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TRAFFIC NOISE IN LAHORE CITY, PART I: ROAD TRAFFIC NOISE

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Traffic noise survey was conducted at 15 sites in the different residential and commercial areas of Lahore city and at each survey site, noise data were collected from 0900 to 1700 h. The data collected have been analyzed for the recorded range, L_{A99}, L_{A90}, L_{A50}, L_{A10} and L_{A1} and approximate vales of L_{Aeq8h} were evaluated for each survey site. The results are discussed with reference to some criteria for community annoyance and ways and means to limit high-level traffic noise are suggested.

Key words**:** Environmental pollution, Noise pollution, Traffic noise, Lahore city.

Introduction

Road traffic noise is the most widespread source of noise in all countries and the most prevalent cause of annoyance and interference. Traffic noise surveys conducted in Karachi by Shaikh *et al* (1987 and 1997) and Hyderabad by Shaikh and Shaikh (2000) shows that in (i) Karachi with the exception of a few occasional peaks, the levels of traffic noise levels vary in the range of 61 to 97 dB(A), with L_{A90}, L_{A50} and L_{A10} values in the range of 70.1 - 78.4, 79.6 - 84.5 and 85.6 - 90.8 dB(A), respectively and (ii) Hyderabad in the range of 57.1 - 101.9 dB(A), with L_{A99}, L_{A90}, L_{A50}, L_{A10} and L_{A1} values in the range of 60.4 - 73.3, 66.2 - 79.6, 75.2 - 82.8, 85.0 - 90.9 and 89.1 - 99.0 dB(A), respectively and L_{Aeq12h} values in the range of 81.2 - 86.9 dB(A). These levels are excessively high and much above the community annoyance limits recommended by the International Standards Organization (ISO) and some other individual countries. Roadside dwellers and traders are constantly exposed to such a high level noise for about more than 12 h a day.

The result of another survey (Ahmad 1992; Ahmad 1994) in Karachi, Lahore, Faisalabad, Hyderabad and Sukkur shows that the levels of traffic noise in these cities vary in the range of 72 - 95, 74 - 90, 70 - 92, 60 - 90 and 60 - 85 dB(A), respectively. However, the methodology used by these surveys, such as (i) most of the readings reportedly taken in dB (ii) distance of the meter from the nearest line of flow of vehicles (iii) time weighting (iv) fewer readings (v) average values generally based on minimum and maximum readings and (vi) incorrect range of values raises questions about the credibility of the results and inferences to made thereof (Shaikh and Shaikh 2000; Shaikh 2003). The Environmental Protection Department, Lahore, has reported traffic noise levels for six places in Lahore, in the range of 26 - 121 dB (not dB(A) (EPD 1996). For Village Bath, Lahore, traffic noise levels have been reported in the range of 26 - 50 dB (not dB(A), which is unimaginable and may have been occasioned by technical problem in the measuring equipment (e.g. battery voltage drop). EPA's measurement of traffic noise levels with the handheld device inclined at about 45 degree was irregular and rendered the results unreliable. More standard measurement procedures were employed in the surveys carried out by Shaikh *et al* (1987, 1997 and 2001).

Therefore, in order to have detailed assessment of prevailing road traffic noise in different areas and localities, traffic noise survey was conducted at 15 sites on busy roads with heavy traffic density in the residential and commercial areas of Lahore city. Due to the absence of proper regulatory laws to limit highlevel traffic noise in Pakistan, the results are discussed with reference to the community annoyance criteria, recommended by ISO and some other individual countries. Some suggestions for limiting highlevel traffic noise are also discussed.

Materials and Methods

Measuring instruments and techniques. The measuring instrument consisted of a Sound Level Meter. The meter was regularly calibrated against an acoustic calibrator and checked before and after each series of measurements. During all the measurements, the meter was kept at 1.5 m above the ground level and at a distance of about 5 m from the edge of the nearest

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line of flow of vehicles (ASA 1984; Hassel and Zaveri 1988) and about 1-2 m from the façade (ISO - 1996 (1982), PSI - 4005 (1997); however, in some cases due to existing road situations, measurements were made at kerbsides. Traffic noise data was recorded in dB(A) with time constant 'fast'.

