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Evaluation of Environmental traffic noise pollution and in urban community

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ABSTRACT

Traffic noise is a major environment source of pollution in the whole planet, both in developed and in undeveloped nations. The study being reported here has been carried out on one of the busy and most crowded street in downtown area in Kerman, which has heavy traffic during the day. Total of 6 measuring points were selected along streets. In this study the A-weighted continuous equivalent sound level values and statistical levels L_{10}, L_{50}, L_{90} and L_{99} were manually measured at each site separately. The mean value of continuous equivalent sound level for commercial-Residential, Commercial and Residential was 67.69, 71.68 and 56.02 dBA respectively. The results of the study establish the fact that noise levels are more than the acceptable limit compared to the standards of the governmental legislations. This paper also describes the reaction to environmental noise of the city of Kerman. A total of 250 questionnaires were processed. The results of the interview questionnaire which included a number of parameters reveal the following; (i) the main isolated noise sources were traffic (50%) and street noise (34%); (ii) 70% of the people classified the noise in his/her street as "very high"; (iii) 52% and 48% of the respondents have answered that noise bother them in morning and evening respectively; (iv) 86% and 86.8% of the subjects have answered that traffic noise produce physical and psychic annoyance to them; (v) the main outcomes of exposure to noise were: irritability (40.8%), insomnia (24%), difficulty to concentrate (16%) and conversation disruption (16%).

1. INTRODUCTION

Traffic noise is considered as one of the important sources of noise pollution that adversely affects human health (Aparicio et al. 1993; Williams and McCrease, 1995). Noise pollution is a major problem for the quality of life in urban areas. Noise is a third most hazardous type of pollution, right after air and water pollution (WHO 2005).

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This study presents the results obtained from a social surveyed and noise measurement carried out in the city of Kerman, Iran. Kerman is one of the 30 provinces of Iran. Kerman city had an estimated population of 533,799 in 2005. In Kerman, the increases in the population and in the number of circulating vehicles have led to an increase in the urban noise levels. Governmental data about total annual car registered in Kerman for March 2007 to February 2008 are shown in figure 1. The government data showed that total car registered per year was 56139. On average, there was about 15% growth per month. This indicated that problems associated with traffic noise are expected to be more significant. The need for studies regarding the urban noise pollution and its consequences for the community has motivated various researches on the problem in several countries (Arana and Garcia 1998; Abdel-Raziq and Zeid 2000; Zannin et al. 2001; Zannin et al. 2003; Khilman 2004; Piccolo et al. 2005). Noise effects have various impacts on mental and physical health and disturbance of daily activities. It may affect sleep, conversation, lead to perception of annoyance, causes hearing loss, cardiovascular problems as well as affects task performance (piccolo 2005).Table 1 shows the environmental noise exposure standards for free field established by Iranian government (IDE 1998).

Therefore, the objective of this survey is to evaluate the environmental traffic noise pollution and attitudes of exposed individuals in urban community. This research represents the first study of community noise levels in city of Kerman located south eastern in Iran .

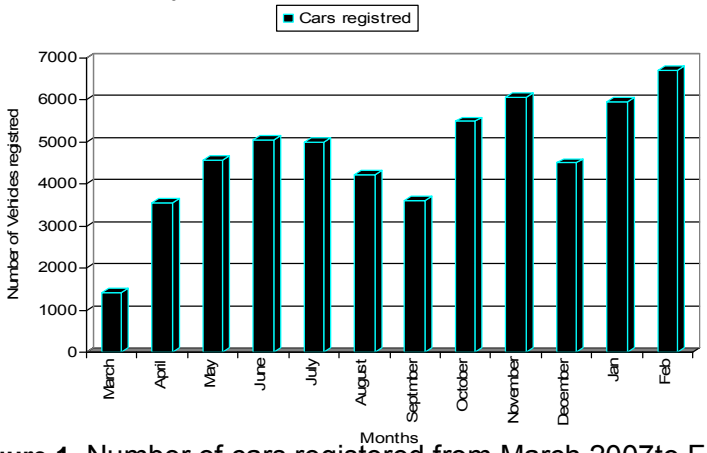

Figure 1. Number of cars registered from March 2007to February2008.

Table 1. Environmental noise exposure standards in Iran (IDE).

