

## Digitalisering op het spoor

Lunchlezing Platform Bruggen, 26 januari 2022

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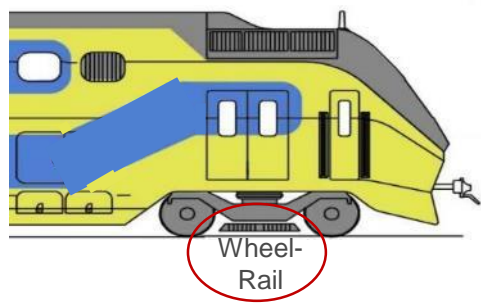
**ProRail**

## VERSUS

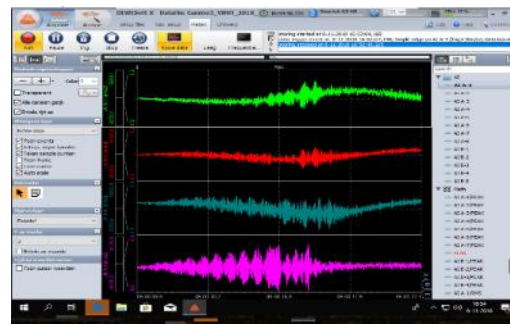
- Technology push -- Market pull
- Voorspellend onderhoud -- Prestatiegericht onderhoud
- Data delen -- Data is business model aannemer
- Gekozen ontwikkelpartners -- Aanbesteding
- Zelf ontwikkelen -- Aan de markt overlaten

# Spoorstaaf monitoring – Wiel-rail contact

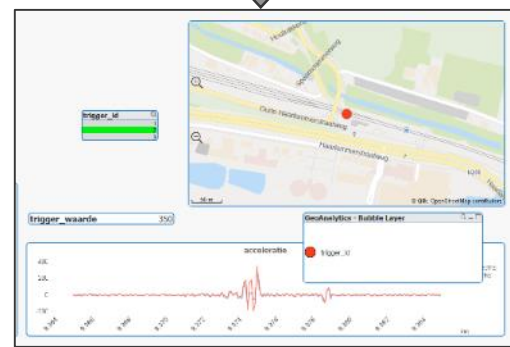
14 Sensors on 2 passenger trains



Realtime sensor data



Dashboard



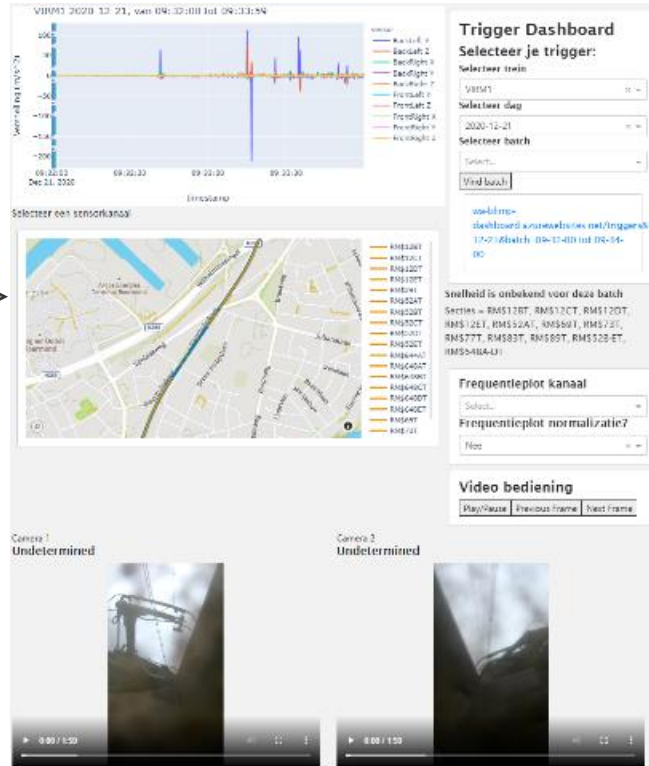
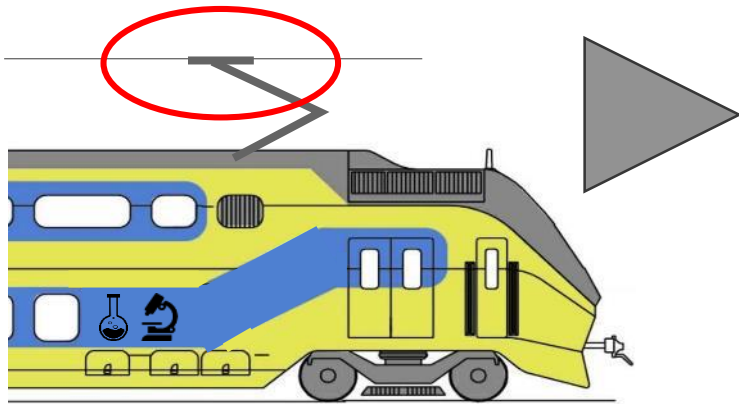
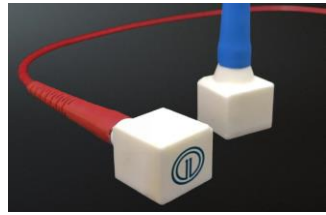
Preventive maintenance



