

# Idejno rješenje lokalne ceste

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Đurečić, Matea

Undergraduate thesis / Završni rad

2019

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**University of Split, Faculty of Civil Engineering, Architecture and Geodesy / Sveučilište u Splitu, Fakultet građevinarstva, arhitekture i geodezije**

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UNIVERSITY OF SPLIT



DIGITALNI AKADEMSKI ARHIVI I REPOZITORIJI

**SVEUČILIŠTE U SPLITU**

**FAKULTET GRAĐEVINARSTVA, ARHITEKTURE I GEODEZIJE**

**ZAVRŠNI RAD**

**Matea Đurečić**

**Split, 2019.**

**SVEUČILIŠTE U SPLIT**  
**FAKULTET GRAĐEVINARSTVA, ARHITEKTURE I GEODEZIJE**

# **IDEJNO RJEŠENJE LOKALNE CESTE**

**Završni rad**

**Split, 2019.**

**SVEUČILIŠTE U SPLITU FAKULTET GRAĐEVINARSTVA, ARHITEKTURE I GEODEZIJE**

Split, Matice hrvatske 15

STUDIJ: PREDDIPLOMSKI SVEUČILIŠNI STUDIJ GRAĐEVINARSTVA

KANDIDAT: Matea Đurečić

BROJ INDEKSA: 4385

KATEDRA: Katedra za prometnice

PREDMET: Ceste

**ZADATAK ZA ZAVRŠNI RAD**

Tema: Idejno rješenje lokalne ceste

Opis zadatka: Uz pomoć programa za projektiranje cesta Autocad Civil 3D potrebno je izraditi idejno rješenje lokalne ceste između zadanih točaka A i B na situaciji koja je preuzeta iz programa iz kolegija Ceste.

Zadatak treba sadržavati:

1. Kopiju programskog zadatka
2. Tehnički opis s prikazom korištenja programa Civil 3D
3. Građevinsku situaciju u M 1:1000
4. Uzdužni presjek u M 1:1000/100
5. Karakteristične poprečne presjeke u M 1:200
7. Računalne ispise koordinatnih točaka osi
8. Proračun količina zemljanih radova
9. Proračun količine radova po presjecima

U Splitu, travanj 2019.

Voditelj Završnog rada: Dr.sc. Dražen Cvitanić

## Idejni projekt lokalne ceste

### **Sažetak:**

Uz pomoć programa za projektiranje cesta AUTOCAD CIVIL 3D izrađeno je idejno rješenje lokalne ceste na posebnoj geodetskoj podlozi prema zadatku iz kolegija Ceste. Cesta je projektirana za godišnji dnevni promet (PGDP) od 950 vozila na dan, na brdovitom terenu. Projektna brzina ceste iznosi 40km/h. Idejno rješenje izrađeno je prema Pravilniku o osnovnim uvjetima za projektiranje ceste.

### **Ključne riječi:**

idejno rješenje, projektna brzina, os ceste, duljina prijelazne krivine, radijus krivine, niveleta, poprečni presjek, uzdužni presjek

## Preliminary design of the road section

### **Abstract:**

With the help of the road design software AUTOCAD CIVIL 3D, the conceptual solution of the local road was developed on a special geodetic basis according to the task from course Roads. The road is designed for annual average daily traffic (AADT) of 950 vehicles per day, on hilly terrain. The design speed of the road is 40 km / h. The conceptual solution has been developed according to the Regulations on the basic conditions for the design of public roads.

### **Keywords:**

preliminary design, project speed, road axis, length of transition curve, curve radius, roadway, cross section, longitudinal section

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# 1.0 PROGRAMSKI ZADATAK

SVEUČILIŠTE U SPLITU  
FAKULTET GRAĐEVINARSTVA, ARHITEKTURE  
I GEODEZIJE

Split, ak.god. 2017/2018.

Katedra za prometnice

Studij: Preddiplomski

Nastavni predmet: CESTE

Student/ica: Đurečić Matea

## ZADATAK

Treba izraditi idejni projekt dionice ceste između točaka A i B naznačenih na priloženoj geodetskoj podlozi u mjerilu 1:1000.

Zadano je:

- PGDP - prosječni godišnji dnevni promet: **950 voz/dan**
- vrsta terena: **brdoviti**.

Idejni projekt treba sadržavati:

1. Tehnički opis
2. Proračun horizontalne geometrije
3. Proračun proširenja kolnika u krivini
4. Proračun vertikalne geometrije i kota nivelete
5. Proračun vitoperenja kolnika
6. Građevinska situacija MJ. 1:1000
7. Uzdužni presjek MJ. 1:1000/100
8. Normalni poprečni presjek MJ. 1:50
9. Karakteristični poprečni presjeci MJ. 1:100
10. Predmjer radova
11. Aproximativni troškovnik

Predmetni nastavnik:

  
izv.prof.dr.sc. Deana Breški, dipl.ing.grad.

## 2. TEHNIČKI OPIS

### OPĆENITO

Na priloženoj geodetskoj podlozi u mjerilu 1:1000 izrađen je idejni projekt ceste na dionici od točke A koja se nalazi na 175m nadmorske visine, do točke B koja se nalazi na 155m nadmorske visine.

Cesta je projektirana za prosječni godišnji dnevni promet od 950 voz/dan i to na brdovitom terenu.

Predviđena projektna brzina za ovu kategoriju ceste je  $v_p=40$  km/h. Duljina trase je 318,66 m.

### HORIZONTALNI ELEMENTI

Za određenu kategoriju prema pravilniku, minimalni radijus krivine je 45 m, a prijelaznice 30m.

Trasa konstruirane ceste ima dužinu od 318,66 m, a sastoji se od tri pravca i dvije krivine. Prva krivina ima radijus  $R=50$  m i duljinu prijelaznice  $L=40$  m. Druga krivina ima radijus  $R=90$  m i duljinu prijelaznice  $L=40$  m. Svaka krivina je konstruirana pomoću dvije prijelazne krivine oblika klotoide i jednog kružnog luka. Proširenje kružnog luka za promet teretnih vozila s priključkom u prvog krivini iznosi 1,68m, a u drugog 0,93 m.

### VERTIKALNI ELEMENTI

Maksimalni nagib nivelete je 12%, a minimalni radijus krivine 300 m.

U programu se tok sastoji od dva pravca i jedne krivine.

Nagib prvog pravca je 7,08% , a drugog 5,57%.

Tangenta krivine je dužine 134,69m , a radijus konveksne krivine 9000 m.

### POPREČNI PRESJEK

Cesta ove kategorije ima dva kolnička traka širine svakog po 2,95 m, betonski rubni trak širine 0,20 m te bankine širine 1,0 m i nagiba 4% . Cesta se dijelom nalazi u zasjeku, usjeku i nasipu. Na usjecima se izvode rigoli za odvodnju vode i drenaža koja je postavljena u glinenu posteljicu. Nagibi usjeka su 2:1 , a nasipa 1:1,5.

### KOLNIČKA KONSTRUKCIJA

Projektom je predviđena kolnička konstrukcija sa sljedećim slojevima:

- Asfalt- beton habajući sloj- AB11 u debljini od 4 cm
- Bitumenizirani nosivi sloj- BNS22 u debljini od 6 cm
- Mehanički zbijeni nosivi sloj-MZNS u debljini 30 cm.

### ODVODNJA

Odvodnja kolnika predviđa se otvorenim sustavom odvodnje prihvaćanjem kolničkih i pribrežnih voda u zasjeku i usjeku u betonske rigole te kontroliranim ispuštanje u teren direktno ili betonskim cijevnim propustima kroz trup oklinka.



## **3.0 GRAFIČKI PRILOZI**

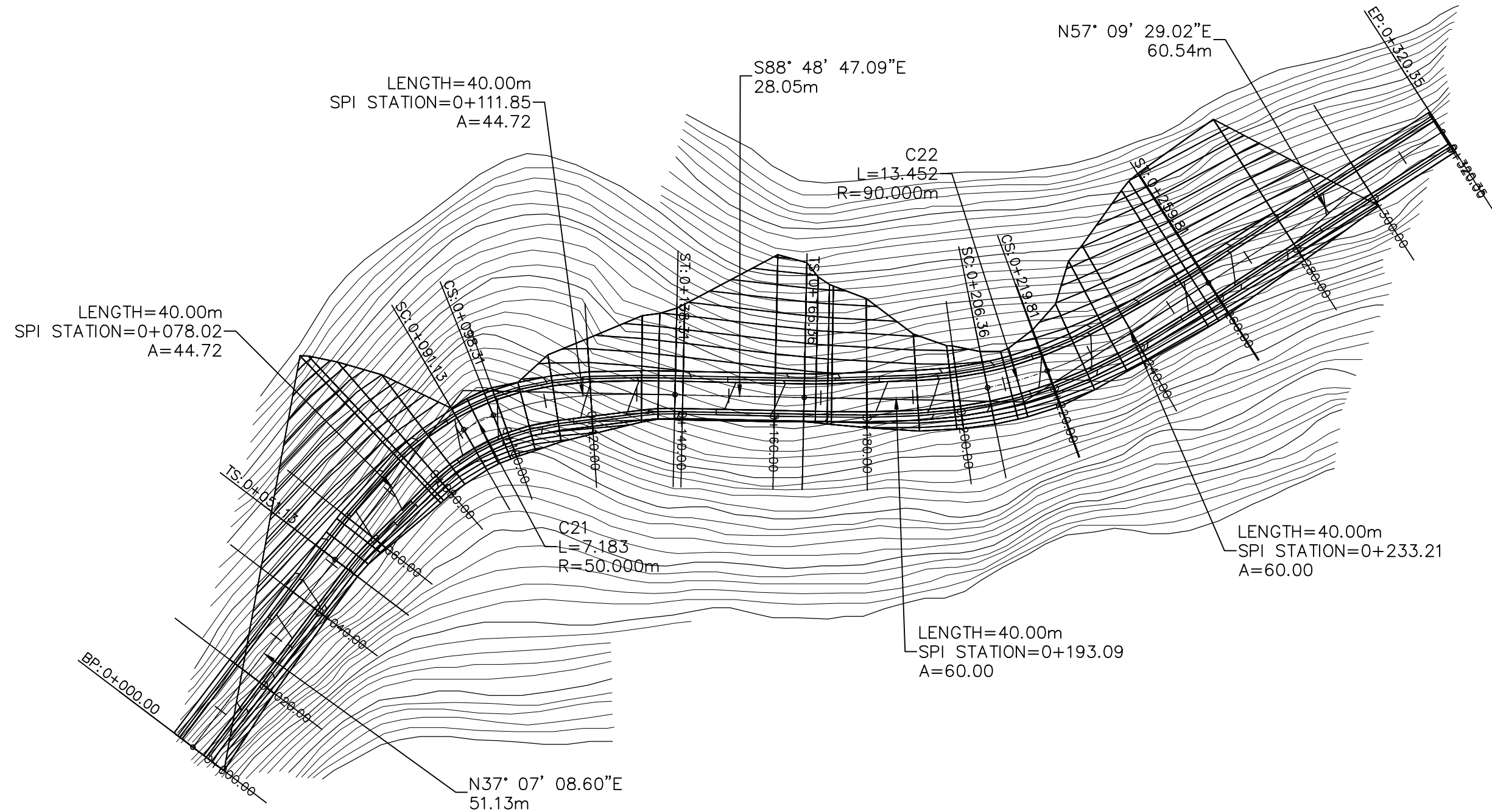
3.1 SITUACIJA M 1:1000

3.2 UZDUŽNI PRESJEK M 1.1000/100

3.3 NORMALNI POPREČNI PRESJEK M 1:50

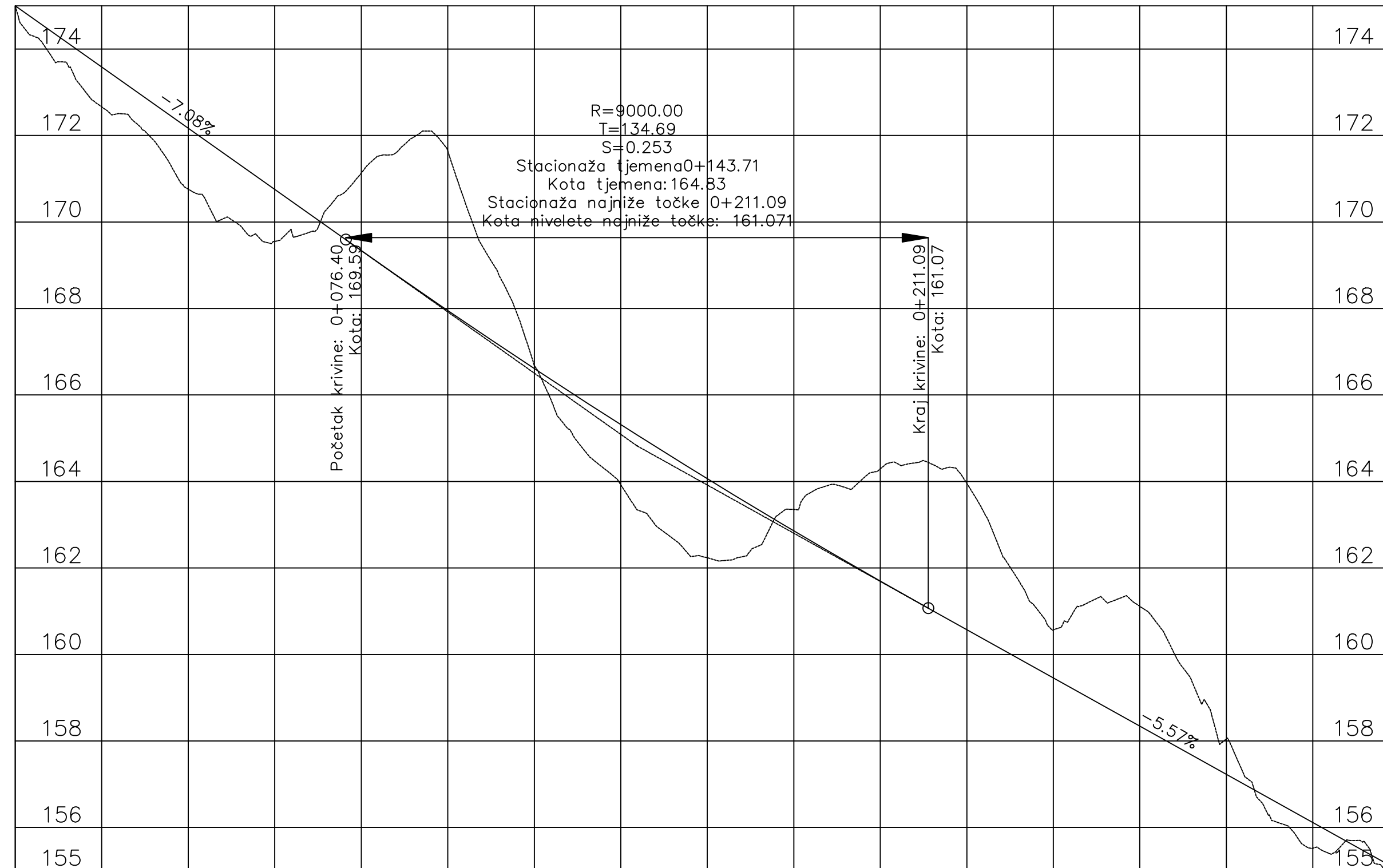
3.4 KARAKTERISTIČNI POPREČNI PRESJECI M 1:200

SITUACIJA  
M 1:1000



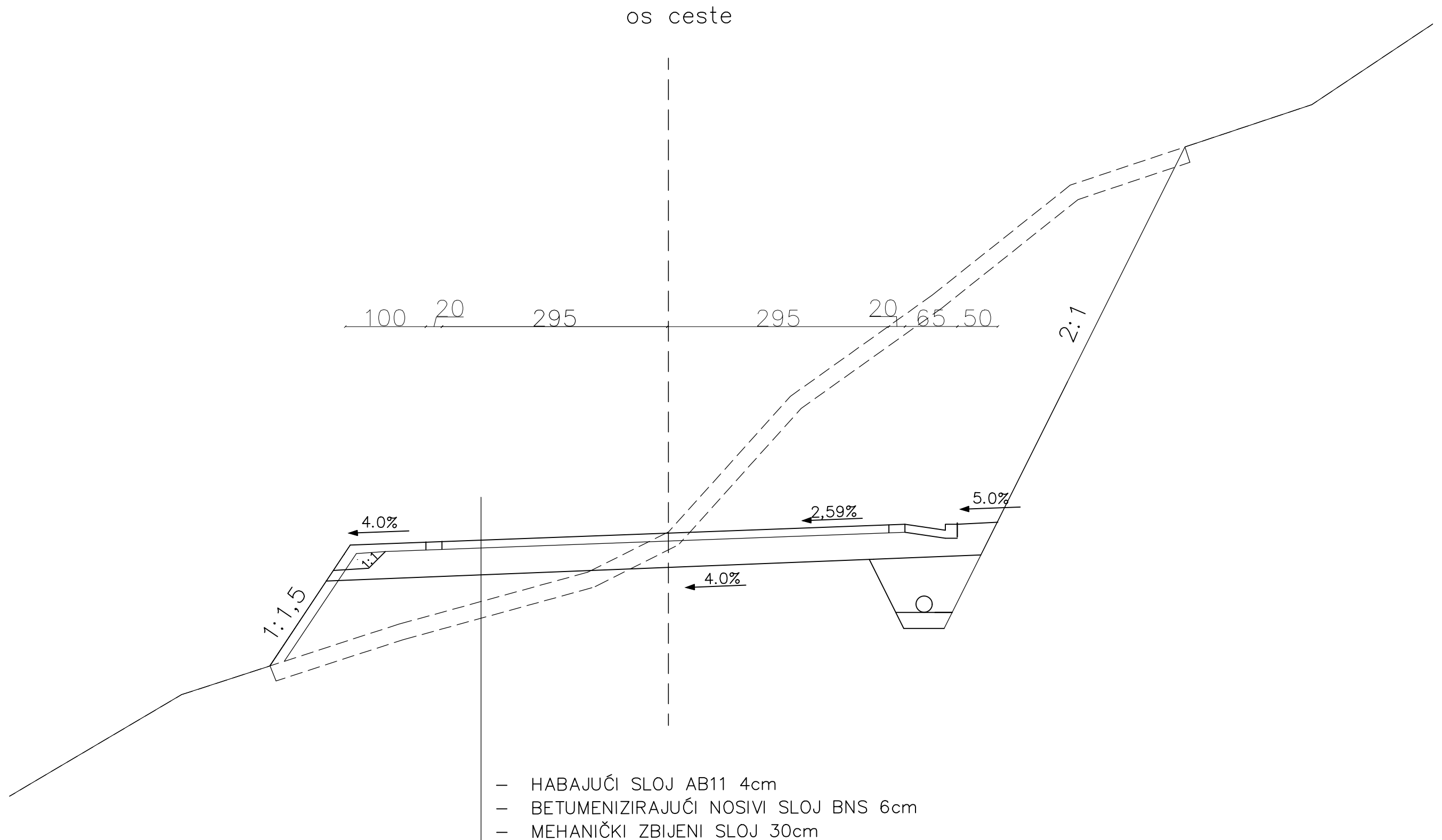
		ZAVRŠNI RAD
Faza	IDEJNO RJEŠENJE LOKALNE CESTE	CESTE
Sadržaj	SITUACIJA	
Mentor	DRAŽEN CVITANIĆ	
STUDENTICA	MATEA ĐUREČIĆ	
Godina	2018./2019.	3.1

