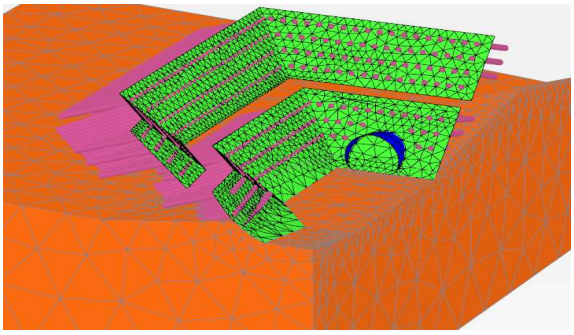
Project datasheet Tunnel

Project name: Access Tunnel Design, Bonsucesso Underground Mine

Location: Paracatu, MG, Brazil

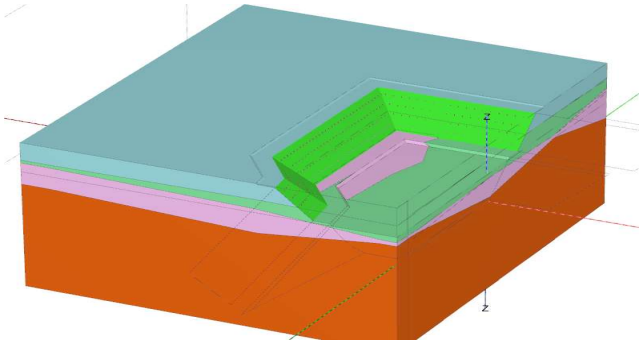
Client: Nexa Resources

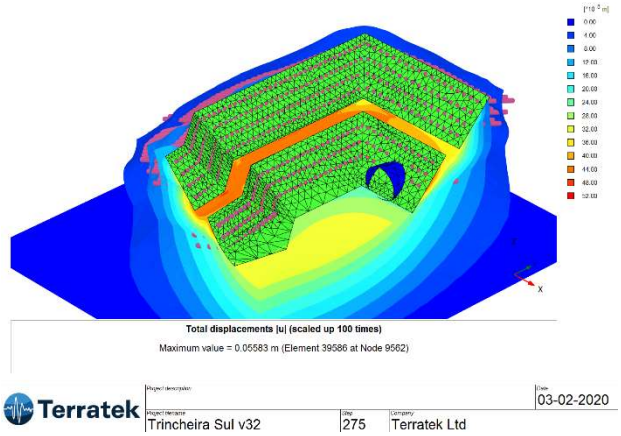
Description: The project consists of the design of two 20 m deep trenches and four tunnels to access the ore. Inside the trench, there are two portals giving access to two tunnels. Each tunnel has a 40 m^2sectional area. The geotechnical solution for the trenches was soil reinforcement utilizing the soil nailing technique. For the tunnels, the solution was a NATM type solution in which the sandy materials will be stabilised employing horizontal jet-grouting (HJG) columns. Terratek also designed an umbrella-type crown reinforcement with HJG. The tunnel primary lining to be 25 cm thick sprayed concrete. The secondary lining will be 30 cm thick cast in situ concrete.

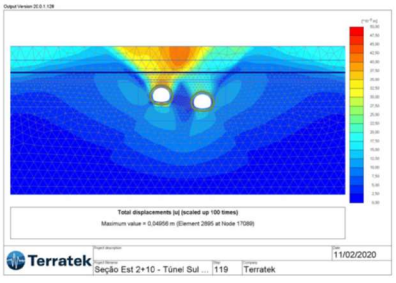


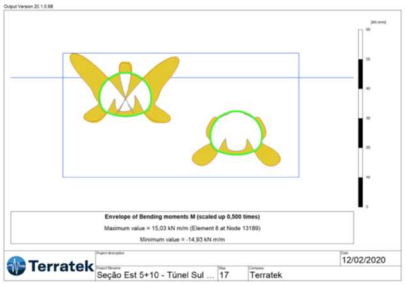
Services provided by Terratek:

Terratek was the designer and also carried out site investigation









Project datasheet Tunnel

Project name: Transoeste Tunnels

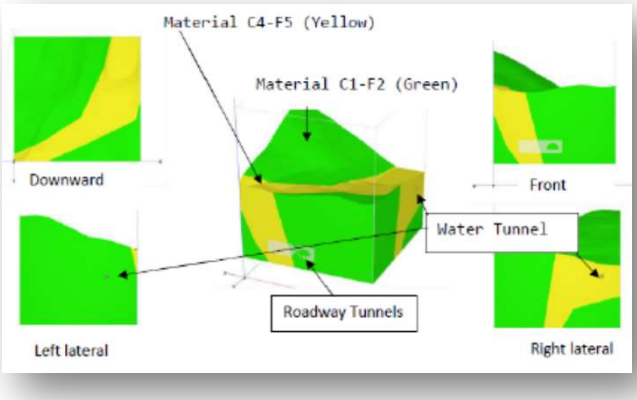
Location: Rio de Janeiro, Brazil

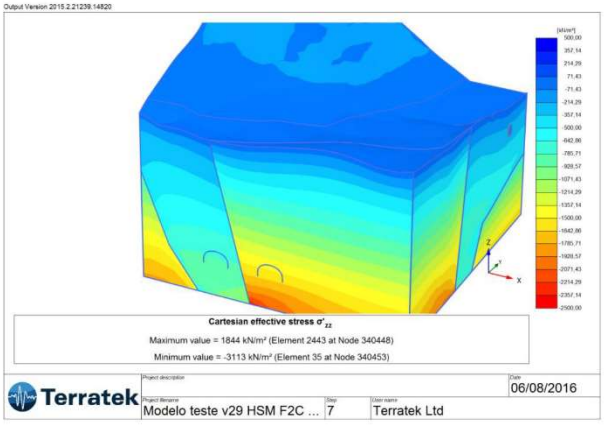
Client: Transoeste JV

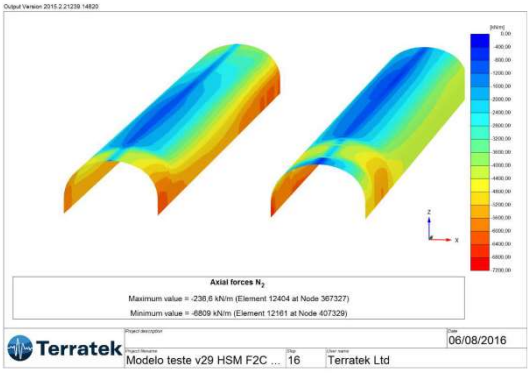
Description: Twin Transoeste Road tunnels, 120 m^2 area each, excavated in 2014 through hard gneiss crossing 45 m underneath Guandu Water Supply Tunnel which was built in 1965. The new tunnels crossed a geological fault zone and could affect the old water tunnel.

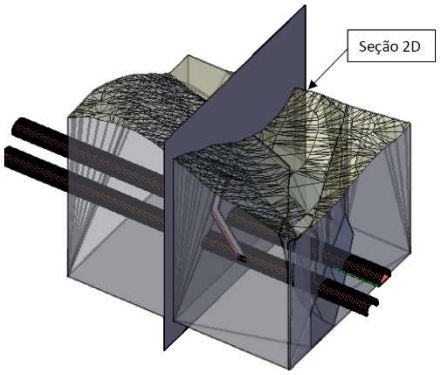
Services provided by Terratek

- 2D & 3D Plaxis numerical analyses
- Analysis of the behaviour









Project datasheet Tunnel

Project name: Tunnel 5, Ring Road

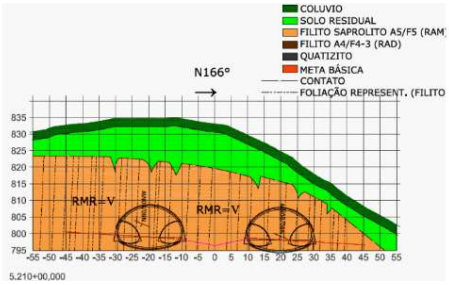
Location: São Paulo, Brazil

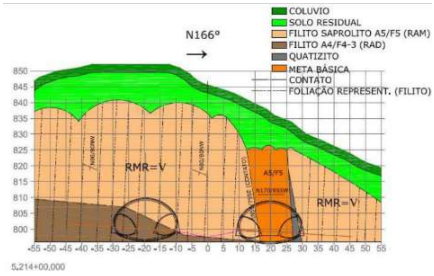
Client: Construcap Contractors

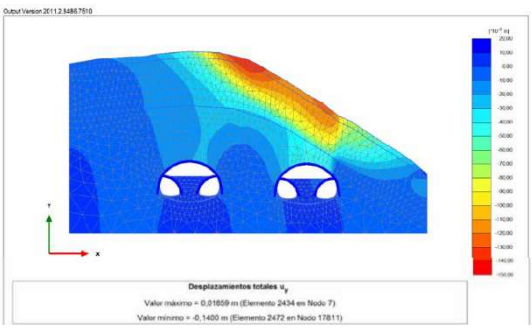
Description: Road tunnel, 120 m^2 area, which failed in 2015 close to one portal.

