ΣΥΛΛΟΓΟΣ ΕΛΛΗΝΩΝ ΣΥΓΚΟΙΝΩΝΙΟΛΟΓΩΝ
HELLENIC INSTITUTE OF TRANSPORTATION ENGINEERS
ΕΛΛΗΝΙΚΟ ΙΝΣΤΙΤΟΥΤΟ ΜΕΤΑΦΟΡΩΝ (Εθνικό Κέντρο Έρευνας & Τεχνολογικής Ανάπτυξης)
HELLENIC INSTITUTE OF TRANSPORT (Center for Research & Technology Hellas)
3ο ΔΙΕΘΝΕΣ ΣΥΝΕΔΡΙΟ για την ΕΡΕΥΝΑ ΣΤΙΣ ΜΕΤΑΦΟΡΕΣ ΣΤΗΝ ΕΛΛΑΔΑ
3rd INTERNATIONAL CONGRESS on TRANSPORTATION RESEARCH IN GREECE

EGNATIA MOTORWAY OBSERVATORY: MONITORING OF SPATIAL IMPACTS OF TRANSPORT INFRASTRUCTURE

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Abstract: This article attempts to approach the issue of developing monitoring structures for the spatial impacts of transport infrastructures. The Egnatia Motorway Observatory is examined as a characteristic example of that. Through the Observatory, Egnatia Odos A.E. (the company in charge of the construction and operation management of the motorway) sees to the systematic assessment of the spatial impacts of the Egnatia Motorway, so that the effects of the motorway on the social and economic cohesion, the spatial organisation, the transport system, and the environment in Northern Greece are fully documented. In this way the Egnatia Observatory supports the integrated management of the motorway, and provides useful material to development bodies for the planning and the decision-making processes.

Keywords: egnatia, motorway, development, impacts, transport, indicators, observatory.

1. INTRODUCTION

The allocation of € 6.7 bn from national and community resources for the construction of the Egnatia Motorway (including three vertical axes) imposes taking supplementary actions to multiply the benefits, and mitigate the impacts, of the operation of the motorway. For this reason it is necessary to monitor and assess the impacts of the Egnatia Motorway, not only on the transport system and the operation of the road network, but also on the economic, social, and territorial cohesion, as well as on the environment, of the geographical zone crossed and influenced by.

In this context, Egnatia Odos A.E. (the company in charge of the construction and operation management of the motorway) established and operates the Egnatia Motorway Observatory, in order to: (a) support the integrated management of the motorway, (b) contribute to the utilisation of the project in the cohesion and development of a greater area, and (c) contribute to the harmonized assessment of impacts of Trans European Transport Networks on the cohesion of the European area.

2. GENERAL FRAMEWORK

The monitoring and study of spatial impacts of transport infrastructures is a special cross-discipline scope. Its evolution is based on the development of know-how and involves spatial planning, design and management of transport systems, regional development, geography and environmental sciences, as well as other disciplines depending on focus and processing. The combination of the above with ICT tools and new other technology means provides the most modern view of the scope and signals the digital operation of similar mechanisms.

Generally, the development of mechanisms or systems that are involved in the management of reliable and comparable data, and the monitoring of a scientifically documented system of indicators, is considered to be a fundamental principle for the assessment of the spatial impacts of transport infrastructures. The main value added of this effort lies in securing validity and comparability of results at various geographical levels and with a long-term perspective. The utilisation of new technologies, specifically the Internet and various statistical and spatial analysis tools such as GIS, promotes further the development of such mechanisms that operate increasingly at the digital level.

In total, one may say that the purpose of establishing and operating such mechanisms (e.g. transport observatories) serves the following needs: (a) monitoring of characteristics of traffic and transport operation, (b) assessment and monitoring of environmental impacts, (c) monitoring of development impacts, (d) monitoring of land use and real estate changes, (e) supporting the systematic assessment on the basis of requirements of EU funding programmes. The respective EU initiatives characterised by a continuous and consistent operation are, for the most part, organised departments or associations of competent transport organisations in cooperation with research centres and private design companies.

3. THE EGNATIA MOTORWAY OBSERVATORY

The Egnatia Motorway Observatory is the only Greek transport observatory that has a permanent organisation and operation. Through the Observatory, Egnatia Odos A.E. (EOAE) sees to the assessment of spatial impacts of the Egnatia Motorway and vertical axes system in close relation to the project implementation progress, i.e. “before” and “after” its construction and operation. In this way the impact of new transport infrastructures on the social and economic cohesion, the spatial planning, the transport system and the environment in N. Greece shall be documented. The ultimate goal of the Observatory is to provide supporting services both for the integrated management of the Egnatia Motorway and for the development policies and programmes in the greater impact zone.

