The effect of noise in outdoor spaces on the users of Imam Al-Sadiq General Hospital in the Hilla city

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Abstract

This study was conducted between 2018-2019 due to the importance of Imam Al-Sadiq (peace be upon him) General Hospital, which is considered one of the most modern hospitals in the province of Babylon, as well as its clinical capacity, so its importance emerged. The theoretical studies included a review of the modern local and international sources and studies that pertain to the problem of noise and its impact on human health and the useful means to mitigate its severity.What is the second stage? A - The field study was conducted through spot visits to the hospital, collecting maps and data, and determining the noise sources and their intensity.

B - Questionnaire: It was conducted to find out the opinion of hospital users about noise and its psychological and health impact on them. It included patients, visitors, and staff (medical, administrative) of the hospital. Several proposals have been developed to treat noise and reduce its intensity, thus providing the appropriate environment for users of external spaces in the hospital.Noise has become an essential part of daily life to which man is constantly exposed, as it has become one of the pests of the times due to the increase in its sources in terms of vehicles, laboratories, trains...etc. The effect of which is not limited to disturbance and nervous and psychological tension only, but also extends to the incidence of dangerous diseases, such as heart diseases and brain disorders, which threaten human health, and make noise one of the main dangers to his life.This was confirmed by a recent study that people who are exposed to noise and noise for a long time in the workplace or during recreational activities may be more susceptible to heart disease (https://www.arab48.com ›). Al-Muaini (2015) mentioned that noise constitutes a system of anxiety and disturbance to the natural surroundings of the human being, which can be considered as a pollution caused by the city. It is now a serious problem in urban areas resulting from the increase in population density, manufacturing operations, works, engines...etc. Noise pollution problems are increasing day by day, especially in crowded urban areas next to highways, main streets, airports...etc. The wrong choice of the location of the Imam Al-Sadiq (peace be upon him) General Hospital in the center of Hilla and on both sides of the most crowded streets, negatively affected the comfort of the hospital's users, including doctors, patients, visitors, and functional and service staff due to the noise generated by the movement of cars, in addition to the difficulty of access to the hospital and that the noise does not affect the users of the external spaces only, but may reach its intensity to the internal spaces in the hospital and cause inconvenience to the hospital users. Therefore, when designing the hospital's external spaces, this important factor must be taken into consideration, by presenting appropriate proposals to mitigate its severity in accordance with international standards used for this purpose.

Research problem

The noise problem is one of the important problems that hospital users suffer from because of its negative effects on human health, scientific performance and comfort, Where the hospital's location is adjacent to the most crowded streets of the city, especially Street 60 and Al-Tahmaziyah Street, which is one of the main sources of noise that hospital users suffer from, especially in outer spaces.

research aims

Develop solutions and design proposals to mitigate the noise resulting from the movement of cars in the streets surrounding the hospital.

Work stages

First: The theoretical study, which includes:

Noise has become an essential part of daily life to which man is constantly exposed, where it has become one of the pests of the times due to the increase in its sources in terms of vehicles, laboratories, trains...etc. The effect of which is not limited to disturbance and nervous and psychological tension only,Rather, it extended to the incidence of dangerous diseases, such as heart diseases and brain disorders, which threaten human health and make noise one of the main risks to his life, which was confirmed by a recent study that people who are exposed to noise and noise for a long time in the workplace or during recreational activities may be more vulnerable For heart disease, (https://www.arab48.com ›).

1- There are several definitions of noise, which are:

1. Noise is a mixture of annoying and unwanted sounds, which negatively affect the activity and productivity of individuals as well as their effect on the nervous system and the heart and the functioning of the brain and other body systems. Noise is a type of physical pollution, which makes it one of the biggest pollution factors in the environment (https://www.arab48.com ›).

2. Noise was defined as a harmful and disturbing sound for daily activities such as work, rest, and study (Al-Jabbari, 2004).

3. Al-Muaini (2015) defines noise in general as any unwanted or unwanted sound, and the release of unwanted sounds into the atmosphere is called noise pollution.

4. As for Hajouz (2011), he defined noise as all annoying sounds that are the result of industrial development that created rapid movement of the various means of transport and as a result of the increase in the number of factories and laboratories and the great use of machines and machines in various fields.

