COMPARISON OF SPATIAL RELATIONS IN *MENZIL* COMPLEXES ON THE HISTORIC ROUTES OF ANATOLIA

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Abstract: *Menzil* Complexes were constructed at the crossroads of significant trade routes since the Anatolian Seljuk period. These social structures promoted the growth of cities, facilitated commerce, and ensured safety in the Ottoman period. In the design of *menzil* complexes, it is critical to thoroughly examine the interconnections and interactions between commercial, residential, religious, and educational spaces. The study aims to determine the relationship between the functions in the *Menzil* complex by Visibility Graph Analysis (VGA) connectivity (the connection between spaces) and through vision (movement path) analysis. In this way, the position and significance of the different functions in the design of the *menzil* complexes, established to promote urban development and trade, will be determined. The method of the study consists of two steps. In the first step, the functions of the spaces and the transitions between spaces were identified. In the second phase, the relation between the spaces that have different functions is investigated with the VGA connectivity, and through vision analysis by DepthMapX 0.8.0. As a result, it is seen that the complexes could be designed with different sizes and functions depending on the budget determined for their construction as well as the characteristics of their nearby surroundings. The plan organization of the complexes is not similar in terms of their region and route, however, the primary targets about the spatial relations and usage of architectural elements in all complexes are conserved. Ensuring spatial relationships while protecting the main design ideas in different plan organizations shows the development of the architectural planning approach of that period.

Keywords: *Menzil* Complexes, Visibility Graph Analysis, Plan Organization.

ANADOLU'NUN TARİHİ GÜZERGAHLARINDA YER ALAN MENZİL KÜLLİYELERİNİN MEKÂNSAL İLİŞKİLERİNİN KARŞILAŞTIRILMASI

Özet:

Menzil Külliyeleri, Anadolu Selçuklu döneminden itibaren önemli ticaret yollarının kavşağında inşa edilmiştir. Bu sosyal yapılar Osmanlı döneminde şehirlerin büyümesini teşvik etmiş, ticareti kolaylaştırmış ve güvenliği sağlamıştır. Külliyelerin tasarımında ticari, konaklama, dini ve eğitim mekanları arasındaki ilişkilerin analitik olarak incelenmesi ve mekanların ilişkisini belirleyen ilkelerin ortaya çıkarılması önemlidir. Çalışma, menzil külliyelerindeki farklı fonksiyonlar arasındaki ilişkiyi Görüş Grafiği Analizi (VGA) bağlantısallık (mekanlar arası bağlantı) ve görsel algı (dolaşım rotası) analizi yoluyla belirlemeyi amaçlamaktadır. Böylece kentsel gelişmeyi ve ticareti teşvik etmek amacıyla kurulan *menzil* külliyelerinin tasarımında farklı fonksiyonların konumu ve önemi belirlenecektir. Çalışmanın yöntemi iki aşamadan oluşmaktadır. İlk aşamada yapılardaki mekânların fonksiyonları ve mekânlar arası geçişler belirlenmiştir. İkinci aşamada, DepthMapX 0.8.0 yazılımı kullanılarak farklı işlevli mekânlar arasındaki bağlantısallık ve dolaşım rotası incelemiştir. Çalışmanın sonucunda, külliyelerin inşa edildiği alanın çevresel ve topografik özelliklerinin yanı sıra inşası için ayrılan bütçeye göre farklı boyutlarda ve işlevlerde tasarlanmış olduğu görülmüştür. Külliyelerin plan organizasyonları bölgeye veya rotaya göre benzerlik göstermemiş, ancak tüm külliyelerde mekânsal ilişki ve mimari eleman kullanımı ile ilgili ana kararlar korunmuştur. Farklı plan organizasyonlarında mekânsal ilişkilerin ana tasarım kararlarını koruyarak sağlanması, o dönemin mimari planlama yaklaşımının gelişimini göstermektedir.

Anahtar sözcükler: Menzil Külliyeleri, Görüş Grafiği Analizi, Plan Organizasyonu.

