

## IDENTIFICATION OF MEASURING POINTS LOCATIONS OF THE NOISE MADE BY SURFACE URBAN TRAFFIC

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**Abstract:** Sonic pollution is characteristic to urban congestions, having harmful consequences upon inhabitants' health. Sonic pollution evaluation became the big cities' local's city hall desideratum, in order to take necessary measures to reduce it. The paper presents the results of a study concerning the identification of measuring location for acoustic level measurements. The study is a stage of the CEEX no.129/2006 SICOMSUV project.

### 1. INTRODUCTION

Outside equipments' noise mainly of those used in constructions and public works is a major part of environmental noise, known also as residential noise or internal noise. Other external noise sources are those made by the road traffic, aerial and railway traffic, and industry vicinity. Also internal noise exists.

About 40% of EU population is exposed to traffic noise on a pressure level above 55 dBA during daytime and 20% at levels above 65dBA [1]. In Romania this percentage is situated at lower values because of lower noise intensity during night time and due to the fact that 45% of inhabitants live at countryside where traffic intensity is very low.

The outside equipments' noise may cause disease like anxiety communication interference, sleep disease, heart and psycho-physiological disease, decrease of individual performances, productivity, social behavior and especially hearing disease.

For the noise produced by outside equipments noise level measuring and the identification of its effects on human beings is extremely important. That is why noise attenuation including noise management needs to be actively introduced in this specific field. OCDE and OMS, besides EU, played an active role in the assignation of an efficient frame to counteraction the noise effects and to impose adequate noise levels.

### 2. NOISE POLITICS AND MANAGEMENT

#### 2.1. Public management principles

These principles have been presented and recommended by the UNO (United Nations Organization) Agenda and European Chart of Traffic, Environment and Health, and their implementation is strongly recommended by the WHO (World's Health Organization), a specialized Agency inside UNO.

a) **Caution principle** states that the noise level must be reduced to the lowest possible level specific to a particular situation. Where the possibility to affect the inhabitants health has higher values, actions toward health protection must be made, without expecting a complete scientific evidence of the fact.

b) **Contaminator pay principle**, states that those responsible for the noise must pay complete costs associated with sonic pollution, including noise level monitoring, management, noise level reduction and surveillance;

c) **Prevent principle** states that actions must be made to avoid or to reduce the noise on the source and also, the urbanism planning must be directed by an environment impact on people's health evaluation.

## 2.2. Efficient noise management

Numerous models in different stages of effective noise management politics development and implementation are available and measures can be adopted to increase the quality and efficiency of the noise management.

a) **measures to increase the legal frame:** noise emission control and monitoring, control options evaluation, noise transmission control, noise maps control, noise exposure modeling, noise emission control and law application.

b) **technical measures:** emission decrease through service modify, new engine technologies, transmission decrease;

c) **population education and informing:** population awareness increase regarding the noise impact on health, noise emanation modeling and monitoring, the increase of noise experts, initiation of searching and developing activities regarding noise impact.

An efficient noise management implies the adoption of noise national standards based on European and international standards and directory lines and also on technological, social, economic and political factors.

Environment noise management is related to environment noise impact analysis which have to enclose: a brief description of the existent environmental noise, noise level of the considered source, an evaluation of the negative effects on health, an estimation of the population subjected to risks, a computation of the exposure/response ratio, an evaluation of the risks and their acceptability and a cost/profit analysis.

Noise management for the case of outdoor equipment may imply:

a) human exposure at high level of noise monitoring;

b) noise emission attenuation which takes into account specific affected environment, an environment with multiple noise sources, sensitive periods of time, high level of risk groups – such as workers and neighborhood people;

c) consideration of sonic consequences of the activities which implies the use of the outdoor equipment;

d) the use of the surveillances systems for the monitoring of the negative effects regarding noise injuries;

e) noise politics efficiency evaluation regarding the decrease of the noise negative effects on humans health and noise exposure.

