

Jilin Yinsong Water Supply Project

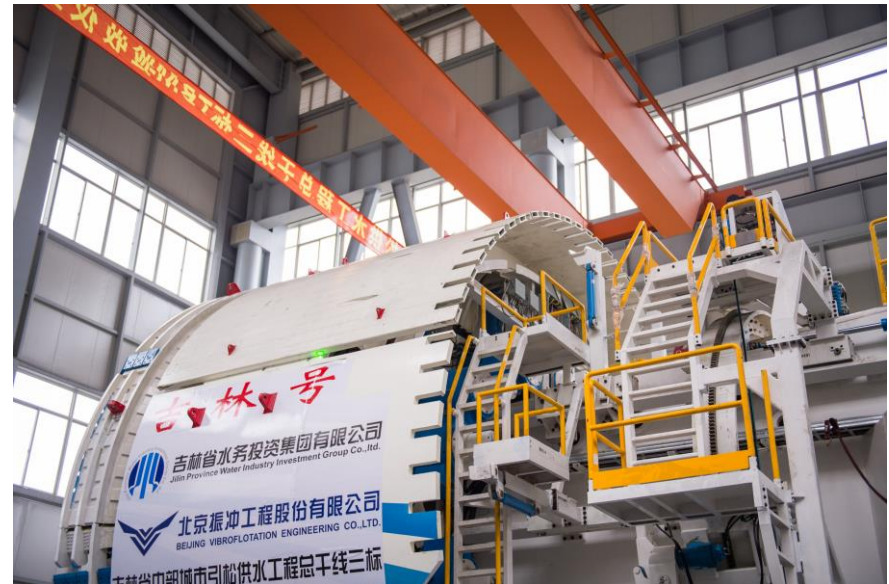
China

Presented by : Yong Sheng Qi, The Robbins Company



Outline

- Project Overview
- Jilin Lot 3 Tunnel
- Logistics and Ground Support
- Record-Setting Advance
- Conclusions



Project Overview

- The main purpose of the project is to draw water from the Fengman Reservoir on the upper reaches of the Di'er Songhua River and send it to the central part of Jilin Province
- The total length of the water delivery route is 736.3 km
- Annually:
 - 148 million m³ of water for agriculture will be provided
 - The excessive exploration of underground water will be reduced by 283 million m³
 - the demand for the water by 10.6 million people in urban and rural areas will be met



Fengman Dam and Reservoir, Jilin Province

Project Overview

The project is of great strategic importance:

- Optimize water resource distribution
- Improve regional eco-systems
- Ensuring food production and water safety for people in urban and rural areas
- Promote the sustainable development of economy and society in Jilin Province



Severe droughts plague Jilin Province

Jilin Lot 3 Tunnel

- 24.3 km long tunnel
- Constructed by contractor Beijing Vibroflotation Engineering Co. Ltd. (BVEC)
- 7.9 m diameter open-type (Main Beam) TBM



