



БЪЛГАРСКА БРАНШОВА АСОЦИАЦИЯ ПЪТНА БЕЗОПАСНОСТ



Създаване на работни групи за обновяване на нормативната база и идентифициране на проблемни участъци чрез дигитален двойник на пътя

Проф. д-р инж. Борислав Христов

VIII годишна конференция на тема
БЕЗОПАСНА ПЪТНА ИНФРАСТРУКТУРА

I ЧАСТ

Създаване на работни групи за въвеждане, допълване или изменение на нормативната база

Създаване на работни групи

1. Членове на работната група

- Университети
- Строителни фирми (*при норми за строителство на пътища*)
- Проектантски фирми (*при норми и директиви за проектиране на пътища*)
- Администрация
- Федерален изследователски институт за пътища (*институт по пътища*)
- Други заинтересовани

Желателно: не повече от 10 – 15 души в работна група!

2. Избор на ръководител на работната група (от членовете)

- Университетски преподаватели (*при норми свързани с резултати от научни проекти – строителство и проектиране*)
- Инженери/експерти от практиката (*проектантски и строителни фирми*)
- Эксперти от институти

Arbeitsgruppe Straßenentwurf

Arbeitsausschuss: Autobahnen

Leiter: BDir. Dipl.-Ing. Rohloff, Bonn
Arbeitskreis 2.1.1 „Autobahnen“
Leiter: Univ.-Prof. Dr.-Ing. Lippold, Dresden
Mitglieder: Prof. Dr.-Ing. Bark, Gießen
Dr.-Ing. Drews, Heusenstamm
BDir. Dipl.-Ing. Frey Stein, Hannover
Dipl.-Ing. Irzik, Bergisch Gladbach
Dr.-Ing. Kleinschmidt, Dresden
Dipl.-Ing. Klippel, Berlin
Univ.-Prof. Dr.-Ing. habil. Kockelke, Siegen
RDir. Dipl.-Ing. Kuss, Hoppegarten
ORBR Dipl.-Ing. Mattner, Gelsenkirchen
BDir. Dipl.-Ing. Moritz, Bensheim
OBR Dipl.-Ing. Nink, Bonn
Dipl.-Ing. Richter, Erfurt
MR Dipl.-Ing. Scheuer, München
BDir. Dipl.-Ing. Silvanus, Bonn
Univ.-Prof. Dr.-Ing. habil. Steinauer, Aachen
Dr.-Ing. Weiser, Bochum

Arbeitskreis 2.1.2 „Stadtautobahnen“
Leiter: Univ.-Prof. Dr.-Ing. Wirth, Neubiberg
Mitglieder: Ltd. RBDi. a. D. Dipl.-Ing. Bartz, Berlin
Dipl.-Ing. Berlitz, München
Ltd. BDir. Dipl.-Ing. G o j, Augsburg
Dr.-Ing. Großmann, Hamburg
Dr.-Ing. Hoffmann, Hannover
Ltd. BDir. Dipl.-Ing. Holzwarth, Stuttgart
RBmst. Dipl.-Ing. Münnich, Aalen-Unterkochen
Dipl.-Ing. Norta, Trier
Prof. Dipl.-Ing. Santowski, Frankfurt am Main
Dipl.-Ing. Spengler, München
RBmst. Dr.-Ing. Trapp, Aachen
Dipl.-Ing. Voß, Berlin

Forschungsgesellschaft für Straßen- und Verkehrswesen



Arbeitsgruppe Straßenentwurf

Richtlinien
für die Anlage von Autobahnen

RAA



Ausgabe 2008

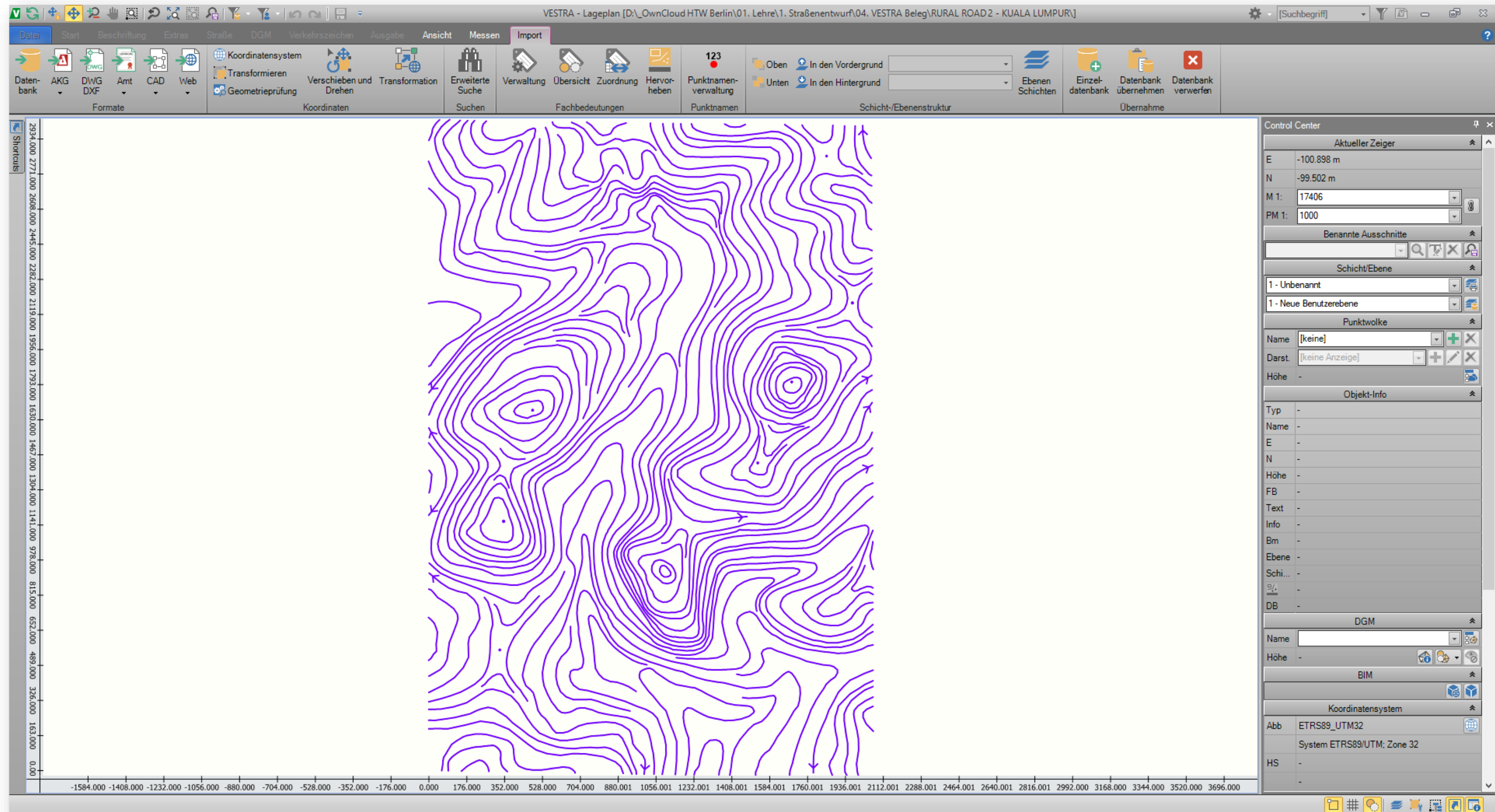
Издават се от Изследователската асоциация за пътища и трафик (FGSV) в Кьолн.

II ЧАСТ

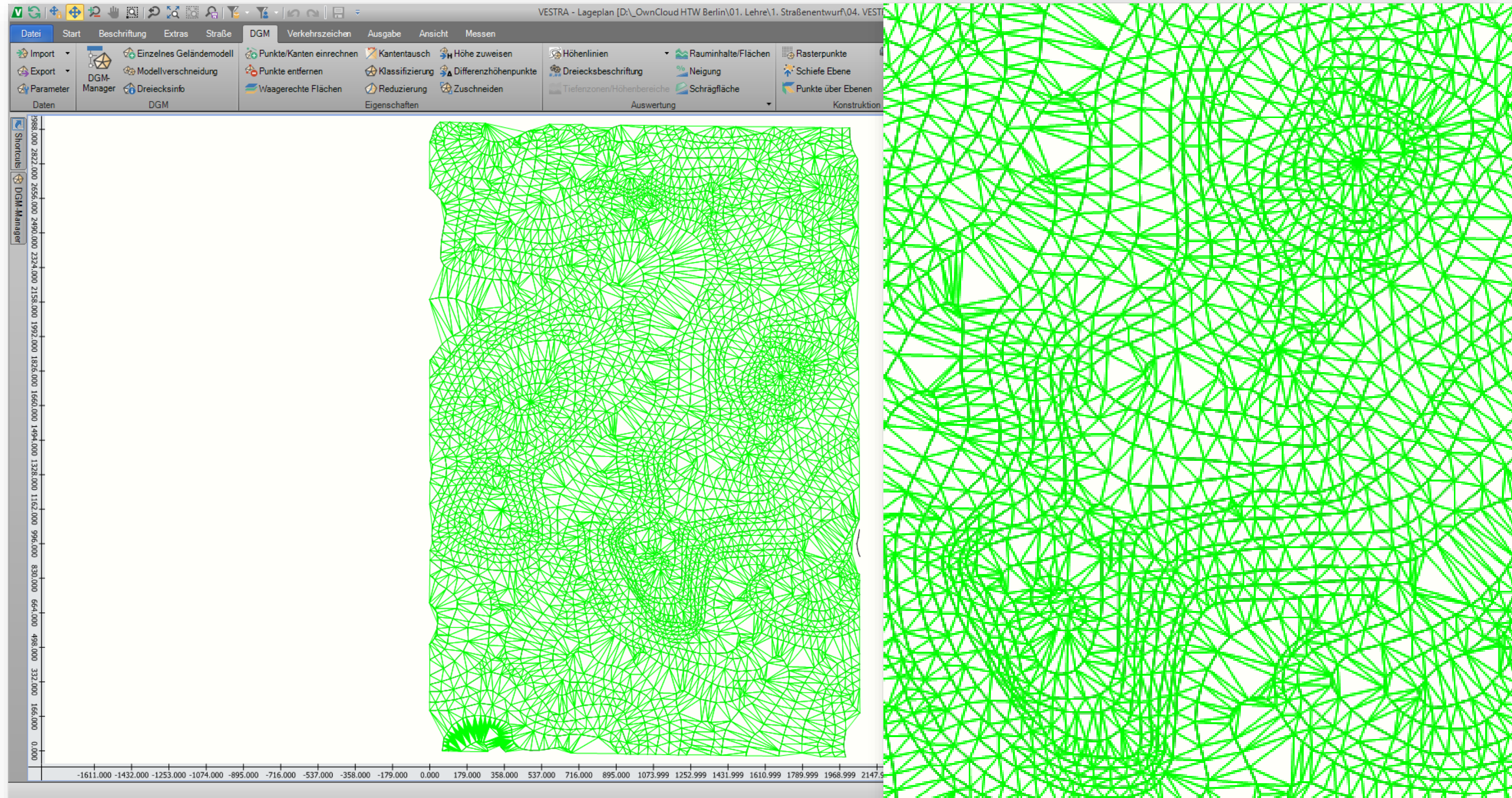
Идентифициране на проблемни участъци чрез дигитален двойник на пътя



