JOURNAL OF RESEARCH IN URBAN PLANNING AND ARCHITECTURE
ENVIRONMENT IDENTITY (JRUPA-EI)

JOURNAL OF RESEARCH IN URBAN PLANNING AND ARCHITECTURE-
ENVIRONMENT IDENTITY (JRUPA-EI)
NO.1 (3), Summer 2020
http://www.ei-journal.ir
P.43-59

3D dimensional sound presentation in urban space for placement to optimize industrial workshops with using of GIS and Cityengine (case study: region 12, area3, Tehran city)

Amir SHakibamanesh[1], Yosof Mousavi[2]

Received:06 August -2020 **Accepted: 17 September-2020**

Abstract

The issue of sound and noise pollution is very important in the present conditions of cities. In this regard, since the city of Tehran is prominent in this matter, it is necessary to address this issue in this city. Sound pollution comes from a variety of sources, including the small industrial workshops that are located in urban areas in all cities, the most important of them. So far, a lot of research has been done on this issue. What distinguishes this study from other research is the examination of sound distribution in the third dimension. The present research, conducted in the area of three districts of the 12 city of Tehran, seeks to optimize the location of industrial workshops in altitudinal layers. In this regard, 5 points of the area and 70 stations were considered for measuring the sound. Using GIS software, spatial and descriptive information of the stations was examined and then the data of these stations was analyzed. Then, with the introduction of GIS data into the CityEngin software environment, the patterns examined were from the highest amount of sound to the lowest sound level. The study found that the best place to locate these workshops in the heights of the underground floor, as well as preventing the concentration of workshops alongside and preventing the placement of workshops along the main streets, equalize the level Reduced Leq at the receiver's point. Other solutions, including imposing legal restrictions on workshops, the use of audio barriers, including vegetation, were also presented.

Keywords: "3D Sound presentation"،" Noise Pollution" ،"GIS،Industrial workshops"،" CityEngin.

Reference to article:
Amir SHakibamanesh , Yosof Mousavi (2020): 3D dimensional sound presentation in urban space for placement to optimize industrial workshops with using of GIS and Cityengine(case study: region 12, area3, Tehran city)..*Journal of Research In Urban Planning and Architecture - Environment Identity (JRUPA-EI)* NO.1 (3), Summer 2020.P.43-59
http://www.ei-journal.ir/article_118568.html?lang=en

[1] Professor of Urban Desing,Faculity of Architecture and Urban Studies,Tehran Art University,Tehran,Iran . a.shakibamanesh@art.ac.ir (Author)

[2] Masters of Urban Desing,Faculity of Architecture and Urban Studies,Tehran Art University,Tehran,Iran . Yoosof.moosavi@yahoo.com

1-INTRODUCTION

The issue of noise and noise pollution is of great importance in locating urban uses, the problems caused by noise in the past are not comparable to the problems of modern society (Mirtaheri et al., 1396: 68). The sound has altered and irregular characteristics, which if it is higher than the standard, can be a potential source for injuries and physical and mental disorders (Nekohi et al., 2013: 917). Noise refers to any type of unwanted and undesirable sound. Noise means a message that contains no information and its intensity changes randomly over time. In acoustics, noise is heard as audible energy. They define that it has an adverse and negative effect on the physical and mental health of living organisms (Madadi et al., 2014).

Sources of noise pollution are of two types: industrial and non-industrial (Nekouhi et al., 2013: 918). Sound evaluation and control in industrial environments has long been considered. This is due to the health effects, variety of different processes and equipment for sound production (Golmohammadi et al., 1394: 53). Accordingly, the pattern of location and proximity of land uses in order to achieve sound comfort in urban spaces is one of the important principles of urban planning, the type of land use depends on their sensitivity to noise pollution (Mohammadi Deh Cheshmeh and Shanbehpour, 350: 1395). In this regard, and considering that in urban environments, especially in residential areas, small industries and industrial workshops are the main sources of noise pollution, so research on the issue of noise control and organization of these workshops is an important issue. Has become. An issue that has been less addressed so far. Of course, it will be mentioned earlier that industrial noise pollution has been worked on, but this research that has been done is more related to the indoor environments of the workshops and less attention has been paid to the impact of the workshops' noise on the surrounding uses.

Among the cities of Iran, Tehran receives more noise pollution due to heavy traffic on highways and small and large industries in urban areas. Of course, as mentioned above, some research has been done on the issue of noise, but so far no research There is no word on how noise from industrial workshops affects surrounding uses. This issue is the main necessity of this research. Contrary to the numbers written above, in many areas of Tehran, the situation is very critical and noise pollution has become a threat to the lives of residents.

Given the importance of the research topic, it must be understood why the use of 3D maps can be effective. Two-dimensional noise maps alone will not be enough to reduce or control noise pollution. Using two-dimensional maps, obtaining information about: Accurately calculating the number of people affected by noise pollution, determining critical points with high pollution intensity and determining the most polluted routes in terms of noise levels will be difficult and sometimes impossible Was. The reason for this is that it is not possible to show changes in sound intensity in two-dimensional maps of noise pollution. Two-dimensional maps of noise pollution do not provide sufficient information to calculate the efficiency of applying the effect of sound walls and sound insulation materials in reducing this pollution (Seong et al., 2011; 338). In order to find a better solution to these problems, it is necessary to have a noise pollution map that can provide complete information about the effects of noise pollution in all directions. This is possible by having a three-dimensional map of noise pollution, which the purpose of this study is to use a more efficient method in noise discussion to achieve better results.

2-Theoretical framework of research

2-1- Noise pollution in urban spaces

Noise pollution in urban spaces is defined as: Unwanted noise with duration, intensity or quality that causes physical and mental harm to humans (M. Adams et al., 2006; MD Adams et al., 2008; Alam, Alam Rahman, Dikshit, & Khan, 2006; Arras, Massacci, & Pittaluga, 2003). Suburban transportation, railways and related activities, construction, and industry are among the most important sources of noise pollution in urban spaces. In the discussion of noise pollution in industrial workshops, many studies have been done, all of which deal with the effect of noise on the workshop environment and less on the effect of workshop noise on the residential environment and other surrounding uses (Ranjbar et al., 2012: 45). Table 2 summarizes the most important studies and researches on noise pollution.

