Tunnelling Journal

The Great Italian Tunnelling Boom

Never before has Italy seen a period of such intense investment in tunnel infrastructure. We asked Enrico Maria Pizzarotti, president of SIG, the Italian Tunnelling Society, and board member of Pro Iter Group, how the country's tunnelling sector is rising to the challenge.

TJ: What are the biggest challenges facing the tunnelling industry in Italy today?

EMP: The Italian tunnelling industry is currently facing one of the most intense and transformative phases in its history. The unprecedented wave of infrastructure projects triggered by €194.5 billion of funding from the Next Generation EU programme for Italy's National Recovery and Resilience Plan (PNRR) has generated a volume of works never seen before in the country. Around €23.8 billion of the PNRR has been allocated to 'Infrastructure for Sustainable Mobility'.

Major railway, metro, road, and water projects are simultaneously under construction, placing enormous pressure on the entire supply chain. To cite just one metric, about 25 TBMs were in operation simultaneously in Italy in 2025, a number expected to grow to 60 TBMs between 2026 and 2028.

To withstand these pressures, the entire sector has reacted with exceptional tenacity and adaptability to make up for a scarcity of resources, particularly, human resources such as tunnelling engineers, geologists, technical specialists and skilled construction workers. To address this gap in resources, the industry is being pushed to innovate more decisively, integrating automation and robotics into processes such as segment production, site logistics, and monitoring systems.

One of the key challenges is the rapid integration of digitalisation across all stages of project development. This digital transition

Enrico Maria Pizzarotti, president of SIG, the Italian Tunnelling Society

requires significant investment, new competencies, and a cultural shift across the industry. Advanced BIM methodologies, digital twins, real-time monitoring systems, and data-driven construction management are increasingly becoming standard practice, both in design and execution.

A further demand for the sector is Italy's huge number of existing tunnels, most of which have been in service for over 50 years. There are over 1,600 railway tunnels, with a total length of over 1500km; over 2,000 highway and road tunnels, with a total length of over 1,350km; 150km of metro tunnels; and hundreds of kilometers of hydraulic tunnels and caverns. These tunnels must be refurbished, restored and modernised which in many cases means enlargement.

Finally, there are two further important related aspects which SIG is focusing on. The first is contract management in relation to the uncertainties inherent in the construction of underground works. The second is the training of the next generation to whom we can offer our enthusiasm and a guarantee that we will enable their professional development.

TJ: Who is building all the tunnels? Where are all the resources coming from?

EMP: Italy's major contractors are playing a central role in this transformation: Webuild, Ghella, Eteria, Toto Costruzioni Generali, Pizzarotti and others are investing heavily in technological innovation, process standardisation, and international know-how. All the major tunnelling projects are currently being designed, built and managed by Italian consultants and contractors – in addition to their projects overseas.

Most of the skilled resources - engineers, professionals, surveyors, construction site personnel - are Italian, thanks to the resilience and entrepreneurial ability of Italy's underground supply chain. As far as the TBMs and related specialist equipment and machinery are concerned, they come largely from Germany and China but are managed mostly by Italian personnel. The Italian industry provides and supplies most of the other equipment and materials needed.

From an education perspective, Italian universities are constantly introducing new tunnelling modules and courses, often in collaboration with the industry, to prepare the next generation of tunnellers for the challenges of the near future. There are Second Level Masters courses in tunnelling at Politecnico di Torino and Politecnico di Milano, Università di Napoli "Federico II", Università di Roma "La Sapienza" and MEng courses in tunnelling, geotechnical engineering and underground works in the main Italian Universities.

TJ: What advances in technology have there been for tunnelling in Italy thanks to the current tunnelling boom?

EMP: Without innovation, the planned level of investment would not have been sustainable, especially in the medium term. The Italian tunnelling sector has moved quickly, adopting the best technical and technological solutions to

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bring innovation, efficiency, safety and sustainability to all phases of construction.

