

The Potential of Being the Quiet Place of the Khans Courtyards in Istanbul Historic Peninsula

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ABSTRACT

The importance of noise from transport and industrial sources on human health were emphasized by Environmental Noise Directive. As well as actions to minimize the impact of this noise on human, the directive impresses on the need to protect quiet areas having good environmental noise quality. Therefore, studies on identification, determination and utilization of quiet areas in urban and rural contexts have increased in many countries in Europe. Sound environments in historic city centres consist of different sounds from dense tourism, trade, entertainment, recreation etc.; consequently, the noise problem is inevitable. Quiet areas enable people get away from noise and reduce the adverse effects of it by providing opportunities for rest, relaxation and restoration to them. In this paper, the khans courtyards in Istanbul Historic Peninsula (Turkey) were considered as potential Quiet Places. Noise measurements, soundscape recordings with soundwalk method, observations and surveys were realized to determine quantitative and qualitative quietness in the courtyards. The paper reports the preliminary results of the Quiet Place perception in Turkey, and it reveals that the inner courtyard is a protected place against the outside noise sources, but it is necessary to take measure for the noise sources inside the courtyard.

Keywords: Quiet places, Courtyard, Khan

1. INTRODUCTION

In 1970's, Schaffer attracted attention to the issue that open areas should be quiet. He mentioned that sounds might be more clearly heard and distinguished in quiet areas with low noise level, and therefore such areas identified as hi-fi (high fidelity) had required/preferred sound environment (1). Besides, quietness/tranquility properties of open areas have been a subject to academic studies in terms of contribution to mental renewal in psychology (2,3). Nevertheless, it is possible to tell that the number of studies related to quiet areas significantly increased with the introduction of Directive 2002/49/EC in 2002 in member countries.

In the Directive on the Assessment and Management of Environmental Noise 2002/49/EC which is in force in Europe, the quiet area in urban environments are referred as “quite area in agglomeration and defined as “an area, delimited by the competent authority, for instance which is not exposed to a value of L_{den} or of another appropriate noise indicator greater than a certain value set by the Member State, from any noise source” (4). Several recommendations (L_{day} 45-55 dB) are made in the studies conducted regarding the limit values mentioned in the Directive (5). However, it would not be quite right to assess the potential of areas being quiet only over the limit values. Because social, cultural, economic differences, local characteristics like the urban history and cultural heritage (6) and properties like biodiversity and different nature forms affect the annoyance and quietness/tranquility perception (7). Moreover, even if the sound pressure levels in courtyards are above these limit values, these areas may have a refreshing effect and a potential to be a quiet area due to the difference of sound pressure level between the inside and outside of such areas (8) and to their effects on the Restorativeness (9). Courtyards do not only offer a visually aesthetic aspect when viewed from the

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buildings, but they may also be used as places for activities such as refreshing, relaxing, reading a book, sunbathing, contacting people around as an area with lower levels of environmental noise (9). Additionally, spending time in quiet areas such as parks, gardens and courtyards may allow people to get mentally refreshed by walking away from the busy and stressful city life (1).

In this study, the potential of using the public courtyards in urban areas as quiet areas which would allow people to walk away from the noise of the city and get mentally refreshed is evaluated by addressing over the courtyards of historical khans in the Historical Peninsula of Istanbul.

2. METHODOLOGY

In this study, field surveys were performed in the courtyards of 5 selected khan buildings to study the quietness potential of historical khan courtyards in Historical Peninsula of Istanbul. In field surveys, noise measurements and sound recordings as well as observations and questionnaires, were conducted for the objective and subjective assessment of quietness.

2.1 Area Selection and Observation

While khan buildings to be studied were selected from the commercial and touristic region concentrated around Grand Bazaar located in Eminönü-Beyazıt which used to be the center of trade of Historical Peninsula of Istanbul during Ottoman Empire Era, the extent of the open areas of use of khan courtyards, functions in the courtyard and the type of transportation around them were taken into account. Five khans were selected in total; three with an area greater than 500 m² which did not get crowded by retail trade within the courtyard were connected to pedestrianized areas (1. Balkapanı Khan, 2. Büyük Valide Khan and 3. Büyük Yeni Khan) and two were directly connected to a road with vehicle traffic (4. Vezir Khan, 5. Taş Khan) (Figure 1).

