

DESIGN AND CONSTRUCTION OF HIGHWAYS IN GREECE: THE CASE OF EGNATIA ODOS MOTORWAY IN NORTHERN GREECE

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1. THE EGNATIA ODOS MOTORWAY PROJECT

1.1 Significance

The Egnatia Motorway and its vertical axes are the backbone of Northern Greece transport system. **670 km** long, it is the first high standard road axis that runs “horizontally” through Greece from Igoumenitsa to Kipoi-Evros. It shortens distances and brings areas like Epirus, Western Macedonia and Thrace out of their isolation. It multiplies investment in transport, industry and tourism and links the industrial centres of the West and the East.

The Egnatia Motorway is the most important modern infrastructure project concerning the development and communication of our country with Europe, the Balkans and Asia Minor. It is part of the Trans-European Transportation Network and one of the 14 priority projects in the European Union. The Egnatia Motorway is also a collector route for the Balkan and South-eastern European transport system. Pan-European Corridors IV (Berlin - Sofia - Thessaloniki), IX (Helsinki - Alexandroupolis) and X (Vienna - Belgrade - Thessaloniki) all end at the Egnatia Motorway.

The Egnatia Motorway is connected with 4 ports, 6 airports and 9 vertical axes that ensure access to the countries of South-Eastern Europe.

Along its route, one can meet areas of exquisite natural beauty (e.g. the mountainous areas of Northern Pindos, the wetlands of Aliakmonas, Strimonas, Nestos and Evros Rivers, and Koroneia and Volvi Lakes) and of unique historic importance (e.g. the archaeological site of Dodoni, the remains of ancient Egnatia etc).

1.2 Technical Characteristics

The Egnatia Motorway is a highway of international standards crossing Northern Greece “horizontally”, from Igoumenitsa to Kipi, Evros. Its total length is **670 km** and its cross section **24.5m** (22 m in mountainous areas). It is a dual carriageway separated by a median, with two traffic lanes and a hard shoulder per direction, except for a 45 km long section (Klidi – Thessaloniki – Derveni) that has three traffic lanes and a hard shoulder per carriageway.

Tunnels

When complete, the Egnatia Motorway will have a total of 74 road tunnels of an overall combined axis length of 50 km (**100 km** measured as single bore). This means that 7% of the overall length of the motorway will be carried through tunnels. Their construction cost-including all E&M systems- amounts to 30% of the total estimated construction cost.

The majority will be bored tunnels, while in certain cases the cut-and-cover construction is applied. 15 of these tunnels are classed as large, with lengths ranging from 800 m to 4.6 km. All tunnels are twin-bore ones. Each traffic direction is carried through a separate bore and a main consideration in their design is the provision for cross passages connecting the tunnel bores to ensure safe passage in case of a fire emergency. Special emphasis is laid on the installation of a high standard monitoring and control system, which will ensure the safe operation of tunnels.

LONG TUNNELS ON THE EGNATIA MOTORWAY

Region	Tunnel Name	Length (m)
Epirus	Dodoni	3,350
Epirus	Driskos	4,590
Epirus	T8	2,635
Epirus	Krimnos	1,080
Epirus	Neo Anilio	2,135
Epirus	Metsovo	3,550
Thessaly	Panagia	2,700
Western Macedonia	Syrto	1,500
Western Macedonia	Koiloma	1,080
Central Macedonia	S10 (Kastania)	2,240
Central Macedonia	Paggaio	1,100

Bridge Structures

Along the axis of the Egnatia Motorway there are about 1.670 structures; 490 of them are ravine bridges, valley bridges and over/underpasses, while 1.180 constitute small culverts of a span of up to 6 m. The major structures of the axis comprise bridges with an overall combined axis length of 40 km (**80 km** measured as single branch). Many of these bridges have special features, such as lengths of 1.000 m., individual spans up to 235 m and pier heights of 110 m.

Region	Structure Name	Carriageway length/max span (m)	Height (m)
Epirus	Aracthos	1.000/142	80
Thrace	Nestos	450/40	10
Macedonia	Greveniotikos	920/100	40
Epirus	Krystallopigi	850/55	30
Epirus	Metsovitikos	540/235	100
Epirus	Votonosi	490/230	53
Epirus	Megalorema	480/45	28
Macedonia	G12 (section Polymylos-Lefkopetra)	465/110	90
Thrace	Lissos	450/45	15
Epirus	Mesovouni	260/100	30

1.3 Other Projects

EGNATIA OΔOS A.E. has undertaken, in parallel with the main motorway, the design and construction management of three, out of nine, main vertical axes which link the Egnatia Motorway with Albania and Bulgaria.

