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Original Research Article

A Comparative Study of Qalah Sangi Parand and Haj Kamal Caravanserais on the Way to the Silk Road: A Solution for Retrieving the Lost Parts

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ABSTRACT

As historical resorts, caravanserais played a role in welcoming and accommodating travelers. The route of Silk Road passed through numerous routes, cities, and deserts, and without caravanserais, it would have been unimaginable to pass through these arid and barren oases. The region of Iran is also one of these. It is not an exception and has diverse climate and environmental conditions, and the existence of caravanserais in these crossings was vital so that we see the establishment of countless caravanserais in this geographical area. The central region of Iran has been very important in the distant past due to the presence of cities and Rey town. For that reason, it has been the central focus of passages and roads. That explains why countless caravanserais used to be built in its vicinity. This research is based on a comparative study of suburban Sangi and Haj Kamal caravanserais in Robat Karim, in terms of the architectural form in the southwest of Tehran province. These two caravanserais have different styles from each other. The main focus of the present research is on the reinterpretation of the architecture of the aforementioned caravanserais. This is the first research that has investigated the physical characteristics of caravanserais in the Robat Karim region so that their hidden values can be known. This comparative study will ultimately lead to more optimal restoration and retrieval of the lost and damaged parts of the caravanserai. The research method of the present study is based on library studies, field research, comparative study, and interpretation and analysis of the gathered data. The purpose of this article is to introduce and recognize the studied caravanserais. This research attempts to review and examine tangible heritage aspects of Iranian caravansarai in the region of Robat Karim.

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Introduction

The Silk Road was a collection of roads (Takmil Humayun, 2018) that was active from the 5th century BC to the 17th century AD (ibid.). This cultural and commercial path has seen the formation of cultures, arts, civilizations, businesses, and wide trade. Caravanserai, as one of these midway establishments, has played an important role in sheltering travelers. The Greek historian Herodotus attributes the invention and creation of caravanserais to the Iranians so that he points to countless caravanserais and inns in the Iranian Empire. Along the long route of the Silk Road, there are various caravanserais with different styles and types, such as the caravanserais of Central Asia and Asia Minor and the Indian and Iranian subcontinents. The caravanserais of the Silk Road in Iran also had a wide variety. These caravanserais range from east to west and from They were spread from the north to the south of the country and fortunately most of them still exist, but with the passage of time and the indifference of the times and the decline of the prosperity of the Silk Road and the introduction of automobiles and the new way of life, they have become abandoned and isolated. which are important from the point of view of architecture and aesthetics. There are two caravanserais in the southwestern area of Tehran province and in the Robat Karim area, which were active and frequented in the past and accommodated travelers and caravans. These caravanserais have different architectural styles. The reason for choosing these two caravanserais for study is that they have unique features such as longevity and architectural style and the role of Parand stone caravanserais in the architectural evolution of other Iranian caravanserais. Parand stone caravanserais according to the French researcher Maxim Siroux, is one of the influential caravanserais in Iranian architecture in terms of architecture and it is a pioneer and an archetype among post-Islam caravanserais. Having rooms without porches and courtyards without porticoes, the length and width of the rooms, and the geometric ratio between the rooms and porches, as well as the presence of a throne in the center of the courtyard for the first time in the caravanserais of the geographical area of Iran, and the presence of an underground room in the central pavilion of the caravanserai for the first time is one of the unique features of Sangi Parand caravanserai (Siroux, 1949). Siroux writes about this caravanserai: “In this caravanserai, which was probably built in the pre-Seljuq period, a few points should not be forgotten: the building plan with rooms that are parallel to each other and it looks old perpendicular to the central courtyard. In addition, the presence of porches around the central courtyard and the lofty projection of the main courtyard are two features that should not be forgotten. This caravanserai was chosen for study. The reason for choosing Haj Kamal Caravanserai in Robat Karim is its unique architectural design and the non-compliance of the main axis of the building with its entrance complex. Robat Karim region has been the main branch and link connecting east to west and north since the distant past. It has been to the south of Iran and has had an important position in the highways of the geographical area of Iran and the upstream area. In this research, two caravanserais attributed to two different historical periods have been read. The reason for choosing these two caravanserais, in addition to the above, is their architectural typology and the selection of each of them based on their architectural features in each historical period. Seljuk and Qajar period caravanserais each have their unique characteristics, the Seljuk period is the period of prosperity and revival of caravanserais and the Qajar period is the last period of the caravanserais life and the different social and cultural characteristics of caravanserais are other factors for choosing these two caravanserais. The research method and findings of this research can be generalized to other caravanserais in Iran. Since the stone caravanserai is semi-ruined, recognizing its characteristics and the caravanserai of the same period and finding their similarities and differences, helps to retrieve the lost spaces and present its restoration plan. As they are related to the same region, there is the possibility to compare caravanserais and provide solutions to restore lost or damaged parts. This research aims to make a small contribution to the recognition and protection of this ancient heritage by introducing and reviewing their architecture. These valuable monuments have been registered as National heritage and in addition, Sangi Parand Caravanserai has been registered in the UNESCO World Heritage List along with 53 other Iranian caravansaries, which reflects its importance and value. It was carried out by one of the authors of the article.

