

# **Routine Maintenance Management System (RMMS) of Egnatia Odos Motorway**

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**Key words:** routine maintenance management, outsourcing, GIS

## **SUMMARY**

The use of an information system for the management of the motorway routine maintenance on the Egnatia Motorway has resulted as a need after the company's (Egnatia Odos SA) decision to proceed to the outsourcing of the relevant works, thus changing the traditional way of procurement, which was the direct labor.

"Egnatia Odos SA" (EOSA) uses an information system (Routine Maintenance Management System - RMMS) for the effective management of the routine maintenance of the motorway. This information system allows EOSA to control the works of the maintenance contractors, in order to improve the quality and effectiveness of the maintenance services. The principle aim of the RMMS is to manage and optimise the maintenance of the motorway with respect to traffic safety and maintenance costs. The RMMS database comprises information relating to the geographical location of the road network, maintenance requirements, required resources for planning maintenance works and the performance of the maintenance contractors.

## **ΠΕΡΙΛΗΨΗ**

Η χρήση ενός πληροφοριακού συστήματος για τη διαχείριση της στοιχειώδους συντήρησης του αυτοκινητοδρόμου της Εγνατίας Οδού προέκυψε ως ανάγκη κατόπιν της απόφασης της εταιρείας (Εγνατία Οδός ΑΕ) να προχωρήσει στην εκτέλεση των σχετικών εργασιών με εξωτερικούς συνεργάτες, αλλάζοντας τον παραδοσιακό τρόπο εκτέλεσης των εργασιών που ήταν μέχρι σήμερα η μέθοδος της αυτεπιστασίας.

Η Εγνατία Οδός ΑΕ (ΕΟΑΕ) χρησιμοποιεί ένα πληροφοριακό σύστημα (Σύστημα Διαχείρισης Στοιχειώδους Συντήρησης – ΣΔΣΣ) για την αποτελεσματική διαχείριση της στοιχειώδους συντήρησης του αυτοκινητοδρόμου. Αυτό το πληροφοριακό σύστημα παρέχει στην ΕΟΑΕ την ικανότητα να ελέγχει τις εργασίες των εργολάβων συντήρησης προκειμένου να βελτιώσει την ποιότητα και την αποτελεσματικότητα των υπηρεσιών συντήρησης. Ο απώτερος σκοπός του ΣΔΣΣ είναι η επαρκής διαχείριση και η βελτιστοποίηση της συντήρησης του αυτοκινητοδρόμου σε σχέση με την ασφάλεια της κυκλοφορίας και τις δαπάνες. Η βάση δεδομένων του ΣΔΣΣ περιέχει πληροφορίες σχετικά με τη γεωγραφική θέση του δικτύου του αυτοκινητοδρόμου, με τις απαιτήσεις συντήρησης, με τους απαιτούμενους πόρους για τον προγραμματισμό των εργασιών συντήρησης καθώς και με την επίδοση των εργολάβων συντήρησης.

# Routine Maintenance Management System (RMMS) of Egnatia Odos Motorway

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## 1. INTRODUCTION

Egnatia Odos SA (EOSA) is a state-owned company that has been commissioned by the Greek government to construct, maintain and operate the Egnatia Motorway. Egnatia Motorway (660 km long and 24.5 metres wide over the greatest part of its length) starts at the port of Igoumenitsa (Ionian sea, West) and ends at Kipoi (Greek-Turkish border, East). It is part of the Trans-European Road Network, thus the specifications of operation are very strict in the interests both of its national and international users. Currently, half of the Egnatia Motorway has been opened to traffic.

The Board of Directors of EOSA has decided to outsource the routine maintenance works. This fact led the managers of the Operations & Maintenance Division (OMD) to investigate the international market in order to purchase an information system adequate to cover the company's maintenance needs.

The Routine Maintenance Management System (RMMS) is an integrated information system comprising computerized procedures used by motorway organizations for the effective management of the routine maintenance of motorways. Routine maintenance comprises maintenance works at regular intervals, the frequency of which depends on the weather conditions or on the traffic volume in conjunction with the weather conditions. The RMMS is based on a Relational Data Base Management System (RDBMS) for the storage and retrieval of data, as well as on a Geographical Information System (GIS) for their graphic representation.

