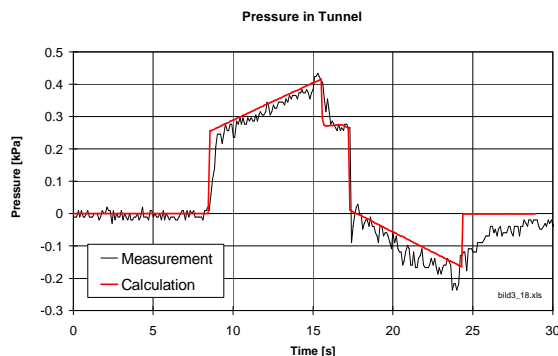
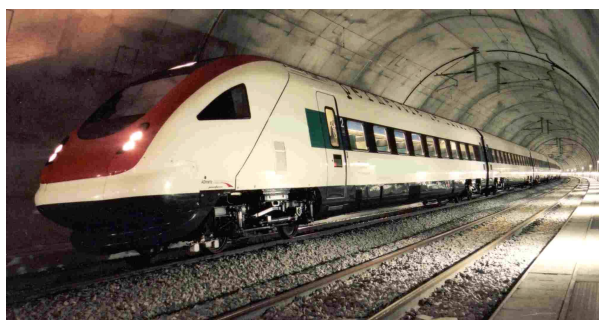


Staggered arrangement of portals to reduce recirculation of tunnel air



Comparison of measurement and simulation of the pressure changes caused by a train journey in a tunnel



High speed train journeys through tunnels (here ICN in the Grauholz tunnel) leading to increased wind and pressure loads

Description

The extraordinary length of some new European railway tunnels (e.g. Brenner, Gotthard, Guadarrama, Loetschberg and Lyon-Turin base tunnel) leads to the paramount importance of the aero- and thermodynamic aspects for the tunnel design.

One of the major tasks is to provide fundamentals for decisions to the project managements with the aim to guarantee a tunnel climate with sufficiently low temperature and humidity for an undisturbed and low-maintenance train operation. Additionally, the aerodynamic conditions in the tunnels need to be acceptable.

Services

In order to provide basic design parameters for long tunnels, HBI Haerter Consulting Engineers provided all or some of the following services for the projects mentioned above:

- Providing simulations to model pressure, flow velocity, temperature and humidity in a complex tunnel system
- Comparison of the simulations with measurements and continuous refinement of the models
- Evaluation of micro-pressure waves (sonic boom)
- Development of measures to improve the tunnel climate during normal and maintenance operation and pointing out potential optimisations and sensitivity studies
- Calculation of pressure in passenger trains and development of pressure comfort criteria
- Development of measures to reduce pressure fluctuations in passenger trains
- Integration of work results in project
- Interface for co-operation with specialists from universities as well as test laboratories
- Definition and implementation of a monitoring concept for the continuous refinement of data relevant for climate prediction