Type of areas	Daytime(dBA) 07:00-22:00	Night-time (dBA) 22:00-07:00
Residential	50	30
Residential-Commercial	60	50
Commercial	65	55
Residential-Industrial	70	60
Industrial	75	65

2. MATERIALS AND METHODS

A. Sound level measurements

This study was focused on one of the busy and the most crowded street in Kerman, which have heavy traffic during the day. Total of 20 measuring points were selected along the roads, pavements and in the shopping areas of the city center to adequately represent the different acoustically residential-commercial, commercial and residential situations. In this study the A-weighted continuous equivalent sound level values L_{Aeq}, $L_{\max}$, $L_{\min}$ and statistical levels L_{10}, L_{50}, L_{90} , L_{99} were manually measured at each site separately. The measurements were taken in free flowing traffic condition four times a day, i.e. 6-7 A.M., 10-11 A.M., 5-6 P.M. and 9-10 P.M. on various days of the week. Noise levels were measured 1.5 m above ground using a Class I 2231 Bruel and Kjaer integrating sound level meter with a 4230 B and K calibrator. During the study there was no wind and no rain.

B. Questionnaire description

In order to knowing the opinion of the citizens from the area we surveyed about how the noise levels have affected their daily life, a specific questionnaire has been designed. The survey questionnaire contained four different parts. The first part identified sex, age, education and material status. The second part contained information about accommodation. The third part

has questions where information about noise levels and its effects on people's habit is obtained. In the last part, the main noise type and its variation with time is evaluated.

3. Results

C. Noise level at different stations

Analysis of the mean values for L_{Aeq}, $L_{\max}$, $L_{\min}$ at different time intervals (morning and evening) for main downtown street and its 6 connecting streets are displays in Figs 2-4. In the commercial-Residential area, maximum L_{eq} was recorded 73.8 dB (A) and minimum L_{eq} value was 63 dB (A). For the commercial and Residential areas, maximum L_{eq} and minimum L_{eq} values are 75.32, 67.32 and 62.79, 50.3 dB (A) respectively. An overview of the data reveals that most of the stations were affected with traffic noise as these noise levels were higher when compared to the governmental legislations (see table 1).

