Highway Tunnel

Twin Bore Highway Tunnel T1 - Demir Kapija-Smokvica Motorway Section of European Corridor 10 & Part of the National Road M-1 (E-75)

Skopje

Project

Full face design of the twin bore highway tunnel T1 with excavation and primary support classes (E&S) for the tunnel's main body, the cross passages and the lay-bys.

Construction Cost

Total cost of the highway: approx. € 270m

Project Schedule

Design: 2013
Construction: 2012 - 2015

Project Description

North bore length: ~1275m
South bore: length ~1214m
E&S classes for the main tunnel, the cross passages (vehicular and pedestrian) and the lay-by
Main tunnel's typical excavation cross section: 75-81m^2

Method of tunnel excavation

NATM – drill & smooth blasting – heavy mechanical means
Maximum overburden: 215m

Geology

Jurassic Limestones massive to well bedded, moderately weathered and highly fractured at the fault zones, Basalts slightly weathered and Diabases-Spilites slightly to moderately weathered

Our Services

- Geotechnical & Structural Design of tunnel T1
- Geological – geotechnical interpretation and evaluation
- Determination of the appropriate support classes, establishment of the application criteria for each category and description of the construction stages sequence
- Calculation analysis for the support measures adequacy per class and assessment of the stress-state stability conditions using 2D and 3D simulation models
- Elaboration of technical reports, detailed construction drawings, calculation notes, instrumentation and monitoring program
- Consultancy Services

Client

AKTOR S.A.

General view of tunnel's T1 south entrance portal

Tunnel's excavation face and underground stretch with the primary support measures

RockFill Highway Embankments

Demir Kapija-Smokvica Motorway Section of European Corridor 10 & Part of the National Road M-1 (E-75)

Scopje

Project
Design of rockfill reinforced embankments for the Demir Kapija – Smokvica motorway. Construction phase design for the incorporation, utilization of suitable rock type fill materials obtained from the cuts of the project in the motorway embankments.

Construction Cost
Total cost of the highway: approx. € 270m

Project Schedule

Design:	2010, 2013
Construction:	2012 - 2015

Project Description
- Total highway length: 28km
- Reinforced embankments' total length: 5km
- Reinforced embankments' max. height: 40m
- Reinforced embankments' slope: 2:3 and 1:1 (v:h)

Geology
Gabbro – diabase complex, rock formations of Diabases and Spilites locally covered with soil-like superficial mantle consisting of diluvium deposits and talus – scree materials.

Our Services
- Geotechnical Design of rockfill reinforced embankments
- Slope stability analysis checks, dimensioning of the rock type embankments and determination of the necessary and appropriate per case reinforcement requirements (tensile strength of the geogrid elements, length, vertical spacing)
- Elaboration of technical reports, detailed construction drawings, calculation notes, technical and constructability issues
- Consultancy Services

Client
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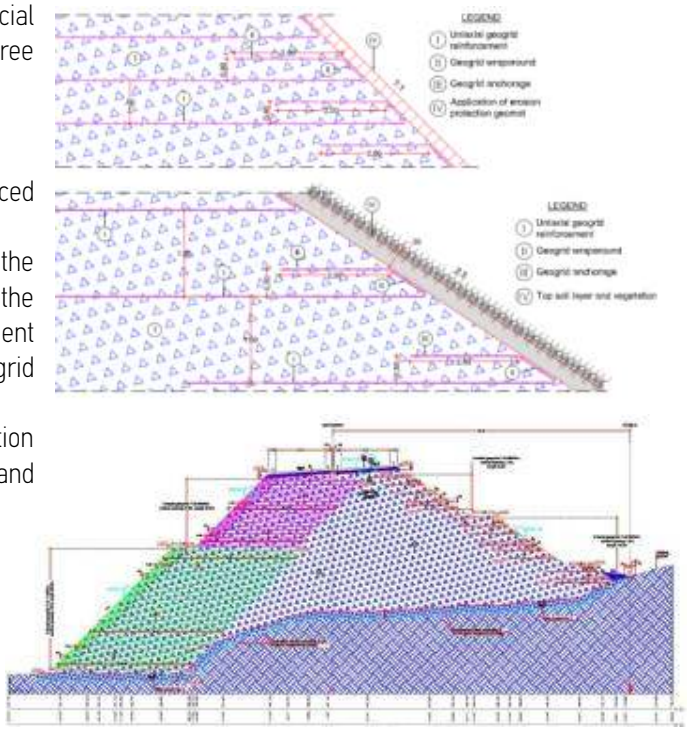
Modulation of embankments' anchoring benches

Placement and leveling of fill material



Typical cross section and construction details for the rock fill embankments

Rockfall Protection & Slope Support Works

Demir Kapija-Smokvica Motorway / Celevecka Gorge Section of European Corridor 10 & Part of the National Road (E-75)

Scopje

Project

Rockfall protection works design and slope support-stabilization measures design at the Celevecka river gorge. The alignment of Tunnel T1 crosses the rivers' stream with very steep, adverse rocky morphology bringing about high risk of potential rockfalls.

