Taiwan High Speed Railway

SHORT DESCRIPTION

Lot 6 (C 260) is 36.60 km long and includes seven tunnels with a total length of 9,245 m. The 7,276 m long Paghuashan Tunnel is the longest of tunnels. The lengths of the two northern and four southern shorter tunnels range between 163 m and 721 m. The tunnels had cross sections between 125 to 135 m^2, depending on excavation class and thickness of the inner lining.

THE PROJECT

The **Paghuashan Ridge** consists of deposits of coarse gravel and sands which, due to high preloading conditions, are extremely compact and temporarily stable, even without cohesion. In addition to these deposits ground water can be found in various water bearing layers caused by a pronounced system of sand and gravel lenses.

CHALLENGES

All seven tunnels were constructed in the mining method, with separate crown, bench and invert drives. The Paghuashan Tunnel was driven from the portals as well as from two additional intermediate access locations which, at times, allowed the excavation of up to six tunnel drives simultaneously. After project completion, the intermediate access tunnels serve

as emergency adits. Excavation of the adits was carried out with full face excavation.

Based on the geotechnical concept the excavated cross-section of the standard profile was approximately 132 m^2. Tunnel support was facilitated with steel fibre reinforced shotcrete and lattice girders.

The 40 to 60 cm thick reinforced inner lining was constructed in 12.50 m long blocks with a total of 5 vault and 3 invert shutters. The sealing system, which allows water pressures of up to 3 bar for an undrained tunnel, consists of an arch membrane (umbrella) and a water impermeable concrete invert. In sections where the water pressure exceeds 1.5 bar, sealing of the tunnel was done with a full round sealing membrane.

Both, tunnel support as well as inner lining were included in load-bearing analysis. With respect to possible exposure to earthquakes, the degree of reinforcement was comparatively high, especially in the area of the portals. Construction of the inner lining within 14 months required a daily concreting performance of up to 2,100 m^3.

FURTHER INFORMATION

Key Figures

- Realization 2000 – 2004
- Total length 9,245 m
- Excav. cross section 132 m2
- Geology Large, compact gravel and sand, sandstone and siltstone

Implenia on site
Implenia Construction GmbH,
Civil Engineering
Landsberger Straße 290 a, D-80687 Munich

Scope of works
Technical leadership
Consortium participation 50 %

Performed services
Tunneling works

Construction methods

- Excavator drive with divided tunnel face, reinforced shotcrete support,
- L = 9,245 m, A = 132 m^2
- Final in-situ concrete inner lining, t = 40 60 cm

Project Participants

Client
Taiwan High Speed Rail Corporation

Planner
IREG (International Railway Engineering Group)

Consortium
Bilfinger Berger AG
Continental Engineering Corporation

FACTS

Location	Changhua, ▯▯▯ , Taiwan
Status	completed
Construction volume (value of our services)	166 M EUR
Start of construction	May 2000
Completion	May 2004
Other tunnelling	✓

SERVICES

Tunnelling

Transport tunnels