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A landscape study of tourist resort at Darbandikhan Lake according to the environmental and recreational needs

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ABSTRACT

From October 10, 2021 to July 10, 2022 this research was done to design a tourist resort in Bani quein and the island at Darbandikhan Lake. The location is 230 km northeast of Baghdad. Globally it is at latitude 35° 06 '58' -35° 21 '07' N, and longitude 45° 40 '59' - 45° 44 '42' E. The information of the research was collected according to four methods of data collection. First method was personal observation through several visits to the sites at different times. The second was an analysis of architectural plans obtained from the site. The third was in personal interviews with specialists in the directorate of Municipality and Tourism in the town of Darbandikhan. The fourth method to collect information was done via a questionnaire form. The study reached several results, among the favorite recreational activities of residents and tourists, presence of a special area for families was at the rate of 95%. Children area was at the second rank which was 94%, places for viewing, insight, and marketing of cultural and industrial products, boating activity and walking activity were 93% 89.9% and 84% at third, fourth and fifth rank respectively. According to these needs, two tourist resorts were proposed. In addition to studying the environmental factors in the city, the most important negative aspects of the climate were taken into account due to the lack of humidity (17%) and the high temperature above (40 C⁰) during the summer months and vice versa during the winter months, the temperature drops to (0 C⁰).

KEY WORDS:

Tourist Resort, Darbandikhan Lake, Recreational Activity, Tourist Resort Design, Landscape Design

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دراسة الفضاءات الطبيعية لمنتج سياحي عند بحيرة دربندخان وفقا للاحتياجات البيئية والترفيهية

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الخلاصة

تم إجراء البحث خلال الفترة من 10 أكتوبر 2021 إلى 10 يوليو 2022. وكان الهدف تصميم منتج سياحي في بني قوين وجزيرة في بحيرة دربندخان. يقع الموقع على بعد 230 كم شمال شرق بغداد. عالمياً عند خط العرض 35° 35' 06" وخط الطول 45° 42' 44" E 45° 59' 40" O. تم جمع المعلومات البحثية وفق أربع طرق لجمع البيانات. هذه الأساليب هي ملاحظات شخصية من خلال عدة زيارات للمواقع في أوقات مختلفة. والثاني هو تحليل المخططات المعمارية التي تم الحصول عليها من الموقع. والثالث في مقابلات شخصية مع مختصين في مديرية البلدية والسياحة في مدينة دربندخان. الطريقة الرابعة لجمع المعلومات تمت عبر استمارة استبيان. توصلت الدراسة إلى عدة نتائج ، من بين الأنشطة الترفيهية المفضلة للمقيمين والسياح وجود منطقة خاصة للأسرة بنسبة 95%. كما احتلت منطقة الأطفال المرتبة الثانية بنسبة 94% ، وأماكن مشاهدة وتبصر وتسويق المنتجات الثقافية والصناعية ، ونشاط القوارب ونشاط المشي 93% و 89.9% و 84% في المرتبة الثالثة والرابعة والخامسة على التوالي. ووفقا لهذه الاحتياجات فقد تم اقتراح مخططين سياحيين لموقعي الدراسة. بالإضافة إلى دراسة العوامل البيئية في المدينة ، فقد تم أخذ أهم الجوانب السلبية للمناخ في الاعتبار بسبب قلة الرطوبة (17%) وارتفاع درجة الحرارة فوق (40 درجة مئوية) خلال أشهر الصيف والعكس صحيح. خلال أشهر الشتاء تنخفض درجة الحرارة إلى (0 درجة مئوية).

الكلمات المفتاحية: بحيرة دربندخان ، منتج سياحي ، البيانات.

