

ITALY

Name of Association: Società Italiana Gallerie (SIG) – Italian Tunnelling Association

Type of Structure: Non-profit, open association

The Italian Tunnelling Society (SIG) promotes and coordinates studies and research in the field of tunnelling and underground construction works.

SIG is a founding nation of the ITA (International Tunnelling Association) and EUTF (European Underground & Tunnel Forum).

Number of Members: About 800 members (among which 86 are corporate and 250 are young members)



ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

Congresses:

- 04-05/05/2023 Samoter Conference (Verona) – “The great underground infrastructures of the next decade and the SIG Working Groups contribution for the development, innovation and safety of tunnelling”
- 16/11/2023 (Brescia) “Precast segments for TBM tunnel linings: “Industrialization and sustainability”
- 01/12/2023 (Milan) S. Barbara Conference, World Tunnelling Day, Adolfo Colombo Lecture (held by Ing. Remo Grandori) “Industrial, logistic, and organizational challenges, as well

as innovations, for the contemporary construction of 300km of tunnels for the expansion and the upgrade of the Italian railway network” (available on Youtube in Italian)

Publications:

- Handbook on Tunnels and Underground Works (Volume 2: Construction – Methods, Equipment, Tools and Materials)
- Quarterly journal “Tunnels and Major Underground Works” (since 1976, with issue n. 144 in December 2023), with technical papers, news from construction sites and tenders, editors’ letters, reports on the tunnelling market, etc.

Events:

- 10-11/03/2023 – EUTFym Regional Event – Visit to the construction sites of the Giovi 3rd Pass + Social Event in Genoa – With 50 young tunnellers from France, Switzerland, Austria, Germany, Netherlands, Spain, and Portugal.

Technical Visits:

- 20/01/2023 – State road SS685 “delle Tre Valli Umbre” (structural restoration interventions of the damage suffered due to the seismic events of 2016)
- 01/02/2023 – Lonato tunnel and S. Giorgio in Salici tunnel on the Brescia-Verona high-speed railway
- 16/03/2023 – Modane/Avrieux ventilation shaft on the Mont Cenis base tunnel (Turin-Lyon railway)
- 14/04/2023 – San Fermo tunnel (A9 Lainate-Como-Chiasso highway)
- 13/09/2023 – Grottaminarda tunnel (Napoli-Bari high-speed railway)
- 24/10/2023 – Merano north-west road by-pass (Lot 2)

Webinars:

- In early 2023, the SIG Young Members group launched a series of live webinars (recordings available on the SIG Youtube channel) where young tunnellers can present a project or research they have been working on.



The goal is to share their experiences across the tunnelling industry (clients, contractors, consultancies, universities, etc.).

By the end of 2023, five episodes were successfully made, all with over 300 views.

- 29/03/2023 – Analysis of an urban excavation: the St. Mary Abchurch case study
- 07/06/2023 – Accelerating digital change: automation and innovation in the tunnelling world
- 26/07/2023 – Mechanised tunnelling with pipe jacking: the “La Batiáz – Le Verney” power utility tunnel case study
- 25/10/2023 – The safety of tunnels in operation within the TERN network: the Italian Law 264/2006 and the role of Tunnel Safety Officer (Responsabile di sicurezza gallerie)
- 13/12/2023 – Monitoring of tunnel induced deformation phenomena by means of satellite interferometry: settlements in urban areas and reactivation of landslides

CURRENT TUNNELLING ACTIVITIES

Third Giovi Pass, Genoa - Tortona Railway: 37km of twin tunnels along the 53km section between Genoa and Tortona. About 65% conventional excavation and 35% by EPBM (10m dia), with squeezing ground and the presence of gas and asbestos. The Valico tunnel (27km) is going to be the longest in Italy, on a par with the Hirpinia Tunnel on the Napoli-Bari railway. At the end of 2023, 87% of tunnelling activities were completed.

Brenner Base Tunnel: a 55km twin bored tunnel between Tulfes/Innsbruck (Austria) and Fortezza (Italy) with three underground safety areas and a pilot/service tunnel. Including the junction

within the Innsbruck urban tunnel, it will have a max. underground length of 64km (the longest in the world). There are two sections on the Italian side:

- 1) The section Mules 2-3, involving 65km of tunnelling (20km conventional and 45km with TBMs), currently at 91% progress;
- 2) The section under passing the Isarco river (with artificial ground freezing underneath the river) completed in 2023.

