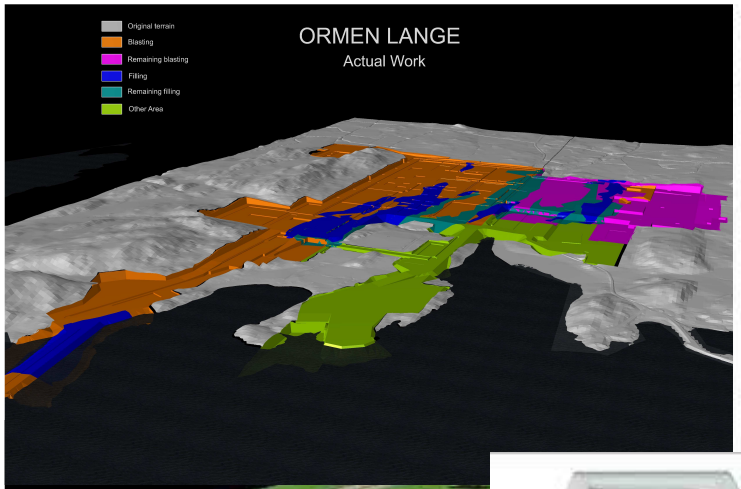
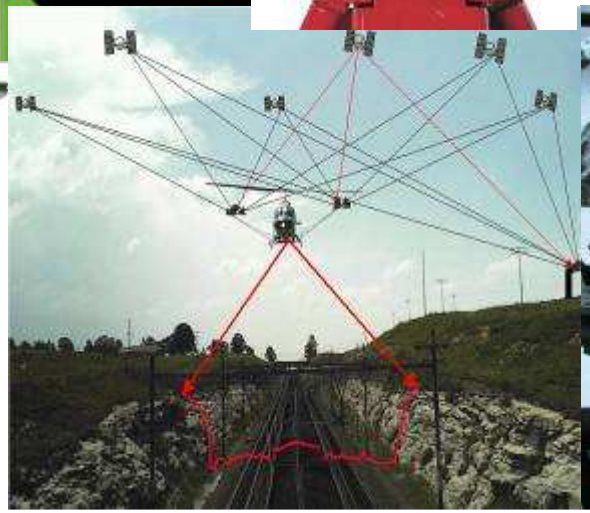
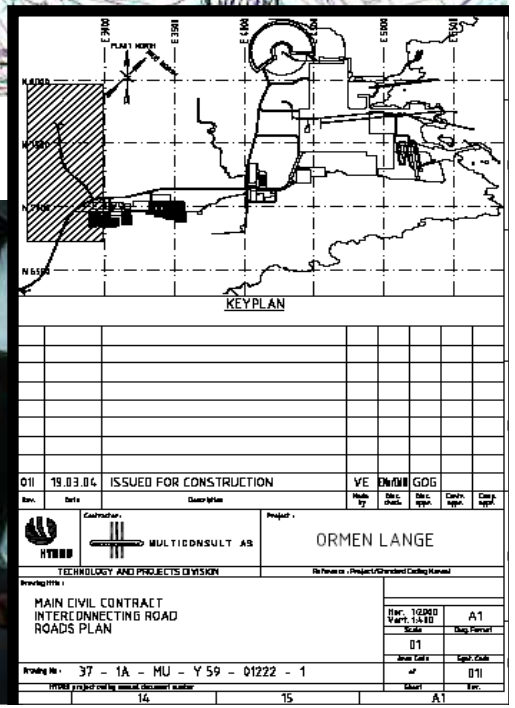
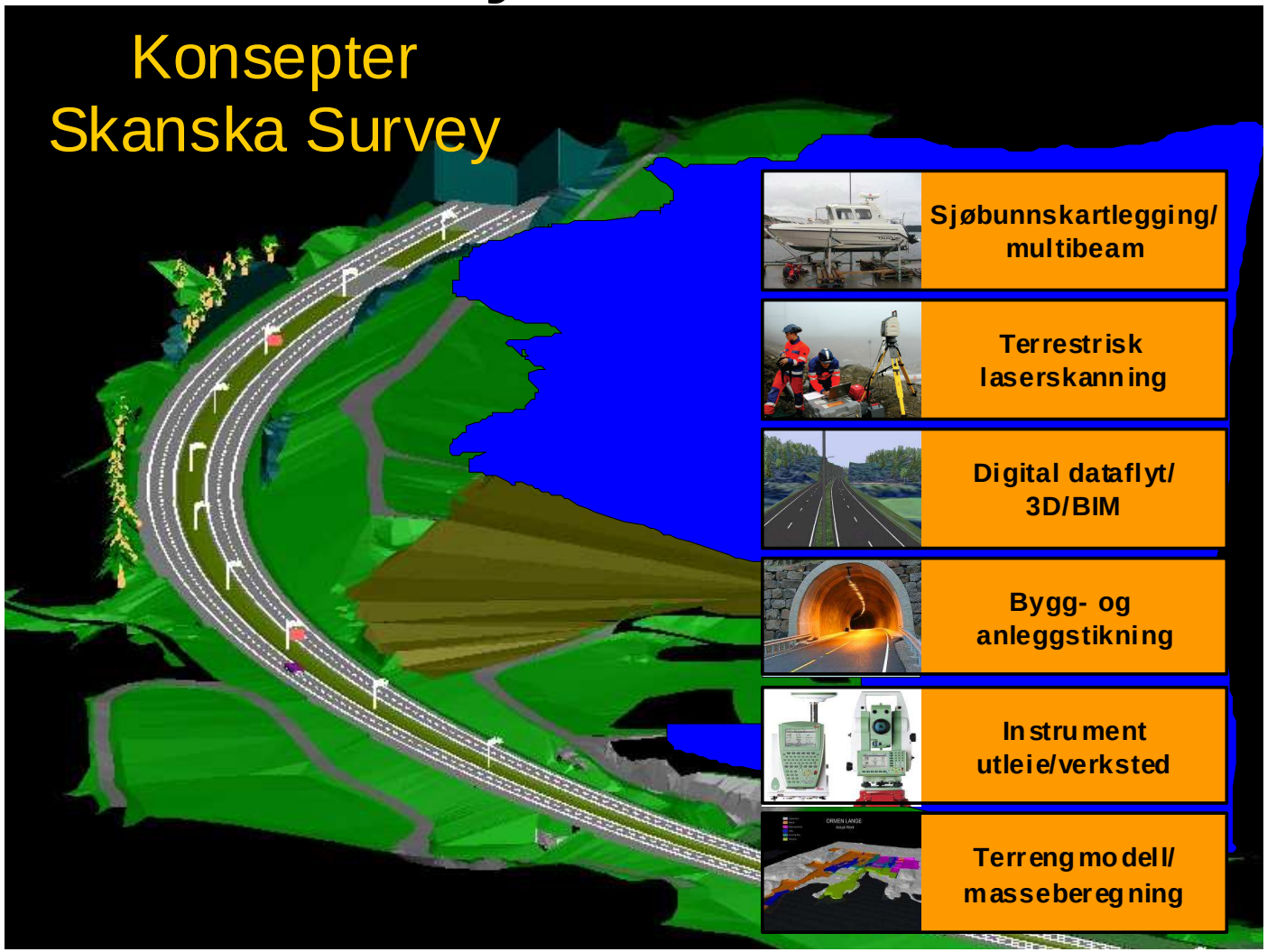
Machine guidance.
Skanska Norge AS







Skanska Survey



- Offices in:
  - Bergen
  - Stavanger
  - Trondheim
  - Oslo
  - …but do work all over Norway

- 60 co-workers. (of a total of 100 survey engineers in Skanska)
- Supports Skanska's projects. Surveying, data-flow, mass calculation, documentation etc. "Problem solvers"
- Work for others too. (NCC, Veidekke, ….)
- Top of the line hw/sw.

Important projects

(total contract sums 4,5 billion NKr)

OPS E39 (BOT)
Orkdalsveien

Ormen Lange MCC/MIC

The Bjørvika Project –
Submerged Tunnel

SKANSKA

Machine Control
Civil Construction
Skanska Norway

Graders (3 systems)

Tunnel drilling rig (10 systems)

Sea vessels (3 systems)

Digital construction data

Dozers (8-10 systems)

Excavators (40-50 systems)

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3D dataflow for civil construction earth moving

