

THE “NEW DIVERTED BED” OF THE SPERCHIOS RIVER AND THE NEW NATIONAL ROAD ATHINA-LAMIA IN THE AREA OF THE “ALAMANA BRIDGE” AND THE IMPACT TO THE ENVIRONMENT TO THE COASTAL AREA OF THE MALIAKOS GULF AND THE DELTA (FTHIOTIDA-GREECE)

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Abstract

The purpose of this work is to depict and evaluate the alterations in the geomorphological characteristics and the hydro-geomorphological processes as well as the effects to the environment of the coastal area of the Maliakos gulf and the delta of the Sperchios river, as a result of the construction of the “new bed” of the new diverted bed of Sperchios river, the “New Alamana Bridge” and the construction of the long embankments which are constructed in order to facilitate the road works for the New National Road Athina-Lamia in the section Thermopylae - Lamia (Fthiotida-Greece).

1. INTRODUCTION

For the construction of contemporary highway networks there is a need of particular constructions (bridges, embankments, etc.), which alter the natural characteristics of the environment, form new characteristics and conditions and a particular landscape which comprises of roads, excavations, embankments and bridges in the areas where it crosses or bypasses the natural obstacles, such as at the places where we see morphological elevations and the beds of rivers and torrents. The disruption of the morphology of the relief and the natural hydro-geomorphological processes is more intense especially in the case where the new road is constructed mainly across the morphological slopes and in the direction of the flow of the surface and underground waters and causes, linear disruption of the pattern of the relief and of the hydro-geomorphological processes. The normal

natural flowing conditions of rivers, torrents and pluvial waters is disrupted. In the long run, these results are unfavorable as far as the maintenance cost, the efficiency of the road works and the effects to the natural environment which can be alteration of the landscape, the surface and underground waters, the fauna and the flora and the natural ecosystems in general.

2. MATERIALS AND METHODS

2.1 Geographical location of the study area

The greater study area is located in the lower lowland area of the town of Lamia (Greece) and the estuaries of the Sperchios river in the gulf of Maliakos. For the construction of this new road artery under study in the national road in the part Thermopylae - Lamia, which is about 12 kilometers long and has highway specifications, were necessary specific construction works, such as bridges, excavations and embankments.

2.2 Investigation method

What was used was the planning data of the project, that is the detailed technical characteristics of the excavations, embankments and of the bridges which were combined with data that arose from the in situ observations of the evolution of the phenomena relative to the hydro-geomorphological conditions (erosions, depositions of dragged material, solid contributions from rivers and currents).

3. RESULTS - DISCUSSION

3.1. Changes in geomorphological structure and the hydro-geomorphological processes

The changes in the geomorphological structure and the hydro-geomorphological processes in the study area are mainly attributed to the construction of the bridges and to the long embankments which have been formed at some places for the purposes of the construction of the road at the Thermopylae - Lamia section, which have caused a linear disruption of the form of the relief, mainly across the morphological slopes, but also across the main axes of the discharge of the waters and especially the rivers of the area (Mertzanis A. and Papadopoulos A. 2004). The different parameters relevant to the changes in the

geomorphological structure and the hydro-geomorphological processes of the study area, the details of which have been investigated in detail, are described as follows and they are:

1. The construction of the new bridge in the river Sperchios which is approximately 100 meters long, and is constructed for the facilitation of the new highway in combination with the arrangement – artificial stabilization and shift to the north of the main bed of the river Sperchios, is an important element for the future development of the area of the estuaries and the delta. As it has already been mentioned, these arrangement – constructions result in the change of the natural hydro-geomorphological processes and their natural characteristics and their transformation to new artificial hydro-geomorphological processes and the result is the creation of new characteristics of the environment and of a specific landscape which comprises of roads, embankments, bridges, artificially formed river beds and artificial drainage channels, such as the one which was constructed for the creation of the new bed of Sperchios river. Another result of those construction works is the creation of a new form of the Delta in the area of the new site of outfall of the Sperchios river to the Maliakos gulf, as well as the formation of new destabilization processes of the dynamic of the coastal area and the limitation of the extension of the coast line at the expense of the sea line, in the old position of outfall (old Delta) or even the creation of conditions of regression of the coast line at this site (Zalidis H.G. and Matzavelas A.L., 1994, Sigalos G. and Alexouli-Livaditi A. 2006a, Sigalos G. and Alexouli-Livaditi A. 2006b).



Fig. 1 & 2: Geographical location of the study area (Fig. 1). The new Delta of the river Sperchios (Fig. 2) (Source: Google Earth)

These changes in combination with the uncontrolled pumping of the underground waters and the limited supply of dragged material to the lower alluvial area, downstream of the highway (towards the Maliakos gulf) is possible to lead to phenomena of lowering of the soil surface and to the creation of irreversible conditions, which are the impregnation of sea or briny waters and the flooding of this terrestrial area, which will result in the future shrinking of part of the wetlands.

