Highway Tunnel

Rapsomati Tunnel

Tripoli – Kalamata Highway

Southern Greece

Project
Highway tunnel

Construction Cost
Total cost: approx. € 29,3 m.

Project Schedule
Design: 2000-2001
Construction: 2000-2003

Project Description
Length: 1300m
Cross section: 104m^2

Method of tunnel excavation
NATM – drilling and blasting

Final Lining
Reinforced concrete C20/25

Geology
Thin bedded limestones, phyllites and schists
Max. overburden: 127m

Our Services
Detailed geotechnical & structural design

Client
AKTOR S.A.

Entrance portals

Tunnel with final lining

Left bore exit portal

Structures

Cut & Covers and Lane Covers in sections A & B of Rapsomati Tunnel's exit N.R. Tripoli - Kalamata

Southern Greece

Project

Cut & Covers Structures – Lane Covers

Construction Cost

Total cost:	approx. € 15,4 m.
Cost of Lane Cover A	approx. € 4,19 m.
Cost of Lane Cover B	approx. € 11,2 m.

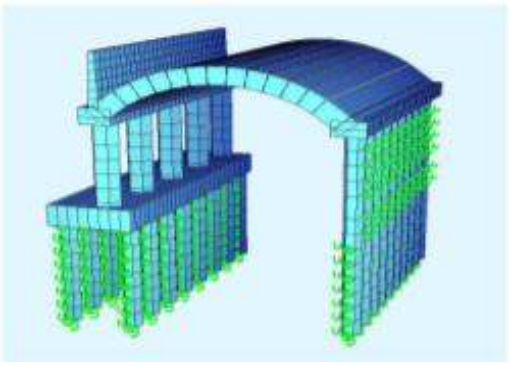
Project Schedule

Design:	2008
Construction:	2008-2009

Project Description

Cut & Covers – Lane Covers founded in circular cross section columns and appropriate reinforced concrete piles

Length of Lane Cover A:	95m
Length of Lane Cover B:	263m
Maximum useful height:	9,40m

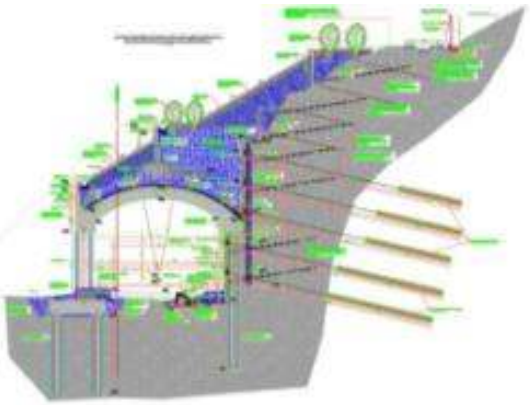


Geology

Weathered mantle of limestones, thin bedded limestones, pelites and shales

Our Services

- Evaluation of the geological – geotechnical investigations
- Elaboration of geotechnical design
- Structural design of the lane covers
- Slope stability analysis for the temporary and permanent cut slope
- Dimensioning and design of lane cover's backfilling
- Detailed geotechnical & structural design
- Designs jointly elaborated by OMIKRON KAPPA CONSULTING S.A. and EDR GmbH, Munich



Client

MINISTRY OF E.PP.PW.
GENERAL SECRETARIAT OF PUBLIC WORKS
GENERAL DEPARTMENT OF TRANSPORTATION WORKS

Highway Cut Slopes

Rockfall Protection Design
ATHINEO – LEFKTRO (RAPSOMATI)
TRIPOLI – KALAMATA ROADWAY

Southern Greece

Project

Rockfall protection design at Athineo – Lefktro section (Rapsomati area) of the Tripoli – Kalamata road axis (Peloponnese)

Construction Cost

Total cost:	approx. 0.5 m. €

Project Schedule

Design:	2008
Construction:	2009

Project Description

Assessment of the cut slope stability and determination of the necessary support and rockfall protection measures

Length:	450m

Geology

Rocky slopes of medium inclination with height up to 50m

Thin to medium bedded Limestones

Our Services

- Detailed geotechnical design
- Identification and evaluation of the potential slope failure mechanisms – elaboration of detailed stability audit
- Execution of stability analysis (rockfalls)
- Determination of the necessary support – stabilization measures
- Detailed dimensioning of the mitigation systems, technical specifications and construction method statement
- Elaboration of technical report, construction drawings and bill of quantities (BOQ)
- Consulting services during on site application
- Designs jointly elaborated by OMIKRON KAPPA CONSULTING SA and EDR GmbH, Munich

Construction Details

Installation of approx. 400m of rockfall protection barriers

Client

MINISTRY OF E.PP.PW. - GENERAL SECRETARIAT OF PUBLIC WORKS, GENERAL DEPARTMENT OF TRANSPORTATION WORKS

Rockfall protection area

Slopes Rehabilitation

Rapsomati Tunnel of Road Axis Tripoli - Kalamata

Southern Greece

Project
Rehabilitation of existing open cut slopes of the highway

Construction Cost
Total cost: approx. € 0,9 m.

