Tender Designs of Major Infrastructure Highway Projects
Tunnels & Earthworks (Cuts & Embankments)
of the Comarnic – Brasov Motorway
Romania

Project
Tunnels, cuts and embankments of the Comarnic – Brasov Motorway
Romania.

Construction Cost
Total Cost: approx. € 1.5bn.

Project Schedule
Tender Design: 2013
Construction: 2014 -

Project Description
• Sinaia, Busteni & Predeal Twin Bore Highway Tunnels
  Sinaia length: 5.890m
  Busteni length: 6.200m
  Predeal length: 7.500m
  Excavation cross section: 84m² -132m²
  Effective cross section: 66m² -81m²

  NATM – Mechanical excavation, drilling and blasting

Final Lining
Reinforced concrete

• Highway Cuts and Embankments (Section from Ch. 110+600-168+600)
  Embankments: Ltotal = 26.0km
  Cuts: Ltotal = 11.0km

Geology
• Alluvial deposits, limestones, flysch, marbles, schist
  and conglomerates
• Groundwater
• Max. overburden at the tunnels: 195m – 340m

Our Services
Tender design and preparation of the technical offer on behalf of ViStrAda Nord

Client
ViStrada Nord Consortium (VINCI S.A. - VINCI Construction Grand Projects
S.A.S. - VINCI Construction Terrassement S.A.S. – STRABAG A.G.
- STRABAG S.E. – AKTOR Concessions S.A. - AKTOR S.A.)
Railway Project
Consulting services, technical review and checking of designs and Panagopoula Railway Tunnel associated detailed designs
Athens - Patras High Speed Railway Line, Section Rododafni – Psathopirgos
Greece

Project
• Consulting services, technical review and checking of the designs of the project: “Construction of the New Double High Speed Railway Line at the section Rododafni – Psathopirgos from CH. 91+500 until CH. 113+000 and Panagopoula Railway Tunnel design”.
• Panagopoula railway tunnel detailed designs.

Construction Cost
Total cost: approx. € 293 m.

Project Schedule

Project Description
Consulting services, technical review and checking for the following structures:
• Four (4) Roadway Bridges
• Thirty (30) Railway Bridges
• Fifty (50) Retaining Walls
• Panagopoula twin bore railway tunnel including entrance and exit structures with total length ~8.500m

Panagopoula railway tunnel detailed designs:
• Panagopoula railway tunnel West adit
  Length: 68m, Cross section: 44m², Overburden: 35m
• Panagopoula railway tunnel West adit portal (Length: 18m, Piles Ø 1.20)
• West cavern and cross gallery of Panagopoula railway tunnel
  Length: 52m, Cross section: 77m², Overburden: 62m
• Intermediate cavern and cross gallery of Panagopoula railway tunnel
  Length: 55m, Cross section: 77m², Overburden: 202m

Geology
Quaternary deposits of clayey scree from the marls weathering encountered in the area and pliocene and pleistocene sediments characterized by marls (stiff clays) and conglomerates alternations, limestones, chertstones

Our Services
• Consulting services, review and checking of the designs of the project in order to identify adequacy and incompleteness of the available designs relevant to the projects’ feasibility and constructability
• Detailed design of Panagopoula railway tunnel West adit and portal
• Detailed designs of the intermediate and west caverns and cross galleries of Panagopoula railway tunnel

Clients
• AKTOR S.A. – J&P AVAX S.A. – INTRAKAT S.A. Joint Venture
• AKTOR S.A. – J&P AVAX S.A. Construction Joint Venture
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
AKTOR S.A.
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
Construction: 2013-2014

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
AKTOR S.A.
Highway Embankments – Cuts - Structures
Final geotechnical designs for Poligiros – Uranoupoli Motorway
Greece

Project
Earthworks final geotechnical designs (embankments and cuts) and foundation designs for overpasses, underpasses, culverts, bridges, cut & covers of a 38 km motorway stretch at Poligiros – Uranoupoli motorway, Greece.

Design Cost
Design cost: approx. € 321 k.

Project Schedule
Design: 2010 – on going

Project Description
• Total highway length: 38km
• Embankments’ total length: 1km
• Embankments’ height: 14 – 21m
• Cuts’ total length: 0,5km
• Cuts’ height: 9 - 13m

Geology
Gneisses, peridotites and dunites, recrystallised limestones or marbles, phyllites, red clays, alluvial deposits and alluvial fans

Our Services
• Geotechnical surveys programming
• Geological – geotechnical interpretation and evaluation
• Earthworks final geotechnical designs (cuts and embankments)
• Foundation designs for overpasses, underpasses, bridges, culverts, cut & covers
• Elaboration of technical reports, construction drawings, calculation notes
• The project was undertaken in the frames of the Design Consortium “Prisma Consulting Engineers S.A. – Omikron Kappa Consulting S.A. – Markos Liras – Ioannis Pantekis – Konstantina Michalopoulou”

Client
MINISTRY OF INFRASTRUCTURE, TRANSPORTATION AND NETWORKS (GR)
Highway Cut Slopes

DUBAI – FUJAIRAH FREEWAY

Slope Stability Audit - Slope Stabilization and Rockfall Protection Design, United Arab Emirates

Project
Slope stabilization and rockfall protection design at the Dubai-Fujairah Freeway. Geotechnical evaluation and determination of the required preventative and protective measures, as well as repair and remedial works

Construction Cost
Total cost: approx. 300 m AED

Project Schedule
Design: 2009 - 2010
Construction: 2009 - 2011

Project Description
Assessment of the cut slope stability and determination of the necessary slope stabilization works and rockfall protection measures
Design Length: 22.0 km

Geomorphology - Geology
Mountainous terrain with steep rocky slopes of significant height (exceeding 50m up to 110m)
Ophiolite complex (gabbros, basalts, dunites, peridotites, serpentinites, breccia)

Our Services
• Technical advisor - consultant services and special expertise in geotechnical engineering and rock-soil mechanics
• Geotechnical design
• Identification of the encountered geotechnical problems and evaluation of the potential slope failure mechanisms – elaboration of detailed stability audit
• Execution of stability analysis (planar, wedge, rockfalls, composite failures)
• 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 BOQ’s
• On site technical expertise and consulting services
• Inspection, monitoring and maintenance plan

Construction Details
• Cut slope re-profile
• Scaling works
• Reinforced concrete, shotcrete, anchored buttress
• Pre-stressed anchors
• Rockfall barriers (low, medium, high energy absorption capacity)
• Slope surface stabilization systems (anchored wire mesh, spider net)