At each survey site, noise data were collected from 0900 - 1700 h in every 10 m. In each set, ten readings were recorded in a period of about 2 m and repeated after intervals of 8 m. In each measuring mode between the intervals, the noise level was worked out as the average value of 10 readings. Also the maximum and minimum values in each measuring mode were recorded. The data collected have been analyzed for L_{A99}, L_{A90}, L_{A50}, L_{A10} and L_{A1} and approximate values of L_{Aeq8h} for each survey site are evaluated by using the following relationship (May 1971):

$$L_{Aeq} = L_{A50} + (L_{A10} - L_{A90})^2 /56$$

Preferred Speech Interference Levels (PSIL) for each survey site have been evaluated by using the relationship between PSIL and dB(A) (May 1971):

PSIL = dB(A) - 7

Results and Discussion

The results evaluated for the recorded range and percentile values for the 15 survey sites are given in Table 1. Fig 1, 2 and 3 show the diurnal variation, statistical distribution and cumulative distribution, respectively of road traffic noise recorded at Shalimar Chowk from 0900 to 1700 h. The result shows that in Lahore, the levels of road traffic noise vary in the range of 60.4 - 97.3 dB(A), with L_{A99}, L_{A90}, L_{A50}, L_{A10} and L_{A1} in the range of 63.1 - 66.3, 68.3 - 74.1, 74.8 - 82.4, 84.3 - 87.5 and 89.6 - 94.1dB(A), respectively and estimated L_{Aeq8h} values 82.4 - 85.4 dB(A). The evaluated PSIL are found to be in the range of 58.3 - 77.5 dB for about 80% of the daytime.

The road traffic noise levels reported for 22 sites in Lahore by Ahmad (1992 and 1994) show that in Lahore city traffic noise levels vary in the range of 74 - 90 dB(A) and average values in the range of 77 - 85 dB(A) and traffic noise level at these sites fluctuates in the range of 3 - 11 dB(A), which is unimaginable.

For community annoyance for cities with business, trade and administration, like Lahore (i) ISO - 1996 (1982) suggests maximum limit of 55 - 65, 50 - 60 and 40 - 50 dB(A) L_{Aeq} for daytime, evening time and night, respectively (ii) World Health Organization (WHO 1980) allows 55 dB(A) L_{Aeq} (iii) for urban residential areas with high background noise levels, Denmark (1982) allows 50 dB(A) L_{Aeq} for daytime (iv) for areas which are primarily residential, Germany allows 55 dB(A) L_{Aeq} for daytime and 40 dB(A) L_{Aeq} for night (Federal Republic of Germany 1974). Earlier surveys on road traffic noise nuisance show that more than 50% of the population, surveyed were annoyed at about 68 dB(A) in Paris (Aurbee 1971), 60 dB(A) L_{Aeq} in London (Longdom 1976) and 56 dB(A) L_{Aeq} in Stockholm (Fog and Jonsson 1968). For non-occupational noise exposure, Walsh-Healy noise rules (Anon 1969) allows 75 dB(A) L_{Aeq} for 8h a day or 80 dB(A)

Table 1
Road traffic noise levels at fifteen survey sites in Lahore city

S. no.	Place	Recorded range dB(A)	L_{A99} dB(A)	L_{A90} dB(A)	L_{A50} dB(A)	L_{A10} dB(A)	L_{A1} dB(A)	L_{Aeq8h} dB(A)
1.	Ferozpur road	60.8 - 95.6	63.2	73.5	80.7	87.3	92.7	83.9
2.	Centre point, gulberg	62.1 - 92.6	63.7	70.1	78.8	85.1	89.6	82.8
3.	Yateem Khana road	64.6 - 96.9	66.7	74.1	81.9	86.8	93.2	84.8
4.	Secretariat chock	62.6 - 92.4	65.5	71.9	81.2	86.1	90.6	84.8
5.	Mall road	64.7 - 93.5	64.7	73.3	81.3	86.8	91.5	84.5
6.	Shalimar chock	62.3 - 93.3	64.4	70.9	80.8	86.9	92.7	85.4
7.	Shah Alam chock	61.5 - 95.5	64.2	77.6	80.4	85.6	91.6	83.4
8.	Bhatti gate	63.2 - 97.3	65.4	72.1	81.2	87.5	94.1	85.4
9.	Chock-Sadder cantt.	62.3 - 91.7	63.6	70.6	79.6	85.9	91.7	83.6
10.	China chock	61.2 - 92.3	62.8	68.3	78.9	85.7	91.5	83.4
11.	Mazzang chock	62.3 - 91.8	64.4	70.3	78.9	84.4	89.8	82.5
12.	Chock chooburi	62.5 - 92.8	65.4	72.1	82.4	87.2	92.0	83.7
13.	Chock Ghari Soohahu	63.4 - 92.2	66.3	72.2	80.1	85.8	92.7	83.3
14.	Minar-e-Pakistan	60.4 - 95.5	64.2	71.5	78.9	86.6	92.6	83.7
15.	Model town	61.2 - 95.3	63.1	70.1	79.3	84.3	92.7	82.4

