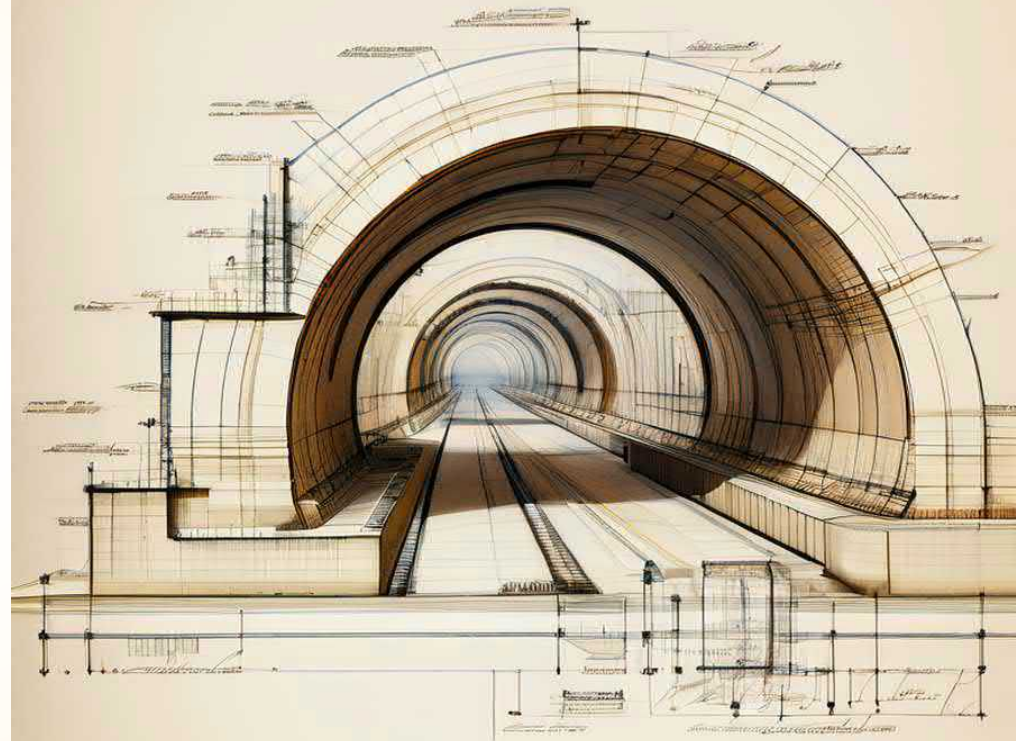


GEODETSKI RADOVI NA TUNELU „NOVI”

Antonio Zovko, Emina Redžić
Lipanj, 2024.

HI
HERING



Izvođač radova: Hering d.d.

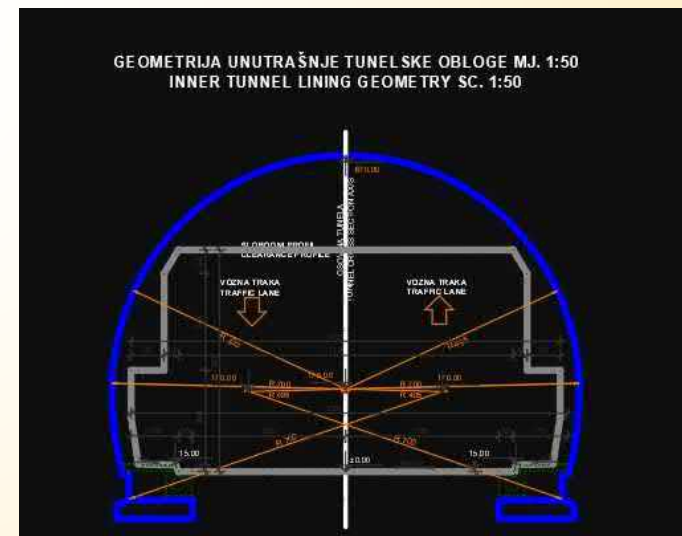
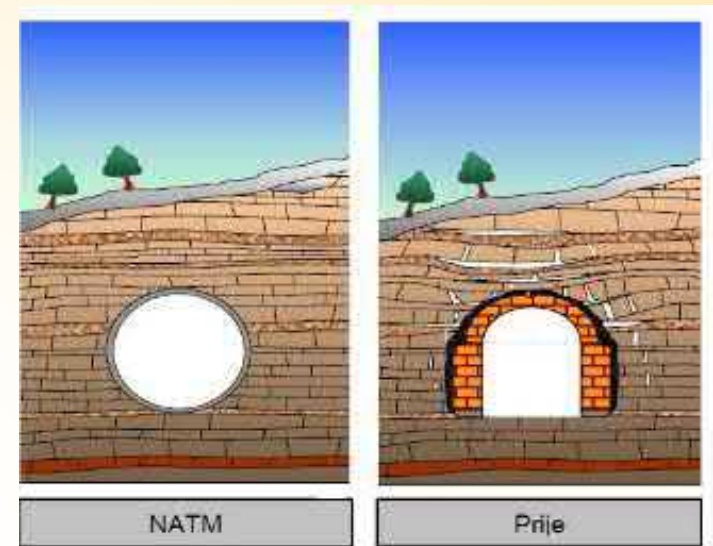
UVOD

- Potreba za izgradnjom obilaznice
- Projekat tunela
 - 899m dužina glavne tunelske cijevi,
 - 867m podzemnog iskopa
 - 730m dužina servisne cijevi
- NATM

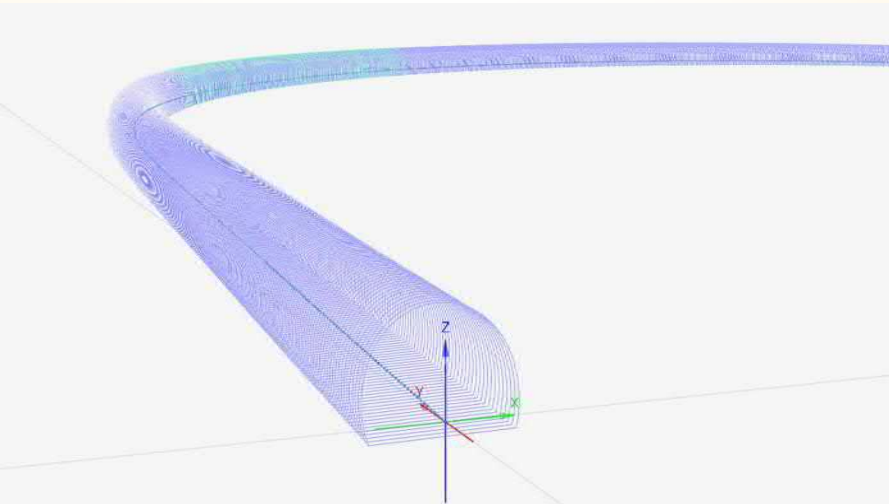


- Osnovna nosiva komponenta tunela je stijenska masa;
- Održavanje čvrstoće stijenske mase;
- Poprečni profil treba bit zaobljen;
- Podgrada treba biti fleksibilna i tanka;
- Mjerenja in – situ.

