Noise levels of the "In town without my car" on the 22nd September 2000, in urban environment

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Abstract: It is well known that noise is one of the most significant environmental impacts that road traffic causes in a city. Road traffic noise levels vary over time and space, due to different traffic conditions and the development structure of the city. In the frame of the September 22nd European campaign of the "In town without my car!", an attempt for the estimation of noise levels of city Volos was carried out by the Transport Laboratory of the Civil Engineering Department of University of Thessaly. More specific, it was compared the measurements of noise level at different sampling points over a map of the target zone, on the 22nd September 2000 and the corresponding measurements of noise level at the same points on the previous day. It is also mentioned the difference between the noise levels between these measurements and contemporary measurements at the same place (2000-2006).

Key-Words: noise level, traffic, urban environment

1 Introduction

It is well known that noise is one of the most significant environmental impacts that road traffic causes in a city. Environment noise levels vary over time and space, due to the diversity of traffic and site conditions, the population density, the degree of development and the activities occurring in this measured place. There have been many researches, worldwide, carried out to determine the acoustic conditions of different cities and the corresponding, physiological and psychological effects [1],[4],[5].

The Transport Laboratory of the Civil Engineering Department of University of Thessaly has significant experience in acoustic research projects and many studies have been carried out regarding to road traffic noise. As a result of these studies is the drawing up acoustic maps of cities. In this paper, the results of a project for comparative reports about the noise level of city of Volos are presented. More specific, it was compared the measurements of noise level at different sampling points over a map of the target zone, on the 22nd September, the European campaign "In town without my car" namely a day with reduction of motor traffic, and the measurements of noise level at these points on the previous day, at a normal situation. It is also mentioned the difference between the noise levels between these measurements and contemporary measurements at the same place.

Volos is a city situated at the centre of the Greek mainland and it is the capital of Magnesia prefecture. The city of Volos suffers from traffic congestion during peak hours and especially in the main arterial roads which cross the city centre.

The European campaign of 22nd September has as result to encourage public awareness of the need to act against pollution caused by the increase in motorized traffic in the urban environment.

Figure1 : Restricted area of city of Volos

In the frame of this special day, a target zone at the centre of the city was selected, in order to reducing motor traffic. It is undoubtly that reducing road traffic in the city center has a strong impact on noise. This phenomenon is confirmed everywhere through recorded measures. The magnitude of this

reduction is a significant factor to investigate. This reduction is not only a solution for noise pollution but also for improving the quality of urban life. This zone of restricted area to be studied is shown in Figure 1.

2 Measurement database

The basic target of this project was the determination and the comparison of city's acoustic field between two successive days :

- On September 21st 2000 (normal day)
- On September 22nd 2000 (European campaign)

During the method, 15 separate sampling points were selected over a map of the target zone of the city.

The separate locations of these points are presented in Figure 2. The measurement locations were selected to be as generically representative as possible of the restricted area.

Measurements sites are characterized by more continuous by quite constant values of the following parameters: road surface, traffic behavior, traffic speed, road slope and topographical characteristics.

The period of measurements was 10.30-14.00 daytime and all measurements were taken in accordance with the Environmental Noise Directive recommendations [1]. Measurements were taken at four different times of day, they lasted 15 min and they performed with a 2237 B&K type sound level meter with a tripod.