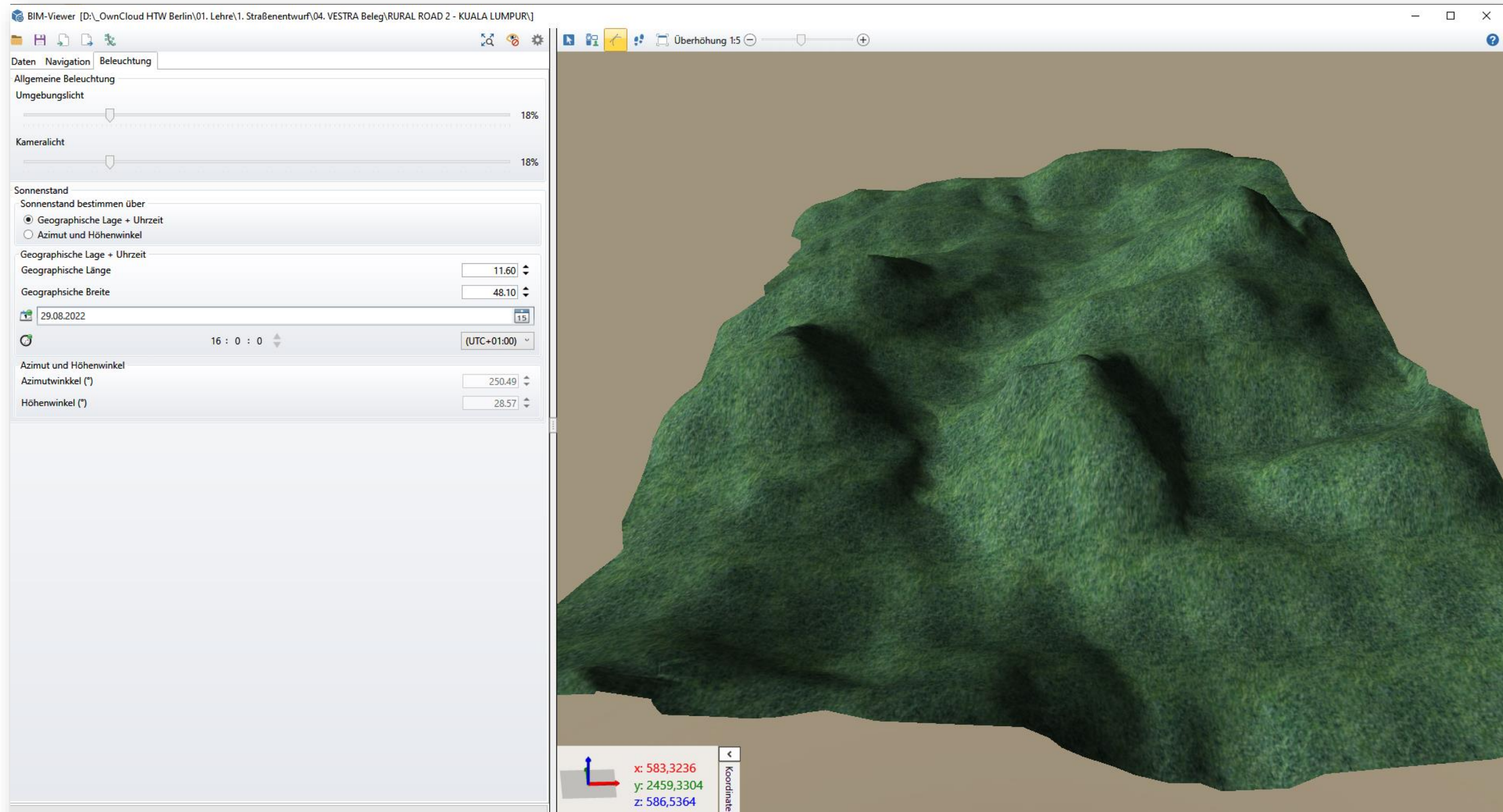
Топографска карта



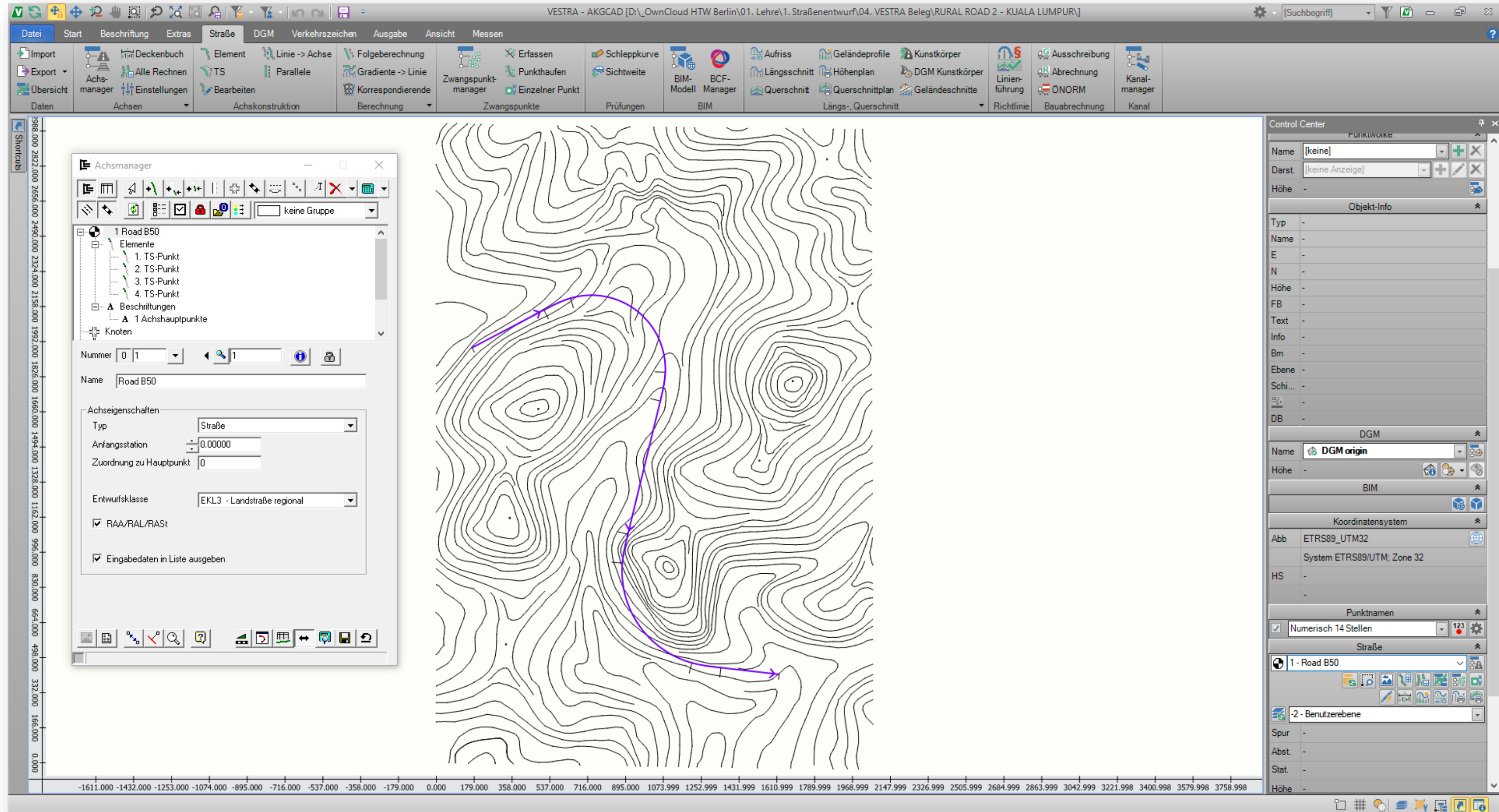
Цифров модел на терена



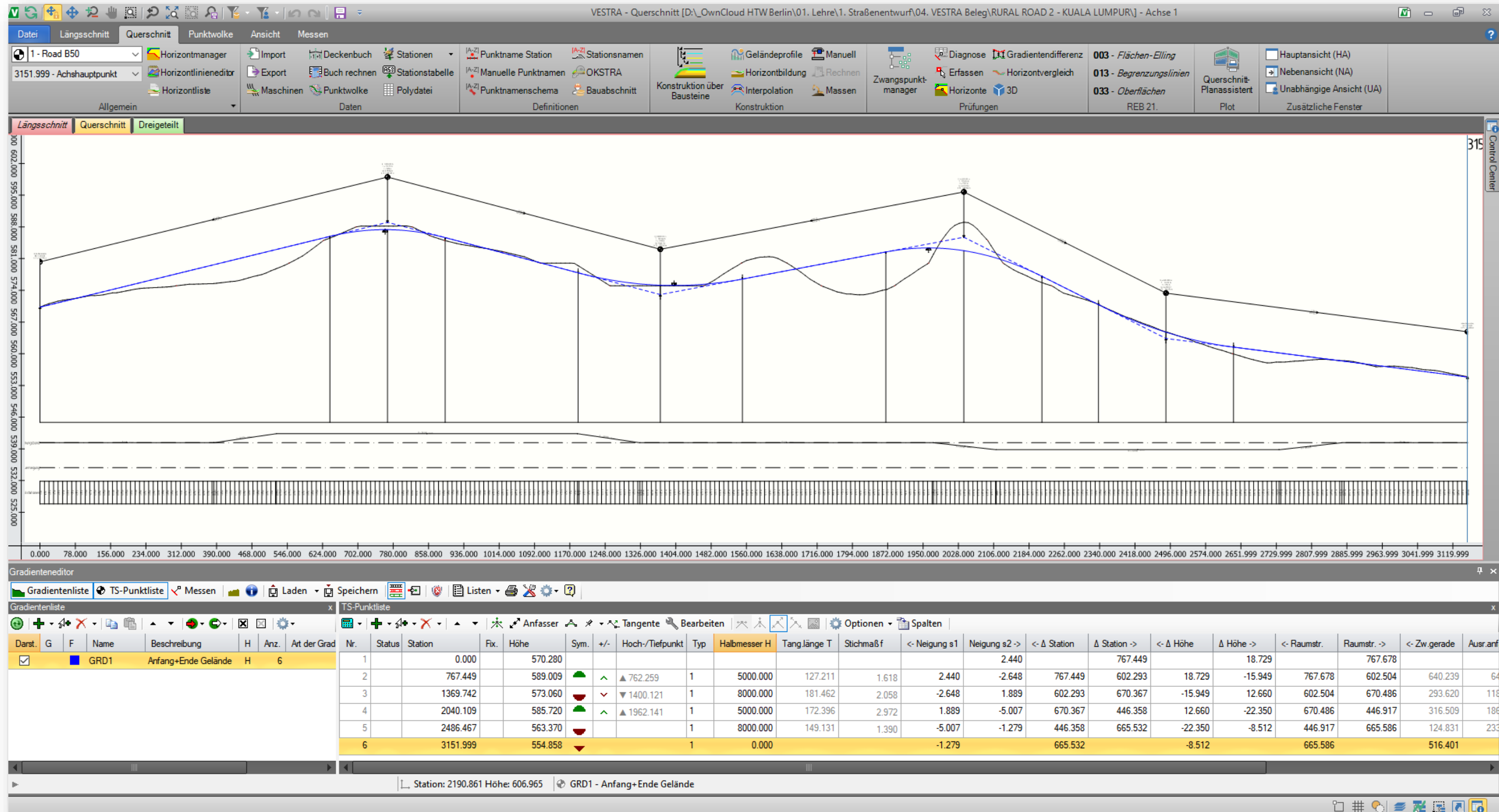
Цифров модел на терена



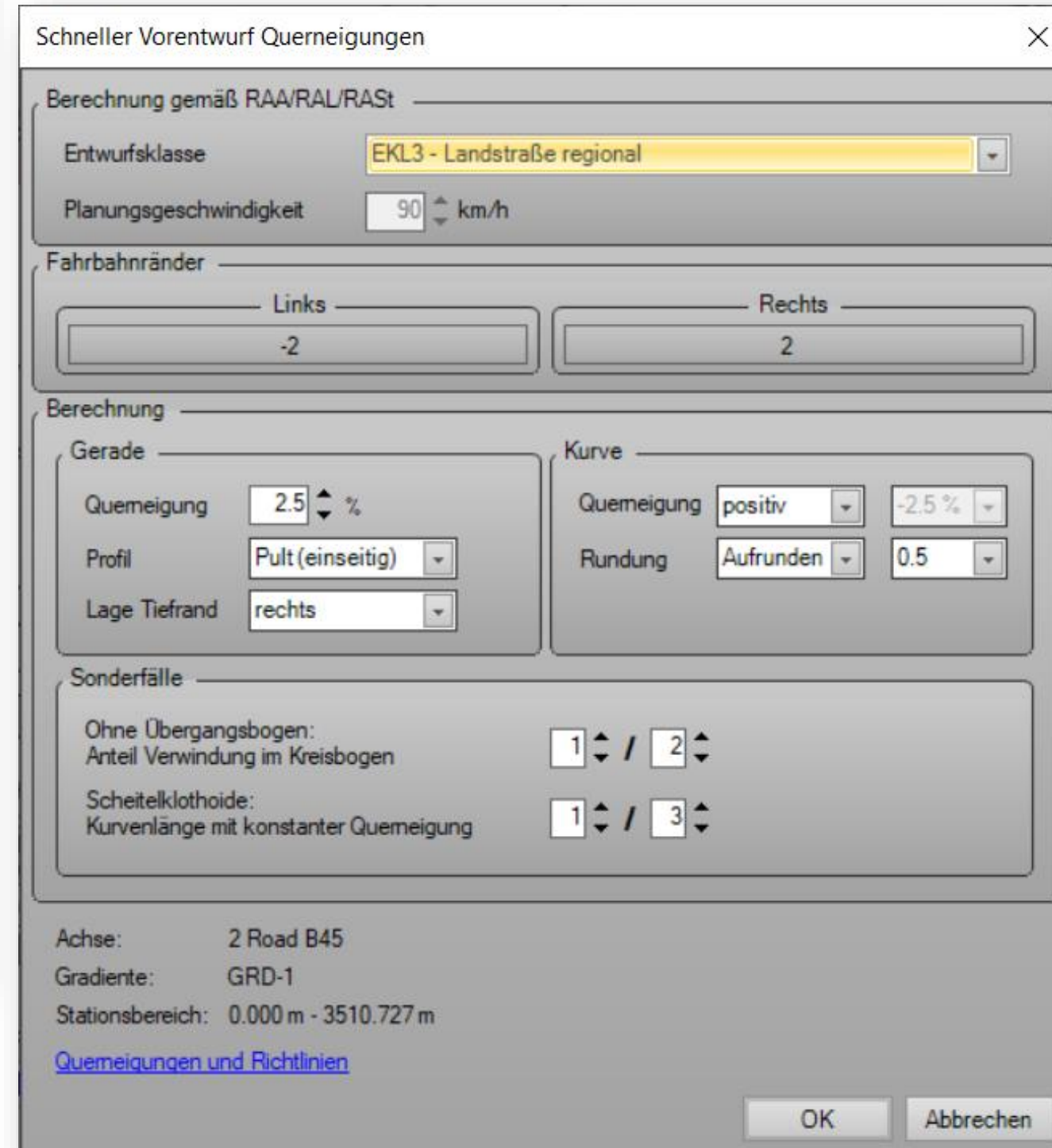
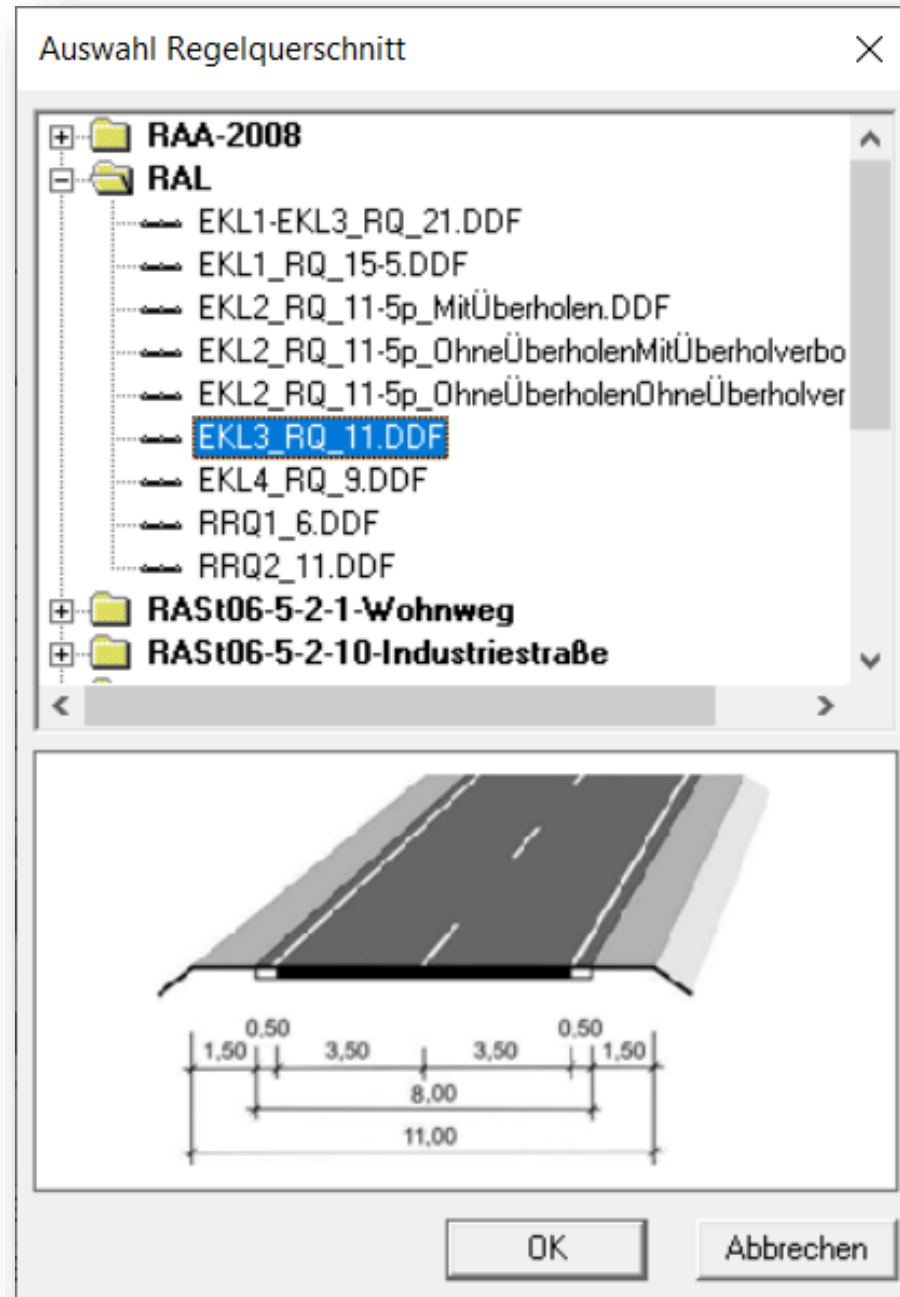
Ос на пътя