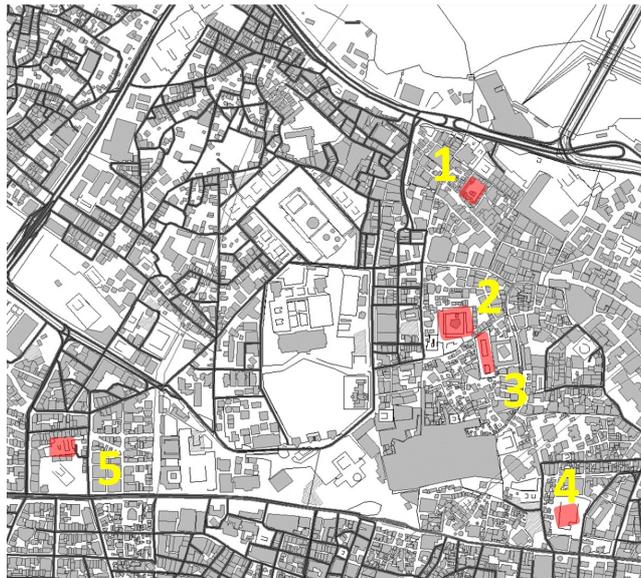


Figure 1 – Map indicating the courtyards selected in the historical peninsula - 1. Balkapanı Khan, 2. Büyük Valide Khan and 3. Büyük Yeni Khan, 4. Vezir Khan, 5. Taş Khan. (map source: Hidro-tek LLC)

Following the selection of the areas, observations were conducted to investigate the matters such as the size of the area, attributes of the entrance, opportunity of free entrance to the areas, activities in the region, water factor in the courtyard, cultural elements, presence of plants, sources of sound within and outside the courtyard.

2.2 Sound Level Measurements and Sound Recordings

To determine the sound pressure level within and outside the courtyard, as well as their differences, measurements and recordings in the area were conducted according to and by developing the method used by Maffei, Masullo and Oliviero in the study for the determination of quiet areas in historical places (8, 9) (Figure 2).

The measurements and recordings were performed twice a day, one in the morning and one in the afternoon, and they were taken on point basis within the courtyard (min 3 min. per point) and by using soundwalk method outside the courtyard.

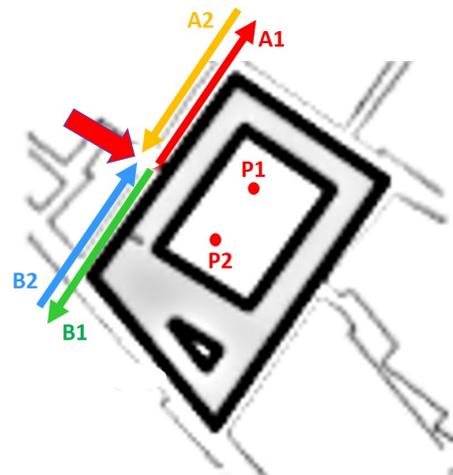


Figure 2 - Map indicating the measuring points within the courtyard for Balkapani Khan and the soundwalk routes for measurements outside the courtyard (map source: Hidro-tek LLC)

2.3 Questionnaire

In this study, questionnaires were conducted to understand how quietness potential of courtyards were assessed subjectively. Questionnaires were prepared to question personal information, noise sensitivity, mental refreshment status and the annoyance status based on the type of sound. The questionnaire also includes a significant different test created by using the adjective pairs to understand how the areas were defined subjectively. Questionnaires were performed simultaneously with noise level measurements and sound recordings in the participant group mainly consisting of khan employees and tourists.

3. STUDY AREAS-COURTYARDS OF KHANS

In this section, information related to the physical status and the usage of khan courtyards obtained through literature search and observations conducted in the area are given in order as follows.

1. Balkapani Khan: The area of the courtyard of the two-story historical building constructed in 16th century is 1000 m². The entrance gate of the building opens to a pedestrianized road with a busy retail commerce flow. Therefore, the outdoor noises consist of noises originating from trading (shopping noise, airplay) and transportation (sound of steps, handcarts and engine) as well as human voice. It is free to enter the courtyard from morning until evening (08.00 am - 06.00 pm). The entrance gate of the courtyard is kept open during use. The entrance of the courtyard allows direct access to the courtyard for pedestrians; however, it is not suitable for vehicle entry (Figure 3). There are business units (mostly wholesalers), catering units and production workshops in the courtyard of the building. There is a small masjid in the middle of the courtyard and there are several small tree saplings, ivy and potted plants inside. Sound environment within the courtyard results from the trade (shopping sounds, noise of the handcart, noises of eating and drinking) and religious use (adhan and preaching) as well as human actions.



Figure 3 - Balkapani Khan entrance gate and views inside the courtyard.

