Effectiveness of traffic management strategies in New Ionia

Costas Portokalidis
Urban and Regional Planner – Transport engineer
PHD Candidate, University of Thessaly
Department of Planning and Regional Development, School of Engineering
Volos, Greece
e-mail: kport@prd.uth.gr

George Lymberopoulos
Civil Engineer – Transport planner
POLINDE Consulting Engineers,
Athens, Greece
e-mail: lymberopoulos@polinde.gr

ABSTRACT

This paper estimates the consequences of implementing an alternative approach for the through traffic of vehicles along the major axis (arterial) of the Municipality of Nea Ionia and more specifically the Kastamonis - Al. Panagouli road. More specifically, it addresses the effects that through traffic has to residential blocks and the surrounding urban environment, based on a philosophy of traffic "reorganization" with the limitation or total prevention of through traffic movements in residential areas and the implementation of traffic measures for local trips. The need to analyze the operation of the project road system and the detection of the problems, led to a series of traffic counts and surveys for the pre-implementation stage as well as for the post implementation stage. These results are compared to the previous state traffic volumes as well as the estimated volumes after the implementation of the measures. The analysis conducted shows that a realistic assessment of changes in traffic, following the implementation of new measures is an open challenge, not always positive. Overall, the prediction in complex systems such as this, affected by various external factors may present significant shortcomings in secondary or tertiary assessments. However it is an important analytical tool that can lead to assist in decision making even in cases where estimates are not absolutely realistic.

1. Introduction

In recent years the Municipality of Nea Ionia has experienced rapid economic and social development in the context of the overall growth of the Greater Metropolitan Area of Athens. This development has affected the urban environment leading to deteriorating urban and traffic conditions. The city, which is centrally situated in the Metropolitan Area presents major through traffic problems due to the increase in population and mobility that has resulted in an increase in the demand for passenger and goods movement by private means. This continuous increase in the demand for travel in correlation with the fact that the urban areas have not been designed and developed forecasting such demand, creates serious traffic and environmental problems (CEC, 2007; Ministry of Works, 2008; Giannis et al., 2009 etc.).

The main road network, which serves the largest percentage of traffic, has reached its capacity and is congested both geographically and over time. The results of this situation are the bigger delays and an increase in air and noise pollution (Aravantinos, 1997; Vlastos, 2008, etc.). In addition to trying to avoid the congested network, drivers try to discover new routes through residential areas, deteriorating the quality of life of the residents in those areas.

Addressing traffic congestion with a program of building new roads and generally with the expansion of transport infrastructure requires significant, and often unavailable, funding. Implementation of such plans is often difficult due to the limited space available in an urban setting and due to the environmental impacts and public reaction that is related to such projects. The negative implications of such projects are considered important obstacles to the

"sustainable planning"[1] of cities. The problem is completely related to the quality of life of the residents, as stated in the Green Paper of the European Union (EU, 2007). Based on the problems stated above, effective traffic management of the existing road network and the relevant infrastructure presents a major challenge.

2. Objectives and Methodological Framework

This approach initially attempts, by analyzing the characteristics of the through traffic along Kastamonis Road, to find solutions for the rearrangement of the traffic so as to achieve a new "balance" between supply and demand for travel. Once the measures have been implemented new traffic counts are undertaken so as to make a comparative analysis between the forecasts and the actual new situation that has been formed. Finally the actual efficiency of the traffic measures is evaluated (audited) using the traffic volumes and travel characteristics of the examined road network.

More analytically, this paper estimates the consequences of implementing an alternative approach for the through traffic of vehicles along the major axis (arterial) of the Municipality of Nea Ionia and more specifically the Kastamonis road and addressing the environmental effects that it causes to residential blocks, based on a philosophy of traffic "reorganization" with the limitation or total prevention of through traffic movements in residential areas and implementing traffic arrangements for the local movements.

The aims set out were the:

1) improvement of the level of service of the project road network,
2) limitation of traffic congestion,
3) reduction in traffic accidents,
4) limitation of through traffic movements,
5) reduction of the environmental effects due to vehicle movements
6) improvement of the quality of life for the residents in the project areas.

The need to analyze the operation of the project road system and the detection of the problems, led to a series of traffic counts and surveys. The traffic data collected and used in this study assisted in the:

- understanding of the traffic operation,
- the evaluation of the traffic characteristics in the project area.