Specifically, the three main vertical axes, **300 km** long, are:

1. **Siatista – Krystallopigi** (Albania – Branch of Pan-European Axis VIII), motorway, 80 km long, € 280 M cost.
2. **Thessaloniki – Serres – Promachon** (Bulgaria – Pan-European Corridor IV), motorway, 96 km long, € 290 M cost.
3. **Ardanio – Ormenio** (Bulgaria – Pan-European Corridor IX), express-way, 124 km long, € 240 M cost.

Apart from the above, EGNATIA OΔOS A.E. has also been awarded the execution of works in the area of Thessaloniki (such as the upgrading of Junctions on the Eastern Ring Road), as well as interventions in the existing national or provincial road network connected to the Egnatia Motorway (such as the works on the Chalkidiki axis, the improvement of the coastline alignment of Strymonas – N. Peramos section etc).

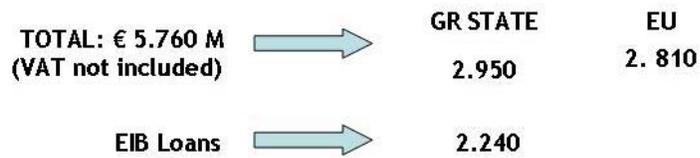
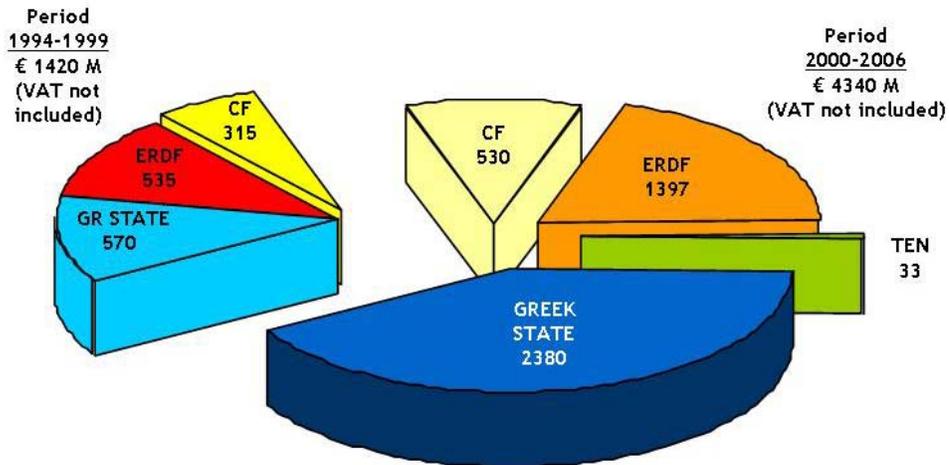
1.4 Project Cost & Funding

The total cost of the **670 km** long Egnatia Motorway amounts to € 5.000 M (without VAT).

The construction cost of the three basic vertical axes (**300 km** long) and the rest of the company projects amounts to € 760 M.

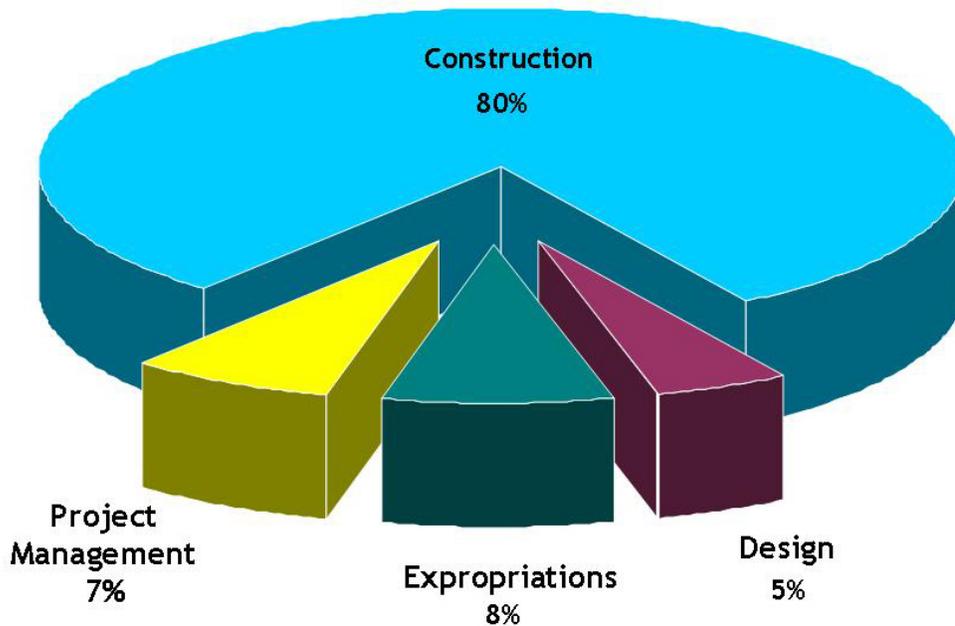
The above projects, the **total budget** of which amounts to € 5.760 M ,or **€ 6.770 M, (VAT included)**, have been co-funded by **European Funds** (European Regional Development Fund and Cohesion Fund) with the amount of **€ 2.810 M**. At the same time the national contribution to the project has been covered by the **European Investment Bank**, which granted to the Greek State six loans amounting to **€ 2.240 M**.

