

Original Article



Evaluation of Noise Pollution in Residential Areas Under the Influence of Truck Traffic in Ramshir, Khuzestan-Iran

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Abstract

Background & Aims: Noise is one of the types of urban pollution that causes human annoyance. This study aimed at investigating noise pollution in residential areas under the influence of truck traffic in Ramshir in 2023.

Materials and Methods: In this applied research, sound parameters were measured by a sound meter capable of measuring the minimum sound level, maximum sound level, equivalent continuous sound level (Leq), and sound pressure level (SPL) of sound parameters at 10 stations in the morning and at night with 3 repetitions. In addition, noise annoyance was determined in 100 people in residential areas exposed to urban noise using the ISO 15666 noise annoyance questionnaire. Measurements were performed over three months in two day and night shifts using a TES-1358C analyzer sound meter device (TES Company, Taiwan). The raw data were entered into SPSS 21 and Excel software and then categorized, and the necessary results were extracted, including the average of the data, as well as the maximum and the minimum of the data.

Results: The results revealed that the average SPL was 88.25 dB during the daytime on Tawheed Street, so it had the highest measured sound level compared to other investigated areas. Further, the Leq was 82.17 dB at night in the Shariati area, which had a higher SPL than other areas. The highest Leq of the day was related to Naft Street Station, with an average value of 83.40 dB, while the lowest Leq value attributed to Damghani Street Station was measured with an average value of 71.41 dB. The highest Leq of night noise was related to Shariati Street Station, with an average value of 82.17 dB. The impact of truck noise was highly uncomfortable, uncomfortable, and slightly uncomfortable for 13%, 37%, and 36% of people, respectively.

Conclusion: In general, in the range of 10 stations, the SPL and Leq were measured higher at night and day than the standards of the Iranian Environmental Organization and the Environmental Protection Agency (55 dB during the day and 45 dB at night for residential areas). According to the sum of the answers, the sound of the trucks in the intended city could hurt people. People are most dissatisfied with the sound of trucks in the morning and at night.

Keywords: Noise, Traffic-related Pollution, Residential Areas, Ramshir, Iran

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1. Introduction

Noise is one of the harmful factors that can cause shortand long-term health problems. Noise pollution can be described as regular exposure to high sound levels that can have adverse effects on humans or other living organisms and gradually pose a potential threat to a person's physical and mental health, thereby affecting overall well-being [1]. Vibrations caused by noise pollution disrupt people's daily activities. According to the World Health Organization, a sound level of less than 70 decibels does not harm living organisms, regardless of the duration or continuous exposure. The permissible threshold for tolerable noise is about 80 dB for normal people, and exposure to constant noise above 85 dB for more than 8 hours may be dangerous [2]. Transportation-related noise pollution appears in many forms, such as road, aviation, marine, and train noise. Specifically, traffic noise refers to offensive sounds produced by vehicles on public roads. Car engines, exhaust systems, aerodynamic friction, and interactions between vehicles and the road system are all factors that create this type of noise [3,4]. Another factor to consider when dealing with traffic noise is poor urban planning. This

creates serious traffic noise problems where residential properties, facilities such as schools, hospitals, religious places, and other social structures are often built adjacent to major roads without proper sound insulation or buffer zones [5]. These buildings can reflect, absorb, and transmit sounds. However, the amount of reflection, absorption, and transmission also depends on other factors such as building materials and structures [6].

People living in urban environments may be exposed to noise pollution from various sources. This pollution comes from cars and trucks on roads, industrial activities, and trains transporting goods to or from industrial facilities [7]. Environmental noise in urban residential areas has a positive relationship with the total volume of traffic on the roads and the density of industrial facilities [8]. Therefore, communities near industrial sites may be seriously affected by air and noise pollution from traffic, which can contribute to adverse health outcomes [9]. Although sound pollution consists of a wide range of frequencies, the effect of exposure to different sound frequencies is not well understood yet [10].