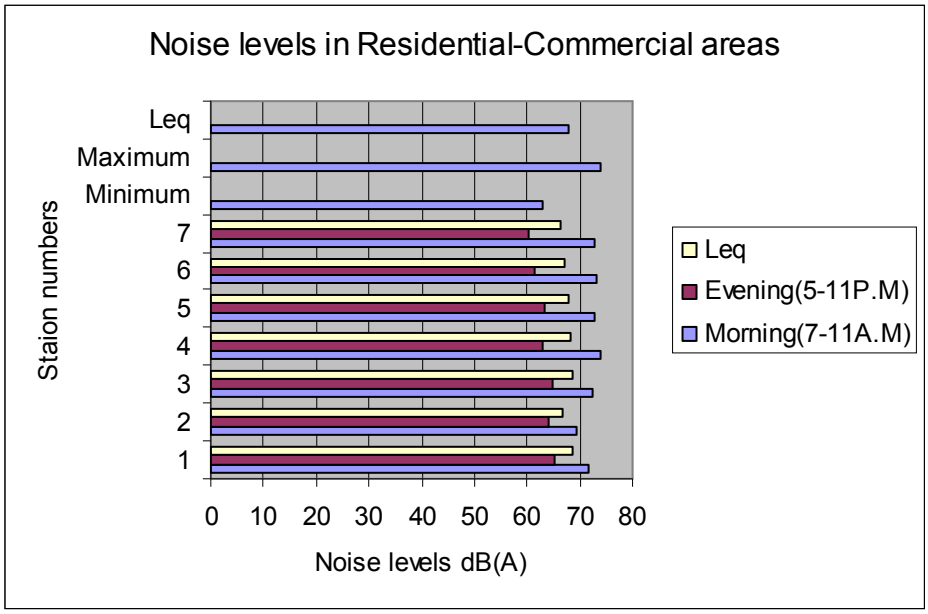

Figure 2. Noise measurements in residential-Commercial areas

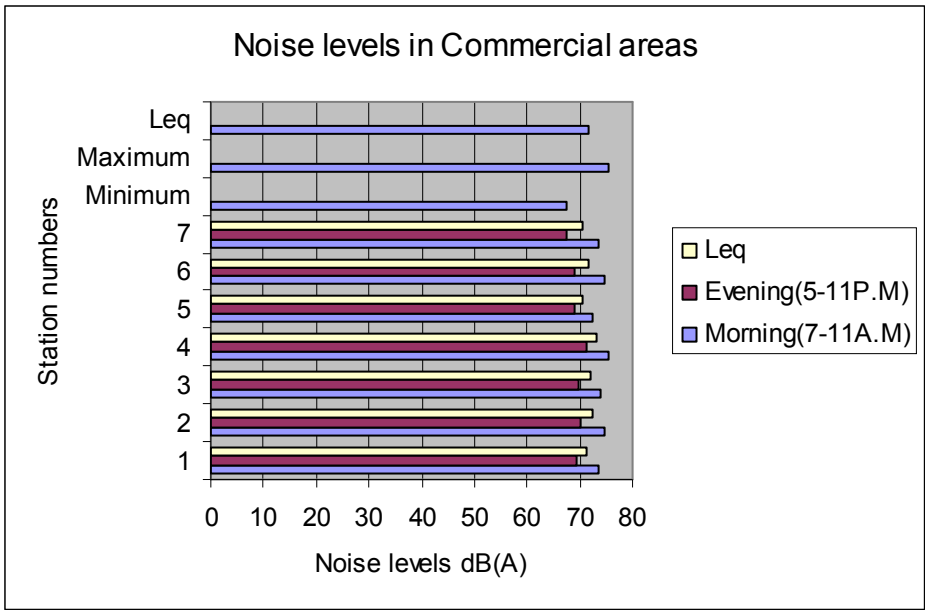

Figure 3. Noise measurements in Commercial areas

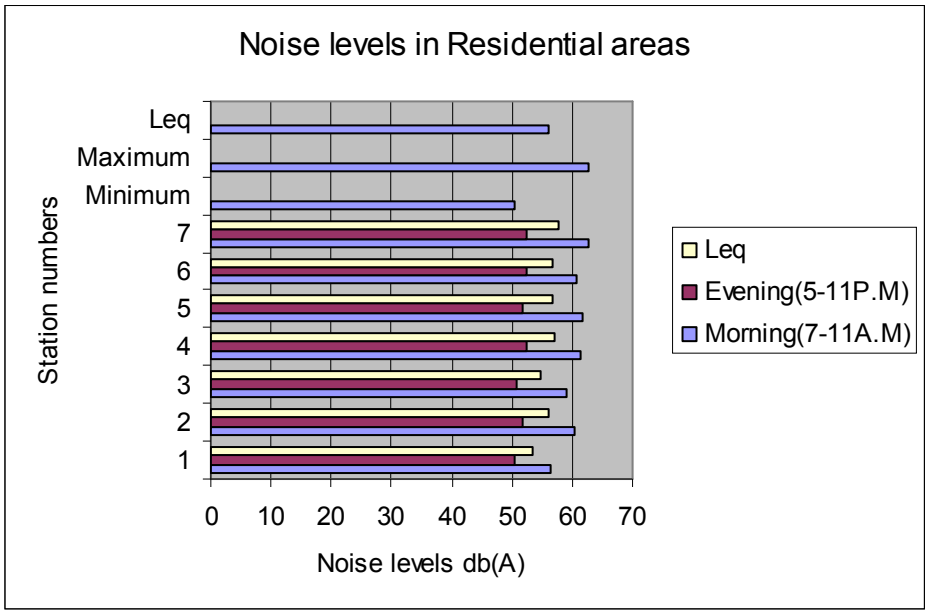

Figure 4. Noise measurements in Residential areas

D. Attitude of the people towards noise

Among the participants 40% were men and 60% were female, and they were between 18 and over 50 years old. Of those polled, 32% among age group 18-30 years old, 40% between 30 and 50 and 28% were over 50.

The frequency distributions of the subjects concerning the noise types in their home are present in Fig. 5. The major parts of the respondents (50%) have answered that traffic noise, about 34% have answered that street noise and 16% have answered that construction noise. In another question, the subjects have classified the noise in