OS1 PROFILE



Stacionaža	0+000.00	0+010.00	0+020.00	0+030.00	0+040.00	0+050.00	0+060.00	0+070.00	0+080.00	0+090.00	0+100.00	0+110.00	0+120.00	0+130.00	0+140.00	0+150.00	0+160.00	0+170.00	0+180.00	0+190.00	0+200.00	0+210.00	0+220.00	0+230.00	0+240.00	0+250.00	0+260.00	0+270.00	0+280.00	0+290.00	0+300.00	0+310.00	0+320.00
Kote nivelete	175.00	174.29	173.58	172.88	172.17	171.46	170.75	170.04	169.34	188.64	167.95	167.28	166.61	165.96	165.32	164.68	164.06	163.46	162.86	162.27	161.70	161.13	160.57	160.02	159.46	158.90	158.34	157.79	157.23	156.67	156.11	155.56	155.00
Kote terena	175.00	173.70	172.66	172.10	170.76	170.05	169.55	169.87	171.13	171.79	171.64	169.10	166.68	164.92	163.92	162.83	162.24	162.40	163.35	163.92	164.29	164.48	163.96	162.02	160.57	161.29	161.11	159.69	158.05	156.28	155.52	155.70	155.00
Horizontalni elementi	L = 51.13 N37° 07' 09"E		L: 40.00		R: 50.00 L: 7.18		L: 40.00		L = 28.05 S88° 48' 47"E		L: 40.00		R: 90.00 L: 13.45		L: 40.00		L = 60.54 N57° 09' 29"E																
Vertikani elementi	G = -7.08% L = 76.40				R = 9000.00 L = 134.69										G = -5.57% L = 108.91																		
Vitoperenje	2.50% -0+051.13 -2.50%		8.00% sta: 0+091.13 D: -8.00%		8.00% sta: 0+098.31 D: -8.00%		2.50% 0+134.31 -2.50%		2.50% 0+169.36 0+192.36 0.00%		L: -6.60% sta: 0+206.36 D: 6.60%		L: -6.60% sta: 0+219.81 D: 6.60%		2.50% sta: 0+239.01 D: 2.50%																		

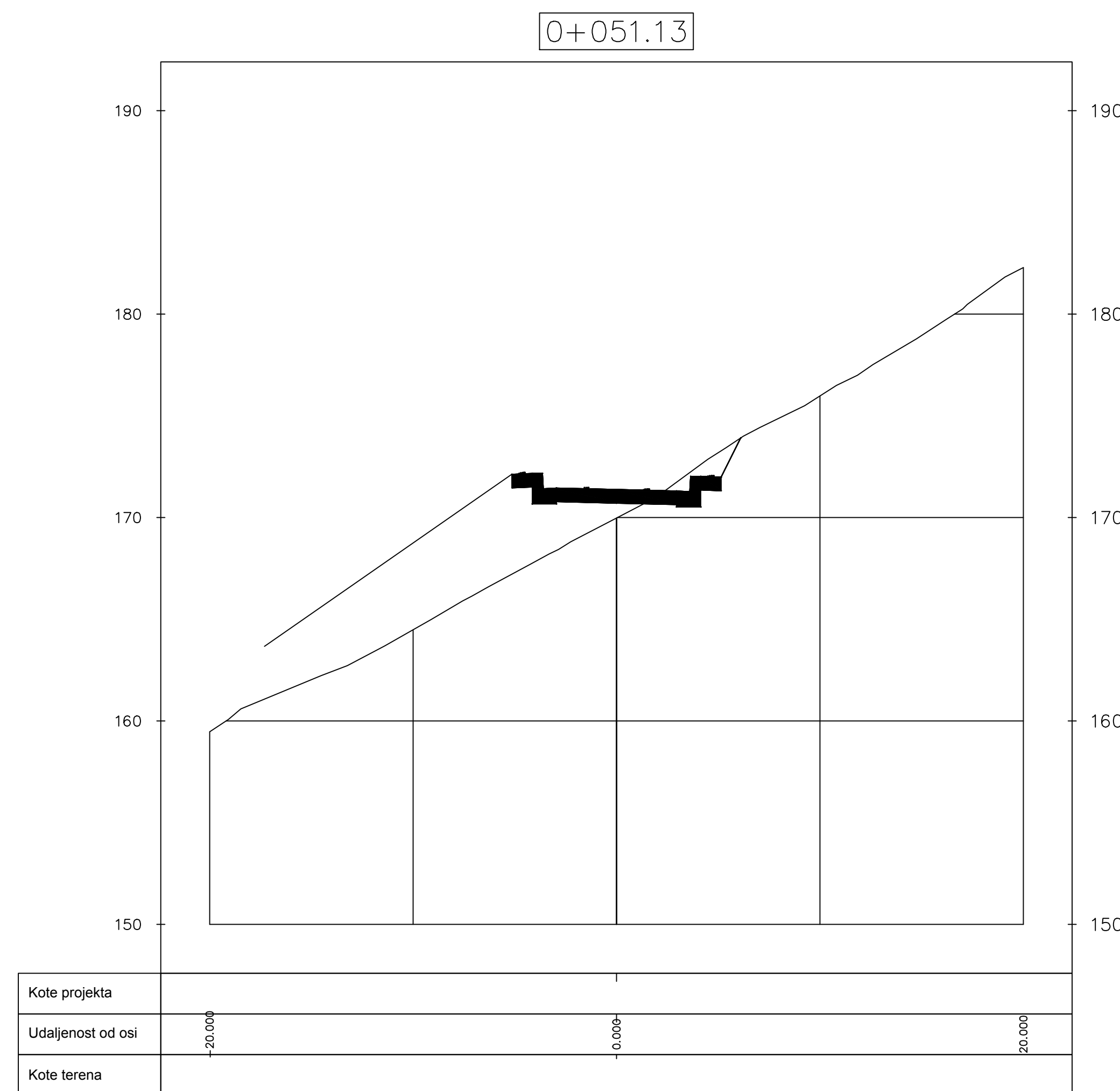
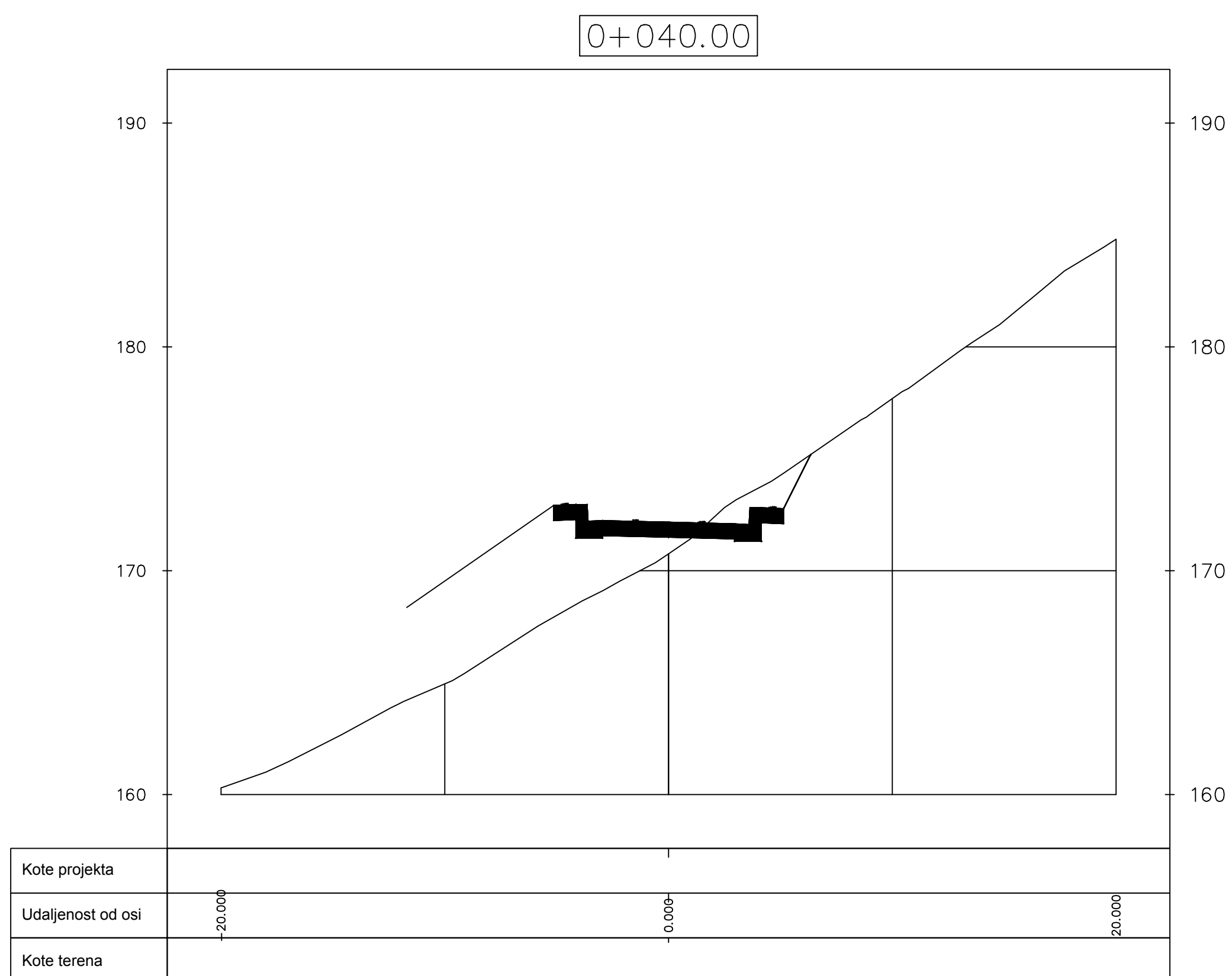
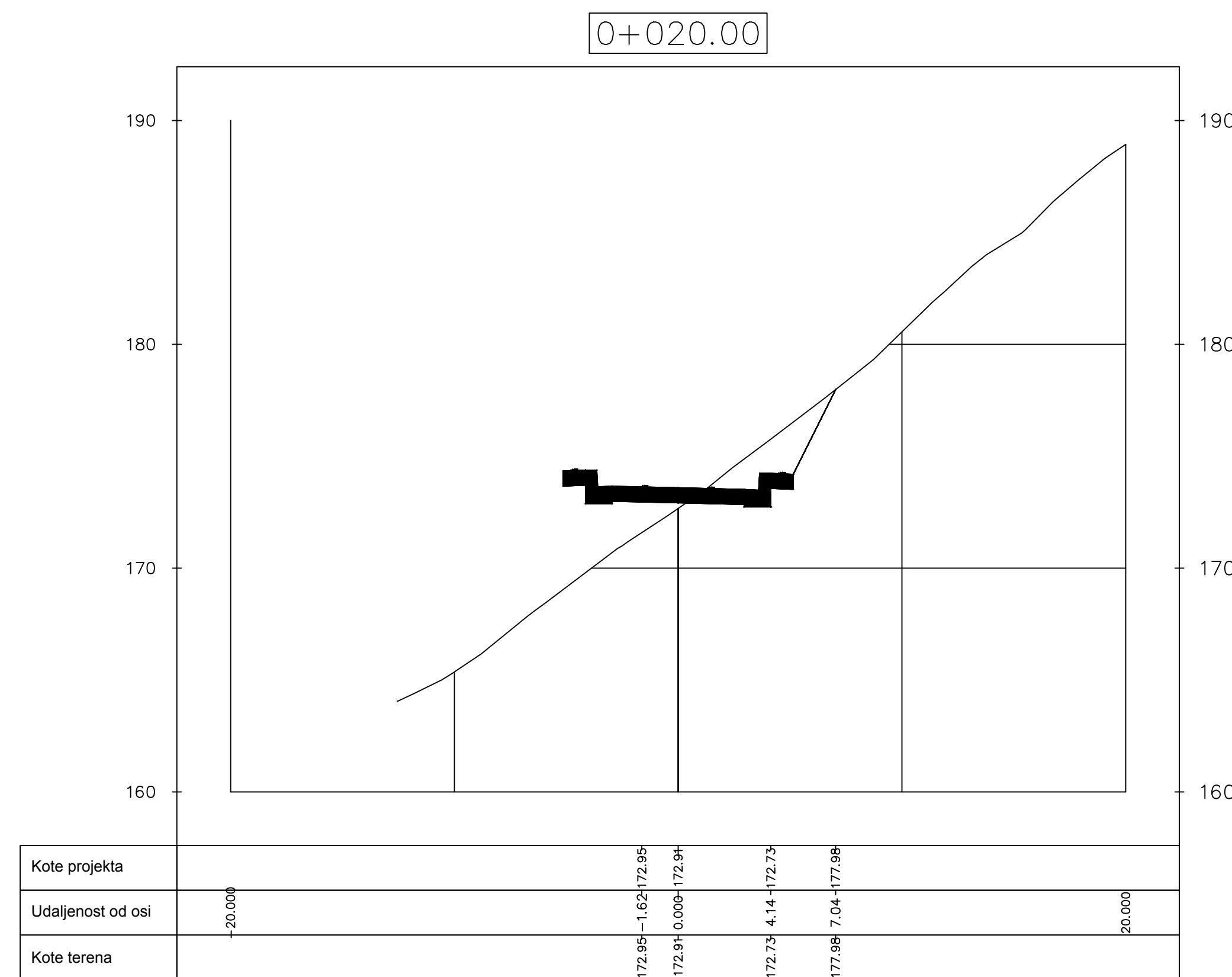
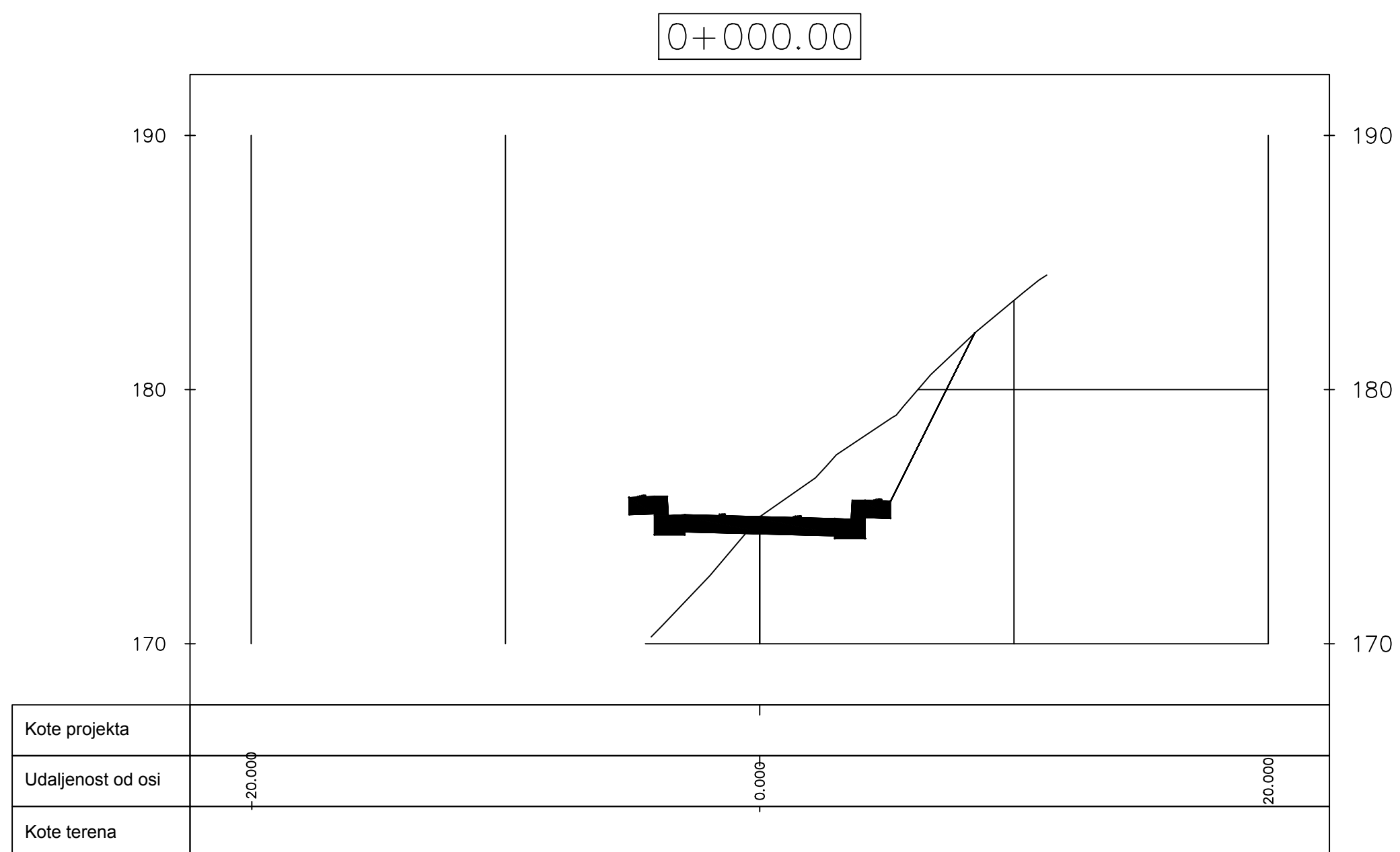
NORMALNI POPREČNI PRESJEK  
M 1:50

