TAIym 35

TAIYMTIMES

ANNUAL WINDOW INTO YOUTHFUL EXCELLENCE IN TUNNELLING

Journey of TAIym: Who, What and Why of the association

Voices from the Field: Experiences of Young Tunnel Engineers

Innovation Corner: Emerging Technologies in Geotechnics & Underground Works

Global Connect: How Young Members Are Shaping ITA's Vision


HERRENKNECHT
Tunnelling Systems
NORTHEAST
BOUNDARY
TUNNEL

FOREWORD

As the tunnelling industry continues to carve its path through mountains, cities, and riverbeds, it is not only the structures we create that matter, but also the communities, knowledge, and innovation that shape them. This inaugural issue of the TAIym Magazine is a reflection of that spirit, a platform built by young members, for young members, with the collective aim of bridging generations, sharing wisdom, and celebrating the breakthroughs that are redefining underground construction.

Inside these pages, you will find a rich tapestry of perspectives. From the vision of our President and Vice President of TAI, who share their journeys and aspirations for the future, to the voices of our committee members whose milestones speak of passion and perseverance, this issue captures the vibrancy of a community united by its love for tunnelling. The insights from our senior professionals, remind us how experience and innovation go hand in hand and how the younger generation has a responsibility to build upon this legacy with curiosity and courage.

We also highlight trends and developments shaping our industry today, from the evolution of cross passage construction to the remarkable rise of Steel Fiber Reinforced Concrete as a sustainable game-changer. These stories go beyond technical detail from the remarkable rise of fiber reinforced concrete as a sustainable game changer to the evolution of artificial intelligence in the field of tunneling; they showcase how India is steadily positioning itself at the forefront of global tunnelling innovation. At the same time, our coverage of TAIym's academic collaborations, workshops, and international representation at the World Tunnel Congress illustrates how our young members are not only learning but also leading, representing India on the world stage with pride.

This magazine is not just a compilation of articles; it is a testament to the energy and ambition of young tunnellers in India. It is an invitation to learn, to share, and to stay connected with a fraternity that thrives on collaboration. Whether you are a student exploring tunnelling for the first time, a professional in the field, or a seasoned veteran, we hope these pages inspire you to engage deeper, with both the science and the spirit of underground works.

Together, let us continue to build, not just tunnels and dams, but also bridges across generations, ideas, and innovations.

— Editorial Team, TAIym Magazine

Message from the President of TAI

Greetings from the Tunnelling Association of Indian Young Members (TAIym)!

I am delighted to introduce the very first issue of the TAIym Magazine, October 2025, a platform created by young members, for young members. This inaugural edition captures what TAIym truly represents: collaboration, innovation, and the shared voice of the next generation of tunnelling professionals.

In this issue, we introduce what TAIym is, present the TAIym Committee, and showcase recent trends and developments in the tunnelling industry, thoughtfully compiled by young engineers who are shaping the future of underground infrastructure. The magazine also highlights the major activities and initiatives led by TAIym, reflecting the strength of our young members not only at the national level but also on international platforms, where their contributions are being recognized and celebrated.

The spirit of TAIym lies in bringing together passionate young tunnelling professionals, providing them opportunities to learn, share, and lead. This first edition is a step towards building a community that thrives on knowledge exchange, technical growth, and global collaboration, ensuring that the next generation of tunnellers carries forward the values of innovation, sustainability, and excellence.

I extend my heartfelt thanks to all contributors, the editorial team, and every young member who has put their efforts into making this magazine a reality. I encourage all readers to engage with the content, draw inspiration from the stories and insights shared, and actively participate in the growth of TAIym.

With warm regards,

R.K. Dhiman
President
Tunnelling Association of India

Message from the Chair, TAIym

It gives me immense pride and pleasure to present to you the first edition of the Tunneling Association of India, Young Members (TAIym) Magazine.

This magazine is more than just a publication, it is a platform created by the young, for the young, and with deep respect for the legacy of those who came before us. It represents a new chapter in the growing narrative of the Indian tunneling industry, showcasing the passion, talent, and determination of the next generation of tunneling professionals.

India is currently witnessing a tunneling revolution. From urban metro systems crisscrossing our megacities, to high-speed rail corridors and critical hydropower and water infrastructure in challenging Himalayan terrain, tunnels are becoming the arteries of modern India. With increasing emphasis on sustainable and resilient infrastructure, tunneling has never been more crucial to national development.

Amidst this rapid expansion, it is heartening to see young engineers and professionals stepping up, contributing not only with fresh technical knowledge and energy but also with innovative approaches and a collaborative spirit. Whether working on site or behind design terminals, young members are pushing boundaries, learning rapidly, and solving problems that shape our country's future underground.

However, this journey would not be possible without the invaluable mentorship and support of the experienced generation. Their knowledge, born out of decades of practical challenges and solutions, continues to be our guiding light. The synergy between experience and youth is the true strength of the Indian tunneling sector today.

Through this magazine, we aim to:

- Showcase young voices and their work
- Share knowledge across generations
- Celebrate achievements within our community
- Inspire more young professionals to join and thrive in the world of tunneling.

We invite contributions, feedback, and collaboration from all corners of the industry. Let this platform be a bridge, not just through mountains and under cities, but also between generations and ideas.

Let us dig deep, think big, and build the future, together.

With warm regards,

Mr. Ayush Raj
Chair
Tunnelling Association of India Young Members

THE JOURNEY OF TAIYM: FROM FOUNDATIONS TO FRONTIERS

TRACING THE GROWTH OF THE TUNNELLING ASSOCIATION OF INDIA YOUNG MEMBERS —ITS MILESTONES, ITS VISION, AND ITS ROLE IN SHAPING UNDERGROUND ENGINEERING.

OUR STORY

"It all began back in later part of 2018. A small group of young, like-minded underground engineers came together with a simple but powerful idea: to create a space where students, early-career professionals, and researchers could connect, learn, and grow together. What started as a few passionate conversations quickly transformed into something bigger—the birth of TAIym (Tunnelling Association of India Young Members) in 2019.

From day one, the vision was clear: build a strong and inclusive community of young tunnelling professionals in India, and make sure their voices, ideas, and aspirations found a place in the larger tunnelling conversation. Over the years, TAIym has grown into a collaborative platform where knowledge meets opportunity, bridging the often-wide gap between academia and industry.

Being part of the global network gave TAIym an even stronger purpose—bringing Indian young professionals to the international stage. Through events, workshops, and exchanges, members not only gained exposure to global best practices but also contributed fresh perspectives from India's rapidly expanding underground infrastructure sector.

At its core, TAIym's mission has always been simple: to inspire, connect, and empower the next generation of tunnelling professionals. This means promoting technical excellence, encouraging dialogue between students, industry experts, and government bodies, and creating pathways for leadership and innovation.

Today, what began as a handful of enthusiastic engineers in 2018 has become a thriving platform for hundreds of young professionals across India. TAIym continues to be the launchpad for new ideas, careers, and collaborations—shaping not just the future of its members, but the future of tunnelling in India itself.

ABOUT US

Tunnelling Association of India – Young Members (TAIYM) is a dynamic platform dedicated to uniting and empowering the next generation of professionals in the field of tunnelling and underground construction. Functioning under the aegis of the Tunnelling Association of India (TAI), which is the Indian representative body of the International Tunnelling and Underground Space Association (ITA), TAIYM serves as a vital link between emerging talent and established expertise.

Our mission is to foster knowledge-sharing, skill development, mentorship, and innovation among young engineers, geologists, planners, and professionals passionate about underground infrastructure. We aim to build a robust ecosystem that encourages interdisciplinary collaboration, research, and awareness of modern tunnelling technologies and practices.

What We Do?

Capacity Building & Outreach: We organize technical webinars, workshops, field visits, and awareness campaigns to expose young professionals to cutting-edge practices in tunnelling.

Networking & Mentorship: We create opportunities for students and early-career professionals to connect with leading experts and organizations in the industry.

Youth Representation: We represent India's young tunnelling professionals in international platforms like ITA Young Members (ITAYM), promoting visibility and participation on the global stage.

Encouraging Innovation: TAIYM fosters discussions around sustainability, safety, digital transformation, and indigenous solutions relevant to tunnelling in India.

WHO CAN JOIN?

TAIYM welcomes students, early-career professionals (typically under the age of 35), researchers, and enthusiasts from diverse disciplines related to tunnelling and underground space—be it civil engineering, geotechnics, construction, urban planning, or environmental sciences.

TAIYM REFLECTIONS

From Screens to Knowledge: A Year of Webinars and Events
Looking back at TAIym' s knowledge-sharing sessions—bringing together experts, young professionals, and new ideas.

Over the past year, TAIym has demonstrated its unwavering commitment to professional development and industry engagement through a diverse range of initiatives. At the forefront has been its highly successful webinar series an initiative that has evolved into a cornerstone of knowledge sharing within the tunneling community. These sessions have consistently brought together subject matter experts, emerging professionals, and thought leaders, fostering a collaborative environment where technical insights and innovative ideas are exchanged freely.

Complementing the webinars, TAIym has actively organized and participated in several impactful events, including the celebration of World Tunnel Day, which served as a platform to recognize the contributions of tunneling professionals and promote awareness of underground infrastructure. Additionally, site visits to ongoing tunnel projects have provided young members with invaluable exposure to real-world engineering practices, bridging the gap between academic learning and field application.

TAIym has also extended its outreach to academic institutions through college visits, aimed at guiding and inspiring the next generation of tunnel engineers. These interactions have not only helped students understand the career pathways available in tunneling but have also strengthened the connection between industry and academia.

Collectively, these initiatives reflect TAIym's holistic approach to nurturing talent, fostering innovation, and building a vibrant professional community. This collective contribution spanning webinars, field engagement, and academic outreach stands as TAIym's most valuable asset, reflecting its vision to empower the next generation of tunneling professionals and advance excellence across the industry.

Milestones of TAIym: Building the Future of Tunnelling Together

The Tunnelling Association of India Young Members (TAIym) has steadily grown into a vibrant platform where learning, collaboration, and innovation converge. Over the past year, the committee has reached several milestones that showcase its commitment to nurturing talent, fostering global connections, and advancing the tunnelling industry.

Academic Collaborations: Bridging Classrooms & Caverns

With strong collaborations with institutions such as MIT-WPU, IIT Delhi, and IIT Jammu, TAIym launched its Student Mentorship Program—a first-of-its-kind initiative designed to connect academia with industry.

Through one-on-one mentorship, students gain valuable insights during their master's thesis projects, guided by seasoned professionals who share practical knowledge from real-world tunnelling challenges. Beyond academics, the program encourages students to participate in industry events, technical tours, and guest lectures, helping them prepare for future careers.

Registered Mentors at MIT-WPU:

- Mr. Ayush Raj
- Mr. Chiranjib Sarkar
- Mr. Aejaz Ahmad
- Mr. Sourav Kumar Agarwal
- Mr. Rushi Randeria

Seminar at IIT Jammu: Advancements in Tunnelling Technologies

In collaboration with IIT Jammu, TAI & TAIym hosted a one-day seminar bringing together students, academicians, and industry experts.

The event created an inspiring dialogue between young minds and professionals, covering the latest tunnelling innovations, real-world challenges, and career opportunities. With expert presentations and interactive sessions, the seminar not only expanded technical knowledge but also highlighted India's growing role in global tunnelling.

Workshop at MIT-WPU: Underground Space for a Sustainable Planet

This landmark workshop, featuring the President of ITA, explored how underground spaces can contribute to sustainable development. Students,

professionals, and international experts engaged in discussions on innovative underground strategies, environmental impacts, and the future of sustainable infrastructure.

By fostering interdisciplinary dialogue, the workshop showcased TAIym's commitment to positioning underground space as a key driver for sustainable cities of tomorrow.

On the Global Stage: World Tunnel Congress (WTC)

TAIym continues to make its mark globally.