Client
UAE - MINISTRY OF PUBLIC WORKS, AL AHMADIAH AKTOR
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.P.P.P.W. - GENERAL SECRETARIAT OF PUBLIC WORKS, GENERAL DEPARTMENT OF TRANSPORTATION WORKS
Highway Cut Slopes

TEMPI VALLEY - Slope Stabilization and Rockfall Protection Detailed Design, PATHE SECTION MALIAKOS – KLEIDI MOTORWAY, CONCESSION PROJECT,
Central Greece

Project
Slope stabilization and rockfall protection detailed design at Tempi Valley (National Roadway of Athens – Thessaloniki)

Construction Cost
Total Cost: approx. 3m. €

Project Schedule
Design: 2008 - 2009
Construction: 2010 - 2011

Project Description
Assessment of the cut slope stability and determination of the necessary slope stabilization works and rockfall protection measures
Length: 5.0km

Geomorphology - Geology
Mountainous terrain, very steep rocky slopes of significant height up to 150m
Thick to medium bedded crystalline limestones, Phyllites, soil like formations (limestone boulders, scree – debris materials)

Our Services
• Detailed geotechnical design
• Identification and evaluation of the potential slope failure mechanisms – elaboration of detailed stability audit
• Execution of stability analysis (rockfalls, planar failure, rock wedge formation, toppling, circular slip failure)
• 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 BoQ’s
• Consulting services during on site application

Construction Details
• Scaling works performed manually or/and with the use of mechanical means
• Installation of approx. 1,900m of rockfall protection barriers
• Installation of approx. 5,500m² slope stabilization systems (fully anchored Tecco type mesh, Spider type net)
• Application of approx. 1,350m of permanent, fully grouted rock bolts
• Rehabilitation of the existing fences and the drainage ditches

Client
MALIAKOS KLEIDI CONSTRUCTION J/V
Highway Cut Slopes

PANTELEIMONAS AREA (PLATAMONAS)

PATHE SECTION MALIAKOS – KLEIDI MOTORWAY, Concession Project, Slope Stabilization and Rockfall Protection Detailed Design

Central Greece

Project
Slope stabilization and rockfall protection detailed design at Panteleimonas area (Platamonas) of the National Roadway Athens – Thessaloniki

Construction Cost
Total Cost: approx. 0.5 m. €

Project Schedule
Design: 2008
Construction: 2010

Project Description
Assessment of the cut slope stability and determination of the necessary stabilization works and rockfall protection measures
Length: 2.5km

Geomorphology - Geology
Steep rocky slopes of average height 10 - 20m
Crystalline Limestones, soil formations (limestone boulders, scree materials)

Our Services
• Detailed geotechnical design
• Identification and evaluation of the potential slope failure mechanisms – elaboration of detailed stability audit
• Execution of stability analysis (rockfalls, wedge failure)
• Determination of the necessary support and 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

Construction Details
• Scaling works performed manually or/and with the use of mechanical means
• Installation of approx. 100m of rockfall protection barriers
• Installation of approx. 2,500m² slope stabilization systems (fully anchored Tecco type mesh, drape, Spider type net)

Client
MALIAKOS KLEIDI CONSTRUCTION JV
Slopes, Cuts and Embankments

Slope Stability Audit of existing highway cuts and embankments
Elefsina – Korinthos – Patras – Pyrgos – Tsakona
Motorway, Concession project
Southern Greece

Project
Detailed design of slope repair and remedial works for the existing embankments and cuts of Elefsina – Korinthos – Patras – Pyrgos – Tsakona Motorway

Construction Costs
Total Costs: approx. € ~5 m €

Project Schedule
Design: 2008 –
Construction: 2009 – 2011

Project Description
Rehabilitation of existing cuts and embankments

Geology
Limestones, marly limestones, conglomerates and artificial embankment bodies

Our Services
• Detailed geotechnical design
• Identification and registration of all problems and hazards
• Geological mapping and assessment of the geotechnical parameters
• Stability analysis to determine the potential failures and to work on the protection measures
• Determination of all necessary protection and rehabilitation measures (installation of rock fall barriers, slope support)
• Construction Drawings
• Bill of Quantities - Budget

Construction Details
• Scaling with the use of light mechanical means
• Installation of rockfall barriers
• Installation of slope protection measures
• Application of permanent rock bolts
• Installation of 3-D protection geogrid
• Application of hydroseeding
• Rehabilitation of damaged drainage culvert
• Construction of drainage ditch at the top of existing retaining wall
• Construction of support walls

Client
APION KLEOS Construction JV
Rockfall Protection
Kakia Skala Section
PATHE Highway
Central Greece

Project
Highway protection from rockfalls

Construction Cost
Total cost: approx. €2 m.

Project Schedule
Design: 2003
Construction: 2003

Project Description
Total length of barriers: approx. 2000m

Geology
Limestones and dolomitic limestones
Very steep morphology

Construction Method
Special barriers installed to prevent rockfalls and to absorb kinetic energy

Our Services
Geotechnical analysis and design of rockfall barriers

Client
AKTOR S.A.

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Rockfall Protection Wall
PATHE Highway, Kakia Skala Section
Central Greece

Project
Rockfall protection wall in a highway

Construction Cost
Total cost: approx. € 0.5m.

Project Schedule
Design: 2003
Construction: 2003 - 2004

Project Description
Rockfall protection wall
Length: 1.455m
Height: 1.80m

Geology
Limestones, scree in a seismically active area

Our Services
Detailed geotechnical & structural design

Construction Details
• Rockfall concrete wall with surface foundation
• 3 typical cross sections

Client
AKTOR S.A.
Confrontation of geotechnical hazards in earthworks

**New National Road Agios Nikolaos – Kalo Chorio**
Crete, Southern Greece

**Project**  
Roadway cuts and embankments

**Construction cost**  
Total cost: approx. € 4 m.

**Project Schedule**  
Design: 2010  
Construction: 2011 –

**Project Description**  
Technical inspection of geotechnical hazards for incomplete earthworks, as well as, for earthworks to be constructed

**Geology**  
Limestones, marls formations, debris materials

**Our Services**  
- Review and technical audit of existing geotechnical designs  
- Geotechnical evaluation of incomplete earthworks  
- Proposal of documented technical design solutions for all the earthworks of the roadway stretch

**Client**  
J/V AKTOR S.A. – ELTER S.A.
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
• Turfgrass 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

Client
J/V KASTOR S.A. – ELTER S.A.
Tender designs – services

Concession project for the Construction, Operation & Maintenance of «Milot-Morine» highway
Albania