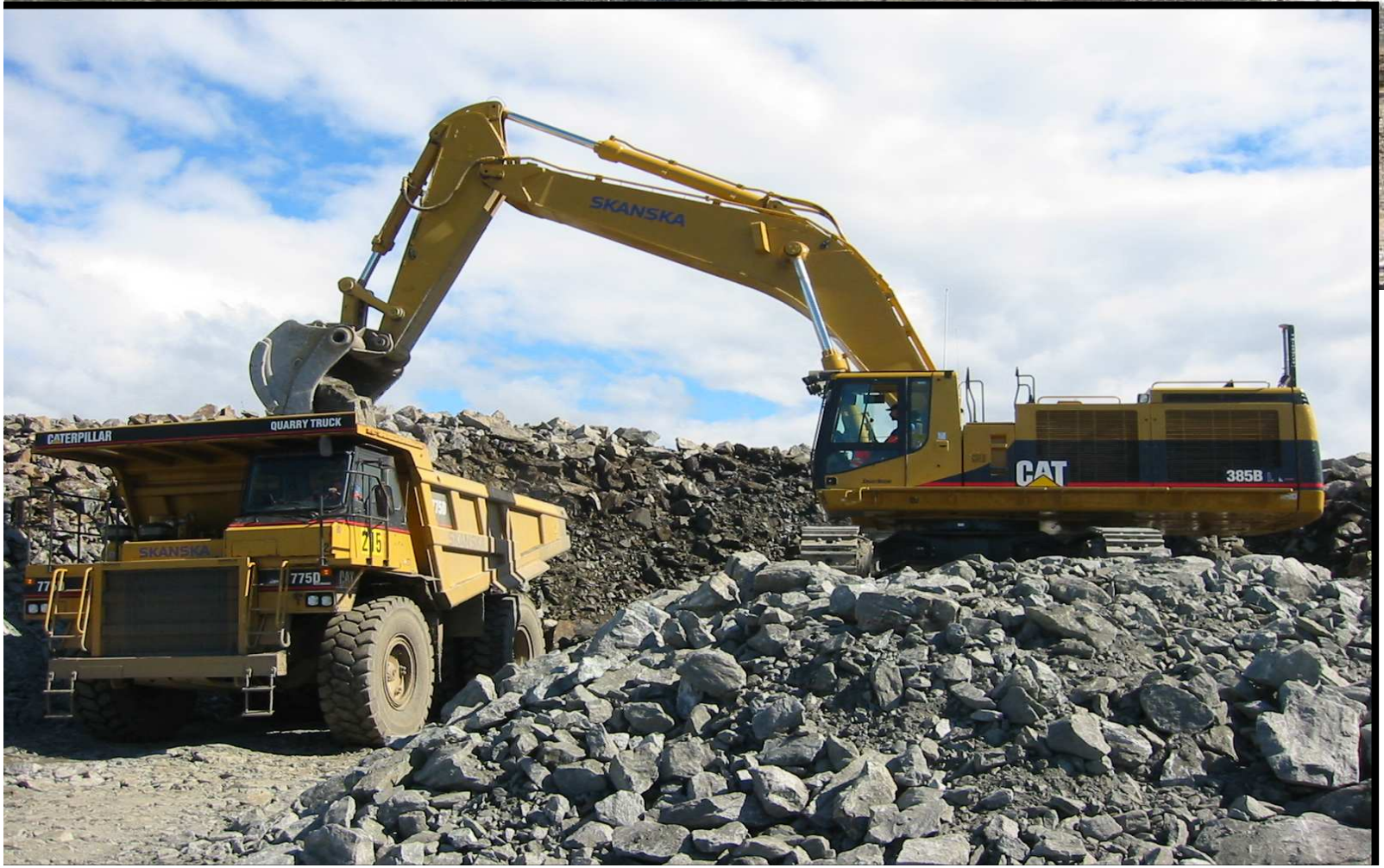
- Used machine guidance the last appr. 8 years
- Program system Microfyn/GeoRog (others) have been used up til now
- Using roadmodels, dtm etc.
- Machine Guidance in almost all earth moving projects today
- All operators wants machine guidance
- Have increased productivity a lot
- We are producing faster and with fewer mistakes
- Digital data from Novapoint, Geo, Bentley etc.

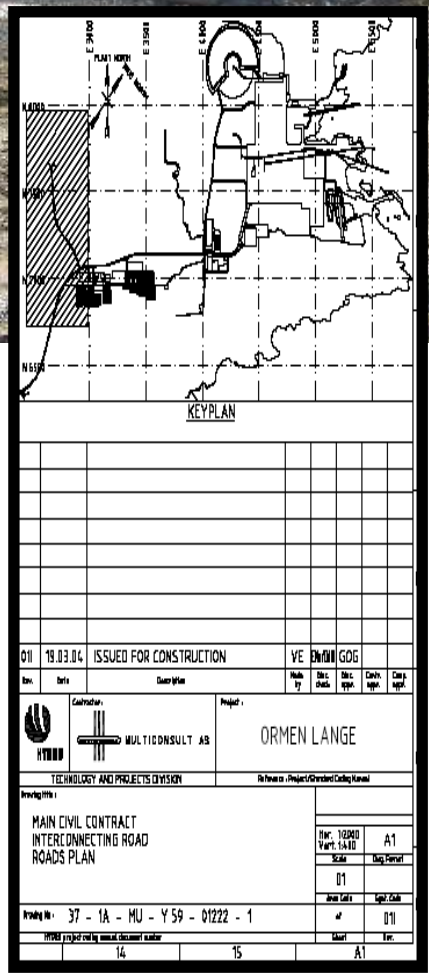
- Main challange: Correct and updated 3D digital data from designer via contractor to operators