- Oblici i položaji portala

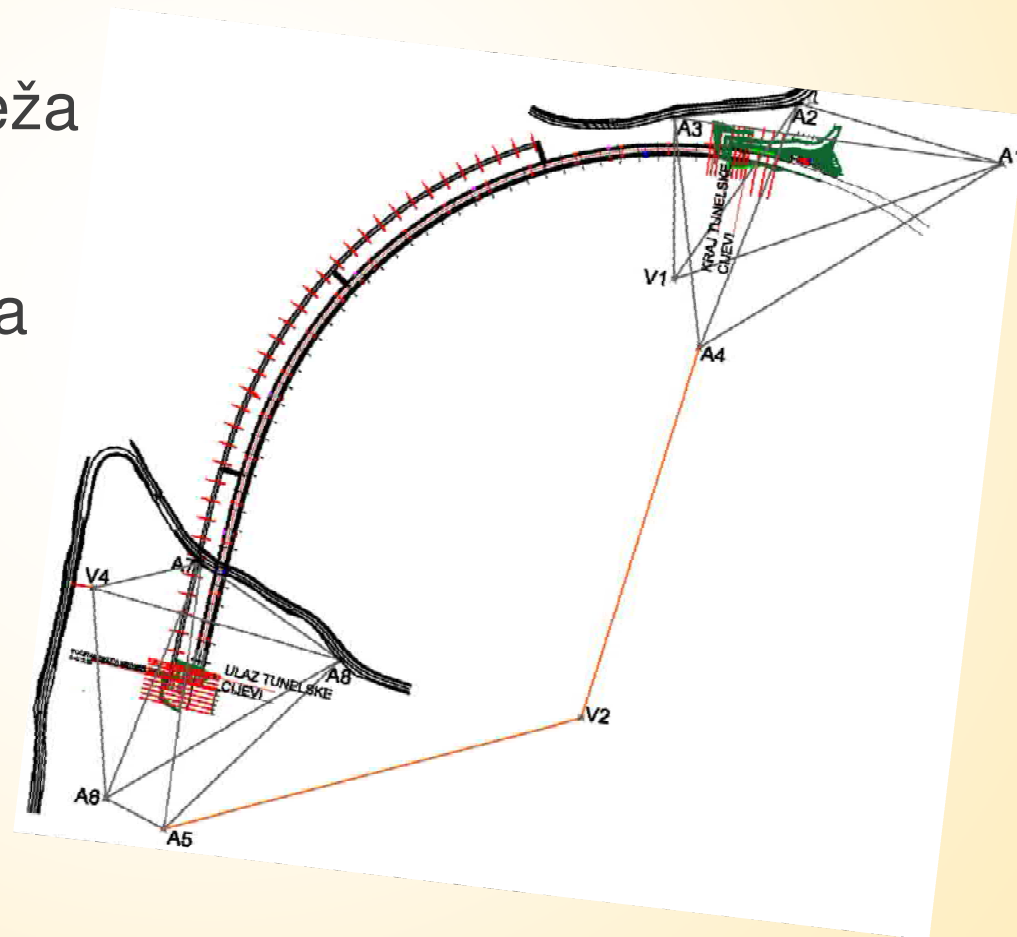


-



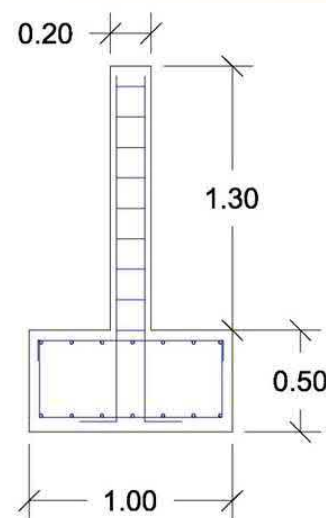
GEODETSKE MREŽE

- Projekat, rekognosciranje i stabilizacija mreže
- Svrha uspostave mreža
- Mjerenje mreže
- Izjednačenje mjerenja

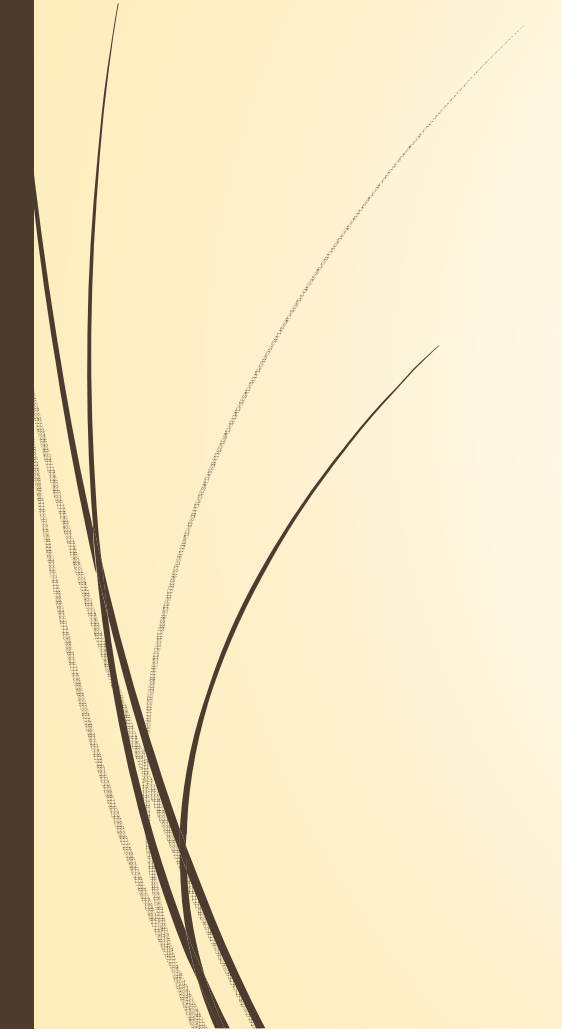


Rekognosciranje i stabilizacija

- Nisu smjele postojati nikakve prepreke između antene i satelita;
- Reflektirajuće površine – multipath;
- Električna postrojenja, željeznička pruga;
- Krošnje stabla, zgrade;
- Klizišta;
- Zona građenja;
- Dogledanje stajališta;



METODE IZMJERE



TERESTIČKA

Triangulacija

Trilateracija

Kombinacija

Poligonometrija

Lučni presjek

Nivelman

SATELITSKA

GNSS

➤ Tip mreže?

MJERENJE MREŽE TUNEL NOVI

- Terestička mjerenja
 - girusna metoda

*Dovoljan broj mjerne opreme

- GNSS mjerenja - statika



TPS izvješće o mjerenjima

Cilj	Datum vrijeme	Hz	V	HD	SD	Refl. Visina
A4	8.2.2023 14:16	360.0000	78.37272	365.8798	373.221	0,2370
A4	8.2.2023 14:17	0,00001	78.37273	365.8797	373.2209	0,2370
V1	8.2.2023 14:17	11.52472	82.16135	359.6283	362.9337	1,445
A3	8.2.2023 14:18	39.14126	86.49045	341.4632	341.9964	0,2370
A2	8.2.2023 14:18	47.43123	86.12206	219.3401	219.8256	0,2380
A4	8.2.2023 14:19	359.59597	78.37233	365.8779	373.2205	0,2370
V1	8.2.2023 14:19	11.52503	82.16101	359.6275	362.9337	1,445
A3	8.2.2023 14:20	39.14105	86.49101	341.4635	341.9961	0,2370
A2	8.2.2023 14:20	47.43125	86.12195	219.3403	219.8258	0,2380
A2	8.2.2023 14:20	227.43091	273.47376	219.3404	219.8257	0,2380
A3	8.2.2023 14:21	219.14035	273.10472	341.4642	341.9966	0,2370
V1	8.2.2023 14:21	191.52488	277.43499	359.6274	362.9336	1,445
A4	8.2.2023 14:21	179.59557	281.22321	365.8799	373.2209	0,2370
A4	8.2.2023 14:22	359.59599	78.37256	365.879	373.2208	0,2370
V1	8.2.2023 14:22	11.52507	82.16095	359.6274	362.9337	1,445
A3	8.2.2023 14:22	39.14156	86.49063	341.4633	341.9963	0,2370
A2	8.2.2023 14:22	47.43158	86.12162	219.34	219.8258	0,2380
A2	8.2.2023 14:23	227.43096	273.47371	219.3408	219.8261	0,2380
A3	8.2.2023 14:23	219.14075	273.10477	341.464	341.9964	0,2370
V1	8.2.2023 14:23	191.52442	277.43513	359.6273	362.9338	1,445
A4	8.2.2023 14:24	179.59562	281.22301	365.8806	373.2209	0,2370
A1	8.2.2023 14:31	0,00000	93.47434	219.3397	219.8245	0,2370
A1	8.2.2023 14:32	359.59599	93.47417	219.3403	219.825	0,2370

IZJEDNAČENJA

- Obrada mjerenih dužina - popravke
- Izjednačenje terestičkih mjerenja – JAG 3D - MNK
- Izjednačenje GNSS mjerenja –TBC-- transformacija

