



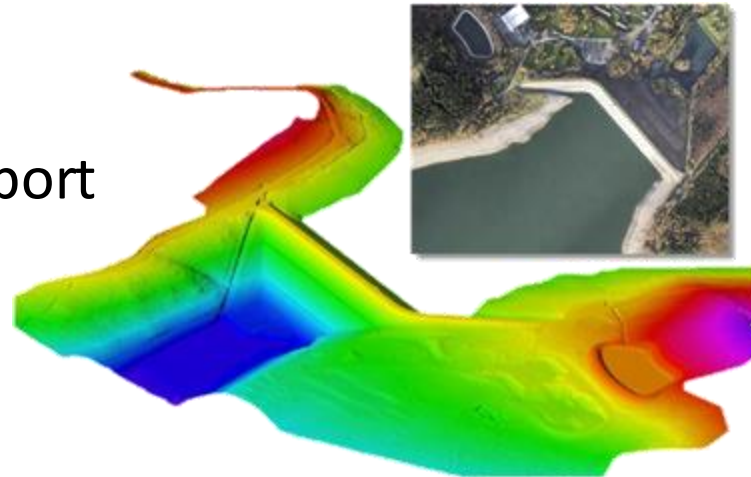
Terrasolid Training Event 2024 - Levi

DOCUMENTATION AND ANALYSIS OF RAILWAY TRACKS

Friederike Schwarzbach, Robert Hau
March 2024

Services:

- ✓ Kinematic methods of Airborne- and Mobile-Laserscanning
- ✓ UAV-based image collection and processing
- ✓ Documentation and analysis of railroad tracks, high-voltage power lines and roads
- ✓ Engineer surveying
- ✓ Assessment of real estate value
- ✓ Purchase, Training and Support of Terrasolid Software in Germany



- Airborne Laserscanning System
 - Partner WekuFly operating a Gyrocopter
 - CCNS 5 - navigation/flight operation
 - AeroControl GNSS/IMU
 - VUX-240 Laserscanner 1.500 kHz
 - DigiCAM / Phase One IXU-R 1000
- Altitude \approx 200-300 m
- Average point density \approx 200 pts/m²
- Ground sample distance \approx 2 cm

