

Japan



Name: Japan Tunnelling Association

Type of Structure: Non-profit, Organization

Number of Members: Total number 1,236 (203 corporate members)

ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

WGs: JTA consists of the following four committees and each committee has WGs and task forces. Technology/International Communication /Events/Public Relations. In each committee, the main activities are:

- Investigation, research and information interchanges on general techniques and on subjects of specific projects.
- Meetings such as lectures, symposiums, workshops, training and site visits
- “Two-days seminars”, “Site Visits” and “Lectures on topics of the year” (organized by Events committee)
- Publication of reports and documents - monthly journal “Tunnels and Underground”
- International cooperation

CURRENT TUNNELLING ACTIVITIES

Tachiaigawa Rainwater Discharge Tunnel project

Tachiaigawa River is a small - medium-sized river of 8m width and 750m long. It has issues with flooding and water quality deterioration caused by rainwater. The Tachiaigawa Rainwater Discharge Tunnel project was put forward by Tokyo Metropolitan Government Bureau of Sewerage to handle these issues. The project consists of two segmentally lining tunnels, each with an i.d of 5m and a length of approximately 780m. A remarkable feature of this project is that the twin-bored tunnels were excavated simultaneously using a special slurry shield TBM, called an H&V (Horizontal variation & Vertical variation) shield tunnelling machine, which consisted of two circular machines jointed to each other. Due to constraints from existing underground structures and land boundaries, the project adopted the first spiral excavation in the world, which rotated one of the twin tunnels by 90 degrees around the other during 137m of drilling. This challenging operation required pin-point control to maintain the constant speed of the above rotation. Therefore, pre-analysis was executed with a simulator for an H&V

machine to optimize the attitude controls. As a result, the spiral excavation has been successfully completed within the control value of the tunnel alignment.

Utilization of a Precast Concrete Lining (PCL) method in a Mountain Tunnel Project to Shorten Construction Time and Improve Productivity

In order to shorten the construction period, conventional methods such as cast in-situ concrete lining would have required several sets of formwork to operate simultaneously. However, in a relatively small tunnel dimension (less than 5m width), it is impossible for several sets of formwork to operate simultaneously since the flow of vehicles, concrete mixers and other machinery is restricted. The PCL method is considered to address this matter. PCL consists of arc-shaped precast concrete (PCa) plates divided into two installed on side walls that have been cast in-situ beforehand. After setting of PCa, concrete backfilling is carried out between PCa plates and the primary support. The positioning of the PCL is possible using mechanized construction without the need for highly skilled workers. Even though the material cost for PCL is higher than the conventional method, cost reduction can still be achieved by the reduction of the number of workers during the placing of the concrete. Moreover, since the PCa are factory-made, the risk of encountering problems such as filling failure of concrete can be reduced ensuring a high quality concrete lining.

FUTURE TUNNELLING ACTIVITIES

The Tokyo Ring Road (Kan-etsu Expressway – Tomei Expressway Section)

The Tokyo Ring Road, some 85km long, connects areas within an approximate 15km radius from the centre of Tokyo. By dispersing the inflow of traffic that passes through the centre of Tokyo, the Tokyo Ring Road will eliminate the chronic traffic congestion in the Greater Tokyo Area. By constructing the Kan-etsu Expressway – Tomei Expressway Section, it will not only alleviate traffic congestion, improve

environment, enhance international competitiveness, and revitalize of communities, but it will also allow Tokyo to continue to function as the capital in the event of a major disaster by facilitating smooth support and recovery operations. The Tokyo Ring Road (Kan-Etsu - Tomei) is the first expressway project in Japan to fully utilize its great underground area. For the section that runs between the Kan-etsu Expressway and Tomei Expressway, a 15.8m diameter deep-bore tunnel structure (up to 40m) has been adopted. The total length is approximately 16.2km, and the two main tunnels with three lanes each are to be constructed by shield machines of about 16m diameter, the largest cross section in Japan. The excavation started from both the north and south sides of the tunnels and 4 shield machines are now in operation. On the north side, the tunnel's starting shaft has been constructed, the machine assembly completed, and the initial excavation began from Jan. 2019. The drilling on the southern side started earlier on Feb. 2017 and as of Sept. 2019, the total excavated length is about 1.9km.

Hokuriku Shinkansen

Hokuriku Shinkansen is a high-speed railway that covers 690km from Tokyo. The Shin-Hokuriku Tunnel, which is one of the tunnel sections under construction, is a 20km long large-scale mountain tunnel for multiple Shinkansen tracks. It is divided into six zones constructed

STATISTICS

1. **Length or volume excavated**
28% mechanized/59% conventional during 2019
2. **Amount (USD or EUR) of tunnelling/underground space facilities awarded in 2019**
US\$38.6bn
3. **List of tunnels completed**
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4. **List of tunnels under construction.**

	No. of construction section	Total length (km)	Contract amount (US\$bn)
Road	234	354	20.7
Railway	74	213	6.2
Waterway	150	261	5.1
Overseas	22	93	4.8
Others	46	96	1.8
Grand Total	526	1017	38.6

by NATM. Construction works in these zones are under severe conditions due to its complex geological characteristics. Especially when excavating through a fault crush zone directly below an existing highway tunnel (about 40m below), increased safety consideration is necessary to not disrupt the highway,

which is an important trunk road. Finite Element Analysis has been conducted beforehand to assess the amount of settlement and pressure on the lining, along with plans to measure and compare during actual excavation. As of October 2019, 96% of the excavation of this tunnel is finished. The start of operation is

targeted at the end of the 2022 fiscal year for the section.

For the rest of the Hokuriku Shinkansen section, an Environmental Impact Assessment is now being carried out to specify the detailed route. It is planned to have several tunnel sections since it passes through urban districts.