CONSTRUCTION TECHNIQUES OF THE 14^{TH}-16^{TH} CENTURY OTTOMAN BATHS IN EDIRNE

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

FİLİZ DİRİ AKYILDIZ

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF DOCTOR OF PHILOSOPHY
IN
CONSERVATION OF CULTURAL HERITAGE
IN ARCHITECTURE

FEBRUARY 2018

Approval of the thesis:

CONSTRUCTION TECHNIQUES OF THE 14TH-16TH CENTURY OTTOMAN BATHS IN EDIRNE

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ABSTRACT

CONSTRUCTION TECHNIQUES OF THE 14TH-16TH CENTURY OTTOMAN BATHS IN EDİRNE

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February 2018, 455 Pages

Ottoman public baths located in Turkey were formed by blending different cultures and their bathing traditions of the civilizations inhabited this region throughout time. These buildings consist of a multi-component system involving different parts that are arranged in a highly sophisticated way. Conservation principles of these buildings may differ from case to case. On the other hand, in all cases, the first stage of any conservation implementation should be based on understanding and appreciation of all aspects of their values. For a precise understanding, all features of the building must be defined, investigated, and documented. Ottoman public baths differ from the other monuments in their complex and advanced physical features, especially their construction techniques and installation systems. The public bath buildings constructed in Edirne, which had been an important role as a capital and maintained its importance for a long time, are include many important information about these systems. The aim of this thesis is to document, analyse, and evaluate the construction techniques of the 14-16th century Ottoman public baths located in Edirne.

Keywords: Construction Technique, Construction Process, Ottoman Architecture, Ottoman Public Bath, Edirne

ÖZ

14-16. YÜZYIL EDİRNE HAMAMLARINDA KULLANILAN YAPIM TEKNİKLERİ

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Türkiye'de bulunan Osmanlı hamamları, yüzyıllar içerisinde bu bölgede yaşamış olan farklı uygarlıkların sahip oldukları kültür ve yıkanma geleneklerinin zaman içinde başarılı bir şekilde harmanlanmasıyla meydana gelmişlerdir. Hamamlar bir çok farklı parçanın oldukça sofistike bir şekilde bir araya getirilmesiyle oluşturulan çok bileşenli bir sisteme sahiptir. Koruma prensipleri elbette yapı bazında değişiklik göstermektedir, ancak her koruma çalışmasının ilk aşaması mutlaka yapıların tüm bileşenlerinin sahip oldukları değerlerle birlikte doğru şekilde anlaşılması olmalıdır. Bunun için yapıların tüm özellikleri doğru şekilde tanımlanmalı, incelenmeli ve belgelenmelidir. Diğer anıtlardan farklı olarak, Osmanlı hamamları, zengin ve gelişmiş fiziksel nitelikleriyle, özellikle yapım teknikleri ve tesisat sistemleriyle öne çıkmaktadırlar. Belirli bir dönem imparatorluğun başkenti olan ve sahip olduğu politik değeri hiçbir zaman kaybetmemiş olan Edirne'de inşa edilen Osmanlı hamamları bu tekniklere ilişkin birçok önemli bilgi içermektedir. Bu tezin amacı, Edirne'de bulunan 14-16. yüzyıl Osmanlı hamamlarının yapım tekniklerini belgelemek, analiz etmek ve bu verileri değerlendirmektir.

Anahtar kelimeler: Yapım Teknikleri, İnşaat Süreçleri, Osmanlı Mimarisi, Hamam, Edirne

To my father Mehmet Diri

ACKNOWLEDGEMENTS

First and foremost, I would like to express my gratitude to my supervisor Prof. Dr. Neriman Şahin Güçhan for her invaluable support and guidance. It has always been a great pleasure to work with her. I thank to Prof. Dr. İlter Büyükdığan for her endless support and valuable documents she provided for me throughout this research. I would also like to thank Prof. Dr. Ömür Bakırer, Assoc. Prof. Dr. Güliz Bilgin Altınöz and Assoc. Prof. Dr. Gülsün Tanyeli, who have patiently encouraged me with their support, valuable criticism and suggestions throughout all this research experience.

I would like to give my thanks to Prof. Dr. Cevat Erder not only for his academic advices, but also his moral supports and golden heart.

I would like to thank Yasemin Didem Aktaş, Pınar Aykaç, Mete Işıkoğlu, Simge Özdal Oktay, Duygu Ergenç, Gökhan Çiçek and Suna Kabasakal Coutignies for their support, invaluable friendship and above all for being in my life.

Most importantly, I would like to express my special thanks to my family; my dearest husband, my best friend and my love Uğur Akyıldız; my greatest luck, my parents Aynur Diri and Mehmet Diri; and my wonder, my sister Başak Diri for their patience, support and trust. It is certain that this study would not be finished without their complimentary love.

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ABBREVIATIONS

BOA	The Ottoman Archives of the Prime Ministry *(Başbakanlık Osmanlı Arşivi)*
KTVKBKM.GA	KTVKB Council Directorate General Archive *(Kültür ve Tabiat Varlıklarını Koruma Bölge Kurul Müdürlüğü Genel Arşivi)*
EEMGM	General Directorate of Immovable Historical Assets and Museums *(Eski Eserler ve Müzeler Genel Müdürlüğü)*
GEEAYK	High Council of Immovable Historical Assets and Monuments *(Gayrimenkul Eski Eserler ve Anıtlar Yüksek Kurulu)*
ICOMOS	International Council on Monuments and Sites *(Uluslararası Anıtlar ve Sitler Konseyi)*
KTB	Ministry of Culture and Tourism *(Kültür ve Turizm Bakanlığı)*
KTVKK	Council for the Conservation of Cultural and Natural Assets *(Kültür ve Tabiat Varlıklarını Koruma Kurulu)*
KTVKYK	High Council for the Conservation of Cultural and Natural Assets *(Kültür ve Tabiat Varlıklarını Koruma Yüksek Kurulu)*
KTVKBK	Regional Council for the Conservation of Cultural and Natural Assets *(Kültür ve Tabiat Varlıklarını Koruma Bölge Kurulu)*

KVKBK	Regional Council for the Conservation of Cultural Assets *(Kültür Varlıklarını Koruma Bölge Kurulu)*
KVMGM	General Directorate of Cultural Assets and Museums *(Kültür Varlıkları ve Müzeler Genel Müdürlüğü)*
MEB	Ministry of National Education / *(Milli Eğitim Bakanlığı)*
MD	*Mühimme* Registers *(Mühimme Defterleri)*
MAD	Classification of *Maliyeden Müdevver Registers* *(Maliyeden Müdevver Defterler Tasnifi)*
TMMOB	Union of Chambers of Turkish Engineers and Architects *(Türk Mühendis ve Mimar Odaları Birliği)*
UNESCO	United Nations Educational, Scientific and Cultural Organization *(Birleşmiş Milletler Eğitim, Bilim ve Kültür Örgütü)*
VBM	Regional Directorate of Foundations *(Vakıflar Bölge Müdürlüğü)*
VGM	Directorate General of Foundations *(Vakıflar Genel Müdürlüğü)*

CHAPTER 1

INTRODUCTION

The Ottoman architecture, whose main framework was set depending on the necessities and potential, was affected by not only its heritage but also all the cultures existing in the borders of empire and its neighbours for centuries. The influence of the Principalities period and Byzantine architecture over Ottoman-era Edirne could be traced clearly.

In the architecture of the Principalities period, there were different architectural styles with the influence of available materials, regional construction techniques, and traveling builders. In the late period Byzantine architecture, a common architectural style was established despite the regional architectural styles. In terms of construction techniques, it can be said that one of the most apparent features of this period is the importance given to the accelerating construction process (Ousterhout, 1999: 210).

In the Ottoman Empire, a common architectural style and construction language appeared in the 14th century, initially in İznik, Bursa, and Edirne. In this century, although the influence of regional variables was still dominant, a style unity used was beginning to be established in central settlements. This style is the result of a synthesis of regional traditions existing in the settlements and the new traditions, which were reshaped in accordance with the available building materials and the new architectural requirements.

According to Kuban (1999: 15), the Ottoman Empire concentrated its architectural culture in the capital cities in accordance with its socio-political structure. As Arel (1970: 94) mentioned, in the early periods of Ottoman Empire, the styles determining the Ottoman architecture were formed in politically important centres such as Edirne, the provincial capital of Rumelia. The architectural styles adopted in rural settlements continued to be effective for a longer period rather than İstanbul, Bursa, and Edirne, where a rapid change had occurred (Arel, 1970: 94). In the classical period, which began with the construction of Edirne *Üç Şerefeli Camii*, a common style had been developed, especially being distinguished with the excellence of ornamentations and upper structures (Kuban, 1987: 82). These developments in Ottoman architecture can also be observed in public baths.

From the 18th century onwards, especially in densely populated central settlements, the number of public baths increased rapidly resulting in a shortage of water and firewood. For this reason, precautions were taken to restrict the number of newly constructed public baths during this century and in the upcoming centuries (Eyice, 1997: 414). It is known that Mahmud III commanded *Hassa Mimarbaşı* (Chief imperial architect) to prevent constructing profit-oriented public baths in the areas where the number of public baths were sufficient by a *ferman* (imperial order) in 1768, as one of these precautions (Eyice, 1997: 414). From this date onwards, building public baths were allowed only in necessary conditions, and instead the existing buildings were repaired (Altınay, 1930: 217).

The Ottoman Empire obviously did not settle in new regions as filling an empty space (Kuban, 1972: 383). Each new settlement means a new socio-cultural, economic and technical combination and the Ottoman architecture had experienced a harmonization period both technically and philosophically. The Empire, which was a combination of many sub-groups with different socio-cultural and ethnic identities, was responsible for addressing and serving all of them. There were different types of buildings used by specific sub-groups, whereas a small number of buildings types such as public baths respond to the common needs of all sub-groups. For this reason, the early and classical period of Ottoman architecture gave great emphasis on the public baths since the Empire was still dealing with urban development and settlement. In this period, a rich visual impact had been created in public baths, which used as showcase face of the Empire, especially on the entrance doors, main façades, and interior spaces. In addition to their political value, Ottoman public baths stand out in terms of their construction techniques, and with their advanced water and heating installation systems, unlike other monumental buildings.

1.1. Bathing Culture and Characteristics of the Ottoman Baths

Ottoman public baths/*Hamam*s are public spaces used for cleaning with water. It is not exactly known when the cleanliness concept was first developed and when water was started to be used for this purpose. The first documents indicating the use of water for cleaning purposes are all originating from religious sources, introducing the concept of cleanliness as a religious requirement.

In these periods, when a sacred meaning was attributed to water, washing one's body with water was not only a way of getting clean but also an instrument for spiritual purification. *Darmacastra*, an ancient Indian sacred book, names bathing among the essentials of religion, while *Zendavista*, a Persian religious source states that cleaning by water is a necessity before worship (Klinghardt, 1927: 4; Aru, 1949: 10). In Hittites, it was required to take a bath with water, in other words, cleaning one's body and spirit was essential in order to go into the temples, make offerings and appear before the kings, who were identified with the gods (Murat, 2012: 126).

Bathing Culture and Public Bath:

For bathing purposes, firstly natural hot and cold water sources were used. Then, specialized spaces for bathing purposes were formed around these sources, or at distances where water could be transported by simple techniques. In the next stage, farther bathing spaces were also started to be utilized by the new methods allowing water to be transported to longer distances. The buildings, where natural spring water was used as it is, are called *kaplıca* or *ılıca*, while in public baths, which are the main focus of this article, water is used after a heating process.

It is supposed that the text "E'Hİ.US.SA" defines a part of a Hittite building meaning "bath", and is one part of monumental palaces and temples that were used for bathing (Darga, 1985: 160). In addition to this, special bathing rooms from 2000 BC were found in Temple V located in the capital city, Boğazköy, as well as in Zincirli and Aslantaş, whose construction technology is differentiated from the other spaces by waterproof plastering and water flow-out hole on its slightly inclined floor (Naumann, 1991: 160). During the excavations in Zincirlihöyük (near Gaziantep), a ruinous structure from the Late Hittite period, dating back to 1200 BC, was found and identified as a bath (Eyice, 1997: 402).

Moreover, an ancient bath ruins in Tel el-Amarna in Egypt, and bathing facilities for Assyrian rulers in Mesopotamia such as the ruins of a bath erected for the King Salmanasar III (859-824 BC) on the Dicle riverside (Eyice, 1997: 402), and *pokuna*s (bathing ponds) dispersed around the forest in the Sacred City of Anuradhapura (3rd century BC) that was a Buddhist settlement in Sri-Lanka (Klinghardt, 1927: 4; Aru, 1949: 10; http://whc.unesco.org/en/list/200) were discovered.

Although it is difficult to indicate its starting date with certainty, the earliest surviving examples that made an explicit impact on specialized spaces for bathing are from the Hellenistic period. The technique of Hellenic *balaneion*s and *gymnasium*s[1]; with their spatial designs, heating systems, clean and wastewater systems, bathing tubs were quite advanced in comparison to their contemporary counterparts (Yegül, 2011: 60). While the technical contribution of Hellenistic examples to "public bathing" is invaluable, their main impact was their primary role in the *social acknowledgment of bathing as a public phenomenon* (Yegül, 2011: 62).

Although their origins are still discussed, Roman *balneae*s and *thermae*s are widely considered to be shaped as a result of a successful blend of Roman and Hellenic traditions (Yegül, 2011: 62-64). The contribution of Roman baths to the architectural tradition is the rational plan scheme and in-wall supported under-floor heating system[2]. These aspects were further developed through time. The finest examples of these buildings from a social and physical perspective are the imperial baths (*thermae*) with impeccable symmetry and rational arrangement. In addition to spaces allocated for bathing, *thermae*s also involve conference halls, libraries, cultic worship rooms, cloisters, walking paths, gardens, sports facilities and running tracks for athletics and other games (Yegül, 2011: 125).

With the expansion of the Roman Empire, Roman baths were spread over Europe, Asia and Africa. Although the general principles remained unchanged,

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[1] The term *gymnasium* here is used to describe the building complex composed of a traditional *gymnasium* and heating system. Unlike *balaneion*s, these buildings were also institutions for sports and education. For two different descriptions of *gymnasium*, see Yegül, 2011: 60.

[2] This system was first designed by Sergius Orata in the 1st century BC to use in Roman houses (Daremberg and Saglio, 1873: 347).

certain differences started to emerge in time, depending on the regional needs and resources.

After the recognition of Christianity, public bathing culture was abandoned mostly because of economic problems and technical issues, the bathing culture in the west declined; as a result, the construction of these buildings decelerated from the 6th century onwards (Yegül, 2011: 249-250, 254).

In the eastern Islamic countries, on the other hand, Roman bathing culture sustained with certain modifications based on regional characteristics. Furthermore, the simplification that took place on the plan scheme and façade arrangements, certain new elements were incorporated into public baths. The construction of these public baths went on until the 20th century in Islamic countries in Asia and Africa; until the 15th century in the Iberian Peninsula in Europe; and until the 20th century in the Ottoman territories, due to an ongoing public bathing culture.

The industrial revolution in the 19th century made a great impact on the social structure, which resulted in differences in daily life and housing culture. In the 20th century, the bathing culture started to be personalized, and bathrooms became an inseparable part of houses. On the other hand, if an important keyword of that era was "progress", the other was definitely "knowledge" (Hobsbawm, 1989: 26). Indeed, the Ottoman baths started to attract the attention of western scholars from 1850 onwards.

The studies that initially focused on these structures were from health and sanitary viewpoint, which were soon started to deal with the technical and social aspects of Ottoman public baths. Ottoman and Russian baths were in the spotlight of these scholarly attention. In this period in Europe and in America, a rapid trend of constructing buildings similar to the Ottoman baths rose. In these buildings constructed using contemporary materials, a pool and a sauna were added to the Ottoman baths' system. These buildings were very popular for approximately a century. While public bathing was in decline in the Ottoman land, it became a primary touristic activity for foreigners. Also at present, the historic public baths continuing the tradition are few in number. Therefore, the historic Ottoman baths are mainly utilised as driving forces for tourism and progress, as other heritage structures (ICOMOS, 2011).

1.1.1. General Description of the Ottoman Baths

Today in Turkey, public baths from the Hellenic, Roman, Byzantine, Seljuk, Principalities and Ottoman periods are found. Ottoman baths were formed by blending different cultures and the traditions of these former civilizations inhabited this region throughout time. Public baths were constructed either as separate buildings or inside the palaces and *han*s. They can also be classified as public baths called *genel hamam, halk hamamı, çarşı hamamı* and private baths like bathing spaces of palaces, mansions, and houses (Ülgen, 1964: 174-178). The public baths constructed as separate buildings, which is the main focus of this study, can be composed of only one section that serves women and men in different times, or of two adjacent sections serving men and women simultaneously. Accordingly, they are called as single or double public baths.

Ottoman public baths were constructed as part of autonomous and local waqf institutions. Some of the baths were run so as to secure the continuity of another building or system providing free service to the people in need (Köseoğlu, 1952: 7; Ünver, 1973: 92). The management of the public baths, an inseparable part of the social life,[3] (even if they were under private ownership) was closely inspected by the state[4].

Ottoman public baths, as other *vakıf* buildings, were united under the Directorate of "*Evkaf Nezareti*" in the *Tanzimat* period in order to bring central budget and central organization, and they transferred to VGM during the early Republican era (Öztürk, 1983; Madran, 2002). Especially until the 1960s, this institution sold a part of its non-religious estates, including entails, to individuals (Köseoğlu, 1952: 8). Thus, the majority of public baths that were originally waqf

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[3] The importance of bathing culture in social life can be seen in proverbs, sayings, folk and fairy tales. For a detailed study, see: Türkyılmaz, 2001: 40-54, 60-64, 79-80; Türkan, 2009: 162-174. Bathing culture remained indispensable even for outside settled life. It is known that in the Great Seljuk army there were portable *hamam* tents called "*çerge*" (Turan, 1984: 370). Ottoman armies also used *hamam* tents (Atasoy, 2005: 2).

[4] In Ottoman laws, especially in those indited by Celalzade, there are certain articles regarding the cleaning of public baths. For example, the attendants had to keep the buildings clean. Water should be kept mild, and the public bath warm. *Tellak*s would work properly. The mezzanines would be tinned, waistcloths clean. (from Ünver, 1973, p. 92: *Kanunname ve kanunnamei Celalzade, XVI.yy sonu*, Ayasofya Library no: 2894, p. 75)

properties became private estates and therefore their conservation became complicated.

The area of use of these buildings that were constructed from the 14th century until the 21st century was extended following the expansion of the Empire. Ottoman public baths were small-sized buildings in the 14th century; however, after Mehmed II's period, they became large-scale structures (Aru, 1949: 30). The 15th and 16th centuries are considered to be the classical period for the Ottoman baths. The perfection in ornamentation and upper structures is a distinct characteristic of classical period Ottoman public baths, especially in the earlier examples (Sözen, 1975: 225).

Ottoman baths constructions increased especially in the 15th and 16th centuries and started to decline from the 18th century onwards. In this period the number of these buildings was tried to be restricted due to their high wood and water consumption (from Ünver, 1973, 92: Ahmed Vasıf Efendi (1736-1806), *Men-i İhdası Hamam, Vasıf Tarihi*, p. 254). In the 19th century, public bath buildings were not profitable anymore[5] and thus only a few new Ottoman public baths were constructed. Rococo, baroque and imperial styles became dominant for the buildings constructed after the 19th century, especially in Istanbul and in the former capital cities (Şehitoğlu, 2008: 18).

In the 20th century, serious transformations took place in daily life and built environment. As bathing culture diverged from being an efficient element of social life, the number of working Ottoman public baths decreased. In the first half of the 20th century, a lot of public baths decayed due to the lack of maintenance or were demolished in order to make room for new roads construction and enlargements (Ünver, 1973: 1). A majority of these buildings under private ownership were pulled down by their owners for economic reasons (Ünver, 1934: 4). In the 1970's, on the other hand, only the public baths in the economically weak settlements, where modern urbanization had not developed, were still functioning (Ünver, 1973: 89).

[5] In Ottoman period, costs for the repair of waqf/*vakıf* waterlines were paid by the waqfs using them. In the 19th century, the majority of waqf were in financial difficulties and had to sell or rent some or all water or the public bath itself (İlhan, 2008: 49).

1.1.2. Architectural Features of the Ottoman Baths

Ottoman public baths should not be considered as buildings constructed only to provide certain social needs and income for waqf institutions. They are the most complex building types in Ottoman architecture, where art and technology are successfully incorporated together (Büyükdığan, 1998: 389).

First of all, the Ottoman baths are a part of the settlement, city, and geography that they are located in. For this reason, the most important factor to deal with is their relationship with water sources and urban tissue. The most important reason for the first Ottoman baths to be constructed on the ruins of the public baths from former civilizations was the fact that these buildings had already achieved this relationship successfully. For the newly constructed Ottoman baths, on the other hand, the accessibility of water resources was the primary concern.

Another important parameter is the relationship of the public bath with its close vicinity. There are some basic rules applicable to the formation of this relationship, depending on whether the structure is located in a residential or commercial zone, or is a part of a complex. For instance, a public bath located in a residential zone is located farther to dwellings than the dwellings to each other. The relationship of a public bath located in a complex with the other units and its position in the height hierarchy is again defined according to certain rules (Ataman, 2000: 68-69). Similarly, for privacy reasons, the relatively smaller women's section is entered from a plain gate normally located on side streets contrary to the impressively ornamented entrance portals of the men's section (Ülgen, 1964: 175; Ünver, 1973: 90).

The exterior façades are rather simple except for the portals, while in the inner spaces a rich decoration is used. Especially marble covering, transition elements, ornaments, shape and arrangement of lightening openings, are the primary elements further enriching the inner spaces.

Plan schemes applied in Ottoman public baths are also shaped based on functional, aesthetical and economic factors. The bath plans are designed so as to follow a spatial flow from cold to warm, in spite of a number of converse examples: *soğukluk/soyunmalık/camekân* (the disrobing area), *ılıklık* (the warm area), *sıcaklık* (the hot area), the water depot and the *külhan* (furnace). The volume starting under the water depot and generally extending up to the *ılıklık* is called *cehennemlik*. In some Ottoman public baths, there is also a *keçelik* (traditional felt production space).

The first and most commonly accepted plan typology is the one suggested by Semavi Eyice (1960: 108-114, 120) based on the *sıcaklık* spaces (Figure 1):

a) Cross-axial plan with four *eyvan*s and four corner *halvet*s,
b) *Sıcaklık* with a star-shaped plan type,
c) *Halvet*s arranged around a square planned main *sıcaklık* space in square plan type,
d) Multi-domed *sıcaklık*,
e) The type of plan that has elongated rectangular *sıcaklık* with a domed central space and two *halvet*s,
f) The plan has *soğukluk*, *sıcaklık* and *halvet*s of the same size

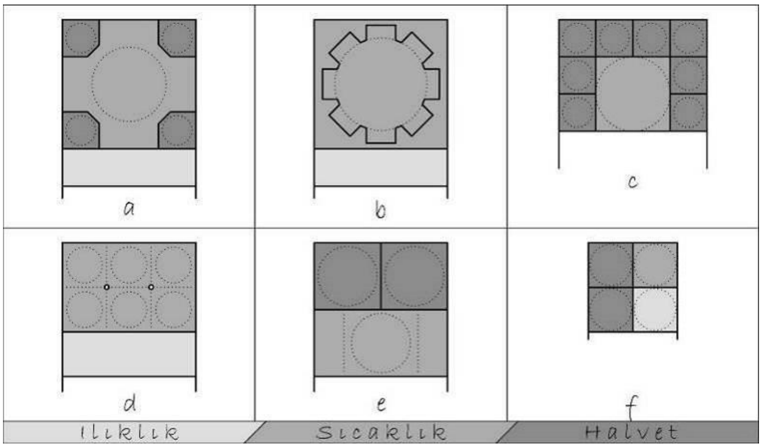

Figure 1. Plan typology of the Ottoman baths according to *sıcaklık* spaces (redrawn after; Eyice, 1960: 120)

The first space that the users enter into the Ottoman baths is the *soğukluk*. The preparations before and after bathing are done in this space. The *soğukluk* is normally the largest and highest space of the entire Ottoman public bath. Its upper structure is either a timber roof or a dome. The ground level is higher than the other spaces. Its entrance door is the most spectacular element of all façades. It has one or two rows of windows. On its walls, 1.5-2.5 metres wide and 1-1.20 metres high *seki*s are found. From the 16th century onwards, niches appear under *seki*s to place the wooden bathing shoes (*hamam takunyası*), and on the walls to place other personal belongings (Önge, 1988: 408). Other architectural elements are *şadırvan* located at the centre and public bath attendant’s room. In certain examples, furnaces one for each to dry towels and to cook coffee can also be seen. The door between *soğukluk* and the *ılıklık* has generally *yaşmak* and vapour release chimney[6]. The *soğukluk* is not heated by the main heating system of the building. Moreover, the *cehennemlik* that is a part of its main heating system does not continue underneath this space.