Operators view

SKANSKA

HOW STUFF WORKS





GPS-signals

Reference station

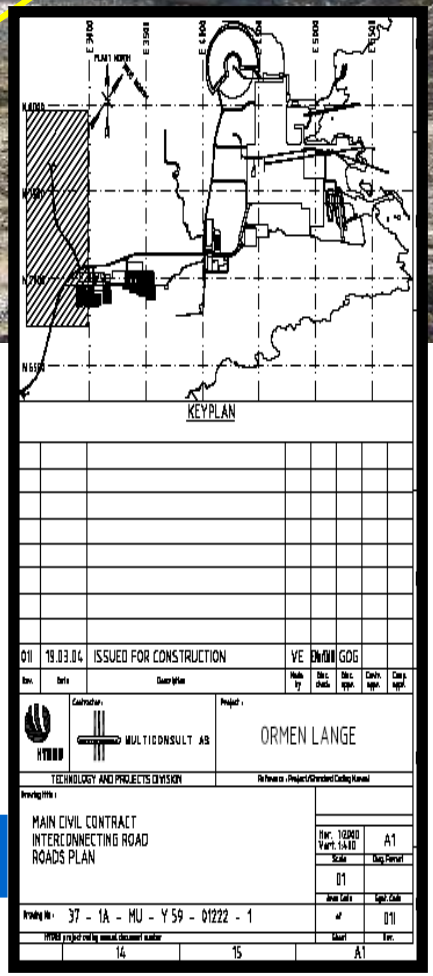
Radio signal

GPS-signals

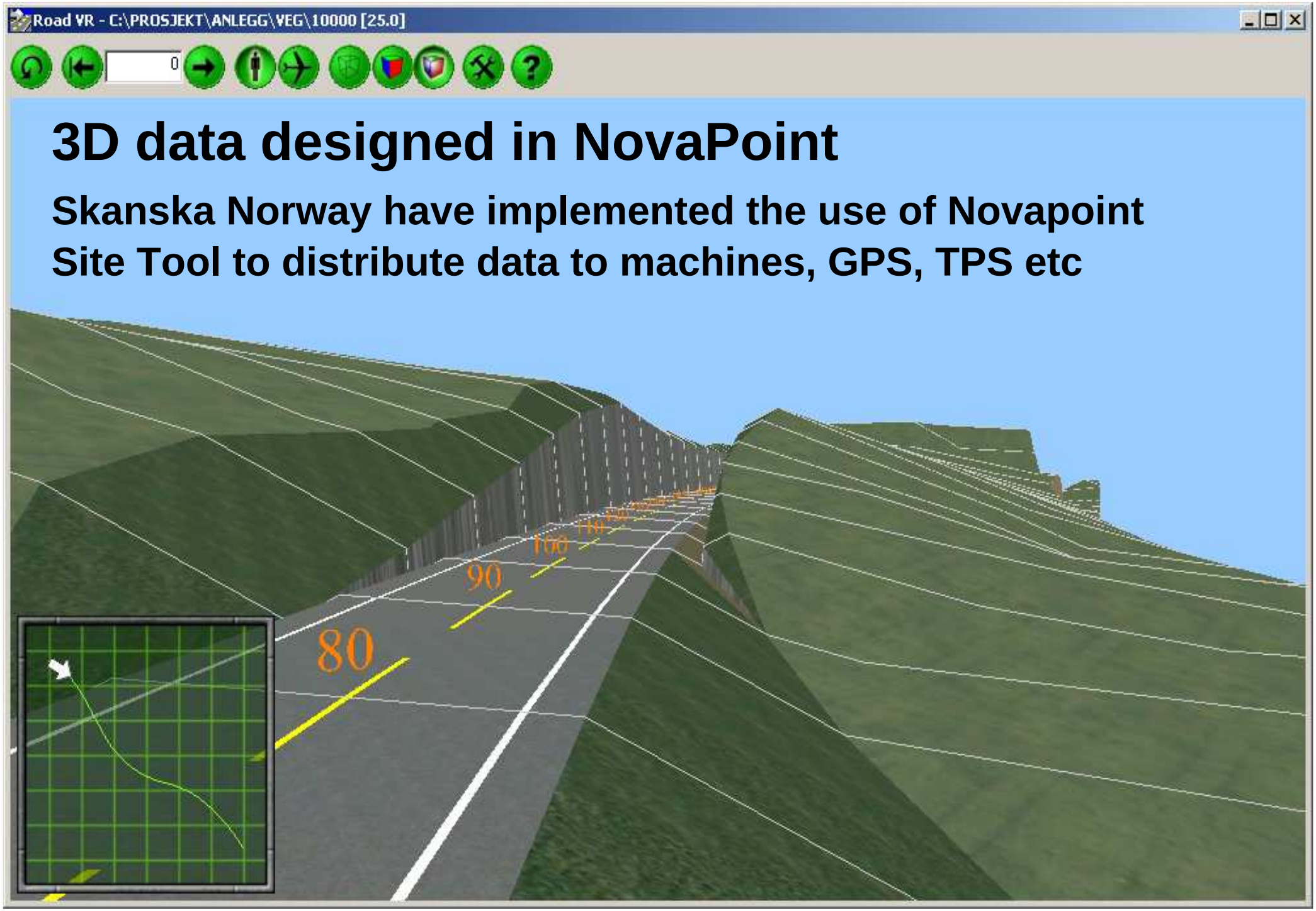
Radio-antenna

GPS-antenna

3D Digital Drawing



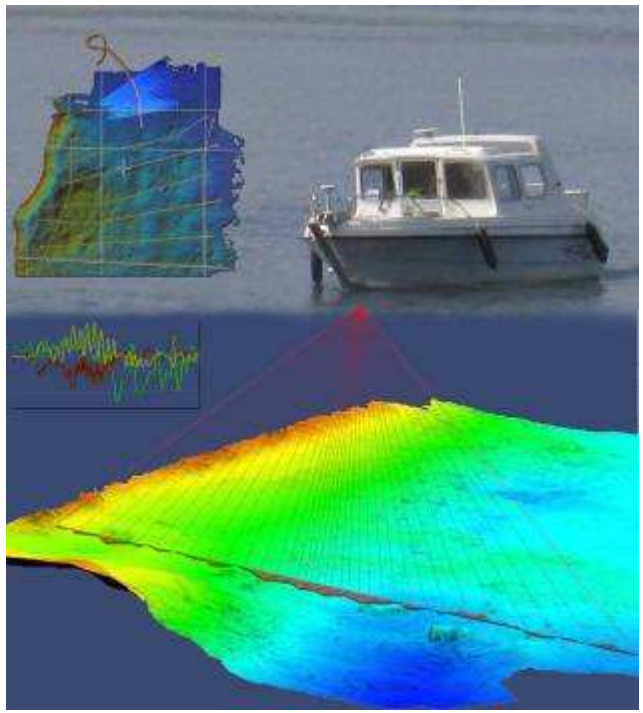

Angle-sensor
Baseline
Coupling
GPS-antenna
Controllbox
3Dmachine PC program
Change of angle
SKANSKA
QUARRY TRUCK
SKANSKA
775D
CAT


Road VR - C:\PROSJEKT\ANLEGG\VEG\10000 [25.0]
0
3D data designed in NovaPoint
Skanska Norway have implemented the use of Novapoint
Site Tool to distribute data to machines, GPS, TPS etc
80
90
100

3D dataflow for civil construction marine operations

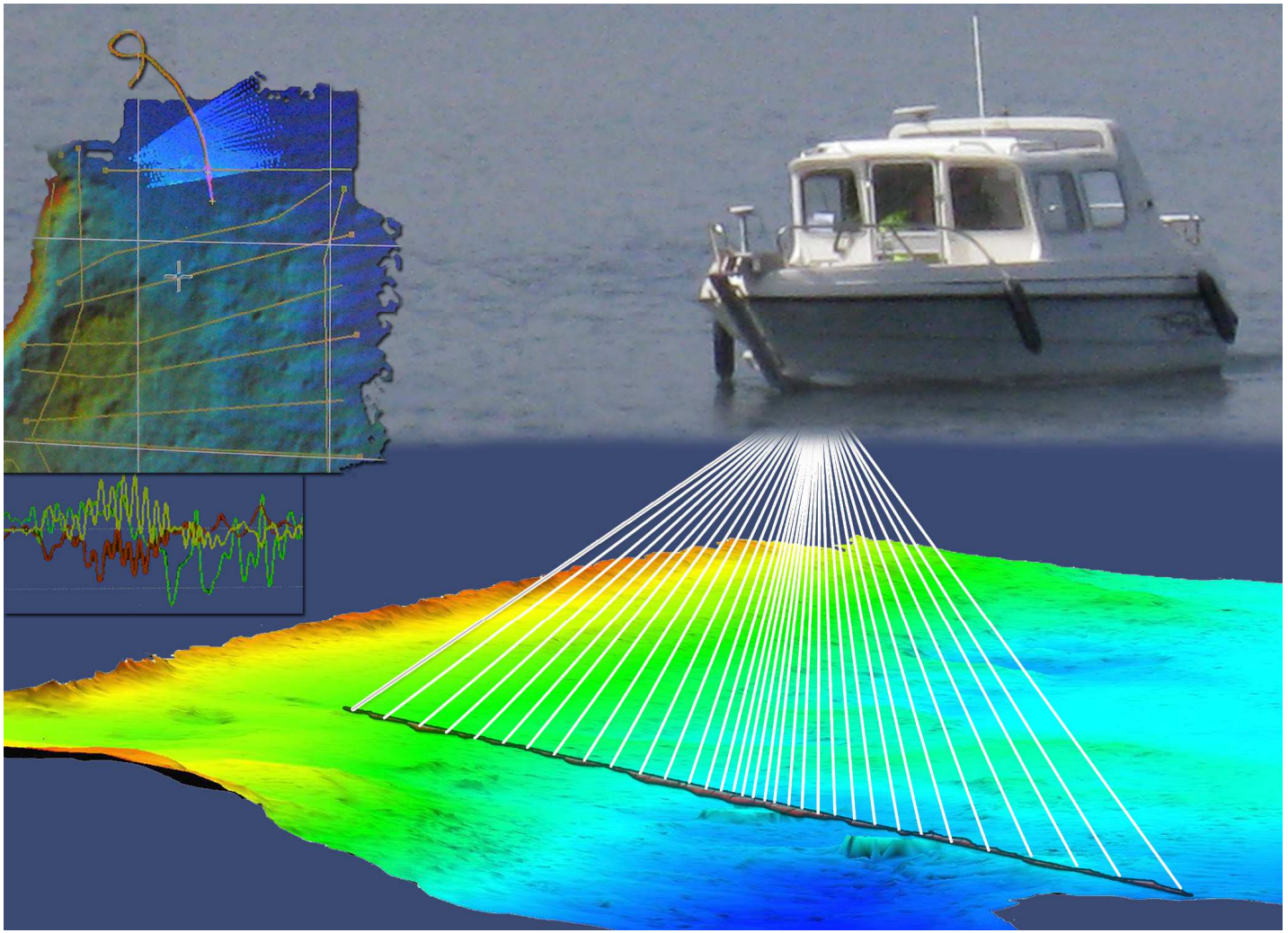
- All sea vessels are beeing operated with GPS and 3D data
- Using a systems developed by Prolec (UK) after Skanska specifications
- 3D Systems for dredging and piling
- Data transfer from 3D modell to computers onboard
- Skanska Norway measures seabottom and updates the model with these data
- Operators can see the terrain dissapearing as they dredge
- Colors indicators of levels and target levels
- Computers shows all operations and movement of dredging