3.1. History and Action Plan

In the period 1999-2002, EOAE proceeded to the necessary preliminary actions for the establishment of the Observatory, by signing a co-funding contract with the DG Energy and Transport of the EU for the amount of € 295,000.

Since 2003 the Observatory entered the main phase of development, organisation, and productive operation according to the approved 5-year Action Plan 2003-2008, which is structured with a clear definition of activities per year, in order for results to be visible and easy to assess according to the following targets:

• Make permanent the productive operation of the Observatory, being a unit of high scientific and know-how level, with the potential of substantial and original contribution both to the enhancement of the development role and to the integrated management of the Egnatia Motorway.

• Complete the calculation, processing, and monitoring of all indicators filled in by the Observatory Unit, and finalise the performance evaluation system.

• Implement the programme for design award and management at the level of regions or prefectures, in order to calculate the indicators not calculated by the Observatory Unit.

• Take a number of systematic and effective actions for the promotion and diffusion of results so that the Observatory may operate as a strategic tool of supply of information and support to policies and programmes of development planning.

• Promote cooperation and networking with other similar organisations in Greece and abroad, as well as with the development agencies in the greater impact zone of the axis.

3.2. Organisation and Production,

The Observatory is a Unit of EOAE under the Support Services Division. By incorporating the Observatory in the existing structure of EOAE the maximum possible compatibility and complementarity with the other activities of the company is achieved, and at the minimum possible cost.

A central element of the Observatory is the development of specialised know-how for the organisation and operation of an information system that enables recording, calculation, and monitoring of various indicators, as well as their geographical analysis. The information system of the Observatory (hardware & software) provides an overall support to the automated and flexible management of statistical physical planning data and base maps. The reliable productive operation of the Observatory is secured by processing and observing strict specifications regarding the range, quality, and validity of data input in the information system.

Specifically, the Information System for Documentation and Data Management is mostly based on the operation of a configured Geographical Information System (GIS) directly linked to databases and other applications, including processed statistical and mapping information on:

- mobility and accessibility,
- economic and social cohesion,
- the balance and networking of settlements, and
- environment quality,

in Prefectures and Regions of the immediate and greater area of impact of the Egnatia mainline and vertical axes.

The information system comprises the operation of a website on the Internet through which Observatory products are presented and diffused in digital format. An electronic library and a base with supporting material and metadata have been also developed. An ultimate objective of the system is to operate as a tool for decision-taking through the production of scenarios at a spatial impact level in a greater zone of the system of the Egnatia mainline and vertical axes.

3.3. The System of Indicators

By applying scientifically documented specifications, methods, and analysis tools used in current *(towards a common)* European practice, the system of indicators comprises 50 indicators that concern specific properties related to:

- socio-economic and physical / urban planning changes,
- environmental impacts,
- transport infrastructure and the operation of the road network.

Therefore, the Observatory records traffic data, environmental effects, socio-economic and land-use changes, and scientifically analyses and assesses the spatial impacts of the Egnatia Motorway in the areas influenced by its construction and operation. Such a procedure constitutes a prerequisite for achieving a rational planning of future investments and developmental actions in Northern Greece. The table below presents a summary description of the System of Indicators monitored by the Egnatia motorway Observatory.

Socio-economic indicators
Basic
Benefited population
Market size (GDP)
City gravity
Growth and prosperity level (GDP per head)
Unemployment rate
Framework
Accessibility of transport modes
Accessibility of industrial areas
Accessibility of sites of cultural & tourist interest
Population change
Urban population changes
Hierarchy of urban centres
Population density
Special
Composition of production by industry sector (GVA)
Labour force
Composition of employment by industry sector
Business location
Foreign trade
Environmental Indicators
Basic
Noise pollution
Tunnel air quality
Cohesion – fragmentation of settlements
Framework
Population no longer exposed to noise pollution
Landscape restoration
Fragmentation of natural areas
Pressure for land use changes
Proximity to conservation areas
Special
Air pollution
Crossing with surface waters
Patterns of use of combined transport modes

Transport Indicators
Basic
Traffic volumes (AADT)
Traffic composition
Average occupancy rate
Travel speeds
Travel time distances
Human mobility and commuting
Commercial transportation
Time distance between towns and terminal stations
Generalized cost of transport
Road safety
Framework
Traffic capacity
Level of service
Induced traffic
Patterns of mobility at border stations
Combined transport modes
Service Station Areas
Changes in residential areas
Changes in the spatial patters of industrial development
Changes in the value of road side plots
Special
Trip generation rates due to special land uses
Change in the choice of location for residence and work
Change in the modal split

In addition, the spatial impacts of Egnatia Motorway are assessed at five "Impact Zones". Impact Zone I refers to a 500m-5km buffer zone of the Egnatia mainline. Impact Zone II refers to the area of the Prefectures crossed by the motorway. Impact Zone III refers to the Prefectures crossed by the vertical axes of Egnatia. Impact Zone IV refers to the Regions crossed by the Egnatia Motorway and its vertical axes. The fifth zone covers the wider area of Greece and the Balkans affected by the changes caused by the motorway's operation in the overall transportation system and the spatial networking.