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Research Question

How can a comparison between Qale Sangi Parand Caravanserai and Haj Kamal Robat Karim offer solutions to retrieve lost parts or repair damaged parts?

Research Background

So far, there have been extensive studies on the caravanserais of Iran. These studies have emphasized and focused more on the architecture of the caravanserais. Studies have also been carried out in the area of the Silk Road, and the authors have reviewed their characteristics. In this section, we introduce and review some of the studies mentioned. In an article, Beheshti et al. (2018) have examined and reviewed the caravanserais of the Silk Road route, and according to historical texts and documents, especially travelogues, they have expressed the quotes of Western tourists and travelers and have recounted and reread their descriptions. In the above article, the authors introduced the Silk Road caravanserais in the regions of Khorasan, Isfahan, Qom, Qazvin, and Kashan, referring to the travelogues of Chardin, Elarios, Tavernier, Delavaleh, and Figueroa. Agha Seyyed Javad Islam & Rahimi (2020) have introduced the roads and caravanserais in Iran, especially in the west of Iran and the city of Hamadan. The survey of caravanserais of Zoghali, Hossein, Khani, Golshan, Sharifieh, Qalamdani, and Mirzakazem has been investigated and evaluated. In an article, Azar Khordad (2023) has reviewed the caravanserais of Khorasan and examined their religious spaces such as mosques, prayer houses, and synagogues, and the religious components of the studied caravanserais and researched religious features such as the presence of altars, religious inscriptions, and religious decorations and arrays. Okin (1997) introduced some Timurid-era caravansaries in Khorasan and reviewed their architectural and physical characteristics in Khorasan region. In this research, Labaf Khaniki et al. (2014) have used travelogues and historical documents to introduce the caravanserais of Khorasan. In this book, the authors have presented architectural maps and pictures of caravanserai with a proposed plan for the future of these valuable buildings. In this book, all the caravanserais in the Khorasan region have been examined one by one. Godard (2009) has introduced and investigated one of the most important caravanserais of the Silk Road in the Khorasan region. In the study of Robat Sharaf, the researcher has introduced the architectural features and decorative arrays and their general structure, and with the help of historical documents, the name of the caravanserais has been He examines it carefully and with a comparative study of Robat Sharaf with other caravanserais of the same period and region, he reread the characteristics of the above caravanserais and Robat Sharaf. In another study, Vahdatpour et al. (2019) investigated the caravanserais and evaluated them from the perspective of the form of architecture. In this review, the researchers have reviewed the proportions, motion circulation, and spatial organization, and finally, they have expressed their differences and commonalities .In another research, Kavian and Gholami (2017) evaluated the development of caravanserais and the transformation of the form of caravanserais have paid. In this article, the researchers reviewed the history of the formation of caravanserais and researched their evolution from the distant past to the Qajar period. In the next step of the article, the authors reread the development of courtyard caravanserais and explored their evolution from the pre-Islamic period to the Islamic period. In another article, Andaroodi and Andres (2018) of the article have discussed the typology of caravanserais in the desert region. In the first step, the authors divide desert caravanserais into six types and describe their architecture. This classification is based on the plan of caravanserais. In the next step, the subgroups of caravanserais have been identified. In the last step, the physical characteristics of caravanserais, including species and subspecies, have been analyzed. In another study, Lotfalikhani and Danai Nia (2017) investigated and classified the stone caravansaries attributed to the Seljuk period. In this article, the researchers introduced the architectural and functional features of four of the Qom caravansaries. In the second stage of their studies, the authors deal with the physical typology of caravanserais and present their classification. This classification is based on the form of the entrance of the caravanserais. In this classification, the elements and components of the caravanserais are also reviewed. In the conclusion of the article, it is stated that although the architects have accepted each other's advice in the design of the caravanserais under study, and the caravanserais are largely similar to each other, in the details of their architecture they are different from each

