

BIM Process Implementation in infrastructure Projects in Denmark

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 - **Architectural Engineer, Technical University of Denmark, 2013**
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- **Spotland A/S 2016-**
 - **Production Manager BIM/VDC**
- **Spotland A/S 2014-2016**
 - **BIM Engineer, 3D/VDC**
- **Royal Danish Academy of Fine Arts**
 - **Research assistant at CITA (Center for Information Technology in Architecture)**
- **Kuubo Architects**
 - **Computational designer**



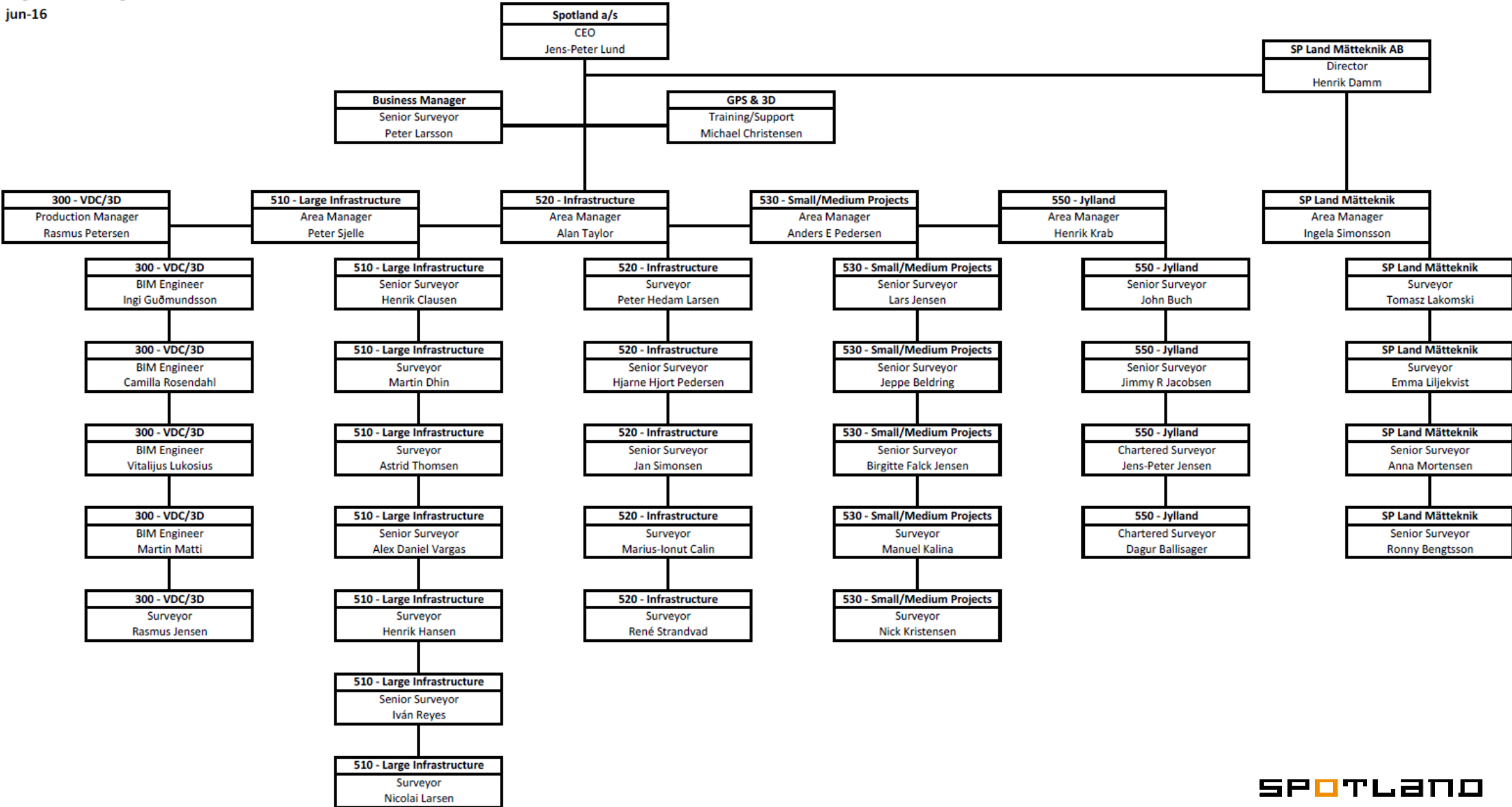
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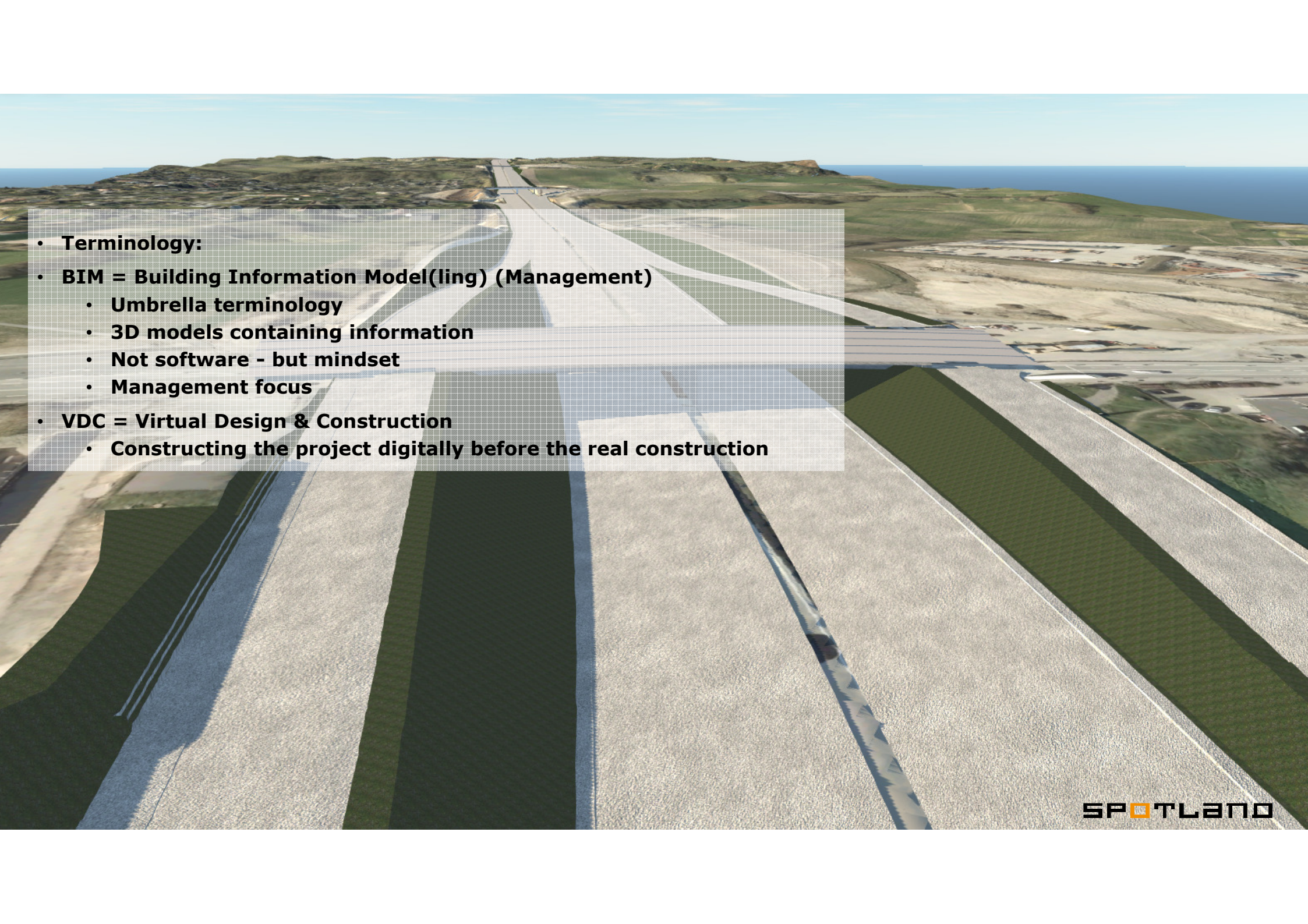
About Spotland

