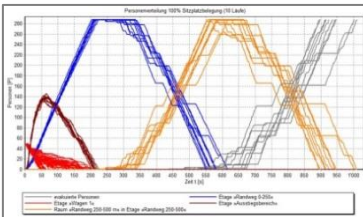


# RISK & SAFETY MANAGEMENT

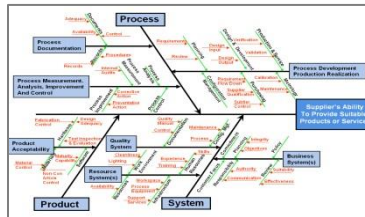
Incidents in underground facilities, particularly fire incidents, pose a great challenge for operators.

An early guidance as well as a professional planning and validation are the key to achieving maximum efficiency and safety during construction and operation. We have gained valuable experience by

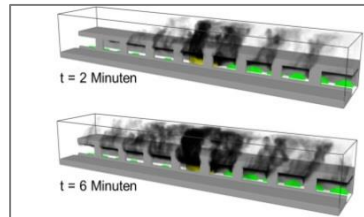
completing successful projects. We support our clients with distinctive specialization as well as extensive knowledge in risk and safety management. Together we design safety measures and plan tunnel-specific safety concepts, which ensure all-encompassing protection of persons and assets.



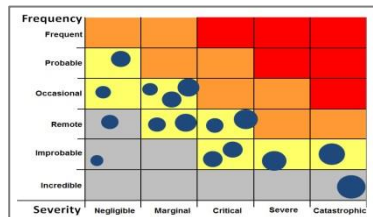
Shape of rolling stock plays a major role in the complex interaction between high-speed trains and tunnels



Validation of simulated pressure fluctuations through our large set of experimental data



Verification of health criteria through simulation of evolution of internal and external pressure (Follo line tunnel)



Development of ventilation and safety concepts for HSR tunnels

## Our Services

### Design - Tendering - Realisation - Commissioning

- Hazard and risk analysis for construction and operation phases
- Safety concepts for underground infrastructure and construction sites
- Safety action plans for construction and operation, based on cost and cost effectiveness
- Design, commissioning and certification testing of safety components
- Incident and crisis management concepts
- Response planning and documentation
- Training and emergency exercises of rescue forces

### Risk Management

- Risk monitoring concepts for operators and regulatory authorities
- Emergency response optimisation concepts in control and monitoring systems
- Scenario-based and quantitative risk analysis (QRA)
- Profitability analysis
- Explosion prevention concepts
- Escape and rescue concepts

### Fire Prevention

- Testing and verification of existing systems
- Simulation, analysis and evaluation of evacuation processes
- Thermo and aerodynamic modelling of fire incidents
- Fire safety design calculations of structures and components

### Maintenance and Refurbishment

- Complete safety assessment
- Condition assessment of all structural elements and equipment
- Planning of refurbishments and upgrades
- Realisation and commissioning

### Assessment and Certification

- Safety certification (for operators, insurances, authorities)
- Assessment of fire protection systems
- Safety certification of design and installation all components and facilities
- Assembly of usability certification of fire safety relevant components

### Expert and Consulting Services

- Functional safety
- Creation of safety documentation for underground traffic infrastructure
- Strategic support as members in regulatory and corporate working groups
- Incident re-enactments and interpretation of physical and energetic data
- Acting as safety officer

## Our Competence

- Comprehensive experience with a wide range of risks in underground spaces
- Interdisciplinary collaboration of underground engineering experts from all fields
- Extensive knowledge of national and international standards and best practices
- Cutting-edge in knowledge through research and development works

## Your Benefits

- Optimal usage of available resources
- Increased planning certainty
- Support and relief in certification processes
- Customised and field-tested safety concepts for assets of all types and sizes
- Prevention of false investments through early analysis and action plans



## Selected References

Project	AGAP Tunnel Control Center Duisburg, Germany	Project	Brussels Metro Nord Belgium
Services	Alarm and hazard prevention plans	Services	Safety planning
Client	Landesbetrieb Strassenbau NRW, TLZ Duisburg	Client	Beliris/STIB
Project	Road tunnel Via Binaria - Via Expressa Rio de Janeiro, Brazil	Project	Tunnel Complex Sochi, Russia
Services	Safety concept, quantitative risk analysis (QRA) and safety documentation	Services	Risk analysis, training and supervision during commissioning
Client	Porto Novo	Client	Russian Railways
Project	Albula Tunnel Switzerland	Project	Lyon Turin Ferroviaire France-Italy
Services	Safety concept	Services	Rescue of persons and safety
Client	Rhätische Bahn	Client	Lyon Turin Ferroviaire

**We are pleased to advise you in detail.  
Contact us.**



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