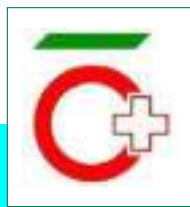


SWITZERLAND



Name of Association: Swiss Tunnelling Society (STS)

Type of Structure: Non-profit, open association

Number of Members: 534 members (thereof 120 young members), 91 corporate members

ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

STS was hosting/organizing/supporting/participating in the following main activities:

- June General Assembly 2023 and 50th anniversary celebration in Lucerne, Switzerland
- June Swiss Tunnel Congress and Colloquium 2023 in Lucerne, Switzerland
- September D-A-CH (Germany-Austria-Switzerland) annual meeting in Bern, Switzerland
- October European Underground & Tunnel Forum (EUTF) annual meeting in Paris, Italy
- May – September 2023, 'Insight in Underground' public visits/events in relation to the STS 50th anniversary celebration, carried out over five days in different regions of Switzerland
- Activation of the new Swiss Tunnel-Database (available via website)
- Activation of the new STS website

Additionally, the STS young members (STSym) were hosting/organizing/supporting/participating in the following events:

- March 2023 ym Regional Event in Genua, Italy
- March Excursion Mauderli AG, Switzerland
- June Young Members' podium at the STS 50th anniversary celebration in Lucerne, Switzerland
- Nov/Dec STSym-Drinks in different locations in Switzerland (Olten, Zürich, Lausanne)

CURRENT TUNNELLING ACTIVITIES

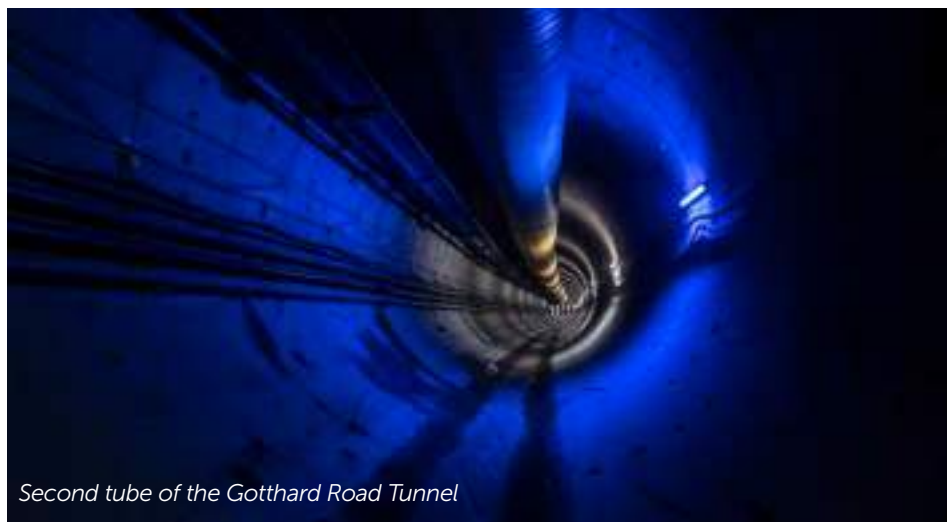
Second tube of the Gotthard Road Tunnel

The second tube of the Gotthard Road Tunnel includes the construction of a new two-lane tunnel with a length of 17km which runs parallel to the existing Gotthard Road Tunnel, 67 new cross-passages to the existing service gallery, five new underground ventilation

caverns linked to the existing ventilation shafts of the existing tube, two new technical buildings in the portal areas Göschenen and Airolo and several comprehensive preparatory works, such as two access adits of 5km length each, and two new sections of the service and emergency gallery.