Surveying and engineering company

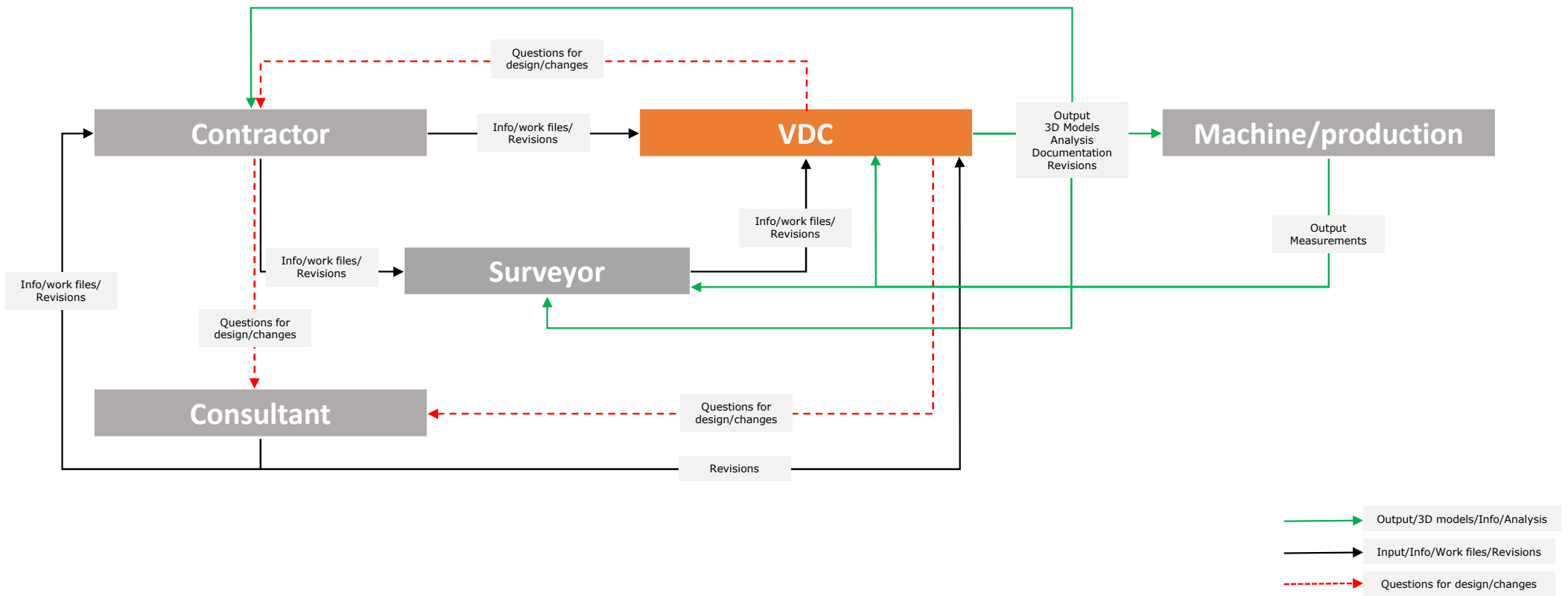
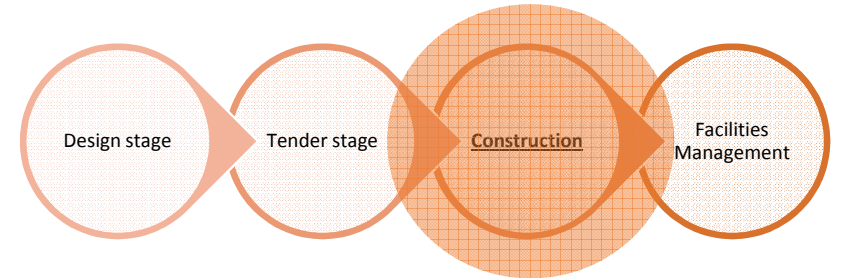
- **Headquarters in Kvistgård, North Zealand**
- **34 surveyors, 5 engineers**
- **Large focus on construction projects and implementation of technology**
- **Specialized in machine control & machine guidance**



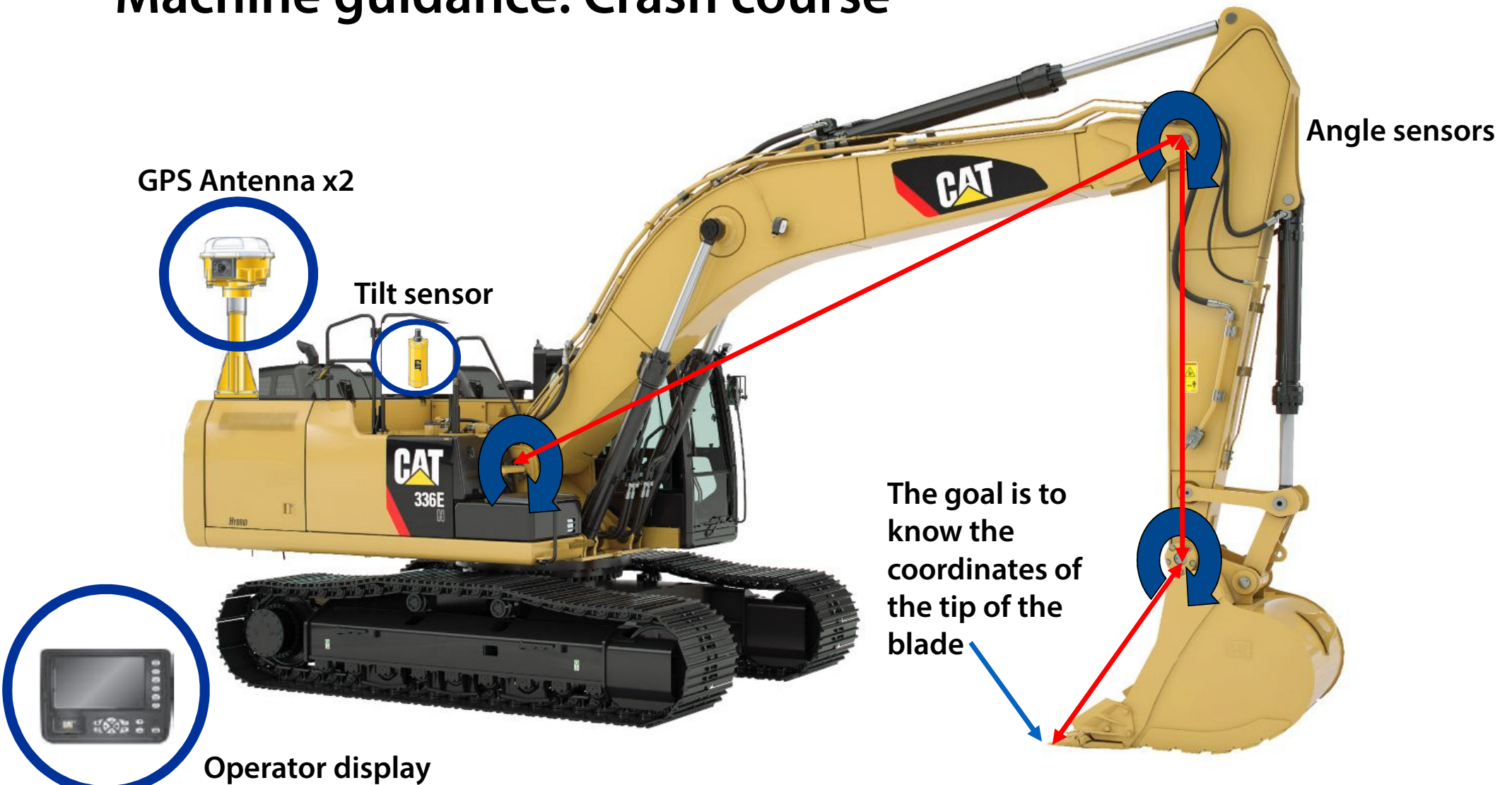


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- **Terminology:**
 - **BIM = Building Information Model(ling) (Management)**
 - **Umbrella terminology**
 - **3D models containing information**
 - **Not software - but mindset**
 - **Management focus**
 - **VDC = Virtual Design & Construction**
 - **Constructing the project digitally before the real construction**

