okt. 2026

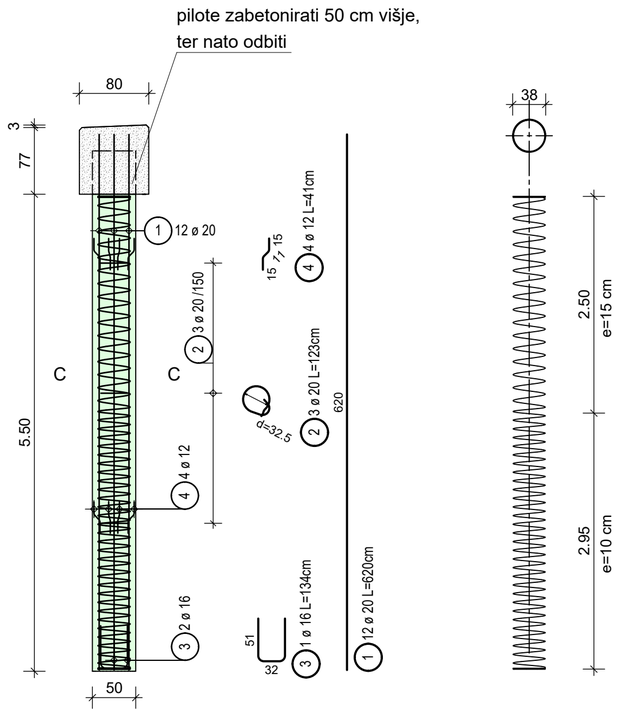
Št. odseka:	Artikula št.:	Fazni/Objekt:	Štev. načrta:
Št. priloge:	G.4.1		Avtor načrta: PNV ažerning, d.o.o.
			Ident. št. načrta:

V/S=420/1320 (0.55 m²)

PILOT Ø50

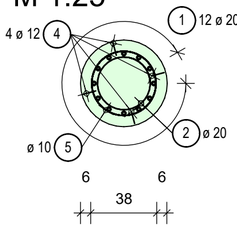
L=5.50 m; 35 kom

M 1:50



PREČNI PREREZ

M 1:25



Seznam palic - oblika krivljenja

Poz.	Kosov	Fi [mm]	Posam. dolžina [m]	Kotirana oblika krivljenja (ni v merilu)	Skupna dolžina [m]	Teža [kg]
1	12	20	6.20	620	74.40	183.77
2	3	20	1.23	d=32.5	3.69	9.11
3	2	16	1.34	32, 51	2.68	4.23
4	8	12	0.41	15, 45°, 11, 15, 45°	3.28	2.91
5	1	10	Tek.m		66.12	40.80

teža za 1 pilot [kg] : 240.82

teža za 35 pilotov [kg] : 8 428.89

PODATKI O MATERIALIH

BETON

LASTNOSTI V SKLADU s SIST EN 206:2013, SIST EN 1026:2016, SIST EN 13670:2010/A101:2010, LASTNOSTI JEKLA V SKLADU S SIST EN 10080:2005

Konstrukcijski element	Mejne vrednosti za sestavo betona							JEKLO	Zaščitni sloj			
	Min.trd.raz. betona C (N/mm²)	Ekspozicijski razred	Odpornost na prodor vode	Maksimalna debelina zrna agregata (mm)	Raz. stopnje konsistence	Razr. vidne površine betona	Izvedba konstrukcijskega elementa	Min.trd.raz. jekla (N/mm²)	Zgornja stran	Spodnja stran	Bočna stran	Zasuta stran
PILOT	C30/37	XF4, XD3	PV-II	Dmax=32	S4	V80	ARMIRAN BETON	B 500-B	-	-	-	6,0
PILOTNA GREDA	C30/37	XF2,XD1	PV-II	Dmax=32	S4	V83	ARMIRAN BETON	B 500-B	4,5	5,0	5,0	5,0
PODBETON IN NAKLONSKI BETON	C12/15	X0	-	-	-	-	NEARMIRAN BETON			-	-	-

Uporabijo se lahko distančniki, PVC/kovinski, iz vlaknastega betona ali betonski distančniki. Distančniki, ki so iz vlaknastega betona ali betona ne smejo vsebovat azbesta, obstojni morajo biti na staranje, zagotavljati morajo min. tlačno trdnost do 700kPa, posebej morajo biti namenjeni za strukturni in vidni beton, izpolnjevat morajo zahteve za beton in armiran beton po SIST EN 206:2013 in protipožarne predpise SIST EN 1991-1-2 in DIN 4201. IMetri morajo tudi enak razteznostni koeficient kot beton.

