Italy

Name: Società Italiana Gallerie (Italian Tunnelling Society)
Type of Structure: Non-profit, open association
Number of Members: About 800 members (80 corporate and 160 young members).

ASSOCIATION ACTIVITIES DURING 2022 AND TO DATE

Congress:

The association, despite the Covid-19 pandemic has organized several technical events:

- 23/06/2022 SIG Conference "Rivestimenti in anelli di conci prefabbricati di gallerie realizzate co TBM" Brescia
- 19 – 22/10/2022 Piazza Tunnelling in Bologna during the SAIE exhibition
- 20 - 21/10/ 2022 YMs SIG Conference "The role of underground infrastructure for the achievement of the U.N. Sultaniale Development Goals" in Bologna during the SAIE exhibition
- 2/12/2022 S. Barbara Conference for the World Tunnelling Day - Colombo Lecture - held by Prof.Ing. Daniele Peila in Milan

Technical Visits:

The association, has also organized technical site visits to relevant underground construction sites:

- 18/03/2022 - "Picchiarella" and Casacastalda" tunnels ss318 Valfabbrica
- 07/04/2022 – The Brenner Base Tunnel – Isarco River under-pass construction
- 13/05/2022 - Linea C Fori Imperiali Station in Rome
- 27/09/2022 - Linea M4 in Milan
- 18/11/2022 - Cefalù Tunnel.

Courses and Seminars:

- 25/03/2022 SIG Webinar – SIG Handbook Presentation "handbook on tunnels and underground work"

Others:

The Italian tunnelling Society is a sponsor of the Master in Tunnelling: design, construction and management (Politecnico di Torino and Politecnico di Milano), Master in "Geotechnical Design" (Università di Roma "Sapienza), Master in "Geotechnical Engineering for Infrastructures (Università di Napoli "Federico II), Master in "Integrated engineering and management of motorway networks" (Politecnico di Torino, Politecnico di Milano and Politecnico di Milano School of Management) and Master in "Sustainable design of geotechnical works and tunnels" (Politecnico di Torino). These collaborations aim to bridge the gap between universities and industry to support the growth of future industry leaders.

Since 1976, the Journal "Tunnels and Major Underground Works" has been SIG's pride and glory. It is currently published once every three months and reached issue 144 in 2023. The periodical presents technical and scientific articles, as well as Editor's letters, news about

construction works and tenders around the world, bulletins from the Italian tunnelling market, reports on technical visits, scheduled training courses and international congresses.

In 2022, with the coordination of prof. Daniela Boldini and prof. Carlo Callari, ing. Remo Grandori, prof. Salvatore Miliziano, prof. Daniele Peila and ing. Andrea Pigorini a special issue of the Journal was published to share and discuss the most recent scientific and technological developments in the field.

The association members regularly take part in the ITA-AITES working group (WGs) and in the SIG working groups. Members proactively collaborate with national and international colleagues to exchange expertise and experience, and to divulge technical, scientific and business know how on underground construction.

The SIG YMs Group, of 160 young tunnellers, actively support SIG activities and connects young professionals from both university and industry. The group appointed, in 2021, a board expanding the number of YMs actively involved in the organization of events and activities. The group has also established a fruitful collaboration with the others ITA Member Nations YM Groups.

SIG is engaged in the drafting of an "Handbook on tunnels and underground works" which will be published in 3 volumes, including the theoretical and construction aspects of the design, construction, monitoring and maintenance of tunnels and underground works.

Volume 1 "Concept-base principles of design" was published in Feb 2022. Volume 2 "Construction – Methods, Equipment, Tools and Materials" was published in Aug 2022 and 3 "Case Histories and Best Practices" will be available soon.

CURRENT TUNNELLING ACTIVITIES

Railway Projects

The third Giovi Pass, Genoa - Tortona Railway: 37km of twin tunnels along the 53km section between Genoa and Tortona, as part of the Rhine-Alpine TEN-T Corridor. The tunnels, excavated for 65% through conventional methods and for 35% by EPBM (about 10m dia.), are located in the complex Apennines range between Piedmont and Liguria. The Valico tunnel (27km) is going to be the longest in Italy. In July 2022, 80% of the tunnelling activities were completed.

Brenner Base Tunnel: when completed in 2032, will be 55km long between Tulfes/ Innsbruck and Fortezza and, considering the junction within the Innsbruck urban tunnel, will have a max. underground length of 64km (the longest in the world). The works include the construction of two single track tunnels (9m dia.) with underground safety areas every 20km and a pilot/service tunnel (6m dia.). Two are the main sites on the Italian side, the section Mules 2-3, and the Section under passing the Isarco river (with artificial ground freezing underneath then river).

