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# COMMUNITY RESPONSE TO ROAD TRAFFIC NOISE IN HANOI – PART I: OUTLINE OF SOCIAL SURVEY AND NOISE MEASUREMENT

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*Road traffic noise, horn sound, dose-response relationships, intervening variable, ICBEN scale*

## 1. Introduction

Though a number of social surveys on community responses to environmental noises have so far been conducted and accumulated in Euro-American countries, few social surveys have been conducted in Asian countries except Japan. [1]

In Asia, Vietnam is now in rapid economic growth and has serious environmental problems such as water, air and noise pollution from transportation and industry. Therefore data on community response to noise from Vietnam is very valuable for the international discussion on the global noise policy as well as Vietnamese noise policy.

A small-scale social survey conducted in Hanoi [2], November 2004, showed that road traffic condition in Hanoi as a city of a developing country is quite different from those in developed countries because of a great amount of motorcycles which create frequent horn sounds. Furthermore, the above survey also gave a hypothesis that the high annoyance and sleep interference in Hanoi may be mainly caused by the frequent horn sounds which are not special but usually heard during all day.

In order to investigate community response to road traffic noise and its characteristics in Hanoi and to find the answer for the above hypothesis, a larger scale social survey of community response to noise together with noise measurement was conducted in Hanoi, September 2005.

## 2. Method

### 2.1 Preliminary Survey 2004

A small-scale social survey of community response to noise had been conducted in Hanoi in November 2004. Sample size was 113. This survey gave out an overview of community response to noise and clues for the next survey.

### 2.2 Social Survey 2005

A larger-scale survey was conducted over four periods in September 2005. The first period was from 3rd to 4th (weekend), the second was from 10th to 11th (weekend), the third was from 13th to 14th (week day) and the last was conducted on 25th (Sunday). Eight

sites in Hanoi were selected considering their traffic volume as shown in Table 1.

Most of them were noisiest roads and streets in Hanoi with the highest traffic volume. The outline of the social survey was shown in Table 1. The modified questionnaire with 5-point verbal scale (extremely, very, moderately, slightly and not at all) and 11-point numeric scale constructed by the ICBEN were used [3]. The questionnaire was translated from the original Japanese to Vietnamese, including 42 questions on housing, residential area, annoyance, activity interferences, symptoms, sensitivity, demographic variables, etc. The questionnaire items were shown in Table 2. All respondents were given questionnaires and supported by interviewers to answer the questions.

### 2.3 Noise measurement

Noise measurements were conducted over two periods, the first from 19th to 20th, the second from 21st to 22nd September 2005. The same measurement and traffic volume counting method as preliminary survey were used. 24 hour-noise measurements were made at reference points 1.2 m high and from 2m to 12 m away from the road shoulders. Short-term noise measurements were also made at the reference points and several points simultaneously. Distance reduction equations were formulated based on the short-term measurements.

Noise exposure to each house was estimated by the 24-hour noise measurement values and the distance reduction equations. Some vertical noise reduction measurements were conducted at Site 01 – Ton That Tung St. The outline of noise measurement was shown in Table 3. Noise exposure at site No 08 (Hong Ha Road) was not measured directly but calculated indirectly by noise data at site No 07 (Tran Quang Khai Road) and noise data measured at balcony of No 89 along Hong Ha Road (Hong Ha Road was closely parallel to and had higher elevation than Tran Quang Khai Road). The traffic volume was counted by reproducing a video camera recording. Some basic statistic methods were conducted to analyze social survey data and calculate noise exposure.

Table 1: Outline of Social survey

ID	Site No 1	Site No 2	Site No 3	Site No 4	Site No 5	Site No 6	Site No 7	Site No 8	Total or Average	
Street/ Road	Ton That Tung	Tran Hung Dao	Tran Quang Khai	Lang	Nguyen Trai	Lang Ha	Truong Chinh	Hong Ha		
Social survey date	3th-4th September	3th-4th September	3th-4th September	13th-14th September	13th-14th September	3th-4th September	10th-11th September	25th-26th September		
Sample size	Row house	25	27	2	337	319	49	324	82	1165
	Apartment	83	111	35	0	147	92	28	15	511
	Total	108	138	37	337	466	141	352	97	1676
Response rate (%)	Row house	53.2	23.9	15.4	48.1	50.9	47.1	61.6	73.9	46.8
	Apartment	27.7	74.0	25.9		69.3	42.6	77.8	60.0	47.2
	Total	31.1	52.5	25.0	48.1	55.5	44.1	62.6	71.3	48.8

