

## TRAFFIC NOISE IN HYDERABAD CITY, PART-II. VEHICULAR CONTRIBUTION TO ROAD TRAFFIC NOISE

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The results of a road traffic noise survey carried out in Hyderabad city showed that the levels of traffic noise in the City are alarmingly high and much beyond the comfortable limits. Therefore, in order to investigate the level of the noise emitted by different types of vehicles plying on the city roads and to assess their individual contribution to high level traffic noise, studies have been carried out on the measurement of noise emitted by motorcycles, buses, auto-rickshaws, and motor vehicle horns as they normally move on the city roads. The data collected has been analyzed for  $L_{v99}$ ,  $L_{v90}$ ,  $L_{v50}$ ,  $L_{v10}$ , and  $L_{v1}$  and results are discussed with reference to the existing motor vehicle rules in Pakistan and motor vehicle noise emission limits set by the EEC and other developed countries. Some suggestions have also been made to limit high level traffic noise.

**Key words:** Traffic noise, Noise pollution, Motor vehicle noise.

### Introduction

Road traffic is one of the most widespread sources of noise nuisance in the major cities of Pakistan. The results of road traffic noise studies conducted in Hyderabad city (Shaikh and Shaikh 2000) show that the levels of road traffic noise in the City vary from 57.1-101.4 dB (A), with  $L_{A99}$ ,  $L_{A90}$ ,  $L_{A50}$ ,  $L_{A10}$ , and  $L_{A1}$  values (i.e., the level of noise exceeded by 99, 90, 50, 10 and 1% of the measurement time) in the range of 60.4 - 73.3, 66.2 - 79.6, 75.2 - 82.8, 85.0 - 90.9 and 89.1 - 100.0 dB (A) respectively and  $L_{Aeq,12h}$  values 81.2 - 86.9 dB (A). These levels are alarmingly high and much beyond the comfortable limits, with roadside dwellers and traders constantly exposed.

Road traffic noise may be regarded as the complex summation of noise produced by individual vehicles in a given traffic stream. The level of road traffic noise at a place varies with time, and generally depends upon (i) traffic density, (ii) composition, speed and condition of vehicles, (iii) reverberation time of the place, (iv) road surfaces. In Hyderabad city, certain types of vehicles make a dominant contribution to high level traffic noise. therefore, in order to have an assessment of noise emitted from different types of vehicles plying the city roads, it is necessary to collect data on the level of noise emitted from different types of vehicles. There are some methods for the measurement of noise emitted from vehicles in motion (ISO-362 1981, BS-3425 1966, EEC directive 84/372/EEC 1984a) and in stationary state (ISO-5130 1982). The sample data on the level of noise emitted from different types of vehicles in different conditions, collected earlier (Shaikh

and Rizvi 1990) by following standard method (ISO-362 1981) shows that the level of noise emitted from in-use buses, motorcycles, and auto-rickshaws with two passenger seats vary in the range of 85-89, 84 - 88, 91 - 95 dB (A) respectively.

The data generated by these methods give the information on the level of noise emitted under certain specified, but generally unrealistic conditions. Vehicles plying on the city roads in real situation generally do not follow these conditions all the time and hence such data does not give a realistic assessment of the contribution of vehicles to traffic noise. therefore, in order to find the actual contribution to noise from different type of vehicles, particularly noisier ones, measurements on the noise emission from individual motorcycles, buses, auto-rickshaws (with 2, and 6 passenger seats) plying on roads in Hyderabad city have been made in their normal running state i.e., irrespective of any specified control on speed, gear, acceleration position, etc. In addition to this, data on the level of noise emitted from motor vehicle horns (and other multi-tone devices) fitted in the vehicles has also been collected. Due to high level background noise levels, data from cars and other light vehicles could not be generated.

