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# Traffic Noise in Lahore City, Pakistan. Part II. Vehicular Contribution to Traffic Noise

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**Abstract.** A traffic noise survey conducted in Lahore city, Pakistan showed that the prevailing traffic noise levels were excessively high and much above the community annoyance limits. Therefore, in order to have an assessment of the level of noise emitted by different types of vehicles plying on the roads in Lahore city, measurement of the level of noise emitted from individual cars, motorcycles, vans, buses, autorickshaws and trucks was carried out in their normal running condition. The data collected have been analyzed for the range of noise emission levels, $L_{V99}$, $L_{V90}$, $L_{V50}$, $L_{V10}$ and $L_{V1}$ values for each category of vehicles. Due to the lack of proper regulatory laws to limit emission of high level noise from individual vehicles in Pakistan, the results are discussed with reference to the vehicular noise emission limits recommended by the Council of European Economic Community, and some other individual countries. Some means and ways to limit the emission of high-level noise from individual vehicles are also suggested.

**Keywords:** noise pollution, traffic noise, motor vehicle noise, noise pollution in Lahore city, community noise annoyance

## Introduction

Road traffic noise is one of the major environmental problems in the urban areas of Pakistan. A road traffic noise survey conducted earlier in Lahore city by Islam *et al.* (2004) showed that the level of traffic noise in the city varied from 60.7-97.3 dB(A), with $L_{A99}$, $L_{A90}$, $L_{A50}$, $L_{A10}$ and $L_{A1}$ values in the range of 63.1-66.3, 68.3-74.1, 74.8-82.4, 84.3-87.5, and 89.6-94.1 dB(A), respectively, and evaluated the $L_{Aeq8h}$ values in the range of 82.4-85.4 dB(A). With the exception of few sites, all the measurements were made at a distance of about 5.0 m from the edge of the nearest line of flow of vehicles. The traffic streams at these sites were generally composed of autorickshaws, buses, motorcycles and cars. These levels are very high and much above the community annoyance limits, as recommended by the International Standards Organization (ISO) and some other individual countries. Roadside traders and dwellers are constantly exposed to high-levels of noise for long periods, which may result in different varieties of physical, physiological and psychological effects on their health.

The level of traffic noise at a certain place varies with time, which generally depends upon the traffic density, composition of vehicles, and especially the noise produced by individual vehicles in a given traffic stream. The other contributing factors include traffic congestion, uneven road surfaces and the reverberation time of the place. The noise produced by an individual vehicle further depends upon its type, make, physical condition and mode of operation, such as its speed, gear, and accelerator position. It has been observed that autorickshaws are the main source of high-level noise, followed by buses, trucks and motorcycles. For assessment of the level of noise generated by an individual category of vehicles, some standard methods have been recommended for the measurement of noise emitted by vehicles in motion (EEC, 1992; ISO-362, 1981; BS-3425, 1966), and in the stationary state (ISO-5310, 1982). A brief study on the measurement of noise emission levels of different types of vehicles in motion, by following the standard method (ISO-362, 1981), has reported the noise emission levels of individual trucks, cars, buses, mini-buses, motorcycles, autorickshaws and vans in Karachi, Pakistan, in the range of 85-90, 73-83, 79-89, 85-88, 84-88, 91-95 and 76-86 dB(A), respectively (Shaikh and Rizvi, 1990).

The measurement of noise emission levels in accordance with the standard methods yields information on the levels of noise produced under certain specified, but unrealistic conditions. Vehicles plying on the roads, in the real-state situations are generally not under these standard conditions all the time and hence such data do not give a realistic assessment of the contribution of different categories of vehicles to the traffic noise. Therefore, in order to find the actual contribution to noise from different types of vehicles, measurement of noise emission levels for individual cars, motorcycles, autorickshaws,

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trucks, buses and vans, plying on the roads in Lahore city, was done during their normal (usual) running state, irrespective of any specified control on speed, gear, and the acceleration position. The results are further discussed with reference to the noise emission levels earlier recorded for different types of vehicles in Karachi and Hyderabad (Shaikh, 2001; 1998; Shaikh *et al.,* 1995). Some suggestions to limit emission of the high level noise from different types of vehicles have been also made.