Project
Tender design and consultancy services for the Milot – Morine highway with respect to the conditions of the cuts and embankments and the existing Thirra tunnel, as well as, the new construction elements of the highway referring to the earthworks for the dualization of the first section of the highway from Milot to Rreshen and the new twin bore Kukes Tunnel

Construction Cost
Total cost: approx. € 258m

Project Schedule
Design: 2012 - 2013
Construction – Operation - Maintenance: 2013 - 2043

Project Description
• Total highway length: 114km
• Existing cuts max. height: ~170m
• Existing embankments max. height: ~60m
• Existing Thirra tunnel: 2* 5.50km= 11km, effective cross section:61.15m²
• New Kukes Tunnel: 2*250m=500m, effective cross section: 50m²

Geology
Rock formations, mostly ophiolites and limestones, with differential degree of weathering, fracturing and tectonic deformation. Soft rock and soil-like formations are also encountered, especially in the first section from Milot to Reps and the last section from Kukes to Morine

Our Services
• Independent diagnosis on the conditions of the entire existing alignment of the highway with respect to the earthworks and preliminary definition of the required works to decrease the geotechnical risk associated with landslides and rockfalls and the current status of the existing earthworks / environmental concerns – Safety assessment of the existing Thirra tunnel
• Method statement with qualitative future maintenance requirements for the existing earthworks (cuts - embankments) and the existing Thirra tunnel
• Tender designs for the construction elements
• BoQ estimates for the interventions required to decrease the geotechnical risk of the existing earthworks, the new earthworks of the highway section to be dualized and the new Kukes tunnel

Client
• VINCI CONCESSIONS SAS - AKTOR CONCESSIONS S.A.
• AKTOR S.A.
Feasibility Studies and General Design

SEETO Road Route 4 Investment Plan

Feasibility Studies for earthworks (cuts, embankments, ground improvements, rock fall & avalanches), tunnels and other structures

Montenegro

Project
Feasibility studies and general design for Road Route 4 connecting the port of Bar with Corridor 10 in Serbia.

Part of Montenegro's highway network lies on Route 4 stretch of the core road network defined by the South East Europe Transport Observatory (SEETO). SEETO road route 4 runs for 597 km between Vatin (Romanian border) – Belgrade (Serbia) – Podgorica (Montenegro) - Bar (Montenegro). The Montenegrin portion, runs for about 180 km, generally North – South, from the Serbian border to the coast at Djurmani where it intersects SEETO road route 1, or Adriatic highway.

Design: 2012-2013

Project Description
Feasibility studies and general designs for the alternative alignments of the project, for earthworks (cuts, embankments, ground improvements, rock fall & avalanches), the tunnels (approx. 29 km of road tunnels per branch with cross section approx. 90-120 m²) and other structures.

Geology
At the beginning of the route mainly limestone and dolomite formations with some conglomerates and peridotites. After Uvac and up to the Serbian border, the geology changes and flysch, clayey marls, sandstone formations and marly limestones are met.

Our Services
- Inception report
- Geotechnical surveys
- Preliminary geotechnical designs
- General geotechnical design and Bidding documents for the construction works
- Operations & maintenance plan
- Environmental and social impact assessments according to the Montenegrin law and the IFIs requirements

Client
- MINISTRY OF TRANSPORT & MARITIME AFFAIRS-MONTENEGRO
- EBRD FINANCED PROJECT
- URS SCOTT WILSON – UK
Cuts, Embankments, MSEW, Culverts, Retaining Structures, Drainage – Hydraulic Works, Ground Improvement Works

Construction of Segment No 1 in Tirana-Elbasan Road (Km 0 till Krabbe Tunnel Entrance Km 13) / FIDIC Conditions of Contract, Albania

Project
Highway earthworks, retaining structures, culverts, hydraulic works

Construction Cost
Total cost: approx. 84m $

Project Schedule
Design - Construction: 2012-2013

Project Description
Final detailed designs of permanent open cuts, embankments, mechanically stabilized earth walls, retaining structures, culverts, gabion walls, piles, dewatering-drainage measures, ground improvement, treatment & rehabilitation works

Embankments: Ltotal = 10km, Hmax = 50.0m
Cuts: Ltotal = 7.5km, Hmax = 60.0m
MSEW: Ltotal = 2.5km, Hmax = 30.0m
Pile walls: Ltotal = 0.7km, Hmax = 22.0m
Gabion walls: Ltotal = 1.5km, Hmax = 7.0m
Culverts: Ltotal = 1.0km, Smax = 2x(3.0mx4.0m)

Geology
Mollasic formations (sandstone, siltstone, conglomerates), Quaternary deposits (silt, clay, sand, gravels, limestone and sandstone boulders)

Our Services
• Detailed geotechnical, structural & foundation designs
• Geotechnical interpretation reports. Evaluation of the in situ conditions, establishment of the foundation profile, the geotechnical engineering properties, the design parameters and loads
• Execution of stability analysis checks under the provisions of International Standards and Guidelines (BS standards, Eurocodes, AASHTO standards), e.g. rotational check, sliding, bearing capacity, settlement, overturning, planar failure, wedge failure etc.
• Detailed dimensioning of the earthworks and structures and determination of the necessary reinforcements, retaining, supports and stabilization measures (strength, bearing capacity, spacing, length, technical specs of material, quality & durability needs)
• Elaboration of technical reports, detailed construction drawings, calculation notes, instrumentation-geotechnical monitoring reports
• Quality, longevity & serviceability assurance of the designed works
• Constructability issues, technical specifications, requirements, construction standards & guidelines
• Designer on site services & Technical Consultancy Services

Construction Details
• Geogrid reinforcement elements, MSEW facing with Terramesh system or gabions, drainage foundation improvement layers, permanent rockbolts-soil nails, pre-stressed anchors, concrete pile walls, gabion walls, reno mattresses, separation geotextiles, drainage holes, drainage ditches, slope erosion protection geomats, steel wire mesh, thickened hydroseeding, monitoring instruments

Client
JV AKTOR – COPRI (Albania)

Construction works

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Cuts, Embankments, MSEW, Culverts, Retaining Structures, Drainage – Hydraulic Works, Ground Improvement Works

Construction of Segment No 3 in Tirana-Elbasan Road (Krabbe Tunnel Exit Km 15.2 till Elbasan city Km 27) / FIDIC Conditions of Contract, Albania

Project
Highway earthworks, retaining structures, culverts, hydraulic works

Construction Cost
Total cost: approx. 86m $

Project Schedule
Design - Construction: 2012-2013

Project Description
Final detailed designs of permanent open cuts, mechanically stabilized earth walls, embankments, retaining structures, culverts, gabion walls, piles, dewatering-drainage measures, ground improvement, treatment & rehabilitation works