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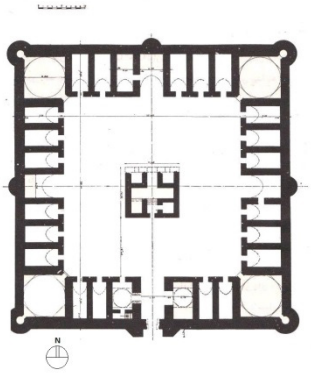
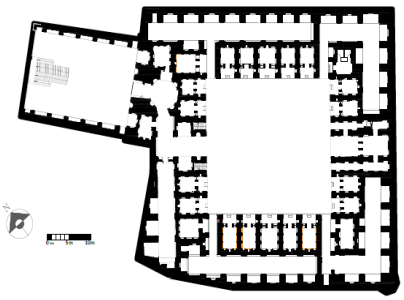
other and they are not similar. This research was done in line with the typology of caravanserais and its methodology can be used in the research of this thesis. In another article, Al Haddad et al. (2023) introduce the historical castles of Jordan and examine the architecture, history, and introduction of the elements and components of these castles. In this article, the images and documents of the castles are given, as architectural spaces such as towers and ramparts. The gate, mosque, church, reservoir, cisterns, and rooms are introduced and their physical features are described. In the next part of this research, the typology of castles is determined. According to the classification of castles, they are divided into two groups: Islamic castles and the crusader.In the next part of this essay, each space is compared with the other. Their architectural elements such as arches, openings, types of covers, and types of decorations have been examined and evaluated. At the end of the research, the differences and commonalities of the castles are given.

Research Method

The main method of collecting information is based on library studies and field observations in the form of descriptive, comparative, and analytical analyses. For this research, two suburban caravanserais of the region of Karim (Tables 1 & 2) were selected. The studied caravanserais are first introduced and then examined in terms of architectural forms. The form of architecture includes aspects such as geometric proportions, spatial circulation, and spatial organization and hierarchy. The present studies are based on what is quantitative and in terms of practical purposes. It is retrospective in terms of time and was compiled inductively. The limitations of this research are the lack of physical access to the Sangi Parand caravanserai and the lack of field survey except for different parts of this caravanserai. The software used in this research includes the AutoCAD program, and in the field surveys, laser and manual meters are used. A professional camera with high resolution is used.

Table 2. Plan of two caravansarais. Source: Authors.

Caravanserai	Picture
Qalah Sangi	
Haj Kamal	

Discussion

• Silk Road

The Silk Road was a route that started from China, and after passing through the countries of Kyrgyzstan, Uzbekistan, Turkmenistan, Afghanistan, and Tajikistan, it reached Iran, and after passing through Iran, it went to Asia Minor (today's Turkey) and from there to Greece and then to Italy is coming. This road is not only a transporter of goods and materials, but it also conveys customs, cultures, traditions, religious and social concepts, and oral traditions (Takmil Homayoun, 2018). On the Silk Road, witness the appearance of architectural diversity Such as bridges, caravanserais, minarets, mosques, castles, etc. (Pirnia & Afsar, 1972).

- Silk Road in Iran

The Silk Road in Iran had various branches, which included main and secondary routes. These routes were used according to the seasons,

Table 1. Physical characteristics of two caravanserais. Source: Authors.

Caravanserai	The geometric shape of the plan	Measure	Spatial composition	Number of entries			Number of Entries	Attributed to the historical period
				General	Main	Sub		
Qalah sangi	Square	Small	Caravansarai- stable	1	1	-	1	Seljuq
Haj Kamal	Square	Small	Caravansarai- stable	1	1	-	1	Qajar

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weather, heat, cold, snowfall, and rain, and the Silk Road was not just a straight and fixed route. The Silk Road was used to exchange various goods and various cultures and traditions. The Silk Road in Iran starts from Sarkhas and extends to Tus, Neishabur, Qoms, and the ancient city of Ray. This road after branching into two branches in the area of Baihaq and Joyn, connecting again in Bastam, adding the Gorgan road to it and again. The two branches in Qoms finally continue to the plains of Ray and Qazvin. Ray was the intersection of several roads that connected different parts of Iran. Here the Silk Road was connected to three other branches:

- Qazvin, Hamadan, Kermanshah, Baghdad
- Isfahan, Shiraz, Kerman, Bandar Abbas and Makran road
- Qazvin road, Soltanieh, Tabriz, Anatolia, Constantinople (Takmil Humayun, 2018).

