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# CHANGING ROAD TRAFFIC NOISE IN HANOI OF PREVIOUS 10 YEARS

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## Abstract

Vietnam architectural specify is open, windows usually open from 250 to 300 days per year for ventilating, therefore road traffic noise impacts directly to community health. Urban noise pollution is mainly from road traffic activities. In Hanoi the number of vehicle increases rapidly. Total of registered motorbikes in Hanoi to 1995 is 450,000 units, to 1998: 768,000, to 2002: 1,250,000 and to 2005 is about 1,700,000 units.

Based on the monitoring results during 10 previous years, the characters of road traffic noise levels in Hanoi are following:

1. There are two peak hours of vehicle flows during the day, the morning peak hour in winter and summer is same at 8-9h, the afternoon peak hour is at 17-18h in winter and at 18-19 in summer. In peak hour the motorbike flow reaches 91% of total traffic flow.
2. The road traffic noise levels in the frequency range from 63hz to 4000hz (low, medium and high frequency) are sameness. With frequency lower than 63hz and higher than 4000hz the noise levels decreased.
3. Hourly average road traffic noise level changed from 65 to 81dB<sub>A</sub>, in the night time it is lower than 70 dB<sub>A</sub>, in peak hour it is reached 78-81 dB<sub>A</sub>. During horning the noise levels can reach 90-100 dB<sub>A</sub>.
4. After previous 10 years the vehicle number increased about 4 times, but average road traffic noise levels increased only 0.5-2.8 dB<sub>A</sub>. Because road and vehicle quality in 2005 better than in 1995.
5. Proposing some measures for decreasing road traffic noise levels in cities.

*Keywords: Horning, Noise level frequency spectrum, Number of motobikes, Road traffic noise levels, Traffic flow.*

## 1. Introduction

Vietnam architectural specify is open, windows usually open from 250 to 300 days per year for ventilating, therefore road traffic noise impacts directly to healthy of people lived next to two sides of streets (specially for shop sellers, traders, vendors and travelers). Road traffic noise is mainly from traffic activities. Transportation mean of Hanoi are increasing rapidly. Total number of registred motobikes in Hanoi to 1995 is 450 000; but 1998 is

768 000; 2000 is nearly 1 000 000; 2002 is 1 250 000; 2004 is 1 500 000; and 2005 is about 1 700 000. It means that during 10 years, the number of motobikes in Hanoi growths 3.8 times.

The report presents the changing of vehicle flow and road traffic noise pollution in Hanoi during 10 previous years.

### A. The frequency spectrum of road traffic noise in Hanoi

Impact of noise to human health depends very much on noise level and its frequency spectrum. In scientific theme KHCN 07.11 (1996-1998) [1], we have determined noise frequency spectrums at four Hanoi streets (Truong Chinh, Northern of Chuong Duong Bridge, Ba Trieu and Nguyen Trai). Measure results of average noise levels according to ½ octave frequency spectrum of the streets are presented in Figure 1. Frequency spectrum of road traffic noise in Moscow is showed to compare. Based on Figure 1, road traffic noise levels with frequency spectrums from 63 Hz to 4000 Hz in Hanoi change insignificantly, but with frequency spectrums smaller than 63 Hz and larger 4000 Hz, they are reducing gradually. But road traffic noise levels in Moscow are decreasing gradually when frequency spectrums reduce from low to high.

