ITA Tunnelling Awards 2024!

We are excited to announce the shortlist for the ITA Tunnelling Awards 2024!

Our esteemed judges had the challenging task of selecting the finalists from an outstanding pool of entries this year and were impressed by the quality of the submissions.Over 100 applications from 19 countries were avaluated. We can now reveal the finalists in the 7 categories.

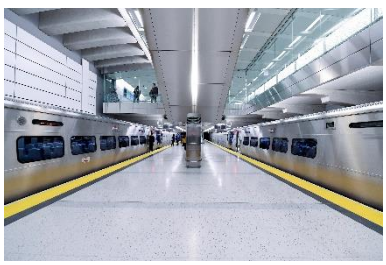
The winners will be announced on 28 November 2024 and rewarded at the annual ITA Awards conference in Genoa, Italy.

MAJOR PROJECT OF THE YEAR *(+500M €)*

Chunfeng Tunnel – Single-Bore, Double-Deck Municipal Tunnel in Shenzhen, China

The Chunfeng Tunnel in Shenzhen, China, is a major infrastructure project aimed at reducing congestion and pollution in the city's densely populated Futian and Luohu districts. Spanning 5.078 km, with a 15.8 m diameter, this double-deck tunnel supports a four-lane road and is constructed using slurry balance TBMs. It navigates through complex geological formations and passes beneath numerous existing structures. The project incorporates innovations such as 78% prefabrication of tunnel structures and advanced cutterhead wear detection, saving €6 million. Once completed, the tunnel will enhance traffic flow, reduce pollution, and improve the urban environment.

LIRR Grand Central Madison – New York City Terminal



Grand Central Madison is a landmark $11.1 billion project by New York's Metropolitan Transportation Authority (MTA), providing direct Long Island Rail Road (LIRR) access to Manhattan's East Side. The underground terminal spans over 65,000 m², with eight new tracks and four platforms housed in two massive caverns. The project involved 9.7 km of hard rock tunneling under Manhattan and 3.2 km of soft ground tunneling in Queens, completed using innovative techniques like ground freezing. By transporting materials through tunnels to Queens, thousands of trucks were removed from the streets, reducing urban impact. Opened in 2023, it increases LIRR capacity by 40% and reduces daily commute times.

Thames Tideway Tunnel – London's New Super Sewer

The Thames Tideway Tunnel is an innovative solution to modernize London's outdated Victorian sewer system. Spanning 25 km, this tunnel intercepts 34 combined sewer overflows to prevent untreated sewage from flowing into the River Thames. Costing £4.5 billion, the project employed six TBMs operating simultaneously in a dense urban environment. Extensive use of the Thames for transporting materials reduced environmental impacts such as carbon emissions and heavy vehicle traffic. Once operational, the tunnel will have a 120-year lifespan and reduce sewage discharges into the river by 95%. The project also featured technical innovations like using electric-powered drilling machines to lower noise pollution.

Thomson-East Coast Line (TEL) Contracts T222 to T310 - Singapore

The Thomson-East Coast Line (TEL) is a fully automated mass rapid transit (MRT) line in Singapore, covering 32 stations over approximately 43 km. This project aims to enhance connectivity and reduce travel time by 50% for densely populated areas. The section under contracts T222 to T310 spans 15 km and includes 13 stations, constructed with the help of 18 Earth Pressure Balance Tunnel Boring Machines (TBMs). With a total tunnel drive length of 29.4 km, the project faced challenges like complex geology and interference with existing infrastructures. Valued at €3.2 billion, innovative solutions such as ground freezing were implemented to minimize urban disruption. Once completed, TEL will significantly transform urban mobility, cutting commute times and improving residents' quality of life.

PROJECT OF THE YEAR *(50 – 500 M€)*

Lot H52 Hochstegen - Brenner Base Tunnel - Austria

The Brenner Base Tunnel (BBT) is a key infrastructure project connecting Fortezza, Italy, to Innsbruck, Austria. Lot H52, the Hochstegen section, involved the construction of 5 km of tunnels, including an exploratory tunnel and main tunnel sections. Innovative solutions were required to manage complex water-bearing geological conditions, using specialized drilling and grouting techniques to stabilize the tunnel. The project is part of the larger Scandinavian-Mediterranean Corridor, enhancing freight and passenger rail services by significantly reducing travel time and energy consumption. This section of the BBT was completed in December 2023, contributing to a sustainable future by reducing road congestion and environmental impacts.