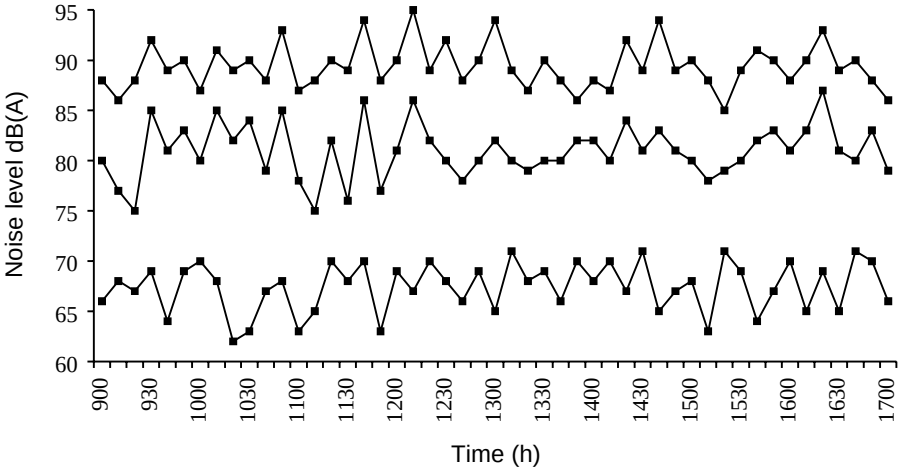

Fig 1. Diurnal variations in road traffic noise levels recorded at Shalimar Chowk from 0900-1700 h. Upper, lower and middle curves show the maximum, minimum and average values recorded in each measuring mode of 2 min duration between each sampling interval.

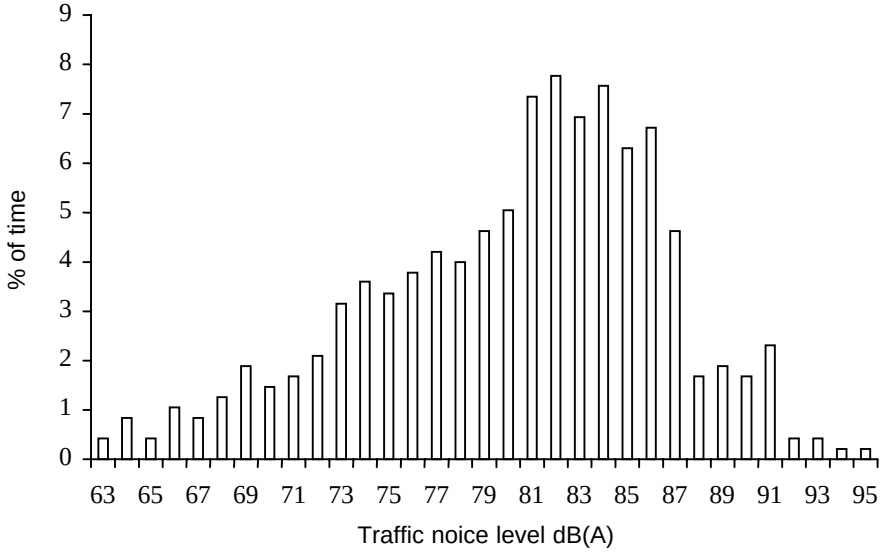

Fig 2. Statistical distribution of road traffic noise recorded at Shalimar chowk from 0900-1700 h.

L_{Aeq} for 4 h a day. For exterior noise in residential areas, Federal Highway Administration (Virginia Department of Highways 1972 and 1973) establishes a standard L_{A10} 70 dB(A) and US Department of Housing and Urban Development (HUD 1971) categorizes the site as unacceptable and discourages the construction of new buildings units, where exterior noise levels exceed 80 dB(A) L_{Aeq} for more than 1 h per 24 h or 75 dB(A) L_{Aeq} for 8 h per 24 h.