1. INTRODUCTION

The *Ulak* system was a postal or communication organization that existed in the early Ottoman period. With the institutionalization of the *ulak* system, the *menzil* organization was established in the mid-sixteenth century. [1]. *Menzil*, literally means a place where one breaks or stays to rest during a journey, is a form of transportation-based communication [2, 3]. The Ottoman Empire built different structures along the main Anatolian and Rumelia *menzil* routes like small bridges, fountains, wells, *han*s, and *menzil* complexes. Although *menzil* complexes were residential buildings situated along the interstate roadways, certain facilities were also offered to pilgrims, traders, tourists, and even those with military training to make their stay more comfortable and secure. These social buildings promoted the growth of the cities, facilitated commerce, and ensured safety. Caravanserais (a large *han* built for the accommodation of caravans on the main roads) and *arasta*s (a bazaar is a group of stores arranged in rows along an open or closed axis, where traders sell similar goods in Ottoman architecture) are crucial components of *menzil* complexes [3-4]. The creation of *menzil* complexes in the sixteenth century was greatly influenced by roadways' topographical factors. *Menzil* complexes are located on main roads, in addition to existing settlements, or in the areas called *Derbent* [4].

There are some critical roads in Anatolia and Rumelia in the Ottoman period. Most of the roads followed the ancient routes. In the Roman and Byzantine eras, roads in the Anatolian

peninsula were divided into three primary directions: north, south, and center. The development of Anatolia routes continued in the Seljukid period [5]. In the Ottoman Empire, the routes were divided into three main roads in Anatolia and Rumelia. These were called "right, middle, and left branches" [3]. Among the Ottoman roads, two routes are particularly noteworthy. The first is the middle branch in Rumelia, the main road extending from Istanbul to Belgrade. The second route is the right branch in Anatolia, or, in other words, the pilgrimage route. The Romans used the Rumelia Middle Branch before the Byzantines and the Ottomans. On the road that shaped the Ottoman conquests in Rumelia, various *Menzil* complexes were built to increase the commercial and political importance of the road [6-7]. The second critical route is the Anatolian Right Branch, alternatively referred to as the Istanbul-Holy Land Road. This road served as a multifunctional main road for military, commercial, communication, and pilgrimage purposes. The Right Branch primarily functioned as a route for religious pilgrimages [3]. Pilgrim convoys, commercial travelers, and military supply chains derive advantages from utilizing these routes [8]. Thus *menzil* complexes have different functions such as *arasta*, caravanserai, *tabhane* (a place of rest in the Ottoman period), *imaret* (a place where large amounts of meals are cooked, distributed and eaten for those staying in the social complex and the needy people in the surrounding area), *bedesten* (an Ottoman covered bazaar covered with equally sized domes selling valuable goods), *medrese* (a school graded between secondary and higher education where Islamic and other sciences are generally taught) and *sıbyan mektep* (a primary education school where children learn how to read the Quran and pray) [3, 9, 10]. There are many studies focused on the characteristics of the *menzil* complexes. Müderrisoğlu (1993) focused on the *menzil* complexes on the Anatolia-right and Rumelia Middle Branch [3]. Cezar (1983) typologically classified commercial buildings of the Ottoman Classical Period according to their plan features. He examined complexes in the city and out of town within this classification [11]. Ertaş (2006) has a study compiling *menzil* complexes' maintenance and repair works on the Anatolian right road [7]. Sınmaz (2017) examined the spatial characteristics of *menzil* complexes [12]. Cantay (2023) examined the Ottoman Period complexes and *menzil* complexes in detail [13]. Numerous studies have been conducted to investigate the properties of a *menzil* complex or to emphasize a specific type of function inside a complex [14-24]. Numerical analysis of the relationships between the areas for commerce, lodging, religion, and education is crucial, as is the identification of the principles behind the arrangement of these spaces within social complex designs. There are studies analysing visual relations of the different functional spaces in historical buildings and heritage sites [25-28, 32]. However, the spatial organization of the historic *menzil* complexes was not investigated. The study aims to determine the relationship between the different functional spaces in the *menzil* complex through Visibility Graph Analysis (VGA) connectivity (connection between spaces) and through vision analysis (movement path). The emphasis is also placed on the relations between spatial organization and the location of the complexes. In this way, the importance and relations of the functions in the design of the range complexes established to promote urban development and trade will be determined.