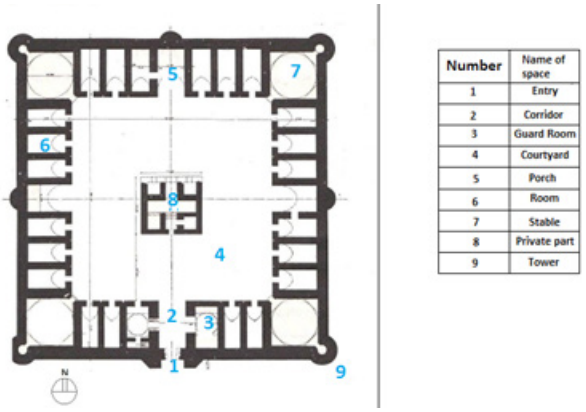
- **Silk Road caravanserais**

The Silk Road witnessed the formation of various service and welfare buildings (Takmil Homayoun, 2018). Along this route, many guesthouses were designed to keep travelers and caravans, goods, and animals safe. These guesthouses have various designs and different names. They had names such as Caravanserai, Sabat, Khan, Sera, Fandoq, and Vakalah (Pirnia & Afsar, 1972). Each of these buildings, in addition to having similar characteristics, also had different characteristics. Among these buildings, Caravanserai is more complex and they were more complete and from the point of view of architecture, complete character, and historical importance, they had a higher status than other welfare buildings. The design of the caravanserais was also varied it could be varied in each region. In the geographical area of Iran, the caravanserais usually have courtyards and four balconies, and sometimes they are completely covered. In other geographical areas such as Central and Minor Asia, these designs still existed, but it is possible. Materials, architectural arrays, and construction techniques are different. Their architecture, form, and materials depended on the climate and geographical conditions, and the location of the caravanserai (Kayani & Wolfram, 1994). Caravanserai were usually planned near main roads and highways caravanserai were placed at certain distances from each other to meet the needs of travelers caravanserai were usually created by benefactors and rulers and kings and were made available to the public. In the definition of these buildings, they are referred to as public benefit buildings (Kyani & Wolfram, 1994). In addition to the written principles of design, other features such as local culture and local architecture were involved in the design of caravanserais.

• Introduction of the studied caravanserais

- **Sangi Parand castle caravanserai**

Parand stone (Sangi) caravanserai is located in Tehran province and Robat Karim city. This caravanserai is located 2 km from the new city of Parand and 1 km from the Shore River. This caravanserai has been registered under the number 10822 in the list of national heritage of Iran. The length and width of the caravanserai is 55×55 meters. The caravanserai is square. The entrance of the caravanserai is on the south side and is prominent and protruding. It is a one-story entrance and has a tall porch. There are four guard towers in the four corners of the caravanserai. There is a semi-circular arch on three sides: the north, west, and east sides. On the sides of the entrance hall, there are two security rooms, one of which has a staircase. The four-porch caravanserai and the porch are similar to each other. The stables are located in the quadrangle of the central courtyard. Their roofs are dome-shaped. The rooms are around the courtyard and are elongated and rectangular and have doorways. Its plan is four-sided and symmetrical. The porches and rooms are level with the central courtyard. The caravanserai has a water well. The caravanserai building is made of irregular and non-geometric stone and bricks (Fig. 1) (Table 3, 5 & 6).



Number	Name of space
1	Entry
2	Corridor
3	Guard Room
4	Courtyard
5	Porch
6	Room
7	Stable
8	Private part
9	Tower

Fig. 1. The components of the caravanserai of Sangi Parand Castle. Source: Authors.

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Table 3. Visual introduction of Sangi Parand Castle Caravanserai. Source: Authors; Koshki & Nemati, 2015.

Name of space	Picture
The entrance of the caravanserai	
Bird's eye view from the caravanserai	 
A view of the central courtyard	
A view of the damaged central pavilion	

- Haj Kamal caravanserai

Haj Kamal Caravanserai is located in Tehran province and Robat Karim city and in the historical part of Robat Karim city known as Bazark. This caravanserai has been registered as one of the valuable works in the list of national works of Iran with number 1558. The caravanserai has a vestibule and in the vestibule, there are platforms and porches on both sides for rest. The entrance is on the northwest side and there are platforms for elderly people on the sides. The entrance is on the same level as the exterior and has one floor. Above the entrance of the caravanserai, there was an inscription in the past, which does not exist now. The entrance door of the caravanserai is wooden. After passing through the doorway, we enter the vestibule. The plan of the vestibule is a regular octagon. There are two guard rooms next to the vestibule which is higher than the level of the vestibule space. After the vestibule, there is a corridor that ends in the northern porch and then in the central courtyard. In this corridor, there is a long rectangular stable, which is on the same level as the hallway space and the vestibule. The rooms are all around They are located in the central courtyard and are one meter higher than the level of the central courtyard and have a ledge, a wall heater, and a door. The rooms have a platform and a porch. The stables are located behind the rooms, and their covering is made of arches and Tavizeh (i.e.Curved branches). The stables have a platform and a porch (dock) on one side, which is 40 cm wide and one meter higher than the ground level. The caravanserai