- **At WTC 2025 in Stockholm, Sweden,** two representatives from the Tunnelling Association of India Young Members (TAIym) actively participated in the congress and its associated ITAym activities. Once again, India proudly contested for a seat on the ITAym Steering Board, reflecting the growing presence and commitment of young Indian tunnelling professionals on the global stage.
- At **WTC 2024 in Shenzhen, China,**TAIym members were elected as India's National Representative at ITA and contested for the ITAym Steering Board. India played a pivotal role in forming the **Asia Pacific Group of ITA nations,** a regional platform addressing shared challenges.
- At **WTC 2023 in Athens, Greece,** TAIym members engaged with global peers in technical sessions and even shared lighter moments—like a friendly **cricket match with ITA President Prof. Arnold Dix.**
- Throughout the congress, TAIym members engaged in meaningful discussions with international experts, strengthening professional networks and fostering knowledge exchange with the global tunnelling community.

These events not only strengthened TAIym's global visibility but also connected young Indian tunnellers with international platforms.

Celebrating World Tunnel Day 2023

From **Delhi to Kolkata to Pune,** TAIym members came together on December 4th for a day of learning and camaraderie. The celebrations included technical talks, interactive games, and a networking dinner. With over **100 participants,** the event highlighted the community's enthusiasm and growing strength.

Tunnelling Asia 2023: Mumbai Hosts the World

In November 2023, Mumbai became the hub of international tunnelling as TAI, DMRC, and MMRCL hosted **Tunnelling Asia 2023** under the aegis of ITA.

Over **300 global experts** gathered to discuss climate resilience, sustainability, risk management, contracts, and cutting-edge excavation techniques. The event also hosted the prestigious **ITA Awards,** celebrating achievements in six categories including *Project of the Year, Innovation, Environment, Safety, and Young Tunneller of the Year.*

Young Tunnellers Conference 2023: Empowering the Next Generation

Held alongside Tunnelling Asia, the Young Tunnellers Conference (YTC) gave young professionals a dedicated platform to exchange ideas and experiences. With 100+ participants, including researchers, industry executives, and students, the conference reinforced TAIym's vision: to nurture talent, encourage innovation, and prepare India's young engineers for future challenges.

This global conference offered young engineers an unparalleled opportunity to learn, network, and showcase India's growing influence in underground construction.

Editor's Note:

From classrooms to global conferences, from mentoring students to shaping policy discussions, TAIym continues to create milestones that empower the next generation of tunnelling professionals. These achievements are not just events—they are stepping stones toward building a resilient, innovative, and globally recognized tunnelling community in India.

Equally important have been the **webinars conducted by TAIym in the past,** where industry stalwarts shared their expertise on diverse aspects of tunnelling and underground construction. These sessions created a knowledge archive for young engineers and professionals to learn directly from the leaders who shaped the industry, where we look back at the rich insights and experiences shared during our webinar series.

LEADERSHIP INSIGHTS

EXCLUSIVE CONVERSATIONS WITH THE VICE PRESIDENT, TAI ON TUNNELLING'S PRESENT CHALLENGES AND TOMORROW'S OPPORTUNITIES

Insights from Experience:

Mr. Rakesh Kumar Khali

Vice President GR Infra Projects Expertise in Hydropower & Tunnels

Why hearing from our seniors matters

Every tunnelling project tells a story—of geology, of perseverance, and of innovation under pressure. While young engineers bring energy and fresh ideas, it is the wisdom of seniors that guides them through the toughest challenges. Their experiences, earned over decades, are the compass that helps future generations move forward.

In this feature, we sit down with **Mr. Rakesh Kumar Khali,** Vice President at GR Infra Projects, whose career spanning over three decades reflects the evolution of India's tunnelling sector. He shares his journey, key challenges, and his advice for the next generation of tunnelling professionals.

Q1. Your journey in tunnelling spans more than three decades. Could you share how it all began, and what moments or challenges defined your career?

Mr. Khali: My journey in the tunnelling industry began more than three decades ago, driven by both professional curiosity and the unique engineering challenges that underground works present. I was fascinated by how tunnels—though hidden from view—play such a vital role in connecting regions, harnessing hydropower, and supporting national infrastructure. This fascination drew me to specialize in tunnel engineering during my postgraduate studies, which became the foundation for my career.

Looking back, there have been several defining moments. Early in my career, working in the Himalayan geology taught me resilience and adaptability, as every face excavation was a classroom in itself. One of the most formative challenges was managing projects under extreme Himalayan conditions, where unpredictable ground behaviour, high overburden, and severe weather demanded innovative solutions and strong team coordination.

Another milestone was transitioning from conventional drill-and-blast tunnelling to adopting NATM and mechanized methods, which reshaped my technical perspective and leadership approach. Equally important were the challenges of leading multi-disciplinary teams and maintaining safety and quality under high pressure. These experiences not only honed my technical expertise but also strengthened my belief that tunnelling is as much about people management and foresight as it is about engineering.

Ultimately, it has been this constant blend of challenges and opportunities that shaped my journey, giving me both professional satisfaction and the motivation to contribute further to the tunnelling industry.

Q2. With hydropower being a major focus in your career, how do tunnelling challenges in hydro projects differ from other sectors?

Mr. Khali: Hydropower tunnelling presents a distinct set of challenges compared to highway or metro projects. While transport tunnels often prioritize alignment optimization, passenger safety, and urban constraints, hydropower tunnels demand performance under extreme geological and hydraulic conditions. Headrace tunnels, pressure shafts, and surge chambers must withstand high water pressures and cyclic loadings, often in remote Himalayan terrain with difficult logistics and limited access.

One instance where innovation proved decisive was in addressing severe squeezing ground in a headrace tunnel. Conventional excavation was leading to repeated collapses and delays. By adopting a modified NATM approach—integrating yielding supports, fore-poling, and continuous monitoring—we were able to stabilize the ground while maintaining excavation progress. This solution not only ensured safety but also saved considerable time and costs.

Such experiences highlight that while tunnelling fundamentals remain common, hydropower projects demand innovative, project-specific adaptations. Success lies in blending global best practices with localized solutions tailored to the geology and operational demands of hydropower.

Q3. How has your association with TAI influenced your work and contributed to bridging industry practices with field execution?

Mr. Khali: My involvement with the Tunnelling Association of India (TAI) has been instrumental in bridging the gap between industry knowledge and on-ground execution. TAI serves as a platform for sharing global best practices, advanced methodologies, and lessons learned across diverse tunnelling projects.

Through seminars, workshops, and technical committees, I have been able to both contribute my field experience and gain exposure to emerging technologies, innovative design approaches, and safety protocols from national and international experts. This interaction has directly influenced project execution. By integrating TAI-endorsed best practices—whether in NATM, TBM deployment, instrumentation, or risk management—into real-world projects, we have been able to improve safety, efficiency, and quality outcomes.

Moreover, TAI facilitates the exchange of knowledge among young engineers, helping them translate theoretical concepts into practical solutions on complex sites. In essence, TAI has created a feedback loop between industry innovation and field-level implementation, which has been crucial for advancing tunnelling standards in India.

Q4. The tunnelling industry has changed drastically since you began. What are the biggest changes, and what skills must today's engineers develop?

Mr. Khali: Since I began my career, the tunnelling industry has undergone significant transformation. Mechanized tunnelling, advanced geological investigation techniques, real-time instrumentation, digital design tools, and safety systems have all redefined how tunnels are planned, executed, and monitored. Projects today are larger, more complex, and demand faster delivery while maintaining strict quality and safety standards.

For today's engineers, the focus should be on developing a hybrid skill set: strong fundamentals in geotechnical engineering, rock mechanics, and construction methodologies, combined with proficiency in digital tools like BIM, digital twins, and AI-based predictive analytics.

Equally important are leadership, selection of the right equipment, risk management, and collaborative skills, since modern tunnelling projects are highly interdisciplinary. Young engineers should also embrace innovation and continuous

learning more proactively than my generation. While we relied primarily on experience and judgment, today's professionals can leverage technology to predict challenges, optimize designs, and improve safety outcomes. By integrating these tools with field knowledge, they can push the boundaries of what is possible in tunnelling, contributing more efficiently and sustainably to India's growing infrastructure needs.

Q5. Finally, what mindset shift do you believe the younger generation can bring to tunnelling?

Mr. Khali: The younger generation has the potential to bring a fundamental mindset shift in how tunnelling projects approach sustainability and safety. Unlike earlier generations, they are inherently more conscious of environmental impact, energy efficiency, and social responsibility. This awareness, combined with fluency in modern digital tools and data-driven decision-making, allows them to design and execute tunnels with reduced material waste, lower carbon footprint, and enhanced safety for workers and surrounding communities.

Young engineers can champion proactive risk management, real-time monitoring, and predictive analytics to anticipate ground behaviour and operational hazards, rather than responding after issues arise. By integrating sustainability considerations into every stage of the project—from design and excavation to waste management—they can embed a culture where efficiency, safety, and environmental stewardship are core, not optional. This mindset shift is crucial for India to meet global standards in tunnelling and underground infrastructure.

Editor's Note:

Through this conversation, Mr. Khali reminds us that tunnelling is not only about engineering but also about leadership, adaptability, and vision. His insights highlight the importance of fundamentals, innovation, and sustainability, offering young professionals a blueprint for success in the tunnels of tomorrow.

POWERING THE FUTURE

HYDROPOWER & PSP: DRIVING INDIA'S ENERGY REVOLUTION

A peek into upcoming hydropower and pumped storage projects in India, and how global energy trends are opening vast opportunities.

Saurabh Yele, Tunnel Engineer Jacobs | Vaishanavi Sanap, Geotech Engineer SMEC

India's energy demand is surging due to rapid urbanization, and electrification. It aggressively pivots towards renewable energy sources, with the rise of intermittent renewable sources like solar and wing, grid stability has become a major challenge. The sun doesn't always shine, and the wind doesn't always blow, leading to fluctuations in electricity supply. This is where Pumped Storage Projects (PSP's) emerge as a critical solution, act as energy reservoirs, storing surplus energy during off-peak hours and releasing it during peak demand.

Why are PSP's Needed?

The fundamental need for PSP's stems from the imperative to balance electricity grids dominated by intermittent energy.

The Idea Behind PSPs!

The core idea behind a PSP's based on simple principle "Gravity-based energy storage", using electricity to pump water uphill to a higher reservoir, and then releasing that water downhill through turbines to generate electricity when demand is high. This cycle allows PSPs to provide essential grid services such as Peak Saving: Meeting peak electricity demand by releasing stored energy, Load Balancing: Storing surplus energy during off-peak hours when electricity is cheap and releasing it during peak hours when electricity is expensive, Grid Stability: Providing ancillary services like frequency regulation and voltage support, crucial for a stable grid and Renewable Energy Integration: Maximizing the utilization of solar and wind power by storing their intermittent output.

Components of PSPs

Upper Reservoir: Located at a higher elevation, it stores water that will be released to generate electricity.

Lower Reservoir: Located at a lower elevation, it collects water discharged from the upper reservoir during generation and stores water to be pumped uphill.

Powerhouse: Houses reversible pump turbines, generators and motors.

Penstocks: Large pipelines that connect the upper reservoir to the powerhouse, conveying water under high pressure.

Tailrace: A channel that connects the powerhouse to the lower reservoir.

Switchyard: Connects the powerplant to the electricity grid for transmitting power.

Control Room: Monitors and controls the entire operation of the PSP.

The Critical Role of Tunnel Excavations in PSPs and HEPs

Tunnel excavations are far more than just digging holes; they are fundamental and often the most challenging part of developing HEPs and PSPs. These underground arteries are essential for the entire system to function, providing pathways for water to be managed, stored, and converted into electricity. The success, efficiency, and safety of a project are directly tied to the planning and execution of its tunneling work.

Tunnels as the Lifeline of the Powerhouse!

In both HEPs and PSPs, the powerhouse where electricity is generated is often located underground to capitalize on the natural elevation difference of a site. Tunnels serve as the vital connection between the water source and the powerhouse.

Headrace Tunnels: These are projects main artery, carrying water from the upper reservoir or a river diversion to the powerhouse turbines. Their size and gradient are critical for ensuring a smooth, high-pressure flow of water.

Pressure Shafts: As the headrace tunnel approaches the powerhouse, it transitions into a steep, vertical or near-vertical shaft. These are high-pressure tunnels that carry water to the turbines, effectively converting the potential energy of the stored water into kinetic energy.

