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NOISE POLLUTION AROUND HIGH TRAFFIC ZONES IN CLUJ-NAPOCA

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Abstract: *The aim of this paper was to measure the full spectrum of noise levels near a high-traffic junction in the city of Cluj-Napoca, due to the growing problems regarding traffic density and lack of acoustic comfort in residential areas around these crowded areas. This investigation was carried out near one of the most crowded and noise polluted zones in Cluj-Napoca, by using a full spectrum sound meter to measure the sound levels at ground level and inside a nearby residential space, at morning, noon, evening and night. The collected noise level data was analyzed and reported on all the time frames at ground level and inside residential spaces, pointing out the high noise level and lack of comfort especially inside the nearby home. These noise readings showed that the average levels observed were above the accepted values according to European Union regulations. Conclusions were made and some solutions were presented that could improve life quality in such overcrowded, high-traffic areas in cities such as Cluj-Napoca where there is a rapid growing rate both demographic and economically.*
Key ***words:*** *noise, pollution, comfort, traffic, urban, residential.*

1. INTRODUCTION

As cities grow, both economically and in size, one's mobility has drastically increased in the last years, though creating a hectic car and public transport traffic, and since in most of the cities, residential areas are often close to main communication axis, it is therefore logic that noise becomes an important issue.

It is the case of Cluj-Napoca, a city that grew at a significant rate in the last 20 years both demographic and in size, and recently the already crowded city center became a cluster of IT companies providing several thousand jobs with relatively no available parking spaces.

As the European Union is concerned raising the living quality and providing everyone with a healthy environment is one of the main objectives and there are multiple regulations regarding air pollution, smoking in public, recycling plans, traffic and also noise pollution.

2. URBAN NOISE

Urban noise is a conglomerate of running engines, rolling tires, honking horns, people speaking, sirens, airplanes, trams etc. which produces a full spectrum of high level noises from 20 Hz to 20.000 Hz and affects our day to day life trough vibrations [1] and annoyance [2].

As there are different kinds of traffic noise there are different materials at disposal to insulate it. It is thus important to know which part of the frequency spectrum should be insulated, thus which solution to use. For instance, speed plays a huge part as where the peak sound level will be on the spectrum, as on urban roads where cars are driving at 40-50 km/h will not have the same frequencies than an expressway or highway where cars are driving at 120 km/ h.

Another factor is the distance from the sound source to the inhabitant's ear, because sound naturally decreases with distance, but unfortunately in crowded city areas distance from the main urban sound sources is a luxury.

Sound barriers can be built between the noise source and residential or pedestrian zones, or by having working places following the road and residential buildings in a second row behind them.

Another major problem is that some surfaces reflect the sound rather than absorbing it so by soundproofing one zone you reflect, and maybe amplify, the sound in other directions, mainly to the neighbors across the street.

According to the world health organization (WHO) in the year 2000 more than 210 million people in the European Union were exposed daily to over 55 dB road traffic noise and a preliminary analysis showed that more than 240.000 people are each year affected by cardiovascular diseases that can be traced to traffic noise, 20% of which suffer a fatal heart attack [3].

Table 1 - Selected values from the WHO Noise Guidelines and WHO Night Noise Guidelines

Specific environment	Critical health effect	Day: LAeq (dB(A)) Night: Lnight (dB(A))	Time base (hours)
Day-time and evening noise			
Outdoor living area	Serious annoyance, daytime and evening	55	16
	Moderate annoyance, daytime and evening	50	16
Dwellings, indoor	Speech intelligibility and moderate annoyance, daytime and evening	35	16
Night-time noise			
At the façade, outside	Body movements, awakening, sleep disturbance	30	All night long

3. CASE STUDY

As one of the main and most crowded streets of Cluj-Napoca, surrounded by mostly residential buildings, Blvd.21 Decembrie 1989 was clearly the best place to emphasize the problem of traffic noise in the city. Full spectrum sound measurements were made once every 12 minutes for an hour, both at street level and inside a dwelling at the façade, three times during the day and once during night-time as follows: 8:00-9:00, 13:00-14:00, 17:00-18:00, 00:00-01:00.

At ground level, the measuring device was placed near the road, just beside a roundabout which is one of the busiest intersections in Cluj-Napoca.

The apartment in which the measurements were made was at the 11th floor at an approximate distance of around 50m from street level, a distance which should have reduced the noise level significantly.

Average and maximum values for 1/3 octave measurements were then used to portrait the noise spectrum from 20Hz to 20 kHz, highlighting the increased values across the spectrum that are much larger than the levels admitted by the WHO.