### Materials and Methods

The measuring instrument consisted of a CEL Integrating Octave Band Sound Level Meter, type CEL -328. The meter was regularly calibrated against a Bruel & Kjaer Pistonphone (type 4220) a standard sound source of 123.8 dB at 250 Hz and checked before and after each series of measurement. These measurements were conducted in selected locations

on tarmac covered and reasonably leveled roads, with buildings on either side and uninterrupted by crossings, roundabouts and traffic lights etc. All the measurements were made when traffic density at the measurement site was very low with background noise levels being the range of 60-65 dB or at least 10 dB (A) below the level of noise of the source. The noise emission data from individual vehicle/horn was recorded in dB (A), with time response 'fast', with the meter at 1.5 m above the ground level and 2 - 3 m away from the buildings facing the roadside. The noise produced by any particular vehicle was measured when it went past the microphone within a distance range of 6 - 9 m (i.e., an average distance of about 7.5 m from the vehicle under test) in the line of sight of microphone, assuring at the same time that vehicles were moving on the other side of the vehicle under observation and that no other vehicles were to be found within about 15 m ahead or behind the vehicle under observation.

Noise emission data was recorded from 1000 auto-rickshaws with two passenger seats, 1000 auto-rickshaws with six passenger seats, 300 buses, 650 motorcycles and 800 motor vehicle horns. The collected data has been analyzed for the noise emission range recorded for the noise emission range for each type of vehicle and horn and  $L_{v99}$ ,  $L_{v90}$ ,  $L_{v50}$ ,  $L_{v10}$ , and  $L_{v1}$  values (i.e. level of noise emitted by each type of vehicle/horn exceeded by 99,90,50, 10 and 1% of vehicles horns observed). The results are discussed with reference to the noise emission limits for motor vehicles set by the European Economic Community (EEC) and other developed countries. Some suggestions have also been made to limit emission of high level noise from different types of vehicles plying on city roads.

## Results and Discussion

The range of recorded noise emission levels and evaluated  $L_{v99}$ ,  $L_{v90}$ ,  $L_{v50}$ ,  $L_{v10}$ , and  $L_{v1}$  values are given in Table 1. Sta-

tistical distribution of noise emission levels recorded from motorcycles, auto-rickshaws with 2 passenger seats, buses, auto-rickshaws with 6 passenger seats and vehicle horns are given in Figs 1-5 respectively. Fig 6 gives the cumulative distribution curves for the vehicles and horns observed. The results show that the levels of noise emitted by these vehicles and horns are very high and much beyond the acceptable limits.

Similar studies on the measurement of noise emission levels, conducted earlier in Karachi city (Shaikh *et al* 1975, Shaikh 1998) show that the level of noise emitted from cars, mini-buses, buses, motorcycles, mini-trucks, trucks, auto-rickshaws (with 2 passenger seats), and horns (in their normal running conditions), were found in the range of 68-84, 76-89, 77-94, 71-93, 71 - 85, 78 - 93 80 - 96 and 79 - 99 dB respectively.

The results of another study reported earlier (Ahmad 1994) and reproduced in Table 2, leaves much more to be desired in respect of observations and also the credibility on inferences made, such as no mention has been made about measuring technique, and, as reported by the author, in taking readings, noise from other traffic far away could not be avoided. The Table shows that noise emission levels reported for different types of vehicles at a distance of 4 m and 10 m are in the range of 49 - 92 dB (A) and 33- 75 dB (A) respectively, misleading the readers. For the measurement of noise emitted by the vehicle, the background noise level should be at least 10 dB (A) below the level of noise of the vehicle being measured. These results may be due to a drop of the battery voltage and hence have no validity. For new vehicles, the EEC proposed a noise emission limit of 75 - 80 dB (A) for motorcycles w.e.f. Oct. 1, 1995 (EEC directive 1984), and a limit of 77 - 84 dB (A) for cars and other passenger and goods carrier vehicles with an increase of 1 - 2 dB (A) for vehicles equipped with diesel engine (EEC directives 1970, 1978, 1984). Department of Environmental Control, Chicago (New