## 3. SONIC POLLUTION. BIHOR COUNTY SPECIFIC ISSUES

### 3.1. Population

Table 1

County	Town (urban)	Population
BIHOR	ORADEA	205.457
	BEIUȘ	10.985
	MARGHITA	17.623
	ALEȘD	10.376
	SALONTA	18.137
	SĂCUIENI	7.028
	ȘTEI	8.683
	VAȘCĂU	2.608
	NUCET	2.394
	VALEA LUI MIHAI	10.317
	<b>TOTAL</b>	<b>293.608</b>

Urban congestions the most exposed to vibrations and sonic pollution. These types of pollution have a negative influence on people's health.

During 2004 the urban population of the Bihor county counted 300.725 inhabitants, while on July 01, 2005 counted 293.608 inhabitants, recording a decrease of 2,3%, which confirms the data regarding the birth rate decrease and population migration after 1990. Urban population of the Bihor county is presented in Table 1.

### 3.2. Noise and vibration in urban congestions

Maximum noise level during daytime (between 6,00 and 22,00 hours), according to STAS 10009/88, is:

- intense traffic streets: 70dB;
- medium traffic streets: 65dB;
- low traffic streets (residential areas): 60dB,

During night time levels need to be 10 dB lower.

During 2005, Oradea City, the following areas were monitored: B-dul Ștefan cel Mare, Moldovei and Lacul Roșu cross street and Petöfi Park, results being presented in Table 2 (DSP Bihor data):

**Table 2**

B-dul Ștefan cel Mare	Daytime	70 dB superior limit of normal values
	Night	64,7 dB with an overflow of 7%
Moldovei and Lacul Roșu cross street	Daytime	67,8dB with an overflow of 1,2%
	Night	64,56 with an overflow of 17,3%
Low traffic area - Șirul Canonicilor and Petöfi Park	Daytime	61dB with an insignificant overflow
	Night	58,7dB with an overflow of 17,4%

Table 3 presents the noise level measured and computed by APM Bihor, in specific functional areas in Oradea, (comparison between years 2004 and 2005). A decrease of the noise level around APM - Bihor area can be noticed, while at Children Hospital and Faculty of Environment Protection an increase of the noise level can be noticed. From the data it can be also noticed that the levels of traffic noise lays inside the limits specified by STAS 10009/1988.

**Table 3**

Year	APM Bihor (yearly average values)	Children Hospital (yearly average values)	Faculty of Environment (yearly average values)	Upper limit (dB)
2005	63,68	65,75	66,34	70
2004	64,14	64,16	66,08	70

### 3.3. Noise

In the majority of the urban settlements in Bihor county the noise doesn't create discomfort and health problems. In order to decrease the noise level from sources located near residential areas, the following measures are taken in the Bihor county's towns and cities:

- phonic insulation of industrial areas with natural or artificial curtains;
- phonic insulation of areas in which public alimentation and productive activities takes place;
- traffic impact decrease through belt highway and speed limit;
- social overheads renewal (courses/day).

Objectives – urban noise diminish through:

- heavy traffic deflection through by-pass routes;

- urbanism certificates issuance for residential areas only for quiet (noise-free) societies;
- streets restoration for traffic fluidization

### 3.4. Urban acoustic

(APM) conducted noise measurements in three zones in Oradea City. The corresponding values for the year 2006 are presented in Table 4. According to Bihor County Environment Protection Agency all data lays inside the limits specified by STAS 10009/1988.

**Table 4**

Month/Year	APM - Bihor dB(A)	Children Hospital dB(A)	Faculty of Environment Protection dB(A)	Upper limit dB(A)
December 2005	66,6	62,9	65,9	70
January 2006	62,0	62,0	64,9	70
February 2006	65,4	66,9	67,5	70
March 2006	67,7	69,0	68,0	70
April 2006	67,7	68,8	68,0	70
May 2006	70,0	68,8	68,0	70
June 2006	67,0	65,9	69,8	70
July 2006	62,0	64,7	64,9	70
August 2006	66,6	68,9	66,3	70
September 2006	72,4	62,8	72,5	70

The case-study proposes to identify a larger number of potentially risky areas by the mean of noise and vibration pollution inside Oradea City. These results will be use as input data for the next stages of the project.

