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Olga Volichenko

Doctor of Architecture
Kyrgyz State Technical University named after I. Razzakov
720044, 66 Ch. Aitmatov Ave., Bishkek, Kyrgyz Republic
<https://orcid.org/0000-0002-1403-8021>

XiaoYu Huang

Doctoral Student
Kyrgyz State Technical University named after I. Razzakov
720044, 66 Ch. Aitmatov Ave., Bishkek, Kyrgyz Republic
<https://orcid.org/0009-0004-6813-6198>

Wei Xiong

Doctoral Student
Kyrgyz State Technical University named after I. Razzakov
720044, 66 Ch. Aitmatov Ave., Bishkek, Kyrgyz Republic
<https://orcid.org/0009-0001-0991-1658>

Fei Wu

Doctoral Student
Kyrgyz State Technical University named after I. Razzakov
720044, 66 Ch. Aitmatov Ave., Bishkek, Kyrgyz Republic
<https://orcid.org/0009-0003-9597-3218>

Azyk Orozonova*

PhD in Economics, Associate Professor
Jusup Balasagyn Kyrgyz National University
720033, 547 Frunze Str., Bishkek, Kyrgyz Republic
Musa Ryskulbekov Kyrgyz Economic University
720033, 58 Togolok Moldo Str., Bishkek, Kyrgyz Republic
<https://orcid.org/0000-0001-6877-7674>

Typology and architectural characteristics of trade complexes on historic trade routes: Analysis on the example of the Great Silk Road caravanserai

Abstract. Studies on the typology and architectural features of trade complexes located on historical routes, caravanserais of the Great Silk Road, remain relevant in the modern world, as these structures not only represent historical heritage but also have the potential to understand the impact of trade and cultural exchange on the formation of the urban environment. The study aims to identify the typology and architectural features of trade complexes located on historical routes, with an in-depth study of the Great Silk Road caravanserais. The study includes the application of an analytical approach, classification method, functional analysis, statistical methods, synthesis method and other

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*Corresponding author



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methodological approaches. The peculiarities and differences in the typology and architectural characteristics of shopping centres located on historical routes were identified. The analysis of changes on the example of caravan trade routes that stretched across medieval Asia and Eurasia is necessary to assess the evolution and challenges throughout their development. The expediency of using the analysis on the example of caravanserais of the Great Silk Road is considered, limitations in the process are identified, and the impact of limitations on the result is analysed. During architectural studies based on archaeological research, attention was paid to the excavations of large urban centres located along the routes. The practical significance of the study lies in the application of the results obtained to eliminate errors in improving the typology and architectural characteristics of trade complexes on historical routes, and the reliability of the analysis on the example of caravanserais of the Great Silk Road, considering various factors, is considered, which will serve as a basis for providing recommendations for the use of the obtained data on the typology of caravanserais

Keywords: archaeological research; cultural exchange; analysis of intercultural interactions; recommendations for development and improvement; excavations of large urban centres

INTRODUCTION

Caravan trade routes were a network of paths and trails along which goods and culture were exchanged extensively between different regions, especially in Asia and Eurasia during the Middle Ages. One of the most famous and significant caravan routes was the Great Silk Road. This trade route was active from around the first century to the 17th century and connected different parts of Asia, Europe and Africa. The main goods transported along the Silk Road were silk fabrics, spices, valuable metals, masterpieces of ideology, and even technology. The relationship between economic development and road networks in the Eurasian continent is an important aspect that has attracted the attention of researchers. This relationship is usually considered in the context of the impact of transport route infrastructure on various aspects of the economy. Road networks facilitate the movement of goods between regions and countries, facilitating international trade and increasing transit volumes.

According to D.P. Berdiev (2023), caravanserais, baths and the bazaar square, surrounded by fortress walls, complemented the shopping street, forming the central commercial and social complex of the city. In modern times there is an urgent need to further study the typology and architectural features of caravanserais, these structures, being public buildings or complexes, are designed for temporary accommodation and service of caravans and travellers, this study will provide a better understanding and preservation of historical and cultural heritage, as well as to apply the acquired knowledge in modern architecture and urbanism to create functional and comfortable public spaces. Furthermore, located along the shopping street, they provided easy access for trade caravans and customers, which promoted trade and exchange in the region. This allowed not only to meet the needs of travellers but also to create favourable conditions for the development of economic activity and cultural exchange (Almaganbetovna *et al.*, 2023).

Following S. Adilkhodzhaeva (2023), trade centres and caravanserais emerged along the route, these are special structures for rest and trade for caravan travellers. The analysis carried out on the example of caravanserais of the Great Silk Road determined relevance and underlines the

importance of analysing similar phenomena and processes in the present context. According to R.T. Darmenov (2023), public baths in the vicinity of caravanserais were an important social and hygienic centre in medieval cities. But the study does not sufficiently address the importance of places located near caravanserais and the market square, these places provided not only convenience and comfort for travellers but also served as important centres of social activity for the local population, given their role in shaping public space and community cohesion. It is important to give them due consideration in urban infrastructure development and planning strategies.