**Table 1**  
Recorded range and evaluated  $L_{v99}$ ,  $L_{v90}$ ,  $L_{v50}$ ,  $L_{v10}$ , and  $L_{v1}$  values of noise emission levels for the vehicles and horns observed

Type of vehicle	Range dB (A)	$L_{v99}$ dB (A)	$L_{v90}$ dB (A)	$L_{v50}$ dB (A)	$L_{v10}$ dB (A)	$L_{v1}$ dB (A)
Auto-rickshaws*	74.7 - 94.3	76.1	80.0	85.3	90.6	93.7
Auto-rickshaws**	80.6 - 97.2	81.7	84.7	88.5	93.8	96.4
Buses	79.2 - 96.4	80.1	82.7	86.4	91.6	95.7
Motorcycles	69.8 - 91.4	70.8	74.6	79.1	85.5	90.6
Vehicle horns	81.7 - 104.3	82.6	85.5	90.7	99.6	103.8

\* With 2 passenger seats; \*\* With 6 passenger seats.

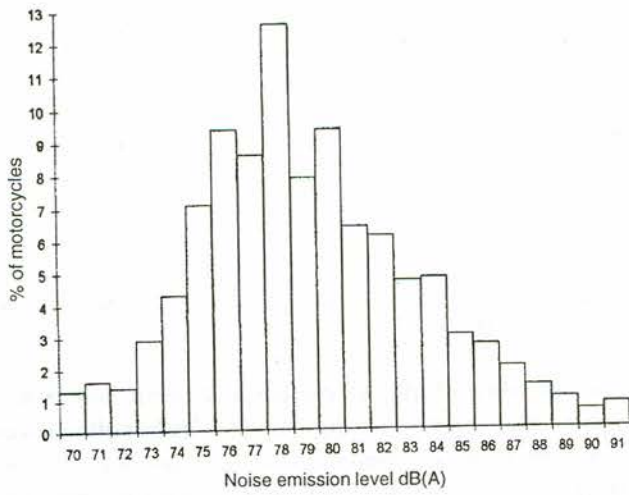


Fig 1. Statistical distribution of noise emission levels recorded from motorcycles

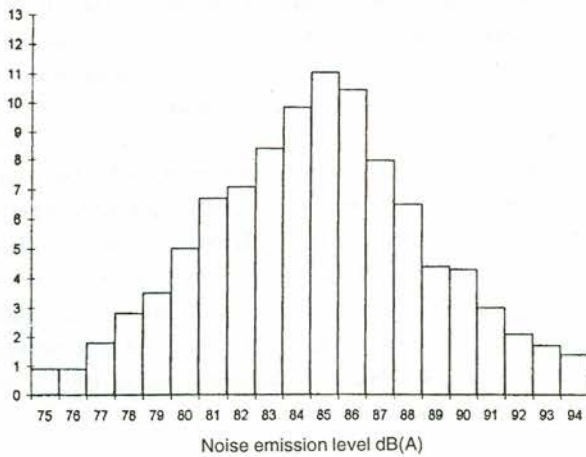


Fig 2. Statistical distribution of noise emission levels recorded from auto-rickshaws with 2 passenger seats.

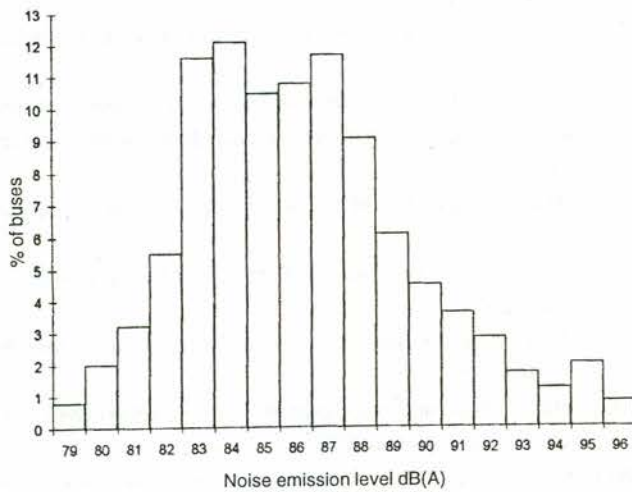


Fig 3. Statistical distribution of noise emission levels recorded from buses.