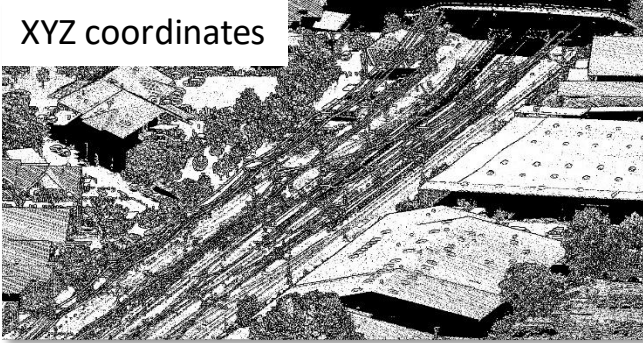


✓ Point cloud

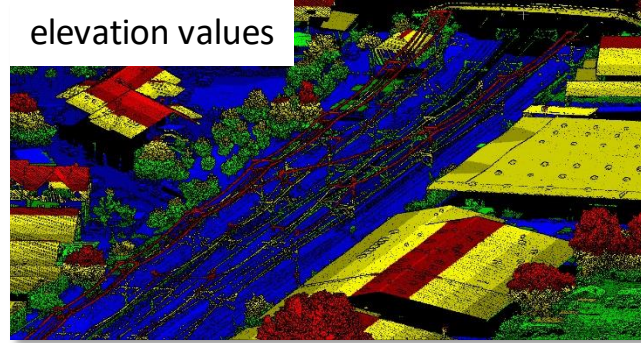
✓ Orthophotos



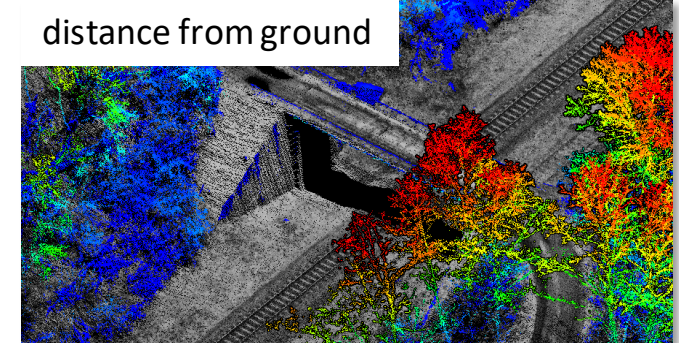
XYZ coordinates



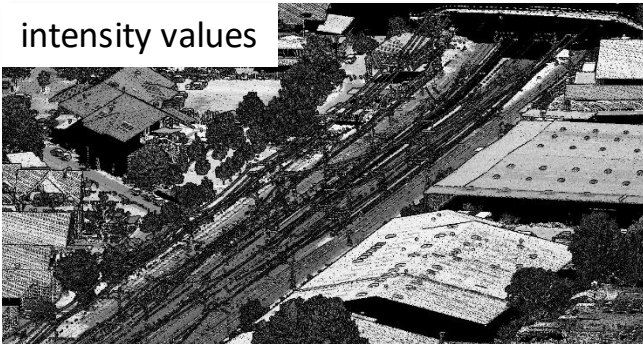
elevation values



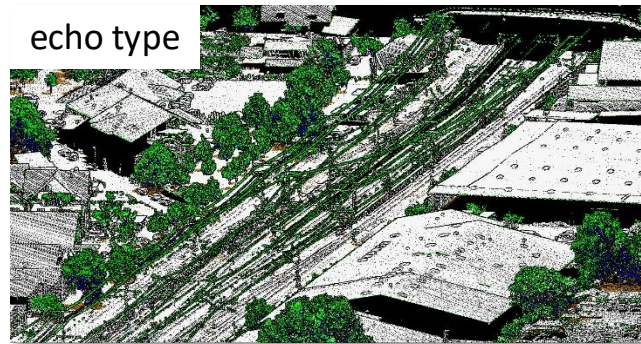
distance from ground