The methodology followed was divided into 6 stages as follows:

Stage A	Reconnaissance and network surveys
Stage B	Traffic counts and surveys
Stage C	Analysis of existing condition and identification of problems
Stage D	Proposals for through traffic management
Stage E	Estimation of the effects of the measures proposed
Stage F	Post implementation analysis

All the above stages include the classic processes of traffic analysis and the attempt to correctly define the existing conditions and traffic characteristics for the road network under investigation. The results of the analysis include the methodological framework in order to

[1] There is a broad literature approach to sustainability. For more details refer to IUCN, WWF, UNEP (1991); WCED (1987); William (1989); Blowers (1993); Haughton and Hunter (1994); Wheeler (1998); Ravetz (1999); Castells (2000); Aggelidis (2004); Kafkalas (2004) etc. In particular, the relationship between sustainability and transport was expressed for the first time in early 1990 by the European Commission (EC, 1992; EC, 1996), where the concept of "urban mobility" was introduced as well as the effort to develop strategies for "sustainable transport " (Replogle, 1991; ICLEI, 1994; OECD, 1996 etc.).

define the appropriate traffic measures, where an attempt is made to estimate the effects (positive and negative) of the implementation of these measures. After implementation, new traffic counts are carried to determine the actual effects of these measures. In this way, the effectiveness of the traffic measures are evaluated on the one hand and a proper assessment of their effects is undertaken on the other. An attempt is made for a final and comprehensive assessment of the methodology used to select the optimum proposal. Finally, the possibility to use the methodology to estimate the effects of similar traffic measures, is assessed.

3. Data Analysis

3.1 Pre-implementation study

The Municipality of Nea Ionia is situated centrally on the primary road system of the capital, and receives much of the overall impact of the increase in traffic. The main road network of the Municipality mainly serves through traffic (see Map 1 and Table 1 below). In the east-west direction and vice versa, the main road network links the eastern municipalities of the metropolitan areas of Athens with the National Highway. In the north-south direction and vice versa, the main road network links the northern areas to the center of Athens. The aim of the construction of the Ethnikis Antistaseos Avenue was to create a main route for through-traffic in the east west direction so as to diminish traffic congestion on Kastamonis Road (poor geometric characteristics, 7m wide road surface). The construction and operation of Attiki Odos also did not have the expected impact on congestion along Kastamonis Road. It is therefore imperative to implement drastic traffic management measures to reduce the negative impacts of through traffic on the quality of life and environment of the residents of Nea Ionia.

Table 1: Traffic counts for through traffic on the examined road network (Morning Peak/ PCU[2] per Hour)

