Three Gorgeous Dam by Laura Brown, Rohan Hegarty

With such a high population density in the cities of China, it's no wonder they are taking full advantage of underground space. This was a significant focus of our trip. We saw models of Tunnel Boring Machines (TBM), attended the Smart Underground Space and Infrastructures Symposium, used the metro, went to the underground market and even saw a new two-level tunnel under construction. For all of us, seeing the construction site and full size TBM was the most impactful.

We went by bus from the site office into what seemed like a normal tunnel. As we went further, the detailing and lights faded out until we could see trucks and workers and were able to get out and walk right to the front of the tunnel boring machine.

While we were in the steering cabin the tour guide raised an interesting question with us about the limitations of underground infrastructure in Shanghai. With so many high-rises being build all with deep foundations and basements and well as an existing metro system it can be hard to find a direct path or a new tunnel. Avoiding obstacles adds time and costs to the project. He told us that for this reason, the tunnel generally follows the river.

- Shanghai Tunnel Engineering Co is the company we visited and is responsible for developing the underground tunnel system in Shanghai.
- STEC has undertaken 13 of the 15 Super-large Diameter Tunnels (above 14 meters in diameter) in China and 18 of 19 tunnels underneath the Huangpu River, which have been built or are being built.
- The largest Tunnel Boring machine has a 17.6m diameter.
- Boring Machines have the advantages of limiting the disturbance to the surrounding ground and producing a smooth tunnel wall.
- Herrenknecht Mixshield Technology is used in Shanghai Tunnel development.

We also now have a greater understanding of tunnel construction and geotechnical engineering after attending the Smart Underground Space and Infrastructures Symposium, where we listened to several keynote speakers from around the world including a Nobel Prize winner.
Ramith said before visiting Shanghai, he was indecisive on which civil engineering path to follow but he was highly fascinated by some of the marvellous geotechnical engineering projects he saw in Shanghai, especially the functioning of a Tunnel Boring Machine, which made him more inclined towards specializing in geotechnical engineering.

Tunnel Boring Machines (TBMS) are primarily used in building tunnels and operate by “excavating rock and soil with a rotating cutter head at the front of the machine and progressively installing curved concrete segments to create a watertight lining inside the tunnels.” ((Metro Tunnel, n.d.) The excavated rock and sand would be moved to the back of the machine via pipes and disposed. We had the privilege of witnessing a huge, state of the art TBM in action, paving a tunnel underneath the heart of Shanghai to facilitate a 3 by 3 lane underground vehicle passageway. Having always had a fascination for the structural complexities of modern day civil engineering wonders, observing a TBM systematically cutting into bare rock and forming a curved concrete structure was truly phenomenal. We also had the privilege of visiting the TBM back-up system which is a trailing support mechanism on the back of the machine which usually include “conveyors or other systems for muck removal, slurry pipelines if applicable, control rooms, electrical systems, dust removal, ventilation and mechanisms for transport of pre-cast segments.” (Tunnel boring machine, 2019)

Bibliography

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