2. Büyük Valide Khan: The two-story historical building constructed in the 17th century has two separate courtyards currently in use which have an area of approximately 100 m² and 3000 m². The entrance gate of the building opens to a pedestrianized road with a busy retail commerce flow as in Balkapanı Khan and thus the outdoor noise sources are similar. It is free to enter the courtyard from morning until evening (08.00 am - 06.00 pm). The entrance gate of the courtyard is kept open during use. The entrance of the courtyard is positioned to allow direct pedestrian access to the small courtyard. The larger courtyard is accessed through the small courtyard. At certain hours, vehicle entry to the courtyard is allowed. In the courtyard of the building there are business units and warehouses (mostly wholesalers) as well as a masjid in the middle. Perennial trees and potted plants and flowers were planted in the courtyard (Figure 4). Sound environment within the courtyard consists of sounds arising from trade (wholesale sounds, handcart sounds), human actions, other living things (birds singing) and religious use (adhan).



Figure 4 - Büyük Valide Khan entrance gate and views inside the courtyard.

3. Büyük Yeni Khan: The three-story historical building constructed in the 18th century has two separate courtyards currently in use which have an area of approximately 600 m² and 300 m². The main entrance of the building is on the same axis with the Balkanapanı Khan and Büyük Valide Khan, and therefore the outdoor noise sources are similar with the other two khans. It is free to enter the courtyard from morning until evening (08.00 am - 06.00 pm). The entrance gate of the courtyard is kept open during use. The entrance of the courtyard is positioned to allow direct pedestrian access to the larger courtyard. The small courtyard is accessed through the larger courtyard. At certain hours, vehicle entry to the courtyard is allowed. There are business units (mostly wholesalers), production workshops and warehouses. Most of the enclosed spaces upstairs are not in use. There are big trees, potted plants and flowers as well as a fountain (Figure 5). Sound sources within the courtyard consist of trade sounds (wholesale trade sounds, handcart sounds), production noises (hammer sounds, tapping), natural sounds (bird singing and water) and human noises.



Figure 5 - Büyük Yeni Khan entrance gate and views inside the courtyard.

4. Vezir Khan: The area of the courtyard of the two-story historical building constructed in 17th century is 2700 m². The entrance gate of the building opens to the road with vehicle traffic and which connects Divanyolu, the main trade and tourism axis of the region, to Grand Bazaar. Therefore, the outdoor noise environment consists of sounds arising from transportation (vehicle sound, horn sound, tramway sound, motorcycle sound, siren sound) trade (shopping sound, airplay, handcart sound) and human actions. It is free to enter the courtyard from morning until evening (08.00 am - 06.00 pm). The entrance gate of the courtyard is kept open during use. A 25 m distance occurred between the road and the courtyard due to the buildings constructed subsequently to perimeter of the khan walls. This

distance has turned into a covert transition area which constitutes a buffer between the road and the courtyard in terms of acoustics. This transition area is suitable for vehicle passage and this causes the courtyard to be use as parking space. Thus, those working in the area share the space used with the car park users. There are business units (mostly wholesalers), production workshops and warehouses. There are a few perennial trees in the courtyard (Figure 6). The sound sources within the courtyard consist of sounds arising from trade (shopping sound, handcart sound), production (hammer sound, machinery sound, air-conditioner fans, compressors, etc.), car park use (vehicle sound, horns), human actions as well as natural sounds (bird singing and wind).



Figure 6 - Vezir Khan entrance gate and views inside the courtyard.

5. *Taş Khan*: The two-story historical building constructed in the 18th century has two separate courtyards currently in use which have an area of approximately 450 m² and 60 m². Both courtyards are accessed through 2 separate roads open to vehicle traffic. The outdoor noise sources exhibit similarities with Vezir Khan. The larger courtyard is accessed through a closed transition area of approximately 45 m which constitutes a buffer area between the road and the courtyard in terms of acoustics and the small courtyard is accessed through the transition area of approximately 20 m. These transition areas are not suitable for vehicle passage. In the courtyard of the building there are clothing shops that rather serve to tourists, various business units and a restaurant in the basement which is accessed from the courtyard. Tourists join in the employees in the use of courtyard. There are trees, plants, flowers and a decorative pool (Figure 7). The sound environment within the courtyard consists of sounds arising from trade (sounds from the conversations between tourists and shopkeepers, shopping sound) and human actions as well as natural sounds (bird singing, water).



Figure 7 - Taş Khan entrance gates and a view inside the courtyard.