Table 1: Important research in noise pollution studies

The most important valuable findings	Targets	researchers	Research
In this research, one of the important points is to make a comparative study of sound propagation with the existence of no sound barriers and to compare the effect of each stage in opposite conditions.	Prepare a noise pollution map and investigate the effect of noise barriers on sound propagation to the receiving points.	Wei-Jiang Zhao et all, Article /) (2017	Three-dimensional mapping of traffic sound by considering the barriers between the facades of buildings and passages.
At this height, buildings can not reduce noise in any situation. This issue is interesting because in research number 2 of the same table, Mr. Hamidreza Ranjbar and others have written that as the height of buildings decreases the amount of sound effect (of course, we mean to consider a series of limitations and factors that are not mentioned in the study). Is) . Another noteworthy point is that other researches have mentioned three categories of vehicles to introduce the sources of traffic noise emission, while in this research it refers to 8 categories from motorcycles to heavy vehicles.	Three-dimensional analysis of the effect of traffic noise on a new section of a major highway - the connection between Bangkok to Swanepohem and Pattaya from a near-ground level to the height of high buildings.	Pichai Pamanikabud, . Marupong Tansatcha Article /) (2010	Three-dimensional analysis of the impact of new highway traffic noise on buildings and surrounding areas.
There are two notable points in this study: first, that it has studied both noise and air pollution, and that in conclusion it has achieved almost interesting results in both cases, and second, the use of software such as ArcScene, Google Earth, X3D.	Construction of a 3D model of sound to analyze the effect of sound from traffic on the Hemmat Highway, on all sides in order to provide comprehensible information about noise and air	Nan sheng (Thesis 2010)	Predicting and three-dimensional visualization of environmental indicators of noise and air pollution

	pollution.		
This research provides valuable findings for researchers who intend to study noise and noise pollution. In this way, it has tested and implemented very different functions of the sound control method in the sources of the transmission path and the receiver point, and has mentioned the results.	Noise study of small industrial workshops and ways to control their noise pollution has been a comprehensive study.	E&F.N.Spon. (book/2004)	Sound control in the industry
The most important discussion that can be mentioned about this research is dealing with the sound of industrial devices in small industrial workshops and how to control the sound of these devices.	Checking the sound of small industrial workshops and how to control the sound of sound production devices in these workshops.	Jacques Chatillon (Article / 2006)	The effect of reference conduction on noise level in industrial halls: simulation and experiment.

However, among the researches and studies done on the subject of noise pollution, less attention has been paid to the way in urban spaces. Also, less studies have been done on the way of sound production of industrial workshops and its effect on the surrounding residential texture.

2-2- Indicators of noise pollution in the environment

As it is known, the measurement and evaluation of sound pressure level indicators should be done based on acceptable and preferably standard time patterns. Therefore, in order to convert the values of sound pressure level over a period of time, it must be converted to an equivalent level. Audio in open and even indoor environments is defined as an equivalent level for certain periods of time around the clock. Also, measuring or calculating the equivalent level of sound pressure level is of special importance for those periods, because it will be able to compare with the allowable limits (Golmohammadi, 115: 1393)[1].

2-3- The effect of environment on sound distribution

The most important issue that needs to be addressed in the discussion of noise pollution is the discussion of the impact of the environment around the sources of noise generation and the receiver point. Natural factors each have an effect on the distribution and distribution of sound. As a rule, artificial factors should be created by taking into account natural factors to prevent the increase of noise pollution. In the meantime, the height of buildings and the skyline can be a very important factor, which needs to be paid more attention.

[1] Different time periods have been adopted in different countries to calculate or base the equivalent balance. The most popular time periods are 7 a.m. to 10 p.m. for the daytime balance (DL) as the 15-hour period of the day and from 10pm to 7am the next day (NL) as the 9-hour level of the night. (EL) and 23 to 7 o'clock in the morning the next day with the coefficients related to the level equivalent of the night (NL) has been set. It has been approved from 10 pm to 7 am for the night level. The permissible noise pollution limit has also been determined accordingly.

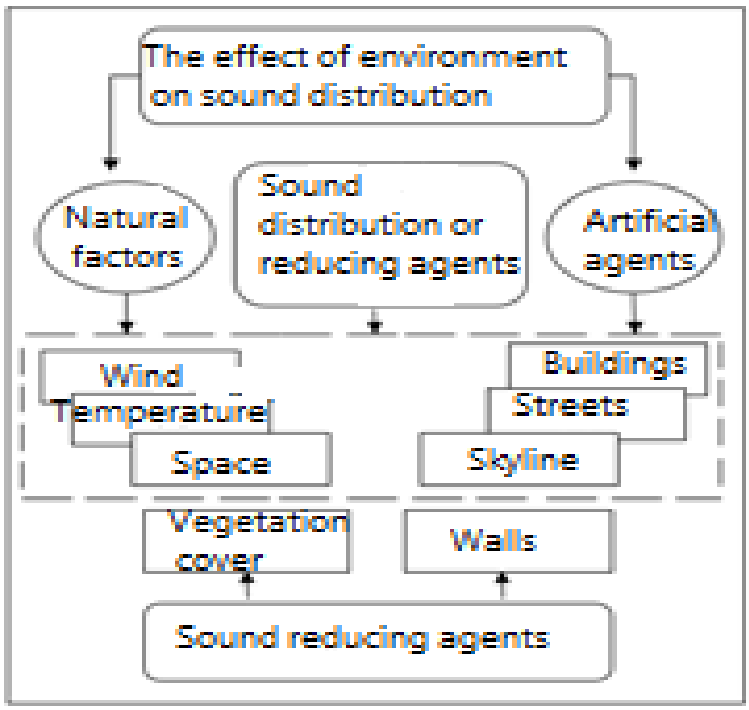

Figure 1: Effect of environment on sound distribution and forgiveness; References: (Ghiabkloo, 30: 1387 Valiaghati, 20,21,22: 1369 and Murphy & King, 2014: 46 and Botteldooren, D, et al and Kang, 2006: 210,211 and Salmons & Pont, 2012: 3)

2-4- Industrial and audio applications
2-4-1- Industrial land use classification

A) Micro-industries: such as bakeries and laundries that are located near residential areas for the benefit of its residents.
B) Light industries: Among the jobs of sound engineers and small industries in urban environments, we can mention industrial workshops and jobs that are engaged in the production and assembly of small industrial parts (Hassani et al., 1396: 3). This type of industrial use is very important for the present study; Because one of the goals of the research is to study the sound produced by this type of industry. The types of sound of these uses are listed in Table 2.
C) Medium industries: such as flax, oil, sugar factories that produce noise and undesirable waste.
D) Heavy industries: These industries account for most of the industries, are large industries that need construction surfaces and special equipment, and seek help from more experts in the production process (Gharkhloo and Farjam, 2001: 50).

Table 2: Types of light industries and workshops in urban environments

Type of profession and occupation	Row
Cutting / turning / parts making / compressors / industrial wheel production	1
Production of shoes / molding / thinning	2
Blacksmithing / Doors & Windows / Cabinets / Welding / Samovars	3
Tin / Channeling	4
Rose color	5

Socks / Knitting / Knitting / Quilting	6
Refinery / Repair Shop / Engine Manufacturing	7
Plasticizing / Plastic and melamine accessories	8
Glassmaking / Glass cutting / Candlestick mirror	9
Dried fruits	10
Copper	11

(Liaqati, 69: 1369Gayathri, K.et al, 2012,)

2-4-2- The sound of urban workshops

Among the small industries and workshops mentioned in the table above, each produces a different amount of noise, while some produce very loud noise that disturbs the environment.