PROJECT FUNDING



COST ANALYSIS

Total cost: € 5.760 M (without VAT) / € 6.770 M (VAT included)

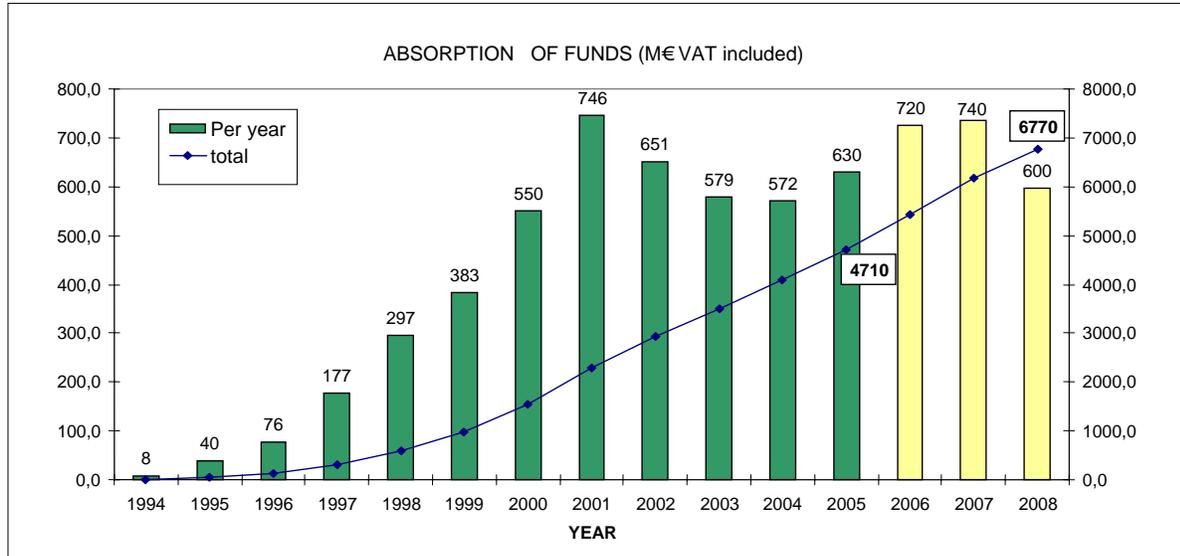


1.5 Progress

The following tables and diagram present the progress of the project and the annual rate of total fund absorption.

EGNATIA MOTORWAY	Length in kms	Total cost (M€ - VAT incl.)
Section constructed before 1994 (common section with PATHE)	25	
Projects after 1997 – Egnatia Odos A.E. responsibility Program funded by CFS II & CFS III		
Completed and opened to traffic (October 2006)	446	2.880
Under construction (will be completed and opened to traffic in 2006)	34	3.020
Other sections under construction	165	
TOTAL OF THE MAIN AXIS	670	5.900

VERTICAL AXES	Length in km	Cost (M€ - VAT incl.)
Sections constructed before 1994 (MEPPPW)	24	
Projects after 1997 – Egnatia Odos A.E. responsibility		
Completed and opened to traffic (October 2006)	64	195
Sections under construction	143	465
Under design existing national road to be upgraded (CSF IV)	69	150
TOTAL OF THE AXES	300	810



2. THE COMPANY "EGNATIA ODOS S.A."

The Company was established under the provisions of art. 5, L. 2229/94. It is a legal entity governed by private law in the form of a Société Anonyme with the Greek State (Ministry for the Environment, Physical Planning and Public Works) being the sole shareholder.

