

# Highway Tunnels

## AS1, AS2 & AS3 Tunnels

### Pathe Highway, Section Kakia Skala

Central Greece

#### Project

Highway tunnels

#### Construction Cost

Total cost: approx. € 97 m.

#### Project Schedule

Design: 2000-2003

Construction: 2000-2004

#### Project Description

- Twin bore highway tunnels (AS1 & AS2)

Total length: 3050m

Cross section: 192m<sup>2</sup>

- Single tunnel (AS3)

Length: 1100m

Cross section: 192m<sup>2</sup>

#### Method of tunnel excavation

NATM – Drilling and blasting

#### Final Lining

Reinforced concrete C20/25

#### Geology

Limestones, scree, in a seismically active area

Max. overburden: 200m

#### Our Services

- Final geotechnical & structural design
- Final structural design jointly elaborated by OMIKRON KAPPA CONSULTING & EDR GmbH, Munich

#### Construction Details

Design of special reinforced concrete structure (RCS) and special reinforced concrete structure with polystyrene (RCSP) for the completion of AS1 tunnel cross section, due to steep morphology and vicinity to existing highway

#### Client

AKTOR S.A.



AS1 Tunnel, right bore (Gerania)



AS2 Tunnel, right bore (Efpalinos)



AS3 Tunnel (Ethra)

## Cut & Cover

# Landscape Rehabilitation of Tunnels portals

Greece

### Project

Cut & Cover structures for the landscape rehabilitation of tunnels portals

### Construction Cost

Total cost: approx. € 1-4 m.

### Project Schedule

Design: 2000 - 2005

Construction: 2000 - 2005

### Project Description

Cut & Cover

Total Length: 5 - 120m

Cross section of horseshoe type

### Geology

Schists, limestones

Weak overthrust materials, sandstones

Siltstones

Groundwater

### Our Services

- Detailed geotechnical & structural design
- Designs jointly elaborated by OMIKRON KAPPA CONSULTING & EDR GmbH, Munich

### Clients

- EGNATIA ODOS S.A.
- AKTOR S.A.
- AEGEK S.A.
- EFKLIDIS S.A.
- J&P-AVAX(HELLAS) S.A.



AS1 tunnel entrance portal structure / cut & cover (Highway PATHE, Kakia Skala section)



S1 tunnel entrance portal cut & cover (Egnatia Odos, section 5.2-5.3)



Agios Nikolaos entrance portals cut & cover structures (Egnatia Odos, section 3.3)

# Highway Bridge

## AG2 Bridge

### Pathe Highway, Kakia Skala Section

Central Greece

#### Project

Highway bridge

#### Construction Cost

Total cost: approx. € 2,7 m.

#### Project Schedule

Design: 2003  
Construction: 2003-2004

#### Project Description

Length: 107m

#### Construction Method

The bridge consists of 2 parts:

- Part 1 is the main bridge with length approx. 62m constructed with prestressed beams and three piers
- Part 2 is the transition part before the 1<sup>st</sup> pier with length 45m

#### Geology

Brecciated limestones, in a seismically active area

#### Our Services

Detailed geotechnical & structural design

#### Construction Details

All piers and the transition part were founded on piles

#### Client

AKTOR S.A.



Transition part construction



Prestressed beams construction



Bridge view after construction

# 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.



# 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

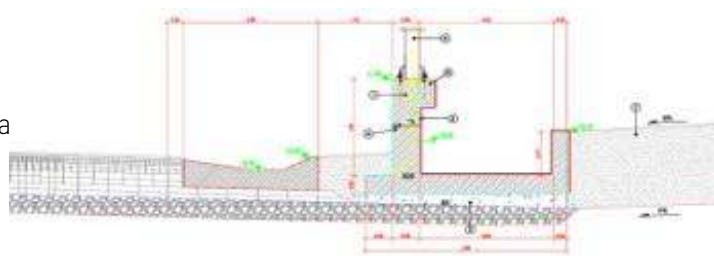
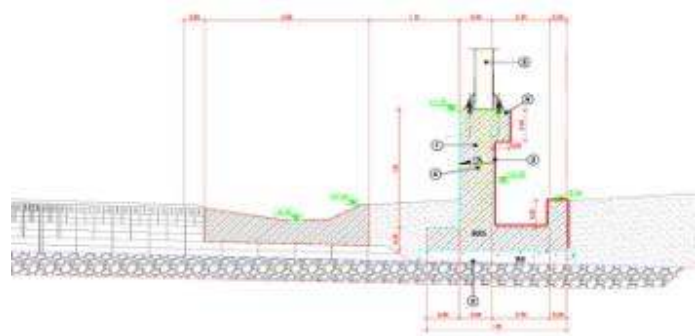
Detailed geotechnical & structural design

### Construction Details

- Rockfall concrete wall with surface foundation
- 3 typical cross sections

### Client

AKTOR S.A.