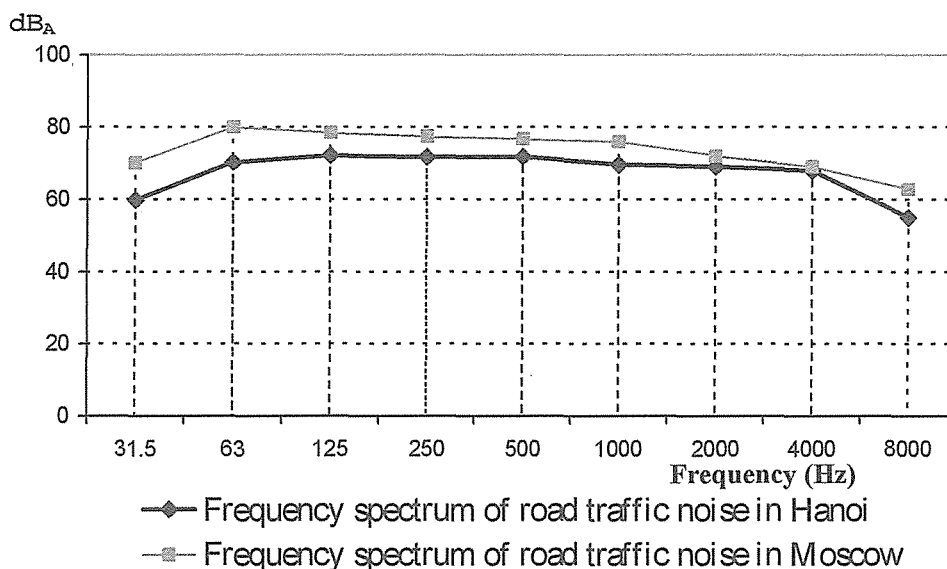


Figure 1: Frequency spectrum of road traffic noise levels

### B. The change of road traffic noise levels in some streets in Hanoi from 1996 to 2005

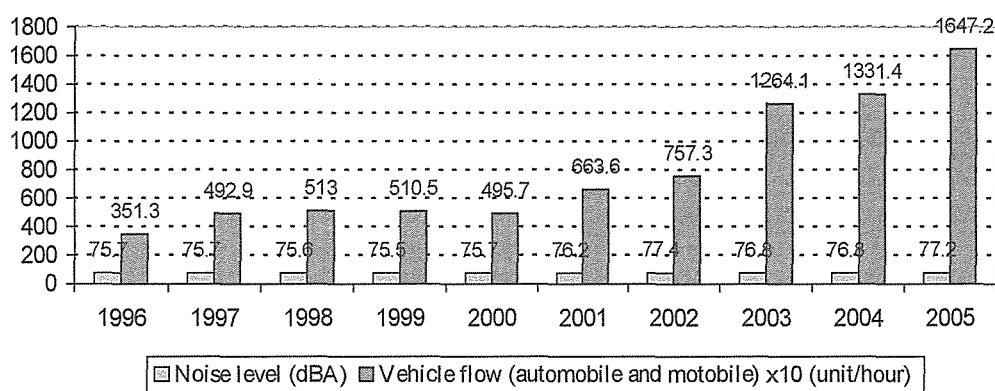
The noise measurement results in Hanoi Environmental Monitoring Program from 1996 to 2005 are presented in Table 1 and Figure 2.

Table 1: Road traffic noise levels in Hanoi from 1996 to 2005 (dB<sub>A</sub>)

Streets	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1. National road 5 (Cau Chui)	75,6	75,1	75,5	76,3	76,9	79,5	79,5	79,7	78,1	78,4
2. National road 1A (South Bus Station)	75,7	75,7	75,6	75,5	75,7	76,2	77,4	77,6	76,8	77,2
3. Tran Hung Dao street	72,4	72,1	72,5	72,2	71,7	72,6	72,5	72,8	71,8	72,9

Source: Annual Environmental Monitoring Report of CEETIA

(The showed values are average of 6 measuring times during a year (one time per two month), and during 7AM to 7PM for each measurement).



Source: Annual Environmental Monitoring Report of CEETIA.

Figure 2: The change of daily average of roads traffic noise levels and vehicle flows at National road 1A in the Southern of Hanoi from 1996 to 2005

## Discussions:

1. Based on Table 1, the road traffic noise levels at National road 5 and 1A (main roads entry Hanoi) have increased year by year, from 2-3  $\text{dB}_A$  after 10 years. But road traffic noise at Tran Hung Dao street (the old street in center of Hanoi) has changed un-significantly.
2. Monitoring results of daily average noise levels and traffic flow in the rush hours at 1A road (next to South Bus Station of Hanoi) from 1996 to 2005 are presented in Figure 2. It shows that the rush hour traffic flow in 2005 is 4.7 times higher 1996 (16 472 compares to 3 513) but road traffic noise level increased only 1.5  $\text{dB}_A$  (from 75.7  $\text{dB}_A$  to 77.2  $\text{dB}_A$ ). According to theory, when traffic flow increases 2 times, road traffic noise level will increases 3  $\text{dB}_A$ . It is explained that 1A road has been improved: road surface is better and wider and number of new vehicles increases but number of old vehicles decreases.
3. Road traffic noise levels at major traffic routes of Hanoi are above 70  $\text{dB}_A$  at day time (from 71.1  $\text{dB}_A$  to 79.7  $\text{dB}_A$ ) but under 70  $\text{dB}_A$  at night time.