Workflow for BIM/VDC



Machine guidance: Crash course



Machine guidance & control

- Uses GPS
- High Precision – as low as 0.002m with total station setup
- Fast execution
- No waiting for setting out
- Better project understanding and overview for operator
- Fast distribution when design changes
- Machines can measure
- Between 10 and 30% more efficient

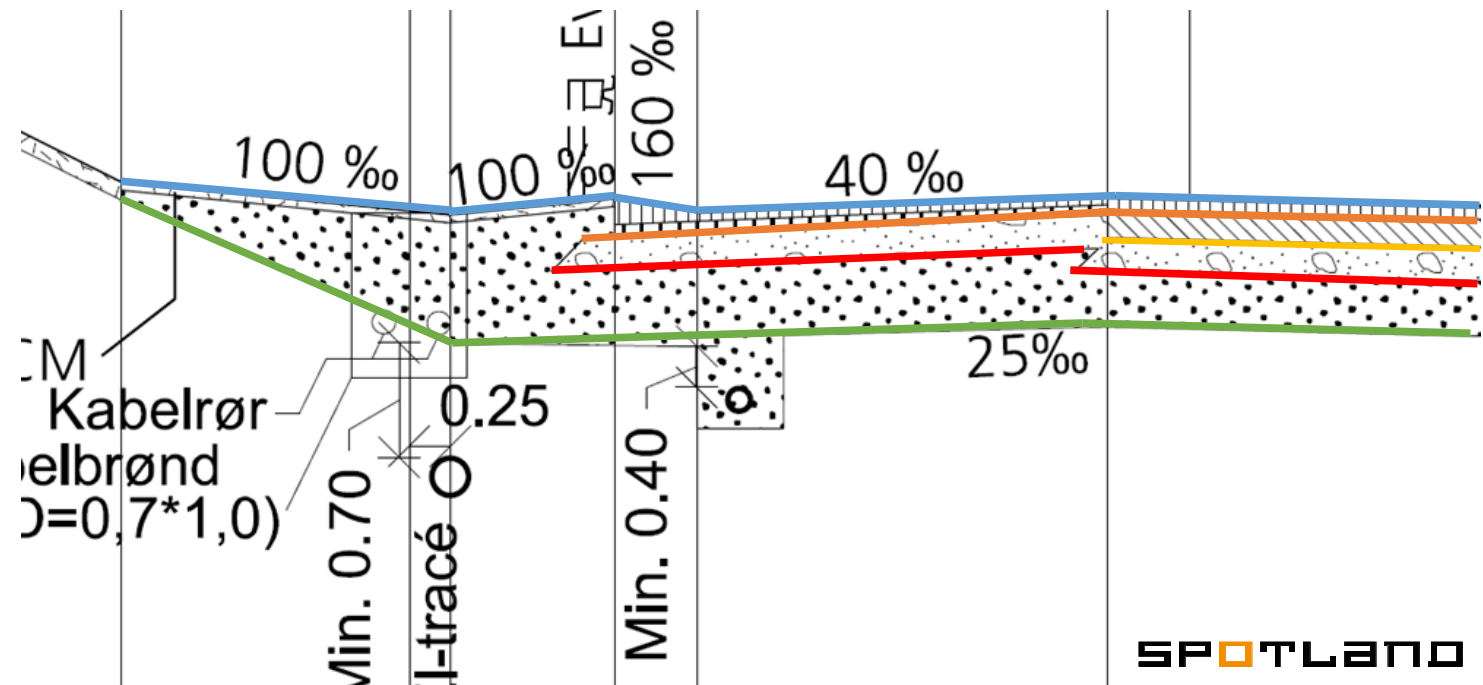
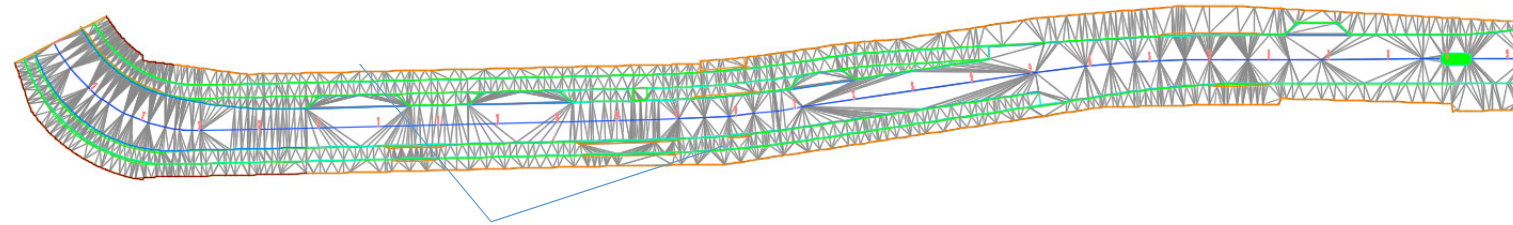
- Challenges:
- Education of both surveyor and operators
- Detail level of drawings from consultants
- Signal interference
- Software versions
- If there is a breakdown – “everything” stops



Machine guidance & control

Models needed:

- Triangulated surfaces
- Background map for guidance (Stringlines)
- Existing piping (optional)
- Future piping
- Misc.