## Materials and Methods

The measuring instrument used in the study consisted of a CEL integrating sound level meter, type CEL-328. The meter was regularly calibrated against an acoustic calibrator (model CQ-20, Quest Technologies, USA), which produces pure tones of 250 and 1000 Hz, both at 94 and 114 dB, and was checked before and after each series of measurements. These measurements were carried out at selected locations on reasonably leveled, tarmac carpeted roads, with buildings on both sides, and uninterrupted by crossings, roundabouts and traffic lights. All the measurements were made when traffic density, at the measurement site, was very low and the background noise level was about 60 dB(A), or at least 10 dB(A) below the level of noise of the vehicle. The noise data for individual vehicles was recorded in dB(A), with meter response 'fast', by placing the 'meter' 1.2 m above the ground level. The noise emission level of individual vehicles was recorded when it went past the microphone within 6-9 m (average distance of about 7.5 m from the vehicle under observation), in line with the microphone, assuring at the same time that no other vehicle was moving on either side of the vehicle under observation and there was no other vehicle within about 30 m ahead or behind this vehicle.

Noise emission data were recorded for 500 individual cars, 500 motorcycles, 500 autorickshaws, 200 vans, 200 buses and 150 trucks. The data collected have been analyzed for the recorded noise emission ranges for each category of vehicles tested, and the observations have been reported as $L_{V99}$, $L_{V90}$, $L_{V50}$, $L_{V10}$ and $L_{V1}$ levels (levels of noise in dB(A) exceeded by 99, 90, 50, 10 and 1% of each category for vehicles observed).

## Results and Discussion

The range of noise emission levels was recorded for the six categories of vehicles in their normal running condition and evaluated as $L_{V99}$, $L_{V90}$, $L_{V50}$, $L_{V10}$ and $L_{V1}$ level values (Table 1). The percentages of vehicles exceeding the noise emission limits of 80, 82 and 85 dB(A) have been reported in Table 2. The statistical distribution of noise emission levels recorded for autorickshaws, trucks, vans, motorcycles, cars and buses, have been respectively given in Fig. 1, 2, 3, 4, 5 and 6. The cumulative distribution of the various categories of vehicles has been given in Fig. 7. The data obtained during the present study on noise emission levels of individual cars, motorcycles, vans, autorickshaws, buses and trucks were noted to vary in the range of 66.7-83.3, 70.6-92.8, 74.8-86.8, 76.4-93.5, 77.6-95.4 and 78.1-94.2 dB(A), respectively (Table 1).

During earlier studies conducted in Karachi city, noise emission levels from individual cars, mini-buses, buses, motorcycles, mini-trucks, trucks and autorickshaws (with two passenger seats) in their normal running condition were recorded in the range of 68-84, 76-89, 77-94, 71-93, 71-85, 78-93 and 80-96 dB(A), respectively. In a similar study conducted in Hyderabad city, the noise emission levels for individual buses, motorcycles, autorickshaws (with two passenger seats) and six passenger seats) were recorded in the range of 79.2-96.4, 69.8-91.4 and 74.7-97.2 dB(A), respectively ( Shaikh, 2001; Shaikh *et al.,* 1998; Shaikh *et al.,* 1995).

Ahmad (1994) has reported noise emission levels of individual

**Table 1.** The traffic noise emission range evaluated as $L_{V99}$, $L_{V90}$, $L_{V50}$, $L_{V10}$ and $L_{V1}$ level values for cars, motorcycles, vans, autorickshaws, buses and trucks in Lahore city, Pakistan

| Type of vehicle | Noise emission range dB(A) | $L_{v99}$ dB(A) | $L_{v90}$ dB(A) | $L_{v50}$ dB(A) | $L_{v10}$ dB(A) | $L_{v1}$ dB(A) |
|---|---|---|---|---|---|---|
| Cars | 66.7-83.3 | 68.3 | 71.6 | 75.8 | 80.2 | 83.7 |
| Motorcycles | 70.6-92.8 | 72.3 | 75.7 | 80.6 | 87.1 | 91.5 |
| Vans | 74.8-86.8 | 75.7 | 77.7 | 81.3 | 85.5 | 87.2 |
| Autorickshaws | 76.4-93.5 | 77.2 | 80.1 | 84.5 | 90.5 | 93.5 |
| Buses | 77.6-95.4 | 80.1 | 81.7 | 86.3 | 92.2 | 94.8 |
| Trucks | 78.1-94.2 | 78.2 | 81.2 | 85.6 | 91.6 | 93.6 |