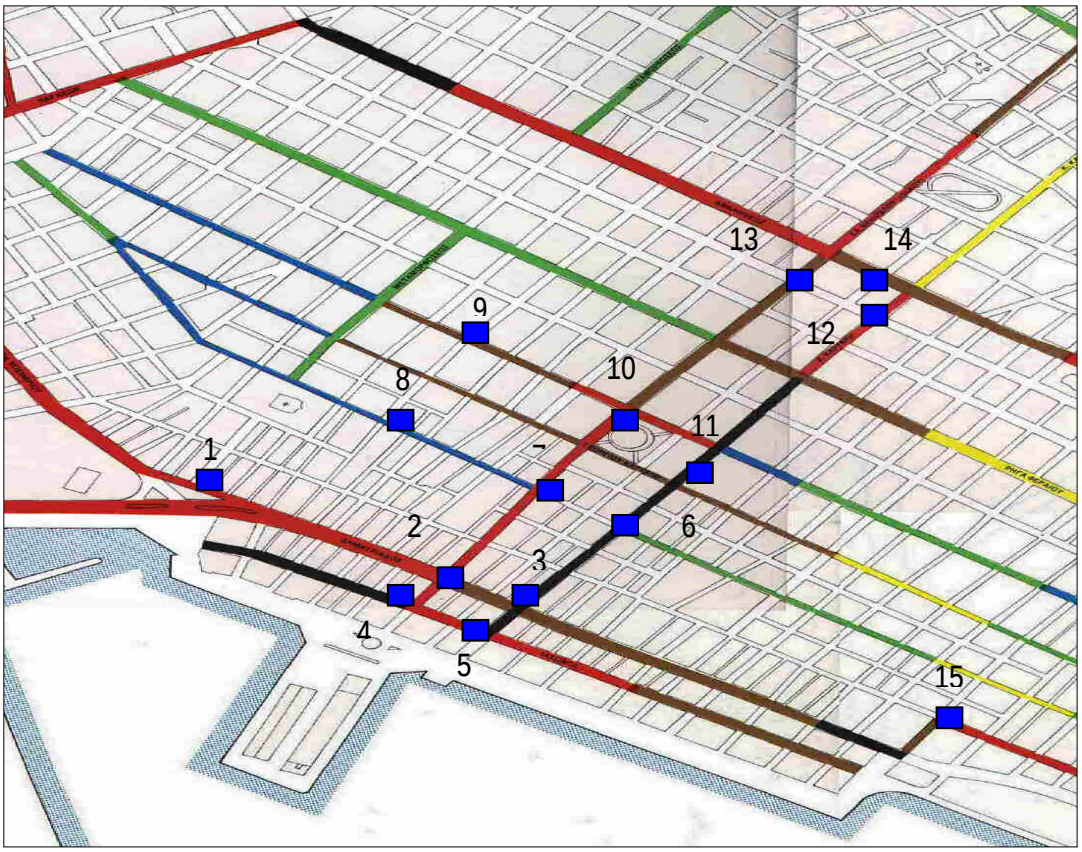


Figure 2 : City map and the 15 sampling points

The sound measured levels were L_1, L_{10}, L_{50}, L_{95}, L_{99}, L_{eq}, L_{max}, $L_{min.}$, where : [6]

- L_i (percentile level) is the sound level that is exceeded i % of the time for the period under consideration
- L_{eq} (energy-averaged sound level) is the equivalent steady-state sound level, which in a stated period of time contains the same acoustic energy as a time-varying sound level during the same period. L_{eq} is accepted as the most representative indicator for noise level by European Noise Directive [3].
- L_{max} and L_{min} are the maximum and minimum noise values at the time of measurements.

The measurements taken during the two successive days are presented in Table 1 and 2.

Table 1: Results of measurements on 22nd September (European campaign)

A/A	Lmax	Lmin	$L_A$eq	L1	L10	L50	L95	L99
1	92,2	64,2	78,5	90,5	81,5	72,5	65,5	66,5
2	86,3	65,6	75,2	82,0	78,5	73,5	68,5	67,0
3	89,5	62,7	75,0	85,5	78,0	71,5	66,0	64,5
4	90,6	64,4	78,0	87,5	81,5	75,0	69,0	66,5
5	88,7	66,3	76,2	84,0	79,0	74,5	69,0	67,5
6	91,9	53,1	74,2	84,5	77,5	68,5	59,0	56,0
7	91,7	60,5	75,3	83,0	78,0	73,0	66,5	64,0
8	89,3	62,3	76,4	85,0	86,0	73,5	66,5	64,5
9	88,5	62,0	76,3	84,0	85,0	73,0	66,5	64,0
10	97,0	63,8	76,4	86,0	79,0	73,0	67,5	65,5
11	97,8	58,7	77,9	87,5	81,0	74,0	65,0	60,5
12	91,8	58,1	76,4	87,5	79,5	72,5	60,5	59,0
13	97,7	58,7	76,7	86,0	78,0	70,5	61,0	59,5
14	89,4	55,1	74,4	85,0	77,5	70,5	61,0	57,5
15	94,7	59,9	76,5	86,0	79,5	73,5	65,5	62,5