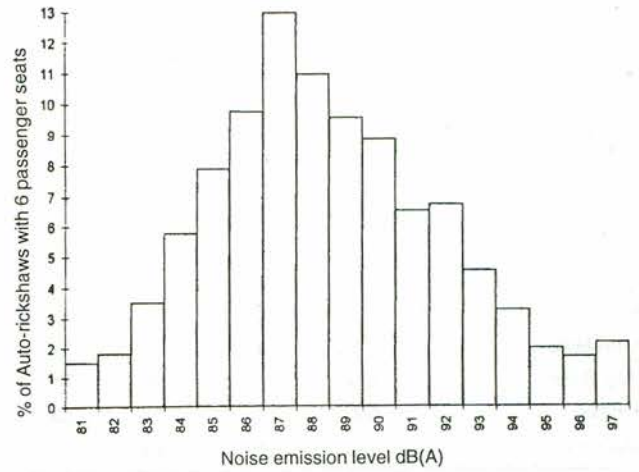


Fig 4. Statistical distribution of noise emission levels recorded from auto-rickshaws with 6 passenger seats.

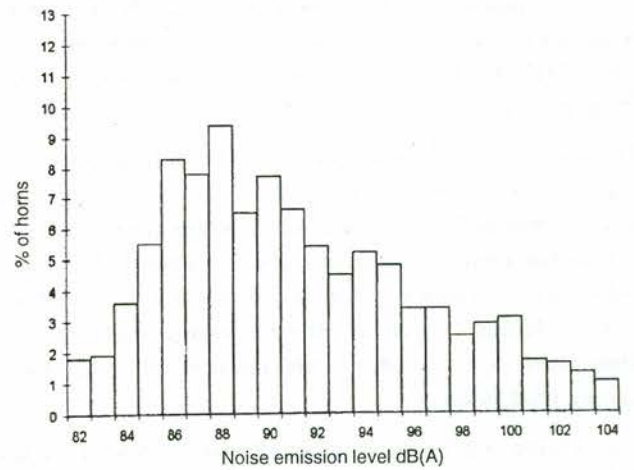


Fig 5. Statistical distribution of noise emission levels recorded from horns

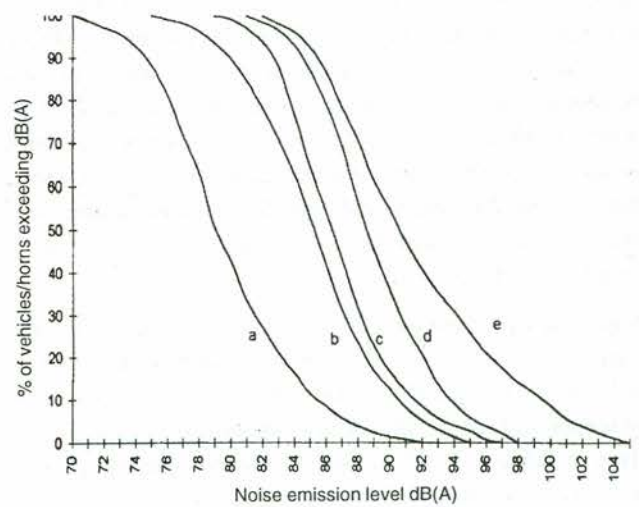


Fig 6. Cumulative distribution of noise emission levels recorded from (a) motorcycles, (b) auto-rickshaws with 2 passenger seats, (c) buses, (d) auto-rickshaws with 6 passenger seat and (e) horns.

