DIGITAL GEOMETRIC DOCUMENTATION OF THE RAIL JOURNEY OF THE HISTORIC TRAIN OF PELION

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ABSTRACT:

The object of this research project is the documentation of the rail journey of the historic train of Pelion. From the beginning, the approach of the issue pointed out the immediate need of its digital geometric documentation. In this context, a complete cartographic background of the rail journey of the little train of Pelion and the wider region was created. The Digital Terrain Model (DTM) of the entire region was first created and then followed the ortho resampling of aerial photos that covered the area of interest. In addition to the photographic documentation of all viaducts, high masonry overpasses and stations of the railway and finding related information of historical and technical interest, there has been the survey, the photogrammetrical documentation and 3D visual representation of two worthy examples of engineering work. The development of a multimedia project took place in order to manage and publicise a great amount of data related to the documentation of the rail journey of the little train of Pelion.

1. INTRODUCTION

The focus of this paper concerns the documentation of the rail journey of the historic train of Pelion. The historic rail journey of Pelion represents a worthy example of Greek industrial heritage.

The Volos – Milies narrow gauge heritage railway, widely known as Pelion Little Train, constitutes a fine example of a typical Decauville public railway of 600mm gauge. Since 1903 and for 68 years, it has been used to connect the city of Volos with seven villages in the central and south-western region of Mount Pelion. In 1985, in recognition of its faithful service to the local population, its historical and cultural value and its engineering features, the Ministry of Culture officially declared the line with all its installations a preserved historical monument. Part of its coastal section was recently put back in action with vintage open summer coaches, while the mountainous section had entered traffic since 1996.

First of all, there has been an attempt of pointed out all published stuff concerning the little train of Pelion, its history and its prospects for the future. A research of the State Railways's (OSE) records, Volos department, followed. This first approach of the issue pointed out the immediate need of digital geometric documentation of the rail journey of the historic train.

2. DIGITAL GEOMETRIC DOCUMENTATION OF THE RAIL JOURNEY

A complete cartographic background of the rail journey of the little train of Pelion and the wider region was created. This cartographic background constituted the basis of the procedure of recording, surveying and documentation that followed, and was also used for the identification of the most important examples of engineering work, masonry and iron viaducts, retaining walls, tunnels and stations of the railway. In addition, the use of this cartographic background would have been essential for the development of a Geographical Information System (GIS) or a multimedia project. Geographical reference is moreover indispensable for the production of this kind of application.

The identification of the overall rail journey of the historic train of Pelion has been possible by using maps with scales 1:50000 and 1:5000. Afterwards, the production of digital orthophotos of the area of interest followed. Geographical reference using orthophotos was chosen, as an orthophoto provides the quality and metric features of both an image and a map. Historic black and white aerial photos dated back in 1953 were used, among others, during the photogrammetric processing for the documentation of the rail journey of the historic train of Pelion, as the network was at that time in full progress and the identification of the rail journey and of all engineering works would have been possible. Most recent black and white and colour aerial photos were used as well to create a complete mosaic of orthophotos for the entire rail journey of the historic train of Pelion.

Figure 1: Location of the rail journey of the historic train of Pelion according to maps with scale 1:5000.

Maps with scale 1:5000 were used for the production of the Digital Terrain Model (DTM) of the region, essential for the

ortho resampling of aerial photos. The Digital Terrain Model (DTM) that was created, using Erdas Imagine 8.7, gives the 3D comprehension of the terrain of the wider region. For this purpose, digitalization of all contour lines of these maps and determination of elevation for each contour line took place also in Erdas Imagine 8.7. Before starting digitalization of contour lines, all maps were rectified according to the Transverse Mercator projection, the GRS 1980 spheroid and EGSA87 datum. For the rectification of these eleven maps that covered the whole area of interest, all points of grid were used in each map.
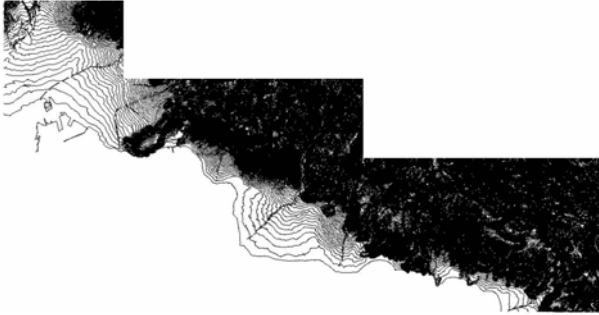