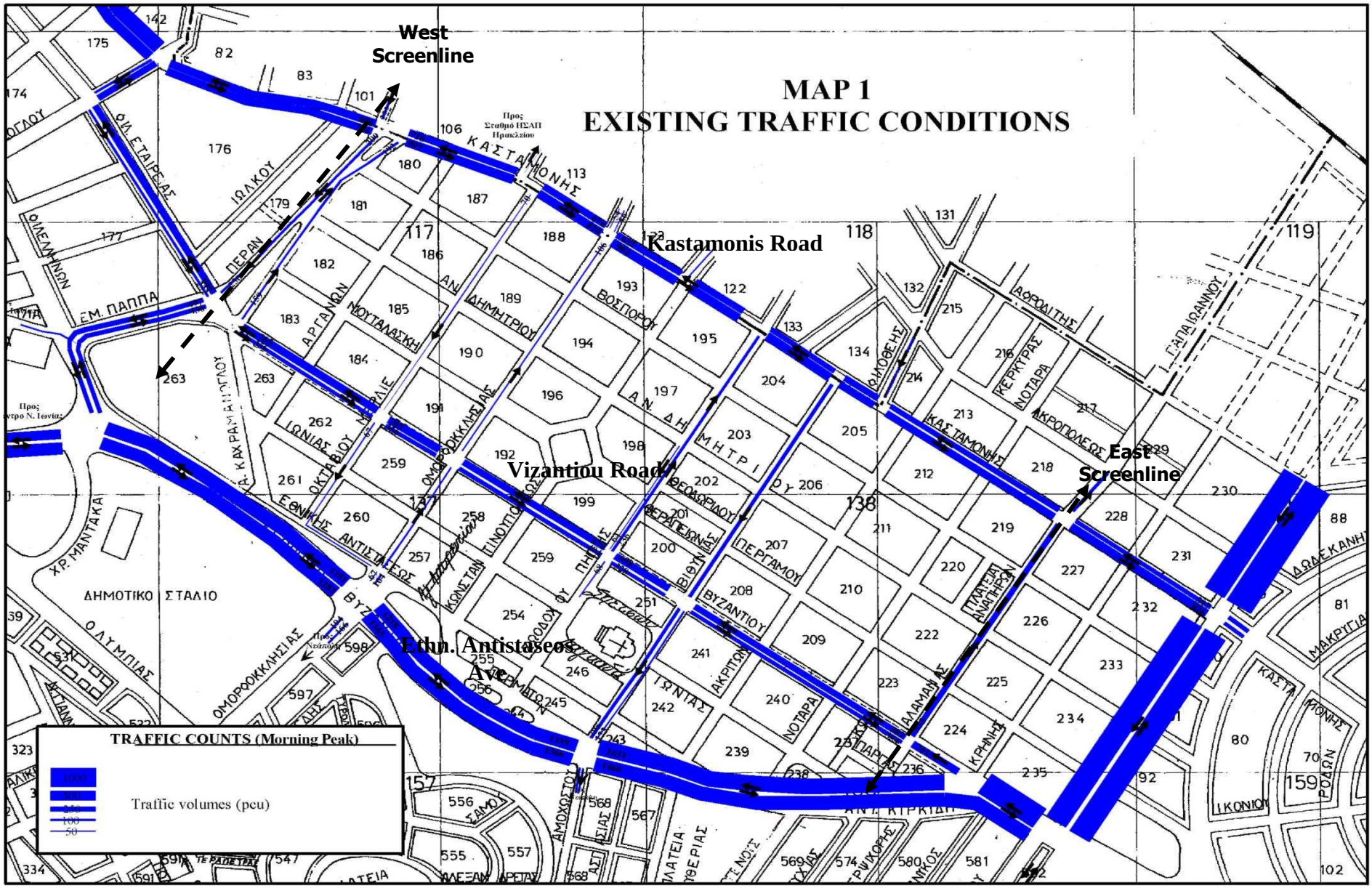
Screenline of analysis	Street Name	Westbound traffic		Eastbound traffic		Total traffic	
		PCU	%	PCU	%	PCU	%
East	Kastamonis	632	22,16	826	31,29	1458	26,55
	Vizantiou	582	20,47	354	13,41	936	17,07
	Ethn. Antistaseos	1631	57,37	1460	55,30	3091	56,37
	Total	**2845**	**100**	**2640**	**100**	**5485**	**100**
west	Kastamonis	718	25,34	907	35,62	1625	30,20
	Vizantiou	765	26,99	356	13,98	1121	20,84
	Ethn. Antistaseos	1351	47,67	1283	50,39	2634	48,96
	Total	**2834**	**100**	**2546**	**100**	**5380**	**100**

Source: Portokalidis, 2005

For a better evaluation along the northern corridor, the traffic volumes were analyzed and the total of all movements in two critical screenlines, on the eastern and western side of the project road. In this way the road was examined in two separate portions and conclusions were formed separately. From the above Table 1 it appears that:

- Ethinkis Antistaseos Avenue takes approximately 50% of the traffic volume whereas the rest is spread in the Kalogreza area. In the Kalogreza area the largest traffic volumes are found on Kastamonis road (it reaches 30% of the total traffic volumes).
- The variation in the total traffic that traverses the Kalogreza area is positive in the westbound direction. A increase in the range of 352 pcu's was noted in the total traffic volumes. This increase is balanced on both Kastamonis and Byzantiou Roads,

[2] Passenger Car Units (PCU).


MAP 1
EXISTING TRAFFIC CONDITIONS
West Screenline
Kastamonis Road
Vizantiou Road
East Screenline
Ethn. Antistaseos Ave.
TRAFFIC COUNTS (Morning Peak)
Traffic volumes (pcu)

showing that the Kalogreza area accepts traffic from the neighbouring areas (Municipality of Irakleio and Neapoli area of Nea Ionia).
- Kastamonis Road has total traffic between 1400 and 1700 pcu's.
- Vizadiou Road has total traffic between 900 and 1150 pcu's

The major part of the traffic volume assessed above, is derived from through traffic that uses the road network of the municipality only for passing. The main origins and destinations served by the through traffic are the eastern suburbs linking up with the National Road Athens - Thessaloniki and the western districts. The above analysis shows that the percentage of through traffic movement in the northern corridor is particularly high and was estimated at approximately **60-65%** of all the movements. Also, the classified turning movement counts showed that the percentage of heavy vehicles along this road is about **10%,** which further aggravates the traffic and environmental problems (Portokalidis, 2005).