Following M.K. Khabdulina & T.V. Koshman (2023), the Multani and Bukhara caravanserais, located close to the Maiden Tower and facing the Shemakha Gate, were important in shaping the planning composition of the public centre. Nevertheless, the proximity of these caravanserais to the Maiden Tower is worth exploring in more detail, their strategic importance in the urban layout of the city may indicate that they occupy a key position, creating important links between the various architectural and historical elements of the city, and given their spatial location, it can be assumed that this is not a coincidence but a conscious decision aimed at strengthening the social and cultural significance of the area.

D.Z. Salokhiddinova & F.F. Soliev (2022) note that the Multani and Bukhara caravanserais oriented towards the Shemakha Gate are likely to be of key importance in the layout of the city's public centre. It is also worth noting that studies focusing on the location of these caravanserais may determine the role of these sites in shaping the axial composition of urban space or serve as a reference point for the direction of urban flow, and additional research in this direction may shed light on the architectural and functional aspects that influence the organisation of space around these sites and their importance in the urban environment. According to S. Shonazarov (2023), caravanserais play not only a practical role in providing services and space for travellers but also have significant importance in shaping the architectural and socio-cultural environment of the public centre of the city.





The study aimed to provide a systematic and in-depth analysis of the architectural, cultural and trade aspects of caravanserais distributed along the Great Silk Road. The research task was to define the role of these structural elements in the formation and maintenance of ancient trade and cultural links between different civilisations. It is worth noting that the historic trade route has existed for several centuries since antiquity and has had a significant impact on the exchange of goods, cultural transitions and interactions between different civilisations.

MATERIALS AND METHODS

A theoretical framework was initially developed, which served both as a basis for the subsequent analyses and as a foundation for the formulation of conclusions. The analysis method was used in the study to determine and highlight problems related to the functioning and structural features of shopping complexes on historical trade routes, as well as the consideration of the role and essence of comparative typological and architectural-planning analysis of caravanserais along the Silk Road route, with the identification of their advantages and disadvantages. The statistical method was used to address the volume and causes of errors in the process of improving trade complexes on historical trade routes, which is the basis for ensuring sustainable development, improving the efficiency of these complexes, as well as the prospective use of the Great Silk Road.

The structural-functional method was employed to address trends, factors and patterns to assess the structural features of caravanserais, such as building materials, architectural styles, and general layouts, to identify key components and elements, identifying effective options and analysing the functional features of caravanserais, such as shopping areas, living spaces, recreational facilities, and their relationship to architectural features, improving the impact of the caravanserais on the caravanserai's livelihood, and improving the quality of the caravanserai's life. The deduction method was used to study the features of the functioning of complexes that include material culture, indicating extensive inter-regional links, these features are the basis for the existence of the caravanserai trade, by identifying the key elements needed to fully analyse the operation and problem solving of this process.

For practical implementation of the study, computer modelling of the formation of the Daewoo-kala caravanserai (11th-13th centuries) and the Taylakhan-ata caravanserai (11th-14th centuries) using the specialised AutoCAD software was employed. This stage involved an analysis of the basic principles of the complexes' functioning, including those reflecting material culture and indicating broad inter-regional interrelationships, using computer modelling techniques. The advantages and disadvantages of these complexes were also analysed, as well as their interaction in the context of the overall caravan trade. An important stage of the study involved examining the prospects for the utilisation of the caravan trade. The study also analysed the operation of the process to improve the typology and

architectural characteristics of trading complexes on historic trade routes. The employed methods aim to avoid possible errors in the process of improving the analysis of caravanserais of the Great Silk Road, including computer modelling methods, analytical approach, comparative analysis methods, and statistical methods. This is relevant for a more accurate assessment of development effectiveness.

The synthesis method was used to summarise the obtained indicators of theoretical analysis and practical experience to formulate recommendations for the use of data on the typology of caravanserais. They aim to solve problems and achieve progressive growth in the process. Particular attention was devoted to the improvement of the quality of caravanserai development, and predictive models and design solutions are presented. Logical and functional analysis methods were applied, providing a more detailed consideration of the concept of "Typology and architectural characteristics of shopping complexes on historical trade routes", this, in turn, contributed to the parsing of situations. The methods were used to characterise the features and functioning principles of the Silk Road caravanserais within the analysis, additionally analysing the complexity of shopping complexes on historical trade routes in the process of functioning, as well as considering scenarios in which there are difficulties in the application of these complexes.

RESULTS

Caravanserais in Central Asia often had a typical oriental style of architecture, with open courtyards, domed ceilings and delicate patterns on the walls. This style of architecture often incorporated elements of Persian, Turkmen and Mongolian design, reflecting the rich cultural heritage of the region. Efficient transport infrastructure facilitates market integration by reducing transport costs and creating a favourable environment for businesses and consumers to interact (Mohimani & Nabavi, 2022). Caravanserais were special structures designed to provide temporary accommodation and rest for travellers and to protect them from threats during the journey. These structures usually included buildings for human and livestock accommodation, warehouses for goods, animal stalls, and walls or fortifications for security.