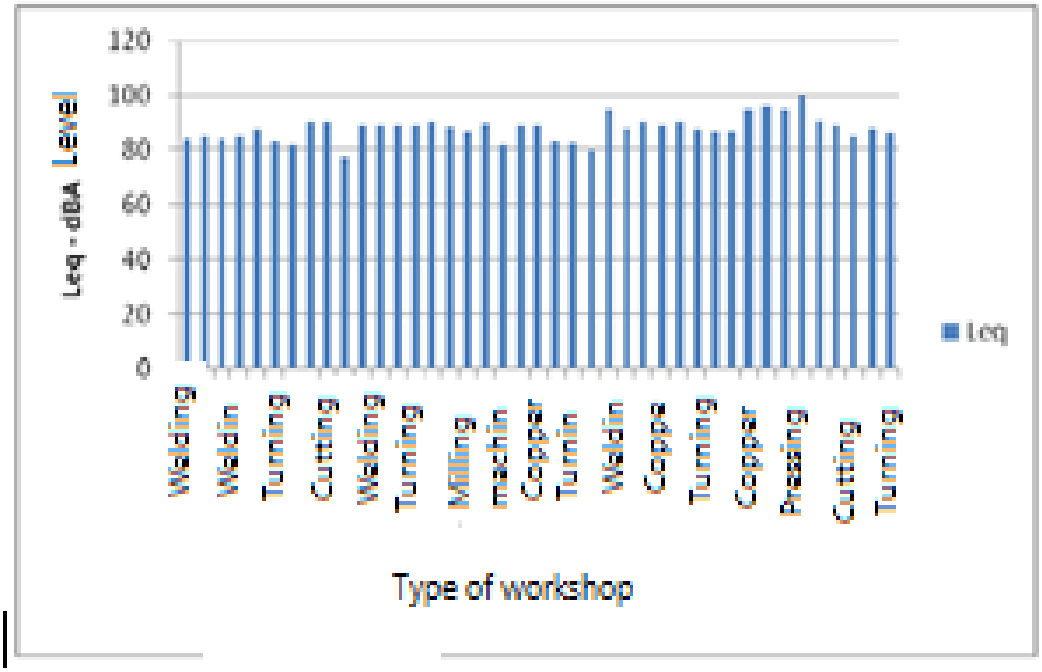

Figure 3: Sound equivalent level (Leq) of some industrial workshops. Source: (Hassani et al., 4: 1396)

2-5- Investigating the effect of placing land uses in the third layer of space, with emphasis on industrial workshops

In principle, the motivation for using three-dimensional visualization in urban planning and geographic information can be a simple conversion from two-dimensional to three-dimensional phenomena due to raw data. For example, in architecture and urban planning, a three-dimensional landscape, raw data ultimately leads to the need for a three-dimensional sample, which in many cases where the original data is two-dimensional, it is not possible to continue and convert the data inevitably. In addition, the development of technology in computer graphics hardware has been led by the gaming industry, which through 3D technology can be used in the field of geo-information. Finally, 3D visualization technology can provide users with interactive explorations and mobile representation close to the real world, which causes

sensitive, deep and visual stimulation of users to turn the product into more and more impressive information (Nan sheng, et al, 2013, Hall , D. A, 2011).

Considering the placement of different uses in different layers of the building is one of the cases that has received less attention in recent decades, and in many cases in urban contexts we see almost the same pattern of placement of uses. Considering the impact of various factors on buildings and the activities that take place in buildings, we will find that the uses that are in buildings are better placed logically (Nan sheng, 2011: 17, Sisman, EE, & Unver, E, 2011: 38).

3- Research methodology

In this research, according to the level of complexity of the research, the method of data collection in each stage has its own complexities. In this regard, the stage of data collection, which was done completely in the field, is very important. Therefore, it has been tried to be used as carefully as possible for data collection. The number and location of measuring stations in each workshop depends on the purpose of the measurement. Given that the research intends to measure sound in different floors of buildings around industrial workshops. Therefore, in order to obtain a more accurate result, the natural and artificial conditions of the environment must be the same. Except for items such as distance, height, etc., in the area of Zone 3, Zone 12, in both tall and medium-sized buildings, we have considered points for measuring and obtaining the required data.

3-1- Measuring tools

The sound level meter is designed to measure the sound pressure level. In the present study, because sound measurement was required in the weighted network A (because the human ear is the criterion for receiving sound here), a type of sound measuring device has been selected (Figure). It has the ability to measure slowly.

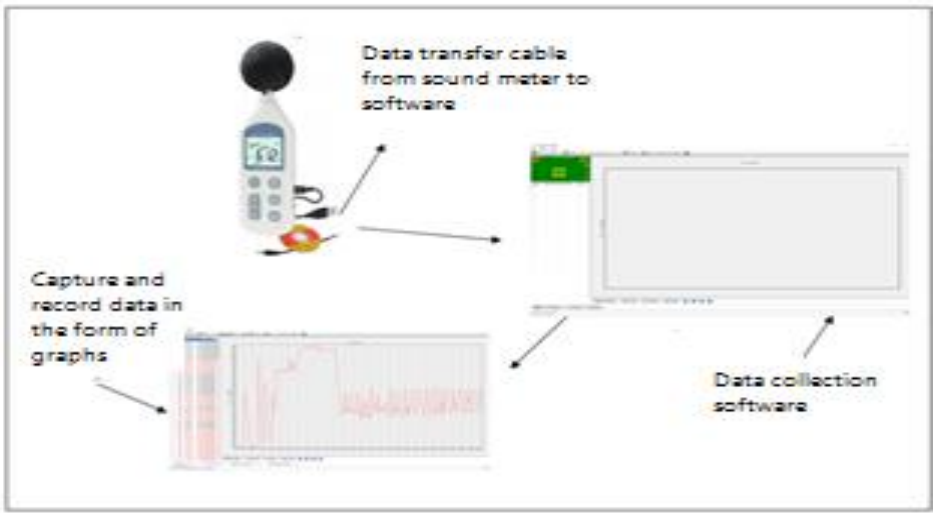

Figure 4: Research measurement tool and its details

3-2- Software used to analyze audio data

In the present study, field data was first extracted and entered into the GIS environment, (the initial research process was to perform zero hundred analyzes in the same software, but because

of the type of data that was very different in a block (ie the range The sound captured in the wall is very different from the sound spectrum of the side wall or roof in a building or block), after the data was taken and entered into the GIS environment, it became clear that this software could not have a suitable spectrum for such data. For this reason, City Engine auxiliary software was used for audio spectroscopy. It should be noted that in the GIS environment, such spectroscopy can be achieved in the discussion of three-dimensional sound maps, but because it considers a block or a building in general and gives spectrum, it does not have the necessary quality for such research.