Lot H71 Isarco River Underpass - Brenner Base Tunnel- Italy

Lot H71, part of the Brenner Base Tunnel project, focuses on the challenging Isarco River underpass, where tunnels were constructed with minimal overburden under major infrastructures like the A22 motorway and the Isarco River. Advanced techniques, including artificial ground freezing, were used to stabilize the ground and prevent river displacement. Spanning 6.2 km, the project involved both single- and double-track tunnels. The innovative methods employed not only addressed the complex geological conditions but also ensured the project stayed on time and within budget. Once completed, the Brenner Base Tunnel will connect northern and southern Europe, improving freight and passenger transport across the Alps.

Musaimeer Pump Station and Outfall Project (MPSO) - Qatar

The Musaimeer Pump Station and Outfall Project (MPSO) is a crucial infrastructure development in Doha, Qatar, aimed at managing groundwater and stormwater over an area of 270 km². The project includes a pump station, a 10.2 km outfall tunnel (one of the longest in the world), and a seabed diffuser for treated water discharge. The tunnel was constructed using a TBM under challenging wet and dry conditions, with precise alignment achieved at a tolerance of 200 mm. Despite the COVID-19 pandemic, the tunnel was completed 58 days ahead of schedule. The project has improved urban water management and helped protect over 30% of Doha's population from flooding. Additionally, all excavated materials were used for land reclamation.

SMP4 Lyon-Turin Saint-Martin-la-Porte Exploratory Tunnel - France

The SMP4 exploratory tunnel is part of the Lyon-Turin rail project, a vital element of the Trans-European Transport Network (TEN-T). Spanning 12.7 km, the tunnel serves both as a geotechnical investigation and a critical section of the future Mont-Cenis Base Tunnel. The project faced complex geological challenges, including unstable carboniferous formations, which were addressed using innovative methods like bi-component grouting and controlled yielding support systems. The tunnel contributes to the shift from road to rail transport, reducing CO2 emissions and improving the capacity of freight and passenger trains across the Alps. It was completed in September 2022, marking a significant milestone for the broader Lyon-Turin project.

RENOVATION PROJECT OF THE YEAR

Genoa Railway Junction Capacity Upgrade – Italy

The Genoa Railway Junction upgrade is a critical infrastructure project aimed at enhancing the city's capacity to manage freight and passenger traffic. This renovation includes the construction of several new tunnels and the rehabilitation of abandoned ones, such as the San Tomaso, Polcevera, and Campasso tunnels. Innovations like widening the Facchini Tunnel for larger freight trains and reusing sections of the old Grazie Bassa Tunnel for emergency access improved project sustainability. The project is part of the broader effort to connect the Port of Genoa to the Trans-European Corridor, linking it with Rotterdam. The work ensures the separation of regional and long-haul trains, allowing for more efficient freight and commuter services.

Manfreida Tunnel Renovation Project – Italy

The Manfreida Tunnel renovation, part of the Genoa-Gravellona Toce motorway, adopts the Tunnel Renewal Strategy (TRS), aiming to extend the service life of the tunnel by 50 years. The project involved partially demolishing the existing lining and rebuilding it with innovative materials to improve waterproofing and structural integrity. The renovation is divided into two phases to minimize traffic disruption, using technologies like prefabricated elements and high-performance sprayed concrete. By utilizing a multi-criteria analysis for optimal solutions, the project focuses on safety, minimizing impacts on traffic, and ensuring the long-term resilience of the infrastructure.