Tailrace Tunnels: After passing through the turbines, water is discharged back into a lower reservoir or a river through tailrace tunnels. They are designed to minimize energy loss and ensure efficient drainage.

Access and Service Tunnels: Beyond the water carrying tunnels, a complex network of access tunnels and adits is required for the construction and maintenance of the underground powerhouse. These tunnels provide pathways for heavy machinery, materials, and personnel, making the entire project feasible

HEPs vs PSPs: A crucial distinction

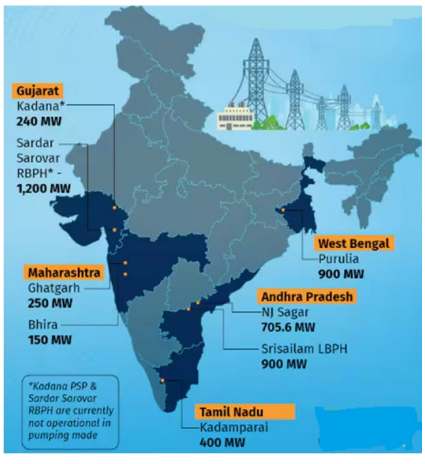
While both PSPs and HEPs utilize water and gravity to generate electricity, their fundamental purposes and operational modes differ significantly.

HEPs are energy producers, converting the kinetic and potential energy of a river's natural flow into a continuous, base load power supply. They rely on a consistent water source and primarily designed for power generation.

PSPs on the other hand are energy storage systems, functioning like a giant battery. Their primary purpose is to balance the electricity grid by storing surplus energy. They use off-peak renewable energy to pump water into an upper reservoir, then release it during peak demand to generate power. This reversible operation enables both storage and generation, serve as PSP can be both a consumer and a producer of electricity, is the crucial feature that sets it apart from a conventional HEP.

India's Shifting Focus to PSPs

India's push for PSPs is a strategic response to its ambitious target of 500 GW of non-fossil fuel capacity by 2030. The move to PSPs is not about replacing HEPs, but about complementing them to build a more resilient and sustainable energy ecosystem.



Picture: Upcoming PSPs, India

As of mid-2025, the total operational capacity is around 6.2 GW. India has a handful of operational PSPs, many of which are part of larger, existing hydroelectric projects. Currently an aggregate capacity over 10 GW are in the construction phase and around 66 GW are in the detailed project report DPR stage, indicating a strong and robust pipeline for future development.

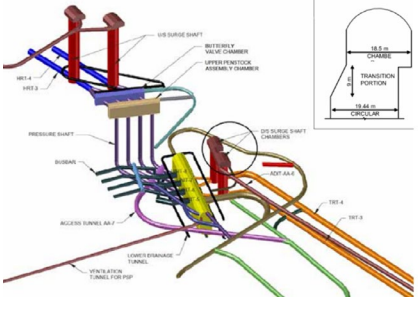
Tehri PSP, 1000 MW, Uttarakhand

The Tehri PSP, located in Uttarakhand on the Bhagirathi River, a tributary of the Ganga River, is designed to add an additional, 1000 MW of peaking power to the Northern Grid, bringing the total capacity to 2400 MW. It uses the existing Tehri Dam as its upper reservoir and the Koteshwar Dam downstream as its lower reservoir.

The project is being developed by the Tehri Hydro Development Corporation (THDC), which is a JV between Government of India and Government of Uttar Pradesh.

Picture: Tehri PSP, Uttarakhand, India.

The construction of the project involved major engineering feats. Engineers had to excavate vast underground caverns and a complex network of tunnels in the geologically sensitive Himalayan region. Key challenges include controlled blasting to protect nearby operational infrastructures and the implementation of innovative designs.



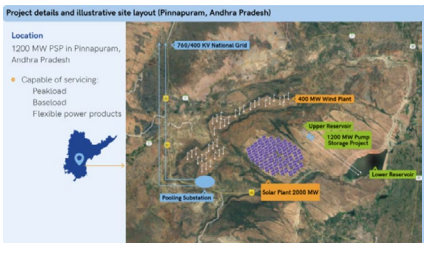
Picture: Three dimensional view of the project layout.

A key innovative feature is the use of variable-speed technology, the use of a reverse flaring in the surge shaft on top, a first of its kind of solution in hydro project. It is design feature where the cross-section of the shaft widens as it goes up, similar to an inverted cone. This allows for more precise power control and higher cycle efficiency, particularly to handle the large differences in water levels between the two reservoirs. The solution was verified through extensive 3D analysis of the underground caverns, including modelling rock bolting to replicate actual ground conditions.

Pinnapuram PSP, 1680 MW, Andhra Pradesh

The Pinnapurum PSP is a revolutionary project in India, conceived as the world's first and largest gigawatt scale integrated renewable energy facility. Located in the Kurnool district of Andhra Pradesh, developed by Greenko Group.

It is designed with a capacity of 1680 MW and an energy storage capacity of 10080 MWh per day. The project utilizes two artificial reservoirs in natural depressions, a key feature as it does not rely on an existing river and thus operates as a closed-loop system. This makes it an ideal solution for storing intermittent power from the co-located solar up to 4000 MW and wind up to 1000 MW farms. The power from all three components solar, wind and pumped hydro will be pooled at a common station and then connected to the national grid.



Picture: Pinnapurum PSP, Andhra Pradesh, India.

Key engineering features include the excavation of extensive tunnels and dams in a dry region and the seamless integration of power rom solar, wind and pumped hydro into a single, dispatchable power source, making it a model for future hybrid renewable energy project.

Its design includes 5 independent steel lined penstocks to carry water from the upper reservoir to a surface powerhouse. The project is an engineering feat due to its location in a dry, non-riverine region, necessitating the construction of large rockfill dams for both reservoirs and extensive excavation for its tunnels and powerhouse.

Kemeng HEP, 600 MW, Arunachal Pradesh

The Kemeng Hydroelectric Project is a 600 MW run of the river scheme utilizing the Bichom and Tenga tributaries of the Kemeng River. It features 2 dams that channel water through an extensive conductor

Picture: Kemeng HEP, Arunachal Pradesh, India.

system to an underground powerhouse at Kimi village.

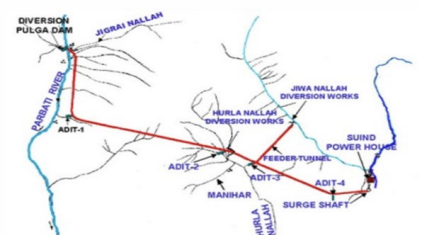
The project was developed and operated by North Eastern Electric Power Corporation (NEEPCO).

The most challenging part of the Kemeng project was constructing its extensive water conductor system through geologically fragile Himalayan terrain. The project's key component is ~15km headrace tunnel, which channels water from Bichom Dam to the powerhouse. Its successful breakthrough marked a major milestone, making it one of India's longest hydropower tunnels at the time. Engineer encountered severe challenges due to highly fractured, unstable rock formations. With the rock mass rated as "very poor," immediate installation of strong support systems was essential to prevent tunnel collapses post-excavation.

Parbati-II HEP, 800 MW, Himachal Pradesh

The Prabati-II Hydroelectric Project is an 800MW run of the river scheme on the Prabati River in Himachal Pradesh's Kullu district. It uses a small diversion dam and a long tunnel system to harness an 862m elevation drop for power generation, minimizing environmental impact on the river's natural flow. The project was developed and is owned by NHPC Limited.

The Prabati-II project faced major engineering challenges, especially in tunneling works, with



Picture: Site layout plan Prabati-II HEP

years of delays due to complex geology and rugged terrain. Its 31.56km headrace tunnel, amongst the longest in India, was build through unstable rock, shear zone, and high pressure. A key achievement was the excavation of 2 inclined pressure shafts over 1.5km each, setting a world record for TBM use in such conditions. Engineers also tackled unexpected geological anomalies like rock bursts and heavy seepage using advanced geotechnical and seismic tomography techniques to ensure tunnel stability and safety.

Picture: Prabati-II HEP, Himachal Pradesh, India

URBAN TUNNELING METHODS INSIGHTS

CROSS PASSAGE CONSTRUCTION METHODS FOR TWIN-TUBE TUNNEL PROJECTS IN URBAN AREAS

C.S. Khokhar, Vishal Bansal (NHAI), Eshita Mishra (AECOM)

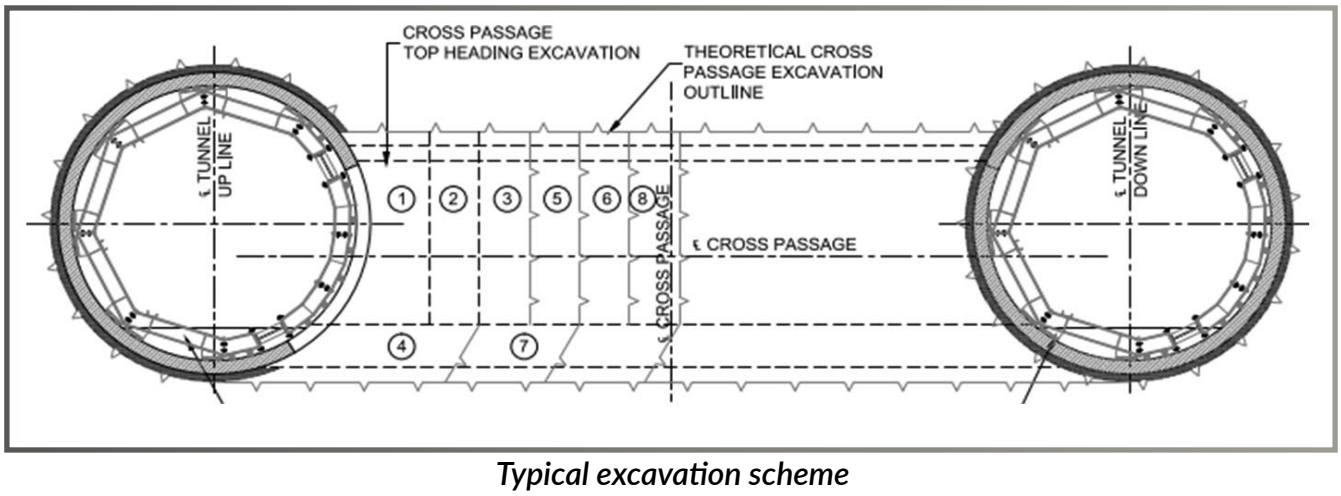
Introduction

Construction of Cross Passages have been always the most challenging work in twin tubes tunnelling project in which, according to National fire protection association (NFPA) guidelines, cross passages must be constructed at maximum interval of 244m. The challenges become much more extreme when ground consists of very fine silty sand combined with high water table. The biggest challenge in the construction of these cross passages is to limit the surface settlements especially if structures like roads, buildings etc. are lying just above the cross passage. Many construction methodologies have been devised in the past to overcome these challenges. These different construction methodologies have different level of suitability and constraints. While, some of them are only applicable in hard rock, others might be possible to execute in soft grounds only.

Selecting the right methodology of construction and design depending upon the ground strata is the most important activity for cross passages construction. The methodology should be safe, feasible and economical at the same time. Hence, it is very important to understand these different types of methods and their applicability in different ground conditions and keeping in mind the space constraints. The limitation, advantages and applicability of these methods have been discussed in detail.