5. Abd al-Rahman (2006) defined noise as unwanted sounds that cause disturbance to the central nervous system that deals with sounds in humans, that disturbing sounds should not exceed 20-25 phon, note that 30-40 phon falls within the normal limits of hearing However, the negative impact of noise begins if it exceeds 50-90 phonons or more. Al-Muaini (2015) mentioned that noise constitutes a system of anxiety and disturbance to the natural surroundings of the human being, which can be considered as pollution caused by the city, and that excessive noise occupies the second place directly after water pollution among the environmental issues that receive serious attention by researchers. Numerous studies showed that city dwellers in most cases considered noise to be the worst characteristic of the residential area, and the noise was considered one of the biggest factors that lead to people's displacement and move often to another part of the city in search of calm. Therefore, noise in cities is a permanent and chronic problem.If a garden has a healing value in a medical environment, it must be quiet. People who use the garden need to feel calm, and be able to hear the sounds of birds, the movement of leaves, the wind, or the sounds of

water in fountains. Therefore, gardens must be designed to reduce negative factors such as noise and others, (Marcus and Barnes, 1995, and Faures, 2007). Marcus and Barnes (1995) note that one study of four hospitals found that users were disturbed by mechanical noises such as air conditioners and street traffic. While Marcus (2007) emphasized that in the planning stage of the hospital, it is necessary that the future spaces of the gardens be away from traffic, entrances, places where there is noise and constant movement, parking spaces, gates and entrances, and helicopter landing pads.

1- Means of noise reduction

The human has turned to search for methods to reduce this disturbing phenomenon (the noise), but he has found nothing but limiting this phenomenon. As a result of the research, he found one successful and inexpensive methods, which is to use plants of all kinds as living barriers that limit sounds. All research confirms the role of plants and their success in limiting this phenomenon by establishing protective belts around factories, factories, and main roads. As the crown of the tree can absorb a quarter of the power of sounds, and reflect the other three quarters, (Hajouz, 2011). It has been pointed out (Shura, 2016) that broad-leaved trees can absorb 25% of the sound vibrations that pass through them if they are distributed in the direction of the noise source, and studies have confirmed that five rows of dense and tall trees can reduce the intensity of noise by an average of 30-40 % . The results of the study, which was conducted on the streets in Erbil province, showed that four types of plants were used (African green cypress, eucalyptus, European olive, myrtle) as plant repellents. The results were that the use of two rows of Elias at a distance of (3 m) from each other and 15 m away from the noise source gave the best results, as the noise intensity reached (64.37) dB in comparsiom with 91.75 dB when there are no plants compared to the absence of plant barriers. Al-Samarrai (1978) mentioned that the noise and its spread in nature is affected by a number of factors, and the decrease of this percentage is due to the increasing distance from the source of noise and the expansion of the surroundings, and he also showed that its level increases with the increase of concrete and asphalt roads compared to dirt roads. Scientists have tried to find various means to reduce noise inside cities, such as establishing buffer zones and barriers and planting plants (HWTN, 2006). Cultivation of plants is one of the modern guidelines to reduce noise (Fang and Ling, 2003). Ayior (1972) stated that the effect of noise is affected by the type and height of trees, their morphological shape, the density of their vegetative crown, the width of their trunk, and the distances and number of planted rows of trees. The use of the afforestation factor is important because trees are characterized by suitable heights that can be increased, good vegetative density and plant thickness, and it is used to reduce noise and that typical afforestation cases reduce noise by (10-15) decibels, in addition to the added aesthetic of the location and streets (Tyagi et al., 2006), The Service Center at the University of Minnesota (2002) indicates the necessity of using a number of rows of trees and shrubs for green belts to reduce noise in cities. Slusher and Wallace (2005) indicated that windbreaks, especially those consisting of rows of tall trees with rows of shrubs and grasses, can be used to reduce noise. The Federal Highway Administration in the United States of America FHWA specified in its publications in (2010) that the use of some materials as bumpers to reduce vehicle noise, such as wood, soil, rubber, treated concrete blocks, and other materials, reduces by 5 decibels of noise intensity and increases the reduction rate by 5. 1 for every 1 m of the height of the erected septum above the level of the human ear. The plants that are most effective in absorbing noise are those that are characterized by thick, dense leaves with bristles with thin necks that allow the greatest degree of flexibility and oscillation, in addition to trees a role in absorbing sounds, they also