Project

JAG3D Version: v20221217
Name of Project:
Project Id:
Customer Id:
Person in Charge: Drago
Date of Calculation: 13.02.2023
Kind of network: linked network
Adjustment Type: Least squares adjustment (L_2 Norm)
Coordinate frame: Gauß-Krüger projection
• Earth radius: $R_0 = 6360132.5669$ m
• Reference height: $h_0 = 500.0000$ m
• Distance reduction
• Direction reduction
• Height reduction
• Earth's curvature reduction
Probability Value α : 0.10 %
Test Power ($1-\beta$): 80.00 %
Description:

Atmosferske korekcije

Atmosferska ppm Refrakcija

Temperatura 19.0 °C

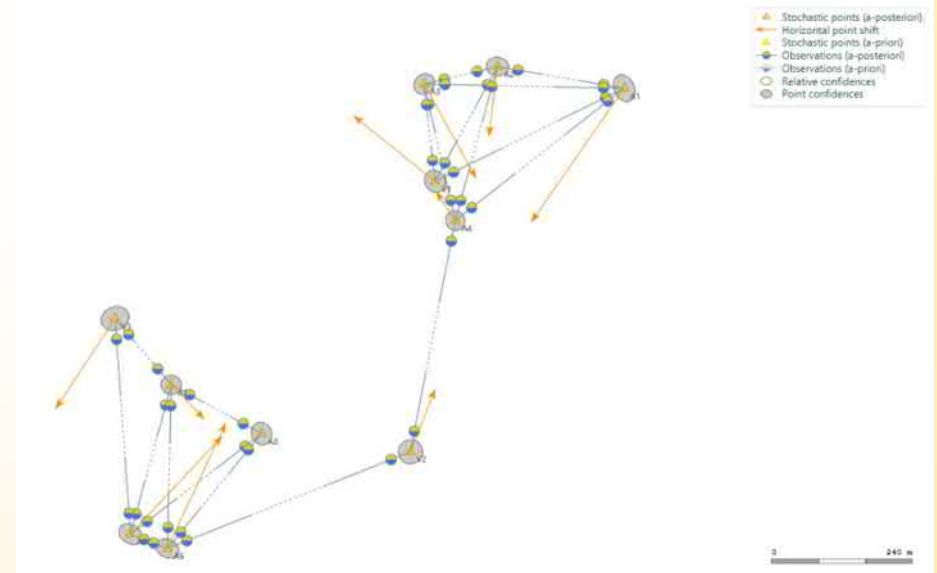
Pritisak 1015.6 mbar

Vlažnost vazduha 69.0 %

Atmosferska ppm 6.5

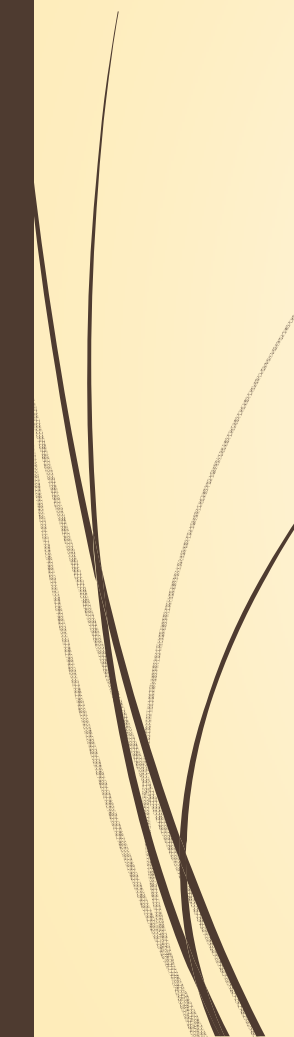
Tačnost merenja se povećava ako se unese temperature, pritisak i vlažnost

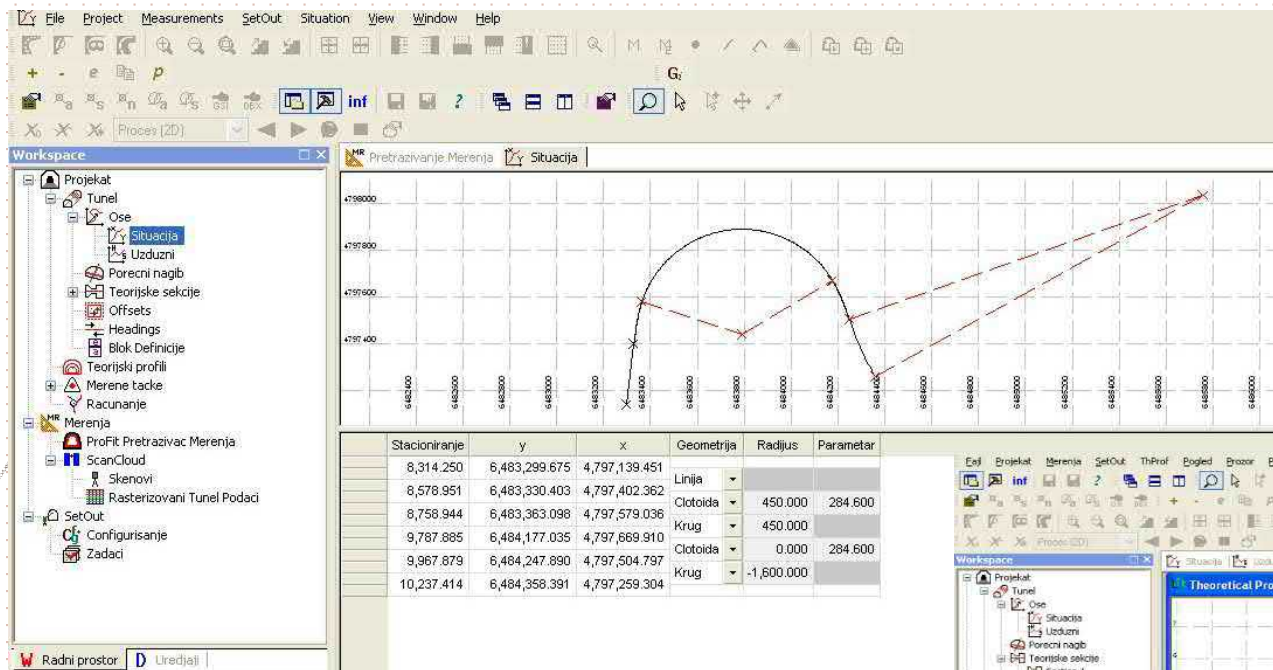
Fn OK Strana Fn





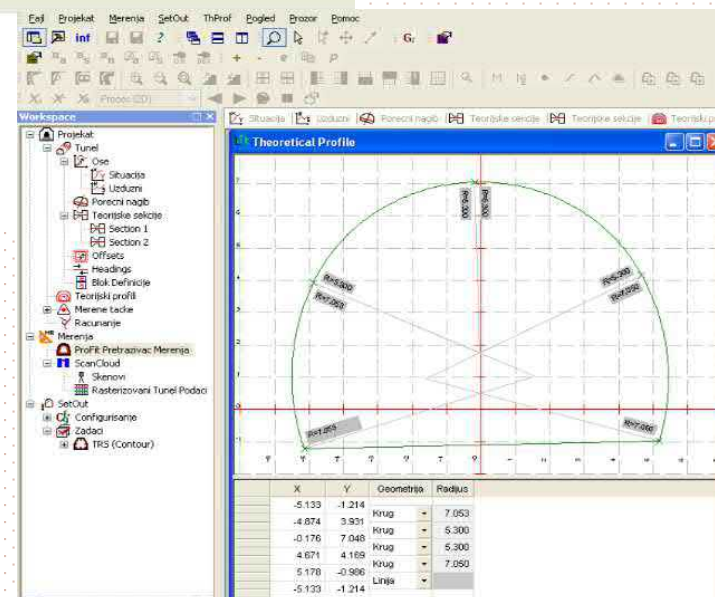
Priprema podataka za obavljanje geodetskih poslova

