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Landscape Design for Egnatia Highway an Infrastructure Project in Northern Greece

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LANDSCAPE DESIGN FOR EGNATIA HIGHWAY AN INFRASTRUCTURE PROJECT IN NORTHERN GREECE

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BIOGRAPHY

DEGREES

- BSc in Forestry – Environmental Studies (Aristotelian University of Thessaloniki)
- Master of Landscape Design (M.L.D.) (University of Newcastle Upon Tyne)
- PhD in Landscape Design (Aristotelian University of Thessaloniki)

PROFESSIONAL EXPERIENCE

1) 1991 to 2000 : Researcher by Aristotelian University of Thessaloniki in the field of Landscape Design and Urban Forestry (by participation in many research projects funded by various Public Sector bodies) and Freelancer professional Landscape Architect specialising in:

- **Environmental Impact Assesment Studies** in transportation works
- **Landscape Design Projects** in
  - **(a)** *public, urban, thematical, ecotouristic parks,*
  - **(b)** Botanical gardens,
  - **(c)** Estate, country and urban gardens
  - **(d)** Transportation networks

2) 1998 to 2001: Consultant and member of staff EGNATIA ODOS A.E. The Egnatia Road constitutes a part of Transpeuropean Network and is one of the fourteen priority projects of the European Union, constructed for the development of Greece and its communication, with Europe and the Balkans. I have experienced there as supervising landscape architect, consultant in Landscape Design projects, preparing a large number of feasibilty studies, supervising native plant production in the nurseries, supervising environmental assesment studies e.t.c

3) 2000 to 2001: Lecturer in the Open University of Greece and in Technological Educational Institute (Environmental Department)

PARTICIPATION IN SCIENTIFIC PROFESSIONAL ASSOCIATIONS

- Geotechnical Chamber of Greece
- Panellenic Chamber Landscape Architects
- International Association of Landscape Architects(IFLA)
- International Association of Erosion Control(IAEC)

PUBLISHED PAPERS

I have published a number of papers in several congress, symposiums and conferences and journals among them is IFLA Central Regional Symposium of Athens at 8-10 September 1998.

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1. INTRODUCTION

The Egnatia Motorway was designed according to the specifications of the Trans-European road network. It is a closed double carriageway motorway 680 kilometres long, with two lanes plus an emergency lane on either side of the central reserve, for a total paved width of 24.5 metres. Egnatia motorway is managed by "EGNATIA ODOS AE". "EGNATIA ODOS AE" was created by a joint European/Greek decision within the framework of the 2nd Community Support Framework, to serve as an motive power of development in Northern Greece, and thus for the entire country. It is a Public Corporation that operates with private sector criteria, under the superintendence of the Ministry of Environment, Planning and Public Works. The Project management and construction have been contracted out to International Firms experienced in the handling and supervision of large-scale projects.

On a national level, the Egnatia Motorway will be the trunk of Northern Greece's transport system, and a gateway opened to the isolated provinces of Epirus, Western Macedonia and Thrace. It will provide opportunities for new investment in sectors like transport (e.g. freight stations), tourism and industry, and will serve as an axis of development for the whole Northern Greece.

On a European level, the Egnatia Motorway unites the industrial centres of the East with those of the West. The bigger a political and economic structure grows, the greater the need for radial channels of communication leading out of the centre - the modern-day Rome - towards the distant regions. This is why the European Union is investing so heavily in the Egnatia Motorway. For the European Union, the Egnatia Motorway is a priority project, one of the fourteen Trans-European Network projects.

The Egnatia Motorway will also be a collector route for the Balkan and Southeastern European transport system. Trans-European Corridors IV (Berlin - Sofia - Thessaloniki), IX (Helsinki - Alexandroupoli) and X (Vienna - Belgrade - Thessaloniki) all end at Egnatia Road, which is in addition extended in nine vertical axes linking Greece with the Balkans (Albania, FYROM, Bulgaria) and Turkey.

