

TUNNEL UETLIBERG



New construction Tunnel Uetliberg, Zurich, Switzerland

The 4.5km long Tunnel Uetliberg is the key building of the western bypass Zurich and connects the motorways (A4/A3) to the Gotthard and Chur

Scope

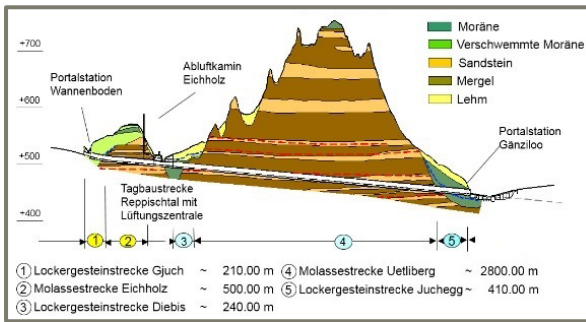
- The project comprises two parallel tubes, each about 4.5km in length. These relate to a walk-in and every 900m with a passable cross-connection. The distance between the SOS and hydrant niches is 150m
- On each of the west and east portal there is a portal station with technical rooms
- In Reppischtal an underground air handling unit is located, which is located above an also underground traffic crossing
- In the soft-ground section and in the basting technical extended rock section, is a horseshoe profile with a width of 14.7m and a height of 12.7m installed
- The normal profile of the approx. 2.8km long Molasse section has a width of 14.4m and a height of 14.2m
- The expansion of all tunnel is a double-shell with a full seal. The seal in the soft-ground section is pressure-maintaining and drained in the practically dry Molasse section (without pressure)

Services Amberg Engineering

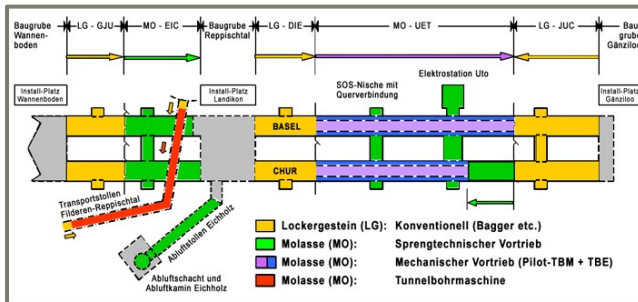
- SIA phases 31 upto 53 (general project – commissioning)
- Overall project, project management, site supervision
- Project planning of all underground structures
- Project planning and coordination of the sub-projects cut-and-cover, construction pits, central
- Support construction manager
- Overall coordination of the overall project
- Coordination with other specialist planners Geology, BSA, environment, traffic, design, surveying



- Situation Tunnel Uetliberg, west bypass



- Geological longitudinal section



- Overview drive methods

AMBERG FACTS

Contracted value Amberg

- CHF 35 Mio.

Project phases & duration

- Project planning: 1983 – 2009
- Realisation of the project: 2001 – 2009

Project details

- Total length: ca. 2x 4.5km.
- Soft-ground sections (3 pc): ca. 860m x 2 tubes
- Molasse section (2 pc): ca. 3'300m x 2 tubes
- Cut-and-cover section (3 pc): ca. 300m x 2 tubes

Excavation method

- Soft-ground sections: conventional core construction in groundwater
- Rock sections: blasting and mechanical drive in rock with TBM pilot ducts Ø5.0m and tunnel boring extension machine (TBE), Ø14.4m
- Exhaust air duct and shaft: Ø8.2m, depth 60m. conventional shaft sinking in soft-ground (underpinning construction) and explosive drive in the rock

Construction details

- Excavation support: steel fibre reinforced shotcrete, reinforcing nets and steel construction
- Full sealing with plastic sealing strip, partially pressure-retaining and drained, dam ring
- In-situ concrete inner lining
- Prefabricated work channel elements (WLK=

CLIENT FACTS

Overall costs

- Total CHF 1'120 Mio. (Basis 1994)

Project overview

- National road tunnel with 2 three-lane tubes (2 lanes, 1 breakdown strip)
- Lane width 10.5m
- Cross-sections of 143m² – 160m²
- Between both tubes, all 300m accessible and all 900m accessible cross-connections arranged
- The ventilation center in Reppischtal and the portal stations Wannenboden and Gänzlöo were created in cut-and-cover
- A longitudinal ventilation is provided as the ventilation system. At the east portal, the tunnel air flows freely. The west portal has an environmental ventilation system installed which can extract the amount of air flowing in from the tunnel. The air is then returned via the exhaust duct above the false ceiling to the ventilation plant Reppischtal and from there blown into the atmosphere via an exhaust duct and chimney