Every day, people travel from place to place using motor



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vehicles such as motorcycles, cars, buses, trucks, and offroad vehicles. As people travel, there will be an adverse side effect of high traffic volume in the form of traffic congestion and traffic noise pollution [11,12]. In a study about noise pollution in the city of Kermanshah, it was shown that educational programs should be implemented to increase the level of awareness and performance of the citizens of Kermanshah because they had a low level of awareness about the effects of noise pollution [8]. In another study, it was reported that noise control measures such as controlling the source and direction of sound propagation and setting up workshops in a suitable place far from residential areas are necessary and can affect the health of workers and people [9]. For example, the sources of noise pollution in the studied areas in India and Romania are mainly attributed to the traffic of motor vehicles and trucks [12,13]. Furthermore, researchers in France found that there is a significant relationship between exposure to noise and transportation and the risks created [14], complaints about noise are more common in cities with high population density [5].

Noise is one of the harmful physical parameters in the work environment that can cause annoyance. Noise annoyance is one of the most important problems caused by unwanted noises. Annoyance is a reaction to unwanted noise and occurs when the noise interferes with the person's main thought or task. Noise annoyance has nothing to do with the health of the users and is merely a measure to express the level of comfort and convenience of the users. There are various qualitative criteria in the category of noise annoyance, among which the most important ones are loudness, sharpness, roughness, and fluctuation [3,10].

Due to the transit road and its special location in the vicinity of Mahshahr and Imam Khomeini ports, Ramshir has become an important city in transportation, so that a very large volume of cargo trucks pass through it every day to transport materials and goods to different parts of the country. Due to the absence of a ring road in Ramshir, the main road and highway pass through its center. Over time, this problem has caused the residents around the road to express their dissatisfaction with the noise caused by the traffic of trucks, and it has even caused some residents to migrate. Therefore, this study was conducted to investigate noise pollution in residential areas under the influence of truck traffic in Ramshir. The study also focused on evaluating the issue of noise pollution and the complaints of the people in the region.

2. Materials and Methods

2.1. Study area

The area examined in this research was the city of Ramshir in Khuzestan province. Ramshir, one of the cities of Khuzestan province, is located in the southwest of Iran. It is adjacent to Ahvaz and Mahshahr Port from the west, Omidieh from the south and east, and Ramhormoz from the northeast. It is 35 km from Mahshahr Port. Despite the small size of Ramshir, due to the existence of a road that acts as a highway for transportation, the traffic of trucks is high. In this research, to investigate the situation of noise pollution on the road of trucks in Ramshir, first, the study area was visited to evaluate the current situation and determine the sources of noise pollution.

2.2. Sampling

In this applied study, the sample size in the study area of 10 stations was selected systematically and according to the noise caused by the trucks in the main sections. In the studied areas, most of the uses were residential. By collecting and analyzing all the information related to the study areas in Ramshir, actions were taken regarding selecting points for measurement stations and conducting field studies, and the stations were determined according to the Environmental Protection Agency (EPA) standard (Table 1). In this investigation, the noise pollution in Ramshir from May to the end of July 2023 was considered in two times of the day (8-11) in the morning and at night (21-24) with 3 repetitions. A standard questionnaire was also used to investigate the annoyance caused by noise among exposed residents.

2.3. Sound measurement method

Measurements were conducted over three months in two day and night shifts by employing a TES-1358C analyzer sound meter device (TES Company, Taiwan). According to the standard of the Environmental Protection Organization, sound equivalent levels (Leq) were recorded at a 10-minute interval. Atmospheric measurements were taken in the same temperature conditions during the day and night.

In this study, in addition to the Leq, the maximum sound created since the beginning of the measurement (Lmax), the minimum sound created since the beginning of the measurement (Lmin), and the sound pressure level (SPL) in each measurement station were registered [11].