2. METHOD

Within the scope of the study, the complexes in the *menzil* routes on the south of Anatolia, the Anatolian right branch, and the secondary road connecting to this right branch, were

examined. The case studies are Öküz Mehmet Paşa Complex, Sokullu Mehmet Paşa Complex, and Lala Mustafa Paşa Complex, located on the Anatolian Right Branch, and Kara Mustafa Paşa Complex and Sinan Paşa Complex, located on the secondary road. The buildings are located in different climates and geographies. Sokullu Complex in the Mediterranean region; there are Öküz Mehmet Lala Mustafa Paşa, Kara Mustafa Paşa, and Yeni Han in the Central Anatolia region (Figure 1).


Figure 1. Position of the studied *menzil* complexes [3]

The analysis consists of two steps. In the first step, the spaces in the buildings and the transitions between the spaces were identified. In the second phase, the relation between the spaces is analyzed in terms of VGA connectivity and through vision via DepthmapX 0.8.0 software. VGA is a method used to measure space arrangement in regular units. It helps determine how this arrangement relates to human behavior within that space. It is a tool that allows for examining the relationship between the spaces and their occupants by analyzing specific spatial properties, particularly those related to visibility [29-32]. VGA connectivity refers to the number of direct connections a cell (or point) has with other cells. That is, the more direct visual contacts a given cell has with other cells around it, the higher the connectivity value of that cell. High connectivity means a cell has more connections, making it easier to move directly from that cell to other cells. This indicates that a space is more open and accessible. If a cell has a small number of connections, this indicates that movement in that cell may be made by deviations. This is low connectivity [30].

Through vision, identify areas more likely to be visited or be used because they are directly on the path between two positions in a building or city. It can be identified as the prediction of user movements. It allows for the examination of the spatial distance between distinct areas in a plan as well as the relationships between these locations. This aids in identifying the areas inside a given location that users more use [29].

2.1. Complexes

Sokullu Complex consists of an *arasta* located in the north-south direction, a *tabhahe*, *imaret*, and caravanserai in the east of the *arasta*, and a madrasah, mosque, bath, and *sıbyan mektep* in the west of the *arasta*. The masses are located adjacent to each other. *Tabhahe, imaret*, and caravanserai are located around the courtyard, and the madrasah has a small open courtyard. The *imaret* and *tabhane* also have small gardens. A temperate climate prevails in the region but receives abundant rainfall. However, the complex is introverted. This could be that the need for security is high [8, 11, 34] (Figure 2).
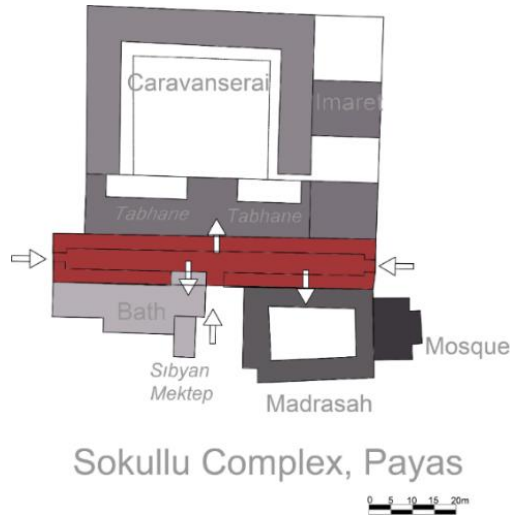

Figure 2. Distribution of functions in Sokullu Complex, Payas [8, 11, 33]

The Öküz Mehmet Paşa Complex, located in the southeast of the Central Anatolia Region, has two caravanserais in the north and south and a bath in the south of the linearly planned *arasta*. The caravanserai, located in the north of the complex, has a courtyard. All spaces can be reached from the *arasta*. In the southeast, there is a mosque independent of the complex. Located in a continental climate, open spaces in the building are limited (Figure 3).
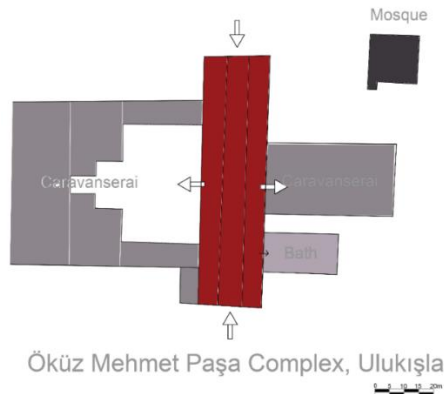