- Challenge: Correct and last revision of 3D data onboard

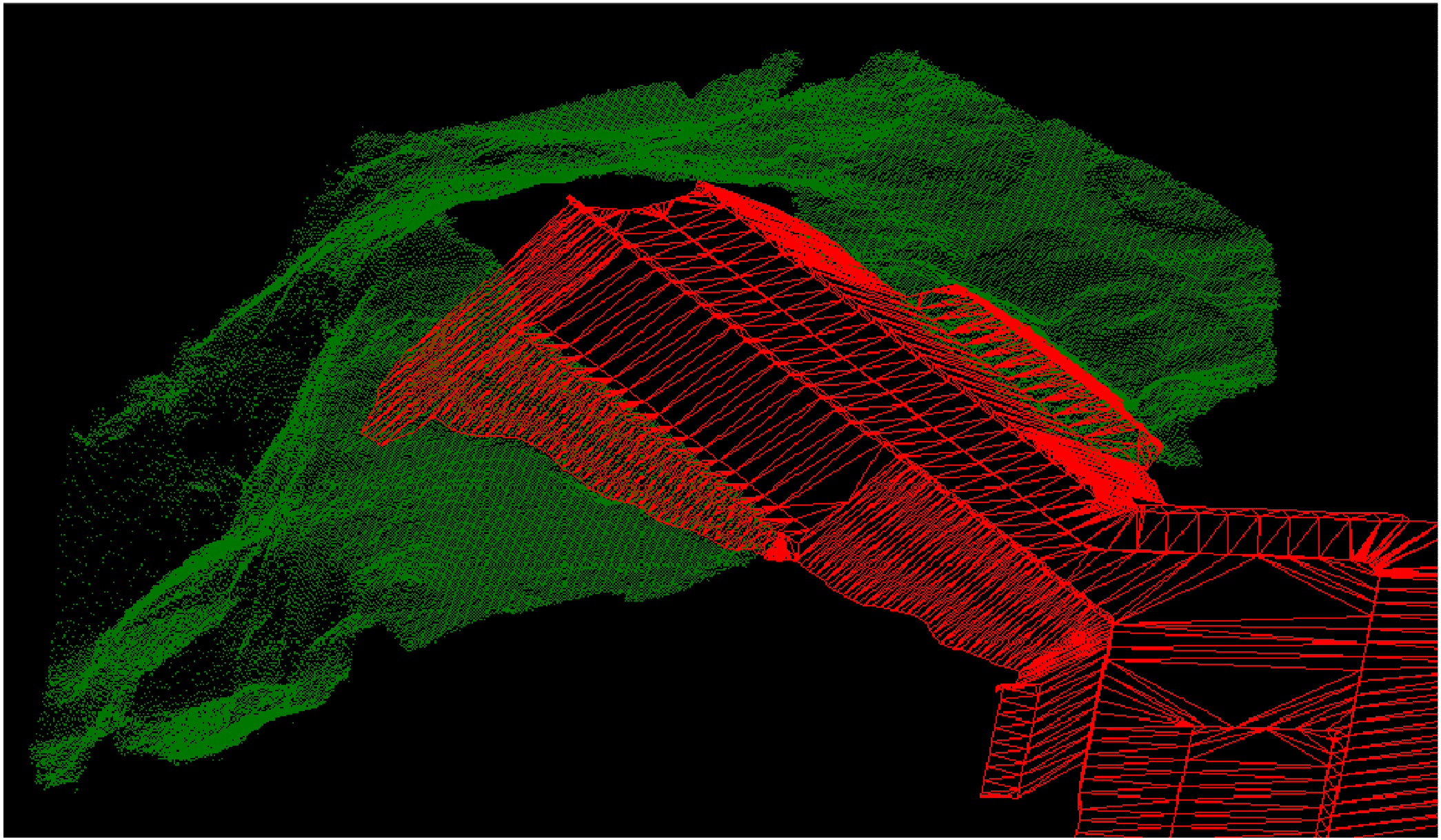


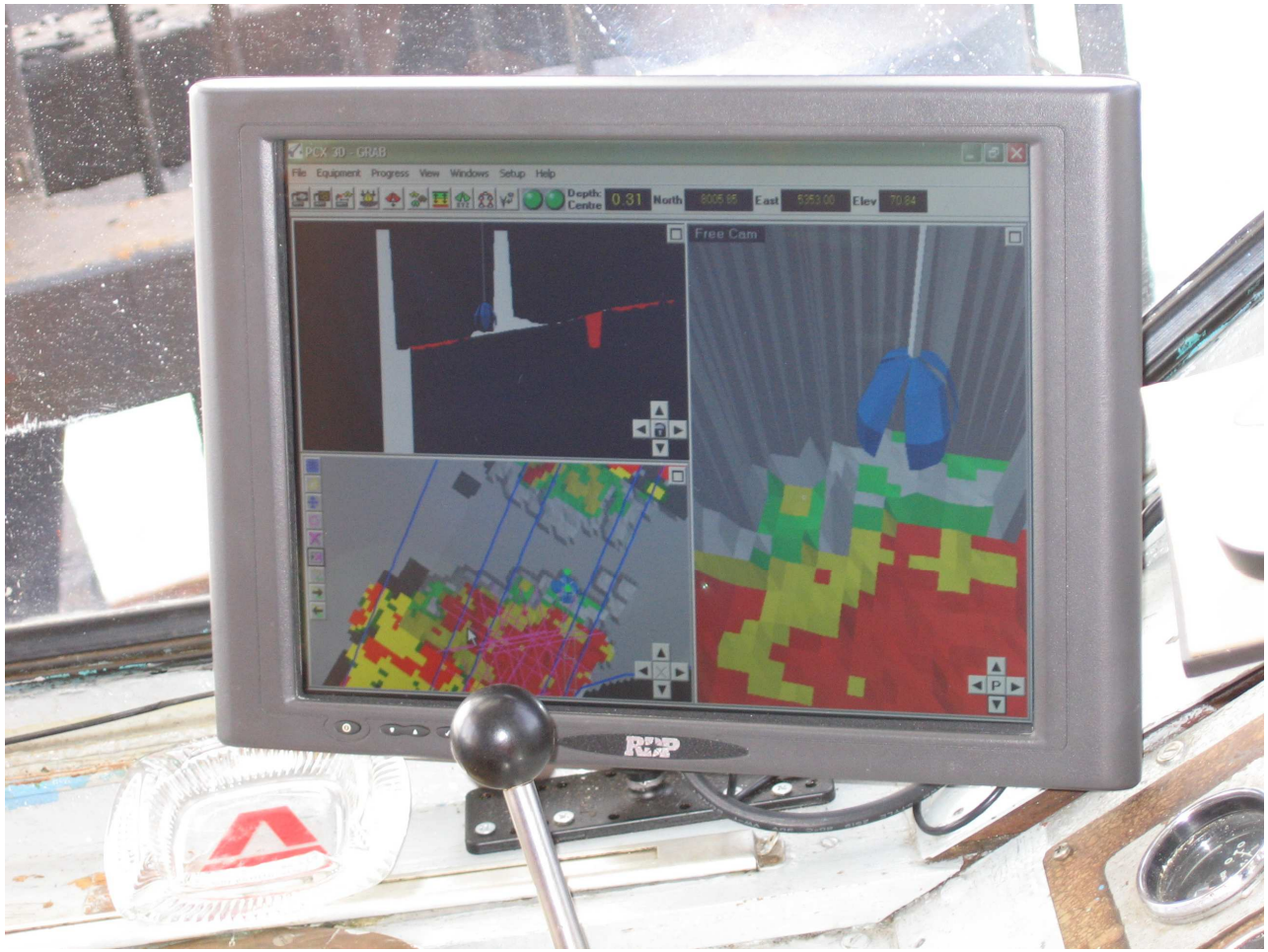
Dredging
GPS-operated with 3d modell onboard

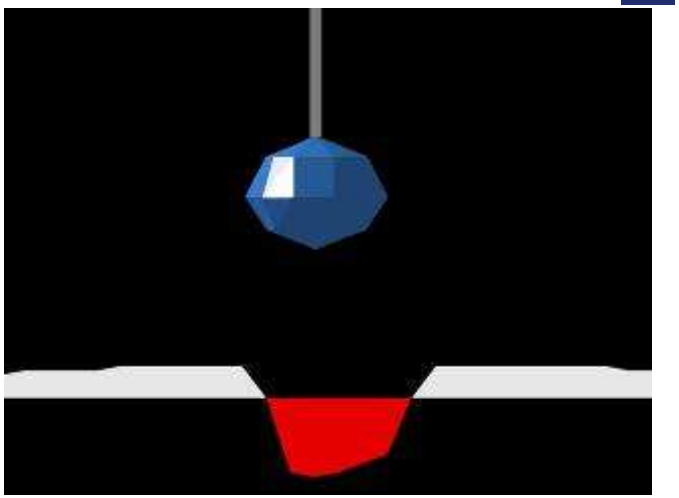
Surveying AS-IS before starting operations

