

Italy



Name: SIG – Società Italiana Gallerie

Type of structure: Non-profit, open association

SIG is a scientific non-profit association, founded in 1974; it mainly promotes and coordinates studies and research in the field of tunnelling and underground construction works. SIG is a founding nation of ITA

Number of members: 670, 85% individual members and 15% corporate members

ASSOCIATION ACTIVITIES DURING 2017 AND TO DATE

In 2017 the Società Italiana Gallerie (SIG) continued working actively as a reference point for Tunnelling and Underground Works in Italy, promoting the dialogue within the industry, sharing knowledge and best practices and providing professional training.

From the last months of 2016, SIG organized several congresses, such as:

- SIG international Conference & ExpoTunnel - Bologna 20th -21st October 2016
Challenging and Demanding Tunnelling projects: design, construction and management
- ITACET and SIG Course – Rome, 1st December 2016
Mechanized Tunnelling: Challenging case histories
- SIG Conference for Santa Barbara 2016 – Rome, 2nd December 2016
Handling and reuse of spoil material resulting from tunnelling excavation
- SIG International Conference – Samoter 2017– Verona, 23rd - 24th February 2017
Long and Deep Tunnels for Railway Infrastructure – Design and Construction
- SIG Conference : sharing experience "The Structural Use of Fiber Reinforced Concrete in Underground Projects" – Rome, 19th May 2017
- SIG Conference for Santa Barbara 2017 – Naples, 1st December 2017
Roman underground road network in Naples & 6th SIG Degree Award Ceremony and is currently working on the organization of the 2018 Conference in Bologna and the WTC 2019 in Naples.

The association also organised several technical site visits to relevant underground construction sites in Italy and abroad, such as the Follo Line sites in Norway, the Genoa-Milan high-speed railway, the Metro Milano M4 and to the Brenner Base Tunnel.

SIG is also a Sponsor of Level II Masters in Tunnelling and Underground Constructions,

activated in Italy at the Politecnico di Torino, the Politecnico di Milano and the Sapienza University in Rome and at the Federico II University in Naples. These collaborations aim to bridge the gap between Universities and Industry, in order to support the growth of future Industry leaders. During 2017, the SIG Young Member Group of the Italian Tunnelling Society, which was founded in 2016, continued to grow, collaborated with the SIG WGs and organized its first workshop in December 2017 in Naples. More than 20 YMs took part to the workshop, which represented an opportunity to discuss the Group activities, to share experiences and to build up a stronger network as well as to start developing the YMs road map to the World Tunnelling Conference 2019.

CURRENT TUNNELLING ACTIVITIES

Railway Projects:

- **Milano – Genova High Speed Railway:** This is also known as Terzo Valico dei Giovi, which represents one of 30 European priority projects, and is a new HS line that will improve railway connections between the Liguria port system with the main railway lines of Northern Italy and the rest of Europe. The project is part of the Rhine-Alpine Corridor, which is one of the corridors of the trans-European transport network (TEN-T core network). The project involves the construction of two single-track tunnels, with a total length of 37km, connected by cross passages every 500m. The tunnels, which are excavated for a 65% through conventional methods and for 35% by TBM, are located in the complex Apennines range between Piedmont and Liguria.
- **Brenner Base Tunnel:** The BBT runs for 55km between Tulfes/Innsbruck and Fortezza and, considering the Innsbruck bypass, it runs for a total of 64km, making it the longest underground railway stretch in the world. The works include the

construction of two single track tunnels (9m dia.) with underground safety areas every 20km and an exploratory/service tunnel (6m dia.). Two of the main sites are on the Italian side, the Section Mules 2-3, which is the last stretch on Italian border, and the Section under passing the Isarco river, which is the southern segment of the Brenner Base Tunnel, before entering the railway station at Fortezza.



Brenner Base Tunnel: Permanent lining casting

- **Turin – Lyon, Mont Cenis base tunnel:** The new railway link Lyon-Turin is the main project for the whole Mediterranean corridor and it is highly strategic because it is the main missing link in the corridor which aims to connect southwestern Europe with Central and Eastern European Countries. The Mont Cenis base tunnel includes two 57.5km long tubes, 45km on the French side and 12km on the Italian side, with about 170 communication bypasses located each 333m. Four intermediate accesses, five central ventilation systems and three underground security areas are also planned. Complementary works are currently in progress as the Maddalena survey gallery, in Chiomonte, Susa Valley, that has been completed in February 2017.
- **Napoli Bari High Speed Railway:** The new Naples-Bari high speed/high capacity railway line is important and strategic for both national and international connections with the South of Italy. It has been included in the 'Scandinavia- Mediterranean' corridor of the Trans-European Railway Network (TEN-T) that sees the division in Naples of the Corridor both in a southerly direction, with the stretch from Naples-Palermo, and in a south-easterly direction for the Naples-Bari line. Six functional and construction sections are foreseen for an overall cost of the investment of about €6bn: Napoli – Cancellò, Cancellò-Frasso, Frasso Vitulano, Apice-Irpinia, Irpinia – Orsara and Orsara – Bovino, with the first 2 sections currently under construction, the second two sections are in the tender process and the last two sections are in the design phase. All sections have many kilometres in tunnels, underpassing the Appennini mountain chain with difficult geological & geotechnical conditions.

