Building techniques of the Zeytinburnu Military Factory built in the 19th century

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ABSTRACT: The Zeytinburnu Military Factory, a large complex, was built with the purpose of modernizing the army as a result of the reform movements of 1826. The necessary materials and machines for the factory whose construction is known to have continued between 1845–1846, were brought from London by Barutçubaşı Hoca Ohannes Dadyan Efendi. British engineer William Frin was responsible of the construction and assembly of the factory. The factory was established on a wide area between the Sea of Marmara and the railroad. A map dated 1918 shows the factory buildings and contains information about their functions. Eight buildings/building groups of the factory are still extant. They show variation in the roof structures and their supports. Three of the 4 cranes in one of the buildings were removed. The factory buildings that house original examples of the period's construction techniques must first be documented in detail and then measures must be taken for their conservation.

1 INTRODUCTION

From the 15th to the 19th centuries, a large portion of the arms and other military supplies for the Ottoman army were manufactured in the various military workshops and factories located in Istanbul, the capital and the seat of the 1st army. The reforms made in the Ottoman military organization within the scope of the modernization movement as of the 18th century increased with the abolition of the “Kapıkulu Ocakları” (troops under the sultan’s command) in 1826 and buildings with various functions were built to satisfy the requirements of the new army. First of all 3 military factories, namely the “İplikhane-i Amire” (Imperial Yarn Factory), “Feshane” (Fez Factory) and “Beykoz Deri Fabrikası” (Beykoz Leather Factory), were established to manufacture cloth, clothes and shoes for the soldiers. These were followed by the Zeytinburnu military factory built in the mid-19th century. All these military buildings reflect the Ottoman architectural influences of the “Westernization” period from the point of view of their architectural forms, construction techniques and style characteristics. The Zeytinburnu Factory stands out as an exclusive example with the variety and originality of its construction techniques.

At the onset, the factory was to be established in Izmir but later it was decided to constructed it in European style and in Zeytinburnu. Although the exact start date of the construction is unknown, we know that construction was ongoing in 1845–1846 during the reign of Sultan Abdülmecid (r. 1839–1861). Monsieur Hetk, a manufacturer who came from England, Hoca Garabet, the palace master builder and Riza, an attendant worked in the construction of the factory and the appliances, equipment and machines for the construction were brought from London by Barutçubaşı Hoca Ohannes Dadyan Efendi. William Frin, an English engineer was responsible of the setting up and assembly works of the factory (İlgürel, 1989).

Citing from the writings of Mc Farlane, an English traveller who was in Istanbul during the construction of the factory, Tuğlaci states that some of the numerous craftsmen, workers and engineers brought from Europe left work because they could not get money. Tuğlaci also states that many workers were killed when the factory’s chimney built by Garabet Balyan according to the incorrect calculations of the British experts collapsed because Balyan’s warnings were overlooked (Tuğlaci, 1993).

The masonry blast furnace, an important unit of the factory, and the foundry were completed in 1846 and smelting of iron ore brought from the mine in Büyükada started (İlgürel, 1989). The “Eser-i Hadid” built according to the plans of Phillips, a British marine engineer, by the Dadyan Brothers in this factory in 1848 was the first home built armoured ship (Tuğlaci, 1993).

As a result of the political crisis in Europe in 1848, the factory made a loss in the first years. The factory’s activities increased after 1850 and steam engines,
pumps, equipment for small enterprises and parts for guns were manufactured in addition to military equipment (Anonim, 1995).

In the second half of the 19th century the factory was transformed into a solely arms and ammunition manufacturing plant and at this time the factory known as the “Zeytinburnu Silah Fabrikası” (Zeytinburnu Military Factory) manufactured goods for the “Tophane-i Amire” (Imperial Canon Factory). Goods manufactured at the factory were presented at the Sultanahmet exhibition in 1861. A technical school in connection with the factory was established at this time (Anonim, 1995). Grooved canons and 140 firearms of different size and make manufactured at this factory were exhibited at the “Istanbul International Exhibition” of 1863 (Önsoy, 1988). Special iron posts for street lighting, iron pipes, ploughs, gardening tools, drawgear were also manufactured at the factory (İlgürel, 1989).

Production at the factory gradually decreased due to its being far from a rich mine, its inefficient operation, competition with Europe and the political problems of the state and it was closed down during World War I and the armistice period (İlgürel, 1989). The factory went back to operation in 1936 and was turned over to the “Ordonance” class of the army in 1948. Today it provides service as the “1st Army Maintenance Centre Commandership” and the maintenance and repairs of army equipment as well as the production of some equipment is executed here.