INTRODUCTION

The term "tourism" is derived from the Latin word "torrance," which means, "to travel, a journey between origin and destination," and the English word is "tour," which means, "ramble." (Murray, et al., 1970). Humans, as tourists may come out of habitats for different purposes. Papoli Yazdi, (2014) classifies the various forms of tourism according to the location: Urban travel, nomadic, tribal tourism, and rural tourism. Environmental tourism, mountain tourism, coastal and seaside tourist, and aerospace tourism (Papoli Yazdi and Saqai, 2014). These days, "marine and coastal tourism are one of the fastest-growing areas within the world's largest industry (Hall, 2001). Today resorts are classified in a multitude of ways, ranging from location-/destination-specific resorts to activity-specific resorts. A resort is defined as a physical location where several tourism-related elements occur to create a cluster of activities, often in attractive locations such as coastal areas, it can be found in mountainous, rural, or city locations' (Page and Connell, 2014). The landscape has an extremely important role in attracting tourists (Guo *et al.*, 2021). Every year, millions of people travel for recreational purposes across the world; Investors, designers, and people working in the tourism sector are faced with a more selective and environmentally conscious tourist mass. For this reason, a successful landscape design increases the quality of tourism facilities (Oğuz, Diriöz and Belkayal, 2010). Resorts are built amid natural splendors, and success depends upon how well the design is integrated into the setting, many internal factors can affect a resort's ability to develop and maintain competitiveness. One such factor is the immediate environment and therefore owns the landscape of the place (Uchechukwu and Enwin, 2021). The designer should gather the relevant information regarding the place, such as Natural resources, Man-made elements, and Natural forces, before selecting the green space sites including both the macro- and micro-climates (Rutledge, 1971). Tour for recreational purposes is not a new phenomenon (Adler, 1989).

The center of resort attractions is recreation space (Hassan, Sheta and El Kordy, 2020). Recreation contains a wide range of activities (Ferguson *et al.*, 2016). Inland and marine waterways are increasingly being used for recreation in various nations across the world. These activities vary from non-contact with water directly like fishing, strolling, birding, and picnicking to whole-body water contact sports like swimming, surfing, and slalom canoeing (WHO, 2013). A site must fulfill some requirements to be developed into a tourist resort such as water conditions must be of a high enough standard for people to make full use of these resources, needs to be big enough to hold a lot of people without being crowded or congested, big enough for future growth, and should be attractive; for instance, it can have a more rural environment than an urban one, which is better for leisure and relaxation. The climate of the tourist resort should allow the use of the site and outdoor recreation facilities for a major portion of the year and conveniently accessible to a relatively large number of visitors by air and other modes of transportation (Gary, 1999) Darbandikhan lake has the more suitable sites for tourist resorts because of the combination of water, beautiful scenery, and comfortable weather. For this reason, it was decided to research and study to investigate the design of tourist resorts at Bani Quein and its island at the Darbandikhan lake in Kurdistan in the northern part of Iraq. The problem of this research is Generally, the problems arise from the negligence of the tourist sites especially tourist resorts and recreational areas in Kurdistan region despite having most of the interests areas that are suitable to become tourist resorts. The problem of this research appears in the following points, the lack of previous research studies on the landscape design process for creating a tourist resort in Iraq generally and Kurdistan region especially. The lack of previous studies on how to change a suitable area that has been neglected to tourist resorts and a lack of environmental awareness of the tourist sites. The research objectives, planning and designing tourist resorts in Kurdistan region in Iraq that contain natural beautiful landscapes, through developing a detailed design for the site, depending on the environmental conditions in the area and the entertainment needs of the city residents, and developing of alternative designs to raise the efficiency of the tourist resorts and to serving tourists.

MATERIALS AND METHODS

The research was conducted in two non-designed sites at the edge of Darbandikhan lake near Darbandikhan town in the southeast of Sulaimani city. Darbandikhan lake is one of the three large lakes in Kurdistan, northern Iraq, 230 km northeast of Baghdad and 60 km southeast of Sulaimani city. It is confined to latitude 35° 06' 58" -35° 21' 07" N, and longitudes 45° 40' 59"-45° 44' 42" E as shown in fig (2).

The First Sample (First Site) is Bani Quein

This area is located in the southeastern side of Sulaimani city and east of Darbandikhan town at the edge of Darbandikhan dam, with an area of 40 acres. Bani Quein is just 20 meters away from the main road on the other 4,600 m away from the town center. The highest water level at Darbandikhan lake is 485m and the lowest is 457m, while Bani Quein 490m above the sea level.