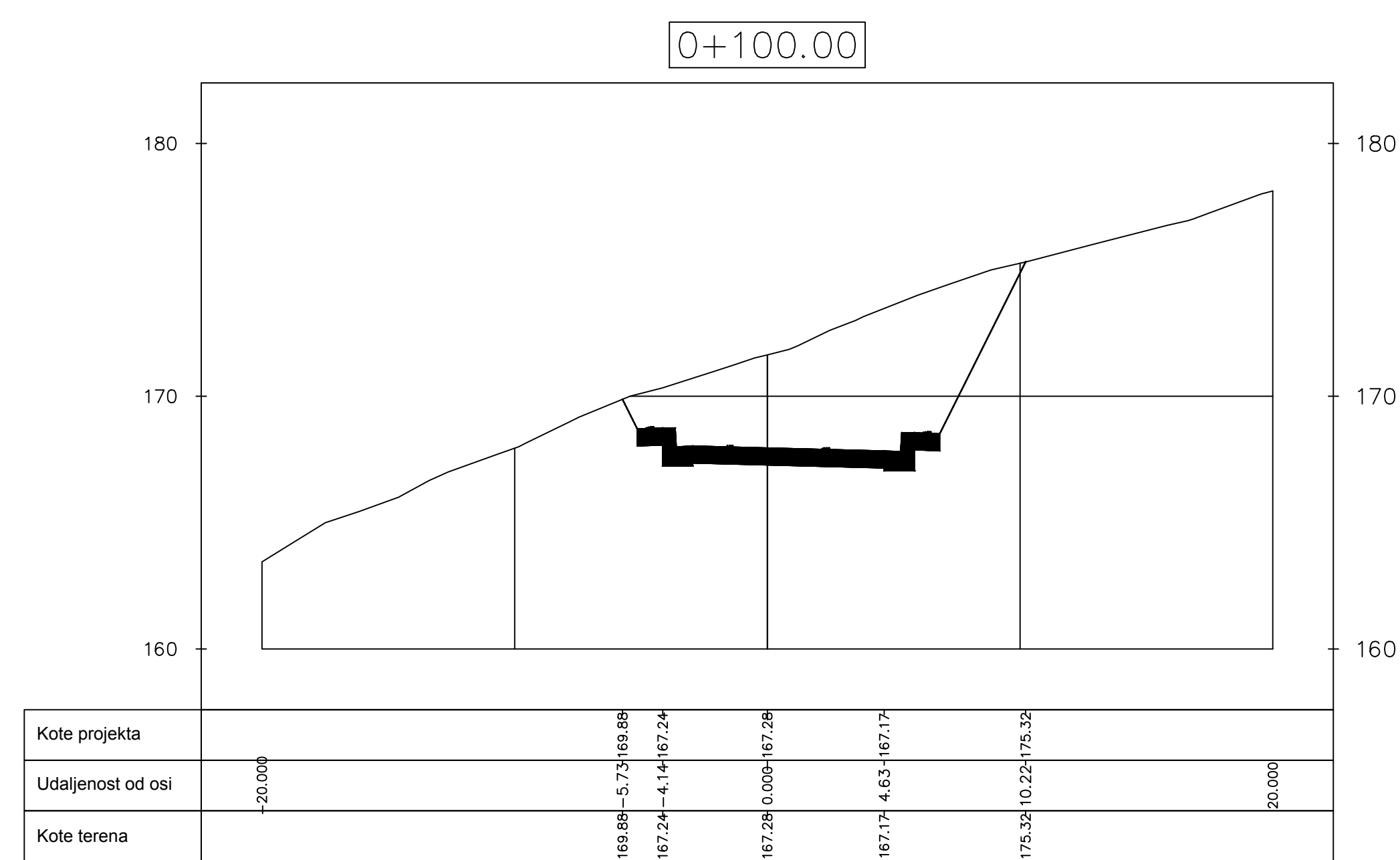
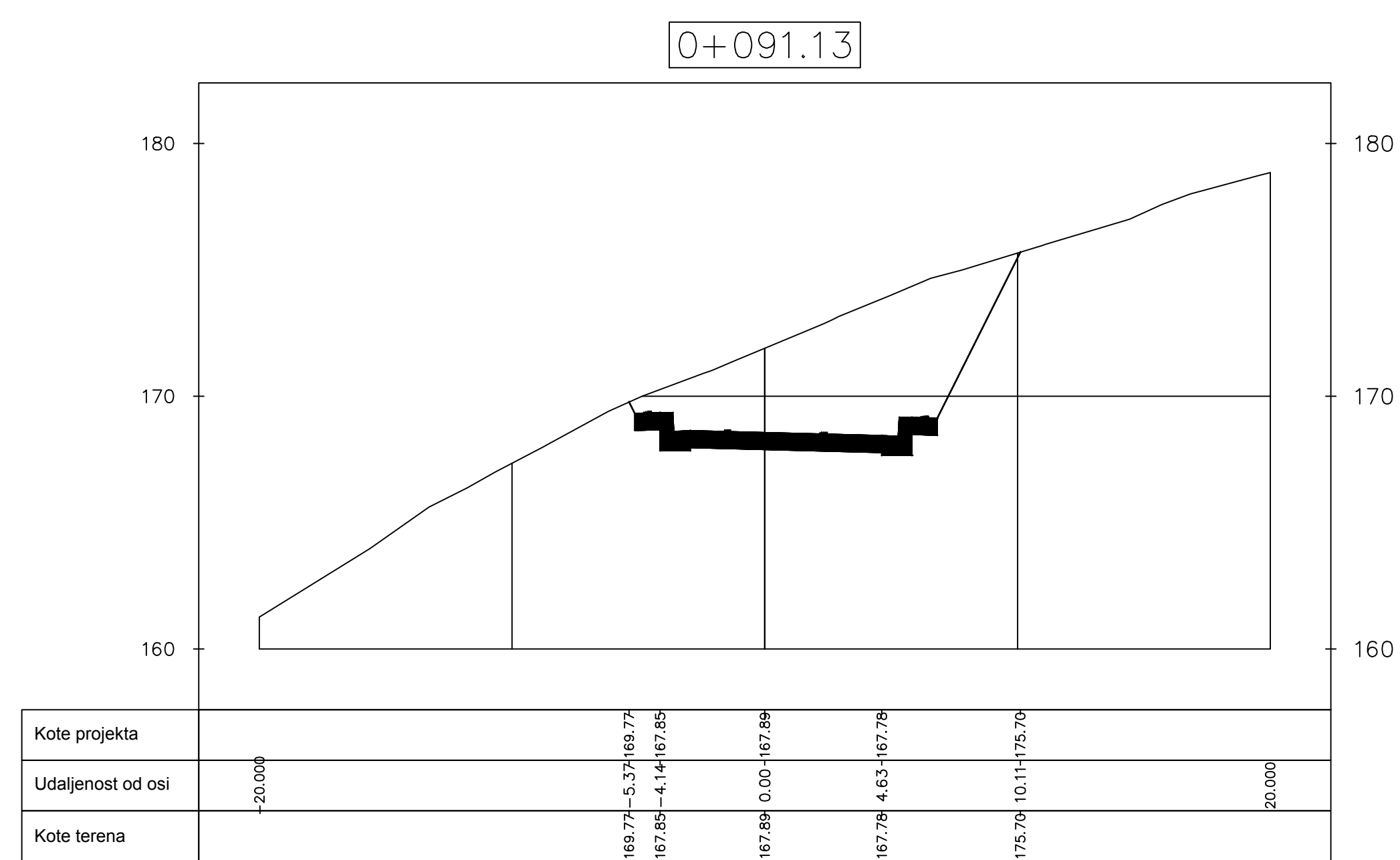
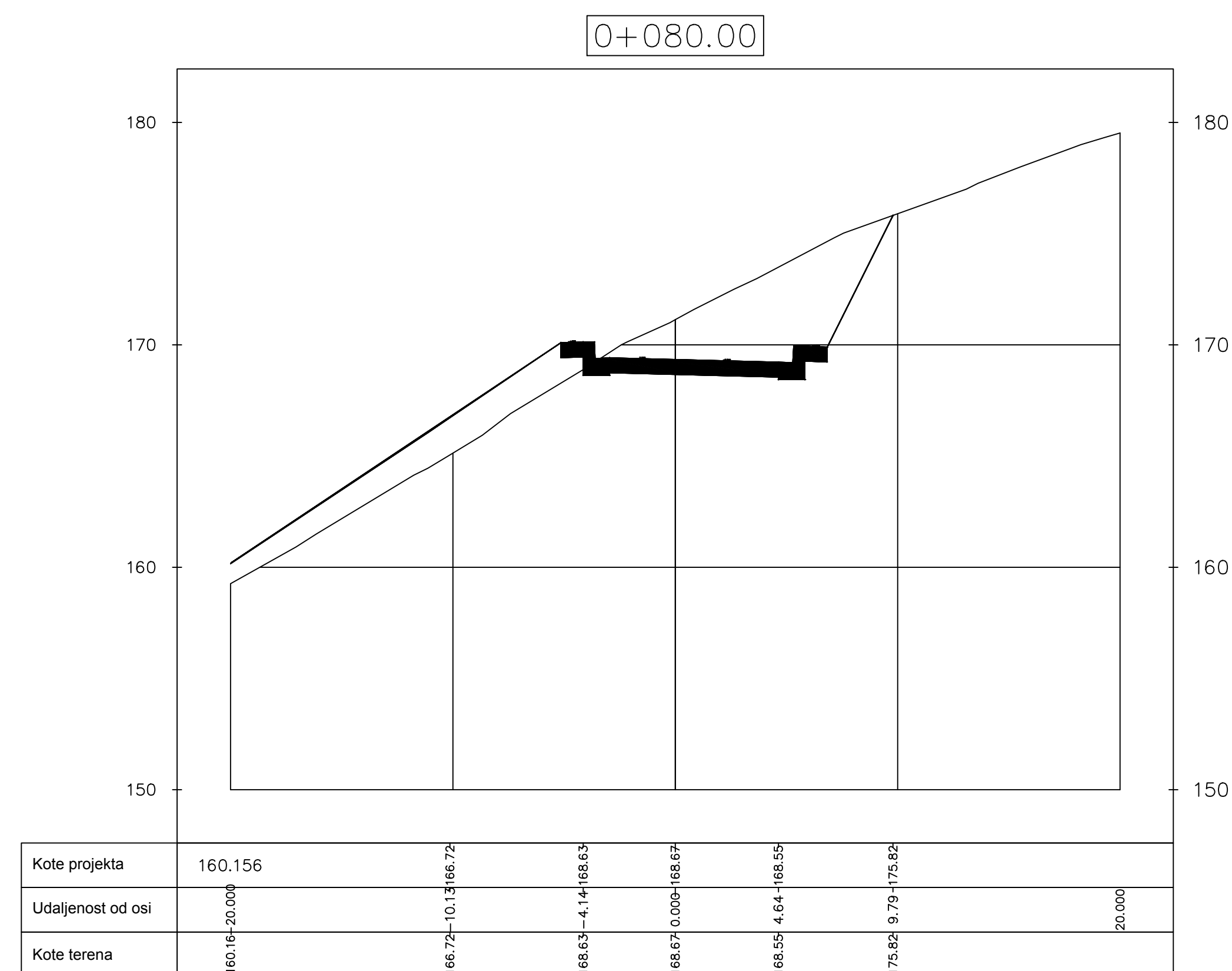
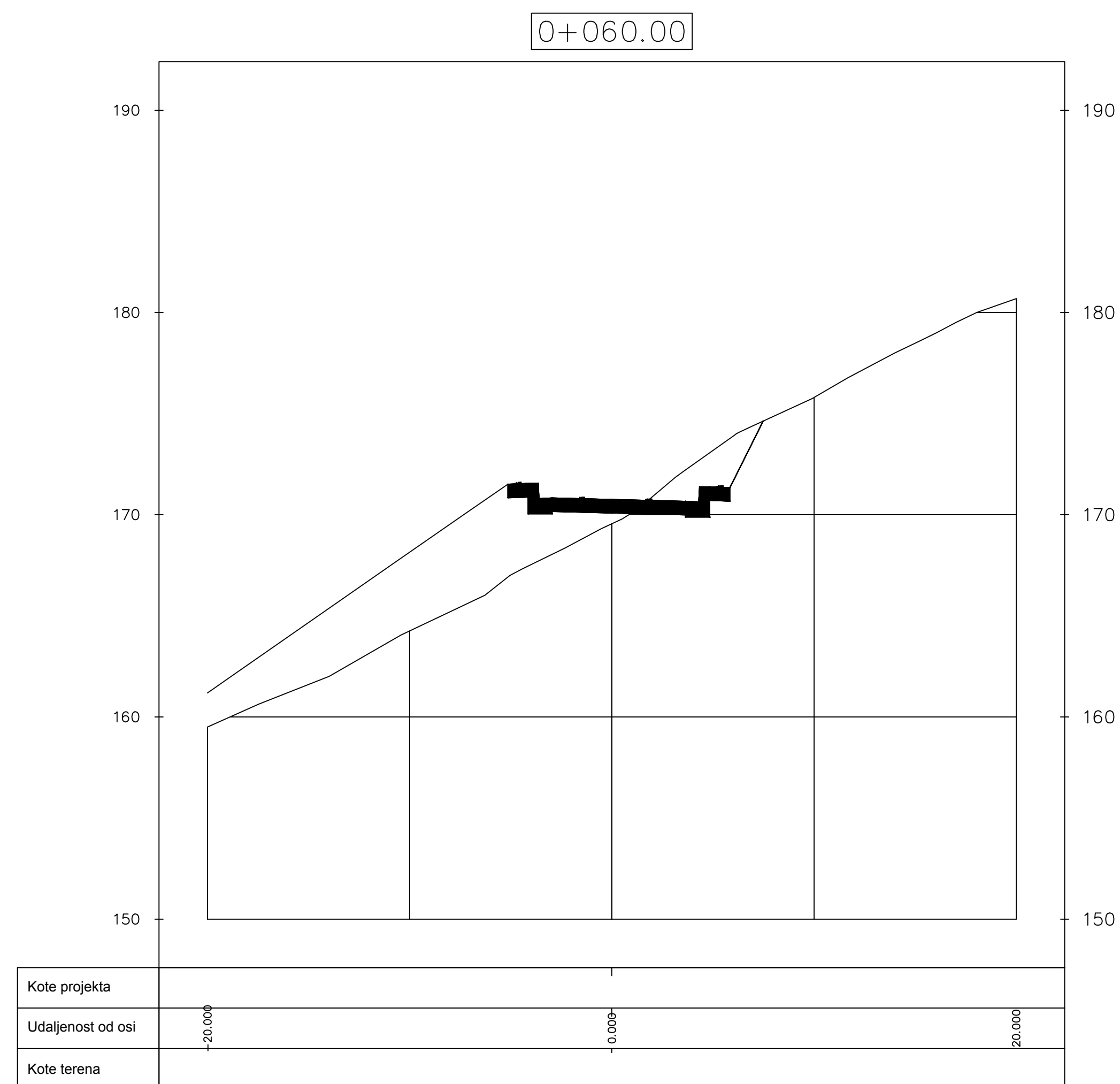


- HABAJUĆI SLOJ AB11 4cm
- BETUMENIZIRAJUĆI NOSIVI SLOJ BNS 6cm
- MEHANIČKI ZBIJENI SLOJ 30cm

 <b>SVEUČILIŠTE U SPLITU, FAKULTET GRAĐEVINARSTVA, ARHITEKTURE I GEODAZIJE</b>		ZAVRŠNI RAD
Faza:	IDEJNO RJEŠENJE LOKALNE CESTE	CESTE
Sadržaj:	NORMALNI POPREČNI PRESJEK	
Mentor:	DRAŽEN CVITANIĆ	
STUDENTICA:	<b>MATEA ĐUREČIĆ</b>	
Godina:	2018./2019.	3.3