## Sensor types:

- Axlebox acceleration (3 axes)
- Cabin acceleration
- Mobile phone acceleration
- Microphone (acoustic)
- Temperature, humidity

# Bovenleiding monitoring – pantograaf-rijdraad



## Detectie van (onder andere):

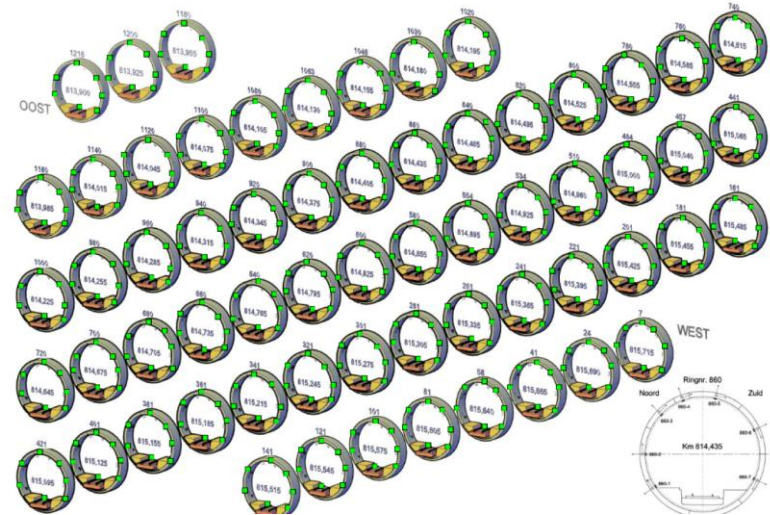
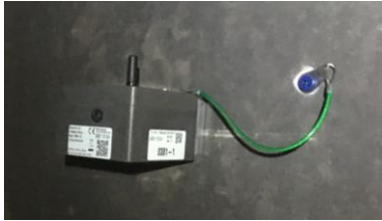
- Harde punten
- Uitgezakte hangdraden
- Inkomende zijdraden
- Contact verlies
- Beweging van de koolstofstrip langs de bovenleiding

- Visie bepaling ism business
- Use case inventarisatie
- Ideeën genereren door te doen

