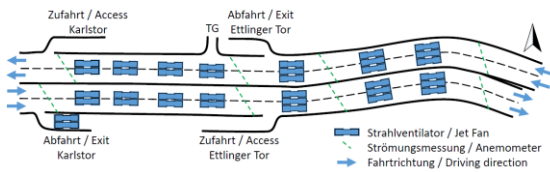
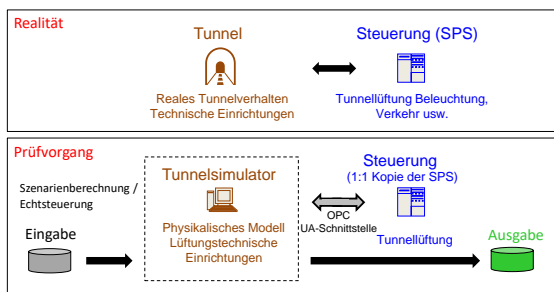


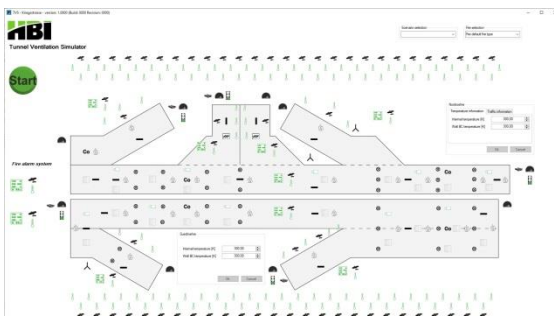
Program structure of tunnel simulator



Route and position arrangement of jet fans and airflow measuring points



Test procedure between tunnel simulator and PLC



Graphical user interface of tunnel ventilation simulator for the Kriegsstrasse tunnel

Description

A tunnel simulator for the tunnel ventilation system was developed as part of the twin-section Kriegsstrasse city tunnel of the combination traffic project engineered for Karlsruhe, which is currently in the planning stage. The simulator forms part of the detailed design package and was included in the tender. The tunnel ventilation simulator virtually represents the physical tunnel, thereby allowing the control system to interact with the actuators and sensors. The aerodynamic responses of the tunnel ventilation system, traffic flow and effects of a fire outbreak are calculated in real time. The resulting responses are linked to the control system (PLC) and graphically displayed on a monitor.

The tunnel ventilation control system defines comprehensive specifications on how the system should be used under normal operating conditions and in the event of a fire outbreak, and this information is programmed accordingly in the programmable logic controller (PLC). The tunnel simulator can efficiently validate the correct operative function of the tunnel ventilation control system before the equipment is even installed by the contractor. To this end, various test scenarios are defined with which all variations – including activating the ventilation system in each fire compartment with different fire loads – are run through an automatic testing routine in a manner that is not possible in physical tunnel.

To use the tunnel simulator, the server structure must first be adjusted between the tunnel simulator and the PLC. Once the adjustment is complete, the second step typically involves a factory acceptance test with software validation of the ventilation control of the PLC using pre-defined test scenarios. When validation is complete, the PLC software can be installed in the physical tunnel.

Services

HBI Haerter Consulting Engineers rendered the following services:

- Tunnel ventilation simulator preinstalled on a PC (hardware-in-the-loop)
- Service performance texts for the tender
- Specifications for the tunnel simulator