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has two porches. Its northern porch has the role of entering the courtyard, and its southern porch is the royal residence. There are two corridors next to the porch that provide access to the Shahneshin (private part) area. At the end of the Shahneshin, there is a private post. The height of the Shahneshin is higher than the level of the yard. The entrance to the stables is possible through the corners of the yard and a long rectangular hallway. The yard is square. In the walls of the courtyard, there are akhiyas (malband), which is a hole in the lower part of the wall, inside which there is a stone malband, where the reins of the cattle are tied. There are two sets of stairs next to the north porch, which enables access to the roof post. There are four rooms for caravans to rest in the four corners of the caravanserai. A guard tower is located in the southwest corner (Fig. 2) (Tables 4, 5 & 6).

• Review of the architecture of Sangi and Haj Kamal caravanserais

In reviewing the evaluation of the studied caravanserais, features such as proportions, spatial organization, spatial circulation, the composition of the entrance facade, and the height of the spaces are examined and studied. The above features will express the architecture of the caravanserais. In the physical analysis of caravanserais (Table 7), the principle of symmetry and flatness, the principle of pivoting, the principle of hierarchy, and full and empty space (Table 7) will be reviewed.

- Geometric proportions of Sangi and Haj Kamal caravanserais

Parand Sangi caravanserai is square in shape. This caravanserai has an area of approximately 3025 square meters. The length of the caravanserai is 55 meters and its width is 55 meters. The shape of the central courtyard of the above caravanserai is square. The dimensions of the yard are 30.34×30.34 meters. And the ratio of length to width is 1 to 1 and its area is 1088 square meters. The dimensions of the caravanserai rooms are 70.6 meters by 3.60 meters and their area is 24.12 square meters. As a result, the length of the rooms is 2 times their width. The length and width of the side stables are 8 meters, and their length and width are equal and square, and their roofs are dome-shaped. The porches are 8 meters long and 6 meters wide. The golden ratio was not used in the construction of this caravanserai. The main part of the caravanserai is an open and empty space. In the stone caravanserai, the filled space is 38.87% of the total area of the building and the empty space is 61.13% of the total area of the building. Haj Kamal Caravanserai has an area of about 3188 square meters. The main form of the caravanserai is square. The area of the caravanserai is 770 square meters. 75.84% of the caravanserai is full space and 24.16% is occupied by empty space. The form of the caravanserai is square and the dimensions of its inner court are 27.95×27.55 meters. Approximately 75% of the caravanserai means two-thirds of it is mass space and the remaining 25% i.e. one-third of it is empty space (Tables 8 & 9). In Haj Kamal caravanserai also did not use the golden ratio. In the stone caravanserai, the figures are right angles and vertical. Rectangular and square shapes are used, and three-dimensional volumes are square cubes. For example, the palace (private part) is square, the stables are square, and the rooms are rectangular. And the courtyard is also square. In the above-mentioned caravanserai, the cornering technique has been used to cover the square-shaped spaces with dome roofs. In Haj Kamal caravanserai, the shapes are also right-angled, and square or rectangular shapes are used. For example, the rooms are rectangular and the stables are rectangular. They are elongated or L-shaped or the middle pavilion is square. And the volume of the above caravanserai is a square cube.

- Spatial organization of Sangi and Haj Kamal caravanserais

The flow and orientation of buildings in Iranian architecture a point worth pondering. According to Professor Pirnia, there are three general Runes (i.e.orientations of the building) in Iranian architecture, which are: Raste (northeast-southwest direction) Rune, Isfahani Rune (northwest-southeast direction), and Kermani Rune (east-west direction). These Runes and orientations cause comfort and maximum use of natural energies. Sangi and Haj Kamal caravanserais both have direction and Isfahani style. The orientation of the caravanserais relative to the main direction of movement determines their entrance and longitudinal axes. In both caravanserais, the entrance axis (main axis) is perpendicular to the main route (Tables 10 & 11) and the longitudinal axis (sub-axis) of both caravanserais is parallel to their main route. The main entrance to the caravanserai in Sanghi Parand Caravanserai is in the middle, but the main entrance to the caravanserai in Haj Kamal Caravanserai is in the corner. The building in Parand stone caravanserai is in the form of a right-angle corner. The central courtyard of the stone caravanserai is square. The access to the stables is done through the corners of the corner. In Haj Kamal caravanserai, the access to the corners of the building is through a rectangular corridor.