Table 2 : Results of measurements on 21st September

A/A	Lmax	Lmin	$L_A$eq	L1	L10	L50	L95	L99
1	92,9	58,2	72,7	82,0	75,5	70,0	62,5	60,5
2	89,1	63,9	75,2	85,5	79,0	72,5	67,0	65,0
3	86,9	61,0	73,8	83,0	77,0	70,5	64,5	63,0
4	84,9	58,6	71,9	82,0	75,0	69,0	61,5	59,5
5	86,2	58,3	71,9	81,5	75,0	68,5	60,5	59,0
6	86,6	56,7	73,0	84,5	77,5	68,5	61,0	60,0
7	85,3	58,1	71,4	81,0	75,0	68,5	61,5	60,0
8	92,9	51,7	73,2	84,0	76,5	65,5	55,5	54,0
9	85,9	57,1	71,4	83,0	74,0	67,0	60,0	58,5
10	93,5	52,5	70,7	81,0	73,5	64,5	58,0	54,0
11	93,1	58,9	74,3	84,5	77,0	70,0	61,5	60,0
12	86,6	53,3	71,5	83,5	74,5	64,5	55,5	54,5
13	85,1	54,6	68,5	77,5	72,5	64,0	57,5	56,5
14	94,6	63,0	77,2	87,0	80,0	73,5	66,0	63,5
15	97,0	54,0	78,0	87,0	80,5	75,0	66,0	63,0

3 Overall analysis

From the analysis reported in this paper it is clear that reducing traffic (cars, vans and trucks) at the target zone at the central of Volos caused significant reduction about of noise level. The average reduction recorded for the energy-averaged sound level L_{eq} is around 5-6 dB, with a maximum value 8.2 dB. The values of noise level reductions of L_{eq} at the different points between the two successive days are shown in Figure 3.

At the points of 14 and 15, the difference of sound level was positive than negative due to the characteristics of points locations. These points are at the borders of restricted area and extra noise charge is observed as the traffic remains heavy at the periphery.

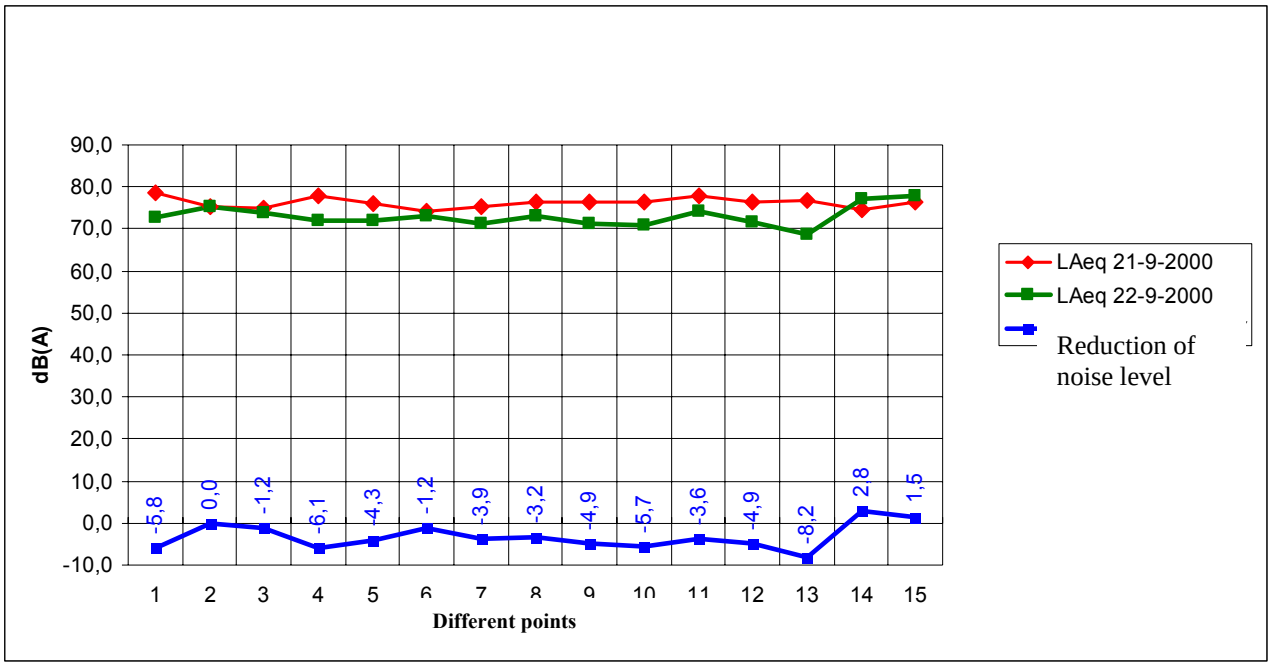


Figure 3: The comparison of the L_{eq} indicator

In general, the decrease has been smaller in L_{eq} and L_{10} than in L_{50} and L_{99}. This is associated with the traffic of motorbikes and other vehicles of similar level of noise emission which remain in the town. Statistical levels L_1 and L_{10} are obviously very high being determined by the transit of single vehicles which behaves as simple point sources.