have the ability to disperse sounds added to the effectiveness of green spaces or herbs in absorbing sounds A belt of trees and shrubs, 19-30 m wide and 12 m high, reduces noise by 5-10 dB (dB), Also, two rows of deciduous shrubs and a row of cypress trees, 6 m wide and 5.5 m long, achieved crowns of 10 dB. Tree species differ greatly in their ability to reduce traffic noise levels, but evergreen species are better when it is desired to reduce sound throughout the year (Al-Qayi, 1993 and Sharbazi, 2009) and based on what was mentioned above that the extent to which noise is affected by the vegetative cover through the effect of the type of trees, the number of planted rows, and their distance from the noise source in reducing noise. In a study conducted by Ahmed and others (2010), they found that using two rows of ace with a distance of 3 m from each other and 15 m away from the noise source gave the best results.

● Green areas perform this function in residential communities by:

Changing the path of the wind that carries the sound from the ear when its source is from the direction of the prevailing winds, by planting a belt or a dense strip of plants between the residential complex and the source of the noise.

- Blocking the source of sound from looking by using plants that distract people from it, and natural sounds that people like in green areas, such as the sound of birds, murmurs of water and the rustling of trees, distract attention from noise.

- Absorbing or reflecting sound, as the leaves, twigs and branches of trees and shrubs are characterized by a great ability to absorb and reflect sound.

● The effectiveness of green areas in reducing noise in general depends on several points, the most important of which are:

The location of the green zone in relation to the noise source: its location should be in the area separating the noise source and the area to be protected, and the closer it is to the noise source, the greater its effectiveness and vice versa.

- Display of the green zone: the display depends on the source and type of noise, and the width must be sufficient for the green zone to perform this function.

- Density of the green area and the plant species that makeup it: The effectiveness of green areas in reducing noise increases, the greater their density, and the more the trees are high and dense the leaves, and the more flexible the leaves. Evergreen trees are more effective in absorbing and reflecting noise compared to deciduous trees because they do so all year round.

- Arranging the plant elements within the green area: it is preferable to gradual the plant elements in terms of height relative to the noise source to get greater effectiveness in mitigating the noise, as shorter plants (fences, shrubs) are planted towards the sound source and increase in height (trees) as we move towards the desired area Protecting it from noise, with the aim of directing the sound upwards and keeping it away from the ear.

- Green areas: the areas covered with green areas and soil are more effective in absorbing noise (Shura, 2016).

Second: The practical and field study, which includes two phases:

The first phase / a case study of Imam Al-Sadiq (peace be upon him) General Hospital in the city of Hilla - Babylon

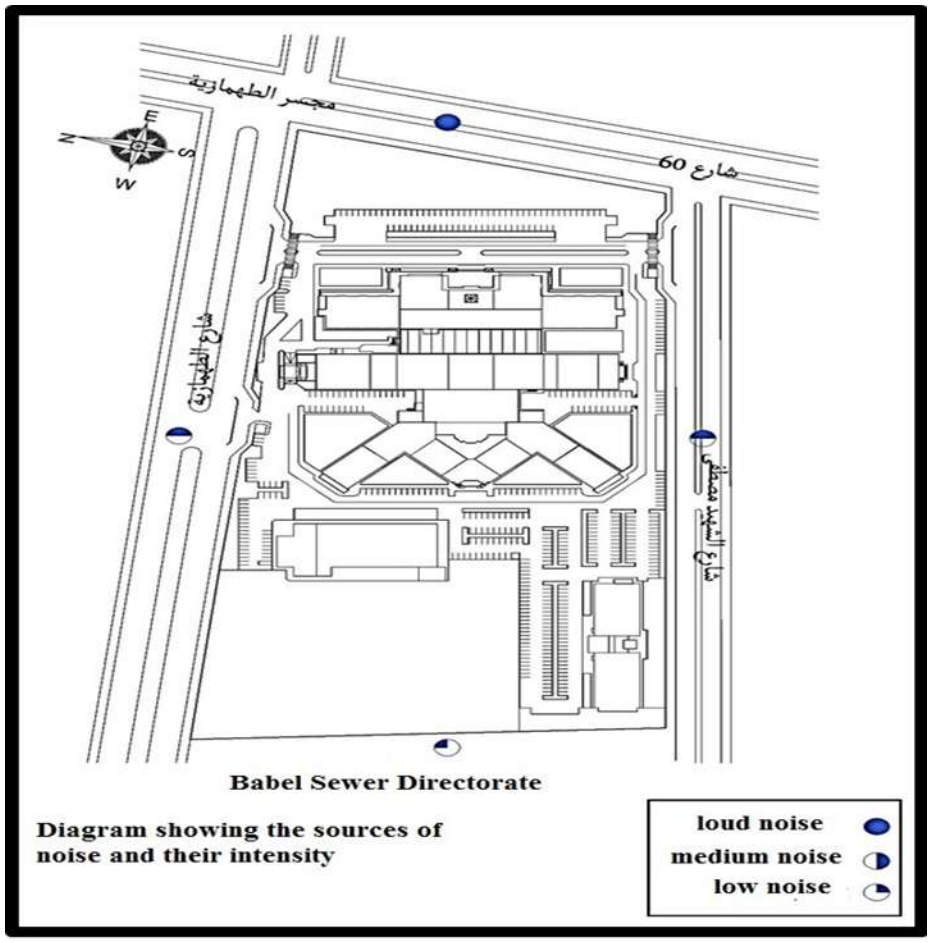
It is one of the government hospitals in Babylon Governorate. The hospital is affiliated to the Iraqi Ministry of Health and was established between (2009-2016). The hospital consists of

