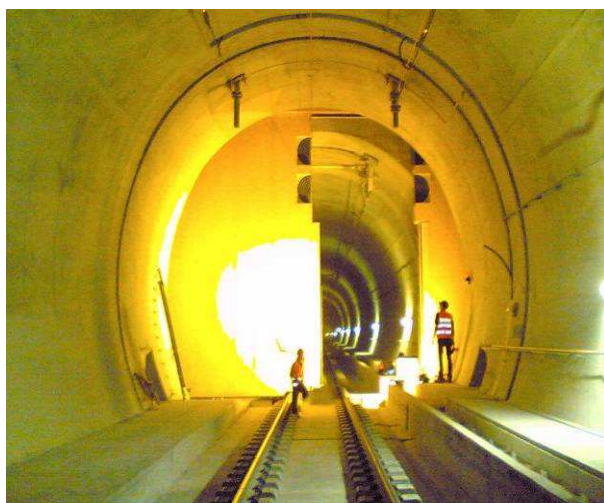


HBI Haerter AG  
Memorial Brandversuch mit Brandklappen und Schlitzen  
Rauchkonzentration = 10%

*CFD calculation of smoke concentration in tunnel and in exhaust duct*



*Equipment at train and in tunnel for aerodynamic measurements during testing of rail line*



*New type of doors for rail tunnels*

HBI Haerter Consulting Engineers provides planning services for reliable tunnel systems with minimal life-cycle costs. This requires combining proven concepts with technical innovations ready for application in projects. Some innovations, recently being developed at HBI, are presented in the following.

### **1-D-Simulation of smoke propagation**

For the one-dimensional simulation of smoke propagation (1-D), reliable numerical models with short computation time have been developed. These take into account, e.g. vehicle movement and thermal effects (chimney effect).

### **3-D-Simulation of fires in tunnels**

Fires in tunnels endanger human life and property. For the precise simulation of the efficiency of fire- and smoke control, HBI tested and improved several CFD-models by using data taken during the fire tests at Memorial Tunnel (USA) and during EUREKA-fire tests.

### **Model for propagation of pollutants**

The fulfilment of environmental requirements of future road tunnels needs to be proven. Emissions from vehicles and their propagation in the near-portal atmosphere are to be simulated. HBI developed and employed adequate numerical tools.

### **Aero- and thermodynamics of tunnels**

For long rail tunnels and underground systems the tunnel climate and the aerodynamic conditions need to be predicted and possibly to be influenced. HBI developed and employed reliable simulation tools, new measurement methods and efficient measures.

### **Mechanical equipment of tunnels**

The mechanical equipment (doors, cabinets, etc.) influences the costs, safety and availability of a tunnel significantly. HBI developed new, partly patented solutions.

### **Tender and review**

The tender process is decisive for a successful project. With specifications adapted to the project, with technical and legal specifications, with possibly prototype-based evaluation procedures and with extensive testing the risks of a project are successfully being handled.