KONSTRUKCIJSKO JEKLO

LASTNOSTI V SKLADU s SIST EN 10025, SIST EN 10210 in SIST EN 10219, IZDELAVA V SKLADU S SIST EN 1090-2

Konstrukcijski element	Vrsta jekla	Razred zaščite proti koroziji	Način zaščite proti koroziji	Ostalo
VARNOSTNE OGRAJE	S 235 JR +Z	1 po PTP invest.	Vroče cinkano min 85nm	ozemljitev jekl.delov

Antikorozijska zaščita z vročim cinkanjem se izvede na gotovih elementih. Naknadno vrtanje, rezanje, brušenje, poliranje, varjenje... ni dovoljeno!
Spajanje posameznih elementov samo z mehanskimi spoji. Izdelavo in montažo jeklenih delov izvesti v skladu s SIST EN 1090-2, razred izdelave EXC2

IZVEDBENI RAZRED v skladu s SIST EN 13670

3. IZVEDBENI RAZRED

2. RAZRED GEOMETRIJSKIH TOLERANC

Investitor: Občina Cirkulane
Cirkulane 58
2282 Cirkulane

Naročnik:

Projektant načrta:
PNV inženiring, d.o.o.
Špičnik 47
2201 Kungota

Naziv	Ime in priimek	Ident. št.	Podpis
Odg.vodja proj.:			
Poobl. Inženir:	mag. Janez MAYER u.d.i.r.g.	RG-0038	
Projektant 1:	Tomaž MAYER d.i.g.(UN)		
Projektant 2:			

Naziv gradnje: Sanacija JP 603081 - Gruškovec 110

Naziv načrta: 2 Načrt s področja gradbeništva

Opis risbe: PILOT Ø50, L=5,5m, 35 Kom

Del risbe:

Št. projekta:	26/9/1311	Faza:	PZI
Št. načrta:	26/9/1311	Merilo:	1:50,25
Šifra CC:		Datum:	okt 2026

Št. odseka:	Arhivska št.:	Faza/Objekt:	Šifra risbe:

Št. priloge: G.5.1

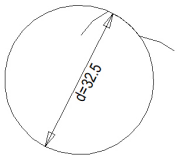
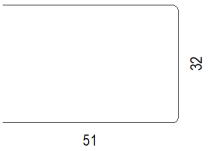
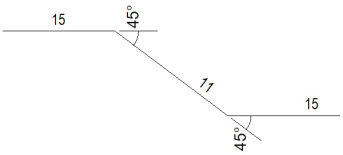
Avtor risbe: PNV inženiring, d.o.o.

Ident. št. risbe:

Seznam palic - oblike krivljenja

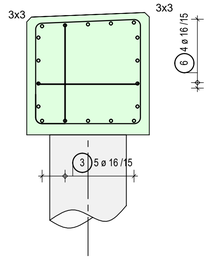
Projekt:
K risbi: G.5.1
Izdelal:
Datum / čas: 17/11/2026 /
Napotek:

Vse oblike palic

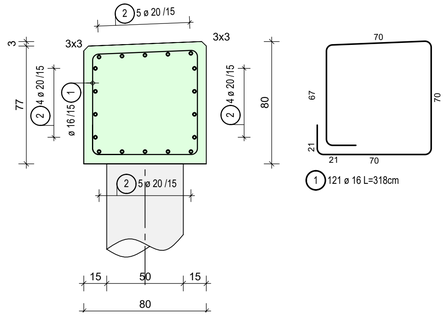
Pozicija	Kosov	Ø [mm]	Kotirana oblika palice	Posamezna dolžina [m]	Skupna dolžina [m]	Teža [kg]
PK1 GRUŠKOVEC 110						
1	12	20		6.20	74,40	183,77
2	3	20		1.23	3,69	9,11
3	2	16		1.34	2,68	4,23
4	8	12		0.41	3,28	2,91
5	1	10		Tek.m	66,12	40,80

