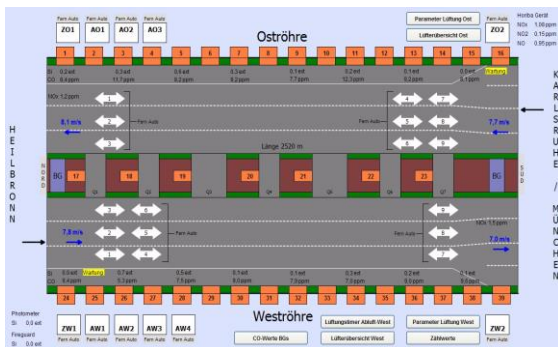




North portal of the Engelberg tunnel



User interface of the tunnel control system

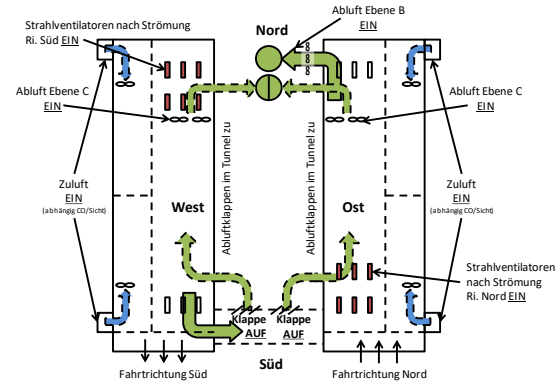
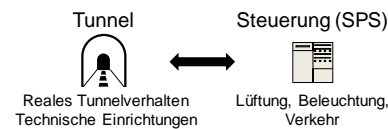
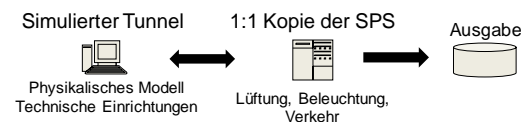


Diagram of previous ventilation system

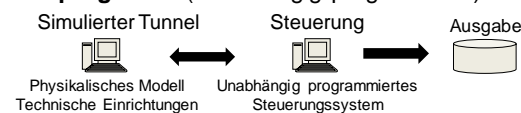
### Realität



### Tunnelsimulator



### Prüfprogramm (Unabhängig programmiert)



Tunnel and controller in reality, in the tunnel simulator and in the tunnel simulator testing program

## Description

The Engelberg tunnel directly connects to the A81/A8 interchange junction in Leonberg. The two sections, along which vehicles travel northbound or southbound in one direction, measure 2,520 meters in length. As part of an extensive retrofit project, the ventilation equipment will also be upgraded to the latest standard. The project is divided into seven construction phases, whereby structural modifications and changes to the ventilation control system are envisaged in each phase. A tunnel simulator was developed to ensure that restrictions placed on through-traffic are minimized as far as possible while also ensuring high levels of functional safety. In this context, the simulator makes it possible to test the tunnel ventilation control programs stored in the PLC during each construction phase to safeguard correct response. HBI Haerter Consulting Engineers defined the ventilation requirements and computational base for the tunnel simulator. To efficiently test the tunnel simulator, HBI wrote a test software application to ensure that the simulator and tunnel ventilation controller function as intended by comparing the test results against the results of the tunnel simulator. Implementation of tunnel simulator, which also integrates the responses of all technical safety equipment (e.g. lighting and video surveillance), was realized by an implementing company.

## Services

HBI Haerter Consulting Engineers rendered the following services:

- Analysis of tunnel ventilation controller for development of a tunnel simulator
- Preparation of concept and description of model requirements/computational bases
- Preparation of requirement specifications for the ventilation module of the tunnel simulator, with definition of test scenarios and target values
- Development of a test program to test the ventilation and physical properties of the tunnel simulator based on computation and comparison of some 1,000 fire outbreak scenarios
- Verification with the test program and proposal of corrective actions