492 beds for inpatients, a number of clinics and specialized centers, and 18 operating theaters.

The purpose of choosing Imam Al-Sadiq (peace be upon him) General Hospital to be the case for the study because it is one of the largest hospitals in the city of Hilla to treat all diseases and therefore it must have the latest treatment methods. The Imam Al-Sadiq (peace be upon him) General Hospital has the main medical specialties, where the Imam Al-Sadiq (peace be upon him) General Hospital covers the province of Babylon and its districts and districts and the nearby provinces. This hospital is considered one of the important hospitals in the province of Babylon in terms of capacity and advanced equipment, but when Looking at the green spaces in the hospital as healing spaces, we find that they suffer from neglect and the presence of medical waste and uncultivated areas. All of this creates an unsuitable environment for patients, visitors and staff, so the study aims to shed light on the weaknesses of these green spaces and the need to design and rehabilitate them to be a suitable garden (including On activities and green spaces that help speed recovery) to create an atmosphere of calm and comfort for hospital users. And the stages of work are based on the studies of Imam Al-Sadiq (peace be upon him) General Hospital on two axes (the comprehensive analysis of the external spaces in the hospital and identification of the components of the site; in addition to the analysis of the movement paths, buildings, open spaces and entrances in the hospital - the second axis is reconnaissance and field studies through field survey And personal interviews and questionnaires to elicit and elicit the most important needs of hospital users (patients, visitors and auditors, functional staff) in the hospital garden.Through field surveys, it was found that noise causes inconvenience to users of external spaces in the hospital.

1- Noisy

One of the problems that must be solved in the design is to reduce the noise of cars. As the hospital is surrounded by four streets (4 lines) that are dense with cars, as Street 60 (four lines of heavy traffic for cars).Traffic noise occurs mainly from car engines, but more than 70 km / h, the noise is due to the movement of tires on the roads is one of the main causes of noise, but well paved roads can reduce tire noise. for example ,The noise generated by a car traveling at a speed of 50 km/h is (70dB), and at a speed of 120 km/h is (80dB). For heavy load cars, they cause a large noise rate of 80 decibels at a speed of 50 km / h, and 90 decibels at a speed of 120 km / h. These parameters differ according to the type of cars and their mechanical condition, (Al Hurstani, 2006). figure (10) shows the intensity of the noise surrounding the hospital.



figure(10): shows the intensity of the noise around the hospital
Source: the researcher's work

2- Problems with the current location of the hospital

The location of the hospital is not in line with international standards for selecting hospital locations, and this is considered one of the problems of the current location, which is the location of the hospital, where the location was chosen impromptu .The hospital is located in the center of the city of Hilla between three streets, two of them are main and the other is secondary, and this causes difficulty in reaching the hospital due to overcrowding, and also the presence of these streets causes a lot of noise due to the movement of cars in the street on the Al-Batul Bridge, as well as these streets, they cause pollution with dirt, dust and smoke from cars. As shown in Figure (1).