For each indicator the following are drafted: (a) The Technical Bulletin providing the scientific and technical – methodological specifications for calculating the indicator. (b) The Calculation Bulletin detailing each step of the calculation and monitoring method. (c) The Results Fact Sheet, presenting the processed results and the long-term and geographical evolution of each indicator.

In general, the system of indicators is not static – it undergoes a constant review and is being adapted to new conditions and requirements, on the basis of scientific developments and the needs of transport & development policies. One should also note that the indicators monitored by the Observatory are compatible with the indicators used by basic EU programmes regarding the spatial impacts of transport infrastructures (e.g. ASSEMBLING, ESPON, EEA-TERM).

Therefore, having secured the scientific documentation, the Observatory prepares Annual Result Reports on the progress of basic properties monitored through the system of indicators. Egnatia Motorway Impact Reports are prepared periodically to present a summary of the

development and evolution status of Impact Zones, focusing on Zone IV. The Impact Reports aim at raising issues regarding the substantial utilisation of the Egnatia motorway operation, so as to support the competent agencies – specifically the Regional and local authorities – in taking the appropriate policy measures.

In this context 30 out of 50 indicators have been calculated and are being monitored to date. On the basis of the results of these indicators the "1st Report on the Egnatia Motorway Impacts" was prepared. The remaining 20 indicators cannot be calculated internally, due to the extent and complex form of the works required in relation to special scientific and technical – methodological approaches. To calculate these indicators, as well as to investigate side effects, a Study Programme budgeted at € 2m approx. has been scheduled.

Indicator results so far show that, in total, the impacts of the Egnatia Motorway on the traffic properties of the road network, the increase in movements, the networking of urban centres, and the improvement of accessibility are positive and immediate. Such changes are expected to be decisive especially for peripheral areas in N. Greece. As to whether such positive changes will lead to spatial development, and especially the regional convergence, or to "bleeding" in favour of the most developed areas, shall depend on the overall spatial and development policies and not exclusively on the operation of the motorway.

3.4. Extroverted Activities

The Observatory provides the interested public with valid data and updated information on the progress of main properties and phenomena related to the socio-economic and territorial cohesion, the transport systems and especially the infrastructure and operation of the road network, as well as the environment, in the greater area of influence of the Egnatia Motorway system. Besides, the approved Regional Frameworks of Spatial Planning of the Regions of Eastern Macedonia & Thrace, Central Macedonia, and Western Macedonia include a special reference to the Egnatia Motorway Observatory highlighting that:

> "the necessity is obvious for the Observatory to cooperate with the current physical planning at the Regional level, especially on issues regarding the intraregional area and the impacts on the spatial organisation, as well as the immediate border area" (GG issue No.: 1471B΄/9-10-2003, 218 B΄/6-2-2004, and 1472B΄/9-10-2003).

In this framework the Observatory implements a Region-specific and Prefecture-specific processing and presentation of results and material, in order to achieve an effective promotion of the objectives and benefits of its works on issues of regional development.

Additionally, as of 06/06/2005 the website of the Observatory is on the Internet at http://observatory.egnatia.gr. The website provides a documented and detailed presentation of results, maps, reports and studies prepared by the Observatory, as well as baseline information on the organisation and the activities of the Unit. During the first year of its operation the website had:

- 1,246,870 hits that correspond to:
- 65,889 page views,
- 27,412 visits (average 75 per day with a average duration of 10 minutes), and
- 12.569 individual (unique) visitors.

Further processing of the website accessibility statistics shows the increased interest of the public for information regarding the latest results and indicator maps, while there seems to be

special demand for the English version of the website, which is not fully developed yet. There is also special interest on behalf of visitors about the traffic on the Egnatia Motorway, about the development status of Regions and Prefectures, as well as about the assessment of main environmental issues such as noise. The most popular files in terms of downloads are the Reports, proving the critical importance of the Internet, not only for the promotion but also for the greater diffusion of Observatory products. For example, in 12 months over 7,000 people downloaded the 1st Impact Report. This would have been very costly and time-consuming, if not impossible, with traditional methods.

