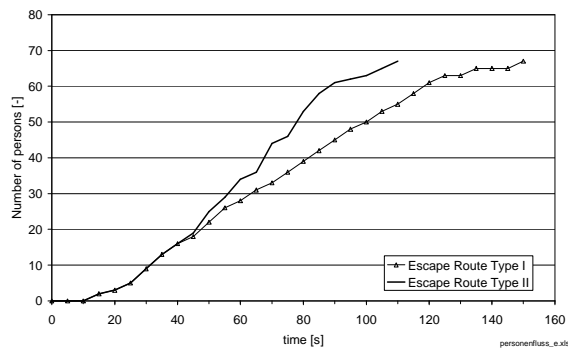
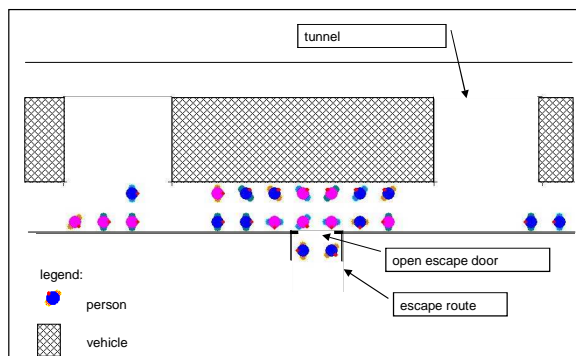


Smoke propagation in the tunnel for a burning lorry; Green: Area, from where escape routes can be reached; Black: smoke distribution, 2 variants



Comparison of different types of escape routes with regard to flow rate of escaping persons for 2 tunnel variants



Persons crowding in front of escape door

Description

In underground transport systems passengers and staff are mainly threatened by toxic gases from tunnel fires. The occupants of the tunnel should have a reasonable chance to reach safe escape routes before the tunnel is filled with smoke.

For the design of the ventilation of the Tunnel Böhämmer HBI Haerter Consulting Engineers analysed the safety of people in an emergency.

Two types of escape routes were compared in the simulations. The analysis was used to demonstrate that the location and design of escape routes are critical for the duration of the evacuation. It was then possible to recommend the favourable type of escape route considering the relevant boundary conditions.

Services

The following simulations served as a basis for the safety analysis:

- Calculation of the smoke distribution with the computer code SPRINT, which solves one-dimensional unsteady equations of flow
- Calculation of the flow rates of escaping people with the code BUILDINGEXODUS, which is designed to simulate the evacuation from complex systems (tunnels, large vehicles, buildings, etc.)

In general, unfavourable limitations of the smoke control or costs for ventilation measures may be compensated by improved escape routes. HBI employs advanced computer tools for simulation of the tunnel ventilation and the sizing of means of egress. This combination allows an efficient optimisation of measures for fire safety.