## 4. CASE STUDY

To identify the potentially risky areas, different locations inside Oradea City were selected. In these locations the traffic level intensity was quantified for different vehicle type: automobiles, trucks, trams, and so on.

Also, traffic intensity was monitored in three different days (a, b and c).

Table 5 presents a detailed situation of measurements, considering the moving direction of the vehicles (data are presented sorted descended by the "All" column).

**Table 5**

Pt.	Day	Street name	Direction (to)	C*	TRK	B	TR M	TR C	All
14	b	POD CONTINENTAL	South (Fortress)	2114	13	22	22		2215
14	b	POD CONTINENTAL	North	1551	28	24	15		1697
12	b	POD DECEBAL	South	1285	21	9			1347
7	a	CANTEMIR DIMITRIE	Belt Highway	1207	22	19		1	1305
7	a	CANTEMIR DIMITRIE	Downtown	1220	13	8	7		1281
7	b	B-DUL STEFAN CEL MARE	North (Biharia)	1161	20	12			1256
12	c	DECEBAL	South	1158	12	22			1221
12	b	POD DECEBAL	North	987	14	9			1031
10	a	CLUJULUI	West	909	44	45			1024
7	b	B-DUL STEFAN CEL MARE	South (Downtown)	930	21	12			996

Pt.	Day	Street name	Direction (to)	C*	TRK	B	TR M	TR C	All
5	a	NUFARULUI	Downtown	944	7	9			980
12	a	1 DECEMBRIE	West (Downtown)	897	1	36			967
10	b	DACIA	West (Biharia)	906	15	11			951
10	a	AVERESCU AL M-SAL	East	834	17	17			896
2	c	MATEI BASARAB	West	815	24	6			869
9	b	DACIA	West (Biharia)	813	6	10			851
9	c	CALEA ARADULUI	North (Downtown)	776	17	10			814
8	b	DACIA	East	732	34	14			799
11	b	POD CENTURA	South (Belt Highway)	684	75	12			776
11	b	POD CENTURA	North (Hungary)	658	82	21			773
9	b	DACIA	East	713	21	7			757
12	a	1 DECEMBRIE	East (Fortress)	695	9	35			752
2	c	SUCEVEI	East	637	60	6			713
4	a	CLUJULUI (Mixandrelor)	Belt Highway	619	27	20			693
5	a	NUFARULUI	Belt Highway	661	9	4			682
1	c	IULIU MANIU	East	639	9	7			675
12	c	DECEBAL	North	636	5	15			670
4	a	CLUJULUI (Mixandrelor)	Belt Highway	543	52	11			621
3	a	NUFARULUI	North (Downtown)	578	22	11			618
3	c	DECEBAL	South	554	17	12			609
3	b	PODULUI	South (Belt Highway)	521	71	0			598
9	a	OGORULUI	East (Cluj - Felix)	509	77	1			589
9	c	CALEA ARADULUI	South (Belt Highway)	528	24	9			586
1	a	CLUJULUI	West (Downtown)	488	78	5			584
3	a	NUFARULUI	South (Baile Felix)	534	27	10			583
13	c	VLADIMIRESCU TUDOR	East (Downtown)	496	14	10			545
11	c	CALEA ARADULUI	East	504	2	9			525
1	a	CLUJULUI	East (Cluj)	458	42	13			524
8	b	DACIA	West (Biharia)	498	9	6			523
5	c	FAGARASULUI	West (Hungary)	46	2	0			52
5	c	FAGARASULUI	East	31	1	0			47
8	a	FAGARASULUI	East (Cantemir Dimitrie)	15	2	0			19
8	a	FAGARASULUI	West (Universității)	11	0	0			14
6	a	ERKEL FERENC	West (NUFARULUI)	0	0	0			0
6	a	ERKEL FERENC	East (Cluj)	0	0	0			0
1	c	PRIMARIEI	West	Street in restoration					0
14	a	UNIVERSITĂȚII	North (Downtown)	Street in restoration					0
14	a	UNIVERSITĂȚII	South (Belt Highway)	Street in restoration					0

**Note: C=cars; TRK=trucks; B=buses; TRM=trams; TRC=tractors**

Data were conditioned in Microsoft® EXCEL®, thus obtaining the diagram in Figure1 which offers information about *potentially risky areas* by the mean of *noise pollution*.