## C. The hourly change of vehicle flow and noise level

The US-AEP funded to CEETIA to carry out monitoring of traffic air pollution during 2004-2005, included traffic flow and noise at Gai Phong street (a monitoring point is 200 meter at north of Giap Bat railway station). Monitoring is continuously 24/24hours during 2 weeks in the Winter (November 2004) and 2 weeks in the Summer (June 2005). The results in November 2004 are presented in Figure 3. The results in June 2005 are presented in Figure 4 and 5.

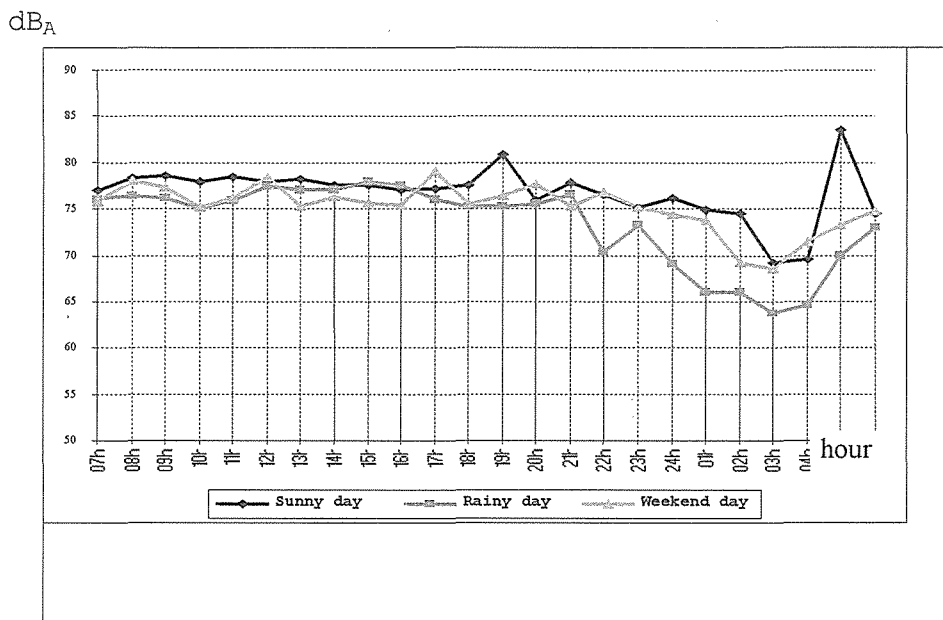


Figure 3: Comparison of noise levels of sunny working day, rainy working day and sunny weekend day (in November 2004)

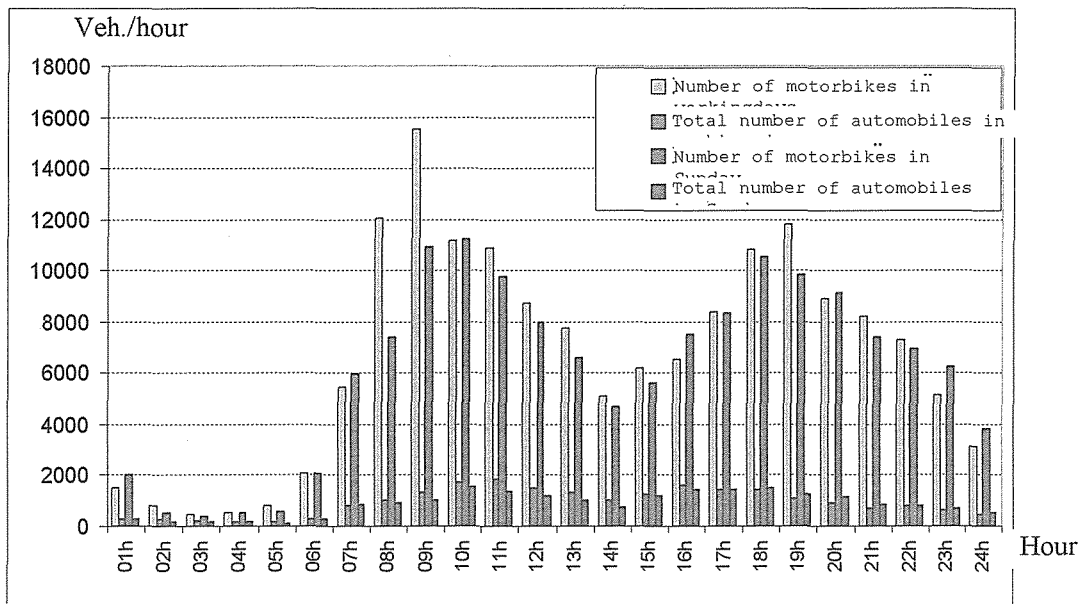


Figure 4: Evaluation of average vehicle flow by hours (vehicle/hour) in three days for monitoring noise level in June 2005