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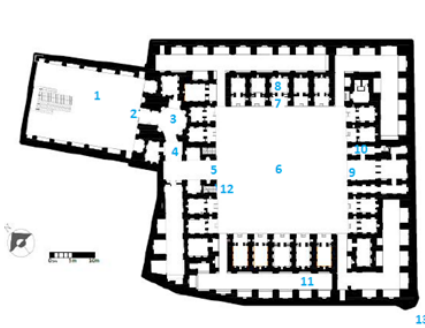


Number	Name of space
1	Jolokhan
2	Entrance
3	Vestibule
4	Corridor
5	Porch
6	Courtyard
7	Ivanche
8	Room
9	Private part
10	Corridor
11	Stable
12	Stairs
13	Tower

Fig. 2. Components of Haj Kamal Caravanserai. Source: Authors.

Table 4. Visual introduction of Haj Kamal Caravanserai. Source: Authors.

Name of space	Picture
Entrance and Jolokhan	
Portal	
Vestibule	

Rest of Table 4.

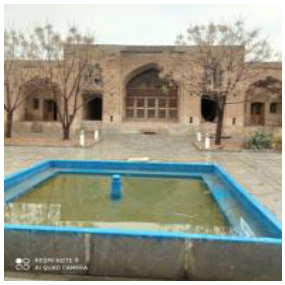
Name of space	Picture
North Porch	
South Porch	
Corridor beside private part	
Niche	
Wall heater	

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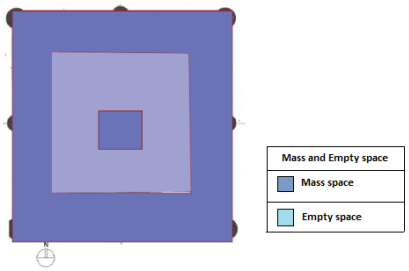
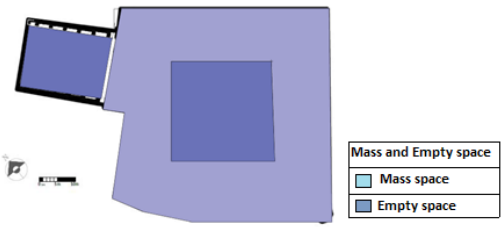
Table 5. Comparison of the architectural features of two caravanserais. Source: Authors.

Caravanserai	Entrance direction	Portal			Location of private part
		Projected		The same level of entrance	
		More	Less		
Qalah Sangi	South	-	*	-	Middle of the central courtyard
Haj Kamal	Northwest	-	-	*	South porch

Table 6. Comparison of two caravanserais. Source: Authors.

Row	Caravanserai	Typology	Location	Tower	General form	Courtyard form	Entrance pattern	Vestibule form	No. of porches	No. of Ivanche	No. of courts	No. of room	Additional parts
1	Qalah sangi	Suburban	Parand	4	Square	Square	Projected	-	4	-	1	22	Has water well
2	Haj Kamal	Suburban	Robat karim	1	Square	Square	Same level of elevation of building	Octagonal	2	18	1	18	Has water well

Table 7. Analysis of caravanserais. Source: Authors.

Caravanserai	The principle of hierarchy	Axis principle	Principle of symmetry	Main form	Mass and empty of space
Qalah Sangi	Ivan-portal-corridor- porch	South porch-north porch	Has it	Squared	
Haj Kamal	Open space before gate-Ivan-portal-vestibule-corridor- porch	North porch-south porch	Has it	Squared	

- **Circulation space caravanserai Sangi and Haj Kamal**

Spatial circulation determines the access to spaces. Hierarchy determines the way of entry from the outside to the inside. Iranian architecture has a movement hierarchy. This feature can be seen in all the elements and components of the historical architecture of Iran. This way of entering the building originates from general and special manners and respect for the privacy of individuals. Jalukhan (i.e. open space in front of the entrance gate) has been gathering travelers and caravans in the past. Caravanserai Sangi Parand has no Jalukhan, but Caravanserai Haj Kamal has Jalukhan and it is in the form of a square space. After Jalukhan, there is a front space which includes the entrance space, threshold, and entrance hall. In Caravanserai Sangi, this atmosphere is not very impressive and rich but the threshold in Haj Kamal Caravanserai is strong and influential. There is still an ancient wooden door in the door and a Dargah (i.e. portal gate). After Dargah, there is Hashti (vestibule), which divides the space. There is no Hashti in the Sangi Caravanserai, and there is a hallway instead. There is a Hashti in Haj Kamal Caravanserai, and it is perfect in the form of eight districts so that the dimensions of the Hashti and the districts are equal. In the caravanserai, the vestibule and the hallway (corridor) are united and it is a rectangular-shaped hallway. After the hall, we enter the Iwan (i.e. porch), which opens to the central courtyard. In Sangi and Haj Kamal caravanserais, after the corridor space, we enter the porch and then enter the central courtyard (Table 12).