The space located between the *soğukluk* and *sıcaklık* is called *ılıklık*. This space can be smaller like a corridor in some examples and called *aralık*. It is also proposed that *ılıklık* was used as a disrobing area during winters in some examples (Aru, 1949: 35). Similarly, it is used as a bathing area for the people who cannot stand much heat. The upper structure is generally a vault, sometimes a dome and in certain examples a combination of the two. In this section, low *seki*s, and sometimes *kurna*s and niches are found at the sides of the wall. The *cehennemlik* extends until the base of this space and the discharge of the fumes whose temperature and intensity decreases by this point stops here. Tıraşlık-usturalık and toilets are accessed in a few examples from the *soğukluk*, but mostly from *ılıklık*. The upper structures of *tıraşlık/usturalık* and toilets, which are generally small spaces with a square plan is domes.

Sıcaklık, which is the main bathing space, is accessed from *ılıklık*. *Sıcaklık* is mostly composed of public bathing space with *eyvan*s and *halvet*s (private bathing cells). The *eyvan*s with rectangular plans and covered with vaults are opened to the domed public bathing space with a square plan. Also in the *halvet*s with square plans, the upper structure is a dome. In the *sıcaklık*, *seki*s, a *göbek taşı* (central platform), *kurna*s and in some examples pools are found. As in *ılıklık*, no windows are found in *sıcaklık*. Necessary lightening is provided by roof-lanterns and through lightening holes usually covered with moulded glass elements. In few examples, traces of the use of oil lamps and/or candelabra are found.[7] This might be in order to support natural enlightening, it may as well indicate that the public bath was in use before sunrise or after dawn (Yegül, 2011: 29). *Sıcaklık* is the hottest among all the spaces. The fumes in *cehennemlik* heats first *sıcaklık*.

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[6] According to Önge (1988: 408), in the pre-16th century examples, there was an intermediary space between bathing spaces and *soğukluk,* so-called *aralık,* which gave access also to *tıraşlık* and toilets. After the 16th century, this space was removed, and vapour chimneys were introduced to prevent vapour in bathing spaces coming into *soğukluk.*

[7] Among specialized niches for artificial lightening tools, the most detailed solution was introduced by Mimar Sinan. For a surviving example see: İstanbul *Ayasofya Hamamı*.

The rectangular water depot is usually positioned in such a way that the longer side leans on *sıcaklık*. The depot, heated by *külhan*, supplies the clean water need of the public bath and is composed of a single space only for hot water, or two spaces for hot and cold water. The space is covered with a vault in the same shape as the plan. The copper caldron used for heating purposes and located in the middle of the depot, water control window opening to *sıcaklık* and top window on the vaulted upper structure are the architectural elements of the water depot. Another architectural element used in depots is *maksem* niche. In certain examples, water coming to the public bath arrives first to the *maksem* niche placed in the wall on the outer face of the water depot, and then distributed from this point (Önge, 1988: 413).

Clean water leaves the depot and arrives at the taps at the *kurna* levels through *pöhrenk*s placed with a certain inclination on the walls of bathing spaces. There are generally two *pöhrenk* lines on bathing spaces for hot and cold water.[8] Water used in bathing spaces is either conveyed to toilets or discharged from one side of *ılıklık* through conduits on the ground.

Külhan that is used to heat the water inside depot is placed on the same axis with the caldron in the middle of the depot. It has a chimney to provide necessary air for combustion and to prevent backfire when the furnace's cover is opened. However, most of the fumes are directed towards the *cehennemlik* to heat the public bath. The fumes in the *cehennemlik* heat *göbek taşı* and in some instances *seki*s in *sıcaklık* and *ılıklık*.

The *cehennemlik*, heating the public bath, is located underneath *sıcaklık* and *ılıklık* spaces and is approximately 1-1.5 metres high. The *cehennemlik* pillars supporting the flooring on top of it are placed in certain intervals and in parallel with the walls. Fumes flow openings are formed on the foundation walls to provide fumes circulation along *cehennemlik* on this level. Fumes are laterally transferred from the opening at one end of the *külhan* furnace to the *cehennemlik* and to the *tüteklik*s in the vertical direction. By means of *tüteklik*s, not only walls are heated, but also fumes are gradually discharged from the public bath. The intensity and temperature of the

[8] There are certain examples, where these do not exist at all or there is just one such line in the *ılıklık*. Similarly in a few examples, there is just one line in the *sıcaklık* for hot water, but these are normally pre-Ottoman Turkish baths dated 12th and 13th centuries (Önge, 1988: 404).

fumes decrease from the *külhan* to *ılıklık*. In addition, the temperature of the spaces is also adjusted by using varying distances between *tütekliks* in some public baths.[9]

Access to *külhan* is provided through the courtyard, which is also used to store firewood. In some examples, in the courtyard, there are special spaces to store firewood and wells to provide and collect water, as well as cisterns and water wheels to fill the depot.

The load-bearing walls of public baths are stone and/or brick masonry, but there are a number of examples that the *soğukluk*, without a direct relation to the heating system and whose main function is not bathing, are constructed by using timber framing. The *sıcaklık* and *ılıklık* walls are the thickest, as they also have *tütekliks*. Brick is the most widely used construction material in the vaults and domes; however, there are a number of cases where stone and hollow fired clay units are seen.

Lime-based mortar and plaster are used on wall surfaces, heating system and water conveyance system. Different levels of vapour and water tightness of the final product are achieved by changing the components in these mixtures and their proportions, and the most suitable solution was found according to the needs of where the material is used. Marble is also used on the walls up to a certain height. Use of marble can be seen on slab coatings and at *göbek taşı* located in *sıcaklık*. Another material that is used for coating purposes on the walls and on the floor is glazed tile. There are a few examples, where *kalem işi* decorations are found in *soğukluk*s and in *sıcaklık*s (Önge, 1988: 420). At the upper structure, mostly roof tiles are used. Lime-based plaster, slate and lead coating are also used to cover domes and vaults. On the window and lightening holes, on the other hand, glass and oil paper are used.

1.2. Problem Definition

Ottoman public baths constructed during 14th and 20th centuries were shaped under the influence of bathing traditions of different cultures, as mentioned above. These buildings consist of a multi-component system involving different parts that are arranged in a highly sophisticated order. Ottoman baths have different aspects in addition to being a place where people are bathing in public. They are also a part of

[9] For an extant example, see: Tire, *Yeniceköy Hamamı*.

the urban tissue, urban history, daily life, Ottoman *Vakıf* institution etc. like the other monument types of Ottoman architecture.

Moreover, public baths are one of the most complex building types in Ottoman architecture according to their rich diversity of construction technique. Ottoman baths have remarkable physical features; rational plan schemes with different spaces at different temperatures, impressive inner façades, a wide variety of transition elements and upper structures etc. The fluids, pressurised water and fumes, the control of which is quite difficult even with today's technology, were also integrated into the Ottoman bath buildings. This building type is distinguished from the others by especially their advanced construction techniques and installation systems. Due to the complicated design requirements, very advanced construction, and material cognizance were practiced for the Ottoman baths resulting with the generation of successful technical solutions. These monuments bear the traces of the Ottoman builders' high-level knowledge about construction and materials, information of which is very important for the knowledge of Ottoman construction history.

Many researches were carried out so far to understand the physical features of the Ottoman bath. The first scholarly literature, focused on physical characteristics of the Ottoman baths in Turkey, was prepared in 1921 by Glück and in 1927 by Klinghardt. These studies differed from the former ones are significant with their detailed architectural drawings. After these early examples, research on physical characteristics of the Ottoman baths has continued until today. However, when we focus on the information provided by these studies, there are distinct differences between the information quality and quantity. The studies regarding the physical characteristics usually focus on the general architectural characteristics and/or construction materials. Only some of these studies dealt with the construction technique of a specific public bath or a specific part of a group of public baths. In fact, most of the researchers dealt with the architecture of the Ottoman baths, overlooking their advanced construction techniques and installation systems.

As mentioned above, the construction techniques of the Ottoman baths represent Ottoman builders' high-level of knowledge about construction and materials, and it is very important for the knowledge about Ottoman construction history. Likewise, this information is very important for future conservation studies.

However, there are not comprehensive and detailed research about this issue. Thus, the remaining historic Ottoman baths in Turkey have been losing their document value day by day, because of the lack of maintenance as well as restorations with insufficient knowledge, expertise, and improper control mechanism.

This risky situation is also valid for remaining 14^{th}-16^{th} century public baths in Edirne. These remaining buildings, located in the former capital of the Ottoman Empire that never lost its political value during that era, is losing their document, aesthetic and technical values progressively. It is essential to take precautions to prevent this risk, at least for the mitigation of this risk. The underlying problem is the fact that these buildings are not understood correctly and adequately. Unfortunately, even the general physical and architectural features of most of these buildings have not yet been documented. Although architectural drawings of general physical features of some of them have been prepared in the scope of academic or project purposes, the information or traces about technical values (which are one of the most important features of this building type) are about to be lost completely.

When existing documentation practices are evaluated, it can be seen that proper attention to construction techniques and installation systems have not been paid. The traces of how the Edirne public baths built in 14^{th}-16^{th} centuries are constructed and the construction details used from the load-bearing elements to the finishing techniques, which are not only invaluable for architectural and construction history but also for conservation practices, have not been understood and analysed yet. Moreover, due to the structural problems and demolitions, information about these aspects are about to disappear.

1.3. Aim and Scope

Considering the above-mentioned problem, the aim of the thesis is gathering reliable and comprehensive information regarding the construction techniques of the early Ottoman baths to improve knowledge about Ottoman construction techniques and history, to serve in future conservation interventions, and at least to provide a basis for future studies.

Thus, a systematic research has been made to define the state of knowledge on the physical features of the Ottoman baths located in Turkey. Results of this research revealed that some of the cities were in the first ranks of the studies about these buildings; İstanbul, Bursa, and Edirne, respectively (Figure 1, Table 1). In these studies, there are much information (plan scheme, façade and section drawings, and laboratory analyses about materials etc.) about the physical features of the Ottoman baths located in these cities, which could be used as a basis for a construction technique research.

The observability of construction techniques, keeping original material and construction characteristics are important criteria for the selection of the Ottoman baths for this study. Therefore, the Ottoman baths located in İstanbul and Bursa were excluded from the thesis scope, because the Ottoman baths located in these cities are subjected to intense conservation implementations for many years.

On the other hand, the buildings for this study are selected by their construction dates in order to avoid the differences related to the technological developments in time. Only the early Ottoman baths built between the 14^{th} and 15^{th} and in the early 16^{th} century are selected as cases to be studied in this thesis. These public baths had an important role in the early Ottoman period as *non-confessional urban foci* in order to appeal to each of the religious and ethnic groups (Kafesçioğlu, 2010: 108).

Moreover, Kuban (1999: 16) stated that the Ottoman architecture of Edirne consist of four main periods, which are identified as the Mehmed I (1413-1421) era and before, the Murad II (1421-1444) era, the conquest of İstanbul (1453), the classical Ottoman era and after. He also highlighted that the most important of them is the Murad II period with regard to the settlement history of Edirne. In this thesis, Ottoman public baths constructed between the 14^{th} and 16^{th} centuries were chosen as the research topic since the comprehensive examples of Edirne architectural heritage were produced and the main character of Edirne settlement tissue was developed with a rapid construction activity during this period.

Only fourteen of Ottoman public baths constructed in Edirne still exist today; which are *Abdullah Hamamı*, *Beylerbeyi Hamamı*, *İbrahim Paşa Hamamı*, *Kum Kasrı Hamamı*, *Mahmudiye Kışlası Hamamı*, *Merkez Askeri Hastanesi Hamamı*, *Mezit Bey Hamamı*, *Gazi Mihal Bey Hamamı*, *Saray Hamamı*, *Sokullu Hamamı*, *Tahmis Hamamı*, *Tahtakale Hamamı*, *Topkapı Hamamı* and *Yeniçeriler Hamamı*. However, two of these buildings, *Mahmudiye Kışlası Hamamı* and *Merkez Askeri*

Hastanesi Hamamı, were also excluded from this thesis, since they were built during the 19th century.

In addition to these fourteen Ottoman public baths, there are the foundation remains of *Aşçılar Hamamı, Şifa Hamamı* and *Tahtalı Hamamı*. Although these ruins could have provided considerable information about foundation systems of Ottoman public baths, they are not observable as standing buildings. Most of their important traces are not accessible due to the soil deposit and plants above them.

In line with these potentials and constraints, all of the twelve public baths built between the 14th and 16th centuries in Edirne were examined within the scope of this thesis. Similar to İstanbul and Bursa public baths, the Ottoman baths located in Edirne, which are in use and/or have been subjected to any restoration or significant repair by use of modern techniques, were also excluded from the primary study. The Edirne public baths, keeping their original construction techniques and are observable clearly, which are built between the 14th and 15th and early 16th centuries were selected as the primary case studies for the research into the construction techniques of the early Ottoman baths. These buildings are *Beylerbeyi Hamamı*, *İbrahim Paşa Hamamı*, *Gazi Mihal Bey Hamamı*, *Topkapı Hamamı* and *Yeniçeriler Hamamı*.

For a detailed evaluation of the construction technique and process of the Ottoman baths located in Edirne, physical features of the construction sites, location of the material sources (stone quarries, brick kilns, and woodland areas), characteristics of the construction materials, and structural behaviour of the buildings were determined for each of these five public baths studied in detail. While some experimental and analytical studies about the material and structural behaviour should be carried out for the understanding of construction technique, these studies are out of the scope of the thesis, even though the information came from prior researches on this issue is utilized for a comprehensive understanding.

Table 1. The number of sources (PhD theses, MS Theses, and books) by cities about the Ottoman baths in Turkey until 2013

	PhD	MS	Book	total:
ADIYAMAN	1			1
AFYON		1		1
AMASYA		2	1	3
ANKARA		7	1	8
ANTALYA		1		1
AYDIN		1		1
BALIKESİR		1		1
BATMAN	1			1
BİLECİK		1	4	5
BOLU		1	2	3
BURSA	1	6	9	16
ÇANAKKALE		1		1
ÇANKIRI		1		1
ÇORUM		1	1	2
DİYARBAKIR	1	3		4
EDİRNE	1	6	2	9
ESKİŞEHİR		2	2	4
ERZURUM		1		1
GAZİANTEP	1			1
İSTANBUL	1	21	9	31
İZMİR	1	7	4	12
KARABÜK		1	1	2
KASTAMONU		2		2
KAYSERİ	1		1	2
KİLİS	1			1
KOCAELİ			1	1
KONYA		2		2
KÜTAHYA		1		1
SİVAS		2		2
ŞANLIURFA	1	2		3
TOKAT		1	3	4
total:	11	75	41	127

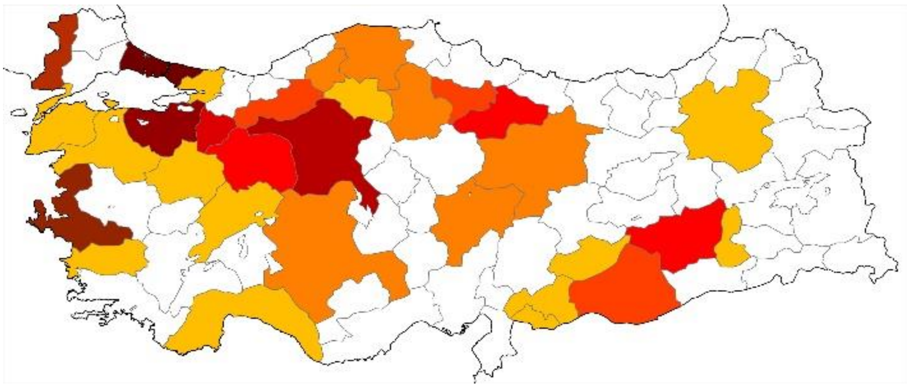

Figure 2. Distribution of the number of sources by cities about the Ottoman baths in Turkey until 2013 (increases of numerical density presented by colour scale; from yellow to brown)[10]

1.4. Methodology

Based on the mentioned potentials and constraints, within the scope of the thesis, the twelve Ottoman baths constructed during 14th and 16th centuries were studied and five of them were selected as main case studies, which are *Gazi Mihal Bey Hamamı* (1421-1422), *Beylerbeyi Hamamı* (1428-1429), *Yeniçeriler Hamamı* (the first half of the 15th century), *Topkapı Hamamı* (1440-1441) and *İbrahim Paşa Hamamı* (the second half of the 15th century). Methodologically, this research was developed in seven main phases, which are literature survey, pre-site survey, site survey, documentation, analysis, evaluation, and conclusion.

In the first phase, written and visual materials related to bathing cultures, public baths, Ottoman baths, construction techniques used in the Ottoman architecture, Edirne settlement history, water related structures and water sources located in this city were collected and examined. In addition, the information about the location of the possible stone and clay quarries, the physical and mechanical properties of building materials and structural behavior of masonry systems were gathered.

This literature involved academic publications (books, dissertations, journal papers, symposium papers, research reports, research sheets, maps, illustrations, etc.), official documents (official reports, Regional Conservation Committee decisions, cadastral maps, etc.) and personal archives (photograph archives of Machiel Kiel, İlter Büyükdığan and Neriman Şahin Güçhan).

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[10] Unless otherwise stated, all images presented in this thesis have been drawn or photographed by Filiz Diri Akyıldız.

The historical documents such as account-books kept during constructions, imperial orders, annuals, inscriptions, and miniatures contain vital and detailed information on the Edirne settlement history, construction process and regular maintenance of Edirne public baths. The translations of these documents prepared mostly by historians and architecture historians were collected and examined. The publications prepared by Barkan (1972; 1979), Onur (1972), Dijkema (1977), Orbay (2011; 2012), and Orbay and Oruç (2013) were used as main sources.

These sources were systematically classified so as to provide an interactive database, which was formed according to the type of the sources and the information. By this way, the database was updated throughout the entire process. The general information related to the bathing cultures and the Ottoman baths were presented in Chapter 1. The information gathered from this phase related to Edirne presented in Chapter 2 and used in Chapter 3 as a guide to an integrated approach. In addition to that, the information obtained from the literature survey was utilized throughout the study to review, support, and enhance all of the other phases.

In the second phase, the pre-site survey was conducted in July 2012 and the public baths to be studied were selected based on the observability of their authentic construction techniques, as mentioned above. The buildings, the authentic construction details of which could not be observed or built in the 19th century, were excluded from the scope of this study. Meanwhile, as the method of the site survey became clearer; the extent of the information to be collected was defined for the selected public baths, which keep their authentic features and have not been subjected to any conservation or significant repair. In this context, an information gathering method for site survey was also formed in this phase (Figure 2, Figure 3). The proposed method for site survey was first tested on the *Beylerbeyi Hamamı* in August 2013 (Figure 2) and according to the outcomes, the method was reviewed and enhanced.

The site survey was conducted in the third phase. The primary aim of this phase is to understand the construction process of the Ottoman baths built in the 14th-16th century in Edirne and to define their construction techniques and materials. The information gathering method, which was formed by Şahin (1995) and used by Diri (2010) in her master's thesis, is collecting necessary information where system section changes from the foundation level of the building up to the superstructure. Based on this method, all architectural and structural details of studied public baths were documented by the use of photographs, measured section and detail drawings, and written observations in August 2014 and August 2015 (Figure 3, Figure 4).

Some spaces within the 14th-16th century Ottoman baths located in Edirne could not be studied due to the soil deposits. Similarly, although the ruins could have provided considerable information about the foundation systems, most of the important traces of the ruin of *Tahtalı Hamamı* are not accessible due to the soil deposit and plants on them. In addition, in some Edirne public baths, most of the authentic details lost their readability due to the repairs made by the use of modern materials and techniques. The lack of permission to investigate the buildings under private ownership is another reason as to why the existing information could not be documented. For this reason, *Abdullah Hamamı* and *Tahnis Hamamı* could not be studied in detail within the scope of this thesis; on the other hand, their construction techniques are readable.

The construction materials used in the selected public baths are also documented. The physical and mechanical properties of these materials, especially the masonry units, mortars and plasters are very important for public bath structures, which are in a direct relation with water and vapour. The laboratory analyses are out of the scope of this thesis; however, the information gathered from prior researches on this issue is utilized. The research projects about the physical, mechanical and microstructural features of building stones used in the Ottoman architecture headed by Erguvanlı (Sayar, Erguvanlı, 1962; Erguvanlı, 1981) and the plasters and mortars used in the *Sultan Selim Saray Hamamı* and the *Beylerbeyi Hamamı* headed by Hasan Böke (Böke et. al, 1999) was used as the primarily sources.

In the fourth phase, the information gathered in the site survey was digitalized by the use of AutoCAD 2015 in a systematic manner including site plan, plan, reflected ceiling plan, sections, system sections, and point details, from 1/200 to 1/2 scale precision. All of the studied buildings in detail were drawn using this system and presented in Chapter 3-4 and Appendix B.

In the fifth phase, different load-bearing elements, architectural elements, and installation systems of all studied Ottoman baths were grouped based on their different features, which are the construction techniques, forms, building materials, and finishing techniques. The construction processes, components, and working principles of each technique were defined based on the information gathered directly from the buildings. The results of these observations gathered from the third, fourth and fifth phases are presented in Chapter 3.

In the sixth phase, documented information was evaluated and compared in a systematic manner to reveal the frequency of the usage of construction principles and details. The information gathered directly from buildings studied in detail were evaluated and compared by considering other key factors, including physical features of the construction sites, locations of the water sources, physical characteristics of building materials and the structural behaviour of masonry systems. The characteristics of building materials and construction details are defined starting from the load-bearing elements to the finishing techniques. By this way, reliable and comprehensive information is produced for the understanding of the construction process and construction techniques of an Ottoman bath built in Edirne during 14^{th} to16^{th} centuries, which is the most important contribution of this thesis. In addition, in this phase, the pre-construction activities and post-construction precautions estimated during construction are evaluated with the main construction process. The results of this phase are presented in Chapter 4.

In the last phase, main conclusions obtained at the end of this study are drawn. The new construction details, which are revealed in this study for the first time, are presented and evaluated. Moreover, the importance of this study is underlined not only for conserving the 14^{th}-16^{th} century Edirne public baths but also the other monuments from this period. An evaluation regarding the specific information gathering method that should be used in such studies is made within the limits of the experience gained in this study. Lastly, the necessity of information resources, used or could not be used in this thesis, as well as their apparent or potential contribution to similar studies are also evaluated. The outcomes of this phase is presented in Chapter 5.