The decision for the establishment of the company was a result of discussions carried out between the Greek Government and the European Community during the preparatory phase of the CSF II (1994-1999). The public Sociétés Anonymes were instituted by Law 2229/94 (article 5). It was jointly decided by both parties (the Greek Government and the EU) that the materialization of large infrastructure projects supported by EU funds could not become a reality without modernizing the Greek public works production structures.

The responsibility for the materialisation of the Egnatia Motorway project was assigned to the Company in February 1997; at that time, the Company also undertook the responsibility for all the works that were currently in progress.

The **Objectives** of the Company, according to the articles of association, are:

- to **design, manage, supervise, construct, maintain, organize, equip and operate** the **Egnatia axis** from Igoumenitsa to Kipi, the road network generally connecting or servicing, directly or indirectly, the above axis, as well as other road works in Greece or abroad.
- to **award**, in part or as a whole, to third parties, the design, construction, expansion of the axis or sections of the axis through concession, in compliance with the standing provisions, as well as to supervise and monitor the execution of associated contracts and to check respective designs.
- to **undertake** the execution of **other projects** after the issuing of the Ministerial Decision.
- To **prepare recommendations** and advise on issues related to all of the above.

The Company is managed by a nine-member **Board of Directors**.

According to the Articles of Association, the day to day running of the Company is carried out by a 5-member Managing Committee. This comprises, the Chairman and Vice Chairman of the Board of Directors, the CEO, the General Manager and the Head of the Project Manager's Team.

As shown in its Organisation Chart, the Company comprises five administrative divisions corresponding to five groups of company actions, namely (1) the project materialisation, (2) the planning, project finance and project controls, (3) the operation and maintenance of the axis, (4) the support services provided and the technology used, and (5) the financial management and the exploitation of the axis.

2.1 Project Manager

For the management of the project that was funded by CSF II, the Company has from the very start (22.11.95) concluded a Project Management contract with the company "Brown & Root", which later was succeeded by "Kellogg Brown & Root" following an international competition. In the context of this contract, approximately 25 executives of the project manager were integrated into the Corporate Organisation Chart. The role of the PM, according to the corporate organization chart in force, is central to decision-making and planning issues, as well as to the proper implementation of the Quality Assurance System adopted by the company.

2.2 Construction Management

Since December 1996, for the supervision of CSF II works, the Company concluded contracts with three Construction Managers, one for each geographic region of the project (east, central, west).

In 2004, the company proceeded to a strategic decision; to assign construction management duties to specially established units within the company that would comprise company personnel and external consultants. Thus, the management of construction is now carried out by the company itself.

2.3 Funding the company

The funding for the projects and the company operation is achieved through successive increases of the Capital Stock, which is supported by the national Public Investment Program.

3. PROJECT AND DESIGN MANAGEMENT FRAMEWORK

The project management framework adopted by the Company, the Project Managers and the Construction Managers is based on the company "Regulations", the "Quality Management System", which satisfies the standard of the Hellenic Organisation for Standardisation (ELOT Standard, EN ISO 9001:2000), and a series of decisions taken by the Board of Directors concerning the method of exercising their responsibilities.

The observance of the management framework aims at ensuring the good management of the Company and the project, minimizing the risk of illegal practices and actions and minimizing the probability of failures in the design and construction contracts.

3.1 Quality Assurance – Audits

To ensure quality in the performance of the Company activities and the project execution, EGNATIA ODOS A.E. applies a substantiated “Quality Management System” (QMS), which was re-evaluated in July 2006 and the company was certified anew for another three-year period by the Hellenic Organisation for Standardisation (ELOT Standard, EN ISO 9001:2000). The QMS includes a Quality Manual, Operating Procedures and Work Instructions.

Regarding the observance of the Company Regulation and legislation in general, as well as the way of operating and managing the design and construction contracts, the Company is subjected to external audits conducted by the funding agencies of the European Community, agencies of the Greek government and private agencies authorised by the Greek Government.

Through the “Quality Management System”, the company has established a series of internal audits pertaining to the quality management of the project under construction and the due application of the company procedures.

Finally, through the Health & Safety Unit, the Company audits the observance of the relevant regulations on all sites of the project. Corrective action is taken following recommendations made by checkers.