This motorway is of tremendous geostrategic importance for the entire region. Three major traffic-generating areas, namely the Black Sea, the Aegean (Eastern Mediterranean) and the Adriatic/ Ionian Seas, will be linked by a quadrangle formed by the Egnatia, two of its vertical axes (Ardanio - Ormenio - Burgas and Siatista - Krystallopigi - Pogradec - Tirana - Durres), and Trans-European Corridor VIII (Durres - Skopje - Sofia - Burgas). Although the construction of Corridor VIII has been held up by the lack of financing and the political instability in the region, the immediate construction of the other three sides of this quadrangle will foster substantial development in the transport sector.

2. EGNATIA ODOS AND THE LANDSCAPE

The Egnatia Motorway is one of the first large-scale public works to apply a system of Landscape

and environmental management, that is, a method of organising and implementing environmental protection measures. From one end of the motorway to the other, through a variable landscape, which consists of the mountains of Pindus and the plains of Macedonia and Thrace, the successive natural and man-made landscapes are exceptionally diverse (see figures 1,3).

The Egnatia Motorway is constructed steadily and methodically, and is the first highway in Greece to be designed and built from the beginning. Along the route of the highway there are:
Natural Habitat areas protected under the European "Natura 2000" Network, wetlands protected under the Ramsar Convention, wildlife conservation areas (formerly wildlife reserves), sites and monuments of historical interest.

Designing and building the Egnatia Road, 680 kilometres of modern motorway that cuts across the mountainous backbone of Greece (the Pindus range) and crosses just about every river in the country, plus the existing north-south road and rail network, means designing and building a raft of technical works. These include bridges and tunnels, long cuts and embankments, on top of the hundreds of kilometres of road that have to be laid; and they make this a project of a scale and a magnitude hitherto unknown in Greece, on both the quantitative and the qualitative level. The difference is even greater on the qualitative level, given the broad spans, tall piers, long tunnels, deep broad cuts and thickness of pavement required, and all the study and construction procedures associated with them (see figures 1,4).

This radical re-ordering of magnitude and dimension is the result of the high specifications required for a modern motorway, for the Egnatia Motorway is the first Greek highway to be designed and built from the outset to international specifications. The functional requirements for such a road demand broad surfaces, gentle gradients and wide curve radii, geometrical features that make it necessary to separate the alignment of the road from the natural relief of the ground. This, in turn, requires major technical intervention, especially when the morphology of the terrain is as difficult as it is in the mountain massifs of western and central Greece. In short, it is probably fair to say that whereas an ordinary road is built to follow the contour of the ground, a motorway is constructed alongside it.

3. LANDSCAPE PROTECTION AND DESIGN BY "EGNATIA ODOS SA"

Egnatia odos protects the landscape trough:

- The Landscape Guidelines (OSAT, in its Greek acronym), which is a tender document for designs and construction.
- Special studies for landscape restoration exceeding a total of 150 km.
- Special measures for the protection of slopes against surface run-off and erosion (hydro-seeding).
- Native plant breeding programme, for use in nurseries.

3.1 The Landscape Guidelines

Greece has a long and honourable tradition in road engineering. Its mountain roads represent some of the most impressive in Europe particularly given the equipment with which they have been constructed. The roads represent effective means of overcoming significant physical barriers

and in so doing reflect the high levels of skill and knowledge amongst engineers. However, most of these roads have been built with little attempt to reduce environmental impacts, reflecting low expectations from the authorities and the public. The result is what is apparent as an undue emphasis on road construction itself as opposed to the weighted approach desired in other parts of the European Union (Land Use Consultants, 1999).

