

# UNDERGROUND SPACE

## PLANNING AND DESIGN DEVELOPMENT

Diverse applications from industrial plants, research facilities, hydroelectric power stations, recreational facilities, protective structures, storage facilities, waste disposal facilities and quarries have a joint characteristic. They need large areas, which are becoming ever scarcer. The consequences are significant land acquisition costs. If situated near residential areas, resistance to the planned facilities is likely, leading to new legal requirements and delays.

Conditions placed on the environmental compatibility of facilities lead to expensive measures. Some of the facilities need a high level of protection, while others require uniform environmental conditions. Building a facility in an underground cavern can be the optimal solution – underground facilities need less or no land, have less impact on the surrounding countryside, prevent certain obligations, offer uniform climatic conditions and very high levels of protection.



Feasibility, preliminary design, cost estimate



Study comprising cost estimate for structural works



Volumetric Design and construction technology



Implementation, site supervision

## Our Services

### Phase 1 – Planning

- Feasibility studies
- Underground Space Planning Approach
- Visioning
- Existing Data interpretation
- Preliminary and schematic design
- BIM, 2D and 3D models and drawings
- Invitation to tender documents
- Geotechnical and structural analysis
- Safety concepts and evacuation planning
- Approval procedures

### Phase 2 - Realisation

- Sustainability Approach
- Detailed design
- Geotechnical Expertise
- Construction technologies
- Logistics planning
- Site supervision
- Quality management
- Stakeholder management
- As built documentation

### Phase 3 – Operation

- Benchmarking with other facilities
- Energy efficiency
- Facility inspection
- State assessment
- Asset management
- Conservation of value planning
- Renewal and refurbishment
- Expansion planning

### Services in all phases

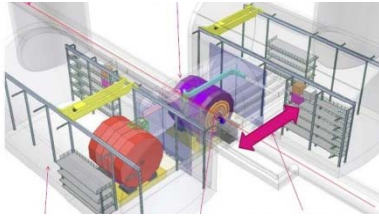
- Strategic Planning
- Vision and concept development
- Concept analysis
- Project Review
- Project management as client representative
- Risk management
- Planning and Consulting
- Safety evaluations and adaptations

## Challenges in developing the underground space

- Finding the right site location
- Site layout for max. utilization of rock mass value
- Minimum but reliable safe distance between caverns
- Layout with the least geomechanical interaction between caverns
- Stakeholder management
- Identifying most suitable construction technology
- Formulating logistics concept for access and muck transport
- Ventilation and cooling systems
- Fire and safety measures
- Smooth integration into existing urban areas
- Sustainable measures

## Our Competence

- Over 50 years of experience worldwide
- Innovative and feasible underground solutions
- Expertise in solving complex non-standard problems
- Advanced modelling and simulation tools
- Interdisciplinary collaboration of underground engineering experts from all fields



Geotechnical dimensioning and positioning



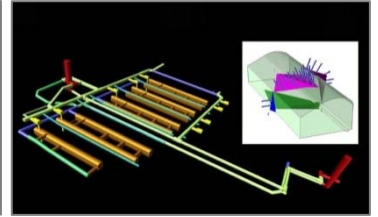
Quantitative risk analysis and Design Review

## Your Benefits

- A competent partner for the professional evaluation of your needs
- An assessment of the environmental impacts and deriving of optimal design alternatives
- A cost-efficient design and time savings
- Direct access to skilled and internationally trained engineers with solid practical know how



Feasibility studies, stability analysis and ventilation concept



Design checking and rock stability

## Selected References

Project	Sha Tin Cavern Development Study Hongkong	Project	Schollberg Quarry Switzerland
Service	Quantitative Risk Analysis, Comparison with relevant risk guidelines and the international state-of-the-art through similar projects worldwide	Service	Feasibility studies, Stability analysis, Ventilation concept, Supervision of quarrying works, Approval procedures
Client	Civil Engineering and Development Department Hongkong	Client	Baustoffe Schollberg AG
Project	Mountainfab Sargans Switzerland	Project	Jurong Rock Cavern Singapore
Service	Feasibility study, Design, Construction supervision	Service	Design review of the underground caverns as well as the access and service tunnels
Client	Espros Photonics Corporation (EPC)	Client	Jurong Town Corporation (JTC)
Project	Underground Science City Singapore	Project	CERN. New particle accelerator Switzerland
Service	Detailed concept design, Cost estimate, Ventilation and Safety Concept	Service	Project management for feasibility studies and cost estimate, Initial design and risk analysis
Client	Jurong Town Corporation (JTC)	Client	European Organisation for Nuclear Research (CERN)

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

**Contact us.**



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