The Second Sample (Second Site) is Island

The island is one of the most interesting areas in Kurdistan and has beautiful scenery, located on the Darbandikhan lake with an area of 91 acres. The island is 900m away from the main road, and 5,400m away from the town center. The highest water level at Darbandikhan lake is 485m and the lowest is 457m, while the island is 520m above sea level.

Data Collection

A study is conducted to set accurate information about the site sample, from Oct 10th, 2021 to Jul 10th, 2022, using four methods of data collection: personal observation, interviews with officials, analysis of architectural designs, and questionnaires with residents and tourists.

1-Observation

To develop the tourist resorts designs for Bani Quein and its island, the two sites were visited several times to collect information and take data about the sites, which included:

1. Site survey.
2. The actual area that is allocated to the tourist resort.
3. Determine location and elevation directions.
4. Study the natural ingredients present at the sites.
5. Water source
6. Soil test.
7. Gathering Environmental information about the site

After collected information about the sites, in the first step assemble the base plan and determining the topography of the site as shown in fig (4). Then, conduct a site analysis and determining the orientation with the prevailing wind direction of both sites. In the third step, drawing a bubble diagram and determining each public, private, activity, playground, and utility area. As shown in Fig (5).

2-Analysis of the architecture plans: Although there are no previous plans or designs for the study sites, it is essential to create an appropriate layout and design for the study sites. However, Bani Quein was designed as a tourist resort in the past by an Emirati designer, and most of the work has been completed. But due to administrative issues, this project has stopped, and cannot see the design master plan at the directorate of Darbandikhan tourism because of copyright.

3-Personal interviews: The information was collected from specialists, directors, engineers, and supervisors of each Darbandikhan municipality, along with the directors of tourism in Darbandikhan, who gave useful information.

4-Questionnaires: The questionnaire was the most important method that has a direct relation between designer and client. For this purpose, distributed (153) forms in two ways: the first one to city residents and tourists at the sites directly (Questionnaires form as a Appendix 1) and secondly sharing through the Internet to some special people from October 10th, 2021 to July10th, 2022.

Environmental factors of the site:

Environmental conditions play an important role in the planning and designs of the tourist resort and their differences from one region to another. There is one difference in design processors, natural and physical components for the site. Whatever the conditions of climate and type, when planning and design, the designer's goal is to create an atmosphere that is suitable for human living, and they do this by using various climatic controls, design processors, and the selection of suitable natural and physical elements (Dahl and Molnar, 2003). Environmental factors include climate and soil.

A.Climate factors: Climate information was collected on the study site from Darbandikhan dam directorate at Darbandikhan, which included data for 20 consecutive years (2000-2020) of temperature, the amount of precipitation, and 10 consecutive years (2010-2020) of winds and humidity (Table 1).

1. Precipitation: The rainfall in the study area is mostly in the form of rain, sometimes it snows in December, there are a few cases of hail in March and April. annual precipitation is 667 mm.

2. Temperature: The study area is characterized by large differences between temperatures during winter and summer. The temperature rises clearly from the beginning of May to a maximum during July, then decreases, but the cold period begins in the middle of November, reaches its minimum during January and then rises at the beginning of March. The daily maximum temperature may approach 40 °C in hot summer periods, while the minimum daily temperature can drop to below zero in the cold winter (Azeez, Ahmad and Karim, 2020). The average annual temperature in Darbandikhan Lake was 22.4 °C.

3. Humidity: July and August, with an average relative humidity of 17%, are the least humid months. And February is the most humid month in Darbandikhan, with an average relative humidity of 63%

4. Wind: The most important winds that should be taken into account are the northern and northeastern winds, which are the prevailing winds in the area. One of their characteristics is that it is dry and hot in the summer, the windiest month (with the highest average wind speed) is June (9.3km/h). The calmest month (with the lowest average wind speed) is November (6km/h).

5. Solar radiation: June has the longest days of the year in Darbandikhan, with an average of 14.5h of daylight. December has the shortest days of the year in Darbandikhan, with an average of 9.8h of daylight.

