

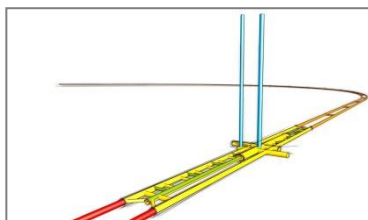
# DEEP & INCLINED SHAFTS

Shafts are key channels between ground level and sub-surface works and operations. Moreover, shafts are imperative links within the duplex transport logistic chain and are vital for operational safety.

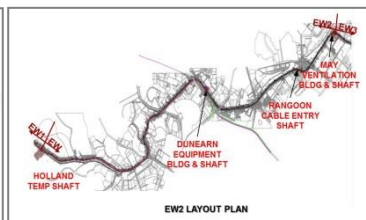
The construction of shafts is very often challenging. Intelligent site logistics, professional material management, water ingress management during shaft sinking, guaranteed water impermeability during operation and uncompromising safety are key factors for success.

As a result, smart shaft conception and design involves more complex factors than many standard engineering approaches, to successfully meet these varied requirements during construction and subsequent operations.

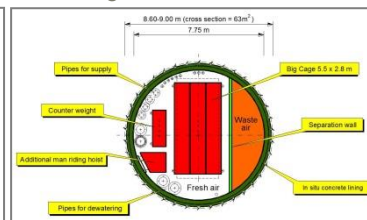
Amberg Engineering's multidisciplinary team offers distinctive expert knowledge paired with proven practical experience: from shallow metro shafts in soft soil to entire logistical concepts and deep shafts pushing the boundaries of what is feasible, in al-pine crossing tunnels.



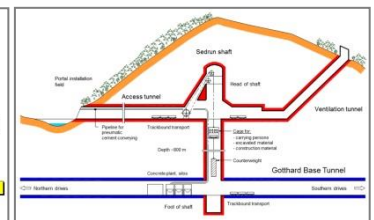
400m deep twin shafts, 12m diameter, Semmering Base Tunnel - Austria



Design inspection for accredited checker on shafts, EW2 - Singapore



800m deep, 9m diameter shaft, hoisting concept, Gotthard Base Tunnel (GBT) - Switzerland



Duplex logistic concept during tunnel heading, GBT - Switzerland

## Our Services

### Shallow shafts for metro and urban projects

- Entrance and reception shafts for TBM drives incl. soft eye technique or as part of deep excavations for stations added subsequently
- Circular and rectangular shafts
- Retaining wall systems such as pile walls and diaphragm walls in soft soil / groundwater conditions
- Special function shafts such as peanut-shaped shafts or rescue shafts

### Deep shafts in rock and soft ground

- Deep shafts >1000m as intermediate points of access for long tunnels
- Deep vertical shafts of 400m with dia. of up to 12m
- Deep shafts of 120m in depth and up to 30m excavation size in soft soil

### Raise boring and reaming shafts

- Raise Bore shafts with upper and lower access, up to 800m deep
- Reaming bore (after raise drilling) by drill & blast or through mechanised excavation techniques

### Geotechnical, structural and waterproofing design

- Design of underground shaft head caverns and hoisting chambers
- Geotechnical and structural design - from soft soil to hard rock, in all project phases
- Special solutions for the boundary between soft soil and heavily weathered and competent rock
- Special solutions for pre-grouting, water proofing; design of waterproof structures

### Logistical concepts and capacity dimensioning

- Overall site logistic concepts
- Capacity dimensioning with several supply chains
- Shaft hoisting concepts

### Ventilation, risk, safety and rescue

- Ventilation design for construction & operation
- Thermo & aerodynamic simulation of fire and smoke dispersal
- Hazard scenario & Quantitative Risk Analysis (QRA) for construction and operational phases
- Safety, escape and rescue concepts

### Consultation services and support during shaft sinking

- Consultation services regarding water ingress prevention, pre-grouting and waterproofing
- Optimisation of ventilation and energy consumption
- Maintenance, safety and risk management during construction and operation of shaft sinking and shaft hoisting equipment

### Specification of hoisting equipment

- Specification of shaft hoisting equipment
- Specification of state of the art vertical and horizontal logistics equipment

### Tender and contract management

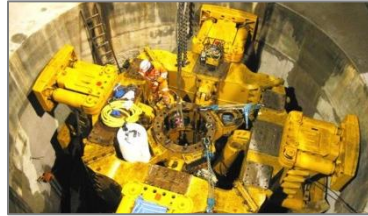
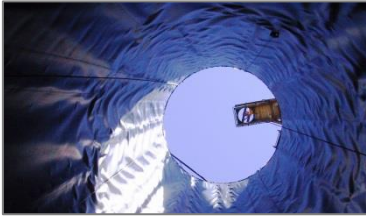
- Specification and evaluation of tender documents
- Contract management and owner consultation services for shaft construction and shaft logistics
- Expert knowledge in international standards applied in shaft sinking and hoisting

## Our Competence

- Comprehensive knowledge and experience in all fields of shaft design, shaft logistics and safety during construction and operation
- Solid track record of assignments for owners, contractors and regulatory authorities
- Expertise in international standards for shaft sinking and hoisting operations

## Your Benefits

- Employ proven expert knowledge to reduce your project risks and avoid exceeding construction cost budget
- Benefit from value engineering and project optimisation based on solid track record during both design and construction phase
- Ensure maximum transport capacity, reduce your long-term operations and maintenance costs



## Selected References

Project	Shafts Sedrun I and II, Gotthard Base Tunnel Switzerland	Project	Shafts SBT 2.1 and 1.1, Semmering Base Tunnel Austria
Services	Logistics concept, shaft diameter definition, design for all project stages, site supervision for shaft 1 and raise boring shaft II	Services	Dimensioning of shaft logistics and overall logistics, shaft diameter definition, design of concept for all project stages
Client	AlpTransit Gotthard AG	Client	ÖBB
Project	Singapore MND Underground Utility Plants Singapore	Project	Ratle Hydro Electric Project J&K India
Services	Study of technical and operational feasibility, geotechnical design, construction methods, shaft logistics, cost estimation and comparison with over-ground solutions	Services	Detailed design for civil works for all under-ground structures (excavation and support details) incl. underground power station, pressure and surge shafts and tunnels
Client	Ministry of National Development	Client	Larsen and Toubro, Faridabad
Project	Pumped storage Hydro Grimsel 3 Switzerland	Project	North-South Transmission Cable Tunnel Contract NS1 Singapore
Services	Project design and tender documents for machine hall caverns, pressure shaft	Services	Design check for shafts, mined tunnels, bored tunnels and ancillary structures,
Client	Kraftwerke Oberhasli	Client	Singapore Power Assets Ltd (SPPA)

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



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