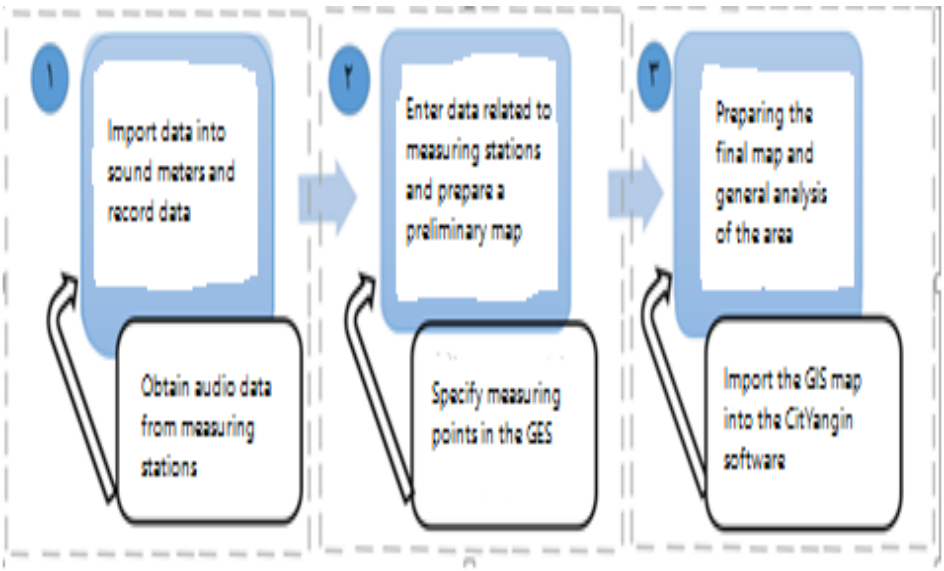

Figure 5: The process of entering research data into software

3-3- Review of the study area

District 12 is one of the old districts of Tehran, which is located in the center of the city. District 3, District 12, is the primary nucleus of Tehran, which in the Safavid period consists of two neighborhoods, Sangalaj and Sirus, and Tehran Bazaar (as the strongest economic and business territory of the country and has a political, social and religious atmosphere) with a floating population of more than one and a half Millions of people are located in the geography of this area. Because it is one of the old areas of Tehran, many industrial workshops are concentrated in this area, which is the main reason for this research.

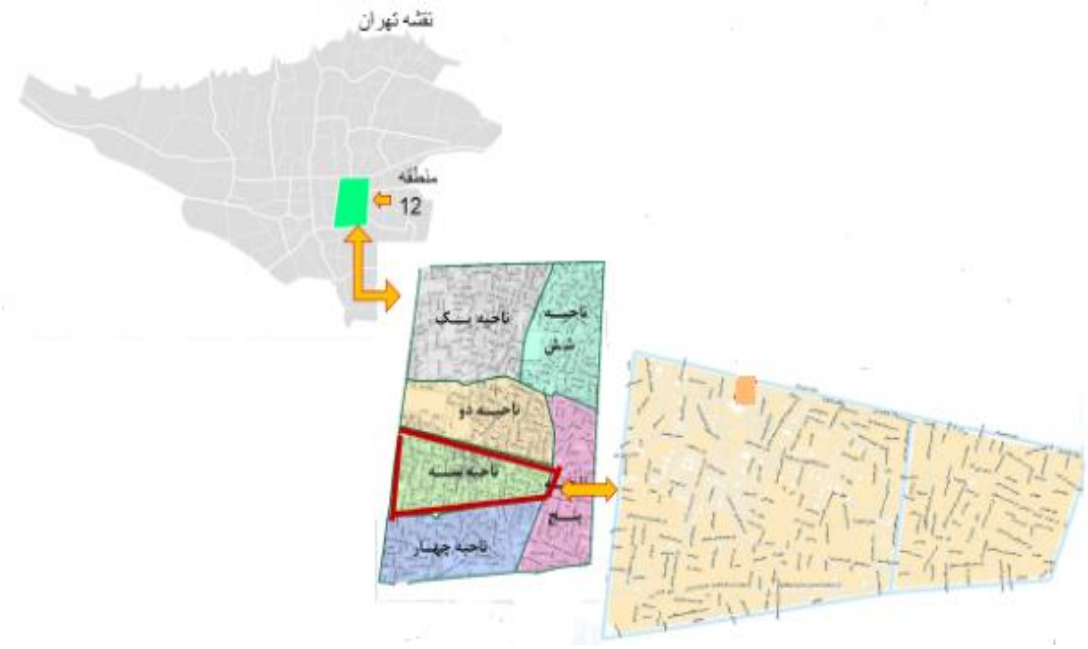

Figure 6: Location of Area 3, Region 12 in Tehran

3-4- Investigation of the distribution of industrial workshops in Region 3, Area 12 of Tehran

In order to know the status of activities, industries and occupations that somehow have noise pollution in their work process and increase ambient noise pollution in Tehran, many field studies were conducted as well as the use of extensive research findings and then a list of all occupations was provided. And all the activities that were contracted in the area of Area 3, Region 12 of Tehran Municipality were identified.

Figure 7: Distribution of industrial workshops in the study area; Source: (Bavand, 2006)

3-5- Selection of sound measuring stations

Field data collection is very important in this research. In this regard, in the field of cognition, every effort has been made to obtain an accurate knowledge of the study area, so that the necessary precision can be used when selecting measuring stations. In this research, an attempt has been made to include different models of industrial workshops. As mentioned in the picture above, the volume of industrial workshops, here too, by referring to these tables and also considering the workshops that are in a category and produce sound close to almost everyone, the location of these workshops in the residential context and Other factors are considered in 5 points of the study area and 70 measuring stations, which will be analyzed in the following data of measuring stations. It should be noted that in all measuring stations located on the ground floor, the measurement was done in two meters of the facade and also in the stations that are located in the height due to the restriction to the middle floors of the buildings behind the roof. According to the studies that have been done on the subject of measurement in various researches, the way of choosing the measurement time depends on the intensity of changes in the data of the measuring stations. Periods of one hour, 24 hours, or even 15 hours during the day and nine hours during the night can be used to determine the equivalent sound level (Leq). In the present study, by examining the intensity of these changes, the duration of time in some stations is one hour and in some other stations, due to the small changes in sound, between 8 to 10 minutes has been considered, which seems to give a good result.

Figure 8: Position of selected points for sound measuring stations

4- Analysis of data, tests and research findings

4-1- Analyzing the data of measuring stations number one

As the position of this point is well shown in Figure 8: It is located on Rey Street and above Ghayam Square. They seemed to make an unbearable noise when several of these workshops started working at the same time. At this point, due to the high density of workshops in one wall and also due to the fact that these workshops are located in the wall of a main street, traffic

noise has been added to their noise pollution and has created a very bad situation. The analysis of the audio data of the stations of this point is given below.