Services provided by Terratek

- Expert consultancy services to analyse the failure mechanisms and to identify the causes;
- Instrumentation analysis
- 2D & 3D Plaxis numerical analyses
- Analysis of the behaviour





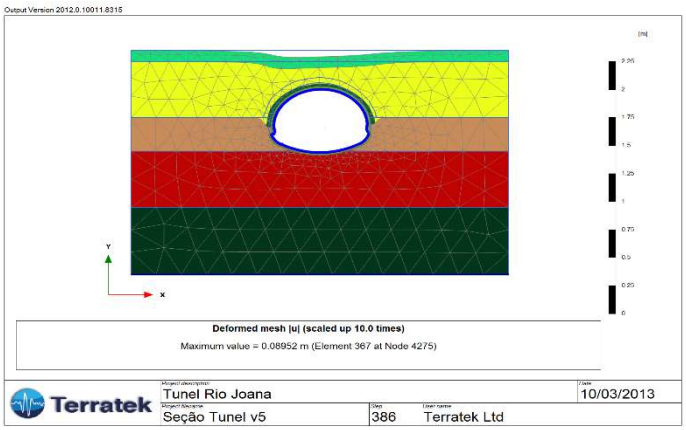


Project datasheet Tunnel

Project name: Tunnel Rio Joana

Location: Rio de Janeiro, Brazil

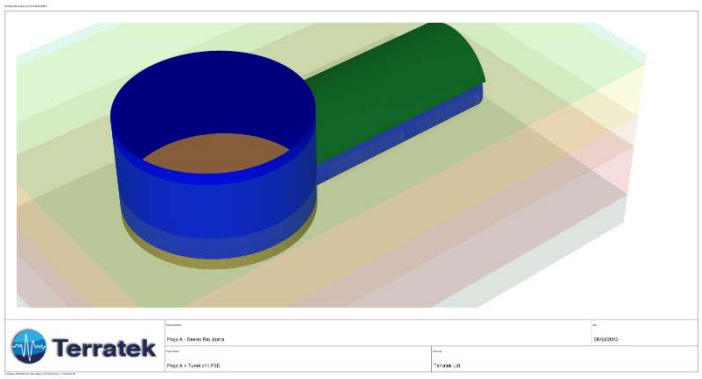
Client: Mendes Jr. Contractors

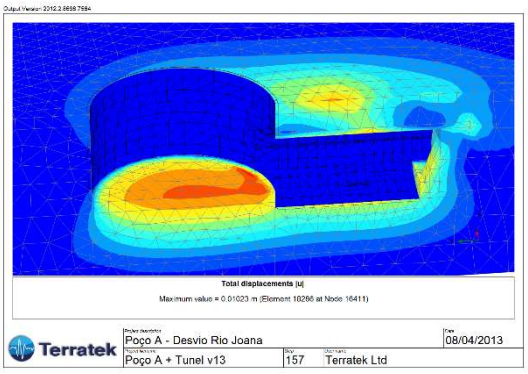


Description: Drainage tunnel, 40 m^2cross-section-area, through rocks and soils, 2.7 km long tunnel

Services provided by Terratek

- Design review and sign-off reports
- 2D and 3D numerical modelling of the excavation through Plaxis program
- Instrumentation analysis
- Analysis of the behaviour
- Expert geotechnical advice