Figure 2: Representation of contour lines.

Figure 3: The Digital Terrain Model (DTM) of the area of interest.
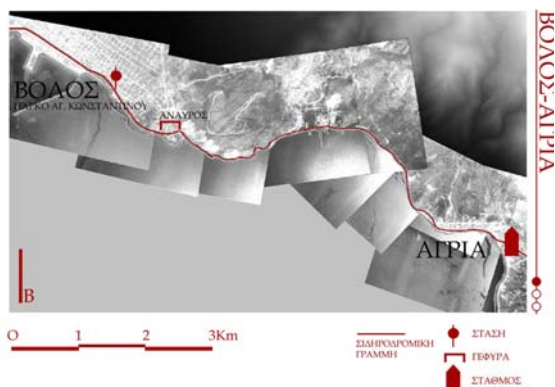

Figure 4: Part of the rail way (coastal itinerary Volos-Agria) identified in the mosaic of orthophotos.

During the process of the ortho resampling in Erdas Imagine 8.7 for all aerial photos, the Digital Terrain Model (DTM) of the region was used and also the rectified maps with scale 1:5000 for the determination and measurement of Ground Control Points (GCP's). For the documentation of the entire network, 62 black and white and one colour aerial photos were used overall. The mosaic of orthophotos for the entire rail journey of the historic train of Pelion contains the geographical reference and apparently the projection info (Transverse Mercator projection, GRS 1980 spheroid, EGSA87 datum) of the (DTM) and the rectified maps with scale 1:5000.
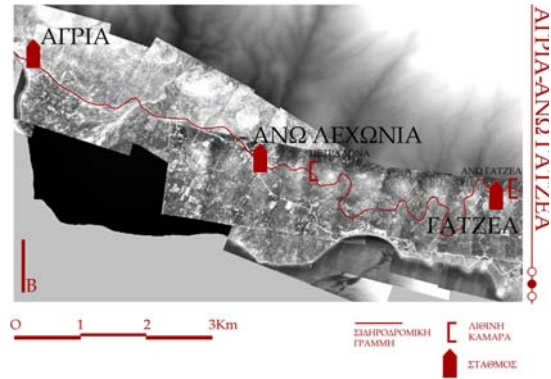

Figure 5: Part of the rail way (mountainous itinerary Agria-Gatzea) identified in the mosaic of orthophotos.
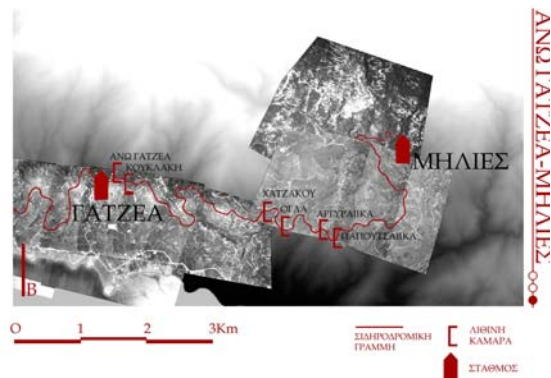

Figure 6: Part of the rail way (mountainous itinerary Gatzea-Milies) identified in the mosaic of orthophotos.
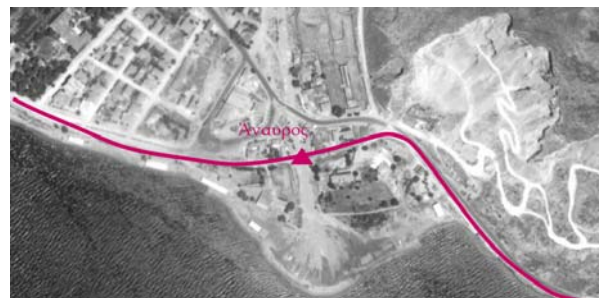

Figure 7: Part of the offshore rail way, near Volos outskirts.