Highway Projects:

- **Variante di Valico (A1 Bologna – Florence), Santa Lucia Tunnel:** Expansion of the Appennine section of the A1 motorway, between Bologna and Florence, which is a strategic stretch that links northern and southern Italy and plays a major role in the movement of people and goods between Europe and the Mediterranean. The entire project is 66.6km



Buonomo Municipio Torrione Incoronata archeology

with about 50% of the alignment excavated by TBM and conventional tunnelling. The Santa Lucia Tunnel length is about 7.6km and is excavated by an EPB machine which has a diameter of 15.87m and represents the Europe's largest TBM.

Metro Projects:

- **Naples Line 1 and 6:** The Naples Metro Lines 1 and 6 are included into an integrated metro system serving the whole city that today embodies six underground railway lines and four funiculars. This is one of the largest infrastructure projects currently under construction in Italy and it will see, at last, the service expanded with two rail lines, 93km of track and a further 30km of new light rail connecting 114 stations together.
- **Rome Line C:** Line C is the third Metro Line in Rome. It is one of the strategic infrastructure projects in Italy and is one of the biggest European construction projects: the overall investment is about €3.8bn. Line

C is the first metro line in Italy to be fully automated. Line C crosses the entire city of Rome like a backbone, from the east to the north-west. It extends for about 25.5km (18km underground), with 30 new stations (20 underground).

- **Milan M4:** The new Line 4, built entirely underground and 15km long from Linate to Loreteggio, will provide a fast connection along the east/south-west route passing through the historical centre of the city. It involves a light and fully automated driverless metro system, with automatic platform screen doors and a CBTC signalling system.

FUTURE TUNNELLING ACTIVITIES

Railway Projects:

- **Napoli Bari High Speed Railway:** The alignment has an overall length of about 178km from Naples to Foggia and 121km of railway line is still to be built for the completion of the line that will run mainly underground (about 68km in bored and cut and cover tunnels). As mentioned before the sections Irpinia-Orsara and Orsara-Bovino (40km) are in the final design phase and 37km out of 40km are in tunnel. The most complex underground works are in this sections, not just for the length of the longest tunnel (at 27km length Hirpinia Tunnel will be the longest railway tunnel in Italy), but mainly because of the geological and geotechnical context in which tunnels have to be constructed. The Hirpinia tunnel crosses reliefs in the Southern Apennines with structurally complex formations (scaly clay) featuring methane gas and a high level of tectonisation with particularly critical mechanical behavior due to swelling and squeezing conditions together with geomorphological conditions linked to a high level of surface erosion, slipping and complex landslides typical of Apennine reliefs and the high seismic condition. The Tender process is scheduled in 2019 and the completion of the work for December 2026.
- **Palermo-Catania-Messina new railway line:** The Palermo-Catania-Messina line is

part of the Scandinavian-Mediterranean Core Corridor no. 5 (Helsinki-La Valletta) of the Trans European Networks-Transport (TEN-T). The alignment has an overall length of about 110km from Fiumetorto (close to Palermo) to Catena Nuova (close to Catania) where a new single line will be built and a length of about 40 km between Catena Nuova and Catania and 42km between Fiumefreddo (close to Catania) and Giampilieri (toward Messina) where the existing single track line will be doubled. 8 functional and construction sections are foreseen for an overall cost of the investment of about €8bn. Nearly 50% of the alignment will be built in tunnel and all the tunnel sections (7 out of 8) are currently in the design phase. The tender process for the first tunnel section (Fiumefreddo-Giampilieri with 37km of tunnels out of 42km of line and with the new underground railway station of Taormina), is scheduled in 2019.

- **Verona-Fortezza new railway line:** As part of the Southern Access to the Brenner Base Tunnel, four functional lots have been identified, giving priority on the sections that currently have limits of performance and speed. The section n. 1 from Fortezza to Ponte Gardena has a length of about 23km and is currently in the final design phase: the tender (design and build) is scheduled within 2018. The section includes the Scaleres Tunnel (about 16km long), and the Gardena Tunnel (about 6km long), separated by a short stretch on a viaduct crossing the Isarco River. The overall development of all the underground works is approximately 62km, including the 2 twin bore tunnels, connection tunnels, lateral adits and complementary works. The main tunnels will be bored with a maximum overburden of 800m, in the Bressanone Granite and Quartz Phyllites with good geotechnical properties, except for fault zones. Both conventional and TBM excavation is foreseen.

Highway Projects:

- **Gronda di Genova:** The project, called "Gronda di Ponente", foresees the construction of a new carriageway, the widening of the existing A10 highway in the section which crosses the municipality of Genova, as well as the strengthening of the A7 and A12 highways. The project consists of over 70km of road, of which 53km are in tunnels, 25 tunnels, of which 12 on the highways and 13 on the interchanges, 21 bridges and viaducts, of which 11 are new and 10 are an implementation of the existing.

