Maroggia Railway Tunnel
Switzerland

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Maroggia Railway Tunnel is located in the European railway Corridor Rhine-Alpine, connecting the North sea with the Mediterranean sea.

Corridor Rhine-Alpine is a project to improve rail freight transportation in Europe and to encourage modal shift from road to rail.
Maroggia railway Tunnel is located in a narrow passage between the lake of Lugano and a steep mountain slope ensuring the traffic between Switzerland and Italy.

In 2011 the large-scale project "4m-Corridor" requested all tunnels along the north–south railway corridor of Switzerland to ensure an operation of freight trains with a larger profile providing corner height of 4 m.
The 570 m long Maroggia tunnel of the Swiss Federal Railways (SBB) is in operation as double – track railway tunnel since 1874. The tunnel is considered as one of the oldest tunnels in Switzerland. The horseshoe shaped tunnel lining consists of masonry and is backfilled by stones and blocks.
In order to meet the new standards, a track lowering of ca. 25 cm was planned initially requiring a double-sided underpinning of the masonry lining.

**Initial project**

In the tender offer, an innovative alternative solution was brought from a constructor that could clearly reduce the time for completion: one-sided widening of the tunnel profile

**Executed project (alternative solution)**
Alternative solution:
- one sided breaking of the existing masonry lining
- supporting the remaining lining with anchored beam
- replacing by new lining of reinforced concrete

Immediate excavation support with rock bolts and shotcrete
Breaking of existing tunnel lining
New tunnel lining of reinforced concrete
Escape route
Drainage replaced and adjusted
New loading gauge of the Swiss railways
Existing loading gauge of the Swiss railways
Overhead conductor rail
Stabilization by grouting and anchors
Supporting beam with anchors, main support during construction
New tunnel lining of reinforced concrete
Bonding of railway ballast with special resin
Alternative solution:
- one sided breaking of the existing masonry lining
- supporting the remaining lining with anchored beam
- replacing by new lining of reinforced concrete
Challenges:

Rolling wave planning
practically no time available for planning in advance

Work Safety
extremely tight space available in the working track

Railway Operational Safety
ongoing traffic in the other track inside the tunnel, about 200 trains per day = 1 train every 6 minutes or ca. 70’000 per year
Challenges:

**Environmental protection**
drink water protection area, lake of Lugano

**Difficult Geological Condition**
sliding slope, geological fault zone, soft soil near portal (cut-and-cover section), ongoing geological exploration

**Risk of impairment neighbouring structures**
highway tunnel above the Railway tunnel, especially in the sliding slope, Church above tunnel (UNESCO World Heritage)
Challenges:

Innovative Solutions

continuous supporting the remaining masonry over the whole rock section (length of ca. 500 m) with supporting beam

widening the tunnel profile in the portal section of soft soil (cut-and-cover section)

widening the opening of the portal walls and replacing the monumental stones of the edge
**Added - Value:**

**Renovation Time:** reduction by ca. 25% toward the time of the initial standard concept d.h. ca. 6 months.

**Cost Savings:** time reduction opened the way for an earlier realisation of neighbouring projects along the “4m corridor”

**Minimization impact on the railway traffic** during the renovation.

**Satisfaction of railway passengers** that passes weekly through the Alps professionally or for vacations: “4m corridor” inclusive Gotthard base tunnel reduce travel time up to 30-60 minutes.

Facilitation of european freight transport and modal shift from road to rail.

**Quality** of tunnel: renewal of the tunnel lining

**Inspiration of tunnel engineering:** successful innovation
Maroggia Railway Tunnel
Switzerland

**client:** Swiss Federal Railways (SBB)

**project and construction management:**
Rothpletz, Lienhard + Cie AG;
Pini Swiss Engineers SA

**structural work contractors:**
Marti Tunnelbau AG,
Mancini&Marti S.A.

Thank you!