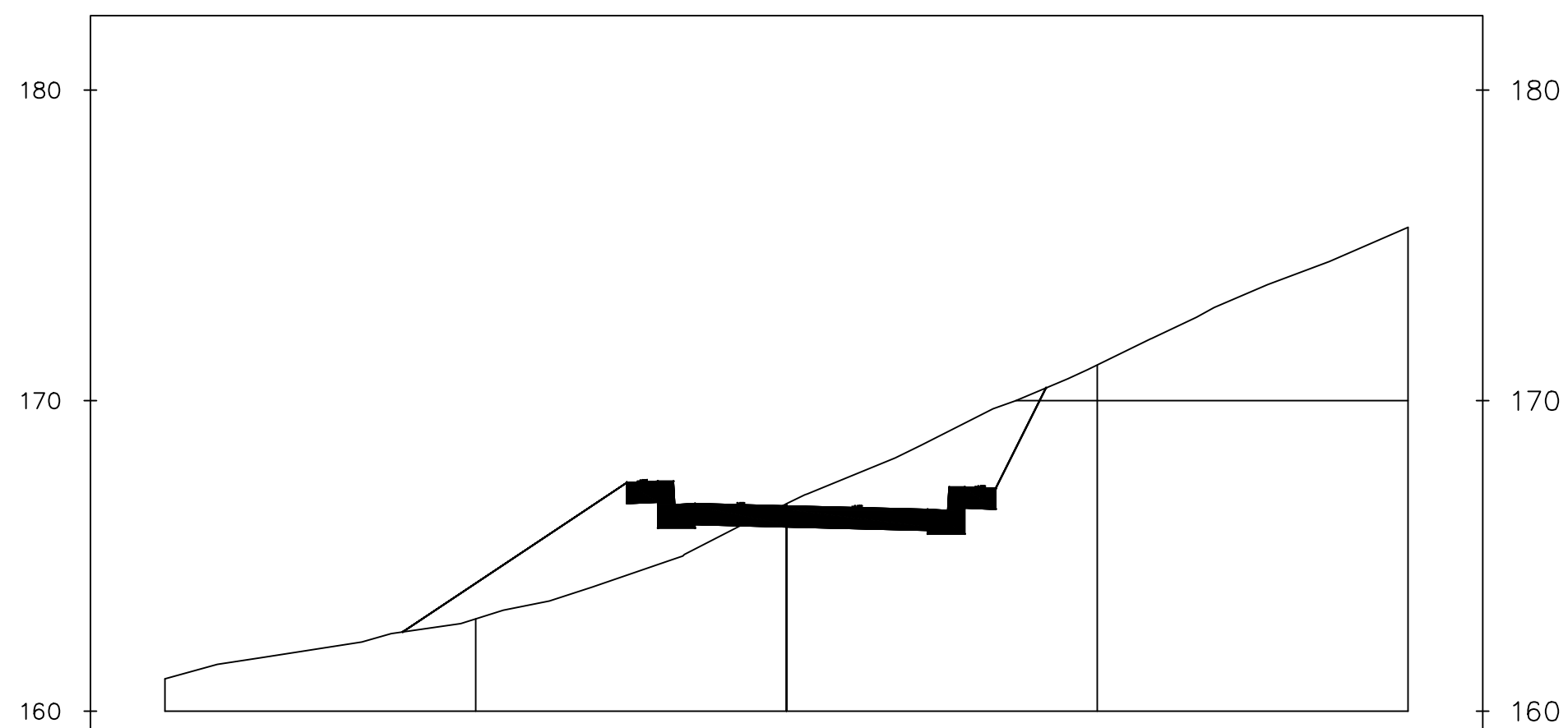
KARAKTERISTIČNI POPREČNI  
PRESJECI  
M 1:200





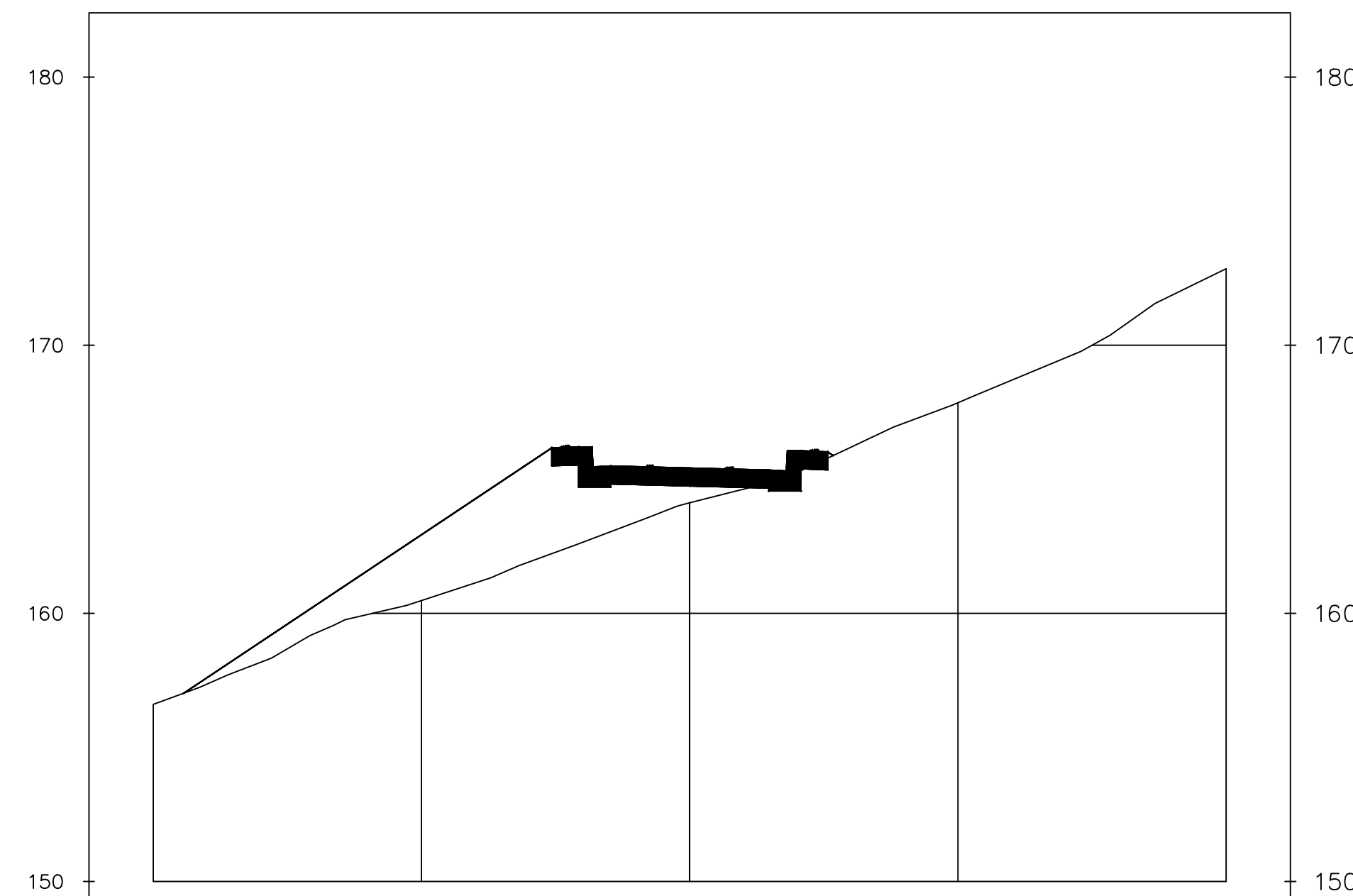
KARAKTERISTIČNI POPREČNI  
PRESJECI  
M 1:200

0+120.00



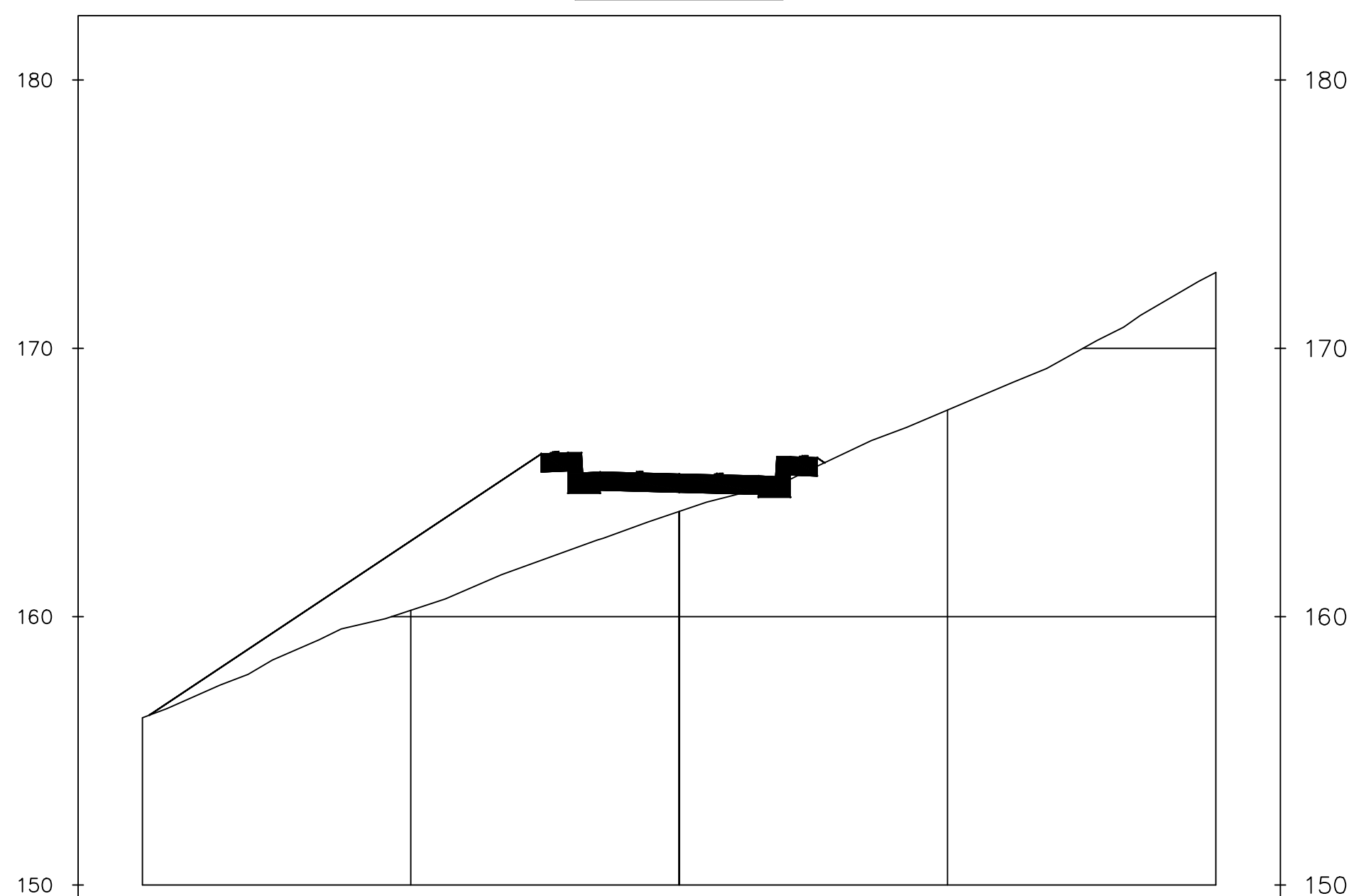
Kote projekta							
Udaljenost od osi	-20.000	162.55-12.35	165.90-4.14	165.94	165.83	170.41	20.000
Kote terena		162.55	165.90	165.94	165.83	170.41	

0+138.31



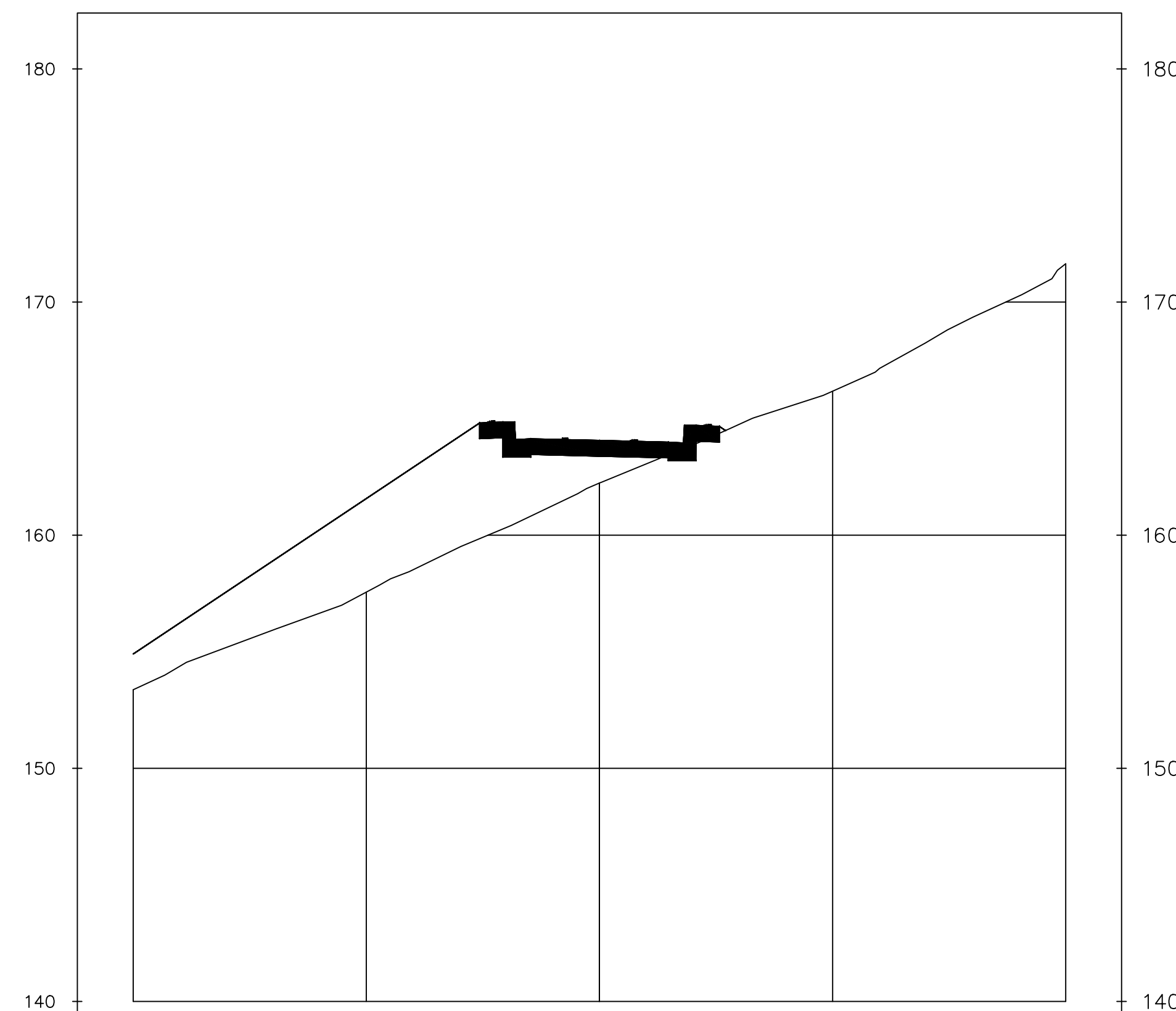
Kote projekta							
Udaljenost od osi	-20.000	157.02-18.87	164.71-4.14	164.75	164.57	166.89	20.000
Kote terena		157.02	164.71	164.75	164.57	166.89	