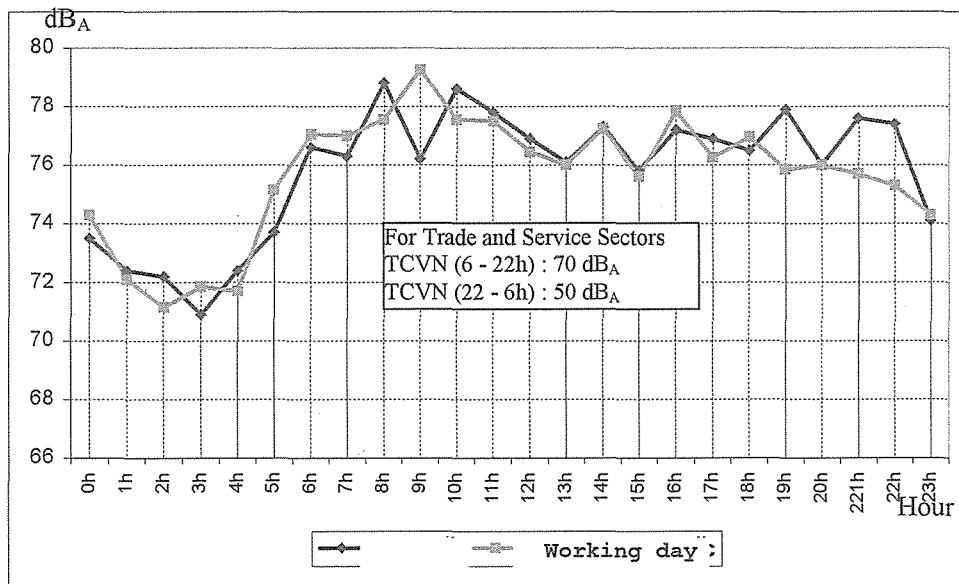


Figure 5: Comparison of noise level LAeq (dBA) evaluated by hour in Sunday and two working days (June 2005)

## Discussions :

### 1. On the vehicle flow:

Giai Phong road is a south entry gate and a major traffic route of Hanoi so its traffic flow is really large. Based on the monitoring results, there are some comments as below:

- + The daily vehicle flow in November 2004 (Winter) is 148 623 motorbikes and 20 919 autobikes per day, and June 2005 (Summer) is 159 303 motorbikes and 22 529 autobikes per day. It means that the vehicle flow in Summer is larger than in Winter 7.2%.

+ The changing of hour vehicle flow has two peak hours: at 8-9AM for both Winter and Summer, and 17-18PM for Winter and 18-19PM for Summer. The vehicle flow at peak hour is 14 000 – 16 900 vehicles/hour, in which motorbike rate is 91.8%; car rate is 4.9%; light truck rate is 1.4% and heavy truck rate is 1.9%. The vehicle flow is minimum at 1-2AM, with motorbike rate is 72.8%; car rate is 10.2%, light truck rate is 4.6% and heavy truck rate is 12.4%.

+ Vehicle flow at working day is larger than weekend day 10-11%. Rate of motorbikes in working day is also larger than weekend day (average working day is 88.4% and weekend day is 86.9%).

## 2. On the road traffic noise level:

Based on data in Figure 3 and 5, some evaluations are below:

+ The hourly average road traffic noise levels in Summer and Winter are similar and changing from 64.6 dBA to 80.6 dBA. The average noise level at peak hour is 78 to 81 dBA. The average noise levels are minimum during 1AM to 4AM and changing from 64.6 to 72 dBA. During horning (from buses or heavy trucks), noise levels can reach 90-100 dBA.

+ Comparison noise levels of working day and weekend day: noise levels at day time of working day are higher than weekend day from 1-2 dBA, but at night time from 1AM to 4AM, the difference of working day and weekend day's noise levels is un significantly. The noise levels of rainy day are lower than sunny day from 4-6 dBA (due to vehicle flow is smaller).