2 ARCHITECTURAL CHARACTERISTICS

The Zeytinburnu Military Factory is located over a large area of 128,121 m² in the west of the city between the Sea of Marmara and the railroad line. The Prime Ministry Ottoman Archives has various documents related to the construction, repairs and use of the factory buildings for the period between 1261–1334/1849–1916. The German Union Map (“Alman Sendika Haritası”) dated 5 October 1918 shows that the factory consisted of a number of detached and adjacent buildings (Fig. 2). The captions on this map contain information on the different units of the time and their functions. However, no information could be obtained about the original plans of the mentioned buildings.

Eight buildings/building groups of the factory have survived to the present. Some of the buildings in the factory area as well as the quay by the sea and the boat landing no longer exist (Fig. 3). The quay was filled in during the 1950–1960s, and the factory’s connection with the sea was cut off with a seaside road. The buildings that have survived have to a large extent preserved some of their original façade characteristics and construction techniques.

2.1 Building no. 1

The building shown as the “muhafaza bölüğü koşuşları” (guards’ division barracks) on the map dated 1918 is located next to the entrance gate of the factory area. The single storey rectangular building has round headed windows and doors. The building with plastered and painted façades is covered with a hipped roof. The wall thickness of the solid block masonry building varies between 65 cm and 87 cm.

2.2 Building no. 2

The structure shown as the “büyük havuz” (large tank) on the map dated 1918 is located at the west of the factory area. It consists of a superstructure with a circular plan scheme over an almost square base. The base section contains a wide round headed opening, which is used to enter the lower level section of the structure. The base of the solid block masonry structure is in alternating courses of ashlar and brick. On the façade, there is moulded dressing between the base and upper section. There are 154 cm long metal ties on the façades of the base. The structure is now used as a water tank (Fig. 5).

2.3 Building group no. 3

According to the map dated 1918, this group of buildings located in the north-south direction in the centre of the factory area consists of 5 adjacent one-storey units. From north to south, the first unit housed the “bakır hâdde-hânesi” (copper rolling mill) and the “şah-merdân ocakları ve buhâr kazganları” (piles of furnaces/drop forges and steam boilers), the 2nd unit housed the “demir hâdde-hânesi” (iron rolling mill). Part of the east facing section of this unit is demolished. The 3rd unit contains the “buhâr kazganları” (steam boilers), “pirinç kılıç-hânesi” (brass sword atelier) and the “maden döküm-hânesi” (metal foundry). The 4th unit has the “kılıç-hane” (sword atelier), “buhâr kazganları” (steam boilers) and “kundak fabrikası” (gunstock factory) and the 5th unit houses various functions defined as the “büyük çark-hane” (major machine shop) and “seri atışlı kundak fabrikası” (repeat fire gun stock shop).

Today, the dimensions of units 1–3 are 27.70 × 71.20 m and they are divided into two spaces with a wall extending in the north south direction. The main walls of the solid block masonry units are 114–118 cm thick. The roofing with wooden structure rests on the main walls. The windows and doors are round headed. The space in the east section contained 4 cranes of which only one exists today (Fig. 1).

The 4th and 5th units in solid block masonry are 49.60 × 52.75 m and have a wall thickness of 115–126 cm. In this group of buildings only the space...
“kılıçhane” (sword atelier) in the west direction is covered with a masonry barrel vault. Tie beams have later been placed in the vault that has windows on its east façade. The other units are covered with wooden roofing supported by wooden posts with a cross section of $36 \times 35$ cm (Fig. 6). The windows and doors of these units are round headed and the façades are plastered and painted.

2.4 Building group no. 4

This building group located at the south of the factory area extends in the east west direction and consists of one-storey adjacent units (Fig. 4). In the

Figure 1. The crane in the building group no. 3 (2001).

Figure 2. The German Union Map (“Alman Sendika Haritasi”) dated 5 October 1918 (Factory Archive).

Figure 3. The sea side buildings of the factory (IRCICA Archive).
map dated 1918 these units are designated as “şarjör ve mukavvâ kutu dairesi, kovan birinci ameliyyat dairesi, kovan ikinci ameliyyat dairesi, dinamo dairesi, kırşun ve kovan-hâne dairesi, imlâ dairesi, çinko sandık dairesleri, fişek fabrikası, kırşun ve gömlek i’malat-hânesi, kırşun presleri, kapsül i’malat-hânesi” (charger and cardbox shop, cartridge case initial operations shop, cartridge case secondary operations shop, dynamo shop, bullet and cartridge case workshop, explosives shop, zinc can workshops, cartridge factory, bullet and jacket workshop, bullet presses, cap/primer workshop).