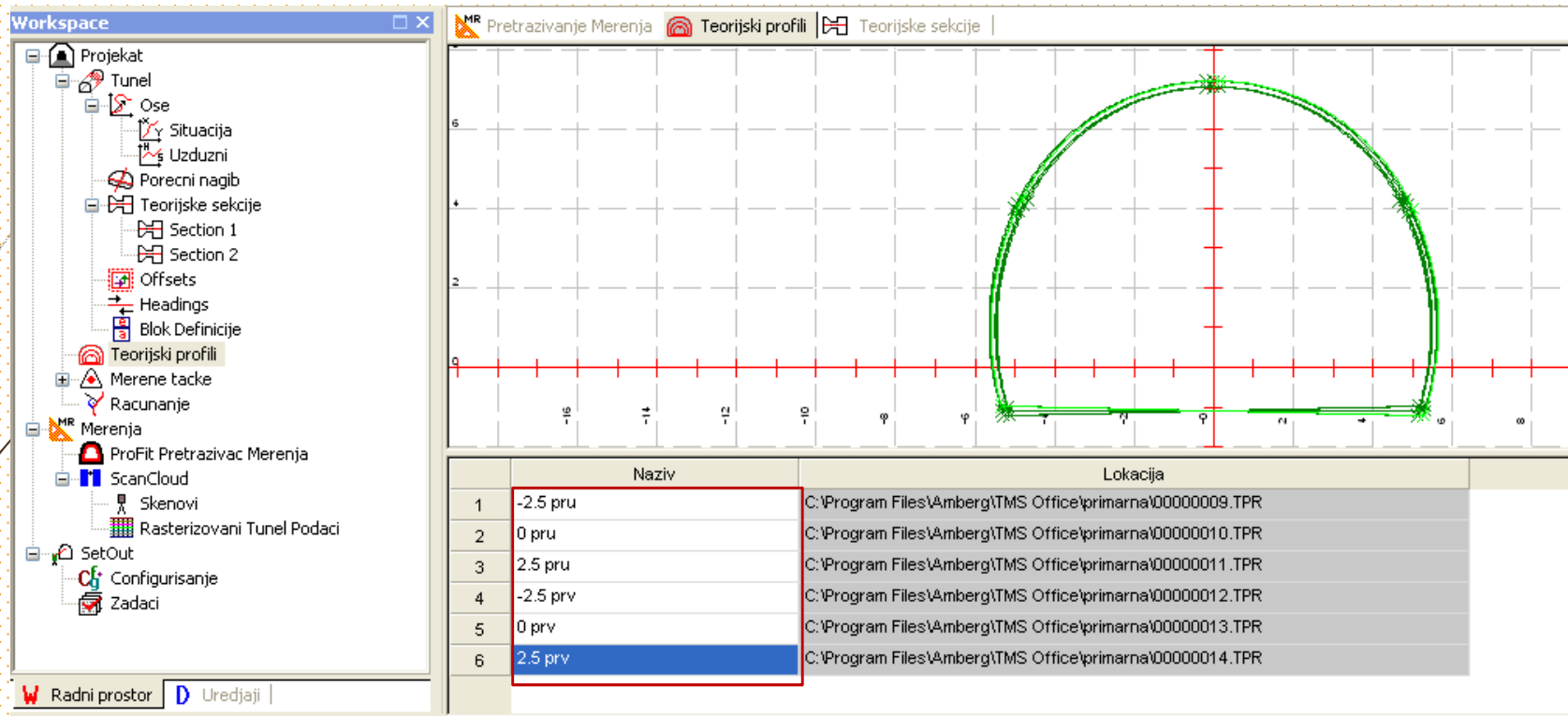
- Provjera projektne dokumentacije
 - Izrada dodatnih crteža za potrebe kontrole i obrade podataka
 - Amberg / TMS Office paket
 - iSure program – bušilica
- 