Table 2: Questionnaire items

HOUSING FACTOR (Q. 1-11)	House type; Length of residence; Number of floors; House structure; Layers of doors; Type of doorframes; Direction facing doors...
RESIDENTIAL AREA (Q. 12-16)	Length of residence; Climate in the area; Relationships with neighbors; Comments on living space...
ANNOYANCE (Q. 17-25)	From neighbors; from traffic noise; Frequency of annoyance Specific time; specific season; Vehicle types creating; vibration...
ACTIVITY INTERFERENCE (Q. 26)	Annoyance due to road traffic noise; Vibration; TV/radio disturbance; disturbance in falling asleep...
SYMPTOM (Q. 27-28)	Symptoms relating hearing ability; Symptoms relating respiration
SENSITIVITY, ATTITUDE ETC. (Q. 29-36)	Sleeping with open-windows in certain seasons; Usual sleeping conditions; Environmental factors; Resting with open-windows; environment pollution
DEMOGRAPHIC VARIABLES (Q. 37-42)	Occupation; Length of staying home; Members of family; Age ; Gender

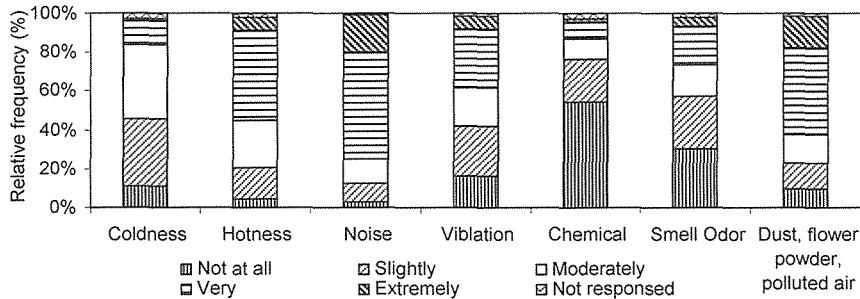


Figure 1: How sensitive are you to the following

### 3. Results

#### 3.1 Distribution of community response to road traffic noise in Hanoi

Along survey sites, 54% of survey houses were built by concrete and brick, 25% by brick, 11% were concrete and steel score inside, 9% were others and “no” wooden structure. Most of windows had single pane (59%), double pane was only 5% and 33% for others. The frame was wooden (44%), aluminium (28%) and others (26%). 75% of respondents have living room facing to the main roads, 60% have bed room facing to the main roads and 93% did not have garden. Noise exposure and traffic volume at every site were calculated in Table 4.

More than 95% of respondents chose the answer “Yes” for the question “Are you annoyed by road traffic noise in a day?”, and 84% of respondents felt annoyed everyday due to road traffic noise, especially in late afternoon (74%) while the traffic volumes usually were highest. The respondents were almost equally annoyed by motorbikes, cars and heavy vehicles: 60% for motorbikes, 55% for cars and 65% for bus, heavy vehicles. 22% of respondents were extremely annoyed by the road traffic noise and 56% was very annoyed, 22% was very annoyed by road traffic vibration (See Figure 1) and 20% of respondents were disturbed very much by being awakened (See Figure 2).

42% of respondents said “yes” for the question (Would you move if there was a better house for you?) but 57% said “no”. 63% chose “noise” for the