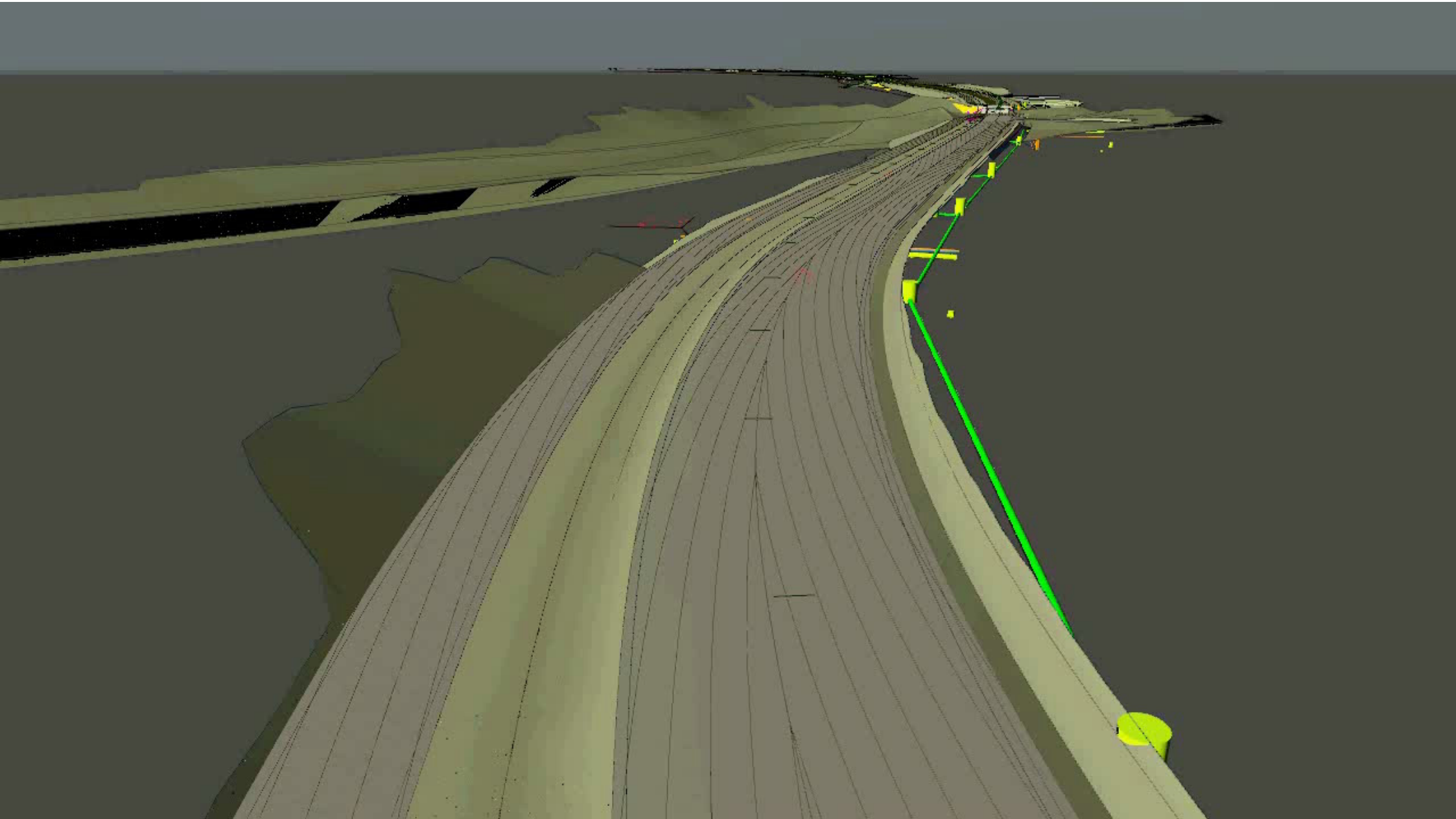


When is the VDC Engineer utilized?

- Tender and planning phase
- 3D Models for volume estimates
- Simulation of earth logistics
- 4D simulation = 3D + Time
- 3D models for machine control
 - Road layers, interrim road models, sewers/drainage, foundation excavations, future terrain etc.
- **Visualization**
 - Geotechnical
 - Project Overview
- Drone Postprocessing
- Supporting the surveyors