3.2 New Traffic control Proposals

According to the analysis described above, in the proposal stage, the new traffic measures were assessed based on the analysis of existing traffic volumes and the corresponding effects on traffic due to the proposed measures. In particular, the traffic measures proposed include forming Kastamonis Road into a one way Street from Kimis Avenue until Peran road in conjunction with a series of traffic measures on the rest of the examined road network such as traffic signals, one way streets etc. (see Map 2). More specifically, the following conclusions were derived (Portokalidis, 2005):

- The through traffic on Kastamonis Ave will be drastically reduced. It is estimated that approximately 35-40% of the traffic will be diverted to Ethn. Antistaseos Ave.
- The traffic conditions along Kastamonis road is expected to improve and to drastically reduce travel times for vehicles in the area.
- The through traffic on Vizantiou is expected to increase by about 9-10% in the eastbound direction. This situation will be managed by using some more traffic control and calming measures like the installation of new traffic signals and the improvement of the signal timings on the existing ones.

During the final steps of the development of the proposals for the study of the management of the through traffic it was found that the main intervention of making Kastamonis Road a one-way, together with a range of other supportive measures, would reduce the overall traffic along this road as well as in the rest of the Kalogreza area. The main objective was to shift the through traffic onto Ethinikis Antestaseos Ave, thereby reducing the overall noise and air pollution from residential areas. In other words an attempt was made to implement the bases of sustainable mobility, as is defined in the introductory sections.

3.3 Post-implementation study

A realistic assessment of the impacts of the traffic measures, was undertaken after the full implementation of the project and a period for the normalisation of the traffic. The following Table 2 (see also Map 2), presents the general forecasts and trends of the traffic volumes on Kastamonis and Vizadiou Road, before and after the implementation of the traffic.

In particular, regarding the success of the main traffic measures, making Kastamonis Road a one-way showed that the estimated traffic on the road was relatively accurate (the percentage reduction of almost 55% in reality as opposed to the estimated 64% of the study - see east screenline). The analysis of the western screenline shows that the estimates of the study to reduce traffic below 10% (around 8%) are underestimated (over 27%). This development is very important and indicates that the main goal, to divert traffic from Kastamonis Road to the primary arterials and especially the Ethinikis Antistaseos Road, was achieved (Municipality of Nea Ionia, 2008; Polinde Consulting Engineers, 2007 & 2008).

Table 2: Post-implementation traffic counts analysis
(Morning Peak/PCU per Hour)

Street Name	Screen Line	Traffic Counts		
		Pre Stage	Estimated (%)	Post Stage[3] (%)
Vizantiou	East	936	No effect	1128 (+20,5%)
	West	1121	1233 (+10,0%)	1087 (-3,0%)
Kastamonis	East	1458	530 (-64,0%)	663 (-54,5%)
	West	1584	1445 (-8,7%)	1155 (-27,1%)

Source: Polinde Consulting Engineers, 2007 & 2008

On the other hand the assessments of the impacts of the measures for the rest of the road network were not very accurate. In particular, the actual traffic volume on the eastern Vizantiou screenline, shows an increase of 20%, where no changes in traffic conditions were estimated, at least in the specific direction. Some smaller increases in traffic in the range of 10% were expected in western screenline on this road, but the change is noted as -3%. Note that this result is a positive aspect of the traffic measures implemented, even though it was not estimated as effective during the study. This inability to correctly assess the impact of the new traffic measures that were found in the post implementation stage were greater than the estimated counts, due to drivers finding the conditions in a one way street better, and the capacity in the direction of flow greater. Even though the post stage traffic volumes are greater than the estimated, they are significantly less than the pre stage traffic volumes. This shows an improvement in the traffic management within the Kalogreza area in the post stage phase ((Municipality of Nea Ionia, 2008; Polinde Consulting Engineers, 2007 & 2008).

