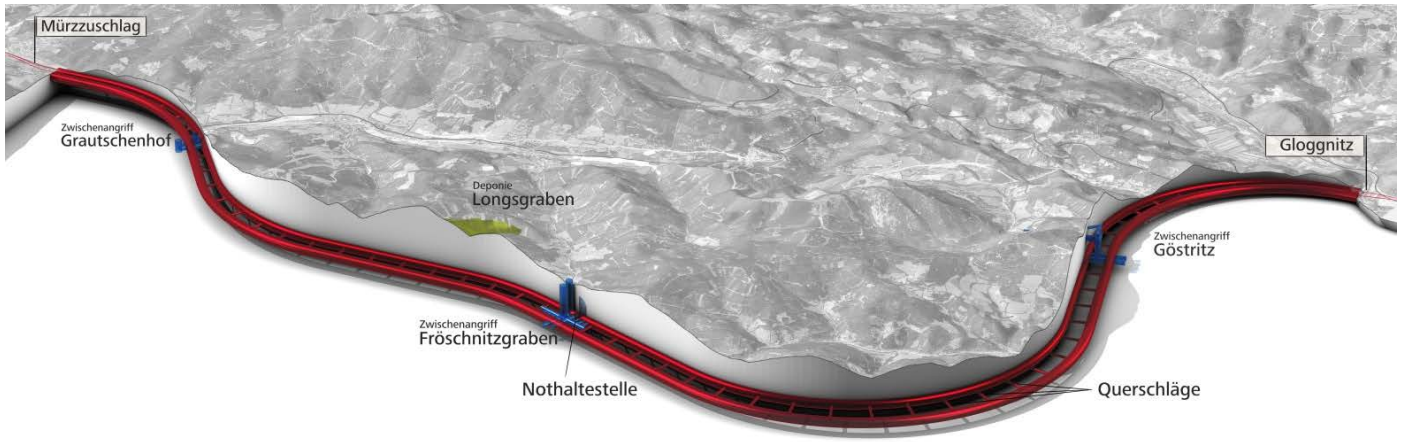
SEMMERING BASE TUNNEL



Semmering Base Tunnel, Gloggnitz-Mürzzuschlag, Austria

The new Semmering base tunnel is planned as a high-performance rail link with a gradient below 10 ‰ and designed as flat trajectory. The Semmering base tunnel is the core of a high-speed rail link of the developed Südbahn-Semmering rail network.

Scope

- Three tunnel sections (SBT 1.1 – Gloggnitz, SBT2.1 – Fröschnitzgraben, SBT 3.1 – Grautschenhof)
- System of 2 single track tunnel tubes, length each 27.3km, overburden of up to 880m
- Cyclic heading 18.7 km, cross-section 60 – 100m^2
- Continuous heading 8.6km, cross-section 80m^2
- Cross passages at 500m distance
- Shafts up to 450m depth, diameter 14m, caverns at shaft head and shaft bottom
- Emergency stops (SBT 2.1)

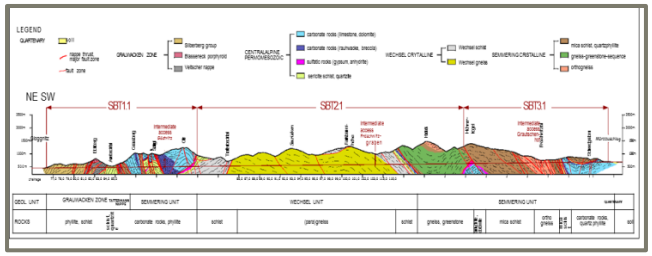
Challenges

- Complex geology, mainly gneisses and shales, mining through larger fault systems
- Supply and disposal of the headings via intermediate access, e.g. shafts, caverns and access galleries
- Prognoses for ingress of formation water of up to 300 l/s, special grouting necessary, deep shafts

Amberg Services

- Preliminary design and submission planning
- Geo-mechanic planning, detailed design and involvement for tendering
- General contractor at site
- Client consulting in respect to grouting as securing construction measure for TBM heading