Vsota PK1 GRUŠKOVEC 110	**240,83**
Vsota preko vseh elementov	**240,83**
Število izvedb	35
Skupna teža	**8.428,89**

POGLED NA ZAKLJUČEK
M 1:20

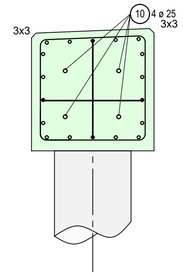


PREČNI PREREZ
M 1:20



1 121 ø 16 L=318cm

DETAJ DILATACIJE
M 1:20

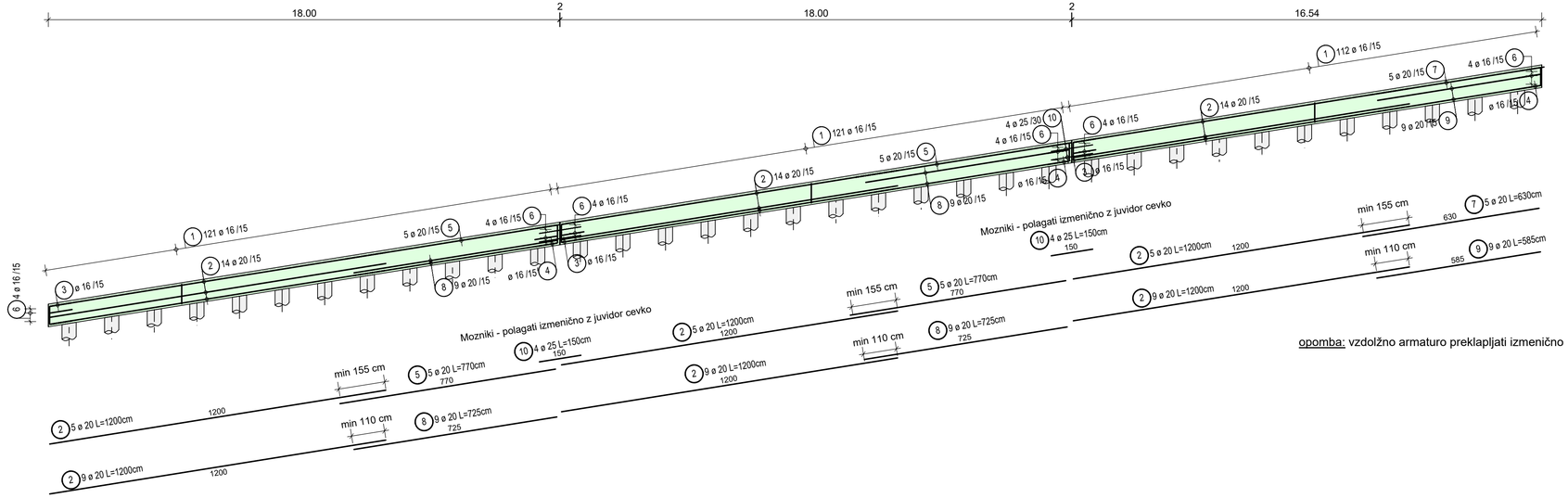


Seznam palic - oblika krivljenja

Poz.	Kosov	Fi [mm]	Posam. dolžina [m]	Kotirana oblika krivljenja (ni v merilu)	Skupna dolžina [m]	Teža [kg]
1	354	16	3.18	70 / 10 / 21 / 67	1125.72	1778.64
2	54	20	12.00	1200	648.00	1600.56
3	15	16	-X-	81° / 169° / 80 / 70	33.48	52.90
4	15	16	-X-	75 / 80 / 96° / 45	33.48	52.90
5	10	20	7.70	770	77.00	190.19
6	24	16	2.27	50 / 67	54.48	86.08
7	5	20	6.30	630	31.50	77.81
8	26	20	7.25	725	188.50	465.60
9	13	20	5.85	585	76.05	187.84
10	8	25	1.50	150	12.00	46.20