Refurbishment of the Heinenoord Tunnel – Netherlands

The Heinenoord Tunnel, constructed in 1969 using the immersed tube method, serves over 110,000 vehicles daily in the Netherlands. The renovation project involves the complete replacement of tunnel technical installations, concrete repairs, and asbestos removal. A significant challenge was the addition of a central gallery for safer escape routes, which was built using prefabricated elements during a four-week period in the summer of 2023. By pretesting and using mock-ups, the work was streamlined to minimize traffic disruptions. Despite closures for necessary works, the project aims to reduce future interruptions, improve tunnel safety, and ensure faster completion. The project is set for completion by December 2024, with a total cost of approximately €200 million.

TECHNICAL INNOVATION OF THE YEAR

Advanced Tunnelling Assistance System, Italy

The innovative Advanced Tunnelling Assistance System **(**ATAS) implements real-time TBM data analysis and monitors data using AI/machine learning. This permits a continuous monitoring of the excavation and perform, from the measured parameters, estimates on the variation of geological conditions at the excavation face. In addition, ATAS constantly updates settlement criteria evaluations based on real-time added information and permits automatic evaluation of new excavation parameters (such as adjusting face pressure) to mitigate the risk. The system has been applied for the first time on one of four 8.78m diameter TBM drives excavated for rail node development project in the centre of the very congested city of Łódź in Poland. The ATAS takes advantage of existing data to optimize TBM excavation and reduce excavation risks. This is particularly important in urban areas, where the consequences of accidents can be extremely severe.

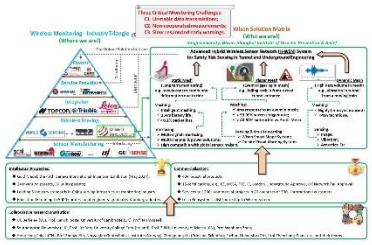
Disc Cutter Wear Sensor Package and TBM Monitoring System, South Korea

Newly developed technology that maximizes excavation efficiency by remotely measuring disc cutter wear using a package that consists of magnetic sensors, hall sensors, a power supply battery, a wireless communication module, an Arduino board, and an external casing. As the disc cutter ring wears, the relative distance between the ring and the magnetic sensor increases. This affects the magnetic flux density which can be detected by the sensor, thereby obtaining voltage measurements. Using these voltage values from the sensor, the relative distance of the disc cutter ring can be calculated. A deep learning-based algorithm for assessing wear conditions and predicting the remaining cutter life has been developed, which can be provided to users through the monitoring system. The innovation lies in measuring the wear of disc cutters through sensors instead of relying on man-entry interventions, allowing for data-based decisions on when to replace the disc cutter.

MIRET-Tunnel AI, Italy

MIRET, Management and Identification of the Risk for Existing Tunnels, is a methodology, an IT environment and a series of tools for planning and management of infrastructures and tunnels, aiming to the digital transformation of the whole asset management and life cycle, from element inspection to decision-making. MIRET combines mobile mapping surveys, artificial intelligence for analysis, digital models, risk analysis and shared working environments. Inspections are performed using ARCHITA, an ETS system for the multi-dimensional mobile mapping of tunnels that integrates laser scanners, ground penetrating radars, and linear and thermal cameras on a bimodal vehicle with a survey speed of 15-30km/hr. ARCHITA moves the inspection phase from on-field to back-office guaranteeing more reliable and cost-time efficient data. The digitalization is performed from 3D point cloud to CAD and IFC, with a good level of information from the integration of HD photos, radargrams and thermal images. Currently, the data refers to the years from 2017 to 2023. These data are subject to a quality control process, where the preparation of the vulnerability map is carried out by an engineer and/or geologist specializing in tunnels. MIRET-Tunnel AI defines an approach to tunnel management focused on high level technology, Smart Data and letting the authority take decisions in a faster, more reliable and traceable way.