AMBERG ENGINEERING



- Simplified geological profile

- Access bridge at portal Gloggnitz

- Animation of rail operation Semmering base tunnel

AMBERG FACTS (Arial, 12pt, bold)

Contracted value JV
- Total: approx. 25.6 Mio. €

Contracted value Amberg
- Total: 2.0 Mio. €

Project Phases & Duration
- Planning 2006 – 2023
- Realisation 2014 – 2026

Project details
Lot SBT 1.1 – Gloggnitz
- Intermediate access Göstritz, access gallery
- Shaft head and shaft bottom caverns, shafts 250m deep
- 2 single track tunnel tubes with cyclic heading, lot length approx. 7.3km
- Cross passages every 500m
- Overburden 730m

Lot SBT 2.1 – Fröschnitzgraben
- Intermediate access Fröschnitzgraben, shafts 450m deep, shaft bottom caverns
- 2 single track tunnel tubes with cyclic and continuous heading, lot length approx. 13.0km
- Emergency stop
- Cross passages every 500m
- Overburden 880m

Lot SBT 3.1 – Grautschenhof
- Intermediate access Grautschenhof, shafts 100m deep and shaft bottom caverns
- 2 single track tunnel tubes with cyclic heading, lot approx. 7.0km
- Cross passages every 500m
- Overburden 765m

CLIENT FACTS

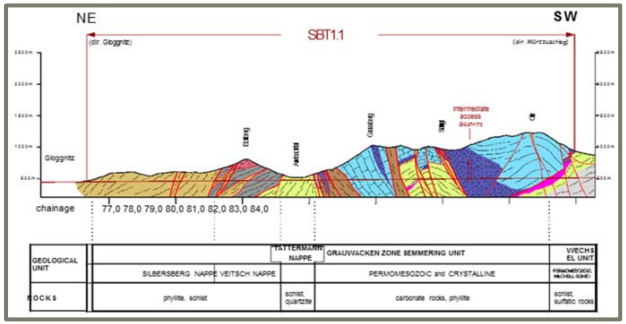
Overall costs
- Total: approx. 3.3 Bio. €

Overview Project
- Semmering base tunnel high performance rail link
- 3 tunnel sections with shafts, access galleries, shaft head and shaft bottom caverns
- 2 single track railway tunnel tubes with 27.3km length each
- Cross passages and shafts plus access galleries
- emergency stop

Geology
- Alpine formation with carbonates, shale and gneisses
- Passing through Grassberg-Schlagl-, Kleinen Otter-und Hühnerkogel-fault system

AMBERG ENGINEERING

CHALLENGES – SBT 1.1



Geological profile lot SBT 1.1 – Gloggnitz

Geological Conditions and Formation Water

- Formation: Carbonates and Shales
- Heading through both water bearing carbonate formations of the Grassbergs and Kleinen Otter
- Heading through the Grassberg-Schlagl-fault zone
- Prognosis of water ingress of up to 300 l/s
- Overburden approx. 730m

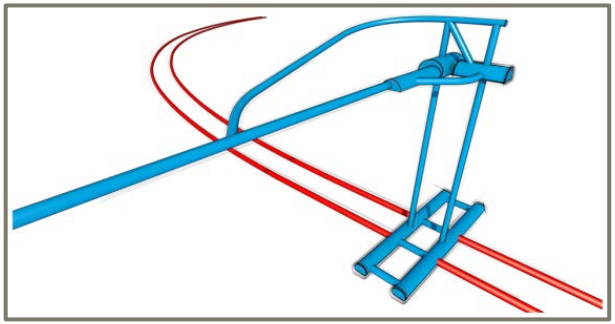
ENGINEERING APPROACH – SBT 1.1

Situation with lot SBT 1.1 – Gloggnitz

Tunnelling Logistics

- Supply and disposal of the different headings via intermediate access Göstritz (shafts and access gallery)
- Mucking via portal Gloggnitz by train

