



## Felskinn/Metro Alpin (CH) Rehabilitation

|                              |   |
|------------------------------|---|
| <b>Country</b>               | Switzerland                               |
| <b>Type</b>                  | Rehabilitation, Permafrost                |
| <b>Client</b>                | Saastal Bergbahnen AG                     |
| <b>Main Contractor</b>       | ARGE Metro Stollen                        |
| <b>Execution of the work</b> | Renesco AG                                |
| <b>Designer/ Engineering</b> | Alp Bauingenieure AG, Rinaldo Andenmatten |
| <b>Construction Period</b>   | 2021, 10/2025, 04/2026                    |

## Project Description

In the winter sports resort of Saas-Fee, canton of Valais, skiers & mountain tourists can reach the Metro Alpin valley station from the Felskinn middle station via an approx. 50m long access tunnel. Water increasingly penetrated the tunnel, which was built in 1984, as well as the underground valley station, causing the shotcrete and parts of the rock to loosen and fall down. The safety of people was therefore no longer guaranteed. The renovation works of the underground connection between the Alpin Express II and Metro Alpin stations, the world's highest underground funicular railway, was located at 2,980 meters (9,777 feet) above sea level and in high alpine terrain.

For the partial work in the year 2021, around 150m<sup>3</sup> of concrete (or sprayed concrete, mixed demolition) and 150m<sup>3</sup> of rock needed to be broken out and removed. Afterwards, the tunnel was sealed with an exposed sheet geomembrane (multi-layer, geocomposite) over an area of around 3'000m<sup>2</sup>. Around 500 mortar anchors (20-40cm) were required to secure the membrane system, and additionally, the rock should be reinforced with around 200 rock anchors (1.5m). Part of the rock is reportedly asbestos-containing serpentinite. Due to the asbestos, special safety measures were necessary to protect the personnel from possible dust emissions. Based on thawing the permafrost, the work continues until 2026.

## Scope of Service

Rehabilitation of the structural waterproofing. As a visible (exposed) seal and drip water protection, a 1.8mm thick, multi-layer (geocomposite) waterproofing sheet membrane based on flexible PVC with an internal polyester fabric (inlay), was used. The membrane is self-extinguishing and has the fire rating 5.2 according to BKZ classification (Swiss standard).

- Supply & Install of the waterproofing system incl. diverse protection systems (e.g. panels)
- Supply & Install of the termination details consisting of adhesive tapes with epoxy resin
- Supply & Install of the penetrations & steel clamping, flanges & perimeter seals
- Supply & Install of the anchorage & fixings
- Grouting services



1. Metro Alpin valley station at 3'000m
2. Access tunnel for pedestrians at construction
3. Final view of the access tunnel