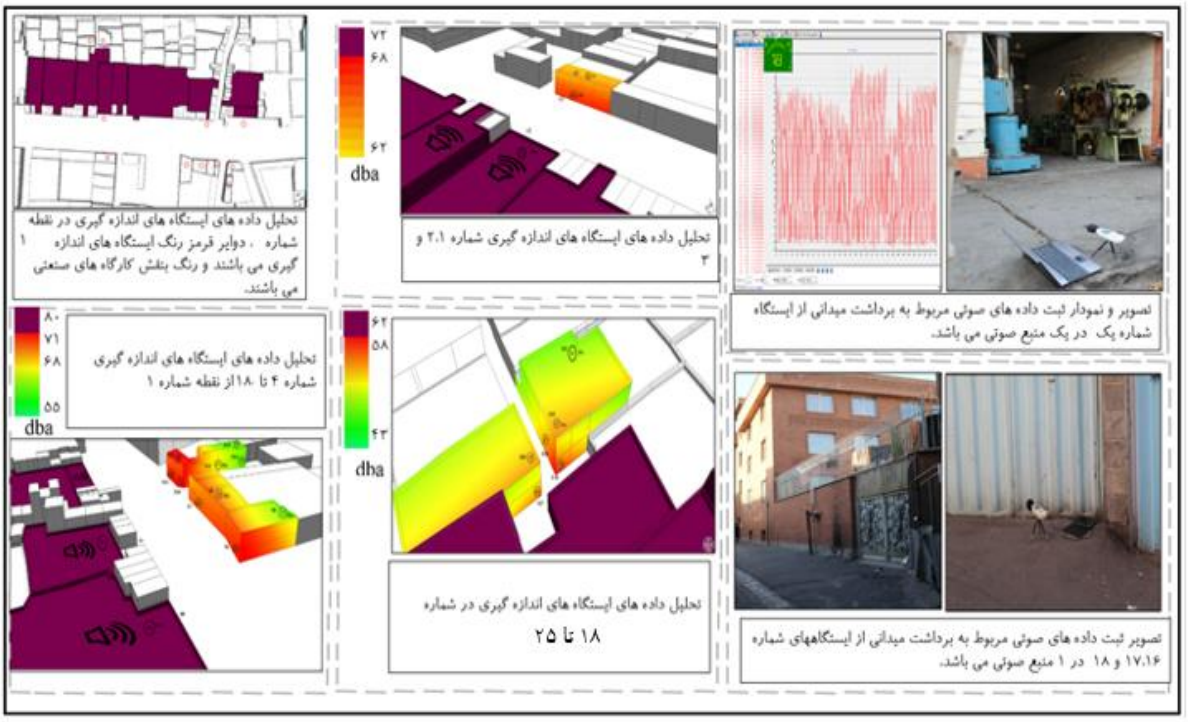

Figure 9: Voice data analysis, stations one to 25 points number one

4-1-2- Measuring station number two (around Ahmadi street in Bazaar neighborhood)

At this point, according to the objectives of the research, there was a place to study the effect of the combination of distance factors, texture and sound barriers in reducing sound. As shown in the plan image of this point, the texture of this point has many alleys and empty spaces that affect the forgiveness of sound. At this point, 18 measuring stations are considered, which will be discussed below.

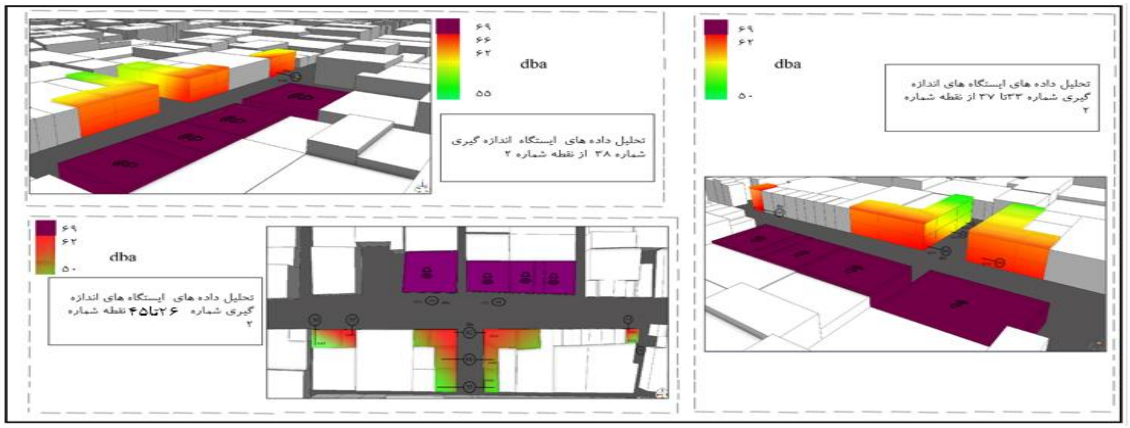

Figure 10: Audio data analysis, stations 26 to 45, point two

4-1-3- Measuring station number three (at the beginning of Mousavi street towards Khayyam)

The location of this point is at the beginning of Mousavi Street towards Khayyam. As one of the most important goals of the present study is the study of sound at height. This is exactly the reason for choosing this point. Because at this point, the industrial workshop is located on the ground floor and it seems to be a very suitable model for examining sound at height, but this time it is not as a receiver point but as a source of sound production. Also, the next model in point number 5 has been tried to check the industrial workshop, which is located on the top floor. At this point, 7 sound measuring stations have been considered and more efforts have been made to keep the stations close to the sound production sources. A noteworthy point in the data analysis of this point is the significant sound drop at the receiver point, which is also well shown in the figure below.