This information system allows (EOSA) to control the works of the maintenance contractors, in order to improve the quality and effectiveness of the maintenance services. The principle aim of the RMMS is to manage and optimise the maintenance of the motorway with respect to safety and maintenance costs.

The need for using such an information system, i.e. the RMMS, is based on reliable data for the motorway items and their condition, the scheduling of motorway maintenance works as well as the assessment of the maintenance contractors.

EOSA employs the software system "*highways by exor*" developed by the Exor Corporation UK. The basic structure of the software is presented in figure 1.

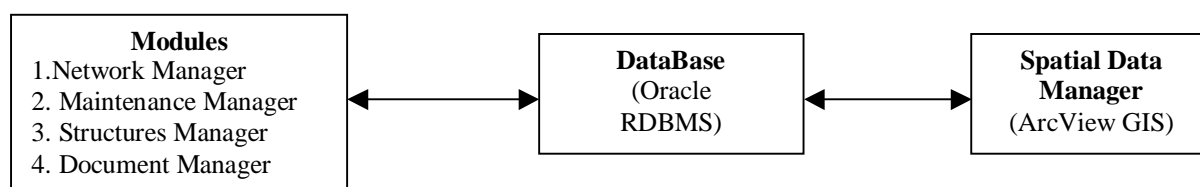


Figure 1. The EOAE's RMMS structure

## 2. RMMS MODULES

OMD currently uses the first two modules (Network Manager and Maintenance Manager) in order to manage: 1. The Motorway Network, 2. The Motorway Inventory, 3. Inspections/Patrols and Defects, 4. Reports, 5. Budgets, Contracts and Contractors 6. Work Orders and Treatments.

This paper describes, in brief, the content of the above.

### 2.1 Motorway network

In order to describe the motorway network, the OMD created a **Linear Referencing System (LRS)**. The network of the Egnatia motorway is divided into maintenance **Links** and **Sections** per direction of traffic [3]. The **Network Manager** is used for the definition and management of the LRS.

A **maintenance Link** consists of a motorway section between two successive grade-separated interchanges (ICs). For maintenance purposes, a maintenance Link can be further divided into one or more **maintenance Sections**. A further grouping of maintenance Links and/or Sections is called **maintenance Group**. At interchanges, each slip road represents a unique maintenance Section and, therefore, in this case, the Links coincide with the maintenance Sections. A 13-digit code is assigned to each motorway section per direction.

The use of the LRS is necessary for the unique and accurate identification of the inventory items and their possible associated defects. The item and defect identification is based on the maintenance section, the chainage (Ch) and the cross sectional position (XSP).

Data, describing the Egnatia motorway network, can be input through suitably configured forms of the **Network Manager** module, Figure 2. Simultaneously, a graphical representation of the motorway network is achieved using GIS, which provides a mapping representation of this information aiding the management of data. Any modification to the network data is depicted via the GIS once the data from the forms has been input and vice-versa.

The screenshot shows a software window titled 'ΕΓΝΑΤΙΑ ΟΔΟΣ' with a menu bar (Action, Edit, Block, Field, Record, Query, Help, Window) and a toolbar. The main window is titled 'Road Sections' and contains the following data:

(L) - D*	L	Υψηλούς*	A2__	Τομέας*	30_31_	Τμήμα*	00001	ID τομέα*	A2__30_31_
Μήκος*	7073.000	Υψοβ. μήκος*	M	Μέτρηση					
Περιγραφή	ΤΜΗΜΑ ΣΥΝΤΗΡΗΣΗΣ 01 ΑΠΟ Α/Κ 30 ΠΡΟΣ Α/Κ 31								
Τύπος*	AP	Γενικής χρήσης		Ημ/νία εισαγωγής*	01-JAN-2001				
Κατάσταση*	0	Σε λειτουργία		Ημ/νία κυκλοφορίας*	01-JAN-2001				
Παραχώρηση*	A	Παραχωρημένος			— (ΔΧ) 01-JAN-2001				
Τύπος καταστρώματος*	D	Δύο λωρίδες ανά κατεύθυνση		Ημ/νία διαγραφής					
Περιβάλλον οδού*	R	Αγροτικά		Τελευταία επιθεώρηση	01-JAN-2001				
Admin Unit*	A2__	ΕΓΝΑΤΙΑ ΟΔΟΣ		Όριο ταχύτ.					
Διάστημα Επιθεώρησης				Οχήματα/ημέρα					
Κατ. Συντήρησης*	1	Εθνικό Δίκτυο		HGV %					
				Number of Lanes	2				
Κατηγορία τμήματος*	AP	Γενικής χρήσης		Κόμβος αρχής	000122				
Κατεύθυνση δικτύου				Κόμβος τέλους	000123				

At the bottom of the form, there is a button labeled 'Nodes'.