Embankments: $L_{total} = 10.0\, \text{km}, H_{max} = 40.0\, \text{m}$
Cuts: $L_{total} = 5.0\, \text{km}, H_{max} = 60.0\, \text{m}$
MSEW: $L_{total} = 1.0\, \text{km}, H_{max} = 20.0\, \text{m}$
Gabion walls: $L_{total} = 0.35\, \text{km}, H_{max} = 9.0\, \text{m}$
Culverts: $L_{total} = 0.5\, \text{km}, S_{max} = 2.0\, \text{m} \times 2.5\, \text{m}$

Geology
Mollasic formations (sandstone, siltstone, conglomerates), Quaternary deposits (silt, clay, sand, gravels, limestone and sandstone boulders)

Our Services
- Detailed geotechnical, structural & foundation designs
- Geotechnical interpretation reports. Evaluation of the in situ conditions and establishment of the foundation profile, the geotechnical engineering properties, the design parameters and loads
- Execution of stability analysis checks under the provisions of International Standards and Guidelines (BS standards, Eurocodes, AASHTO standards), e.g. rotational check, sliding, bearing capacity, settlement, overturning, planar failure, wedge failure etc.
- Detailed dimensioning of the earthworks and structures and determination of the necessary reinforcements, retaining, supports and stabilization measures (strength, bearing capacity, spacing, length, technical specs of material, quality & durability needs)
- Elaboration of technical reports, detailed construction drawings, calculation notes, instrumentation-geotechnical monitoring reports
- Quality, longevity & serviceability assurance of the designed works
- Constructability issues, technical specifications, requirements, construction standards & guidelines
- Designer on site services & Technical Consultancy Services

Construction Details
- Geogrid reinforcement elements, MSEW facing with Terramesh system or gabions, drainage foundation improvement layers, permanent rockbolts-soil nails, pre-stressed anchors, concrete pile walls, gabion walls, reno mattresses, separation geotextiles, drainage holes, drainage ditches, slope erosion protection geomats, steel wire mesh, thickened hydroseeding, monitoring instruments

Client
JV AKTOR – COPRI (Albania)

Construction Works

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Highway Embankments
“Construction of “Struma” Lot 4 Highway, section “Sandanski-Kulata” from km 423+800 to km 438+500, Bulgaria”
Bulgaria

Project
Final designs, techniques, mechanical mixing guidelines and documentation for the construction of the embankments of the motorway project “Struma” Lot 4, section “Sandanski-Kulata” from km 423+800 to km 438+500, Bulgaria

Construction Cost
Total cost: approx. € 35m

Project Schedule
Design: 2012- 2013
Construction: 2012- 2013

Project Description
Earthworks aggregate excavation volume 2,000,000m³ and embankment fills volume 1,700,000m³ (out of which an important portion consists of upgrading the existing alignment through lateral extension to a four lanes motorway)
Embankments mainly low in height
Max. embankment height: 8m

Geology
Alignment crossing plains featured with alluvial deposits (consisting of clays, silts and sands and mixtures) and hills of weathered peridotites

Our Services
• Evaluation of available laboratory tests on the parent (“unsuitable”) soil materials for embankment’s fill use
• Evaluation of available laboratory tests on the potential “borrow” materials for embankment’s fill use
• Substantiated design, for mechanical mixing of the “unsuitable” materials of the project with the “borrow” materials (mixing proportions, laboratory tests, field trials etc.)
• Substantiated design for the construction of two (2) test embankments and monitoring instrumentation program
• Interpretation of the monitoring results of the two test embankments

Client
AKTOR JOINT-STOCK CONSTRUCTION COMPANY
Railway Project

Railway Embankments Design for the New Double High Speed Railway Line Liakokladi - Domokos
Central Greece

Project
Designs of reinforced embankments for the project: “Design of infrastructure works from CH 25+000 until CH 52+000 of the New Double High Speed Railway Line at the section Liakokladi – Domokos”

Project Schedule
Design: 2007 - 2009
Construction: 2008 - 2011

Project Description
Total length of excavation works: 4000m
**Embankments**: soil or rock fill material reinforced with geogrids
Modulation geometry: one or double sided
Reinforced slopes with gradient 2:3
Deck width: 13.0m – 13.5 m
Maximum height: 20m

Geology
Recent disposals, scree, serpentinized peridodites, limestone’s flysh formations, weathered mantle, schistosed serpentinites, ophicalcites (encountered as highly weathered or as rocky formations)

Our Services
• Detailed design
• Construction drawings

Construction Details
• Construction of drainage – foundation improvement layer and application of separation geotextile
• Construction of embankments with soil fill materials
• Foundation of the embankments with reinforced geogrids
• Installation of 3-D protection geogrid for slope protection

Client
Construction J/V AKTOR S.A. - Terna S.A.
Railway Project – Subbase and Trackbed Reinforcement

Earthworks at North Portal of Kallidromo Railway Tunnel of the New Double High Speed Railway Line Tithorea - Lianokladi

Fthiotida Providence, Komnina Region

Project
Subbase and trackbed reinforcement of the new double track high speed railway line Tithorea-Lianokladi at section 14+300 – 19+000

Construction Cost
Total Cost: approx. 1,2 m. €

Project Schedule
Design: 2009 - 2010
Construction: 2011 -

Project Description
Determination of the subbase requirements of the new double track high speed railway line Tithorea-Lianokladi at section 14+300 – 19+000

Geomorphology – Geology
• Clayey-marl formations, with scattered intercalations of sandy-marl
• The presence of the sand layers in combination with the inclination of the layers acts as a water bank, creating confined water masses of high capacity and hydrostatic pressure
• During slope excavation, intense water flow was monitored from the sand layers of the “champagne” effect type and creation of mudflow

Our Services
• Investigation of the in-situ geotechnical conditions of the subbase
• Qualitative classification of the subbase according to UIC719R 2008
• Selection of the required subbase reinforcement according to UIC719R 2008
• Appropriate reinforcement of the subbase with geogrids and soil replacement in sections of the project where the minimum requirements of the UIC719R 2008 are not met.