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Table 8. Dimensions and Proportions of Caravanserai. Source: Authors.

Caravanserai	Name of space	Length	Width	Height	Area	Length/width	Height/length
Haj Kamal	Room	3/35	3	4/4	10/05	1/17	1/31
	Courtyard	27/95	27/55	5/75	770/2	1/01	0/20
	South porch	13/20	9/75	7/25	128/7	1/1	0/55
	North porch	11/05	4/05	5/75	44/75	2/73	0/52
	Stable northwest	31	5/50	5/65	113/15	8/49	0/18
	Stable northeast	37/60	5/85	5/65	219/96	10/16	0/15
	Stable southeast- a wing L	9/65	5/55	5/65	53/55	2/68	0/58
	Stable southeast- a wing L form	20/15	5/75	5/65	115/86	5	0/31
	Stable southwest- a wing L form	9/70	5/50	5/65	53/35	2/62	0/58
	Stable southwest- a wing L form	21/30	5/75	5/65	122/47	5/5	0/28
	Stable in corridor	20/25	3/95	5/30	79/98	5/13	0/26
	Entrance	4/45	10	6/15	44/5	0/44	1/38
	Ivanche (Small porch)	2/05	3/05	4/40	6/25	0/67	2/15
	Vestibule	5/50	5/50	6/60	23/74	1	1/2
	Corridor access to the stable from the courtyard	7/50	1/80	5/30	13/50	4/17	0/71
	Corridor of vestibule to porch	9/70	3/45	5/30	33/46	2/81	0/55
	Guard room	4/10	3/60	4/40	14/76	1/14	1/07
	Worker room-1	4/40	3/60	4/40	15/84	1/22	1
	Worker room-2	4/30	3/80	4/40	16/34	1/13	1/02
	Worker room-3	6	3/05	4/40	18/30	1/97	0/73
	Worker room-4	4/90	3/30	4/40	16/17	1/48	0/90
Qalah Sangi	Room	6/70	3/60	5/75	24/12	1/86	0/86
	Courtyard	34/30	34/30	5/75	1176	1	0/17
	South porch	8/40	4/70	5/75	39/48	1/79	0/68
	North porch	8/40	4/70	5/75	39/48	1/79	0/68
	East porch	7/70	4/70	5/75	36/19	1/64	0/75
	West porch	7/70	4/70	5/75	36/19	1/64	0/75
	Entrance	3/30	4/40	6/15	14/52	0/75	1/86
	Guard room	7/20	3/70	5/75	26/64	1/95	0/80
	Stable	8	8	5/75	64	1	0/72
	Private part	10	8/80	10	88	1/14	1

Table 9. Proportions and dimensions of caravanserais. Source: Authors.

Caravanserai	Area in percent	The relation of the spaces area to total area											
		Courtyard in percent	Empty space in percent	Mass space in percent	Room in percent	Ivanche in percent	Porch In percent	Entrance and access in percent	Worker room in percent	Guard room in percent	Stable in percent	Private part in percent	Load bearing elements in percent
Haj Kamal	3188	770/2	24/16	75/84	5/67	3/52	5/43	4/88	2/09	0/46	23/57	-	30/02
Qalah Sangi	3025	1088	38/87	61/13	9/5	No Ivanche	5	5/9	No Ivanche	1/76	8/46	2/9	28/1

Table 10. The form of the spatial organization of caravanserais. Source: Authors.

Caravanserai	Direction(Orientation of building)	Orientation to the main path		Location of main entrance related to courtyard	The form of access of the courtyard to the corners of the building	
		Entrance axis	Longitudinal axis		Main	Sub
Qalah Sangi	Isfahani(northwest-southeast)	Perpendicular	Parallel	Middle	Corner	-
Haj Kamal	Isfahani(northwest-southeast	Perpendicular	Parallel	Corner	Rectangular	-

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Table 11. Axes of Caravanserai. Source: Authors.