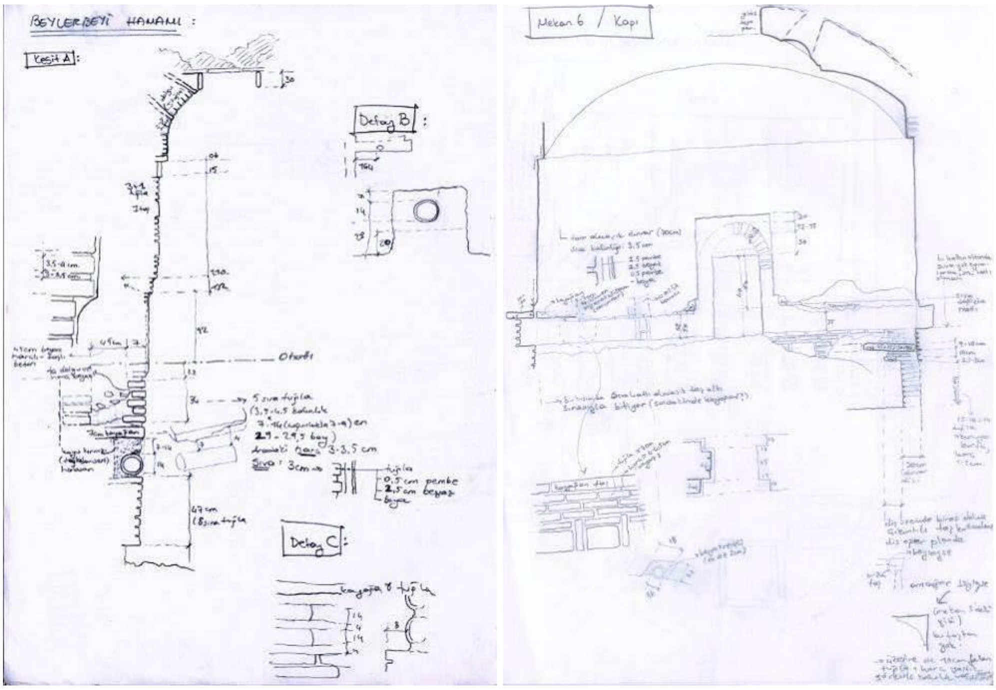

Figure 3. Sketches of the Edirne *Beylerbeyi Hamamı* showing information collected in 2013 August to review the proposed system of information collection

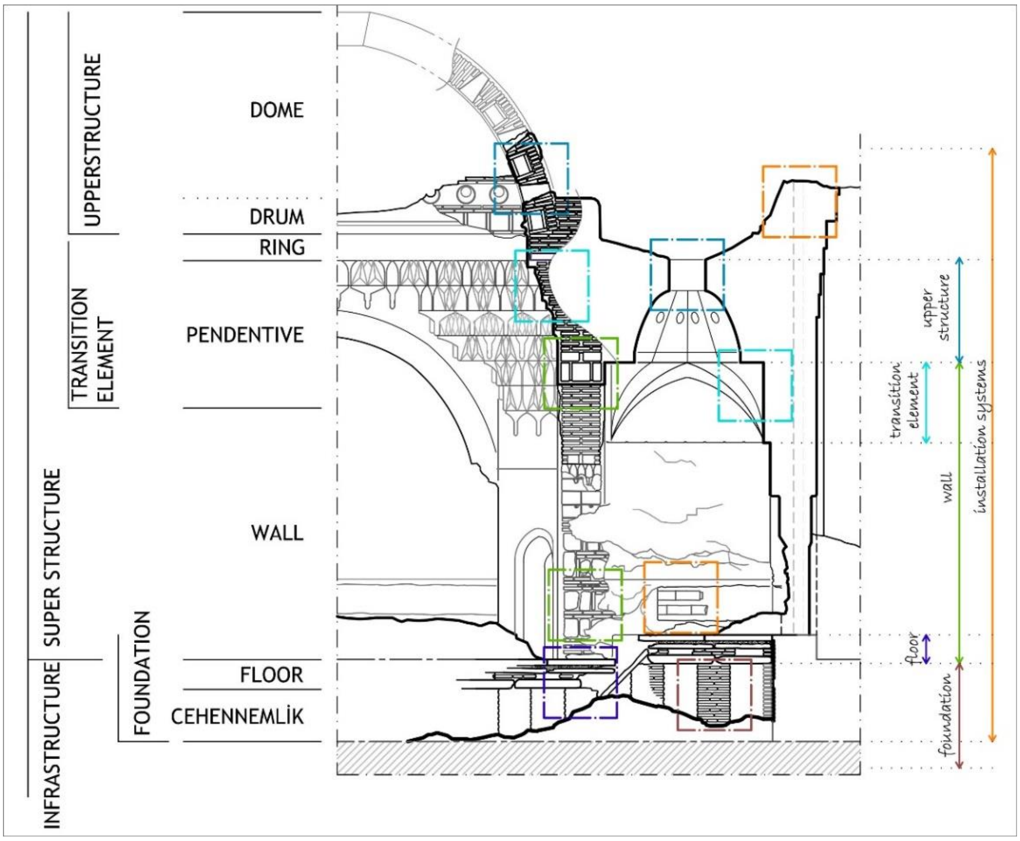

Figure 4. A representative drawing showing the relationship of building parts and survey method on a section drawing

CHAPTER 2

AN HISTORICAL OVERVIEW OF EDİRNE AND WATER STRUCTURES LOCATED IN EDİRNE

Edirne, which is located in the Thracian Region in the southeastern part of the Balkan Peninsula, is believed to be inhabited by the Thracians firstly and became an important urban settlement under the rule of the Ottoman Empire (Gökbilgin, 1994, 425). The changes in settlement tissue and bathing culture over the centuries have also affected the urban water supply system and public baths.

In this chapter, location of Edirne, environmental features which must affect the architecture, urban history and architectural heritage built by different cultures and/or under different rulers throughout the centuries are presented. At this stage, in accordance with existing literature, the development of the settlement and the position of architectural heritage, especially public baths, in the settlement are examined. In accordance with this purpose, the locations of the urban water supply network and structures related directly to water are determined and the relation between each other and the settlement are analysed.

2.1. History of Edirne and Architectural Heritage of Edirne

Edirne is situated on the southeast end of the Balkan Peninsula in the Thracian Region, where Tunca and Arda Rivers meet Meriç River, at North41°40'41", East26°33'49" longitudes. Edirne is surrounded by Kırklareli and Tekirdağ to the east, Greece to the west, Bulgaria to the north and Aegean Sea to the south. The immediate vicinity of the city is covered with fertile broad plains and hills.

The Meriç Valley, which stands out as a natural corridor within the mountainous structure of the Balkan Peninsula has been an indispensable route for road transport between Europe and Asia since the early ages. This valley extends between the Balkan Mountains and the Rhodope mass in a wide groove, providing access to the Sofia basin and thus to the Niş River valley, the Morova valley, the Tuna valley and the southern plains of Hungary. From here, a natural corridor formed by the Vardar River reaches the Aegean Sea. In the mountainous area where natural corridors reach the sea or large plains, important cities such as Thessalonica and Belgrade took place due to the geographical features of the area. Similarly, Edirne was founded in this zone where Meriç reached the plains of Thrace. These natural corridors, of course, have served as an easy passage for migrants and invaders as well as for trade routes. (Darkot, 1993, 2)

The region between the point where the Meriç River opens to the plains and the sea is largely a swampy ground. The surroundings of Edirne makes it possible to establish a settlement, which could be active in all seasons thanks to its geological structure and topographical features. In the whole region, the central settlement of Edirne is a point of intersection/a node between İstanbul, Bulgaria, Eastern Europe and the inner parts of the Rhodope mass. In addition, the area is a dominant and sheltered location with the natural ditch formed by the half-circle drawn by the Tunca River and the slope increasing from the west to the east. (Darkot, 1993, 2-3).

2.1.1. Edirne Before the Ottoman Empire

According to the information obtained from the written sources, in the Antique period, the first inhabitants in Edirne Region were the Thracians (Gökbilgin, 1994, 425). The majority of the sources use the name "Orestia" or "Orestias", including late Byzantine sources (Gökbilgin, 1994, 425), although there are different opinions[11] due to the existence of several small settlements close to each other in the region (Mansel, 1993, 21).

It is known that from 1400 BC to 1200 BC (Mansel, 1993, 21)[12] the Aka Civilization dominated the region creating a strong cultural and architectural influence including the architecture during long years and the people have been in cultural and economic interaction with the Greek Colony cities (Mansel, 1993, 22).

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[11] *Uscudama*, *Goneis*, *Orestia* and *Orestias* (Mansel, 1993, 21)

[12] In the Mezek position, situated to the west of Edirne, domed tombs dating to the 5th or 4th BC have been found. This type of structure, which is directly related to the Aka civilization, has continued to be used for a long time in this area although it was abandoned much earlier in the other regions where the Aka culturally dominated (Mansel, 1943, 5)

In 513 BC, Thrace entered the Persian dominance. After the fall of Persian hegemony, in the mid-5th century BC, it stayed within the dominance of a great state extending to Varna, founded by the Odrys, (Mansel, 1993, 22). After the falling of this state in the 4th century BC, the region was under the domination of Macedonia; however, being exposed to the Galat and Celtic invasions during a long period.

After the abolishment of the Macedonian kingdom by the Romans in 168 BC, the region entered the Roman domination (Mansel, 1993, 23). The year 123-124 AD was a very important turning point for Edirne. “Publius Aelius Hadrianus Augustus”, who was in Thrace on this date, made Orestia a city settlement due to its strategic importance and gave the name "Hadrianopolis/Adrianopolis" which means "the city of Hadrianus" (Mansel, 1993, 23). This meant the growth and enrichment of the settlement and therefore the development of the built environment.

Despite the fact that Hadrianopolis being an important Roman fortress, *castrum*, (Eyice, 1993: 40) there are no buildings that have reached to our day from that period. Only a few ruins of the city's fortification walls[13] originally built in this period and used later by the Byzantine Empire and the Ottoman Empire can be observed (Figure 5).

There are cylindrical towers on the four corners of the fortification walls, twelve towers along the four main walls and the entrances and exits to the city are provided by eight gates (Abdurrahman Hibri, 1996, 15[14]). Strong predictions can be put forward about the area that the citadel has covered by considering; the location of the four main towers (Makedon, Kafeskule, Germenkapı, Zındanaltı Towers), the gridal system that has been used in the inner Citadel since Roman times and the remains of the wall that still stand today (Figure 6, Figure 7).

[13] Thefortification walls of the city are represented in the coins seen in “A Catalogue of the Greek Coins in the British museum” and “Berliner Musee, Beschreibung der antiken Münzen”: There is a gate in the middle of two cylindirical towers with a conic top, some towers have windows (Mansel, 1993, 25).

[14] "Enisü'l-Müsamirin" written by Abdurrahman Hıbri and translated into Turkish by Ratip Kazancıgil in 1996, contains information about the general and architectural features of Edirne during the period starting from the conquest of the city by the Ottoman Empire until 1635-1665. This work is of great importance in terms of being the first city history writing in the Ottoman Empire.

The city showed a rapid development during the Roman period owing to its location and being on an important node of land and river paths and it is mentioned in the map and road books of the ancient period made in the 3rd and 4th centuries AD (Mansel, 1993, 26). Constantinus' defeating Licinius in Rome and moving his capital from Rome to Constantinopolis-Byzantium in 324, have further increased the strategic importance of Hadrianopolis, located on the periphery of the capital of the Eastern Roman Empire and on the roads connecting to Central Europe. (Mansel, 1993, 27).

Between the middle of the 4th century and 11th century, Thracian settlements with increasing importance have been affected by many internal and external confusions (Eyice, 1993, 45-53). Despite the conflicts ongoing over the 12th and 13th centuries, Hadrianopolis continued to be an important trading centre (Eyice, 1993, from 57: Bratianu, 1929, 119-120, 132).

It is known that the settlement area in this period was limited to Kaleiçi and Aina, which was located on the opposite side of Gazi Mihal Bridge (Gökbilgin, 1994, 427). However, there are hardly any buildings reached today as a whole from the Byzantine period. The sources refer to two churches[15] which were converted by the Ottomans, *Kilise Camii* and *Halebi Camii* (both buildings were damaged in the 1752 earthquake), another church on the foundations of which the *Yıldırım Bayezid Camii* is constructed, and the Sinatikon Church in the Kaleiçi which did not exist today (Eyice, 1993: 67-74).

In addition to these, the Byzantine Period *Çukur Hamam* took place where the Bulgarian Catholic School is located, and also the *Eski Camii*, *Hace Siyah Mescidi* (in the place of Hagia Segezori Church) and *Küçük Eski Camii Mescidi* (in the place of Küçük Hagia Sophia) may have been built in the locations of Byzantine churches and perhaps using their foundations (Ahmet Badi Efendi, 2014: 100, 107-108, 145, 161, 268) (Figure 7).

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[15] One of these two churches was called Edirne Hagia Sophia Church. It is known that the building, which was demolished during the 1752 earthquakes, has survived although in a ruined state until the end of the 19th century, but was then destroyed in order to serve as building material at this period (Eyice, 1998: 36).

Figure 5. Drawings dated 1829-1830 of Edirne fortification walls and the gate (Source: http://eng.travelogues.gr: Sayger, C. and Desarnod, A. J., 1834. Album d’un voyage en Turquie fait par ordre de sa majesté l’empereur Nicolas 1er en 1829 et 1830, Imprimérie de Firmin Didot Frères, Paris.)

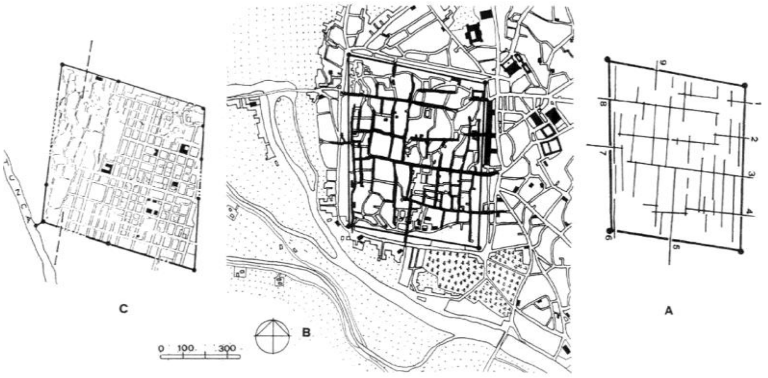

Figure 6. The plan scheme and location of the gates after 1905 fire; 1) *Kule* Gate, 2) *Orta* Gate, 3) *Balık Pazarı* Gate, 4) *Tavuk* Gate, 5) *Manyas* Gate, 6) *Germe* Gate, 7) *Keçeciler* Gate, 8) *Kafes* Gate, 9) *Topkapı* (Source: Yerolimpos, 1993: 135).

2.1.2. Edirne During the Ottoman Empire

In the period of Murad I, the Ottoman armies started to conquer Thrace and they besieged Edirne in 1361 (İnalcık, 1993, 159). After the city guard left the city, the inhabitants opened the doors and rendered the city to the Ottoman Empire depending on an agreement made between the sides (Eyice, 1993, 62). Murad I gave the administration of the city to Lala Şahin Paşa and continued to use Bursa and Dimetoka as the centre for a while. While the Ottomans were organizing expeditions to İstanbul, Thrace and Macedonia, Edirne was used as a main base of operations for the conquest of İstanbul and the Balkans.

According to Emecen (1998, 50); Edirne has emerged as an important settlement with its strategic position especially in the Roman and Byzantine periods, but it has never been a great centre probably because of the intense occupation and invasions. According to the historical resources, the reason that Sultan Murad I did not stay in Edirne but started living in Dimetoka and Bursa again after the conquest of Edirne is that Edirne was a small settlement, Dimetoka is a more convenient place to live and the city possesses a *Tekfur* Palace[16] (Peremeci, 1939, 12).

The city was declared as the capital of the Ottoman Empire in 1365 and the palace (*Saray-ı Atik*), which was started to be built with the instructions of Murad I on the hill behind *Selimiye Camii*, was completed in 1368 (Figure 7) and the whole state administration has been moved from Bursa to Edirne. After this date, Edirne became the capital of the Ottoman Empire until the conquest of İstanbul by Mehmed II in 1453.

The oldest structure built during the Ottoman period was *Yıldırım Camii* constructed on the foundations of an ancient Byzantine church in the period of Bayezid I in 1397 or 1400 (Aslanapa, 1993, 224) (Figure 7).

When the city was seized, the Byzantine and Genoese Christian populations and the Jewish population did not leave the city and lived together with the Muslim people who were brought here from Anatolia. The vast majority of the people brought by the Ottoman rulers from Anatolia to Rumelia, sometimes by voluntarism, sometimes by exile, were nomadic and semi-nomadic. However, the sudden enormous increase in the number of over 200 different professions and performers in the Thrace region which cannot be related to the time pass, shows that a part of the relocated people were chosen among the artists and craftsmen specialized in various fields who are probably chosen according to the need[17] (Taş, 2009, 65).

In the late 14th century, the first Ottoman settlements in Edirne began to be established in the old Kaleiçi district, which has also been used before (Figure 8).

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[16] *Tekfur* palaces are a type of official monuments built for and used by feudal landlords of Byzantine Empire.

[17] The ruling of "18 *Muharrem* 972/26 August 1564", calling the master craftsmen and carpenters present in Edirne to come to Istanbul to work in the water supply network, shows that they are quite a number of people quite competent in their arts (Yiğit, 2010, 254: MD no: 6, page 39, volume 77).

Some of the neighbourhoods in this district were later preferred by Christian and Jewish citizens because of their close proximity to the commercial axis, and when the non-Muslims came to the majority, non-Muslim neighbourhood names replaced the Muslim names (Kazancıgil, 1998, 28-29, 33).

The Jewish community in Edirne had a special place in the social structure. Starting from the declaration of Christianism as the official religion in Byzance in year 313 until the inclusion of Edirne in the Ottoman territories, the Byzantine Jews[18] were forced to change religion and were subjected to pressures due to their beliefs (Taş, 2009, 124). Perhaps for this reason, relations with the Jewish community developed and progressed very quickly in the conquest of Edirne by the Ottomans.

The city came to prominence as a military centre in the time of Bayezid I, and preparations for European and Asian campaigns took place here (Peremeci, 1939, 12). In 1402 AD, with the defeat of Bayezid I to Timur's Army, all the habitants of the palace and the treasury in Bursa were moved to Edirne by Süleyman Çelebi, a son of Bayezid I.

During the era of Murad II, urban construction activities accelerated (Figure 8). The *Eski Camii*, which was the first monumental building of this period, was built in 1414 and the *Muradiye Camii* was built in 1436 (Figure 7). One of the early works, the *Üç Şerefeli Camii* was also built by Murad II between 1438-1447 (Figure 7). The construction of the *Saray-ı Cedîd-i Âmire* (*Yeni Saray*/New Palace), which is now called "Edirne Palace", situated between the two branches of Tunca River, started with the instructions of Murad II and was completed in 1450 (Aslanapa, 1993, 225) (Figure 7, Figure 8). After this period, a large number of new buildings and structures were constructed in the area of *Saray-ı Cedîd-i Âmire*, and it became a very rich complex in years.

Some of the buildings that were built during the Murad II period and are of great importance for Ottoman architecture can be listed as follows; *Muradiye Camii, Darülhadis Camii, Gazimihal Camii, Şah Melek Camii, Saruca Paşa Camii,*

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[18] According to Galanti (1947, 12), the Jews who were expelled from Palestine by Roman Emperor Adrien in the 2nd century AD, settled in Edirne. However, the earliest found traces of Jewish settlement date to 389 (Taş, 2009, 124).

Bedesten, Tahtakale Hamamı, Topkapı Hamamı, Acemioğlanlar Kışlası, Harbiye Mektebi. The first example of the great mosque type of the Imperial period, the *Üç Şerefeli Camii*, was also built by Murad II (İnalcık, 2006: 171). In this period, a new gate was added to the fortification walls which have been used also in the Roman and Byzantine periods. The name of this gate, built by Murad II, is thought to be the *Topkapısı* (Armoury Gate) because of the city armoury (*tophane*) located on the inner side (Figure 6); in fact, the name of the public bath built in this region during the same period is *Topkapı Hamamı* (Abdurrahman Hıbri, 1996, 15). (Figure 7)

Bertrandon de la Broquière (1807: 236-267), who stayed in Edirne in 1433, mentioned the beauty and crowds of the city of Edirne in his travel notes. He described the town as a large and animated trading centre, where Venetian, Catalan, Genoese and Florian merchants can be seen.

In 1453, when Mehmed II conquered İstanbul and proclaimed it the capital, Edirne became the second important centre of the Empire. However, Edirne continued to be the base of action for the Balkan and European campaigns after this date as well[19]. The city, being a political and commercial centre had also remained as an important cultural centre for a long time, especially due to the fact that the sultans and senior state officials preferred to live there. *Bayezid Külliyesi* (the imperial complex of Bayezid II), one of the characteristic examples of Ottoman 15th century art, was built by architect Hayrettin in Edirne between 1484-1488 by order of Bayezid II (Aslanapa, 1993, 226).

Since the 15th century, Edirne's expansion has accelerated. After Kaleiçi, the Debbağhane district became the first settlement area, it is followed by the Kirişhane district extending towards south-east up to to the Kirişhane building located at the place known as *Kasımpaşa Burnu*. While the population growth and extension continued in these districts, the district of İstanbul Road/Ayşe Kadın was established on the line extending towards east from the İstanbul Gate of the Citadel. The district where the gunpowder factory and the janissary rooms took place in the time of Mehmed II and which is known as Kıyak or Buçuktepe due to the "*zaviye*" and the

[19] After the conquest of Istanbul, Mehmed II returned to Edirne and spent most of his time in the Palace of Edirne (Peremeci, 1939, 17).

“*türbe*” (tomb) of Kıyak Baba, who is one of the first who came to Edirne, was also established during this period of development.

In the north-eastern part of the city, the *Menzil Ahırı* (meant “Range Barn”, named this way because of the stables belonging to the Edirne Palace), Muradiye and Tekke Kapı districts; Saraçhane and Horozlu Yokuşu districts were established near Saraçhane Bridge. In the west of Tunca River; at the end of 14^{th} century Yıldırım/Eski İmaret district, in the first half of the 15^{th} century Gazi Mihal/Orta İmaret district and in the late 15^{th} century *Yeni İmaret/İkinci Bayezid İmareti* districts have been established. In the following years, the hills in the west were settled with the name of Hıdırlık. (Kazancıgil, 1992, 30-95) (Figure 8)

In 1555 Dernschwam (1992, 333) mentioned the abundance in the city, the variety of products in the markets and the four great bakeries in the city. Edirne was the centre of attraction for the public with all these features and one of the three glorious cities of the Ottoman Empire; İstanbul, Edirne, and Bursa. Likewise, the three settlements carried to today the development of the early Ottoman architecture are Bursa, İznik and Edirne, but unlike the other two settlements, Edirne retains many important post-development works of Ottoman architecture (Aslanapa, 1993, 223). (Figure 7, Figure 8)

It is also understood that the sultans attached a special importance to Edirne as well. It is noteworthy that Süleyman the Magnificent would come to Edirne before the expeditions to East and stay here for months for the preparations. The construction of many imperial structures that stand out among their contemporaries in terms of quality and quantity in the city proves that Edirne was always an important centre. The *Selimiye Camii* (Aslanapa, 1993, 227), built by Sultan Selim II during the years of 1568-1574, is one of the best indicators showing that the city continued to be esteemed after the declaration of İstanbul as the capital.

In the 16^{th} century, new districts were established along the Tunca coast and within the area which starts from the İstanbul Road Gate of the Citadelle extending to the east. (Gökbilgin, 1994, 428). According to the Ottoman tax registers, noted in the *Tapu Tahrir Defterleri*, in this period when the population has almost doubled (Dimitrov, 2012: 72), it can be seen that the city continued to develop rapidly and steadily, and many cultural assets which are the important examples of the Ottoman architectural history were built. (Figure 7, Figure 8)

In the establishment of the new districts, the tradition of Muslims and non-Muslims living in separate neighbourhoods generally continued. In the first phase of the establishment of the Muslim districts, the core/nucleus of each district, the social centre of which is mosques and masjids (Ergenç, 1984: 73), consisted of religious, social and charitable facilities such as *imaret*, mosque, masjid, *zaviye*, public bath, fountain which mostly take place in the waqf system (Kazancıgil, 1992, 17-18). It can be said that the waqf institution provides urban development and support sustainability by establishing and sustaining the buildings that will meet the basic religious, social and cultural needs of a city (Barkan, 1942: 279-304).

According to the *Maliye Ahkâm Defterleri*, in the last quarter of the 16th century, there were 22[20] waqfs in Edirne, where the waqf system is highly developed. These waqfs were generally working in a systematic way of financing religious and educational structures with income from the others (Tabakoğlu, 2000, 157-158). These structures were first built, and then the people were settled around these buildings. The same system is also applied in Christian districts, the only difference being the churches and synagogues forming the core.

However, the distinction of the religious-based neighbourhood usually does not come as a result of a necessity or imposition[21], in many neighbourhoods this social

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[20]In the last quarter of the 16th century, the names of the twenty two waqf institutions in Edirne can be listed as follows: Sultan Bayezid Han Vakfı, Sultan Selim Han Cami-i Şerif Vakfı, Sultan Murad Han İmaret-i Vakfı, Sultan Murad Han Darü'l-Hadis Vakfı, Sultan Murad Han'ın kerimesi Ayşe Sultan'ın Camii Şerifi Vakfı, Pir Mehmet Paşa Vakfı, Yıldırım Bayezid Han Vakfı, Sarıca Paşa Vakfı, Kasım Paşa Camii Vakfı, Rüstem Paşa Vakfı, Sultan Orhan Vakfı, İmaret-i Cadide Vakfı, Şehzade Sultan Mehmet Han Vakfı, Mahmut Paşa Vakfı,Medine-i Münevver'e Vakfı, Halil Paşa Camii Evkafı, Fatma Sultan Vakfı, Nasrullah Paşa Vakfı, Mahmud Çelebi Evkafı, Sinan Paşa Vakfı,Camii-i Atik Vakfı, Murad Paşa Vakfı, Fazlullah Paşa İmaret-i Vakfı and Karapolat Vakfı (from Günalan, 1993, 206-207: MAD year: 984/1576, no: 7534).

[21] In some cities, such as Damascus and Aleppo, which have entered Islamic domination through conquest, there are strong physical divisions among neighbourhoods. As a result of the public disturbances took place between 9th and 11th centuries, communities have different religions and ethnicity built walls between neighbourhoods (Can, 1995, 46, 49, 136). However, this stuation is not general or usual fort he Ottoman cities. Most of the settlements, where a strong central authority and therefore security is provided, neighbourhoods are not a defence area; on the contrary, there are such places in which communities with different cultures and religious are lived together and communicated with all their differences safely (Ergenç, 1984: 70).

structure developed in a different formation later in time. When neighbourhoods were first established, they addressed a particular community and similar communities were settled due to the facilities offered. However, with the sale or rent of buildings over time a diversity occurred among the people of the district.