# Botlektunnel - sensoren



- 372 tiltsensoren
- In ringen



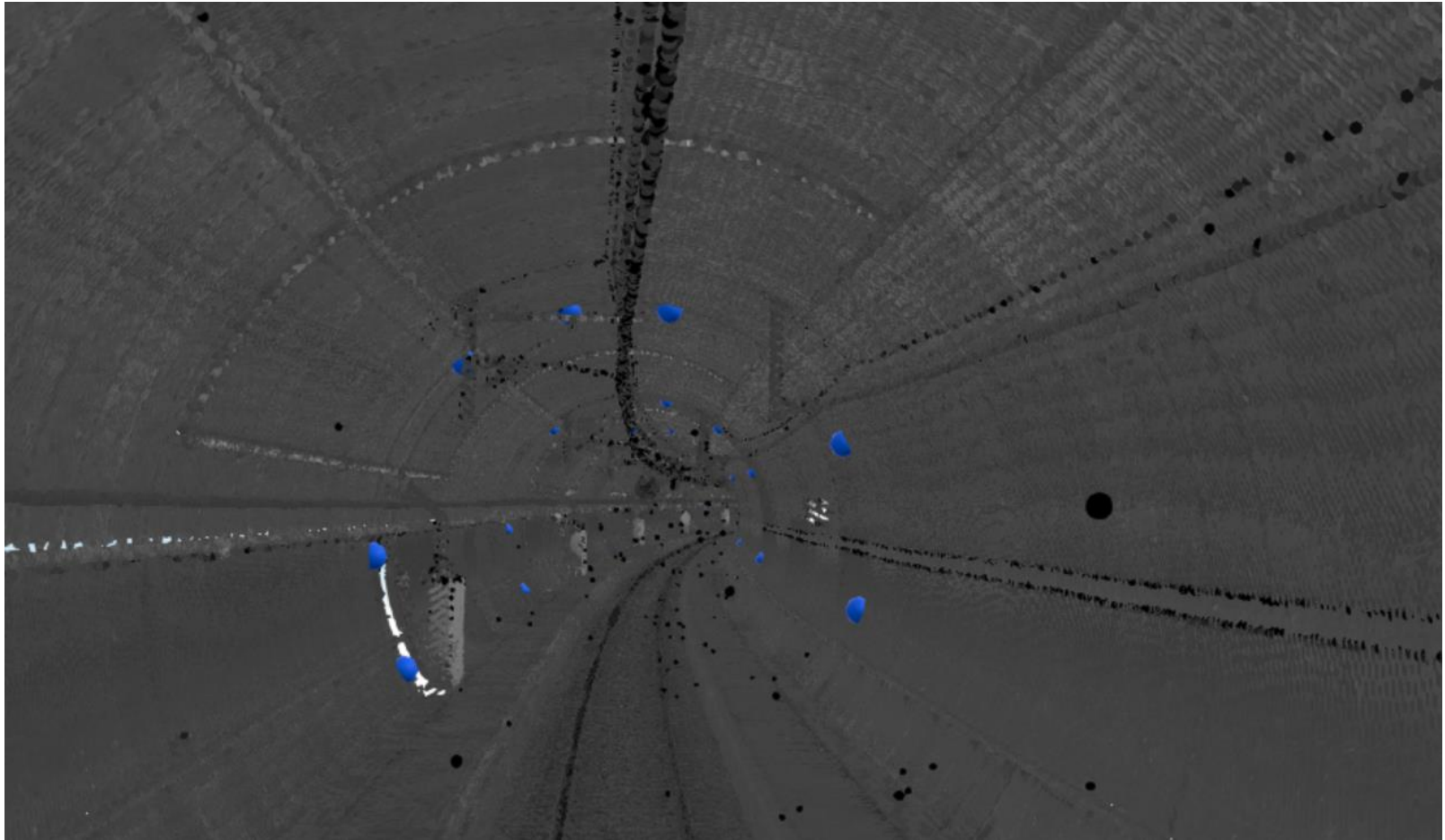
PI Vision Botlektunnel status

B0007 11/12/2021 3:00:09 PM	B0241 11/12/2021 3:06:09 PM	B0484 11/12/2021 3:12:09 PM	B0740 11/12/2021 6:32:39 AM	B0980 11/12/2021 6:08:39 AM	B1200 11/12/2021 6:14:39 AM
B0024 11/12/2021 3:00:39 PM	B0261 11/12/2021 3:06:39 PM	B0510 11/12/2021 3:12:45 PM	B0760 11/12/2021 6:33:09 AM	B1000 11/12/2021 6:09:39 AM	B1216 11/12/2021 6:15:09 AM
B0041 11/12/2021 3:01:09 PM	B0281 11/12/2021 3:07:09 PM	B0534 11/12/2021 3:13:09 PM	B0780 11/12/2021 6:33:39 AM	B1020 11/12/2021 6:09:39 AM	B1230 11/12/2021 6:10:09 AM
B0058 11/12/2021 3:01:39 PM	B0301 11/12/2021 3:07:39 PM	B0554 11/12/2021 3:13:39 PM	B0800 11/12/2021 6:34:09 AM	B1040 11/12/2021 6:10:09 AM	B1246 11/12/2021 6:10:39 AM
B0081 11/12/2021 3:02:09 PM	B0321 11/12/2021 3:08:09 PM	B0580 11/12/2021 3:14:09 PM	B0820 11/12/2021 6:04:39 AM	B1048 11/12/2021 6:10:39 AM	B1260 11/12/2021 6:11:09 AM
B0101 11/12/2021 3:02:39 PM	B0341 11/12/2021 3:08:39 PM	B0600 11/12/2021 3:14:39 PM	B0840 11/12/2021 6:05:09 AM	B1063 11/12/2021 6:11:09 AM	B1276 11/12/2021 6:11:39 AM
