

Workshop on  
**“Best Practices for Safe Cross Passage – Investigation, Design and Construction**  
8-9<sup>th</sup> September 2016 at New Delhi.



Tunnelling Association of India and Central Board of Irrigation and Power is organizing the Workshop on **“Best Practices for Safe Cross Passage – Investigation, Design and Construction”** on 8-9<sup>th</sup> September 2016 in the Conference Hall of CBIP at New Delhi.

In recent years, lots of soft ground tunnels, including metro tunnels and road tunnels, have been constructed in many cities. Nearly all tunnels have cross passages between two tubes. Cross passage construction between twin tunnels is one of the most critical aspects of an underground metro tunnelling project. Tunnelling professionals often face a world of unpredictability. They do not need more unpleasant surprises that can arise during cross-passage construction. This includes soil, rock, water and gas conditions that are not as expected or accurately investigated. Designer and contractors often prescribe significant temporary steel support systems within the mainline tunnels during cross passage construction to help support the estimated loads and minimize deformation during break-in and break-out. Such an approach is expensive and time-intensive. A significant improvement could be realized by incorporating the required support into the liner system. Further, Cross passage construction often requires expensive and time consuming dewatering and ground improvement to stabilize the soil. These processes require significant effort and are often a significant source of risk and cause of delay. Conventional dewatering via surface wells has been replaced in some instances by vacuum dewatering from the tunnel level and by ground freezing. Ground improvement is accomplished through jet grouting and fore poling. One common way to add predictability into cross passage construction is by modifying the ground conditions, to give tunnellers a better idea of what to expect. Often, this is achieved by drilling down from the surface and treating the ground at the location of the cross-passage or, in some other way that makes the ground easier to work. This can pose several kinds of problems:

- There is a need to reach the site from surface, which can cause conflicts with landowners regarding access, and concerns about possible impacts to their property.
- There is a large impact on public utilities as well as blocked off access to stores, roads, sidewalks and driveways.
- Cost involved in drilling and injection.
- Modifying the ground condition treatment may take days or even months to complete thereby adding uncertainty to the schedule.
- Even when the modifying treatment is established, there is no certainty regarding the conditions that the cross passage builders will encounter.

There are many kind of methods to build in cross passages in soft ground such as, cut-and-cover, mining methods, and combined method, in which the most successful and popular one, mining method with ground improved by artificial ground freezing and its risk prevention and safety protection measures, are introduced.

The objective of this workshop is to update the knowledge of tunnelling professionals, i.e., Engineers, Geologists and tunnel technician to understand on various issues & challenges being faced during investigations, design, construction and how they can be newcomer. The Workshop was designed for professionals working in public or private sector organizations dealing with the design and construction of tunnel and underground works.



The workshop was inaugurated by **Dr. Mangu Singh**, President Tunnelling Association of India and Managing Director, Delhi Metro Rail Corporation Limited and addressed the participants.



**Prof. Tarcisio B. Celestino**, President, International Tunnelling & Underground Space Association (ITA) graced the inaugural session as **Guest of Honour** and addressed the participants. The other dignitaries who graced the inaugural session are Lt. Gen. **Suresh Sharma**, AVSM, Director General, Border Roads Organization, Mr. **V.K. Kanjlia**, Secretary General, Tunnelling Association of India and secretary, Central Board of Irrigation and Power and **Mr. A.C. Gupta**, Treasurer, TAI and Director – Water Resources, CBIP.



During the workshop, the éminent national and international ressource speakers made the following presentations and shared their experiences of best practices in cross passages construction on different projects with the participants of the workshop.

- The side cost of non-underground solutions for infrastructure - *Prof. Tarcisio B. Celestino, President, ITA*
- Problem in execution of cross passage in Delhi Metro Phase-III – *Stefen Lowry and Ashish Bansal, DMRC*
- Challenges in execution of cross passage in Chennai Metro

Phase-I – *V.K. Singh, Chief General Manager – Underground, CMRL*

- CTM Cross Passages – Connections with Segmental Linings - Advancement in Cross Passage Construction - *Dr. Harald Wagner*
- The importance of correct pre-treatment of the ground for cross passages in soft ground – *Ron Mickell, AECOM*
- Best ground support practices in Cross Passages - Touching the geotechnical challenges and the general ground support in cross passages and showing one case study for example.- *V. Günther, Dwidag*
- Geophysical Investigations for cross passages tunnel Projects – *Dr. Sanjay Rana, Parsan Overseas Pvt. Limited*
- Difficulties in Cross Passage Construction in TBM Tunnel and its Solution from Normet – A Case Study on CMRL, BMRCL, DMRC - *Mr. Milon Mukhopadhyay, Managing Director, Normet India Pvt. Limited*
- Design considerations for Cross Passages in Conventional Tunnelling - Temporary and Final Supports - *Dr. Florian Krenn, Managing Director, Geoconsult*
- Advanced Pre Support for Cross Passages” - Focus on advanced pre-support only - including spiling but main focus will be tube connections and automatization. – *V. Günther*
- Automatization of Steel Ribs Placing – *Giorgio Klaus Pini, CP Technology, Italy*

- Mechanised Excavation System for Cross Passages : the Smart Cross Passage - *Costanzo Graffi, SWS*
- Challenges of cross passage construction in varied geology – *R.G. Saini, Project Director, Larsen & Toubro Limited*
- Theory and application of Steel fibre reinforced shotcrete in underground construction – *Chandan Vaidya, General Manager – Bekaert Industries Limited*
- Water proofing of cross passage during construction – Materials for support, water proofing including construction chemicals – *Abhishek Jain, Sika India Limited*
- Risk assessment and management for tunnel and underground works –*R.K. Vishnoi, Executive Director – Designs, THDC India Ltd.*
- Safety issues during cross passage construction – *Devendra Gill, AGM, DMRC*



100 delegates from various Govt. as well as private agencies including consultants, contractors, academicians participated and exchange of views and ideas with professionals at international level.



Group photograph during the inaugural session