The results show that the L_{A90} values of noise levels at these survey sites exceed 68.3 dB(A), which are above the maximum permissible noise levels recommended for community annoyance in the urban residential areas. The L_{A50}, L_{A10} and evaluated L_{Aeq} 8 h values at these sides exceed 78.8, 87.5 and 82.4 dB(A), respectively, indicating that traffic noise levels in Lahore city are excessively high and much above the limits recommended for community annoyance and may result in adverse effects on roadside traders and dwellers, who are constantly exposed to such a high level non-occupational noise for a long duration. The PSIL values 58.3 - 77.5 evaluated above, show that for reliable face-to-face communication, between the speaker and listener at a distance of one metre, the speaker has to use 'raised' to 'shouting' voice (Webster 1968, 1969), which is discourteous. But due to poor education and lack of knowledge about the civic privileges and ill effects of high-level noise, no vigorous community action has been surfaced against highlevel traffic noise in the major cities in Pakistan.

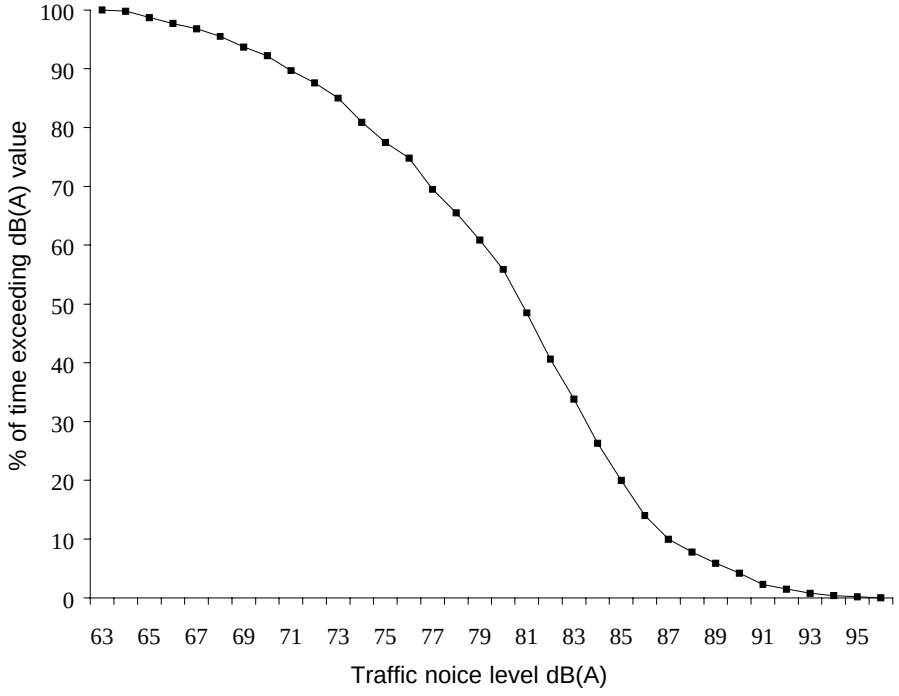

Fig 3. Cumulative distribution of road traffic noise recorded at Shalimar chowk from 900-1700 h.

As mentioned earlier (Shaikh and Shaikh 2000) the main reason of highlevel traffic noise in Pakistan is the absence of proper regulatory laws to limit highlevel traffic noise. The other reasons are poor model of vehicles, emission of high level noise from individual vehicles, use of defective silencers, use of pressure horns and other multi-tone devices, poor maintenance of vehicles, poor condition of vehicles, rash driving, etc.

The existing Motor Vehicle Rules (1969) in Pakistan may control emission of high-level noise from an individual vehicle to some extent, but due to some unknown reasons, these are not being implemented properly. The Pakistani standard (NEQS 1993) allows a limit of 85 dB(A) at a distance of 7.5 meters from the source, with no mention of type of vehicle and measuring technique, hence it may not be useful in controlling emission of highlevel from different type of vehicles. Therefore, in order to limit emission of highlevel noise from different type of vehicles, there is an urgent need to revise this standard. In this regard, as recommended earlier by one of the authors (Shaikh 2001), noise emission limits for different type of vehicles may be set as (i) 85 dB(A) for auto-rickshaws, buses and trucks, (ii) 82 dB(A) for motorcycles, mini-buses and mini-trucks and (iii) 80 dB(A) for cars and other light vehicles, which are very close to the motor vehicle noise emission limits recommended by the European Economic Community (EEC directives 1978, 1984a, 1984b), legislated and properly implemented. Eventually, one may hope to set Pakistani Standard in the light of type and engine capacity of the vehicles.

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