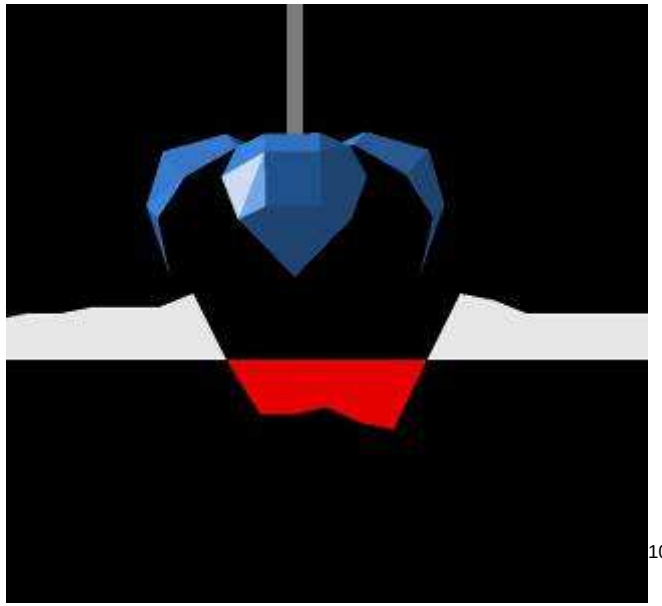


Molo, Product Jetty

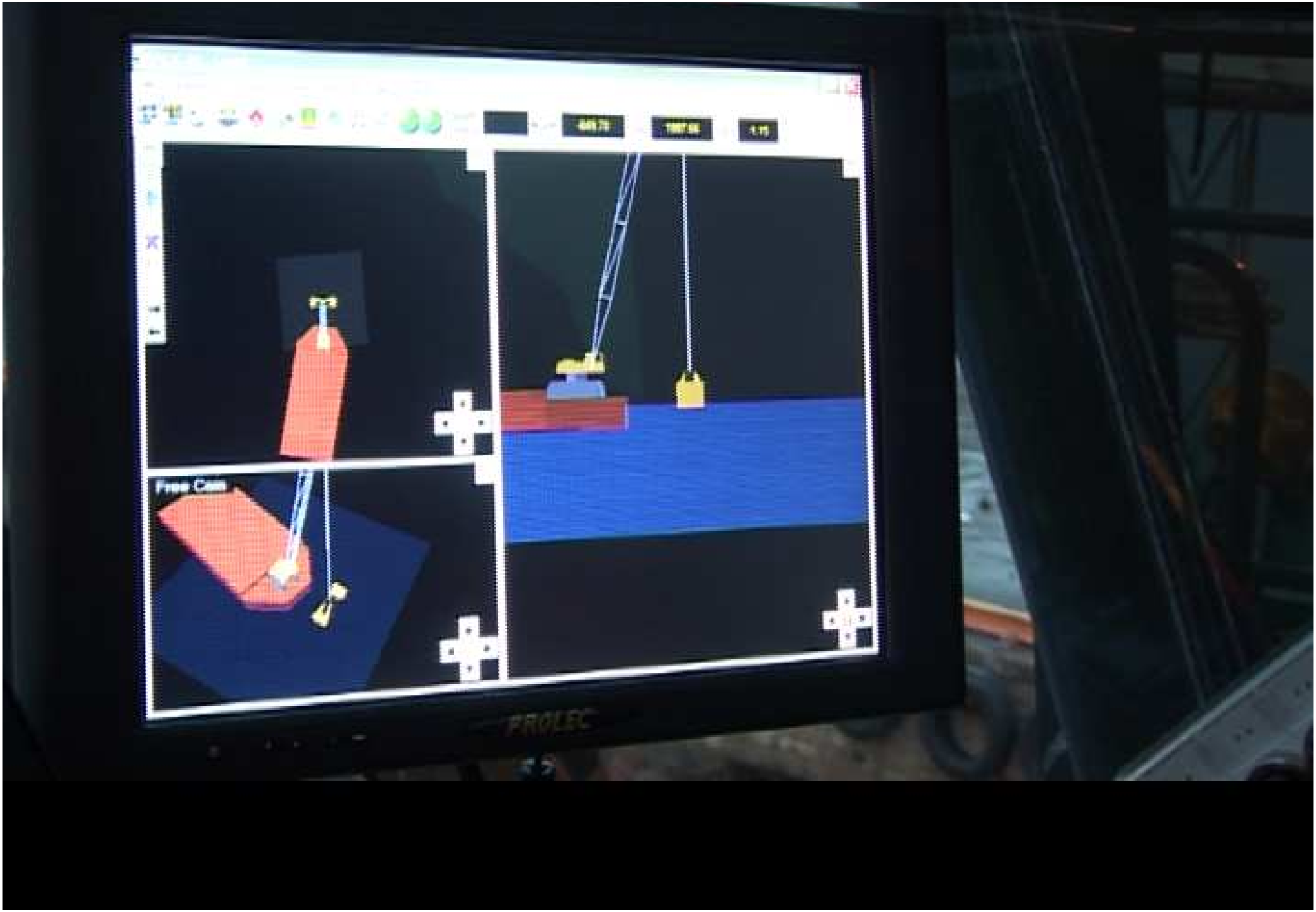



PCX 3D - GRAB
File Equipment Progress View Windows Setup Help
Depth: Centre
0.31
North
East
Elev
Free Cam