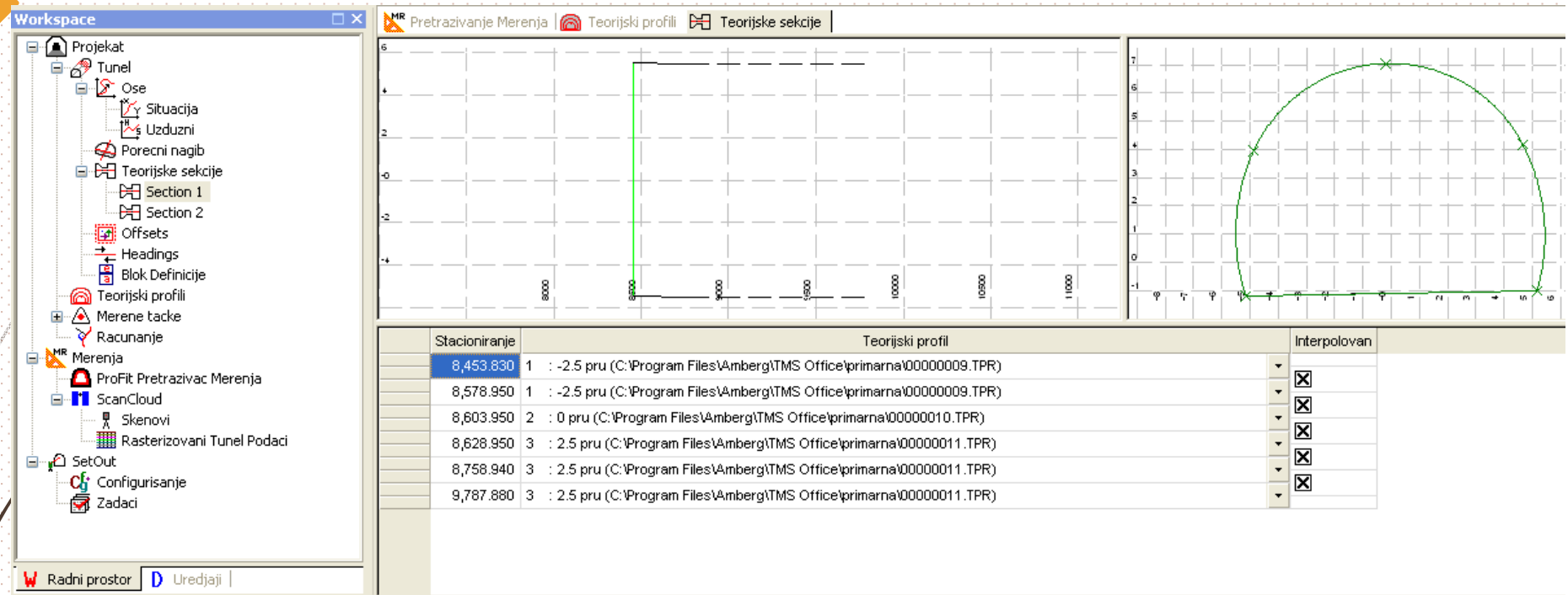
Unos horizontalnih elemenata trase

Formiranje karakterističnog poprečnog profila

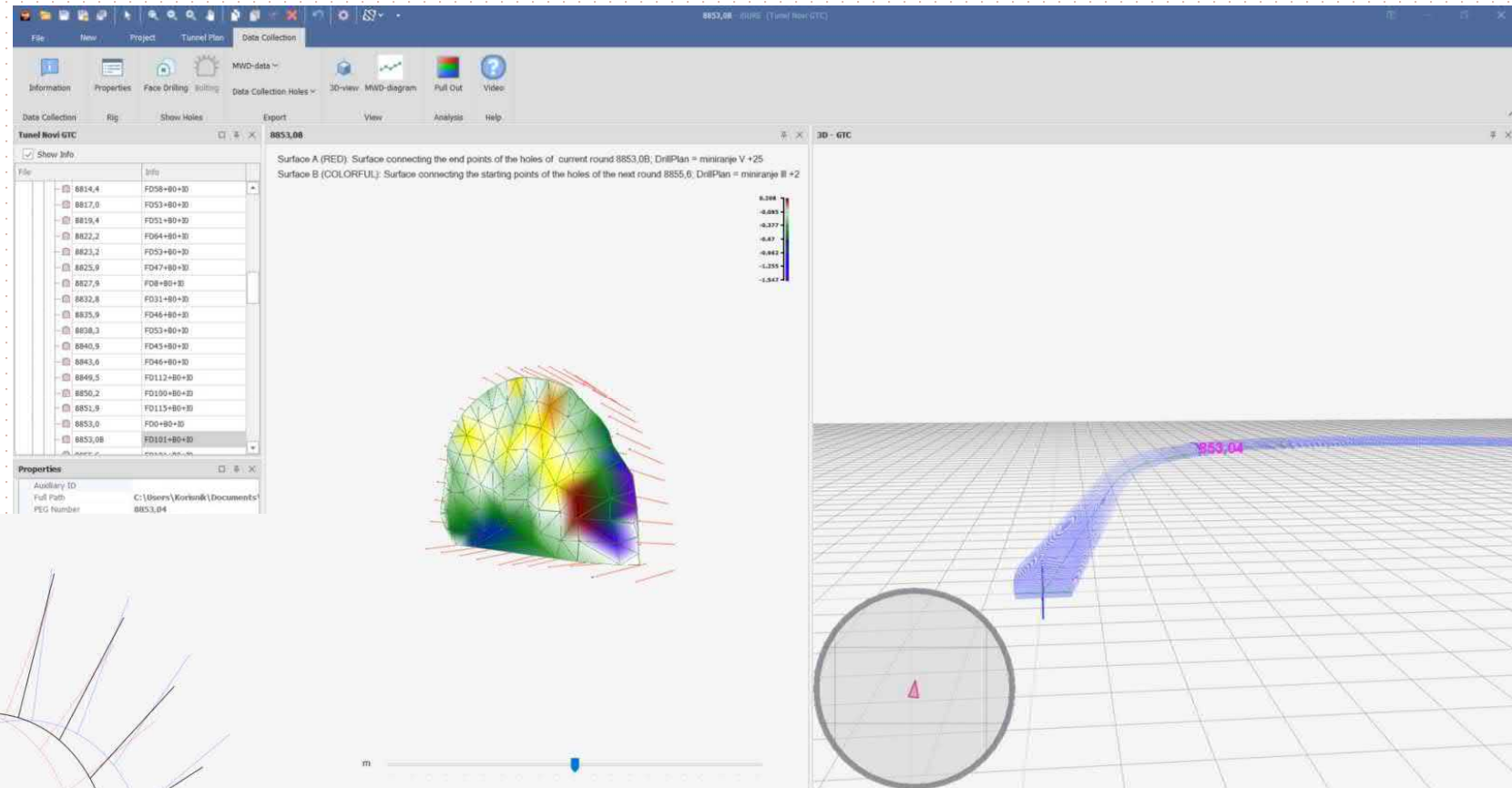




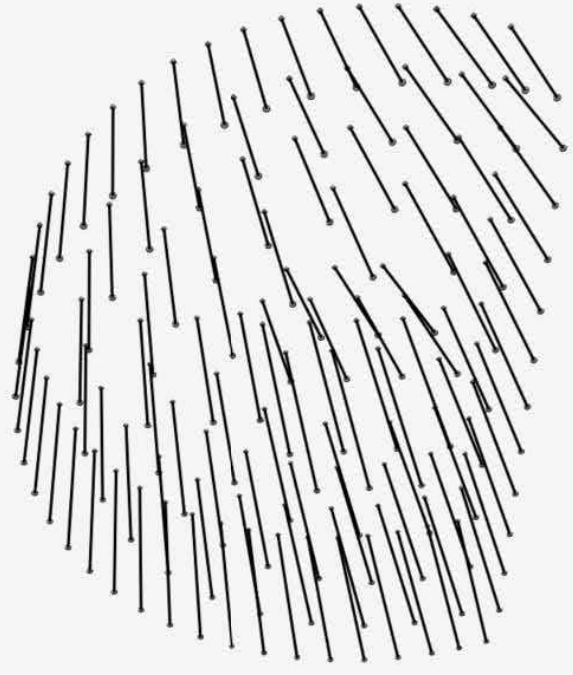
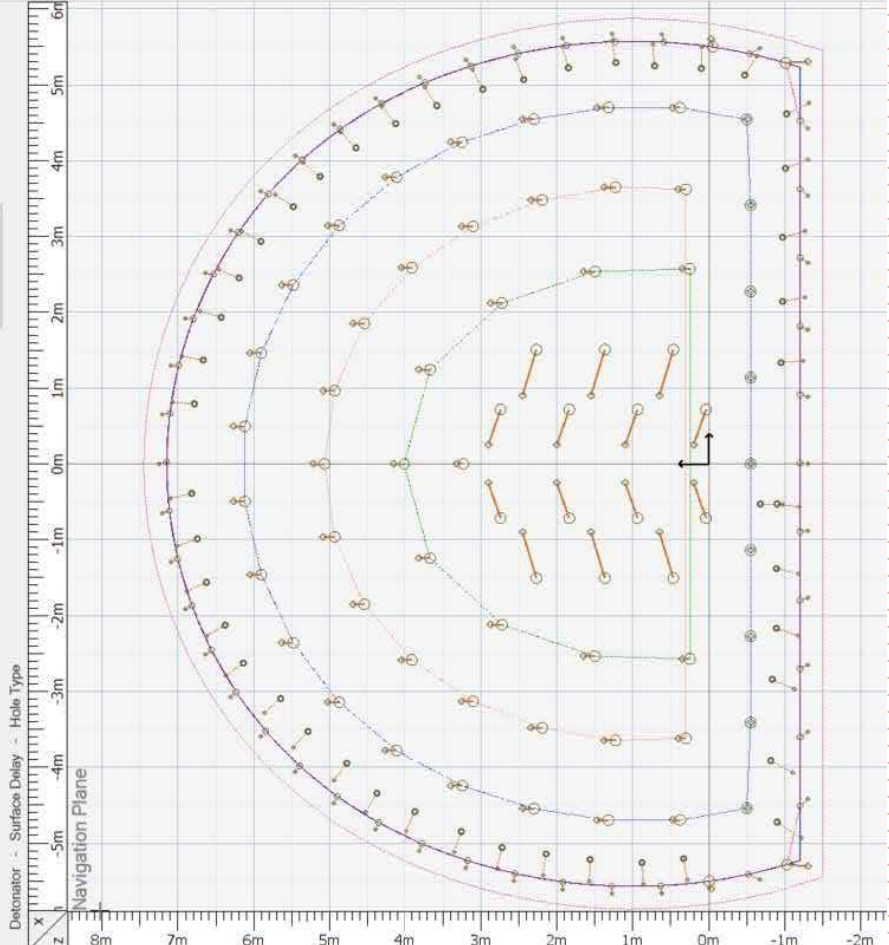
Teorijski profili