In this century, the fire outbreak in 1572 at Hisar Üstü damaged many commercial and monumental buildings and about hundred dwellings belonging to the Jews burned (from Yiğit, 2010, 224: 16th century MD no.28, p.311, c.780).

An earthquake[22] with a large impact area took place on September 10, 1509 and the aftershocks arrived on October 23 and November 16 caused damage to many buildings, partial destruction of mosques and loss of many lives (Ambraseys, Finkel, 2006: 30-36).[23] The aftershocks with a large impact area of the earthquake of March 1509 continued until 1515 (Ambraseys, Finkel, 2006: 37). Together with the September 1509 earthquake, on the same date, a flood occurred. This disaster, which caused extensive damage, is mentioned as one of the three largest floods in Edirne during the Ottoman Period (Osman, 1998: 23). On May 19, 1591, another flood affected the *Saraçhane Çarşısı* and its close vicinity giving a lot of damage to the built environment (from Yiğit, 2010, 242: 16th century MD no. *Zeyli* 5, p.29, c.120).

Edirne, which served again as a military base with the war started with Austria, entered a difficult period. A huge earthquake had damaged many structures in July 1633 (Ambraseys, Finkel, 2006: 56), a large fire that took place between September 21-28, 1663, burnt the bazaar completely (Andreasyan, 1973: 75), and in October 1657, one of the three major floods that occurred during the Ottoman rule had damaged a vast area (Ahmet Badi Efendi, 2014b: 458).

However, despite all these disasters and destructions, the city, continuing to draw the attention of the sultans, continued its development and reached the widest borders in the 17th century (Gökbilgin, 1994, 426).

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22 This earthquake, which is based in İstanbul and called as the Great İstanbul Earthquake, seriously affected the city life and was called "*Kıyamet-i Suğra*" (small doomsday) among the people at that time.

23 Se efor more information on the magnitude of the historical earthquakes that have been mentioned throughout this Chapter: *http://www.deprem.gov.tr/tr/tarihseldepremler*

In the 18th century, Edirne, being as a second capital city, is still an important centre where the Venetian and French merchants still bringing their fabrics from the west; the silk, buffalo skin and beeswax coming from Ereğli-Marmara and Tırnova, and is an important centre for grain trade (Gökbilgin, 1994, 429). Due to this characteristic, it was closely influenced by the political crises in the administration and was exposed to internal strifes[24]. Due to political tensions, the city's prominent feature thereafter was that it had become a military centre for the soldiers coming from İstanbul and Anatolia (Kazancıgil, 1995, 76; Parmaksızoğlu, 1996, 344).

The 18th century was a destructive period for the built environment as well. In years 1733-1734, a fire that affected the area from *Üç Şerefeli Camii* to *Ekmekçizade Ahmet Paşa Kervansarayı*, and then another fire, which damaged about 60 districts in 1745, caused a great damage in the city (Gökbilgin, 1994, 427; Peremeci, 1939, 26). It is also known that at the end of this century the city was also affected by plague epidemic (Heron, 1797: 384).

An earthquake with a large impact area occurred on July 29, 1752 demolished many buildings, caused damage in most of the monumental structures, and the loss of life was mentioned as 100 (Peremeci, 1939, 26; Eyice, 1994, 431; Ambraseys, Finkel, 2006: 116). In this earthquake: Some of the walls of the *Saray-ı Cedîd-i Âmire* in the Yeni İmaret District were demolished; all the minarets in the city were demolished except the four minarets of *Sultan Selim Camii* and one minaret of *Mustafa Paşa Camii* and *İbrahim Paşa Camii*. Many domes were completely collapsed; fortification walls, military facilities, two madrasahs, a school, a church, all bridges, countless mosques and inns were either ruined or seriously damaged; in addition to these, many dwellings, commercial buildings, and courtyard walls have also been ruined (Ambraseys, Finkel, 2006: 117-119). The aftershocks continued for three months (Ambraseys, Finkel, 2006: 120).

On November 26, 1756, an Edirne-based earthquake was recorded which even affected the buildings in İstanbul (Ambraseys, Finkel, 2006: 129). On June 13, 1762,

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[24] The Edirne Case, which took place at the beginning of the century is the most sensational of them. The event known as Edirne Case in history is the dethronement of Sultan Mustafa II and substitution of Sultan III in his place and the execution of *Şeyhülislam* Feyzullah Efendi (Peremeci, 1939, 23).

an earthquake caused structural damage to the *Üç Şerefeli Camii* and *Üç Şerefeli Külliyesi*[25] (Ambraseys, Finkel, 2006: 130).

Another earthquake with a large impact area occurred on August 5, 1766, affected İstanbul, Bursa, Biga and the whole Thracia Region, caused for demolishing seven minarets and being damaged some mosques, public baths and fortification walls (Ambraseys, Finkel, 2006: 140, 143). The devastating aftershocks lasted for almost a year, and in the aftershock of the March 26, 1767, one of the greatest ones, *the Dizdarzade Zaviyesi* and its timber mosque were seriously damaged (Ambraseys, Finkel, 2006: 143-146).

It is not wrong to say that the downfall of the *Saray-ı Cedîd-i Âmire* has actually started after the earthquake of 1752. According to the information obtained from Rıfat Osman Bey, after the earthquake, some preliminary renovation works were held in 1787, 1802-1803, 1807, 1811 and 1827-1828 at the palace where most of the parts had been left empty and neglected, some parts with serious damage were destroyed. From 1805-1806, some parts of the building were used as armoury, and in 1829, the Russians established their camps in the garden of the palace during the occupation which caused great damage to the structure. During the 1878 Russian occupation, the building was burnt down by the Ottomans with the fear of losing the ammunition to the Russians. (Eyice, 1994, 433)

Only a few structures belong to *Saray-ı Cedîd-i Âmire* are reached today: *Matbah-ı Amire* (palace kitchen), *Babüssade* (*Akağalar Kapısı*), *Cihannüma Kasrı*, *Kum Kasrı Hamamı*, *Adalet Kasrı*, *Fatih Köprüsü*, *Kanuni Köprüsü*, *Şehabeddin Paşa Köprüsü*, *Av Köşkü*, *Su Maksemi* (water distribution depot), *Namazgahlı Çeşme* and *Aşçılar Hamamı* (Özer, 2014, 39, 49).

In 1829, an earthquake with a large impact area affected Thessaloniki, Edirne, İstanbul and Bucharest. Between 1860 and 1893, many earthquakes with large or middle-level impact area were recorded, but there is no documentation of structural damage (*http://www.deprem.gov.tr/tr/tarihseldepremler*).

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[25] This earthquake has probably damaged many structures, but only the *ferman*s related to the repair of the *Üç Şerefeli Camii* and *Üç Şerefeli Külliyesi* (from Ambraseys, Finkel, 2006: 129: *ferman*s dated 1762 and October 1763) can be reached.

The flood of January 1844, one of the three major floods in Edirne in the Ottoman period, harmed quite a large area like the other ones (Osman, 1998: 23). Various precautions have been taken to prevent the loss of life and property caused by floods. It is known from Moltke's notes (1969: 107) about Edirne that he took when he came in 1837 that in winters the river flooded and in order to prevent the damage on the built environment a wide area was enclosed with high walls.

According to an inscription belonging to 1898, a barrier had been set along the riverbank at this date (Onur, 1972: 16). It is known that the *Sultan İkinci Bayezid Hamamı* which was in ruins at that time was also demolished in 1893-1894 and the construction material in it was used at the Kargalık and Yıldırım sides of *Yeni Köprü*, on two sets built on the Meriç River (Peremeci, 1939: 98). Based on this information we can say that the riverside sets needed repair in regular intervals and certain areas were renewed.

Edirne has lived in a calm period for four centuries under the Ottoman domination, however, beginning from the 18th century it witnessed administration conflicts and in the 19th century foreign invasions for the first time. The deterioration that has occurred in the city in the built environment usually caused by neglect, fire or natural disasters. However, during the 19th and 20th centuries Edirne was destroyed by human hands. Four big battles took place and the structures, as well as other components, suffered a great damage. Of the four wars which took place, the first two was held between Russians and Ottomans in 1829 and then in the years 1877-1878. The third war was held between the Bulgarians and the Ottoman Empire in 1912-1913, and the fourth one was held between the Greeks and the Ottomans in the years 1920-1922 (Peremeci, 1939, 28-30; Baykal, 1993, 180, 183-188, 194; Çağan, 1993, 197; Kazancıgil, 1995, 100, 142).

Unfortunately, the human-caused damage is not limited by the war period. Reconstruction activities have been devastating for the built environment almost as much as the war. The fortification walls which were built in the Roman period and continued to be used during the Byzantine period and which were changed during the Murad II period and repaired by Mahmut I after the earthquake of 1752 were preserved until the middle of the 19th century. However, starting from 1866-1870, the government has begun to demolish the walls in order to obtain building material for the construction of hospitals, schools, government buildings and military (Eyice, 1993, 65; 1994, 431). In the central settlement of Edirne according to the records of 1875, there were approximately 315 mosques in the first half of the 17th century, this number became 240 mosques in 1875 and about 150 mosques in 1902 (Kazancıgil, 2013: 74).

In 1902, the fire occurred in Kaleiçi caused the complete destruction of the area, and the area was reconstructed according to a plan prepared by a French team in 1908 (Akansel, 2004: 200). The Great Synagogue, now the only synagogue of Edirne, was built in 1906-1907 by the French architect Depre instead of the thirteen synagogues, which were completely destroyed in this fire (Akansel, 2004: 200).

In the 1930s, the VGM sold many historical buildings to private persons. Most of these buildings were demolished and houses were built in their places (Eyice, 1994, 431). According to the study of Rıfkı Melül Meriç, 120 mosques and dervish lodges were sold between 1928-1948 (Eyice, 1994, 441). The Council for Conservation of Monuments (*Abide Koruma Heyeti*) prepared a report which identifies the cultural assets to be protected in the city in 1935 and in 1938 with updates, according to which, there are 21 extraordinary, 19 first degree, 40 second degree, 65 third degree monuments. According to a study carried out by the EEMGM in 1940, there are 157 historical monuments to be protected in Edirne (Aslanapa, 1949, 178-184). On the other hand, a report was prepared by architect Sedat Çetintaş in 1940, which opened a way for the destruction of 65 of the third degree historical monuments (Çetintaş, 1938; Eyice, 1994, 441). The earthquake that took place in 1953 caused structural problems in most of the historical buildings in the city and many buildings such as *Gazi Mihal Camii* were left in ruins after this event (Eyice, 1994, 431). In 1965, the GEEAYK updated the registration list.

In 1940, Prof. Dr. Ernest Egli prepared the city's first development plan. Due to the rapid population growth in the city, a new plan was prepared by the Province Bank (*İller Bankası*) in 1963 and for the same reason, in 1974; an Additional Development Plan was prepared for the areas left outside the plan. Despite the insufficiency of the plans to reach the growth rate of Edirne, the city is actually a slow urbanized city which is mostly rural compared according to other cities of Turkey. In particular, the forced migration of most the Christian citizens to the Balkan countries because of the "Convention Concerning the Exchange of Greek and Turkish Populations" signed at Lausanne and the migration of the Jewish citizens to İstanbul and abroad caused a decrease in the number of the population of the city. These migration movements lasted until the 1960s, after which the city entered the process of immigration, especially in line with the rapid industrialization of the agricultural sector and the rapid industrialization took place after 1973. (Eyüboğlu Erşen, 2009, 151)

However, in this process, the rapid urbanization had seriously affected the historic urban fabric despite some planning efforts to protect the urban fabric, sometimes even through planning. The new road proposed by the 1940 Development Plan led to the destruction of the city fabric of Kaleiçi. The Development Plan, which entered into force in 1951, caused the destruction of the urban fabric around *Selimiye Camii* and the 1967 development plan allowed intensive and high storey construction in Kaleiçi (Eyüboğlu Erşen, 2009, 152).

Three years after the “Immovable Historical Assets Law” (*Eski Eserler Kanunu*) brought into force in 1973; the GEEAYK began to work on description and registration for the cultural properties in need of protection. The GEEAYK declared *Selimiye Camii* and its surroundings, also Kaleiçi and its surroundings as an “urban protected area” between 1974 and 1976. In 2008, the Conservation Development Plan was put into force. (Eyüboğlu Erşen, 2009, 151)

Along with all these developments, Edirne *Selimiye Camii* and *Selimiye Camii Külliyesi* were added into the World Heritage List in 2011 as a cultural asset in accordance with the 1st and 4th criteria[26] and with the 35 COM 8B.37 numbered decision taken at the 35th Session of the UNESCO.

[26] The 1st and 4th criteria for sellection;

1st criteria: to represent a masterpiece of human creative genius,

4th criteria: to be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history (http://whc.unesco.org).

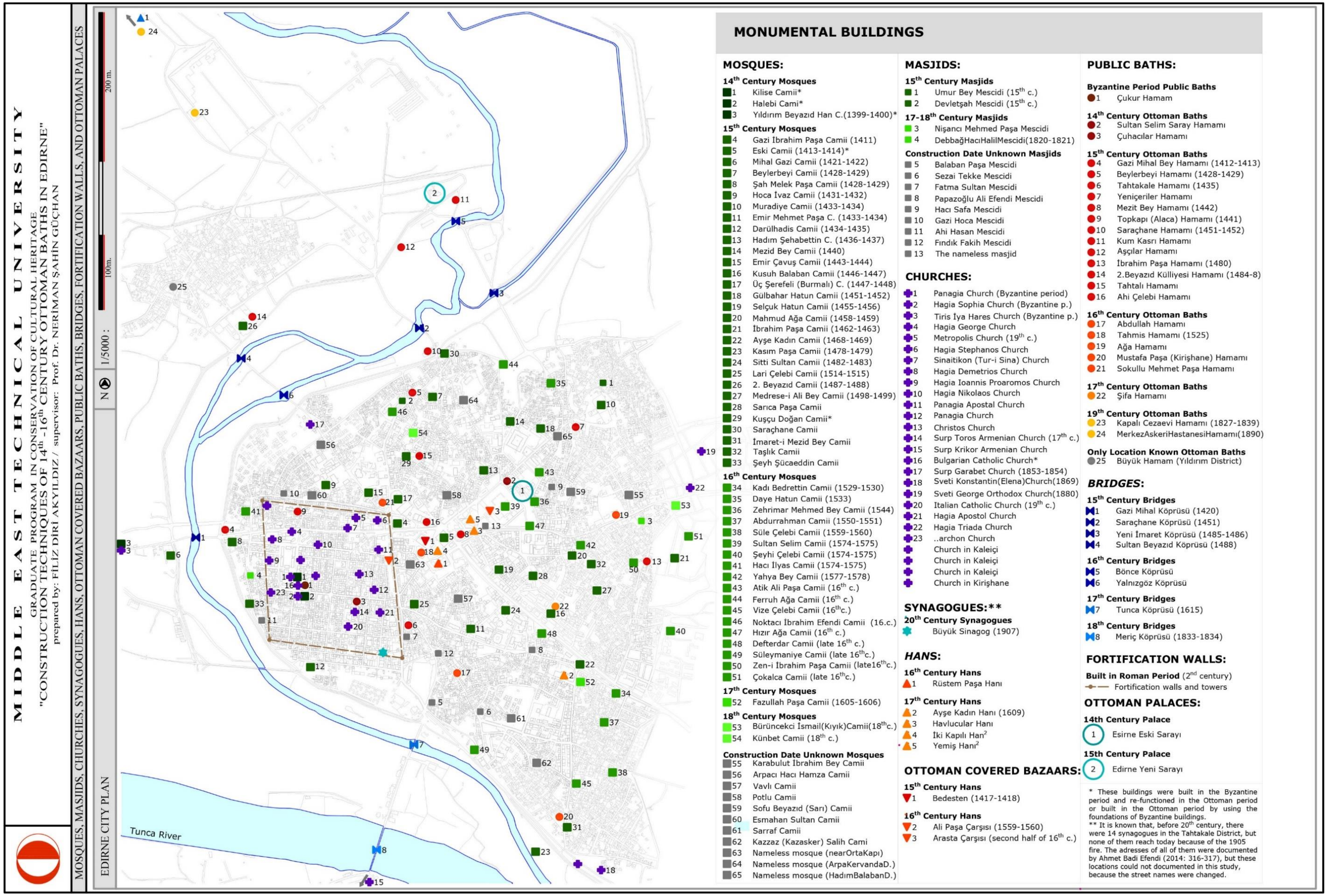

Figure 7. Location of historic monuments of Edirne (according to gathered information from: Dündar, 2007; Ousterhout, Bakirtzis, 2007; Ahmet Badi Efendi, 2014a; Arakelian, 2016)

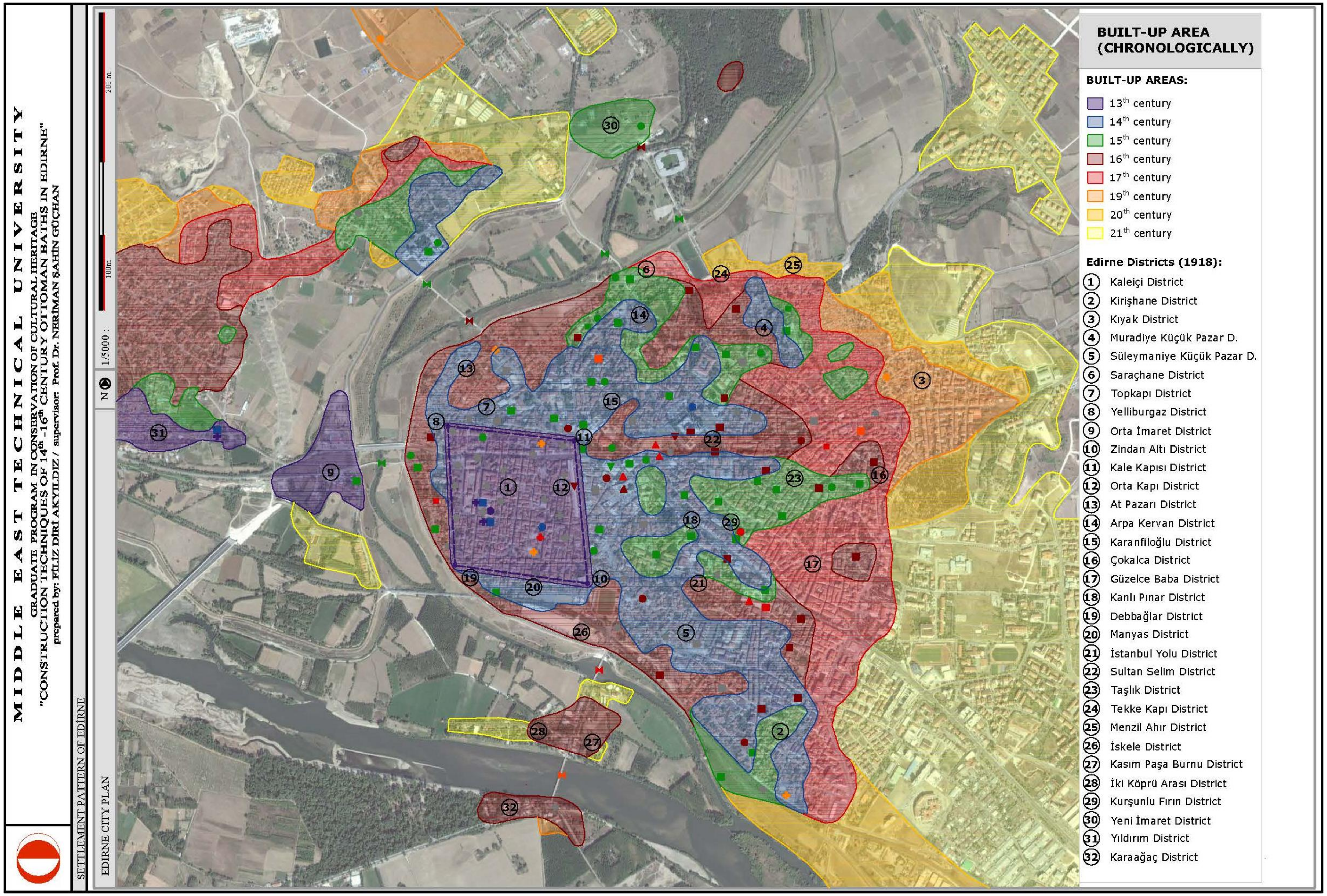

Figure 8. Hypothetical map of built-up area of Edirne according to chronological order (according to gathered information from: Özdeş, 1947: 26-31; Dündar, 2007; Ousterhout, Bakirtzis, 2007; Ahmet Badi Efendi, 2014a; Arakelian, 2016; base map: GoogleEarth-Pro)

2.2. Water Conveying Systems and Public Baths in Edirne

One of the fundamental needs of every settlement is water. Thus, water has an important role in the Edirne settlement history and the water-related structures have important information for analysing settlement patterns. In accordance with this, in this chapter, the general features of water related structures of Edirne and the relation between them are presented.

2.2.1. Water Conveying Systems in Edirne

Three sides of Edirne are surrounded by Arda, Tunca and Meric Rivers. The main water source of the city is the Tunca River. The Meriç River is not used as a water source, while the Arda River is only used for irrigation of agricultural areas. However, as evidenced by the presence of wells in most of the dwellings, due to the changing flow of the surrounding water resources and the deficiencies in the water transmission system, the issue of clean water has been troubled during the period of settlement in the area.

The underground water is unrestricted and easily accessible in the settlement area where Pliocene clay, sand and gravel formations are dominant. The underground water can also be found in the northern region, which is in a calcareous formation. The area around the river covered with alluvium can be irrigated even with shallow wells.

Although there is no exact information about how the city provided water before the Ottoman period, some of the water supply network used during the Ottoman period as well must have been constructed in the antique period. However, even if the previous water resources were sufficient, the rapid urbanization faced by Edirne after it became the capital probably has brought problems about the water supply. After Edirne being a capital, the city developed in a short time and many new districts were built and numerous constructions that required water such as mosques, masjids, public baths, and fountains were built (Figure 7, Figure 8). Despite the lack of sufficient information on details, it is known that the water needs of the newly constructed structures were met by wells from underground resources and by freshwater resources in the immediate vicinity through partial water lines (Peremeci, 1939: 99; Onur, 1978: 35). For instance, the water need of the Yeni İmaret was provided from the water source located near the *Aynalı Bağ Tabyası*, from the source at Sarayakpınar Village and from the source of Bönce water source near the Hızırlık Position by the water network system, which was constructed up to the Palace (Peremeci, 1939: 102-103). Other than these, according to Evliya Çelebi, many *at sakası* (water-bearer horses) and *saka* (water-bearers) carried water from the rivers to the city (Dağlı, Kahraman, 2011a: 589).

Particularly in the 16th century, when urban development movements increased and the settlement area of the city expanded rapidly, it became obligatory to find new water resources and to produce a holistic solution.

With the instructions of Hürrem Sultan, the water supply problem has been solved with a great extent with the *Taşlımüsellim Suyalları* (*Taşlımüsellim* Water Supply Network) which was built by Mimar Sinan in 1530 and has developed with various additions in accordance with the needs in time (Figure 9). The *Taşmüsellim Suyolları*, which reaches a length of forty five metres including the interconnections, is still in a functioning state today as well. It starts collecting water from two main routes: one starting from six kilometres south of Sinanköy/Pravadi Village, and the other starting from fifteen kilometres south of Taşmüsellim Village. Both of the routes join each other in the twenty kilometres northeast of Küçük Döllük Village, and then the water joined from various other resources as well, finally reaches to the *maksem* (water collection and distribution structure) in Taşlık (Arısoy, Öziş, 2008, 241).

This system, which stands out in its period and which is used to develop solutions for the water problem of İstanbul later, includes various water collection and transmission structures. The system consists of two main water collection structures. Among them, the one which is at the beginning of Sinanköy branch has the characteristics of a gallery. The structure at the beginning of the Taşlımüsellim branch is composed of several different structures thought to have been built in different dates. The former is, probably the oldest water collection structure in the region, a heptagonal domed structure that serves as a water collecting pool for horizontal galleries that collect underground water. The second one is a large domed structure with a rectangular plan constructed by the use of pebbles on the stream bed, likely to have been used to raise the flow rate of the gathered water or to increase the water level in order to prevent the leaks. Linked to this large dome, there is also a small water collection structure with a rectangular plan scheme, which is thought to be synchronous and co-operative with this large vault (Arısoy, Öziş, 2008, 242).