Figure 3. Distribution of spaces in Öküz Paşa Complex in Ulukışla [11, 33]

Lala Mustafa Paşa Complex is located in the Ilgın district on the Anatolian Right Branch. The *arasta* situates in the east-west direction. The western side of the *arasta* was designed as an open space. Caravanserai, *tabhane*, mosque, *sıbyan mektep*, and *imaret* surround a courtyard in the south of the *arasta*. The courtyard is reached with a single passage from the *arasta*, and there is access to the mosque, *imaret*, *sıbyan mektep*, and *tabhane* from the courtyard. Access to the spaces except *arasta* is highly controlled (Figure 4).
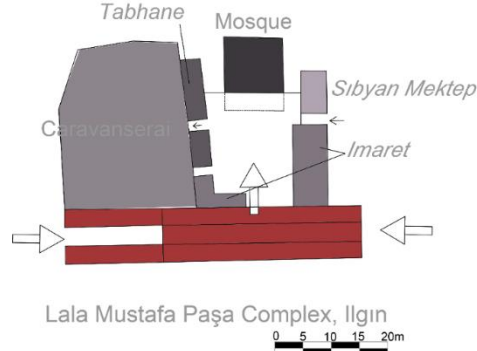
Figure 4. Distribution of spaces in Lala Mustafa Complex in Ilgın [11, 35]

There is a caravanserai northeast of the Kara Mustafa Paşa Complex, located on the secondary road branching off from the Anatolian right-way branch to the northeast, and a mosque, a madrasah, and a bath are in the southwest. The *arasta* is designed as an open space. The courtyard of the mosque and madrasa can be accessed from the outside and the *arasta*. It is noteworthy that the use of open space is relatively high in the complex although it is in harsh climates (Figure 5).
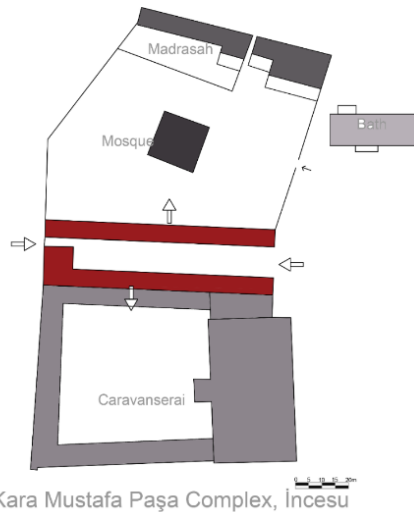
Figure 5. Distribution of functions in Kara Mustafa Paşa Complex in İncesu [11, 35]

There are caravanserais adjacent to the north and south of the *arasta* situated in the central axis of the Yeni Han Complex, located in a similar climate to Kara Mustafa Paşa Complex. Unlike the Kara Mustafa Paşa Complex, there is no open space in Yeni Han (Figure 6).
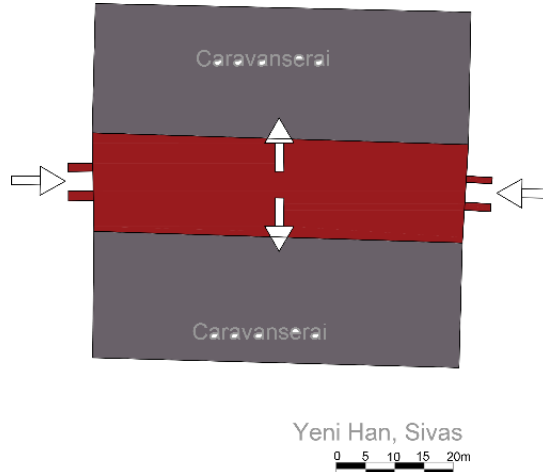

Figure 6. Distribution of spaces in Yeni Han Complex in Sivas [11]