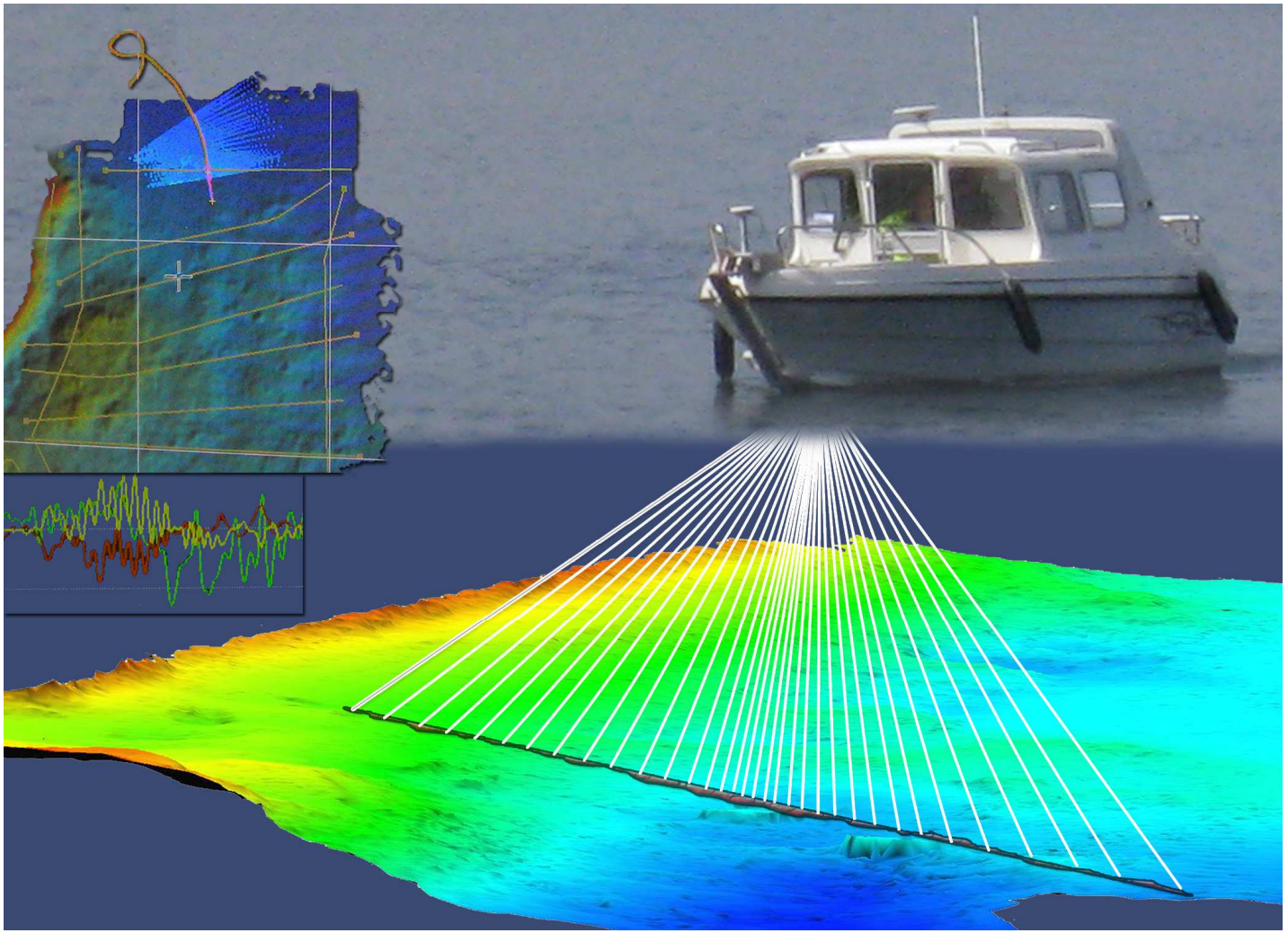




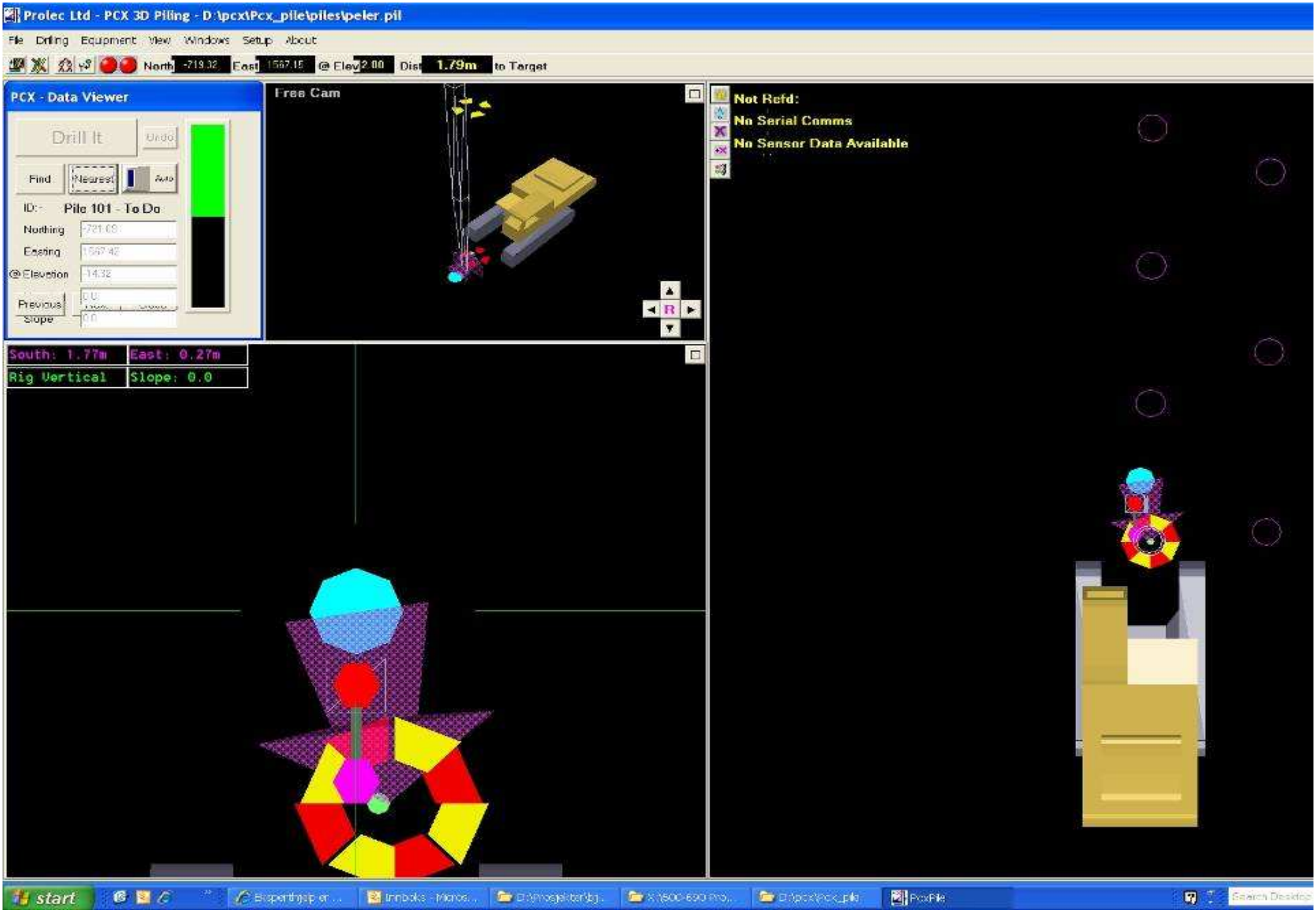
SKANSKA

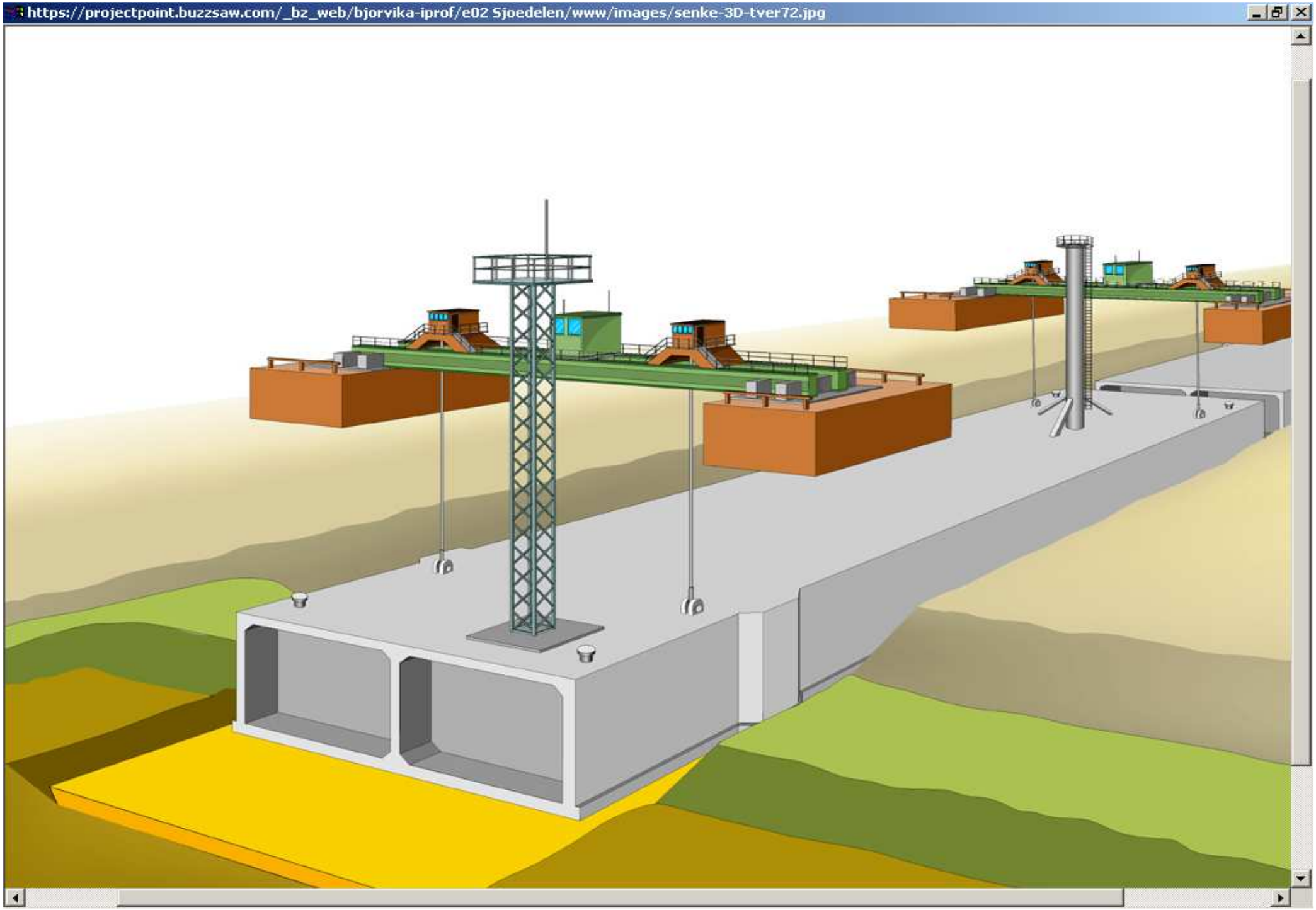

Free Cam
PROLEC

Surveying for documentation and mass calculation



- Piling in Bjørvika , Oslo
  - Brage is equipped with piling system


Prolec Ltd - PCX 3D Piling - D:\pcx\Pcx_pile\piles\peler.pil
File Drilling Equipment View Windows Setup About
North -719.32 East 1567.15 @ Elev 2.00 Dist 1.79m to Target
PCX - Data Viewer
Drill It
Undo
Find
Nearest
Auto
ID: Pile 101 - To Do
Northing -721.03
Easting 1567.42
@ Elevation -14.32
Previous
Slope 0.0
Free Cam
Not Refd:
No Serial Comms
No Sensor Data Available
South: 1.77m
East: 0.27m
Rig Vertical
Slope: 0.0
start


https://projectpoint.buzzsaw.com/_bz_web/bjorvika-iprof/e02 Sjoedelen/www/images/senke-3D-tver72.jpg

Civil construction underground

- Tunnelgeometry (road and tunnel) from designer
- Skanska is using Bever Team to produce drill plans, theoretical sections, scanning etc
- Several tunnelrigs with full sequence drilling systems
- Using Bever Team and Atlas Systems for operators
- Scanning with Bever and Leica Scanners for documentation

- Using **Novapoint Tunnel** for complete 3D dataflow from designer to contractor

Operators view

SKANSKA

Digital dataflow in tunnel projects

Novapoint VIPS

Digitale modeller

BEVER TEAM 3.0

Atlas Copco

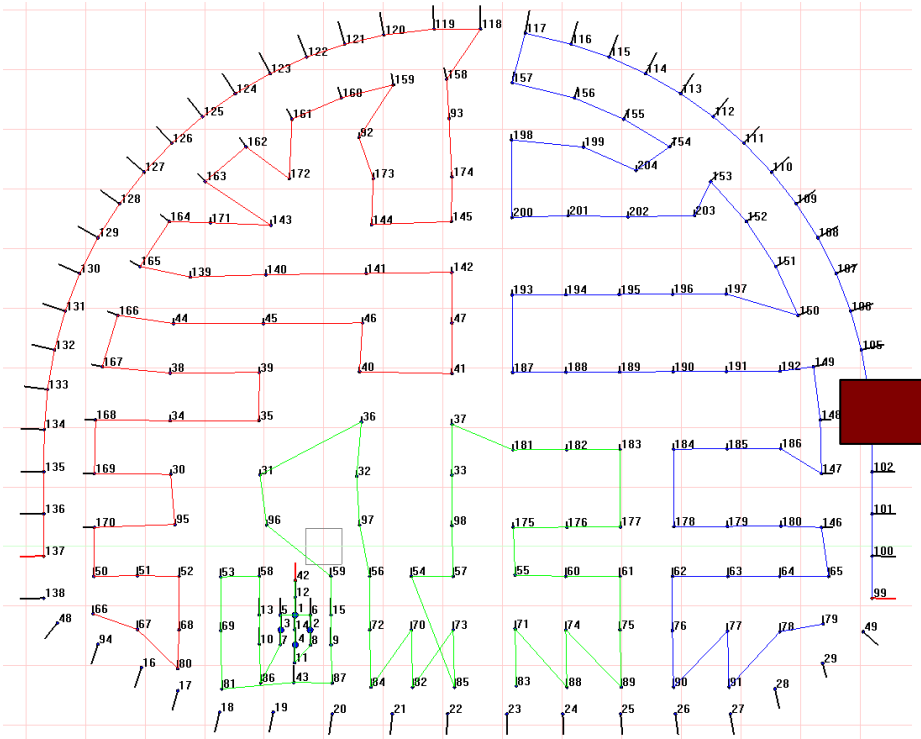
AMV ETABL. 1860

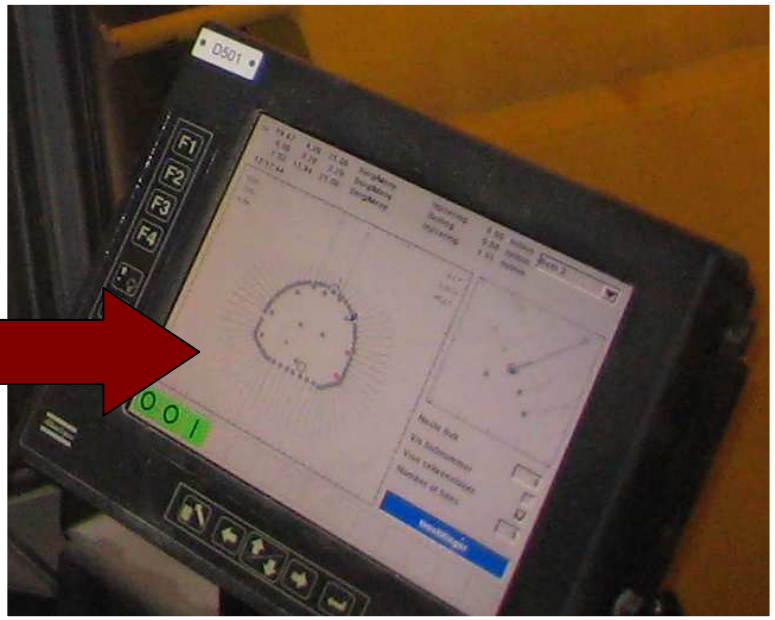
ESSVERK

- Design data direct from designer to tunnel programs
- Open formats used for machine guidance and surveying (LandXML, IREDES XML)
- The contractor saves time, and have greater assurance that it is correct