Figure (1): Pictures showing the location of the hospital

Source: researcher's photo

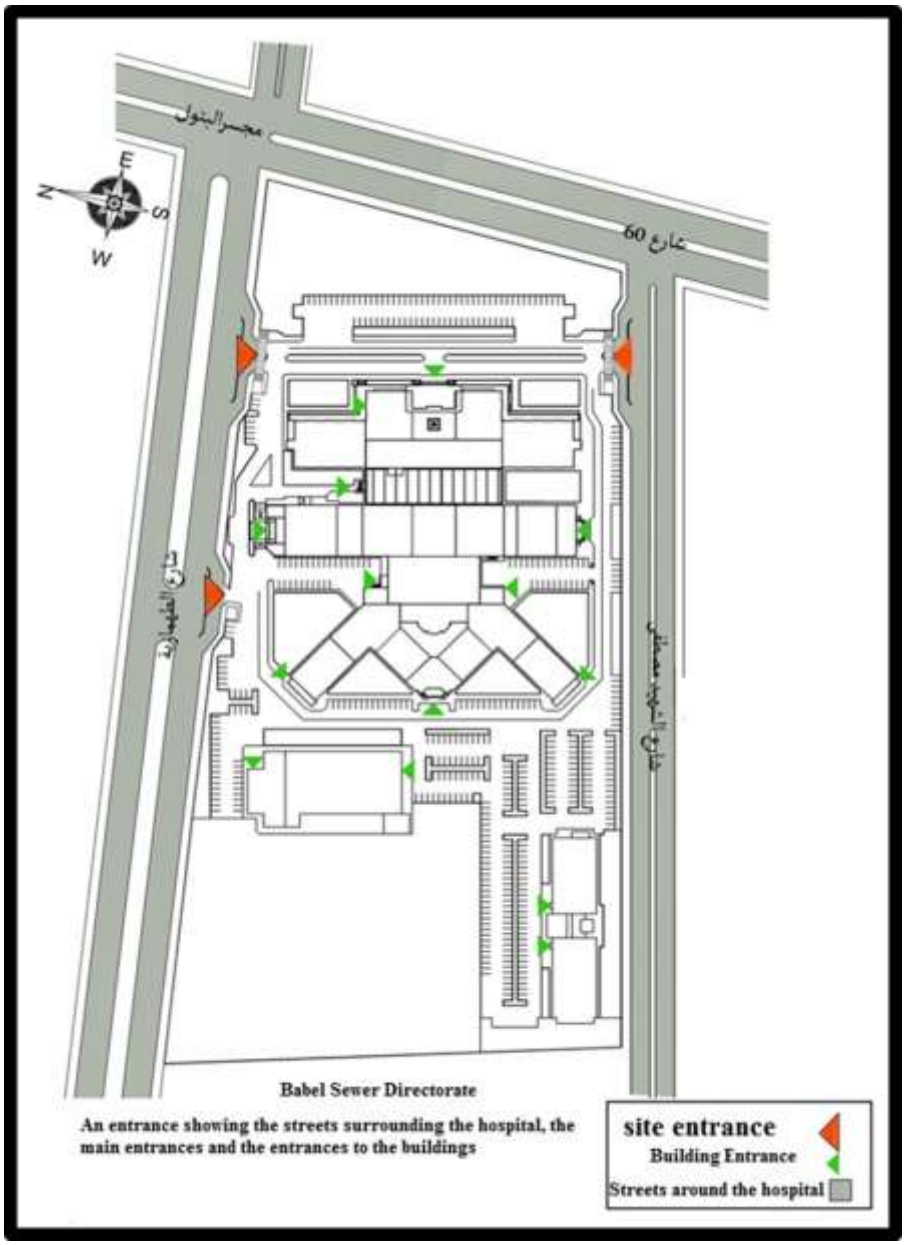
3- Preparing hospital maps and plans

The sources of pollution and their intensity have been determined at the general location of Imam Al-Sadiq (peace be upon him) General Hospital through the location of Imam Al-Sadiq (peace be upon him) General Hospital in the city of Hilla, the center of Babylon Governorate, on Street 60 and the Al-Tahmaziah area, surrounded by streets on three sides, which are:

● Street 60 // It is characterized by a high traffic density of small and large cars, because it connects Baghdad with the southern governorates, contains the Al-Batool Bridge, and borders the hospital from the east.