PRODUCT/EQUIPMENT INNOVATION OF THE YEAR



Advanced Hybrid Wireless Sensor Network System for Safety Risk Sensing in Tunnel and Underground Engineering, China

Real-time wireless sensor monitoring systems have been heavily applied in daily monitoring projects globally. Existing systems however, reach a limit when three critical monitoring challenges are encountered: unstable data transmissions in an underground construction environment; non-cooperated measurements when using mixed systems from various suppliers; and slow response to early warnings when wireless sensors are in deep battery saving hibernation mode. The advanced Hybrid Wireless Sensor Network (H-WSN) System, developed in China, for the first time, has systematically and structurally defined the next generation of WSN monitoring for safety risk sensing in underground construction while properly addressing the three limiting challenges. The H-WSN has complete, original, systematically embedded software designed on wireless communication protocol of Static Mesh for long term trend, Trigger Mesh for trigger event detection, and

Dynamic Mesh for high volume data handling; complete, original, systematically embedded hardware design to interface all the major categories of sensors; and high quality, reliable, instant data for safety risk sensing, management and control. Since March 2021, the H-WSN has served 1,200 commercial projects in 20 countries and is credited with avoiding 300 major accidents by timely warnings in the real world. Extensive collaboration with international university researchers and industrial colleagues, has generated significant economic, social, and environmental benefits for tunnel and underground engineering community.

Deep Underground Type 0-90° Continuous Conveyor Equipment, China

The 0-90° continuous conveying equipment continuously and efficiently transports TBM excavated material along tunnels and up inclined or vertical shafts to the surface. The horizontal transportation system uses a common flat belt to convey soil to the bottom of the inclined or vertical shaft while the 0-90° lifting system is usually a corrugated edge conveyor belt that changes direction through various rollers, forming a closed circular structure with continuous rotation. The continuous conveyor equipment effectively solves the problem of rapid vertical transportation of excavated material from shield tunnel headings to improve the efficiency and safety of muck handling and discharge. The operating speed of the conveyor belt can be automatically adjusted based on the amount of excavated material produced and the control system is equipped with functions such as leakage protection, overload protection, and no-load protection to ensure the safe operation of the vertical lifting system. Compared with traditional spoil removal methods, the deep underground type 0-90° continuous conveyor transportation equipment increased excavation efficiency by 33% and reduced energy consumption by about 30%.

SOGUN: Geometric Control System for Shotcreting and Other Tunnelling Works, Spain

Developed by the R&D Department of Spanish contractor Dragados, SOGUN is a compact unit whose functionality signifies an advancement in tunnel construction technology, particularly in shotcrete applications. In an automated process, SOGUN scans the tunnel in 3D with an integrated LiDAR to generate a surface point cloud. This data is compared to the pre-loaded theoretical surface and an image is projected on the tunnel wall, indicating areas of excess or missing concrete thickness. This process is completed in under a minute, far quicker than the traditional spray-painting method. The shotcrete operator then needs only to look at the tunnel to understand the task to be performed as displayed in areas of different colours according to numerical information about the difference between the actual and the theoretical tunnel surfaces. Additional applications include determining over- or under-excavation and checking the tunnel's dynamic gauge to detect clashing areas with the tunnel surface. SOGUN enhances productivity, reduces costs, and minimizes workers' risks, introducing superior quality finishes, as well as promoting sustainability by optimizing material usage, reducing waste, and leading to a lower environmental footprint.

Ultra-Small Turning Radius Hard Rock TBM, China

The horizontal turning radius of a conventional TBM is about 300-500m. However, the 4km route of the 3.53m diameter drainage corridors from the first layer to the fourth layer for the Jinyun Pumped Storage Power Station in Zhejiang Province, required a TBM with a turning radius of less than 30m, about 10 times the tunnel diameter. A TBM for the purpose was designed and developed by CREG, China Railway Engineering Equipment Group, and was launched in November 2021. After boring 22 sections with a turning radius of 30m, it achieved maximum monthly advance rates of 660.5m and a maximum daily advance rate of 38.38m. In December 2022, the TBM successfully broke through, realizing the completion of the whole route six months ahead of schedule.