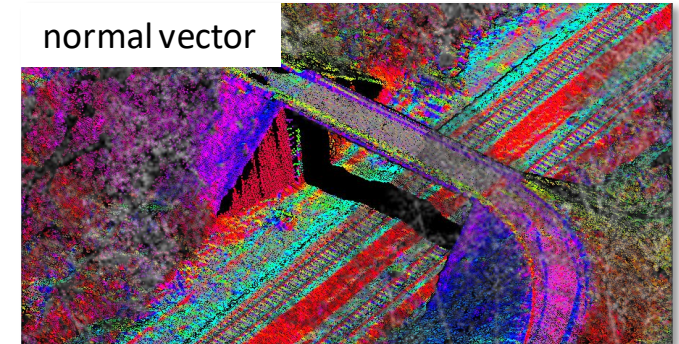
intensity values



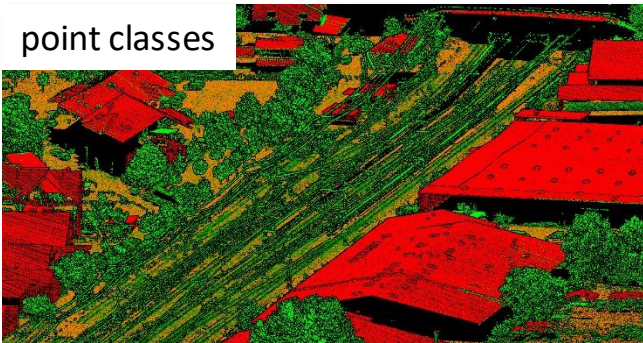
echo type



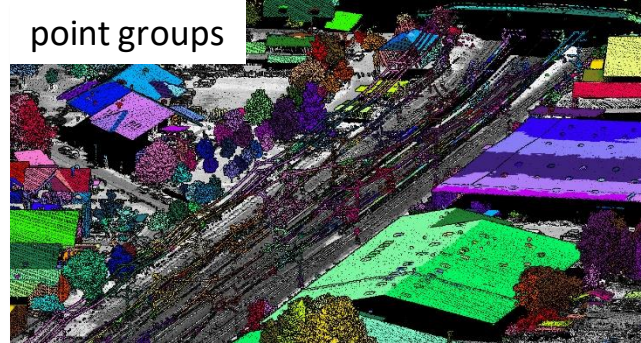
normal vector



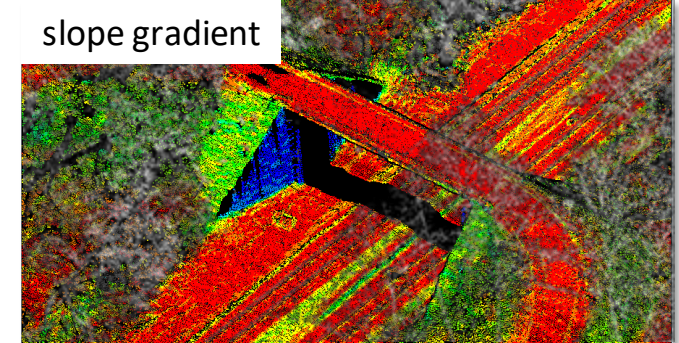
point classes

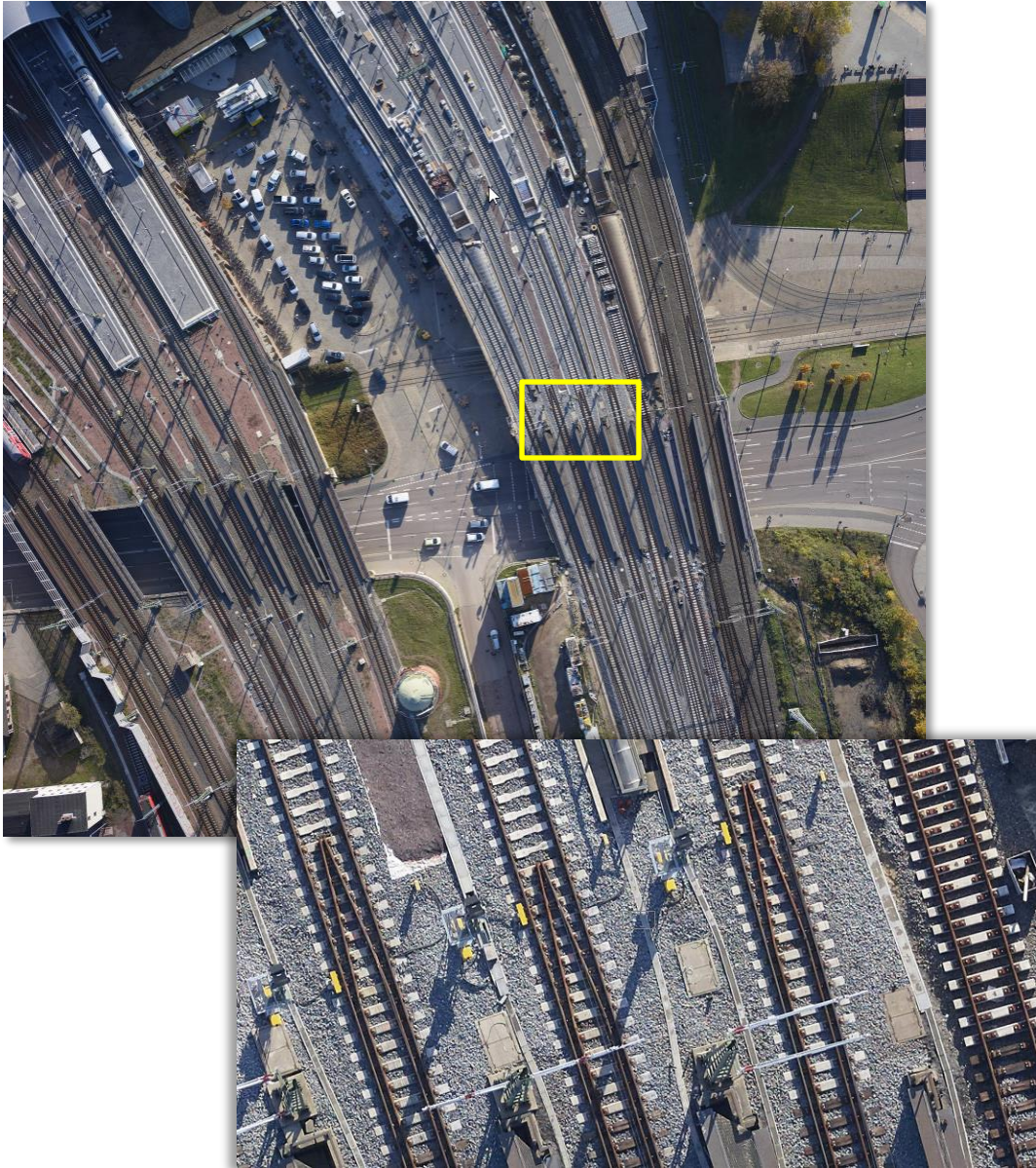


point groups