Надлъжен профил



Напречен профил и въртене на настилката

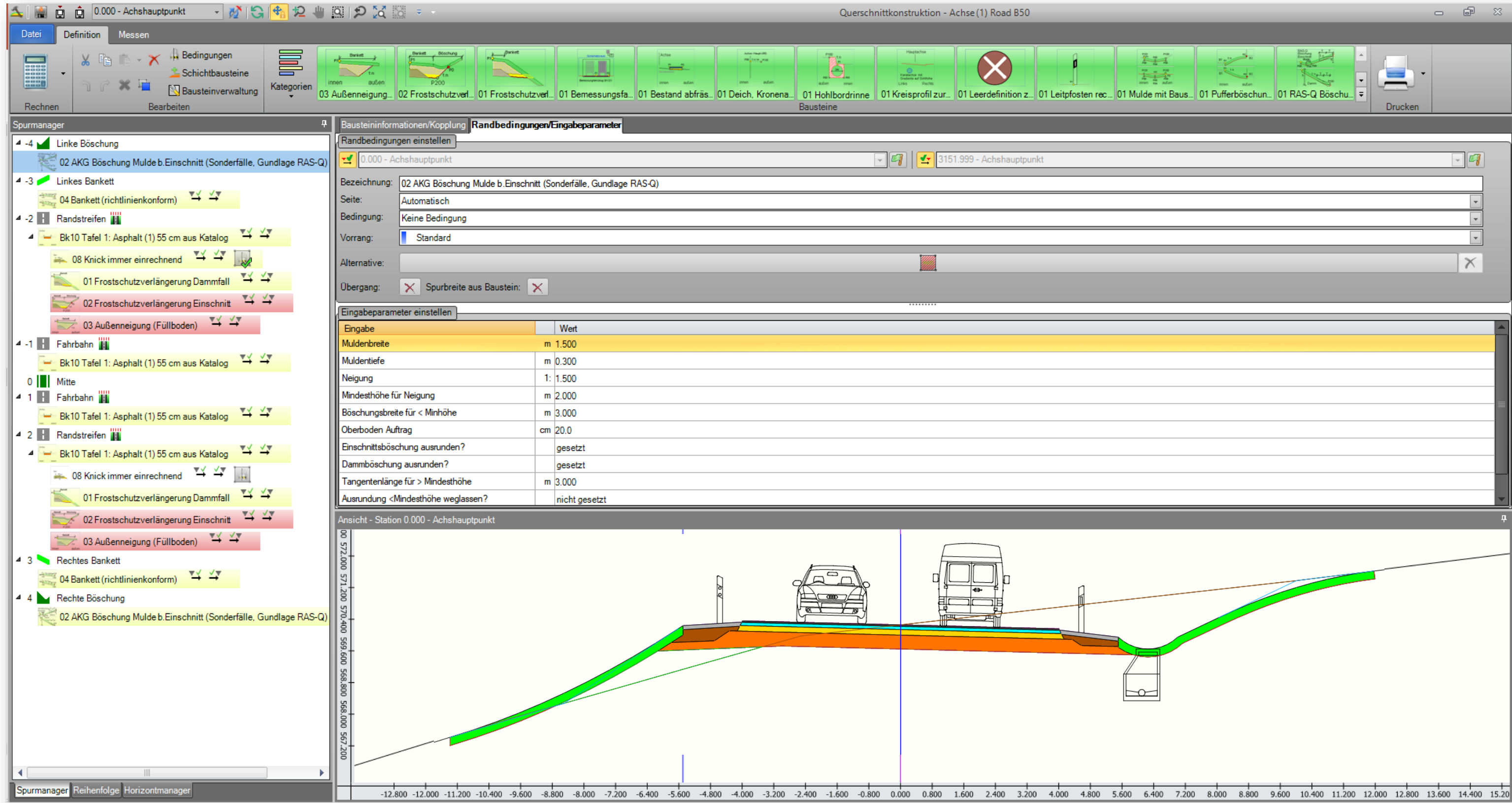


Deckenbuch Achse 2 Road B45

Breite | Neigung | Hochbord

	2	1	1	2
	Randstreifen	Fahrbahn	Fahrbahn	Randstreifen
0.000	2.500 %	2.500 %	-2.500 %	-2.500 %
983.182	2.500 %	2.500 %	-2.500 %	-2.500 %
1002.182	0.000 %	0.000 %	0.000 %	0.000 %
1021.182	-2.500 %	-2.500 %	2.500 %	2.500 %
1125.535	-7.000 %	-7.000 %	7.000 %	7.000 %
1669.427	-7.000 %	-7.000 %	7.000 %	7.000 %
1811.780	-2.500 %	-2.500 %	2.500 %	2.500 %
2046.679	-2.500 %	-2.500 %	2.500 %	2.500 %
2064.679	0.000 %	0.000 %	0.000 %	0.000 %
2082.679	2.500 %	2.500 %	-2.500 %	-2.500 %
2202.929	6.500 %	6.500 %	-6.500 %	-6.500 %
2891.572	6.500 %	6.500 %	-6.500 %	-6.500 %
3047.822	2.500 %	2.500 %	-2.500 %	-2.500 %

Напречен профил



Откоси и пътни окопи

Querschnittkonstruktion - Achse (1) Road 850

0.000 - Achshauptpunkt

Definition Messen

Rechnen Bearbeiten

Bedingungen Schichtbausteine Bausteinverwaltung Kategorien

Spurmanager

4 Linke Böschung

02 AKG Böschung Mulde b. Einschnitt (Sonderfälle, Grundlage RAS-Q)

4 -3 Linkes Bankett

04 Bankett (richtlinienkonform)

4 -2 Randstreifen

Bk10 Tafel 1: Asphalt (1) 55 cm aus Katalog

08 Knick immer einrechnend

01 Frostschutzverlängerung Dammfall

02 Frostschutzverlängerung Einschnitt

03 Außenneigung (Füllboden)

4 -1 Fahrbahn

Bk10 Tafel 1: Asphalt (1) 55 cm aus Katalog

0 Mitte

1 Fahrbahn

Bk10 Tafel 1: Asphalt (1) 55 cm aus Katalog

2 Randstreifen

Bk10 Tafel 1: Asphalt (1) 55 cm aus Katalog

08 Knick immer einrechnend

01 Frostschutzverlängerung Dammfall

02 Frostschutzverlängerung Einschnitt

03 Außenneigung (Füllboden)

4 3 Rechtes Bankett

04 Bankett (richtlinienkonform)

4 4 Rechte Böschung

02 AKG Böschung Mulde b. Einschnitt (Sonderfälle, Grundlage RAS-Q)

Allgemeine Bausteine

01 Leerdefinition z... 02 Oberbodenanp... 03 Oberbodenabr... 04 Oberbodenabr... 04A Oberbodenab... 05 Oberbodenabr... 05A Spezialoberb... 06 Darstellung Fre... 07 Weitergabe Fre... 08 Deckenbuchnel... 09 Geländeabtrep... 10 Brückenkappe 11 Kopplungspunk...

Bausteine für Spuren

01 Bestand abfrä... 02 Einzelschicht 03 Bestand abfrä... 04 Bankett (RAA... 04A Bankett für W... 04B Bankett mit g... 05 Bankettverläng... 06 Abgesenkter Mi... 06a Mittelstreifen... 07 Oberbodenauf... 08 Tunnel Maulpro... 09 Brücke mit zwe... 10 Brücke mit eine...

Bordsteine

01 Hohlbordrinne 02 Pendelrinne an... 03 B... 07 Bordstein DIN... 08 Spitzrinne 09 Bordstein mit R... 10 Rundbordstein... 11 Rinnenmulde 12 Kastenrinne 12A Kastenrinne...

Böschung Damm/Einschnitt

01 RAS-Q Bösch... 01A RAL Böschun... 02 AKG Böschun... 02A AKG Böschun... 04 Einschnitt mit B... 05A Gabione, Mul... 05B Gabione 05C Einzelgabion... 06 Böschung, kon... 07 Graben mit Ml... 07A Graben mit... 08 RE 85 Böschun... 09 Lärmschutzwall...

Böschung zum Puffern zwischen 2 Zwangspunkten

01 Mulde in Dam... 11 Damm, Entwäs... 12 Aufschlitzen G...

Deichquerschnitt

01 Deich, Kronena... 02 Deich, Landseit... 03 Deich, Landseit... 04 Deich, Landseit... 05 Deich, Landseit... 06 Deich, Wasser... 07 Geländeschnitt...

Einzelsegmente zum Koppeln

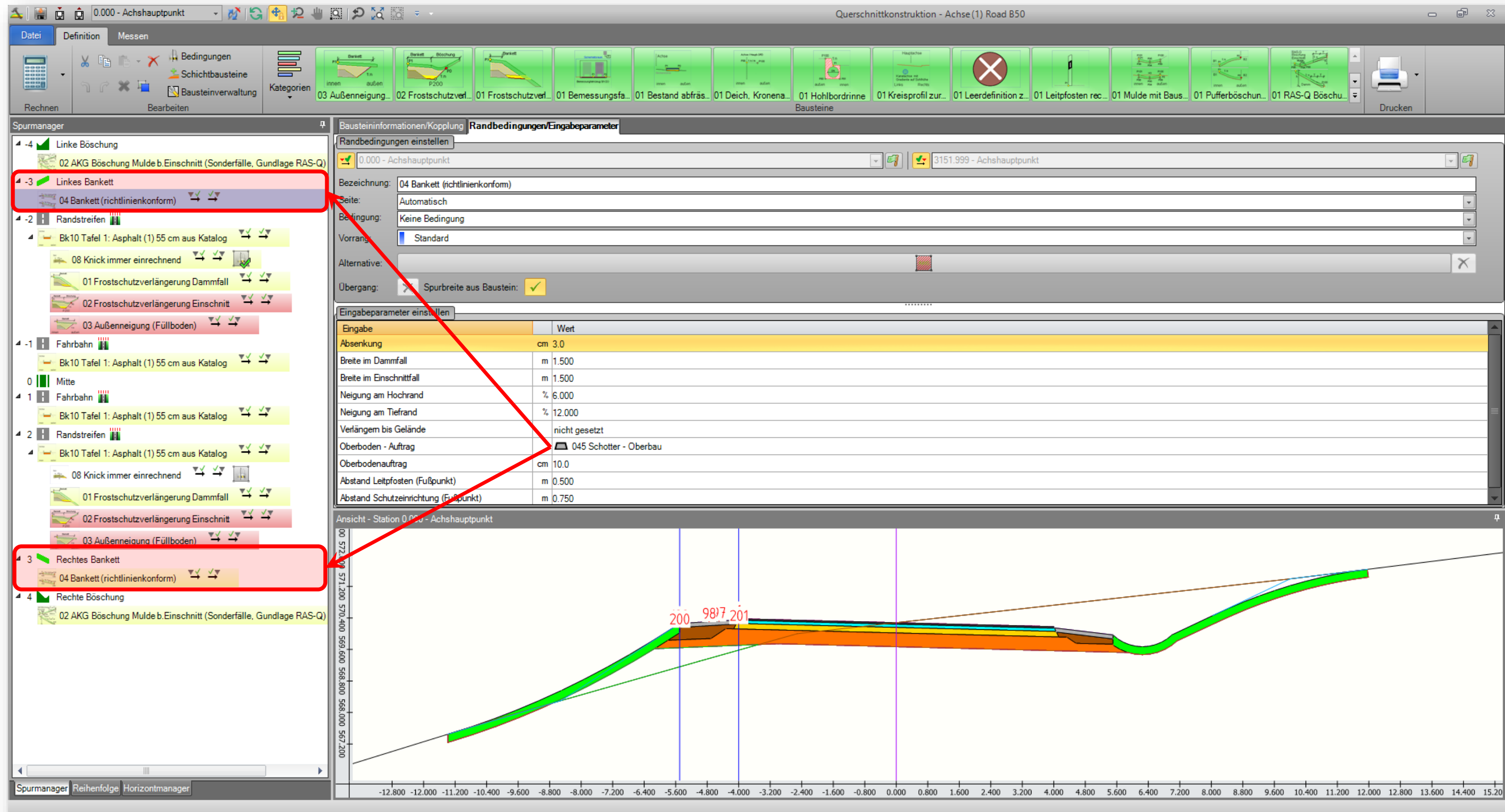
01 Mulde mit Baus... 01A Mulde eckig... 02 GRD Mulde mit... 02A Mulde an Gra... 03 Anpassungsm... 04 Graben mit Ba... 05 GRD Graben 06 Anpassungsga... 07 RAS-Q Böschu... 07A RAL Böschun... 08 AKG Böschung... 08A AKG Böschun... 09 Geländeschnitt...

Drucken

2.000 12.800 13.600 14.400 15.200

Градивни елементи

Банкети



Пътна настилка

Road and Transportation Research Association

Working Group Infrastructure Management



Guidelines
for the standardisation
of pavement structures of
traffic areas

R1

RStO 12

Указания за
стандартизиране на
конструкциите на
пътните настилки

Edition 2012
Translation 2015

(Thicknesses in cm; E_{v2} -minimum values in MPa)