Skupna teža [kg] : 4538.72

POGLED PILOTNA GREDA
M 1:100



<u>opomba:</u> vzdolžno armaturo preklapljati izmenično

PODATKI O MATERIALIH

BETON

LASTNOSTI V SKLADU s SIST EN 206:2013, SIST EN 1026:2016, SIST EN 13670:2010/A101:2010, LASTNOSTI JEKLA V SKLADU S SIST EN 10080:2005

Konstrukcijski element	Mejne vrednosti za sestavo betona: Največja vsebnost kloridov	Predpisan izpad	Odpornost na prodor vode	Največja velikost zrna agregata [mm]	Razr. razred konsistence	Razr. razred površine betona	Izvedba konstrukcijskega elementa	JEKLO: Največja vsebnost kloridov	Zaščitni sloj: Zgornja stran	Spodnja stran	Bočna stran	Čelna stran
PILOT	C30/37	XF4, XD3	Pv-3	Dmax=32	S4	tB5	ARMIRAN BETON	B 500-B	-	-	-	6,0
PILOTNA GREDA	C30/37	XF2,XD1	Pv-3	Dmax=32	S4	tB3	ARMIRAN BETON	B 500-B	4,5	5,0	5,0	5,0
PODBETON IN NAKLONSKI BETON	C12/15	X0	-	-	-	-	NEARMIRAN BETON		-	-	-	-

Uporabijo se lahko distančniki, PVC/keviniki, iz viaknastega betona ali betonski distančniki. Distančniki, ki so iz viaknastega betona ali betona ne smejo vsebovat azbesta, obstojni morajo biti na staranje, zagotavljati morajo min. tlačno trdnost do 700kPa, posebej morajo biti namenjeni za strukturni in vidni beton, izpolnjevati morajo zahteve za beton in armiran beton po SIST EN 206:2013 in protipožarne predpise SIST EN 1991-1-2 in DIN 4201. Mleti morajo tudi enak razteznostni koeficient kot beton.

KONSTRUKCIJSKO JEKLO

LASTNOSTI V SKLADU s SIST EN 10025, SIST EN 10210 in SIST EN 10219, IZDELAVA V SKLADU S SIST EN 1090-2

Konstrukcijski element	Vrsta jekla	Razred zaščite proti koroziji	Način zaščite proti koroziji	Ostalo
VARNOSTNE OGRAJE	S 235 JR +Z	1 po PTP invest.	Vroče cinkano min 85nm	ozemljitev jekl.delov

Antikorozijska zaščita z vročim cinkanjem se izvede na gotovih elementih. Naknadno vrtanje, rezanje, brušenje, poliranje, varjenje ... ni dovoljeno!
Spajanje posameznih elementov samo z mehanskimi spoji. Izdelavo in montažo jeklenih delov izvesti v skladu s SIST EN 1090-2, razred izdelave EXC2

IZVEDBENI RAZRED v skladu s SIST EN 13670
3. IZVEDBENI RAZRED
2. RAZRED GEOMETRIJSKIH TOLERANC

Investitor:	Občina Cirkulane Cirkulane 58 2282 Cirkulane
Naročnik:	
Projektant načrta:	PNV inženiring, d.o.o. Špičnik 47 2201 Kungota
Naziv gradnje:	Sanacija JP 603081 - Gruškovec 110
Naziv načrta:	2 Načrt s področja gradbeništva
Opis risbe:	ARMATURNA RISBA
Del risbe:	PILOTNE GREDE

Naziv	Ime in priimek	Ident. št.	Podpis
Odg.vodja proj.:			
Poobl. inženir:	mag. Janez MAYER u.d.i.r.g.	RG-0038	
Projektant 1:	Tomaž MAYER d.i.g.(UN)		
Projektant 2:			

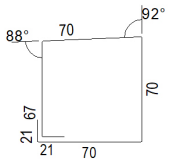
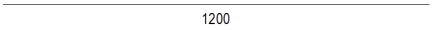
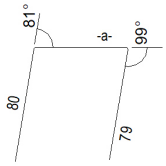
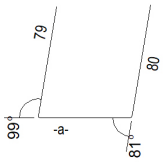
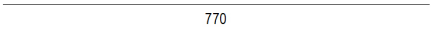
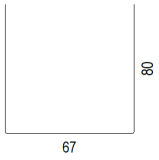
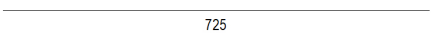
Št. projekta:	26/9/1311	Faza:	PZI
Št. načrta:	26/9/1311	Merilo:	1:100,20
Šifra CC:		Datum:	okt 2026