The digital geometric documentation of the rail journey of the historic train of Pelion proved to be essential, as a cartographic background, for the development of a multimedia project. The same cartographic background could also be used for the development of a Geographical Information System (GIS) concerning mainly the management of industrial heritage.

3. DOCUMENTATION OF VIADUCTS AND STATIONS OF THE RAILWAY

The photographic documentation of all viaducts, high masonry overpasses and stations of the railway took place. In this context, the survey, the photogrammetrical documentation and 3D visual representation of two worthy examples of engineering work, Taxiarchis metallic viaduct, near Milies, and high masonry overpass of Kouklaki, near Ano Gatzea, followed.

Figure 8: Kouklaki high masonry overpass, near Ano Gatzea.

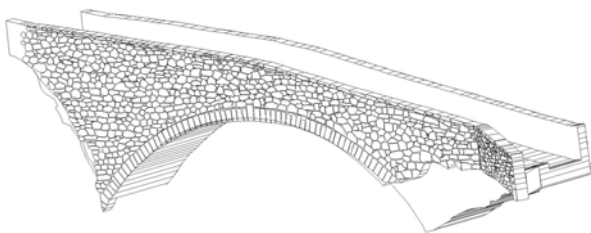**Figure 9:** 3D visual representation of Kouklaki high masonry overpass, near Ano Gatzea.

Figure 10: 3D visual representation of Kouklaki high masonry overpass, near Ano Gatzea.

The Reflectorless total station TCR 305 of LEICA was used for the measurement of control points. The professional camera Rolleiflex 6008 Metric was used for the acquisition of images. During the photogrammetric process, the commercial software IRASC was used for the rectification of images. The

3D visual representation of these monuments was finally completed using AutoCAD 2006 and 3D Studio VIZ R3.

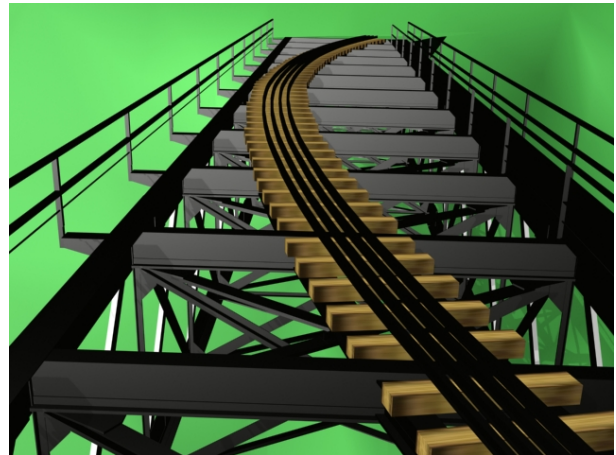**Figure 11:** Taxiarchis metallic viaduct, near Milies.

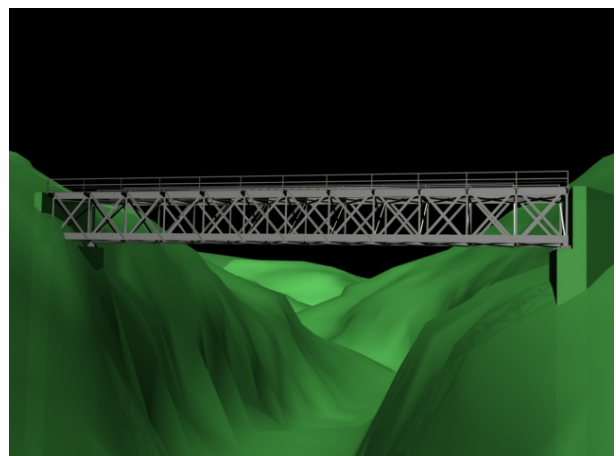**Figure 12:** 3D visual representation of Taxiarchis metallic viaduct.