In 2023 the project achieved several milestones:

- In the northern part, the Lot 243 completed the excavation of several logistic galleries and caverns and also finished the excavation of the northern access adit using an open gripper-TBM with a length of 4km. The excavated tunnels and caverns were handed over to the main contractor to continue the installation works underground, as these tunnels and caverns will be used to host the main concrete production plant and the plant for the production of the segmental lining.
- The closed shield TBM for the southern access adit, with an excavation diameter of 7.46m, successfully completed the excavation of the 5km long access adit. Currently, the machine is being disassembled in an underground cavern. Afterwards, the access adit will be handed over to the main contractor for the excavation works in the geologically complicated fault zone "Guspis."
- Progress on the primary lots, both north (Lot 241) and south (Lot 341), is on schedule, and the construction site is in full operation.
 - 1) In the northern section the contractor started with the excavation of the open-pit for the northern portal and almost completed a counter-excavation by D&B. Additionally the works for the logistics caverns for the excavation of the main fault zone north called "Mesozoikum" started.
 - 2) In the southern section, the open-pit for the southern portal has been



Second tube of the Gotthard Road Tunnel

completed, and excavation for the launch tube of the main TBM has commenced using conventional methods (excavator and D&B). Furthermore, the contractor has executed extensive installation works, including those for the water treatment plant, the primary concrete production facility, and the hallway designated for the production of the segmental lining.

- The lot responsible for the material management and logistics of the entire project (Lot 111) started the main installations in the southern area of the project (foundations and structures of the conveyor belt running from the southern portal to its main construction site, silos for the transfer of the excavated material in the train stations of Airolo and Göschenen, and foundations for the main material treatment plant).
- As part of the events commemorating the 50th anniversary of the Swiss Tunnelling Society, the client opened the construction site to the public, celebrating two days of open doors and welcoming more than 2000 visitors each day in the northern and southern construction sites. It was an extraordinary opportunity to showcase this megaproject to the wider public.

Flood protection for the Sarneraa valley (central Switzerland)

In 2005, the city of Sarnen was repeatedly flooded by a rapidly rising lake. To protect the Sarneraa valley, including the city of Sarnen, the canton of Obwalden decided in 2014 to build a 6557m long flood protection tunnel. The tunnel is designed with a discharge capacity of 100m³/s. The tunnel was excavated using the S-1216 TBM. Tunnelling began in January 2021 and ended on 15th March 2023. Very difficult geology was encountered during TBM advance. Large water inflows of more than 400 l/s from karstic caves within exceptionally hard limestone had to be managed during the initial excavation. More than 1541 steel rings were installed to secure faulted limestones and marls, in particular during the last 2km. The inner lining with 20cm of shotcrete has been under construction since summer 2023 and is scheduled for completion in winter 2024. The town of Sarnen will then be protected from further flooding by spring 2026.



Flood protection for the Sarneraa valley

New RBS underground station (Bern)

The existing RBS station in Bern was opened in 1965. Designed for around 16,000 passengers a day, it is now used by up to 60,000 passengers a day. With the construction of the new RBS station, the capacity will be adapted to current needs and the forecast development. The new four-track RBS station will be located below tracks two to seven of the Swiss Federal Railways (SFR) station. The current RBS station will be abandoned for rail operations.

The new four-track RBS station will be built below the current SFR station. It consists of two large underground caverns, each with two tracks and a 12m-wide central platform. Escalators

and lifts will lead from the platform level to the RBS distribution level and on to the new central underpass. From there, passengers can reach the mainline and suburban train tracks and the city. The trains enter the RBS station through a new, almost 1km long, partly double-track tunnel. This new tunnel branches off from the existing RBS-Schanzentunnel and runs largely under road and railroad land.

Parallel to the RBS work, SFR is building the new central underpass and the city of Bern is adapting the road network around Bern station. The project is extremely complex, challenging and fascinating. The new facilities have to be built in the middle of the city in full operation. A



New RBS underground station (Bern)

wide variety of construction methods are being used. One of the main difficulties is the technical and, in particular, temporal coordination of the project components of the various project partners.

The new Bern RBS station is scheduled to go into operation in the second half of 2029. The project is scheduled for completion in 2032. The total costs, financed by the federal government, the canton of Bern and the city of Bern, amount to around CHF1,217M (prices as of fall 2016, excluding inflation and VAT).

