The Project
The Perjen Tunnel is part of the Inntal motorway A 12 and is situated north of Landeck in Tyrol. The single tube tunnel is 2.9 km long and was opened in 1983. The ventilation system is semi transversal. In regular operation fresh air is supplied via a ventilation duct above a false concrete ceiling. In case of fire the direction of air flow in this ventilation duct should have been changed, so that smoke could be extracted. This ventilation system did not meet new standards for the following reasons:
- It would have taken approximately 5 minutes to establish reverse ventilation (i.e. start of smoke extraction).
- Smoke extraction capacity was insufficient.
- The structure was designed just to carry dead load and the most un favourable ventilation pressures. There was no spare load bearing capacity.

Structural Design
The intended cutting of new 3x3 m louvers at 95 m interval into the existing false ceiling required the complete re-analysis of the ventilation duct. The structural system of the 20-year old, thin reinforced concrete slab had to be partially transformed into a suspended slab. The original false tunnel ceiling is of very efficient design. The regular concrete thickness is only 15cm. It is a highly utilised structure with no spare load bearing capacity. There was insufficient capacity to compensate for the change of the static system as induced by the cutting of the new 3x3m louvers. Reconstruction required the reinforcement of the structure with doweled, corrosion-resistant steel structures and externally applied carbon-fibre reinforcement.

Ventilation Design
Several kilometres of joint sealing were applied using flexible external taping. Fans were retested to identify the new performance behaviour. The efficiency of the ventilation ducts was significantly improved due to joint sealing.

Electro-mechanical installations
Most of the electrical and electronic installations were modernized, and some new computer software was installed.
A new fire detection system, allowing the localisation of heat every 17.5 m, was installed. An emergency air supply system to feed emergency call niches was installed. Compressed air can be fed into each emergency call niche by the opening of a valve. The compressed air is stored at a central compressor station. It is fed to the niches through a pipe which is placed in a fire protected position in the fresh air ventilation duct.

Execution of works
The works were executed during a complete tunnel closure of several weeks.
PROJECT:
TUNNEL SAFETY UPGRADE
PERJEN BASE TUNNEL

TYPE OF PROJECT:
Motorway tunnel

LOCATION:
Landeck – Zams, Tyrol, Austria

CLIENT:
Arlberg Strassentunnel AG

TIME OF SERVICES:
05/2001 – 05/2003

RECONSTRUCTION COSTS:
580,000.– €

PROJECT DATA:
Single tube, double lane tunnel; Length: 2.9 km
Excavation cross section: 67.5 – 80.1 m²
Ventilation: semi transversal, 2 ventilation sections, 2 ventilation stations at the portals

Geoconsult’s Services
• Preliminary Design
• Tender Design
• Final Design
• Construction supervision
For all 3 design phases:
• Electro-mechanical design
• Ventilation design
• Structural design

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Application of new tunnel coating