Sprayed Concrete lining Method

Sprayed concrete lining method is the most common method for Cross passages construction. This method has been adopted for different types of ground including hard rock as well as soft ground with high water table. However, risk of surface as well as ground settlement increases as we move from high strength to low strength ground. This method becomes more complex when soft ground (silty sand / sandy silt) is encountered with high water table. To overcome, such adverse ground conditions, pre-excavation ground treatment/ improvement is advised. This method is generally used when



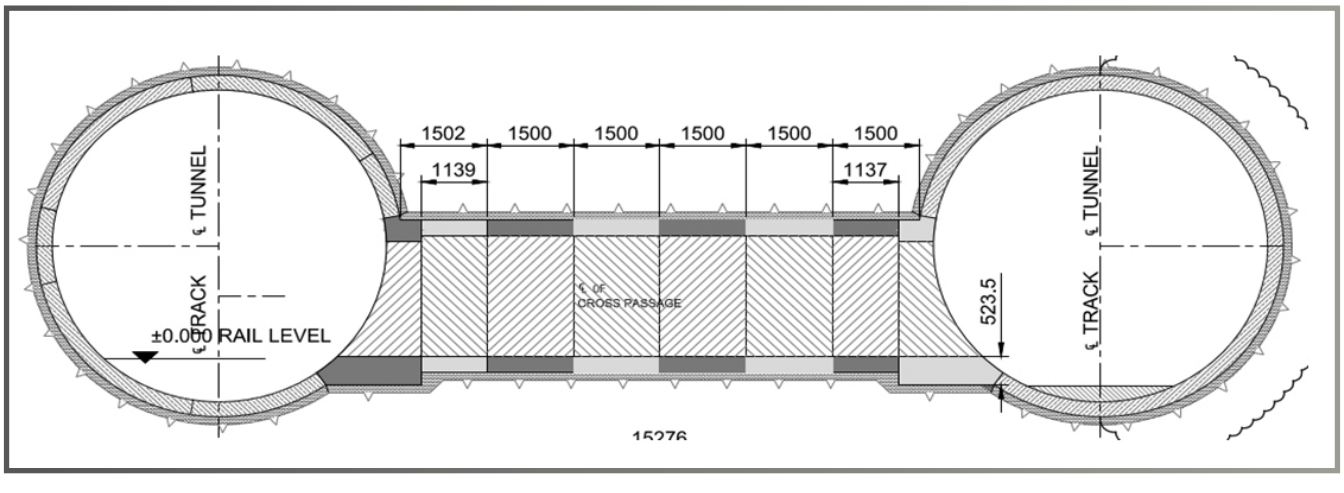
Typical excavation scheme

the ground is stiff with moderate to high cohesive values (rock, clay and compacted sand/silt) along with low water table. Typical NATM scheme is generally followed while excavating this type of ground. The ground is excavated for a typical round length ranging from 0.8-2.0m (designed as per ground conditions) and is supported using Shotcrete, Lattice girders and wire mesh as per design.

While Soil can be excavated using Jack hammer or excavator depending on the space available, hard rock should be excavated using only control blasting. While excavating hard rock, vibrometers must be used at all time to control the vibrations so as to limit any damage to the Main tunnel segments. Localized grouting, face anchors and forepoling might be required during excavation in this type of scheme depending on the ground behavior. Rock bolts shall be used in case of rock.

The complexity of sprayed concrete lining method increases manifold when the ground is expected to be weak and the water table is high. In these cases, ground improvement is generally done before excavation of the cross passage as well as before opening the segment of the main tunnel. Many techniques have been developed and implemented in the ground in past as part of ground improvement for the same:

a) Piperoofing
b) TAM grouting
c) Jet grouting
d) Ground replacement by Micro-piling
e) Ground freezing method



Box Pushing Method

This is a recent addition to cross passage construction methods used in Bangalore as well as Delhi Metro. While in Bangalore, steel boxes were pushed into the ground, in Delhi, RCC boxes of pre-defined dimensions were pushed using jacking arrangement taking thrust from the main tunnel. This method again is successful and economical only in ground where high water ingress mixed with soil is expected.

The boxes are pushed into the ground at a stroke length of 100-150mm. The cycle of excavation is - first to excavate up to 100-150mm and then push the box by same distance to support the excavated portion. It is strongly advised against pushing the boxes through the ground without excavating since the reaction frame is not designed to take those huge forces which might damage the main tunnel otherwise.

The benefits of the scheme turned out to be manifold. The settlement values observed at the ground surface as well as the crown were negligible. The process of excavation was much faster as compared to the conventional method. The safety of the workers was ensured since all the sides (except face) of the cross passage were surrounded by RCC lining of the box and at no time were unsupported.

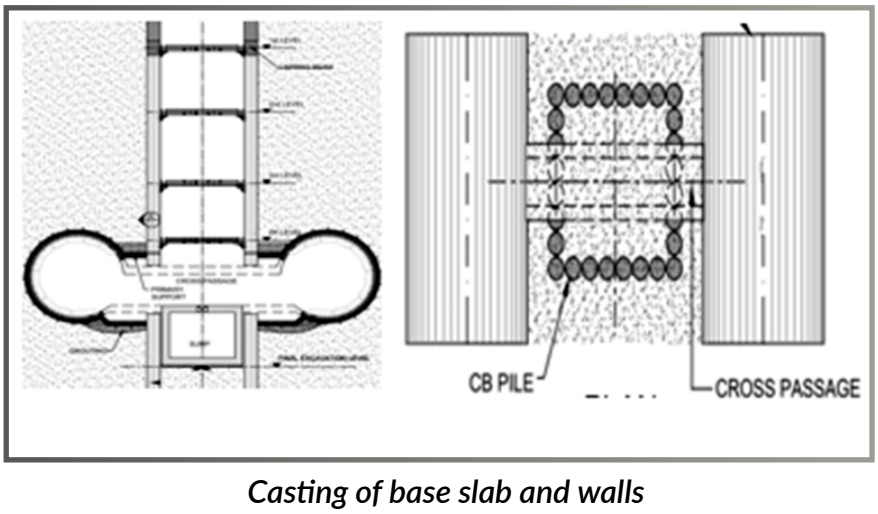
For the space and design considerations, both RCC and steel box pushing methods face similar kind of problems. Jacking force required for steel sections are lesser for similar sections as compared to RCC and hence, leads to faster excavation. However, during execution, RCC box pushing provides the edge of saving the time of in-situ final concrete lining.

It is observed that waterproofing and joint sealing is much more difficult in RCC box pushing if alignment hasnot been controlled during the pushing. This problem does not occur in steel box pushing since even if there is a misalignment, the final in-situ concrete lining will be able to accommodate the waterproofing either by the membrane or by the crystalline grout admixture concrete. Moreover, the in-situ final lining gives the passage a proper shape throughout the alignment.

Top down Excavation Method

This is one of the oldest and widely adapted methods used for construction of shallow tunnels, as it is quick and cost effective but its application for construction of cross passages depends upon a lot of factors like type of strata, time of construction, water table, space availability on surface etc. When the cover depth of cross passage is less and the surrounding areas are available for constructing the shaft, this method is considered. Figure 12 below shows a typical scheme of top down cross passage construction method.

This method is suitable for all classes of soil and has low cost in comparison to all other methods, as the cost of construction mainly depends on the cost of the nominal supporting systems. The biggest advantage of this method is that the influence to the main body of the tunnel is minimum. The tunnel can be handed over for the track laying and other activities and cross passage construction can be carried out as a parallel activity. Moreover, the requirement of construction technique requires lesser expertise as compared to other methods, and the construction pace is faster.



Casting of base slab and walls

But it is not preferred in congested areas as the construction causes major disruption at surface because of relocation of utilities already in place, also when there is high groundwater table a heavy construction will be required to resist buoyancy and a proper waterproofing scheme will be required to make the cross passage water tight.

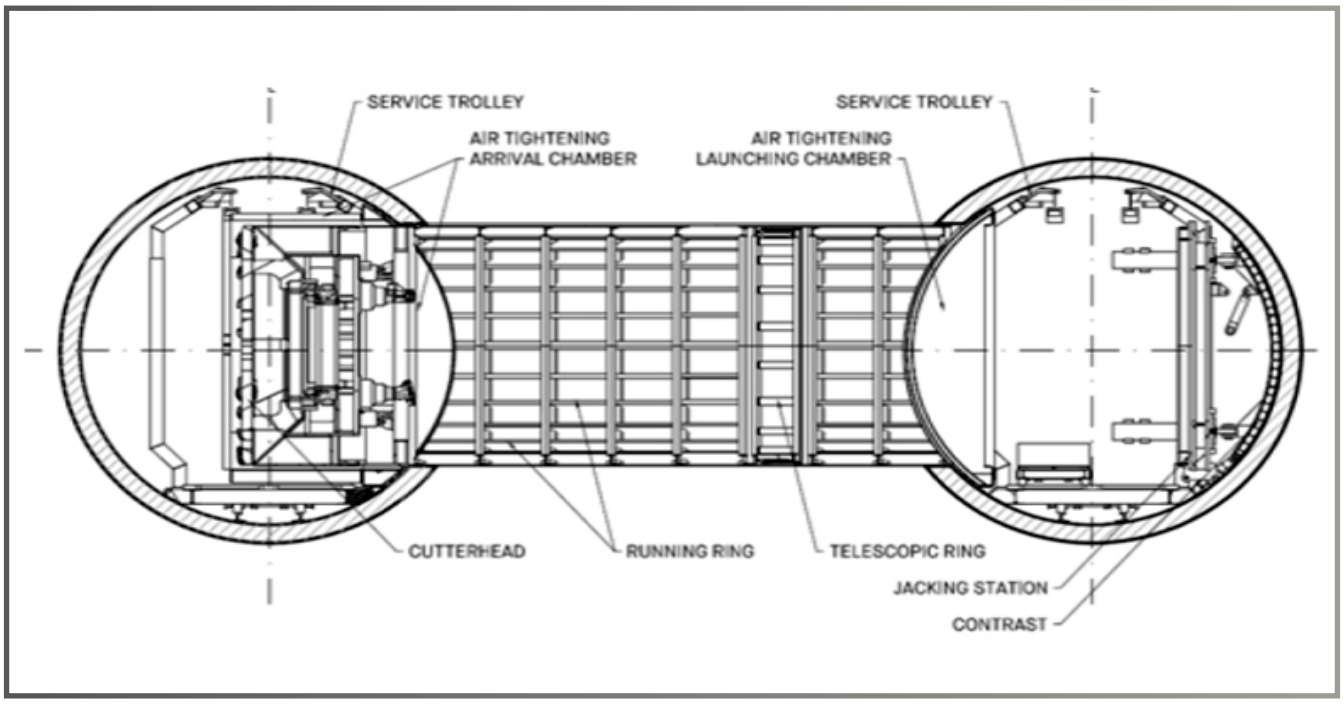
Mining with small scale TBM

TBM mined cross passages are emerging as an innovative solution to execute cross passages in complex geotechnical conditions, keeping in view worker and structure safety, and cost and time schedules. It is a fast way of constructing cross passages and can be cost effective if the numbers of cross passages are more as it promises high production performance for sequential excavation of multiple cross-passages, fast equipment positioning, installation and re-installation along main tunnels, self-contained equipment (external supply piping system not required). This method can be adopted without any pre excavation support system or any kind of ground improvement method.

As this is still a new method of construction, it will take some

time to master, but it is foreseen that this method can develop into a production-line process, in which the needed equipment and crew can just move along the tunnel, drilling one cross passage after the other, to solve one of the most critical problems in tunnel construction.

Small scale TBM's are used for excavating the cross passage, these TBM's use the rail tracks installed to service the TBM excavation of the main tunnel tubes. Cross passage TBM is mounted on the tracks, positioned sideways so that it can drill through the tunnel wall, and then excavate the cross-passage to the parallel tunnel.



Summary and Conclusions

Many methods have been discussed above for cross passage constructions. On the basis of authors' understanding and experiences the summary of these methods has been provided.

The selection of right method for different conditions is the most important aspect of the planning of the cross passage (CP) construction. Despite all the considerations, safety shall be of paramount importance while deciding the methodology. Before deciding any methodology, a complete risk assessment and safe system of works should be devised accordingly and maintained at all times.