These pools, where various freshwater streams are collected and directed by the tunnels and the channels, are built with stone masonry. In the pools where the water is collected at first, the water is purified by sinking of the solid materials like mud. The clear water is transferred to a second pool with the aid of the corridors and channels (Onur, 1978: 19)

The urban water supply network has been constructed generally compatible with the land. However, in some cases, uneven level terrain features have been encountered. The inverted siphon system formed by the pipes installed along the valley slope was used for the passage of the water to the opposite side of the valley slope to a same or lower level by the help of air pressure. The aqueducts were used for the wider valleys or where one side of the valley is lower than the other. These stone masonry structures, used during the transfer of water from one slope to another, were built with the principle of a bridge. However, they differ from bridges, which serve as means of transport, with their arches, which narrow from the bottom upwards, and with the herringbone form of the upper parts that allow the rainwater to flow (Onur, 1978: 19). Along the waterline, there are a total of twelve aqueducts (4 in the Taşmüsellim branch, one in the Sinanköy branch and seven in the part after the joining), most of them with one span, varying from 20 m to 105 metres in length. (Arısoy, Öziş, 2008, 242) (Figure 10). The hilly areas encountered along the water line were surpassed inside the elevations by the use of tunnels.

Various systems have been used along the way to separate the water from rough waste and keep it clean, from the collection of water to the transmission of it to the urban network. Resettling, clarification, sedimentation, ventilation and filtration were applied to the water all along the water line. In this system, which was generally called "*kaptaj*" (catchwork), savaks[27] (a type of sluice), chimneys and filters made by clay-gravel were used. The surrounding of the water line was designated as "*kaptaj sahası*", meant catchwork interaction area, and this area was not allowed for settlement and agriculture. All the internal surfaces of the water channels constructed with stone masonry, which works as water pipes, were plastered with waterproof lime-based mortar made with marble dust (Onur, 1978: 22).

The water collected from sources of a peak height of 160 m; was brought to the *Taşlık Maksem* in *Buçuk Tepe* 105 metres high in the city with the help of aqueducts, reverse siphon applications and tunnels (Onur, 1978: 22). *Taşlık Maksem*, which is in a state of ruin nowadays, was the main water distribution structure in Edirne (Arısoy, Öziş, 2008, 242). The main water line goes to *Muradiye, Kavakaltı* and *Mahmud Aga Maksem*s from *Taşlık Maksem*, and goes to the *Tepe Mezarlığı Su Maksemi* from *Muradiye Maksem*, and then to the *Saray Maksemi* from *Tepe Mezarlığı Su Maksemi* (Oral, 1978, 43). (Figure 11)

The water is distributed to the urban water network with the help of *lüleli sandık*[28] systems, as it is at *Taşlık Maksemi*. By the excavations and researches carried out in the *Saray-ı Cedîd-i Âmire*, information about *Saray Maksemi* can also be obtained. This rectangular structure, built with masonry stone, sits on a vaulted foundation system, the water coming from the water towers are collected in the storage room of the structure, and the water is distributed through six sections/cases and distributing boards standing vertically on the wall (Öz, 1993: 221). Similar methods should have been used for other distribution depots. It is presumed that 36 litres of water pass from one *lüle* per minute (Onur, 1978: 20), but due to the seasonal variation of the water supply, it is impossible that water passes from the *lüle*s at the same rate every period. Although this system does not allow equal water regulation in all seasons, it provides the water to be distributed proportionally.

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[27] *Savak*; Is a term used for the mechanism for making water flow in different directions (*http://www.tdk.gov.tr*).

[28] "*Lüleli sandık"*: The term used for rectangular spaces in the face of a wall, where the water pipes in varying numbers and widths are present.

A water tower, which is high in order to avoid the decrease of water pressure, and which has an open end to prevent the water pipes from exploding when the water pressure was high, was built to distribute water to the public baths, fountains, mosques and other water-related buildings. In order to distribute the water coming to the water towers proportionally, it is also preferred to use the measuring methods with *lüle*s. It is known that there are fifteen water towers in the city, one in Yıldırım District (*Yıldırım Su Terazisi*), two in Sarayiçi Mevkii (*Adalet Kasrı* and *Terazi Kasrı*[29] water towers). However, among these structures, only the *Adalet Kasrı Su Terazisi* on the water line leading to Sarayiçi still stand today (Figure 11).

One of the situations that required a special solution in urban water transmission was to cross the riverbeds. The only relevant information on this subject is the system used in the Bönce Bridge, which is located in the transition to Sarayiçi Position. This bridge was built by Mimar Sinan, and the *Taşmüsellim* water supply network was extended to Sarayiçi during the construction of this bridge (Osman, 1998: 1957). In 1986 during the deepening excavations of the Tunca river bed for the purpose of flood control, it was discovered that the passage was provided by an inverted siphon built with stone masonry at a distance of 50 m from the bridge. Such a reverse siphon technique or a water pipe installed in the bridge may have been used in other bridges as well.

For water transport in the city, terra cotta water pipes, with a diameter of 30 cm in *maksem*s and water towers, and a diameter of 20 cm in the connection lines, were used. Waterproofing special mortars were used at the joints of the pipes, and the pipes are completely covered with lime-based waterproof mortar wrapped in linen ropes of 3 cm thickness, thus protecting the water line from moisture in the soil (Onur, 1978: 27).

However, there is no drawing or sketch of how the water distribution network took place in the city. Today the most reliable source about the city water lines of which we have very little knowledge, are the fountains and the monumental buildings where water was used that reached to our day. According to R. Melül Meriç, there

[29] Terazi Kasrı: The Tower's stones were dismantled in 1895 for use in other structures (Osman, 1998; Aslanapa 1949).

were approximately 190 fountains in Edirne (Eyice, 1994, 439). However, only the names of 125 of them and locations of 98 of them are known today (Karademir, 2007: 22-204) (Figure 11).

It is also known that in this system, which is formed by outlines, additions and interconnections were made when necessary. For example, it is known that in the years when the *Selimiye Camii* was built, large additions were made, and in 1572, the water needed for the mosque is brought from Kayı Village by building a partial water supply network (from Yiğit, 2010, 228: 16th century MD no.10, p.161, c.246). Since the water brought for the mosque was not enough, in 1574, 60.000 akçe were requested to bring the water to the mosque and 40.000 akçe of this money were spent and one *lüle* and one *masura* of water was brought[30] (from Yiğit, 2010, 228: 16th century MD no.26, p.277, c.795).

It is known that the Edirne water supply network is managed by a *nazır* (supervisor) (from Yiğit, 2010, 231: 16th century MD no:73, p.12, c.81). The most competent officer of water distribution in the city is the *bostancıbaşı*. Among the duties of the *bostancıbaşı* are the supervision of the waters around the city, deciding whether it can be brought to the city or not, and the distribution of the water in a fair manner (from Yiğit, 2010, 235: 16th century MD no.7, p.275, c.779 and no.10, p.161, c.246). Although it was very rare, other officials outside the city might be assigned to work in Edirne water supply network if necessary.[31]

In order to meet the water requirements of the new constructions built in the city, those who realize or found these works were supposed to find additional water supply also. The new source they find is connected to the main water network and then the amount of water they supply is given to the building (from Yiğit, 2010, 231: 16th century MD no.7, p.275, c.779). The water need of the districts in Edirne were met by a benefactor or the neighbourhood residents. Like all other new structures that require water, for the fountains as well; the person or group who will build the

[30] In excavations carried out by the Edirne Archaeological Museum in 2016, some of these channels were unearthed.

[31] For example, in 1595, the *İstanbul Suyolu Nazırı* (the supervisor of the İstanbul water supply network) was commissioned for the maintenance and repair work of the Edirne water supply network (from Yiğit, 2010, 235: 16th century MD No:73, p.12, c.28).

fountain find the water source from the outside of the city, and with the approval of the *bostancıbaşı*, the same quantity of water is provided for the fountain (from Yiğit, 2010, 242-243: 16th century MD no.43, p.274, c.511). If the inhabitants of the district build the fountain, the necessary money for the construction should be provided from the "*avarız akçası vakfi*".

"*Avarız akçası vakfi*", is one of the most important institutions in the Ottoman neighbourhood system. This institution is a kind of common fund established for the collection of the money to be used for the common expenditures of the residents of the district.[32] These common expenses are; the repair of religious buildings, educational facilities and fountains in the area and the supply of consumable material, the payment of the salaries of religious workers and the permanent staff of the educational establishments and the taxes paid for the Empire. The money to be collected from the persons is calculated according to the number of the buildings in the neighbourhood and it is collected from everybody in proportion to the existence of their wealth. (Ergenç, 1984: 76, 78)

Another task of the *bostancıbaşı* and *su nazırı* is to ensure the safety of urban water supply network. *Hassa Mimarbaşı*[33] also has authority in terms of safety, as *Suyolcular Ocağı*, which is responsible for maintenance and repair of the network, is related to *Hassa Mimarlar Ocağı*. For example, about two metres (three *arşın*) of the area around the network is left empty and constructions, vineyards and gardening is prohibited in this area (from Turan, 1963, 171: March 17, 1582 dated edict, TM 129, plate: 5).

Regardless of the fact that they are built before or after the water supply network, because the public benefit is concerned, buildings, vineyards and gardens that do not comply with this edict are demolished and the toilets involved with the

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[32] Apart from the expenditures made for the common expenses of the community, some money was lended with an interest (15% maximum), to the persons who are in need from the common money. In a sense, it is a matter of both social assistance and putting into good use of common money. (Ergenç, 1984: 75-76, 78)

[33] As an example of this authority this example could be presented; the May 16, 1575 dated order was sent to *Mimarbaşı* Sinan by *Suyolu Nazırı* Davud Ağa to examine the buildings damaging Kağıthane and Kırkçeşme water supplying networks. (from Turan, 1963: 171: TM, 124 fortissimo, plate: 1).

water supply network are removed (from Turan, 1963, 171: January 27, 1583 dated edict, TM 111, plate: 42). Waste throw to the water supply network (from Turan, 1963, 171: July 1585 dated edict, TM 116, plate: 49) and whatever the reason, any action that would impede the flow of water was prohibited and malpractices were punished.[34]

Figure 9. Schematic representation of *Taşlımüsellim Suyolu* (according to information gathered from Akmandor, 1968; Öziş, Arısoy, 1986)

Figure 10. An aqueduct of *Taşlımüsellim Suyolu* (Source: Edirne Municipality, Photograph Archive, 2013).

[34] It is known that the *kadı* of Bursa sanctioned the persons who blocked the water supply network in in the Bursa Reyhanpaşa District (from Günalan, 2005, Appendices: *Kamil Kepeci Tasnifi* year:960, no: 63, page: (131)257, edict no: 508).

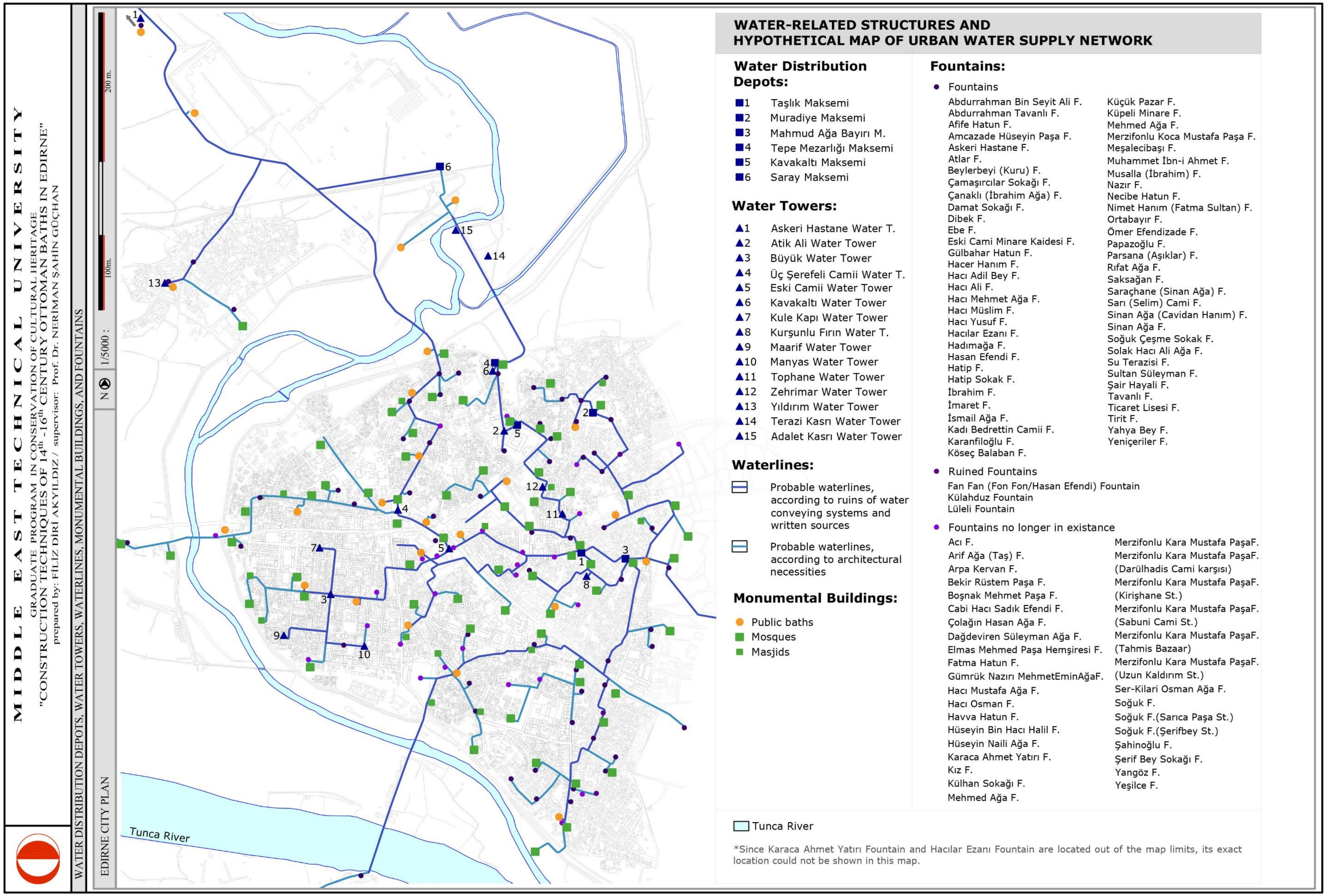

Figure 11. Location of water-related structures and hypothetical map of location of water conveying systems in the Edirne central settlement area (according to gathered information from: Onur, 1978; Dündan, 2007, Ahmet Badi Efendi 2014a)

2.2.2. Public Baths in Edirne

There are a total of 39 public baths in Edirne, most of them constructed in the 15th and 16th centuries. However, only fourteen of them exist today. This loss is due to the damage caused by natural disasters or to be left empty and neglected because of the fact that the building is not preferred in 14th-18th centuries. Whereas the reason in the 19th century is the wars and in the 20th century the wrong urban politics (see. Chapter 2.1.2).

The public baths built during the Ottoman Empire were constructed with an awareness conscious that they are the assets that can address all the sub-groups of the society, affect all the components in the new settlement areas and the multicultural towns that will be developed. Especially those in the age of development of the Empire were also constructed and used to serve as a kind of a displaying media. The early Ottoman baths built with this approach expose the most successful and detailed solutions of their era. The examples of this type of building, being constructed in a city like Edirne where all innovations are applied early and meticulously due to its location and political importance makes them more worthwhile. At the same time, Edirne is a centre where competent masters builders, capable of working in harmony with each other applying the techniques used in Asia and Europe due to the rich cultural diversity of the city (see. Chapter 2.2.2). The fact that only a limited number of examples of the constructions built in this rich background reach the present day is a great loss not only in terms of preservation of cultural assets but also in terms of the history of art and architecture.

A total of 38 different public baths are mentioned in the 17th century Edirne. According to written sources (Ayverdi, 1989a: 377-381, 464-477; Abdurrahman Hıbri,1996: 45-46; Ahmed Badi Efendi, 2014a: 263-268; Gökbilgin, 1993: 104-108; Eyice, 1994: 439; Kazancıgil, Gökçe, 2005: 93; Peremeci, 1939: 94-99); only sixteen of them are in working condition (Ahmed Badi Efendi, 2014a, 263-264), twenty three baths are still standing on those days. According to mentioned written sources, these public baths are as follows:

1. *Abdullah Hamamı*: Named as *Yeşil Direk Hamamı* as well, it was founded by Şarabdar Abdullah Bey in Kovacılar District, 16th century. It is a single public bath. The upper structure of the *soğukluk* section was defined as a dome in some resources and as timber roofing in others.
2. *Ağa Hamamı*: Founded by Maktul İbrahim Paşa in the 16th century, in Kıyık District, close to the janissary rooms and janissary mansion, called *Servi Sarayı* as well. In 1866-1867, the timber roofing of the *soğukluk* was dismantled for the purpose of repair, and as it is not realized, the building is left empty and damaged. In 1884, the building was bought by a Jesuit priest and a hospital is built in the place of the *soğukluk* space. In 1885-1886 it was totally demolished.
3. *Ahi Çelebi Hamamı*: It is named as *Çubukçular Hamamı* or also known as the *Oğlanlı Hamam* because of the spolia marble element with a relief of a male head on one of the basins. It was founded by Ahi Çelebi who was a palace physician in the Sultan Bayezid II period, near the *Eski Camii* in the late 15th century. It is a single public bath. The *soğukluk* space has a dome. The public bath, built for Ahi Çelebi's school waqf, was sold to a private person at an unknown date. It is known that it was not used in the middle of the 20th century and was in a state of ruin.
4. *Beylerbeyi Hamamı*: It is founded in the period of Murad II, by a *Beylerbeyi* (*Mirmiran*), named as Commander Yusuf Paşa, in 1428-1429. The *soğukluk* which consists of a *şadırvan* is originally spanned with a dome; however, it was demolished and a timber roofing construct instead of it. In fact, it was built as a double public bath but only the male part of the building that was destroyed overtime was repaired by Ekmekçizade Ahmet Paşa. It was damaged in the Balkan War and was not used after that time.
5. *Çuhacılar Hamamı*: Located in Kaleiçi District. Founded by Yahşi Fakih in the end of 14th century or beginning of 15th century[35] and continued to be operated by private individuals. It is a single public bath. Repaired by Hasan

[35] Some sources date the 16th century as the date of construction of the public bath. However, as the the first Ottoman historian, Yahşi Fakih, who was the one who founded the building, it must have been built in the late 14th or early 15th century (Şahin, 2013: 181).

Ağa, the chamberlain of Ekmekcizade Ahmet Paşa in H. 1018/ M. 1609-1610, but in the 20th century became ruins again.

6. *Çukur Hamamı*: Located in Kaleiçi District. It is a single public bath. It is the only bath stayed from the Byzantine Period. After it was demolished, the Bulgarian Catholic School is built in its place.
7. *İbrahim Paşa Hamamı*: Founded by Hundi Hatun binti Hızır Bey, wife of the İbrahim Paşa, the vizier of Mehmed II, in the second half of 16th century in Kıyık District. It is a single public bath. The *soğukluk* section was spanned by a timber roofing.
8. *Kasım Paşa Hamamı*: Founded as a double public bath by Evliya Kasım Paşa at the end of the 15th century. In 1572-1573 it was repaired (from Günalan, 2005: Appendices: *Kamil Kepeci Tasnifi* year: 980, no: 67, page: (253)505, edict no: 1774). At the beginning of the 17th century, a part of the ruined public bath was repaired by Ekmekçizade Ahmet Efendi and continued to be used as a single bath. The *soğukluk* was first built spanned by a dome, and then a timber roofing system was built instead of the dome, which was destroyed in 1851-1852. In 1896-1897, the building was demolished by the owners and the building materials were sold.
9. *Kazasker Hamamı*: It was built in the second half of the 16th century by Amasyalı Abdurrahman bin Seydi Ali who was the *kadı* of Edirne and then *Kazasker* (army judge). It is thought to be located at the opposite the *Vavlı Camii*. It is a single public bath, disappeared before the 20th century.
10. *Kum Kasrı Hamamı*: The public bath, which is part of the complex of the *Yeni Saray* (*Saray-ı Cedîd-i Âmire*), was built in the middle of the 15th century during the reign of Mehmed II. It is a single public bath.
11. *Mezit Bey Hamamı*: This building, located at the junction of seven roads, near the *Camii Atik*, was built in 1442 and founded by Mezit Bey, who founded the *Yeşilce Camii* and *Yeşilce İmareti* as well. It is a single public bath. The *soğukluk* section was built with a timber roofing. This bath, which is a waqf property, was sold to a private person at an unknown date.
12. *Gazi Mihal Bey Hamamı*: Located on the bank of the Tunca River, this public bath was founded by the Gazi Mihal Bey in 1412-1413 in the early days of

the Murad II period. It is a double public bath. There are separate specialized spaces for *keçe* (felt) production. It fell in ruins in the 17th century. It must have been repaired later as it appears to have been used as far as the Balkan War period. However, it has not been used after the Balkan War.

13. *Mustafa Paşa Hamamı*: The public bath, also known as *Gazi Mustafa Paşa Hamamı/Kirişhane/Küçük/Salhane/Yeşilce Hamamı*, founded by Gazi Mustafa Paşa in the 16th century in the Edirne Kirişhane District. It is built in front of the *İmaret-i Mezit Bey Camii* (named as *Yeşilce Camii*). It was a single bath. The *soğukluk* space was built with a dome. The building was completely demolished by the permission of its owner and approve of municipality.
14. *Sokullu Mehmet Paşa Hamamı*: This public bath, also known as the *Üç Şerefeli Hamamı* and *Çifte Hamam*, was founded by Sokullu Mehmet Paşa and constructed by Mimar Sinan in the second half of the 16th century. It is a double public bath. The *soğukluk* space is spanned with a dome. Built as part of the *Üç Şerefeli Camii Vakfı*, but the bath is sold in private property in the 20th century.
15. *Sultan II. Bayezid Külliyesi Hamamı*: It was a double public bath built between the years 1484-1488. Although it is not clear which bath it is, it is known that a bath from *Sultan II. Bayezid Vakfı* was repaired in 1576-1577 (from Günalan, 2005: Appendices: MAD year: 984, no: 7534, page: 792, edict no: 2411). Authentically, the water of the bath was provided from the Tunca River via a large water wheel[36], but in 1677 this waterwheel was completely destroyed. As the public baths are adjacent to the mills, it is likely that the water was supplied from here. The *soğukluk* section was built with a dome. The bath which was in ruins in 1893-1894 was demolished by the VGM and the building materials were used in two sets of Yeni Köprü on the Meriç River on the sides of Kargalık and Yıldırım districts (Peremeci, 1939: 98).
16. *Sultan Selim Han (Saray) Hamamı*: It was founded by Bayezid I, in the 14th century, in the Taş Odalar District, near the *Saray-ı Atik*. It is a double public bath. The *soğukluk* is spanned with a dome. When it was first built, it served

[36] See more information on water wheels: Karslıoğlu, 1987, minute: 4.35-6.06.

only the palace, after the construction of the *Selimiye Camii*, it was made open to the use of the public. It was donated to the *Selimiye Camii*. It was not used after the Balkan War until 2012 when it was repaired.

17. Şifa Hamamı: This building, formerly called as Yekta Hamamı, was built by Karanfiloglu Ali Efendi in the 17th century, a timber roofing was used to span the *soğukluk* space. It was a single public bath. It is known that it was closed not used at the beginning of the 20th century.
18. *Tahmis Hamamı*: This bath, also known as *Boyacılar Hamamı*, was founded in 1525 by Çoban Mustafa Paşa, one of the viziers of Sultan Süleyman. It is a single public bath. Unlike other single baths, it is only open for use by men. Authentically the *soğukluk* space built with a dome, after the dome was damaged in the earthquake that took place in 1752, this space spanned with a timber roofing. It has not been used since the beginning of the 20th century and is in ruins.
19. Tahtakale[37] Hamamı: It was built by Murad II in 1435. It is a double bath. The *soğukluk* spaces are spanned with high domes as compared to the others. The public bath, which was part of the *Darül Hadis Camii Vakfı* when it was built, was owned by private individuals in the 20th century.
20. *Tahtalı Hamamı*: Also called *İshak Paşa Hamamı*, the public bath was built by İshak Paşa, the grand vizier of the periods of Murad II, Mehmed II and Bayezid I, near the *Kuş Doğan Camii* in the 15th century. It is a single public bath. The *soğukluk* space of the building was built with a timber roofing. It was left empty for a while, then repaired in 1669 and started to be used again. However, it is known to be in ruins at the beginning of the 20th century.
21. *Topkapı Hamamı*: the public bath also named as *Alaca Hamam* located in the Kaleiçi District. According to the inscription panel of the building, it was founded by Murad II in 1440-1441. It is a double public bath. The *soğukluk* was spanned by a timber roofing. Since the men's section is cold, this part is not much preferred in the winter. This bath, which has been used until the end of the 19th century, has not been used since the Balkan Wars.