 $\ensuremath{\text{Table 1.}}\xspace$ Table 1. The coordinates of the sound parameter measurement locations in Ramshir

Station	Location	Longitude (E)	Latitude (N)
1	Naft Street	30.90°47′67″	49.42°08′37″
2	Besaat Street	30.90°26′93″	49.41°90′19″
3	Tohid Street	30.90°16′33″	49.41°82′39″
4	Cheraghzadeh Street	30.89°95′69″	49.41°62′93″
5	Molavi Street	30.89°85′76″	49.41°54′37″
6	Shariati Street	30.89°06′94″	49.40°82'28"
7	Jomhouri Street	30.88°94′61″	49.40°75′82″
8	Montazeri Street	30.88°80′96″	49.40°63′22″
9	Valeih Asr Street	30.88°69′25″	49.40°51′95″
10	Damghani Street	30.88°16′36″	49.40°03′08″

The size of the sample and statistical population were calculated based on equation (1):

Eq. (1): Sample size = number of repetitions × frequency of morning and night × number of days of the week × number of months × number of stations

3 * 2 * 2 * 3 * 10 = 360

It should be noted that 360 numbers were studied for 4 audio parameters. A total of 1440 measured parameters were obtained, and the statistical population of people exposed to noise pollution included 100 questionnaires considering various demographic variables. To ensure the correctness of the sound meter measurement and the sound meter calibration method, it is necessary to first calibrate it with a standard sound tube. This generator is called the calibrator model CELL-110/2, which produces a certain level of pure sound equal to 114 dB at a certain frequency.

2.4. Determination of noise annoyance

In this research, the ISO 15666 noise annoyance questionnaire was used to evaluate noise annoyance. The Persian version of this questionnaire has been approved by Iranian researchers, and Cronbach's alpha coefficient has been reported as 0.81. To investigate the level of noise annoyance of people living in the study areas, 100 questionnaires with 16 questions were prepared, and during 3 months, sampling was completed by people from different urban areas in the region. According to this questionnaire, the surveyed people were asked to respond to the level of annoying noise in their living environment. In this questionnaire, people were questioned about their experiences of emotions during the day, such as feeling tired, weak, reduced concentration, discomfort, and tinnitus. In this questionnaire, demographic data, such as gender, age, occupation, and education, were also taken into consideration [15,16].

2.5. Data analysis

The data were collected, and the raw data were entered into SPSS (version 21) and Excel software. Then, they were categorized, and the necessary results were extracted, including finding the average of the data along with the maximum and minimum of the data. Moreover, the results of the questionnaires were drawn in the form of an illustrative diagram after being processed in Excel and underwent analysis.

3. Results

The highest SPL was observed during the day at station 3, so it had the highest measured sound level compared to other investigated areas. Additionally, the SPL in the night at station 6 was higher than other areas. In all the studied areas, the highest average SPL was higher in the morning than at night, with the exception of Shariati Street. The highest Lmax value on the day was related to station 8, while the lowest Lmax value was attributed to station 9. The highest Lmax at night was associated with station 6, whereas the lowest Lmax value was related to station 8. The highest amount of Leq per day was obtained at station 1, while the lowest value of the Leq parameter was observed at station 10. In addition, the highest amount of Leq at night was obtained at station 6, whereas the lowest value of the Leq parameter was associated with station 3. Based on the results, the lowest value of Lmin per day was related to station 9. The highest Lmin at night was attributed to station 6, while the lowest Lmax value belonged to stations 2 and 10 (Table 2).

Considering that the *P* value was smaller than 0.05 (P < 0.05), the analysis of variances was heterogeneous, and there was a significant difference in terms of SPL and Leq between the 10 studied areas (P < 0.05, Table 3).