Potentially risky areas were marked on the Oradea map, being thus subjected to further studies.

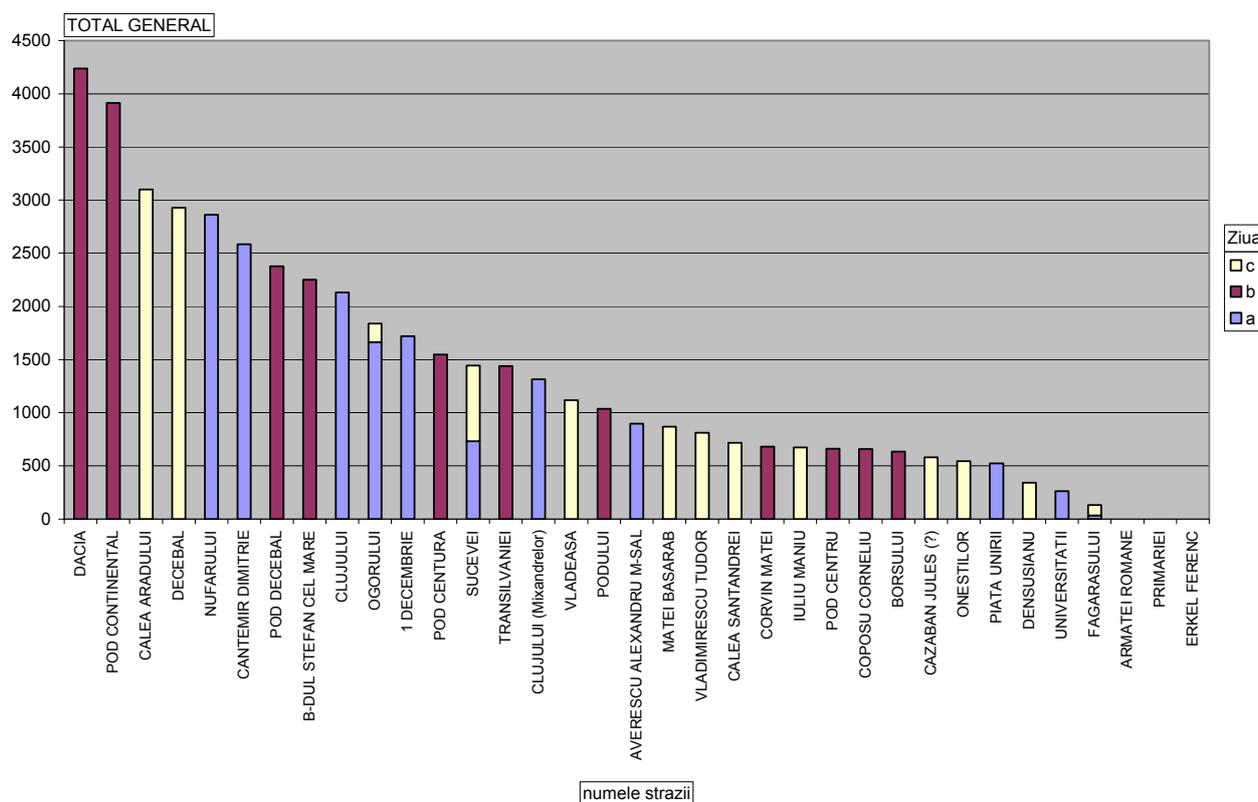


Figure 1 Potentially risky zones diagram in Oradea urban area

## 5. CONCLUSIONS

The study's aim was to identify the high transited streets in Oradea, which are subjected to high level of traffic noise.

Former measurements (APM Bihor, 2005 and 2006) indicate that upper limits established by Romanian specific standard (STAS 10009/1988) are not out of boundaries during daytime measurements. Situation changes during night, and is presented in Table 2.

Case study results are subjected to further conditioning in order to obtain the map of noisy areas in Oradea urban area.

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