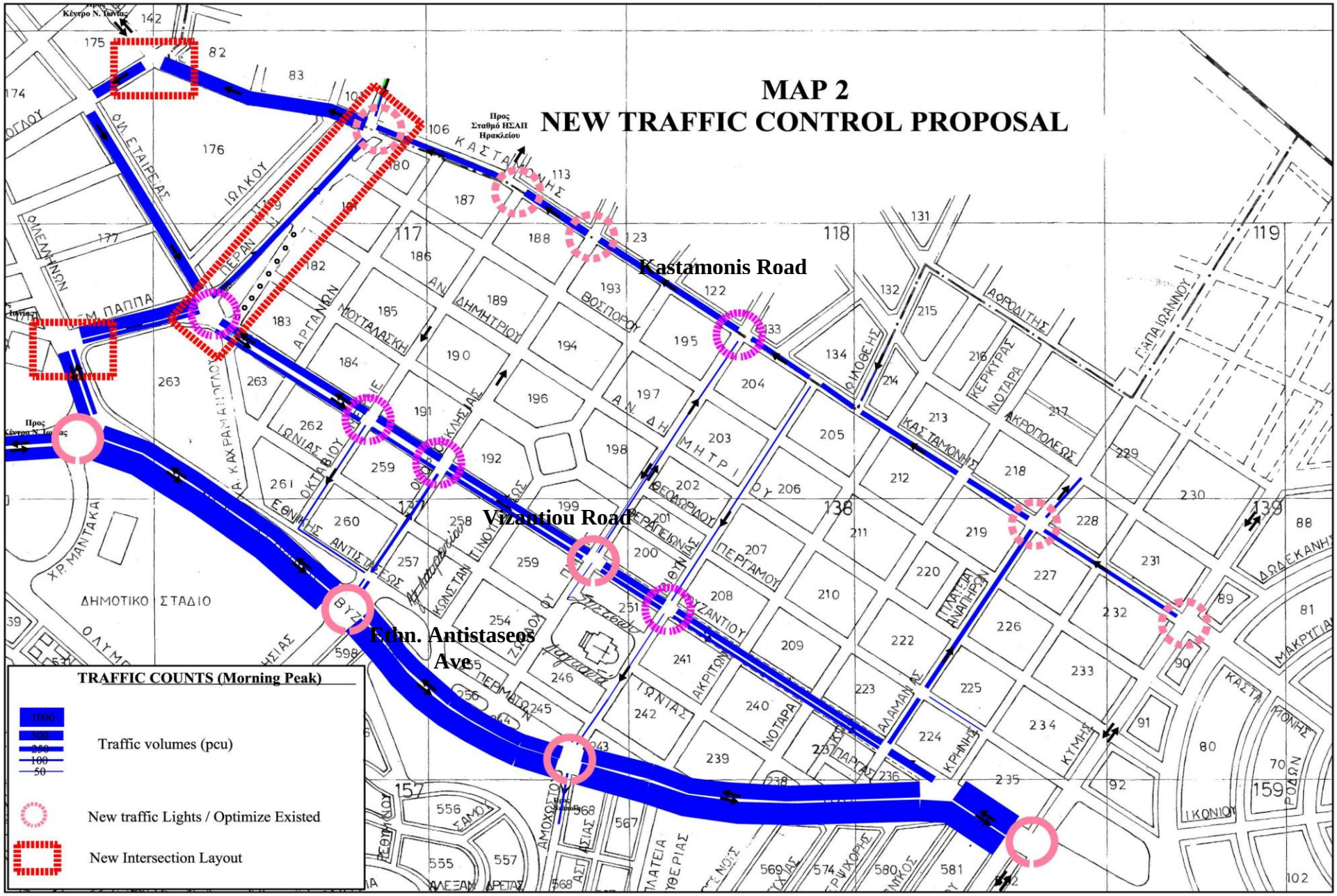
4. Conclusions

The traffic measures that were proposed and implemented are shown above and in Map 2. The overall implementation of the proposals was considered the most appropriate solution, as the system operated as a whole, interconnected and interdependent. This means that traffic measures affect the entire study area, even if they are localized in their implementation. It should be noted that the main aim of the proposal is to minimize or even eliminate the negative effects that may be created from the implementation of the traffic measures. The design attempted, through the analysis and diagnosis of the current situation in the area, to create a reference framework that qualifies the measures that allow the implementation of the optimal solutions.

The philosophy of the proposal was developed using the following criteria:

- The design should be holistic.
- The proposed measures should be realistic so that they can be implemented but they should also have vision of the future of the area.
- The difficulty in obtaining the required financial resources and the weaknesses are often found in Local Government Organizations makes it highly imperative that the measures interventions are prioritized by their importance, necessity and feasibility of their implementation.
- The proposed traffic measures should be based on the principles of sustainable development and should be environmentally friendly. The ability of future generations to enjoy at least the same possibilities and opportunities in natural and

[3] While estimating the effects of the measures, five sets of traffic counts were undertaken during different periods (08/06/2006, 03/10/2007, 19/11/2007, 16/01/2008 and 27/03/2008).