Client
Earthworks at North Portal of Kallidromo Railway Tunnel
Fthiotida Providence, Komnina Region

Project
Landslide rehabilitation and slope protection in 3 areas of the project
from Ch. 15+365 up to Ch. 15+665
from Ch. 15+710 up to Ch. 15+835
from Ch. 16+651 up to Ch. 16+804

Construction Cost
Total Cost: approx. 4 m. €

Project Schedule
Design: 2009 - 2010
Construction: 2011 -

Project Description
Works for the stabilization of the landslide phenomena and the final rehabilitation of the area, taking into account the in-situ conditions and minimizing any destabilization risks.
Total affected area ~ 28,000m²

Geology
• Clayey-marl formations, with scattered intercalations of sandy-marl
• The presence of the sand layers in combination with the inclination of the layers acts as a water bank, creating confined water masses of high capacity and hydrostatic pressure
• During slope excavation, intense water flow was monitored from the sand layers of the "champagne" effect type and creation of mudflow

Our Services
• Geotechnical investigation program and geotechnical interpretation of the landsliding mechanism
• Drainage works design
• Design of the best possible slope layout and removal of the landslide materials
• Stabilization and rehabilitation embankments
• Landslide retaining pilewalls
• Long-term anticorrosion slope protection
• Execution of back analysis and determination of the potential sliding surfaces

Design Details
• Excavation layout for partial removal of landslide material on 1:3 slopes
• Geometrical and reinforcement calculation of the necessary pilewall systems for the protection of the excavations and strengthening of the subbase
• Application of reinforced embankment for stabilization and rehabilitation of the area with 1:3 slope
• Application of 3D geocomposite and adequate hydraulic protection of the slopes

Client
Technical Works
Retaining Walls with Strip Foundation
Elefsina – Korinthos – Patra – Pyrgos – Tsakona Motorway, Concession Project
Central & Southern Greece

Project
Retaining walls at embankments’ toes
Retaining structures at open cuts’ toes

Construction Cost
Total cost: approx. € 8m.

Project Schedule
Design: 2009 - 2011
Construction: 2009 -

Project Description
Retaining walls
Total length: 2.290m
Height: 2.0m-9.75m
Retaining structures
Total length: 820m
Height: 2.0m-8.00m

Geology
Marls, conglomerates, limestones, scree materials, alluvial deposits, gravels, clays, silts, sands

Our Services
• Estimation of the input geotechnical design parameters
• Definition of the geometry of the structures (cross section, height etc.)
• Elaboration of all the necessary analysis and checks for structures dimensioning
• Detailed construction drawings
• Detailed geotechnical & structural design

Construction Details
• Reinforced concrete C20/25, C30/37
• Surface foundation
• Additional components at walls crest (safety barriers, sound barriers etc.)

Clients
• APION KLEOS Construction JV
• OLYMPIA JOINT VENTURE
(HOCHTIEF Construction AG - AKTOR S.A.)
• AKTOR S.A.
• VINCI CONSTRUCTION GRANDS PROJETS S.A.S.
Technical Works
Underpasses
Elefsina – Korinthos – Patra – Pyrgos – Tsakona Motorway, Concession Project
Central & Southern Greece

Project
Detailed design of nineteen (19) Underpasses

Construction Cost
Total cost: approx. € 6.5m.

Project Schedule
Design: 2009 - 2011
Construction: 2009 -

Project Description
Three (3) types of underpasses
• Underpasses founded in two cast in situ reinforced concrete pile series
• Underpasses with surface (pad) foundation (box type)
• Underpasses consisting of two wall-type abutments founded in reinforced concrete piles

Geology
Conglomerates, marls, scree materials, alluvial deposits, gravels, clays, silts, sands

Our Services
• Estimation of the geotechnical design parameters and the maximum groundwater level
• Definition of the geometry of the underpasses (cross section, height etc.)
• Elaboration of all the necessary analysis and checks for structures dimensioning
• Detailed construction drawings
• Detailed geotechnical & structural design

Construction Details
• Reinforced concrete C20/25, C30/37
• Surface foundation
• Foundation in piles

Clients
• OLYMPIA JOINT VENTURE (HOCHTIEF Construction AG – AKTOR S.A.)
• AKTOR S.A.
Special Geotechnical Applications

Reinforced Embankment Final Designs and Mechanically Stabilized Earth Wall Detailed Designs Elefsina – Korinthos – Patras – Pyrgos - Tsakona Motorway, Concession Project
Central & Southern Greece

Project
Detailed designs of mechanically stabilized earth walls with height up to 15m and reinforced embankments of height up to 26m for treating with adverse geometries during the construction of highway embankments

Construction Cost
Total project's cost: approx. € 80 m.

Project Schedule
Design: 2009 - 2010
Construction: -

Project Description
Total reinforced embankment and MSEW length: ~8300m
Maximum height: 26m
MSEW slope: 1:1 up to vertical
Reinforced embankment slope: 2:3 up to 1:1

Geology
Pliocene and Plio-pleistocene Marls, Conglomerates, Alternations of Marl-Conglomerates, Alluvial Deposits, Weathered slope materials, Sands, Gravels, Clay-Silts

Our Services
• Geotechnical interpretation and design parameter assessment
• Stability evaluation of MSEW with specialized software
• Internal and external stability checks
• Appropriate geogrid application according to fill material characteristics
• Gabion walls layout in geometrically complex areas
• Detailed design

Client
AKTOR S.A.
Special Geotechnical Applications

Complex Retaining Systems and Structures
Elefsina – Korinthos – Patras – Pyrgos - Tsakona
Motorway, Concession Project
Central & Southern Greece

Project
Detailed designs for construction of retaining wall system with single or double pile-walls and application of permanent prestressed anchors for the secure execution of highway works in adverse geotechnical and geometrical areas

Construction Cost
Total project’s cost: approx. € 9 m.

Project Schedule
Design: 2009 - 2011
Construction: -

Project Description
Total length of complex retaining systems: ~1000m
Maximum height of retaining systems: 35 m

Geology
Pliocene and Plio-pleistocene Marls, Conglomerates, Alternations of Marl-Conglomerates, Alluvial Deposits, Weathered slope materials, Sands, Gravels, Clay-Silts

Our Services
• Geotechnical interpretation and design parameter assessment
• Geotechnical parameters optimization with slope stability back analysis
• Specific load check of the retaining system from random sliding surfaces
• Serviceability check of the retaining system
• Check and dimensioning of prestressed anchors according to EC7
• Assessment and determination of the seismic load according to the area’s geotechnical profile
• Detailed design

Clients
• OLYMPIA JOINT VENTURE
  (HOCHTIEF Construction AG - AKTOR S.A.)
• AKTOR S.A.

Retaining wall at geometrically adverse areas cross section

Composite retaining system with prestressed anchors cross section

Composite triple retaining system with prestessed anchors cross section
Highway General Excavation Works

Earthworks Designs
Elefsina – Korinthos – Patras – Pyrgos - Tsakona Motorway, Concession Project, Central & Southern Greece

Project
Detailed geotechnical earthwork designs in the Korinthos – Patras stretch from C.P. 20 up to C.P. 80 (Cuts & Embankments)

Construction Cost
Total project's cost: approx. €180 m.