The Landscape Guidelines and appendices produced by Land Use Consults, Brown & Root and have to be completed by EGNATIA ODOS staff and with the help of the University of Thessaloniki as consultant. The Landscape Guidelines seek to redirect this approach using the well-proven skills of Greek engineers and environmental designers. The main purpose of the Landscape Guidelines is to help change this new approach into actions. It will ensure that the landscape of the finished road meets fully the Company's strategic objectives. It is envisaged as a tool to 'inspire and educate, 'guide and control' designers and contractors. **'Inspiration and education'** will come through advice on new approaches and techniques or on adapted uses of existing techniques. These will be a mix of techniques proven elsewhere and totally new techniques specifically evolved in Egnatia Odos. **'Guidance and control'** should be achieved through the Landscape Guidelines being used to set performance standards to be used in the contractual documents. These may have little application on Egnatia Odos. The Landscape Guidelines themselves are deliberately not, specifications. They provide a suggested approach for designers to help them identify landscape issues raised by the road, to establish objectives for a satisfactorily resolving of these issues and to identify problems and appropriate problem-solving methods. Given the size of the project, the immense variety of landscapes through which the road will pass, is neither possible nor correct to provide standard specifications for landscape related issues of the road. The wide variety of landscape and the enormous range of type and scale of landscape issues and problems make it necessary that designers study closely these issues and problems at a local level. Only after such a study - can suitable solutions and associated specifications be found. The unsatisfactory alternative is a preselected set of specifications that can never hope to cover all issues and would be the intricacies of a local scale. If such preselected specifications were applied, they would inevitably lead to the application of incorrect and inappropriate solutions with highly detrimental effects on the environment of the road. The Landscape Guidelines do not provide obligatory solutions, standard details or rigid formulas for use throughout the road (with rare exceptions) (Land Use Consultants, 1999).

The Landscape Guidelines try to raise awareness of landscape issues in the designer's mind and to suggest a process by which solutions can be generated. By the term "designer", we mean the whole design team (highway, structural, soil mechanics, tunnels, bridges etc.) and not just the landscape designer. It is essential that all of the team members support the Guideline approach, are aware of its contents and use them as and when appropriate. As much of the work will be the responsibility of the engineers, their support is particularly important. It is equally important that solutions proposed by the team are integrated, feasible and long lasting (Land Use Consultants, 1999).

All teams require a leader and in this case the most appropriate professional is the landscape architect. Landscape architects have already led the specialist team on the landscape assessment of each section of the road and are therefore better informed. The landscape architect has also an overall appreciation - at least in theory - of the environmental issues at stake and possibly the greatest desire in resolving them. However, it should be noted that the number of Landscape Architects (University graduates) in Greece is limited.

3.2Landscape Design Studies

Regarding OSAT and the Landscape Design Specifications that constitute the appendix of OSAT, special Landscape Design Studies exceeding a total of 150 km has been carried out during the last three years (Land Use Consultants, 1999).

A landscape designing study aims mainly at restoring the landscape affected by road construction works, incorporating the motorway into the landscape, emphasing on important areas (e.g. archaeological sites), while at the same time observing the principles of efficient operation and safe use of the road. The landscape restoration includes, among others, the protection of slopes against surface erosion and the reinforcement of their stability, the improvement of road functionality, the aesthetic improvement of the landscape, the adaptation of the road landscape to the surrounding environment, the visual guidance of the user, the screening of lights of vehicles moving in the opposite direction, protection against wind etc.

These solutions that proposed solve landscape problems. Those are the solutions proposed, which resolve landscape problems: (Land Use Consultants, 1999)

- **Satisfactory:** They must meet identified environmental objectives. Thorough assessment of the landscape through which the road will pass and assessment of the alignment will identify a number of landscape issues in need of a satisfactory resolution.
- **Feasible:** Proposals that satisfactorily meet environmental objectives must also be feasible.
- **Technical:** Is it technically correct? As we in simple words say: will it work? For instance, will a chosen angle of slope be stable and will the chosen plants survive?
- **"Constructubility":** Technically correct solutions may prove not constructible, because of site conditions or lack of available resources including skills. Highly complex landscape solutions may prove to be beyond the existing levels of expertise or meet a lack of availability of materials.
- **Sustainability:** Solutions should not be over-reliant on resources both during construction and on required maintenance after completion.
- **Affordable:** Solutions must be within the acceptable budget limits for the works.
- **Visually Appropriate:** Solutions can be satisfactory and feasible yet visually inappropriate. Being visually inappropriate means that the solution is not in keeping with its landscape context Planting is another landscape issue in which it is easy to introduce inappropriate kinds and/or styles of use. Generally planting should be selected, in species and in pattern of layout, to reflect and harmonise with the surrounding context, rather than reinforce a separate quality of the road corridor.

The Landscape Design Study includes the following stages: Prestudy, Definitive Study.