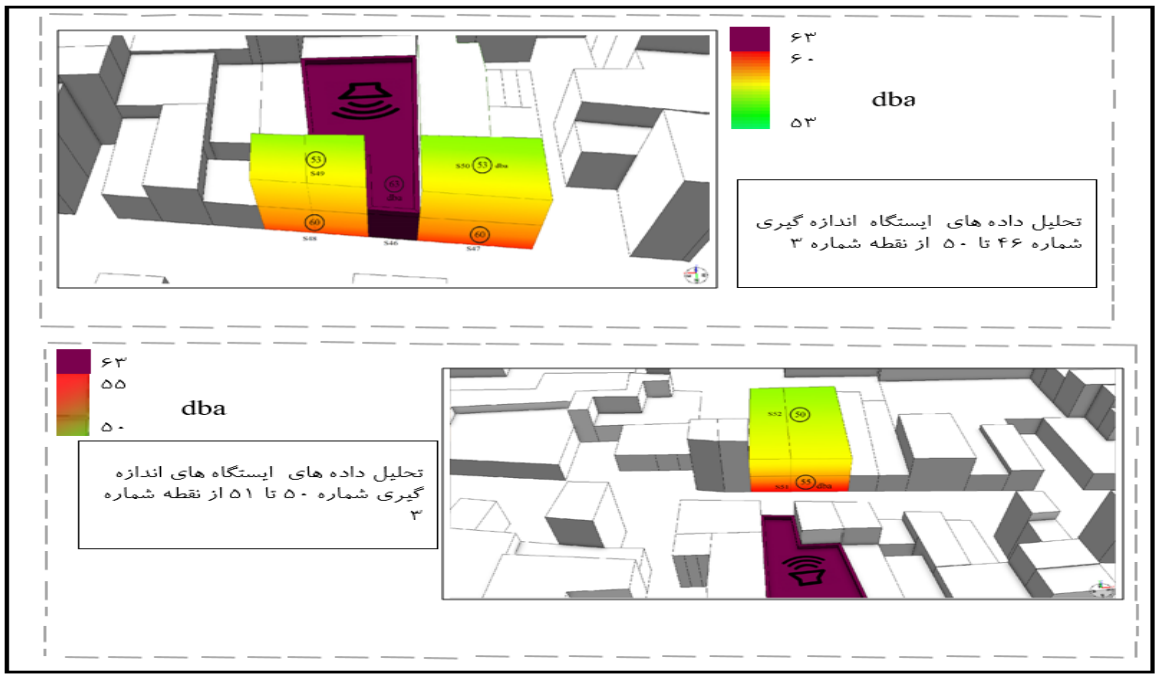

Figure 11: Measuring stations 46 to 52 points number three

4-1-4- Measuring station No. 4 (Ahmadi St. in Bazaar neighborhood)

One of the main reasons for selecting this point was the existence of a suitable texture for research tests. According to the objectives of the research, as mentioned earlier, in the field of field studies, due to the importance of the work, a lot of effort has been made to select the best models for measuring sound.

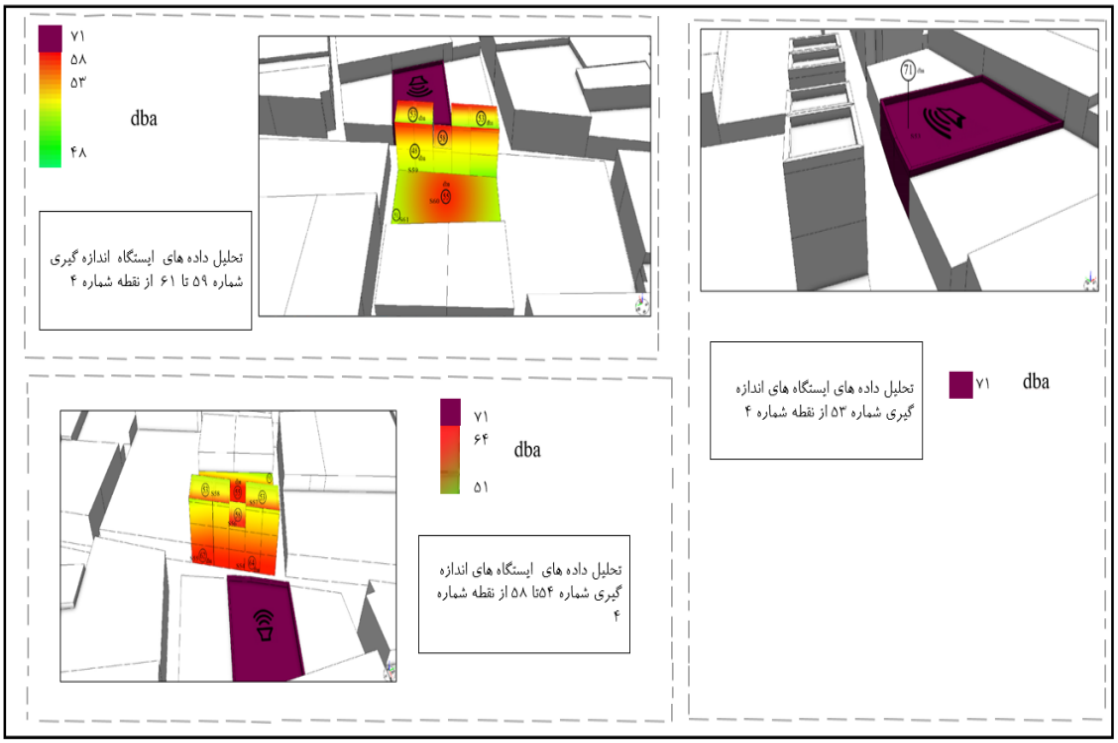

Figure 12: Measurement stations 53 to 61, point 4

This point is also located on Ahmadi Street near Moazen Alley in the Bazaar neighborhood. The reason for choosing this point, as mentioned above, is to further investigate how height affects sound amplification. It is located above the ground floor, which can also be a good model for examining sound sources at height. LT is.