The permissible level of sound intensity in Iran in residential areas is 55 dB during the day and 45 dB at night, and the international standard in residential areas is 45 dB [8]. The comparison of the sound measured data in the studied stations using the t-test with the standard values

 Table 2. Measurement of sound parameters during day and night in 10 regions of Ramshir

Station -	SPL (dB)		Leq (dB)		L _{min} (dB)		L _{max} (dB)	
	Day	Night	Day	Night	Day	Night	Day	Night
1	84.22 ± 0.20	64.10 ± 0.06	83.40±0.38	64.10±0.33	71.20 ± 0.02	65.21 ± 0.02	82.20±0.15	74.22 ± 0.10
2	80.14 ± 0.02	69.25 ± 0.45	79.02 ± 0.12	69.25 ± 0.20	70.40 ± 0.01	63.01 ± 0.45	81.90 ± 0.22	74.56 ± 0.19
3	88.25 ± 0.15	62.10 ± 0.15	78.90 ± 0.25	62.10 ± 0.23	66.20 ± 0.12	63.02 ± 0.34	76.10 ± 0.50	74.59 ± 0.50
4	84.02 ± 0.18	76.12 ± 0.18	80.46 ± 0.11	76.12 ± 0.06	68.10 ± 0.25	67.42 ± 0.02	82.30 ± 0.08	79.14 ± 0.10
5	80.02 ± 0.43	80.30 ± 0.16	75.01 ± 0.19	80.30 ± 0.19	72.30 ± 0.02	71.26 ± 0.45	80.06 ± 0.07	79.43 ± 0.12
6	76.01 ± 0.28	82.17 ± 0.25	75.01 ± 0.02	82.17 ± 0.52	69.60 ± 0.12	73.11 ± 0.43	79.40 ± 0.25	85.12 ± 0.35
7	78.23 ± 0.50	64.14 ± 0.45	74.26 ± 0.52	64.14 ± 0.12	70.20 ± 0.43	69.24 ± 0.15	79.10 ± 0.22	78.14 ± 0.50
8	84.01 ± 0.06	73.11 ± 0.03	81.02 ± 0.08	73.11 ± 0.05	73.30 ± 0.02	63.02 ± 0.02	86.80 ± 0.02	70.13 ± 0.02
9	78.19 ± 0.45	66.12 ± 0.18	74.23 ± 0.29	66.12 ± 0.32	64.10 ± 0.45	67.51 ± 0.45	75.10 ± 0.20	79.50 ± 0.12
10	76.12 ± 0.05	71.24 ± 0.24	71.41 ± 0.28	71.14 ± 0.12	67.30 ± 0.46	63.01 ± 0.11	77.20 ± 0.26	75.14 ± 0.08

Note. SPL: Sound pressure level; Leq: Equivalent continuous sound level; L_{min}: Minimum sound level; L_{max}: Maximum sound level.

Sum Squares			df	Mean Square	F	Sig.
Leq	Between regions	1648.21	9	274.70	57.97	0.00
	Within the regions	497.54	105	4.74		
	Total	2145.76	359			
	Between regions	1564.56	9	260.76	37.21	0.00
SPL	Within the regions	735.87	105	7.01		
	Total	2300.43	359			

Table 3. One-way analysis of variance for sound levels in Ramshir stations

Note. df.: Degree of freedom; Sig.: Level of significance; SPL: Sound pressure level; Leq: Equivalent continuous sound level.

revealed that the *P* value was smaller than 0.05. Thus, with a probability of 95%, the average level of sound pressure during the day and night in all areas of Ramshir for all the investigated parameters had a significant difference with the standard level of sound (55 dB for day and 45 dB for night; P < 0.05, Table 4).

A survey was conducted to determine the level of annoyance among the residents of Ramshir. About 69% of the respondents were women, and 31% were men. Most of the questioned people (39%) were between 40 and 60 years old, and 7% of people were over 60 years old (Table 5).

All people (100%) answered the question about how loud trucks are at their place of residence. About 28% believed that the sound of the truck in their place of residence was loud, and 61% and 11% rated it as moderate and low, respectively. Nearly 12% of people answered positively, while 88% answered negatively to the question of exposure to sources of dust noise from the sound of trucks. Sources of noise other than truck noise, according to the respondents, are noisy workshops, industrial centers, drilling operations, urban development, traffic, and transport vehicles. About 71% of the questioned people could concentrate despite the noise. The disturbing sound of trucks in 48% of people caused interference in conversation with others. Approximately 68% of people mentioned interference while listening to and watching radio and television.