Line	Load class	BK100	BK32	BK10	BK3.2	BK1.8	BK1.0	BK0.3
	B [million of ESALs]	> 32	> 10 – 32	> 3.2 – 10	> 1.8 – 3.2	> 1.0 – 1.8	> 0.3 – 1.0	≤ 0.3
	Thickness of frost resistant pavement structure ¹⁾	55 65 75 85	55 65 75 85	55 65 75 85	45 55 65 75	45 55 65 75	45 55 65 75	35 45 55 65
1 Asphalt base course on frost blanket course								
1	Asphalt surface course	12	12	12	10	4	4	4 ^{e)}
	Asphalt base course	22	1R	14	12	16	14	10 ^{e)}
	Frost blanket course	Σ34	Σ30	Σ26	Σ22	Σ20	Σ18	Σ14
Thickness of frost blanket course		- 31 ²⁾ 41 51	25 ³⁾ 35 45 55	29 ³⁾ 39 49 59	- 33 ³⁾ 43 53	25 ³⁾ 35 45 55	27 37 47 57	21 31 41 51
2.1 Asphalt base course and base course with hydraulic binders on frost blanket course or layer of non-frost-susceptible material								
2.1	Asphalt surface course	12	12	12				
	Asphalt base course	14	10	8				
	Cement stabilized base course (HBB)	15	15	15				
Thickness of frost blanket course		- - 34 ³⁾ 44	- 28 ³⁾ 38 48	- 30 ³⁾ 40 50				
Frost blanket course		Σ41	Σ37	Σ35				
Thickness of frost blanket course		- - 34 ³⁾ 44	- 28 ³⁾ 38 48	- 30 ³⁾ 40 50				
2.2 Asphalt base course and stabilized granular material on frost blanket course or layer of non-frost-susceptible material								
2.2	Asphalt surface course	12	12	12	10	4	4	4
	Asphalt base course	18	14	10	10	15	15	15
	Stabilized granular material	15	15	15	15	15	15	15
Thickness of layer of non-frost-susceptible material		10 ⁴⁾ 20 ⁴⁾ 30 40	14 ⁴⁾ 24 34 44	18 ⁴⁾ 28 38 48	10 ⁴⁾ 20 30 40	14 ⁴⁾ 24 34 44	16 ⁴⁾ 26 36 46	6 ⁴⁾ 16 ⁴⁾ 26 36
Frost blanket course		Σ45	Σ41	Σ37	Σ35	Σ31	Σ29	Σ29
Thickness of layer of non-frost-susceptible material		10 ⁴⁾ 20 ⁴⁾ 30 40	14 ⁴⁾ 24 34 44	18 ⁴⁾ 28 38 48	10 ⁴⁾ 20 30 40	14 ⁴⁾ 24 34 44	16 ⁴⁾ 26 36 46	6 ⁴⁾ 16 ⁴⁾ 26 36
2.3 Asphalt base course and stabilized granular material on layer of non-frost-susceptible material								
2.3	Asphalt surface course	12	12	12	10	4	4	4
	Asphalt base course	18	14	10	10	15	15	15
	Stabilized granular material	20	20	20	20	15	15	15
Thickness of layer of non-frost-susceptible material		5 ⁴⁾ 15 ⁴⁾ 25 35	9 ⁴⁾ 19 ⁴⁾ 29 39	13 ⁴⁾ 23 33 43	5 ⁴⁾ 15 ⁴⁾ 25 35	14 ⁴⁾ 24 34 44	16 ⁴⁾ 26 36 46	6 ⁴⁾ 16 ⁴⁾ 26 36
Frost blanket course		Σ50	Σ46	Σ42	Σ40	Σ31	Σ29	Σ29
Thickness of layer of non-frost-susceptible material		5 ⁴⁾ 15 ⁴⁾ 25 35	9 ⁴⁾ 19 ⁴⁾ 29 39	13 ⁴⁾ 23 33 43	5 ⁴⁾ 15 ⁴⁾ 25 35	14 ⁴⁾ 24 34 44	16 ⁴⁾ 26 36 46	6 ⁴⁾ 16 ⁴⁾ 26 36
3 Asphalt base course and crushed rock base course on frost blanket course								
3	Asphalt surface course	12	12	12	10	4	4	4 ^{e)}
	Asphalt base course	18	14	10	10	15	15	15
	Crushed rock base course ⁷⁾	15	15	15	15	15	15	15
Thickness of frost blanket course		- - 30 ³⁾ 40	- - 34 ³⁾ 44	- 28 ³⁾ 38 48	- - 30 ³⁾ 40	- 24 ³⁾ 34 44	16 ³⁾ 26 36 46	- 18 ³⁾ 28 38
Frost blanket course		Σ45	Σ41	Σ37	Σ35	Σ31	Σ29	Σ27
Thickness of frost blanket course		- - 30 ³⁾ 40	- - 34 ³⁾ 44	- 28 ³⁾ 38 48	- - 30 ³⁾ 40	- 24 ³⁾ 34 44	16 ³⁾ 26 36 46	- 18 ³⁾ 28 38
4 Asphalt base course and gravel base course on frost blanket course								
4	Asphalt surface course	12	12	12	10	4	4	4 ^{e)}
	Asphalt base course	18	14	10	10	15	15	15
	Gravel base course	20	20	20	20	15	15	15
Thickness of frost blanket course		- - 25 ³⁾ 35	- - 29 ³⁾ 39	- 33 ³⁾ 43	- - 25 ³⁾ 35	- - 29 ³⁾ 39	- 31 ³⁾ 41 51	- - 23 ³⁾ 33
Frost blanket course		Σ50	Σ46	Σ42	Σ40	Σ36	Σ34	Σ32
Thickness of frost blanket course		- - 25 ³⁾ 35	- - 29 ³⁾ 39	- 33 ³⁾ 43	- - 25 ³⁾ 35	- - 29 ³⁾ 39	- 31 ³⁾ 41 51	- - 23 ³⁾ 33
5 Asphalt base course and crushed rock or gravel base course on layer of non-frost-susceptible material								
5	Asphalt surface course	12	12	12	10	4	4	4 ^{e)}
	Asphalt base course	18	14	10	10	15	15	15
	Crushed rock or gravel base course	30 ⁵⁾	30 ⁵⁾	30 ⁵⁾	30 ⁵⁾	30 ⁵⁾	30 ⁵⁾	25 ⁵⁾
Thickness of layer of non-frost-susceptible material		45	45	45	45	45	45	45
Frost blanket course		Σ60	Σ56	Σ52	Σ50	Σ46	Σ44	Σ37
Thickness of layer of non-frost-susceptible material		45	45	45	45	45	45	45
Above 12 cm made of non-frost-susceptible material, lower remaining thickness is to be compensated by the material above								

Избор на конструкция на пътната настилка

Aus Katalog wählen
Schichtbaustein in aktuellem Katalog auswählen

Filter

Belastungsklasse:

Aufbau:

Oberbau:

Horizonte zuordnen

Schicht	Horizont
Asphaltdeckschicht	006 Asphaltdeckschicht
Asphaltbinderschicht	010 Asphaltbinderschicht
Wasserdurchlässige Asphalttragschicht	068 Wasserdurchlässige Asphalttragschicht

Spurmanager

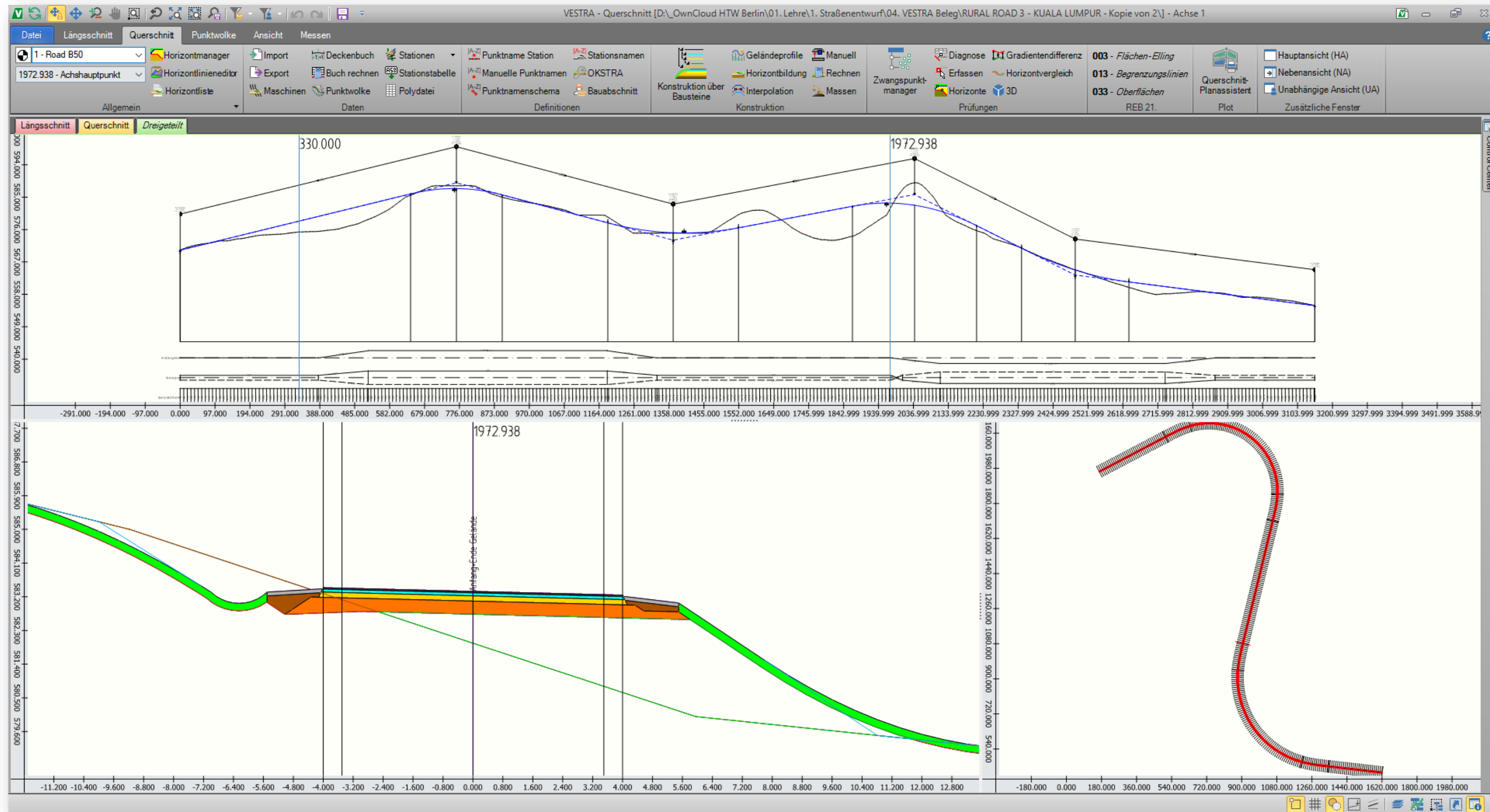
- 4 Linke Böschung
- 02 AKG Böschung Mulde b.Einsch
- 3 Linkes Bankett
- 04 Bankett (richtlinienkonform)
- 2 Randstreifen
- 1 **Fahrbahn**
- 0 Mitte
- 1 Fahrbahn
- 2 Randstreifen
- 3 Rechtes Bankett
- 04 Bankett (richtlinienkonform)
- 4 Rechte Böschung
- 02 AKG Böschung Mulde b.Einsch

Typ	Bk 100	Bk32	Bk 10	Bk3.2	Bk 1.8	Bk 1.0	Bk0.3	keine (Tafel 6)
Tafel 1: Asphalt								
1	 Oberbau (cm): 65, 75, 85	 Oberbau (cm): 55, 65, 75, 85	 Oberbau (cm): 55, 65, 75, 85	 Oberbau (cm): 55, 65, 75	 Oberbau (cm): 45, 55, 65, 75	 Oberbau (cm): 45, 55, 65, 75	 Oberbau (cm): 35, 45, 55, 65	 Oberbau (cm): 40
2.1	 Oberbau (cm): 75, 85	 Oberbau (cm): 65, 75, 85	 Oberbau (cm): 65, 75, 85					 Oberbau (cm): 30, 40