3.5. Review and Perspectives

The establishment, development, and productive procedure of the Observatory from 1999 until mid-2006 has cost almost € 700,000. In review:

(1) The productive operation was organised, equipped, and put forward with the following main results:

- calculation of 30 out of 50 indicators, with a special geographic or/and sectional processing and production of respective Results Fact Sheets,
- preparation of 3 studies, a business plan, and cooperation with external partners – consultants,
- issuing of 8 reports, 25 working papers, recommendations and technical reports, and 16 information leaflets,
- development of important know-how at the level of systematic documentation, data management, indicator monitoring, and information,
- development of own infrastructure at the level of statistical data and base maps, digital library, and measurement equipment.

(2) The Observatory took various promotion – diffusion and networking actions:

- organisation of 2 conferences,
- development and operation of a website,
- distribution of products to over 400 interested bodies, research centres, and scientists in Greece and abroad,
- delivery of data and material following requests to 48 agencies and over 100 individuals (mainly students and researchers),
- organisation of 3 lectures by experts,
- design, development, and management of the website for the European Corridor Thessaloniki – Istanbul (www.etcti.org)
- participation in 8 scientific conferences and 2 workshops.

As concerns the medium-term perspectives it is established that:

(1) Ongoing and thorough work is required regarding the updating and expansion of the geographic and statistics database.

(2) The positive progress of works in relation to the calculation of indicators is based on a complex system of interlinking of databases and methodological manipulations, which should secure the continuation of the operation results production. For this reason the Observatory is currently developing a system of automated update of data relevant to the calculation and processing of indicators.

(3) The system of indicators requires processing and inputting new accessibility indicators related to mobility of goods and combined transport, tourist development, competitiveness, and land use/value. The investigation and assessment of the situation in the Regions of South East Europe in relation to main indicators is also considered important.

(4) An overall conclusion regards the great importance of the digital development and operation of the Observatory. Apart from the procurement of the necessary equipment the issue of continuous technical and scientific improvement and support is under investigation, as well as the more automated and flexible operation of the information system. For example, to this direction the design of a special application (use of Flash and WebGIS technologies) is being developed for the presentation of indicator results for each Region and Prefecture through a dynamic map and an interactive menu on the Observatory website.

(5) Finally, the most important evolution and perspective at the same time is the operation of the Observatory as a "system of monitoring and information". The open concept adopted regarding the diffusion of the produced material, assisted by the wide range of provided data and information from the Internet and the increased demand thereof, set up the framework of this perspective. Special care is now required for maintaining a high level of information services regarding both the validity and updating of results, and the development of useful and easy-to-use applications on the website.

5. CONCLUDING REMARKS

The integrated investigation of spatial impacts of transport infrastructures require a systematic monitoring, combined assessment, and analysis of a series of socio-economic, transport, and environment parameters, via respective indicators, distinguishing the respective spatial entities or impact zones, as well as the various moments in time (construction stage, completion, operation). Moreover, information supply alone is not enough for the effective use of the above in the planning procedure and decision-making. Special analysis and synthesis are required to bridge the gap and achieve a balance between objective data (measured and statistically analysed) and information immediately useful for supporting the assessment and the decision-making (e.g. synthetic analysis and correlation of results, projections, assessments and production of scenarios, special views, report and study summaries, news from other means and sources etc).

In this context the Egnatia Motorway Observatory is an organisation with permanent scientific – technical structure, capable of providing valid and updated information and documentation for critical phenomena and properties concerning the spatial impacts of the Egnatia motorway beyond the usual statistical reports. This is achieved through a continuously renewed infrastructure of statistical, descriptive, and mapping data collected and processed with scientifically documented methods in an Information System for Documentation and Data Management developed for this purpose.

Through results fact sheets, maps, reports, events, and especially through the website, the wider supply of information is achieved to development bodies and the wider public, along with assistance for research, study or even educational needs. In this way the Observatory substantially contributes to the optimisation of the planning and decision-making procedure and monitoring on issues of transport and spatial development. Further development and operation of the Observatory shall generally contribute to the effort for a systematic assessment of spatial impacts of large-scale transport infrastructures in Greece and the greater area of South East Europe.

ACKNOWLEDGEMENTS

Special reference should be made to the excellent scientific work of the research teams of (a) Spatial Development Research Unit (Scientific Responsible Prof. G.Kafkalas) and (b) Transport Engineering Laboratory (Scientific Responsible Prof. M. Pitsiava) Aristotle's University of Thessaloniki, and the continuous cooperation with the Observatory thereof. Special reference should also be made to experts Dr Athena Yiannakou (PhD Urban & Regional Planning) and Elias Dimitriadis (Surveyor Engineer, GIS specialist) and of course to Antonis Perpatidis for the wonderful translation of the paper from Greek into English.