Caravanserais were often built of brick, stone or clay, depending on the available resources in a particular region. Roofs were covered with ceramic tiles or wooden beams to protect from sun and precipitation (Darendeli & Binan, 2021). Inside the caravanserai, rooms were usually provided to accommodate merchants and travellers, as well as spaces for storing goods and feeding animals. Public spaces were also an important element, where travellers could rest, exchange information and make contacts for future transactions. Caravanserais were built with the comfort of travellers in mind. They usually had comfortable areas for camels and other animals to park, and ventilation systems to keep them cool on hot days. Some caravanserais were equipped with baths, mosques and shops for the convenience of visitors.



The diversity of languages, religions, arts and sciences flourished due to the interactions that took place along these routes. This contributed to the formation of cultural ties between East and West (Kostopoulou *et al.*, 2022). Aultepe was the first caravanserai opened in Sogd on the route from Shakhrisabz to Kesh (Erkurgan site). Several facts testify to its recognition as a caravanserai. Firstly, the absence of a stylobate platform, which is a characteristic feature of castles. Secondly, the absence of a large ceremonial, reception hall, which is different from castle architecture. Thirdly, an absence of cooking hearths in the living rooms, except the utility room in the central planning core. Fourthly, along the perimeter of the outer walls, there are blocks consisting of a living room and a utility room, which is a characteristic feature of the planning organisation of the caravanserai known as rabat. These features testify to the functional specificity and structural features of Aultepe, confirming its role in the system of caravan trade on the Silk Road.

Caravanserais were not just architectural structures, but also economic centres where goods, ideas and cultural influences were exchanged between different peoples and civilisations. Their location on key trade routes made them an integral part of medieval trade and exchange (Deljavan & Çınar, 2023). Tash-Rabat, a feudal caravanserai, is located in the Chon-Kemin valley of Kyrgyzstan, in the Chatyr-Kel district. It is one of the most unique and interesting architectural constructions in Central Asia. It dates to the 15th century and its uniqueness lies both in the use of stone as a building material and in its composition (Niknam Asl *et al.*, 2022). One of the main features of Tash Rabat is its building material – stone. At a time when most caravanserais were built of clay or brick, the use of stone made Tash Rabat unique in its kind. This gives the structure not only durability but also a special appearance (Abedi *et al.*, 2023). Tash Rabat has a square shape with an inner courtyard. Its architectural composition includes majestic walls, up to 10 m high and 1.5 m thick. Inside the caravanserai, there are various rooms for the accommodation of travellers, storage for goods and livestock, as well as halls for meetings and trade. Externally, the structure appears imposing and monumental, embodying the grandeur of medieval architecture in Central Asia (Ergashev, 2023). As a typical caravanserai, Tash-Rabat served as a resting place and security for caravans and travellers passing through the region. It also played the role of a trading centre where goods and cultural ideas were exchanged between different ethnic groups and cultures.

The process of dissecting the caravanserai building volume into individual elements, called morphemes, is a method of analysis, that provides a more detailed analysis of its structure. These morphemes may include architectural details, structural units, decorative elements and other features that characterise the main components of the building. Once the morphemes have been identified, their interrelationships and organisation into structural groups are analysed. This allows to reveal of spatial regularities in the organisation of the caravanserai, such as interrelations

between different parts of the building, the sequence of its elements, their functional purpose and interaction. This method visualises not only the internal structure of the caravanserai but also its functional and aesthetic aspects. It allows researchers to better understand the organisation of space within the building, its use and its importance to travellers and traders on the Silk Road and other trade routes (Latham-Sprinkle, 2023). When the Arab Caliphate established itself in Maverannahr, the use of kyoshkas (feudal castles before the Islamic period) and ribats (rabats), fortresses, gradually evolved into their use as inns for caravans. These structures provided security, comfort and shelter for caravan travellers and their animals. Tash Rabat represents an important historical heritage of Kyrgyzstan and Central Asia as a whole. Its unique architecture and history of use make it an object of study for researchers and tourists, as well as a symbol of the cultural wealth of this region.

Caravanserais of circular shape, which represent a unique phenomenon, are found predominantly in Khorezm (e.g. Deu-kala, Orta-kuyu, Talaykhan-ata, Ak-Yayla) and functioned on the routes from Asia to the Volga region and the Caucasus in the 11th-13th centuries. They were distinguished by the outer contour of walls made of raw brick about 2 m thick, creating a circle with a diameter of 50-60 m. In the centre of the circle, there was a square courtyard with a well. The planning structure of the premises around the courtyard was complex and varied (Fig. 1).

