

## EVALUATION OF SOCIAL IMPACT OF TRAFFIC NOISE IN AMMAN, JORDAN

KHAIR JADAAN, HALA GAMMOH, RAMI AMMOURAH\*, ZAINA AI-NABULSI

*Civil Engineering Department, University of Jordan, Amman, Jordan*

*\*Email: rami.ammourah@gmail.com*

### Abstract

Few road traffic studies were conducted in Jordan, but the issue is drawing an increasing attention due to its growing magnitude and various impacts as a result of the high increase in vehicular traffic. This study further investigates the issue with the aim of providing an understanding of its social impact on residents of Amman, the capital of Jordan. Traffic noise levels were measured at selected locations along urban arterials and a social survey was performed to examine the reactions and attitudes of the neighboring residents towards these levels of traffic noise. The survey included social characteristics of individuals, and their attitudes towards traffic noise, and how it impacted their daily activities. A predesigned questionnaire was used for this purpose which included questions to evaluate the awareness of respondents of the problem and its environmental and health impacts. The financial impact that residents perceive of noise and the need for attenuation measures were also addressed. The results of the study also revealed that the impact of traffic noise on people can cause annoyance while performing daily activities were 24% of respondents reported that they get annoyed by traffic while working, 49% while resting, 34% while talking to others, 31% while talking on the phone, 39% while reading, 38% while watching TV and 53% of respondents get annoyed while sleeping. The respondents have also pointed out the following effects of noise: twist in mood (53%), headache (36%), and difficulty in concentration (40%). About 57% of respondents think traffic noise reduces the value of their properties and a total of 31% are willing to sell their house at reduced cost. About 59% of respondents consider attenuation measures necessary, and in order to reduce the noise, about 54% of respondents were willing to pay for attenuation measures which reflects the public awareness of the issue magnitude.

*Keywords:* traffic noise, noise level, survey, social impacts.

### 1. Introduction

The issue of traffic noise in Jordan has been drawing an increasing attention over the last few years, due to its increasing magnitude due to the high increase in vehicles calling for the need to perform studies assessing this problem and trying to find solutions to alleviate it.

A few studies were conducted in Jordan concerning road traffic noise. This study further investigates the issue in order to provide better understanding of the magnitude and impact of the problem. Subsequently, a survey was performed which examined the reactions and attitudes of residents towards this problem in each of the roads that were taken into consideration. The survey included social characteristics of individuals, and their attitude towards traffic noise, and how it impacted their daily activities.

### 2. Literature Review

Traffic noise has become a recognized problem all over the world. A large number of studies into the various aspects of traffic noise and its impacts were carried out in various countries. A recent study in India evaluating traffic noise impact on the quality of life among residents [1] showed that more than half of the total sample expressed annoyance with traffic noise during daily activities, while also causing headaches and nervousness.

A study in Sweden [2] examined the effects of road traffic noise during the night, and the results showed a significant decrease in subjective sleep quality and 50% of the test persons experienced difficulties in falling asleep, as compared with quiet nights, the time required to fall asleep was on average 12 minutes longer. Finally, a significant increase in tiredness during the day was found after nights with noise exposure.

Hedonic price models have been widely used to estimate implicit noise values and in housing price studies and produced significant declines in values due to traffic noise [3, 4]. In The Republic of Korea, a study evaluating the monetary effect of traffic noise on property values in Seoul Korea [5]. Hedonic price models were estimated using a set of data from the city, and it was found that with every 1% increase in traffic noise a 1.3% decline in land value was associated, and based on that, the annual cost per kilometer due to traffic noise was estimated at about \$347 thousand. A study in Europe (den Boer, Schrotten 2007) showed that over half of Europe's population is exposed to unacceptable noise levels, with noise from road transport being the major source. This study illustrated that health of millions of Europeans is affected by traffics noise, and the social cost of it is over 40 billion Euros yearly, and that passenger cars and Lorries are mostly responsible for the bulk of costs.

Comparing the study of North Korea with the one in Europe we can say that the cost of road traffic noise is consistent in both studies, which further emphasizes the importance of studying and mitigating road traffic noise.

In Jordan, few studies were carried out into the same subject. A study by (Jadaan and Dakhlallah 2005) investigated the attitudes of Jordanians towards traffic noise. The study was performed along urban arterials in Amman, and results have shown that traffic noise levels exceeded the maximum allowable limits, and that this problem was considered disruptive to the extent that over 50% of residents considered moving to quieter locations.