6. The comfort zone: Olgyay, (1973) chose the period, which fell between 21 and 27 degrees Celsius, with a relative humidity of 30 to 70 percent and movement of air, sun, and shade. (It was the time of day when a person feels entirely at ease and does not experience any discomfort in his actions.) (Olgyay, 1973). There are no months of the year that fall completely into the field of thermal comfort. As shown in fig (1), the proportion of comfortable days in Darbandikhan was about 20% of the total days of the year. The cold period requires exposure of green space to the sun, as the cold period in the sites is approximately equivalent to 53% of the total days of the year.

B. Site soil characteristics: Soil conditions of the site include:

1. Topography: The topography of the land of Bani Quein is a semi-flat surface with a slight slope, especially towards the south side, and in island increase the slop gradually from the south to north side when gaining to the center of the island it is the highest point, and then decreases gradually towards the north direction. It is surrounded by mountains, from north, east and southeast of the lake (Al-Saudi, 1976)

2. Soil testing: physical-chemical properties of soil for suggested design in a tourist resort in Bani Quien and its island. Soil testing in Darbandikhan region is the soil acidity (pH) is between 7.6 to 7.8, the amount of calcium carbonate is 144 g/kg, and the degree of electrical conductivity is 0.67 dSm⁻¹ at 25°C While the class of soil texture did not differ according to the layers and are the clay, as the amount of organic matter is 30.70 kg⁻¹. (Table 2).

Table (1) Table metrological data of Darbandikhan (2000-2020)

Years	Months	Avg. Temperature/ C°		Avg. Precipitation mm	Years	Months	Humidity%		Avg. Windspeed / m/s
		Max.	Min.				Max.	Min.	
2000 to 2020	January	12.85	5.37	134.56	2010 to 2020	January	83.3	45.6	2.55
	February	14.30	6.32	111.73		February	83.1	40.1	2.65
	March	19.60	9.58	92.28		March	81.5	35.2	2.81
	April	24.80	13.95	63.51		April	76.3	28.9	2.55
	May	31.95	20.47	26.48		May	61	17.9	2.56
	June	39.55	27.05	0.71		June	41.5	9.5	2.62
	July	42.90	30.16	0.00		July	38.6	7.1	2.75
	August	43.05	29.68	0.55		August	40.1	7.2	2.65
	September	38.35	24.84	0.98		September	41.3	8.7	2.45
	October	30.60	19.21	31.15		October	54.7	18.2	2.52
	November	19.90	11.68	83.16		November	73.3	36.9	2.43
	December	14.50	7.37	101.30		December	81.4	45.2	2.64

Source (Directorate of Darbanikhan Dam)

Months	Hours of the day							
	0	3	6	9	12	15	18	21
Jan								
Feb								
Mar								
Apr								
May								
Jun								
Jul								
Aug								
Sep								
Oct								
Nov								
Dec								



Fig. (1): The Range of comfort zone in Darbandikhan

Table (2) Soil analyses of Darbandikhan

Soil Properties				<i>Elevation (M) 485</i>		
<i>Soil Depth (0-30) cm</i>				<i>Longitude 45° 44' 42" E</i>		
				<i>Latitude 35° 06' 58" N</i>		
Physical properties		Particle size distribution (PSD)				
		<i>gm. Kg⁻¹</i>		<i>Sand</i>	<i>Silt</i>	<i>Clay</i>
				<i>124.32</i>	<i>494.56</i>	<i>381.13</i>
				<i>12.432%</i>	<i>49.456%</i>	<i>38.113%</i>
		Textural Class		<i>SiC (Silty clay loam)</i>		
Chemical properties				<i>Electrical conductivity Ece dSm -1 at 25°C</i>		<i>0.67</i>
				<i>Organic matter. gm. kg⁻¹</i>		<i>30.70</i>
<i>PH</i>	<i>7.72</i>	<i>N available %</i>		<i>P Available(ppm)</i>		<i>K Available(ml/l-1)</i>
		<i>151</i>		<i>3.3</i>		<i>0.08</i>
<i>Soluble ions</i>	<i>Ca+2</i>	<i>Mg+2</i>	<i>Na +</i>	<i>K +</i>	<i>HCO3⁻²</i>	<i>SO4²⁻</i>
<i>Meq L⁻¹</i>	<i>4.31</i>	<i>3.14</i>	<i>1.01</i>	<i>0.14</i>	<i>5.20</i>	<i>2.4</i>
Total CaCO3 (calcium carbonate) g/kg					144	