2. In the greater part of the study area the road axis at the section Thermopylae – Lamia, passes over an embankment of about 5-10 m high. An exception to that is the case of the sections where bridges are used, which are the cases of the river Sperchios from position km. 201+200, up until km. 201+300 (Alamana's bridge) and the new bed of Sperchios river from position km. 206+900, up until km. 207+000. Also, the highway passes through a bridge of approximately 1.000 meters long over the new railroad track under construction from position km. 202+800, up until km. 203+900. Those embankments that were constructed transversely to the morphological slopes and to the main outflow axis of the rivers and currents in the area, in combination with the construction of the road surface which has new gradients relative to the preexisting relief, have caused changes in the direction of the movement and in the natural flowing conditions of surface waters which flow according to the processes in the area in the thin layer of water over the soil. The compaction and the waterproofing of the asphalt layer forces the surface derived waters and especially those of the thin layer over the soil surface to follow the gradient of the drainage "pluvial drains" and to abandon their natural course which followed the general direction of the gradients of the relief. The embankments which were constructed for the purposes of the new highway as well as the embankments of smaller width and height which were constructed before 1950 for the purposes of the construction of the old National Road Athens - Lamia in the valley of Lamia, work as a "barrier" and cut off the transfer of the upper surface layer of the underground waters and also of all the detained on the soil surface flooding waters, downstream of the valley of the Sperchios river and the Delta area.
3. The presence of these embankments at least for the section from Thermopylae to Lamia (Anthili) disrupts the possibility of transfer and deposition of dragged materials from the parts upstream of the water currents and especially from the river Sperchios in the lower area of the outfall and the Delta. Despite the intense torrential character and the great solid dragging ability of the Sperchios river, the supply to the Delta and to the area of the outfall of the water current to the Maliakos gulf actually occurs only through the main stream of outflow and the newly formed bed of Sperchios river, while the rest of the lower banking up area downstream of the highway (towards the Maliakos gulf) does not, as it would be expected, receive in its entirety flooding waters and brought materials. These brought materials are transported through the river bed, are deposited in it and

bank up both the new and old riverbeds, thus resulting in the containment of its size and its supplying capabilities and furthermore in the presence of flooding incidences upstream of the motorway. Often Sperchios river overflows at the Delta and in this way the main flow of its river bed is changed, even though it remains in the southern part of the valley of the river. In 1889 as a result of the disruption of the natural bund, we had the last diversion of flow of the river Sperchios. Also, after 1957 begun the illuviation of a large area of the shallow part north to the present river bed due to the construction of an overflow channel. Already ever since the ancient times (480 b.C) the shift of the coastline and the Delta to the east comes to 8-10 km, while the well known historical site of the “narrow passage of Thermopylae” where according to references the sea line was up to the present monument of Leonidas in the national road Athens – Lamia (Tziavos C. 1977, Anagnostou H. and Tziavos H. 1977, Zamani A. and Maroukian H. 1979, Zamani A. and Maroukian H. 1980, Maroukian H. and Pavlopoulos K. 1995). Kotoulas (1988) studied the evolution of the delta of the river during 1943-1971 and came to the conclusion that the overall size of the Delta has increased in these 28 years by 6,62 Km², which corresponds to 0,236 Km²/year. More specifically, in the diversified river bed where, the Delta has increased by 4,0 Km², which correspond to 0,33 Km²/year. The above demonstrates explicitly the great transfer of dragged solid material by the Sperchios river and their deposition into the coastal and delta areas. Also, indicative of the transferring processes of the river Sperchios is the fact that during 1958- 1970, that is, a duration of 12 years, in the main river bed alone there were deposited 310.000 m³ of material. Over the same period, the Delta of the river in the area of the diversified river bed moved towards the sea 2 Km, that is by 160 m/year while the bottom of the sea at a distance of 1.020 m from the delta was limited to only 0, 80 m (Kotoulas D. 1988). It is noted that the dragged material consist an important source of supply of nutrients and organisms that thrive in the deltas which are complicated systems of very fragile balance. The benthic organisms transfer energy from the the precipitant and the producers to consumers higher up in the food chain (fishes, birds) and in this way they significantly contribute to the food chain and to the high productivity of the ecosystem.

4. CONCLUSIONS

The long embankments, have caused a linear disruption of the form of the relief, because they are formed mainly across the morphological slopes, but also across the main axes of the discharge of the waters and especially in the valley and the discharge axis to the sea, of the Sperchios river and also the rest of the currents that drain the area. Another important impact to the environment of the coastal

area and the alluvion of the estuary of the river Sperchios, is the shift to the north of the main bed of the river Sperchios, where a new delta form (new Delta) was created in the location of the new site of discharge of the river into the gulf of Maliakos. The result of this, was the destabilization of the existing balance in the coastal area

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