[37] The word tahtakale is derived from the word "taht al-kal'a" in Arabic and means "under the kale".

22. *Yeniçeriler Hamamı*: This building was founded by Beylerbeyi Yusuf Paşa, one of the commanders of Murad II era, in the second half of the 15th century and located Muradiye Açık Pazar district. As it is located close to the janissary rooms, and therefore preferred by janissaries, it is known by this name. It is a single public bath. The *soğukluk* section of the building was constructed with a timber roof system.
23. *Yıldırım Hamamı*: It is located in the Yıldırım District, near the *Küpeli Camii*. It is a single bath. The *soğukluk* section is built with a timber roof. The water need was met with bitter water drawn from the well through a wheel. In 1877-1878, it was demolished by the Russian invasion and disappeared shortly thereafter.

In the early 17th century, there were fifteen public baths in Edirne were either in ruins or completely destroyed (Abdurrahman Hıbri,1996, 46-47; Ahmed Badi Efendi, 2014a, 263-268);

1. *Ağaçpazarı Hamamı*: Founded by İsmihan Sultan, the sister of Mirliva Hakkı Paşa, near the Ağaç Pazarı Fountain.
2. *Çangallı Hamamı*: The exact location of the bath built in Molla Fahreddin District is unknown.
3. *Delikli Kaya Hamamı*: The exact location of the public bath at Daye Hatun District is unknown.
4. *Dere Hamamı*: No information is available except that the bath was located in Yıldırım District.
5. *Hıdır Ağa Hamamı*: Founded by Hıdır Ağa bin Hüseyin in the first half of the 16th century, in front of the water tower in Kilerci Yakup/Hıdır Ağa District. It was a single bath. It was destroyed after being left empty for many years.
6. *Kilimli Hamam*: There is no information except that it was founded by İbrahim Paşa.
7. *Mahmut Paşa Hamamı*: It was founded by Mahmut Paşa, who was vizier during the reign of Mehmed II, in Tabakhane/Debbağlar District in 1460-1461. It is a double public bath. There are ten private alcoves with basins in the form of pergolas climbed by ten steps. There are separate specialized

spaces for *keçe* production. This relatively large-scaled public bath, which had hosted 60 bath attendants at the time, remained empty after 1591-1592. It is known that it was repaired in 1667-1668, but was completely destroyed afterwards.

8. *Rehan/Yerekan Hamamı*: The bath in Kaleiçi District took its name from the bloodstone (*kantaşı*) basins. It is known to have completely disappeared in the 17th century.
9. *Saraçhane Hamamı*: It was founded by Hadım Şahabettin Paşa in 1451-1452 in Mihalkoç District. It was a double public bath. The *soğukluk* was spanned with a dome. Since 1817-1818 the elephants that came to Edirne was kept in the *soğukluk* space of this bath, for this reason, the bath was also called as the *Fil Hamamı*. It is also called *Şahabettin Paşa Hamamı*. It was not used as a public bath since 1611-1612. It was completely demolished in 1868-1869 and a military police station was built in the place 1878-1887 where the bath was located.
10. *Sarıca Paşa Hamamı*: Founded by Sarıca Paşa, between the *Sarıca Paşa Medresesi* and *Selimiye Camii* in Sarıca Paşa District. The exact location is unknown.
11. *Taşlık Hamamı*: Built in Medrese-i Ali Bey District.
12. *Yeni Hamam*: It was the only public bath in the Emir Şah District. It was demolished in 1879-1880 and replaced with two houses.
13. *Yerekan/Yarakan Hamamı*: The location of the public bath in Kaleiçi District is not known exactly. It was a single bath. It took its name from a basin made of "*yarakan* stone" inside.
14. *Büyük Hamam* in Yıldırım District: It is known that it was located in Yıldırım Bayezid District together with the water tower. However, its location is not known exactly.
15. *Küçük Hamamı* in Yıldırım District: It is known that it was a very small public bath built beside the *Yıldırım Bayezid Han Camii*.

In Edirne, in addition to these buildings, there were two public baths constructed in the 19th century:

1. *Mahmudiye Kışlası Hamamı*: It was founded by Mahmut II in 1827-1839 at the same time with the constructions of the military barracks in thesouthwest of the barracks used today as the Edirne Closed Prison. The building constructed as a single public bath. (Ünkazan, 2006, 37)
2. *Merkez Askeri Hastanesi Hamamı*: It was founded by Müşir Veysel Paşa in 1890 near the Central Military Hospital. This public bath built as a single bath. (Ünkazan, 2006, 86)

In 1920, only five baths were in use except *Mahmudiye Hamamı* and *Merkez Askeri Hastanesi Hamamı*; *Abdullah Hamamı, Mezit Bey Hamamı, Sokullu Hamamı, Şifa Hamamı* and *Tahtalı Hamamı*. *Beylerbeyi Hamamı, Çubukçular Hamamı, Kasım Paşa Hamamı, Muradiye Hamamı, Saray Hamamı, Tahmis Hamamı, Tahtakale Hamamı* and *Topkapı Hamamı*; on the other hand, were standing but were out of use. (Osman, 1998: 69)

Only fourteen of these baths are still present today; *Abdullah Hamamı, Beylerbeyi Hamamı, İbrahim Paşa Hamamı, Kum Kasrı Hamamı, Mahmudiye Kışlası Hamamı, Merkez Askeri Hastanesi Hamamı, Mezit Bey Hamamı, Gazi Mihal Bey Hamamı, Saray Hamamı, Sokullu Hamamı*, *Tahmis Hamamı, Tahtakale Hamamı, Topkapı Hamamı* and *Yeniçeriler Hamamı* (Figure 11, Figure 12). Ruins of *Aşçılar Hamamı* located in Sarayiçi position are unearthed thanks to the excavations and surface researches done by the *Yeni Saray* Archeological Site Excavation Team (Özer, 2015: 12-14) (Figure 11, Figure 12).

Only the remains of the foundations of *Aşçılar Hamamı*, *Şifa Hamamı* and *Tahtalı Hamamı* reached today. Eight Ottoman baths could not exist today but according to the information obtained from the written sources, their locations could be determined, these are; *Ağa Hamamı, Ahi Çelebi Hamamı, Çuhacılar Hamamı, Çukur Hamam, Mustafa Paşa Hamamı, Saraçhane Hamamı*, *Sultan II. Bayezid Külliyesi Hamamı*, and *Yıldırım Semtindeki Büyük Hamam* (Figure 12).

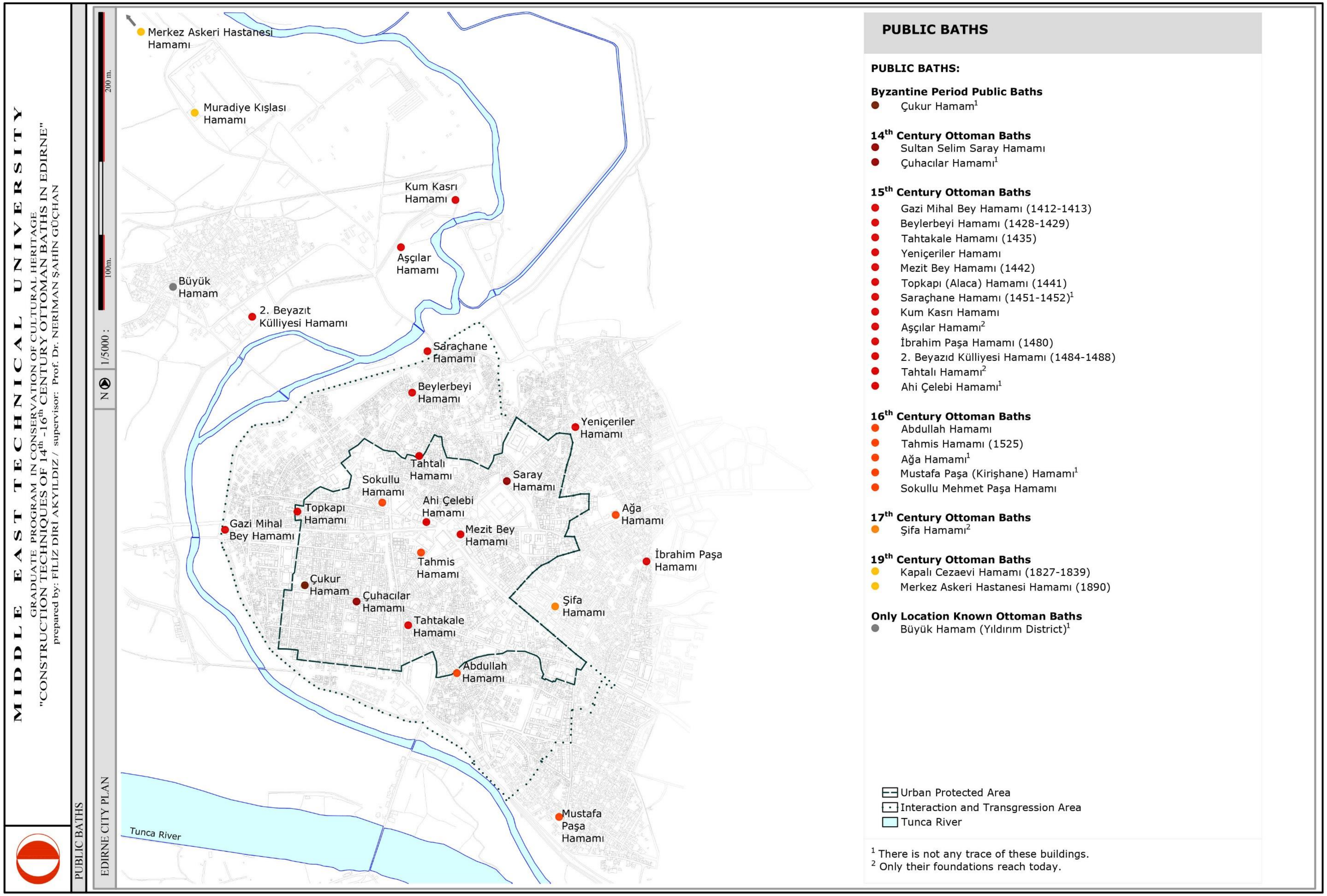

Figure 12. Locations of historic public baths of Edirne

2.3. An Evaluation of The Knowledge Gathered about Water Conveying Systems and Water Related Structures in Edirne

After falling under the Ottoman Empire domination, Edirne became the capital and maintained its importance for a long period, also the city had developed consistently until the 18th century. It can easily be observed that the number of monuments increased as the urban tissue expanded (Figure 7, Figure 8). It is known that before new areas were to be opened for settlement, the infrastructure was completed and if necessary, was improved.

In the Ottoman period Edirne, as in the other Ottoman cities, in areas that were to be opened for settlement for the first time, a core including religious, commercial and educational structures were built using waqf system. This core was also improved in districts with increasing population. With regard to district level, it is known that many subgroups belonging to different ethnic and religious origins lived together; however, the core structures were based on the majority/dominant subgroup. Especially religious and educational buildings were built according to the needs of the major subgroup of the society. On the other hand, public baths, different from other structures, served to all subgroups of the society and were an integral part of urban cores/nuclei, regardless of the socio-cultural characteristics of the neighbourhood.

It is understood that as the city developed, water provision became the primary concern and the existing systems were swiftly improved and extended (Figure 7). It is very important that settlement history should be studied regarding the water components, which are essential for all components of the society, as well as the monumental buildings, in order to correctly understand the settlement. For this reason, in order to establish the relationships between urban development in Edirne, monuments, waterlines, *maksem*s (water distribution depots), water towers, fountains and public baths, literature review was made and various maps analysing the interactions between different components were prepared (Figure 7, Figure 8, Figure 11).

It is noticed that the expansion or development of urban area can be clearly followed through the construction dates of fountains and public baths (Figure 11). Especially during 15th and 16th centuries, when the city developed rapidly, increasing number of public baths were constructed in newly developing areas. There is, in addition, a remarkable relationship between population density and number of fountains in the neighbourhoods (Figure 7, Figure 8).

With regard to building level, public baths cannot be considered as a single structure. These buildings are part of a much more extensive group: urban water-related structures. The connection between the public baths and urban water supply network, which is one of the most important features of public baths, can only be determined by detailed evaluation of water supply network.

These maps (Figure 7, Figure 8, Figure 11) give information about water supply network plan of Edirne and place selection criteria. It is seen that the water lines were designed so that they can be expanded towards developing areas and special structures to collect water and raise water levels were carefully placed considering the slope of the terrain. Newly built public baths were located near the existing water lines and fountains were built on these connecting lines (Figure 11).

There are only a few studies on water lines and water structures, which considerably limited this study. This situation is especially obvious in Kaleiçi district, a region where there was an old Byzantine settlement. There is no detailed document; in addition, almost all of the water structures are destroyed. Although some documents belonging to early Republic era interventions mention about Byzantine ruins and their traces, no detailed architectural documentation was done; hence, no information on urban water supply network belonging to the Byzantine Empire remains to this date.

There is a sketch on water lines and urban water supply network developed during the Ottoman Empire; however, no detailed academic study has been done on water distribution depots and water towers (Figure 9, Figure 11). A similar picture holds true for structures directly related to water in the city like fountains and public baths.

The city was used as a settlement in the Roman period when the bathing culture and bathing spaces were developed. However, there is no information on a public bath constructed in that period. In the literature, there is information about only *Çukur Hamam*, thought to be built in the Byzantine period, as a public bath constructed before the Ottoman period (Ahmet Badi Efendi, 2014a: 268).

At the same time, it is known that many public baths were constructed during the Ottoman period. Literature study reveals that there were 38 different public baths in Edirne in the 17^{th} century (Ayverdi, 1989a: 377-381, 464-477; Abdurrahman Hıbri, 1996: 45-46; Ahmed Badi Efendi, 2014: 263-268; Gökbilgin, 1993: 104-108; Eyice, 1994: 439; Kazancıgil, Gökçe, 2005: 93; Peremeci, 1939: 94-99).

Two new public baths were constructed in the military area located northwest of the settlement. However, only fourteen of these public baths remain today. Also, traces of two public bath foundations can be observed. There is regrettably little information about destroyed twenty five public baths, locations of only ten among them are known. (Figure 12)

Preservation of the public baths that still stand today is extremely difficult with existing legal framework. *Yeniçeriler Hamamı* and *İbrahim Paşa Hamamı*, built in the 15^{th} century and reached to this day, and the historic urban tissue around these buildings remain outside of the “interaction and transition zone” outlined in Edirne Conservation Development Plan enacted on October 5, 2007 (Figure 12). Although the preservation orders for these building lots help protect the structural integrity of these buildings, the urban tissue surrounding them left unprotected.

Location and construction dates of fountains are important information sources not only for the determination of urban water lines but also for understanding the development of urban areas and population increase. Unfortunately, many had been demolished as they lost functionality in changing daily life, many had been relocated to different spaces as ornamental objects as they are relatively easy to be moved compared to other structures; therefore, detailed documents on this type of structures were almost never prepared.

Written sources state that almost 190 fountains were presented in Edirne during the Ottoman period (Eyice, 1994, 439). Among these, only 62 fountains and three ruins remained to present day (Figure 11). There is almost no information for the ones that did not stand today. Nevertheless, it is crucial to protect these structures with correct documentation because of their historical and architectural values and also for their documentary value that provides information contributing to the understanding of the city and other water-related structures.

In addition, social and economical changes a city lives through provide important information to understand the public baths. The neighbourhood of these structures and the economic power of their founders, as well as the socio-economical structure of the city when these public baths were built and the meaning they carried for the Empire affected the architectural features and construction quality of public baths. Similarly, disasters in the city reveal information on the authentic details and the Ottoman period repairs of these structures. These features mentioned above are evaluated and considered with city history on 3rd and 4th chapters (see. Chapter 3.1-13, 4.3).

CHAPTER 3

CHARACTERISTICS OF THE 14^{TH}-16^{TH} CENTURY OTTOMAN BATHS IN EDİRNE

Most of the water-related structures constructed in Edirne are demolished. As mentioned above (Chapter 2.3), mostly only the names are known today; however, there is not any information about their locations or physical features. Twelve of the fourteen public baths in Edirne that still exist today were built between 14^{th} and 16^{th} centuries. These are:

- *Sultan Selim Saray Hamamı* (14^{th} century),
- *Gazi Mihal Bey Hamamı* (1421-1422),
- *Beylerbeyi Hamamı* (1428-1429),
- *Tahtakale Hamamı* (1434-1435),
- *Yeniçeriler Hamamı* (the first half of the 15^{th} century),
- *Mezit Bey Hamamı* (the first half of the 15^{th} century),
- *Topkapı Hamamı* (1440-1441),
- *Kum Kasrı Hamamı* (the second half of the 15^{th} century),
- *İbrahim Paşa Hamamı* (the second half of the 15^{th} century),
- *Abdullah Hamamı* (16^{th} century),
- *Tahmis Hamamı* (1525),
- *Sokullu Mehmet Paşa Hamamı* (16^{th} century),

Within the scope of this thesis; *Gazi Mihal Bey Hamamı, Beylerbeyi Hamamı, Yeniçeriler Hamamı, Topkapı Hamamı* and *İbrahim Paşa Hamamı* were examined in detail during the field study. These buildings were not used for any purpose since the 19^{th} century, were not repaired using modern materials or techniques, and did not involve late-period additions; therefore, it was possible to study the authentic construction techniques. Information on the construction techniques was obtained directly from these buildings and was improved with literature review.

Kum Kasrı Hamamı, Sultan Selim Saray Hamamı and *Tahtakale Hamamı* were also investigated in the scope of this thesis. However, recent comprehensive repairs on these public baths prevented the investigation of authentic information on construction techniques. Therefore, architectural drawings and photographs related to them prepared before the repairs were obtained from public and private archives, and reviewed by comparing with the current state of these buildings.[38]

Sokullu Mehmet Paşa Hamamı and *Mezit Bey Hamamı* were also investigated within the scope of this study. However, it is not possible to understand the authentic construction techniques of these structures as they continued to serve as public baths since they were constructed except few short periods, and due to recent comprehensively repairs they went through. Documentation before the repairs did not involve written or photographic details. Hence, there was no information on the authentic construction techniques for these two public baths.

Tahmis Hamamı and *Abdullah Hamamı* are under the personal ownership and as the owners did not permit any interior study, only façade characteristics were investigated. As in all other public baths, KVKBK files and related literature were reviewed for these public baths, too. However, there are few resources on these structures and due to the insufficient quality of those, no information was obtained on the construction techniques of these public baths

In this chapter, gathered information on these twelve public baths, built between 14th and 16th centuries in Edirne and still remained today (Figure 12), is presented chronologically. Locations, construction dates, conservation implementations and the current state of these public baths are provided. General architectural features of these buildings, their exterior façades and spaces are defined.

Different from the other public baths, detailed information about the construction techniques of *Gazi Mihal Bey Hamamı, Beylerbeyi Hamamı, Yeniçeriler Hamamı, Topkapı Hamamı* and *İbrahim Paşa Hamamı*, of which authentic

[38] Especially, publications of Edirne Yeni Saray Archaeological Excavation team under the supervision of Prof. Dr. Mustafa Özer on *Kum Kasrı Hamamı* (Özer, 2013, 2014); academical studies of İlter Büyükdığan (Büyükdığan, 1989, 1991, 1992, 1998), scientific research project headed by Hasan Böke (Böke, et al., 1999) and detailed studies of Edirne KVKBK within conservation projects on *Sultan Selim Saray Hamamı*; detailed studies of İlter Büyükdığan within the concept of his academic studies on *Tahtakale Hamamı* provide means for documentation of authentic construction techniques and made these information reach to present day.

construction techniques are survived and readable present day, is given based on the information directly gathered from these buildings. Authentic construction techniques and the early Ottoman period repairs are grouped as foundation, wall, transition element and upper structure systems in accordance with the construction order and presented under separated main headings. Arches, openings, architectural elements and finishing techniques, which still exist, are explained under corresponding main headings. Installation systems, which were constructed together with the main shells and were present at every level, are presented as separate headings.

Evaluations on general architectural features of Edirne public baths constructed in the early and classical periods of Ottoman architecture based on the comparison of these buildings is presented at the end of the section.

3.1. Sultan Selim Saray Hamamı

Sultan Selim Saray Hamamı is situated in Meydan District, at the intersection of Muradiye Street, Mimar Sinan Street and Taş Odalar Street, at the northeast of *Selimiye Camii*, northwest of *Taş Odalar*. The building is placed at 45 Plot, 381 Block, 6 Lot (Figure 12). The public bath, registered under A4 inventory number by Edirne KVKBK, is located in the "urban protected area" of Edirne Conservation Development Plan approved in 2007 (Figure 12).

Selimiye Camii is constructed in the area around *Saray-ı Atik* (Ahmet Badi Efendi, 2014a, 70). The public bath is a structure remains from *Saray-ı Atik*, constructed in 1368, hence is called as *Saray Hamamı* (Ahmet Badi Efendi, 2014a, 261); and is devoted to *Selimiye Camii;* hence is called *Sultan Selim Saray Hamamı*. This double public bath was constructed as a service unit of *Saray-ı Atik*, but after the construction of *Saray-ı Cedîd-i Âmire,* constructed between 1568 and 1574, the building devoted to *Selimiye Camii* and was started to be used as a *çarşı hamamı/public bath* (Peremeci, 1939, 94-95).

According to Ahmet Badi Efendi (2014a, 261), the public bath is thought to be constructed by Murad I (1326-1389), but must have been constructed by Bayezid I (1360-1403). Ayverdi (1966, 495), on the other hand, states that the public bath must have been constructed in the first half of the 15th century as its name appears in 1482 dated waqf records. Gökbilgin (1952, 118), in addition to above information, notes that the wall on the Mimar Sinan Street must have been renewed in the 16th century, during *Selimiye Camii* was constructed. This wall must have been comprehensively repaired at the end of the 19th century. Indeed, it is known that in 1892-1893, part of the wall collapsed on the road and one person was trapped in the wreckage and died (Ahmet Badi Efendi, 2014b: 745).

A document[39] belonging to 1565-1567 mentions the repair of the eight domes of *Sultan Selim Saray Hamamı* and according to this document, the public bath is a part of *Sultan Satı Hatun Vakfı* (Günalan, 2005: Appendices).

The public bath was closed during the Balkan Wars and abandoned empty until recently (Peremeci, 1939, 95). According to the information on Edirne KVKBK file on the public bath (File No: 22.00.299), *Beylerbeyi Hamamı* is under the ownership of five different persons in 1957 and the owners applied to EEMGM in order to pull down the building. EEMGM decided that *Sultan Selim Saray Hamamı* is a historical building in need of protection and cannot be demolished by the decision dated 04.07.1958 and numbered 943.

Governor of Edirne in 01.06.1958 and Edirne Municipality in 26.05.1960 send official letters to EEMGM stating that the wall of the public bath on Mimar Sinan Street must be pulled down, as it constituted a risk for the neighbourhood. EEMGM did not approve demolition with the 10.08.1960 dated and 1377 numbered decision, rather decided that the public bath should be maintained and precautions should be taken to protect it.

Similar decisions were repeated during the 1970s. Edirne Municipality stated that the wall of the public bath on Mimar Sinan Street constituted a risk and asked permission to the controlled demolition of the risky damaged parts of the wall. Structural problems on the *soğukluk* main walls of the public bath also took place in newspapers (Figure 13). Eventually, that wall fell over due to a wind in 1971 (Figure 14). Wall wrecks on the road were cleaned by Municipality, risky parts of the wall still standing were dismantled and removed to the inside of the public bath.

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[39] 1565-1567 dated MAD No: 2775, Page: (604)1170, Decision No: 2725: "Verdict to Edirne Kadısı (judge), about the repairs of eight domes of public bath next to Edirne Saray-ı Atik, belonging to deceased Sultan Satı Hatun Vakfı…" (Günalan, 2005: Appendices)

In 1992, neighbourhood residents submit a petition for repair of the building. The conservation study on *Sultan Selim Saray Hamamı*, expropriated VGM, was were started by 04.12.1995 dated and B.02.1.VGM.0.10.01.B-6491-95 numbered decision. Edirne KVKBK adjudged to preparing measured drawings, restitution drawings and a conservation project by the22.12.1995 dated and 2890 numbered the decision. The conservation project (devised according to 13.12.2007 dated and 1708 numbered decision) of the public bath located within "the urban protected area" in the 1/1000 scaled Edirne Conservation Development Plan (approved by the KVKBK's 05.10.2007 dated and 1632 numbered decision) (Figure 12), was approved by 03.09.2008 dated and 2029 numbered decision. The conservation project was conducted in 2008. Today, the building is used as a public bath.