CL= clay loam, SiCL = silty clay loam, SiC = Silty Clay, ECe = electrical conductivity, CaCO3 = calcium carbonate
 Source (Soil department at University of Sulaimani / College of Agriculture)

Recreational needs of residents and tourists

Nowadays, most of the successful designs for green spaces are those that meet the recreational needs of their visitors and residents. For the tourist resort design to achieve its goals of meeting the needs of the residents, some interviews were held and opinions were performed with the specialists and directors, engineers of the town municipality, and directors of tourism in Darbandikhan of both genders, and of the different age level, the sample of the respondent's participation was varying in ratio, as the percentage of males was higher than females (56%). category of age (Greater than 30) has higher participation in this process at the rate 59%.

RESULT AND DISCUSSION

A-Tourist resort site

The sites that were chosen to construct the proposed tourist resort are very convenient due to their proximity to Darbandikhan city. Fig (3). It was easily accessible and connected to the surrounding in several major ways, on the other hand, the site has enough area to hold a lot of people and allow future growth, and be away from the hustle and bustle of daily life. This and the surrounding area

are a biologically diverse areas for wildlife and are listed as an Important Bird Area in Iraq by BirdLife International. Many people benefit from this lake and its water as it is used as a source for drinking and irrigation water, as important fisheries, and as a beautiful site used by many for recreation. (Ararat *et al.*, 2008) and full of native plants as shown in (Table 3). That has a significant role in lowering summer temperatures and improving the environment of the region by giving fresh air to the site. On the other hand, the presence of water has a significant role in improving sites environment too, which is why the resort tourist sites meet most of the criteria used in the selection of the resort tourist.

Every table must have a descriptive title and, if numerical measurements are given, the units should be included in the column heading. Vertical rules should not be used (see Table 1). Tables should be cited consecutively in the text.

Table 3: Native Plants at Study Area and Surrounding

Tree	<i>Quercus aegilops</i>	<i>Quercus infectoria</i>	<i>Salix acmophylla</i>	<i>Morus alba</i>
Shrub	<i>Vitex sp</i>	<i>Nerium oleander</i>	<i>Rubus sanctus</i>	<i>Anagyris foetida</i>
Herb	<i>Thymbra spicata</i>	<i>Mentha longifolia</i>	<i>Equisetum ramosissimum</i>	<i>Gundell tournefortii</i>
Grass	<i>Phragmites communus</i>	<i>Aegilops crassa</i>		
Aquatic plant	<i>Typha sp</i>	<i>Phragmites sp.</i>		

Source (Researchers work)

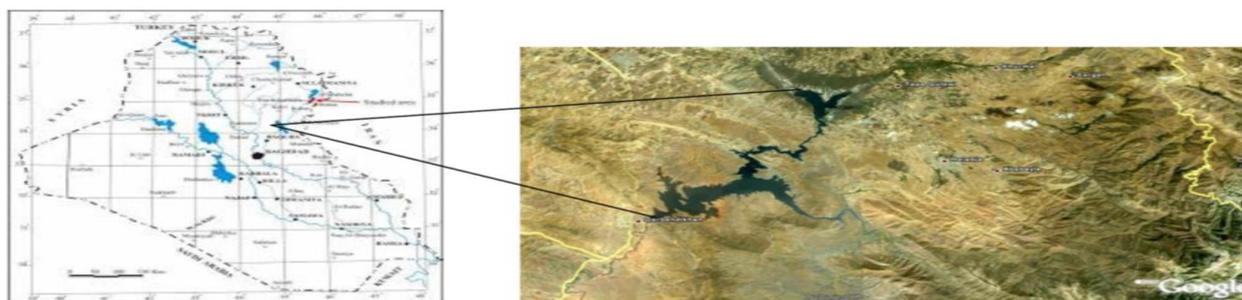


Fig (2) Location of Darbandikhan lake (Source: (Azeez, Ahmad and Karim, 2020))