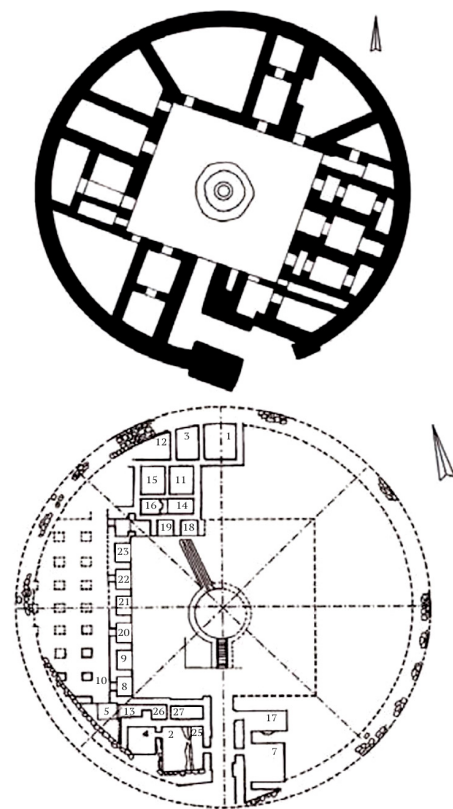


Figure 1. Deu-kala caravanserai (11th-13th centuries), and Taylakhan-ata caravanserai (11th-14th centuries)
Source: M.M. Andrews & S.G. Bernard (2020)



The construction of Tash Rabat from unfinished slabs of mountain blue and red slates with rough cement masonry is a unique example of an architectural style that characterises the local building traditions of that time and place. The blue and red oil shales used in the construction of Tash Rabat were local materials available in the surrounding mountains. Oil shale is a durable and fracture-resistant material, making it an attractive choice for construction. It is possible that the slates may not have been processed or finished by hand, preserving their natural appearance and texture. This could have been done either because of limited resources and facilities or to preserve the natural beauty of the material.

Caravanserais, which served as housing and trading posts for caravans and travellers, had their own design and planning features. Caravan routes in Syria were strategically placed near key trade routes and settlements. They provided travellers and traders with convenient points for resting and exchanging goods. Caravan routes in Syria usually passed through important trading cities such as Damascus and Aleppo. Many caravanserais in Syria included defensive elements, such as walls and towers, to provide security for travellers against various threats, including robber raids. Caravanserais were often built of brick, stone or other strong materials, providing resilience and creating stable structures. Many caravanserais had a courtyard that served as a place for resting and parking animals. This created a space for travellers to exchange and meet. Inside the caravanserais, special premises were provided for trade and exchange of goods. This facilitated the development of trade relations along the routes. Caravanserais provided facilities for travellers, including places to sleep and food offerings. This contributed to safety and comfort during long journeys. Overall, caravanserais in Syria were an integral part of the Silk Road infrastructure, facilitating trade, and cultural exchange and providing security for travellers along the trade route.

The origin and classification of caravanserais, as well as the influence of local and regional peculiarities on their architecture and decor, are interesting aspects of the study of history and culture. Caravanserais have ancient roots and are connected with the development of trade routes and caravan trade. Their appearance is connected with the need to provide travellers with places to rest and ensure safety on long journeys. Caravanserais can be classified by size, functionality and architectural features. For example, there were large caravanserais designed to serve large caravans, as well as smaller and more isolated structures for individual travellers. Caravanserais often reflected local building traditions and used distinctive materials. For example, in desert regions clay and brick might be used, while in mountainous regions stone and wood were favoured. The interiors and facades of caravanserais may have been decorated with various decorative elements such as wood carvings, mouldings, frescoes and mosaics. These decorations may have reflected local traditions and religious influences.

Caravanserais on the Silk Road through Asia may have differed from their counterparts in other regions. East Asian caravanserais, for example, may have been influenced by Chinese architectural traditions. In regions with Muslim influence, caravanserais may have had characteristic elements of Muslim architecture such as arched entrances, columned halls and domes. The study of these aspects provides insight into how different cultural, geographical and religious factors have shaped the architectural designs and decorative elements of caravanserais throughout history. The typology of caravanserais includes different architectural forms and functional features of these structures depending on their location, historical context and role in trade. Stationary caravanserais were permanent nodes on trade routes and were usually located in strategically important places. They included living and storage areas, animal stalls and sometimes defensive structures to protect against attacks. Mobile caravanserais may have been temporary and travelled with the trade caravans. They were accommodation and resting facilities for caravans during their journey, usually consisting of tents or primitive structures. Some caravanserais were associated with religious or cultural centres and served not only as places for rest and trade but also for prayer, learning and knowledge exchange. Depending on their location and their role in trade networks, caravanserais could serve a variety of functions, including providing security, trade, accommodation for travellers and animals, and the provision of various services and goods. Each type of caravanserai had its characteristics and specificities, reflecting the needs and nature of trade and cultural exchanges in different times and regions.

