THE TRACES OF 20th CENTURY ARCHITECTURAL HERITAGE AND CONSTRUCTION TECHNOLOGIES IN ISTANBUL PORT

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Abstract. In 1850s, the modernism movement and the consequent changes in architecture that influenced the whole world had an impact on the Ottoman Empire. In this period, not only the external trade deficit of the Ottoman Empire increased, but also the control of European capital over Ottoman economy kept growing. In addition, western companies and entrepreneurs had contributed to the public works in Istanbul. In this context, the first quay in Istanbul was constructed in 1895 by a French entrepreneur, Marius Mitchel, on the shore between Karaköy and Tophane in Galata region. In 1907, Mitchel has quit the work and Ottoman Bank became involved as a partner. As a result, Galata Customs Building (1907-1911) was constructed for the customs of Istanbul port; followed by Çinili Quay Khan (1910-1911) and Central Quay Khan (1912-1914), which were constructed in accordance with the office functions of this period. In 1935, Karaköy Passenger Hall was added to these buildings, symbolizing the development in sea transport. These commercial buildings, which are the products of transition from 19th century architecture to 20th, are the modern and pioneer buildings of their period because of their architectural orders, façade formations and different construction techniques of post-Industrial revolution.
1 INTRODUCTION

Starting from the first quarter of 18th century, a new perspective for European civilization was adopted by the Ottoman Empire and this westernization concept was transformed into an essential renovation movement in governmental and social structure. The symbolic vision of this renovation could be seen in the western capital image which was tried to be applied to Istanbul. However, the contrast created by the traditional urban fabric, which consisted of timber buildings, required a thorough modification in urban and architectural structure. Therefore, the initial steps of implementing any change were taken with the decision of constructing buildings that are required as the necessary structures of modern state and public in line with the reforms, such as administrative, education, health, transportation and public buildings, according to European architectural design models with modern building materials and building construction technologies. The reason for this is Ottoman Empire could not experience “Enlightenment” and “Industrial Revolution” as in Europe because of the internal dynamics of its society and its conservative structure; therefore it was dependent on western industry.

Fabricated building materials of European industry, such as brick, steel girders and concrete, as well as construction technologies like steel frame, iron-concrete and concrete were important determinants of Ottoman architecture in the historical evolution starting from the 19th century.

2 HISTORICAL BACKGROUND OF ISTANBUL PORT

Golden Horn, a sea cove separating the plateaus of Istanbul’s Historical Peninsula and Beyoğlu, is mostly sheltered from the southern and northern winds with the surrounding high hills. In addition to its suitable position, Golden Horn was the center of maritime activities for Byzantine and Ottoman empires due to its size (width approximately 700 meters and depth approximately 45 meters). It served as an ideal port for the different types and sizes of ships which existed until 19th century. In general, new arriving ships dropped anchor in Golden Horn and could directly embark to the shore for transferring cargo. Since the shores on both sides of the Golden Horn declined steeply, it was possible to transfer cargo from the large trade ships of the later periods by means of rafters. This is an important feature of Golden Horn compared to the other ports of the same period [1] (Figure 1).

Parallel to the technological developments following the Industrial Revolution, starting from the middle of the 19th century, steam engine ships made of iron replaced the wooden
sailing ships. Until the last quarter of the 19th century, there were approximately 400-500 ships embarked in Istanbul Port, however since there were not any quays, each maritime agency had their own pontoon and a team of boatmen. The cargo transfer from the ships was conducted via these boats [1]. In addition, the commercial activities were increasing and regular boat trips were established for transportation. In this context, therefore, at the last quarter of the 19th century it was considered to modernize outdated port facilities and to construct quays for embarkment in order to increase the capacity of Istanbul Port.

At first, some of the projects were rejected due to the complaints of maritime agencies, local residents and different stakeholders with interest in this issue. In 1879, a contract was signed with a French entrepreneur, Marius Mitchel, who has also realized the construction of lighthouses for Istanbul Port. According to the contract, quays would be constructed on the shores between Tophane-Azapkapı and Sirkeci-Unkapı. The construction of these quays required large areas of land infill in front of the present shore line. The contract also included the construction of new customs and health offices on the infill zone. In exchange for this contract, the contractor company would have the right to use the quays for 70 years and to take a certain amount of commission from cargo transfer during the time of concession. In addition, the bridges on the Golden Horn would be rented to the company [2].