Mont Cenis base tunnel, Turin – Lyon: the main project of the Mediterranean TEN-T corridor, consisting of 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 hree underground safety areas.

Brescia-Verona high speed railway: With 6.6km of bored tunnels, together with 10.2km of cut&cover tunnels will allow the railway to underpass the A4 highway twice (Lonato and Sona) and an urban centre nearby the Mincio river. In 2022, the first bore of the Lonato tunnel (twin bore) was completed with the second is due to be excavated in 2023.

Napoli Bari high Speed Railway: the Napoli-Cancello section is under construction with the first example in Italy of a cut & cover tunnel excavated in hyperbaric conditions below the water table. The Cancello - Frasso Telesino section includes a 4km tunnel (Monte Aglio), with the excavation completed in June 2022.

Works have started on the Apice-Hirpinia section, with the construction of the portals for the tunnels Rocchetta (6.5km), Melito (4.4km), and Grottaminarda (2km).

Florence High Speed Railway Junction: The km long twin tunnels, excavated by EPBM (9.4m dia.) will speed up the services along the Rome-Milan route and free up capacity on surface for regional commuter trains. The tunnelling contract was awarded in 2022, and construction is going to start in 2023.

Messina-Palermo railway: On the Fiumetorto-Castelbuono section, excavation by the conventional method of the 4.1km S. Ambrogio tunnel (single tube, double track) was completed in 2022. A 10m diameter TBM was launched in 2022 to excavate the 6.7km long Cefalù tunnel (twin tube) through clayey sandstones, siltstones and quartz sandstones, with a max. depth of 300m and a max. hydraulic pressure of 5 bar. Also, an underground station will be built to serve the town of Cefalù. The 13km project will increase capacity and cut travel times between Messina and Palermo.

Genoa urban railway junction: sextuplication of tracks along the Brignole-Principe section and quadrupling of the Voltri-Sanpierdarena sections which are the busiest portions of the Genoa urban railway junction. The project will include with the extension of the existing Colombo tunnel and S. Tommaso tunnel.

Metro Projects

Naples Metro - Line 1: a new metro line often in sand below water table, excavated with use of advanced technologies such as ground freezing and vertical shaft boring machine (SBM). A twin bore TBM tunnel is currently under construction between Capodichino Airport station and Poggioreale station, of 1km length, to close the Line 1 ring. One bore has been completed while the second one is still under construction.

Rome Metro - Line C: Oone of the most complicated metro projects, in a poor geotechnical context, underneath millenary monuments and through archaeological finds unique in the world. The investment is about €3.8bn for a project extending from south-east to north-west, extending for about 25.5km (18km underground), with 30 new stations (20 underground). Currently the section between San Giovanni and Colosseo / Fori Imperiali is under construction, with works commencing for the extension to Piazza Venezia.

Milan Metro - M4: 15km of twin tunnels from Linate to Lorenteggio through loose sand below the water table and several interchanges with the three existing lines. Currently the central stretch passing through the historical centre of the city is under construction with two EPBMs of 9.1m diameter which allow one track plus a station platform per bore to minimize station excavation from surface and disruption to the city. A first section of the line started service in 2022, with completion expected in 2024.

FUTURE TUNNELLING ACTIVITIES

Railway Projects

Napoli Bari High Speed Railway: The construction of the Hirpinia-Orsara (29km) and Orsara-Bovino (11km) sections started in 2022 with the tunnel portals. The Hirpinia Tunnel will be the second longest in Italy (27km twin bored) and just 500m divide it from the Orsara tunnel (10km twin bored). These tunnels will cross the Southern Apennines with complex clay formations, presence of methane gas, within a highly seismic area. A critical mechanical behavior is expected due to swelling and squeezing. Six TBMs were ordered in 2022 to start excavation in 2023.

Palermo-Catania railway: TThe project will link the two main cities and metropolitan areas in Sicily and involves the excavation of 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 third longest in Italy. All the contracts were tendered in 2022 and will be awarded in 2023.

Messina-Catania railway: 37km underground over a 42km alignment between Fiumefreddo (nearby Catania) and Giampilieri (nearby Messina), including an underground station in Taormina. The project will link the two main cities on the east coast of Sicily and part of the Salerno – Reggio Calabria railway toward the south, to link Catania with Bari, Naples and Rome. Construction started in 2022, with TBMs starting the excavation in 2023.

Verona-Fortezza new railway line: As part of the Southern Access to the Brenner Base Tunnel, seven lots will be built. The Trento by-pass (with the Trento tunnel, 11.5km) and the Fortezza - Ponte Gardena section (23km, with the tunnels, Scaleres, 15.4km, and Gardena, 6.3km) will be the first two being built, with construction starting in 2023, with maximum overburden of 800m within Granite and Quartz Phyllites, as well as fault zones. The other lots in future will include the tunnels Val d'Ega (10km), and Zugna (16,7km).