Advanced machine guidance

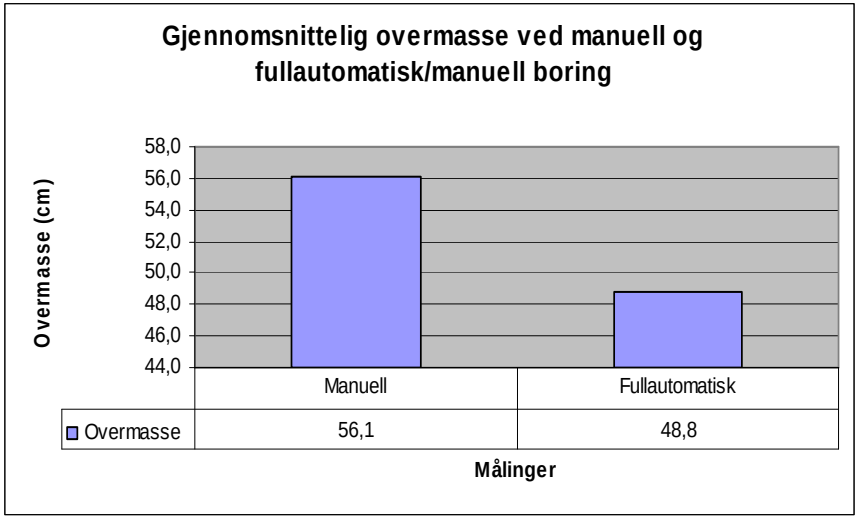
- Automated drilling

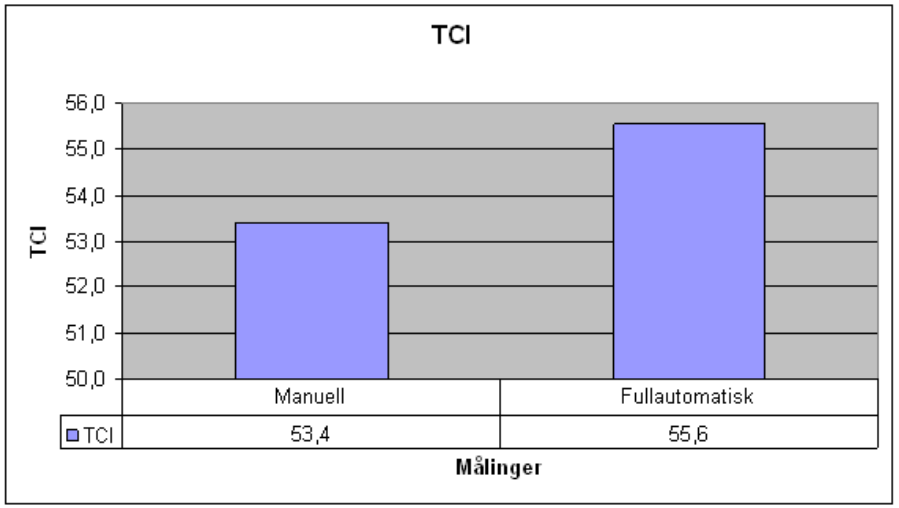




Automated drilling

- Increased quality
- Smoother contour
- Less blasting





VIPS - SiteTool – Geo – GeoROG/Leica

Novapoint

Site Tool

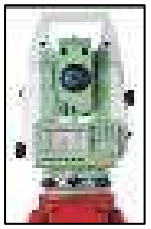
LandXML
Stringlines

SBG·GEO

RoadRunner
data

Survey
data

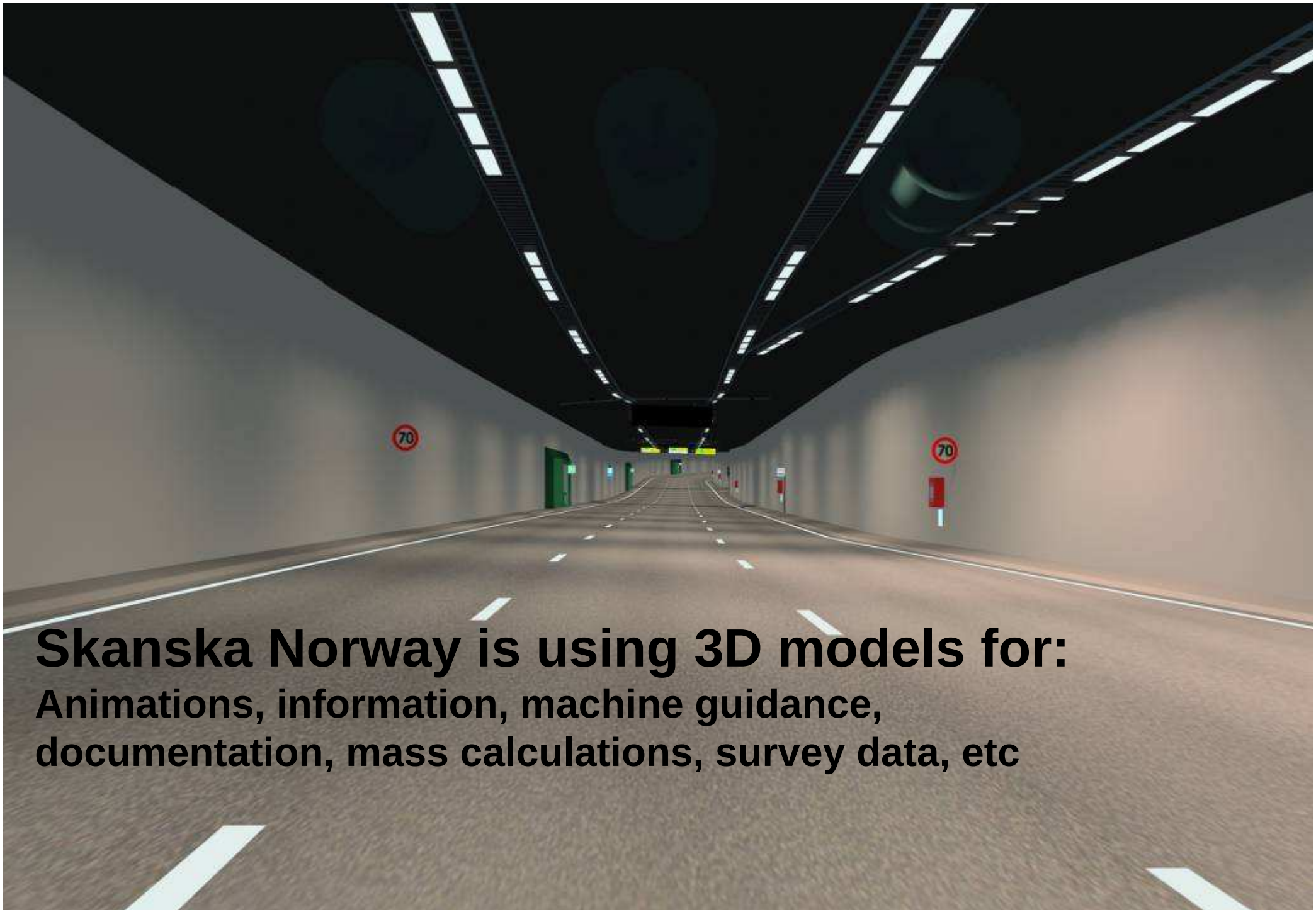
Stringlines
DTM



GEO·ROG

Export from Site Tool

- Roadlines/Stringlines
- Horizontal-geometry
- Vertikal-geometry
- Terrain-model (DTM)
- Koordinates (XYZ)