B0121 11/12/2021 3:03:09 PM	B0361 11/12/2021 3:09:09 PM	B0620 11/12/2021 3:15:09 PM	B0860 11/12/2021 6:05:39 AM	B1080 11/12/2021 6:11:39 AM	B1290 11/12/2021 6:12:09 AM
B0141 11/12/2021 3:03:39 PM	B0381 11/12/2021 3:09:39 PM	B0640 11/12/2021 6:30:09 AM	B0880 11/12/2021 6:06:09 AM	B1100 11/12/2021 6:12:09 AM	B1306 11/12/2021 6:12:39 AM
B0161 11/12/2021 3:04:09 PM	B0401 11/12/2021 3:10:09 PM	B0660 11/12/2021 6:30:39 AM	B0900 11/12/2021 6:06:39 AM	B1120 11/12/2021 6:12:39 AM	B1320 11/12/2021 6:13:09 AM
B0181 11/12/2021 3:04:39 PM	B0421 11/12/2021 3:10:39 PM	B0680 11/12/2021 6:31:09 AM	B0920 11/12/2021 6:07:09 AM	B1140 11/12/2021 6:13:09 AM	B1336 11/12/2021 6:13:39 AM
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B0221 11/12/2021 3:05:39 PM	B0461 11/12/2021 3:11:39 PM	B0720 11/12/2021 6:32:09 AM	B0960 11/12/2021 6:08:09 AM	B1180 11/12/2021 6:14:09 AM	B1366 11/12/2021 6:14:39 AM

Legenda

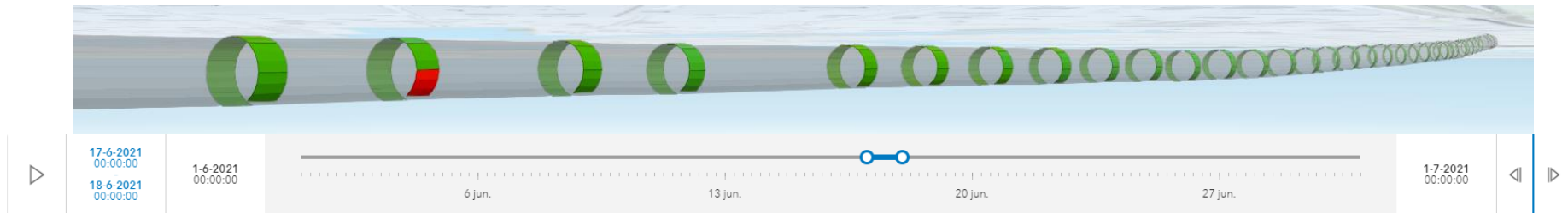
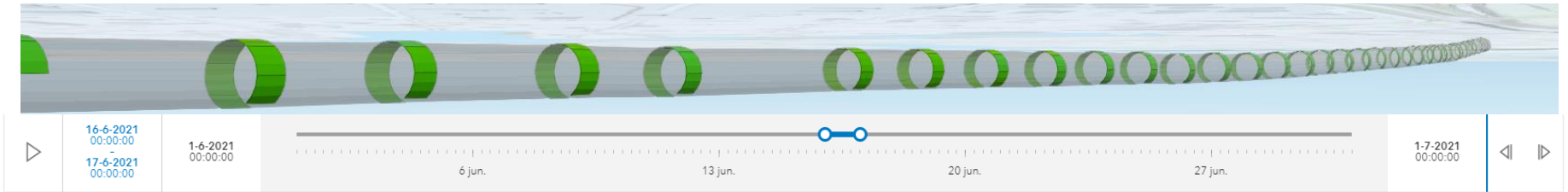
- Afwijking < |0.029|
- Afwijking tussen |0.029| en |0.034|
- Afwijking tussen |0.034| en |0.038|
- Afwijking > |0.038|
- Geen data afgelopen 24 uur