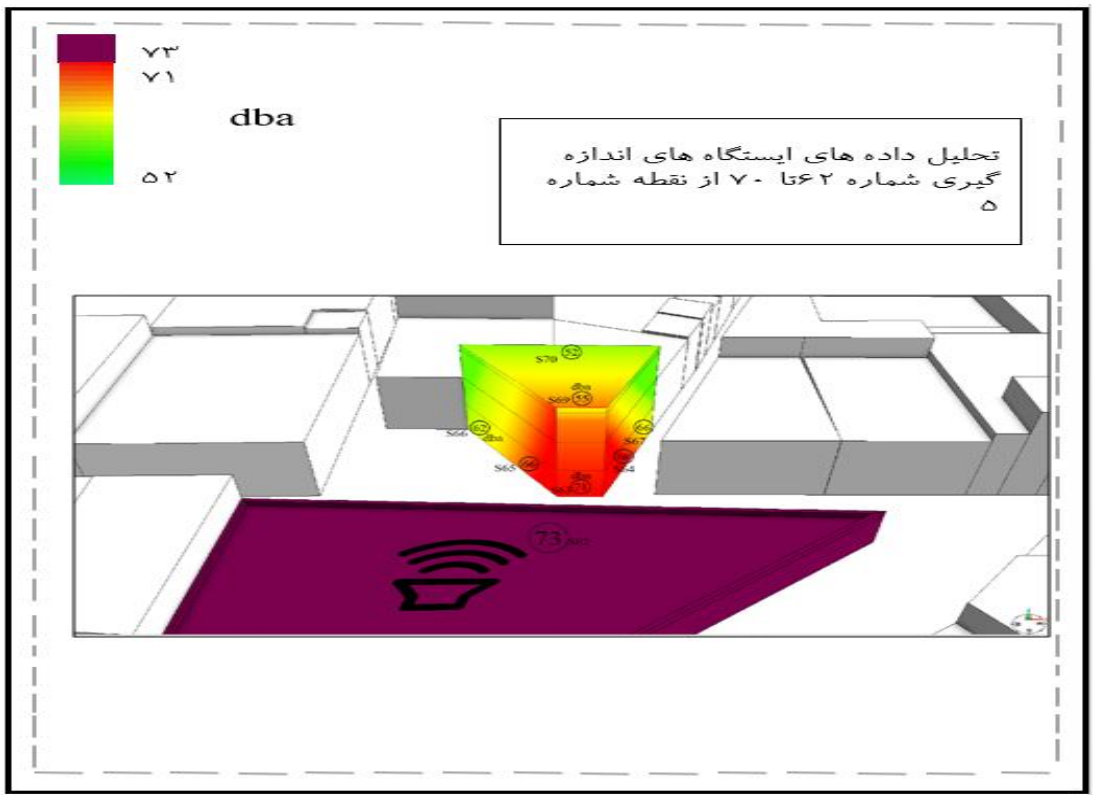

Figure 13: Measuring stations No. 62 to 70 Point No. 5

4-2- Production of sound map of the area with City Engine and its analysis

In order to obtain the sound map of the whole area, in addition to the stations specified for measurement, other points in the area were considered to obtain the average sound of the area in all its points, and after obtaining the data, it entered the GIS environment and Prepare a map with the required information and then enter the prepared map into the software environment of City Engine software and a three-dimensional sound map was produced by analyzing the sound of the area. There is noise pollution and of course there are safe noise points in the area that are marked on the map. Careful studies using data obtained from the area have shown that the presence of industrial workshops on the main streets is not recommended at all because the traffic noise merges with the workshop noise and creates unbearable noise. Also, in the parts of the area where the workshops are located in the basement, less noise pollution is produced than in the places where the workshops are located on the ground floor and the upper floor.

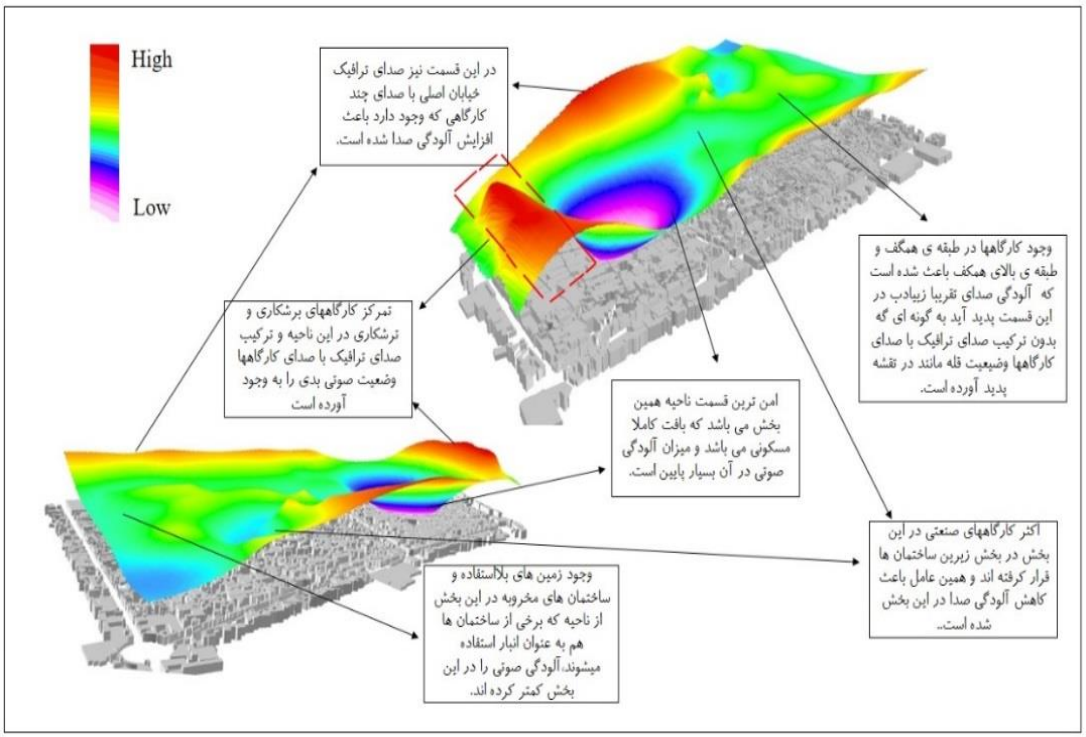

Figure 14: Three-dimensional sound analysis map of the study area

5- Summarizing and concluding

The present study sought to investigate the role of the third dimension in the distribution of sound produced by industrial workshops in District 3, Region 12. However, due to the nature of the research, such conditions seem to exist in many cities, so the research results can be useful for other areas as well. However, in addition to studying the three-dimensional distribution of sound in industrial workshops, the discussion of locating these uses in the third layer and how to forgive in the blocks of the area has also been considered. . Therefore, first the most important step was to be careful in selecting the measuring stations in the study area and then to be careful in how the data were collected. In this regard, five points in the selection area and data were obtained from 70 main measuring stations and 30 sub-measuring stations. It should be noted that the method of data collection was equivalent to the amount of sound

(Leq) and also the time conditions were considered. After collecting the data, the station information was mapped using GIS software and then the data extracted from the stations were analyzed using City Engine software. The most important results obtained from the research were summarized as follows: Industrial workshops on the main street wall make a very scary noise because their sound merges with the traffic noise, so the first step should be to remove the industrial workshops from the main street wall. Another important point was that it was found that the workshops located on the ground floor send much less noise to the environment than the workshops located on the ground floor and upper floors, so as much as possible the industrial workshops in this area should be encouraged to go to the ground floor. A very important step has been taken to reduce noise pollution. The next point is that workshops located at intersections as well as in narrow alleys will cause a lot of damage to the surrounding noise environment and should not be located in these places. Another thing is the effect of the skyline in forgiving the sound of the workshops, so that in areas where the skyline is not observed and short buildings are located among tall buildings in a wall, the industrial workshop should not be in the wall in front of it because the sound comfort of the back wall completely Also, as the factories are located on the ground floor, they emit less noise to the surrounding environment. The upper floors are dedicated to residential use. Other smaller results are reported in the research process.

Subscripts

Weight Grid A is a grid that roughly mimics the frequency response of the human ear at different frequencies by an electrical circuit in a sound leveling device and applies it to the measured sound.