3. FINDINGS

In the study, functions such as *arasta*, caravanserai, madrasah, mosque, bath, *imaret*, *tabhane*, and *sıbyan mektep* were identified within the *menzil* complexes. We can classify the functions as trade, accommodation, religion, nutrition, and education. Although the masses that constitute these functions in the *menzil* complexes are adjacent, open courtyards between the masses or belonging to a single mass, also draw attention. The highest usage of open space is in Kurşunlu and Kara Mustafa Paşa Complexes. There is no open space in Yeni Han. All complexes have *arasta*s, caravanserais, and mosques. Then, the most preferred functions are bath and *imaret*. Sokullu Complex includes all the functions mentioned. It is noteworthy that while one complex on the route contains all functions, the next complex has only accommodation and trade functions (Table 1).

Table 1. Functions in *Menzil* Complexes

Complex	*Arasta*	Caravanserai	Madrasah	Mosque	Bath	İmaret	Tabhane	*Sıbyan Mektep*

Kara Mustafa Paşa Complex, İncesu	✓	✓	✓	✓	✓			
The Öküz Mehmet Paşa Complex	✓	✓		✓	✓			
The Sokullu Complex, Payas	✓	✓	✓	✓	✓	✓	✓	✓
Lala Mustafa Paşa Complex	✓	✓		✓		✓	✓	✓
Yeni Han, Sivas	✓	✓		✓		✓		

It was noted that each of the complexes featured entrances that led from the *arasta*. Kara Mustafa Paşa and Lala Mustafa Paşa also have entrances from the courtyard. Upon analysis, it has been noted that the Sokullu Complex has multiple functions, leading to a corresponding increase in the number of entrances. The study revealed that the *arasta* gates predominantly opened into the caravanserai or the courtyard in which the caravanserai is situated. In Öküz Mehmet Paşa and Yeni Han, there are caravanserais on both sides of the *arasta* and there are passages to these caravanserais (Table 2).

Table 2. Connection between the different functioned masses

| Name of the complex	Location of the Entrance Gates		*Arasta* Gate 1 opens to	*Arasta* Gate 2 opens to	*Arasta* Gate 3 opens to
	Arasta	**Courtyard**			
Kara Mustafa Paşa Complex, İncesu	2	1	Caravanserai	Courtyard Mosque Madrasah	
The Öküz Mehmet Paşa Complex	2		Caravanserai (Winter)	Caravanserai (Summer)	
The Sokullu Complex, Payas	3		Caravanserai	Bath	Madrasah
Lala Mustafa Paşa Complex	2	1	Courtyard Mosque, *İmaret,* Caravanserai		
Yeni Han, Sivas	2		Caravanserai	Caravanserai	

The results of connectivity and through vision analysis are presented in Figure 7. The VGA procedure assigns different values (color-coded from red for "very high" measures to dark blue for "very low" measures) to each grid square for representation. The graphs are color-coded to indicate connection and visibility. While each cell receives a connection value for precise numerical analysis, color coding enables the quick and intuitive interpretation of data.

The results of the Kara Mustafa Paşa Complex show that the *arasta* and madrasah cells have low connectivity values. The courtyards of the caravanserai, mosque, and madrasah have the highest connectivity values. Therefore, they are visually and socially integrated into the plan. The integration between *arasta* and courtyards is low. Since this complex has large courtyards, the courtyards have high connectivity values. The through-vision analysis of Kara Mustafa Paşa shows that users tend to go towards the circulation area of the *arasta* and the courtyards. The reddest area that has been used chiefly is the caravanserai courtyard (Figure 7).

The results show that the *tabhane*, *imaret*, and *sıbyan mektep* have low connectivity values in the Lala Mustafa Paşa Complex. The courtyards surrounded by the mosque, *imaret*, and *tabhane* have the highest connectivity. This means that the courtyard has the most connection with other spaces. The caravanserai also has high connectivity. The circulation area of the *arasta* has low connectivity. The result of a through vision analysis of Lala Mustafa Paşa shows that users mostly use the circulation area of the *arasta*, the passage between the *arasta* and the courtyard, and the route between the courtyard and the caravanserai. The analysis determined that the courtyard is the most active area. *Tabhane*, *imaret*, and *sıbyan mektep* have low through vision value (Figure 7).