In 21% of the mentioned people, the noise caused by trucks led to insomnia. In 8% of cases, the noise from the airplane caused them to jump out of bed. In addition, 48% of people were disturbed by the sound of trucks during the day and night. None of the people experienced tinnitus when exposed to the sound of the truck. About 2% of people also got headaches when faced with the sound of trucks. According to the research subjects, the highest amount of truck noise in the morning and night was 12% and 17%, respectively, while the lowest amount was 2% and 4% in the afternoon and evening, respectively. According to these people, the most dissatisfaction with truck noise was in the morning and at night. The impact of truck noise was highly disturbing, disturbing, and slightly disturbing in 13%, 37%, and 36%, respectively. Nearly 92% of the people under study were not familiar with the effects of noise pollution on human health, and

 Table 4. Comparison of sound parameters in day and night shift stations with

 Iranian sound standards

Time	Parameters	Т	df.	Sig.	Difference of Means
Day (55 db)	L _{max}	33.68	359	0.00	16.95
	L _{min}	14.19	359	0.00	5.70
	Leq	22.23	359	0.00	9.43
	SPL	32.06	359	0.00	13.72
Night (45 db)	L _{max}	31.01	359	0.00	23.54
	L _{min}	37.56	359	0.00	13.54
	Leq	38.44	359	0.00	12.17
	SPL	42.83	359	0.00	52.21

Note. df.: Degree of freedom; Sig.: Level of significance; SPL: Sound pressure level; Leq: Equivalent continuous sound level; L_{min} : Minimum sound level; L_{max} : Maximum sound level.

92% of the people in the study were not familiar with the measures to control and reduce noise pollution in places and personal protective equipment (Table 6).

Discussion

Noise pollution in cities is considered one of the most important environmental problems, the intensity of which has increased in recent years due to the increase in population density in cities, the increase in the number of motor vehicles, the increase in industries in the vicinity of cities, and the increase in construction activities. In this research, at all the sound sampling stations in Ramshir, the average sound level was equivalent, and the SPL was higher than the standard values of Iranian sound. Based on t-test results and comparison with the sound standard in residential environments, it was found that the difference between the average sound levels in the studied area was less than 0.05 (P < 0.05). Accordingly, the test was significant (P < 0.05), and sound levels in all stations were higher than the sound standard in residential environments (P < 0.05). In some cities in Iran, unfortunately, there is no ring road around the cities, and this problem causes trucks and trucks to enter the cities, and the city of Ramshir is no exception to this rule. Noise pollution is currently one of the environmental problems of large cities, but despite the small size of Ramshir, noise pollution is high due to the existence of a road that serves as a highway in transportation and one of the main environmental problems in the city of Ramshir is noise

pollution caused by the sound of trucks passing by on this highway. Traffic noise from highways creates problems for surrounding areas, especially when there are high traffic volumes and high speeds. The problem of vehicular traffic noise is caused by different types of vehicles, such as heavy, medium, and heavy-duty trucks and buses, cars, and two-wheelers [3]. Inappropriate transportation systems in cities are among the most important sources of noise pollution in terms of extent and penetration into the innermost layers of life [5,12-14].

The average SPL in the 10 studied areas during the night shift, with the exception of Shariati Station, was

 Table 5. Demographics of the participants in the noise annoyance survey of Ramshir

Characteristics	Items	Abundance (%)
Condor	Men	31
Gender	Women	69
	12-20	17
A == (+)	20-40	37
Age (y)	40-60	39
	>60	7
	High school	23
	Diploma	35
Education	Associate degree	19
	Bachelor's degree	15
	Master's degree	8
	Employee	29
	Retired	6
Type of job	Freelance job	21
	Housewife	39
	Student	5