Salerno – Reggio Calabria high speed railway: After the Covid-19 pandemic, the Italian government decided to include this massive project in the strategic infrastructure plan of the country. Crossing one of the most complex areas of the country in terms of morphology, geology, and seismicity, it would have 180km of twin tunnels over a 400km total length, with an estimated cost of €20bn. It will link the Calabria region – and

eventually Sicily – to the wider high speed and freight railway network of the country. The first section (Battipaglia-Romagnano) was tendered in December 2022 and will be awarded in 2023.

New Santomarco tunnel: A brand new 15.8km twin bore tunnel (about 10m dia.) will replace the existing Santomarco tunnel, which is single track and has a small cross section, linking the tyrrhenian coast line to the Cosenza valley. Four TBMs are anticipated to be used (two on each side) to shorten construction times. The project will increase accessibility of Cosenza for passenger services and will boost freight transportation capacity between the ports of Calabria and Puglia and then – through the Adriatic line – towards the north of Italy. The contract is going to be tendered in 2023.

Catania urban railway junction: A new double track line will underpass the city underground, replacing the existing single track, with the addition of three new underground stations. This will require 1.1km of bored tunnel and 2.3km of cut&cover tunnel in a densely populated area, below the water table, in a geological context ranging from loose soil to very hard volcanic rock.

Genoa – Ventimiglia railway: There is a last section of this line, between Andora and Finale, which is still single track. A new 32km double track will be built, with six twin bore tunnels of a total length of 25km involving about 50km of tunnel excavation.

Metro Projects

Turin Metro – Line 2: The route will be 27km long with 33 planned stations and will run entirely through twin bore tunnels (8m dia. TBM). Construction works are expected to start in 2023.

Catania Metro: An extension of the existing metro has been financed and partially awarded at both ends of the current line. The project will include more than 6km of new twin tunnels (10.5m dia.). By 2022, all the contracts were awarded, except the section between Misterbianco and Paternò, which is still on tender phase.

Naples Metro – Line 10: In 2022 the authorities of Campania region received funds for this brand new metro line linking the city centre (Cavour) and the existing metro network to the north-east area of the city. The alignment would be 12km long and run entirely underground. 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.

Milan Metro – Line 5 extension: in 2022 local authorities confirmed the completion of the scheme design for the extension to Monza and the tendering process in 2023, with construction starting in 2024 and completion expected in 2030. The extension will include 12 new stations over 11km of new underground alignment.

Highway Projects

Gronda di Genova: The project, called "Gronda di Ponente", is going to involve the construction of a new highway, the widening

STATISTICS

1. Length of tunnels excavated during 2022

Railway	Highway	Metro	
7	-	-	TBM
7	-	-	Conventional
14	-	-	Total

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

Railway	Highway	Metro
1.6	-	-

3. List of tunnels completed

Railway	Highway	Metro
Nuova San Tomaso	-	-
Nuova Colombo	-	-
Bretella di Voltri	-	-
Monte Aglio	-	-
Lonato (BP)	-	-
Sant'Ambrogio	-	-

EDUCATION ON TUNNELLING IN THE COUNTRY

II 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.mastertunnelling.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/-/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/*
- Politecnico di Torino – Master in "Sustainable design of geotechnical works and tunnels" *https://didattica.polito.it/master/progettazione_opere_gallerie/2021/home*

MSc courses (after a bachelor's 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
- Università di Parma

of the existing A10 highway in the section which crosses the municipality of Genoa. It will include more than 70km of new road, 54km of which will be underground, within 23 tunnels.

Hydraulic Projects

Peschiera acqueduct (Rome): A new 27km long tunnel with an internal diameter of 3.6m is going to be built parallel to the existing aqueduct. The new tunnel will allow inspection and maintenance of the existing one, which is about 80 years old and has been in operation without interruption. Also, the project will increase the resilience of water supply to Rome (3 million people). The contract is going to be tendered in 2023.

"Marcio" Acqueduct (Rome): two new 20km long micro-tunnels (2.5m internal dia.) are planned to replace two 100 years old existing aqueducts. The contract was tendered in 2022.

SMAT sewer (Turin): a new 14.4km long sewer tunnel, with a 3.2m internal diameter, will be built parallel to the old one built 40 years ago, from south of the city to the Castiglione Torinese treatment plant. Given the urban environment (including underpassing of Lingotto railway station), a TBM with 4.1m excavation diameter will be employed, with 20m deep and 25m wide shafts built along the alignment. An automatic rail system will be used to move the segments within a 9km long tunnel to minimise the interferences with traffic on surface.