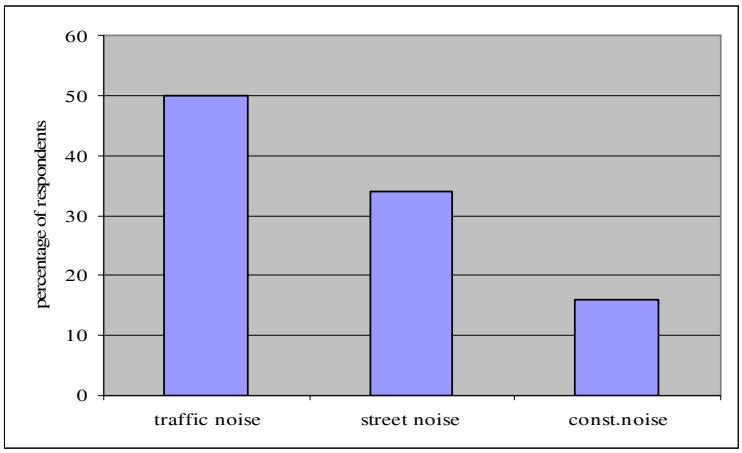

Figure.5: Frequency distribution concerning types of noise

his/her home as "very high" (70%), "high" (18%), and "normal" (12%). Fig. 6 displays frequency distributions of subjects concerning the noise levels. In More than half out of the respondents have affirmed that they had been living at the same home for more than 5 years and 40% had been living at the same home for 1 to 5 years and 10% had been living at the same location for less than one year.

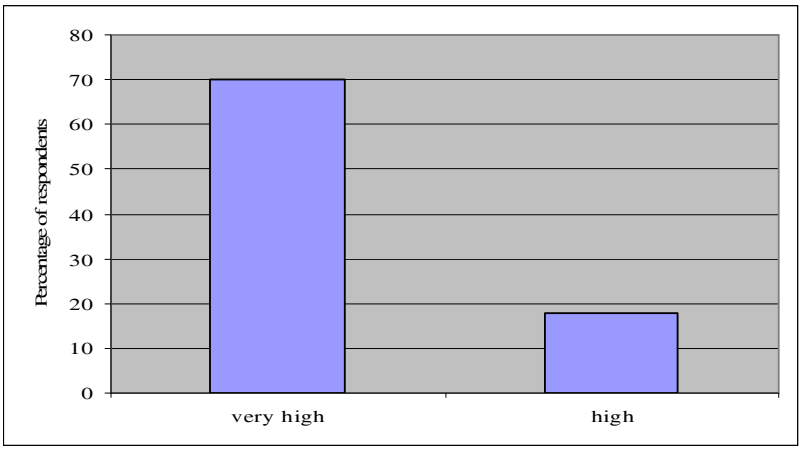

Figure 6: frequency distributions of question concerning levels of street noise

The respondents have been asked "what time does noise bother them more". For this question, 52% out of them answered that noise bother them in the morning and 48% answered that noise bother them in the evening.

Asked about what noise sources have caused annoyance, the majority of the respondents (50%) have pointed the traffic, followed by the street (34%) and (16%) construction. No doubt the traffic is a continuous noise source, as well as street and construction in many cases.

The majority of the respondents have answered that they sometimes felt annoyed by noise in his/her home and have pointed out that at least one of these noncontiguous sources as the cause of annoyance. The frequency distributions of the subject's answered that traffic noise produces physical and psychic annoyance to them are displays in Fig. 7. Nearly 86% of the respondents have answered that traffic noise produce physical and 86.8% have answered that noise produce psychic annoyance to them.

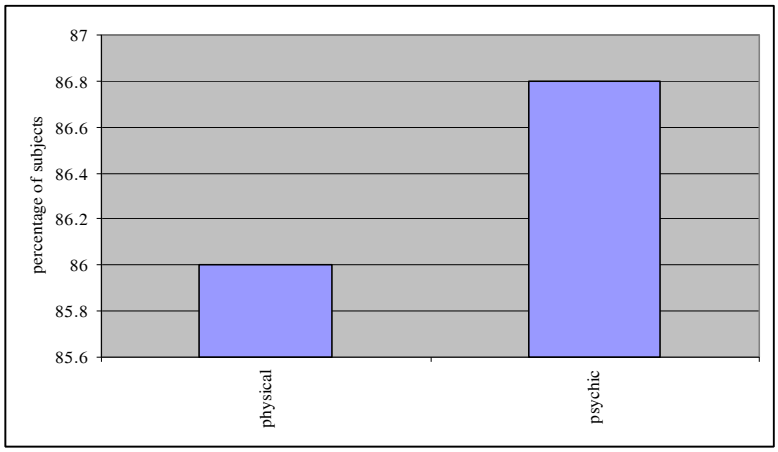

Figure 7: Frequency distributions of physical and psychic annoyance produce by high noise levels

As expected, the majority of the respondents (80%) have answered that traffic noise has negative impacts on their health and safety. By considering this new focus, it is possible to construct a new point of view in this analysis. For example, the respondents who felt irritability by the noise (40.8%), and the respondents who have insomnia (24%), the respondents have difficulty to concentrate (16%) and the respondents have conservation disruption are (16%) as shown in Fig.8.