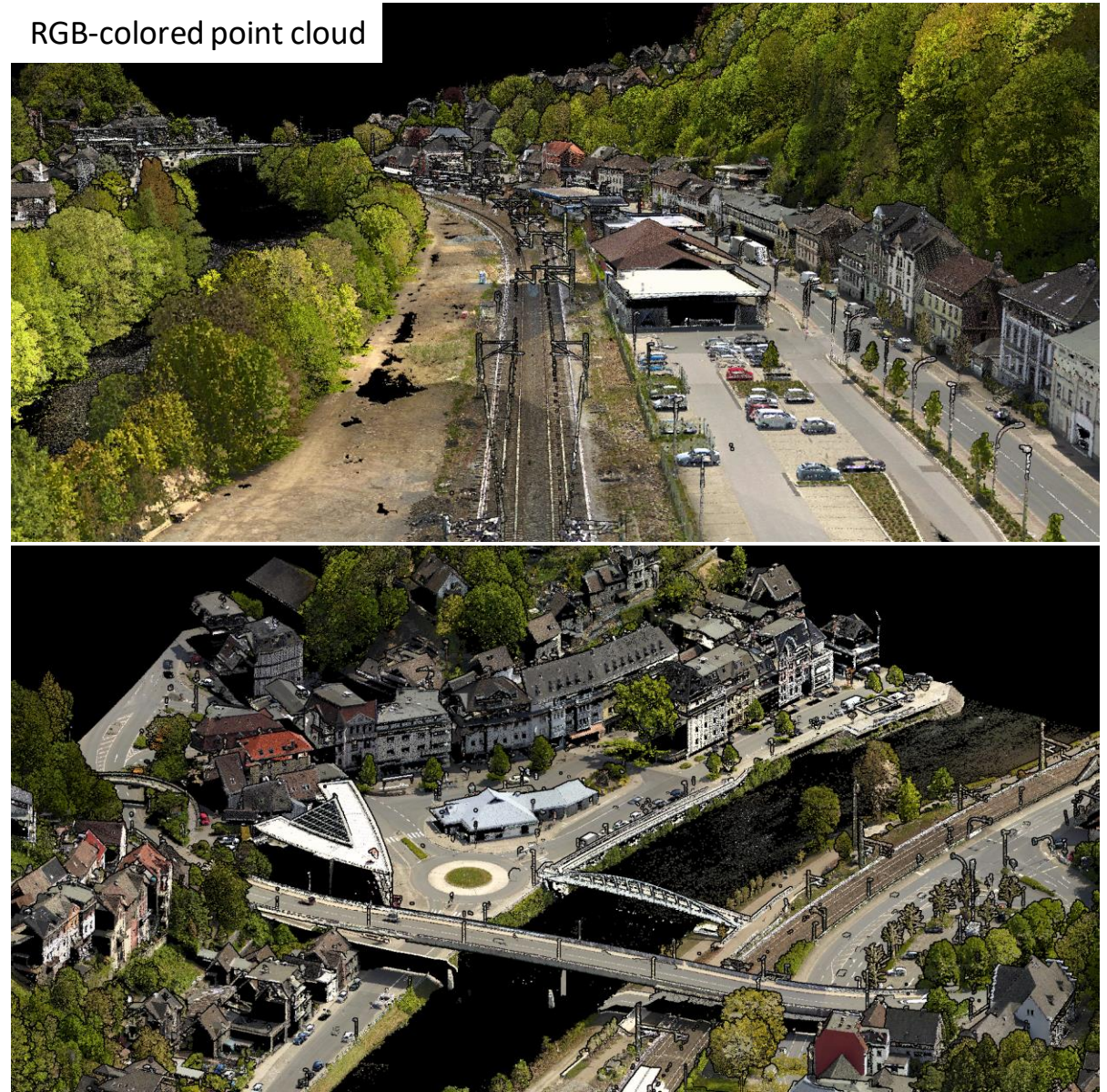


slope gradient



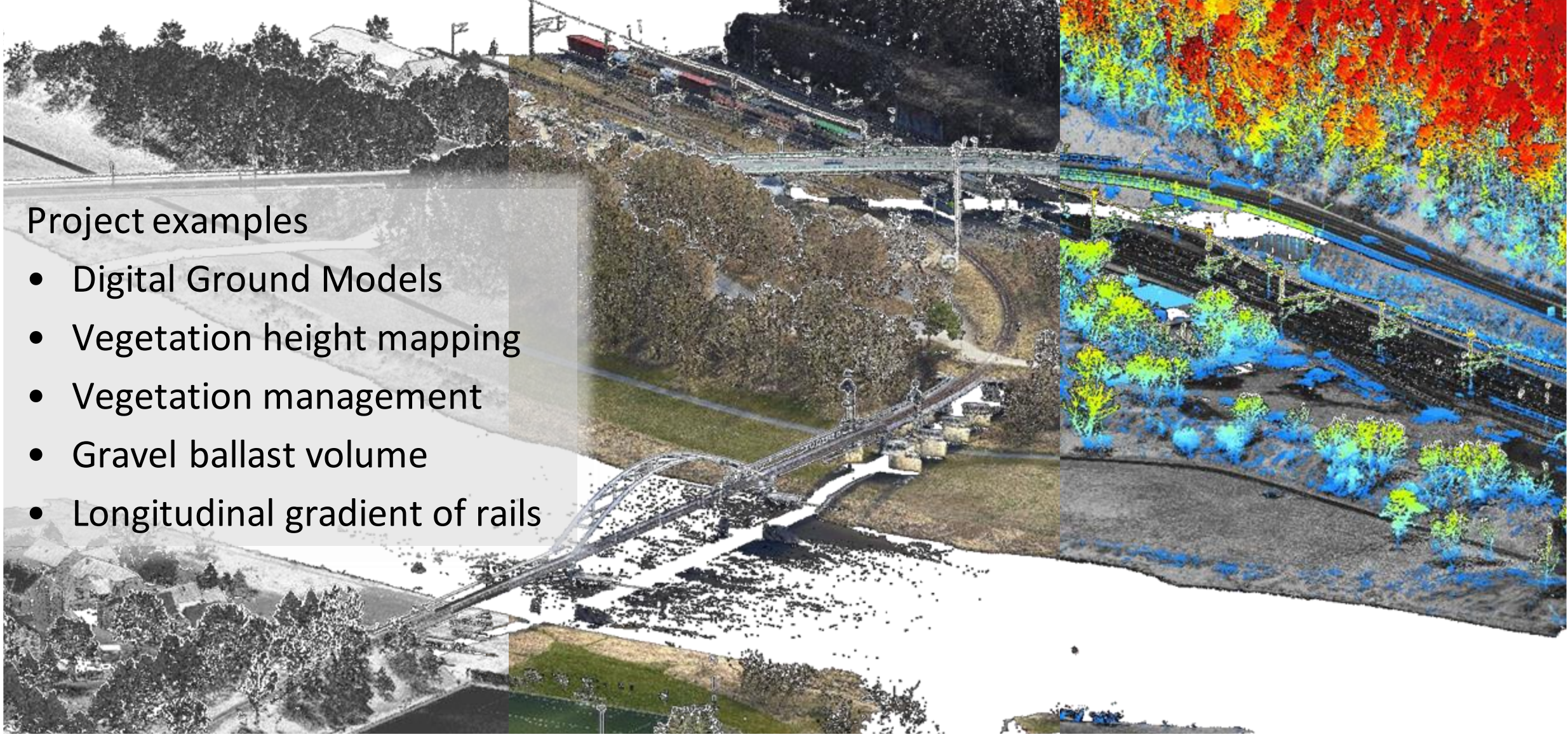


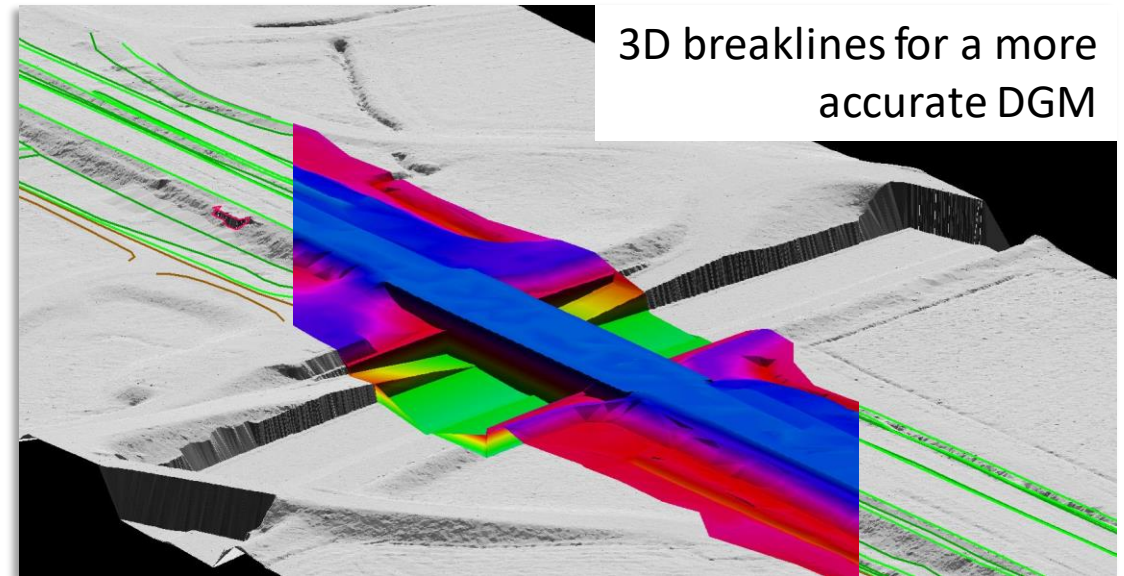
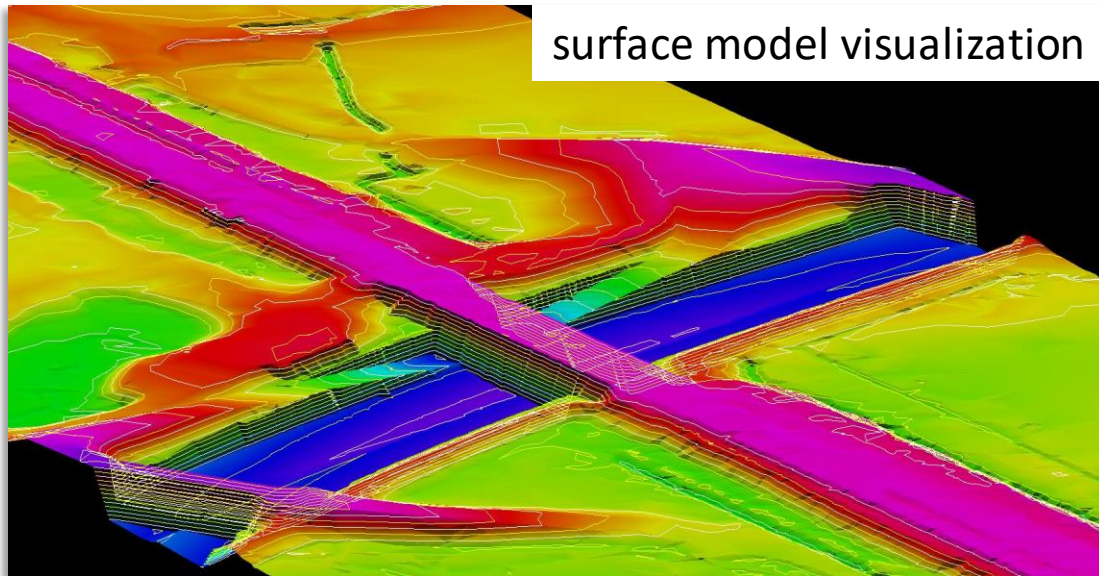
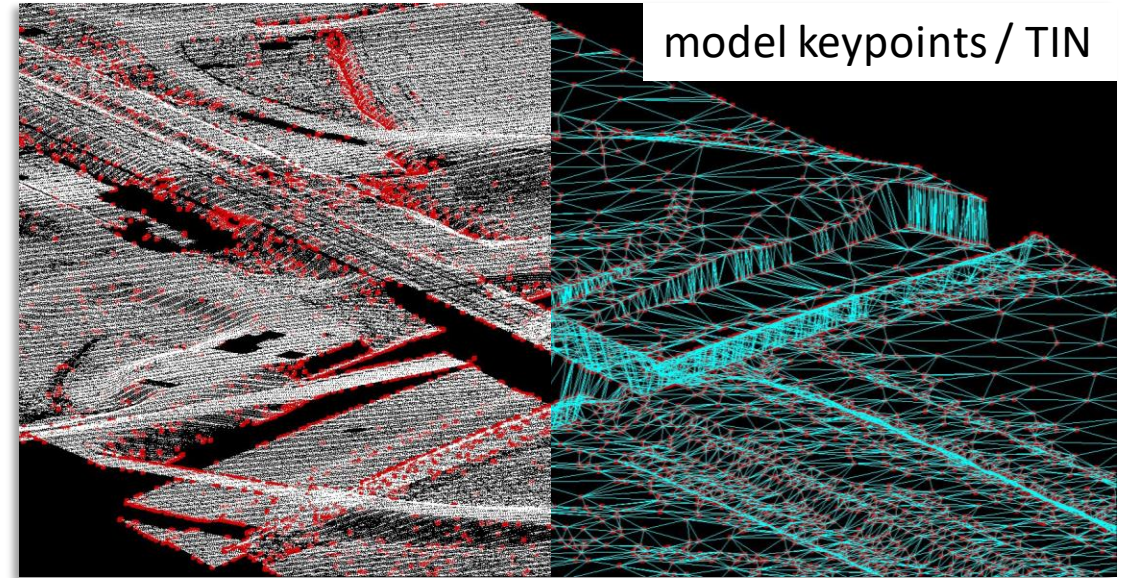
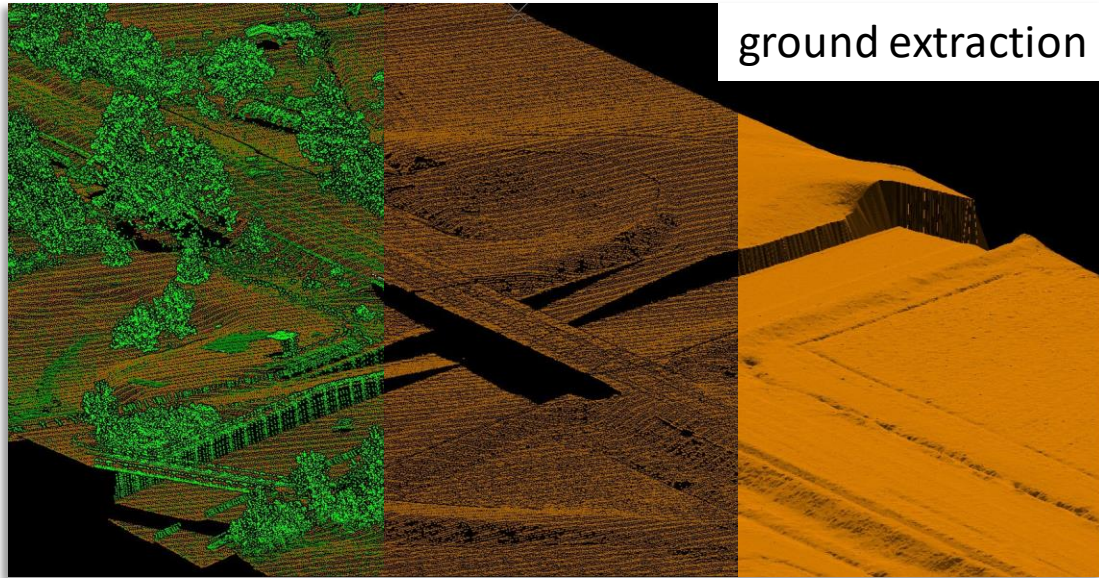
RGB-colored point cloud