Typical cross sections

# Retaining Wall

## Retaining Wall T16

### PATHE Highway, Kakia Skala Section

Central Greece

#### Project

Retaining wall for the protection of the highway

#### Construction Cost

Total cost: approx. € 2,1m.

#### Project Schedule

Design: 2003  
Construction: 2003 - 2004

#### Project Description

Retaining wall  
Length: 375m  
Height: 2,0m-9,75m

#### Geology

Limestones, scree in a seismically active area

#### Our Services

Detailed geotechnical & structural design

#### Construction Details

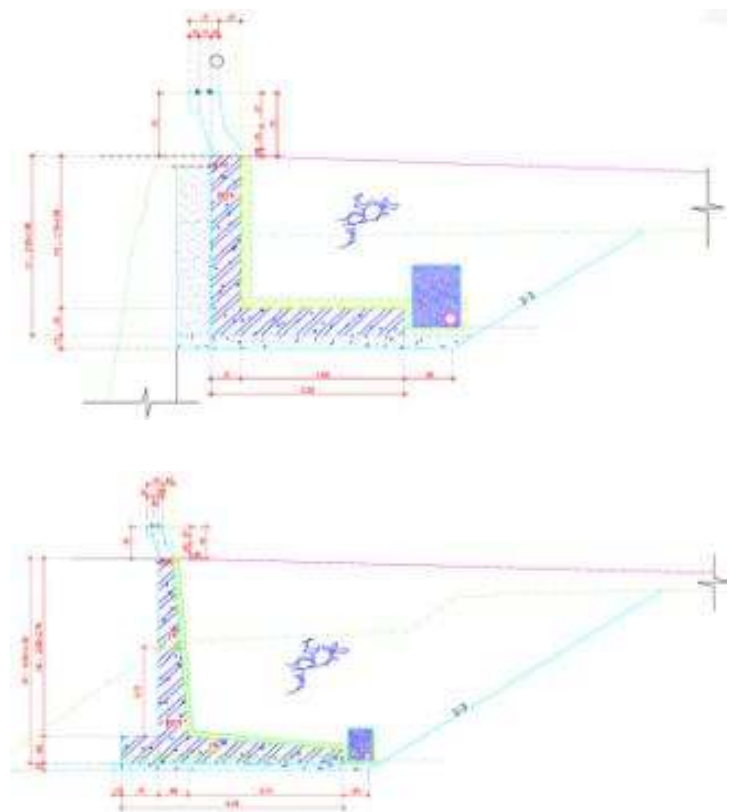
- 32 concrete sections
- Surface foundation in 16 sections
- Pile foundation in 6 sections

#### Client

AKTOR S.A.



Piles construction for the foundation of a retaining wall



Typical cross sections

# Culvert

## Culvert OA3

### PATHE Highway, Kakia Skala Section

Central Greece

#### Project

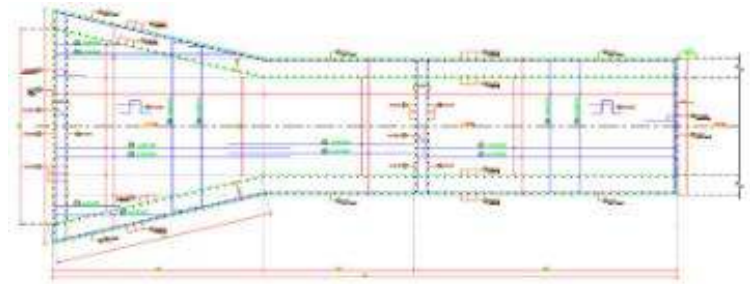
Highway hydraulic work

#### Construction Cost

Total cost: approx. € 0.4 m.