$L_{v99}$, $L_{v90}$, $L_{v50}$, $L_{v10}$, $L_{v1}$ = respectively, levels of noise exceeded by 99, 90, 50, 10 and 1% of the respective category of vehicles

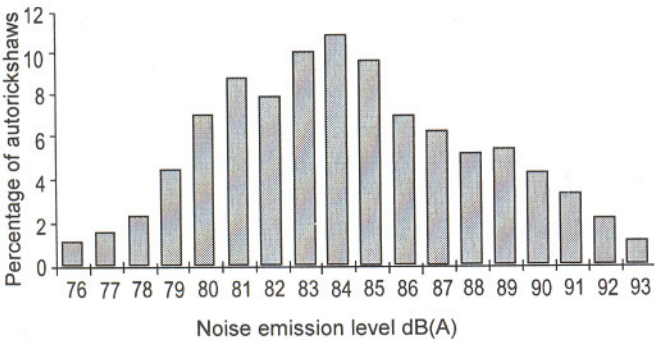


**Fig. 1.** Statistical distribution of noise emission levels recorded for autorickshaws.

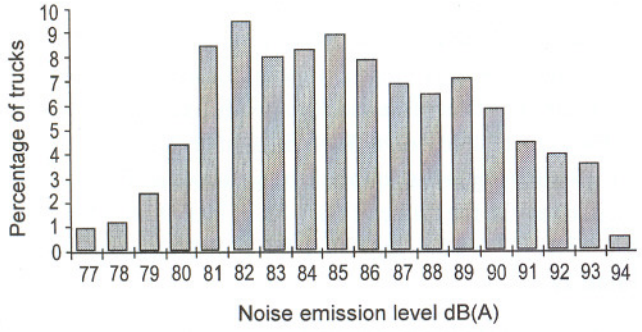


**Fig. 2.** Statistical distribution of noise emission levels recorded for trucks.

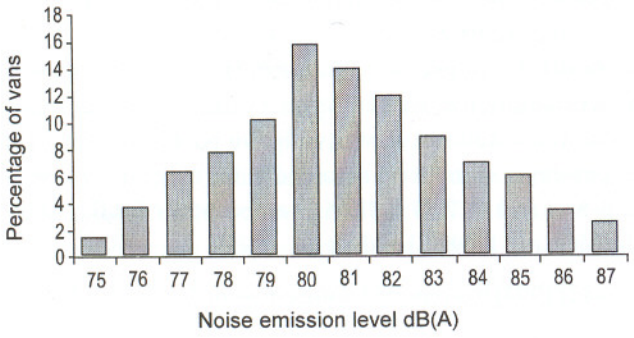


**Fig. 3.** Statistical distribution of noise emission levels recorded for vans.

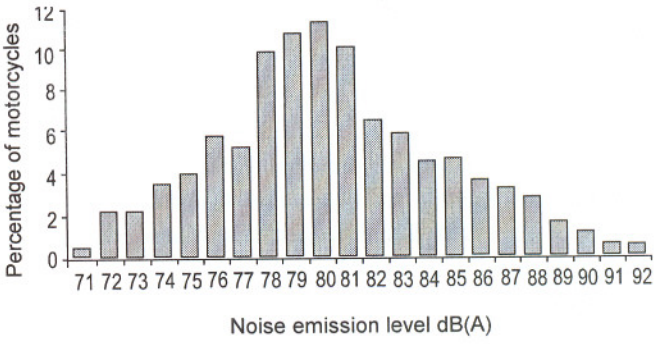


**Fig. 4.** Statistical distribution of noise emission levels recorded for motorcycles.

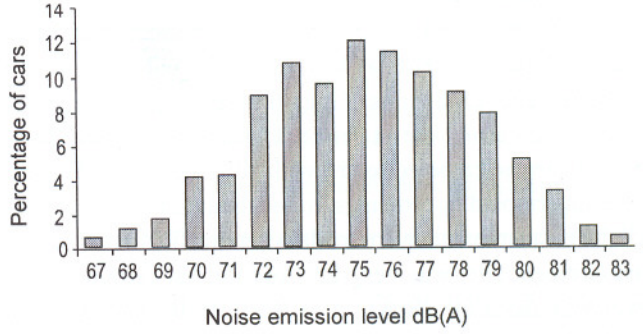


**Fig. 5.** Statistical distribution of noise emission levels recorded for cars.

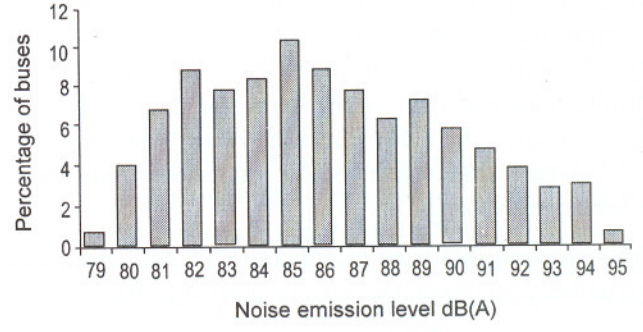


**Fig. 6.** Statistical distribution of noise emission levels recorded for buses.

autorickshaws, motorcycles, scooters, taxis/cars, jeeps, minibuses, buses and tractors: (i) at a distance of 4 m from the source in the range of 86-91, 68-70, 49-50, 51-58, 62-69, 64-72, 69-93 and 74-84 dB(A), respectively; and (ii) at a distance of 10 m in the range of 72-75, 52-58, 56-60, 33-40, 44-54, 57-55, 59-62, 60-64 and 60-66 dB(A) respectively, with no mention of the measuring techniques used. The lower values are unimaginably low and below the background level. Furthermore, as reported by Ahmad (1994), while taking these readings, noise from other far away traffic could not be avoided. While measuring the noise levels of a source, the background noise level should be at least 10 dB(A) below the level of noise of the source