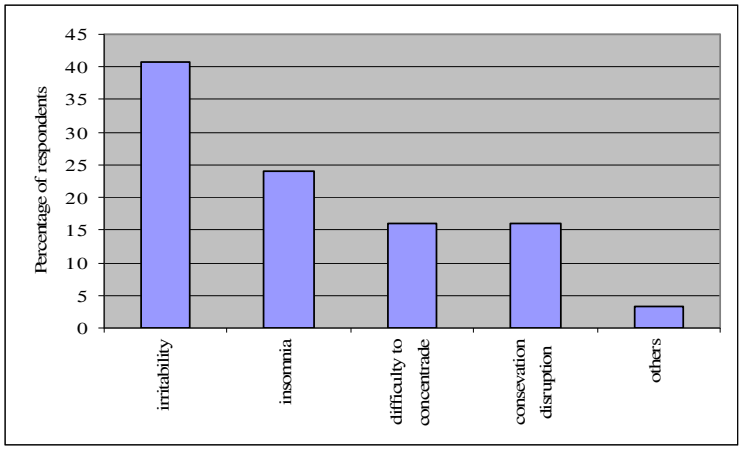

Figure 8: Respondents answers to question "what does the noise cause on you?"

A cross classification analysis was performed on the data with respect to the traffic noise and physical annoyance of the subjects. Among those who belief very high traffic noise produce physical annoyance answered were 9 times as frequent as those who belief traffic noise does

not produce physical annoyance (72% vs. 8% respectively). Those belief traffic noise produce psychic annoyance were also more than 8 times as many as those does not belief the problem

Table 1. Cross classification of participants by noise levels and physical &psychic annoyance.

Variable	noise levels		
	Very high	High	Normal
Does traffic noise produce physical annoyance?			
Yes	180	30	5
No	20	10	5
$X^2 = 10.5, \quad df = 2, \quad \rho = 0.5$			
Does traffic noise produce psychic annoyance?			
Yes	200	10	7
No	26	4	2
$X^2 = 11.82 \quad df = 2, \quad \rho = 0.5$			

(80%vs.10.4% respectively). The test of chi-square strongly supported the existence of such trend. Those who beliefs traffic noise produce physical and psychic annoyance are more answered community traffic noise is very high.

The likely impact of those community annoyances on traffic noise was also examined. The result of the chi-square test indicated that these differences in traffic noise involvement rates were not by chance, but as a function of the level of physical annoyance produced by high traffic noise $X^2 = 10.5, \quad df = 2, \quad \rho = 0.5$. Similarly, and as supported by the chi- square test, those beliefs that, very high traffic noise produced psychic annoyances are more when we compared with their does not beliefs counterparts ($X^2 = 11.82 \quad df = 2, \quad \rho = 0.5$).

4. Discussions

Pollution in cities is a growing problem due to the fact that the urban environment is becoming increasingly crowded and busy.

In this research, noise levels were measured in Kerman. Simultaneously with measurements of noise, the opinion of 250 residential who levied in area concerning their level of annoyance, traffic noises, as well as awareness concerning the health impact of noise, were surveyed.

This study has revealed that most of the stations were affected with traffic noise as these noise levels were higher when compared to the standards of the governmental legislations. The findings of this part of the study are in agreement with other studies (Zannin et al. 2003; Georgiadou et al. 2004).

Nearly 52% of subjects were beliefs noise bother them in morning and 48% beliefs noise bother them in evening as reported by others (Uris and Cervera 2001). This study has revealed that the more unpleasant noise was traffic noise and etc. This part of study is in agreement with other study (Saadu et al.1998, Ouis, 2001).

Results indicated that 50% pointed out the traffic noise is the main source of annoyance 34% pointed out the street noise.

Finding of the study showed, that traffic noise has negative impacts on human health and safety, as reported by others (Mato and Mufuruki, 1999; Georgiadou et al., 2004).

5. CONCLUSIONS

This study investigated the traffic pollution and community response to urban traffic noise in Kerman and has revealed that, in Kerman downtown streets, noise levels were generally high. There was one in two of people surveyed beliefs that noise bothers them during morning between 7A.M. to 11A.M. Out of the total people interviewed, about 50% pointed out the traffic noise is the main source of annoyance, 86% and 86.8% of the people reported that traffic noise produced physical and psychic annoyance to them. Four in fifths of people reported that traffic noise has negative impact on their health and safety.

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