

AXEN TUNNELS - MOUNTAIN SIDE



Renovation of Axen Tunnels, Mountain Side, Brunnen–Fluelen, Switzerland

Project description

The Axen tunnels along the shoreline of the southern part of the Lake Lucerne (Lake Uri) are of an age of 100 years plus. The goal of the renovation work was to safeguard another 50 years of operation, especially as northern feeder line for the Gotthard Base Tunnel.

Tunnel Morschach double track, 414 m
Tunnel Morschach, single track, 1'100 m
Tunnel Fronalp, 2'793 m
Tunnel Stutzeck-Axenbergl, 3'375 m

Scope

- Vault refurbishment, renewal of invert
- Renewal of tunnel floor
- Renewal of tunnel drainage
- Renewal of self-rescue facilities
- Deepening niches
- Renewal of railway infrastructure
- Restoration of retaining walls
- Provisional track changes

Challenges

- All restoration works to be performed under operation (partially single track operation)
- Restoration of construction substance
- Supervision and coordination of all involved parties
- Very limited access and difficult logistic conditions

Amberg Services

- Condition assessment
- Project design for all phases
- Construction supervision and documentation
- Client representation



- Renewal of the ancient construction substance



- Work in double track section



- Use of special inventory

AMBERG FACTS

Contracted Value Amberg

- Total Amberg: CHF 1.4 Mio

Project Phases & Duration

- Design 2004 – 2007
- Realization 2008 – 2009

Project Details

Constructional Measures

- Vault renovation from maintenance train
- Invert works with street work inventory
- Work in double track sections with operation on other track
- Work at single track sections
- Line work sites with limited accessibility
- Installation of self-rescue facilities
- Refurbishment of portals

Railway infrastructural measures

- Renewal of pavement
- Renewal of all cable facilities
- Replacement of catenary wire by a conductor rail on the ceiling

Construction Operation

- Partially work at night shifts
- Partially work in persisting single track operation phases
- Installation of provisional track changes with 3 switches during construction time as operational pre-condition.
- Use of various special installations

CLIENT FACTS

Overall Cost

- Overall cost CHF 30 Mio

Overview Project

- In view of the opening of the Gotthard Base Tunnel the Axen Tunnels were fitted up
- Safeguarding of 50 years of remaining lifetime
- Restoration of vault structural safety and invert serviceability
- Elimination of deficits of railway loading gauge (clearance)
- Production of norm conform construction parts and railway infrastructural components
- Installation of the latest generation equipment of railway infrastructure
- Improvement of self-rescue conditions
- Constructional implementation with a minimum of restrictions to the railway operation

Geology

- Alternating formation of limestone rock
- Strongly varying ingress of formation water
- Portals sections in soft soil areas

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CHALLENGES



- Vault works under railway operation



- Invert work in double track section



- Limited accessibility of line sites

ENGINEERING APPROACH



- Vault renovation and sealing work



- Removal of existing pavement



- Installation of provisional track changes

TECHNICAL SOLUTIONS



- Use of special inventory for tunnel refurbishment



- Renewal of invert and drainage



- Special inventory for rail construction