The typology of Silk Road caravanserais includes a variety of forms and styles of these structures that developed along the entire route from China to Europe. Major nodes along the Silk Road route were usually protected by fixed fortresses that also served as caravanserais. These fortresses provided caravans with a haven during their journey and included living quarters, warehouses and defence structures. Some caravanserais were built as large inns or public buildings designed to accommodate and serve travellers and traders. They may have had restrooms, dining halls, baths and other facilities. Some caravanserais were associated with religious sites such as mosques, monasteries or temples. These complexes provided travellers not only places to rest but also opportunities for prayer and spiritual renewal. In some cases, caravanserais included trading pavilions and markets where traders could sell their goods and exchange goods with other travellers. These types of Silk Road caravanserais demonstrate the diversity of function and character of these structures, reflecting the richness of cultural and commercial exchange along this ancient trade route.

Morphological analysis at the local level examines the structural elements and architectural solutions used in the formation of the volumetric and spatial composition of the object (e.g. a platform-stylobate, 1 m high, with a caravanserai on top); exterior and interior walls are made of pasha



blocks adjacent to raw brick masonry; The box vaults are made of square bricks; the cantilevered sails are made of bricks laid at an angle to form stepped arches; the arches of the doorways are wedge-shaped; the corner towers project three-quarters of the facades and have a diameter of 3.2 m at the base; entrance portal protrudes from the wall by 2.8 m; aivan portals are located in the courtyard. At

the structural level, the relationship between the structural elements is revealed due to their functional purpose and load. The outer walls are reinforced with massive towers and buttress pylons, and the north wall has an entrance portal with high pylons and a wide entrance arch. The main facade is decorated with “paired half-gables” extending to the bottom, with perspective arches above (Fig. 2).



Figure 2. Chaldivar Caravanserai

Source: K.F. Hmood & J. Goussous (2022)

The Chaldivar Caravanserai is a historical site that is one of the many caravanserais located along the Great Silk Road. It is an architectural complex that was used to temporarily house caravans travelling along this ancient trade route. Chaldivar has distinctive architectural features typical of the caravanserais of the Great Silk Road. It usually consists of a large building surrounded by walls, sometimes with towers for security. Inside the complex, there was usually a courtyard where caravans could leave their animals and goods, as well as spend the night and rest. In addition, the caravanserai may have had various commercial establishments such as shops and restaurants that provided services for travellers. Caravanserais like Chaldivar played an important role in trade and cultural exchange between East and West. They were not only places of recreation and trade, but also

centres for the exchange of ideas and cultural influences. As of 2024, these historical complexes are often sites of tourist interest and help to preserve the historical legacy of the Silk Road.

The typology of caravanserais is divided into three main types: covered caravanserais resembling a kiosk (ribat, rabat); aivan-type composition with one courtyard, which according to the principle of placing rooms around the courtyard was subdivided into gallery type (gallery around the perimeter of the courtyard), sectional (groups of vaulted rooms adjoin the courtyard by their ends) and sectional-gallery type (combination of the first and the second); multi-courtyard composition consisting of 4 identical courtyards, of one central (through) courtyard and small courtyards on the perimeter, T-shaped arrangement of courtyards (Table 1).

Table 1. Typology of caravanserais

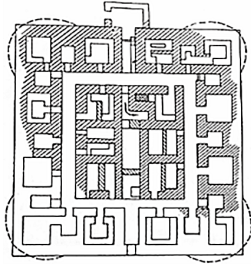
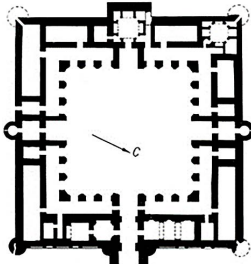
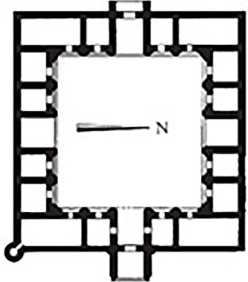
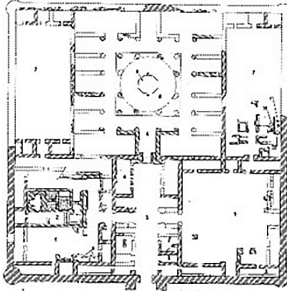
Type	Layout	Characteristic	Caravanserais
1. Covered (no courtyard)	 <p>Aultepe, 5th-6th centuries</p>	<p>Ribat or Rabat fortress. Central core – group of household rooms; bypass corridor; perimeter rooms – repetition of the section – large room with soufs (residential) + small room (storage)</p>	<p>Aultepe, 5th-6th centuries; At-Tahmalaj, 9th-10th centuries; Tash-Rabat, 11th century; Zindan-i Harun al-Rashid, 10th-11th centuries</p>
Gallery-style			
2. One courtyard	 <p>Dayahatyn, 12th century</p>	<p>Courtyard; four-haywan composition; columned gallery around the perimeter of the courtyard; corridor-shaped rectangular rooms; four round corner towers + two in the middle of the north and south walls</p>	<p>Dayahatyn, 12th century; Chaldivar (Manakeldy), 10th-12th centuries</p>