4. FINDINGS

4.1 Measurement Results

As result of the analysis of acoustic data obtained through he measurements and sound recordings at the points and on the routes in study areas, the L_{A10} , L_{Aeq} and L_{A90} values which indicate the sound pressure levels inside and outside the courtyard in the morning and in the afternoon are given in Table 1. Point measurement values inside the courtyard and route measurement values outside the courtyard were calculated by taking separate averages for their statuses in the morning and in the afternoon.

In the morning, while mean L_{Aeq} value measured inside 5 courtyards is 55 dB, mean L_{Aeq} value measured outside 5 courtyards was calculated as 60 dB. In the afternoon, while mean L_{Aeq} value measured inside 5 courtyards is 59 dB, mean L_{Aeq} value measured outside 5 courtyards was 66 dB.

Table 1 - Sound pressure levels measured inside and outside the courtyards (dBA)

time		1.Balkapanı Khan		2.Büyük Valide Khan		3.Büyük Yeni Khan		4.Vezir Khan		5.Taş Khan	
		inside	outside	inside	outside	inside	outside	inside	outside	inside	outside
Morning	L _A	inside	outside	inside	outside	inside	outside	inside	outside	inside	outside
	L _{A10}	56.88	72.73	63.48	71.61	67.61	68.5	61.67	76.87	49.56	69.99
	L _{Aeq}	60.09	61.72	51.42	52.55	60.01	58.66	57.75	63.78	48.5	61.15
	L _{A90}	48.87	59.14	51.7	56.61	55.95	55.23	55.98	60.21	44.63	58.47
Afternoon	L _A	inside	outside	inside	outside	inside	outside	inside	outside	inside	outside
	L _{A10}	60.85	69.36	62.77	73.33	62.66	73.64	65.59	78.51	66.62	71.03
	L _{Aeq}	58.47	66.07	60.53	66.13	60.54	67.54	62.29	64.43	53.52	64.18
	L _{A90}	53	60.26	50.93	60.77	55.43	61.96	59.58	62.35	45.93	58.87

Findings related to Sound Pressure Level:

Inside the courtyards, except for Balkapanı Khan, the levels measured in the afternoon were higher than the morning. The levels outside had increased parallel to the expectations with the increase in the volume of use in the afternoon. The reason for the deviation of Balkapanı Khan from general is the preaching, which is of the religious activities, performed during the measurements.

The L_{Aeq} values outside the courtyards were measured close to each other; however, the indoors values differ from one courtyard to another. According to this; Taş Khan has the lowest indoor noise. It is followed by Büyük Valide Khan, Balkapanı Khan, Büyük Yeni Khan and Vezir Khan, respectively. The main factors increasing the level indoors are the penetration of sounds outdoor and/or the diversity of the sound sources indoors. Two- or three-story courtyard walls serve as a barrier between the inside and outside; however, the spaces on the gates providing transition between inside and outside the courtyard facilitate the penetration of the outdoor noises. Therefore, the physical quality of the transition gains importance. For example, the buffer area which is passed to reach the courtyard has an impact on the lower levels in the courtyard of Taş Khan compared to other courtyards. In addition to this, the number and diversity of indoor sound recordings of Taş Khan is fewer than other courtyards.

Findings related to Sound Pressure Level Changes:

The differences between L_{Aeq} values inside the courtyards and L_{Aeq} values outside vary depending on the *time of the day and the courtyards* (Table 2). In some cases, while level inside was measured 13 dB lower than outside (Taş Khan), there were instances where the level inside exceeded the level outside (Büyük Yeni Khan).

The difference of level between the inside and the outside of the courtyards according to the time of the day basically varies based on the usage intensities. In Balkapanı Khan, Büyük Valide Khan and Büyük Yeni Khan, the level differences between the inside and outside exhibited an increase in the afternoon. Although the intensity of use in these three courtyards indicate a significant difference based on the time of the day, this arises from the significant increase in the intensity of use outside in the afternoon. Car park use outside Vezir Khan and retail sales activities for tourists in the courtyard of Taş Khan intensifies in the afternoon parallel to the outdoor environment. For this reason, the level difference between inside and outside in the morning in these two khans is higher than the afternoon.