# Botlektunnel – puntenwolk vanuit meettrein



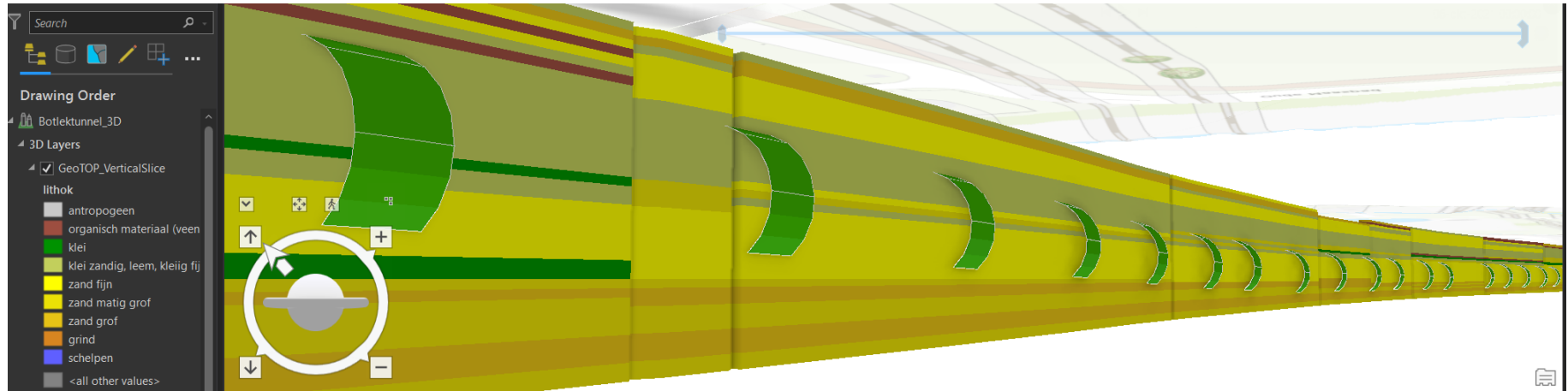
# Botlektunnel – sensoren in 3D

- Visualiseren in 3D van de verschillende segmenten met tiltwaarden, in de tijd