Project datasheet Tunnel

Project name: Gasduc III

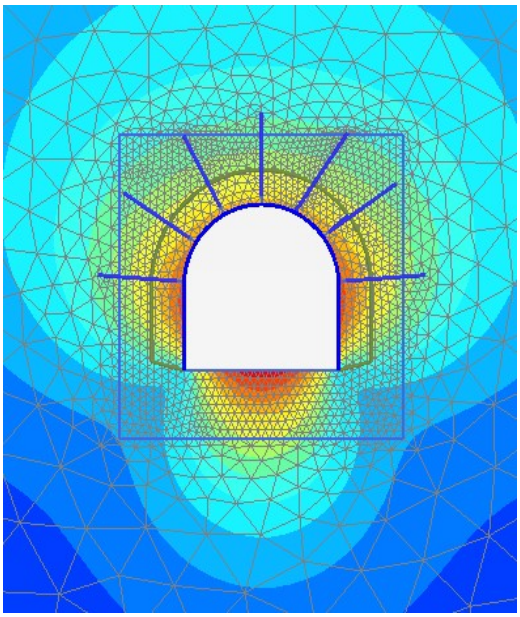
Location: Rio de Janeiro, Brazil

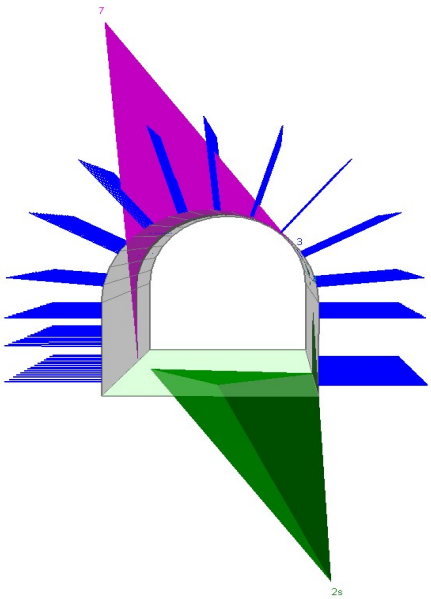
Client: Colares Contractors

Description: Existing tunnel, built by 2011 with concrete lining spalling, excavated through hard rocks, 40 m^2 cross-sectional area, 3 km long. The purpose of the tunnel is to accommodate gas pipelines.

Services provided by Terratek

- Tunnel lining inspection;
- Rock mass classification based on existing records
- 2D numerical modelling with Plaxis to analyse the existing support
- Unwedge analysis
- Design of lining reinforcement





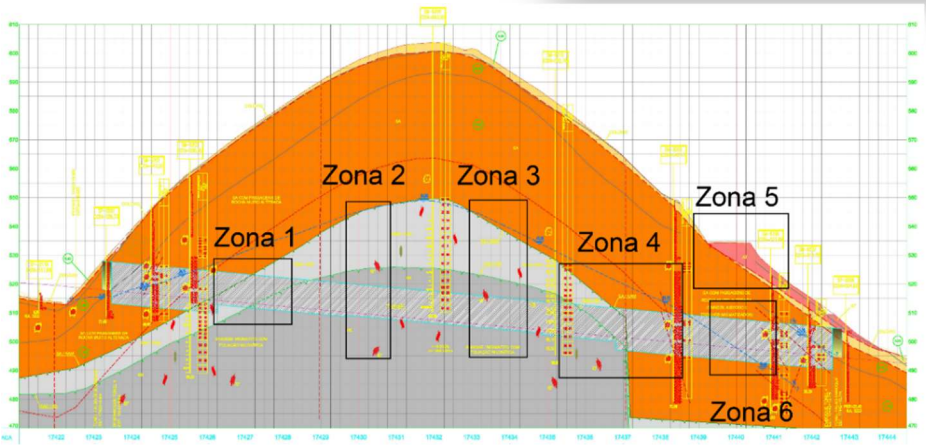
Project datasheet Tunnel

Project name: Cafezal Tunnel

Location: São Paulo, Brazil

Client: Ossa Contractors

Description: Road tunnel, 220 m^2 cross-sectional area, 800 m long, double tunnel.



Services provided by Terratek

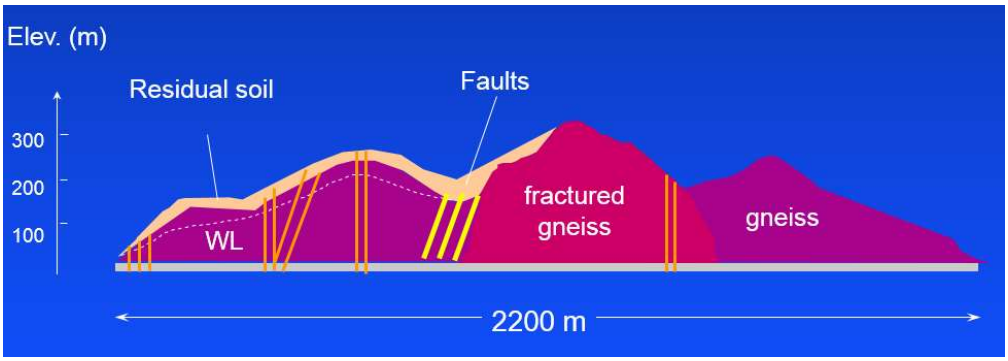
- Design review report
- Instrumentation and monitoring;
- Installation of inclinometers, standpipe piezometers, convergence targets;
- Instrumentation readings and analysis;
- Site supervision and rock mass classification.