The physical properties of courtyard entrance and the diversity and number of noise sources inside the courtyard have an impact on the level differences between the inside and outside *varying by the courtyards*. The difference between the inside and outside of Taş Khan's courtyard is higher than other courtyards. This results from the impact of acoustic buffer area located between the courtyard of Taş Khan and outside. Likewise, there is a buffer area at the transit to the courtyard of Vezir Khan, however due to the busy use of car park within the courtyard in the afternoon, the level inside increased more compared to Taş Khan. This instance caused the decrease between the level difference between inside and outside:

Table 2 - Sound pressure level differences between outside and inside the courtyards (dBA)

Time	1.Balkapanı Khan		2.Büyük Valide Khan		3.Büyük Yeni Khan		4.Vezir Khan		5.Taş Khan	
	M	A	M	A	M	A	M	A	M	A
L _{A10}	15.85	8.51	8.13	10.56	0.89	10.98	15.2	12.92	20.43	4.41
L _{Aeq}	1.63	7.6	1.13	5.6	-1.35	7	6.03	2.14	12.65	10.66
L _{A90}	10.27	7.26	4.91	9.84	-0.72	6.53	4.23	2.77	13.84	12.94

4.2 Questionnaire results

As result of the questionnaires, conducted simultaneously with the field measurements in khan courtyards, it was determined that khan courtyards were mostly used by the people working in the area and that they came to the khans almost every day.

According to the questionnaire results:

- All courtyards were assessed as substantially “quiet/tranquil” (except for Vezir Khan and Taş Khan - between 71% and 85%) and “relaxing” (except for Vezir Khan - between 86% and 100%). Taş Khan was found “quiet/tranquil” and “relaxing” by 100%. The courtyard of Vezir Khan was found 56% “tranquil” and 28% “relaxing”.
- In the sound environment assessment of all courtyards, the type of the sound sources and their relaxing effect had an impact as well as the sound levels within the courtyard. The majority of the sounds affecting the sound environment within the courtyard was found “relaxing”, or to the contrary, if most of the sounds are “annoying” the sound environment was assessed as “annoying”.
- In general, there were natural sounds (such as bird singing, wind) and soundmarks of the area (adhan, water, etc.) in the courtyards, and the mechanical noises (fan noises, vehicle noises, etc.) were found “annoying”. Accordingly, denser trees and plants in Taş Khan caused the sound environment to be assessed positively and denser mechanical sounds in Vezir Khan due to functions inside the khan and the use of courtyard lead to a negative assessment of the sound environment.
- In the assessment of all courtyards, it was determined that the soundmarks defined for the areas had an impact.
- Besides, the presence of tree, plant and water elements in the courtyards as well as the historical and cultural values were considered as characteristics which might have positive effects on the quietness perception.

4.3 Evaluation

Based on the findings related to sound pressure level obtained in field measurements; the order from quiet to noisy is as follows: Taş Khan, Büyük Valide Khan, Balkapanı Khan, Büyük Yeni Khan and Vezir Khan.

According to the findings related to the sound pressure level changes, the level difference between indoors and outdoors in the morning in descending order was Taş Khan, Vezir Khan, Balkapanı Khan, Büyük Valide Khan, Büyük Yeni Khan and Taş Khan, Balkapanı Khan, Büyük Yeni Khan, Büyük Valide Khan and Vezir Khan in the afternoon.

According to the observations in the area; Taş Khan courtyard has the smaller number of sound sources and types indoors and it mainly houses natural sounds in the sound environment. Vezir Khan has the most number and type of sound sources indoors, and majority of the sound sources are artificial and mechanical sounds.

Based on the data of the questionnaire conducted in the area; the most “quiet/tranquil” courtyard is in Taş Khan as per the subjective assessments, while the least “relaxing” courtyard was agreed to be the one of Vezir Khan. Although the noise levels in the three courtyards other than these two are above the acceptable limits (45-55 dB), (51-60 dB) they were subjectively assessed as substantially “quiet/tranquil” and “relaxing”.

According to the overall assessment; the courtyards with the highest potential of being “quiet/tranquil” and “relaxing” have characteristics such as low L_{Aeq} value; high difference in the level between inside and outside; low type and number of sources; indoor sound environment mostly

consisting of natural sounds; incorporating natural elements such as trees, plants and water as well as cultural values: and presence of an acoustic buffer area in the transition between inside and outside.

5. CONCLUSIONS

The quietness potential of courtyards of the buildings located in the regions, which are crowded especially due to trade and touristic activities in the historical city centers, may be defined clearly in connection with the lowness of sound pressure level. With this field survey, findings indicating that the perception of quietness varied depending on the characteristics such as noise level as well as the noise level difference (*outdoor - indoor*), the type and number of indoor noise sources, the architecture of the place, the presence of natural and cultural fittings indoors (tree, plant, flower and water elements, historical and cultural values) were obtained. Based on the findings, it is planned to develop the study conducted within the scope of assessing the quietness potential of the areas in historical city center and designing new quiet areas in such environments.

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