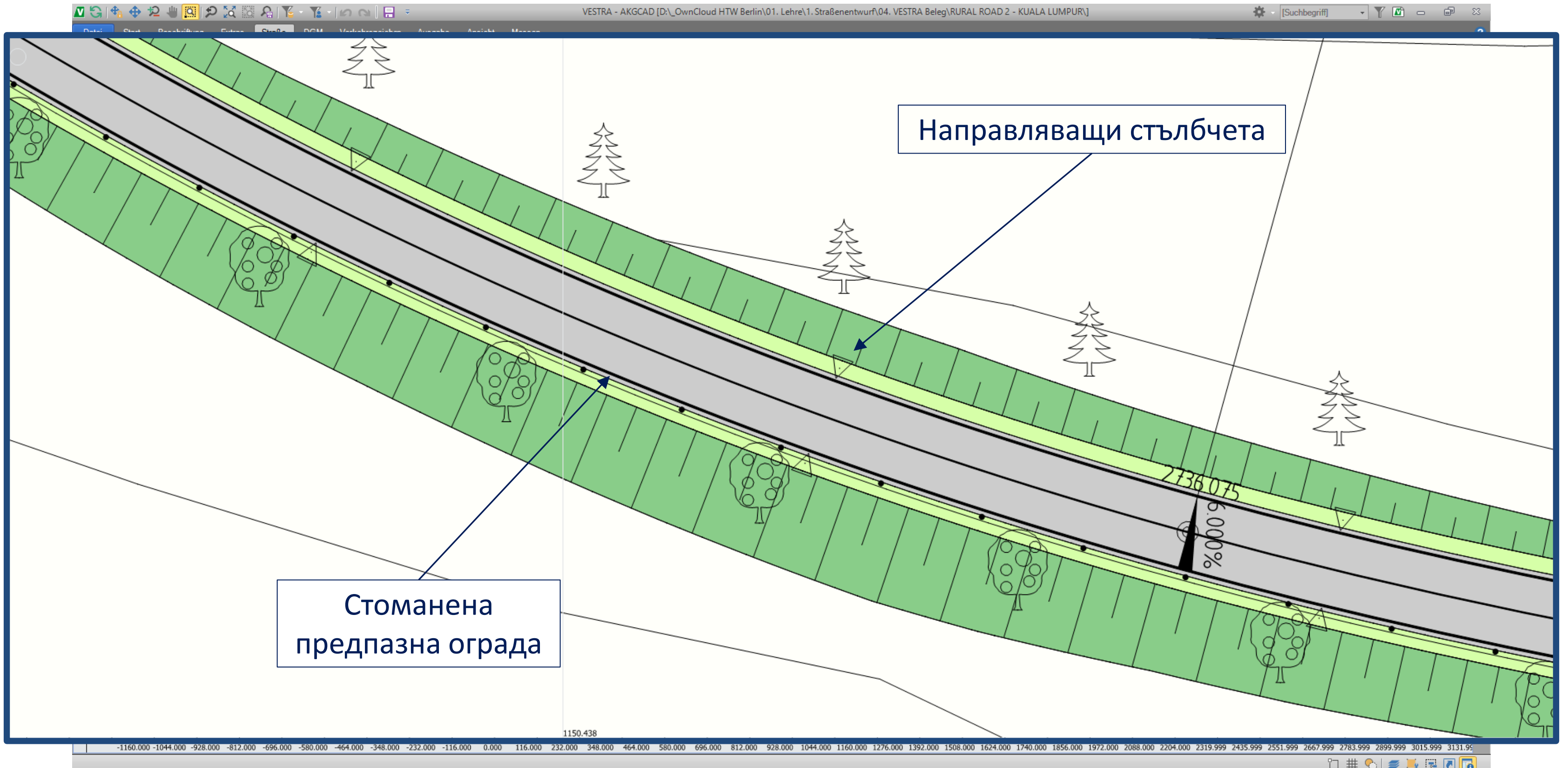
Frostschutzschicht

Spurmanager Reihenfolge Horizontmanager

3 проекции



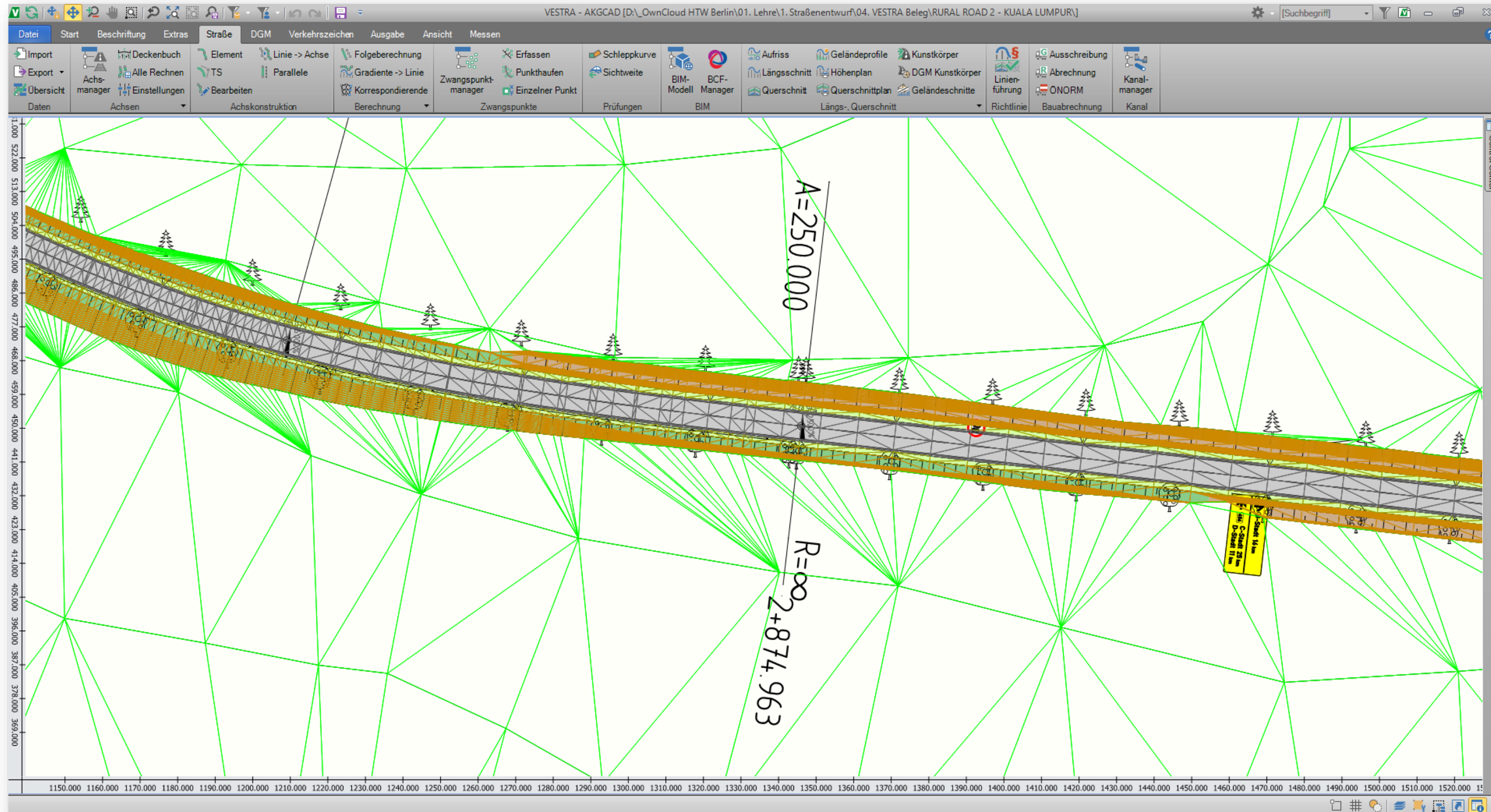
Земно тяло



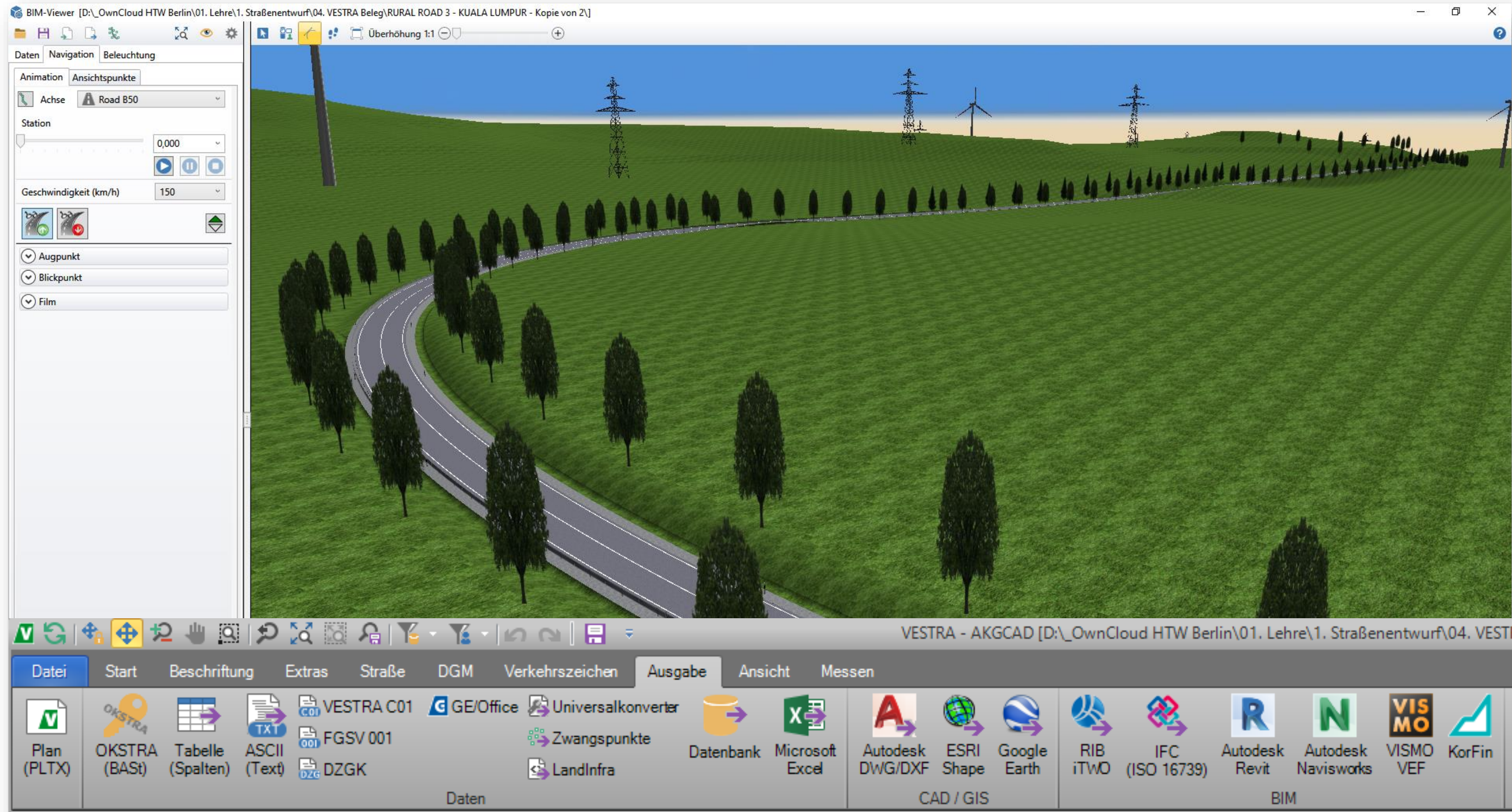
Stomanena
предпазна ограда

Направляващи стълбчета

Пресичане на дигиталните модели



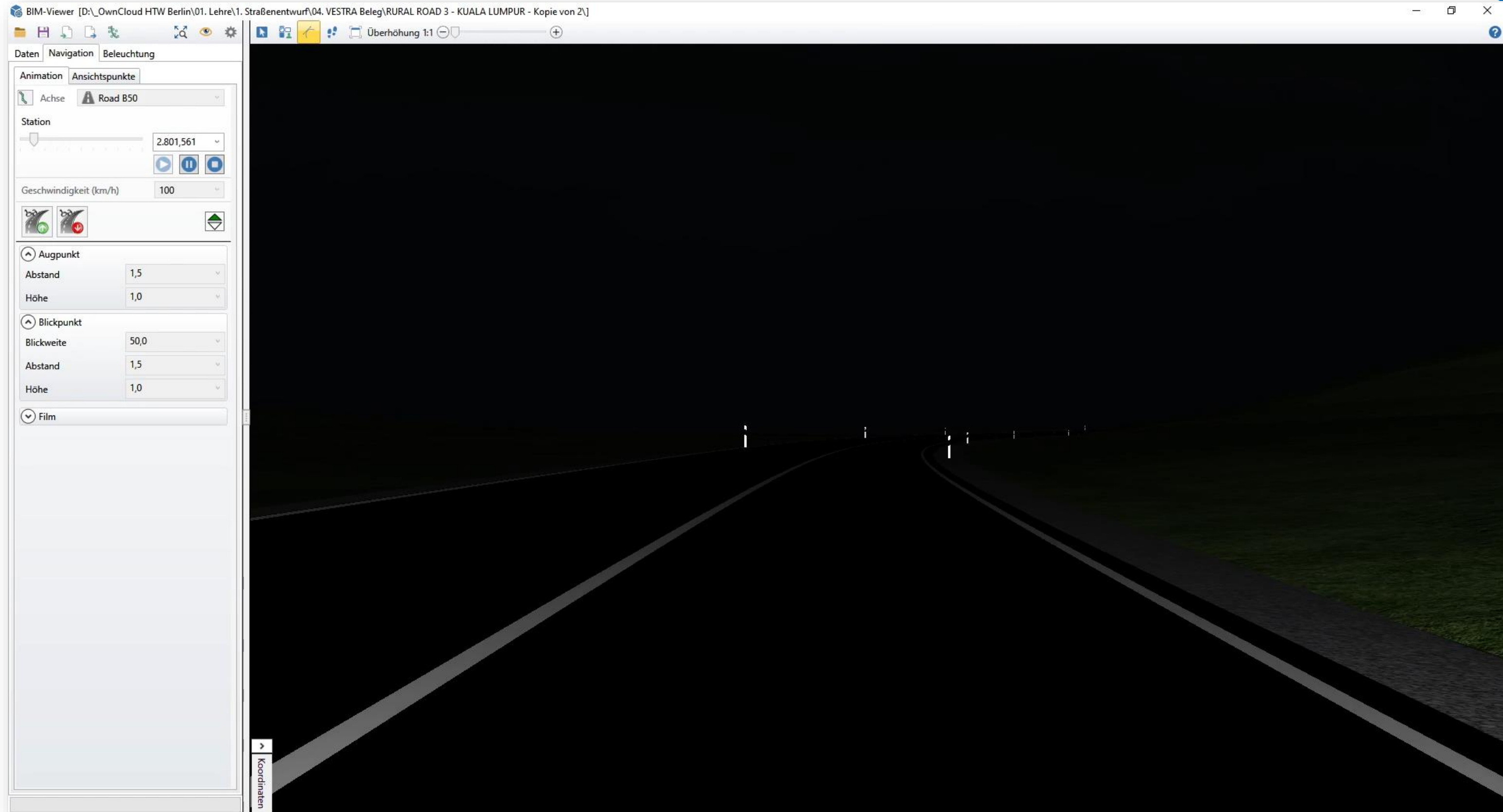
BIM