Figure 2. Road sections form

## 2.2 Motorway inventory for Routine Maintenance

The motorway inventory records the visible road inventory items based on the LRS. The OMD created its own motorway inventory for routine maintenance based on the road inventory of the Highways Agency UK [1].

The inventory for routine maintenance comprises nine (9) categories of road items represented by a 2-digit code (roman numerals). For each item, the system stores a description, the associated attributes, conventions and certain rules that apply to each inventory item.

The inventory items are divided spatially into the following two categories:

1. **Point** items are those that occur at a specific location along the section and have virtually the same start and end chainage.
2. **Linear** items are those that occur over a particular length and have a start and end chainage.

The OMD undertakes **inventory surveys** in order to establish the motorway inventory for the sections opened to traffic. The OMD uses a combination of two survey methods: video survey for items visible on camera (e.g. markers, lighting columns, bridges, etc) and on foot surveys using odometers and Data Capture Devices (DCD) for items that are not visible on camera (e.g. culverts, boundary fences, etc). The outputs of these two methods are ASCII files that identify and describe uniquely every item of the motorway (spatial data - Sections, Ch and XSP based on the LRS - and attribute data). These files are uploaded to the RMMS database using specific procedures of the **Maintenance Manager** module thus creating the Egnatia motorway inventory for routine maintenance, Figure 3.

Inventory Items

As at 14-MAY-2002

Inv Type	Start Chain	End Chain	XSP	Road Id	Description	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FR	2	2	8	A2_42_43_00001	ΤΜΗΜΑ ΣΥΝΤΗΡΗΣΗΣ 01		3	*					
DN	3	37		A2_38_39_00001	ΤΜΗΜΑ ΣΥΝΤΗΡΗΣΗΣ 01	3	10	ΒΕΤΟ					
FR	3	3	3	A2_32_31_00001	ΤΜΗΜΑ ΣΥΝΤΗΡΗΣΗΣ 01		1	ΣΤΗΓ					
FR	4	4	8	A2_30_31_00001	ΤΜΗΜΑ ΣΥΝΤΗΡΗΣΗΣ 01		3	*					
FR	5	5	7	A2_38_37_00001	ΤΜΗΜΑ ΣΥΝΤΗΡΗΣΗΣ 01		2	*					
IO	10	10	2	A2_38_39_00001	ΤΜΗΜΑ ΣΥΝΤΗΡΗΣΗΣ 01	1	12	1	2	*			
FR	11	11	3	A2_30_29_00001	ΤΜΗΜΑ ΣΥΝΤΗΡΗΣΗΣ 01		2	*					
FR	11	11	2	A2_30_31_00001	ΤΜΗΜΑ ΣΥΝΤΗΡΗΣΗΣ 01		2	*					
FR	11	11	3	A2_38_39_00001	ΤΜΗΜΑ ΣΥΝΤΗΡΗΣΗΣ 01		2	*					
DN	13	35		A2_29_30_00001	ΤΜΗΜΑ ΣΥΝΤΗΡΗΣΗΣ 01	2.4	10	CONC/					

Inventory Item Attributes

Road Id	A2_38_39_00001	(1)	Τύπος Ιατού	1	Σιδηροστράτος
Road Length	24110	(2)	Ύψος στήριξης	12	
Inventory Type	IO Ιατός οδοφωτισμού	(3)	Βραχίονες στήριξης	1	Μονός
Start Chain	10	(4)	Σχήμα βραχίονα	2	Ευθύγραμμο
End Chain	10	(5)	ID Κωδικός		
XSP	2 Δεξί έρρισμα	(6)	Σχόλια	*	
Surveyed By	System Admi	(7)	Ηλεκτρική τάση +		
Start Date	01-DEC-2001	(8)	ID Πίνακα διανομής +		
End Date					
Offset					

Figure 3. Inventory items form

## 2.3 Inspections/Patrols and associated Defects

According to EOSA's Motorway Maintenance Manual – Vol. 1: Routine Maintenance [2], **Inspections** (Safety and Detailed) and **Patrols** must be carried out on a regular basis on the motorway. The manual also specifies the procedures and frequencies of these inspections and patrols in order to determine what routine maintenance tasks are required.