Gubrist highway tunnel, 3rd tube and refurbishment of the existing ones (Zurich region)

The 3rd tube of the Gubrist tunnel is a construction project designed to alleviate the bottleneck at the Gubrist tunnel in Switzerland. The tunnel has a total length of 3.3km and was constructed using mechanized rock excavation (MUF) from the Affoltern side. The breakthrough in Weiningen took place on September 22nd, 2020 after around three years of driving and the 3rd tube was put into operation on April 20th, 2023. The tunnel was cut using a roadheader (TSM) with excavation support of fibre-reinforced shotcrete and steel arches as well as partial rock anchors. One cycle of excavation and support took approx. six to eight hours. With three cycles in three-shift operation, the tunnel advanced by up to 6m a day. The excavated cross-section is 180m².

In Weiningen, 200m of tunnel were built whilst at the same time, the new Weiningen half connection with an additional 100m-long overpass was built. On the Affoltern side, 95m of cut-and-cover was constructed and a temporary loading station was built with a connection to the Swiss Federal Railways line to allow removal of the excavated material.

The tunnel excavated material was transported to the loading station via conveyor belt and loaded onto freight trains. During the tunnel excavation, two to three trains with 18 wagons each transported a total of around 700,000m³ of rock to the former quarry near Wildeggen every day. This meant that a total of 160,000 truck journeys could be avoided.

The operating and safety equipment was installed by specialist companies by summer 2022. This included the signalling, lighting and ventilation in the 3rd tube and the three operations centres. This was followed by extensive



Gubrist highway tunnel 3rd tube

functional and safety tests up to spring 2023, with the first traffic rolling through the tunnel in April 2023.

Once the 3rd tube has been commissioned, the two existing tubes of the 3,250m long Gubrist tunnel (commissioned in 1985) will be repaired one after the other as part of the expansion of the Zurich northern bypass (ANU) and extended by around 100m. The main work includes the removal of the existing carriageway slab, the service and exhaust air ducts, the lateral walkways, and the intermediate slab. The dismantled elements are reinstalled in an adapted position so that the available traffic space is optimized or enlarged. The lowered roadway will rest on a buried utility duct. In addition, new SOS niches in the 2nd tube, a new service duct in the Weiningen open-cast mine, and anti-circulation walls in the Affoltern portal pre-zone will be built. In both tunnel tubes, the surface protection system, the hydrant line and the operating and safety systems will be replaced.

Construction work for the repair started in July 2023. Traffic should be flowing through all three tunnels by the end of 2027. The shell construction costs for the repair of the 1st and 2nd tunnel tubes amount to CHF 245M.

Evouettes road tunnel (Wallis)

The Evouettes bypass on the H144 is a two-way road which improves the link between Villeneuve in Switzerland and

St-Gingolph on the border between Switzerland and France, south of Lake Geneva. The road continues on the French side to the thermal town of Evian.

The topography led to the following works: Two road junctions (total L = 473m); two tunnel entrance passages (total L = 163m); two rectangular cut-and-cover tunnels (total L = 49m); two cut-and-cover tunnels with a profile similar to that of the main tunnel (total L = 59m); a tunnel (L = 657m, internal radius = 5.3m); and an emergency tunnel (L = 120m).

The tunnel is curved, with two traffic lanes, excavated in an alluvial fan through loose ground (sandy-gravelly and silty-gravelly moraines). The geological conditions are described as difficult. Systematic ground reinforcement is required. The excavation of the tunnel ascends for around 150m before descending for around 500m from the north portal to the south. The full cross section is excavated using a mechanical excavator.

The standard ground support enabling works include: 45 near-horizontal overlapping jet-grouted columns (min. diameter 80cm; length 12m) distributed around the excavation perimeter of the tunnel and at the bridge piers. The columns have been installed at an angle of 7.29° to the axis of the tunnel to enable successive sets of columns to overlap each other by 3m. Thirteen jet-grouted columns (min. diameter 80cm, length

12m) are positioned at the leading edge of the excavation. These columns are inclined at between 0 and 5° to the horizontal. The ground support consists of sprayed fibre reinforced concrete followed by sprayed concrete reinforced with steel girders and a welded mesh.

The temporary invert is formed using poured concrete reinforced with HEB 180 or 220 beams. The permanent invert and lining are of unreinforced concrete.

The main difficulty was the passage under the village, due to greater than expected settlement (~8cm) which occurred during the installation of the jet piles. Work resumed in February 2022 after an 11-month stoppage. In the most critical section, the company proposed using a double cantilever vault. The tunnel was open on 13th November 2023 for a total cost of the Les Evouettes bypass of around CHF134M, including CHF85M for the tunnel. It will be financed mainly by the Swiss trunk road fund.