Št. odseka:	Arhivska št.:	Faza/Objekt:	Šifra risbe:
Št. priloge:	G.5.2	Avtor risbe:	PNV inženiring, d.o.o.
		Ident. št. risbe:	

Seznam palic - oblike krivljenja

Projekt:
K risbi: G.5.2
Izdelal:
Datum / čas: 17/11/2026 /
Napotek:

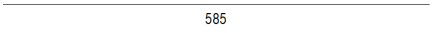
Vse oblike palic

Pozicija	Kosov	Ø [mm]	Kotirana oblika palice	Posamezna dolžina [m]	Skupna dolžina [m]	Teža [kg]
PK1 GRUŠKOVEC 110						
1	354	16		3.18	1.125,72	1.778,64
2	54	20		12.00	648,00	1.600,56
3	15	16		-X-	33,48	52,90
4	15	16		-X-	33,48	52,90
5	10	20		7.70	77,00	190,19
6	24	16		2.27	54,48	86,08
7	5	20		6.30	31,50	77,81
8	26	20		7.25	188,50	465,60

Seznam palic - oblike krivljenja

Projekt:
K risbi: G.5.2
Izdelal:
Datum / čas: 17/11/2026 /
Napotek:

Vse oblike palic

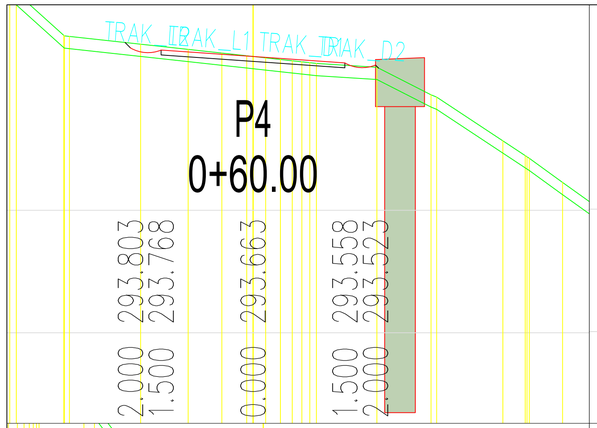
Pozicija	Kosov	Ø [mm]	Kotirana oblika palice	Posamezna dolžina [m]	Skupna dolžina [m]	Teža [kg]
9	13	20		5.85	76,05	187,84
10	8	25		1.50	12,00	46,20
Vsota PK1 GRUŠKOVEC 110						**4.538,71**
Vsota preko vseh elementov						**4.538,71**
Število izvedb						1
Skupna teža						**4.538,71**

