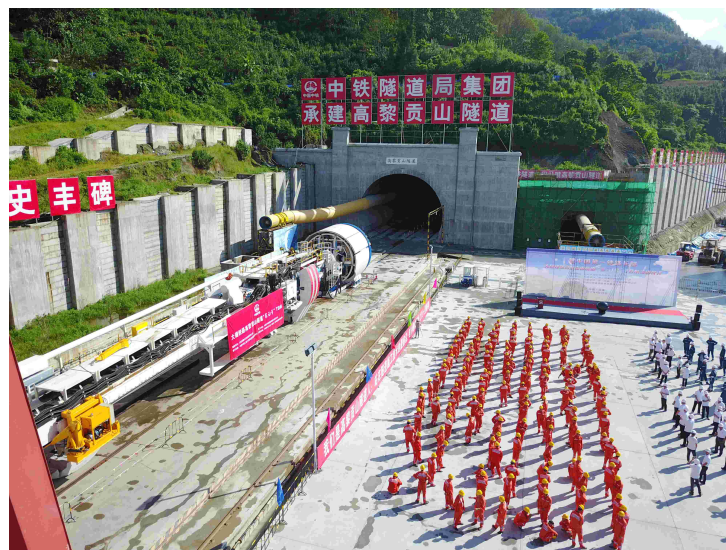


Gaoligongshan Tunnel on Dali-Ruili Railway, The Longest Mountain Railway Tunnel in Asia

1 Project overview

Da-Rui (Dali-Ruili) Railway is a key project in the *Chinese Mid-to-Long Term Railway Network Plan*, which can improve the road network distribution and national western development strategy and highlight the bridge and connection effect of Yuanna Province, China on opening to Southeast Asia and South Asia. Gaoligongshan Tunnel, the longest tunnel on Da-Rui Railway, is 34 538 m long with a maximum burial depth up to 1 155 m. The tunnel is on straight line with double spur grade. The auxiliary gallery scheme of one parallel pilot tunnel + one inclined shaft + two vertical shafts was adopted. The tunnel was constructed by drilling and blasting method, except for exit section, which was constructed by one large-diameter TBM and one small-diameter TBM.



2 Project geological conditions

The geological characteristics of Gaoligongshan Tunnel include “Three Highs” (high geotherm, high geo-stress, and high earthquake intensity) and “Four Actives” (active neotectonic movement, active geothermal water environment, active external dynamic geological conditions, and active slop superficial transformation process). The geological conditions along the tunnel are poor. The poor geological conditions of

tunnel section constructed by drilling and blasting method include geotherm, active fracture zone, fault zone, rock burst, soft rock deformation and radioactivity. The poor geological conditions of tunnel section constructed by TBM include fault zone, altered rocks, jointed zone, rock burst and soft rock deformation. The high geotherm and water, active fractured zone, high geo-stress, landslide and soft rock large deformation are obvious.

3 Challenges

- (1) High temperature and heat damage
- (2) Large deformation of soft rock
- (3) Large water inflow in the tunnel
- (4) Weak and broken rock may block TBM construction
- (5) Strict management and control of construction organization reduces high safety risk
- (6) High ventilation requirements

4 Main technical innovations

The engineering challenges faced in Gaoligongshan Tunnel are high geotherm, active faults and rupture zones. Deep shafts and TBM under complex geologic conditions, and special construction technology is required. The following research projects are currently approved” construction methods in high geothermal environment, new TBM designs for complex geological conditions, key construction techniques of super=deep shafts and heat-resistance concrete for super-long tunnel with large burial depth and high geothermal environment. The new TBM designs and applications for complex geological conditions have been approved by CHINA RAILWAY and is ongoing.



Caiyun, the largest-diameter open hard rock boring machine independently-developed by China

5 Project schedule

The project entrance section started on 29th Dec., 2014. The works on inclined shaft #1, vertical shaft #1, vertical shaft #2 and the tunnel exit started on 1st Dec., 2015. The phase one is scheduled to be completed by 30th May, 2022, with a duration of 89 months. The phase two, the excavation of the parallel pilot tunnel, is scheduled to start on 14th Oct., 2018 and to be completed by 30th Nov., 2025. The total duration of the entire project is 131 months.