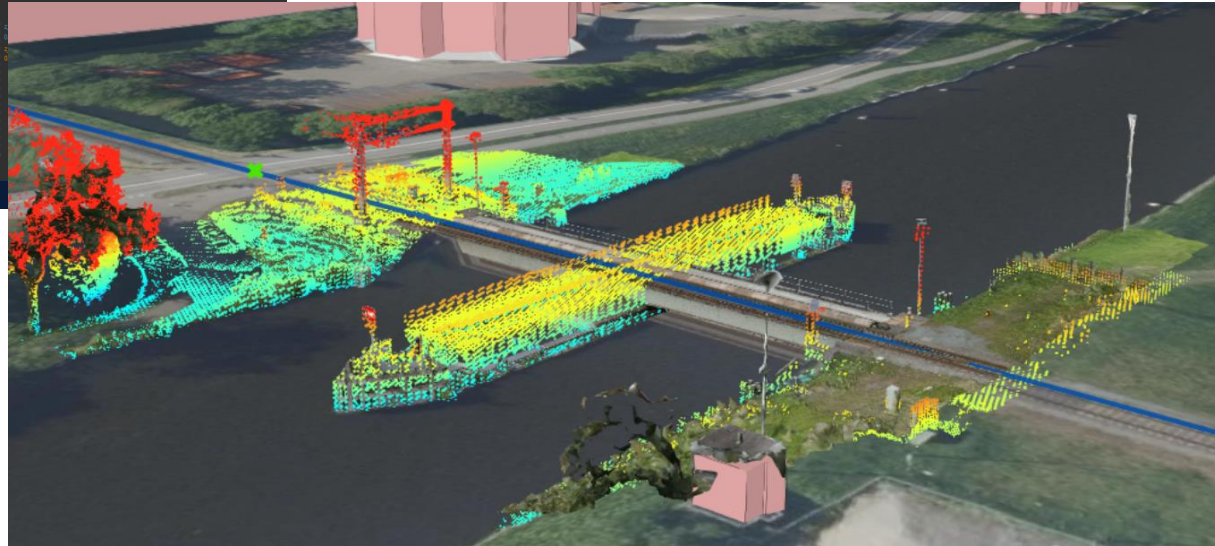




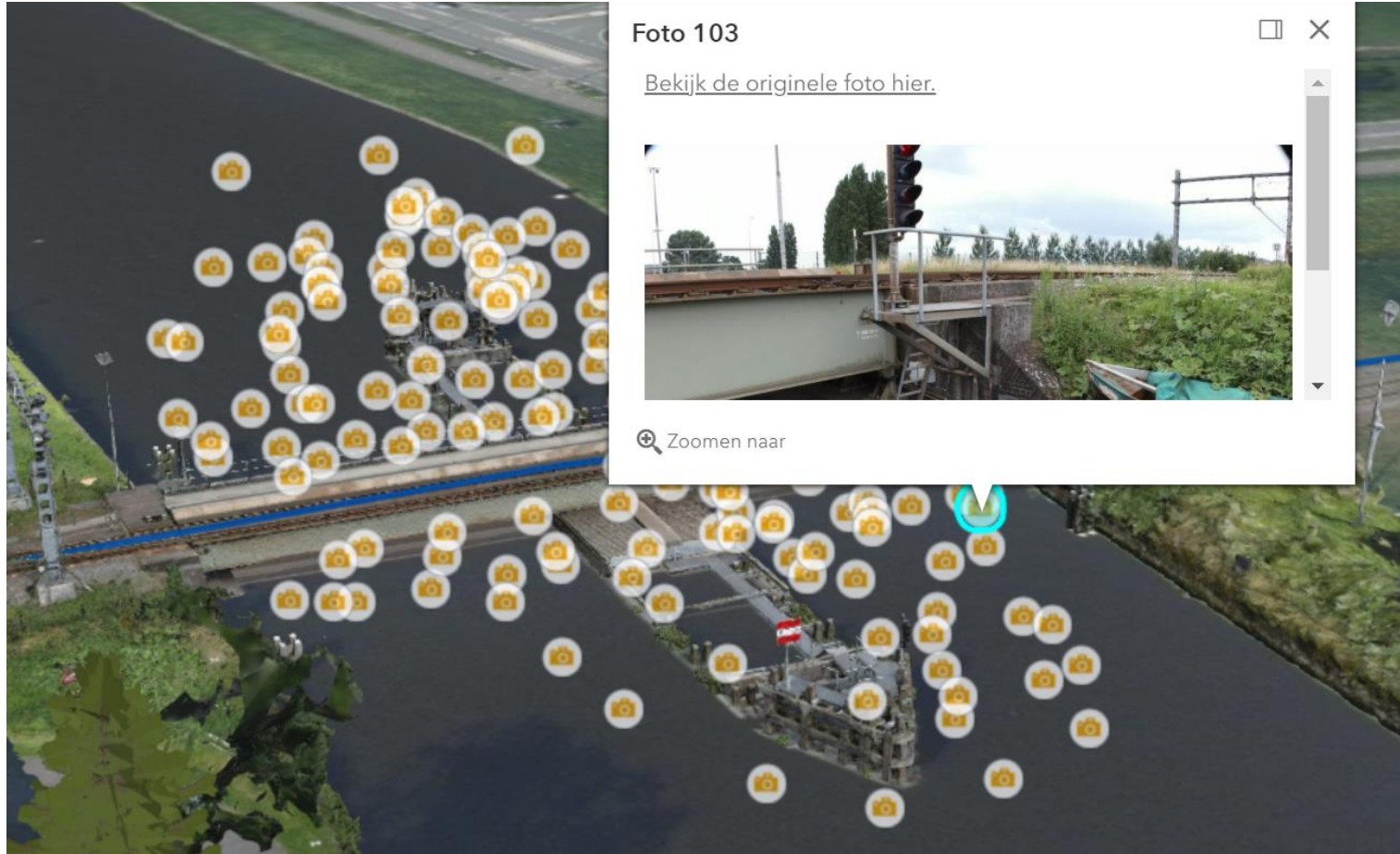
- Combineren van eigen data met andere bronnen, zoals GeoTOP (ondergronddata)