These measurements results can be seen in the charts below:

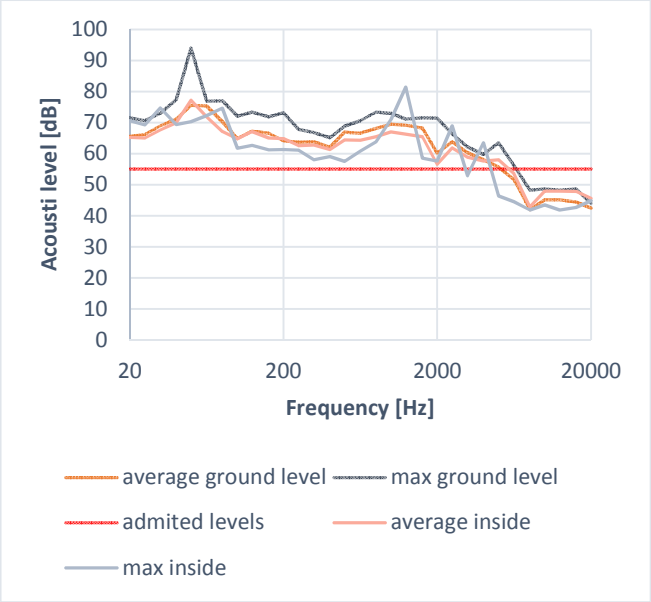

Fig. 1. Acoustic profile at 8:00-9:00

4. OBSERVATIONS

As seen in these charts, noise levels were above recommended comfort values on almost all the frequency spectrum, especially at night.

It can be observed that the noise produced by the rolling tires somewhere at around 20 Hz to 80-100 Hz which has similar values during the day is significantly decreased during the night due to traffic fluidity.