Table 6. The results of the survey of the residents of the study areas of Ramshir

lower than the day shift, and there was a significant difference between the measured values for sound levels during the day and night (P < 0.05). On a sunny day, the sun heats the earth, and then the earth returns its heat to the lower layers of the atmosphere. As the lower layers of the atmosphere heat up, the sound travels upward. In this case, the effect of the heat of the earth, compared to the direct sound propagation mode, causes the level of noise pollution around the road. At night, if the sky is clear, the earth gives back its heat and cools down faster than the air, and as a result, the lower layers of the atmosphere cool down faster than the upper layers. In fact, with the increase in height from the earth's surface, the temperature increases, and as a result, the movement of sound waves changes downward. In such a situation, the amount of noise around the road increases compared to the direct emission mode [17]. Ambient sound levels measured at a given location depend on a number of specific variables. In particular, many authors have found that the observed noise levels are mainly related to the characteristics of road traffic and, in particular, traffic volume, car horns, rolling stock and tires, and vehicles. Several studies have shown that the urban condition of a given area is also a highly important factor that affects environmental noise levels [5,8,12,14]. Basically, due to increasing population density, commercial activities, and traffic volume in the city, noise levels are different for both day and night [17].

All the people questioned felt uncomfortable about the sound of the trucks. Approximately 49% of people felt most uncomfortable at night, and 34% of them felt most uncomfortable in the morning. In addition, 11% of people felt the most discomfort in the evening, and 6% felt the most discomfort at noon. People feel the most discomfort when they rest at night. In the evening and at

No.	Questions	Yes (%)	No (%)
1	Are you concentrating despite the sound of the truck?	71	29
2	Do annoying sounds interfere with your conversations with others?	48	52
3	Does the sound of the truck disturb you while listening to the radio or television?	68	32
4	Does the sound of the truck make you sleepless?	21	79
5	Does the sound of the truck wake you up?	8	92
6	Do you get irritated by the sound of the truck during the day and night?	48	52
7	Do you get a headache after being exposed to the sound of a truck?	2	98
8	Do you suffer from tinnitus due to the sound of trucks after the disturbance?	0	100
9	Does the sound of the truck affect other members of your family?	31	69
10	Does the sound of the truck disturb people's concentration while studying?	12	88
11	Do you think there is a big difference in the volume of truck noise at different hours?	62	38
12	Do you also face noise in your workplace?	14	86
13	Do you know about the effects of noise pollution on human health?	8	92
14	Are you familiar with sound control methods (personal protection) in places?	8	92
15	Are you willing to cooperate in noise pollution reduction programs?	67	33
16	Do you encounter other sound sources in addition to the sound of trucks?	12	88

night, which are considered to be the most sensitive hours in terms of noise nuisance for people living near the road, the temperature factor increases noise pollution. In cloudy weather, the aforementioned effects do not appear, and the path of sound waves is straight [17]. Researchers have reported that people affected by noise and noise pollution may suffer from communication and sleep disorders, memory, lack of proper learning, stress, increased blood pressure and blood lipid disorders, increased blood concentration and blood sugar, and activation of the factor causing blood coagulation. Further, noise caused by heavy vehicles such as trucks increases heart and brain attacks as well as heart and arterial diseases [18-21]. In residential areas and urban environments, noise pollution caused by road vehicles, airplanes, industrial machinery, artillery and mining explosions, wind turbines, compressors, and ventilation systems is highly common [22,23], and the noise caused by trucks in cities that do not have a ring road, and the transportation of these vehicles passing by the city center [24,25] confirm the results. Some cities in the world, such as New Delhi in India [26] and the Guangzhou region of China [27], imposed restrictions to control and reduce noise pollution caused by noisy vehicles. Dissatisfaction with noise is influenced by factors related to sound. Pollution caused by traffic is considered a stressful factor. In some maps, the effects of sound are examined as an indicator of streets, and as a result, the role of sound is considered a risk factor for human health. Noise pollution has different effects on mental and physical health, harming daily activities [28,29]. In a study evaluating the noise pollution at Mehrabad Airport among the residents of the Tehransar region, a questionnaire containing 12 questions was distributed among them. By examining and analyzing the answers provided in the answer sheets, it was concluded that the studied area is exposed to noise pollution exceeding the standard. In fact, this pollution is more in the flight path of airplanes. This noise pollution is caused by the airport during the day and is annoying at night, and most residential areas are exposed to excessive residential noise (55 dB during the day and 45 dB during the night). This causes discomfort and disrupts the peace and sleep of the residents of this area. However, in the current research, the questionnaire was used as a supplement, and in addition to the distribution of the questionnaire, sound measurement using a sound meter was utilized as the main task in the research [30]. It should be noted that the results of the current project also confirm those of this research. Similar to Ramshir, noise pollution is at a high level in Qazvin. The average equivalent sound level obtained from the three regions of Qazvin was compared with the standard values of Iran, which were reported to be more than 4 times the standard limit in the two middle and southern regions, and this limit was lower in the northern region of the city. In the present study, the measured sound in all the investigated