Table 1. Continued

Type	Layout	Characteristic	Caravanserais
		Block-style	
2. One courtyard	 <p>Rabat Suran</p>	<p>Courtyard; four-haiwan composition; vaulted living rooms are arranged in groups of two on either side of the iwan on the north and south sides; on the western and eastern sides – one on each side of the iwan</p>	<p>Rabat Suran, 11th-12th centuries; Sary-Bulun, 11th-12th centuries; Al-Asker, 10th-12th centuries; Southern and Eastern Caravanserais in Misriana, 10th-12th centuries</p>
3. Multi-yard composition (2 or more courtyards)	 <p>Rabat-e-Malik</p>	<p>5 courtyards – 3 in the northern part (front, residential), 2 in the southern part (household); two-part composition; mosque (central passage); bathhouse (south-western courtyard); corrugated decoration of external walls; domed rotunda (central northern courtyard)</p>	<p>Rabat-i-Sharaf, 11th-12th centuries; Akcha-Kala, 11th-12th centuries; Rabat-i-Malik, 11th-12th centuries; Aqir-Tash, 10th century; Kunya-Kala, 10th century</p>

Source: compiled by the authors

Aultepe is an ancient caravanserai that was built in the 5th and 6th centuries. This caravanserai is a significant historical site that served as an important stop on the trade routes of the time. Architecturally Aultepe was a typical representative of the caravanserais of its time, consisting of covered galleries or aivans surrounding a courtyard. The interior may have been used as a place of rest and lodging for caravans and travellers. As one of the stops on the Great Silk Road or other trade routes, Aultepe may have served not only as a resting place but also as a trading centre where merchants and caravaners could exchange goods and commodities. Caravanserais, which provided shelter for travellers as well as a hub for the exchange of both material goods and intellectual information, have become a symbol of the history of the Silk Road. They were not only stopping points for rest and exchange but also key hubs for trade and distribution of goods in the remote and impassable sections of the route. The architecture of caravanserais, corresponding to general requirements and laws, was uniform and developed synchronously in different countries connected by trade routes. It represented a unified model for a temporary stay of travellers with caravans. The common structural norms and rules, as well as the widely accepted architectural system in building practice, were characterised by stability and mass reproducibility. The architectural forms of caravan posts reflected the influence of cultural traditions and the peculiarities of the building art of each region while retaining their uniqueness.

The presented classification of caravanserais is based on the characteristic principles of planning organisation due to the insufficient preservation of the ruins of their structures, which leaves out aspects of their form, time of

creation and semantic significance. The layout of the Chaldovar (Manakeldy) caravanserai correlates with similar structures in Central Asia, such as the caravanserais in Dehistan, Daya-Khatyn, Beleuli in Khorezm (Turkmenistan), which also have a common compositional scheme, including a courtyard with surrounding rooms, corner towers and intermediate buttresses, as well as a single entrance and so on. Despite this, the Chaldovar caravanserai stands out among its counterparts by its distinct organisation of functional and procedural relations, having no direct parallels with other structures. The decorative design of the main facade of the Chaldovar caravanserai, consisting of complicated corrugations, for example, in the form of two half corrugations separated by a shallow straight niche, was also used in the design of the facade of the steppe palace of Rabat-i Malik (Uzbekistan). However, a significant difference in the application of this architectural decoration should be noted. In the case of the Chaldovar caravanserai, the facade plastic of rhythmically repeating elements covers the entire surface of the facade, in contrast to Rabat-i Malik, where this technique was not used on such a scale as it was in earlier constructions, for example, of the 6th-8th centuries.

DISCUSSION

The internal walls of the building are up to 1.4 m thick and are built on alabaster in Tash Rabat, indicating serious construction and the use of durable materials to create this structure. This significant thickness was chosen to ensure the strength and resistance of the building to external influences such as winds, earthquakes or other natural factors, as well as to provide thermal insulation and safety for those living or staying inside. Alabaster was used as a



material for masonry walls. Alabaster is a mineral that when mixed with water forms a strong bonding mortar which then hardens and strengthens the wall (Shumka *et al.*, 2020). This construction method produces strong and durable walls by providing good adhesion and stability. Alabaster has several advantages as a building material. It is readily available, making it a cost-effective choice. In addition, alabaster has good strength and resistance to a variety of conditions, making it ideal for use as a bonding material for large and thick walls, as in the case of Tash Rabat. The use of alabaster to bind the walls of Tash Rabat ensures not only their strength but also the durability of the structure for years to come. This allows the structure to stand the test of time and retain its architectural value and historical significance.