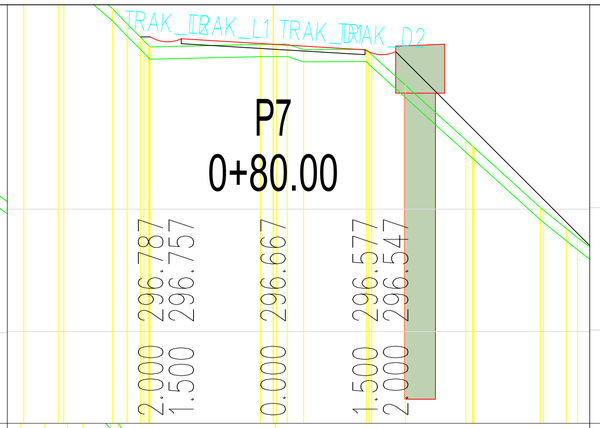
Seznam palic - oblike krivljenja

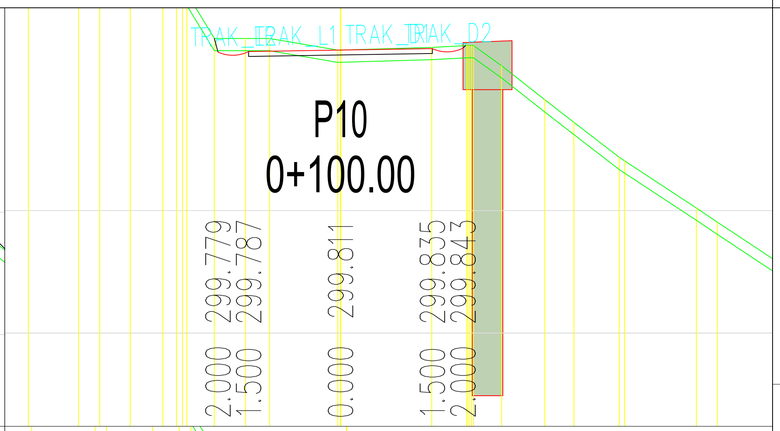
Projekt:
K risbi: G.5.2
Izdelal:
Datum / čas: 17/11/2026 /
Napotek:

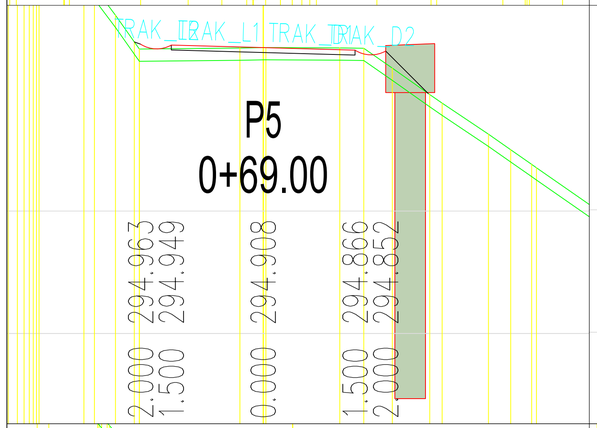
Poligonalno položene palice

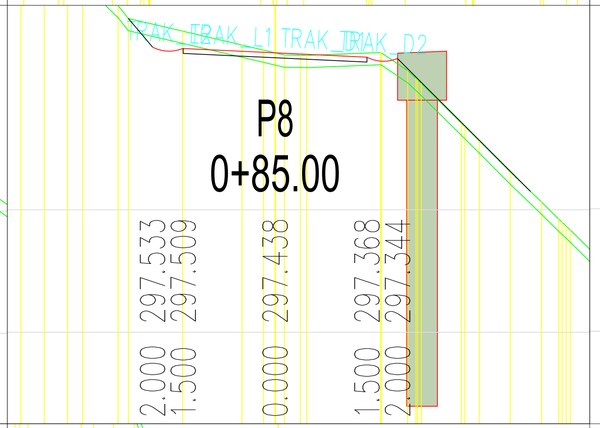
Pozicija	Kosov	Krak										
		a [cm]	b [cm]	c [cm]	d [cm]	e [cm]	f [cm]	g [cm]	h [cm]	i [cm]	j [cm]	[cm]
Pozicija 3												
3.1	3	63										222
3.2	3	64										223
3.3	3	64										223
3.4	6	65										224
Pozicija 3: 15 Ø 16 Gesamtlänge: 33,48 m												
Pozicija 4												
4.1	6	65										224
4.2	3	64										223
4.3	3	64										223
4.4	3	63										222
Pozicija 4: 15 Ø 16 Gesamtlänge: 33,48 m												