areas was recorded higher than the standard [31]. The results of a study determined that in 20 areas of Zanjan, like Ramshir, most areas were exposed to noise pollution, and in most cases, the noise pollution level was higher compared to the standard, which is consistent with the results of this research. Furthermore, the hourly changes are completely a function of the amount of people's movement habits and the traffic load in the commercial areas of Zanjan [32], which indicates noise disturbance in most stations and times and confirms the results of the present research. The study of noise pollution caused by traffic in the city of Alexandria, Egypt, revealed that, based on the measurement, the noise level in the streets was equal during the day and at night, and according to Egyptian environmental law, it was higher than the permissible limit [33,34]. However, in the current research in Ramshir, there was a significant difference between the sound levels recorded during the day and night, and in both times, it was more than the permissible limit, which contradicts the results of this research. Urban noise also shows the differences that exist in different societies. Noise pollution dates back to the beginning of urbanization processes. Historically, ancient cities already had this problem. In ancient Rome, carts were prohibited on the streets during the evening hours to allow residents to rest. During the Middle Ages, several cities maintained these regulations. In this regard, industrialization brought with it a significant change in noise pollution related to countless aspects of urban life, from occupational hygiene in manufacturing centers to the concept of urban public transportation [15,17].

Conclusion

According to the results of the study in the desired areas and the measurement of sound parameters and the traffic of vehicles, including trucks, in the residential areas of Ramshir, the traffic of trucks in residential areas was an important factor in causing noise pollution in the city. The results of the noise annoyance of the residents demonstrated that the most dissatisfaction with the volume of truck noise is in the morning and at night. In general, for 10 stations at night and day, the measured Leq and the SPL were above the standards of the Iran Environmental Organization and the EPA. According to the total answers, the sound of truck traffic in the city caused noise annoyance to people. To reduce noise pollution, the first step is related to the manufacturers of transportation vehicles, car manufacturers, and generally equipment manufacturers, which must be approved by the government to implement the standard of equipment manufacturing and enforce its implementation. In the second and third stages, special laws should be formulated by authorities regarding construction noise. Safety headphones and sound insulation are used in industries and sealing tires, and sound sensors are employed in hospitals. Moreover, shelter belts are utilized in residential areas to protect against the adverse effects of sound. In the future, it is necessary to work on reducing the environmental sources of vehicle noise by developing low-noise automobiles, airplanes, and ships. In the urban environment, for heavy vehicles and cargo transportation, to control the noise, it is possible to create time traffic restrictions for the traffic of trucks, to create a special parking lot for trucks for the natives of the urban area, to prevent unnecessary traffic in the city, and to set specific hours for the passage of trucks and vehicles. Special traffic axes should be constructed to separate the passage of heavy vehicles from residential areas and institutionalize the culture of not producing noise pollution.

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Competing Interests

There is no conflict of interests between the authors.

Ethical Approval

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