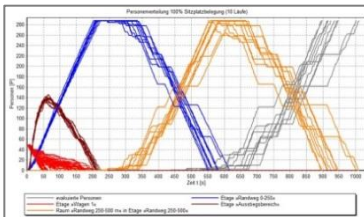


RISK AND SAFETY MANAGEMENT

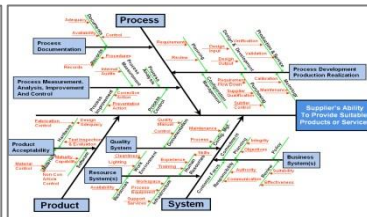
Incidents in underground facilities, particularly fire incidents, pose a great challenge for operators.

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 comple-

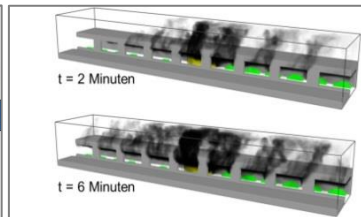
ting successful projects. We support our clients with distinctive specialisation as well as extensive knowledge in risk and safety management. Together we design safety measures and plan tunnel-specific safety concepts, which ensure all-encompassing protection of persons and assets.



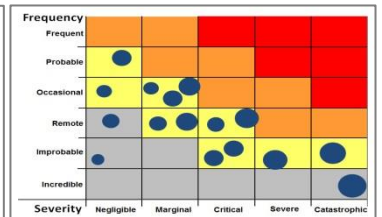
Simulation result: evacuation process from a railway tunnel



Root cause analysis of an incident inside a road tunnel



Simulation of smoke propagation



Risk assessment matrix of a metro tunnel

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 (ORA)
- Profitability analysis
- Explosion prevention concepts
- Escape and rescue concepts

Fire Prevention

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

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 under-ground 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
Service	Alarm and hazard prevention plans	Service	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
Service	Safety concept, quantitative risk analysis (QRA) and safety documentation	Service	Risk analysis, training and supervision during commissioning
Client	Porto Novo	Client	Russian Railways
Project	Albula Tunnel Switzerland	Project	Lyon Turin Ferroviaire France-Italy
Service	Safety concept	Service	Rescue of persons and safety
Client	Rhätische Bahn	Client	Lyon Turin Ferroviaire

**We are pleased to advise you in detail.
Talk with us.**



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