Project Schedule
Design: 2005
Construction: 2005 - 2006

Project Description
- Rehabilitation of failures in the slopes of open cuts in a highway section of approx. 3km length
- One-sided and two-sided open cuts constructed from a previous contractor with medium uniformly gradient 2:3 and fluctuant height from 1m up to 10m, which were appearing serious hydraulic mining problems, surface erosions and failures of small depth

Geology
Marls of clay and consistence and sand marls
Alluvial

Our Services
- Detailed geotechnical design
- Identification and registration of the slopes problems
- Execution of stability back-up analyses for the assessment of the geotechnical engineering characteristics of soils
- Assessment of the necessary earth works interventions for the rehabilitation of failures
- Assessment of flood protection and anti-corrosion measures
- Construction drawings
- Bill of Quantities, Budget

Construction Details
- Installation of loose material of the existing failures with granular crust material
- Installation of 3-D Geogrids ENKAMAT type for the anti - corrosion slopes protection
- Turf grass planting over the slopes surface
- Planting of small trees
- Installation of drainage wholes at the foot of the slope
- Construction of drainage trenches over the slopes crown

Open cut slopes view prior to rehabilitation

Open cut slopes view after rehabilitation

Client
J/V KASTOR S.A. – ELTER S.A.

Open Cuts

Rapsomati Tunnel of Road Axis Tripoli - Kalamata

South Greece

Project
Highway general excavation works

Construction Cost
Total cost: approx. € 1,5 m.

Project Schedule
Design: 2005
Construction: 2005 - 2009

Project Description

- Permanent one-sided and two-sided slopes of the u-turn road in the entrance of Rapsomati tunnel
  Length of open cut: 314m
  Max. height: 25m
  Modulation of left open cut slopes in 1 slope with gradient 1:1 (height: width)
  Modulation of right open cut slopes in 2 slopes with gradient 2:1 and intermediate benches
- One-sided open cut slope of the open road in the area of the exit of Rapsomati tunnel
  Length: 60m
  Max. height: 37m
  Slope modulation in 4 open cut slopes with gradient 2:1 with intermediate benches, 4m width

Open cut area view in Rapsomati tunnel exit

Open cut typical cross section

Geology
Thin-bedded medium-bedded limestones
Intercalations of clayey schists, red pelites and limestones

Our Services

- Detailed geotechnical design
- Execution of geotechnical investigation program
- Assessment of design geotechnical parameters
- Geometric project design
- Execution analysis of slopes stability
- Technical report
- Bill of Quantities, Budget

Construction Details

- Installation of fully grounded rockbolts in combination with reinforced connecting beams
- Installation of prestressed anchors on the slopes at the area of the exit of the Rapsomati tunnel
- Surface protection of permanent slope with GEOBRUGG grids, TECCO G65 type
- Construction of perimetrical drainage trenches and drainage wholes
- Planting of small trees

Client
J/V KASTOR S.A. – ELTER S.A.

Embankments

Rapsomati Tunnel of Road Axis Tripoli - Kalamata

South Greece

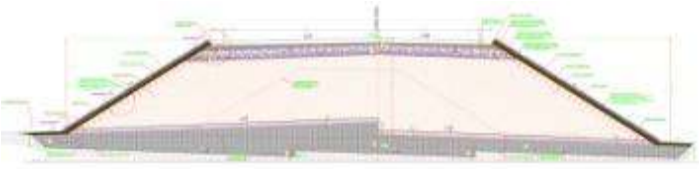
Project
Highway embankments

Construction Cost
Total cost: approx. € 1,6 m

Project Schedule
Design: 2005
Construction: 2005 - 2006

Project Description
- One-sided and two-sided embankments of highway
  Length: 380m
  Max. height: 12m
  Crown width: 31m
  Modulation of the embankment in 1 slope with gradient 2:3 (height: width)
- Widening of the existing embankment due to the construction of Megalopoli interchange
  Length: 820m
  Max. height: 7m
  Modulation of the embankment in 1 slope with gradient 2:3 (height: width)

Embankment construction works



Embankment typical cross section

Geology
Marls and sand marls
Alluvial flabellum

Our Services
- Detailed geotechnical design
- Geometric project design
- Check of the embankment settlements and consolidations
- Assessment of the embankment and open cut stability
- Technical description of works for the embankment construction
- Construction drawings
- Technical report
- Bill of Quantities, Budget

Client
J/V KASTOR S.A. – ELTER S.A.

Failure Rehabilitation

Rapsomati Tunnel of Road Axis Tripoli - Kalamata

South Greece

Existing failure of the open cuts with material removal inside the road traffic sidewalk outline

Project
Highway open cuts with significant failures

Construction Cost
Total cost: approx. € 2,4 m.

Project Schedule
Design: 2005
Construction: 2005 - 2006

Project Description
- Demolition of slope support pile wall, which due to failure moved inside the road traffic sidewalk outline
- Design of 2 new pile walls of 80m length in combination with cap beam and wall construction at the face of the pile walls
- Data piles: Φ1,2 of 11m length up to 13m
- Support of the existing slope in which was indicated in progress instability
  Slope length: 250m
  Max. slope height: 11m
- Design of support pile wall of 162m length in combination with cap beam and wall construction at the face of pile walls.
- Data piles: Φ1,2 of 12m length
- Rehabilitation of the existing slope's failure and modulation of new geometry
  Slope length: 600m
  Max. slope height: 35m
- Modulation of new geometry of slopes with gradient 1:2 (height: width), 8m length with intermediate benches of 6m width

Geology
Marls, sand marls
Clayey scree

Support pile wall construction

Our Services
- Detailed geotechnical design
- Geometrical design of rehabilitation works
- Design and dimensioning of support and protection measures
- Execution of stability analyses
- Construction drawings
- Bill of Quantities, Budget

Construction Details
- Installation of rip rap behind the pile walls and the lower open cut bench
- Construction of drainage trenches over the slopes and wholes crown
- Installation of 3-D geogrid against corrosion at the slopes surface, in combination with slopes planting

Client
J/V KASTOR S.A. – ELTER S.A.