LYON – TURIN – BASE TUNNEL

Lyon–Turin Base Tunnel
Lot St. Jean de Maurienne, France – Bruzolo, Italy

Construction of new high-speed rail link, 2 tunnels with single-track tubes, 2 viaducts and 2 stations

Scope
- Reference project for the new international railway link France – Italy
- Review of pre-design for the international section France – Italy
- Final Design for the international tunnel section France – Italy

Challenges
- High overburden of up to 2'400 m
- Inflow of thermal water
- Risk of natural gas deposits
- Asbestos layers
- Pressurized rock sections
- Difficult geology
- Rock bursts

Amberg Services
- Project review and assessment
- Detailed planning
- Detailed project and tender design
- Adaptations of project as necessary

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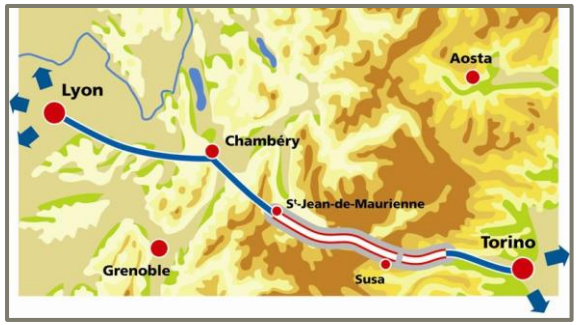

- Outline of tunnel project

- Site view of portal area

- Excavation in difficult geology

AMBERG FACTS

Contracted value JV
- CHF 14.8 Mio

Contracted value Amberg
- CHF 1.3 Mio (without pre-design)

Project Phases & Duration
- Pre-Design (Previous Contract) 2005 – 2006
- Review Pre-Design 2009 – 2012
- Final Design 2011 – 2012

Project Details
Base Tunnel
- TBM and drill & blast
- Cross section 70 m^2
- 2 single track tunnels
- Concrete lining
- 57.5 km length

Additional Structures
- La Braz, Modane and Clarea: Emergency Stations
- Access Galleries
- Various technical caverns
- Tunnel intersections in Modane
- Ventilation Shaft 600 m in Modane

Tunnel Bussoleno
- Tunnel access route 2.1 km
  Intersection for future Bussoleno Tunnel

CLIENT FACTS

Overall costs
- Overall costs 9’600 Mio €

Overview Project
- Lengthda of base tunnel: 57.5 km
- Slope: 2.0 – 8.0 ‰, Cross-section: 70 m^2
- Length Tunnel interconnection 2.1 km
- Stations in Suza
- Bridge over the Dora river
- 3 emergency stations
- 1 intervention sites
- Technical caverns at emergency stations and intervention sites

Technical Information
- Single track tubes by TBM and drill & blast
- Ancillary facilities, ventilation shaft, intervention sites and emergency stops by drill & blast (NATM)

Geology
- Complex geology in the Ultradauphinois, Briançonnais and Piémontais domains
- Overburden up to 2’400 m
- Risk of natural gas deposits
- Asbestos layers (roche verte)

Contact person
Mr. Alain Chabert
Directeur des études et Projet
Lyon-Turin Ferroviaire SAS
Tel: +33 479 68 56 50
eMail: alain.chabert@telt-sas.com

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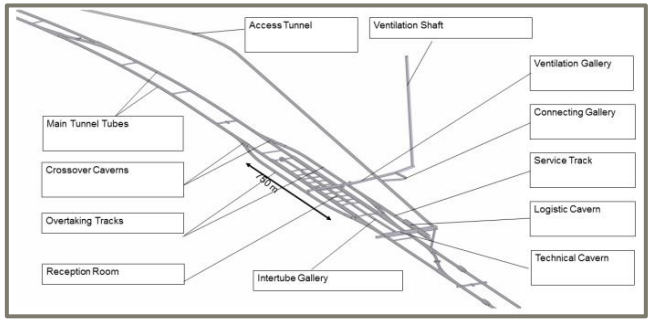
CHALLENGES

Layout of tunnel project

Complex rock structures

- High overburden approx. 1’500 m in average
- Pressurized formation, squeezing conditions
- Rock bursts
- Asbestos layers in rock
- International, border-crossing project

ENGINEERING APPROACH

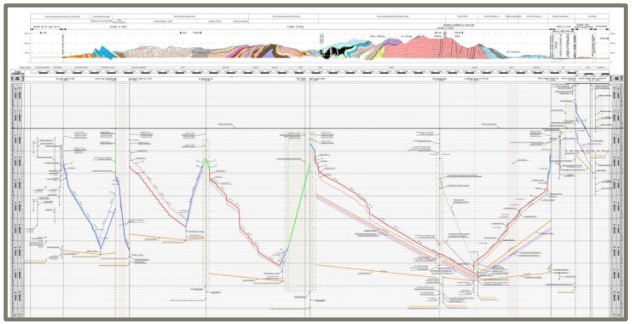


Schematic layout of station Modane

Design of a Complex Project

- Definition of Cross section
- Geological assessment
- Definition of the excavation methods
- Detailed site investigation
- Rock support
- Final lining
- Ventilation and safety concept
- Design of external structures, bridges and stations
- Modelling of fire scenarios
- Project cost evaluation
- Site installation
- Construction logistics
- Environmental planning

TECHNICAL SOLUTIONS



Construction schedule with intermediate access

Main Solutions

- Definition of TBM parameters
- Elaboration of construction schedule incl. construction phases
- Definition of site installations
- Intermediate access
- Deposit areas

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