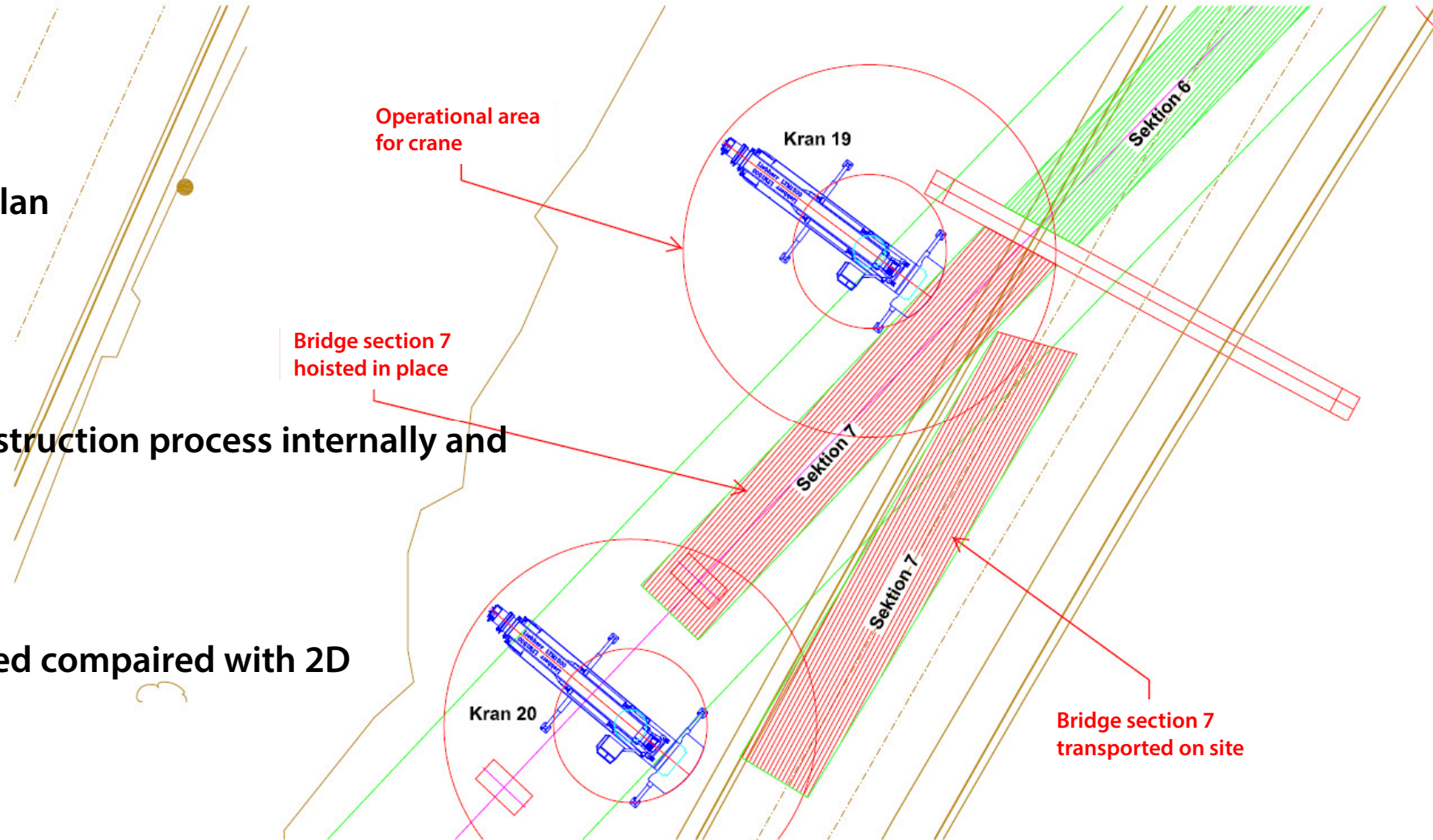


Visualization/Simulation

- Simulating phase plan

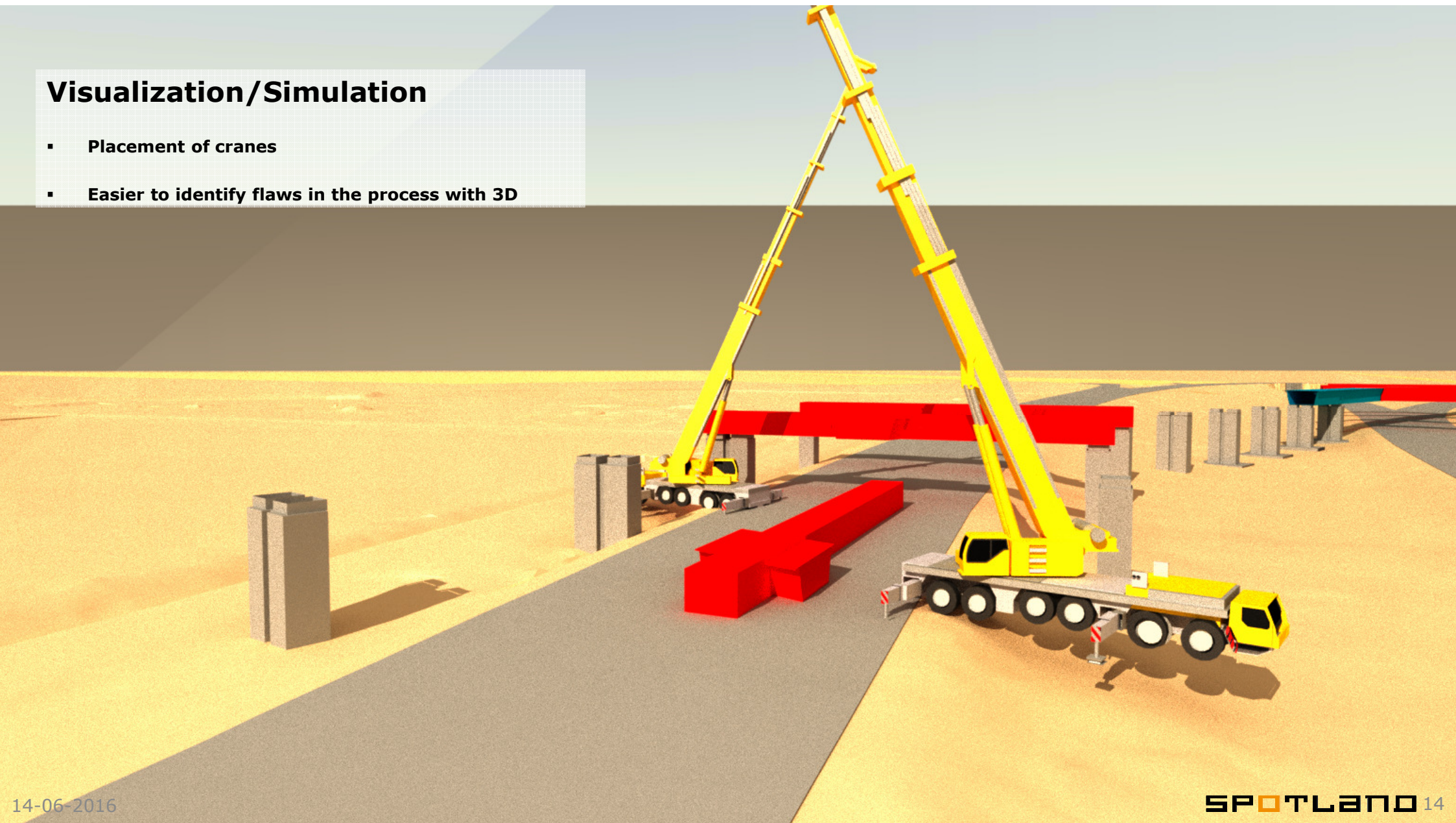
- Illustrating the construction process internally and towards client