Stacioniranje svih tlocrtnih i poprečnih promjena - interpolacija

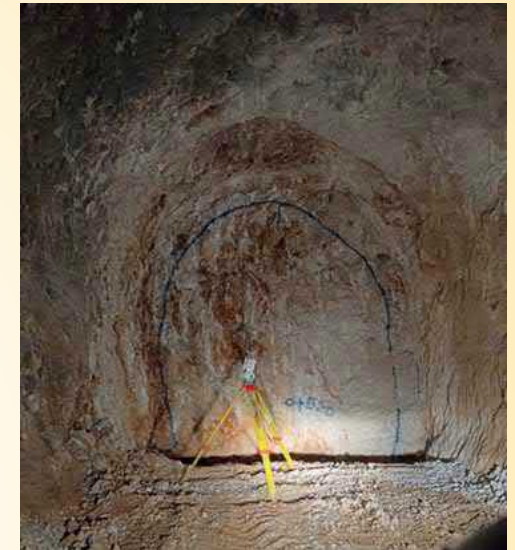


iSure



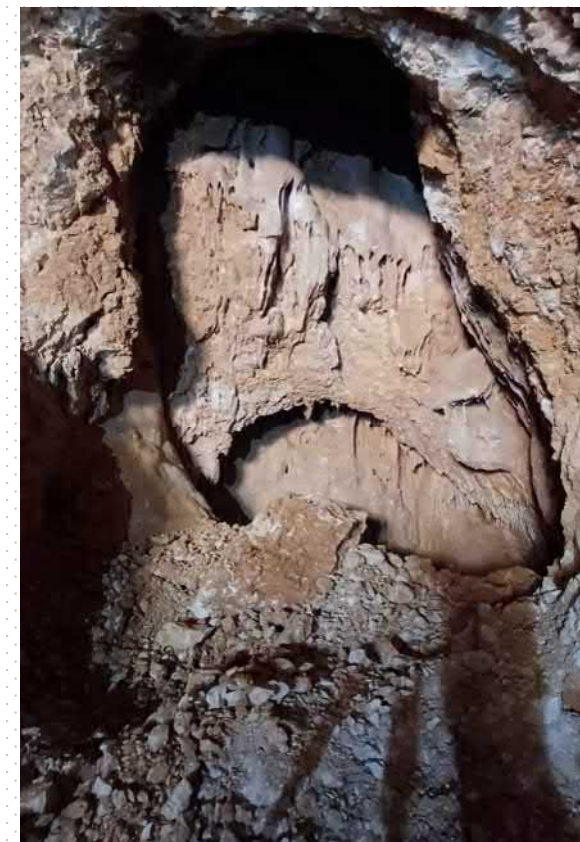
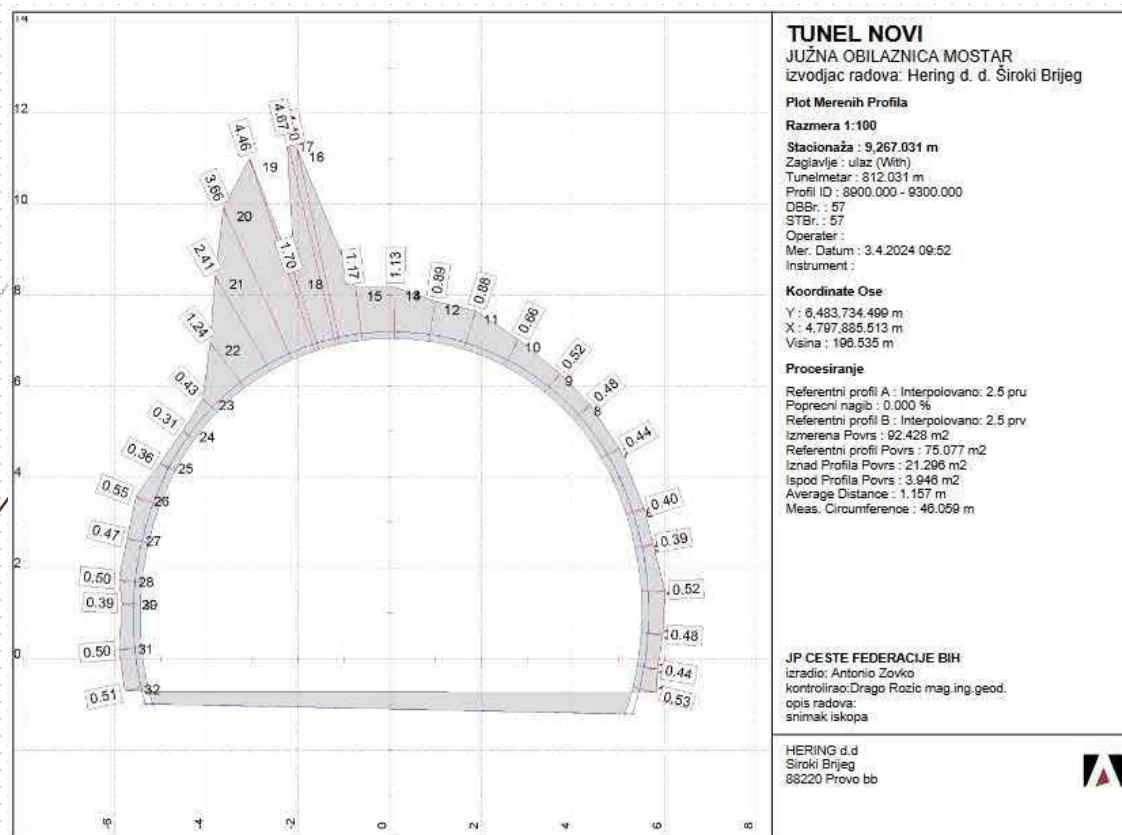
FAZA ISKOPA

- Obilježavanje konturne linije čela;
- Pozicioniranje bušilice;
- Kontrola i snimak iskopa;
- Obilježavanje svih promjena u geometriji tunela