● Al-Tahmaziah Street // It is bordered on the north side and is characterized by a high traffic density, but it is less than Street 60.

● Al-Shaheed Mustafa Al-Asadi Street // It borders the hospital from the southern side and is characterized by a low traffic density almost, as planned (1)



figure(2): shows the main entrances to the hospital and the secondary entrances to the buildings

Source: the researcher's work

1- Questionnaire

The questionnaire is defined as a set of various questions that are related to each other and in a way that achieves the goal sought by the research in light of the research problem. Also, the questionnaire is a direct communication method and an important tool in design studies because it achieves clarity in answering the questions posed as well as enabling the verification of the validity of information and directing questions to the survey participants according to their culture,The questionnaire is also one of the most important means of collecting data from scientific research for its ability to provide the necessary description of the topical place to be studied, in addition to measuring the different and similar opinions of

the different groups about the components of the garden environment to be studied. The questionnaire was relied on as a statistical method for the ease of inventorying information, providing data and coding it according to the need of the study, in addition to the absence of the need for writing by the target sample, whether it was personal information or research information of interest to the study (Kandilji, 1993 and Khader, 2010). The closed questionnaire (a type of questionnaire that depends on predetermining the answer choices for the question presented for the study) was used so that the required sample members choose the appropriate answers for their personal ideas and that fit with the place of study to be studied, in order to determine the largest possible amount of information required to be provided from This research study. The closed questionnaire was designed and prepared by reviewing many Arab and foreign studies that dealt with this subject, field visit to the study site (hospital gardens), personal interviews with officials, specialists and hospital users, and also by noting the most important problems and obstacles that Al-Imam Al-Sadiq Hospital (pbuh) suffers from.) general.

The results and discussion of the questionnaire

The results of this research study reveal and give us an insight into the opinions and preferences of the users of Imam Al-Sadiq (peace be upon him) General Hospital regarding the external spaces in the hospital, where most of the respondents in the questionnaire were not satisfied with the current situation of the external spaces in the hospital, Where the noise from the four streets around the hospital was not addressed. The users of the gardens expressed their strong desire to have a peaceful, comfortable and beautiful landscape in the design surrounding the hospital, and they felt that this would contribute positively to the psychological and health condition of the hospital users, and would provide the opportunity to spend part of their free time there.

❖ The effect of noise from car traffic on the users of Imam Al-Sadiq (peace be upon him) General Hospital

Undoubtedly, there is noise that results from the movement of cars in the street, whether this movement is in the streets near the hospital or in the internal streets of the hospital. And that this noise affects the users of these gardens.. And to know more about the extent of the effect of this noise on the users of hospital gardens, The results of the study showed that 73.1% of the surveyed patients found that the noise resulting from the movement of cars affects the users of parks in the hospital. While 11.9% of the sick respondents answered (a little) that it affects park users and 14.9% somewhat affects park users. As for the visitors and auditors, 63.9% of the respondents found that the noise resulting from the movement of cars around the hospital affects them negatively. While 22% of the respondents saw that the noise caused by the movement of cars somewhat affects the users of the parks, and 13.9% of the respondents found that the noise affects the users of the parks. The results of the study showed that the hospital staff (doctors, administrators) differed in Estimating the degree of influence of this noise,While 45.5% of them believe that the degree of impact of noise is a lot, and 26.3% believe that this effect is to some extent, compared to 28.5% who see that the effect of noise resulting from the movement of cars outside and inside the hospital is little, as shown in Table (1).

Table (1): The effect of noise generated in the movement of cars outside and inside the hospital on the gardens of Imam Al-Sadiq (peace be upon him) General Hospital

Medical and administrative staff		Visitors		patients		Noise effect
percentage%	number	percentage%	number	percentage %	number	
45.5	41	63.9	55	73.1	49	Much
28.5	26	13.9	12	11.9	8	Little
26.3	24	22.0	19	14.9	10	To some extent
100	91	100	86	100	67	Total