- Detail level increased compared with 2D



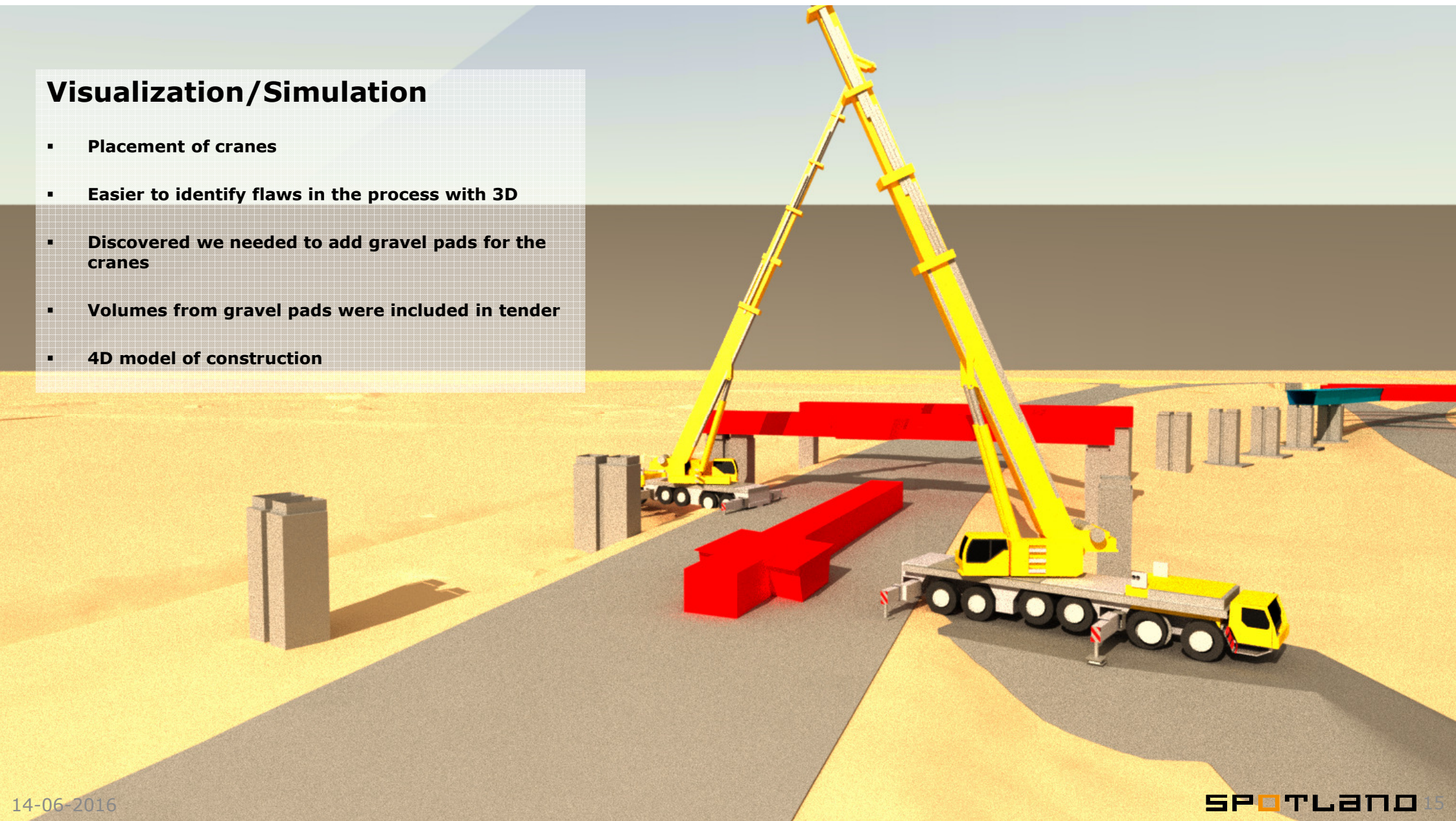
Visualization/Simulation

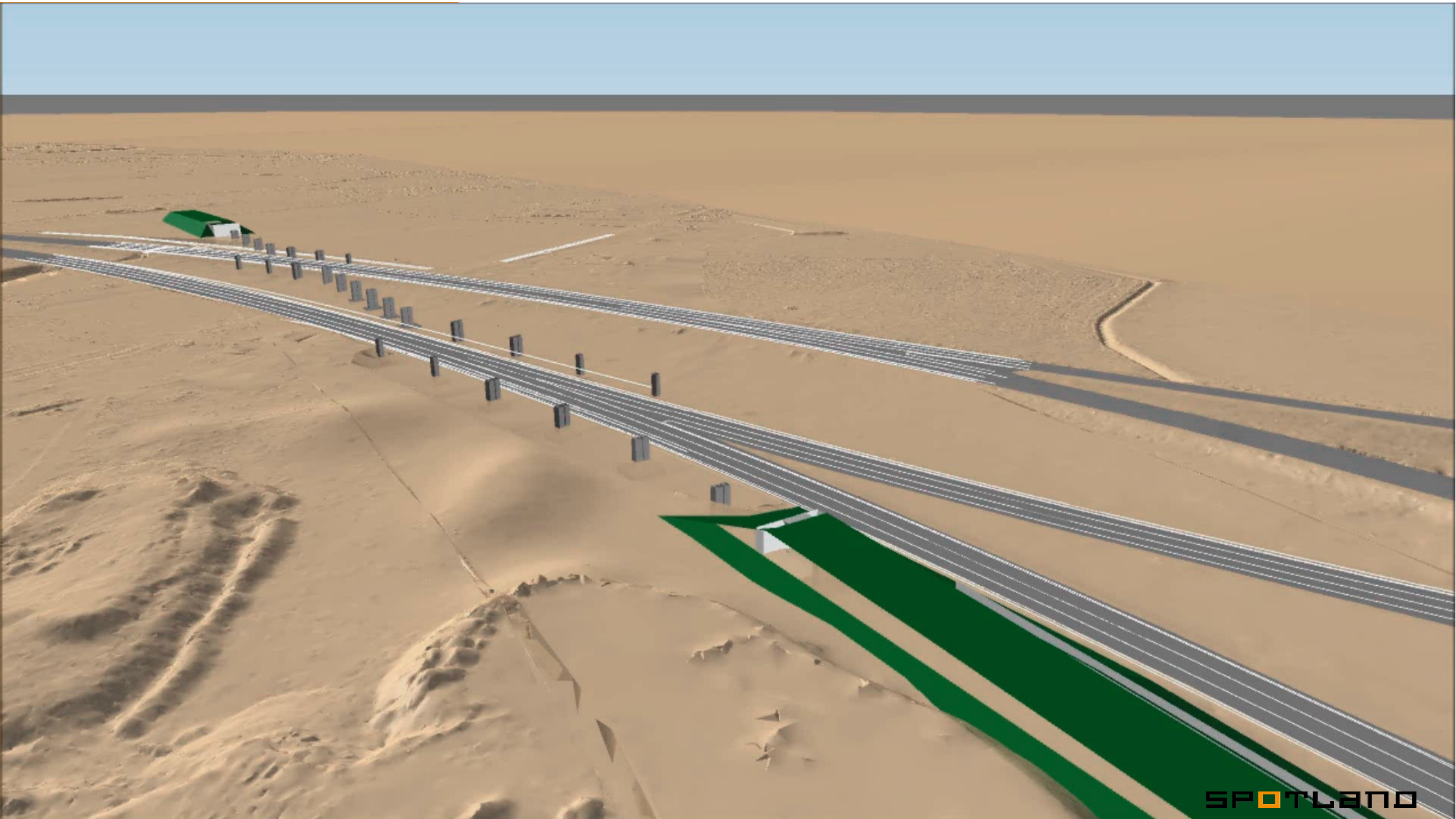
- Placement of cranes
- Easier to identify flaws in the process with 3D



Visualization/Simulation

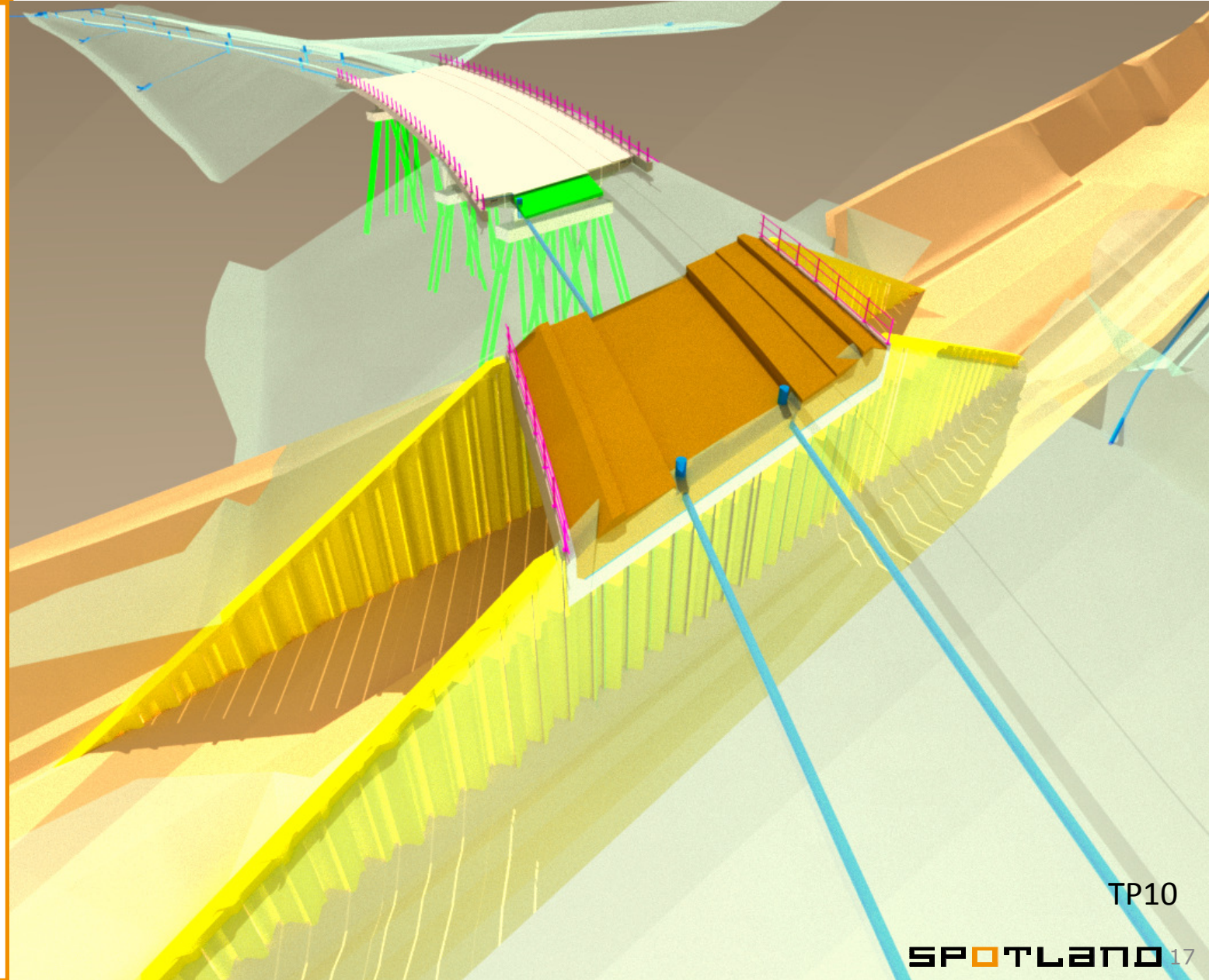
- Placement of cranes
- Easier to identify flaws in the process with 3D
- Discovered we needed to add gravel pads for the cranes
- Volumes from gravel pads were included in tender
- 4D model of construction





QA of design

- **Aggregate model**
 - Combines all discipline models
- **Visualization**
 - Navisworks/Infraworks
- **Updated while the project is ongoing**
 - Model contains up to date information
- **Obviously relies on amount of models available and their quality**