0+140.00



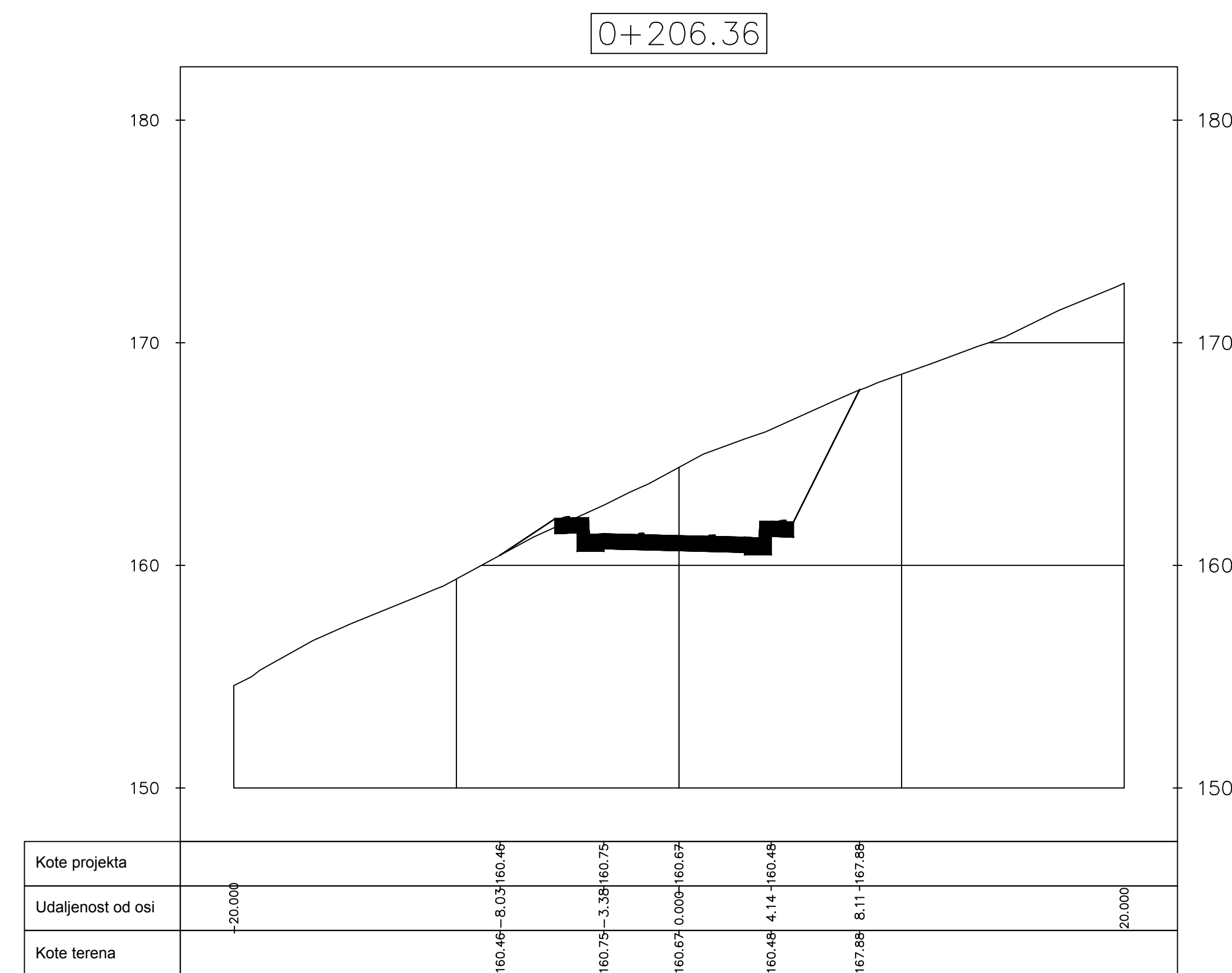
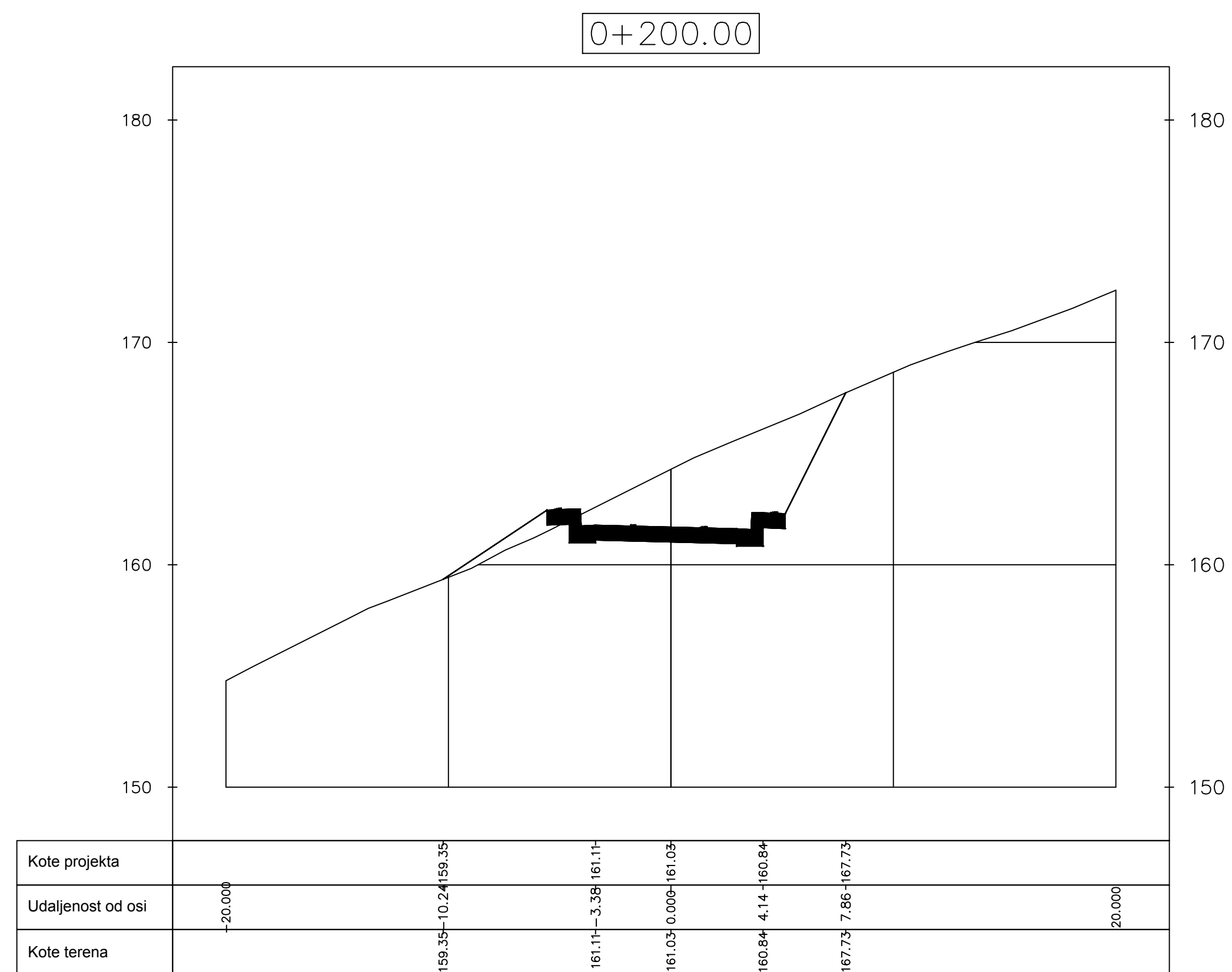
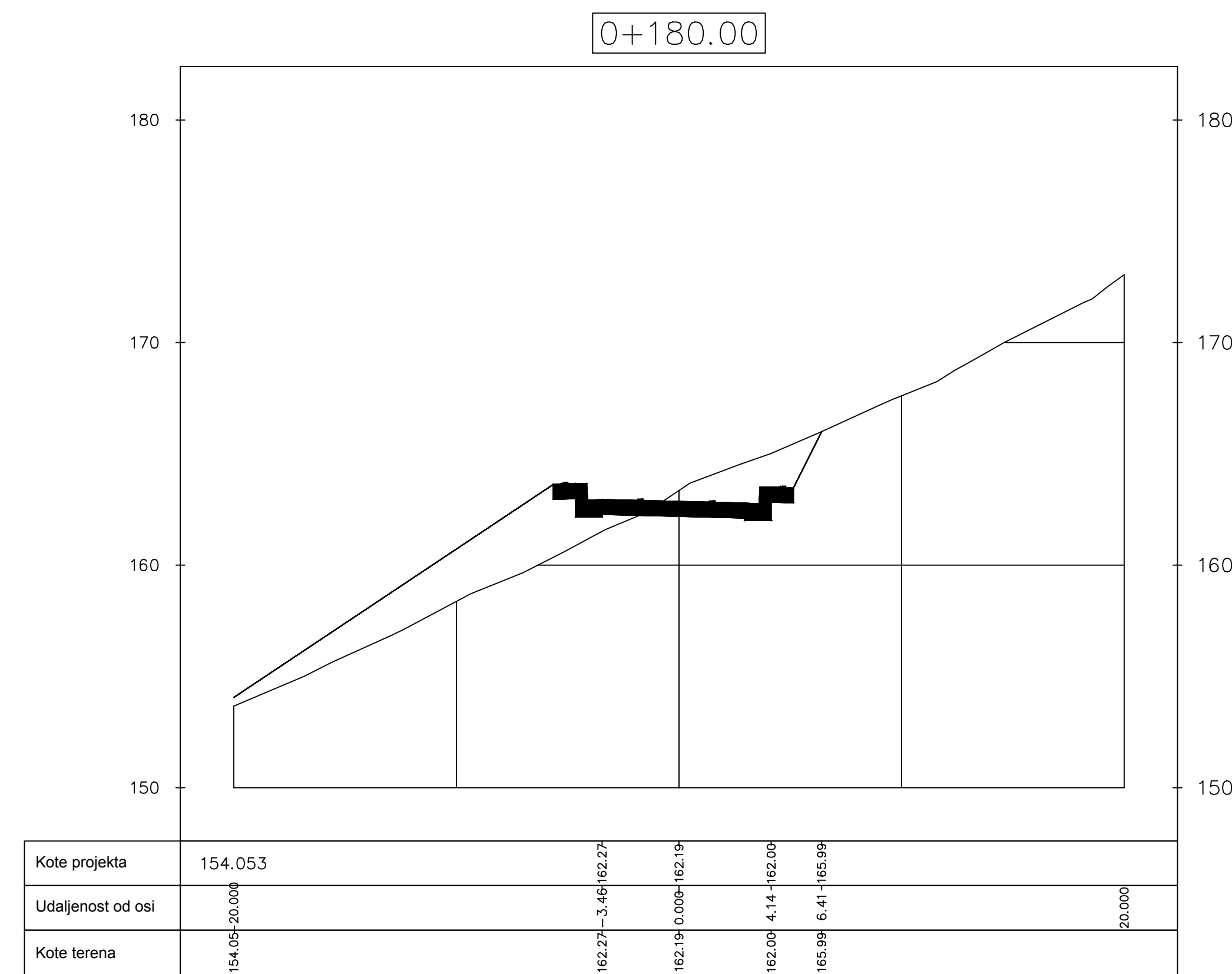
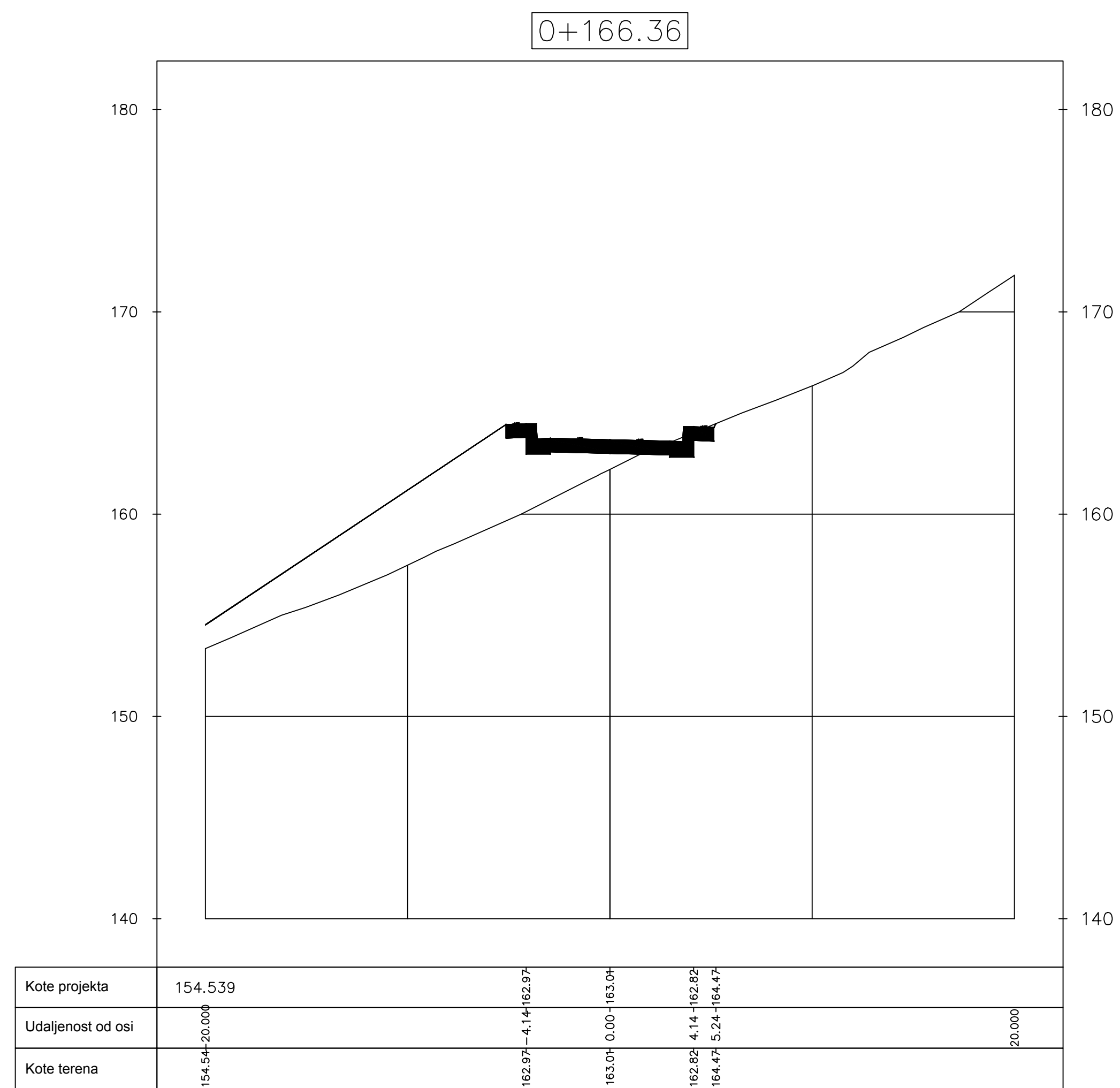
Kote projekta							
Udaljenost od osi	-20.000	156.34-26.99	164.61-4.14	164.65	164.46	165.74	20.000
Kote terena		156.34	164.61	164.65	164.46	165.74	

0+160.00



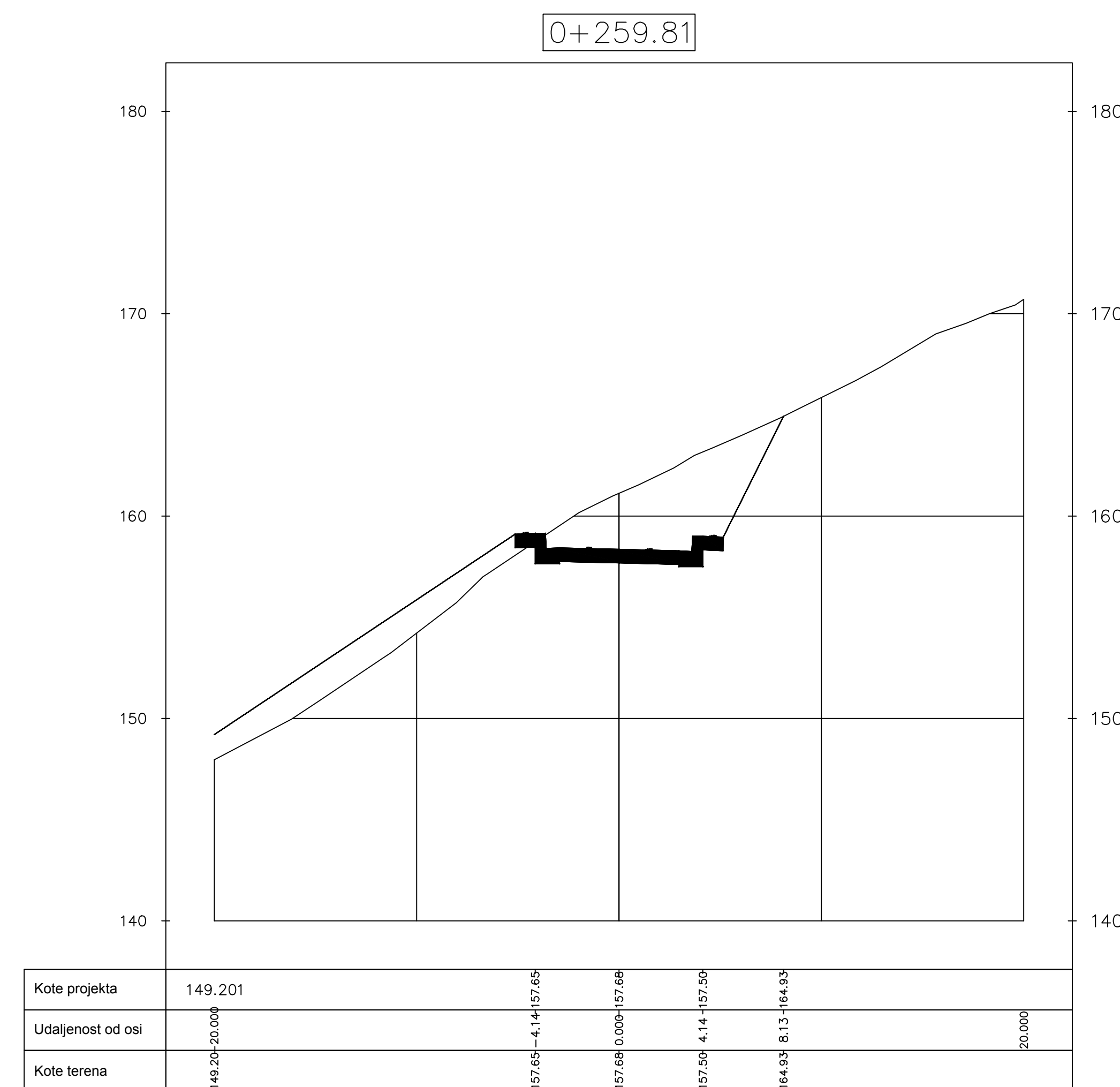
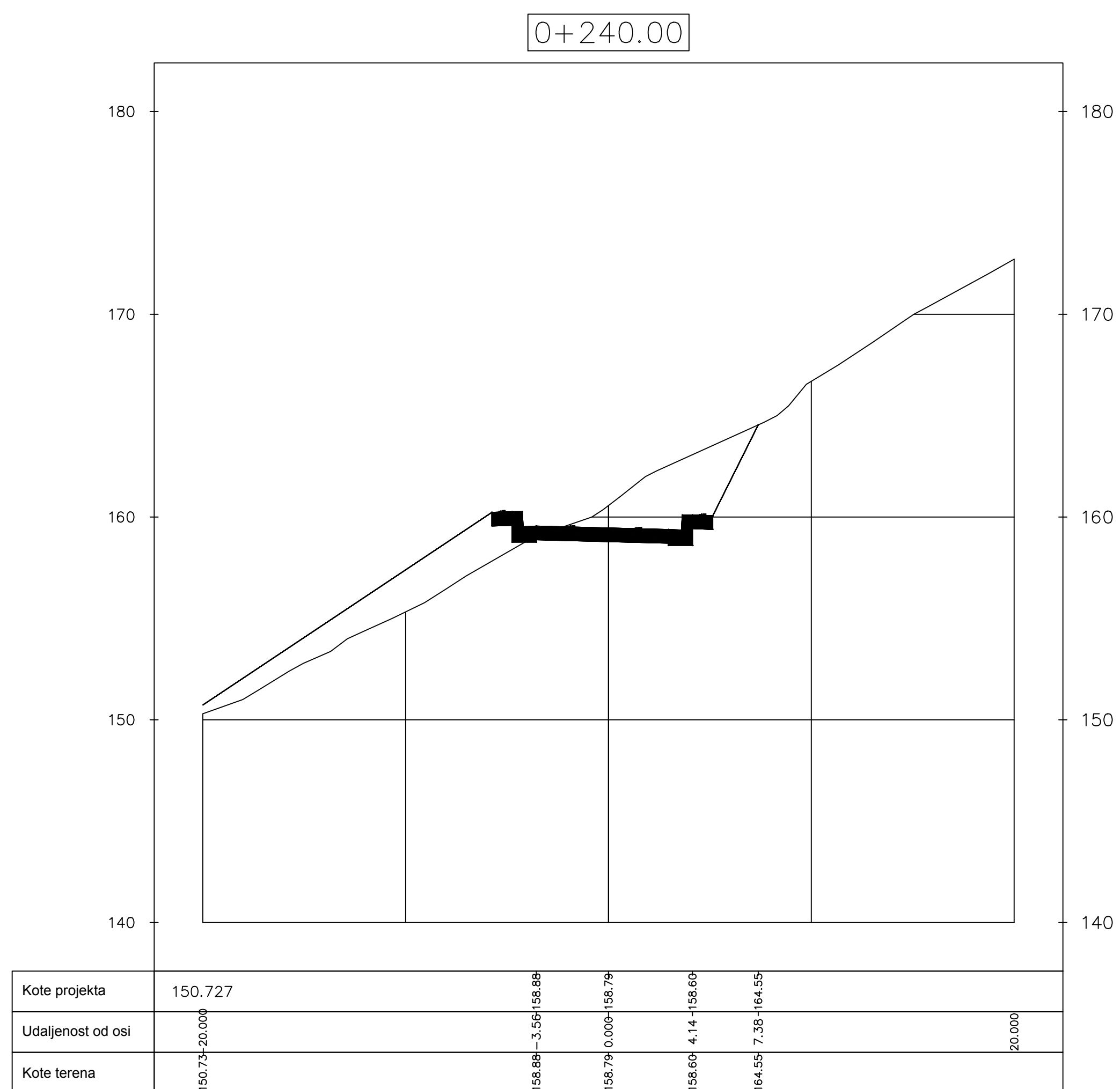
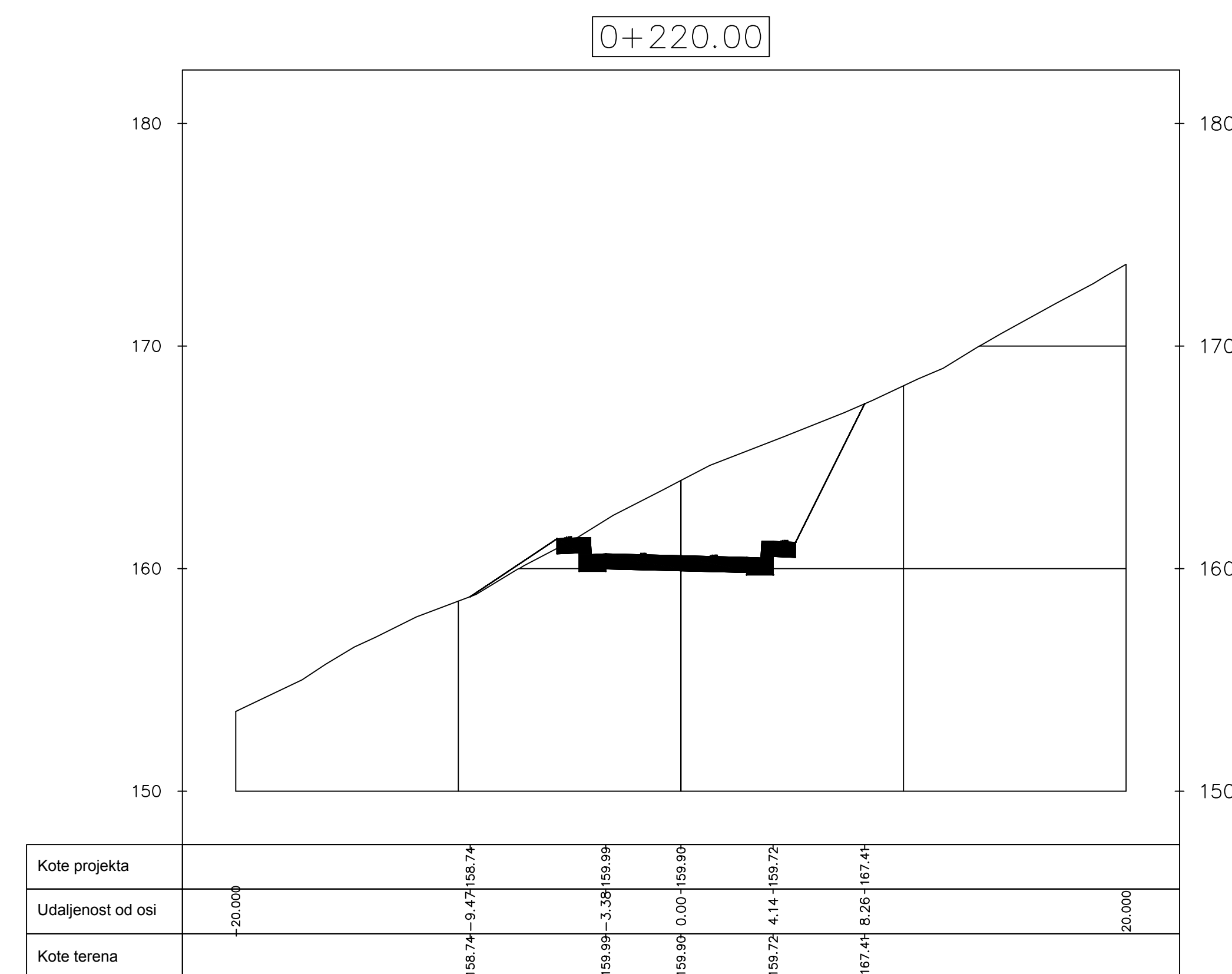
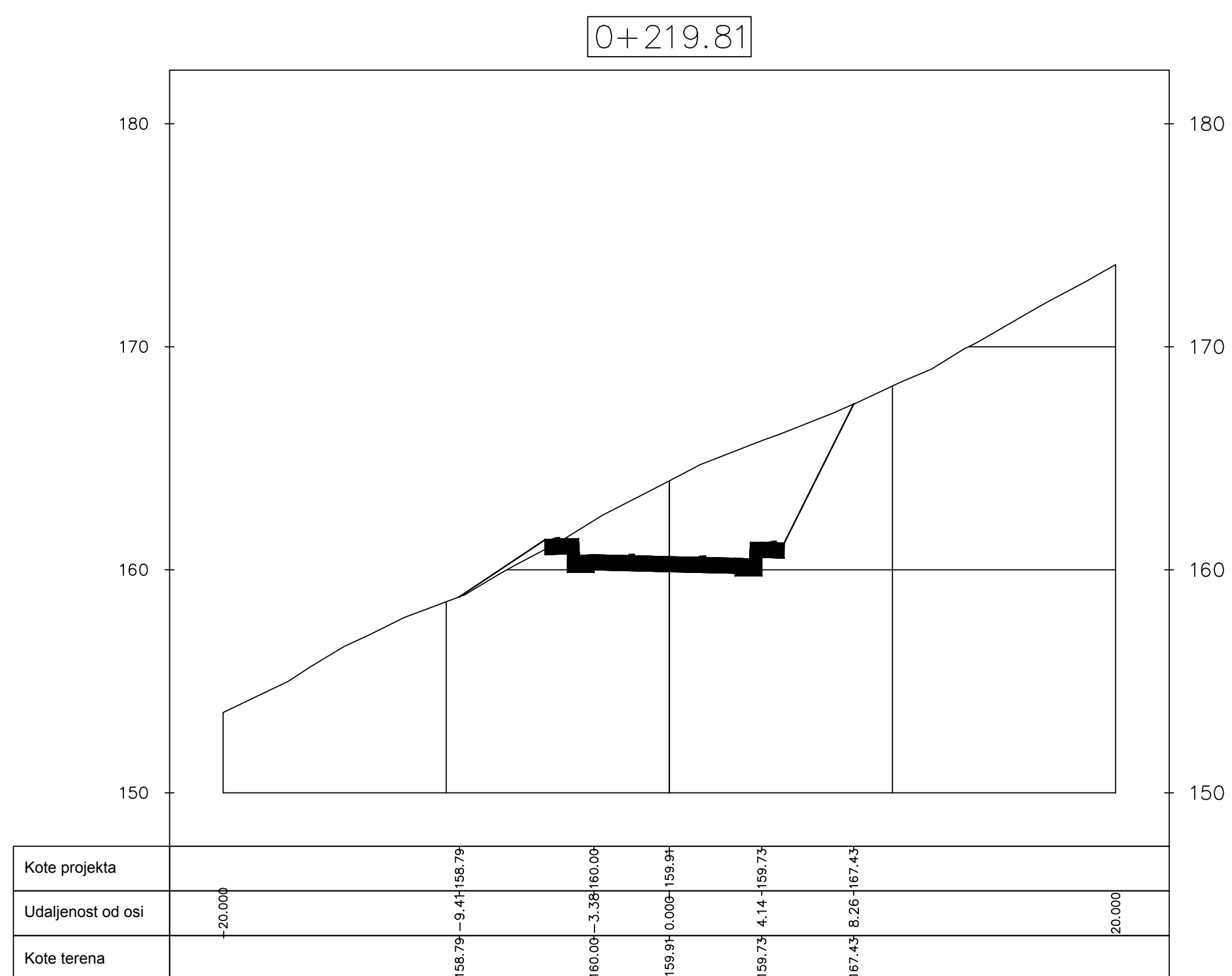
Kote projekta							
Udaljenost od osi	-20.000	154.91-20.00	163.36-4.14	163.39	163.21	164.49	20.000
Kote terena		154.91	163.36	163.39	163.21	164.49	