### **3. Methodology**

A Bruel and Kjaer type 2215 Precision sound level meter was used for measuring L10 (1hr) noise level. Readings were taken during two 1-hour periods between 7:00 and 8:00 and between 19:00 and 20:00. The two periods which are 12 hours apart aimed to cover the morning and evening traffic conditions. The measurements were taken during work days in summer. The device was held in arms about 1.2m above the ground level and at a distance of 3.5m from the near side curb of the road. Noise measurements were carried out at 34 locations along urban arterials in Amman, in order to identify the magnitude of the noise levels under various traffic conditions

A social survey was carried out as a part of this study in order to evaluate the effect of traffic noise on the daily activities of residents along the studied sites. A predesigned questionnaire was used for this purpose. The questionnaire consists of fifteen questions and was distributed to a random sample of 100 citizens residing along the urban arterials where noise levels were measured. A copy of the questionnaire is shown in appendix A. The home-interview survey method was used to ensure full understanding of questions in a way that satisfies the purpose of the study.

The respondents were asked about the magnitude and effects of traffic noise on some specific daily activities, the questionnaire also included questions to evaluate the awareness of respondents of the problem and its environmental and health impacts. The financial impact that residents perceive of noise was also addressed through asking them to estimate the effect of noise on the value of their properties. The need of attenuation measures was also investigated.

### **4. Results and Discussion**

The noise levels measured at 34 locations for both day and night time are listed in Table 1. The results of noise measurements show that the noise levels in all locations are significantly high and exceed the maximum allowable noise level adopted in Jordan which is 63 Db. The environmental effects of traffic noise are obvious among Jordanians where 80% of respondents consider traffic noise an environmental pollutant. Also 79% consider traffic noise a public health problem which reflects the public awareness to this issue as shown in Table 2.

Table 1. Measured day-time and night-time level L10 (1 hr) at 34 location in the city of Amman

| Location number | Identification                | L10 (night time) | L10 (day time) |
|-----------------|-------------------------------|------------------|----------------|
| 1               | Interior circle               | 73               | 71             |
| 2               | First circle                  | 56               | 64             |
| 3               | Second circle                 | 61               | 66             |
| 4               | Third circle                  | 64               | 67             |
| 5               | Fourth circle                 | 67               | 66             |
| 6               | Fifth circle                  | 68               | 70             |
| 7               | Sixth circle                  | 67               | 67             |
| 8               | Seventh circle                | 65               | 68             |
| 9               | Eight circle                  | 70               | 73             |
| 10              | Sport city circle             | 68               | 78             |
| 11              | Abdoun circle                 | 66               | 66             |
| 12              | Swieleh circle                | 70               | 71             |
| 13              | Gardens Street                | 70               | 72             |
| 14              | Safeway-Gardens junction      | 73               | 71             |
| 15              | Princess Basma street         | 61               | 69             |
| 16              | Allstiqlal street             | 73               | 79             |
| 17              | Abu Nsair Street              | 73               | 75             |
| 18              | Al-Madina Al- Munawara street | 67               | 70             |
| 19              | Airport Highway Al-Sakhra     | 78               | 80             |
| 20              | Almosharafa street            | 66               | 73             |
| 21              | Queen Rania street            | 72               | 72             |
| 22              | King Abdullah II street       | 76               | 78             |
| 23              | Prince Ali Bin Hussien street | 70               | 71             |
| 24              | Prince Shaker street          | 71               | 66             |
| 25              | Al-Sinaa' street              | 70               | 73             |
| 26              | Jordan street                 | 74               | 77             |
| 27              | Al-Mahatta street             | 72               | 80             |
| 28              | King Hussien street           | 74               | 76             |
| 29              | Khalil Alsaket street         | 69               | 68             |
| 30              | Cairo street                  | 70               | 70             |
| 31              | Khalid Bin Alwaleed street    | 66               | 71             |
| 32              | Zahran street                 | 80               | 79             |
| 33              | South buses terminal          | 71               | 71             |
| 34              | Raghdan buses terminal        | 73               | 79             |