BEYOND ENGINEERING

City Rail Link Goes Beyond in Tāmaki Makaurau, Auckland, New Zealand

The new City Rail Link for Auckland, New Zealand, will transform rail services in the city. Comprising 3.45km of new twin tunnels connecting four train stations, the new link will double rail capacity and create exciting new public spaces. Working beyond engineering, City Rail Link referenced local history and indigenous Māori culture prioritised a strong partnership with the indigenous Māori mana whenua tribes, working together on design, environment and social outcomes. Two new underground stations are named Karanga-a-Hape and Te Waihorotiu, and two existing stations with Māori names Maungawhau and Waitematā are redesigned to accommodate new nine-car electric trains are renamed. The EPBM that excavated twin 1.6km bored tunnels was named in recognition of the Māori rights activist Dame Whina Cooper.

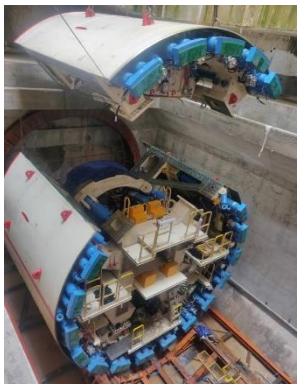
Eco-friendly Metro Construction for Challenging Coastal Geological Environments, China

The Qingdao Metro Line 6 (Phase I) Project is a demonstration Project approved by the National Development and Reform Commission that spans 30.8km with 21 underground stations and about 25km of connecting running tunnels. The project has successfully developed and promoted a series of prefabrication and assembly construction technologies for urban mass transit, making it the metro line with the largest application scale of such technologies in China. The stations employ a simple decoration process using fair-faced concrete, and the decoration design in public areas effectively combines functionality with artistry. This has vigorously advanced the eco-friendly and low-carbon transformation and upgrading of Qingdao Metro construction. Furthermore, all production and installation processes have been localized, stimulating an industrial scale worth RMB 1.3 billion.

Modern Underground Cemetery - Where Creativity, Sustainability and Efficiency Meet Tradition, Israel

Enabling the re-use of the space beneath an existing cemetery, the underground cemetery is a first-of-its-kind, designed, excavated, and constructed in compliance with the strict requirements of an ultra-Orthodox community. Using state-of-the-art design and construction methods while working within the constraints of the existing urban zoning and regulations, the underground cemetery revives Jewish burial traditions that were prevalent more than 2,000 years ago. Planning and construction of the project solves an acute shortage in burial space while avoiding encroachment on sensitive open space, providing an environmentally friendly, uncomplicated, sustainable, accessible, cost-effective solution for this highly regimented community.

Risk Control for Safe Shield Tunnelling Through Complex Strata of the Pearl River System, China



The 4.76km section of the Guangzhou Metro Line 18 between Shaxi and Shiliugang Stations in Panyu District runs through highly weathered muddy formations with the groundwater influenced directly by the Pearl River tidal action creating frequent water head fluctuations. Significant risk management and control technology was developed by the project to support the shield TBM drives of the twin tunnels as they passed under three rivers, beneath three viaducts and more than 20 buildings, and passing alongside the South China Expressway Viaduct. The project has established a complete set of stable risk prevention measures and systems which has controlled the shield tunnel drives greatly reducing various risks during the construction process.

YOUNG TUNNELLERS OF THE YEAR

Adriano Martoccia, Italy

For seven years since completing his studies as a structural and geotechnical civil engineer, Adriano Martoccia has been working in the technical department of contractor Ghella. To date he has worked on several diverse projects in Italy and abroad and is currently a senior project engineer on the Trento high speed railway project leading a team setting up for launch of four dual mode TBMs to excavate 20km of twin tunnels. Advancing projects that drive progress and innovation is his career ambition.

Hanan Samadi, Iran

After graduating from University of Tehran with an MSc in engineering geology, Hanan Samadi, is advancing her career in a male-dominated industry and in a fiercely traditional country. Through her pioneering work in machine learning and artificial intelligence in Iran, Hanan has made tangible differences in the environment in which tunnelling machines operate.

Luigi D'Angelo, Italy

Currently working as a Project Engineer for Italferr on the Naples-Bari high speed railway, Luigi D'Angelo is proposing a gradually move to a new role providing support and coordination to underground projects all over Italy with the aim of helping to standardise design choices and processes to improve and simplify the productive chain for clients and all parties involved.