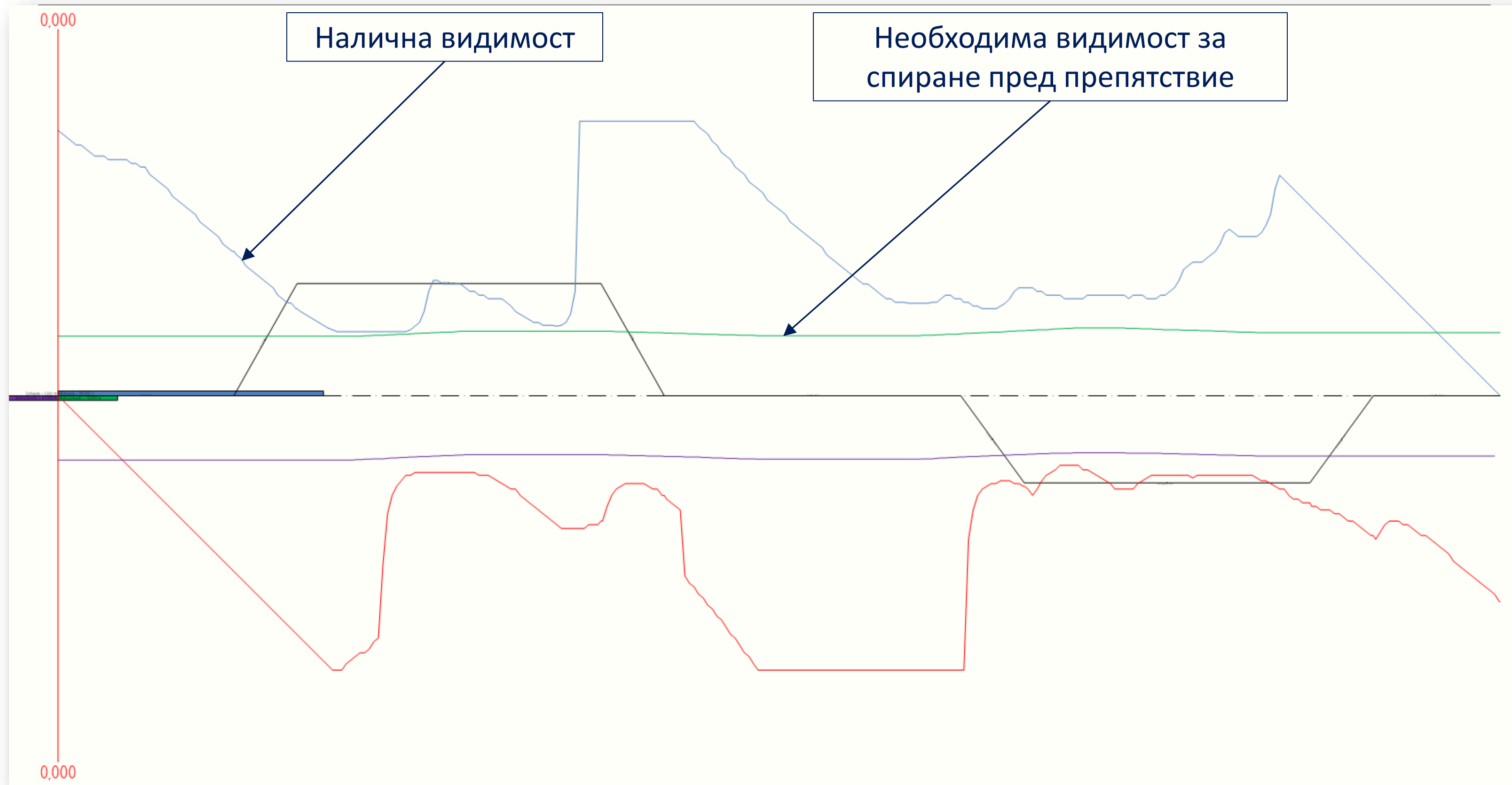
BIM



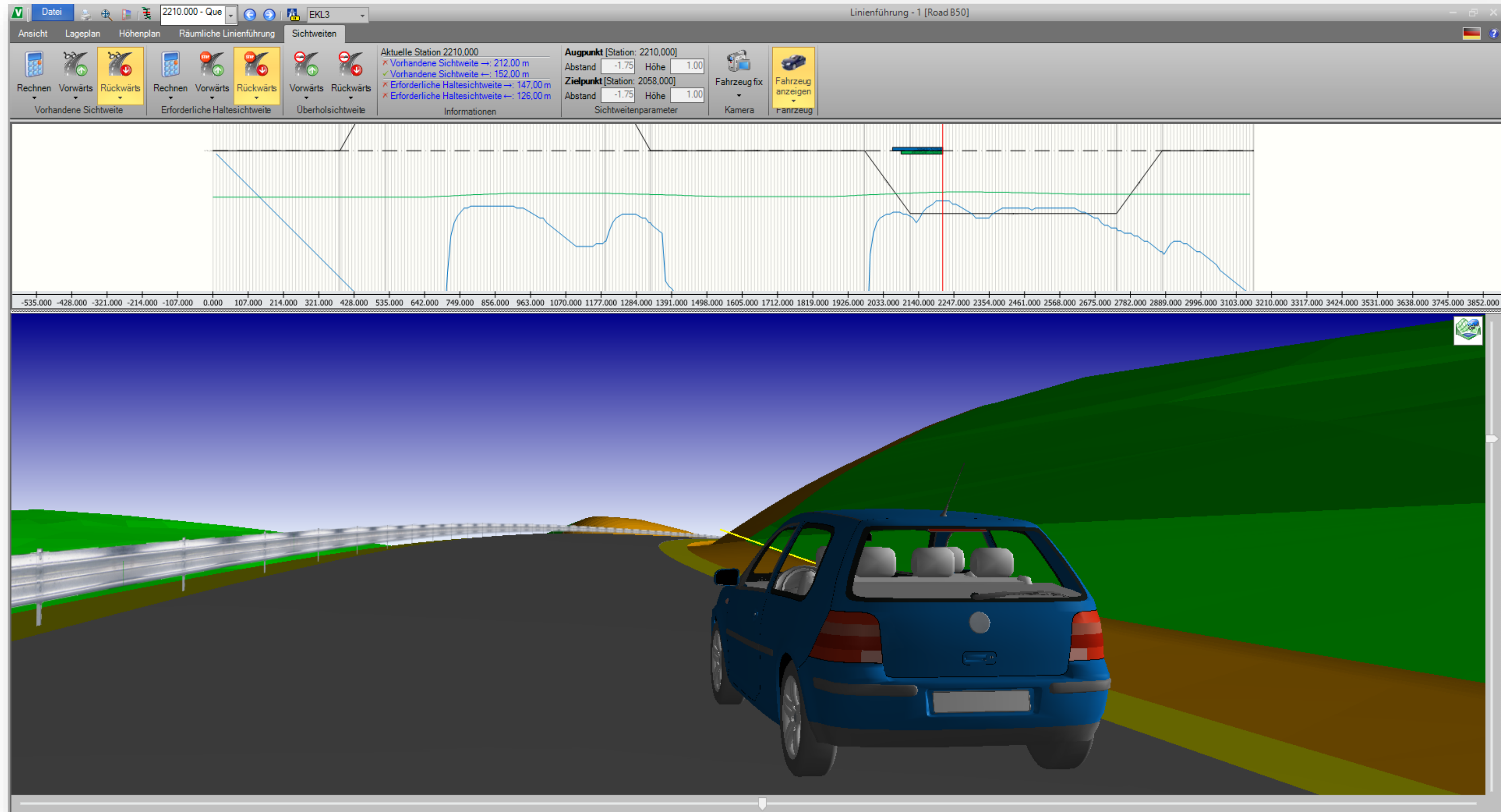
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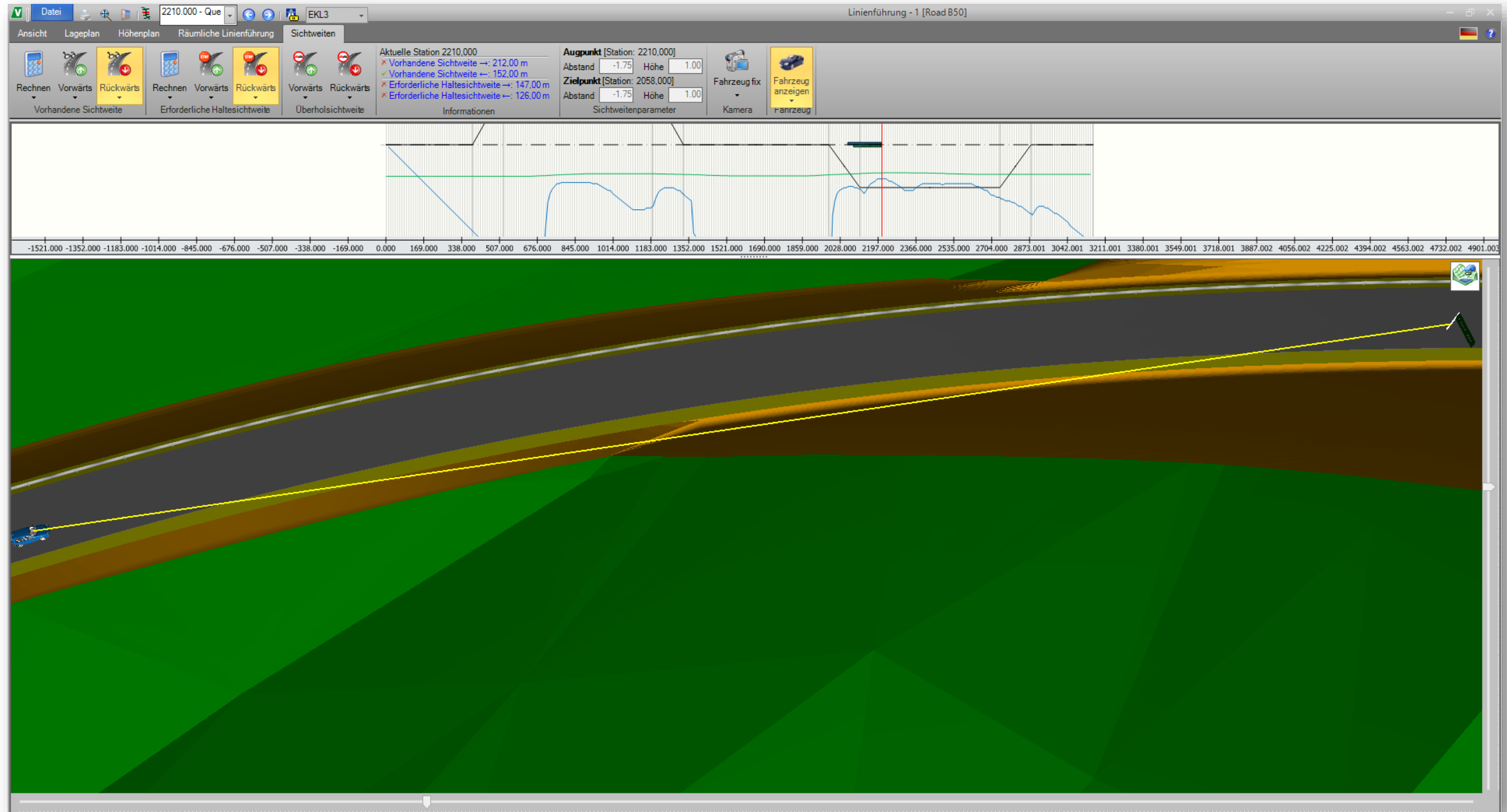
Видимост



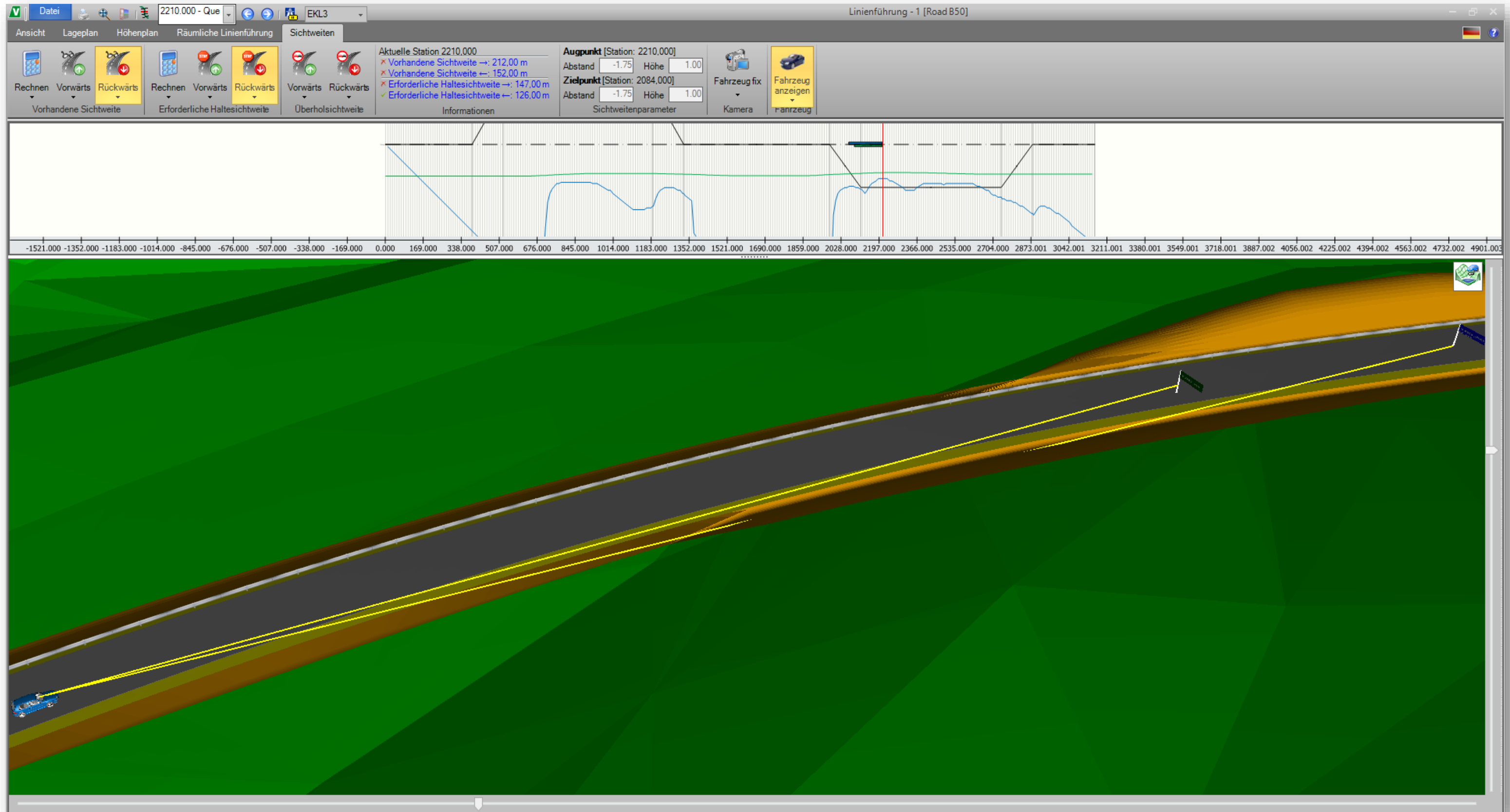
Налична видимост при км 2+010 (152,00 m)



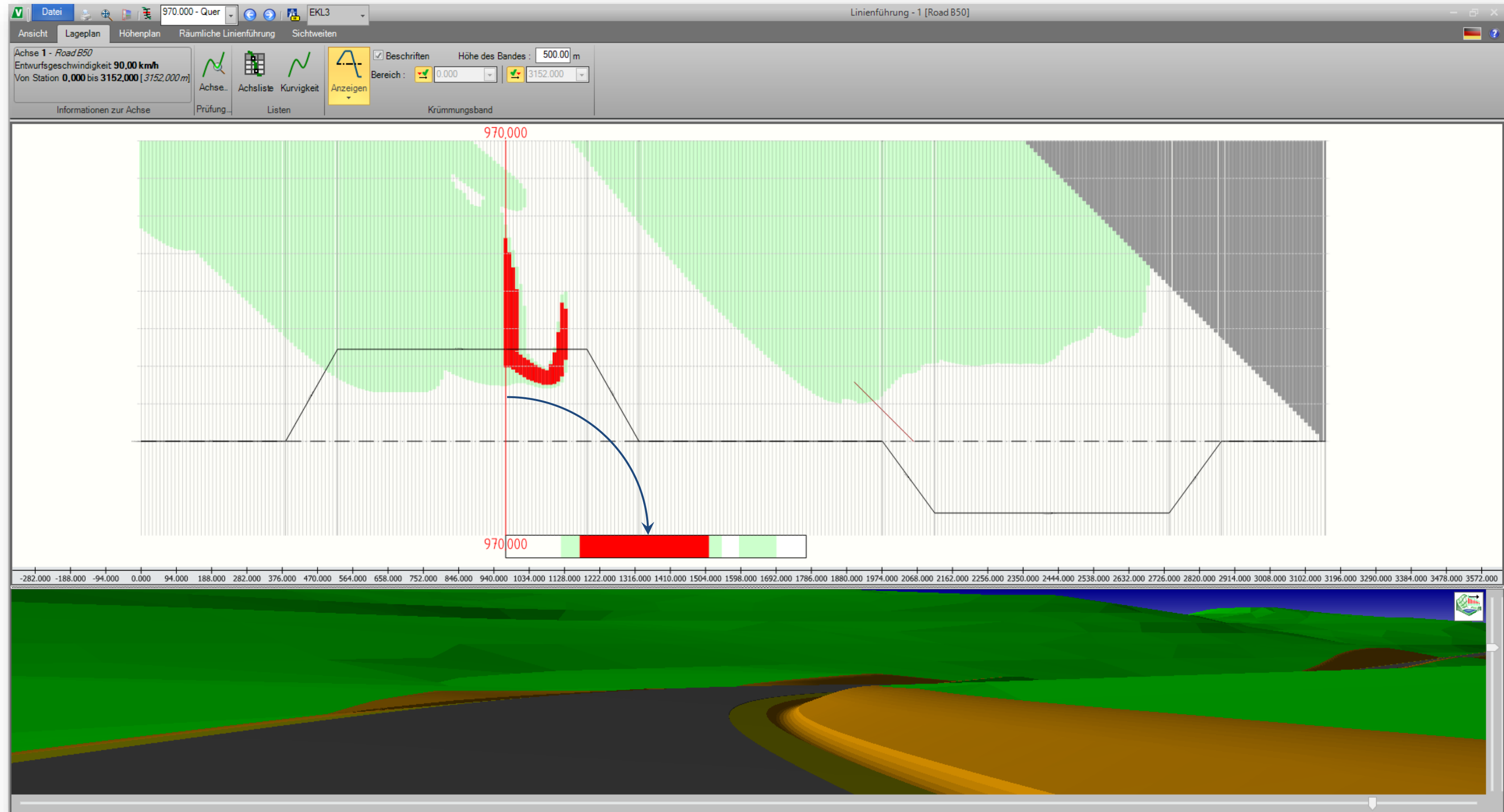
Налична видимост при км 2+010 (152,00 m)