#### Project Schedule

Design: 2003  
Construction: 2003 - 2004



Culvert plan view

#### Project Description

Rectangular culvert

Upstream section:

Length: 221m (closed cross section)  
11m (open cross section)

Height: 2.5m

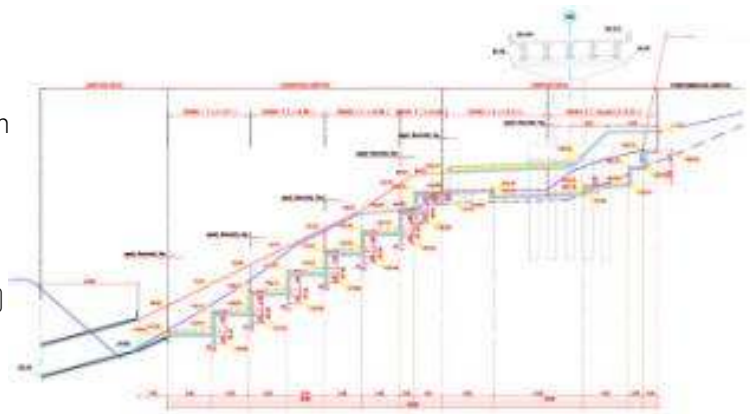
Width: 2.0m

Downstream section:

Length: 30m (closed cross section)  
45m (open cross section)

Height: 2.5m-7.6m

Width: 2.0m



Culvert longitudinal section

#### Geology

Limestones

Seismically active area

#### Our Services

Detailed geotechnical & structural design

#### 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

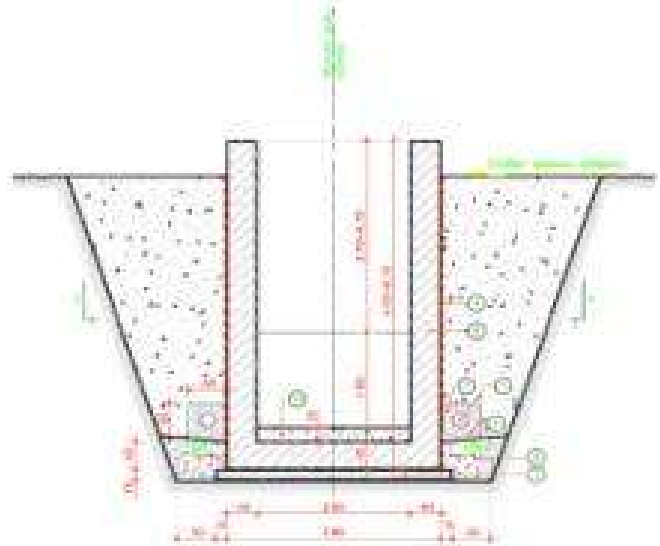
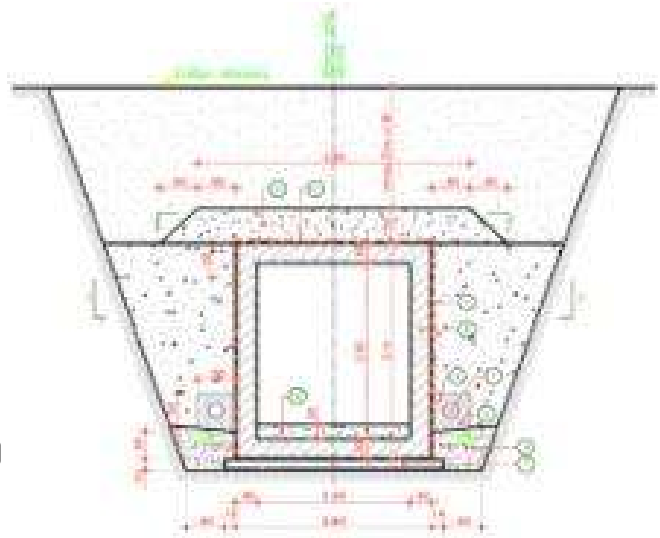
Seismically active area

#### Our Services

Detailed geotechnical & structural design

#### Client

AKTOR S.A.



Open and closed type culvert typical cross sections



# 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

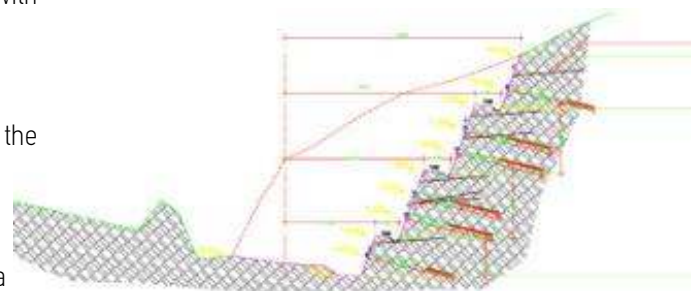
- Elaboration of a special excavation method in distinct phases with application of rockbolts in the ground of each excavation phase
- Design of rockfall barriers
- Protection wall and special barriers installed to prevent rockfalls and to absorb kinetic energy, for the protection of the existing Railway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

## Client

ALTE S.A.



Slopes view during construction



Typical cross section