Given the extraordinary volume of work, it was necessary to address four particularly significant areas:

- overall environmental sustainability, short- and long-term
- industrialisation of processes to guarantee the reliability of timescales, costs, quality and durability of the works
- safety of people, both during construction and operation
- the enormous amounts of materials, machinery and human resources required in a very limited time frame

Such complexity, especially in relation to the amount and variety of data involved, can only be fully managed by systems based on artificial intelligence (AI), at least partially. AI can intervene, with human supervision, in the entire process chain by:

- optimising design, including through simulation and digital twins
- planning and managing projects, including advanced risk management techniques
- implementing and managing real-time structural monitoring and surveillance platforms
- governing the maintenance of complex works through the timely interpretation of monitoring data

To get the most value from AI, we need to completely integrate all the processes as quickly as possible. This then provides a decision-making tool to compare possible infrastructure solutions, alternative methods for construction of underground infrastructure and the many possible solutions in relation to environmental, social, organisational and management issues related to the underground works. However, high-value tasks, where there is insufficient data to allow algorithms to operate effectively, should be reserved for designers and technical staff.

TJ: What are Italy's most important current and future underground projects?

EMP: Major rail projects include the Mont Cenis Lyon-Turin base tunnel, the Brenner Base Tunnel between Italy and Austria and the Terzo Valico high-speed line between Genoa and Tortona. Other high-speed projects include the Napoli-Bari line, the Salerno-Reggio Calabria lines – tenders expected for some contracts in 2026 - and the Florence high-speed railway junction beneath the city. In Sicily, the Messina-Palmero and Messina-Catania lines and are under construction.

Metro projects include Naples Metro Line 10, Rome Metro Line C extension, Milan Metro Line 5 extension, for which tenders are expected in 2026 and the Turin Metro Line 2, for which some contracts will be awarded in 2026 with further tenders to come.

Tenders for the Genoa sub-port road tunnel and the Gronda di Genova are expected to be issued in 2026, while several other highway projects are underway. Water projects include the new Peschiera aqueduct, to be awarded in 2026, and Marcio aqueduct in Rome, the Bisagno stormwater tunnel and SMAT median sewer collector in Turin.

Looking further ahead, the Messina Strait Crossing between Italy and Sicily will include 20km of twin rail and road tunnels with detailed design and preliminary works due to start in 2026.

- More information on these and other projects can be found on the SIG website (https://www.societaitalianagallerie.it/notizia/2132/monografia-the-italian-art-of-tunnelling-2024/) and in the ITA Member Nation Activity Reports: 2025 edition due July 2026 (https://tunnellingjournal.com/ita-activity-report/)

TJ: Can you talk about some of the recent or current projects you have been involved in?

EMP: Pro Iter is currently involved in many road designs, especially in central and southern Italy for ANAS, the national highways authority. These include several tunnels, mainly conventionally excavated.

We have worked on the Brenner Base Tunnel Italian side since the Lot Aica-Mules Exploratory and Service Tunnel in 2005 and will continue to do so until its completion. The 22km twin tunnels Lot Mules 2-3 reached the border with Austria in 2025 and has moved into civil underground works for plant accommodation.

Our other projects in an advanced phase of completion are: Lot 2 of the Merano's ring road system in South Tyrol, which consists of three very different tunnel sections and includes an underground roundabout connecting to a seven-storey underground car park; the refurbishment of the San Pancrazio hydroelectric power plant in South Tyrol, where Pro Iter made significant design changes to optimise new underground tunnels, shafts and caverns in highly challenging geology.

Enrico Maria Pizzarotti is the current president of SIG Società Italiana Gallerie - the Italian Tunnelling Society – a senior partner and board member of Milan-based engineering company Pro Iter Group and honorary president of Pro Iter Progetto Infrastrutture Territorio, the division of Pro Iter which specialises in the design and construction management of transport infrastructure.

A civil engineering graduate from the Politecnico di Milano with more than 35 years' experience in the sector, Pizzarotti has worked on underground projects worth around €2 billion over the past decade, among them the Italian Fortezza-State Border stretch of the Brenner Base Tunnel where he is the designer responsible for the detailed design. He has spoken at numerous seminars, conferences and university master courses and has authored and co-authored many papers and technical publications, including the SIG's Handbook on Tunnels and Underground Works, Vol. 1, 2 and 3 (Taylor & Francis 2021-2024).

Società Italiana Gallerie
Italian Tunnelling Society

Società Italiana Gallerie (SIG) – the Italian Tunnelling Society - was founded in 1974 and today has over 800 members.
www.societaitalianagallerie.it