The Follo Line project EPC Drill & Blast – Challenges and opportunities in tunnel survey
Amberg Norge AS
About the Amberg Group

The Amberg Group

- 400 employees world wide
- 50 years of experience in underground
- 40 countries we’re involved in Projects
- 100% family owned
- 2013 founding Amberg Norge AS
The Follo Line Project

The project
- Currently Norway’s largest transport project
- City centre of Oslo – city Ski (southwards)
- Increase the train capability to Oslo
- Reduce travelling time by 50%
- 22km new double track line
- 20km of double tube tunnel
  - Main Tunnel TBM
- Realignment of existing tracks Østfold Line
Alignment

Connection to Oslo Central Station
Amberg Norge

Drill & Blast / Drill & Split Lot
Amberg Norge

Double Tube TBM Tunnel

Open section and new Station at Ski

Asland rig

22km
Project phase

Milestones
- Main construction phase started in 2015
- Completion in December 2021

Amberg involved
- Service for the Drill & Blast Lot
- Since July 2015 present on the site with 3 surveyors
- Service for the Oslo S Lot
- Since February 2016 present on the site with 4 surveyors
Amberg Technologies / Norge role in the project

The Setup

- Contractor: Società Italiana per Condotte d’Acqua, Roma
- Lot Drill & Blast / Drill & Split, around 5km tunnel
- All services done with own systems
- Heading surveying
- As-built control measurements
- Monitoring South portal
Tunnel control and navigation concept on site

**System they use**

- Amberg Navigator tablet systems (#6) with Leica TS15 instruments (#5) Leica MS50 (#1) Amberg Laser Scanner (#1) Faro Laser Scanner (#1)
- Guidance of the drill rigs and profile measurements by the foreman
- After every blast the geologist scans for documentation and geology mapping
- Scanning of undulation by the surveyor
Amberg Navigator & Amberg Tunnelscan
Data Import
BIM from design to production

Importing data from Land XML

- Design data from BIM
- Measuring results delivered into the BIM platform
- Interface from regional tools to our solutions
  - Novapoint
  - Gemini
  - Bever Control
How to work with BIM in the tunnel?

The practical approach

- Amberg Tunnel 2.0 as Tunnel Information system
  - 3D production tool
  - Supports all kind of measuring data
- Data transfer and setting out in Amberg Navigator
- Q-checks of design
- Clash Control for verification with the 3D design model
System – Amberg Navigator

**Touch and build**

- Tablet based system (since 2013)
- More than 100 systems is use (worldwide)
- Intuitive user handling concept
- All 3D design data in one tablet
- Control Total Stations, Leica MultiStations and Laser Scanners
- Tailored to your needs – 25 different tasks
Real time scanning results in the tunnel

**Blast Round Scan**
- Scanning after every advance
- Georeference point cloud in the tunnel
  - Automatic sphere detection
- Scan processing in the tunnel
- Direct stake out of critical areas

**Results:**
- Profile View
- Map View
- 3D-View
Amberg Tunnelscan – New product since 2016

Blast Round Scan Analysis

- New algorithm for efficient tunnel scan data processing
- Merge scans areas from different construction stages (E.g. excavation or shotcrete) automatically together without manual work
- Report
  - Volumes
  - Map view
  - Profiles
Amberg Tunnelscan – More examples

Kinematic scanning results

Tunnel inspections in 3D

Shaft processing

Layer thickness control
Norway Specific developments

Follo line example data
- Blast round scan analysis
- Map view for geology mapping
- 3D for over- under break

More improvements for NOR
- Import Export to Novapoint
- Import of KOF File from manufacturer
- Norwegian language support
Amberg Tunnel: All-in-one Tunnel survey management

Tunnel survey management

Traditional surveying
- Surveying network
- Stake out above ground (portal)

Heading surveying
- Machine Control
- Stake out under ground

Monitoring / Geotechnics
- As-built survey
- Above ground
- Underground
Amberg Tunnel: All-in-one Tunnel survey management

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  - Above ground
  - Underground
Summary & Outlook

**From an obstacle to a friend**
- Increase productivity on site
- Minimise downtimes on site
- Every construction stage is documented (evidence)
- Time saving from 4h to 4min for the same results
- Geologist are scanning on the Follo line project
- Geology mapping, Cloud based systems
- Working group IFC v5.0

*The difficulty lies not so much in developing new ideas as in escaping from old ones*  
(John Manyard Keynes)
Amberg Tunnel New Features

Workflow
- Amberg Cloud

Amberg Navigator
- Infrastructure Task
- Documentation Task

Amberg Tunnelscan
- High Resolution Image
- Undulation Analysis

BIM interface
- Interface to BIM platforms
- Data import and export
Amberg Tunnel and Laser scanner – it’s fun!
More information about the Amberg Solution you get under www.amberg.no
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