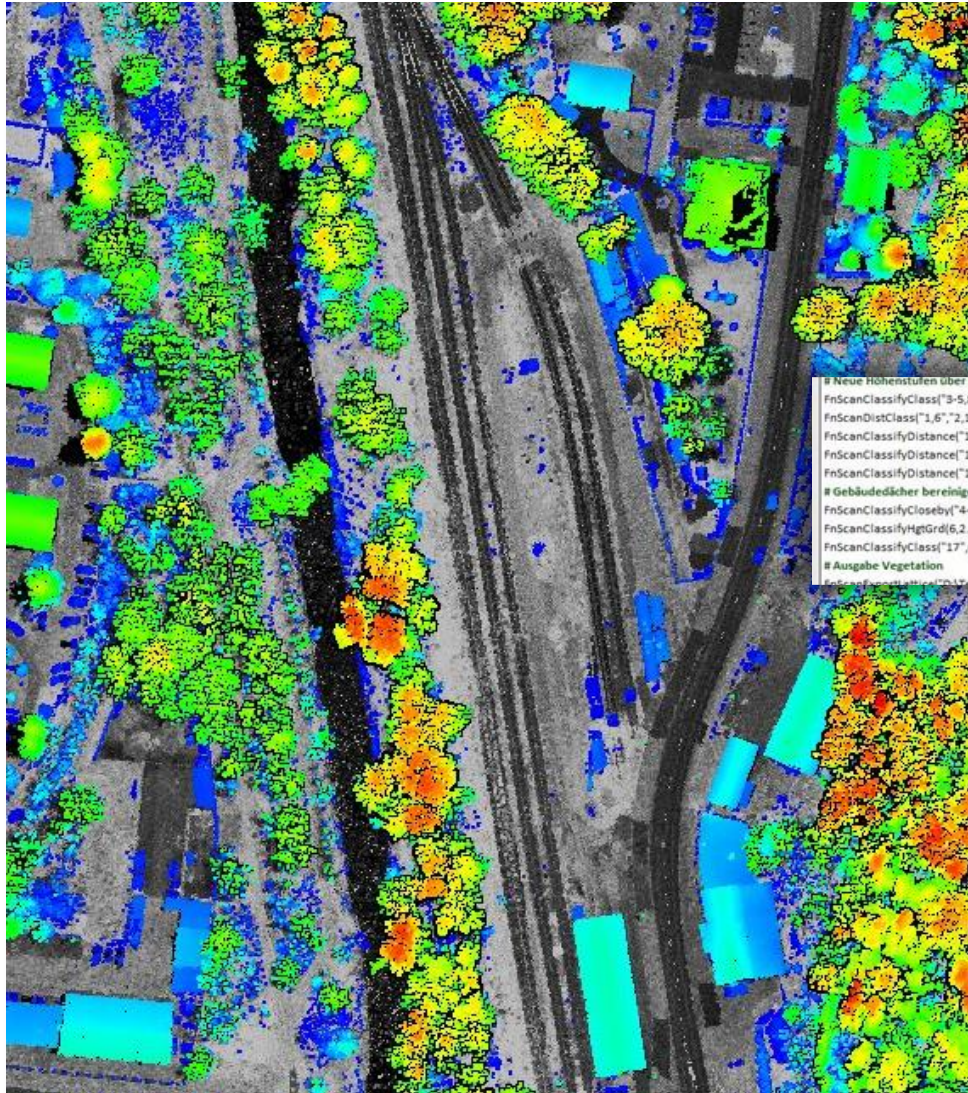
Project examples

- Digital Ground Models
- Vegetation height mapping
- Vegetation management
- Gravel ballast volume
- Longitudinal gradient of rails