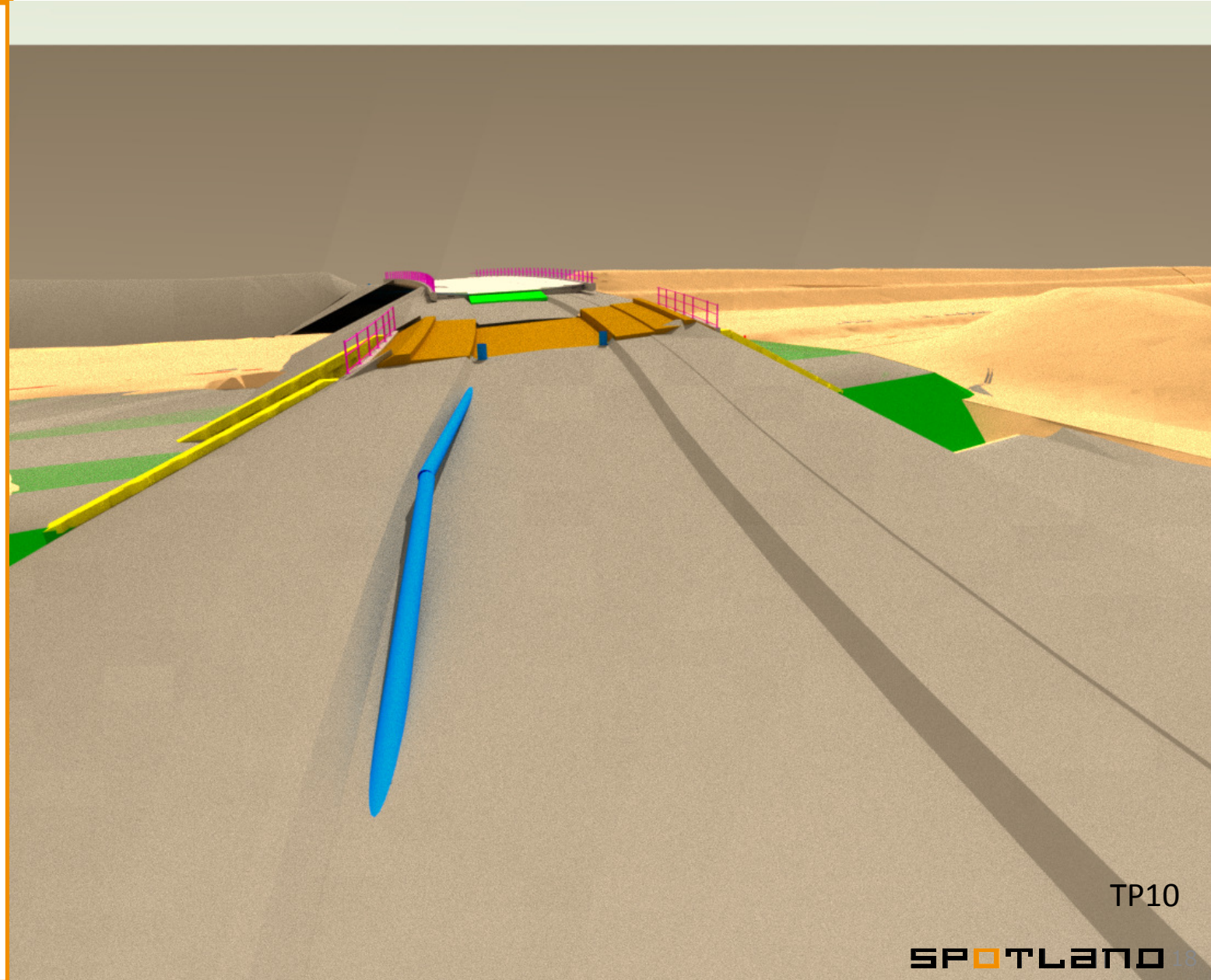


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QA of design

- Visualization
- Input to planning meetings
- Basis for discussion
- Easier to identify errors
- Reduces risk



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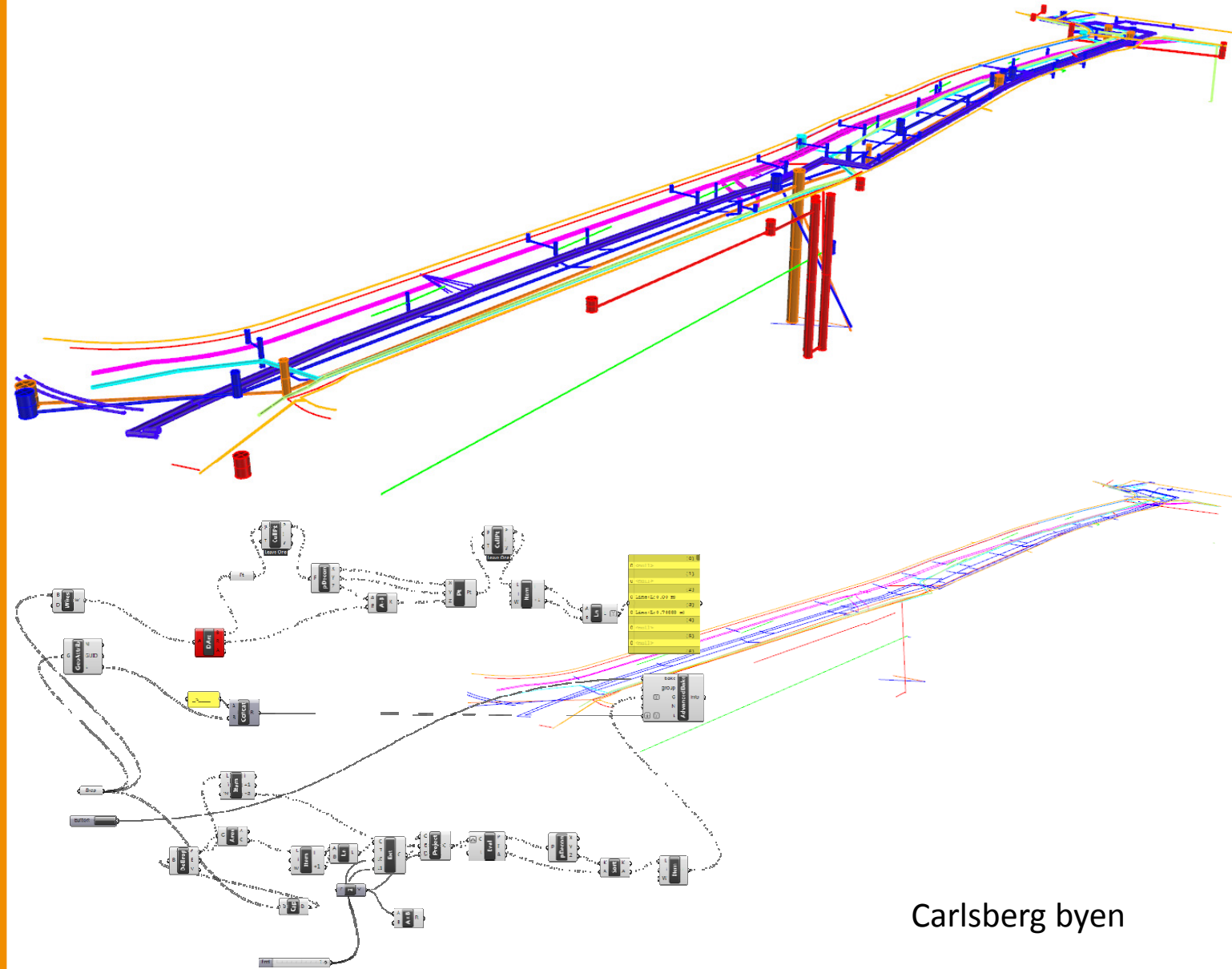
QA of design

- Faulty 3D models delivered
- Remodelled correctly from construction drawings
- Used for setting out and visualisation of the project



Data reduction

- Models are sometimes too detailed for machine guidance.
- Complex pipe system with many existing and new pipes
- Extracting the essential for machine guidance (The bottom line in 3D)