Method	Ground Suitability	Land Requirement at Surface	Cost	Construction Time	Remark
NATM without ground improvement	All types of soils and rock with high cohesion and low water table	NIL	Low	Less	Rock excavation should be done via controlled blasting
NATM with pipe roofing	Ground with low cohesion, fractured rock, shallow cross passages	NIL	Moderate	Moderate	-
NATM with TAM grouting	Silty sand with high water table	NIL	High	High	Grout material should be chosen depending on the ground permeability
NATM with jet grouting	Silty sand with high water table	Required temporarily	High	Less	High skill, precision and continuous monitoring required
NATM with ground freezing method	Low strength ground composing silt, sand, gravels etc. with high water table	NIL	High	High	Cost per cross passage shall decrease with the increase in number of cross pasages
Box-pushing method	Low strength ground with high water table	NIL	Moderate	Moderate	Face stability shall be ensured at all time white excavation
Top-down Excavation	Shallow cross passages in all types of soil	Required temporaily	Moderate	Moderate	-
TBM Mined	All types of ground	NIL	High	Low	Cost per cross passage shall decrease with the increase in number of cross passages

Credits: *This article is based on the paper "Cross Passage Construction Methods for Twin-Tube Tunnel Projects in Urban Areas" by C.S. Khokhar, Vishal Bansal, and Eshita Mishra, published in the Journal of Rock Mechanics and Tunnelling Technology, Vol. 26(1), 2020.*

TRENDS & DEVELOPMENTS

Global Trends in Tunnelling

Latest Trends in Steel Fiber Reinforcement

Introduction

Underground construction is entering a transformative phase. Driven by rising demands for **faster execution, enhanced safety, sustainability, and cost efficiency,** the industry is moving away from traditional reinforcement techniques like wire mesh and rebar cages to advanced alternatives like steel fiber reinforced concrete (SFRC). Among the global leaders driving this transformation, steel fibers have emerged as a breakthrough solution. With superior tensile strength, optimized geometries, and proven performance in real-world projects across India, Steel fibers are shaping the future of underground excavations, tunneling, and permanent linings.

India's tunnelling and underground construction sector is witnessing a quiet revolution with the widespread adoption of **Steel Fiber Reinforced Concrete (SFRC).** What began as a replacement for traditional wire mesh in shotcrete is now expanding into permanent linings, cast-in-place solutions, and even precast segments. This shift is not just about materials—it represents a larger movement toward faster, safer, and more sustainable tunnelling.

Steel Fiber Shotcrete as Primary Support

One of the most successful applications of steel fibers has been in **shotcrete for primary support.** In projects ranging from railways to hydropower steel fibersare replacing conventional mesh reinforcement. Their use accelerates cycle times, reduces shotcrete thickness, and

eliminates the hazards of mesh installation, while delivering superior crack control and durability.

Validated through EFNARC and EN standards, steel fiber shotcrete has already been implemented in some of India's most ambitious projects, including the **Mumbai-Ahmedabad High-Speed Rail, the Pakaldul Hydropower Project,** and the **Atal Tunnel.** The message is clear: steel fiber shotcrete has moved from being an alternative to becoming the standard of modern tunnel support.

Permanent Linings with Steel Fiber Shotcrete

Beyond temporary support, India is now embracing **steel fiber shotcrete for permanent linings.** Using double-hooked-end fibers with tensile strength up to 1800 N/mm², this method is particularly suited to short tunnels, crossovers, and cross passages where rebar cages and formwork are impractical.

Here, sprayed concrete becomes both the final lining and the structural backbone, eliminating the need for gantries, cages, and complex reinforcement. While material costs may appear higher, the overall savings in time, labor, and logistics make it a cost-effective choice. Projects such as the **MMRC Sahar Crossover** and the **Dedicated Freight Corridor tunnels** have already showcased the efficiency of this method.

Cast-in-Place SFRC Linings

For tunnels requiring permanent durability and watertightness, India is transitioning to **cast-in-place SFRC linings.** Double-hooked-end steel fibers, up to 60 mm in length with tensile strength of 2200 N/mm², are now replacing conventional reinforcement.

By ensuring crack widths below 0.2 mm, these linings deliver heightened durability and long-term resilience while cutting down steel consumption and labor requirements. Landmark projects such as the **USBRL Tunnel** and the **Bhanupali-Bilaspur Rail Line** are setting benchmarks for the use of SFRC in cast-in-place designs.

Precast SFRC Segments

Perhaps the most transformative application lies in **precast SFRC segments,** which are redefining how tunnel linings are designed and installed. By substituting or supplementing rebar with high-performance steel fibers, precast segments achieve superior load-bearing capacity, crack control, and fire resistance.

Not only do these segments enhance safety under impact and fire conditions, but they also bring sustainability benefits by reducing steel consumption by more than 50%, cutting significant CO_2 emissions. In projects like the **DMRC DC-05** and the **Rishikesh-Karnprayag Rail Line,** hundreds of SFRC rings have already been successfully installed, marking a new era of efficient and eco-friendly tunnelling.

A New Benchmark for Indian Tunnelling

As India accelerates its underground infrastructure projects, SFRC is proving to be more than just an innovative material—it is a **new benchmark for efficiency, safety, and sustainability.** From high-speed rail to hydropower, SFRC is enabling faster construction cycles, reduced dependence on conventional reinforcement, and greater durability of tunnel structures.

By combining rigorous global testing standards with on-site validation, SFRC solutionsare positioning India's tunnelling industry at the forefront of global best practices.

CREDITS:

Content sourced from Bekaert technical submissions and project case studies in Indian tunnelling and underground construction.

Artificial Intelligence and Machine Learning in Tunnelling:

Redefining the Underground Future

Artificial Intelligence (AI) and Machine Learning (ML) are no longer abstract concepts reserved for data scientists or tech startups. In recent years, they have begun to reshape the tunnelling industry—an engineering discipline where complexity, uncertainty, and risk are inherent. By transforming how data is collected, processed, and applied, AI and ML are enabling safer, faster, and more sustainable underground construction.

Why AI and ML matter in Tunneling

Tunneling projects face unique challenges: variable ground conditions, high financial stakes, and tight construction schedules. Traditional decision-making often relies on limited site investigations and engineer judgment, which, while invaluable, cannot always predict unexpected events. AI and ML bridge this gap by analyzing vast datasets in real time, identifying patterns invisible to the human eye, and supporting data-driven decisions.

Key possible Applications scenario

Ground Condition Prediction

By integrating geological, geotechnical, and geophysical data, ML models can forecast ground behavior more accurately.

This improves TBM (Tunnel Boring Machine) performance planning, reducing delays and equipment wear.

TBM Performance Optimization

AI systems analyze operational parameters such as torque, thrust, penetration rate, and cutter wear.

Predictive algorithms suggest optimal operating conditions, increasing efficiency while minimizing downtime.

Risk Management & Safety

Machine learning models detect early warning signals of failures—such as abnormal vibrations, water ingress, or deformation.

Real-time monitoring linked to AI-driven dashboards helps engineers take proactive safety measures.

Design & Digital Twins

AI-powered digital twins replicate tunnel behavior under different scenarios, allowing engineers

to test design choices virtually before implementation.

This reduces costly modifications during construction.

Sustainability & Cost Efficiency

AI optimizes resource use (shotcrete, steel fiber, energy), reducing both costs and carbon footprint.

ML-driven logistics planning ensures smoother supply chain management for large-scale projects.

Global and Indian Perspectives

Globally, AI adoption in tunnelling is accelerating. European and Japanese projects already use AI-based TBM monitoring systems, while digital twins are becoming standard for metro and high-speed rail tunnels.

In India, where tunnelling is rapidly expanding—from Himalayan rail links to urban metro networks—AI applications are still in early stages. However, initiatives such as predictive TBM monitoring, AI-driven geotechnical data management, and automated lining design checks are beginning to surface. These developments hold enormous promise for improving safety and efficiency in the country's ambitious underground infrastructure pipeline.

Challenges Ahead

Data Availability: AI thrives on quality data, yet tunnelling projects often lack standardized digital datasets.

Adoption Gap: Engineers and contractors need training to integrate AI tools into daily practice.

Cost of Implementation: Initial setup costs can be high, though long-term savings are significant.

The Road Forward

The convergence of tunnelling and AI is not about replacing engineers—it is about empowering them with smarter tools. By blending human expertise with machine intelligence, the industry can minimize risks, optimize performance, and build tunnels that are not only technically sound but also economically and environmentally sustainable.

As India pushes forward with megaprojects like the Bullet Train, hydropower tunnels, and expanding metros, embracing AI and ML will no longer be optional—it will be essential. The underground future is being redefined, one algorithm at a time.

"One such prominent AI and ML application was used in TBM-Data driven monitoring and prediction of squeezing ground for Tunnel 8 of Rishikesh Karanprayag Rail project- First of its kind in an Indian tunnelling project by Norwegian Geotechnical Institute (NGI) in collaboration with Rail Vikas Nigam limited (RVNL). The overall objective of the data driven application was to develop

a) A system for early detection of squeezing in the shield areas of TBMs.

b) A system for prediction for the squeezing potential ahead of the TBMs Output was in the form of Squeezing risk plots based on data received from the TBMs such as thrust force, TBM torque, void displacement data etc."

INNOVATIONS & BREAKTHROUGHS

A LOOK AT RECENT BREAKTHROUGHS, CUTTING-EDGE TECHNOLOGIES, AND GLOBAL TRENDS REDEFINING THE UNDERGROUND CONSTRUCTION LANDSCAPE.

Breakthroughs in Indian Tunnelling (2024–2025)

Z-Morh Tunnel (SonaMarg, J&K) — All-Weather Connectivity Achieved

Sonamarg Opens Year-Round — Z-Morh Tunnel Inaugurated

In a landmark achievement for Himalayan infrastructure, the 6.5 km Z-Morh Tunnel at Sonamarg was inaugurated, ushering in year-round access to the picturesque valley. Built as part of India's broader Zojila corridor programme by NHIDCL, the tunnel ensures uninterrupted connectivity, vital for tourism, trade, and defence logistics. The project underscores India's growing tunnelling expertise in high-altitude, geologically challenging terrain.

Prime Minister inaugurates the Z-Morh Tunnel, ensuring year-round access to Sonamarg. (Image: India Today/Press)

Rishikesh–Karnaprayag Rail Link — India's Longest Railway Tunnel Breakthrough

14.57 km Janasu Tunnel Breaks Through — A Record for Indian Railways

The Rishikesh–Karnaprayag rail project marked a defining milestone with the TBM breakthrough of the 14.57 km Janasu Tunnel, now India's longest railway tunnel in Himalayas. Executed under RVNL and constructed by L&T, the tunnel showcases advanced TBM application in Himalayan rail infrastructure. With its completion, the project strengthens Uttarakhand's connectivity, promising reduced travel times and resilient transport links. The complete 125Km long railway line includes rail track within tunnels for more than 100Kms lengths making it one of a kind project in India.

The Janasu Tunnel TBM breakthrough — India's longest rail tunnel at 14.57 km. (Image: RVNL/PIB)

Silkyara Tunnel (Uttarakhand) — A Story of Resilience

From Collapse to Breakthrough — Silkyara Tunnel Reborn

The Silkyara tunnel captured global attention after the 2023 collapse that trapped 41 workers for 17 harrowing days. Following their dramatic rescue, engineers redesigned support systems and reinforced safety protocols before resuming construction. In 2025, the tunnel achieved breakthrough — a triumph not only of engineering but of human spirit. The project now stands as a testament to India's resilience and commitment to safer tunnelling practices.

Silkyara breakthrough — lessons learned and safety reinforced. (Image: PTI/Indian Express)

Mumbai Metro Line-7A — TBMs Connect to the Airport

Urban Tunnelling Mastery

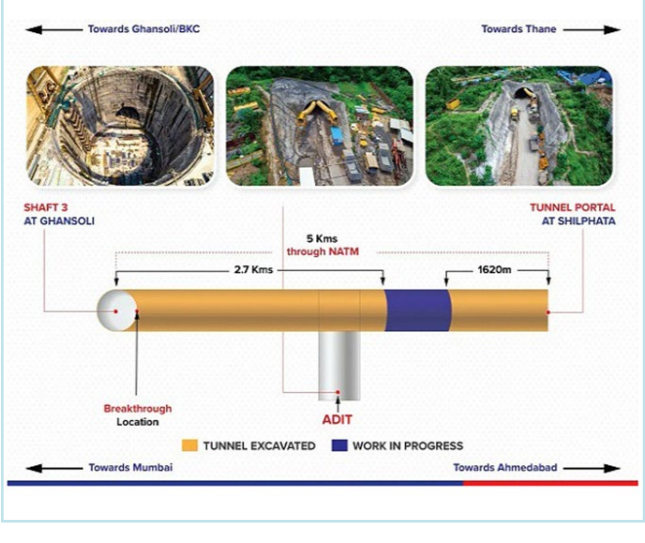
Breakthroughs to CSMI Mumbai Metro Line-7A achieved multiple TBM breakthroughs in its complex Andheri–CSMIA alignment, including the final drive by TBM Dhruv. Engineers overcame significant challenges, tunnelling beneath existing metro lines, utilities, and sensitive airport infrastructure. The breakthroughs highlight India's expanding mastery of urban TBM logistics and precision tunnelling in congested megacity environments.