Following recent studies by R. Lin *et al.* (2024), the network of trading town centres and caravanserais, also known as road stations, played a key role in maintaining a lively commercial activity for many centuries until the 15th century. These commercial complexes served as important nodes on historic trade routes, providing a variety of functions. Town centres provided places for the exchange of goods, trade and interaction between merchants and travellers. Currently, improvements in the quality of various methods and devices are required, characterised by a variety of structural and architectural features, these methods and devices have been specifically adapted to the needs of caravans and trading communities. After scrutinising the functioning of caravanserais, or road stations, they played an important role in the supply system. The results of this study concur with those of the researchers in that indeed caravanserais played the role of an artery supporting commercial activities along the entire Silk Road route.

Following R.W. Alnaemy (2024), the outer walls of the caravanserai of Tash Rabat form a square at the base, the side of which is 32 m. These walls are not only the boundary for the caravanserai itself but are also private walls for the adjacent cells, rooms and corridors. The base of the caravanserai is square in shape, which is typical of many oriental-style architectural structures, including caravanserais. This fact confirms that the author's research is in line with current trends in architecture, the square shape provides not only compactness but also symmetry of the structure, which is an important aspect in creating functional and aesthetically pleasing buildings, in this case, the use of a square base of 32 m allows for optimal distribution of the interior of the caravanserai, providing convenience for its visitors and efficient use of space. There has not been sufficient mention in this study of the importance of external walls to the architectural appearance of the Tash Rabat caravanserai, these walls play a key role in the architectural design, providing not only its structural strength and security but also serving as the basis for its functionality, they define the contours and boundaries of the structure as well as providing privacy and protection for those living and inside, their importance as a fundamental element influencing the overall aesthetics and functionality of the entire caravanserai complex is emphasised.

S. Hafeez *et al.* (2024) identified that mazars are shrines in Asian culture that often have a recognisable architectural appearance. They can be places of worship, mausoleums, or places of remembrance for famous individuals. The appearance of a caravanserai compared to a mazar indicates its religious and cultural significance. To ensure that these caravanserais function more effectively, the use of rough-hewn stone for the construction of the facades gives the buildings a traditional and authentic appearance which is important for the preservation of the historical value and cultural heritage of the region, this style of stonework can also provide additional strength and durability to the building which is necessary for its long-term use in the context of intensive trade and cultural exchange on the caravan routes, thus an appearance reminiscent of ancient buildings. Notable for its focus on the significance of the style of stonework that gives the caravanserai an authentic appearance and sense of historical durability, this study also emphasises the need for careful analysis of the data to gain a full understanding of the architectural features and cultural context of these structures.

R. Kana'an & A. Shalem (2024) note that the mention of an Asian mazar indicates that the caravanserai conforms to the traditional architectural styles of the region. This may include elements of ancient Asian architecture that are characteristic of the culture and history of the place. The mazar appearance of the building may carry symbolic meaning and be an important element of the cultural heritage of the region (Kemalbekova *et al.*, 2023). The results of this study indicate that caravanserais not only represent a place of temporary accommodation for travellers but also have significant cultural and historical significance that inspires respect and admiration, these structures play an important role not only in providing convenience and safety for travellers but also in preserving the cultural heritage and traditions of the region. It is also important to note that the caravanserai of Tash Rabat was undergoing intensive development at this stage, this description emphasises its uniqueness, cultural richness and connection with the traditional architectural styles of the region, moreover, it highlights its religious and historical significance, emphasising its role in shaping the cultural heritage and identity of this region.

H. Osni (2024) demonstrated that the second stage, falling between the 7th and 10th centuries, was characterised by the strengthening and expansion of the trade route. During this period, major cities, centres of trade and cultural exchange began to appear and flourish along the Silk Road. The third stage, 13th-14th centuries, is associated with the last great unrest and the peak of Silk Road activity (Trushaj, 2023). Nevertheless, this study does not address the fact that many caravan trade routes were actively developed during this period, linking diverse regions and along which unique cultural and economic monuments emerged. It is also worth noting that each of these phases contributed to the history and significance of the Silk Road, reflecting its dynamic development and impact on world history, hence the distinction between this study and the author's work.





As M.S. Alsubaie *et al.* (2024) note, the cells of the caravanserai of Tash Rabat are rooms of various sizes arranged in rows, sometimes creating a labyrinth-like structure, among them more than forty. Each keli has a domed light hole in the centre, reminiscent of a tunduk in a yurt. The kelis offer a variety of sizes to suit the different needs of travellers and traders. It is also worth noting that the cultural and architectural influences of the Tash Rabat caravanserai spread over a wide area, this included a variety of spaces ranging from small rooms for single travellers to large rooms for caravans and groups. This diversity provides convenience and meets the needs of different categories of travellers and traders, making the caravanserai a centre of vitality and cultural exchange across the many spaces of the journey.

CONCLUSIONS

The study reveals that management strategies gradually led to the fact that the route passing through the Kaghan's stakes in Semirechye became the main route of ambassadorial caravans. The study shows that caravanserais on the Silk Road vary in their architectural form and functionality, representing a wide range of structures from large stationary fortresses to temporary tents and mobile structures. Caravanserais served a variety of functions, including providing shelter for caravans, protection from attack and convenience for travellers, some also had trading areas, baths and places of prayer. The study analysed the changes in the architectural features of caravanserais which may have occurred following the evolution of time and location, for example, as trade increased and security improved, larger and more elaborate structures became necessary.