KARAKTERISTIČNI POPREČNI  
PRESJECI  
M 1:200

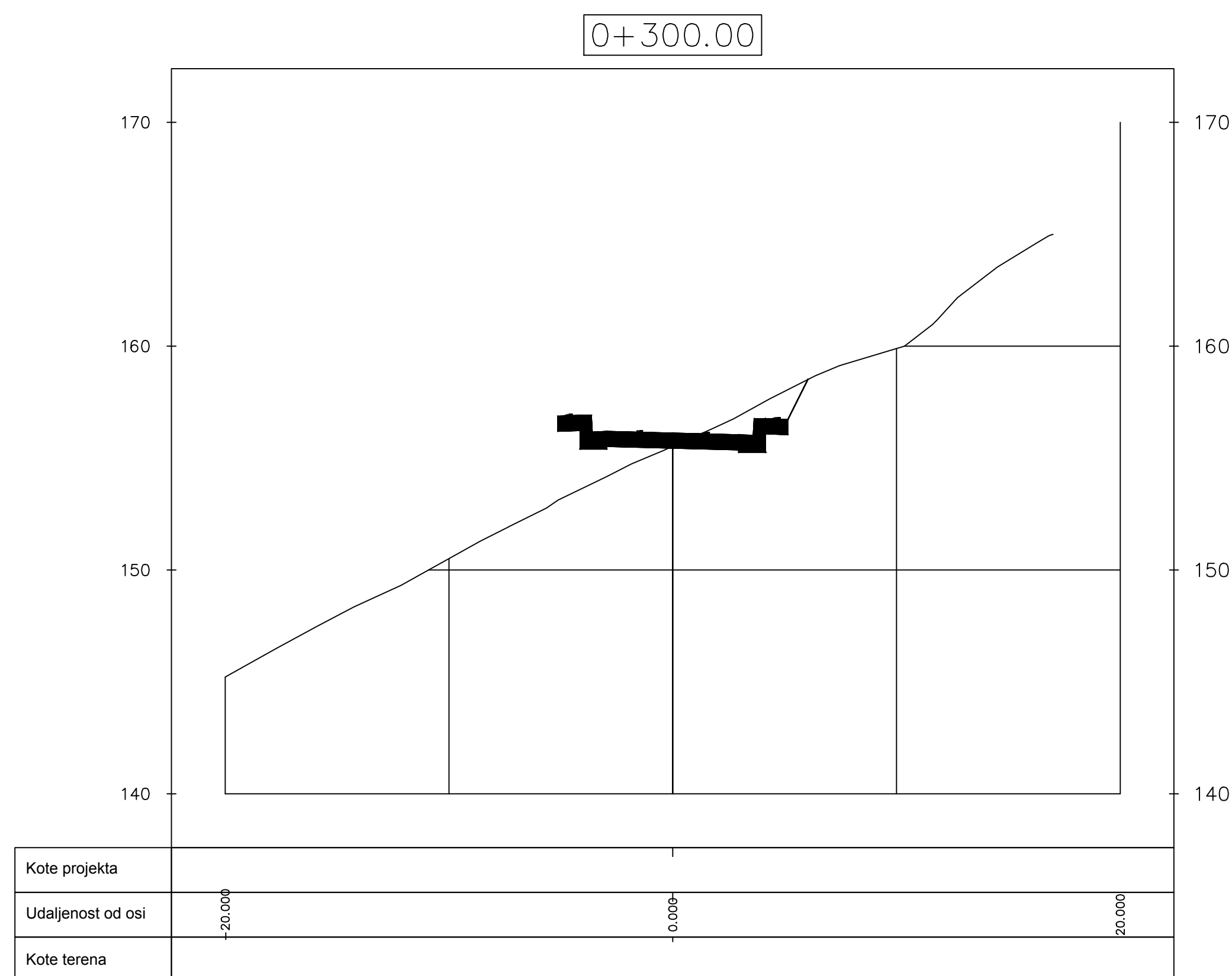
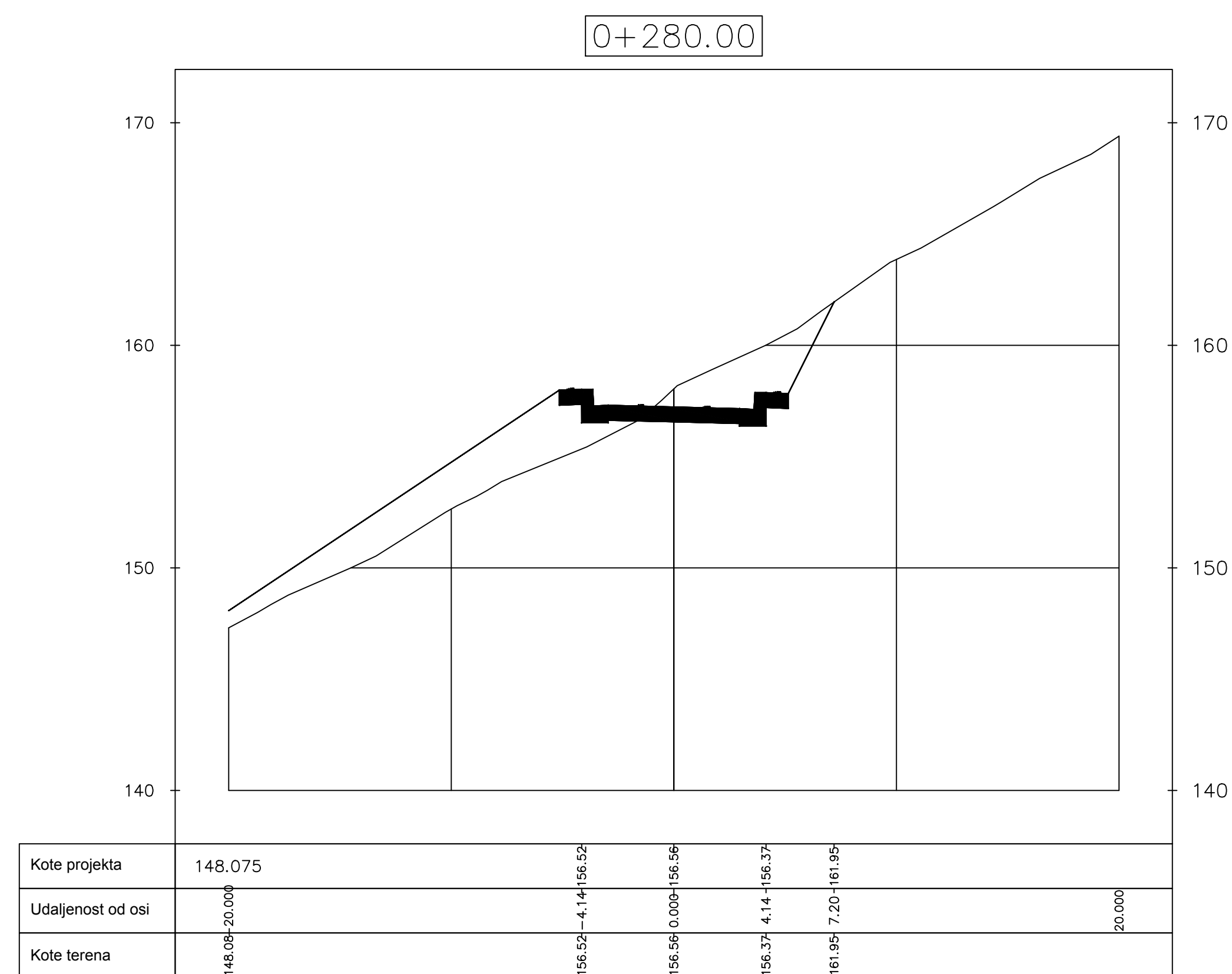
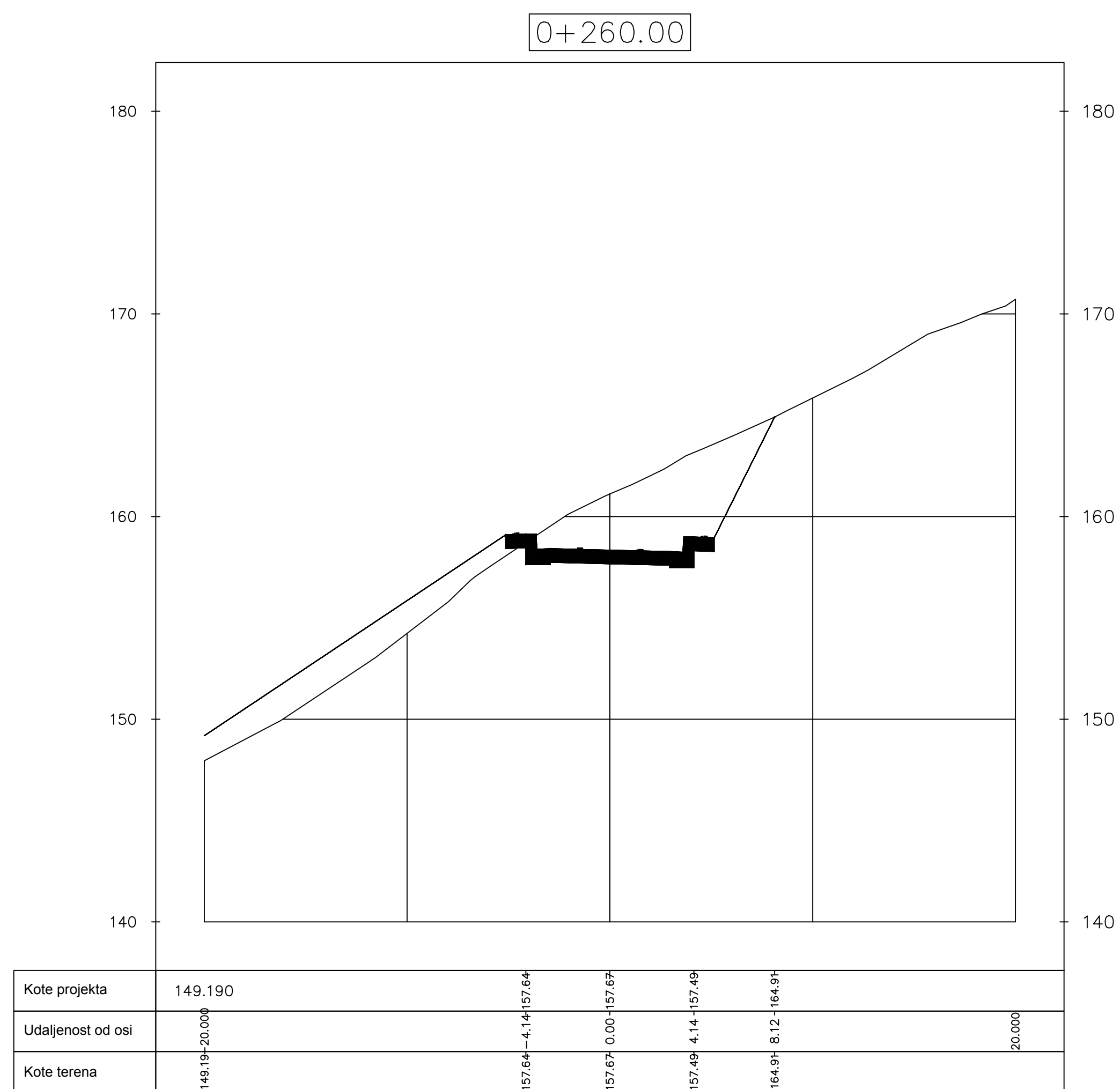




KARAKTERISTIČNI POPREČNI  
PRESJECI  
M 1:200



KARAKTERISTIČNI POPREČNI  
PRESJECI  
M 1:200



## 4.0 OBRADA NA RAČUNALU

Prilikom izrade predmetnog zadatka korišteno je računalo uz odgovarajući softver Autodesk AutoCAD Civil 3D. Postupak projektiranja trase na računalu sličan je ručnoj izradi rješenja ali mnogo brži. Radu na računalu prethodi definiranje problema, uočavanje nedostataka te određivanje načina na koje bi se idejno rješenje kvalitetno izradilo.