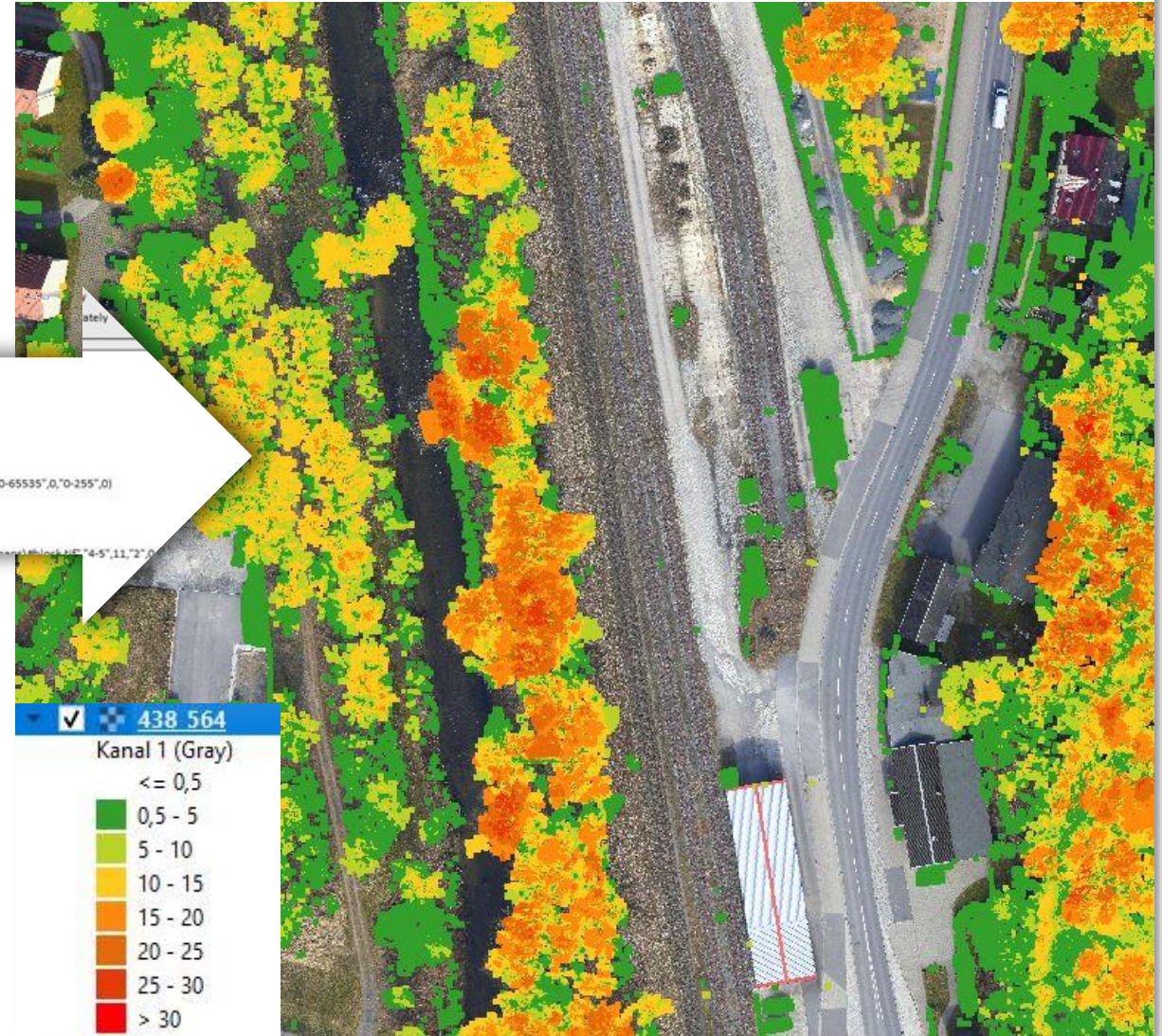


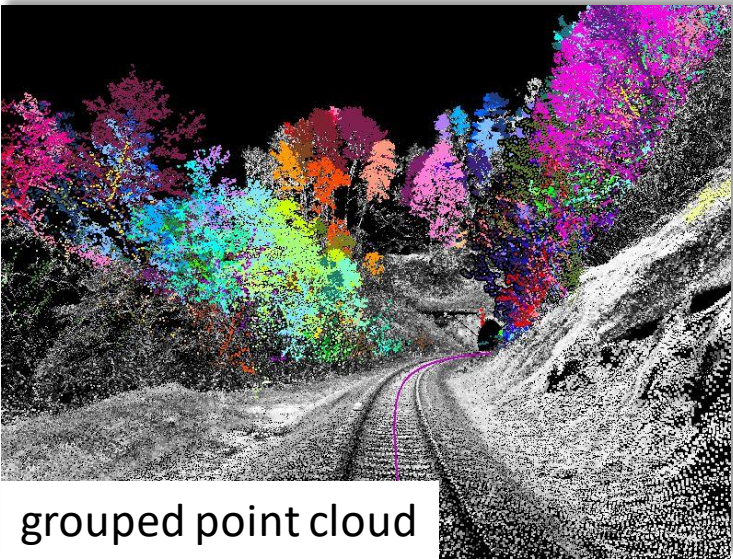


distance from ground computed

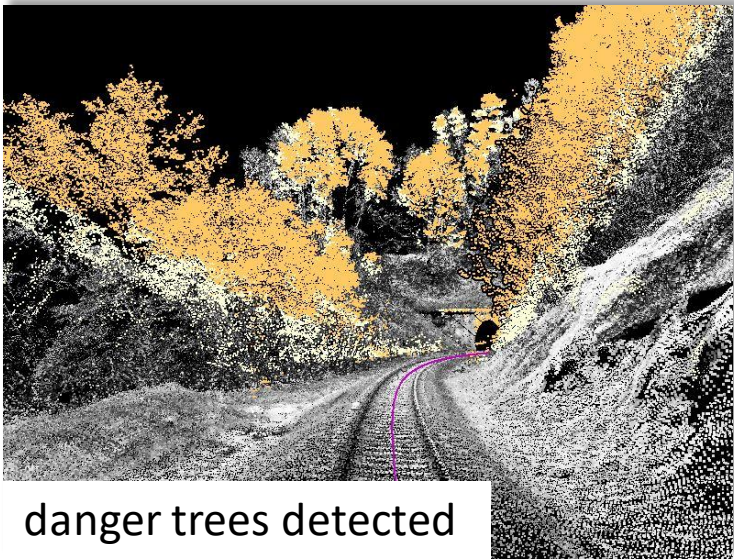


GeoTIFF with pixel value = height above ground

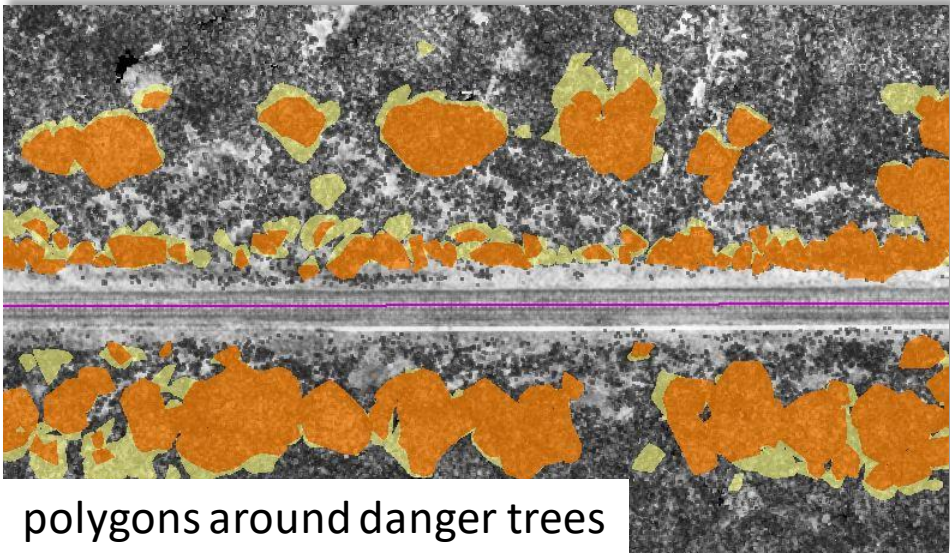




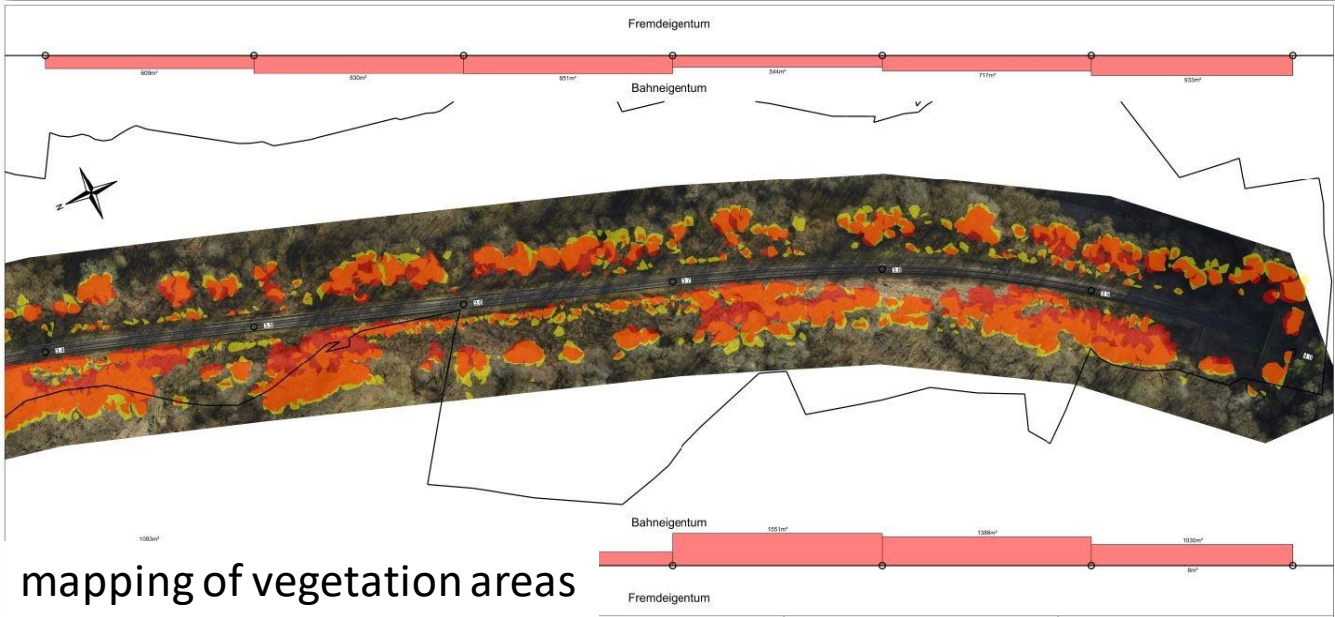
grouped point cloud



danger trees detected



polygons around danger trees



mapping of vegetation areas



DB