TBM 'Dhruv' achieves breakthrough on Metro Line-7A near CSMIA. (Image: MMRDA/J Kumar)

Mumbai–Ahmedabad High-Speed Rail — First Underground Breakthrough

India's Bullet Train Digs Deep —Tunnel Breakthrough Achieved

India's first high-speed rail corridor reached a major tunnelling milestone in Mumbai. NHSRCL reported the first breakthrough in the 21 km underground section from BKC to Shilphata, with 2.7 km completed. The stretch includes India's longest rail tunnel and exemplifies the leap to large-diameter, long-drive tunnelling for high-speed infrastructure. This breakthrough signals rapid progress toward India's vision of bullet train connectivity.



HSR tunnel breakthrough in Mumbai — a milestone for India's first bullet train project. (Image: NHSRCL/ETInfra)

USBRL Project (Jammu & Kashmir) — Historic Rail Connectivity Realised

Engineering the Himalayas — USBRL Commissioned in the Kashmir Valley

The Udhampur–Srinagar–Baramulla Rail Link (USBRL) has transitioned from dream to reality, with key sections now operational and connecting the Kashmir Valley to India's national rail grid. Featuring over 110 km of tunnels — including T-49 (12.75 km, India's longest transport tunnel) — and the world's highest railway bridge over the Chenab, the project represents one of the most challenging rail engineering efforts ever attempted in the Himalayas. USBRL is already transforming mobility, fostering economic integration, and ensuring year-round connectivity for millions in Jammu & Kashmir.

USBRL — tunnels and Chenab Bridge in operation, redefining Himalayan rail connectivity. (Image: Northern Railway/PIB)

Underground LPG Storage Cavern — Largest in India

EIL Engineers India's First LPG Storage Cavern

In a pioneering achievement, Engineers India Limited (EIL) has successfully executed the development of India's largest underground rock cavern for LPG storage, for Hindustan Petroleum Corporation Limited (HPCL) in Mangalore, Karnataka.

The cavern is located within the premises of an existing LPG plant and has a storage capacity of 80,000 MT of LPG, making it the single largest LPG cavern in India. What makes this project even more remarkable is its first-of-its-kind design, with the cavern excavated beneath pre-existing surface facilities. This innovative approach allows for dual usage of land, significantly optimizing space utilization and setting a benchmark for future infrastructure projects.

India's Largest LPG storage cavern at Mangalore — engineered by EIL. (Image: EIL/Press)

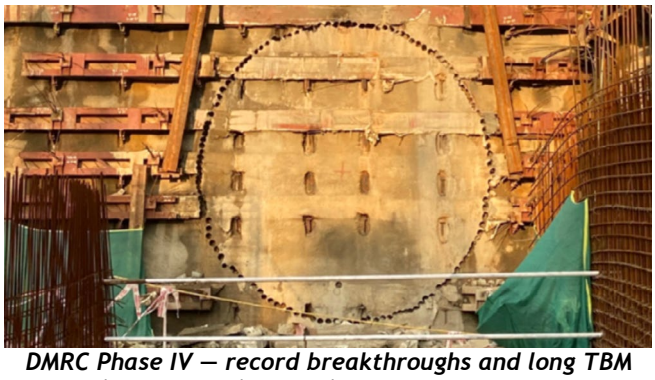
Delhi Metro Phase IV — Expanding Underground Connectivity

DMRC Phase IV — New Underground Corridors Take Shape

The Delhi Metro Rail Corporation (DMRC) has made rapid progress on its Phase IV expansion, particularly in tunnelling works. Multiple breakthroughs were achieved between 2024 and 2025 across key corridors:

- **Janakpuri West–RK Ashram (Magenta Line extension):** TBMs achieved over half a dozen breakthroughs, including one of the longest drives of nearly 2 km between Derawal Nagar and Pulbangash.
- **Aerocity–Tughlakabad (Silver Line):** TBMs crossed complex geology in south Delhi, with drives exceeding 1.8 km, ensuring smooth alignment through congested urban pockets.
- **Maujpur–Majlis Park (Pink Line extension):** Several breakthroughs were recorded, connecting dense east Delhi neighbourhoods underground for the first time.

These achievements demonstrate DMRC's mastery in orchestrating simultaneous TBM operations in one of the world's busiest megacities. With more than a dozen breakthroughs already achieved and some of the longest TBM drives in Delhi's history completed, Phase IV reinforces DMRC's role as a global leader in urban metro tunnelling.



DMRC Phase IV — record breakthroughs and long TBM drives expanding Delhi's underground reach. (Image: DMRC/Press)

CELEBRATING PEOPLE

"Achievements That Inspire: TAIym Members Past & Present"

The contributions and milestones of our young members who continue to set benchmarks in tunnelling and geotechnical engineering.

MY EXPERIENCE AT WTC 2025

Lalita Jagdish Mahale, Tunnel Design Engineer at Lombardi Engineering India

The World Tunnel Congress (WTC) is known as the global stage of the tunnelling industry, where the brightest minds come together to share ideas, exchange knowledge, and showcase innovations that shape the future of underground space. For years, I had dreamed of being part of it. The dream began during my Master's in Tunnel Engineering at MIT Pune, when I first learned about WTC and its importance in the industry. This year, that long-awaited aspiration came true as I had the privilege of attending WTC 2025 in Stockholm, Sweden.

My journey to this point has been closely tied to my association with the Tunnelling Association of India Young Members (TAIym). Since joining as a student member in 2019, TAIym has been a platform of growth and opportunity for me. From being an active participant to becoming a committee member in 2021 and now serving as Social Media Secretary, I have experienced the value of community, mentorship, and exposure. And this year I had honor of representing TAIym at WTC 2025.

The atmosphere at WTC was unlike anything I had experienced before. Thousands of professionals, engineers, researchers, contractors, designers, academics, and young members came together under one roof, creating an energy that was inspiring. The technical sessions were rich with content, from the latest developments in mechanized tunnelling and conventional excavation methods to risk management, digital modelling, and

sustainable practices. Each presentation opened new perspectives and demonstrated how far our industry has come, while also sparking ideas about what can be achieved in India.

Equally enriching were the ITA Working Group meetings. Sitting in on these discussions offered a rare glimpse into how international experts collaborate to set standards, share best practices, and address common challenges. These conversations reinforced for me that tunnelling is not just about solving engineering problems, but about creating global knowledge that benefits society at large.

One of the highlights of my experience was interacting with and interviewing leading tunnelling professionals from around the world. Their insights into technological advancements, project challenges, and advice for young engineers were not only informative but also motivating. I am proud that these conversations have been captured and shared on TAIym's YouTube channel, making them accessible to many more young members.

Beyond the technical knowledge, WTC 2025 was a powerful reminder of the human side of our industry. I was struck by the strong presence of women in leadership roles, directing projects, guiding design teams, and representing clients. Watching them lead with confidence and expertise was deeply inspiring. As a young woman in this profession, it gave me not only pride but also a renewed determination to pursue my path with greater dedication.

The congress left me with a sense of wonder at the pace of change in our field. The use of AI and digital twins in tunnelling, the advancements in underground technology, and the focus on sustainability and resilience showed me how innovation is transforming underground construction globally

WTC 2025 was more than a conference; it was a transformative journey. It broadened my horizons, strengthened my professional network, and inspired me to contribute with even more passion to the growth of tunnelling in our country. I carry back with me not just technical knowledge, but also memories, confidence, and motivation that will guide my path forward.

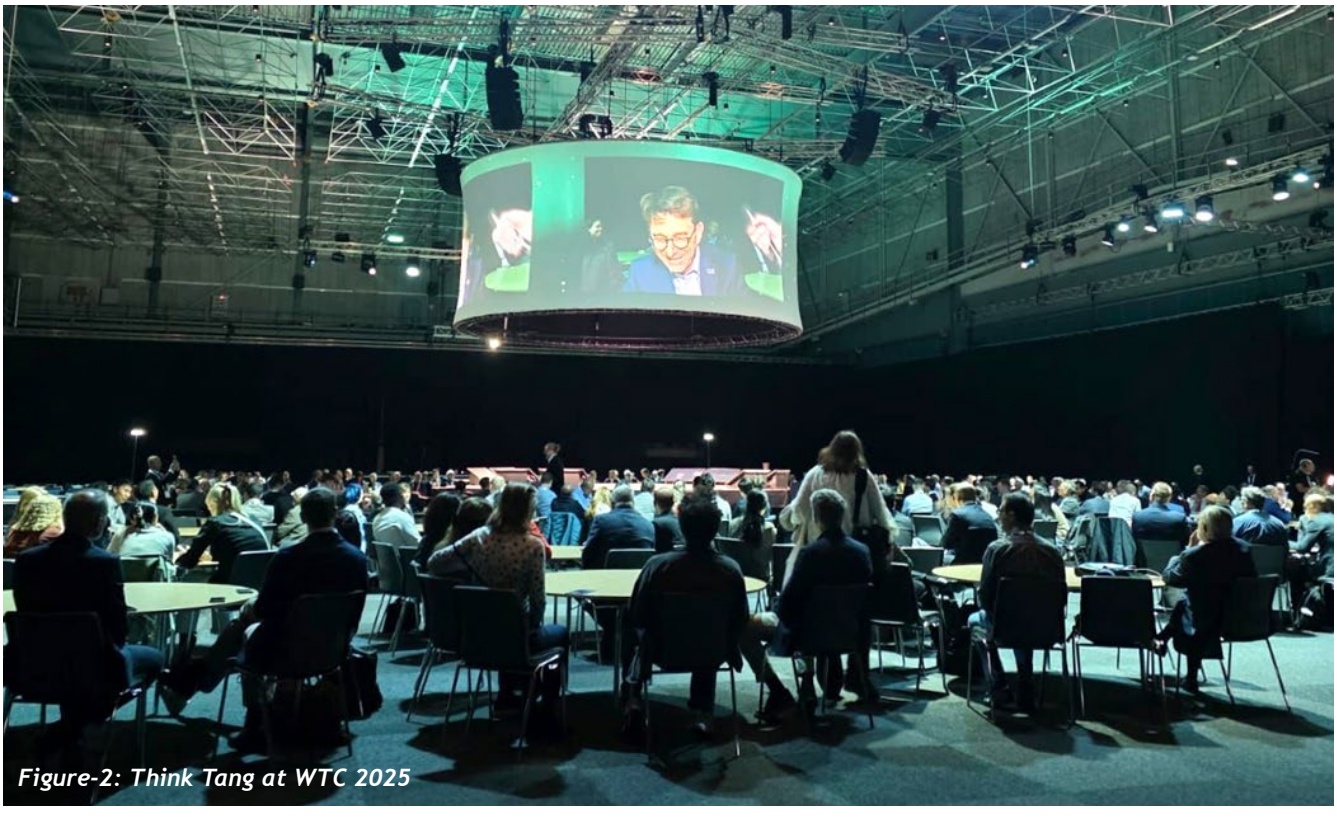


Figure-2: Think Tang at WTC 2025

Shaping the Future of India's Underground: Rishabh Gupta's Journey as a member of India's Young Tunneller group.