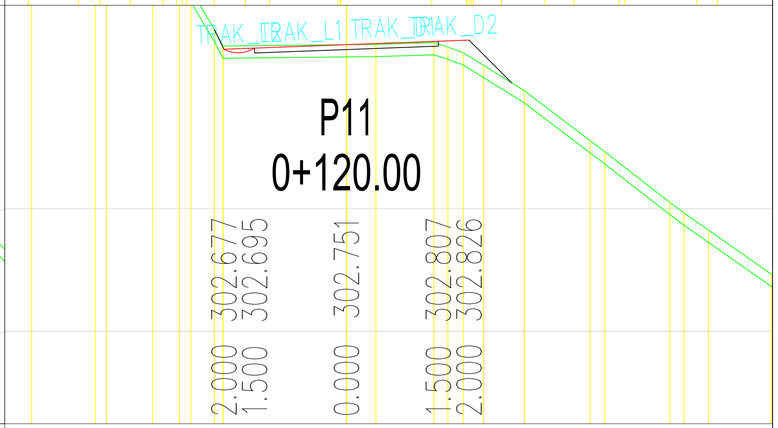


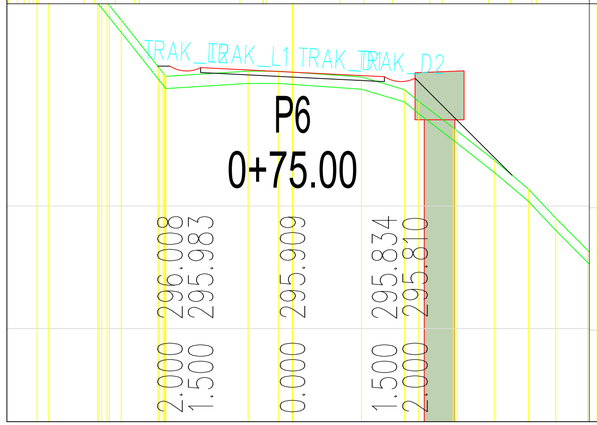


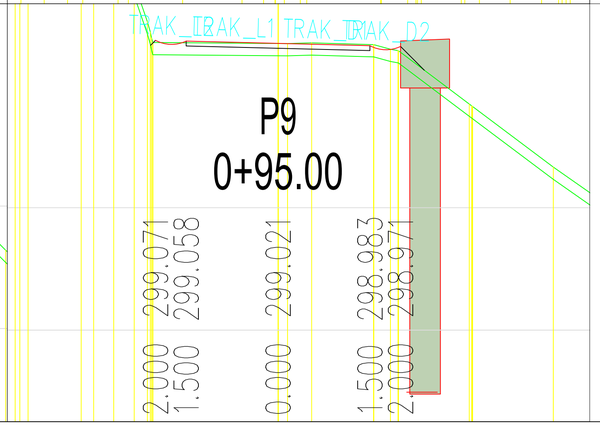








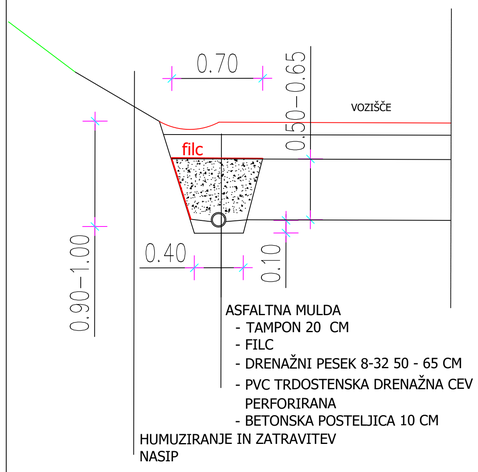




Naročnik: Občina Cirkulane, Cirkulane 58, 2282 Cirkulane		Projekt: Sanacija JP 603081 – Gruškovec 110	
Izvajalec: PNV inženiring		Odsek:	
Podizvajalec:		Pododsek:	
Naziv	Ime in priimek	Ident. št.	Podpis
Odg.vodja proj.:		Opis risbe:	Prečni profili cestišča
Poobl. inženir.:	mag. Jonez MAYER u.d.i.r.g.	RG-0038	Del risbe:
Projektant 1:	Tomaž MAYER d.i.g.(UN)	Št. projekta:	26/9/1311
Projektant 2:		Št. načrta:	Merilo: 1:50
		Šifra CC:	Datum: nov 2026

Št. odseka:	Arhivska št.:	Faza/Objekt:	Šifra risbe:
Št. priloge: G.6.1			Avtor risbe: PNV inženiring d.o.o.
			Ident. št. risbe:

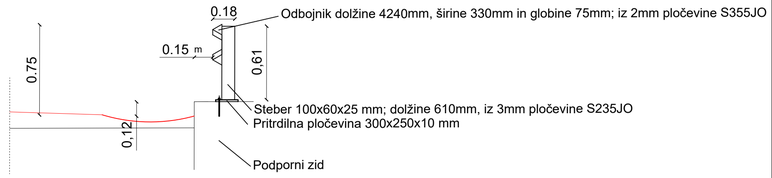
DRENAŽA
DETAJL
M 1:25



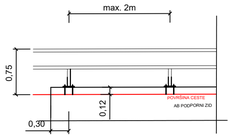
ASFALTNA MULDA
- TAMPON 20 CM
- FILC
- DRENAŽNI PESEK 8-32 50 - 65 CM
- PVC TRDOSTENSKA DRENAŽNA CEV ϕ 125 - PERFORIRANA
- BETONSKA POSTELJICA 10 CM