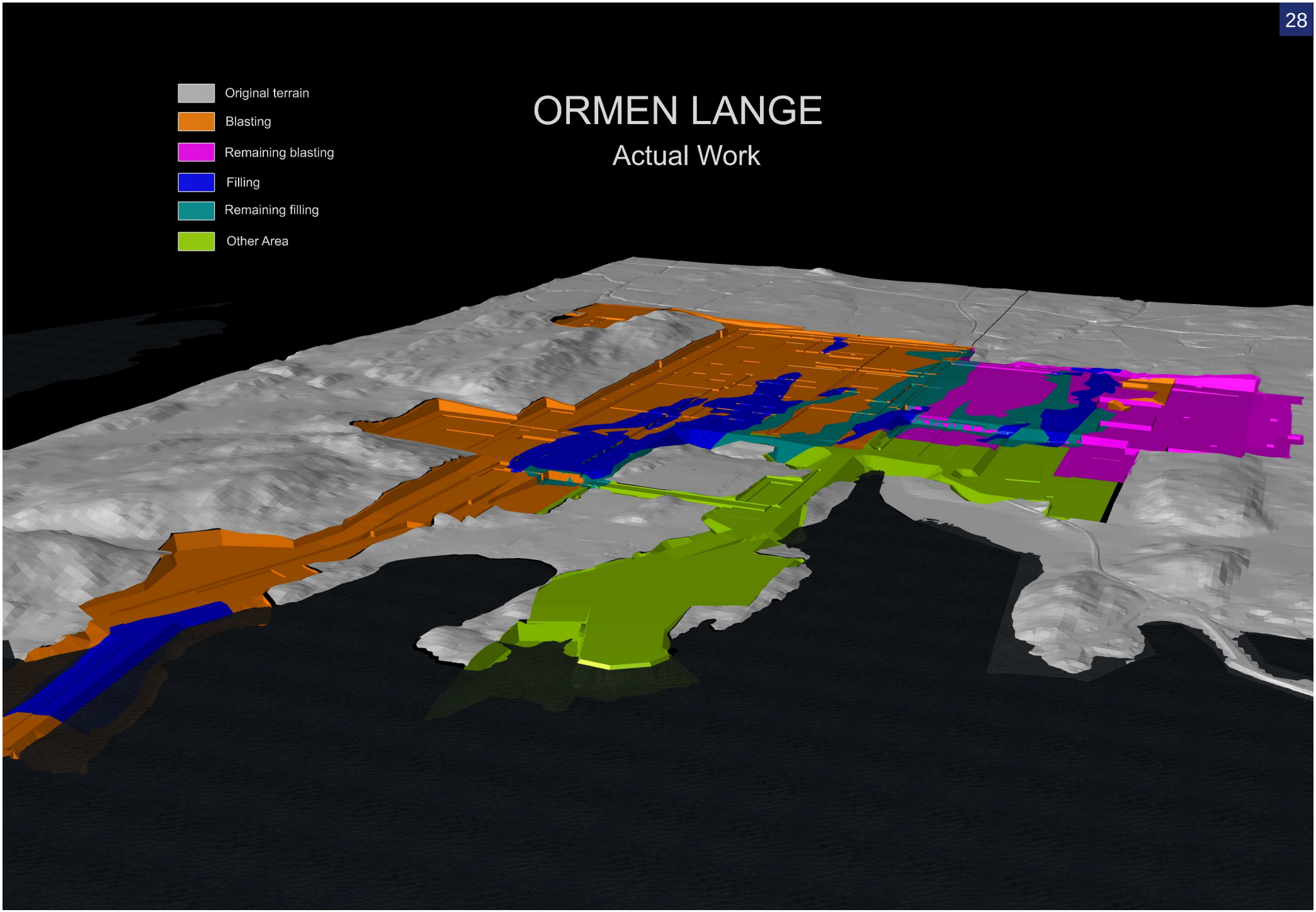


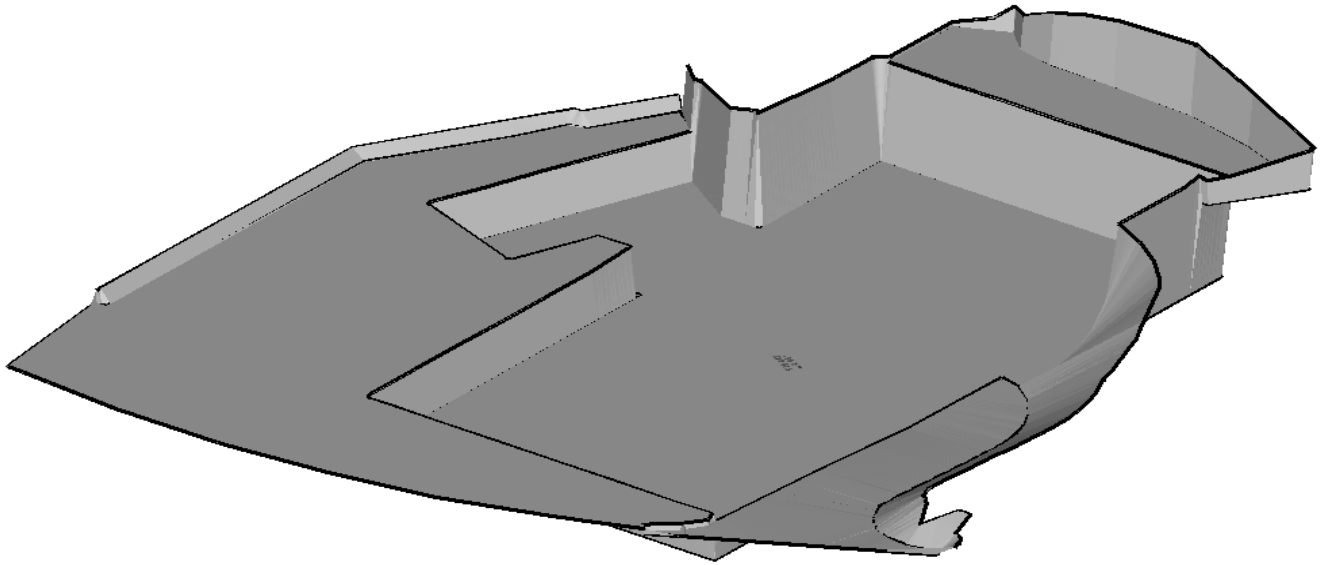
Skanska Norway is using 3D models for:

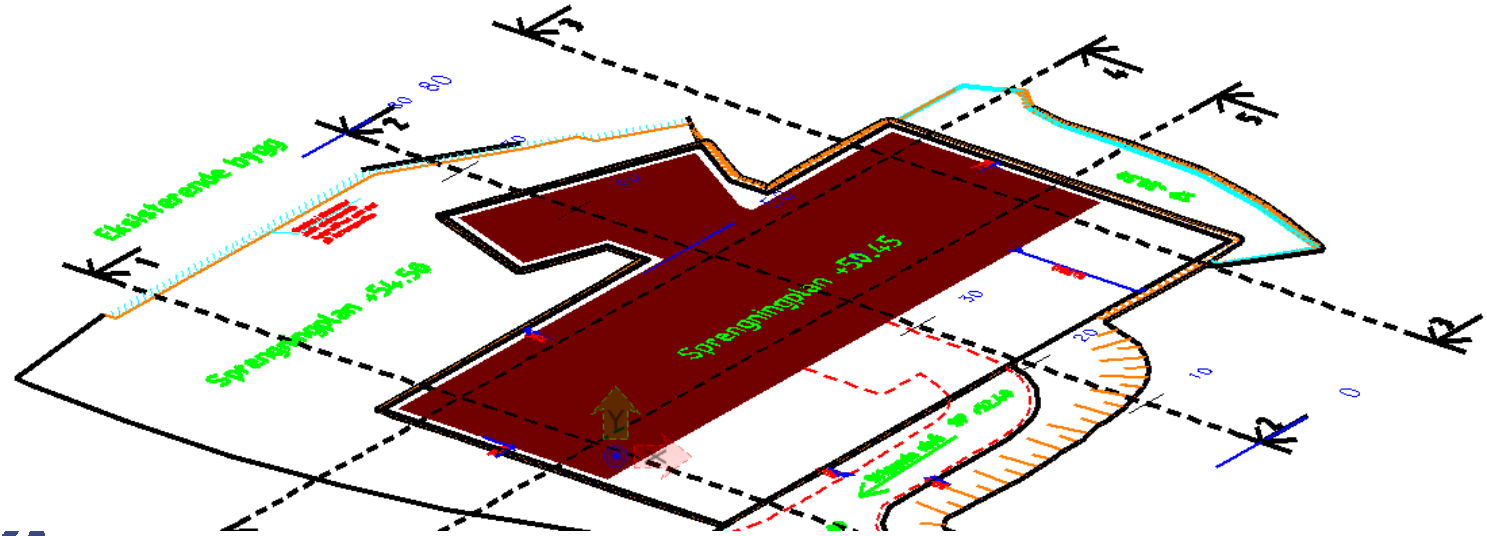
Animations, information, machine guidance, documentation, mass calculations, survey data, etc

ORMEN LANGE

Actual Work






Befintlig byggnad
Sprängningsplan +51,50
Sprängningsplan +50,45
80
60
40
20
0
30
20
10
0


0.11
MIKROFYN
XC 3D
0.00
MENU
F1
F2
F3
F4
F5
F6
Project test2
HeightRef test2
Screen 3DTop
ToolPoint Middle
Unit Metric
Surface test2
Line
Profile
Point
GPS No pos
Sats 0
CQ 99 cm


0.11
MIKROFYN
XC 3D
0.00
MENU
F1
F2
F3
F4
F5
F6
Long 0.0 %
0.00
0.11
Cross 0.0 %
GPS No pos
Sats 0
CQ 99 cm

Advantages with machine guidance:

- Increased productivity
- Fewer production errors
- Less dependent on the surveyor

Requirements:

- Correct and up to date 3D data
- Data available prior to production

The road ahead:

- Dataflow to the machines (WLAN, radio e.l.)
- Design of complete 3D models (Ex. Building pits, ditches)

Questions?