Project datasheet: Tunnel

Project name: Covanca Tunnel

Location: Yellow Line, Rio de Janeiro, Brazil

Client: OAS Contractors

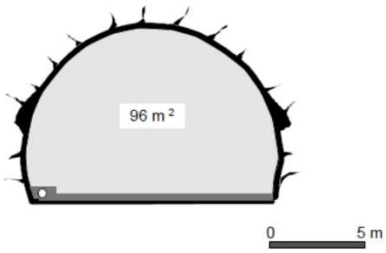


Description:

Rock tunnelling through hard rock excavated by drilling and blasting, 96 m^2 cross-section and 1800 m long.

Services provided by Terratek

- Consultancy services for the design of the fibre sprayed concrete lining;
- Analysis of the laboratory testing programme on lining samples



Project datasheet Tunnel

Project name: Tunnel Cerrillos

Location: Tarija, Bolivia

Client: Queiroz Galvão Contractors

Description: Tunnel excavation in conglomerates employing conventional method (NATM), tunnel section area 80 m^2, 1 km long

Services provided by Terratek

- Instrumentation and monitoring;
- Analysis of the behaviour;
- Expert geotechnical advice

Project datasheet Tunnel

Project name: Two Lions Tunnel

Location: Salvador, BA, Brazil

Client: Odebrecht Contractors

Description: Tunnel excavation in residual soils and rocks, 500 m long, 80 m^2cross-sectional area.

Services provided by Terratek

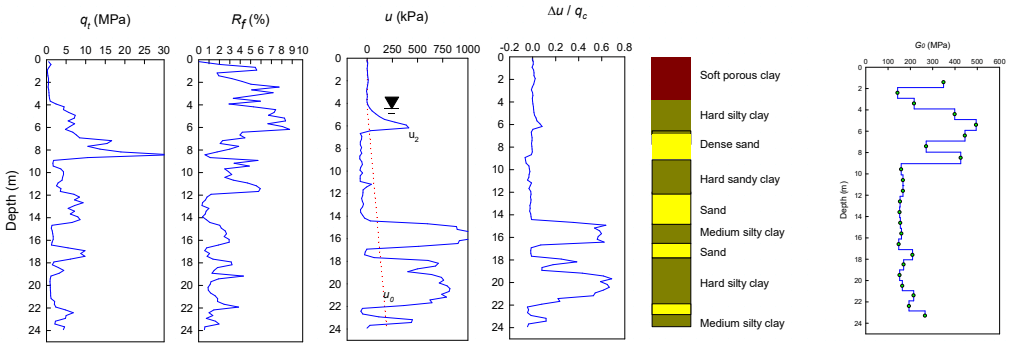
- Site supervision
- Instrumentation analysis
- Analysis of the behaviour
- Expert geotechnical advice

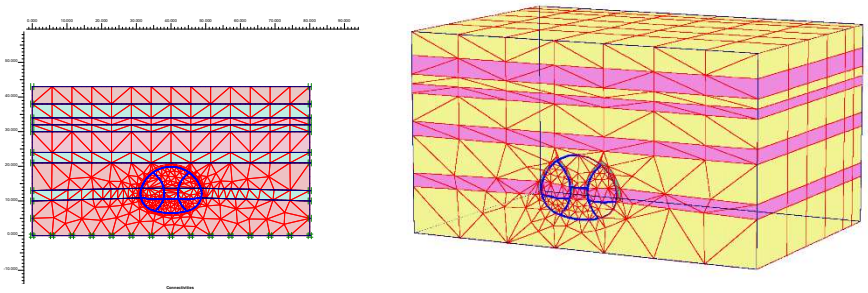
Project datasheet Tunnel

Project name: Luz Station, São Paulo Underground

Location: São Paulo, Brazil

Client: Themag Consulting Engineering SA, São Paulo





Description: Underground station, cross-section area 220 m^2

Services provided by Terratek

- In situ testing CPTU and Seismic CPT
- 2D and 3D numerical modelling of the excavation through Plaxis