TECHNICAL SOLUTIONS – SBT 1.1



Layout of intermediate access

Intermediate Access Göstritz

- Access gallery of 1km length
- 2 shafts, depth 250m
- Shaft head and shaft bottom caverns (temporary for construction period)
- Cyclic heading in direction Gloggnitz and Mürzzuschlag

AMBERG ENGINEERING

CHALLENGES – SBT 1.1

- View of site installation

- Reinforcement works at night

- Drilling works at portal area

TECHNICAL APPROACH – SBT 1.1

- Site view at night

- Completion of reinforcement works

- Start of heading works

TECHNICAL SOLUTIONS – SBT 1.1

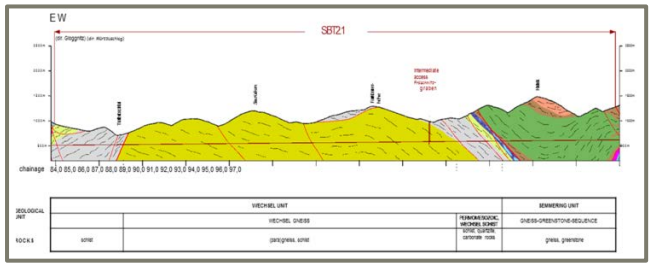
- Reinforcement works in portal area

- Portal area at night with portal rims

- Start of tunnel heading

AMBERG ENGINEERING

CHALLENGES – SBT 2.1

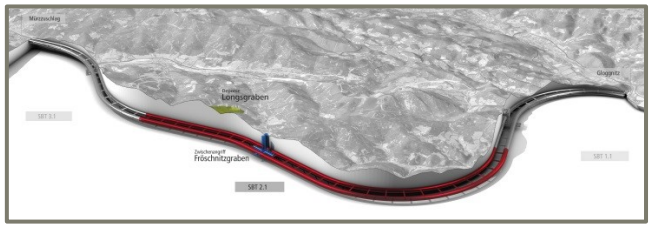


Geological profile lot SBT 2.1 – Fröschnitzgraben

Geological Conditions and Formation Water

- Formation: Gneisses and shales
- Heading through the fault zone at the boundary of the cover and the Trattenbachtal fault
- Prognosis for formation water ingress up to 200 l/s
- Overburden up to 880m

TECHNICAL APPROACH – SBT 2.1

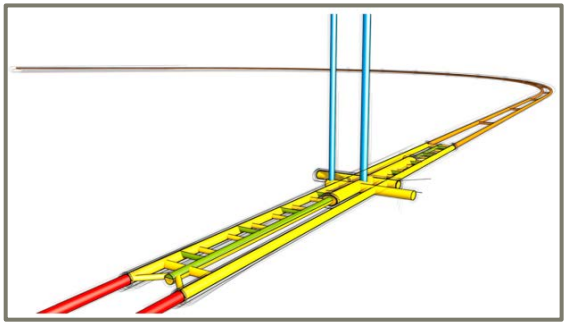


Situation with lot SBT 2.1 – Fröschnitzgraben

Tunnelling Logistics

- Supply and disposal of heading operation via intermediate access Fröschnitzgraben (shafts)

TECHNICAL SOLUTION – SBT 2.1



Layout intermediate access Fröschnitzgraben

Intermediate Access Fröschnitzgraben

- 2 shafts, depth 400m
- Shaft head and shaft bottom caverns (temporary for construction phase) with cross-sections of up to 310m^2
- Emergency stop for later operation
- Continuous heading direction Gloggnitz, cyclic heading direction Mürzzuschlag