In the ever-evolving field of tunnelling, where precision meets perseverance, Rishabh Gupta has emerged as one of themostpromisingyoungprofessionals making a tangible mark in India's infrastructure development having nearly a decade experience. Currently working as Sr. Manager (Tunnel Design & Planning) at RITES Limited, he has been entrusted with some of the most challenging and high impact tunnelling projects across the nation. Rishabh's role has not been limited to planning and design; he has also been at the forefront during moments of crisis. Notably, he was deputed by the RITES management as part of the expert rescue team during the Silkyara tunnel collapse (2023)—a mission that tested the resilience and expertise of India's tunneling professionals. He is also part of working group which is dedicated to contributing for nation's safety framework by working on the "Tunnel Safety Guideline for India", formulated under the National Disaster Management Authority (NDMA), Ministry of Home Affairs & IIT Delhi—a pioneering step toward strengthening safety protocols in underground works. In recognition of his exceptional work, he was recently conferred with an RITES Annual award for the Best Technical work for 2024-25 by RITES management and further Tunnelling Association of India (TAI) for "Significant Contribution to Tunneling, Kolkatta Chapter 2024" as a young member—an honor that reflects both his technical excellence and leadership potential. As India undertakes ambitious infrastructure projects, tunneling is increasingly becoming the lifeline of modern connectivity. Professionals like Rishabh Gupta represent a new generation of engineers who combine technical mastery, crisis-handling experience, and a vision for safety and sustainability—ensuring that India's underground future is in capable hands.

राहुल मित्थल
अध्यक्ष एवं प्रबन्ध निदेशक
RAHUL MITHAL CEng FIMechE (UK)
CHAIRMAN & MANAGING DIRECTOR

RITES

राइट्स लिमिटेड
(भारत सरकार का प्रतिष्ठान)
RITES LIMITED
(Schedule 'A' Navratna Enterprise of Govt. of India)
TEL. (Off.) : (0124) 2571600, 2571602
FAX : (0124) 2385777
E-MAIL : cmd@rites.com

30 November, 2023

Dear Shri Rishabh Gupta,

I commend your commitment and selfless service in assisting the operation of evacuation of the workers trapped in the Silkyara Tunnel in Uttarkashi.

Your immediate response in rising to the occasion and fortitude in the face of the challenge are testament to the courage of your conviction and commitment to serving the country and reflect your resilience and strength of your character.

Your exemplary action has inspired all of us and 'Team RITES' is proud to have you as our member.

Keep the flag flying!

Warm Regards,

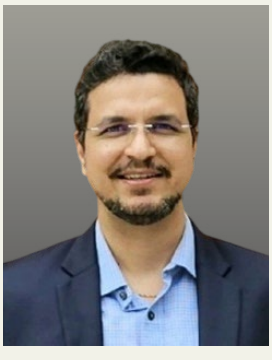
(RAHUL MITHAL)

SHRI RISHABH GUPTA
MANAGER
CED
RITES
GURUGRAM.

Transforming to GREEN

कॉर्पोरेट कार्यालय: शिखर, प्लॉट नं. 1, सेक्टर-29, गुरुग्राम-122 001 (भारत). **Corporate Office:** Shikhar, Plot No. 1, Sector-29, Gurugram -122 001 (India)
दूरभाष: (Tel.): (0124) 2571666 फैक्स: (Fax): (0124) 2571660, ई-मेल (E-mail) info@rites.com वेबसाइट (Website): www.rites.com
पंजीकृत कार्यालय: स्कोप मीनार, लक्ष्मी नगर, दिल्ली-110092 (भारत). **Registered Office:** SCOPE Minar, Laxmi Nagar, Delhi-110092 (India)

YOUNG MEMBERS MAKING A MARK IN THE INDUSTRY: AWARDS & RECOGNITIONS



AKX Malik,
Senior Engineer, L&T

Selected as a Finalist for the prestigious International Young Tunneller of the Year at the ITA-AITES Tunnelling Awards 2025, to be held in Belgrade, Serbia.

Vishal Bansal,
Tunnel Engineer (Design), NHAI

Delivery Excellence Award –
TUMAS India (2024)

Presented in recognition of exceptional leadership in managing design teams and delivering multiple complex tunnelling and underground infrastructure projects on time, within budget, and to the highest standards of quality and safety.

Esha Diwakar,
Tunnel/Geotech Engineer, Geoconsult India

Esha was recently honoured with the Tunnel FEM 2025 Young Women Achiever in Tunnelling India Award, a recognition of her dedication and growing contributions to the tunnelling and underground construction industry.

Manisha Yadav,
PhD Research Scholar, Department of Civil Engineering, IIT Roorkee
(Supervisor Dr. Akanksha Tyagi)

Ms. Manisha Yadav received the Best Paper Award at the 8th ICRAGEE, IIT Guwahati, for her research on the Deformation Response of Shallow Rectangular Tunnels in Saturated Sand under Seismic Loading. She was also honored with the Student Excellence Award for Women in Tunnelling at TunnelFem 2025, recognizing her academic excellence and impactful doctoral research in tunnelling and underground construction.

GLOBAL TEAMWORK

TAIYM × ITACUS: Building Underground for Tomorrow's Cities

Exploring with ITACUS and the shared vision of sustainable, resilient, and human-centric underground spaces.

The International Tunnelling and Underground Space Association's Committee on Underground Space (ITACUS) is one of the five permanent committees of ITA-AITES. Its mission is clear: to advance the responsible, innovative and human-centred use of underground space across the globe.

While tunnelling is often associated with metros, utilities and civil infrastructure, ITACUS challenges us to think beyond. The underground is not just a void to be excavated, but a resource for creating sustainable, resilient and liveable cities.

"If it isn't in policy, it isn't funded. ITACUS works to change that."

Through its global advocacy, ITACUS highlights that the underground is not only a technical domain but also a social and cultural one, demanding interdisciplinary dialogue and inclusive planning.

A vision for cities and regions

At ITACUS, the vision is simple: "The Next Level Up is Down." As cities grapple with climate change, rapid urbanisation and space scarcity, the underground is emerging as a critical layer of urbanism. By unlocking its potential, we can build climate-resilient infrastructure, reduce heat islands, store energy, manage water, and create new spaces for people to live and thrive.

Global engagement & partnerships

ITACUS has positioned itself as ITA-AITES's interdisciplinary knowledge bridge, expanding its role from tunnelling to integrated urban solutions. It engages with the United Nations (UN-Habitat, UNDRR, UNEP), the Government of India, Indian Institute of Technology (IITs), ISOCARP and many others to ensure underground space features in global policy frameworks.

Recent contributions include inputs to UN Environment Programme's Sustainable Infrastructure Partnership and Green Growth Knowledge Platform, leadership at the World Urban Forum and UN Conference of Parties on Climate Change (UNFCCC COPs), dialogues with the Intergovernmental Panel on Climate Change, to name a few.

Together with other ITA-AITES committees, particularly ITACET, ITACUS delivers lectures and workshops worldwide, showcasing how underground solutions support climate adaptation, disaster resilience, energy storage and green mobility.

ITACUS Activity Groups

ITACUS channels its work through five dedicated Activity Groups, each led by experts and supported by members across disciplines and regions:

- **AG1 – Young Professionals Think Deep Programme (YPTDP)**

  Lead: Petr Salak

  This flagship youth initiative brings together engineers, planners, architects and scientists to design underground strategies for real-world cities. YPTDP workshops have been held in Hong Kong, Gdansk, Wroclaw and beyond, offering young voices a platform to innovate and shape urban futures.

- **AG2 – Urban Sustainability**
  Lead: Dr Chrysothemis Paraskevopoulou

  Focused on embedding underground space into broader sustainability agendas, this

group explores links with energy systems, resource efficiency, mobility transitions and environmental impact reduction.

- **AG3 – Urban Adaptation**
  Lead: Mahak Agrawal

  This group investigates how underground solutions can enhance resilience to climate change, flooding, extreme heat and disasters. It connects technical knowledge with governance and policy to help cities adapt to mounting risks.
- **AG4 – Think Deep National Action Programmes (TDNAPs)**
  Lead: Abidemi Agwor

  Active in countries such as the UK and Nigeria, TDNAPs are local platforms that integrate underground planning into national and city policies, translating ITACUS's global vision into practice.
- **AG5 – Urban Integration**
  Lead: Marilu Melo Zurita

  This group works at the interface of design, culture and society, examining how underground projects can be better integrated into the daily lives of citizens, enhancing quality of life while respecting heritage and identity.

Together, these activity groups demonstrate that underground urbanism is multi-faceted, spanning policy, sustainability, resilience, culture and youth empowerment.

Shaping global dialogue

In recent years, ITACUS has taken underground space to the forefront of international debate:

- World Urban Forum (Cairo 2024) – advancing underground solutions in policy.
- COP28 Dubai & COP29 Baku – spotlighting underground space as a climate resilience strategy.
- NYC Climate Week & UN Summit of the Future 2024 – linking underground urbanism to sustainability goals.
- Hong Kong YPTDP 2024 – empowering young professionals to rethink resilient cities.

Thought leadership & knowledge sharing

ITACUS has contributed widely to research and practice. Underground Spaces Unveiled (Cornaro & Admiraal) won ISOCARP's Best Book Award 2018 and is now taught at ETH Zurich. Recent publications such as Underground Spaces for Climate Resilience and Sustainability (Springer, 2025), edited by Mahak Agrawal reinforce its thought leadership.

Beyond publications, ITACUS has produced and contributed to various podcasts, films (Growth Below – awarded at the UN-Habitat Better Cities Film Festival) and global campaigns that make underground urbanism accessible to wider audiences.

Join The Conversation

As climate change, rapid urbanisation and resource pressures intensify, underground space has never been more critical. ITACUS invites collaboration from India and beyond — from experts and students alike — to help reimagine and realise the potential beneath our feet.

For those interested in connecting, reach out to Antonia Cornaro, Chair of ITACUS, or Mahak Agrawal, Steering Board Member and Activity Group Lead: Urban Adaptation, on LinkedIn.

Find more information on ITACUS:

- Webpage: **https://about.ita-aites.org/wg-committees/itacus**
- LinkedIn: **https://www.linkedin.com/company/itacus-the-ita-committee-of-underground-space/**
- Instagram: **https://www.instagram.com/itacus_ita.aites/?hl=en**

For ITACUS, the underground is not invisible. It is central to building resilient, liveable and sustainable cities.

TECHNICAL WEBINAR

TECH TALKS THAT BUILD TOMORROW

#50 Geological Complexities in Tunnelling management Approaches and Safety Practices

Dr. Rakesh Kumar Khali
Vice President – operations, GR Infraprojects.
Vice President – Tunnelling Association of India

#49 Ground Characterization and TBM Performance Evaluation in challenging ground conditions

Dr. Anshul Sindhwani
Lead Engineering Geologist
L & T Construction India

#48 Urban Tunnelling Interactions and Challenges

Mr. Jitendra Manwani
Senior Geotechnical Engineer, CEng (I), MIE, Geoconsult India

#47 Time Dependent Deformation in Tunnels

Dr. Chrysothemis Paraskevopoulou
Associate Professor
University of Leeds, UK

#46 Digital Advances in Geotechnical Data for Infrastructure Projects

Dr. Farzin Hamidi
Senior Geotechnical Engineer, Seequent

Mr. Richard Lowries
Senior Customer Solutions Specialist
Seequent

#45 Urban Adaptability: Harnessing the Potential of Underground Spaces

Ms. Antonia Cornaro
Expert & Business Development Underground Spaceat Amberg Engineering, Lecturer ETH Zürich & Chair ITACUS

Ms. Mahak Agrawal
Research Associate, at Columbia's Center on Global Energy Policy

#44 Sydney Metro City & Southwest – exposing more geological unknowns

Dr. David Och
Technical Director – Geology (NSW Tunnels Lead), WSP & Adj. Assoc. Professor (UNSW)

#43 Soft Ground Tunnelling

Dr. Benoit Jones
Managing Director
Inbye Engineering

#42 Collar Beam at Interface of Tunnels – Geotechnical and Structural Considerations

Dr. Arnab Sur
General Manager (Structures & Geotech),
Ayesa India Pvt. Ltd.

#41 Geophysical tools for safe tunnels

Dr. Sanjay Rana
Founder and Managing Director
PARSAN Overseas Pvt. Ltd.

