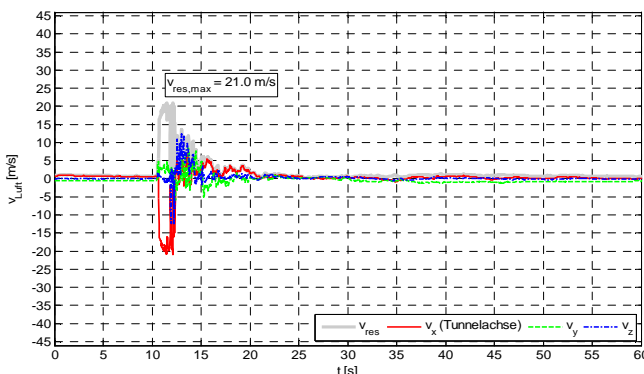


Autonomous Prandtl's pitot tube mounted at pantograph to measure the surrounding air velocity



3D flow measuring system for assessing the air flow on the tunnel sidewalk during train passage



Flow history in x (red), y (green) and z direction (blue) as well as the resulting flow velocity during a single train passage of the ICE-S with 200 km/h

Description

During the commissioning phase of the Gotthard Base Tunnel (GBT), extensive test runs with various train types and train speeds were performed as part of the homologation process. The following objectives were achieved by aerodynamic measurements:

- Verification of design assumptions (pressure load, wind load, pressure comfort, etc.) for the tunnel and the rolling stock
- Contribution to the acceptance process (operation license regarding aerodynamics and safety approval)
- Collection of base data for the support of planning assumptions in the area of aerodynamics for design of future projects

Services

HBI Haerter Consulting Engineers provided the following services:

- Elaboration of the measurement concept for commissioning of the Gotthard Base Tunnel
- Execution of measurements of train-induced pressure variations and air speed (1D and 3D) in the train tunnel, in the anti-circulation shaft at north portal, and in trains
- Elaboration of the measurement concept regarding pressure comfort measurements on passenger trains
- Analysis of the measured data and allocation to the specific test runs
- Elaboration of maximum positive and negative pressure deviation from normal pressure in the rail tunnel system
- Identification of the maximum pressure difference between rail and service tunnel
- Determination of the maximum pressure variation and of the surrounding air speed at the train to check the pressure comfort criteria and air speed conditions, respectively
- Elaboration of the pressure loss coefficients
- Elaboration of the maximum flow velocities in the rail tunnel (1D and 3D) in relation to operation conditions
- Comparison of the results obtained by measurements and numerical simulations