3.2 Awarding Procedures

Aiming at the effective and uniform management of the awarding procedures applied for the construction of the Egnatia Motorway and its Vertical Axes, “EGNATIA ODOS AE” established a flexible decision-making scheme within the lines of the existing legal framework, introduced a series of innovations in the management of its designs and works.

The Company adopted standard highway construction specifications as imposed by modern construction practices and international safety regulations. With regard to the award of works contracts, clear requirements were set for the engineering experience and financial capacity of candidates, in order to ensure their ability to meet their contractual obligations within a framework of competition principals. Furthermore, in order to minimise contract failure risks, the Company established and standardised a series of supporting tendering documents clearly laying out its requirements as far as construction is concerned. These documents mainly aim at ensuring the prompt completion of contracts within specified cost limits and the immediate opening of operational road sections to traffic thus safeguarding that value for money principles are observed in the project.

3.3 The Management of Designs

In its effort to systematize design works and provide guidance to its Designers, so that designs are conducted and checked in a uniform manner, the Company established a set of Guidelines for Conducting Road Works Designs (O.S.M.E.O).

In addition, EGNATIA ODOS A.E., in cooperation with Greek and foreign experts, introduced and applied Landscape Guidelines (O.S.A.T.) to lay down the obligations of designers and constructors in minimising the impact of the motorway construction on the environment.

EOAE adopted the establishment of standard designs for small structures (culverts and Retaining Walls), tunnel details and E/M installations, Tunnel Service Buildings and architectural designs for tunnel portals.

Furthermore, innovative organisational schemes were introduced, such as the involvement of design checkers, external design managers and experts in addressing and solving demanding problems.

Finally, since 1997, the Company established the policy of call-up contracts for the preparation and checking of designs. According to this, design contractors are selected on the basis of a general description of the design's thematic scope via international competitions. Framework contracts are immediately signed, yet, the contract is actually awarded as soon as the need arises for conducting or reviewing a design. Specific contractual scopes are awarded through respective work orders, which also constitute a specific financial commitment. This policy minimised the time required for the award of designs, allowed for the immediate addressing of design problems arising during construction and made it possible to select adequate designers for specific design scopes.

3.4 The Environment & Cultural Heritage along the motorway

The successive natural and manmade environments along the project are exceptionally diverse. The Egnatia Motorway runs through Greek landscapes of exquisite beauty and ecological importance. Its alignment follows the Ancient Roman Via Egnatia. Along this ancient route, within an approx. 1000 meters zone, 270 sites of historical interest have been identified, while, in its vicinity, significant archaeological sites and natural resources of critical importance are located. The Egnatia Motorway runs through Pindos and other Greek mountains and reveals a variety of exceptionally interesting geological formations, valleys and ravines.

EGNATIA ODOS A.E. proceeded to actions aiming at the protection and preservation of the cultural heritage of Greece, as well as at its enhancement, when this is feasible.

Along its route, 270 sites of historical interest have been identified. EGNATIA ODOS A.E. has already financed more than 45 archaeological excavations along the axis at a cost amounting to € 11.5 million. The finds unearthed are significant and date back to various historical eras. In several cases, the motorway alignment was either changed or improved with costs amounting to € 80 million.

Thus, EGNATIA ODOS A.E. has already financed **more than 7%** of the total budget for the **Environment & Cultural Heritage** frameworks.

3.5 Project Monitoring & Modern Project Management Systems

In its effort to achieve the time-effective construction of such a large and significant project, "EGNATIA ODOS AE" introduced in the production process a number of innovations.

From the very beginning and in compliance with the methods and practices followed worldwide, the Company adopted and implemented advanced project monitoring and management systems.

The bulk of information produced at different levels of project administration is huge and diverse, while its monitoring, collection and processing is of uppermost necessity for the control and rational management of the project. Equally significant is the need to be able to integrate and use this information in responding to the requirements and demands of the Company Administration, its Shareholder and the funding bodies.

A notable innovation introduced in the Company organisational structure is the setting up of special units that support the project and are fully responsible for the collection, classification, storage, processing and distribution of information. Information management is effected through advanced information systems and special applications.

Within this framework, the Company developed and now successfully uses the following Project Monitoring Information Systems:

1. Electronic Management System for Documents and Designs (Primavera Expedition)
2. System for Cost Control & Contract Management (Primavera Expedition)
3. Project Planning (Primavera Project Planner)
4. Integrated Project Information System (PIS)
5. Geographical Information System (GIS)

3.6 Monitoring of Funding

The “EGNATIA ODOS experience in managing the Community Programs that fund the project is vast. The Company prepares and forwards to the competent Managing Authorities funding requests and project technical sheets. It prepares funding proposals to the Public Investment Program. It is responsible for preparing applications for loan granting by the European Investment Bank (EIB).