**Table 2**  
Noise emission levels reported for vehicles at a distance of 4 and 10 m (Ahmad 1994)

Type Vehicle	Reported Noise Levels			
	dB (A) <sup>a</sup>		dB (A) <sup>b</sup>	
Auto-rickshaws	86	92	72	75
Motorcycles	68	70	52	58
Scooter	70	84	56	60
Taxis/Cars	49	54	33	40
Jeeps	51	58	44	54
Mini buses	62	69	52	55
City Buses	64	72	59	62
Trucks	69	73	60	64
Tractors	74	84	66	60

<sup>a</sup> at a distance of 4m, <sup>b</sup> at a distance of 10 m.

Noise Regulations 1971) allows a limit of 81 dB (A) for motorcycles, cars and other vehicles heavier than 8000 lbs. w.e.f. Jan 1, 1980. All these limits have been set a distance of 7.5 m from the source.

The reasons for emission of high level noise from individual vehicles in Pakistan may be contributed to (i) few regulatory laws to limit high level motor vehicle noise, (ii) poor education of commercial vehicle drivers, (iii) many vehicles are old models, (iv) poor maintenance of vehicles, (v) use of defective silencers, (vi) use of pressure horns and other multi-tuned devices, (vii) rash driving and (viii) to some extent uneven road surfaces.

The existing motor vehicle rules in Pakistan (Motor Vehicles Rules 1969) may help in controlling emission of high level noise from individual vehicles and horns to some extent, but due to some unknown reasons these are not being implemented properly. For new vehicles, Pakistani Standards (NEQS 1993) allows a limit of 85 dB (A) at a distance of 7.5 m from the source without specifying measurement technique and type of vehicle, hence its implementation would not be very much useful in controlling emission of high level noise. Therefore, there is a need to review Pakistani Standard by setting noise emission limits for new motor vehicles closer to that as allowed by the EEC.

Regarding the in-use motor vehicles, it is recommended that noise emission limit of (i) 85 dB for auto-rickshaws, buses and trucks, (ii) 82 dB (A) for motorcycles, minibuses and minitruck and (iii) 80 dB (A) for cars may be set up, then as given in Table 3, 53.0% of auto-rickshaws with two passenger seats, 87.4% auto rickshaws with six passenger seats, 64% buses and 27.1% motorcycles will exceed these limits. As 87.4% of auto-rickshaws with 6 passenger seats produces

**Table 3**  
Percentage of vehicles crossing the recommended upper limits of noise emission levels

Type of Vehicle	90 dB(A)	88 dB(A)	85 dB(A)	82 dB(A)
Auto-rickshaws*	12.5	23.4	53.0	---
Auto-rickshaws**	36.1	56.7	87.4	---
Buses	16.6	31.8	64.8	---
Motorcycles	1.4	3.8	11.5	27.1

\* with 2 passenger seats; \*\* with 6 passenger seats.

noise exceeding 85 dB (A), one has to do something in this respect rather urgently, for they seem to outclass all vehicles responsible for noise pollution. The noise emission levels from vehicles may be controlled by proper maintenance of vehicles, using good quality silencers, avoiding rash driving, etc. As far as horns are concerned, it is meant to draw other's attention over and above the ambient traffic noise. Therefore, the noise emission limit for horns should be set at least 10 dB (A). This may be controlled by banning pressure horns and other multi-tuned devices producing sound over and above 95 dB (A). Regulatory laws to control motor vehicle noise within the acceptable limits need to be implemented seriously, perhaps by a phased programme to ensure that the noise emission limits do not exceed (i) 85 dB (A) for auto-rickshaws, buses and trucks, (ii) 82 dB (A) for motorcycles, minibuses, minitrucks and 80 dB (A) for cars and other light vehicles may help to reduce the noise levels considerably. Eventually one may hope to set Pakistani Standard (NEQS 1993) closer to the international standards.

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