However, due to technical reasons, the construction of the quays in Golden Horn (between Karaköy-Azapkapı and Eminönü-Unkapani) was abandoned. Also, the bridges were not rented because of political reasons. Consequently, a new contract was signed with Marius Mitchel on November, 10, 1890. According to this, construction works would start in two years and would be completed in 14 years. With this contract, the concession period was extended to 85 years, in exchange for the construction of buildings, docks and entrepôts for port facilities [1].

In 1891, Marius Mitchel has established “Société Anonyme Ottomane des Quais, Docks et Entrepôts de Constantinople” with the support of French banks. The construction of quays started in 1892 [2].

Construction works on Galata shore continued albeit the difficulties and 1894 earthquake. In February 1900, the first part of Galata quay, consisting of 370 meters, extending between Tophane and Karaköy was inaugurated (Figure 2). The ships for inner-city transport could dock from their side, while about 10 ships would be able to dock stern-to. For infill, approximately 560,000 m³ of rubble stone was used, while 35,024 m³ of hewn stone was used for quay walls. The total expenditure was 28,448,550 gold francs [3].

Figure 2: Golden Port – Beginning of the 20th century (Ottoman Bank Archives).
In order to support maritime activities, first Galata Customs Building (1907-1911) was constructed by the company, followed by Çinili Quay Khan (1910-1911) and Central Quay Khan (1912-1914). In 1935, with the construction of Karaköy Passenger Hall, the quay has reached its present state (Figure 3).

Figure 3: Istanbul Port aerial view (2014).

3 GALATA CUSTOMS BUILDING

According to the contract signed in 1890, the company was responsible to design the project of a customs building which would serve for exchanging goods. The company prepared and presented the project to the government for approval in 1905. However, the project was found controversial, since it was planned to be constructed according to the contemporary construction techniques of the period, instead of stone masonry. After the company provided a guarantee for potential negative conditions, the construction of Galata Customs Building was initiated on March, 16, 1907. The building was constructed on an area of 7000 m$^2$ with an expenditure of 1.272.797 francs and completed in 1911 [2] (Figure 4).

Figure 4: Galata Customs Building- First quarter of the 20th century [5].

After the foundation of the republic, the ports were nationalized and this building continued to function as customs. Following the construction of Haydarpaşa Port on the Asian coast
of Istanbul, the building was used as a post office for cargos/parcels. Lastly, the building became the property of Marine Enterprises and hosted multiple functions like duty free shops, hospital, and service and administration offices. The building was evacuated in 2005, since its surrounding area was tendered to be renovated as “Galata Port” with built operate transfer model. Later the tender was put on court and the case was won. As a result, the tender is cancelled and the building is still not open for use.

3.1 Architectural Design

The building consists of two storeys, the ground floor and the first floor. It is based on a long rectangle with dimensions approximately 35 m by 185 m. Considering its plan and façade order, the building is separated into two main parts. The building is designed with an inner courtyard, which is a symmetrical structure extending in east-west direction and positioned in northwestern (Karaköy) part. This part has dimensions of 35x110 m, which makes up the main body of the building with its mass, plan and façade design (Figure 5-6).

![Figure 5: Galata Customs Building- Survey of the first floor and construction system (Survey: Restoration Department of YTU).](image)

![Figure 6: Galata Customs Building- Drawings of the northwestern façade (Survey: Restoration Department of YTU).](image)

The middle section of this space, which has dimensions 15x30 m and connects the entrance from the quay and the street, is designed as an inner courtyard as a common space appropriate for customs function (Figure 7). This courtyard is closed with a steel construction in the form of a barrel vault. Daylight for this space is provided via a roof lantern placed over the vault (Figure 8).
The spaces that are positioned parallel to the quay and the street are connected with the courtyard via surrounding corridors. There are two light shafts, which are almost as large as a courtyard, located at the northwestern and southeastern extremes of the building to let natural light in. However, the original plan scheme of the building was totally changed due to inappropriate interventions made in the past. There is another building located at southwestern (Tophane) direction on a right triangle shaped lot with a length of 75 m. This building has a complicated plan scheme due to the interventions made through the course of time (Figure 5).

The façades of Galata Customs Building are designed according to an eclectical architectural style that combined different styles of Western architecture. The architectural order of the southwestern (quay) and northeastern (street) façades is defined by five pediments. The windows are designed with triple modules. The parts with pediments are projected from the main façade and their windows are designed wider and larger; thus the long façades became more dynamic. Horizontal eaves and longitudinal engaged columns divide the façade into equal and axial parts, which reflects the façade design of Renaissance and Neoclassic eras.
The ground floor of the building is coated with embossed stone faux plaster, while the upper floor is coated with plain plaster (Figure 6-9).