3.7 Operation – Exploitation - Maintenance

Parallel to the management of design and construction, “EGNATIA ODOS AE” is responsible for the operation, maintenance and exploitation of the motorway for a time period of 50 years. For the safe operation of the motorway and the management of traffic, the company has adopted telematic systems supported by adequate information systems. “EGNATIA ODOS AE” was the first body in Greece to prepare a Maintenance Manual and relevant technical instructions. In addition, it is planned to install 5 Motorway Administrations Centres (MAC) together with secondary MAC along the whole axis length.

For the provision of services to the road users, it is intended to construct in stages Service Areas at 17 locations and Rest Areas at 23 locations along the motorway.

4. OTHER ACTIVITIES

EGNATIA ODOS A.E. is a dynamic organization equipped with an efficient organisational structure, advanced know-how, modern management tools, a long experience in cooperating with expert foreign construction companies and International Organisations, and executive officers with expertise in the management of large projects; these

advantages render it an organisation fully competent of undertaking the project and construction management of other infrastructures both in Greece and abroad.

Eloquent examples of how the company capabilities in the time-effective and efficient management of a project are acknowledged constitute two decisions issued by the Greek Government. The first decision assigned to the Company the restoration of the damages caused by the floods on the Cycladic Islands (19 islands) in February 2003. Restoration works budgeted at more than € 50 M were executed both with high-quality standards and under very strict deadlines.

The second decision concerned the assignment of activities within the framework of intergovernmental cooperation with neighboring countries, such as the management of four major highways designs in Albania, which were funded by the General Secretariat for International Economic Relations.

Recently, EGNATIA ODOS A.E. was assigned the responsibility of completing the design, awarding procedure and construction of projects in three more vertical axes (Komotini – Nymfaia – Greek-Bulgarian borders, Xanthi – Ehinós – Greek-Bulgarian borders and Florina – Niki – FYROM borders).

Parallel to its main activities, the company participates in the Managing Committee for the development of the European Transport Corridor Thessaloniki – Istanbul and is fully responsible for the operation of the competent Technical Secretariat for Road (www.etcti.org). The decision for the Corridor development was the result of an agreement between the Ministers of Transport & Telecommunications of Greece and Turkey, ratified by the Memorandum of Understanding signed in 2004. The project is concerned with the road connection between Thessaloniki and Istanbul by expanding the Egnatia Motorway, and the upgrading of the existing railway connection between Greece and Turkey.

4.1 Observatory of the Egnatia Motorway spatial impacts

In order to study the impact of the motorway operation in Northern Greece, the company established the Observatory of Spatial Impact (<http://observatory.egnatia.gr>).

The Observatory allows the recording of traffic data, environmental impact, economic and social changes and subsequently the scientific analysis and evaluation of the Motorway's impact on the areas affected by its operation.

4.2 Production and management of corporate knowledge

During the design, construction and operation of a technical project, the companies involved in the production process have the opportunity to accumulate a plethora of knowledge that is usually obtained at great human and financial cost. In our country, very few technical companies and organizations have the infrastructure for systematically capturing, acquiring, converting and integrating that knowledge or have any interest in doing so.

Egnatia Odos A.E. has systematically worked for the production of company knowledge in four directions:

- Design and Construction of Projects
- Protection of the Environment and Cultural Heritage
- Road Operation and Maintenance
- Decision-Making Support Systems

One of the Company top priorities is to diffuse its corporate knowledge to the technical industry of this country, as this knowledge was obtained with the financial contribution of the Greek people.

Today, many Company innovations constitute a current practice in various Bodies, Sociétés Anonymes of the Public Sector, and the MEPPW.

5. FINAL REMARKS

“EGNATIA ODOS AE” has a vision; not to be restricted to this major project but rather seeks to be established as a decentralized organization implementing modern infrastructures in Northern Greece and the Balkans.

Based in Northern Greece, the Company virtually implements decentralization of decisions and offers further possibility for the development of the northern Greece potential.

The good reputation the company has built has allowed it to dynamically assert the undertaking of new projects therefore securing its viability.

“EGNATIA ODOS AE” not only wishes but is also able to successfully undertake the implementation and management of large-scale Construction Projects.