Since April 2023, all the contracts on the Austrian side have been awarded.

Mont Cenis base tunnel, Turin – Lyon:

two 57.5km long twin tubes (45km on the French side and 12km on the Italian side), with 170 cross-passages (every 333m), four intermediate adits for construction and emergency, five ventilation plants and three underground safety areas. It is going to compete with the Brenner Base tunnel for the title of longest railway tunnel in the world.

The section on the Italian side is:

- 1) CO 03/04, 12km, between the French border and Susa, awarded in September 2023. This area was previously studied by means of a 7km exploratory tunnel excavated between 2012 and 2017. Also, there is a 1.9km twin bore junction tunnel (not part of the base tunnel) to link Susa to the Italian railway network, which is part of the CO 01 section, that was issued for tender in 2023 and will be awarded in 2024.

Brescia-Verona high speed railway:

6.6km of twin bored tunnels (Lonato) and 10.2km of cut&cover to underpass twice the A4 highway (Lonato and Sona) and an urban centre. The TBM completed the first bore of the Lonato tunnel in 2022, and started the second bore in 2023, which will be completed in 2024.

Verona-Fortezza new railway line:

as a southern access to the Brenner Base Tunnel, seven lots will be built, giving priority to the sections currently limiting the line's performances the most. Construction started in 2023 for the Trento by-pass tunnel (11.5km) and the Fortezza - Ponte Gardena section (Scaleres, 15.4km, and Gardena, 6.3km), with five TBMs to be launched in 2024 and three TBMs between 2025 and 2026.

Two additional sections in future will include the tunnels Val d'Ega (10km), and Zugna (16,7km).

Napoli Bari high Speed Railway:

- 1) Napoli-Cancello section: the Casalnuovo c&c tunnel is under construction (first example in Italy of cut&cover excavation in hyperbaric conditions below water table)
- 2) Telesse-Vitulano section: conventional tunnelling activities on Tuoro S. Antuono (1.6km), Cantone (0.98km), Limata (0.3km), S. Lorenzo (1.7km), Ponte (0.45km), Roventa (0.2km), Le Forche (2.4km)
- 3) Apice-Hirpinia section: One TBM is excavating the Grottaminarda tunnel (2km) and will then start the Melito tunnel (4.4km); One TBM will start excavating the Rocchetta tunnel (6.5km) in 2024 (all single bore tunnels).
- 4) Orsara-Bovino section, two TBMs are going to start excavating a 10km twin bore tunnel in 2024
- 5) Hirpinia-Orsara section: Four TBMs will start excavating a 27km twin bore tunnel between 2024 and 2025 (longest in Italy on a par with the Giovi 3rd Pass tunnel). Complex clay formations with squeezing and swelling, presence of methane gas, within a highly seismic area.



Florence high speed railway junction:

An 8km twin bore tunnel, excavated by two EPBMs underpassing the city centre of Florence to speed up the high-speed services along the Rome-Milan route and free up capacity on surface for regional commuter trains. Construction with the first TBM started in 2023.

CURRENT AND FUTURE TUNNELLING ACTIVITIES

Messina-Palermo railway: On the Fiumetorto-Castelbuono section, a 10m diameter TBM is working to excavate the 6.7km long Cefalù tunnel (twin tubes). Also, an underground station is going to be built to serve the town of Cefalù.

Genoa urban railway junction: The project involves the sextuplication of tracks along the Brignole-Principe section and quadrupling of the Voltri-Sanpiederarena sections which are the busiest portions of the Genoa urban railway junction. The project was completed in 2023 and included the extension of the existing Colombo tunnel and S. Tommaso tunnel.

Palermo-Catania railway: More than 70km of tunnels through the central areas of Sicily, such as: Alia (20km), S. Catena (7.8km), Marianopoli (6.6km), Salso (3.9km), Trinacria (13.4km), Montestretto (2.3km), Sicani (5.3km), Dittaino (2.3km). The Alia tunnel will be the 3rd longest in Italy. All the contracts were tendered in 2022 and awarded in 2023. 17 TBMs will be used, with 11 of them to be launched in 2024.