- **Safety Inspections** (once a week) and **Patrols** (six days a week) are carried out by a slow moving vehicle, in order to identify defects, hazards and emergency events that are likely to be dangerous or cause serious inconvenience to the motorway users.
- **Detailed Inspections** are usually carried out once or twice a year in order to establish programmes of works for routine maintenance tasks not requiring urgent rectification.

Figure 4. Inspections form

These inspections are carried out by the maintenance contractors' staff (inspectors) under the supervision of EOSA's technicians.

The Contractors' inspectors record **defects** on the motorway using paper forms and/or DCDs. Having identified a defect, the inspector is required to record its position (based on the LRS) and give a description of it using the predefined, by the OMD, codes and his/her judgement about the defects condition, necessary actions and required maintenance methods.

EOAE's Motorway Maintenance Manual – Vol. 1: Routine Maintenance [2] defines two categories of defects:

- **Category 1:** defects that require prompt attention because they represent an immediate or imminent hazard
- **Category 2:** all other defects

The recorded defects are supervised by EOSA's engineers on a regular basis (usually every one-two days) and then are uploaded to the RMMS database. The OMD uses the **Maintenance Manager** module, in conjunction with the **Network Manager** module, to record and manage information concerning Inspections and Patrols, associated Defects and recommended Repairs, Figure 4 & 5. That way, there is a detailed list in the system of Inspections and Patrols, associated Defects and recommended Treatments. Inspections and Defects are uniquely identified by a serial reference number (**Inspection ID** and **Defect ID**) generated by the system, e.g. Inspection ID: 934 (Fig. 4) is associated with Defect ID: 842 (Fig. 5) and vice-versa.

Figure 5. Defects form

## 2.4 Reports

Although the RMMS comes with predefined reports for almost all procedures and actions regarding maintenance, the OMD, in conjunction with EOSA's IT Unit, have created **in-house reports** in order to cover specific needs of the Department. These reports (analytical and general) are based on the RMMS database, are fully customised and published on EOSA's Intranet. Users can input selection criteria, Figure 6, and retrieve information regarding items of the motorway inventory, inspections/patrols and associated defects.

Figure 6. Selection criteria forms for Inventory and Defects

As mentioned, these reports, Figures 7 and 8, are supplementary to the software's default reports for the motorway inventory as well as for inspections and defects.

ΕΓΝΑΤΙΑ ΟΔΟΣ Α.Ε.		ΤΟΜΕΑΣ ΛΕΙΤΟΥΡΓΙΑΣ ΚΑΙ ΣΥΝΤΗΡΗΣΗΣ				
ΑΝΑΛΥΤΙΚΟ ΜΗΤΡΩΟ ΑΥΤΟΚΙΝΗΤΟΔΡΟΜΟΥ ΣΤΟΙΧΕΙΩΔΟΥΣ ΣΥΝΤΗΡΗΣΗΣ						
Τμήμα:	A2_29_30_/00001 ΤΜΗΜΑ 01 ΑΠΟ Α/Κ 29 (ΑΓ. ΑΝΔΡΕΑΣ) ΠΡΟΣ Α/Κ 30 (ΠΑΛΙΟ)				Μήκος:	5655 μ.
Στοιχείο:	ΙΟ-Ιστός οδοφωτισμού					
A/A	ΧΘ Αρχής	ΧΘ Τέλους	Εγκάρσια Θέση	Χαρ/στικό	Τιμή	Περιγραφή
1	43	43	8-Διαχωριστική νησίδα - Αριστερό έρεισμα	ID Κωδικός		
				ID Πίνακα διανομής + Ύψος	12	
				Βραχίονες στήριξης	2	Διπλός
				Ηλεκτρική ισχύς +		
				Σχήμα βραχίονα	2	Καμπύλο
				Σχόλια	*	
				Τύπος ιστού	1	Σιδερωιστός
2	91	91	8-Διαχωριστική νησίδα - Αριστερό έρεισμα	ID Κωδικός		
				ID Πίνακα διανομής + Ύψος	12	
				Βραχίονες στήριξης	2	Διπλός
				Ηλεκτρική ισχύς +		
				Σχήμα βραχίονα	2	Καμπύλο
				Σχόλια	FR	
				Τύπος ιστού	1	Σιδερωιστός