NETZE

Nebel & Partner

Vermessung · Geoinformation

Bearbeiter

Datum:

Vegetationsmanagement

Pflegetstufe variabel (Baumfallkurve)

Strecke xxxx

Streckenbezeichnung

Streckenabschnitt

A - B

km 0,000 - km 4,000

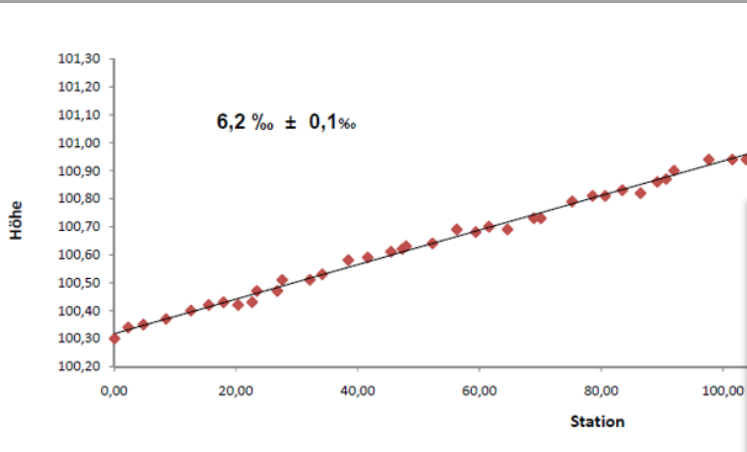
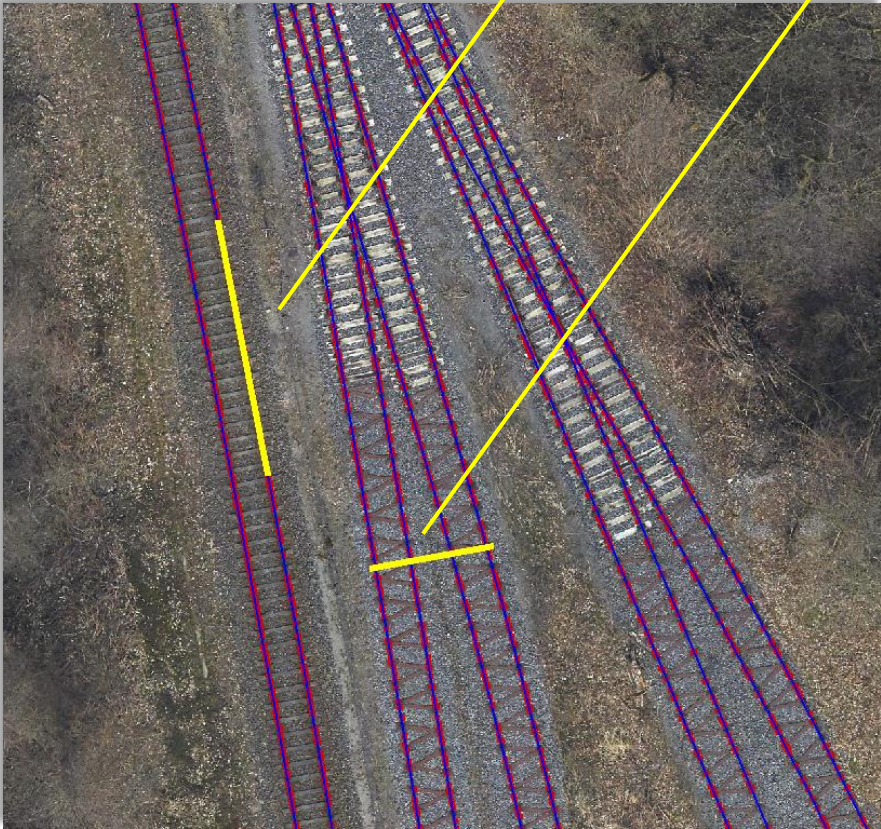
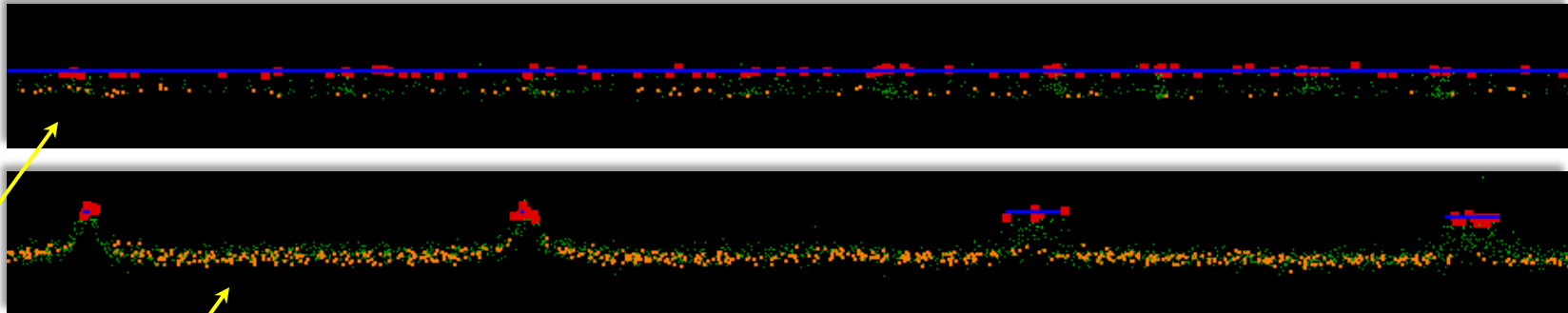
Datengrundlage: Airborne Laserscanning Befliegung vom 12.02.2022