Messina-Catania railway: 37km underground over a 42km alignment (Giampilieri-Fiumefreddo section), including an underground station in Taormina. Construction started in 2022,

with four TBMs out of five starting the excavation in 2024 (the 5th one in 2026).

Salerno – Reggio Calabria high speed railway: Section 1a (Battipaglia-Romagnano) was awarded in 2023 and four TBMs are expected to be launched in 2024. Section 1b and 1c (Romagnano-Praia) will require 11 additional TBMs to be launched between 2025 and 2026.

New Santomarcò tunnel: A 15.8km twin bore tunnel (with four TBMs) to replace the existing ("old") Santomarcò tunnel between Paola and Cosenza. The tender is expected to be issued in 2024.

Naples Metro - Line 1: A twin bore TBM tunnel is currently under construction between Capodichino Airport station and Poggioreale station, on a 1km length. One bore has been completed while the second one is going to be finished in 2024. In 2024 the last TBM section (about 1km) between Capodichino and Di Vittorio is going to be awarded to close the Line 1 metro ring.

Rome Metro - Line C: while completing the stations of San Giovanni and Colosseo/Fori Imperiali, in 2023 works started on Piazza Venezia station, surrounded by millenary monuments and through archaeological finds which are unique in the world. This new station will be 45m deep, with 85m deep diaphragm walls, and will have three direct underground accesses to the Fori Imperiali, the Altar of the Nation and the Venezia Palace. It will require 10 years of works and €700M (15-20% of which is for archaeology).

Turin Metro – Line 2: The route will be 27km long with 33 planned stations and

will run entirely through twin bore tunnels TBM. The alignment will intersect the existing metro line 1 at Porta Nuova railway station. The tender is expected to be issued and awarded in 2024, with construction works to start in 2025.

Catania Metro: 6km of new twin tunnels to extend the existing metro at both ends of the current line, to reach the densely populated towns north-west of Catania (Misterbianco and Paternò) as well as the international airport of Catania Fontanarossa. By the end of 2023, all the contracts were awarded.

• **Naples Metro – Line 10:** A 12km long brand-new metro line with twin bore tunnels. Trains and stations will be short (about 50m) to minimise the extension of station boxes and hence the risk of delays due to archaeological findings or unexpected utilities diversion. The tender was issued in 2023 and will be awarded in 2024.

Milan Metro – Line 5 extension: 12 new stations over 11km of new underground alignment. The tendering should be issued in 2024 with construction starting in 2025.

Gronda di Genova: 70km of new highway, 54km of which will be underground, with 23 tunnels. Preliminary construction activities started in 2023 (utilities diversion, base camps, explosive ordnance clearance, etc.) with construction to start in 2024.

Genoa sub-port tunnel: A twin bore 4km road tunnel (16m excavation diameter) undercrossing the Genoa port bay. Preliminary construction activities started in 2023, while proper construction should start in 2024, with a cost of €900M.

State road SS 340 "Regina" (Tremezzina by-pass) – nine bored tunnels with a total length of 17.5km are under construction with both conventional and mechanised tunnelling, with about 1km excavated by the end of 2023.

State road SS 106 Jonica – eight twin bored tunnels, with a total length of 11.8km are under construction with conventional method, with about 4km of twin tunnels completed by the end of 2023.

Bisagno stormwater tunnel (Genoa): a 6km tunnel (1km conventional and 5km by TBM) is under construction to prevent

flooding and hydrogeological damage in the city of Genoa during severe storm events.

Campolattaro dam tunnel (Benevento): A 7.5km TBM tunnel to use the reservoir for drinking water supply to 2.5M people as well as the irrigation of about 15,000 hectares for agricultural production. The tender was awarded in 2023 and construction is going to start in 2024.

Peschiera aqueduct (Rome): A 27km tunnel (internal diameter 3.6m) will be built parallel to the existing aqueduct, allowing its maintenance and hence increasing the resilience of water supply to 3M people in Rome. The tender is going to be issued in 2024.

Marcio acqueduct (Rome): 36km of tunnelling (from 1.8m to 2.5m internal diameter) to replace two 100 years old existing aqueducts. The contract for the first section of 7.5km was awarded in 2023 and construction is going to start in 2024.