Figure 7. Analytical Inventory form

ΕΓΝΑΤΙΑ ΟΔΟΣ Α.Ε.		ΤΟΜΕΑΣ ΛΕΙΤΟΥΡΓΙΑΣ ΚΑΙ ΣΥΝΤΗΡΗΣΗΣ								
ΚΡΙΤΗΡΙΑ ΑΝΑΖΗΤΗΣΗΣ										
Τμήμα:	Κατηγορία φθοράς: 1									
Στοιχείο Μητρώου: ΙΟ	Ιστός οδοφωτισμού			Κατάσταση φθοράς: ΜΗ ΑΠΟΚΑΤΕΣΤΗΜΕΝΗ						
Ημερομηνίες Τεχνικής Αστυνόμευσης:	Κωδικός φθοράς:									
A/A	Κωδικός Φθοράς	Περιγραφή Φθοράς	Κωδ. Στοιχείου Μητρώου	Χιλιόμετρ. Τμήμα	Εγκάρσια Θέση	Κατάσταση Φθοράς	Κατηγορία Φθοράς	Ημερομηνία Τεχνικής Αστυνόμευσης	Αποκατάσταση Έως	Ημερομηνία Αποκατάστασης
1	157	HF01 Λαμπτήρες που δε λειτουργούν	ΙΟ Ιστός οδοφωτισμού	0 A2_KA_31_/00001	8 Διαχωριστική νησίδα - Αριστερό έρεισμα	ΜΗ ΑΠΟΚΑΤΕΣΤΗΜΕΝΗ	1	11/02/2003	11/03/2003	
2	158	HF01 Λαμπτήρες που δε λειτουργούν	ΙΟ Ιστός οδοφωτισμού	0 A2_KA_31_/00005	8 Διαχωριστική νησίδα - Αριστερό έρεισμα	ΜΗ ΑΠΟΚΑΤΕΣΤΗΜΕΝΗ	1	13/02/2003	13/03/2003	
3	170	HF02 Λαμπτήρες αναμμένοι την ημέρα	ΙΟ Ιστός οδοφωτισμού	0 A2_KA_31_/00001	0 Άλλού	ΜΗ ΑΠΟΚΑΤΕΣΤΗΜΕΝΗ	1	03/03/2003	31/03/2003	
4	199	HF02 Λαμπτήρες αναμμένοι την ημέρα	ΙΟ Ιστός οδοφωτισμού	513 A2_32_31_/00001	2 Δεξι έρεισμα	ΜΗ ΑΠΟΚΑΤΕΣΤΗΜΕΝΗ	1	28/03/2003	25/04/2003	
5	200	HF02 Λαμπτήρες αναμμένοι την ημέρα	ΙΟ Ιστός οδοφωτισμού	405 A2_KA_32_/00001	1 Δεξι πρηνές	ΜΗ ΑΠΟΚΑΤΕΣΤΗΜΕΝΗ	1	28/03/2003	25/04/2003	
6	396	GF99 Άλλη	ΙΟ Ιστός οδοφωτισμού	9100 A2_32_31_/00001	9 Αριστερό πρηνές	ΜΗ ΑΠΟΚΑΤΕΣΤΗΜΕΝΗ	1	20/06/2003	18/07/2003	

Figure 8. General Defects form



## 2.5 Budgets, Contracts and Contractors

The RMMS provides the capability to create, maintain and review budget data of any maintenance contract. Financial years, work categories (item codes), budgets per work category, VAT rates, etc, can be defined in the system. The most important step is the definition of work categories based on those of the contract. The system provides information on the allocated and the actual amount as well as on the balance per work category, Figure 9.