The location plays an important role in the success of any organization, whether it is production or service. And the importance of the location for hospitals increases, where it provides services to a large group of sick citizens who need a suitable place for them in terms of proximity and distance from their homes. The results showed that 82.1% of the sick respondents see the hospital's location as inappropriate.While 17.7% of the respondents consider the patients suitable. As for the auditors and visitors, the results of the questionnaire showed that 66.2% of the auditors and visitors found that the current hospital location is inappropriate due to the difficulty of access, overcrowding, noise and other reasons. While 33.7 % of them answered that the location is appropriate , and this may be due to the proximity of their home . As for the staff (medical and administrative), The results of the study showed that the vast majority of the cadre working in Imam Al-Sadiq (peace be upon him) General Hospital, which represents 83.5%, see the hospital's location as inappropriate, compared to 16.5% of the cadres who see the hospital's location as appropriate, as shown in Table (2).

Table (2): shows the respondents' opinion on the appropriateness of the location of Imam Al-Sadiq (peace be upon him) General Hospital

Medical and administrative staff		Visitors		patients		Convenience
number	percentage %	number	number	percentage %	number	
16.5	15	33.7	29	17.9	12	suitable
83.5	76	66.2	57	82.1	55	inappropriate

100	**91**	**100**	**86**	**100**	**67**	**Total**

❖ The role of gardens in the speedy recovery of patients:

The effect of the presence of gardens in hospitals does not depend on the psychological situation of patients, but rather it increases the speed of patients' recovery. The results of the study showed that 68.6% of patients answered (yes), and 10.4% answered (no).and 20.9% answered (to some extent). The results of the questionnaire showed that 76.7% of the visitors and reviewers found that the presence of gardens in the hospital a lot helps to speed up the recovery of patients. While 18.6% of visitors and auditors believe that gardens to some extent help speed recovery, and 4.6% of them believe that gardens have a small role in the speed of recovery of patients. As for the (medical and administrative) staff, the results of the study showed that 71.4% of the functional staff find that the gardens have an important role in the speed of recovery of patients, while 24.2% of the staff working in the hospital found that the effect of the gardens to some extent helps speed the recovery of patients, And 4.4% of the cadres answered that gardens help a little in the recovery of patients, as shown in Table (3).

Table (3): shows the role of the gardens of Imam Al-Sadiq (peace be upon him) General Hospital in the speed of the patient's recovery

Medical and administrative staff		**Visitors**		**patients**		**The role of the gardens**
number	**percentage%**	**numbe r**	**numbe r**	**percentage %**	**numbe r**	**in the speed of recovery**
71.4	**65**	**76.7**	**66**	**68.7**	**46**	**Much**
4.4	**4**	**4.6**	**4**	**10.4**	**7**	**Little**
24.2	**22**	**18.6**	**16**	**20.9**	**14**	**To some extent**
100	**91**	**100**	**86**	**100**	**67**	**Total**

Third: Develop solutions and design proposals to reduce noise

The following design was proposed to reduce the noise and wind in various directions by making windbreaks around the hospital. Since the front garden is adjacent to the main noise source, 60th Street, several rows of evergreen trees were proposed to reduce the noise effect. Also, on the northern side adjacent to Al-Tahmaziah Street, as the secondary source of noise, we did not suggest several rows along the road due to the lack of sufficient areas designated for planting trees, except for the part adjacent to the front garden and the garden of future expansion. As for the southern side, it has been proposed to plant one line of deciduous trees (the rosary) interspersed with evergreen trees at regular intervals in order to form a coherent and coherent framework of tree lines in the mixed design and irregular in the natural design in order to allow the sun's rays to enter the southern gardens, Especially in the morning time and the prevailing winds of the region are northwest, so several rows of evergreen trees and a lake of water with a fountain pumping water to a high altitude were suggested in the face of these winds.

Figure (49): The natural design proposal for the entire site

Source: the researcher's work

Recommendations

1- Taking the necessary means to reduce noise by planting lines of trees and shrubs around the hospital.

2- Determining the speed of the movement of cars by placing alarm clocks near the hospital and also trying as much as possible to divert the movement of cars to Street 80.

3- Planting lines of dense trees in front of the hospital walls from the outside, due to their environmental importance and also to reduce the intensity of noise.

4- Building the hospital walls from materials that absorb noise, in addition to increasing the height of the walls.

5- Pay attention to the covering of 60th Street well, because the friction of tires with asphalt is a major cause of noise.

6- Accountability by traffic police for the safety and repair of car engines due to the noise caused by tired engines.

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