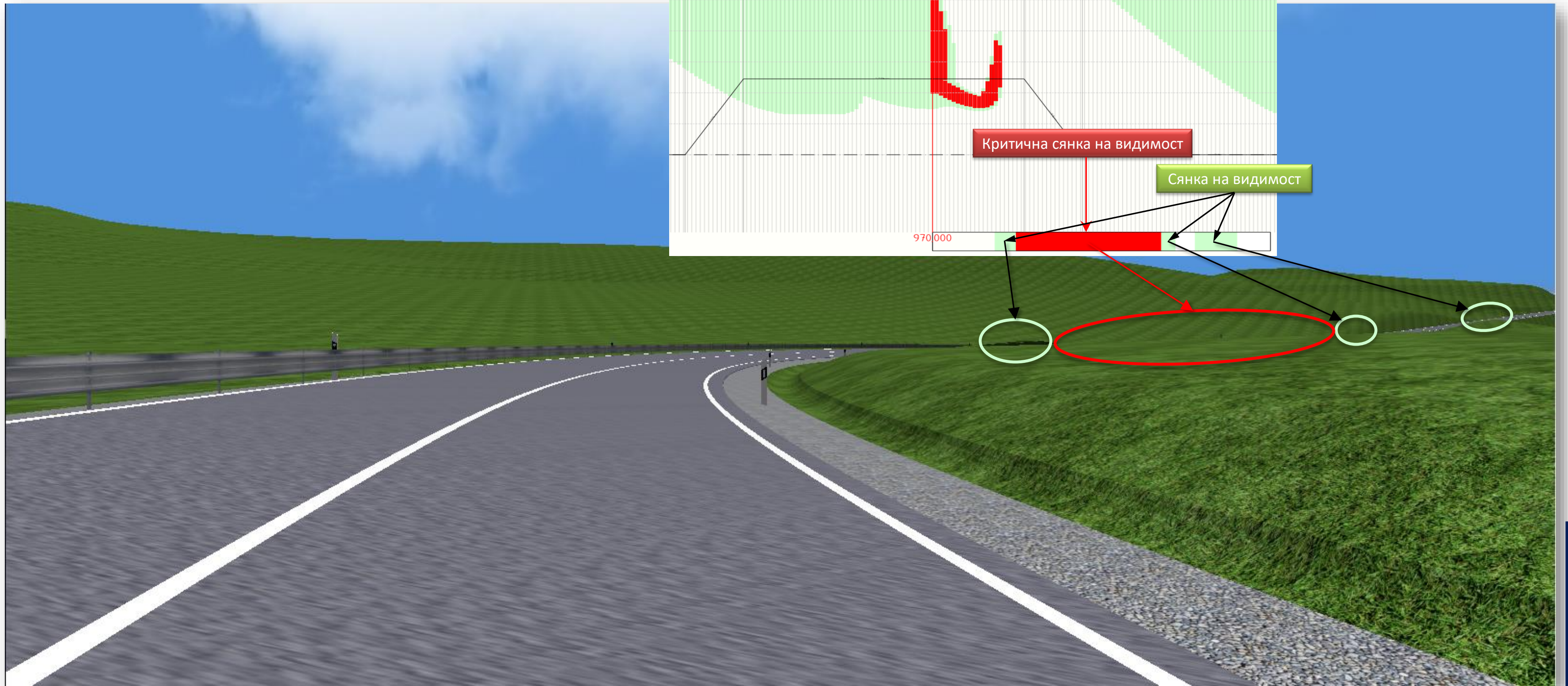
Мин. видимост за спиране пред препятствие (126,00 m)



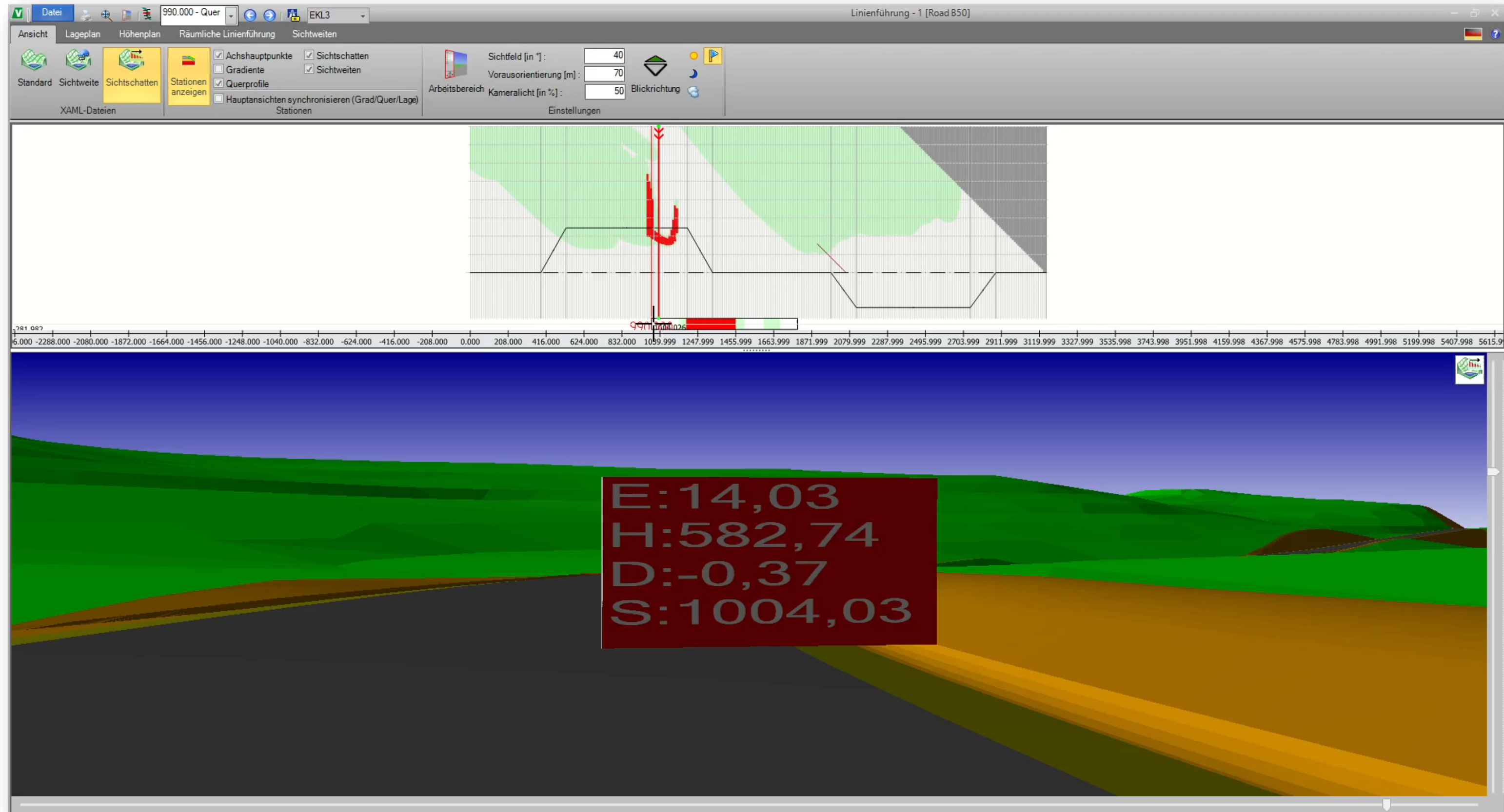
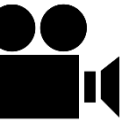
Недостатъци на трасето свързани с безопасността



Сянка на видимост



Недостатъци на трасето свързани с безопасността



BIM

Daten Navigation Beleuchtung

Animation Ansichtspunkte

Achse Road B50

Station 697,684

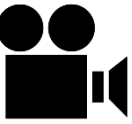
Geschwindigkeit (km/h) 100

Augpunkt
Abstand 1,5
Höhe 1,0

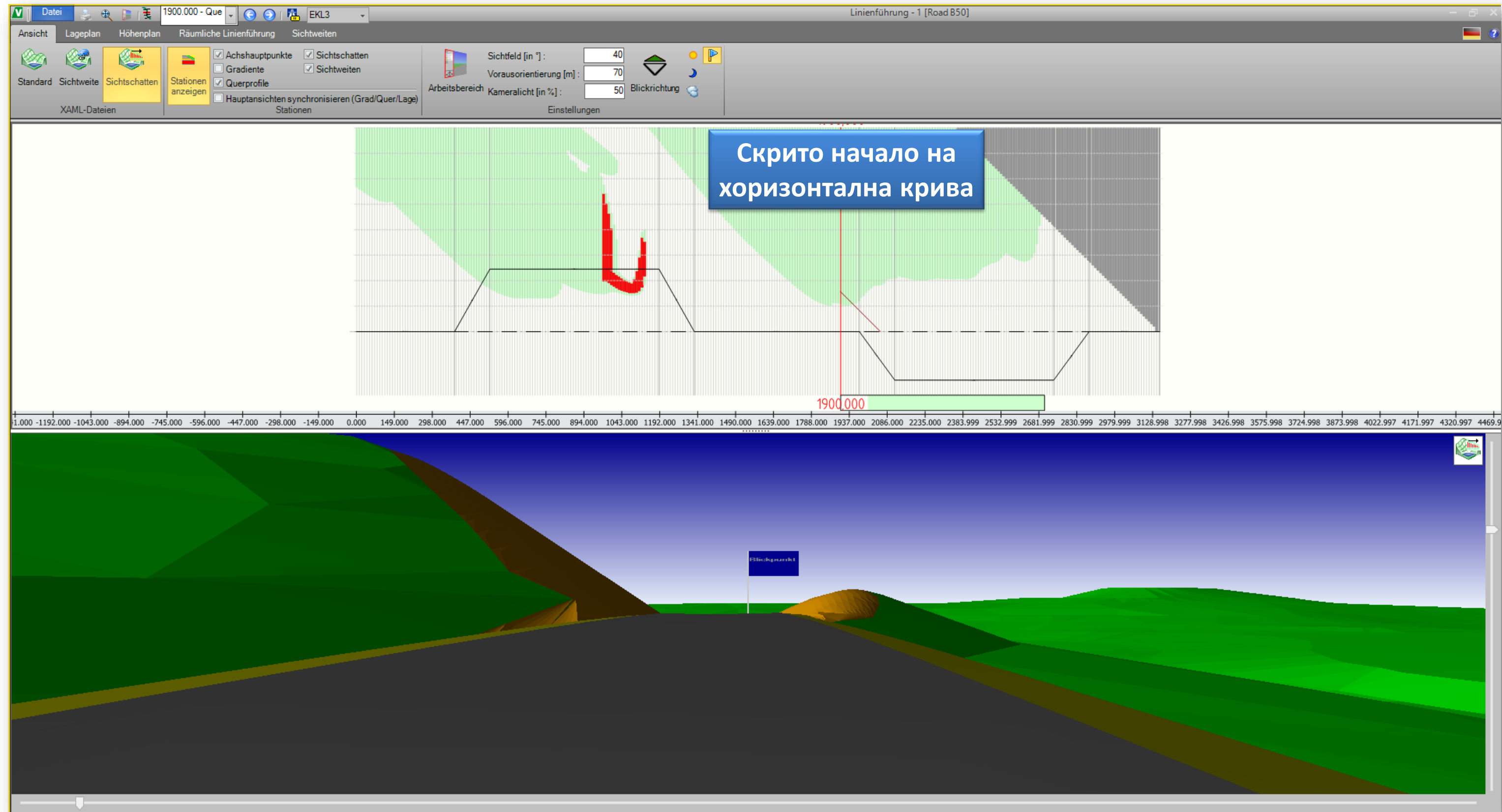
Blickpunkt
Blickweite 100,0
Abstand 1,5
Höhe 1,0

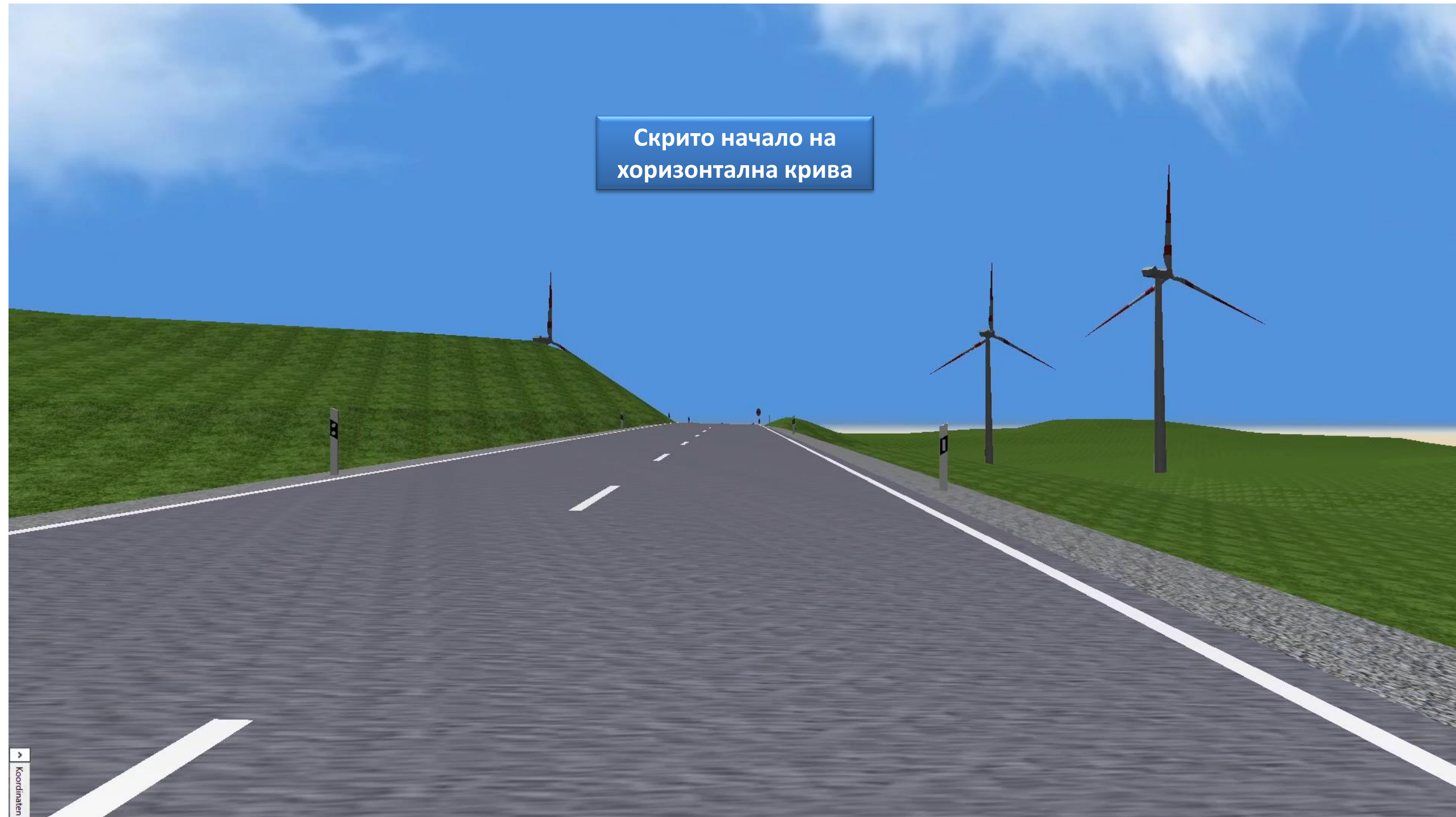
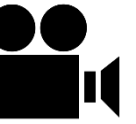
Film