The results show that the bath and closed spaces of the caravanserai-looking courtyard have low connectivity values in Öküz Mehmet Paşa Complex—the caravanserai courtyard and the middle of the *arasta* have the highest values. The highest values present a linear axe between caravansaries and *arasta*. The result of through vision analysis of Öküz Paşa Complex shows that users mostly use the circulation area of the *arasta* and the main axes between the *arasta* and the caravanserai. The most frequently used area is in the middle of the *arasta*. The bath has the lowest through vision value (Figure 7).

In Taşhan, which contains only a caravanserai and an *arasta*, high connectivity and through vision were detected in the transitions between the caravanserai and *arasta* (Figure 7).
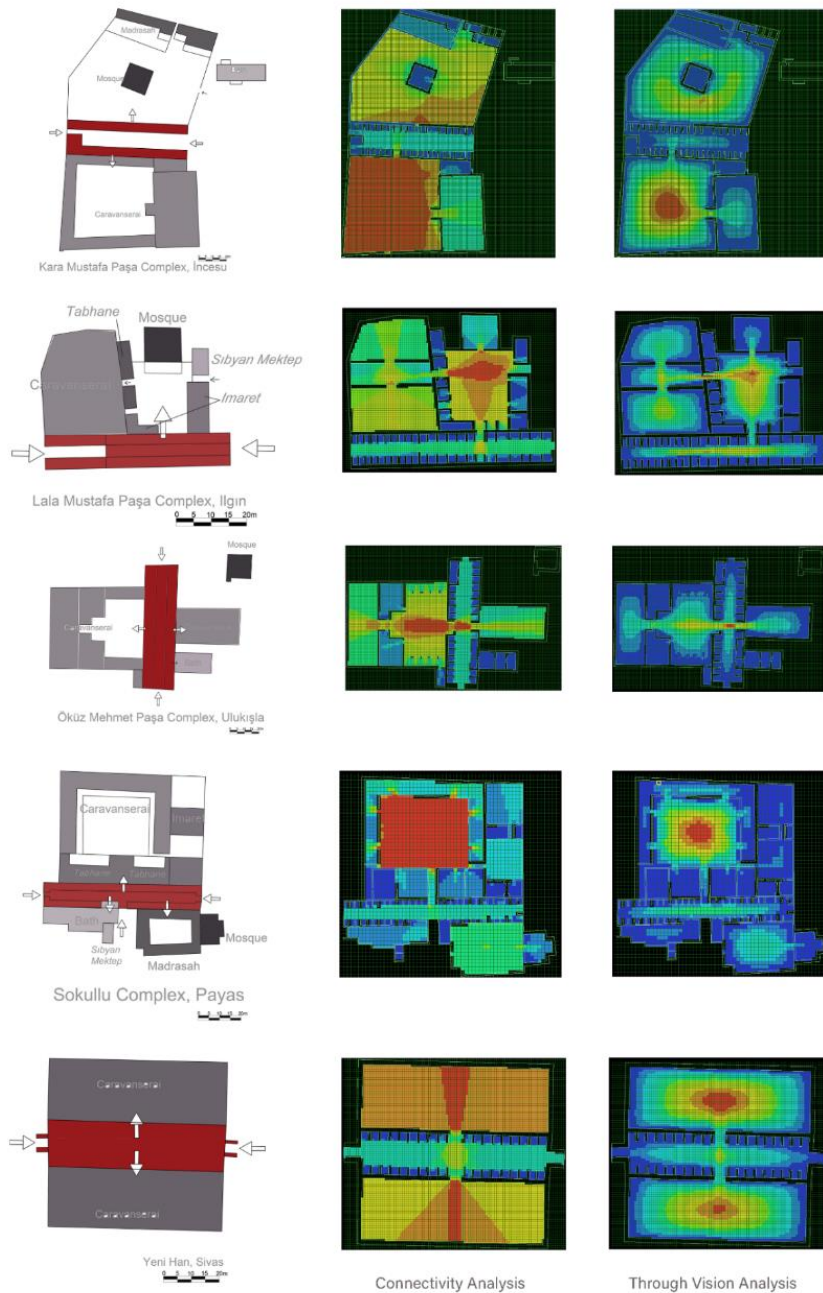
Figure 7. The results of connectivity and through vision analysis (color-coded from red for "very high" measures to dark blue for "very low" measures)

