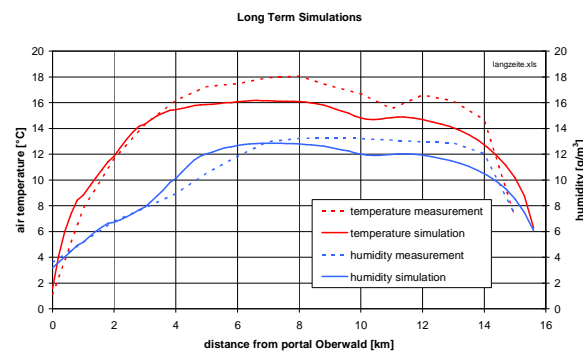
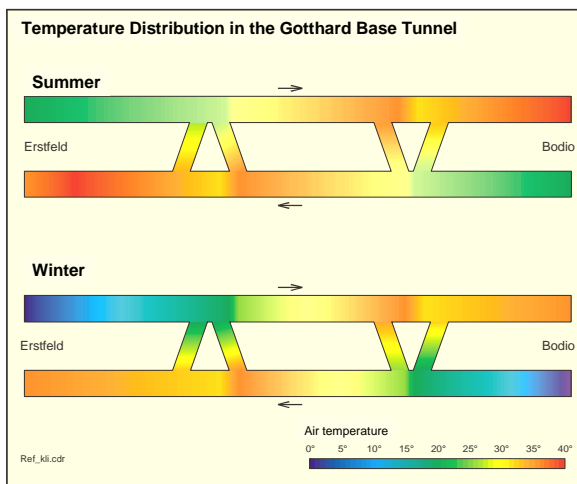


Measurement for validation of the computer code



Comparison of measured and simulated values



Calculated temperature profile for the Gotthard base tunnel

Description

As part of the design of the new Swiss Cross-Alpine Rail Tunnels (NEAT) a complex computer code for numerical simulation was developed to predict the climate in long tunnels during operation. The program allows to determine the temperature and humidity in the tunnel sections and to investigate different measures to ventilate and cool the tunnels. The simulation program computes the tunnel climate considering train-induced flow, waste heat due to traction power, heat and water flow through the rock towards the tunnel, evaporation of water as well as transport of heat and humidity by train and influences at the portals.

The model was validated and refined by climate measurements in the Furkatunnel (length 15.4 km). For more than 2 years the tunnel temperature and humidity were continuously monitored with an interval of 1 km along the tunnel. Additionally, a wagon of the railway was equipped with temperature sensors to measure wagon temperatures and heat transport by trains in the tunnel.

Services

HBI Haerter Consulting Engineers provided the following services:

- Modelling of air velocities during train operation taking into account the complex timetables and tunnel geometries
- Modelling of temperature and humidity in the tunnel during operation over several years
- Evaluation and optimisation of measures to improve the tunnel climate, such as ventilation, ventilation shafts, air exchangers etc.
- Set up and maintenance of measuring devices (flow, temperature and humidity) in a tunnel under operation as well as in a train running on schedule
- Sensitive studies in order to evaluate the required degree of precision of the input data