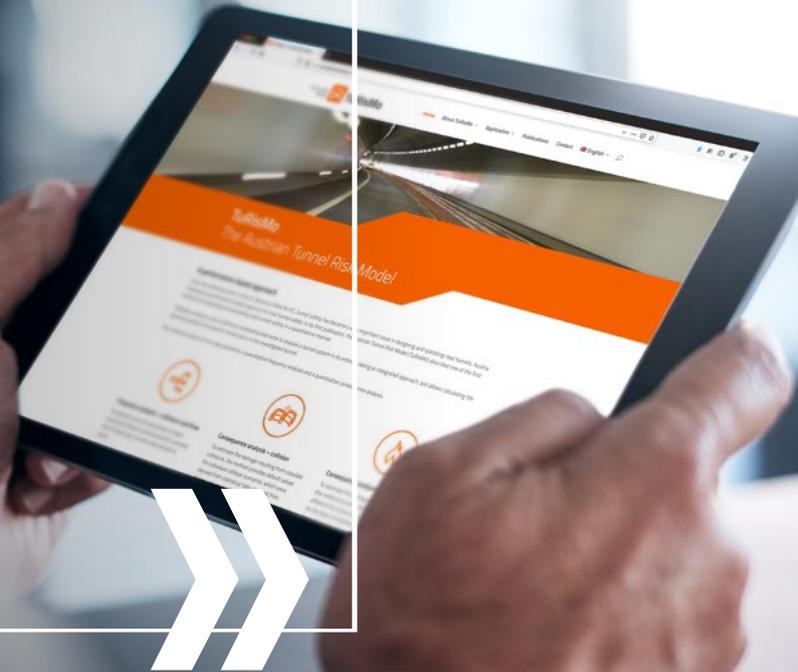


TURISMO. THE AUSTRIAN TUNNEL RISK MODEL.

ENGINEERING EXCELLENCE.

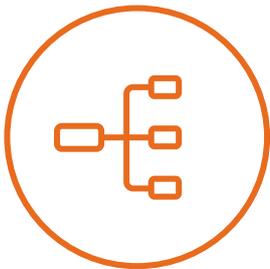


TuRisMo

The Austrian Tunnel Risk Model (TuRisMo), the first comprehensive system-based risk assessment tool to cover collisions and fires in road tunnels, enables almost any parameter that influences tunnel safety to be quantified, in all types of tunnel. By applying this tool, tunnel owners and operators are able to optimize safety and minimize costs.

TuRisMo consists of two core steps, namely quantitative frequency and quantitative consequence analyses.

TuRisMo combines a set of different methodical elements to analyze a tunnel system in its entirety. This allows the expected societal risk for tunnel users to be calculated within the investigated tunnels.



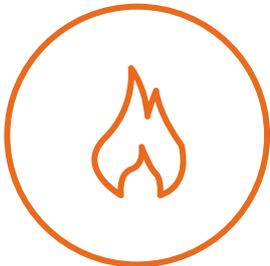
FREQUENCY ANALYSIS > COLLISIONS AND FIRES

Use of event tree analysis to calculate the frequency of characteristic incident scenarios that involve collisions and fires



CONSEQUENCE ANALYSIS > COLLISIONS

Estimation of damage values of collisions (casualties) on the basis of a statistical evaluation of tunnel collision data (considering collision scenarios, vehicle involvement, and velocity)



CONSEQUENCE ANALYSIS > FIRES

Estimation of the consequences (casualties) of different tunnel fire scenarios using default values (the standard method) or complex smoke propagation and evacuation simulation models (the detailed method)



TuRisMo

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Detailed consequence analysis workflow for fire incidents in TuRisMo

- Linear fire model – definition of fire growth up to maximum heat release rates of 5 MW, 30 MW and 100 MW
- 1D airflow simulation – transient one-dimensional CFD simulation to determine temporal development of longitudinal flow velocity
- 3D smoke propagation simulation – three-dimensional CFD simulation (FDS) to determine spatial and temporal smoke and temperature distribution
- Egress simulation – simulation of human behavior in a fire emergency, taking into account the effects of fire hazards on the evacuation speed and survivability of persons, by applying an accumulation-based intoxication model
- Exposure projection – superposition of survivability likelihood and distribution of persons to estimate the expected number of fatalities



„Unser Tunnelrisikomodell (TuRisMo) ist richtungsweisend für die quantitative Bewertung von Sicherheitsmaßnahmen in Tunneln.“

Bernhard Kohl, Tunnelsicherheitsexperte

APPLICATIONS OF TURISMO IN RISK-BASED STUDIES

TuRisMo can be used to:

- demonstrate sufficient levels of safety in case of deviations from prescriptive requirements
- select the best design alternative, or combination of risk mitigation measures, to minimize risk
- identify the most cost-efficient solution to fulfil minimum safety requirements
- support decision-making in the planning phase, during operation or for the upgrade of existing tunnels
- quantify the effects of specific shortcomings (e.g. aging of ventilation system) in existing tunnels upon user risk
- quantify the effects of potential compensation measures upon risk, and identify the most cost-efficient combination of these compensation measures



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