Figure 13: 3D visual representation of Taxiarchis metallic viaduct.

Figure 14: Façade of Volos station.

Figure 17: Photos taken during the restoration works, (OSE) records.

4. DIGITALISATION OF (OSE) HISTORIC RECORDS

A great amount of data related to the documentation of the rail journey of the little train of Pelion was found in State Railway's (OSE) records. The digitalisation and file management of these records (maps, plans, photographic stuff etc) offered an important source of research, concerning the restoration works of stations such as Agria, Ano Lechonia, Ano Gatzea and Milies and viaducts of Brichonas, Taxiarchis and Milies. These records include also photos of old steam trains and of the railway Volos - Milies before the restoration works.
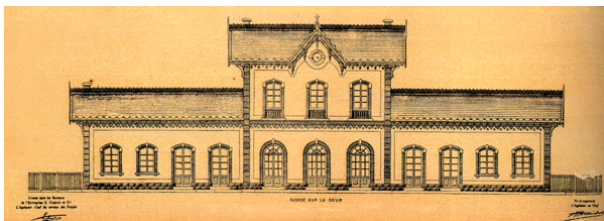
5. MULTIMEDIA PROJECT

While trying also to register and administrate a great amount of data (texts, digitised maps and plans, digitised pictures, files of three dimensional representations, Digital Terrain Model, digital orthophotos etc), concerning the documentation of the rail journey of the little train of Pelion, there has been an attempt of creating a multimedia project. This multimedia project provides the means for the publication of a great amount of information concerning the historic train of Pelion and the attempt of documentation of its rail journey in the context of the present research as well.
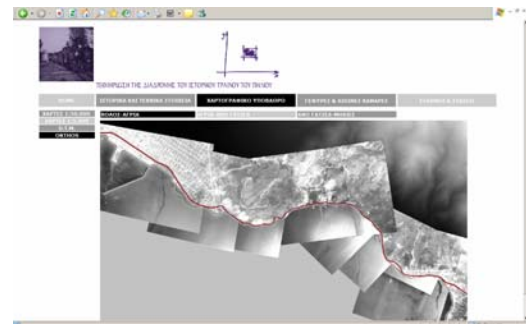

Figure 15: Façade of Volos station, (OSE) records.

Figure 18: Layout of the multimedia project concerning the cartographic background of the railway.

Figure 16: Photos taken during the restoration works, (OSE) records.

Figure 19: Layout of the multimedia project concerning all viaducts and high masonry overpasses of the railway.

The software used for the development of this multimedia project was Dreamweaver MX of Macromedia. This software offered the choice of working in an intuitive visual layout interface or a streamlined coding environment. The design, development and maintenance of websites and web applications proved to become rather quick and easy using this particular software.

Figure 20: Layout of the multimedia project concerning all stations of the railway.

6. CONCLUSIONS

The whole number of infrastructures of train of Pelion constitutes a worthy example of Greek industrial heritage, from constructive, technological and architectural point of view. In other words, it's a monument with tight bonds with history, culture and social life of the region. The rail journey Volos – Milies is an industrial landmark, a significant component of our tradition.

The application of fast developing digital technologies to the survey and documentation of cultural monuments was actually the main field of study of this project. The research for the rail journey of the historic train of Pelion was the ignition to put into practice a whole number of methods, techniques and principles related to the protection and conservation of our industrial heritage.

Finally, the existence of a multimedia project concerning the documentation of the rail journey of the little train of Pelion, could become a useful object of study not only for specialists but also for anyone who wants to look through our industrial heritage.

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