A detailed analysis of the operation of the caravanserai, a key element of the architectural landscape of medieval Asia, is produced. Special attention is paid to the analysis of technological processes, as well as to the identification of problems arising in the process of creating caravanserais. Implementation of effective tools contributes to the successful resolution of these issues and the prevention of mistakes in the future. Caravanserais were not only trade sources, but also centres of cultural and social exchange. They contributed to the rapprochement of different cultures and peoples and played an important role in the dissemination of ideas and art. This study has successfully achieved its objectives, including analysing the typology and architectural features of trade complexes located on historical routes, with a special focus on the caravanserais of the Great Silk Road. The process of creating fortresses (rabats) to ensure the safety of the roads has also been considered earlier. Some caravanserais may have been decorated with carvings, mosaics, frescoes or other decorative elements reflecting local traditions and art.

The studied typology and architectural features of trading complexes on historic trade routes will endeavour to meet modern requirements for the future prospective use of caravanserais. Planned research aims to develop and implement innovative methods of analysis, using the caravanserais of the Great Silk Road as a case study, to contribute to the development of the archaeological field.

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CONFLICT OF INTEREST

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Ольга Воліченко

Доктор архітектури

Киргизький державний технічний університет ім. І. Раззакова
720044, просп. Ч. Айтматова, 66, м. Бішкек, Киргизька Республіка
<https://orcid.org/0000-0002-1403-8021>

СяюЮ Хуанг

Докторант

Киргизький державний технічний університет ім. І. Раззакова
720044, просп. Ч. Айтматова, 66, м. Бішкек, Киргизька Республіка
<https://orcid.org/0009-0004-6813-6198>

Вей Сьонг

Докторант

Киргизький державний технічний університет ім. І. Раззакова
720044, просп. Ч. Айтматова, 66, м. Бішкек, Киргизька Республіка
<https://orcid.org/0009-0001-0991-1658>

Фей Ву

Докторант

Киргизький державний технічний університет ім. І. Раззакова
720044, просп. Ч. Айтматова, 66, м. Бішкек, Киргизька Республіка
<https://orcid.org/0009-0003-9597-3218>

Азик Орозонова

Кандидат економічних наук, доцент

Киргизький національний університет ім. Жусупа Баласагіна
720033, вул. Фрунзе, 547, м. Бішкек, Киргизька Республіка
Киргизький економічний університет ім. Муси Рискулбекова
720033, вул. Тоголок Молдо, 58, м. Бішкек, Киргизька Республіка
<https://orcid.org/0000-0001-6877-7674>

Типологія та архітектурні характеристики торговельних комплексів на історичних торговельних маршрутах: аналіз на прикладі караван-сараїв Великого Шовкового шляху

Анотація. Дослідження, присвячені типології та архітектурним особливостям торговельних комплексів, розташованих на історичних маршрутах, караван-сараїв Великого Шовкового шляху, залишаються актуальними в сучасному світі, оскільки ці структури не лише репрезентують історичну спадщину, а й володіють потенціалом для розуміння впливу торгівлі та культурного обміну на формування міського середовища. Мета дослідження полягає у виявленні типології та архітектурних особливостей торговельних комплексів, розташованих на історичних маршрутах, з поглибленим вивченням караван-сараїв Великого Шовкового шляху. Дослідження включає в себе застосування аналітичного підходу, методу класифікації, функціонального аналізу, статистичних методів, методу синтезу та інших методологічних підходів. У процесі дослідження було виявлено особливості та відмінності в типології та архітектурних характеристиках торговельних комплексів, розташованих на історичних маршрутах. Має важливе значення проведення аналізу змін на прикладі караванних торговельних шляхів, що простягалися через середньовічну Азію та Євразію, з метою оцінювання еволюції та ускладнення в ході їхнього розвитку. Розглянуто доцільність використання аналізу на прикладі караван-сараїв Великого Шовкового шляху, виявлено обмеження в ході процесу, проаналізовано вплив обмежень на результат. Виявлено, що під час архітектурних досліджень, які ґрунтуються на археологічних пошуках, була приділена увага розкопкам великих міських центрів, розташованих уздовж маршрутів. Практична значущість роботи полягає у застосуванні отриманих результатів для усунення помилок у покращенні типології та архітектурних характеристик торговельних комплексів на історичних маршрутах, також розглянуто надійність застосування аналізу на прикладі караван-сараїв Великого Шовкового шляху з урахуванням різноманітних чинників, що слугуватиме підґрунтям для надання рекомендацій щодо використання отриманих даних типології караван-сараїв

Ключові слова: археологічні дослідження; культурний обмін; аналіз міжкультурних взаємодій; рекомендації для розвитку та покращення; розкопки великих міських центрів