under observation, and for the measurement of noise emission level of an individual vehicle, a distance of 7.5 m has been recommended (ISO-362, 1982). The methodology used in these measurements, such as background noise levels, distance of the noise measuring meter from the source, and incorrect range of noise emission levels, raises questions about the credibility of the reported data and, as a result, inferences drawn from these observations. The lower

**Table 2.** Percentage of vehicles exceeding the recommended vehicular noise emission limits of 85, 82 and 80 dB(A)

| Type of vehicles | Percentage of vehicles exceeding the recommended vehicular noise emission limits | | | | |
|---|---|---|---|---|---|
| | 90 dB(A) | 88 dB(A) | 85 dB(A) | 82 dB(A) | 80 dB(A) |
| Cars | | | | 1.8 | 10.0 |
| Motorcycles | 2.4 | 7.0 | 18.8 | 35.9 | |
| Vans | | | 12.0 | 40.0 | |
| Auto-rickshaws | 11.0 | 21.8 | 45.0 | | |
| Buses | 22.0 | 36.0 | 61.0 | | |
| Trucks | 18.4 | 32.0 | 56.7 | | |

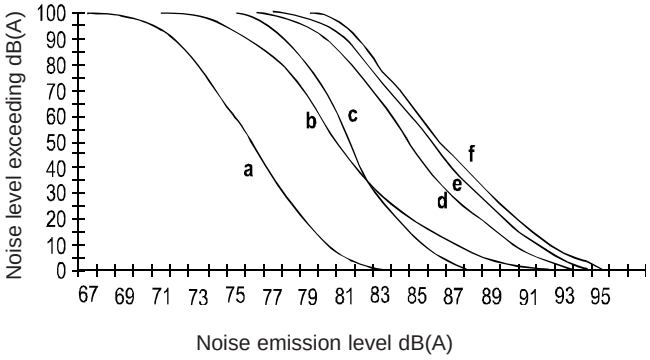


**Fig. 7.** Cumulative distribution of noise emission levels recorded for (**a**) cars, (**b**) motorcycles, (**c**) vans, (**d**) autorickshaws, (**e**) trucks, and (**f**) buses in their normal running conditions.

values of noise emission levels reported by this author may be attributed to the voltage drop of the battery of the meter (Shaikh, 2003).

For new vehicles intended for the carriage of passengers or goods with engine power up to 150 kW or permissible mass up to 3.5 tonnes, a limit of 74-80 dB(A) with a margin of 1 dB(A) has been recommended for vehicles equipped with direct injection diesel engines (EEC, 1992).