Project Schedule
Design: 2008 - 2011
Construction: 2008 -

Project Description

Total length of Excavation Works
Cuts: 12,000m
Bare or partially reinforced embankments: 23,000 m

Open Cuts:
• Slope layout and reinforcement of open cuts
• Use of fully grouted permanent or prestressed anchors
• Slopes with gradient 1:2.3–1:3.1
• Maximum slope height: 12m
• Maximum total cut height: 65m

Embankments:
• Soil fill material
• Bare or partially reinforced embankments with geogrids due to seismic design
• Modulation Geometry: one or double sided
• Slopes with gradient 2:3
• Deck width: 30m - 50m
• Maximum height: 14m

Geology
Pliocene and Plio-pleistocene Marls, Conglomerates, Alternations of Marl-Conglomerates, Alluvial Deposits, Weathered slope materials, Sands, Gravels, Clay-Silt, Limestones

Our Services
• Geotechnical interpretation and design parameter assessment
• Geotechnical parameters optimization with slope stability back analysis
• Stability evaluation with specialized software
• Appropriate geogrid application according to fill material characteristics
• Check and dimensioning of prestressed anchors according to EC7
• Assessment and determination of the seismic load according to the area's geotechnical profile
• Application of geocomposites for hydraulic erosion control as well as rock barrier – rock fall systems
• Detailed design

Clients
• OLYMPIA JOINT VENTURE (HOCHTIEF Construction AG – AKTOR S.A.)
• AKTOR S.A.

OMIKRONKAPPA Consulting

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Highway General Excavation Works

Highway Excavation Works, PATHE SECTION, Maliakos – Kleidi Motorway, Concession Project
Central Greece

Project
Highway excavation works for Maliakos Kleidi Motorway GU 10 ~ 14, GU 16 ~ 19, GU 24 ~ 25

Construction Cost
Total Cost: approx. € ~600 m.

Project Schedule
Design: 2007 - 2009
Construction: 2007-

Project Description
Total length of excavation works:
GU 10 ~ 14: 5,350m /
GU 16 ~ 19: 6,050m / GU 24 ~ 25: 17,200m
1. Embankments: soil fill or rock fill material reinforced or loose with geogrids
   Modulation geometry: one or double sided
   Reinforced slopes with gradient 2:1 ~ 2.3
   Deck width: 30m - 50 m
   Maximum Height: 11m
2. Open Cuts: Modulation and support of open cuts
   Slopes with gradient 2:3
   Maximum height: 10m

Geology
GU 10 ~ 14: Recent disposals, Phyllites
GU 16 ~ 19: Recent Disposals, ophiolithic sequence, Limestones, marbles
GU 24 ~ 25: Disposals, ophiolithic sequence

Our Services
• Ground geotechnical interpretation report
• Geotechnical drawings of longitudinal and cross sections
• Detailed geotechnical design
• Construction drawings

Construction Details
1. Embankments:
   • Construction of drainage trenches at the foot of the slope
   • Construction of embankments with soil fill or rock fill materials
   • Foundation of the embankments with reinforced geogrids
   • Construction of support walls
   • Construction of embankments with severe gradient and gabion facing
   • Foundation of the embankments with the use of piles
2. Open Cuts:
   • Installation of anchors
   • Installation of meshes
   • Construction of support walls

Client
MALIAKOS KLEIDI CONSTRUCTION JV
Special Geotechnical Applications

Retaining Works inside a Landslided Area
Pathe Section Maliakos – Kleidi Motorway,
Concession Project
Central Greece

Project
Construction of retaining wall system with single or double
pile-walls for the secure execution of highway works inside
landslied area

Construction Cost
Total project’s cost: approx. €1.5 m.

Project Schedule
Design: 2010 - 2011
Construction: -

Project Description
Construction of retaining wall system with single or double
concrete cantilever pilewalls for the secure execution of
highway works inside a landslided area
Total length of pilewall system: ~300m
Maximum height of pilewall system: 10m
Total slope height: 30m

Geology
The bedrock of the landslide area includes ophiolite rocks
The overlying soil materials consist of a sequence of slided
masses

Our Services – Design Details
• Detailed design of permanent open cut
• Geotechnical interpretation and design parameter
  assessment
• Special design and dimensioning of the pile system with
  finite elements software
• Specific load check of the retaining system from random
  sliding surfaces
• Serviceability check of the retaining system
• Assessment and determination of the landslided area’s
  seismic load

Client
MALIAKOS KLEIDI CONSTRUCTION JV
(HOCHTIEF - AKTOR - J&P AVAX - VINCI CGP - AEGEK -
ATHENA)
Special Geotechnical Applications

Embankment Designs with lightweight materials,
Pathe Section Maliakos – Kleidi Motorway,
Concession Project
Central Greece

**Project**
Bridge replacement by Embankment with lightweight materials (EPS) in combination with special protection structures for the protection of the central natural gas pipeline and the high speed railway line from Athens to Thessaloniki

**Construction Cost**
Total project’s cost: approx. € 18 m.

**Project Schedule**
Design: 2009 - 2011
Construction: -

**Project Description**
Combination of conventional and lightweight embankment with EPS application for the protection of the central natural gas pipeline and the high speed railway line from Athens to Thessaloniki and optimization of the construction conditions
Total embankment length: ~700m
Total lightweight embankment length: ~120m
Maximum lightweight embankment height: 10-16m
Lightweight embankment slopes: 2:3 up to vertical

**Geology**
Alluvial deposits, silt-clay of low to medium plasticity
Bedrock formation from weathered layers of amphibolitic schist

**Our Services – Design Details**
- Detailed geotechnical design
- Geotechnical investigation and pile loading tests
- Trial embankment monitoring for a 3-month time period
- Technoeconomic design for minimizing construction cost
- Geotechnical foundation design and optimization of the protection structures of the central natural gas pipeline, the National Road and the high speed railway from Athens to Thessaloniki
- Structural and seismic protection design of the conventional and lightweight embankment
- Design of retaining wall for lightweight and conventional embankment with mixed foundation on piles and slab-type footing

**Client**
AKTOR S.A.
Special Geotechnical Applications

Mechanically Stabilized Earth Walls
Pathe Section Maliakos – Kleidi Motorway, Concession Project
Central Greece

Project
Mechanically stabilized earth walls with height 10-16m constructed by gabions as retaining walls or bridge abutments

Construction Cost
Total project’s cost: approx. € 5 m.

