Tunnels and Caverns

- **Fields of Expertise**
  - Road tunnels
  - Railway tunnels
  - Utility tunnels
  - Water tunnels (hydropower plants, water supply and wastewater disposal systems)
  - Adits
  - Caverns
  - Shafts

- **Highlights**
  - Construction methods in soft ground and hard rock (sequential excavation, TBM excavation with gripper TBM, shield TBM, hydro-shield TBM, EPB TBM; micro tunnelling)
  - 1,000+ km of tunnels
  - 57 km – one of the world’s longest tunnels (Gotthard Base Tunnel, Switzerland)
  - 55 km – one of the world’s longest tunnels (Brenner Base Tunnel, Austria / Italy)
  - 14.4 m diameter TBM – the world’s largest hard-rock TBM (Niagara Tunnel, Canada)
  - All disciplines covered in-house (rock and soil mechanics, geotechnics, structural engineering, aerodynamics, ventilation, safety, risk assessment, supervision)

- **Selected References**
  - Gotthard Base Tunnel (SEM / TBM, 57 km), Switzerland
  - Brenner Base Tunnel (SEM / TBM, 55 km), Austria / Italy
  - New Ebensfeld-Erfurt Railway Line (SEM, 37.8 km of tunnels), Germany
  - Perschling Tunnels (TBM, 7.44 km of tunnels), Austria
  - Pfänder Tunnel, 2nd Tube (TBM, 6.6 km), Austria
  - Niagara Tunnel Project, Water Diversion Tunnel (TBM, 10.4 km, 500 m³/s), Canada
  - Limberg II Pumped Storage Plant, Tunnels and Shafts, Kaprun HEPP (SEM / TBM), Austria

- **ILF Services**
  - Channel Tunnel, Undersea Crossover Cavern (SEM, span: 21.2 m), United Kingdom

ILF provides all services required for the successful implementation of tunnel and cavern projects.

- **Principal services:**
  - Feasibility study
  - Conceptual design
  - Permit application design
  - Detailed design
  - Preparation of tender documents
  - Construction design
  - Construction supervision
  - As built design

- **Supplementary services:**
  - Collection of geological and hydrogeological data
  - Geological and hydrogeological investigation programmes incl. evaluation
  - Geotechnical and geomechanical modelling
  - Numerical modelling and stability analyses
  - Solutions for special problems such as karst, swelling and squeezing rock; compensation of settlements, minimisation of calcification, reduction of vibrations

- **Principal services:**
  - Aerodynamics
  - Safety concepts, safety analyses
  - Evacuation simulations
  - Fire protection measures
  - Emergency ventilation, air-conditioning
  - Noise protection for portal areas
  - Design of doors, gates and shutters
  - Interoperability reviews (TSI)

- **Supplementary services:**
  - Construction management
  - Claim management
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