HUMUZIRANJE IN ZATRAVITEV
NASIP

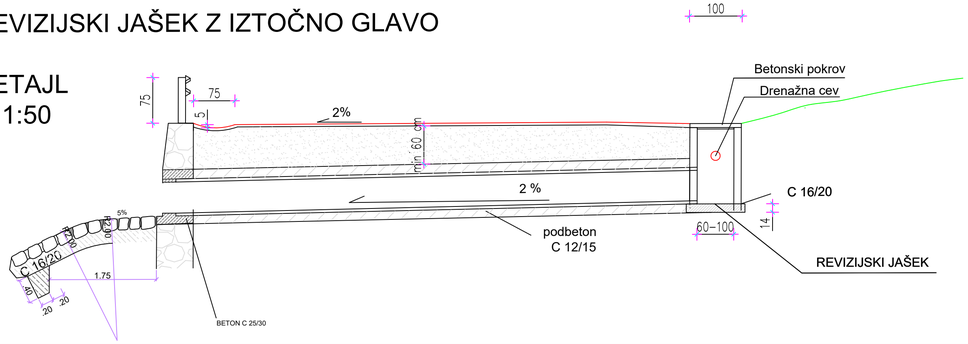
DETAJL
OGRAJA-ZID
M 1:25



M 1:50



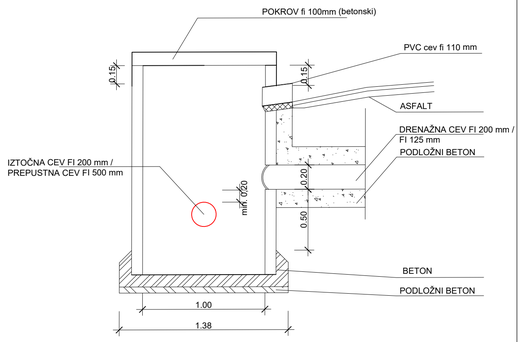
PREREZ PROPUSTA
REVIZIJSKI JAŠEK Z IZTOČNO GLAVO
DETAJL
M 1:50



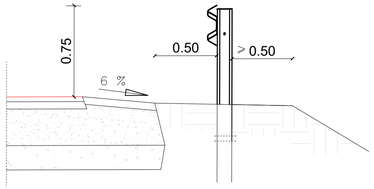
BETONSKI JAŠEK Z VTOKOM IZ MULDE

M 1:25

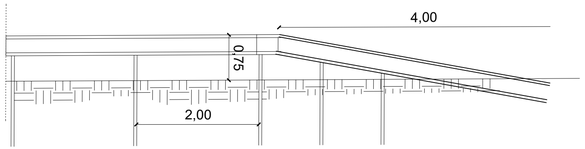
KARAKTERISTIČNI PREREZ



DETAJL
OGRAJA-BANKINA
M 1:25



M 1:50



Investitor:	Občina Cirkulane Cirkulane 58 2282 Cirkulane	Naziv gradnje:	Sanacija JP 603081 – Gruškovec 110
Naročnik:		Naziv načrta:	2 Načrt s področja gradbeništva
Projektant načrta:	PNV inženiring, d.o.o. Spičnik 47 2201 Kungota	Opis risbe:	Detajli ceste
Odg.vodja proj.:		Del risbe:	
Pooblj. inženir:	mag. Jonez MAYER u.d.i.r.g.	Št. projekta:	26/9/1311
Projektant 1:	Tomaž MAYER d.i.g.(UN)	Št. načrta:	26/9/1311
Projektant 2:		Šifra CC:	
		Faza:	PZI
		Merilo:	1:25,50
		Datum:	nov 2026

Št. odseka:	Arhivska št.:	Faza/Objekt:	Šifra risbe:
Št. priloge:	G.7	Avtor risbe:	PNV inženiring, d.o.o.
		Ident. št. risbe:	