# Brug Alphen a/d Rijn - sensoren

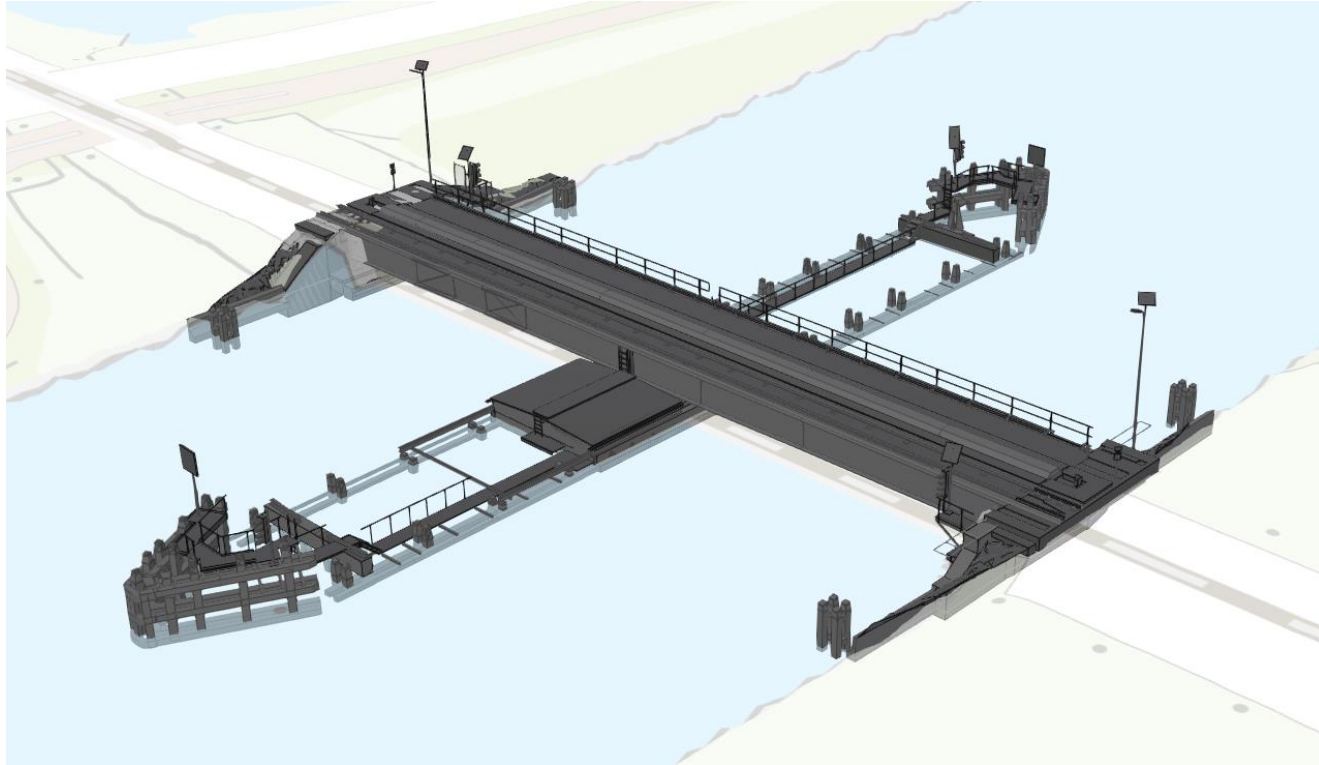


# Brug Alphen a/d Rijn - dronedata



# Brug Alphen a/d Rijn – BIM model

- 3D modellen, wat kunnen we hiermee?



- In productie brengen voor meerdere bruggen/tunnels
- Combineren van meerdere databronnen:
  - Getijden
  - Vaarbewegingen
  - Passeren van zware treinen
  - Werkzaamheden aan spoor, water (baggeren) en omgeving
  - ...
- Inzicht krijgen:
  - Waardoor worden bewegingen veroorzaakt?
  - Wat valt binnen de natuurlijke beweging van de tunnel?
  - Wanneer wordt een beweging onnatuurlijk?



**ProRail**

Going. Growing. Green