Figure 9: Galata Customs Building northwestern façade.

3.2 Construction Technology

In order to understand the construction technology of this building, the sections of the columns and beams were studied, also in some deteriorated areas; it was observed that the structural system is reinforced with girders. In addition, three-dimensional ferro-scanning device was used to study the structural system. As a result, it was concluded that the building is constructed of steel frame.

Steel was produced parallel to the developments in metal technology following the Industrial Revolution. Steel girder has important advantages due to its durability, flexibility, lightweight and easy procession; in addition it has provided new opportunities in architectural design. With steel frame construction technology designed with steel girders, it became possible to cover wide spans and construct high-rise buildings, allowing freedom in design. Starting from 1880s, buildings with steel structure in America and Europe marked modern architecture [4].

Steel framed construction technology is based on the principle of transferring the building load via load bearing elements to the ground as point loads. Therefore, horizontal and vertical load bearing steel girders are designed in a framework system. Due to the loads acting on the building, bending and buckling stresses can occur and this can be prevented by combining different shaped and sized steel girders in order to adjust the dimensions of the load bearing system.

Vertical (column) and horizontal (beam) load bearing elements that constitute the structural system of Galata Customs Building have size 26 x 26 cm approximately. The actual load bearing elements of columns and beams are steel girders hidden inside each element (Figure 10-11). The building is designed in an axial symmetric plan and divided into three sections. However, spatial differences observed in the plan scheme are reflected in the axial dimensions of columns. On the long façade extending from southwest to northeast, the axial dimension is approximately 460, repeating in a regular fashion, while on the façade extending from north-
west to southeast, the axial dimensions change as 290 cm, 310 cm, 325 cm and 480 cm (Figure 5).

The concrete slab floors that cover the interior spaces are reinforced with steel girders with size 20 x 12 cm and with 115 cm interval (Figure 10-11). This floor structure can be defined as a more developed version of brick arch floor used in buildings of the last quarter of 19th century, combined with concrete. However, in brick arch floors, the girders act as the primary load bearing element, while in this system the girder beams are supported by the main load bearing structure, thus acting as secondary beams supporting the concrete slab.

In order to support the joints of vertical (column) and horizontal (beam) load bearing elements against shear and bending forces, triangular metal supports, called “guse”, are used (Figure 10-11). The main walls of the building, which are not load bearing elements constructed of brick, are approximately 25 cm thick at the ground and first floor.

![Figure 10: Galata Customs Building steel frame construction system.](image1)

![Figure 11: Galata Customs Building steel frame construction system.](image2)
4 CENTRAL QUAY KHAN

Marius Mitchell, who realized the construction of quays in Istanbul Port, had quit the work due to several reasons and consequently in 1907, the Ottoman Bank became a partner to the construction company, Société Anonyme Ottomane des Quais, Docks et Entrepôts de Constantinople. The bank has undertaken the management of the company with the help of a businessman from London, Rothschild. According to the renewed contract, the company resumed the work and constructed Çinili Quay Khan (Figure 12) on Galata Quay between 1910-1911 with a cost of 733,000 francs, in order to be used as office space by maritime agencies and customs companies and Central Quay Khan (Figure 13) between 1912-1914 with a cost of 834,000 francs [2].

Figure 12: Çinili Quay Khan [5].

Figure 13: Central Quay Khan (Ottoman Bank Archives).
Çinili Quay Khan was first used by a French entrepot company. In 1937, after the decision to construct new entrepots, the management of the khan was transferred to Customs Administration in order to collect all customs offices in the same place. In addition, the offices of port administration were moved to Central Quay Khan according to the same decision [5]. Today, Çinili Quay Khan is being used as Istanbul Customs and Commerce Regional Directorate, while Central Quay Khan functions as Turkish Maritime Management General Directorate.

4.1 Architectural Design

Central Quay Khan is situated on the infill land between Kemankeş Street and Marmara Sea. It is a six storey high building, positioned parallel to the sea shore. It was designed for office functions, which was a different and new function at the time for Ottoman commercial life.

The dimensions of the building are 30 m by 30 m. Although the building plan resembles a square, the corner where the street façade meets the quay façade is designed in an angular style, thus allowing the sea façade to be wider with different sized chamfers at the corners of the sea façade. The building is open to the exterior from all four sides. Only the ground floor of the building is designed differently. In the past, a line of offices were placed on the northwestern and northeastern façades of the ground floor, independent from the interior and accessed from the exterior. The entrance to the building was accessed through two different doors, one from the middle of the quay façade, one from the chamfered corner at the south.