Carlsberg byen

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Drones/UAVs

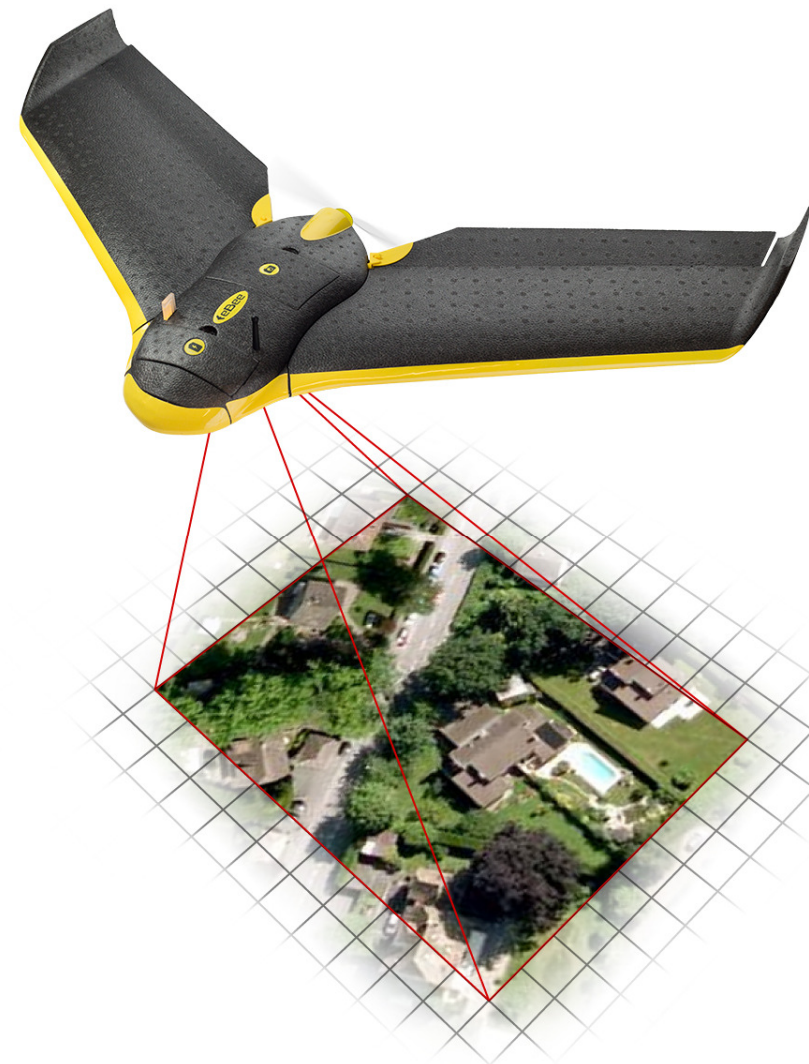
- **Spotland got permission in October 2015 to fly with UAVs in Denmark and Sweden**
 - We are currently the only company in Denmark with permission to fly across rail- and motorways.

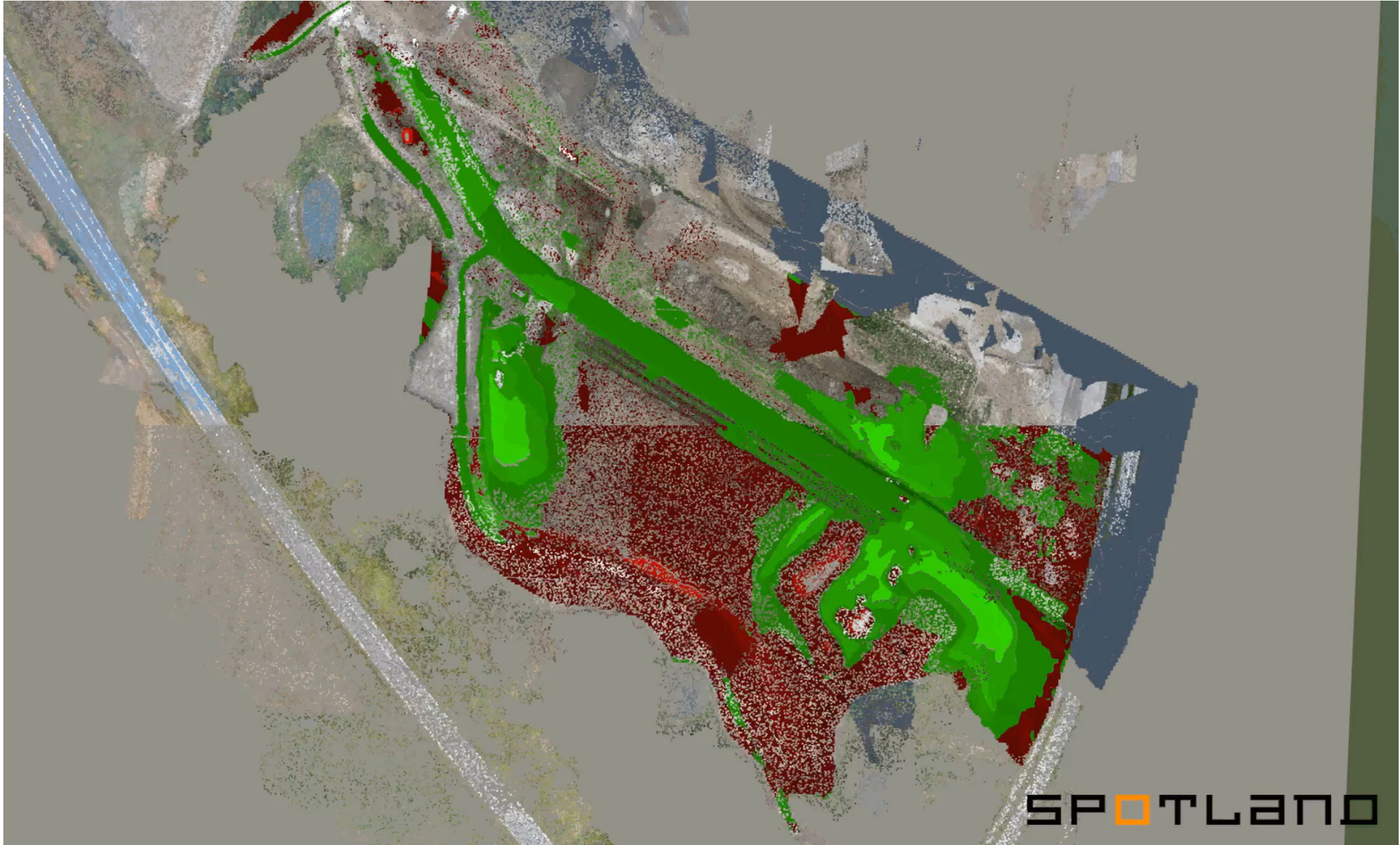
- **Drones:**

- Fixed wing – eBee RTK
- Quadcopter – albris

Usage:

- Fotogrammetry
- Ortofotos
- Point Clouds
- Inspections
- Videos and visualizations

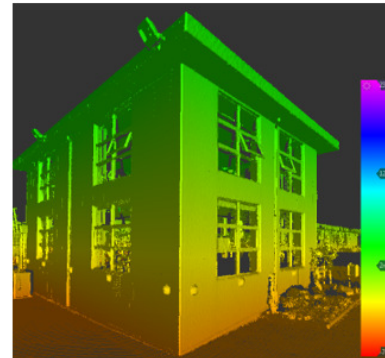
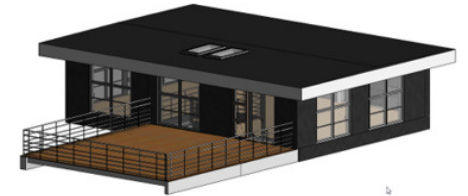
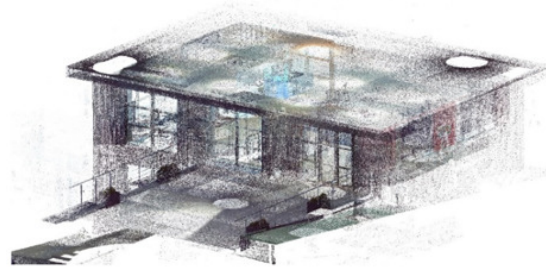




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Scan to BIM

- Scanning
- Point cloud work
- BIM modelling from the point cloud
- Applies to buildings, bridges, tunnels etc.





- **Scanning inside**

- **Point Cloud – for BIM models**
- **Pictures**

- **Indoor Mapping**

- **Indoor navigation comparable to “street view”**
- **Useful to find your way indoors at fx conferences, messe, hospitals etc.**

- **Scanning inside**

- Point Cloud – for BIM models
- Pictures

- **Indoor Mapping**

- Indoor navigation comparable to “street view”
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Robots in Scotland

- Setting out points on plane surfaces
- Markings on roads
- Surveying As-Built
- Reduced risks for surveyors on projects close to high speed roads



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- Questions?

Thank you for listening

Feel free to reach out to us:

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