3.2. 1 The prestudy

The objectives of the prestudy are: (1) to define the strategy of landscape restoration, (2) to define works immediately required for the improvement and restoration of affected landscape (e.g. protection against surface erosion, method and type of planting), (3) to provide an initial estimate

of the required amount and species of plants so as to enable timely production, (4) to estimate the required quantity of irrigation water during the installation and maintenance of plants, (5) to estimate the total cost of landscape restoration works.

The prestudy includes the following stages:
a. Landscape Assessment – Strategy
b. Prestudy development – proposals – drafts – selection of solution for landscape restoration.
c. Development of the selected solution – Bills of Quantities and cost estimate – Completion of prestudy

Therefore the Landscape Assessment – Strategy includes:
(a) A detailed landscape survey
(b) Landscape assessment
(c) Landscape strategy

(a) Detailed Landscape survey – Description of the current situation

This usually includes a detailed survey of the road section in question, which is carried out at this stage. This survey includes stable and dynamic issues of the landscape, the opportunities and any possible impact on the landscape by the road construction. Whereas the Landscape Assessment defines the landscape character, the landscape survey collects more information on natural data. It should specifically include survey element data, noting the slope gradients, the soil data, the existing vegetation, the rural and forest roads and paths and various structures (bridges, culverts, animal passages, rivers and streams, fencing etc). Further ecological and archaeological data can also be pointed out at this stage.

(b) Landscape Assessment

Crucial for to the approach of these Landscape Guidelines is the concept of landscape assessment. The landscape Assessment is a technique by which the existing landscape is studied, so that its qualities are understood along with, its opportunities and constraints, its strengths and weaknesses, and the way, any development proposals (in this case Egnatia Odos) may affect it. The Landscape Assessment will also help identify crucial landscape issues and potential treatments, which may be specific for individual sections. In a similar way landscape quality can be assessed as high, medium or low and the strength of the landscape as robust or fragile. Assessment of a relative quality and strength will help to determine the degree of landscape infrastructure required for the road both in natural extent and in promptness establishment. Above all the landscape assessment gives information on the landscape character of the proposed road landscape in terms of materials and style. Unless there are very good reasons not to act so, the character of the road landscape should match that of its surroundings. The purpose of Landscape Assessment is to provide a baseline record and understanding of the landscape context, into which the road will fit. This will assist the designers of the new road in assessing and anticipated specific landscape and environmental issues, which may arise, both during construction and operation of the project.
To have the greatest benefit, the landscaping process should also affect the character and fitting of the road into the wider environmental context (route selection stage) in establishing groundworks, and in verifying continuity with adjacent sections.

The landscape design usually includes a visual assessment. The first step of a visual assessment is to define the physical limits of the affected visual environment by mapping the future project. The next step is to identify key views in displaying alternatives and assessing impacts. The third step is usually to analyse the visual resources and the response to those resources, for the purpose of determining which resources are of the greater value, as well as of identifying any problems and opportunities. Finally, it is necessary for depicting the appearance of the project, in order to determine its visual effect. (American association of state highway and Transportation officials)

(c) Landscape Strategy

According to the definition of landscape character of the site (landscape assessment) and landscape survey data, the designer proposes a landscape restoration strategy. At this point one should examine the highway study of the road section and of the adjacent sections, in order to obtain an overall assessment of the area. At this stage the designer proposes 2-3 strategy options on landscape restoration method. The designer evaluates all options and proposes the one he considers to be the best. Proposals are then evaluated with the help of Egnatia Odos A.E. that will approve one of the strategy options, for which the remaining study will be exclusively prepared.

(d) Prestudy development – proposals – draft drawings – solution selection

In the course of prestudy development, the designer will define ways and means of restoring the landscape that will include the following:

- Proposals to improve the landscape with the objective to adapt the landscape in the surrounding environment.
- Presentation special interest sites

More specifically, the above proposals should include, among others: The following supplementary structures, additional earthworks, protection methods against surface erosion, planting, water needs. The designer has to propose the best irrigation method in terms of feasibility in conjunction with traffic safety measures and the structures required. This design aims at achieving the necessary compliance of the proposals made by the Consultant with the requirement/ comments of EOAE, the Environmental terms and the overall cost of Design. Specifically as far as the overall restoration cost is concerned, this is defined according to EOAE proposals the consultant has to respect. Proposals of this stage are submitted in draft form with an approximate estimate of the cost. They are presented to the supervision teams in meetings where the restoration method is also selected for each individual slope surface; minutes are kept for decisions.

