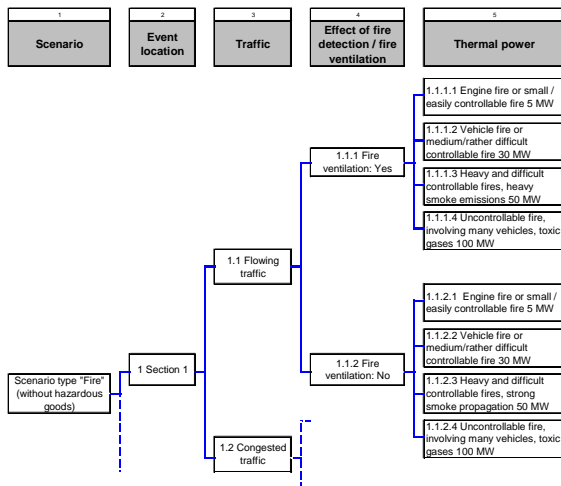
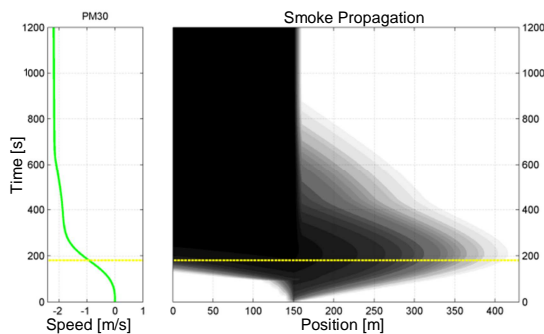


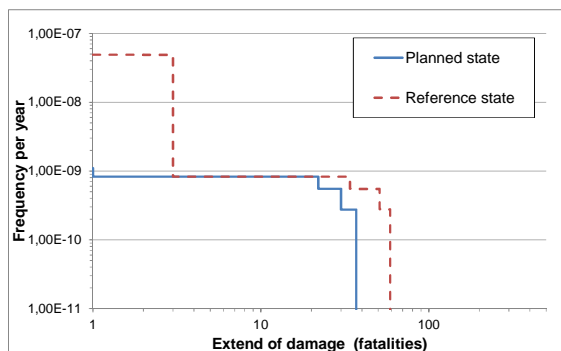
Longitudinal gradient of Apollo tunnel



Excerpt of the "fire" event tree



Calculation of the fire expansion for the tunnel Apollo under congested traffic / no ventilation / fire intensity 30 MW



Sum at risk diagram for the "fire" scenarios

Description

Tunnel Apollo is part of the L103 bypass near Bad Bertrich. It has a length of 438 m and a maximum longitudinal gradient of 5.5 %. The tunnel entered service in 1984 and carries bidirectional traffic.

According to the road tunnel equipment and operation guideline (RABT-2006) a risk analysis is to be conducted for tunnels longer than 400 m that present special characteristics and/or deviations from guideline requirements. It should be determined if the safety level of the tunnel is comparable with that of a guideline compliant one, and if necessary which measures are to be taken.

Services

The risk analysis for the Apollo tunnel considered all safety-relevant tunnel and traffic parameters. For the calculations the tunnel and the reference case are modelled. The risk analysis is in essence a comparison of the safety levels of the tunnel and the reference case. The reference case is considered to be a guideline compliant tunnel.

The following services were provided:

- Detailed modelling of the tunnel and the reference case
- Definition of emergency scenarios and of the event tree for "collision" and "fire"
- Calculation of smoke expansion using the SPRINT computer program
- Identification of escape paths available to the road users
- Ascertainment of the damage with varying fire location and intensity, traffic conditions and ventilation system response
- Calculation of risk and presentation of results

The calculations demonstrated that the tunnel offers a safety level comparable with that of a guideline compliant one, despite not conforming to the guideline requirements. For this reason no measures were deemed necessary.