Budget	Committed	Actual	Balance
21,500.00	18.90	398.65	21,082.45

Figure 9, Budget Form

## 2.6 Work Orders and Treatments

Using the Maintenance Manager module, the OMD is able to create work orders and forward them to the Maintenance contractor. The system requires specific data for use in the work order procedure (contract budget, bill of quantities and other information associated with the maintenance contract).

Having identified defects on the motorway, the OMD can raise work orders and instruct them to the maintenance contractors. Afterwards, following the maintenance specifications, the OMD can audit their actions and performance, Figure 10. There is always a unique link between works orders and their associated defects and inspections.

Currently, the OMD is in the phase of finalizing all the necessary procedures in order to use the RMMS in the production of the Works Orders. Additionally, works orders reports will be generated to cover specific needs of the Department.

The screenshot shows a software window titled 'EFNATIA DAOZ'. The main area contains a 'Work Orders (Defect)' form with various input fields and a summary table. Below the form is a 'Standard Item Totals' table.

**Work Orders (Defect) Form Data:**

- Work Order: 1735/B06/5
- Interim Payment?
- Road Type: LINK
- Road Id: A2\_29\_30\_
- Priority:
- Scheme Type: SS
- Contract: 1735/B06
- Contractor: SS-THEM
- Contractor Score:
- Originator: SYS System Administrator
- Authorised By: SYS System Administrator
- Cost Centre:
- Rechargeable:
- Cost Recharged:
- Job Number: 00000
- Remarks:
- Date Raised: 15-JAN-2004
- Target Complete:
- Date Instructed: 15-JAN-2004
- Last Printed: 15-JAN-2004
- Date Received:
- Date Completed: 15-JAN-2004 00:00

**Summary Table:**

	Estimates	Actuals
Sub Total	68.40	68.40
Balancing Sum	0.00	0.00
Total Cost	68.40	68.40
Labour Units		

**Standard Item Totals Table:**

Item Code	Item Name	Unit	Estimated Quantity	Estimated Cost	Actual Quantity	Actual Cost
F-6.1	ΠΡΟΜΗΘΕΙΑ ΜΕΤΑΛΛΙΚΩΝ ΣΤΗΘΑΙ	LIN.M	8.00	68.40	8.00	68.40

Figure 10, Works Orders Form

### 3. GEOGRAPHICAL INFORMATION SYSTEM (GIS)

The RMMS of Exor uses a suitably customised GIS (**Spatial Data Manager - SDM**) for the management and graphic representation of the network and the items thereof. SDM is a map-based interface to “*highways by exor*”. It is mainly based on GIS technology and utilises ArcView Desktop GIS and the Spatial Database Engine (SDE). The SDE is a server based DBMS that can reside within Oracle for storing spatial data and indexes. On the client side resides ArcView, a Desktop GIS, with display, spatial analysis, querying and data capture functionality. Within the SDM routes are made up of road sections represented by arcs (line features) with intersections represented by nodes (point features).

The SDM, Figure 11, provides the following functionality:

- Full graphic editing of the motorway network held in Network Manager
- Graphic display of all associated network data
- Spatial query tools
- Spatial navigation of the RMMS database
- Spatial processing tools (e.g. buffer, within/without, nearest, etc)
- Map production tools

The SDM is essentially a data integration and capture tool that sits above the “*highways by exor*” system. Consequently, through the map, the user can manage any type of data.