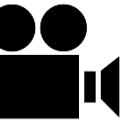
Koordinaten



Недостатъци на трасето свързани с безопасността

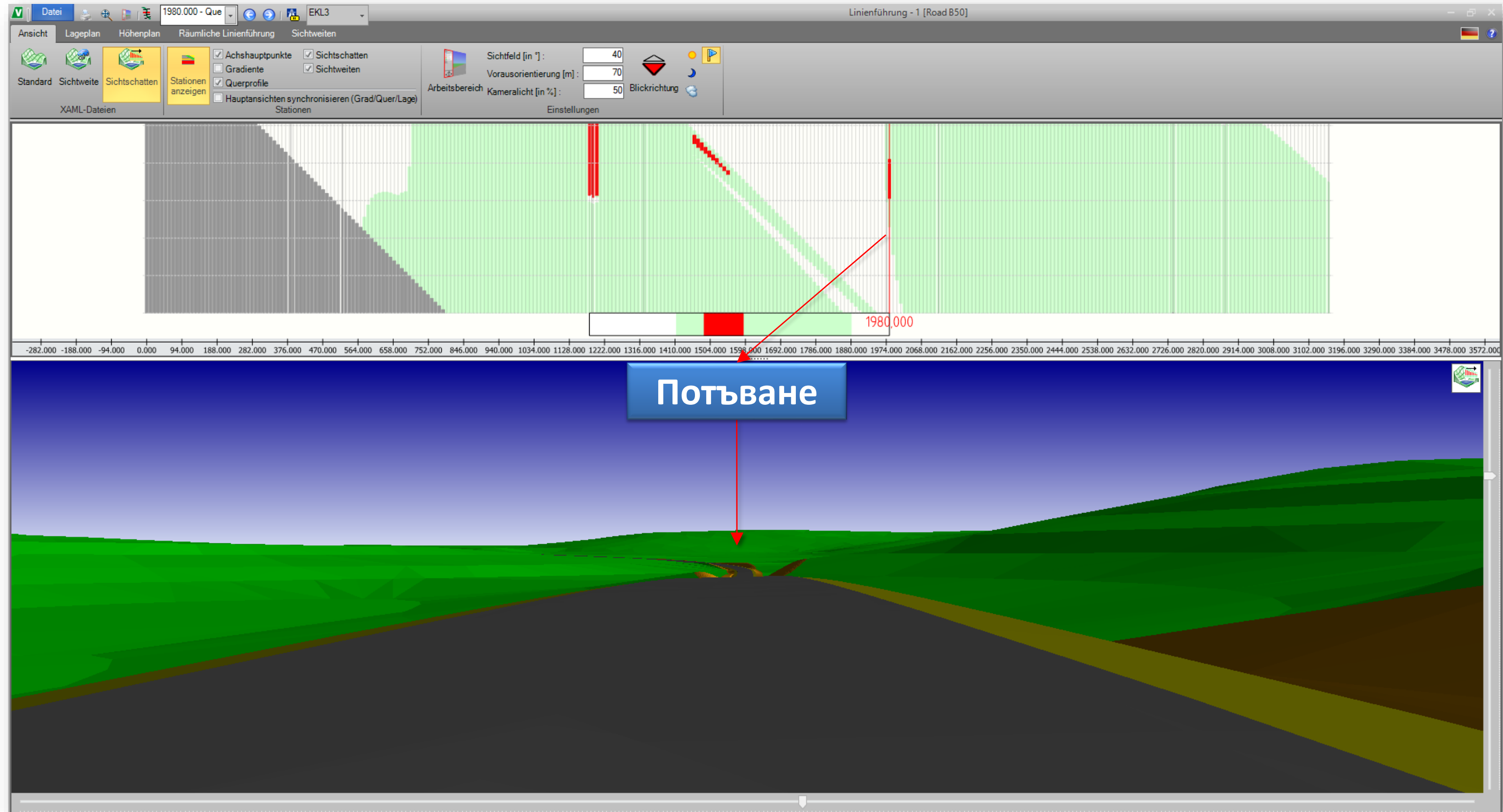




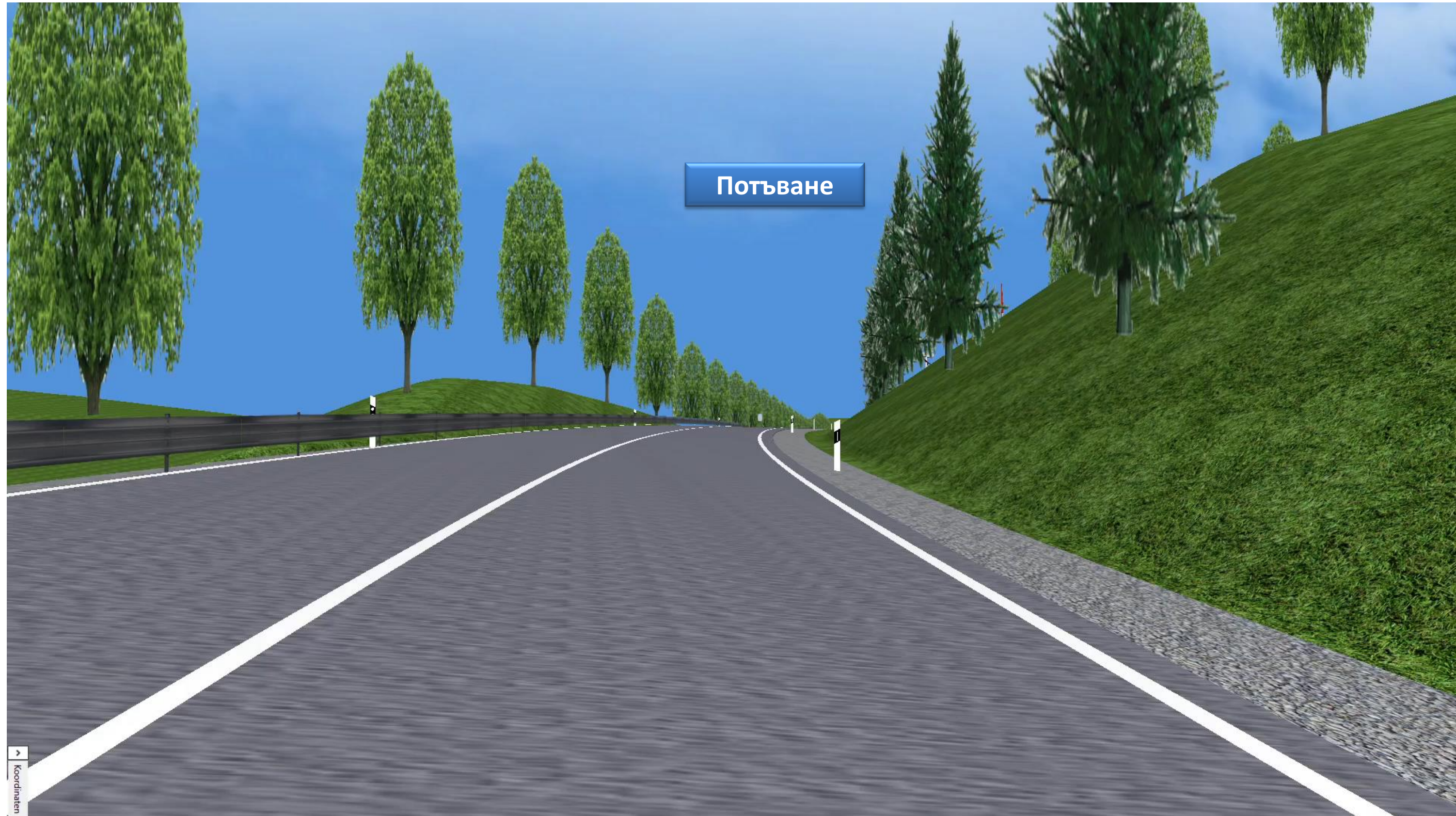


↑
Koordinaten

Недостатъци на трасето свързани с безопасността



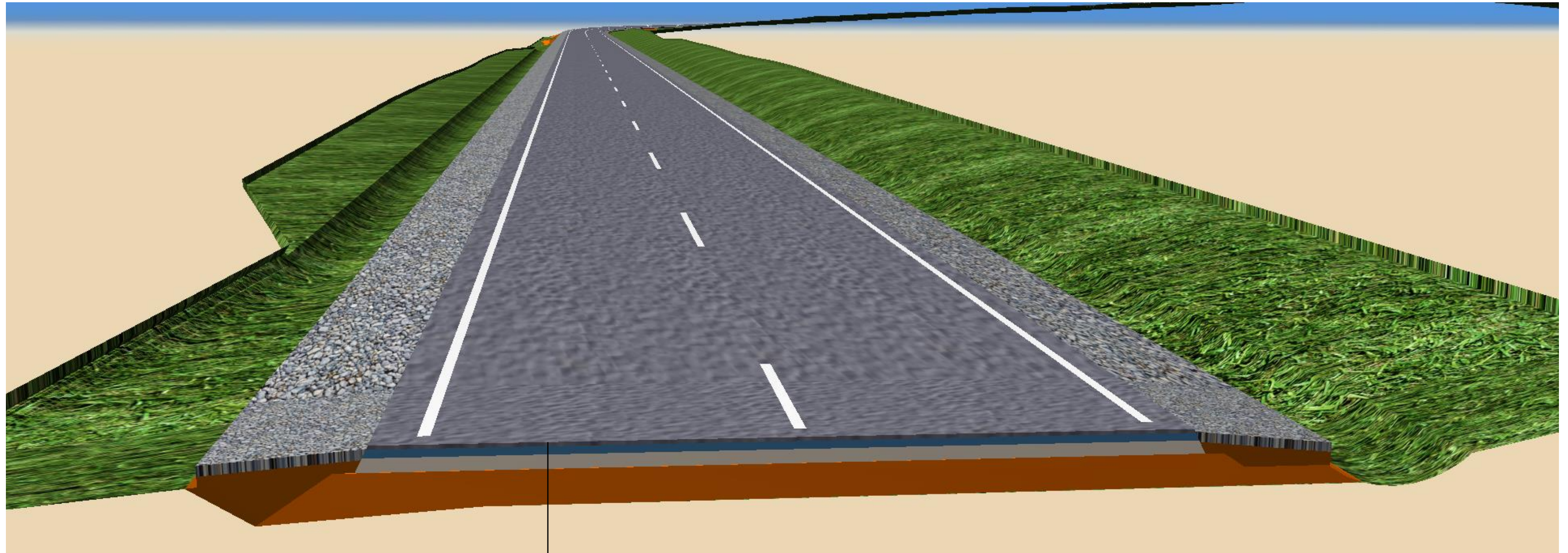
Недостатъци на трасето свързани с безопасността



Недостатъци на трасето свързани с безопасността

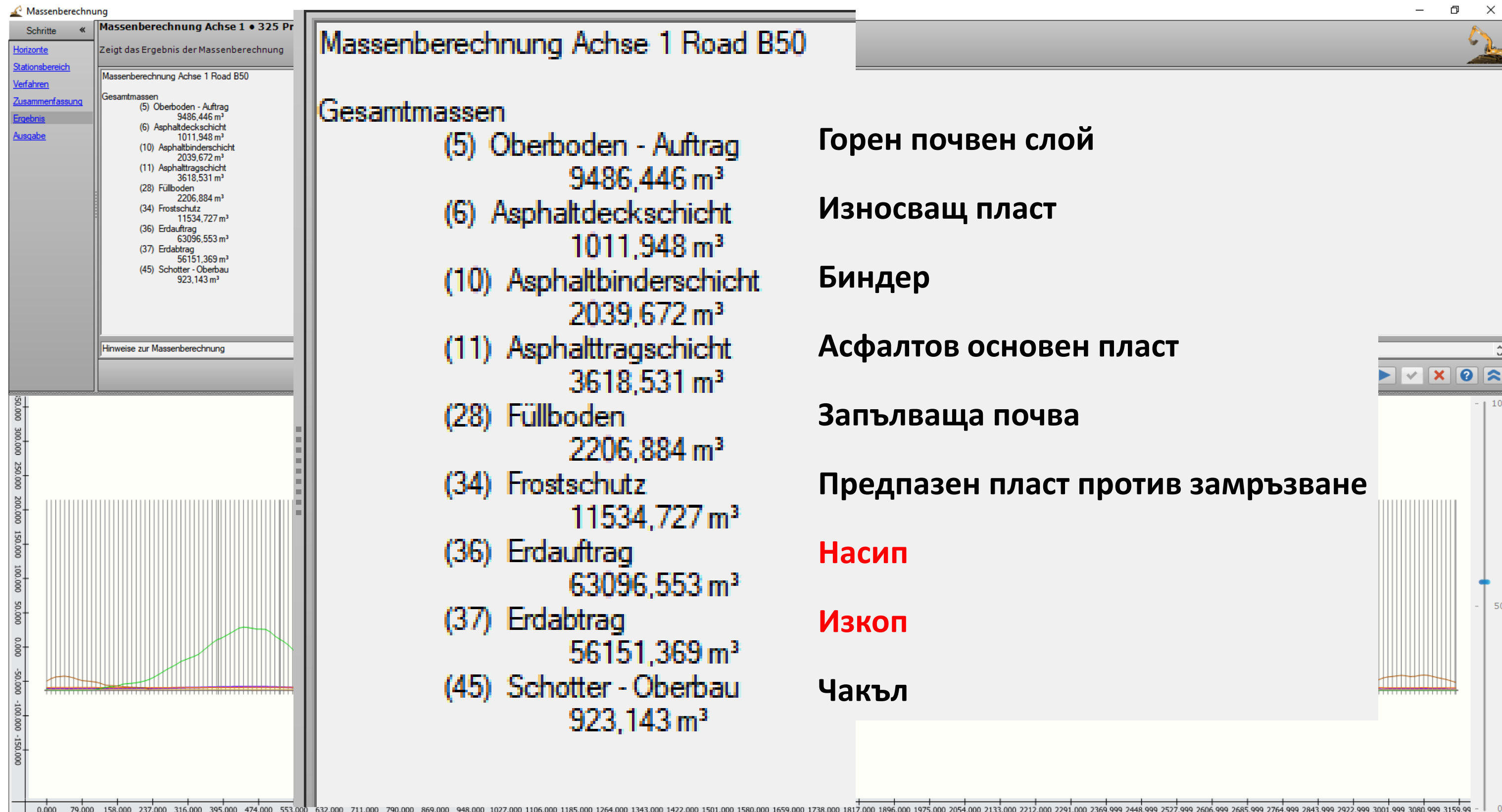


Конструкция на пътната настилка



- 4 cm износващ пласт
- 8 cm биндер
- 14 cm асфалтов основен пласт
- 35 cm предпазен пласт против замръзване

Обем на пътните работи





БЪЛГАРСКА БРАНШОВА АСОЦИАЦИЯ ПЪТНА БЕЗОПАСНОСТ



БЛАГОДАРЯ ЗА ВНИМАНИЕТО!

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