#40 Sustainable Design Strategies for Tunnels

Mr. Sanjoy Sanyal
Founder and Managing Director
Bouw Consultants

#39 Ground Anchors, Design and Construction

Dr. Sebastian Lobo-Guerrero
Geotechnical Project Manager/Laboratory Manager, American Geotechnical & Environmental Services, Inc. Pittsburgh PA

#38 Moving to low carbon lining with Steel Fiber reinforced Concrete

Mr. Benoit de Rivaz
Global technical Manager
Bekaert Underground Solutions

#37 Porto Metro Rubi Line – The Design of the Conventional Tunnels in Residual Soils

Mr. Cláudio Cabral Dias
Head of Ground Engineering & Tunnelling, AYESA

#36 Advances in Underground Space Utilization for Energy Security and Sustainability

Dr. Altaf Usmani
DGM, Technical, UG Storages Expert: Hydrocarbons, Hydrogen, CAES, CO_2
Engineers India Limited

#34 Unlocking the Archimedes Principle: the strength of Immersed Tunnels

Mr. Marcel 't Hart
Senior Structural Engineer
RHDHV & TEC and Animateur ITA Working Group 11

#32 Risk Assessments, Professional Duties, and Other Disasters – a Guide for Young Professionals

Prof. Arnold Dix
President, International Tunnelling and Underground Space Association

#30 Engineering geological evaluation for the geotechnical design of tunnels, with special emphasis to tunnel behaviour appraisal: Experiences from 62 tunnels in Northern Greece

Prof. Dr. Vassilis P. Marinos
Assistant Professor, NTUA, Greece

#28 TBM Tunnelling- brief overview and associated design task in urban areas

Dr. Florian Krenn
Managing director, Geoconsult India

#26 TBM Partial Excavation Operation, Design and Burial Challenges

Mr. Keivan Rafie
Deputy Regional Director – Tunnels Hatch, Canada

#24 Challenges in Drill and Blast Tunnelling in Hong Kong

Dr. Dimos Koungelis
Associate at COWI UK

#22 High Speed 2 - The UK Mega Infrastructure Project A Brief Introduction

Dr. Kurt Zeidler
Principal and Co-founder, Gall Zeidler Consultants

#20 Design of NATM tunnel support system in soft ground condition - a case study

Mr. Sharique Khan
Lead Specialist- Tunnels, COWI India Pvt. Ltd.

#35 Design and construction of mined stations for metro/LRT

Mr. Petr Salak
Managing Director & Senior Tunnel Engineer, Dr. Sauer & Partners Israel

#33 Value proposition and sustainability of TBM tunneling

Mr. Guiseppe M. Gaspari,
PEng, MBA, MSc, MSE
AECOM

#31 Multi-layer lining design: a new framework for tunnel lining design

Dr. Jiang Su
Technical Director Tunnels and Underground Space, Ramboll UK

#29 ZaB - Zentrum am Berg - a unique underground R&D - as well as education and training center

Prof. Robert Galler
Prof. for Geotechnics and Underground Construction, University of Leoben

#27 Use of High-Performance Fibres in PSCL for Road Tunnels in Australia

Dr. David Oliveira
Technical Director Tunnels, Jacobs APAC

#25(I)-TM: An All-In-One Design & Construction Solution For Tunnelling In/Under Any Ground Condition

Dr. Bineshian Hoss
Principal Technical Director Amberg Engineering AG

#23 An unique Experience- Tunneling in Himalayas above 5000m altitude

Mr. Sandeep Singh Nirmal,
Mr. Ahmed Shaz & Lt. Col. Sunny
Rites Ltd. & Border Roads Organisation

#21 Shotcreting and Grouting Methods

Mr. Mukesh Chandra Kothiyal
Quality Head at Zojila Project

#19 Pune Metro- Atypical underground stations

Mr. J Kalyan Kumar
Technical Director,
AECOM India Pvt. Ltd.

#18 Automation in Tunnelling Drill Jumbo

Mr. Tejash Modi
Deputy General Manager – Sales
(Tunneling and Surface Drills)
Sandvik Mining and Rock Technology

#17 Turntables

Mr. Ben Chapman
Managing director, Australian Turntables Co

#16 Managing Safety in Tunnelling

Mr. Michael William Sanderson
EHS IC Head, L&T Construction in collaboration with BTSym

#15 Design of a NATM Crossover at Mumbai Metro Line 3

Ms. Prathap Muniyappa & Akshay Panwar
Geoconsult India Pvt. Ltd.

#14 Use of Umbrella Arches in Tunnelling and their monitoring with Fiber Optics

Dr. Nicholas Vlachopoulos
Prof. of Civil Engineering at the Royal Military College of Canada, Director Queen's-RMC Geo-Engineering Center

#13 Railway Tunnels- Design & operation- Ventilation, Firefighting system & E&M

Mr. Georgios Tziallas
Head of Department, Underground Works

#12 AI Application in Risk Assessment of Soft Ground Tunnel Projects

Dr. Rajat Gangrade
Ph.D., Underground Construction and Tunneling, Colorado School of Mine

#11 Railway Tunnels Design an Operation – Basics and general

Ms. Georgios Tziallas
Head of Department, Underground works, Lombardi Engineering India Pvt. Ltd.

#10 Seismic Performance and Design of Tunnels

Dr. Kyriazis Pitilakis
Prof. Aristotle University of Thessaloniki Greece

#9 Introduction to Emerald Book FIDIC Conditions of Contract for Underground Works

Mr. Mathias Neuenschwander
MSc, Dispute Avoidance and Resolution Expert, with BTSym

#8 Collapsible Soils Settlement Control by Grouting - Brasilia's Subway System

Mr. Max Gabriel Barbosa
Technical Director, Solotrat Centro Oeste EngenhariaGeotecnica Ltd, CBTym

#7 Design Approaches to Avoid Problems During TBM Tunnel Execution

Mr. Cosimo I.
Ayesa Ingenieria y Arquitectura, Spain

#6 Tunnelling experiences in Singapore - Case studies and challenges

Mr. Diwakar Velu
Deputy Project Manager
Land Transport Authority LTA, Singapore

#5 How to design rubber products to make an immersed tunnel watertight

Mr. Nicas van den Brink
Sales Director, TelleborgRidderkerk BV

#4 Design and construction of underpass tunnels in shallow overburden

Mr. Senthilnath G T
Geotechnical & Underground Professional, GHD, Australia

#3 Thames Tideway Tunnel

Mr. Russell Brown
Team Leader, L&T

#2 Strategy for investigations of long tunnels

Dr. Gopal Dhawan
Founder & Chairman, DDAG Pvt. Ltd.

#1 Construction Stage Analysis of Tunnel with Cross Passage

Mr. T Harsha
Geotechnical Technical Manager
MIDAS

Meet the TAIym Adhoc Committee

Mr. Ayush Raj – Chair

Senior Dy. Chief Engineer (Civil) at NCRTC

Ayush Raj leads with both vision and responsibility. With his engineering expertise and ability to drive large-scale projects, he plays a pivotal role in shaping the future of tunnelling and underground works, guiding the committee with confidence and foresight.

Mr. Rushi Randeria –Vice Chair

Senior Tunnel Engineer, Gall Zeidler Consultants

Mr. Randeria is skilled in rock and geotechnical engineering, the design of underground structures, slope stabilization in rock and soil, and ground movement assessment. Mr. Randeria has experience in conducting detailed design and design checks for various components of underground structures.

Mr. Randeria currently serves as the India Young Member Representative at the International Tunnelling Association (ITA)

Mr. Rishabh Gupta

Secretary Technical

Sr. Manager (Tunnel Design & Planning), RITES Ltd.

A Senior Manager at RITES Limited and an alumnus of IIT Roorkee, Rishabh has nearly a decade of expertise in tunnel planning and design. With specialization in slope stability, NATM and TBM tunnelling, and rehabilitation strategies, his leadership ensures technical precision and seamless project delivery across diverse underground works.

Mr. Vishal Bansal – Secretary Technical

Tunnel Engineer (Design), NHAI

With academic foundations at IIT Kanpur and an Erasmus Mundus Scholarship from NTUA, Greece, Vishal has built a strong reputation in geostructure engineering. Currently at NHAI, his innovative designs for MRTS, railway, and highway tunnels showcase both his technical mastery and his dedication to advancing India's transport infrastructure.

Miss. Lalita Mahale

Secretary Social Media, Design Engineer,
Lombardi Engineering India Pvt. Ltd.

Lalita is a Tunnel Design Engineer with experience in urban metro projects and tunneling works in Himalayan geology.

She has worked on the design of tunnels, cross passages, shafts, and underground stations, focusing on stability and support systems. Her expertise includes geotechnical analysis, construction methodology, and ground-structure interaction.

She has contributed to feasibility studies as well as detailed design projects. Lalita holds a Master's degree in Tunnel Engineering from MIT Pune.

Miss. Esha Diwakar

Vice-Secretary Social Media
Tunnel/Geotech Engineer, Geoconsult India

Ms. Esha Diwakar is a Geotech & Tunnel Engineer with a strong academic background from the Indian Institute of Technology (IIT) Delhi. She has been actively involved in geotechnical and underground tunnel projects, particularly metro developments across India. Her role involves working closely with multidisciplinary teams to support safe and efficient underground construction.

Mr. Aditya Mahale,

Secretary Outsourcing
Design Engineer-Tunnel/Geotech,
Lombardi Engineering India Pvt. Ltd.

Mr. Aditya is a tunnel design engineer and brings specialised expertise in the planning, design, and execution of complex tunnel infrastructure projects. With hands-on experience across a broad spectrum of tunnelling methods—including Tunnel Boring Machines (TBM), conventional drilling and blasting, and cut-and-cover techniques—he also possesses a strong foundation in slope stabilisation and geotechnical engineering.

Mr. Vikas Singh,

Vice – Secretary, Outsourcing Strategic Business Development,
Jindal Stainless Steelway Ltd.

Mr. Vikas Singh is in the Strategic Business Development team of Jindal Stainless Steelway, with a strong focus on tunnel and underground space projects, ensuring the provision of safe, cost-effective, and sustainable solutions for this sector.

Miss. Vaishnavi Sanap

Secretary, Resource Management
Design Engineer-Geotech, SMEC India Pvt. Ltd.

Miss Vaishnavi is a Geotechnical and Tunnel Design Engineer in the Dams and Hydropower Division at SMEC. Her work involves the detailed design and analysis of tunnels, underground caverns, pit powerhouses, and large rock slopes for Dams, hydropower and pumped storage projects. She holds a master's degree in Tunnel Engineering from MIT World Peace University and is deeply committed to delivering innovative and reliable geotechnical solutions for complex hydropower projects.

Mr. Kallol Saha

Vice -Secretary, Resource Management
PhD Scholar, IIT Ropar.

Mr. Kallol Saha is a research scholar at IIT Ropar in Geotechnical specialization. His broad area of research is “Shear wave propagation across joints."

Mr. Shuvam Bamotra,

Secretary Co-ordination, Senior Manager,
Tunnel Construction
RITES Ltd.

Mr. Shuvam Bamotra is a Tunnel Construction Engineer at RITES Limited, with a decade of specialized experience in the Tunnel industry. His expertise includes the construction and analysis of tunnels, as well as the evaluation of side slopes adjacent to road and railway tunnels.

Mr. Saurabh Yele

Vice-Secretary Co-ordination,
Tunnel Engineer, Jacobs India.

Mr. Saurabh B. Yele holds a postgraduate degree in Tunnel Engineering from MIT-WPU, endorsed by ITA, and was awarded with the academic gold medal. He has experience in metro, road, and rail projects, along with foundational experience in hydroelectric projects,including HEP and Pumped Storage. He is skilled in analysis and design of underground structures with primary rock supports and permanent structural linings, segmental lining with reinforcement detailing, cut and cover tunnels, rock slope stabilizations and ground movement assessments.

Disclaimer:

Every effort has been made to ensure that due credits have been given to all contributors, authors, and sources featured in this magazine. In case any acknowledgement has been missed inadvertently, we extend our sincere recognition and gratitude. The information presented herein is compiled from trusted references, verified data, and reliable open sources, with the intent to share knowledge and promote learning within the tunnelling community. The views expressed in the articles are those of the respective authors and contributors, and do not necessarily reflect the official stance of TAI or TAIym.

TAIym 35

TUNNELLING ASSOCIATION OF INDIA

YOUNG MEMBERS

1.25k+ followers

7k+ followers

262+ followers

100+ followers