Fig (3) Location of Bani quein and its Island, and their proximity to Darbandikhan city. (Satellite Image)

B-Environmental factors:

During this study of the weather factors at the tourist resort site, it was noticed that the continental climate was hot, dry during the summer, it was cool, and humid during the winter. As shown in (Table 1) that there was a big difference in the relative temperatures and humidity between summer and winter, so tolerant plants should be chosen for a wide range of high

temperatures and low humidity in the summer, and must bear the low temperatures and high humidity. It is preferable to benefit from most of the native plants, trees and shrubs are deciduous and resistant plants when choosing resort plants, on the other hand with two lines of strong windbreaks to smooth out the environmental conditions inside the tourist resort and reduce the effects of harsh weather of the region. And to provide thermal comfort in Iraq's green space during the summer period. It is required to provide shade at a rate not less than 65% of the total area of the green space by using a large tent tree (Al-Rawy, 1988) with providing evaporative cooling of fountains and waterfalls. On the other hand, good topography and semi-flat shape of land indicates its suitability with different designs and models, in addition to that there is fertile and deep agricultural soil suitable for cultivation of most types of plants without the need for reclamation or soil change (Table 2).

C-Recreational activity as tourists need

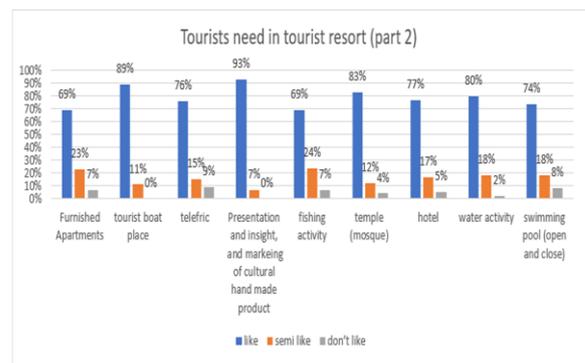
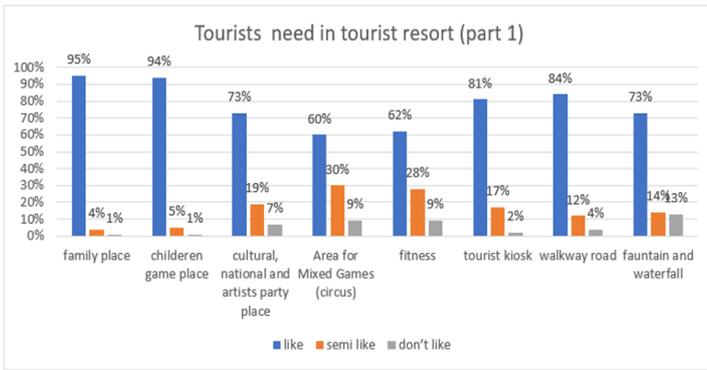
According to the participation of both genders with different age levels, in the recreational activities that are needed in the tourist resort, it was found in (Table 4) that this participation was varying in ratio, as the percentage of males was higher than females (56%) in the questionnaire, and this may be due to the culture and traditions of the people of the city and the region. And the category of age level (Greater than 30) has higher participation in this process at the rate of 59%. It may be due to the changes that the age is affected by, both in the cultural, social, and economic aspects. As for the means to reach tourist resorts, it was noticed from the results in (Table 5) that most of those surveyed were reached the site by a private car 95% because of the lack of sufficient tourist groups so far, and the proportion of using public transportation in this region is at a bad level. Concerning the favorite season to visit the sites, it was noticed through the results that springtime comes in the first place, as the visit rate reached 71% which may be due to comfortable weather in spring, and the favorite type for staying is kiosks and cabins at the rate of 54%. Then based on tourists need at tourist resort as shown in (Chart 1) part (1), the results of the evaluation process in terms of the presence of a special place for family in resort tourists 95% of respondents believe that they like it, At the same time special place for children is one of the most necessary places that must be Present as 94% of the respondents it. Based on these results, it was found necessary to provide safe places for groups and families to sit inside the tourist resort and near the children's play areas because many people come in the form of families with their children. After special place for family and childrens game place, there is a strong desire to add some activities, and parts to the current and future tourist resorts that arise in the region, and these activities and favorite parts are given in order as following: Places for presentation and insight, and marketing of the cultural, handmade product for knowing their culture (93. %), and places designated for tourist boat are fourth (89%) as shown in (Chart1) part (2). Then, walkways roads are fifth (84%) as shown in (Chart1) part (1), places for temple (mosque) in the 6th rank (83%) (Chart1) part (2), then the bridge between Bani Quein and its island (82%) are in the seventh rank shown in (Chart 1) part (3), as is the desire to provide a tour kiosk for a picnic (81%) at the eighth rank (Chart1) part (1), also, the availability of the water activity at the ninth level (80%) (Chart1) part (2) and the allocation of places for water bird and animal (79%) at the 10th rank (Chart1) part (3), and finally a place for holding high-level restaurant comes in 11th place (78%) (Chart 1) part (3).