Construction Cost

Total cost of the highway: approx. € 270m

Project Schedule

Design: 2010, 2013 - 2015
Construction: 2013-2015

Project Description

- Gorge crossing length: ~120m
- Four (4) gorge portals of tunnel T1 examined: North left and right, South left and right
- Rocky slopes' height above the portal areas: max. 250m
- Mountainous region under extremely unfavorable geomorphological conditions, very steep rocky terrain (almost subvertical slopes), potential rockfall source areas along the entire cliff rocky face
- Very high kinetic energies and bounce heights expected, highly hazardous area

Geology

Jurassic Limestone, slightly weathered and karstified with more intense weathering and fracturing limited in the vicinity of faults and fault zones. Structural fracturing of the rockmass from major discontinuity sets.

Our Services

- Geotechnical Design for rockfall protection and slope support works – Works Method Statement
- Identification and evaluation of potential failure mechanisms
- Stability analysis checks (rockfalls, planar and wedge type modes of failure)
- Determination of the necessary and appropriate per portal case rockfall protection/mitigation systems (type of rockfall barriers, energy absorption capacity, post height) and slope support-stabilization measures (type of steel wire mesh, rockbolts, bearing capacity, length, pattern)
- Elaboration of technical reports, detailed construction drawings and calculation notes
- Consultancy Services

Client

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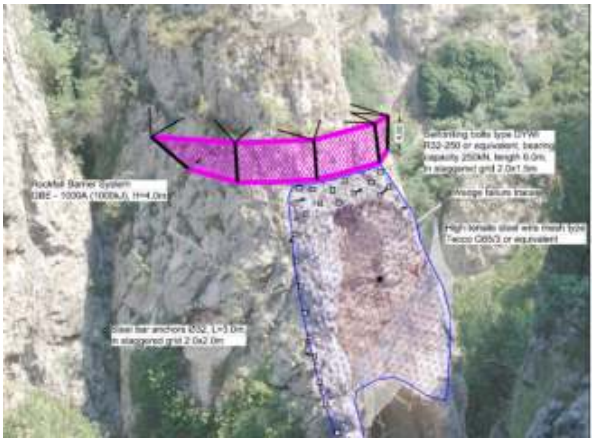
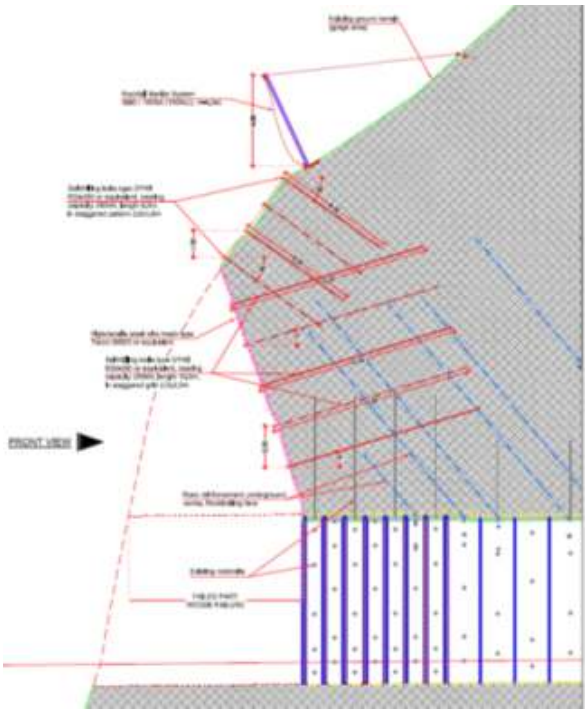
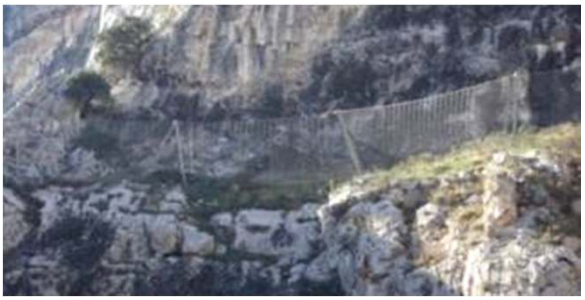




Rockfall protection and slope support measures at the south right gorge portal of tunnel T1



Rockfall protection barriers at the north right and left gorge portals of tunnel T1