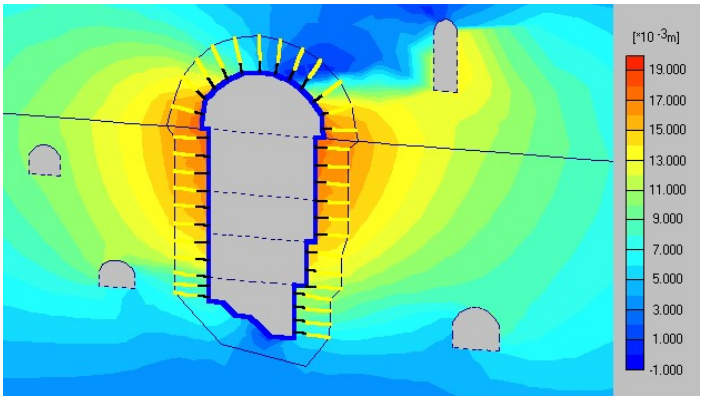
Project datasheet Tunnel

Project name: Queimado Dam, Power House

Location: Minas Gerais, Brazil

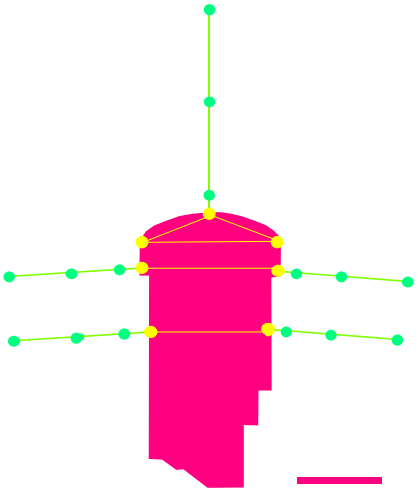
Client: Queiroz Galvão Contractors

Description: Huge Power House excavated in sound rock for accommodation four electric generators, 30 MW. The powerhouse was some 60 m in height and 150 m long.



Services provided by Terratek

- Instrumentation and monitoring;
- 2D and 3D numerical modelling with Plaxis



Project datasheet Tunnel

Project name: Brasilia Tunnel Liner

Location: Brasilia, Brazil

Client: Brasília Metro Co.

Description: False tunnel Armco tunnel liner, section area 120 m^2, 800 m long, located in Águas Claras, Brasília, for the Brasília Metro.

Services provided by Terratek

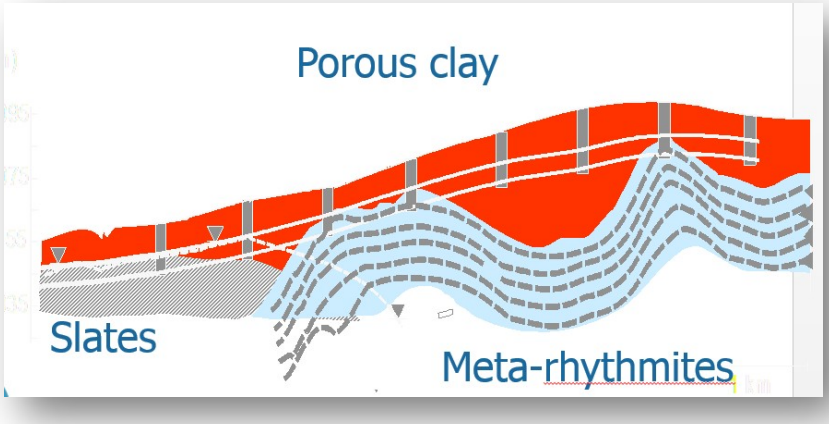
- Design and consultancy
- Analysis of site investigation
- Site supervision
- Instrumentation and monitoring

Project datasheets Tunnel

Project name: Brasília Underground Tunnel

Location: Brasília, Brazil

Client: Brasília Metro Co.



Description: Underground tunnel for the Brasília Underground (Metro) system, the shallow tunnel´s section area is 80 m^2 and it is 6km long. It was excavated by conventional method (NATM)

Services provided by Terratek

- Geotechnical consultancy;
- Analysis of in situ tests: CPTU, DMT and PMT;
- Analysis of the instrumentation data
- Analysis of the tunnel behaviour;
- Stability assessment;
- Instrumentation and monitoring

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