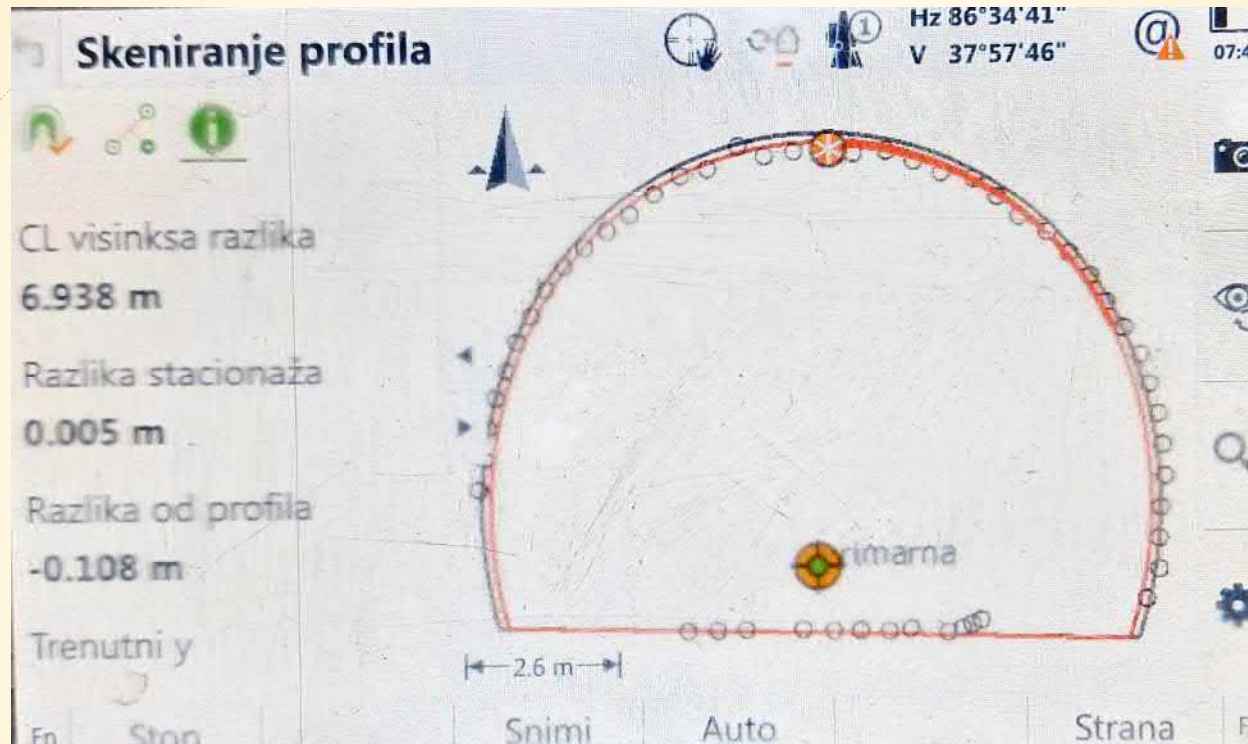




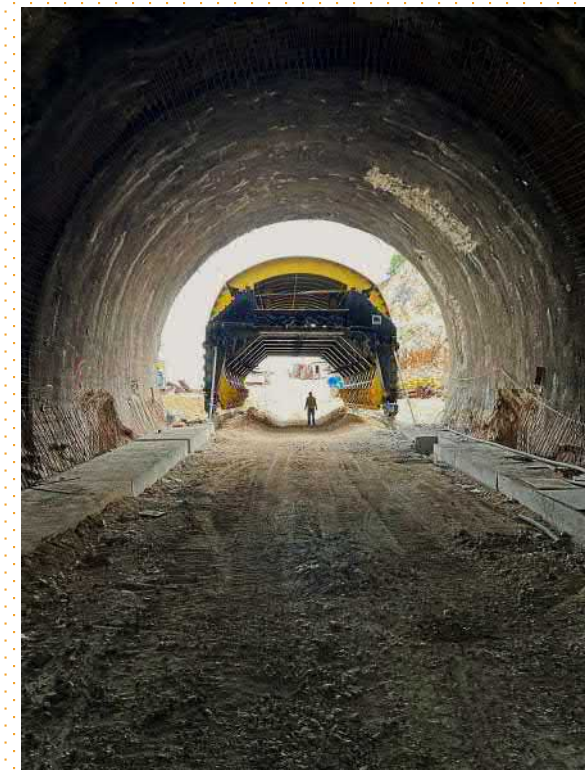
► Obilježavanje konturne linije čela



➤ Prekopprofili



- Prikaz ekrana tunelskog programa u toku snimanja iskopa



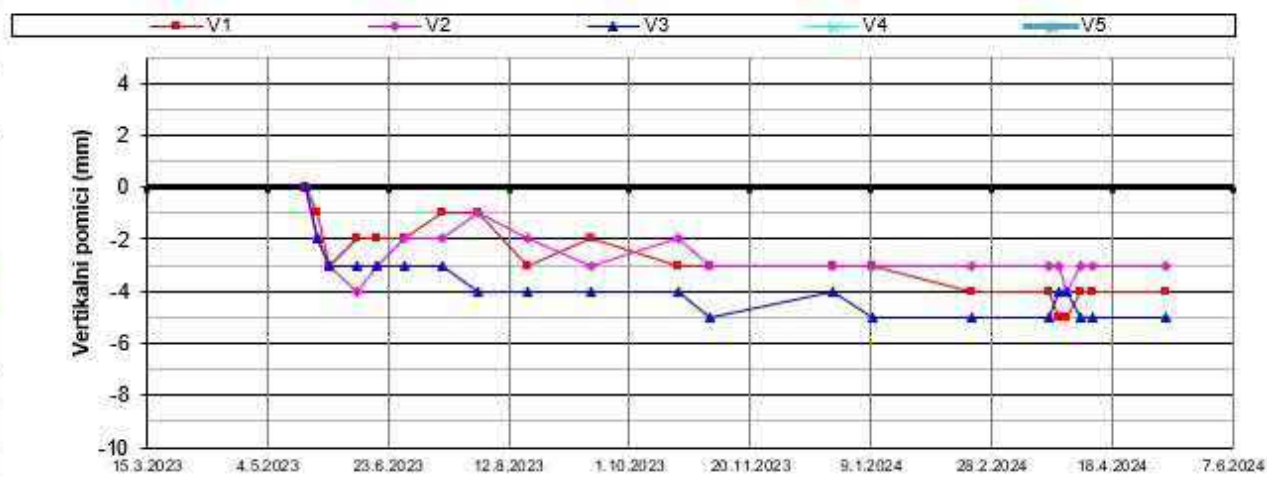
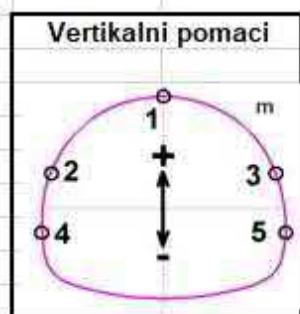
➤ Promjene u geometriji tunela



- Ugradnja rešetkastih nosača

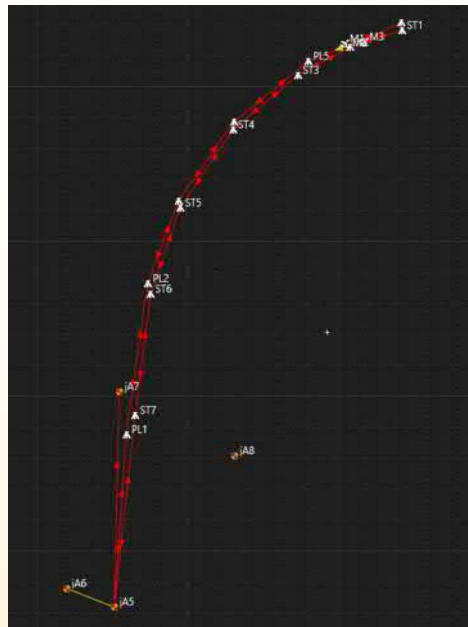
KONVERGENCIJE

- Praćenje slijeganja tunela
- Pet mjernih mjesta
- Interval mjerenja
- Dokaznica umirenja



PODZEMNA POLIGONOMETRIJA

- 100-200 m
- Stabilizacija
- Proboj tunela



Br. Točke	ΔY	ΔX	Q (m)	opis
K14	6483772.449	4797888.356	202.193	s ulazne strane
K14	6483772.447	4797888.323	202.179	s izlazne strane
K14	0.002	0.033	0.014	
odstupanje od srednje vrijednosti za spojnu točku				
Br. Točke	ΔY	ΔX	Q (m)	opis
K14	0.001	0.016	0.007	

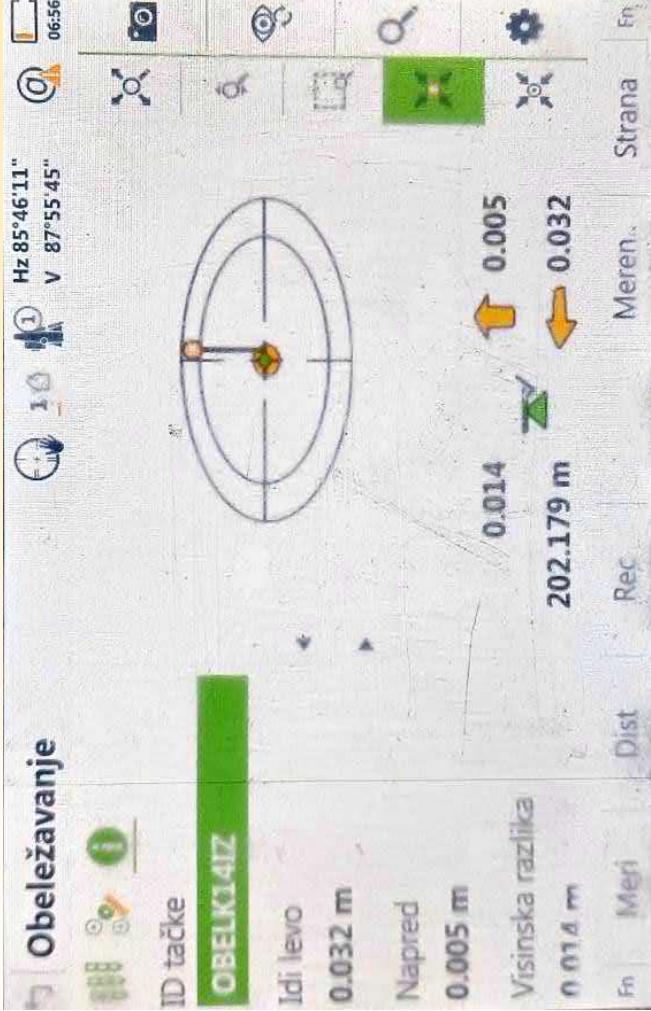
Dopuštena odstupanja po položaju i visini, u skladu s Pravilnikom, .
za eventualno mimoilaženje tunelskih osi vođenih iz dva smjera iznose:

po osi mm ± 60√L po niveleti mm± 23 √L,

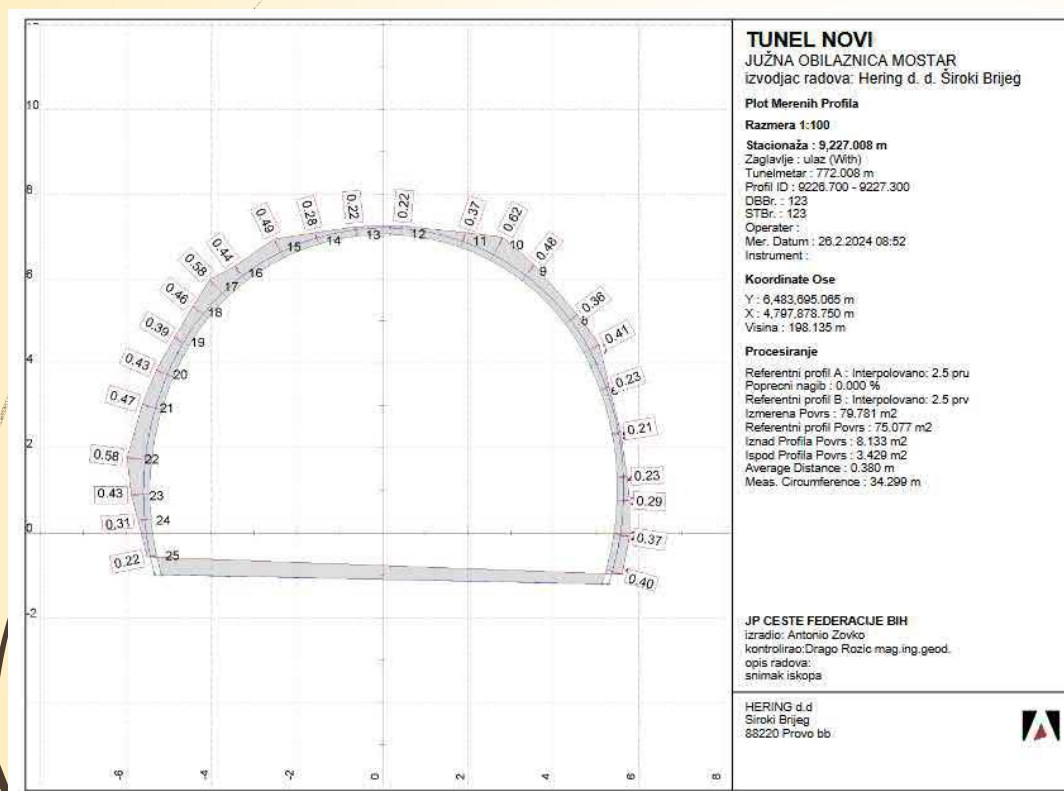
gdje je L- duljina tunela izražena u kilometrima

Kako je u slučaju tunela Novi L≈0.9 km, dopuštene razlike iznose:

po osi ± 57 mm po niveleti ± 22mm



Obrada snimljenih podataka



TUNEL NOVI

JUŽNA OBILAZNICA MOSTAR

izvodjac radova: Hering d. d. Široki Brijeg

JP CESTE FEDERACIJE BIH

Izradio: Antonio Zovko

kontrolirao: Drago Rozic mag.ing.geod.

opis radova:

snimak iskopa

Lista merenih tacaka profila

Profil ID : 9226.700 - 9227.300

Broj tacaka : 25

Stacionaža : 9,227.008

Metoda : String

Operator :

Mer. Datum : 26.2.2024 08:52

Instrument :

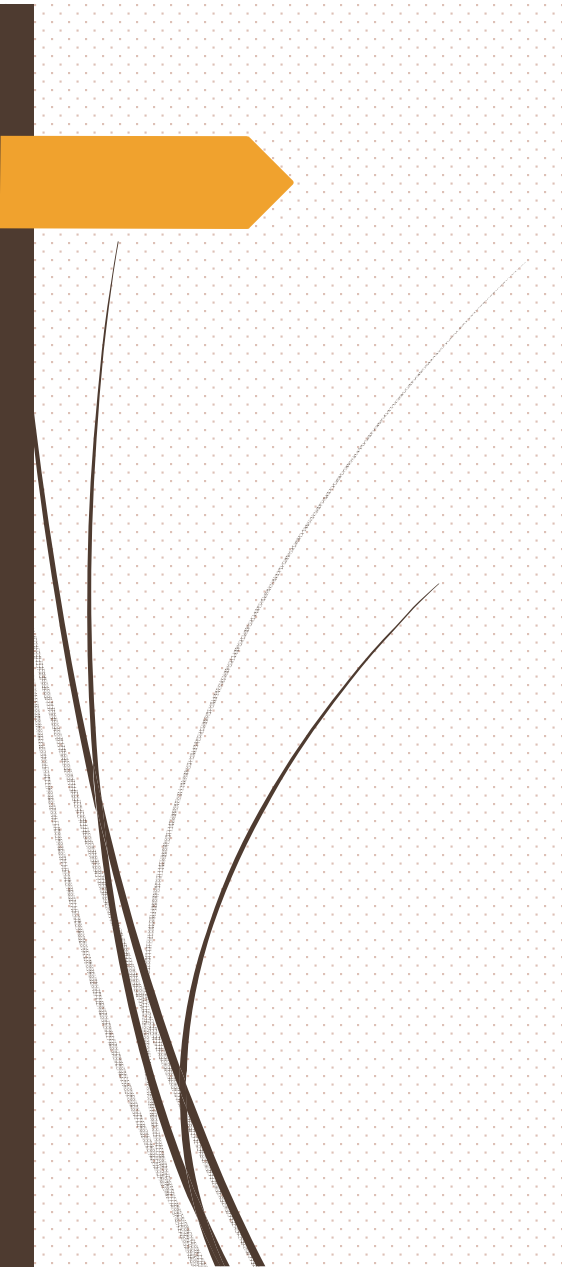
Naziv fajla : C:\Program Files\Amberg\TMS Office\primarna\primarna02_1\00787amt.mpr

TaBr.	Stacionaža [m]	X rel. na osu [m]	Y rel. na osu [m]	Obim [m]	Y [m]	X [m]	Visina [m]	Ponovo
1	9,227.135	5.618	-0.981	0.000	6,483,696.383	4,797,873.287	197.148	
2	9,226.847	5.788	-0.079	0.918	6,483,696.141	4,797,873.061	198.062	
3	9,226.979	5.787	0.769	1.766	6,483,696.268	4,797,873.089	198.906	
4	9,227.021	5.722	1.326	2.327	6,483,696.295	4,797,873.162	199.462	
5	9,226.979	5.580	2.377	3.387	6,483,696.224	4,797,873.292	200.515	
6	9,226.974	5.308	3.456	4.500	6,483,696.161	4,797,873.556	201.595	
7	9,227.249	5.077	4.456	5.526	6,483,696.378	4,797,873.840	202.585	
8	9,226.792	4.559	5.158	6.399	6,483,695.826	4,797,874.250	203.306	
9	9,227.105	3.551	6.340	7.952	6,483,695.914	4,797,875.301	204.476	
10	9,227.193	2.818	6.981	8.926	6,483,695.844	4,797,876.036	205.114	
11	9,226.942	1.951	7.086	9.799	6,483,695.416	4,797,876.830	205.229	
12	9,226.785	0.458	7.254	11.301	6,483,694.945	4,797,878.255	205.404	
13	9,226.948	-0.636	7.232	12.396	6,483,694.871	4,797,879.359	205.375	
14	9,227.107	-1.577	7.093	13.347	6,483,694.827	4,797,880.312	205.230	
15	9,227.084	-2.537	6.936	14.319	6,483,694.600	4,797,881.245	205.074	
16	9,226.998	-3.457	6.300	15.438	6,483,694.320	4,797,882.126	204.441	
17	9,227.007	-4.047	5.978	16.110	6,483,694.204	4,797,882.704	204.118	
18	9,227.084	-4.444	5.353	16.851	6,483,694.195	4,797,883.109	203.489	
19	9,226.964	-4.865	4.623	17.693	6,483,693.967	4,797,883.494	202.764	
20	9,227.056	-5.291	3.849	18.577	6,483,693.988	4,797,883.930	201.985	
21	9,226.964	-5.620	3.040	19.450	6,483,693.827	4,797,884.232	201.179	
22	9,227.054	-5.986	1.783	20.759	6,483,693.838	4,797,884.609	199.918	
23	9,226.943	-5.883	0.900	21.649	6,483,693.750	4,797,884.485	199.038	
24	9,226.922	-5.727	0.298	22.270	6,483,693.762	4,797,884.328	198.437	
25	9,227.065	-5.513	-0.566	23.160	6,483,693.949	4,797,884.149	197.567	
1	9,227.135	5.618	-0.981	34.299	6,483,696.383	4,797,873.287	197.148	

ZAKLJUČAK

- Geodetski radovi su uključeni od faze projektiranja do završetka izgradnje objekta
- Važnost geodetske nadzemne mreže
- Tunelski program i TMS Office





HVALA NA PAŽNJI ! 😊