Metro Projects:

- **Rome Line C:** The T3 stretch construction is currently in progress (3km of twin single-track tunnels, 2 new stations and 2 multi-functional shafts) in the historical centre of the city. In 2018 the two EPB TBMs will start from San Giovanni Station



Above left: The Turin Lyon Chiomonte site. Right: Tunnel repair after an earthquake

toward the Fori Imperiali Area; in mid- 2019 the TBMs will pass near the Colosseo and the Basilica di Massenzio: important consolidation and protection interventions have been carried out to protect the archaeological and monumental heritage.

Young Member Conference: Tunnelling 4.0 – Innovation and new technologies in underground Design & Construction

- SIG Conference for Santa Barbara 2018 – Rome, 30th November 2018

FUTURE ASSOCIATION ACTIVITIES

- SIG Conference – Naples, 11th May 2018 – **The Italian historical underground network : via per mons excisa when tunnelling meet Archaeology, Architecture and Art**
- SIG Internation Conference – SAIE – Bologna, 18th-19th October 2018 - **1st**

Technical Visit on job-sites :

- Metro Catania
- Santa Lucia Tunnel (Variante di Valico)
- Gronda di Genova
- Firenze High Speed Railway Junction
- ST. Martin Le Porte Tunnel (Turin-Lyon)

WTC 2019 – 3-9 May –

Engineering and innovation meet Archaeology, Architecture and Art

STATISTICS

1. Length (km) of tunnels excavated during 2017:

Railway	Highway	Metro	
3	3	5	TBM
7	1	0	Conventional

2. Amount (EUR) of tunnelling / underground space facilities awarded in 2017: €2 billion.

3. List of tunnels completed:

Railway	Highway	Metro
HSR Lyon-Turin Exploratory Tunnel - La Maddalena		Rome Metro. Line C Pantano-San Giovanni
Adriatic line - Ortona Tunnel		Naples Metro. Line 1 : Dante-Garibaldi-CDN
Lercara tunnel on Palermo-Agrigento Line		Naples Metro. Line 6. Mergellina-Municipio
Arcisate Stabio (Induno and Bevera Tunnel)		

4. List of tunnels under construction:

Railway	Highway	Metro
Brenner Base Tunnel - Isarco River under ground pass	Barberino-Firenze nord 3rd lane	Milan Metro line 1
Brenner Base Tunnel - Main Section (Italian side) "Mules 2-3"	Itinerario Agrigento - Caltanissetta A19-SS 640 Porto Empedocle	Metro Milan. San Cristoforo - Linate. Line 4
HC Genoa_Milan main line	SS 105 Jonica Megalotto 3	Rome Metro. Extension line C : San Giovanni-Colosseo
HC Genoa_Milan connection lines	SS 105 Variante all'abitato di Palizzi - 1° Lotto	Naples Metro. Line 1 : CDN-Capodichino Airport
Florence HSR Underpass (railway Station and railway tunnel)	SS 4 Salaria (Miciigliano-Gole del Velino) 1° lotto	Turin Metro. Line 1. Lingotto-Bengasi
HSR Napoli - Bari : Cancellò-Frasso section	SS 4 - Adeguamento tratto Acquasanta Terme - Trisungo Lotto 1° Stralcio 2° dal km 151+000 al km 153+780	
Palermo Messina Railway line - Ogliastrillo-Castelbuono section - Cefalù (5.7 km) S.Ambrogio (3.4 km) and Malpertugio (0.1 km) tunnels	SS1 Nuova Aurelia - Viabilità di accesso all'hub portuale di Savona	
Palermo Railway Ring Giachery - Politeama - 1 section	Variante alla S.S. n° 1 AURELIA (AURELIA BIS) - Viabilità di accesso all' hub portuale di LA SPEZIA	
Palermo Railway Junction. Section B-TRATTA B	E78 - Tratto 1° Grosseto -Siena - Lotti 5-6-7-8	
Circumferea Catania - tratta Nesina Monte Po	SS38 - Lotto I, Variante di Morbegno, dallo svincolo di Fuentes allo svincolo del Tartano.	
Circumferea Catania - tratta Stesicoro Aeroporto	SS 20 - Nuovo tunnel del Col di Tenda	
	SS 95 - Variante di Tito Brienza - 6°lotto	
	SS 45 Variante di Val Trebbia - 1° stralcio funzionale dal km 31+500 al km 32+445	
	Itinerario NORD-SUD SS 117 Centrale Sicula - Lavori di ammodernamento e sistemazione del tratto compreso tra km 32+000 e km38+700	
	SS 79 Ternana - Completamento del tratto Terni - Confine Regionale della Direttrice Civitavecchia-Orte-Terni-Rieti	
	SS 51 di Alemagna - Variante di Vittorio Veneto	