4. CONCLUSION

Menzil complexes are designed by integrating different functions depending on the characteristics of the area they are located in. It is essential to examine the relationships between commercial, accommodation, religious, and educational spaces numerically and to reveal the principles that determine the positions of the spaces in the design of the *menzil* complexes. Many studies focused on the characteristics of the *menzil* routes and complexes. However, the spatial organization of the historic social complexes in the Ottoman period was not investigated numerically. Although *menzil* complexes were residential buildings situated along interstate roadways, certain facilities were also offered to pilgrims, traders, tourists, and even those with military training to make their stay more comfortable and secure. These social buildings promoted the growth of Ottoman cities, facilitated commerce, and ensured safety. In this way, this study is essential to understand the urban and trade development of the Ottoman Empire since connectivity and through vision analysis of the plan organizations of the *menzil* complexes were done.

The functions in case study complexes include trade, accommodation, religion, nutrition, and educational facilities. The *arasta*, caravanserai, madrasah, mosque, bath, *imaret*, *tabhane*, and *sıbyan mektep* functions were determined in the *menzil* complexes. Although the masses that constitute these functions in the complexes are located adjacent to each other, the use of open courtyards between the masses or belonging to a single mass also draws attention. The highest use of open space is in Kurşunlu and Kara Mustafa Paşa Complexes. There is no use of open space in Yeni Han. It is seen that all the complexes have *arasta*s, caravanserais, and mosques. All the buildings had entrances from the *arasta*. *Arasta* gates mostly open to the caravanserai or the courtyard where the caravanserai was located.

VGA Connectivity analysis results identified more open and accessible areas in the *menzil* complexes as courtyards of caravanserais. The transition between the most used passes through caravanserai and *arasta*. It was determined that connectivity (accessible areas) was intense along the axes or on the squares (areas). In examples where different functional masses were added adjacent to the *arasta*, connectivity is concentrated in the transition axis of the *arasta* and in the transition axes from the *arasta* to other masses positioned perpendicular to this axis. In the case studies where the courtyard was reached from the *arasta*, it was observed that the connectivity was higher in the courtyards than in the *arasta*. Spaces with high connectivity mostly contain commercial or accommodation functions. However, the high connectivity observed in the courtyards of the Kara Mustafa Paşa Complex surrounded by the mosque and madrasah. In Lala Mustafa Paşa, it was observed that connectivity was high in the courtyard surrounded by the *tabhane*, *imaret*, and *sıbyan mektep*. The example where the linear connectivity axis is the most clearly identified is the Öküz Mehmet Paşa Social Complex. While the connectivity values are the highest in the courtyard of the Sokullu Complex, which is in the Mediterranean region on the Anatolian right route, the connectivity values are higher in the axes in the complexes located in the Central Anatolia region. However, in Kara Mustafa Paşa, located on the secondary road, it was observed that the *arasta*'s connectivity was lower than the courtyards.

The places with higher accessibility and usage are caravanserais' courtyards and *arasta*s' circulation areas. This shows that trade and accommodation were at the forefront of the *menzil* complexes. The mosques in Kayseri Kara Mustafa Paşa and Lala Mustafa Paşa Social Complexes have high connectivity and through vision due to their position in the complex. The mosque is also adjacent to the Sokullu Complex, but it is not in a location with intense accessibility. Functions such as *imaret*, bath, and madrasah are the areas with the lowest accessibility.

As a result, it was seen that the *arasta*s were placed in the middle axes to highlight the commercial functions, and access to the courtyards or caravanserais was provided from these axes. It is seen that spatial relations were constructed consciously. Commercial and accommodation spaces strategically had been designed as accessible areas. The accessibility of the religious spaces was lower than that of commercial ones. A similar or common plan organization in the *menzil* complexes could not be identified, the each complex is unique. Complexes were probably designed depending on the environmental and topographic characteristics of the area and the budget allocated for the complex. It is seen that there is no clear distinction between plan organizations in terms of region or route, but the primary targets are preserved in terms of spatial organization. Ensuring spatial relationships while protecting the main objectives in different plan organizations shows the development of the architectural planning approach of that period.

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