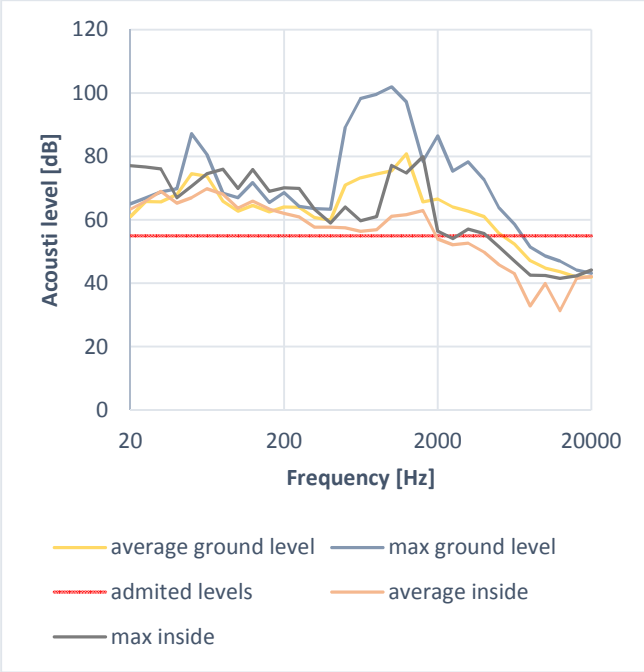

Fig. 2. Acoustic profile at 13:00-14:00

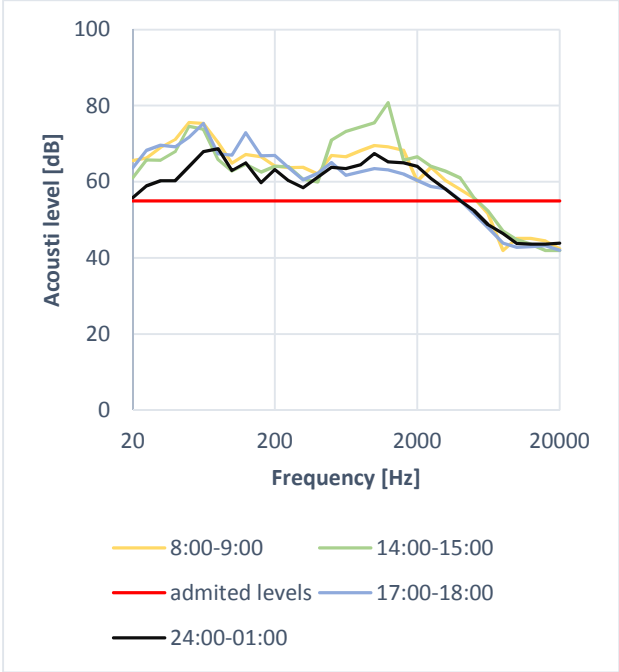

Fig. 5. Average acoustic profiles at ground level

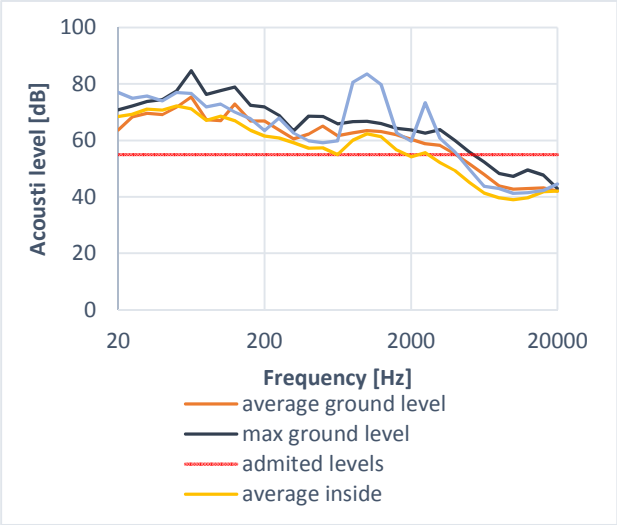

Fig. 3. Acoustic profile at 17:00-18:00

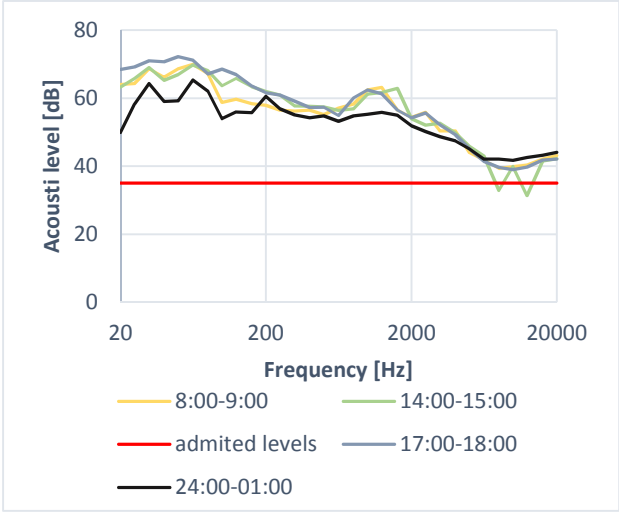

Fig. 6. Average acoustic profile inside dwelling

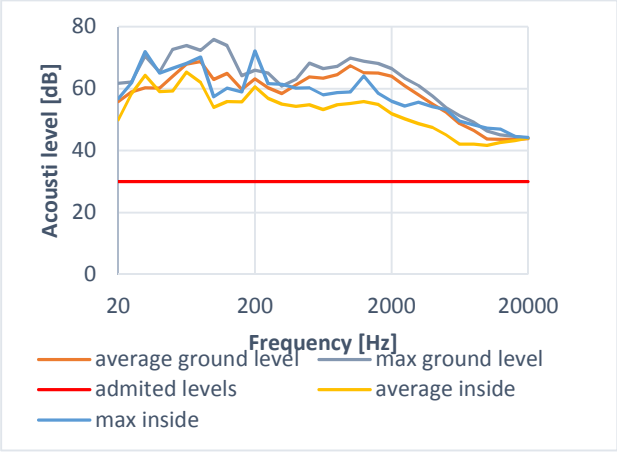

Fig. 4. Acoustic profile at 24:00-01:00

Highest values were at around 100 dB around 500 -1500 Hz and were the results of utility vehicle sirens which were isolated events, but nonetheless very annoying.

Inside the apartment noise levels were much over the comfort values, mostly because the lack of insulation on building and because the amplification of sound that takes place between parallel building facades.

Excluding isolated high-level sounds such as horns, sirens, over-accelerated engines, the curves had similar allures on all time intervals, providing a valid noise profile of traffic

generated sounds at different time intervals during the day.

5. CONCLUSION

The main conclusion is that noise levels are much too loud: at street level with an average difference of 10dB across the spectrum and a maximum difference of 45 dB and inside the apartment with an average 20 dB and an astonishing maximum of 47 dB over recommended noise values.

Also, it seems that traffic noise can be summarized and divided into 3 main categories as follows: tire/pavement noise (low frequencies), engine noise (mid frequencies), sirens and horns (high frequencies). In order to reduce these noises different solutions might be applied.

For example, for tire/pavement noise reduction improved tires with special pattern [4] can be used and also by using different pavements [5].

Mid-rage frequencies levels can be lowered by the increased use of electric mobility and better car design, as for siren and horn noises, their acoustic impact on surrounding dwellings can be lowered by designing and using a more directional and focused siren such as the ones used in public address line array sound systems.

Sound barriers, non-residential buildings, single or multi-storey car park or even earth slopes are recommended to be used when possible as a buffer between noise generating roads and residential areas.

The European Union purpose of decreasing noise pollution through policies and research funding

and more rigorous traffic regulations is a great trend towards a more comfortable life in the cities but must be accelerated.

6. REFERENCES

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Poluarea fonica in zone cu traffic intens din Cluj-Napoca

Rezumat: Scopul acestei lucrari a fost de a masura si evalua spectrul de zgomot intr-o zona cu traffic intens din Cluj-Napoca, aflat in legatura directa cu scaderea comfortului acustic atat la strada cat si in interiorul caselor raportat la dezvoltarea rapida a orasilui in ultimul timp. Masuratorile au fost facute intr-una din zonele cele mai agglomerate din oras, folosind un apparat de analiza a nivelului sonor pe specgru de frecvente, masurand atat la nivelul strazii cat si la nivelul fatadei unui apartament, in patru momente cheie ale zilei. Rezultatele obtinute au fost analizate si comparate ajungand la concluzia ca nivelul de zgomot este prea mare pentru a asigura comfortul cetatenilor atat la nivel stradal cat si in locuinte, lucru care trebuie remediat in conformitate cu normele Europene in vigoare, pentru care au fost prezentate si anumite solutii viabile in concluzii.

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