Geology

- Upper freshwater molasse. Alternate storage of hard sand / siltstone layers and soft marl layers, horizontal stratification
- Soft-ground section of heterogeneous morainic material. In the section Juchegg the tunnel profile lies in the Uetliberg clay. The soft-ground sections lie partially or completely in the groundwater
- Maximum coverage about 320m

CHALLENGES

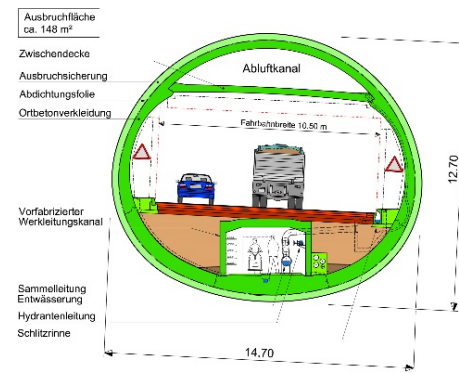
- The drive in soft-ground section took place in the heterogeneous moraine in the groundwater by means of core construction
- The drive in the rock (Molasse) were driven by blasting technology and mechanically with a tunnel boring extension machine (TBE)
- Technically very demanding large structure in hydrogeologically variable subsoil and different geologies. At times, up to ten drives with different construction methods ran parallel
- The ventilation center in Reppischtal and the portal stations Wannenboden and Gänzlöo were built in cut-and-cover.
- Underpass of a 100-year-old SBB tunnel under operation at a distance of 6.5m in blasting
- Underpass transport tunnel at a distance of 3m
- Elaborate surveillance work in the tunnel and on the surface
- The tunnel was equipped was double-shelled with full sealing, in-situ concrete shell, false ceiling, underground duct under the carriageway, cross-connections, as well as SOS and hydrant niches and an underground operation center expanded
- For the diversion of traffic in case of incidents (fire, maintenance work) underground road crossings were provided
- The resulting excavated material and muck, which was not reused on the construction side, was transported by train. For this purpose, a rail loading station was created on both sides of the portal
- Based on the RIA, all excavated material (1.7 mio m³) was transported by rail from the Filderren transshipment facility. About 75% of the total tunnel alignment was driven up from Reppischtal. From there, the material was transported by conveyor belt through a 550m long transport tunnel to the railway loading facility at the west portal. The transport tunnel also served for the construction site delivery of sand, gravel and cement.

ENGINEERING APPROACH



Drive in soft-ground soil

- 3 soft-ground sections (Gjuch, Diebis, Juchegg)
- All soft-ground sections were driven in the core construction method (excavator drive)
- LG GJU and LG DIE: construction support measures with a protective shield of lances in the crown area of the partial cross sections, excavation face with injectable steel anchors
- LG JUC: support measure with pipe arch. Consisting of 4 stages (l=15m)
- LG GJU: groundwater lowering by means of filter wells to partly below tunnel invert level
- Excavation support: steel arches and steel fibre reinforced shotcrete



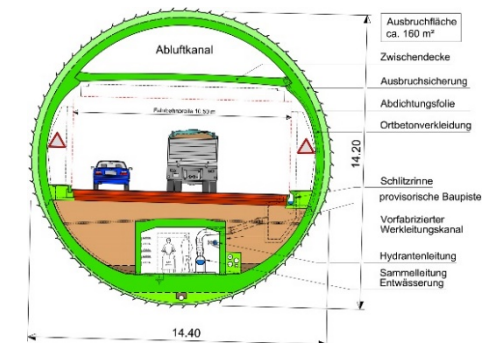
Standard cross-section soft ground

TECHNICAL SOLUTIONS



Drive in rock

- 2 rock sections (Eichholz, Uetliberg)
- MO EIC and MO UET: drill-and-blast advance
- MO UET: mechanical excavation of the pilot tunnel (TBM)
- Subsequent full excavation with a tunnel drill extension machine (TBE) with Hinterscheidtechnics
- Excavation support in TBM-drive: steel fibre reinforced shotcrete with GFK anchors
- Excavation support in TBE-drive: mortar rope anchors, friction pipe anchors, nets and shotcrete
- Interior fittings in the trailer area



Standard cross-section rock

TECHNICAL SOLUTIONS



■ Subdivision upper parament gallery



■ Core construction



■ Exhaust air shaft, sinking in soft ground

TECHNICAL SOLUTIONS



■ Invert lining trailer area



■ Excavation of cross-section passable, SPV



■ Excavation of transport tunnel, TBM

TECHNICAL SOLUTIONS- INNER LINING



■ Cable duct with backfilling



■ Installation drainage, slotted channel



■ Underground crossing