Table 3: Outline of Noise measurement

ID	Survey site	24 hour noise measuring period	Noise recording	Distance from road shoulder to house (m)		Distance from road shoulder to the reference point (m)	Distance reduction measurement (LAeq, 3 min, (dB))	Note
				Minimum	Maximum			
7	Truong Chinh Road	19/9 9:10 - 20/9 9:11		0.8	5.1	7.2	0.8m 80.6dB 3.6m 78.6dB 7.2m 77.8dB	
1	Ton That Tung St	19/9 10:00 - 20/9 10:01		4.5	9.5	10.1	4.5m 74.6dB 7.3m 73.6dB 10.1m 71.9dB	Vertical reduction 1F 6.2m 73.0 dB 2F 9.7m 68.8dB 4F 9.7m 72.1dB
4	Lang Road	19/9 11:00 - 20/9 11:01		0.7	7.1	2	2.0m 74.6dB 7.3m 73.6dB	9/20 Noise recording at road shoulder for 10 min. from 15:05 Range 110
5	Nguyen Trai Road	19/9 12:00 - 20/9 12:01		6.7	13	7.7	2.3m 75.7dB 6.0m 73.7dB 13m 70.7dB	9/20 Noise recording at road shoulder for 10 min. from 14:20 Range 110
6	Lang Ha St	21/9 9:30 - 22/9 9:31	22/9 SP Road shoulder 8:50 - 9:03	4.5	12	12	4.5m 72.0dB 8.0m 70.8dB 12.0m 68.6dB	9/20 Noise recording at road shoulder for 9 min. from 9:13 Range 110
2	Tran Hung Dao St	21/9 10:30 - 22/9 10:31	22/9 SP Road shoulder 10:04 - 10:24	3	7.6	7	3.0m 69.6dB 5.0m 68.9dB 7.0m 67.7dB	9/20 Noise recording at road shoulder for 10 min. from 10:25
3	Tran Quang Khai Road	21/9 11:10 - 22/9 11:11	9/22 SP Road shoulder 10:50 - 10:11	3.2	4.7	5	3.2m 76.4dB 4.7m 76.7dB	Noise measurement 2F Balcony 11:47-11:58 Bed room 12:02-12:13

Table 4: Noise exposure and traffic volume

ID	Site No 1	Site No 2	Site No 3	Site No 4	Site No 5	Site No 6	Site No 7	Site No 8
Street/ Road	Ton That Tung	Tran Hung Dao	Tran Quang Khai	Lang	Nguyen Trai	Lang Ha	Truong Chinh	Hong Ha
Noise exposure LAeq24h (Average point)	72	71	77	75	72	70	77	74
Average distance from road shoulder to house	7.0	5.3	4.0	3.9	9.9	8.3	3.0	
Average No of motor bikes/ day	87184	137785	77597	73981	89814	166610	182032	
Average No of cars/ day	14968	9502	5699	5399	4063	10829	16559	
Average No of heavy vehicles/ day	2668	1496	531	543	1360	5435	1403	

reason. 16% didn't satisfied with the quietness in their living area at all, 53% just slightly (See Figure 3). The rate between male and female was well balance among all sites, 47% male and 52% female. Younger generations are the majority of the respondents (20s: 29%, 30s: 23%, 40s: 20%, 50s: 14% and others: 14%).

### 3.2 Characteristics of Road traffic noise

The characteristics of road traffic noise in Hanoi are quite different from those in developed countries because of a great amount of motorcycles which emit frequent horn sounds. In Figure 4, sharp peaks show the horn sounds. Figure 5 compares the

relative cumulative frequencies of sound levels measured in Hanoi, Vietnam and Tomakomai, Japan. The noise level fluctuates in Tomakomai was widely from the background to the peak since the main traffic is light vehicle. On the other hand that in Hanoi was more narrow since motorbikes passed very crowdedly and frequent horn sounds were emitted in Hanoi, the bike noise consisted of motorbike background noise and high impulsive horn noises. Figure 6 shows the fluctuation of LAeq, 1h at all sites. LAeq, 24h is quite high, ranging from 65 to 75 dB. There were around 10,000 motorbike passages per hour, much greater than car and heavy vehicle volumes.