Figure 13. The main wall of *Sultan Selim Saray Hamamı soğukluk* section located on Mimar Sinan Street (Source: Edirne Hudut Gazetesi, 1971: 1)

Figure 14. The main wall of *Sultan Selim Saray Hamamı soğukluk* section located on Mimar Sinan Street, which demolished because of a sudden strong wind in 1971 (Source: Edirne KVKBK Photograph Archive)

3.1.1. General Description of Sultan Selim Saray Hamamı

Sultan Selim Saray Hamamı lies in the northwest-southeast direction. The public bath constructed in an area by the size of 24x29 metres. It is understood from the traces that on the southwest façade, there were three small commercial buildings/spaces built along with the outer wall of men’s *soğukluk* and spanned with vaults. However, these structures, having functions unrelated to public bath but have a close-relation in the physical aspect, were not included in the conservation project.

The construction technique and authentic systems cannot be observed on the *Sultan Selim Saray Hamamı* in this day because the building serves as a public bath. Therefore, drawings, sketches and photographs taken prior to conservation were used to study the basic architectural characteristic and construction techniques.

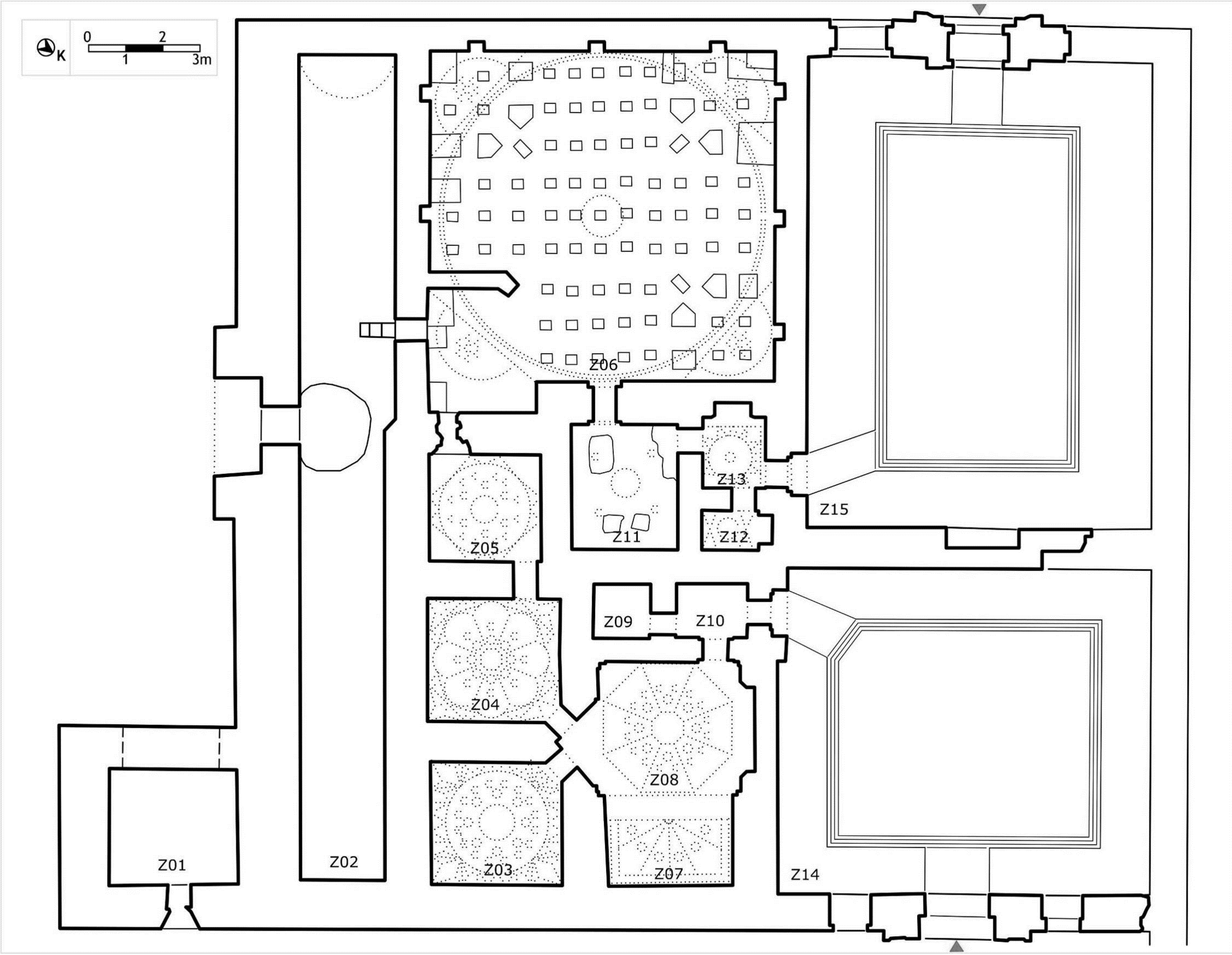

Figure 15. The plan and reflected ceiling plan of *Sultan Selim Saray Hamamı*, 2007 (according to new information gathered from site surveys, redrawn based on Büyükdığan, 1989: 313; İİlter Büyükdığan Photograph Archive; Vanlı, 1993; Edirne KVKBK Archive)

a. Exterior description:

There is the authentic main entrance door of men's section, *soğukluk* window and traces of three small commercial units built together with the public bath on the southwestern façade of *Sultan Selim Saray Hamamı*. It is understood that the *soğukluk* (Z15) main walls were built by two brick and one cut stone courses' repetitions and cut stones were surrounded by vertical bricks, from the photographs taken prior to conservation implementations (Figure 16). It is observed that the main wall of the commercial structure on the west was built together with the men's section *soğukluk-sıcaklık* (Z15-Z06) partition. Photographs reveal traces of two lines of timber lintel at two different levels continuing on the public bath partition wall and commercial unit main wall. In addition, use of *kirpi saçak* (saw-tooth eave) was seen above the drum of men's *sıcaklık* (Z06).

There is cold water depot (Z01) main wall on this façade. Cold water depot is constructed on a vault and a semi-open space is established under the vault (Figure 18). This space must have been used as storage area.

Men's and women's *soğukluk* spaces (Z15-14) main walls are on the northwest part of the public bath. These walls were almost totally demolished before the conservation studies and they were completed at 2008 (Figure 16).

Northeast façade is comprised of the women's *soğukluk* (Z14) entrance, women's section *sıcaklık* spaces (Z07-03), hot water depot (Z02) and cold water depot (Z01) main walls. Information on the authentic details, which lost readability during conservation, can only be obtained from documentation and photographs were taken prior to conservation implementations (Figure 17). These photographs reveal the women's *soğukluk* space authentic door and window openings at two different levels and the cold water depot's (Z01) authentic window openings on northeast façade.

Women's *soğukluk* main walls are built by the same technique as men's *soğukluk*. Women's *sıcaklık* spaces (Z07, Z03) and water depots' (Z01, Z02) main walls are built by repetitions of two brick-one cut stone-three brick-one cut stone courses. However, especially *sıcaklık* spaces were built by local brick masonry system. These sections must have been renewed in a comprehensive repair. As a result of demolitions, holes inside the wall once belonging to *tüteklik*[40], *çörten* and timber lintels can be observed.

The cold water depot (Z01) and hot water depot (Z02) main walls and *külhan* are observed on the southeast side of the public bath (Figure 18). The walls are built by the same technique used in northeast *sıcaklık* spaces. According to the architectural drawings prepared in 2007, the opening leading a controlled transition to *cehennemlik*, which was used for periodical maintenance and cleaning of *cehennemlik*, was placed to the north of *külhan.* Stone masonry system was used in *külhan* walls. Chimney of *külhan* was constructed by brick masonry system. A *künk* on the cold water main wall is observed in pre-conservation photographs. There is no information on the relationship between this *künk* line and water level in the depot. Timber lintel traces are observed on the courtyard walls surrounding the area between *külhan* and cold water depot.

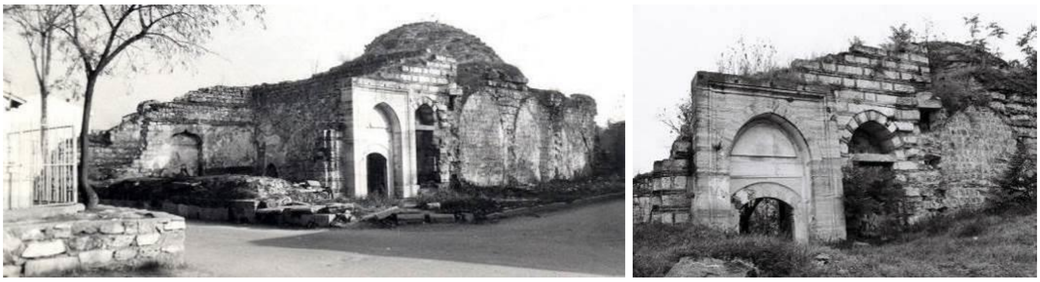

Figure 16. The main entrance door of the *Sultan Selim Saray Hamamı* men's section from west in 1971 (Source: Machiel Kiel Photograph Archive) (left) and from south-west in 1986 (Source: İlter Büyükdığan Photograph Archive) (right)

[40] The flue of chimney placed throughout the bathing spaces walls so that it spans from the *cehennemlik* to upper structure for fumes discharge is called "*tüteklik",* which composed of regular *künk*s.

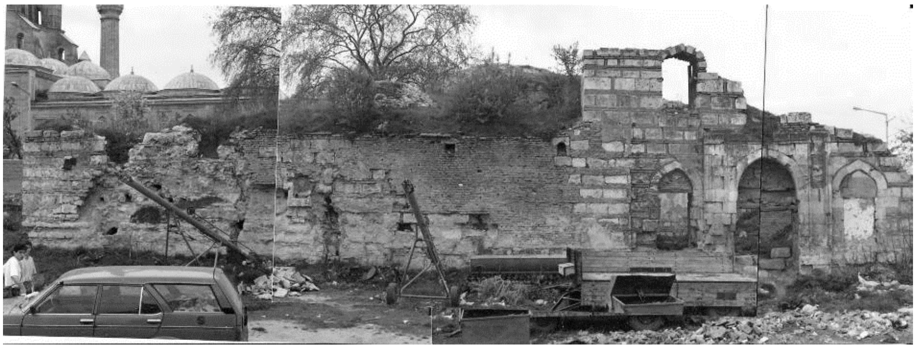

Figure 17. The north-east façade of *Sultan Selim Saray Hamamı*, 1986 (Source: İlter Büyükdığan Photograph Archive)

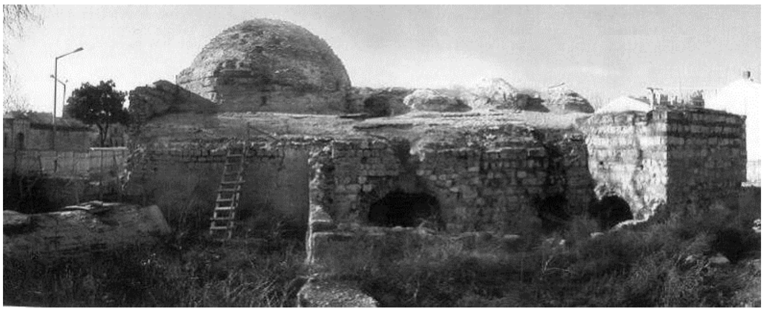

Figure 18. The south-east façade of *Sultan Selim Saray Hamamı*, the 1990s (Source: İlter Büyükdığan Photograph Archive)

b. Interior description:

In *Sultan Selim Saray Hamamı*, which was built as a double public bath, bathing spaces and water depots almost completely, *soğukluk* spaces partially remained with their authentic construction details until the conservation implementations completed in 2008.

Men's *soğukluk* space (Z15) is placed on the northwest edge of the building. It is understood from the old photographs that entrance was through an impressively arched door and inline windows on the door level were used. There is no evidence for the presence or absence of the second line of windows on the upper level. The pre-conservation photographs reveal the presence of *seki* and under *seki* niches. In architectural drawings prepared by *Active Mimarlık İnşaat Mühendislik Dekorasyon Danışmanlık Sanayi and Ticaret Limited Şirketi* (approved in 2007), there is a note stating the presence of a water line on the geometrical centre of the space. However, there is neither a sketch nor a photograph about this detail. The mentioned water system points to a *şadırvan* placed at the centre of *soğukluk* space.

An arched door on the northeast wall of *soğukluk* (Z15) is opened to *aralık* (Z13). There is toilet (Z12) on the north and *ılıklık* (Z11) on the east of *aralık.* The door on the southwest wall of *ılıklık* provides a transition to the *sıcaklık* (Z06) space. There are traces that bathing cells were constructed on the four corners of *sıcaklık* main space by two metres high walls. In accordance with the typology suggested by Semavi Eyice (1960: 106-115, 120), (a) "cross-axial plan with four *eyvan*s and four corner *halvet*s" plan type was applied (Figure 1, Figure 15).

There is women's section *soğukluk* (Z14) on the north edge of the building. The entrance is through an arched door on the northeast side, and two lines of windows, one on the door level and one on the upper level are observed. Pre- conservation photographs reveal the presence of authentic *seki* and under *seki* niches. According to the project approved in 2007, as in men's *soğukluk*, a water line is observed at the geometrical centre of the space. There is no documentation for this detail, either.

An arched door at the south edge of the southeast wall of *soğukluk* opens to *ılıklık* (Z10). The door on the south and east of *ılıklık* provides a transition to the toilet (Z09) and *sıcaklık* main space (Z08), respectively. There is an *eyvan* (Z07) on the north and two *halvet*s (Z03-04) on the east of *sıcaklık* main space. A door on the west wall of the *halvet* located in south opens to another *halvet* (Z05). In accordance with the typology suggested by Semavi Eyice (1960: 106-115, 120), "the type of plan that has elongated rectangular *sıcaklık* with a domed central space and two *halvet*s" (e) was applied (Figure 1, Figure 15).

On the southeast, the hot water depot (Z02) lies through men's and women's *sıcaklık* spaces. The only opening between this depot and bathing spaces is the water control window on the men's *sıcaklık* (Z06). The three-step masonry staircases in front of the window let passing to step down the water depot. At the geometrical centre of hot water depot, in line with *külhan*, there is a circular pit/hole on the floor where a copper caldron is placed. The cylindrical space beneath this hole, *külhan* hearth, is the space where the *külhan* fire is lit. Six fumes channels used to transmit fumes from the *külhan* furnace/hearth to *cehennemlik* were documented on pre-conservation photographs.

There is no information on the interior of the cold water depot (Z01) located at the east edge of the building, or on its relation to the hot water depot (Z02). Similarly, wood storage located at the lower level of cold water depot is not documented in detail. It is a great loss that these two spaces, quite valuable with their authentic characteristics were restored without a proper documentation.

The marble *kurna*s and coloured marble plates used as pavement stones of *göbektaşı* were documented with photographs by Edirne KTVKBKM.GA in 1972 (Figure 19). At the conservation stages, these marble elements were preserved.

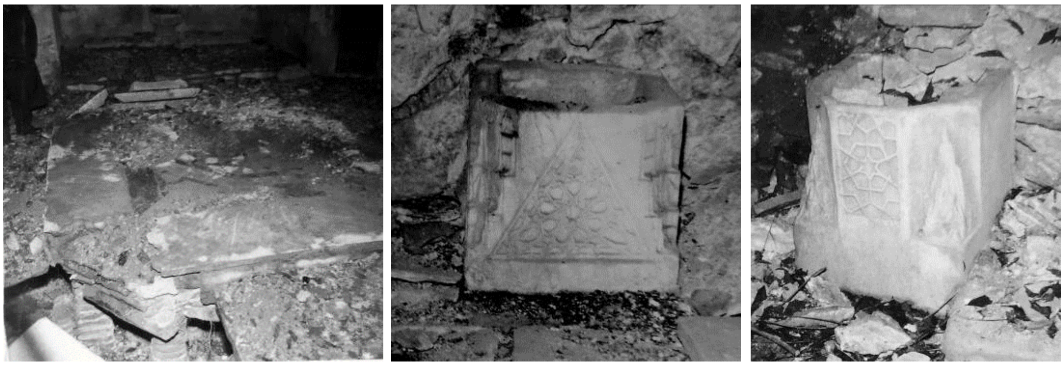

Figure 19. Coloured marble pavement of göbek taşı and marble kurnas of the *Sultan Selim Saray Hamamı* (Source: Edirne KTVKBKM.GA, 1972)

3.2. Gazi Mihal Bey Hamamı

Gazi Mihal/Mihail Bey Hamamı is situated at Süpürgeciler District on Set Boyu Street (Figure 12). The public bath is placed at 50L-Ia Plot, 171 Block, 1 Lot. It is located in "the interaction and transition zone" according to Edirne Conservation Development Plan, which was approved in 2007 (Figure 12).

Edirne-Kapıkule and Talatpaşa Streets pass from north and south of the public bath, respectively. Gazi Mihal Bey Bridge is located in the west, and *Şah Melek Camii* is on the south of the public bath. Today, men's and women's bathing spaces of this double public bath are still standing. Set Boyu Street passes over its külhan and a part of water depot. *Soğukluk*, which did not reach today, must have been located at 50L-Ia Plot, 171 Block, 2 and 3 Lot, which is empty nowadays (Figure 20).

The public bath, which founder was Gazi Mihal Bey, was built in 1421-1422 (Peremeci, 1939: 406). However, the name of the public bath is not mentioned in the waqf documentations of Gazi Mihail Bey. It is known that the public bath was closed in 1829, but functioned until that date (Peremeci, 1939, 98). *Külhan* and some parts of water depots remained under the masonry river barriers built to prevent floods.

Soğukluk did not exist today, either. Evliya Çelebi especially mentioned spaces separated for the use of *debbağ*s (Dağlı, Kahraman, 2011b: 603). Evliya Çelebi writes about *debbağ*s as follows: “There are a hundred thousand different work and profit-making merchant and tradesman… but *debbağ*s are the most profiting among tradesman, and there are many of them.” (Dağlı, Kahraman, 2011a: 607).

The file of the public bath in Edirne KVKBK (file no. 22.00.1407) gives the information that Gazi Mihal Hamamı is registered under A137 inventory number. Architectural drawings, restitution and conservation projects of the public bath were decided to be prepared by 05.11.1999 dated and 660 numbered KTVKYK decision.

Edirne KTVKK’s 10.02.1993 dates 1334 numbered decision listed the buildings that must be expropriated by VGM. In accordance with this decision, to develop a project for *Gazi Mihal Hamamı* and its surrounding, buildings in neighbouring lots to the public bath were expropriated via purchasing by 05.05.2005 dated 2005/463 numbered decision (Figure 20). After this expropriation, estates in the neighbouring lots (171 Block, 2, 3 and 4 Lots) (Figure 21) were demolished by Edirne Municipality without getting permissions from Edirne KVKBK. The report of Edirne Provincial Directorate of Culture and Tourism states that ownership of public bath, which belonged to the state treasury, transferred onto Edirne Municipality at no charge by 16.06.2005 dated, 441 numbered decision. Edirne KVKBK approved Gazi Mihal Hamamı Landscape Project by 08.09.2005 dated and 545 numbered decision and the tombstones located on the south of the public bath were decided to remain where they are.

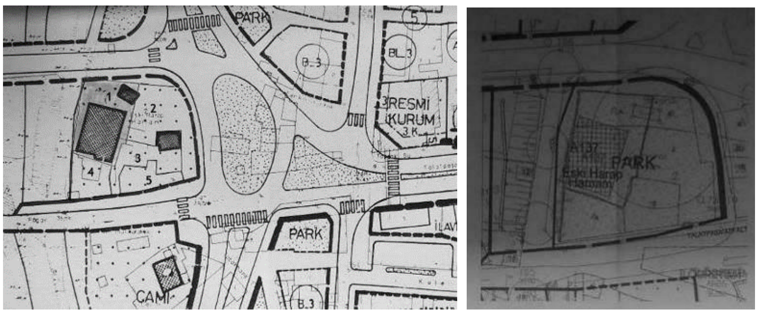

Figure 20. The lot orders of the area in which the *Gazi Mihal Hamamı* located, in 1994 (left) and 2005 (right) (Source: Edirne KTVKBKM.GA, 1972)

Figure 21. Unauthorized building activities constructed around the *Gazi Mihal Bey Hamamı*, 1986 (Source: İlter Büyükdığan Photograph Archive)

According to 1/1000 scaled Conservation Development Plan, approved by 05.10.2007 dated and 1632 numbered decision of KTB Edirne KVKBK, *Gazi Mihal Hamamı* is in “the interaction and transition zone”. The public bath lot was allocated to Edirne Provincial Special Administration by 28.04.2008 dated 75191 numbered decision.

The neighbourhood representative of Çavuşbey District stated that the *Gazi Mihal Bey Hamamı* poses security flaw due to directionlessness and requested a project to be developed in name of residents he represented in 2007 and repeated this request in 2010.

14.01.2010 dated and 2853 numbered decision stated that architectural drawings, restitution and conservation projects should be prepared after a proper surface survey and excavation under direction of Museum for the 1st group cultural property in need of protection

Edirne Museum made an investigation in reply to a denouncement on 30.07.2010 and reported that an illegal excavation was done on the south entrance of the public bath (28.10.2010 dated museum report).

Architectural drawings of the public bath, which was under the ownership of State Treasury and allocated to Provincial Special Administration, was approved by 14.01.2010 dated and 2853 numbered decision of Edirne KVKBK. However, as the conservation project of the public bath was not approved by 2012, conservation activities could not be started yet.

Edirne Provincial Directorate of Security-related Public Security Branch Office prepared a report stating that the *Gazi Mihal Hamamı* constitute a risky region in terms of security and this report was sent to Edirne KVKBK and the necessary response was asked for.

Edirne VBM started the preparation and application of necessary projects on the public bath, of which ownership was transferred to VGM in 2016. Drilling and surface excavations were done in 2016. Especially on the west side of the public bath, part of Set Boyu Street, passing over water depot and *külhan,* caused structural problems due to the load and vibration. Also remaining under the level of roads caused some other structural and material problems on the building.

3.2.1. General Description of Gazi Mihal Bey Hamamı

Gazi Mihal Bey Hamamı is located on a 23x23 metres sized square area and lies in the east-west direction. *Soğukluk* section of the public bath is completely demolished. Today only partial wall traces can be observed. Women's and men's bathing spaces are still standing (Figure 22). Masonry river barriers built on the riverside to prevent floods and Set Boyu Street, which passes over these barriers, pass over *külhan* and part of the water depots. *Külhan* is totally and water depot on the north is partially under the soil.

Water depot on the north is standing; however, because of the deposits, it was not possible to examine this space. Similarly, authentic floor levels of bathing spaces and the southern water depot could not be examined due to soil deposits.