In spite of the prohibitive measures introduced, the mobilization of some motorcycles, taxi and public buses in the restricted area prevented more reduction of noise level.

The values of the percentile level L_1, which is a representative indicator for peak noise level, represent this phenomenon, because their difference between the two days are quite small, shown in Figure 4.

Motorcycles and buses (public transportation) contribute to traffic noise level significantly. Notwithstanding the above, public transportation has to play a major role in a wider plan to be implemented in order to improve the urban environment.

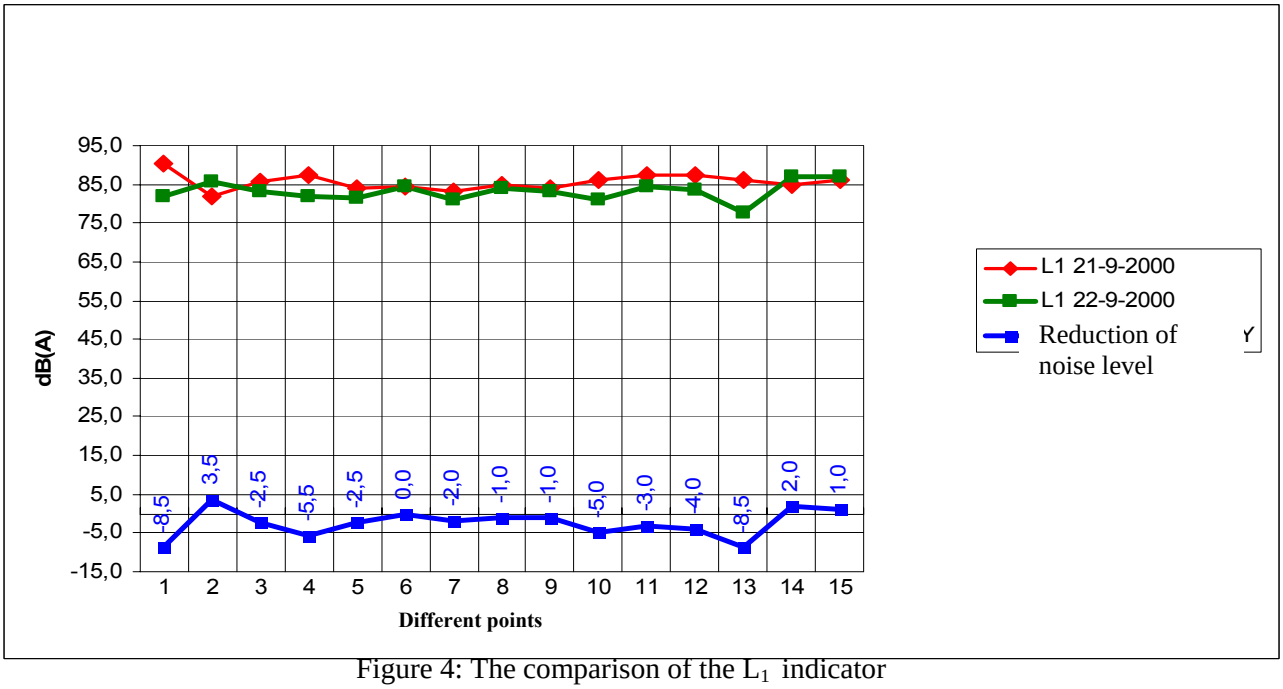
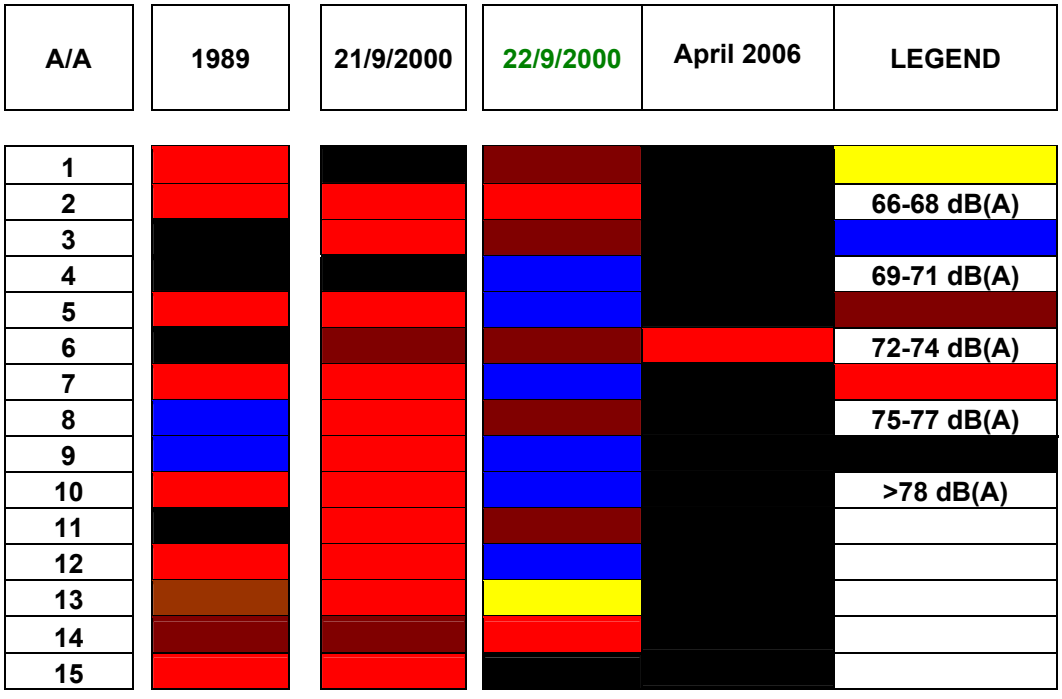