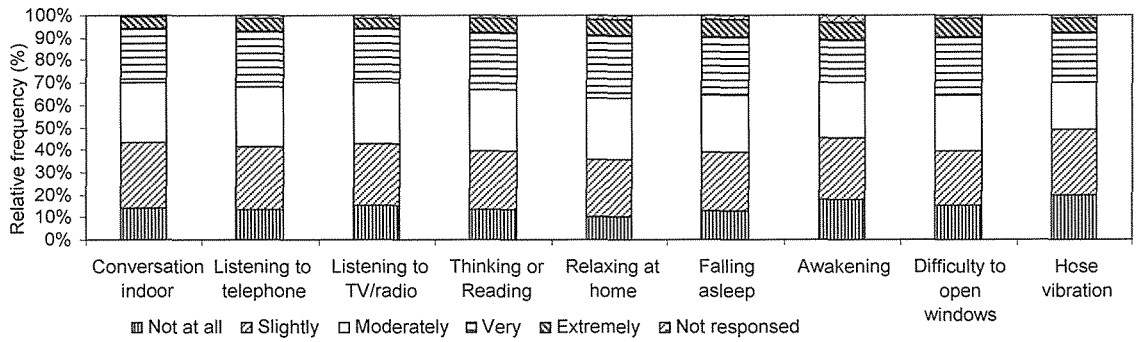


Figure 2: How disturbed are you by road traffic transportation in these cases

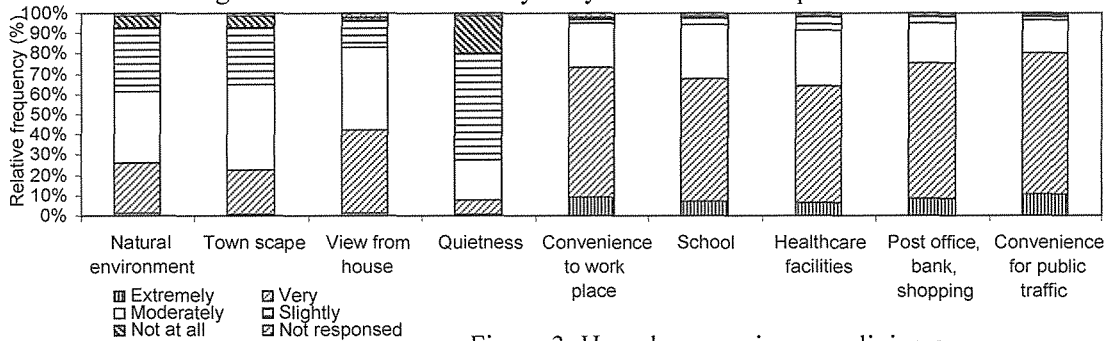


Figure 3: How do you enjoy your living area

#### 4. Summary

This report has brought an overview of the Social survey and Characteristics of Road traffic noise in Hanoi. People living along main road in Hanoi are very annoyed by road traffic noise. The characteristics of road traffic noise in Hanoi are different from those in developed countries because of a great amount of motorbikes that emit frequent horn sounds.

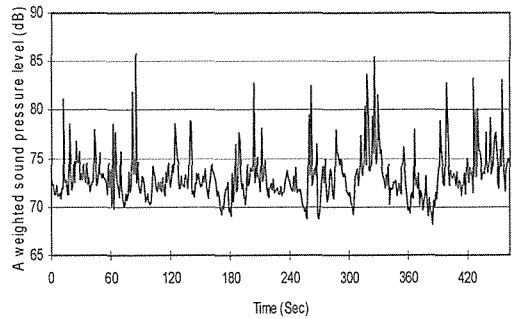


Figure 4: Sound level fluctuation at 6 pm

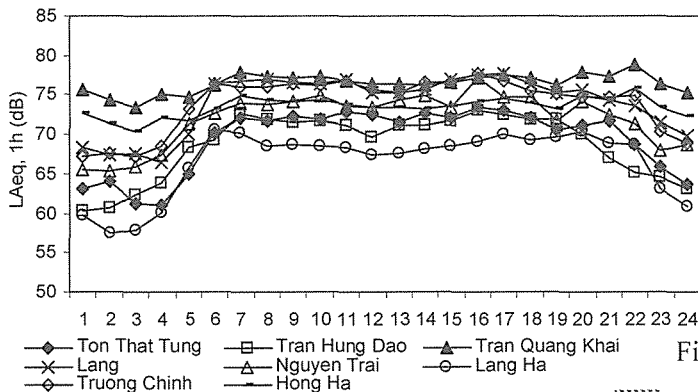


Figure 6: LAeq, 1h at every site

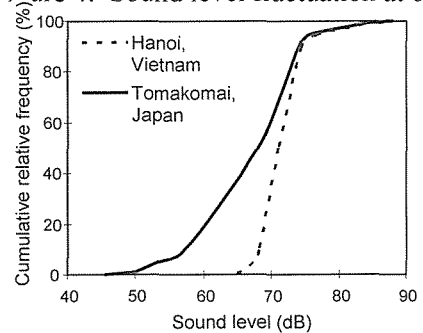


Figure 5: Comparison of relative cumulative frequency of sound levels between Hanoi and Tomakomai

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