FUTURE TUNNELLING ACTIVITIES

Rail Tunnels

- Lötschberg Basetunnel II (BLS, 35,000m)
- Stadelhofen Tunnel (SBB, 7,000m)
- Brüttener Tunnel (SBB, 11,000m)
- Zimmerberg Tunnel II (SBB, 11,000m)
- Crossrail – Lake Crossing Luzern (SBB, 5,500m)
- Geneve Station Expansion (SBB, 6,000m)
- Heitersberg Tunnel II (SBB, 5,000m)
- Grimsel Tunnel (SBB, 21,720m)
- Svitto Tunnel II (SBB, 300m)
- Morges-Peroy tunnel (SBB, 9,000m)
- Neuchâtel-La Chaux-de- Fonds (SBB, 14,500m)
- Täsch-Zermatt Tunnel (MGB, 4,120m)
- Fideris Tunnel (RhB, 1,385m)

Road Tunnels

- Morschacher/Sisikoner Tunnel (Kt. SZ/UR, 8,037m)
- Vingelz Tunnel (Kt. BE, 2,300m)
- City Tunnel (Kt. BE, 700m)
- Port Tunnel (Kt. BE, 1,800m)
- Safety Gallery Fäsenstaub Tunnel (ASTRA, 1,460m)
- Bypass Luzern (ASTRA, 3,450m)
- Bypass Bern Ost (ASTRA, 4,000m)
- Rosenberg Tunnel 3rd Tube (ASTRA, 1,435m)
- Safety Gallery Tunnel Gei and Brusei (ASTRA, 485m)
- Twann Tunnel (ASTRA, 1,700m)
- Nischenberg Tunnel (ASTRA, 1,640m)
- Rhein Tunnel (ASTRA, 4,500m)



Evouettes road tunnel (Wallis)_

- 3rd Tunnel Melide- Grancia (ASTRA, 1,800m)
- Tunnel Cargo Station St. Gallen (ASTRA 2,400m)

Other Projects

- Cargo Sous Terrain Zurich – Haerkingen (CST, 70,000m)

STATISTICS

1. Length of tunnels excavated during 2022:

12,000m/80% TBM in 2023

2. Amount (Eur) of tunnelling / underground space facilities awarded in 2022:

€1,450M in 2023

3. List of tunnels completed

Rail Tunnels: None.

Road Tunnels: 3rd Tube Gubrist Tunnel

Other Projects: CERN HILUMI LHC Project (main works)

4. List of tunnels under construction

Rail Tunnels: Albula Tunnel (RhB, 5,860m), RBS Bern Station Expansion (RBS, 1,200m), Ligerz Tunnel (SBB,

2,119m), Wylerfeld Tunnel (SBB, 300m).

Road Tunnels: Second Gotthard Tunnel Tube (ASTRA, 16,918m), Safety Gallery Cholfirst Tunnel (ASTRA, 1,250m), Safety Gallery Kerenzerberg Tunnel (ASTRA, 5,504m), Visp Tunnel 2nd Tube (Kt. VS, 2,600m), Refurbishment Gubrist Tunnel 1st and 2nd Tube (ASTRA, 3,230m), Riedberg Tunnel (Kt. VS, S: 555m, N: 483m), Safety Gallery Rofla Tunnel (ASTRA, 1,018m), Tunnel de déviation des Evouettes (Kt. VS, 657m), Tunnel des Nations (Kt. GE, 870m), Gallery Schwamendingen and Schöneich Tunnel (ASTRA, 1,680m), Kaiserstuhl Tunnel (Kt. OW, 2,081m), Refurbishment Tunnel Melide-Grancia (ASTRA, 1,800m)

Other Projects: Hydro Power Plant Ritom, Sarneraa spillway tunnel (Kt. OW, 6,557m)

EDUCATION ON TUNNELLING IN THE COUNTRY

- ETH Zurich, Department of Civil, Environmental and Geomatic Engineering
- University of Applied Sciences, in various cities