Prvi korak pri izradi idejnog rješenja na računalu je digitaliziranje terena na temelju zadanih slojnica. Unošenjem slojnica u obliku 3D polilinja sa zadanim nadmorskim visinama pomoću kojih definiramo površinu odnosno trodimenzionalni model terena postojećeg stanja na području obuhvaćenim predmetnim zadatkom.

Nakon toga se unose koordinate točaka tangenti (po dvije za svaku tangentu) koje ih definiraju na terenu. Sjecišta tangenti definiramo ubacivanjem odgovarajućih kružnih lukova i prijelaznih krivina čime se dobiva horizontalni tok ceste.

Sljedeći korak je izrada uzdužnog presjeka ceste. Linija terena se automatski generira iz zadane horizontalne osi ceste. Potrebno je definirati niveletu. Niveleta se postavlja tako da se u konačnici riješe geometrijski i sigurnosni elementi i odvodnja. Između tangenti se umeće kružna krivina radijusa prema potrebi.

Potrebno je definirati i poprečni profil prometnice. Poprečnim presjekom definirani su: poprečni nagib i širina kolnika te pokosi usjeka i nasipa.

Iz definirane osi trase, nivelete i poprečnog presjeka definiramo koridor. Ovime smo dobili poprečne presjeke u svim karakterističnim i zadanim točkama osi ceste, a time i točke spajanja pokosa usjeka i nasipa sa terenom. Ovime smo definirali čitavu dionicu ceste u prostoru.

Kao izlazni podaci dobivaju se računalni ispisi koordinatnih točaka osi, točaka svakog poprečnog presjeka te količina zemljanih radova po presjeku.

## 5.0 IZLAZNI PODACI PROGRAMA

### 5.1 KOORDINATNI RAČUN GLAVNIH TOČAKA OSI

Alignment: OS1  
Description:

<u>Tangent Data</u>			
Description	PT Station	Northing	Easting
Start:	0+00.000	-9652.146	-52010.336
End:	0+51.128	-9611.377	-51979.482
<u>Tangent Data</u>			
Parameter	Value	Parameter	Value
Length:	51.128	Course:	N 37° 07' 08.5969" E
<u>Spiral Point Data</u>			
Description	Station	Northing	Easting
TS:	0+51.128	-9611.377	-51979.482
SPI:		-9589.933	-51963.252
SC:	0+91.128	-9583.171	-51951.522
<u>Spiral Curve Data: clothoid</u>			
Parameter	Value	Parameter	Value
Length:	40.000	L Tan:	26.894
Radius:	50.000	S Tan:	13.540
Theta:	22° 55' 05.9225"	P:	1.326
X:	39.365	K:	19.894
Y:	5.273	A:	44.721
Chord:	39.716	Course:	N 44° 44' 53.1747" E
<u>Curve Point Data</u>			
Description	Station	Northing	Easting
SC:	0+91.128	-9583.171	-51951.522
RP:		-9626.488	-51926.550
CS:	0+98.311	-9580.042	-51945.063
<u>Circular Curve Data</u>			
Parameter	Value	Parameter	Value
Delta:	08° 13' 52.4653"	Type:	RIGHT
Radius:	50.000		
Length:	7.183	Tangent:	3.598
Mid-Ord:	0.129	External:	0.129
Chord:	7.177	Course:	N 64° 09' 10.7521" E
<u>Spiral Point Data</u>			
Description	Station	Northing	Easting
CS:	0+98.311	-9580.042	-51945.063
SPI:		-9575.028	-51932.485
ST:	1+38.311	-9575.585	-51905.597
<u>Spiral Curve Data: clothoid</u>			
Parameter	Value	Parameter	Value
Length:	40.000	L Tan:	26.894
Radius:	50.000	S Tan:	13.540
Theta:	22° 55' 05.9225"	P:	1.326
X:	39.365	K:	19.894
Y:	5.273	A:	44.721
Chord:	39.716	Course:	N 83° 33' 28.3294" E

<u>Tangent Data</u>			
Description	PT Station	Northing	Easting
Start:	1+38.311	-9575.585	-51905.597
End:	1+66.357	-9576.166	-51877.558
<u>Tangent Data</u>			
Parameter	Value	Parameter	Value
Length:	28.046	Course:	S 88° 48' 47.0928" E
<u>Spiral Point Data</u>			
Description	Station	Northing	Easting
TS:	1+66.357	-9576.166	-51877.558
SPI:		-9576.720	-51850.828
SC:	2+06.357	-9574.039	-51837.702
<u>Spiral Curve Data: clothoid</u>			
Parameter	Value	Parameter	Value
Length:	40.000	L Tan:	26.736
Radius:	90.000	S Tan:	13.396
Theta:	12° 43' 56.6236"	P:	0.739
X:	39.803	K:	19.967
Y:	2.953	A:	60.000
Chord:	39.912	Course:	N 86° 56' 40.4278" E
<u>Curve Point Data</u>			
Description	Station	Northing	Easting
SC:	2+06.357	-9574.039	-51837.702
RP:		-9485.860	-51855.715
CS:	2+19.810	-9570.373	-51824.772
<u>Circular Curve Data</u>			
Parameter	Value	Parameter	Value
Delta:	08° 33' 50.6363"	Type:	LEFT
Radius:	90.000		
Length:	13.452	Tangent:	6.739
Mid-Ord:	0.251	External:	0.252
Chord:	13.440	Course:	N 74° 10' 20.9655" E
<u>Spiral Point Data</u>			
Description	Station	Northing	Easting
CS:	2+19.810	-9570.373	-51824.772
SPI:		-9565.767	-51812.192
ST:	2+59.810	-9551.268	-51789.729
<u>Spiral Curve Data: clothoid</u>			
Parameter	Value	Parameter	Value
Length:	40.000	L Tan:	26.736
Radius:	90.000	S Tan:	13.396
Theta:	12° 43' 56.6236"	P:	0.739
X:	39.803	K:	19.967
Y:	2.953	A:	60.000
Chord:	39.912	Course:	N 61° 24' 01.5032" E
<u>Tangent Data</u>			
Description	PT Station	Northing	Easting
Start:	2+59.810	-9551.268	-51789.729
End:	3+20.353	-9518.434	-51738.863
<u>Tangent Data</u>			
Parameter	Value	Parameter	Value
Length:	60.543	Course:	N 57° 09' 29.0238" E

Alignment: OS1-Left-2.950

Description:

<u>Tangent Data</u>			
Description	PT Station	Northing	Easting
Start:	0+00.000	-9650.366	-52012.689
End:	0+51.128	-9609.597	-51981.834
<u>Tangent Data</u>			
Parameter	Value	Parameter	Value
Length:	51.128	Course:	N 37° 07' 08.5969" E
<u>Spiral Point Data</u>			
Description	Station	Northing	Easting
TS:	0+51.128	-9609.597	-51981.834
SPI:		-9587.676	-51965.244
SC:	0+92.308	-9580.615	-51952.995
<u>Spiral Curve Data: clothoid</u>			
Parameter	Value	Parameter	Value
Length:	41.180	L Tan:	27.674
Radius:	52.950	S Tan:	13.927
Theta:	22° 16' 47.5989"	P:	1.327
X:	40.562	K:	20.487
Y:	5.280	A:	46.696
Chord:	40.886	Course:	N 44° 51' 28.1770" E
<u>Curve Point Data</u>			
Description	Station	Northing	Easting
SC:	0+92.308	-9580.615	-51952.995
RP:		-9626.488	-51926.550
CS:	0+99.915	-9577.301	-51946.155
<u>Circular Curve Data</u>			
Parameter	Value	Parameter	Value
Delta:	08° 13' 52.4653"	Type:	RIGHT
Radius:	52.950		
Length:	7.607	Tangent:	3.810
Mid-Ord:	0.137	External:	0.137
Chord:	7.600	Course:	N 64° 09' 10.7521" E
<u>Spiral Point Data</u>			
Description	Station	Northing	Easting
CS:	0+99.915	-9577.301	-51946.155
SPI:		-9572.067	-51933.022
ST:	1+41.095	-9572.636	-51905.536
<u>Spiral Curve Data: clothoid</u>			
Parameter	Value	Parameter	Value
Length:	41.180	L Tan:	27.674
Radius:	52.950	S Tan:	13.927
Theta:	22° 16' 47.5989"	P:	1.327
X:	40.562	K:	20.487
Y:	5.280	A:	46.696
Chord:	40.886	Course:	N 83° 26' 53.3272" E
<u>Tangent Data</u>			
Description	PT Station	Northing	Easting
Start:	1+41.095	-9572.636	-51905.536
End:	1+69.141	-9573.217	-51877.497
<u>Tangent Data</u>			
Parameter	Value	Parameter	Value
Length:	28.046	Course:	S 88° 48' 47.0928" E

<u>Curve Point Data</u>			
Description	Station	Northing	Easting
PC:	1+69.141	-9573.217	-51877.497
RP:		-9483.236	-51875.632
PT:	1+74.222	-9573.179	-51872.417
<u>Circular Curve Data</u>			
Parameter	Value	Parameter	Value
Delta:	03° 14' 04.4438"	Type:	LEFT
Radius:	90.000		
Length:	5.081	Tangent:	2.541
Mid-Ord:	0.036	External:	0.036
Chord:	5.080	Course:	N 89° 34' 10.6854" E
<u>Tangent Data</u>			
Description	PT Station	Northing	Easting
Start:	1+74.222	-9573.179	-51872.417
End:	1+93.475	-9572.491	-51853.176
<u>Tangent Data</u>			
Parameter	Value	Parameter	Value
Length:	19.253	Course:	N 87° 57' 08.4635" E
<u>Curve Point Data</u>			
Description	Station	Northing	Easting
PC:	1+93.475	-9572.491	-51853.176
RP:		-9482.548	-51856.392
PCC:	2+08.394	-9570.727	-51838.379
<u>Circular Curve Data</u>			
Parameter	Value	Parameter	Value
Delta:	09° 29' 52.1798"	Type:	LEFT
Radius:	90.000		
Length:	14.919	Tangent:	7.477
Mid-Ord:	0.309	External:	0.310
Chord:	14.902	Course:	N 83° 12' 12.3735" E
<u>Curve Point Data</u>			
Description	Station	Northing	Easting
PCC:	2+08.394	-9570.727	-51838.379
RP:		-9485.860	-51855.715
PCC:	2+21.341	-9567.199	-51825.934
<u>Circular Curve Data</u>			
Parameter	Value	Parameter	Value
Delta:	08° 33' 50.6363"	Type:	LEFT
Radius:	86.620		
Length:	12.947	Tangent:	6.486
Mid-Ord:	0.242	External:	0.242
Chord:	12.935	Course:	N 74° 10' 20.9655" E
<u>Curve Point Data</u>			
Description	Station	Northing	Easting
PCC:	2+21.341	-9567.199	-51825.934
RP:		-9482.686	-51856.877
PT:	2+36.260	-9560.935	-51812.413
<u>Circular Curve Data</u>			
Parameter	Value	Parameter	Value
Delta:	09° 29' 52.1654"	Type:	LEFT
Radius:	90.000		
Length:	14.919	Tangent:	7.477
Mid-Ord:	0.309	External:	0.310

Chord:	14.902	Course:	N 65° 08' 29.5647" E
<u>Tangent Data</u>			
<b>Description</b>	<b>PT Station</b>	<b>Northing</b>	<b>Easting</b>
Start:	2+36.260	-9560.935	-51812.413
End:	2+55.513	-9551.423	-51795.674
<u>Tangent Data</u>			
<b>Parameter</b>	<b>Value</b>	<b>Parameter</b>	<b>Value</b>
Length:	19.253	Course:	N 60° 23' 33.4820" E
<u>Curve Point Data</u>			
<b>Description</b>	<b>Station</b>	<b>Northing</b>	<b>Easting</b>
PC:	2+55.513	-9551.423	-51795.674
RP:		-9473.174	-51840.138
PT:	2+60.594	-9548.789	-51791.329
<u>Circular Curve Data</u>			
<b>Parameter</b>	<b>Value</b>	<b>Parameter</b>	<b>Value</b>
Delta:	03° 14' 04.4582"	Type:	LEFT
Radius:	90.000		
Length:	5.081	Tangent:	2.541
Mid-Ord:	0.036	External:	0.036
Chord:	5.080	Course:	N 58° 46' 31.2529" E
<u>Tangent Data</u>			
<b>Description</b>	<b>PT Station</b>	<b>Northing</b>	<b>Easting</b>
Start:	2+60.594	-9548.789	-51791.329
End:	3+21.137	-9515.956	-51740.463
<u>Tangent Data</u>			
<b>Parameter</b>	<b>Value</b>	<b>Parameter</b>	<b>Value</b>
Length:	60.543	Course:	N 57° 09' 29.0238" E

Alignment: OS1-Right-2.950

Description:

<u>Tangent Data</u>			
<b>Description</b>	<b>PT Station</b>	<b>Northing</b>	<b>Easting</b>
Start:	0+00.000	-9653.926	-52007.984
End:	0+51.128	-9613.158	-51977.130
<u>Tangent Data</u>			
<b>Parameter</b>	<b>Value</b>	<b>Parameter</b>	<b>Value</b>
Length:	51.128	Course:	N 37° 07' 08.5969" E
<u>Curve Point Data</u>			
<b>Description</b>	<b>Station</b>	<b>Northing</b>	<b>Easting</b>
PC:	0+51.128	-9613.158	-51977.130
RP:		-9643.331	-51937.260
PT:	0+58.374	-9607.716	-51972.354
<u>Circular Curve Data</u>			
<b>Parameter</b>	<b>Value</b>	<b>Parameter</b>	<b>Value</b>
Delta:	08° 18' 12.1721"	Type:	RIGHT
Radius:	50.000		
Length:	7.246	Tangent:	3.629
Mid-Ord:	0.131	External:	0.132
Chord:	7.240	Course:	N 41° 16' 14.6830" E
<u>Tangent Data</u>			
<b>Description</b>	<b>PT Station</b>	<b>Northing</b>	<b>Easting</b>
Start:	0+58.374	-9607.716	-51972.354



End:	0+76.657	-9594.884	-51959.332
<u>Tangent Data</u>			
<b>Parameter</b>	<b>Value</b>	<b>Parameter</b>	<b>Value</b>
Length:	18.282	Course:	N 45° 25' 20.7690" E
<u>Curve Point Data</u>			
<b>Description</b>	<b>Station</b>	<b>Northing</b>	<b>Easting</b>
PC:	0+76.657	-9594.884	-51959.332
RP:		-9630.499	-51924.238
PCC:	0+89.411	-9587.182	-51949.210
<u>Circular Curve Data</u>			
<b>Parameter</b>	<b>Value</b>	<b>Parameter</b>	<b>Value</b>
Delta:	14° 36' 53.7504"	Type:	RIGHT
Radius:	50.000		
Length:	12.754	Tangent:	6.412
Mid-Ord:	0.406	External:	0.409
Chord:	12.719	Course:	N 52° 43' 47.6442" E
<u>Curve Point Data</u>			
<b>Description</b>	<b>Station</b>	<b>Northing</b>	<b>Easting</b>
PCC:	0+89.411	-9587.182	-51949.210
RP:		-9626.488	-51926.550
PCC:	0+95.929	-9584.343	-51943.349
<u>Circular Curve Data</u>			
<b>Parameter</b>	<b>Value</b>	<b>Parameter</b>	<b>Value</b>
Delta:	08° 13' 52.4653"	Type:	RIGHT
Radius:	45.370		
Length:	6.518	Tangent:	3.265
Mid-Ord:	0.117	External:	0.117
Chord:	6.512	Course:	N 64° 09' 10.7521" E
<u>Curve Point Data</u>			
<b>Description</b>	<b>Station</b>	<b>Northing</b>	<b>Easting</b>
PCC:	0+95.929	-9584.343	-51943.349
RP:		-9630.789	-51924.836
PT:	1+08.683	-9581.174	-51931.030
<u>Circular Curve Data</u>			
<b>Parameter</b>	<b>Value</b>	<b>Parameter</b>	<b>Value</b>
Delta:	14° 36' 53.7504"	Type:	RIGHT
Radius:	50.000		
Length:	12.754	Tangent:	6.412
Mid-Ord:	0.406	External:	0.409
Chord:	12.719	Course:	N 75° 34' 33.8600" E
<u>Tangent Data</u>			
<b>Description</b>	<b>PT Station</b>	<b>Northing</b>	<b>Easting</b>
Start:	1+08.683	-9581.174	-51931.030
End:	1+26.965	-9578.909	-51912.889
<u>Tangent Data</u>			
<b>Parameter</b>	<b>Value</b>	<b>Parameter</b>	<b>Value</b>
Length:	18.282	Course:	N 82° 53' 00.7352" E
<u>Curve Point Data</u>			
<b>Description</b>	<b>Station</b>	<b>Northing</b>	<b>Easting</b>
PC:	1+26.965	-9578.909	-51912.889
RP:		-9628.524	-51906.694
PT:	1+34.211	-9578.535	-51905.659
<u>Circular Curve Data</u>			
<b>Parameter</b>	<b>Value</b>	<b>Parameter</b>	<b>Value</b>