The typical floor plan consists of rooms facing the exterior façades with a corridor at the inner side that circulates these spaces, service spaces at the center that are accessed from this corridor, a U shaped staircase for vertical circulation and an elevator forming the core. Light-shafts covered with glass are placed at the front and back parts of the staircase and elevator, starting from the ground floor. These shafts provide light to the spaces between the core and the corridor (Figure 14).

![Figure 14: Central Quay Khan - Survey of the second floor and construction system (Survey: Restoration Department of YTU).](image)

An asymmetrical composition inside a symmetrical one can be seen on eclectic façades which are influenced by late-Art Nouveau. All the façades are designed with vertical and horizontal modules. On the ground floor and first floor, a shop façade is designed with wide windows, while on upper floors an office façade with French windows can be observed. The
fifth floor is narrowing as it gets higher, resembling a mansard roof. This floor, covered with blue tiles of various hues, is differentiated from the others. All the façades are dominated by the central module, which projects slightly starting from the second floor, while the side modules that are designed according to the order of windows are retreated. In general the façades are coated with plaster, with the exception on ground floor and first floor, which are coated with embossed stone faux plaster. Blue and orange colored tiles are used above the windows. On the façades, there are decorations made with cement plaster in the form of keystones, volutes, fluted engaged columns like Doric columns, rose petals, tulip motifs and acanthus leaves. In addition, there are corbels with “makara” motif and rosettes, as well as iron balustrades on the façade (Figure 15-16-17).

Figure 15: Central Quay Khan - Drawing of the southwestern façade (Survey: Restoration Department of YTU).

Figure 16: Central Quay Khan southwestern and southeastern façades
Central Quay Khan is constructed by the Société Anonyme Ottomane des Quais, Docks et Entrepôts with a new construction technique called “iron-concrete”, special to the beginning of 20th century used before concrete frame construction system [6]. As mentioned in “Construction Technology” section of Galata Customs Building, similar investigation techniques were used to study the construction system of Central Quay Khan. In addition, considering the development of concrete construction system, it was determined that a concrete structure reinforced with metal, which is a combination of steel girder and concrete, was used at the vertical and horizontal load bearing elements.

In “iron-concrete” construction technology, a simple example of concrete construction system, horizontal and vertical load bearing elements, which are the combination of steel girders and concrete, are designed in a frame system (Figure 14). The size of the load bearing elements in order to bear bending and buckling stresses can be determined by adjusting the distance between girders according to necessary dimensions and casting concrete in between them. While in steel frame construction technology, the dimensions for horizontal and vertical load bearing elements can be determined by combining steel girders, in iron-concrete construction system the ability to cast concrete at the desirable amount has enabled a more flexible design and economical solutions in building construction.

In Central Quay Khan, the main load bearing elements designed in iron-concrete technique is placed on seven axes on southwestern-northeastern direction and eight axes on northwestern-southeastern direction, obtaining a frame system (Figure 3). Dimension of axes are varying according to the spatial design of the plan scheme. Dimensions of the iron-concrete columns of the frame structure are approximately 50 x 70 cm, while dimensions beams are approximately 30 x 30 cm. There are metal supports called “guse”, placed at 45 degrees at the joints of the vertical and horizontal load bearing elements (Figure 18 and 19).
Concrete floor slabs are 15 cm thick and supported by the steel girders, which are in turn supported by iron-concrete beams. These support elements, which can be defined as secondary beams, are placed in southwestern-northeastern direction at intervals of approximately 110-145 cm, varying according to the space. In the projecting spaces at the center of both façades in southwestern-northeastern directions, secondary beams are placed in both directions, like a coffered slab (Figure 14).

The walls of the building are not load bearing elements and their width varies between approximately 45-50 cm on the ground floor and 35-40 cm on the upper floors. The walls are constructed with brick.

5 **KARAKÖY PASSENGER HALL**

Karaköy Passenger Hall symbolizes the development in transportation; one of the most important aims of the recently founded Turkish Republic, as well as the nationalization.

Toward the end of 1935, a competition was organized for designing a passenger hall between Central Quay Khan and Çinili Quay Khan by Ministry of Economy and Istanbul Port Directorate. 21 projects were submitted to this competition. After the meetings between the jury and the advisory board, none of the projects were found suitable for implementation. As a result, it was decided that 7 projects would be purchased and these would be used in the final implementation project. Finally, three first prizes and four second prizes were awarded.