The higher values of noise emission level of the vehicles tested during the present study were very high and much above the limits recommended by EEC, which may result in a variety of adverse effects on roadside dwellers and traders. The reasons for emission of high level noise from individual vehicles in Pakistan may be attributed to inappropriate and inadequate regulatory laws, poor education of drivers, especially the commercial vehicle drivers, old models of vehicles, poor maintenance, use of defective silencers, and rash driving. For new vehicles, the National Environment Quality Standards of Pakistan (NEQS, 1993) allow a limit of 85 dB(A) at a distance of 7.5 m from the source, with no mention of measuring technique and the type of vehicle, hence its implementation cannot be ensured for controlling noise emission levels of individual vehicles. Therefore, there is an urgent need to revise the Pakistani NEQS (NEQS, 1993) and set new noise emission limits in the light of the type and capacity of vehicles, as are in force in the EEC countries (EEC, 1992). In this regard, Shaikh (2001; 1998) has already recommended noise emission limits of 80 dB(A) for cars and other light vehicles; 82 dB(A) for motorcycles, mini-buses and mini-trucks; and 85 dB(A) for buses, trucks, autorickshaws and other passenger or goods carrier vehicles for implementation in a phased programme.

It may be noted from Table 2 that in setting these limits, 10% cars, 35.9 % motorcycles, 40% vans, 45% autorickshaws, 61% buses and 56.7% trucks will exceed these limits. This is a matter of serious concern and something must be done urgently for they seem to be outclassing all vehicles. The noise level from individual vehicles may be controlled by proper maintenance, use of good quality silencers, and avoiding rash driving. However, regulatory laws to control vehicular noise emission levels within the recommended limits need to be framed and implemented forcefully to protect health of the general population against high levels of traffic noise. It is hoped in this regard that Pakistani Standards on noise pollution are brought closer to the international standards as are in force in other developed countries.

## References

Ahmad, K. 1994. Road traffic noise and its control. *NED University J. Engg. Res.* **1:** 73-83.

BS-3425. 1966. *Methods for the Measurement of Noise Emitted by Motor Vehicles*, British Standards Institution, London, UK.

EEC. 1992. *Council Directive* 92/97/*EEC(1992) of November 10, 1992 Amending Directive 70/157/EEC on the Approximation of the Laws of the Member States Relating to the Permissible Sound Level and the Exhaust System of Motor Vehicles, Official J. Europ. Commun.* **L-371:** 1-31, European Economic Community, Brussels, Belgium.

ISO-362. 1981. *Acoustics-Measurement of Noise Emitted by Accelerating Road Vehicles- Survey Method*, International Standards Organization, Geneva, Switzerland.

ISO-5310. 1982. *Acoustics-Measurement of Noise Emitted by Stationary Vehicles*, International Standards Organization, Geneva, Switzerland.

Islam, K., Ahmad, T., Shaikh, G.H. 2004. Traffic noise in Lahore city. Part I. Road traffic noise. *Pak. J. Sci. Ind. Res.* **47:** 340-344.

NEQS. 1993. *National Environmental Quality Standards for Motor Vehicles Exhaust*, The Pakistan Gazette (Extra-ordinary) Statutory Notification SRO 742/93, Annex. II, 29th August 1993, Government of Pakistan, Islamabad, Pakistan.

Shaikh, G.H. 2003. Road traffic noise in Pakistan: a review. *Pak. J. Sci. Ind. Res.* **46:** 163-167.

Shaikh, G.H. 2001. Traffic noise in Hyderabad city. Part II. Vehicular contribution to road traffic noise. *Pak. J. Sci. Ind. Res.* **44:** 163-167.

Shaikh, G.H. 1998. Vehicular contribution to road traffic noise in Karachi city. Part II. Contribution by cars, trucks and horns. *Pak. J. Sci. Ind. Res.* **41:** 186-189.

Shaikh, G.H., Rizvi, S.S.H. 1990. Frequency and other parametric analysis of road traffic noise in Karachi city. *Pak. J. Sci. Ind. Res.* **33:** 181-186.

Shaikh, G.H., Ahmad, N., Rizvi, S.S.H. 1995. Vehicular contribution to road traffic noise in Karachi city. Part I. Contribution by motorcycles, buses and rickshaws. *Pak. J. Sci. Ind. Res.* **38:** 457-460.