AMBERG ENGINEERING

CHALLENGES – SBT 2.1

- Panorama view of site installation

- Access to disposal area at Lonsgraben

- View of installation site at night

TECHNICAL APPROACH – SBT 2.1

- View of the site

- Disposal area Lonsgraben

- View of conveyor belt to disposal area

TECHNICAL SOLUTION – SBT 2.1

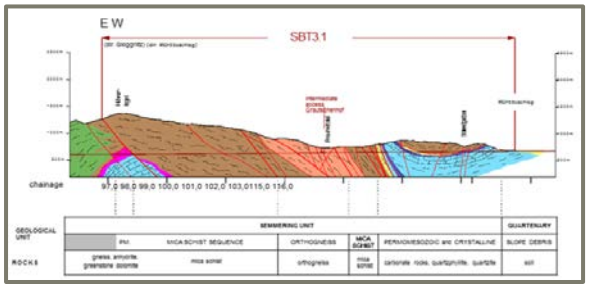
- View of shaft site with shaft tower

- View of site at night

- View into shaft from shaft tower

AMBERG ENGINEERING

CHALLENGES – SBT 3.1

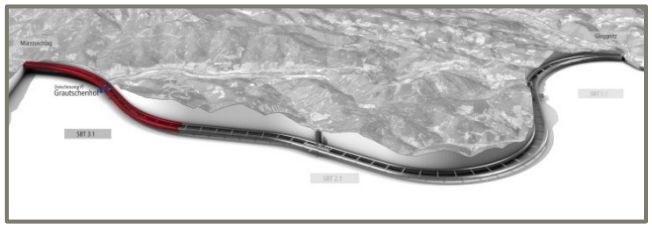


Geological profile lot SBT 3.1 – Grautschenhof

Geological Conditions and Formation Water

- Formation: Gneisses, mica slates and carbonates
- Heading through the Hühnerkogel fault
- Prognosis for formation water ingress up to 300 l/s
- Overburden approx. 765m

TECHNICAL APPROACH – SBT 3.1

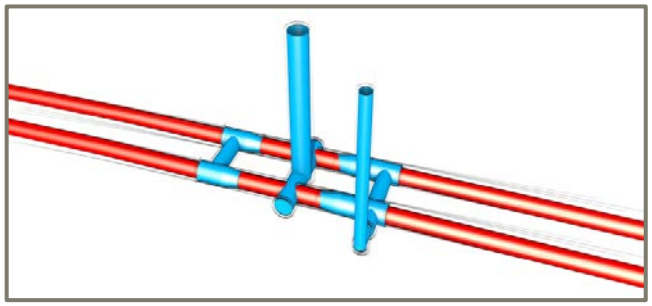


Situation with lot SBT 3.1 – Grautschenhof

Tunnelling Logistics

- Supply and disposal of heading operation via intermediate access Grautschenhof (Shafts)

TECHNICAL SOLUTION – SBT 3.1



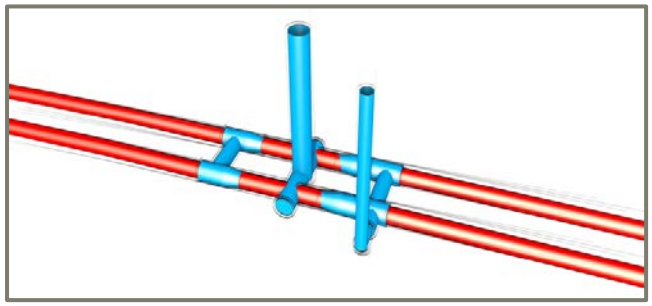
Layout intermediate access Grautschenhof

Intermediate Access Grautschenhof

- 2 shafts, depth 100m
- Shaft head and shaft bottom cavers (temporary for construction phase) with cross-sections of up to 157m^2
- Cyclic heading

AMBERG ENGINEERING

CHALLENGES – SBT 3.1



- Layout intermediate access Grautschenhof

- Pile drilling machine

- Cementing of pile

TECHNICAL APPROACH – SBT 3.1

- Panorama view of installation at site Sommerau

- Drilling rim for shaft head pile reinforcements

- Completed piles

TECHNICAL SOLUTION – SBT 3.1

- View site Sommerau

- Reinforcement mesh for piles

- Reinforcement of portal area Mürzzuschlag

AMBERG ENGINEERING