Delta:	08° 18' 12.1721"	Type:	RIGHT
Radius:	50.000		
Length:	7.246	Tangent:	3.629
Mid-Ord:	0.131	External:	0.132
Chord:	7.240	Course:	N 87° 02' 06.8212" E
<u>Tangent Data</u>			
<b>Description</b>	<b>PT Station</b>	<b>Northing</b>	<b>Easting</b>
Start:	1+34.211	-9578.535	-51905.659
End:	1+62.257	-9579.116	-51877.619
<u>Tangent Data</u>			
<b>Parameter</b>	<b>Value</b>	<b>Parameter</b>	<b>Value</b>
Length:	28.046	Course:	S 88° 48' 47.0928" E
<u>Spiral Point Data</u>			
<b>Description</b>	<b>Station</b>	<b>Northing</b>	<b>Easting</b>
TS:	1+62.257	-9579.116	-51877.619
SPI:		-9579.676	-51850.560
SC:	2+02.912	-9576.929	-51837.112
<u>Spiral Curve Data: clothoid</u>			
<b>Parameter</b>	<b>Value</b>	<b>Parameter</b>	<b>Value</b>
Length:	40.656	L Tan:	27.172
Radius:	92.950	S Tan:	13.614
Theta:	12° 31' 49.2538"	P:	0.740
X:	40.462	K:	20.295
Y:	2.954	A:	61.473
Chord:	40.566	Course:	N 86° 54' 37.1519" E
<u>Curve Point Data</u>			
<b>Description</b>	<b>Station</b>	<b>Northing</b>	<b>Easting</b>
SC:	2+02.912	-9576.929	-51837.112
RP:		-9485.860	-51855.715
CS:	2+16.806	-9573.144	-51823.758
<u>Circular Curve Data</u>			
<b>Parameter</b>	<b>Value</b>	<b>Parameter</b>	<b>Value</b>
Delta:	08° 33' 50.6363"	Type:	LEFT
Radius:	92.950		
Length:	13.893	Tangent:	6.960
Mid-Ord:	0.259	External:	0.260
Chord:	13.880	Course:	N 74° 10' 20.9655" E
<u>Spiral Point Data</u>			
<b>Description</b>	<b>Station</b>	<b>Northing</b>	<b>Easting</b>
CS:	2+16.806	-9573.144	-51823.758
SPI:		-9568.424	-51810.869
ST:	2+57.461	-9553.746	-51788.130
<u>Spiral Curve Data: clothoid</u>			
<b>Parameter</b>	<b>Value</b>	<b>Parameter</b>	<b>Value</b>
Length:	40.656	L Tan:	27.172
Radius:	92.950	S Tan:	13.614
Theta:	12° 31' 49.2538"	P:	0.740
X:	40.462	K:	20.295
Y:	2.954	A:	61.473
Chord:	40.566	Course:	N 61° 26' 04.7792" E
<u>Tangent Data</u>			
<b>Description</b>	<b>PT Station</b>	<b>Northing</b>	<b>Easting</b>
Start:	2+57.461	-9553.746	-51788.130
End:	3+18.004	-9520.913	-51737.263

<u>Tangent Data</u>			
<b>Parameter</b>	<b>Value</b>	<b>Parameter</b>	<b>Value</b>
Length:	60.543	Course:	N 57° 09' 29.0238" E

## 5.2 KOORDINATNI RAČUN DETALJNIH TOČAKA OSI

Alignment Name: OS1

Description:

Station Range: Start: 0+000.00, End: 0+320.35

Station Increment: 20.00

Station	Northing	Easting	Tangential Direction
0+000.00	-9,652.1462m	-52,010.3364m	N37° 07' 09"E
0+020.00	-9,636.1986m	-51,998.2669m	N37° 07' 09"E
0+040.00	-9,620.2509m	-51,986.1975m	N37° 07' 09"E
0+060.00	-9,604.3386m	-51,974.0818m	N38° 14' 47"E
0+080.00	-9,589.6619m	-51,960.5398m	N49° 03' 33"E
0+100.00	-9,579.4426m	-51,943.4843m	N70° 09' 46"E
0+120.00	-9,575.7177m	-51,923.9027m	N86° 23' 02"E
0+140.00	-9,575.6204m	-51,903.9093m	S88° 48' 47"E
0+160.00	-9,576.0347m	-51,883.9135m	S88° 48' 47"E
0+180.00	-9,576.3315m	-51,863.9163m	N89° 42' 21"E
0+200.00	-9,575.1022m	-51,843.9687m	N82° 10' 48"E
0+220.00	-9,570.3077m	-51,824.5931m	N69° 46' 10"E
0+240.00	-9,561.7056m	-51,806.5630m	N60° 16' 51"E
0+260.00	-9,551.1646m	-51,789.5694m	N57° 09' 29"E
0+280.00	-9,540.3182m	-51,772.7660m	N57° 09' 29"E
0+300.00	-9,529.4717m	-51,755.9626m	N57° 09' 29"E
0+320.00	-9,518.6253m	-51,739.1592m	N57° 09' 29"E
0+320.35	-9,518.4354m	-51,738.8652m	N57° 09' 29"E

Alignment Name: OS1-Left-2.950

Description:

Station Range: Start: 0+000.00, End: 0+321.14

Station Increment: 20.00

Station	Northing	Easting	Tangential Direction
0+000.00	-9,650.3660m	-52,012.6887m	N37° 07' 09"E
0+020.00	-9,634.4183m	-52,000.6192m	N37° 07' 09"E
0+040.00	-9,618.4707m	-51,988.5498m	N37° 07' 09"E
0+060.00	-9,602.7148m	-51,976.5579m	N38° 10' 58"E
0+080.00	-9,588.0022m	-51,963.1207m	N48° 23' 05"E
0+100.00	-9,577.2690m	-51,946.0742m	N68° 21' 46"E
0+120.00	-9,572.9382m	-51,926.3243m	N85° 10' 22"E
0+140.00	-9,572.6141m	-51,906.6008m	S88° 49' 45"E
0+160.00	-9,573.0277m	-51,886.6356m	S88° 48' 47"E
0+180.00	-9,572.9724m	-51,866.6421m	N87° 57' 08"E
0+200.00	-9,572.0217m	-51,846.6690m	N83° 47' 53"E
0+220.00	-9,567.6507m	-51,827.1967m	N70° 46' 39"E
0+240.00	-9,559.0872m	-51,809.1610m	N60° 23' 33"E
0+260.00	-9,549.1098m	-51,791.8293m	N57° 32' 10"E
0+280.00	-9,538.2650m	-51,775.0248m	N57° 09' 29"E
0+300.00	-9,527.4186m	-51,758.2214m	N57° 09' 29"E
0+320.00	-9,516.5721m	-51,741.4180m	N57° 09' 29"E
0+321.14	-9,515.9555m	-51,740.4628m	N57° 09' 29"E

Alignment Name: OS1-Right-2.950

Description:

Station Range: Start: 0+000.00, End: 0+318.00

Station Increment: 20.00

Station	Northing	Easting	Tangential Direction
0+000.00	-9,653.9265m	-52,007.9841m	N37° 07' 09"E
0+020.00	-9,637.9788m	-51,995.9147m	N37° 07' 09"E
0+040.00	-9,622.0311m	-51,983.8452m	N37° 07' 09"E
0+060.00	-9,606.5753m	-51,971.1962m	N45° 25' 21"E
0+080.00	-9,592.6191m	-51,956.8735m	N49° 15' 12"E
0+100.00	-9,582.9907m	-51,939.5096m	N72° 56' 02"E
0+120.00	-9,579.7722m	-51,919.8001m	N82° 53' 01"E
0+140.00	-9,578.6547m	-51,899.8710m	S88° 48' 47"E
0+160.00	-9,579.0690m	-51,879.8753m	S88° 48' 47"E
0+180.00	-9,579.2311m	-51,860.0388m	N88° 45' 43"E
0+200.00	-9,577.4759m	-51,840.0167m	N80° 12' 48"E
0+220.00	-9,571.9775m	-51,820.7331m	N67° 58' 06"E
0+240.00	-9,562.9281m	-51,802.7913m	N59° 30' 24"E
0+260.00	-9,552.3697m	-51,785.9967m	N57° 09' 29"E
0+280.00	-9,541.5232m	-51,769.1933m	N57° 09' 29"E
0+300.00	-9,530.6767m	-51,752.3899m	N57° 09' 29"E
0+318.00	-9,520.9149m	-51,737.2668m	N57° 09' 29"E

## 5.3 RAČUN KOTA KOLNIKA

Corridor Name: KORIDOR

Description:

Base Alignment Name: OS1

Station Range: Start: 0+000.00, End: 0+320.35

## CHAINAGE 0+000.00

POINT	X	Y	Z	OFFSET	STRING CUT
1	-52,014.4363	-9,649.0434	175.7512	-5.142m	Hinge_Cut
2	-52,014.4355	-9,649.0440	175.0812	-5.141m	EPS_Sub
3	-52,013.6389	-9,649.6468	175.7912	-4.142m	Back_Curb
4	-52,013.2402	-9,649.9486	175.7912	-3.642m	Top_Curb
5	-52,013.2070	-9,649.9737	175.0412	-3.600m	Flowline_Gutter
6	-52,012.6887	-9,650.3660	175.0737	-2.950m	ETW
7	-52,012.6887	-9,650.3660	174.4037	-2.950m	ETW_SubBase
8	-52,007.9841	-9,653.9265	174.2563	2.950m	ETW_SubBase
9	-52,007.9841	-9,653.9265	174.9263	2.950m	Flange
10	-52,007.4658	-9,654.3187	174.8938	3.600m	Flowline_Gutter
11	-52,007.4326	-9,654.3439	175.6438	3.642m	Top_Curb
12	-52,007.0339	-9,654.6456	175.6438	4.142m	Back_Curb
13	-52,006.2373	-9,655.2485	174.9338	5.141m	EPS_Sub
14	-52,006.2365	-9,655.2491	175.6038	5.142m	EPS
15	-52,003.5978	-9,657.2461	182.2222	8.451m	Daylight

## CHAINAGE 0+025.00

## CHAINAGE 0+050.00

## CHAINAGE 0+075.00

## CHAINAGE 0+100.00

POINT	X	Y	Z	OFFSET	STRING CUT
1	-51,945.4286	-9,574.0532	169.8776	-5.729m	Daylight
2	-51,945.2293	-9,574.6056	168.7030	-5.142m	EPS
3	-51,945.2289	-9,574.6065	168.0330	-5.141m	EPS_Sub
4	-51,944.8899	-9,575.5463	168.7430	-4.142m	Back_Curb
5	-51,944.7202	-9,576.0166	168.7430	-3.642m	Top_Curb
6	-51,944.7061	-9,576.0558	167.9930	-3.600m	Flowline_Gutter
7	-51,944.4855	-9,576.6672	168.0255	-2.950m	ETW
8	-51,944.4855	-9,576.6672	167.3555	-2.950m	ETW_SubBase
9	-51,941.9138	-9,583.7960	167.1660	4.628m	ETW_SubBase
10	-51,941.9138	-9,583.7960	167.8360	4.628m	ETW
11	-51,941.6932	-9,584.4074	167.8035	5.278m	Flowline_Gutter
12	-51,941.6790	-9,584.4467	168.5535	5.320m	Top_Curb
13	-51,941.5094	-9,584.9170	168.5535	5.820m	Back_Curb
14	-51,941.1704	-9,585.8567	167.8435	6.819m	EPS_Sub
15	-51,941.1700	-9,585.8576	168.5135	6.820m	Hinge_Cut
16	-51,940.0157	-9,589.0573	175.3165	10.221m	Daylight

CHAINAGE 0+125.00

CHAINAGE 0+150.00

CHAINAGE 0+175.00

CHAINAGE 0+200.00

POINT	X	Y	Z	OFFSET	STRING CUT
1	-51,845.3620	-9,564.9570	159.3477	-10.240m	Daylight
2	-51,844.7273	-9,569.5785	162.4576	-5.575m	Hinge
3	-51,844.7272	-9,569.5795	161.7876	-5.574m	EPS_Sub
4	-51,844.5912	-9,570.5692	162.4976	-4.575m	Back_Curb
5	-51,844.5232	-9,571.0646	162.4976	-4.075m	Top_Curb
6	-51,844.5175	-9,571.1059	161.7476	-4.034m	Flowline_Gutter
7	-51,844.4291	-9,571.7499	161.7801	-3.384m	ETW
8	-51,844.4291	-9,571.7499	161.1101	-3.384m	ETW_SubBase
9	-51,843.5674	-9,578.0244	161.6217	2.950m	Flange
10	-51,843.5674	-9,578.0244	160.9517	2.950m	ETW_SubBase
11	-51,843.4789	-9,578.6684	161.5892	3.600m	Flowline_Gutter
12	-51,843.4732	-9,578.7097	162.3392	3.641m	Top_Curb
13	-51,843.4052	-9,579.2050	162.3392	4.141m	Back_Curb
14	-51,843.2693	-9,580.1947	161.6292	5.140m	EPS_Sub
15	-51,843.2692	-9,580.1957	162.2992	5.141m	Hinge_Cut
16	-51,842.8994	-9,582.8880	167.7343	7.859m	Daylight

CHAINAGE 0+225.00

CHAINAGE 0+250.00

CHAINAGE 0+275.00

CHAINAGE 0+300.00

POINT	X	Y	Z	OFFSET	STRING CUT
1	-51,758.7511	-9,525.1518	156.8660	-5.142m	EPS
2	-51,758.7506	-9,525.1527	156.1960	-5.141m	EPS_Sub
3	-51,758.2088	-9,525.9920	156.9060	-4.142m	Back_Curb
4	-51,757.9376	-9,526.4121	156.9060	-3.642m	Top_Curb
5	-51,757.9150	-9,526.4471	156.1560	-3.600m	Flowline_Gutter
6	-51,757.5625	-9,526.9932	156.1885	-2.950m	ETW
7	-51,757.5625	-9,526.9932	155.5185	-2.950m	ETW_SubBase
8	-51,754.3628	-9,531.9502	156.0410	2.950m	Flange
9	-51,754.3628	-9,531.9502	155.3710	2.950m	ETW_SubBase
10	-51,754.0103	-9,532.4963	156.0085	3.600m	Flowline_Gutter
11	-51,753.9877	-9,532.5314	156.7585	3.642m	Top_Curb
12	-51,753.7165	-9,532.9514	156.7585	4.142m	Back_Curb
13	-51,753.1747	-9,533.7908	156.0485	5.141m	EPS_Sub
14	-51,753.1742	-9,533.7916	156.7185	5.142m	EPS
15	-51,752.6883	-9,534.5444	158.5105	6.038m	Daylight

## 5.4 PRORAČUN KOLIČINA ZEMLJANIH RADOVA

<b>Volume Summary</b>							
<b>Name</b>	<b>Type</b>	<b>Cut Factor</b>	<b>Fill Factor</b>	<b>2d Area (sq.m)</b>	<b>Cut (Cu. M.)</b>	<b>Fill (Cu. M.)</b>	<b>Net (Cu. M.)</b>
Surface3	full	1.000	1.000	7075.50	6614.83	7414.47	799.64<Fill>

<b>Totals</b>							
				<b>2d Area (sq.m)</b>	<b>Cut (Cu. M.)</b>	<b>Fill (Cu. M.)</b>	<b>Net (Cu. M.)</b>
Total				7075.50	6614.83	7414.47	799.64<Fill>



## 5.5 PRORAČUN KOLIČINA RADOVA

Alignment: OS1  
 Sample Line Group: PRESJECI  
 Start Sta: 0+000.000  
 End Sta: 0+320.353

<u>Station</u>	<u>Cut Area (Sq.m.)</u>	<u>Cut Volume (Cu.m.)</u>	<u>Reusable Volume (Cu.m.)</u>	<u>Fill Area (Sq.m.)</u>	<u>Fill Volume (Cu.m.)</u>	<u>Cum. Cut Vol. (Cu.m.)</u>	<u>Cum. Reusable Vol. (Cu.m.)</u>	<u>Cum. Fill Vol. (Cu.m.)</u>	<u>Cum. Net Vol. (Cu.m.)</u>
0+000.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0+020.000	10.48	104.82	104.82	1.37	13.72	104.82	104.82	13.72	91.11
0+040.000	0.00	104.82	104.82	0.00	13.72	209.65	209.65	27.44	182.21
0+051.128	0.00	0.00	0.00	0.00	0.00	209.65	209.65	27.44	182.21
0+051.130	0.00	0.00	0.00	0.00	0.00	209.65	209.65	27.44	182.21
0+060.000	0.00	0.00	0.00	0.00	0.00	209.65	209.65	27.44	182.21
0+080.000	41.76	402.77	402.77	22.16	245.68	612.42	612.42	273.12	339.30
0+091.128	60.84	538.81	538.81	0.00	147.76	1151.24	1151.24	420.88	730.36
0+100.000	66.56	533.60	533.60	0.00	0.00	1684.84	1684.84	420.88	1263.96
0+120.000	17.59	805.41	805.41	15.54	170.26	2490.25	2490.25	591.14	1899.11
0+138.310	0.85	165.48	165.48	34.89	477.32	2655.73	2655.73	1068.46	1587.27
0+140.000	0.74	1.34	1.34	37.32	61.01	2657.07	2657.07	1129.47	1527.60
0+160.000	0.73	14.69	14.69	63.55	1008.66	2671.76	2671.76	2138.13	533.63
0+166.357	2.18	9.26	9.26	57.22	383.88	2681.02	2681.02	2522.01	159.01
0+166.360	0.00	0.00	0.00	0.00	0.08	2681.02	2681.02	2522.10	158.93
0+180.000	13.57	93.03	93.03	31.14	208.24	2774.06	2774.06	2730.34	43.72
0+200.000	37.76	520.89	520.89	2.44	313.74	3294.94	3294.94	3044.08	250.86
0+206.357	43.76	264.36	264.36	0.41	8.41	3559.30	3559.30	3052.49	506.81
0+219.810	47.77	628.80	628.80	0.81	7.63	4188.10	4188.10	3060.13	1127.98
0+220.000	47.55	9.08	9.08	0.81	0.15	4197.18	4197.18	3060.28	1136.90
0+240.000	24.51	733.88	733.88	24.30	228.38	4931.06	4931.06	3288.66	1642.40
0+259.810	40.29	646.23	646.23	23.16	454.69	5577.28	5577.28	3743.34	1833.94
0+259.810	0.00	0.01	0.01	0.00	0.00	5577.29	5577.29	3743.35	1833.95
0+260.000	40.30	3.83	3.83	22.98	2.18	5581.12	5581.12	3745.53	1835.59
0+280.000	17.70	579.94	579.94	31.26	542.47	6161.06	6161.06	4288.00	1873.06
0+300.000	0.00	176.96	176.96	0.00	312.63	6338.03	6338.03	4600.64	1737.39
0+320.353	0.00	0.00	0.00	0.00	0.00	6338.03	6338.03	4600.64	1737.39

## 6.0 LITERATURA

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- 3) Hrvatske ceste – Hrvatske autoceste, „Opći tehnički uvjeti za radove na cestama“, Institut građevinarstva Hrvatske, Zagreb, prosinac 2001.
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