Project Schedule
Design: 2009 - 2011
Construction: 2011 –

Project Description
Mechanically stabilized earth walls with height 10-16m constructed by gabions as retaining walls or bridge abutments
Total MSEW length: ~500m
Maximum height: 10-16m
MSEW slope: 85° up to vertical

Geology
GU 10 ~ 14: Recent deposits, Phyllites
GU 16 ~ 19: Recent deposits, ophiolithic sequence, limestones

Our Services – Design Details
• Detailed geotechnical design
• Geotechnical interpretation and design parameter assessment
• Stability evaluation of MSEW with specialized software
• Internal and External stability checks
• Appropriate geogrid application according to fill material characteristics
• Gabion modulation in geometrically complex areas

Client
MALIAKOS KLEIDI CONSTRUCTION J/V

MSEW foundation area excavation layout

Grid and gabion connection plan view and details

MSEW bridge abutment longitudinal section
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

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.
Excavation Works

Metsovo Connecting Road
Egnatia Highway, Section 3.2 – 3.3
Northern Greece

Project
Highway general excavation works

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

Project Schedule
Design: 2000 - 2001
Construction: 2003 - 2005

Project Description
Permanent one-sided and two-sided slopes with support measures and retaining walls, according to the stability conditions
Max. length: 430m
Max. height: 11m - 40m

Geology
Flysch formation consisting of thick - bedded sandstones, siltstones and red pelites

Our Services
Detailed geotechnical & structural design

Construction Details
• Design of special rockfall protection barriers
• Installation of prestressed anchors and special grids for the protection of the slopes against corrosion
• Design of retaining walls and pile walls

Client
EGNATIA ODOS S.A.
Railway Excavation Works

Railway Cut Design

High Speed Railway Line, PATHE Axis, Kakia Skala Section
Central Greece

Project
Excavation of permanent slopes for the high speed railway line

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

Project Schedule
Design: 2002
Construction: 2002-2003

Project Description
Length: 100m
Max. height: 40m
Modulation geometry:
4 slopes with gradient 3:1 and intermediate benches with 4m width

Construction Method
Mechanical excavation due to the vicinity with the existing railway line

Geology
• Brecciated limestones, in a seismically active area
• Steep morphology with loose limestone blocks, probably unstable

Our Services
• Detailed geotechnical design
• Construction drawings

Construction Details
• Elaboration of a special excavation method in distinct phases with application of rockbolts in the ground of each excavation phase
• Design of rockfall barriers
• Protection wall and special barriers installed to prevent rockfalls and to absorb kinetic energy, for the protection of the existing Railway Line
• Design of prestressed anchors for the support of the permanent slopes

Client
ALTE S.A.
Excavation Works
Egnatia Highway, Section 5.2 – 5.3
Northern Greece

Project
General excavation works for the foundation of bridges

Construction Cost
Total cost: approx. € 0.3 m.

Project Schedule
Design: 2002
Construction: 2002

Project Description
Modulation of slopes of height up to 15m

Geology
Blocky phyllites, sandstones and limestones

Our Services
Detailed geotechnical design of excavation and support

Construction Details
• Installation of prestressed anchors
• Installation of geobrugg TECCO grids for the protection against corrosion of the slopes and to prevent loose material movement

Client
AKTOR S.A.
Highway Embankment

High Embankment of Metsovo Interchange
Egnatia Highway, Section 3.2
Northern Greece

Project
Highway embankment

Construction Cost
Total cost: approx. € 1,0 m.

Project Schedule
Design: 2000
Construction: 2002-2005

Project Description
Reinforced embankment with gabions combined with geogrids
Modulation geometry:
• Modulation of reinforced slopes with gradient 2:1 & 1:1
• All other slopes were modulated with gradient 1:2
  Length: 110m
  Max. width: 90m
  Max. height: 50m

Geology
Flysch formation consisting of thick – bedded sandstones and red pelites

Our Services
• Detailed geotechnical design
• Construction drawings

Construction Details
• Construction of the embankment with use of sandstone material
• Strength of geogrids 400KNm
• Gabions dimensions 1m x 1m x 2m & 1m x 0,5m x 2m
• Length of the reinforcement bars 20m & 25m

Client
EGNATIA ODOS S.A.
Embankments
Egnatia Highway, Section 5.2-5.3
Northern Greece

Project
Highway embankments

Construction Cost
Total cost: approx. € from 0.15 to 0.6 m.

Project Schedule
Design: 2001-2002
Construction: 2000-2003

Project Description
Embankments constructed with rock fill or reinforced with geotextiles, geogrids and preconstructed elements
Maximum heights: 30-70m

Geology
Phyllites, travertine, sandstones

Our Services
Detailed geotechnical design

Clients
• AKTOR S.A.
• AEGEK S.A.

G6 rock fill embankment, maximum height 50m

G3 reinforced embankment, maximum height 70m

Reinforced earth embankment constructed with travertine materials and preconstructed reinforced elements, maximum height 38m

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Fax: + 30 210 6837499, e-mail: info@omikronkappa.gr, www.omikronkappa.gr
**Highway Embankment**

**G3 Embankment**

**Egnatia Highway, Section 5.2-5.3**

Northern Greece

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**Project**
Highway embankment

**Construction Cost**
Total cost: approx. € 0.6 m.

**Project Schedule**
Design: 2001
Construction: 2002-2003

**Project Description**
Reinforced embankment with geotextiles

Modulation geometry:
- Slopes with gradient 2:3 in the lower 25m
- Slopes with gradient 1:1 with benches per 10m of slope height, up to the embankment crest
  - Length: 140m
  - Width: 50m
  - Max. height: 70m

**Geology**
Phyllites, sandstones, schists

**Our Services**
- Detailed geotechnical design
- Construction drawings

**Construction Details**
- Placement of reinforced earth in the upper three slopes of the embankment
- Maximum length of geotextiles 50m
- Placement of geotextiles per 0.5m up to 1.0m

**Client**
AEGEK S.A.
Highway Embankment
Travertine Embankment
Egnatia Highway, Section 5.2-5.3
Northern Greece

**Project**
Highway embankment

**Construction Cost**
Total cost: approx. € 0.4 m.

**Project Schedule**
Design: 2000
Construction: 2000 - 2002

**Project Description**
Reinforced embankment with pre-constructed elements
Modulation Geometry:
Slopes with gradient 2:3
Vertical slope of reinforced earth with height 10m
Length: 180m
Width: 30m
Max height: 38m

**Geology**
Travertine, loose soil materials

**Our Services**
- Detailed geotechnical design
- Construction drawings

**Construction Details**
- Embankment construction with travertine materials
- Use of reinforced earth of VSL type constituted of steel bars and pre-constructed concrete elements
- Reinforced earth length 10m
- Placement of reinforcements per 75cm

**Client**
AKTOR S.A.
Highway Embankment
Asomaton Embankment
Egnatia Highway, Section 5.2-5.3
Northern Greece

Project
Highway embankment

Construction Cost
Total cost: approx. € 1 m.