The first section of this building group that can be divided into two is located on the southeast side and is $16.50 \times 133$ m and the second section which is on the north-west side is $38.25 \times 95.25$ m. Some units
consist of large single volume spaces adjacent and parallel to one another. The façades of the buildings with depressed arched doors and windows are plastered and painted. Photographs in the archives show that the tile covered units in the southeast have roof windows placed so as to catch the northern light.

The main wall thickness of the group of buildings in solid block masonry varies between 50 and 96 cm. The measurable bricks of the wall are $10 \times 22 \times 6$ cm. In various units of the structure there are load bear-
ers with cross sections of $20 \times 35$ cm, $24 \times 24$ cm and $26 \times 27$ cm and cast-iron columns with a diameter of 21 cm. Wooden and metal truss roof structures are used in the units with gable roofs (Figs 7–12). The cracks formed on the walls of the buildings during the Istanbul earthquake of 1999 were repaired and covered in 2003.

2.5 Building (Hamam) no. 5

The hamam, a detached unit at the south end of the factory area, consists of the changing rooms, trepidarium, caldarium and the water tank. The halvets (very hot cubicle) in the trepidarium and caldarium are covered with vaults while the caldarium is covered with domes. The façades of the solid block masonry hamam are plastered and painted. The vaults and domes are covered with lead. The changing rooms were built at a later period.
2.6 Building no. 6

This is a rectangular 2 storey building located in the south section of the factory area. It has round headed windows. The wall thickness of the main walls of the solid block masonry building is 83–88 cm at the ground floor and 67–73 cm on the floor above. The floors of the building were repaired in reinforced concrete.

2.7 Building no. 7

According to the map dated 1918, this building in the east of the factory area houses workshops and offices such as the “marangoz-hâne fen me’mürlûgu dâiresi, merîm-i mütenevvia fen me’mürlûgu dâiresi” (carpenter’s shop construction registrar’s office, miscellaneous cartridges engineering office). On both floors, the original plan scheme of the 15.90 × 17.10 m 2 storey building consists of a central hall and the various spaces opening onto this hall. There is an elevated entrance accessed by a wide straight stairs on the north-west of the building. The entrance gate is flat arched and the windows of both floors have depressed arches. The building that has moulded eaves dressing is covered with a tiled hipped roof. The main walls thickness of the solid block masonry building is 50–60 cm on both floors. Bricks of 10 × 25 × 5.5 cm have been used for the walls. The original floors and stairs are of wood. The interior partition walls have wooden bearing piles and plastering wooden lathing.

2.8 Building no. 8

The building in the east of the factory area has been designated as the “intizar mahalli” (waiting area) in the map dated 1918. The windows of the single story rectangular building are round headed. The hipped roof building is plastered and painted. The main wall thickness of the solid block masonry building is 77 cm.

3 CONCLUSIONS

The Zeytinburnu Military Factory is the only example of an important industrial building that was built in the 19th century to manufacture a wide range of military equipment that has survived to the present.
The factory reflects the modern and traditional construction technology of the 19th century with its original wood and iron structures, masonry technique and materials and its production activities. Therefore, it is a group of buildings that should be conserved for their value for the archaeology of industry. Changes and additions were made in the functions of the buildings with time, therefore, the buildings now contain different materials and construction details. Metal roof structures as well as timber structures dating of the last quarter of the 19th century are of major importance. As mentioned earlier, an important number of the factory buildings where the materials and structural systems of the period were used to their maximum potential are still standing and functioning.

The factory built to manufacture a large portion of the arms and military equipment for the Ottoman army is also of a documentary nature with the equipment in its various buildings. Therefore, the buildings as well as the equipment they contain must be documented in detail. The expansion of the factory, the traditional and modern manufacturing methods, assembly and operation schemes, as well as the machines, work-benches, tools and equipment imported from Europe, the foreign experts, foremen and administrators who have worked at the factory, the relations established with the Krupp and Karlsruhe factories in Germany are all matters that must be explored in the archive documents.

The existing factory buildings have preservation problems arising from changes of function, earthquake and environmental factors. The factory buildings that have retained their original construction techniques to a large extent and the original equipment in the buildings must be repaired before they lose their originality, and must be reviewed within the context of sustainable preservation.

REFERENCES