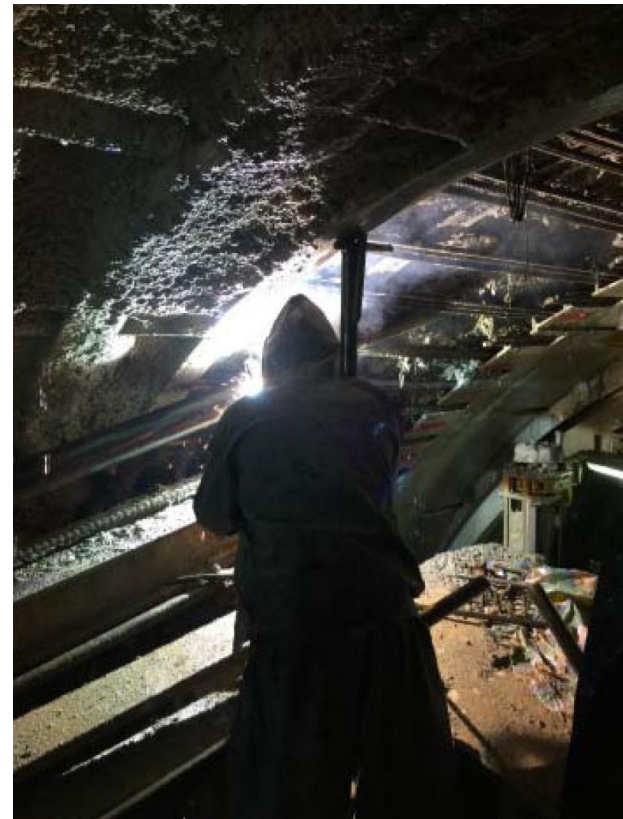
Jilin Lot 3 Tunnel

- Ground consisted of Tuff, Andesite, Granite, and Sandstone
- Max 220 MPa UCS
- 24 fault zones



Jilin Lot 3 Tunnel

- TBM began boring in March 2015
- Ground support program included rock bolts, ring beams, shotcrete and McNally slats to consolidate unstable rock



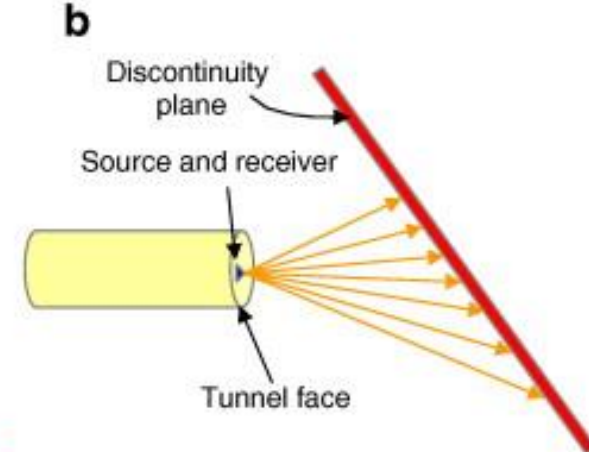
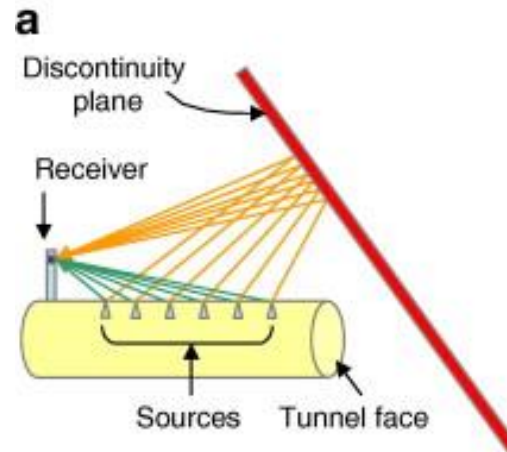
Jilin Lot 3 Tunnel

- The Jilin TBM's first fault zone was encountered after just 87 m of boring, requiring cooperation between the owner, Jilin Province Water Investment Group Co., Ltd., contractor BVEC, and Robbins field service.
- Water inflows and collapsing ground in a section measuring 1,196 m long were resolved with a combination of McNally slats, grouting, and consolidation of the ground ahead of the machine.



Jilin Lot 3 Tunnel

- To detect ground conditions ahead of the TBM, Tunnel Reflection Tomography (TRT) was used
- A method of ground prediction using seismic waves that can identify structures such as loose rock, broken rock, fault zones and water in front of the tunnel face



Jilin Lot 3 Tunnel

- The world record for the size class is held by another Robbins machine, set more than 20 years ago at the Tunnel and Reservoir Plan (TARP) in Chicago, Illinois, USA, for 1,482 m in one month.
- However, given the differences in rock conditions (relatively homogeneous dolomitic limestone averaging 145 Mpa at TARP), the performance at Jilin is exceptional.



Jilin Lot 3 Tunnel

- TBM broke through in Mid-May 2018 a full 147 days earlier than scheduled
- The machine reached over 1000 m per month for three consecutive months
- The contractor cited a number of factors that contributed to the swift advance rates:
 - Stable and reliable TBM performance
 - Technical skills of the service technicians
 - Coordination by all parties involved
 - Developing reasonable working progress arrangements
 - Sophisticated technology