New SMAT median sewer collector (Turin): a 14.4km sewer tunnel (3.2m internal diameter) will be excavated with a 4.1m TBM, with 20m deep and 25m wide shafts along its alignment. The tender was issued in 2023 and will be awarded in 2024.

STATISTICS

1. Length or volume excavated - % mechanized / % conventional during 2023

	Conventional	Mechanised
Railway	4.7km	6.5km
Metro	1.1km	0km
Road	9.7km	0km
Total	15.5km	6.5km

2. Amount (USD or EUR) of tunnelling / underground space facilities awarded in 2023

Railway	Road	Water
5.5bn	0.8bn	0.5bn

About 40 TBMs expected to be in operation at the same time in Italy between 2024 and 2026.

3. List of tunnels completed

- Isarco river underpass (4.5km twin bore main tunnels + 1.7km junction twin bore tunnels)
- Turin metro line 1 (3.4km section Fermi – Cascine Vica)
- State Road SS20 Col di Tenda tunnel (3.3km)

4. List of tunnels under construction

- Valico (Giovi 3rd Pass), 27km (twin bore)
- Brenner Base Tunnel (Mules 2-3, 20km twin bore)
- Lonato, 6.6km (twin bore)
- Grottaminarda, 2km
- Tuoro S. Antuono, 1.6km
- Le Forche, 2.4km
- Florence HSR underpass (8km, twin bore)
- Cefalù (6.7km, twin bore)
- Comancina, 3.5km (twin bore)
- Trebisacce, 3.5km (twin bore)
- Roseto, 1.1km (twin bore)
- Naples metro Line 1, 1km section (twin bore)

5. Tunnels in operation

- > 1600 railway tunnels, with a total length > 1500km of railway tunnels
- > 2000 highway and road tunnels, with a total length > 1350km
- > 150km of metro tunnels

EDUCATION ON TUNNELLING IN THE COUNTRY

Given the huge increase in tunnelling activity expected in Italy in the years to come, tunnelling modules and courses are growing and multiplying more and more within universities, often including collaborations with the industry to prepare the next generation of tunnellers for the challenges they will have to face.

2nd Level Master (after a Master Degree)

- Politecnico di Torino and Politecnico di Milano – Master in “Tunnelling: design, construction and management”



developed in English, endorsed by SIG and by ITA-CET. <https://www.masterstunneling.polimi.it/>

- Università di Roma “Sapienza” – Master in “Geotechnical Design” <https://web.uniroma1.it/masterprogeo/en>
- Università di Napoli “Federico II” – Master in “Geotechnical Engineering for Infrastructures” https://www.unina.it/en_GB/-/15391805-ma_icea_geotecnica-per-le-infrastrutture
- Politecnico di Torino, Politecnico di Milano and Politecnico di Milano School of Management. Supported by Autostrade per l’Italia (Italian Autostrade Group). Master in “Integrated engineering and management of motorway networks” <https://www.masterinfrastruttureautostrade.it/>

MEng courses with tunnelling modules (after a Bachelor Degree)

- Politecnico di Milano, Milan
- Politecnico di Torino, Turin
- Università di Roma “Sapienza”
- Università di Roma Tor Vergata
- Università di Napoli “Federico II”
- Università di Bologna “Alma Mater Studiorum”
- Università Politecnica delle Marche
- Università di Trento
- Università degli Studi del Molise

Education events for university students

The Italian Tunnelling Society (SIG) is also organising specific teaching days of a high education level to students within the main Italian universities. This is managed by Prof. Daniele Peila (SIG Vice-President) and by Prof. Carlo Callari (Member of the SIG ExCo). Universities are selected between those having specific teaching courses focused on tunnelling and underground works, and the lectures involve professionals from Italian contractors and consultants.

By the end of 2023, two events took place at Turin University and Milan University, both with great success:

- 09/06/2023 – “Full face mechanised excavation” (in English) – Polytechnic University of Turin
- 27/10/2023 – “Advanced numerical approaches to the modelling of tunnel excavation and construction” (in English) – Polytechnic University of Milan

Participation was also open to SIG members, and many of them indeed attended the event