Project Schedule
Design: 2003
Construction: 2003 -2004

Project Description
Two-sided soil embankment for the replacement of a previous – failed embankment
Modulation geometry:
One slope with gradient 1:3 (upstream section) and with gradient 2:3 (downstream section)
Length: 90m
Width: 27m
Max. height: 25m

Geology
Travertine, peridotite, loose soil materials, groundwater flows

Our Services
• Detailed geotechnical design
• Final geological and hydrogeological design
• Evaluation of previous failure
• Design of foundation works for the new embankment
• Design and support of the new embankment

Construction Details
• Embankment foundation in one row of piles Ø1,00/1,30, with 16m length combined with cap beam, in the area of the failure surface
• Construction of a riprap layer of thickness 1,5m in the embankment base for the drainage of the groundwater

Client
AKTOR S.A.
Highway Embankment
G6 Embankment
Egnatia Highway, Section 5.2-5.3
Northern Greece

Project
Highway embankment

Construction Cost
Total cost: approx. € 0.15 m.

Project Schedule
Design: 2000
Construction: 2001-2002

Project Description
Rock fill embankment
Modulation Geometry
Slopes with gradient 2:3 of maximum height 20m
with intermediate bench with 4m width
Length: 141m
Width: 40m
Max. height: 50m

Geology
Alterations of gneisses and mica schists

Our Services
• Detailed geotechnical design
• Construction drawings

Client
AEGEK 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)

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

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

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.
Special Geotechnical Applications

Jet Grouting Diaphragm Wall
Egnatia Highway, Section 2.4 – 3.1
Northern Greece

Project
Jet grouting diaphragm wall, for the reduction of water inflows in order to construct the foundations of M2 to M6 piers of T10 bridge at Metsovitikos River

Construction Cost
Total cost: approx. €6 m.

Project Schedule
Design: 2007
Construction: 2007-2008

Project Description
• Jet grouting diaphragmatic wall with secant ground piles
• Central diaphragm wall, with 3 rows ground piles
• 4 additional diaphragm walls at the foundation areas of the piers
• Diameter: Ø 80, Length 10m-20m
• Total walls length: 365m

Geology
• Riverbed deposits (sands, breccia argillaceous materials)
• Conglomerates with high permeability
• High river flood discharge
• High groundwater table

Our Services
Detailed geotechnical design

Construction Details
• Dam construction for the arrangement of the riverbed
• Rip - rap construction for the protection of the main diaphragm wall

Client
AKTOR S.A.
Highway Works
Earth and Structural Works
Romania
Central Europe

Project
Technical & earthworks in a 60km road

Construction Cost
Total cost: approx. € 4 m.

Project Schedule
Design: 2005
Construction: 2005 – today

Project Description
• Retaining walls
• Pilewalls
• Reinforced embankments
• Stream bed modulations with gabions
• Slope support

Our Services
• Audit of existing designs
• Elaboration of construction method statements

Clients
• AKTOR S.A.
• MOCHLOS S.A.
Underground Parking

Store Building with two underground parking facilities

Attiki

Project
2-floor underground parking facilities in 2-floor store building

Construction Cost
Total cost: approx. € 0.3 m.

Project Schedule
Design: 2005
Construction: 2005 - 2006

Project Description
Length: 65m
Width: 40m
Depth: 8m

Construction Method
Pile anchored walls
Modulation of excavation slopes with gradient 1:1 in 1 or 2 benches

Geology
Soil materials (clay, clayey sand)
Clayey marl
Aquifer

Our Services
• Detailed design
• Construction drawings of the retaining structures

Construction Details
• Construction of 3 pile walls: 15m up to 29m length with reinforced concrete piles Φ0.8 of total length 6-8m, in combination with cap beams of height 1.1m and width 0.9m
• Installation of shotcrete over the piles surface
• Construction of drainage wholes
• Construction of 6 pumping shafts with cross section Φ800

Client
AKTOR S.A.
Underground Parking
Viohalko Building
Athens, Greece

Project
Underground parking facilities in nine-floor building

Construction Cost
Total cost: approx. € 15 m.

Project Schedule
Design: 2003
Construction: 2003-2004

Project Description
Width: 37m
Total length: 100m
Depth: 28m

Construction Method
Retaining structure with pile walls and prestressed anchors

Geology
Man-made deposits, soils, Athenian schist

Our Services
Detailed geotechnical design

Client
ELLINIKI TECHNODOMIKI S.A.
Underground Parking
Building IONIA S.A.
Athens

Project
3-floor underground parking facilities in a 4-floor building

Construction Cost
Total cost: approx. € 15 m.

Project Schedule
Design: 2005
Construction: 2005

Project Description
Width: 48m
Length: 53m
Depth: 13m

Construction Method
Pile anchored wall

Geology
Man made deposits, soil materials

Our Services
• Detailed design
• Construction drawings of the retaining structures

Construction Details
• Retaining structures with steel piles Ø600
  consisted of pair of steel beams and reinforced concrete piles Ø800
• Placement of 2 to 3 rows of prestressed anchors with length 10m to 21m with 1 or 2 tendons Ø0.6”,
  connected with horizontal beams UPN 200

Client
AKTOR S.A.
Culvert

Culvert OA9

PATHE Highway, Kakia Skala Section
Central Greece

Project
Highway hydraulic work

Construction Cost
Total cost: approx. € 0.21 m.

Project Schedule
Design: 2003
Construction: 2003 - 2004

Project Description
Rectangular culvert
Length: 79m (closed cross section)
37m (open cross section)
Height: 2.0m
Width: 2.5m

Geology
Limestones
Seismically active area

Our Services
Detailed geotechnical & structural design

Client
AKTOR S.A.
Culvert
Culvert OA3
PATHE Highway, Kakia Skala Section
Central Greece

Project
Highway hydraulic work

Construction Cost
Total cost: approx. € 0.4 m.

Project Schedule
Design: 2003
Construction: 2003 - 2004

Project Description
Rectangular culvert
Upstream section:
Length: 221m (closed cross section)
11m (open cross section)
Height: 2.5m
Width: 2.0m

Downstream section:
Length: 30m (closed cross section)
45m (open cross section)
Height: 2.5m-7.6m
Width: 2.0m

Geology
Limestones
Seismically active area

Our Services
Detailed geotechnical & structural design

Client
AKTOR S.A.