| Strecke | Abschnitt | Freizuhaltenes Profil | | | | Freizuhaltenes Profil | | | | Bemerkung | |
|---------|-----------|------------------------|---------------|-------|---------------|-----------------------|---------------|-------|---------------|-----------|------------------------------------------------------------------------------|
| | | ohne Wachstumszuschlag | | | | mit Wachstumszuschlag | | | | | |
| | | Bahnh | | Fremd | | Bahnh | | Fremd | | | |
| | | Links | Rechts | Links | Rechts | Links | Rechts | Links | Rechts | | |
| | von km | bis km | Flächen in m² | | Flächen in m² | | Flächen in m² | | Flächen in m² | | |
| xxxx | 0,000 | 0,100 | 0 | 0 | 4 | 0 | 0 | 0 | 26 | 0 | parallelaufende Strecken: yyy km 29,0 - 29,4 zzzz km 72,3 - 71,9 |
| xxxx | 0,100 | 0,200 | 0 | 0 | 54 | 0 | 0 | 0 | 92 | 0 | |
| xxxx | 0,200 | 0,300 | 0 | 0 | 104 | 742 | 0 | 0 | 155 | 848 | |
| xxxx | 0,300 | 0,400 | 139 | 0 | 4 | 786 | 148 | 0 | 0 | 913 | parallelaufende Strecke: zzzz km 71,9 - 71,7 |
| xxxx | 0,400 | 0,500 | 118 | 0 | 78 | 86 | 155 | 0 | 124 | 221 | |
| xxxx | 0,500 | 0,600 | 582 | 66 | 93 | 106 | 478 | 164 | 108 | 223 | |
| xxxx | 0,600 | 0,700 | 352 | 226 | 23 | 75 | 343 | 315 | 37 | 159 | |

documentation of vegetation areas


documentation of vegetation areas

rail line digitization based on
highest points on rails



best-fit line derived
from rail top hits

documentation
of rail gradients

| | | | | | |
|--------------------------------------------------------------------------------------------------|----------------|-----------------------------------------------------|------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
|  NETZE | | | Nebel & Partner <small>Vermessung · Geoinformation</small> | | Bearbeiter: Datum: |
| Gleisneigungsdaten ETCS L2 Strecke xxxx | | | | Hinweis: Der Schwellwert für die Bestimmung der ausgleichenden Gradienten beträgt +/- 15mm. Die Bestimmung der Neigungswechsel erfolgte unter der Vorgabe möglichst weniger Neigungswechsel. | |
| km Streckenbezeichnung Streckenabschnitt | | km 0,000 - km 3,000 Bf A - Bf B Bf A2 - Bf A4 | | | |
| Datengrundlage: Airborne Laserscanning Befliegung vom 13.02.2022 | | | | | |
| Hektometer [km] | Gleis | Höhe DHHN2016 | Neigung/Steigung [‰] | Länge Neigung [m] | Bemerkung |
| 0,010 | Richtungsgleis | 245,990 | -3,171 | 25,5 | Neigungswechsel |
| 0,020 | Richtungsgleis | 245,960 | -3,171 | 25,5 | |
| 0,036 | Richtungsgleis | 245,910 | -5,918 | 72,9 | Neigungswechsel |
| 0,040 | Richtungsgleis | 245,890 | -5,918 | 72,9 | |
| 0,060 | Richtungsgleis | 245,770 | -5,918 | 72,9 | |
| 0,080 | Richtungsgleis | 245,650 | -5,918 | 72,9 | |
| 0,100 | Richtungsgleis | 245,530 | -5,918 | 72,9 | |
| 0,109 | Richtungsgleis | 245,480 | -4,395 | 51,7 | Neigungswechsel |
| 0,120 | Richtungsgleis | 245,430 | -4,395 | 51,7 | |
| 0,140 | Richtungsgleis | 245,340 | -4,395 | 51,7 | |
| 0,160 | Richtungsgleis | 245,260 | -4,395 | 51,7 | |
| 0,160 | Richtungsgleis | 245,250 | -10,656 | 41,2 | Neigungswechsel |
| 0,180 | Richtungsgleis | 245,050 | -10,656 | 41,2 | |
| 0,200 | Richtungsgleis | 244,830 | -10,656 | 41,2 | |
| 0,202 | Richtungsgleis | 244,820 | -12,472 | 120,3 | Neigungswechsel |
| 0,220 | Richtungsgleis | 244,590 | -12,472 | 120,3 | |
| 0,240 | Richtungsgleis | 244,340 | -12,472 | 120,3 | |

THANK YOU!

Nebel & Partner
Vermessung · Geoinformation

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