At the end of 1937, one of the first prizewinners, architect Rebii Refik (Gorbon) has prepared an implementation project (Figure 20). It seems that this project is not one of the seven prize-winning projects, however it resembles some parts from each of them. There is also the signature of Prof. Débés on the project, who was one of the jury members.
5.1 Architectural Design

The building is mainly intact today (Figure 21). It can be determined that the project with similar architectural features was revised during implementation. However, the most major changes that influence the architectural design of the spatial order were implemented after the construction of the building. Examples for these changes can be division of the unity of the main passenger hall with shop units; closing of some galleries in this space; addition of glass cases at the exterior; construction of a closed passage between two side towers at the roof and conversion of upper halls, which were used to reach the upper decks of ships that dock at the quay, into office spaces [7].

Figure 20: Karaköy Passanger Hall prizewinning project scale model.

Figure 21: Karaköy Passenger Hall view from the sea.
The main passenger terminal and waiting lounge has formed the main core of the spatial organization. These spaces, with the service spaces and shops placed around them, can be accessed from the street and the quay. At the second, third and fifth floors there are offices, storage and other service spaces, while at the fourth floor the restaurant and its auxiliary spaces are situated [7] (Figure 22).

![Figure 22: Karaköy Passenger Hall - Survey of the second floor and construction system (Survey: Restoration Department of YTU).](image)

5.2 Construction Technology

Cement and iron were used separately with different techniques and designs until the middle of the 19th century. Combined use of these materials in the west started in mid 19th century, while in the Ottoman Empire it started at the last quarter of 19th century. In Ottoman architecture, starting from mid 19th century, cement and concrete was used especially in port cities with transforming social and economic structures and in construction of quays in these cities [8]. In accordance with this concept, the passenger hall was designed with a concrete frame system. The building has a rectangular form and its structural system is comprised of columns with dimensions 45 x 45 cm placed on 11 axes in southwestern-northeastern directions and 16 axes in northwestern-southeastern directions (Figure 22).

Because the building is placed on an infill land, pile foundations were used. The building is constructed according to the concrete norms and static calculations of its time and has survived until today without any constructive problems. However, in 1999 earthquake, it was damaged at some points. The building is divided into three parts with two dilatation axes and these axes were pulled apart 10 cm after the earthquake. This deterioration is probably due to
the different settlements at the foundations. In addition, the tower in the middle of the building was severely damaged. There are large shear cracks between the beams and the landings of the staircase, with detachments up to 5-8 cm in some parts. One the most unique examples of modern architectural heritage in Istanbul, this building were covered with concrete plates on the exterior façade [7] (Figure 23).

Figure 23: Karaköy Passenger Hall - Drawing of the southwestern façade (Survey: Restoration Department of YTU).

6 REFERENCES

All references should appear together at the end of the paper and be listed by number within square brackets in the order in which they appear in the text (see below). References should be quoted in the text by numbers [1].

7 CONCLUSIONS

The transformation of the traditional Ottoman commercial life starting with the westernization period has led to the construction of modern western commercial buildings in Istanbul since the mid 19th century. Central Quay Khan and Çinili Quay Khan, office buildings with customs, insurance and maritime agencies; Galata Customs Building for conduction of customs services of import and export goods through seaway; Karaköy Passenger Hall for serving the maritime passengers are commercial buildings of Istanbul Port. In the early years of the 20th century, the silhouette of Istanbul Port consisted of these buildings, which were constructed not only with western design schemes for maritime transportation and commercial activities, but also with modern construction technologies of their period.

Parallel to the technological developments following the Industrial Period, fabricated building materials of European industry, such as brick, steel girder and concrete, as well as building technologies designed with these materials became actively used in the Ottoman ar-
Architecture in a short period. Between 1907-1934, the buildings in Istanbul Port were built using construction technologies like steel frame, iron-concrete and concrete. These buildings are of special value, since they are among the pioneering and unique examples from which structural history and development process of the Ottoman architecture can be documented.

However, according to a recent project, “Galata Port”, which aims to renovate Istanbul Port, these buildings are facing the threat of losing their original construction technologies with so-called “restoration” interventions that will only preserve their mass, height and façade design. Buildings such as Central Quay Khan, Galata Customs Building and Karaköy Passenger Hall should be preserved and rehabilitated with their original construction material and technique, not only because of their architectural value, but also for their quality of reflecting the industrial and technological level of their period.

Hoping that in few years we will not have to get information only from written sources about 20th century building production techniques...

REFERENCES