Table (4) Gender, Age Level

Gender		Age		
male	female	(Less than 18)	(18-30)	(More than 30)
56%	44%	10%	31%	59%

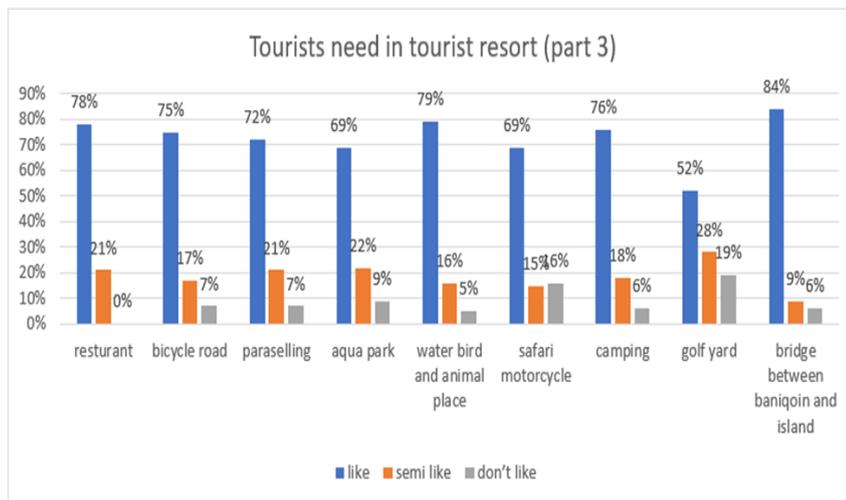
Table (5) Facility visiting, a favorite season for visiting and staying type at a tourist resort

Facility visiting			Favorite season				Staying type			
Private car	Tourist group	Public transportation	spring	summer	autumn	winter	Kiosk and cabins	camping	hotel	motel
95%	3%	2%	71%	21%	3%	5%	54%	27%	13%	6%



(Chart 1) part (1): Explain tourists need for recreational activity at the tourist resort

(Chart 1) part (2): Explain tourists need for recreational activity at the tourist resort



(Chart 1) Part (3): Explain tourists need for recreational activity at the tourist resort

CONCLUSION

A tourist resort is a place to be visited for relaxation, recreation, and picnic. The first criteria for selecting a tourist resort location is the study of human elements, natural and environmental sources about the site. Environmental factors are among the most important factors that directly affect the design of tourist resorts, and these factors include climate and soil, as environmental treatments vary from one region to another and the design changes with it. The design styles for tourist resorts vary between modern, natural, and mixed style, as the topography of the surface of the site was used in the design's tourist resort. The suitable design for the multi-activity tourist resort in the region with a continental climate is modern. Tourist resorts are characterized by the presence of large areas of forests but besides this, the recreational area must not be neglected and taking into account the homogeneity and diversity between species and colors and the forms used in afforestation. Bani

Quein and its Island at the edge of Darbandikhan lake are in the most suitable sites for designing tourist resorts due to their beautiful scenery, pleasant environment and direct connect with the water.