(e) Presentation of selected solution – Bills of quantities and cost estimates – Prestudy completion

After selecting the restoration method for each individual slope surface in draft the bill of quantities and cost estimate are presented for Structures, Planting, and Slope protection All the above are presented in plans, drawings and in written form.

3.2.2 Definitive design

The objective of the definitive study is to present out a more detailed description of the solution

described at the stage of landscape restoration prestudy so that it is possible to tender it and the constructors can implement it in the optimum way. The definite design contains: written text, detailed drawings, specification document on irrigation network material, hydraulic calculation documents, guidelines for aftercare and management, photographs, sketches of characteristic locations of the project. All proposals on the selected solution are described in detail, are justified and technical directions are supplied, together with drawings and specifications required for their accomplishment.

3.3 Special measures of slope protection against surface run-off and erosion (hydro-seeding).

One of the purposes of landscape restoration studies is the protection of slopes from surface erosion, which means the definition of the proper methods of slope protection from surface erosion. In a study of protection against surface erosion the designer:

Proposes surfaces were protection against surface erosion is required and chooses the method for the slope protection justifying his proposal.

He studies the:

- Need of carrying out additional drainage works to protect slopes against surface erosion
- Need of carrying out any additional earthworks to restore the landscape and help the formation of surfaces or determine the need of topsoil.

3.3.1 Hydro-seeding

Hydroseeding is a method used to generate revegetation on inaccessible surfaces like slopes, where other seeding / cultivation methods cannot be successfully applied. This method, when applied on slopes uses special equipment in throwing a mixture of seeds, fertilizer, mulches, soil stabilizer and water.

3.3.2 Selection of a slope protection method against erosion

n order to decide which method will be used for the protection of slopes (mainly cut slopes) against surface erosion (hydroseeding or other method), the designer should examine whether it is possible to cultivate vegetation on the specific bedrock of this slope. Embankment slopes present no problems of vegetation cultivation, because such slopes are covered with 30 cm of topsoil (First Educational Seminar of EOAE, 2000). Cultivate, the checker decides if it is necessary to cultivate vegetation, for the protection of slopes against erosion, considering all top and geological elements of the slope, as well as the presence of drainage works. For example, at low embankments, < 4m high, where the topsoil is of very good quality, no hydroseeding is required because local vegetation will cover the slope in spring (see figure 2,3,4).

3.3.3 Selection of hydroseeding method

The selection criteria for the hydroseeding method to be used on each slope are:

(a) Presence of drainage works,
(b) Slope survey information (level, gradient)
(c) Slope geological – soil data

According to the criteria, which are mentioned above, the risk of erosion and necessary hydroseeding method are assessed.

3.4 Native plant breeding programme, for use in nurseries.

Plants of native Greek flora are used in landscape restoration of EOAE. A great number of those plants have never before been produced in the Greek market of plants, while others such as Phillyrea latifolia have never been produced worldwide (Dafis, et.al., 1997, Ganatsas et. al., 1998, Alifragis et al., 1999, Takos et al, 1999).The plants of the native flora are produced for EOAE in nurseries with the use of propagation material collected from the area, where the plants will be planted. The collection of propagation material (seeds and cuttings) is performed by NAGREF (Ganatsas et. al., 1998, Alifragis, et al., 1999, Takos et al, 1999). The program in question was initiated in 1999 and concerns the production of plants and the landscape restoration of a length of approximately 20 km. Similar programs were performed in 2001, concerning the installation of trees and bushes with the use of direct seeding or the method of hydro seeding. The first results of these experiments are expected in November 2001.

4. CONCLUSION

The measures, which are mentioned above, aim at the landscape restoration and the incorporation of the road into the surrounding variform landscape and the particular prevailing local geological, aesthetic and environmental conditions of the area, as well as the aesthetic improvement of the landscape and the safety of the road.

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