+ Noise levels during night time (from 23PM to 5AM) are over permitted standard TCCP - 50 dBA.

## D. Forecast of road traffic noise level in Hanoi to the year of 2010

Road traffic noise level is unstable (depend so much on time). In order to evaluate road traffic noise level comply with Vietnamese standard, it has to apply integrated equivalent noise level ( $L_{Atd}$ ) in monitoring and forecasting.

Forecast method of average equivalent noise level for vehicle flow, based on Guideline R362, CH-025 305-67, Standard GOCT 19358 -74 of former Soviet Union, and standard JTC 005 - 1996 of China is below :

$$L_{Atd} = L_{A7'} + \sum \Delta L_i, (dBA) \quad (1)$$

In which:

$L_{Atd}$  - average equivalent noise level of vehicle flow (forecasting);

$L_{A7'}$  - specific average equivalent noise level at 1.2m high and 7.5m far from center of vehicle line in standard condition: vehicles move straight on smooth road with vehicle flow include 60% of buses and trucks with average speed 40km per hour;

$\sum \Delta L_i$  – total of adjustment noise levels for different cases in different standard conditions.

## Forecast results

Data in Table 2 forecasts road traffic noise levels of three major roads in Hanoi up to 2010 follow scenario of 7-12% annual vehicle growth.

**Table 2: Forecast of road traffic noise level in Hanoi to the year of 2010 [1]**

No	Road	Width of road surface (m)	Width of left pavement (m)	Width of right pavement (m)	Vehicle flow (veh/hour)	Rate of heavy trucks	$L_{td}$ (dBA)
1	National road 5	2×(7,5+10,5)	2.5	2.5	5630	12%	80,5
2	National road 1	2×(7,5+10,5)	-	4	15388	5%	81,3
3	Tran Hung Dao	16	7	7	6667	2%	77,0

Comparison with noise levels in 2005, forecasted noise levels in 2010 of above roads increases from 2-4 dBA.

## **E. Solutions for decreasing road traffic noise in the cities**

### **1. Prevention of noise from generation sources**

- + Transportation register stations carry out checking and forbidding vehicles not met the noise standards (according to TCVN 5949 – 1999: Acoustic)
- + Improving transportation system to meet urban transportation standards, expanding transportation intersections and arranging transportation routs properly to reduce traffic jams, therefore to reduce road traffic noise levels
- + Based on real situation of Hanoi, some regulations to mitigate road traffic noise level could be applied, such as NO HORNING from 11PM to 6AM for all vehicles run inside city, NO HORNING in some areas of Hanoi, even NO VEHICLES in these areas

### **2. Prevention of noise transmittance**

- + Planting green trees at both sides of road (using big and thick leaf canopy trees to reduce noise)
- + Building noise prevented walls in areas request quiet such as hospitals, schools. These walls should be coated by acoustic absorbed mortar.

### **3. Proper urban planning**

- + When doing urban planning, it is necessary to consider to noise prevention. Public buildings are located next to roads to prevent noise for back ones request quiet like residences, offices, institutes, schools, hospitals, ... Major transportation routes, rail ways, air ports need to be isolated from residential areas.

## **Conclusion**

Based on the monitoring data of road traffic noise level of Hanoi during 10 previous years (1996 – 2005) implemented by CEETIA, there are some conclusions as following:

- + Vehicle flow of Hanoi grows very rapidly, increases 4 times during 10 years with motorbike ratio nearly 91%. It makes road traffic noise level in Hanoi increases from 0.5 to 2.8 dBA.
- + Road traffic noise levels with frequency spectrums from 63 Hz to 4000 Hz change insignificantly, but less than 63 Hz and above 4000 Hz gradually reduce.
- + Change of vehicle flow and noise levels has two peak hours in the morning and in the afternoon: at 8-9AM in the summer and winter and at 17-18PM in the winter and 18-19PM in the summer.
- + Change of hourly average noise levels are from 64 dBA to 81 dBA, from 78 dBA to 81 dBA at peak hours, and peak from 90 dBA to 100 dBA at horning moments.
- + Road traffic noise levels not depends very much on vehicle flow but so much on road quality and ratio of new or old vehicles.
- + Forecasting road traffic noise levels up to 2010 will increase from 2 to 4 dBA compare with 2005.
- + The report has suggested some solutions to mitigate road traffic noise for Vietnamese cities.

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