CONFLICT OF INTEREST

The authors declare no conflicts of interest associated with this manuscript.

D-Design Suggestion for Bani quein and its Island at the Darbandikhan Lake

Based on the results, conclusions, and recommendations of this study and based on international standards in this regard and the needs of city resident and tourist, taking into account the environmental factors of the site as well as the opinions of specialists in this field, and culture and tradition an alternative design for the tourist resort of both sites was proposed and developed. It appears in Diagram (1) about the tourist resort in Bani Quein and diagram (2) about the tourist resort on the island, some of the activities that are present in both sites are recreational activities that contact with water directly such as boating, parasailing, and jet skiing. Other activities that are not in contact with water directly such as fishing, water bird watching, and safari motorcycles. The two designs are characterized by the presence of windbreaks on the north and northeast sides because of the prevailing wind on those sides. In addition, the planting of shade trees with fallen leaves in the west direction due to exposure to these sides to the sun during the winter and for abundant shade in summer. On the other hand planting different types of shrubs around the areas designated for families to make them private. In addition, some of the plants used are native plants with the cultivation of many plants to take advantage of their flowers to continue the presence of flowers in the tourist resorts so as not to lose their aesthetic characteristics throughout the year as shown in the diagram (3). In addition, Beni Quein has one main road with some secondary roads that connect to all parts of the site as shown in diagram (1), Also, the island has one public road that connects all parts of the island but the presence of stairs in the areas of varying topography. And it has a path and a bike path around the island so that everyone can benefit from the view of the lake and enjoy the beauty of the area, as shown in diagram (2), and one bridge to make the link between Bani Quein and its island. (Design by AutoCAD LT (2018))

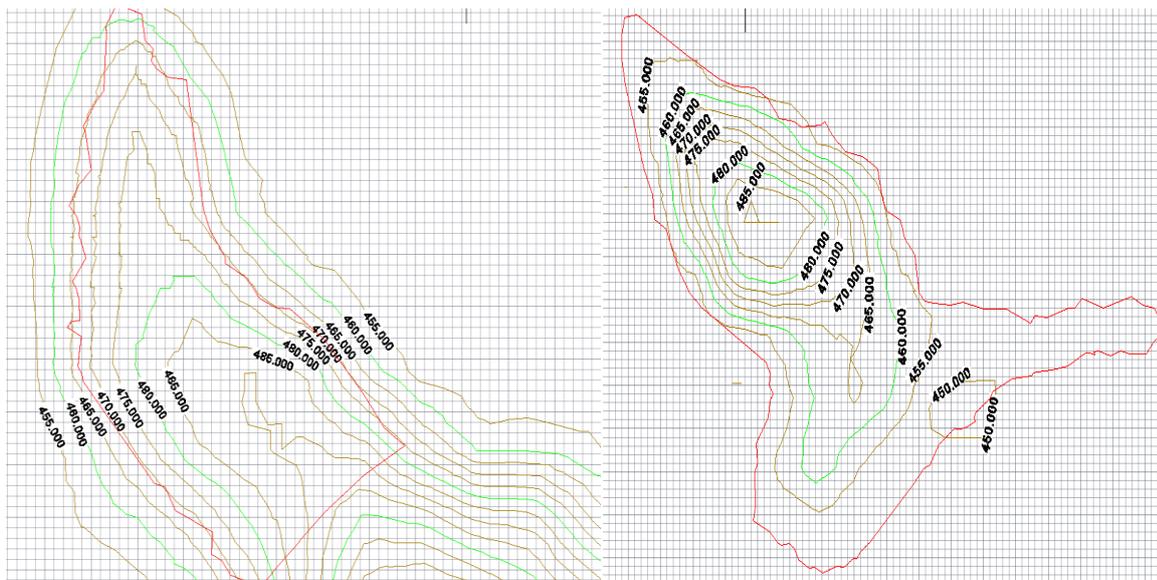


Fig (4) Assemble the base plan that illustrates the topography of the case study area (determined by the surveyor engineer)

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