2 The actual sound in the environment is displayed with the same value on the sound level meter.

3 Indicate how fast the device responds to sound. Most devices have a section for selecting slow or fast mode. Slow mode is mostly used for OSHA applications and listening to conversations, and fast mode is used for noise reduction. For example, it very quickly identifies the source of the burning noise that firefighters are able to use.

references

1- Pourmohammadi, Mohammad Reza (2013). "Urban Land Use Planning", Samat Publications, 182

2- Ghiabkloo, Zahra (1387). "Fundamentals of Building Physics 1 Acoustics", University Jihad

3- Ranjbar, Hamidreza; Qaragazloo, Alireza; Vafainejad, Alireza and Kaljour, Hong Di (2012). "GIS approach based on three-dimensional modeling of noise pollution using three-dimensional models of the city (Case study: part of the logic of Tehran three)". Environmental Science, Thirty-eighth year, No. 4, pp. 125-132

4- Zamanian, Zahra; Perkar, Salahuddin; Pirami, Hamideh; Abdollahi, Mostafa and Kouhnourd, Bahram (2016). "Investigation of noise pollution caused by traffic and its effect on sleep disorders and quality of life of citizens of Shiraz", Journal of Occupational Medicine, Volume 8, Number 4, 66, pp. 58

5- Hassani, Fatemeh; Rahmatizadeh, Shima; Nasiri, Parvin and Monzem, Mohammad Reza (1396). "Investigation of Noise Pollution Status of Sound Production Workshops and Occupations Located in

District 3, District 12 of Tehran Municipality (Grand Bazaar) Using GIS", Quarterly Journal of Environmental Science and Technology, Volume 19, Spring 2017, pp. 1-11.

6- Liaqati, Ghulam Ali (1369). "Acoustics in Architecture", Tehran Shahid Beheshti University Press, third edition.

7- Madadi, Hossein; Moradi, Hussein; Fakhran, Sima; Jokar, Mojtaba and Maki, Taktam (1393). "Modeling the propagation of noise pollution caused by the west bypass of Isfahan in Ghomishloo wildlife sanctuary using the model" SPreAD-GIS, Applied Ecology, Year 3, Issue 9.

8- Mohammadi Deh Cheshmeh, Mostafa and Shanbehpour, Fereshteh (2016). "Measuring the spatial coefficient of sound comfort in the metropolis of Ahvaz", Journal of Environmental Studies, No. 2, pp. 349-364.

9- Mir Taheri, Fereshteh and Kasmaei, Zahra (1393). "Investigation of noise pollution and 24-hour measurement on Shahid Hakim Highway in Tehran", Alborz Disciplinary Knowledge Quarterly, Second Year, No. 4.

10- Gharkhloo, Mehdi and Farjam, Rasoul (2001). "Optimal organization and establishment of disturbing urban industries and workshops (a case study of the central texture of Kermanshah)", Geographical Research, No. 40, pp. 47-71

11- Golmohammadi, Rostam (2016). "Guide to measuring and evaluating noise and vibration in the workplace, Hamedan: Student Publications: Ministry of Health, Treatment and Medical Education, Deputy Minister of Health", Center for Environmental and Occupational Health,

12- Nekohi, Nesiyeh and Hekmabadi, Rajabali and Esmailzadeh, Morteza and Amiri, Hanieh (2013).

13-Adams, M., Cox, T., Moore, G., Croxford, B., Refaee, M., & Sharples, S. (2006). "Sustainable soundscapes:Noise policy and the urban experience". Urban Studies, 43(13), Pages 2385-2398.

14- Adams, M. D., Bruce, N. S., Davies, W. J., Cain, R., Jennings, P., Carlyle, A., . . . Plack, C. (2008). "Soundwalking as a methodology for understanding soundscapes".

15- Alam, J., Alam, M. J. B., Rahman, M., Dikshit, A., & Khan, S. (2006). "Study on traffic noise level of sylhet by multiple regression analysis associated with health hazards. Journal of Environmental Health". Science & Engineering, 3(2), Pages 71-78.

16- Alesheikh, A. A., & Omidvari, M. (2010)." Application of gis in urban traffic noise pollution". International Journal of Occupational Hygiene, Pages 79-84.

17- Arras, F., Massacci, G., & Pittaluga, P. (2003). "Soundscape perception in cagliari, italy". Paper presented at the Proc. of Euronoise.

18- Al-Mutairi, N., Al-Rukaibi, F., & Koushki, P. (2009). "Measurements and model calibration of urban traffic noise pollution". American Journal of Environmental Sciences, 5(5), Pages 613.

19- Babisch, W., Elwood, P., Ising, H., & Kruppa, B. (1993). "Traffic noise as a risk factor for myocardial infarction". Schriftenreihe des Vereins fur Wasser-, Boden-und Lufthygiene, 88, Pages 135-166.

20- Doygun, H., & Gurun, D. K. (2008)." Analysing and mapping spatial and temporal dynamics of urban traffic noise pollution: A case study in kahramanmaraş, turkey". Environmental Monitoring and Assessment, 142(1-3), Pages 65-72.

21- E&F.N.Spon,(2004)," Noise Control in industry, edition published in the Taylor & Francis e-Library".

22- Gayathri, K., Jaisheeba, A. A., & Sornaraj, R. (2012)." Assessment of noise pollution in thoothukudi city". Int J Pharm Tech Res, 4(3), Pages 1345-1350.

23- González, D. M., Morillas, J. B., Godinho, L., & Amado-Mendes, P. (2018)." Acoustic screening effect on building façades due to parking lines in urban environments". Effects in noise mapping. Applied Acoustics, Pages 130, 1-14

24- Hall, D. A., Irwin, A., Edmondson-Jones, M., Phillips, S., & Poxon, J. E. (2013). "An exploratory evaluation of perceptual, psychoacoustic and acoustical properties of urban soundscapes". Applied Acoustics, 74(2), Pages 248-254.
25- Chatillon,Jacques,(2006). "Influence of source directivity on noise levels in industrial halls: simulation and experiments". Applied Acoustics ,68, Pages 682–698
26- Kim, R., & Van den Berg, M. (2010). "Summary of night noise guidelines for europe". Noise and health, 12(47), Pages 61.
27- Nan,Sheng,(2010)"Prediction and 3D Visualization of Environmental Indicators: Noise and air Pollution,Division of Geodesy and Geoinformatics Royal Institute of Technology (KTH) 100 44 Stockholm".
28- Murphy, E., & King, E. (2014). "Environmental noise pollution: Noise mapping, public health, and policy: Newnes".
29- Pamanikabud, P., & Tansatcha, M. (2010)." 3d analysis and investigation of traffic noise impact from a new motorway on building and surrounding area". Applied Acoustics, 71(12), Pages 1185-1193.
30- Salomons, E. M., & Pont, M. B. (2012). "Urban traffic noise and the relation to urban density, form, and traffic elasticity". Landscape and Urban Planning, 108(1), Pages 2-16.
31- Sisman, E. E., & Unver, E. (2011). "Evaluation of traffic noise pollution in corlu, turkey". Scientific Research and Essays, 6(14), Pages 3027-3033.
32- Sjödin, F., Kjellberg, A., Knutsson, A., Landström, U., & Lindberg, L. (2012)." Noise and stress effects on preschool personnel". Noise & health, 14(59), Pages 166-178.
33- Vasilyev, A. V. (2017). "New methods and approaches to acoustic monitoring and noise mapping of urban territories and experience of it approbation in conditions of samara region of russia". Procedia Engineering, 176, Pages 669-674