MAP 2
NEW TRAFFIC CONTROL PROPOSAL
Kastamonis Road
Vizantiou Road
Ethn. Antistaseos Ave
TRAFFIC COUNTS (Morning Peak)
1000
500
250
100
50
Traffic volumes (pcu)
New traffic Lights / Optimize Existed
New Intersection Layout

urban environment should in no way be undermined by the waste of natural resources

Positive aspects of this specific approach can also be characterized by flexibility and adaptability of traffic operations and can be implemented in an integrated framework for sustainable mobility. This is the conclusion of the proposed approach, which attempts to exploit the positive features of the current state of the road while ensuring open public spaces. Finally, the analysis conducted shows that a realistic assessment of changes in traffic, following the implementation of new measures is an open challenge, not always positive. Overall, the prediction in complex systems such as this, affected by various external factors may present significant shortcomings in secondary or tertiary assessments. However it is an important analytical tool that can lead to assist in decision making even in cases where estimates are not absolutely realistic.

References

Aravantinos, A. (2007) *Urban Planning.* NTU Athens, Symmetria Press.

Aggelidis, M. (2004) *Sustainable Development of cities in Europe and Greece*. YPEXODE, Athens.

Vlastos, Th. (2008) *Comments on Green Book: Through a civilization for urban mobility*. NTUA

Blowers, A. (ed.) (1993) *Planning for a Sustainable Development*, London: TCPA & Earthscan Publications

Castells, M. (2000) "Urban Sustainability in the Information Age". *City: Analysis of Urban Trends, Culture, Theory, Policy, Action,* Vol. 4. No. 1, pp.118-122

Commission of the European Communities – CEC, (1992) *Green Paper on the impact of transport on the environment - A Community strategy for sustainable mobility*. COM(92)46. Brussels

Commission of the European Communities – CEC, (1996) *European Sustainable Cities – Report Expert Group on the Urban Environment Directorate* General XI Environment, Nuclear Safety and Civil Protection

Commission of the European Communities – CEC, (2007) *Towards a new culture for urban mobility. Communication from the European Commission.* COM(200)551. Office for official publications of the European Communities, Luxembourg

Commission of the European Communities – CEC, (2007) *The Green Book: A new vision of urban mobility*. Brussels.

Haughton, G. and Hunter, C. (1994) *Sustainable Cities*, Jessica Kingsley Publishers, London

Giannis, G., Sikianaki, A., Mpairaktari, S., Toleris, E., Kaperoni, P., Theofilis, I. and Kopsachili, A. (2009) "Urban mobility strategy for the Greek Cities" Proceedings in *2nd Hellenic conference in urban and spatial planning and regional development*. University of Thessaly, Volos, Greece

International Council for Local Environmental Initatives - ICLEI, (1994) *Local Agenda 21 Participans Handbook* – Local Agenda 21 Model Communities Programme, Toronto: ICLEI

IUCN, UNEP and WWF, (1991) *Caring for the Earth. A strategy for sustainable living*. Gland, Switzerland, and Earthscan, London.

Kaukalas, G. (2004) "Sustainable spatial development: Fundamental topics and points" *Texnika Xronika*. Athens

Municipality of Nea Ionia, (2008) *Post implementation transport study for Kastamonis Anenue*. Municipality of Nea Ionia, Athens.

Organisation for Economic Co-operation and Development - OECD (1996) *Pollution prevention and control: Environmental criteria for sustainable transport*. Report on phase 1 of the project on environmentally sustainable transport (EST). Paris

Portokalidis, K. (2005) *Transport planning and traffic analysis for Kastamonis Anenue*. Municipality of Nea Ionia, Athens.

Polinde Consulting Engineers (2007 – 2008) *Evaluation of traffic measures for Kastamonis Anenue*. Municipality of Nea Ionia, Athens.

Ravetz, J. (1999) *City – Region 2020*, London: Earthscan

Replogle, M. (1991) "Sustainability: A vital concept for transportation planning and development". *Journal of Advanced Transportation*, Vol. 25, No 1, pp. 3-18

Ministry of Works, (2008) *Proposal for the strategy of urban mobility*. Ministry of Works. Athens. YPEXODE

Wheeler, S.M. (1998) "Planning Sustainable and Livable Cities" in (le) Gates M. and Stout R.T. *The City Reader*. New York: Routledge, pp. 434-445

World Commission on Environment and Development – WCED, (1987) *Our common future*. UN.

Williams, D.R. (1989) *Toward a Sustainable World*, Scientific American