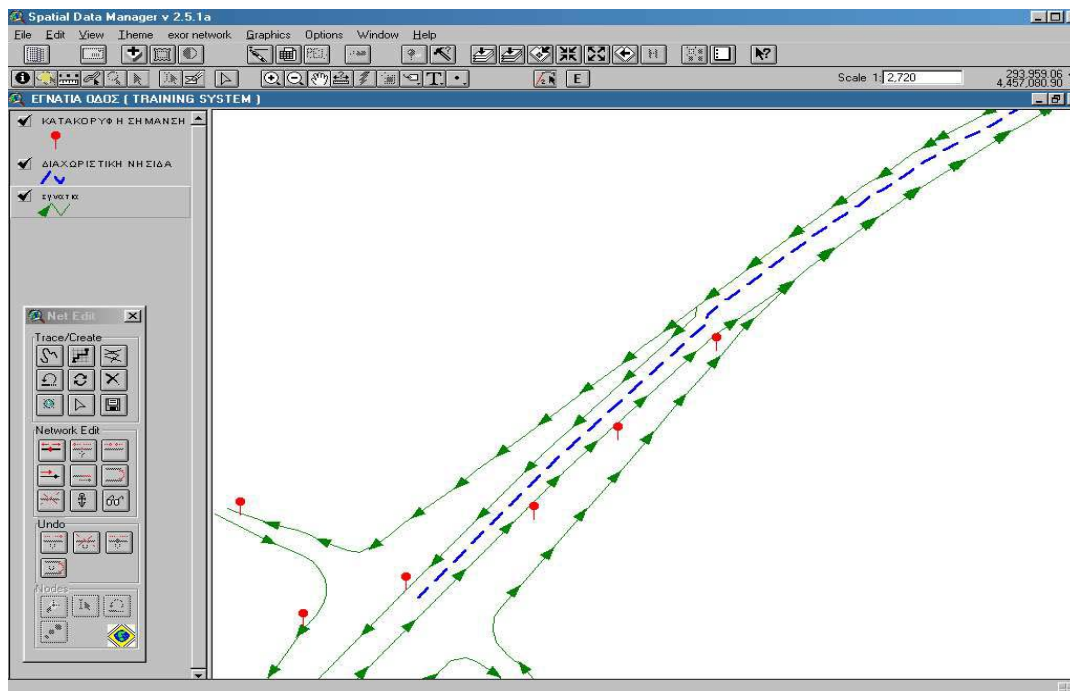


Figure 11, Spatial Data Manager

#### 4. CONCLUSIONS

For the first time in Greece, an integrated information system is being utilised for the effective management of the motorway routine maintenance. As the relevant maintenance works are carried out by private contractors, there is need for effective supervision and management. The RMMS provides the necessary means to implement management procedures for the routine maintenance of the motorway.

The OMD have customised the RMMS according to the specific needs of the motorway. The system enables all the relevant data (inventory, inspection, defect, treatment, work orders, etc) to be assessed and associated, thus providing the necessary information for the management and supervision of routine maintenance projects.

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- [3] Egnatia Odos SA, Operations & Maintenance Division, 2002, Motorway Maintenance Manual, Volume 3: Motorway Inventory for Routine Maintenance, Thessaloniki.

## BIOGRAPHICAL NOTES

**Ioanna Ch. Karakaidou:** Civil Engineer

### Current Job Activities

- Alternate Director, Road Network Support Department, Operations & Maintenance Division, Egnatia Odos SA.

### Other Professional Activities

- Manager, Traffic Signs and Signals Department of DESE, Region of Central Macedonia, Greece

**Dimitrios E. Evangelidis:** Dr. Civil Engineer - Maintenance Discipline Alternate Head, Road Network Support Department, Operations & Maintenance Division, Egnatia Odos SA

### Current Job Activities

- Support of Road Network Management Department on Maintenance Issues
- Preparation of Operation & Maintenance Contracts
- Contracts & Designs Supervisor
- Preparation of the Motorway Maintenance Manual

### Other Professional Activities

- Development of Pavement Management Systems
- Building Designs as Self Employed Engineer
- Lecturer GIS/CAD Systems, University of Thessalia, Greece
- Lecturer in GIS Systems, University of Macedonia, Greece
- Lecturer in Road Asset Management, Technical School of Thessaloniki

**Georgios A. Bantelas:** Surveying Engineer, MSc GIS - Motorway Inventory Engineer, Road Network Management Department, Operations & Maintenance Division, Egnatia Odos SA

### Current Job Activities

- Motorway network management
- RMMS operation and management
- Motorway maintenance projects supervision
- Preparation of the Motorway Maintenance Manual

### Other Professional Activities

- External associate (teaching, research projects, etc) at the Aristotle University of Thessaloniki (AUTH)
- Research student - PhD candidate (School of Civil Engineering - AUTH).
- Self Employed Surveying-GIS Engineer

## CONTACTS

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