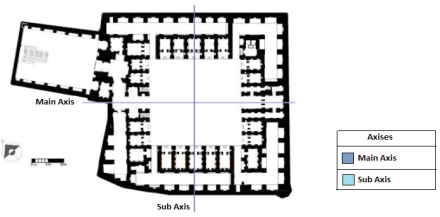
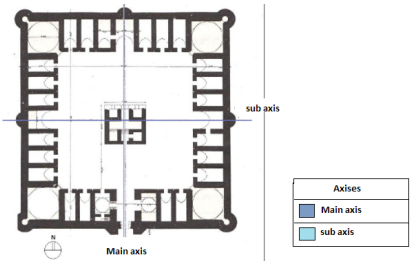
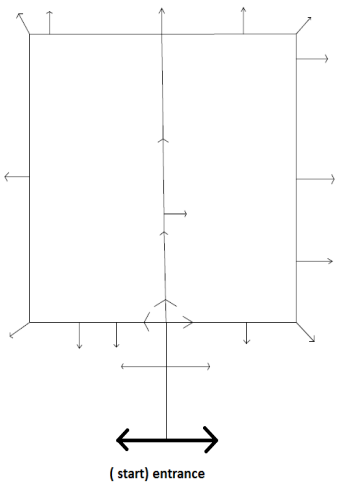
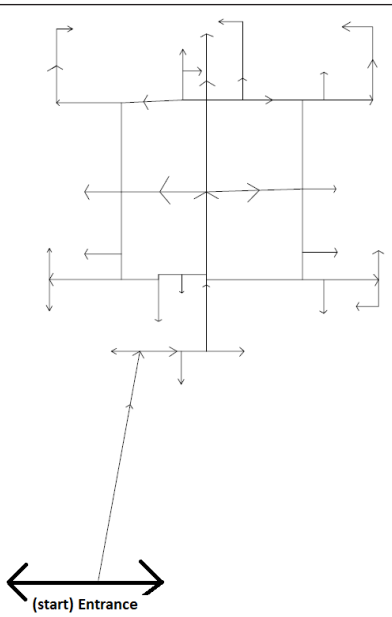
Caravanserai	Picture
Haj Kamal	
Qalah Sangi	

Table 12. Spatial Circulation. Source: Authors.

Caravanserai	Picture
Qalah Sangi	
Haj Kamal	

- Composition of the building entrance and height of the spaces of caravanserais Sangi and Haj Kamal

The composition of horizontal and vertical spaces and their height is one of the factors influencing the symmetry and contrast of the elements and components of the caravanserai. The composition and height of spaces and the reduction or increase of the rhythm and harmony of the elements and components have an effect. In a caravanserai, usually a compositional building, the portal has a special order, so that a special ratio is maintained between the width and height of the portal. In the Sangi caravanserai, the height of the entrance is greater than its width, and the height of the hallway is high. The reason for this should be known in the function of the porch and its symbolic nature. In the caravanserai Sangi Parand, the porches are of the same height as the adjacent spaces, so each four porches has the same height. In the Haj Kamal caravanserai, the south porch, which has the image of Shahnashin, is higher than the neighboring spaces, and the north porch is at the same level and height as the neighboring spaces (Table 13).

Conclusion

A comparative study of caravanserais reveals their differences and commonalities. The differences are related to the different features and the common features are the common elements and components of the caravanserais. The findings of the research show that Qala Sangi and Haj Kamal caravanserais have common or different points. The comparative study of these two structures will determine which one of these elements is common to the two caravanserais and is related to the spatial or functional structure, and which one of the structural elements has changes compared to the other. Understanding the common and different elements can provide solutions for repairs to provide more appropriate repair solutions in caravanserais where parts are missing or damaged. Qala Sangi caravanserai is damaged and needs urgent restoration. By comparing this caravanserai with the caravanserais which have a common geographic location, a common collective route such as the Silk Road, and common physical and architectural features, it is possible to recover the lost fortunes and help them in future repairs. For the first time, it was revealed that the common

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Table 13. Synthesis of entrance and height spaces. Source: Authors.

Caravanserai	Composition form of entrance	Entrance height relative to adjacent surfaces	The height of the porch relative to the adjacent surfaces
Qalah Sangi	- The height of the entrance is greater than the width.	- The entrance is higher than the adjacent levels.	- The porches are adjacent to each other at the same height.
Haj Kamal	- The entrance width is greater than the height.	- The entrance is higher than the adjacent levels.	- The north porch is adjacent to the same height level. - The southern porch is higher than the adjacent levels.

features of these two caravanserais are the same and close to each other in the geographical area, and they share the same common traffic route and the Silk Road, the inventors are the same physical elements. These physical elements are common to both caravanserais in general, but the architect has invented changes in some of the details. This research method and research process can be used in other caravanserais of the Silk Road and other climates and geographical regions, caravanserais that are in a geographical and cultural range and with common physical characteristics, and caravanserais that belong to the same period and can be generalized.

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