Figure 4: The comparison of the L_1 indicator

Table 3: Results of measurements in April 2006

A/A	Lmax	Lmin	L_Aeq	L1	L10	L50	L95	L99
1	96,8	67,4	82,4	95,0	85,6	76,1	68,7	69,8
2	90,6	68,9	79,0	86,1	82,4	77,1	71,9	70,3
3	94,0	65,8	78,8	89,8	81,9	75,0	69,3	67,7
4	95,1	67,6	81,9	91,8	85,5	78,7	72,4	69,8
5	93,1	69,6	80,0	88,2	83,0	78,2	72,4	70,8
6	96,5	55,8	78,0	88,7	81,3	71,9	61,9	58,8
7	96,3	63,5	79,0	87,1	81,9	76,6	69,8	67,2
8	93,7	65,4	80,2	89,2	90,3	77,1	69,8	67,7
9	93,0	65,1	80,1	88,2	89,2	76,6	69,8	67,2
10	101,8	67,0	80,2	90,3	82,9	76,6	70,8	68,7
11	102,7	61,6	81,8	91,9	85,0	77,7	68,2	63,5
12	96,4	61,0	80,2	91,9	83,4	76,1	63,5	61,9
13	102,6	61,6	80,5	90,3	81,9	74,0	64,0	62,4
14	93,9	57,9	78,1	89,2	81,3	74,0	64,0	60,3
15	99,4	62,9	80,3	90,3	83,4	77,1	68,7	65,6

Table 4: Chromatic representation of noise level at the different points of the center of Volos



Similar measurements at the same points of the center of Volos have been carried out on April 2006. Regarding the noise level progress in time (from 1989 to 2006), it is noticeable the increasing values of noise level at the different points of the center of Volos (Table 3). During the last decade, traffic congestion is generated in the main arterial roads which cross the city centre and downgrade the urban environment.

4 Conclusions

Measurements taken for road traffic noise in Volos indicate that noise levels are higher than those set by Greek noise standards and policy to protect public health and welfare in residential areas (maximum permissible level of 67 dB(A)).

The European campaign on the 22nd September is an initiative that corresponds to citizens' concerns over issues of pollution and quality of urban life. It is an opportunity to introduce permanent measures, at the beginning but finally to implement an overall planning centered on public transportation.

With the implementation of this program at the centre of Volos, it is remarked a significant reduction of noise level of about 5-6 dB. It could be a motive for additional research for a general policy.

An effective road traffic noise policy requires an overall concerted approach that balances the need to reduce road-related sound emission without affecting mobility and its associated socio-economic benefits.

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