Table 2. Percentage of people who are affected by traffic noise

|    |   |
|----|---|
| %  |   |
| 63 | annoyed by traffic noise                |
| 80 | environmental pollutant                 |
| 79 | health problem                          |
| 65 | prefer moving away                      |
| 63 | classify noise very high and high       |
| 55 | close windows                           |
| 57 | think TN reduce the cost of building    |
| 31 | would sell house at reduced cost        |
| 59 | consider attenuation measures necessary |
| 54 | willing to pay for attenuation measures |

Table 3. The percentage of people who get annoyed by traffic noise during daily activities

| %  | Activity                        |
|----|---------------------------------|
| 24 | annoyed while work              |
| 49 | annoyed while rest              |
| 34 | annoyed while talk to others    |
| 31 | annoyed while talk on the phone |
| 15 | annoyed while eating            |
| 39 | annoyed while reading           |
| 38 | annoyed while watching TV       |
| 53 | annoyed while sleeping          |

The results of the social survey revealed the seriousness of the road traffic noise problem in the city of Amman as perceived by the general public where 63% of respondents said that they get annoyed by traffic noise, 55% of respondents said that they close the windows always or most of the time due to traffic noise and a total of 65% of respondents consider moving to a quieter neighbourhood. The results of the study also revealed that the impact of traffic noise on people can cause annoyance while performing daily activities where 24% of respondents get annoyed by traffic noise while working, 49% of them get annoyed while resting, 34% get annoyed while talking to others, 31% get annoyed while talking on the phone, 39% get annoyed while reading, 38% get annoyed while watching TV and 53% of respondents get annoyed while sleeping as shown in Table 3.

The respondents have also pointed out the following effects of noise: twist in mood (53%), headache (36%), and difficulty in concentration (40%).

About 57% of respondents think traffic noise reduces the cost of their buildings and a total of 31% of them are willing to sell their house at reduced cost due to traffic noise as shown in Table 4. 59% of respondents consider attenuation measures necessary, and in order to reduce the noise, 54% of respondents were willing to pay for attenuation measures which reflects the public awareness to this issue.

As can be seen in table 2, 3 and 4, a significant portion of community seems to be negatively affected by road traffic noise during daily life.

Table 4. The percentage of people think traffic noise cause the following problems

| %  | Problem                                    |
|----|--|
| 53 | twist in mood                              |
| 40 | difficulty in concentration while studying |
| 36 | headache                                   |
| 26 | distract attention while watching TV       |
| 23 | affect children's' way of life             |

Table 5. Comparison between 2005 and 2012 results

|                                   | 2005 | 2012 |
|-----------------------------------|------|------|
| Annoyed while studying            | 56%  | 40%  |
| Annoyed while watching TV         | 50%  | 38%  |
| Annoyed while speaking            | 35%  | 34%  |
| Affect job accuracy               | 53%  | 24%  |
| Lose concentration while studying | 74%  | 40%  |
| Annoyed while sleeping            | 37%  | 53%  |
| Causes environmental pollution    | 67%  | 80%  |
| Public health problem             | 68%  | 79%  |
| Consider moving away              | 51%  | 65%  |
| Close the window                  | 50%  | 55%  |

## **5. Comparison Between 2005 and 2012 Results**

The city of Amman shows a slight increase in noise level during day time through the years 2005 to 2012 from 69 dB (A) to 72 dB (A); however people may had cope to noise as an average of 34% of respondent annoyed while reading, studying and doing their job in 2012, in comparison to 65% in 2005.

On the other hand the increase in the noise level was much higher at night during the same period from 58 dB (A) to 69 dB (A) ; this resulted in an increased number of resident considering changing their places of residence as a result of noise effects.

Regarding public awareness of traffic noise, study revealed that 80% of the respondents are aware of the negative impact of noise on our health and on the environment, respondents answer positively in our social survey. More than 50% of the people are willing to contribute to be part of the change, as they are willing to contribute toward the cost of attenuation measure.

## **6. Conclusion**

Noise measurements at 34 locations in Amman show that noise levels at all sites exceeded the maximum acceptable limit of 63 dB(A) adopted in Jordan, The results of the social study reflect high public awareness of the road traffic noise problem and its impacts on residents of Amman as 80% of the interviewed people consider it an environmental pollution and a public health problem. The social survey results reveal that 63% of the neighbouring residents are annoyed by road traffic noise during their daily activities to the extent that 65% of respondents considering changing their place of residence. The level of annoyance was found to have increased during the last decade due to the increase of vehicular traffic. These results should prove for decision makers dictate the need to apply necessary noise mitigation measures.

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