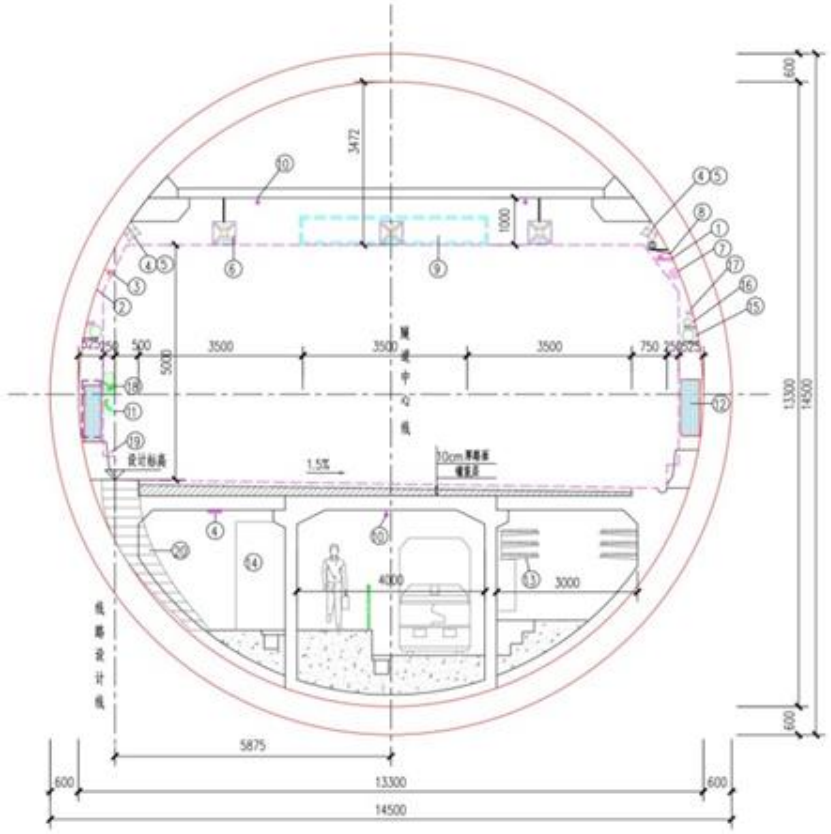
Tunnel Engineering Consultants

Project identification

Shantou SuAi crossing

Type of project

Seismic analysis



Client

China Railway Tunnel Design Institute (CRTDI)

In co-operation with

Guangzhou University, Southwest University

Project assignment

Detailed seismic analyses of bored tunnel section

Country

China

Location

Shantou

Project duration

2016

Project phase

Detailed Design

Construction cost

n.a.
(excl. VAT)

Consultancy fee

€150.000,-
(excl. VAT)

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Project description

The Shantou city is located in the eastern part of the Guangdong province in China, 300 kilometres east of Hong Kong. The Shantou SuAi crossing consists out of two identical TBM made tunnels with a length of 3,500 km crossing the SuAi river. The crossing will connect Longhy district at the northern bank and Haojinag district at the southern bank. Both tubes have an outer diameter of 14.50 m and accommodate 3 traffic lanes.

The responsible design institute has performed the necessary analyses, but since the tunnels are located in an area with high seismic intensity an independent analysis by an international consultant was considered. For this, China Railway Tunnel Design Institute (CRTDI) has awarded TEC to execute an independent seismic analysis.

Scope of work

From CRTDI seismic signals, recorded during previous earthquakes, were received. With SHAKE2000 the response of the soil to those earthquake signals was calculated from which the soil displacements during an earthquake where extracted. Those displacements where required to analyse the behaviour of the tunnel in cross-sectional direction and in longitudinal direction. For both directions a separate calculation model was developed.

For the cross-sectional analyses the displacements from the SHAKE2000 model were imposed on 2 adjacent tunnel rings modelled in 3D with DIANA. With the model the rotations in the segment joints, forces in the concrete and differential displacements between two rings were analysed.

For the longitudinal analyses the complete 3,500 km long tube was modelled with beam elements on which a propagating seismic wave was imposed. With this model the most critical sections along the alignment where identified. By installing the seismic joints on the right locations the joint openings between adjacent rings are limited to also guarantee water tightness in longitudinal direction.

With the performed analyses TEC advised China Railway Tunnel Design Institute on the location of seismic joints and the expected forces and gaps in the tunnel during seismic events. Results of the analyses were discussed with Guangzhou University and Southwest University. TEC also performed a review of the detailed design drawings of the seismic joints.