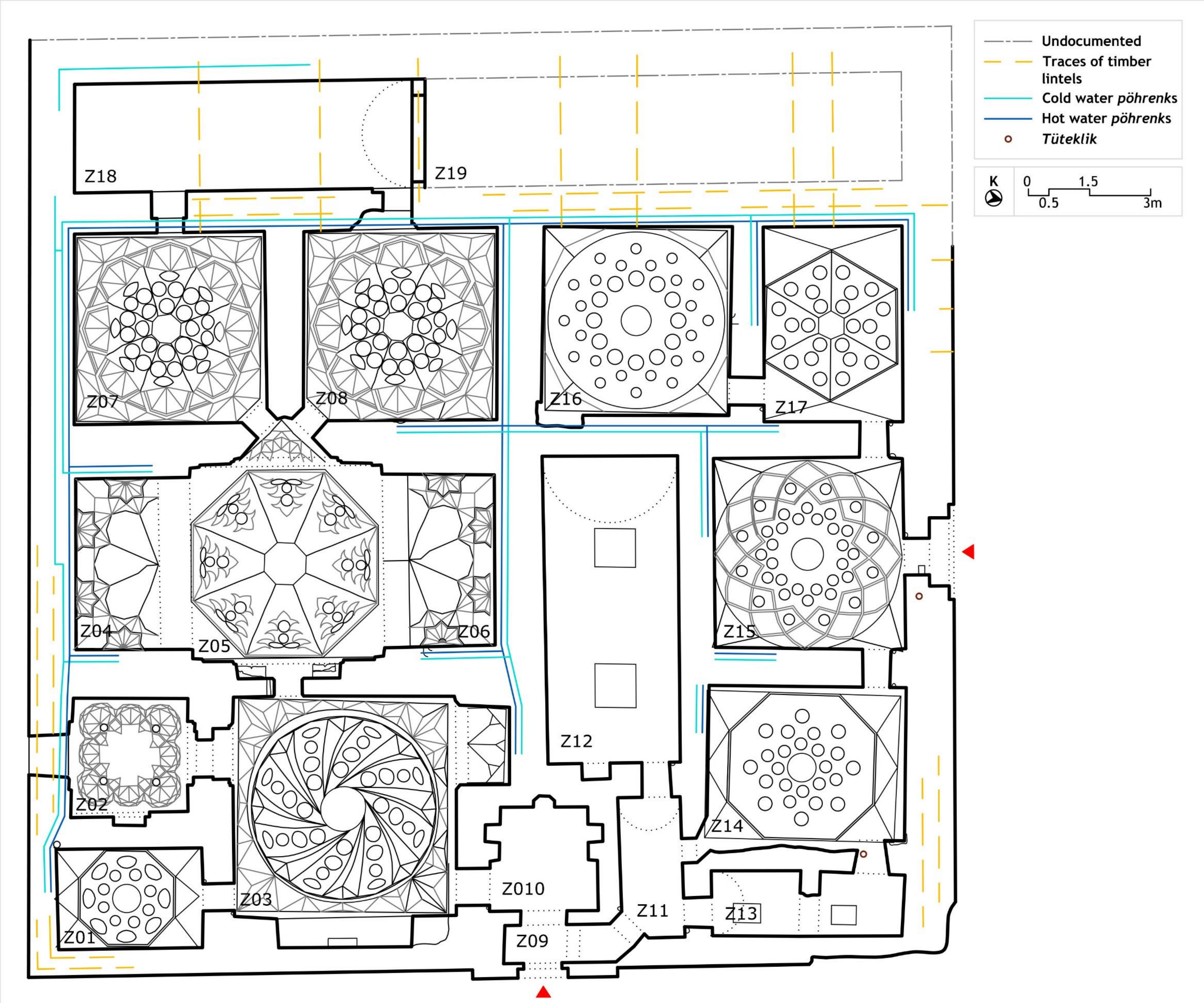

Figure 22. The plan and reflected ceiling plan of *Gazi Mihal Bey Hamamı* (according to new information gathered from site surveys, redrawn based on: Büyükdığan, 1989: 315-316; Asrav, Bilgin, et al. 2012)

a. Exterior description:

West edge of the Gazi Mihal Hamam is buried underground due to river barriers and road. North wall of the public bath is built by repetition of horizontal three brick and two rough-cut stone courses on top of each other, in the alternating wall technique (Figure 23). Rubble stones are surrounded by single vertical bricks. There is a double-line arched impressive door in the geometrical centre of the façade. Photographs from 1986 show 15x15 cm sized timber lintels and *puştuvan*s[41] on the level of the nearly halfway of the door opening, behind three brick courses (Figure 23).

There are no traces of walls belonging to a space expanding towards the north because the northeast edge of the public bath is partially demolished and the northwest edge is buried underground. For the same reason, it is not possible to say that originally there was no space in that area.

Southeast edge of the public bath, traces of a wall spanning towards east built by stone-brick masonry technique can be followed (Figure 24). From these traces, it can be deduced that the eastern wall was indeed the partition wall between men's *soğukluk* and bathing spaces. There is a door opening at the centre of east façade similar to that of north façade (Figure 24). Again, on the east façade, behind three courses of brick, traces of lintel-*puştuvan* can be followed on the same level as on north façade. In addition to this, the presence of three course brickwork on the south of the door opening, nearly 140 cm above this trace, brings the presence of another lintel line to the mind.

On this façade; three stone and three brick courses alternating wall, one brick and one stone surrounded by single vertical bricks courses alternating wall and rough-cut stone masonry walls can be observed together unsystematically. Use of different wall techniques partially and irregularly shows that this wall was repaired at different periods by the use of different techniques.

There is a standing main wall on the southern façade of the public bath (Figure 25). This façade gives an idea of the authentic outer wall characteristics. There is an opening on this façade today; however, this opening is the result of a local demolition.

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[41] "*Puştuvan*", "*puştivan*" and *"puştivan"* terms are used as relatively short timber tie-beams, which connecting timber lintels placed into the masonry walls (Sönmez, 1997: 87).

This wall is built by repetition of double courses brick- double courses cut stone- three courses brick- double courses cut stone. Cut stones are surrounded by single vertical bricks. Lintel and *puştuvan* traces placed inside masonry, as followed in north and east façades, continues in the south façade at the same level.

There are four *çörten*s and traces on the upper level of the wall (Figure 25). Masonry system is finished with this *kirpi saçak* done with four courses of bricks.

Figure 23. The north façade of *Gazi Mihal Bey Hamamı*, 1986 (Source: İlter Büyükdığan Photograph Archive)

Figure 24. The east façade of *Gazi Mihal Bey Hamamı*

Figure 25. The south façade of *Gazi Mihal Bey Hamamı*

b. Interior description:

Bathing spaces, *keçelik* space and water depots of *Gazi Mihal Bey Hamamı*, which constructed as a double public bath, are still standing (Figure 22). Men's bathing spaces located at the north, women's bathing spaces at the south, while *keçelik* as a special space for *debbağ*s located between them and water depots spanning the length of bathing spaces at the west of the building (Figure 22). Only traces of men's *soğukluk* placed the southeast edge of the building reached today (Figure 24). Traces on the east of standing parts of a public bath, where *soğukluk* –demolished today- must have been present are completely lost because of the residential buildings had been constructed in that area. There is no trace on the dimensions and upper structure of this space. There is also no trace of *külhan,* which buried under Set Boyu Street.

There are different opinions on the presence of women's *soğukluk*. Northwest edge of the public bath is buried underground and the northeast edge is partially pulled down, therefore a certain trace of the presence of a *soğukluk* wall extending through north cannot be followed. However, architectural elements and heating system of this square shaped space with a door does not possess necessary specifications to being a *soğukluk.* However, the doors on north and east façades are similar qualitatively and quantitatively. It can be understood from the traces that door on the east façade provides passing from *soğukluk* to bathing spaces. In that sense, it is highly probable that the door opening on the north façade is the transition opening between women's *soğukluk* and bathing spaces.

Today, entrance to the building is through three opening. Opening on the south façade appeared as a result of a local demolition on the main wall. The other two are authentic door openings for entering to bathing spaces. (Figure 22, Figure 23, Figure 24, Figure 25)

Opening on the east façade leads to a hallway (Z09). There are two door openings on the north and west of this hallway. The western door opens to the *aralık* (Z10) with a nearly square-like rectangular plan. *Aralık* is connected to men's section main *ılıklık* space (Z03) with another door. There are two deep niches on the north and east walls of this space. There are two *halvet*s of *ılıklık*, one with a rectangular (Z01) and the other a square (Z02) plan, on the south of *ılıklık* main space. A door on the west of *ılıklık* main space opens to *sıcaklık* main space (Z05). There are to *eyvan*s on the north (Z06) and south (Z05), two similar sized *halvet*s (Z07 and Z08) on the west of this space. Men's section of *Gazi Mihal Bey Hamamı* is built using the "the type of plan that has elongated rectangular *sıcaklık* with a domed central space and two *halvets*" (e), according to the typology suggested by Semavi Eyice (1960: 106-115, 120). (Figure 1, Figure 22)

The door on the north of hallway (Z09) entered via the door on the east façade of the building, opens to a second *aralık* space (Z11). There are two doors on the north and west of this space. The northern door opens to a long rectangular planned space (Z13). Today this space (Z13) is divided into two with a wall and the northern part has a door opening to women's bathing spaces. However, it is understood that this depressed arched door, unmatching to authentic pointed arched door openings, is opened later. This long rectangular space (Z13) must have been a single space and must have included men's section *traşlık* and/or toilets. West door on the second *aralık* space (Z11) opens to rectangular planned *keçelik* (Z12). Evliya Çelebi describes this area as space where *debbağ*s paint *satiye* (Dağlı, Kahraman, 2011b: 603).

The door on the north façade of *Gazi Mihal Bey Hamamı* opens to women's section *ılıklık* space (Z15). Eastern door on *ılıklık* main space opens to long rectangular shaped *halvet* of *ılıklık* (Z14). This space may have only been a *halvet* space for bathing or may have served as *traşlık* and/or toilet. The door on the west of main *ılıklık* space (Z15) opens to *sıcaklık* space (Z17). There is another *sıcaklık* space with similar size (Z16) on the west of this *sıcaklık*. In accordance with typology suggested by Semavi Eyice (1960: 106-115, 120), (f) "the plan has *soğukluk*, *sıcaklık* and *halvet*s of the same size" type is used for the women's section of *Gazi Mihal Bey Hamamı* (Figure 1, Figure 22). This rare plan scheme also used at *İznik İsmail Bey Hamamı* constructed in the early period of Ottoman architecture.

The clean water distribution system can be followed at every space except Z9-10-11-12-13. In addition, some traces relative to *kurna*s are found on Z4-5-6-7-8-16-17 spaces.

On the west of this public bath, there are water depots (Z18-19) spanning all the length of men's and women's *sıcaklık*s. Water depot is divided into two with a support arch. The eastern part (Z18) can be reached through windows of men's *halvet*s. On the other hand, the northern part (Z19) cannot be entered.

3.2.2. Construction Techniques and Building Materials of Gazi Mihal Bey Hamamı

Information on load-bearing elements, finishing techniques, installation systems and architectural elements used in bathing spaces and water depots of *Gazi Mihal Bey Hamamı* were obtained.

a. Foundations:

There are traces on foundations and floor systems of Z01, Z03-08, Z14, Z16 and Z17 spaces of the public bath. Partially floor system and *cehennemlik* space can be followed in Z03-06 and Z08. Foundation walls, starting nearly 45-50 cm below the water line and which can be followed up to 115 cm in depth, are built by rubble stone masonry (Figure 26). Foundation thicknesses show differences with respect to wall thicknesses. In Z03-04 and Z06 spaces, foundation wall thickness is 15 cm thicker than main and partition walls (Figure 26). *Ampatman* is applied at two levels in Z03 space. Foundation wall thicknesses are increased at two stages 10 cm for each; 85 cm and 105 cm in depth.

There are isosceles triangle planned brick masonry corner supports, which curved inwards, with 55 cm long side and 25-30 cm short sides, on the corners of Z04 and Z06 spaces (Figure 27a). The width and thickness of c*ehennemlik* footings*/hypocaust pilae* are 45cm and there are nearly 45 cm distance between each other and between foundation walls. *Cehennemlik* footings were built with full and half-length bricks and 3-3.5 cm lime-based mortar was used between masonry units (Figure 26, Figure 27).

Corner supports are not used in Z03 space. The first line of *cehennemlik* footings is built attached to foundation walls. Other *cehennemlik* footings are placed at 45 cm distances, as in Z04 and Z06.

There are only traces of *cehennemlik* level in Z01 space. It is understood from the traces that the expansion is made on foundation walls. Two lines of *cehennemlik* footings are used in this space which 2.5 metres in length.

On *cehennemlik* footings and foundation walls, 8-10 cm in thick and nearly 70x100 cm in length flagstones are placed in the east-west direction and used as beams. Nearly 8 cm in thick and 90x100 cm in length flagstones are placed perpendicular to beams, almost adjacently to each other on beams and foundations, and used as floor beams. Top of the floor beams are covered with approximately 5 cm thick *horasan* plaster including brick pieces. Floor pavement is completed by placing 6 cm thick flagstones (smooth cut marble or polished limestone) on top of plaster without leaving and space. (Figure 26, Figure 27)

*Seki*s are built by two different systems according to their location. The traces found in *ılıklık* main space (Z03) reveal that approximately 45 cm high *seki*s were made by laying six brick courses on floor beams. The traces found in Z04-05-06 spaces show that *cehennemlik* level was raised in 20-25 cm high *sıcaklık seki*s. In these spaces, *cehennemlik* footings, on which *seki* were built, were laid by using two more brick layers than are other spaces. Also, foundation upper level is raised by half-bricks so that it stays on the equal levels with *cehennemlik* footings. Different from other spaces, two brick courses is used on floor beams (under *horasan* plaster with brick pieces).

Figure 26. Cehennemlik and floor system of the Z06 space of *Gazi Mihal Bey Hamamı*

Figure 27. Cehennemlik sections of Z04 (left), Z06 (middle) and Z03 spaces of Gazi Mihal Bey Hamamı

b. Masonry Walls:

The thickness of partition walls of the building change between 80 and 90 cm, men's-women's *sıcaklık*s partition walls between 100 and 110 cm, water depot-*sıcaklık*s partition wall and outer walls between 100 and 125 cm (Figure 22). Rough cut stone, cut stone and single type bricks of 27,5x27,5x4-4.5 cm dimensions are used in the masonry walls with timber lintels. Lime plaster thicknesses vary between 2 to 4.5 cm. Changes in the masonry bond indicate the public bath has gone through comprehensive repairs in different periods. Masonry walls documented in the building can be examined under five groups.

The first group is the two brick-two cut stone-three brick-two cut stone courses alternating walls seen in the southern outer wall and part of the eastern outer wall (Figure 24, Figure 25). On these walls, cut stones are surrounded by single vertical bricks. Big cut stones are used in the wall corners and sides of openings.

The second group is the walls built by repetition of two brick-two rubble stone-three brick-two rubble stone courses (Figure 23). Rubble stones are surrounded by single vertical bricks. As in the first system, big cut stones are used in wall corner.

The third group walls are built by repetitions of one or two brick and one or two rubble stones courses. It is observed that in some areas rubble stones are surrounded by vertical bricks.

The fourth group is the cut stone masonry system. This system is used only in areas involving portals built by cut stones and partially in few partition walls (Figure 28).

The fifth group is the walls built by rubble stone masonry system. This system is observed partially and irregularly on the building walls (Figure 24). These parts may have been intervened in different periods of the Ottoman Empire when the building was in use.

Traces of two lines of timber lintels and *puştuvan*s, lying the length of the wall, are observed where the masonry walls collapsed locally (Figure 29). The traces reveal that 15-20x15-20 sized square sectioned lintels completely surround the structure 190-245 cm above the original floor level of *sıcaklık* spaces (150- 200 cm above clean water line). There are traces for the presence of another lintel system approximately 140 cm above these lintels, but these traces could not be documented in detail. Lintels placed inside the water depot walls are connected to each other by *puştuvan*s. The traces show that some of the *puştuvan*s on the longer side lay in the open through the space and connect lintels located in different walls.

Figure 28. Use of cut-stone units in masonry walls of the Z10 space of *Gazi Mihal Bey Hamamı*

Figure 29. Traces of timber lintels and puştuvans placed in masonry walls of the *Gazi Mihal Bey Hamamı* south-east corner (left), south exterior wall (middle) and hot water depot (right).

<u>Arches, Openings and Niches:</u>

Arches:

Pointed arches are used in 425 cm opening between *sıcaklık* main space (Z05) and *eyvan*s (Z04 and Z06) (Figure 30). For 100 cm, by corbelled bricks, totally 35cm projection are made horizontally from the wall alignment; bond continued horizontally for 45 cm on the same alignments until spring line is reached. The arch rise is 165 cm from the spring line. These arches of approximately 45 cm height and 73 cm thickness are built by repetitions of one brick amd one half brick course vertically and two brick and one half brick course horizontally with shifting joints (so that joints do not overlap on top of one another).

In the south wall of *Gazi Mihal Bey Hamamı* Z04 *eyvan*, loss of coating makes another arch system visible: the triangular arch (Figure 31). Top of the vertical channel carrying water line coming from the cold water depot, which is located nearly 60 cm above the clean water line within the building, is covered with two stone blocks placed diagonally with corners touching each other. This arch functions as a relieving arch.

Doors:

On the existing doors of *Gazi Mihal Bey Hamamı*, the openings spanned with arches. It is observed that doors in men's *soğukluk*- men's bathing spaces, women's *soğukluk*- women's bathing spaces, Z02-Z03 and Z03-Z05 are visually enriched by portals and pediments (Figure 32). On the doors between Z05-Z07 and Z05-Z08 spaces, it is seen that the corner located in the transition area is chamfered and the portal is used (Figure 32). These doors of 70 to 90 cm varying sizes can be grouped into five according to the construction techniques of arches used on the openings (Figure 33).

The first one (Type 1) is the 45 cm thick one layered door arches (Figure 33). It is used in the door between Z11 main space and hallway, and in Z03-Z05 door. The arch is built by one brick and one half brick courses as voussoir and a shaped limestone as keystone.

The second one (Type 2) is approximately 85 cm thick three-layered door arches (Figure 33). It is used in Z14-Z15, Z15-Z17 and Z16-Z17 doors. Two layers on the periphery were built the same way as in Type 1. The middle layer is built only by one brick and one half brick course repetitions.

The third one (Type 3) is 45 cm thick single layered door arches (Figure 33). It is used in Z02-Z03, Z05-Z07, Z05-Z08 and Z09-Z11 doors. Shaped limestones are used as springers and keystone. There are three courses of brick bond between these two stone blocks.

The fourth one (Type 4) is approximately 85 cm thick three-layered door arches (Figure 33). It is used in Z01-Z03, Z03-Z10 and Z11-Z13 doors. Two layers on the periphery are built the same way as in type three. The middle layer is built only by repetition of one brick and one half and brick courses.

The last one (Type 5) is approximately 85 cm thick three-layered door arch (Figure 33). It is used in Z11-Z12 door. The periphery layers are constructed with three wedge-shaped voussoir limestones. The middle layer is built only by repetition of one brick and one half and brick courses.

Z09 and Z15 door arches providing an entrance for men's and women's bathing spaces cannot be observed. However, it can be said that these door openings were built in the same way as second group relying on comparative studies in building and existing traces. Vapour release chimney used in the Z15 door is another detail that reaches today (Figure 34). There is no information on the technique used in Z9-Z10 door.

There are cylindrical niches carved in the first stone-block used below spring line used on the sides of door openings (Figure 33). The thickness of these niches varies between 10 and 12 cm, and the depth varies between 12 and 15 cm.

Windows:

There are two water control window between hot water depot and men's *sıcaklık halvet*s (Z07, Z08) of this public bath. Z08 window is quite demolished; however, construction technique of the Z07 window can be observed (Figure 35). The window is 63 cm in width and 120 cm in height. Window openings are spanned by brick arches. The window opening is enlarging in one step 28 cm upwards and 14 cm towards the sides of the water depot façade.

Niches:

Niches in the *Gazi Mihal Bey Hamamı* are divided into six main groups. Type 1 niches are approximately 40 and 70 cm in width and approximately 40 cm in depth (Figure 36). These niches have regular tetragon plan and their openings are passed by arches constructed by the use of half bricks. This type of niches are used in Z10 north and south walls, Z11 and Z12 spaces.

Type 2 niches are approximately 40 cm in depth and 70 cm in width (Figure 36). The construction technique is same with Type 1 niches. However, these niches are used with *kurna* and *kurna aynası*.

Niche used in Z10 west wall can be classified as Type 3 (Figure 36). Construction technique of this niche, which was 40 cm in depth and 40 cm width, is almost identical to Type 1 niches. However, circular plan scheme is used in this niches.

There is only one niche classified as Type 4 used in Z09 south wall (Figure 36). This niche with dimensions of 40 cm in depth and 80 cm in width is constructed similarly to first group niches. However, in this example a shaped limestone used as the keystone of the niche arch.

Type 5 niche is used between water control window and *kurna* in Z07 *sıcaklık halvet* (Figure 36). It was 30 cm in width, 30 cm height and 20 cm depth. Top of these small niches are covered with diagonally placed two half-bricks and arch appearance is given by plaster.

Type 6 niches are big in size and have rich contents (Figure 37). 330 cm opening of the niche on the east wall of Z03 space is spanned with mirrored arch, 190 cm opening of the niche on the north wall of Z03 space is spanned with semidome. 120 cm opening of the niche on the north wall of Z10 space is spanned with a portal with muqarnas.

Figure 30. The arch used between the Z05 and Z06 spaces of *Gazi Mihal Bey Hamamı*

Figure 31. The relieving arch used in Z04 south wall of *Gazi Mihal Bey Hamamı*

Figure 32. Door openings of the Z02-03 (left), Z03-05 (middle), Z05-07 and Z05-08 spaces (right) of *Gazi Mihal Bey Hamamı*

Figure 33. Interior door openings of the *Gazi Mihal Bey Hamamı* (from left to right; Type 1, 2, 3, 4 and 5)

Figure 34. The door located between the *Gazi Mihal Bey Hamamı* women' section *soğukluk* and bathing spaces (left) and its vapour release chimney (right)

Figure 35. The water control window placed between the *Gazi Mihal Bey Hamamı* Z07 and Z18 spaces, Z07 façade (left) and Z18 façade (right)

Figure 36. Niche types used in the *Gazi Mihal Bey Hamamı* (from left to the right; Type 1-Z11 north wall, Type 2-Z02 west wall, Type 3-Z10 west wall, Type 4-Z09 south wall and Type 5-Z07 west wall)

Figure 37. Examples of niche Type 6 used in *Gazi Mihal Bey Hamamı* (from left to the right; Z03 eastern, Z03 northern and Z10 northern niche)

Finishing Techniques:

It is observed that two different systems are used for finishing technique of the walls of *Gazi Mihal Bey Hamamı*. The first one is stone covering. Only traces of this system had reached today. There are traces of stone covering around the door opening located between men's *soğukluk* and bathing spaces (Figure 24).

The second one is plastering used on all walls of the building. Lime plaster traces on the exterior façade of the building do not provide enough information on its layers and thicknesses. Three different lime plasters are observed on interior façades. Pink coloured lime plaster of 1.5-2 cm depth is applied all through wall surface in interior wall façades. There is plaster changing line approximately 60-70 cm above the water line (Figure 38, Figure 39). Traces reveal that in order to obtain a regular line, nails were hammered on the wall for alignment (Figure 38). 1-1.5 cm thick white coloured lime plaster was applied as the second layer above this line; while, below this line, red coloured lime plaster was used. The lime-based paint was applied as the third layer.

In some spaces, partially plaster layers belonging to different periods can be observed on top of each other (Figure 39, Figure 40). When the new plaster was applied on the existing one, notches were made on the old plaster layer to strengthen adsorption of plasters (Figure 38).

Brick pieces and organic particles are seen in every plaster, including the repaired plasters (Figure 38). The ratio of brick dust and dimensions of brick particles show differences. These changes cause variation in colour and physical strength of *horasan* plasters. There are not any straw or similar additives in any of the plasters visible to the naked eye.

Decorations on the walls of the public bath also reached to present day. Predating decorations are probably authentic and done by different coloured lime plasters. Particle sizes on these plasters are invisibly small (Figure 39). There are hand carved figures and decorations done using dark red and black paints observed on the repaired plasters applied on the above mentioned layer (Figure 40).

Figure 38. Plastering detail (left), the plaster changing line and notches on plasters (middle) and the plaster changing line (right) from the *Gazi Mihal Bey Hamamı*

Figure 39. Plaster changing line and decorations made by plaster and painting on interior walls of the *Gazi Mihal Bey Hamamı* Z10 space (Source: Ömür Bakırer Photograph Archive, 2012)

Figure 40. Decorations made by painting in the *Gazi Mihal Bey Hamamı*; Z15 (left), Z07 (middle) and Z08 spaces (right)

Figure 41. Decorations made by painting on the arch surface of the Z05 space of *Gazi Mihal Bey Hamamı* (Source: Mihriban Sarı Photograph Archive, 2012)

c. Transition Elements and Upper Structures:

Men's *ılıklık* main space (Z03) is spanned with a sixteen-pieced helical ribbed dome with belt of Turkish triangles with *badem*[42] as a transition element. Rectangular planned pendentives were used for the transition to octagonal plan in Z01 *ılıklık halvet.* A ring built by three courses of brick was used on pendentives for the transition to a circular plan, and the opening is spanned with a dome. On the other hand, square planned opening in Z02 *ılıklık halvet* is spanned with a muqarnas dome. (Figure 42)

Square planned men's *sıcaklık* main space (Z05), is transformed into an octagonal plan by muqarnas pendentives on the four corners. Space is spanned with eight-lobed-dome. At certain alignments, some of the bricks are recessed into the dome section approximately 5 cm and *rumi kabartma* (Kula Say, 2007, 193) are created. *Eyvan*s (Z04, Z06) on the north and south of main space (Z05) are spanned with five-lobed-semidome placed on four projections. The transition to octagonal plan on square planned *sıcaklık halvet*s (Z07-Z08) were made by using *bademli* belt of Turkish triangles and squinches as transition elements and the space is spanned with eight-lobed-dome. (Figure 42)

The square plan of women's *ılıklık* main space (Z15) is transformed to circular with belt of Turkish triangles and space is spanned with a ribbed dome. Vertical bricks are used in ribs making 5 cm projections on the interior surface. The transition from rectangular plan to octagonal plan was achieved by belts of Turkish triangles in *ılıklık halvet* (Z14), and the opening is covered with a dome. (Figure 42)

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[42] Diamond shaped surfaces used between triangular shaped surfaces, used to enrich the belt of Turkish triangles are called "*badem*".

Belt of Turkish triangles were used for the transition from rectangular plan to hexagonal plan in northern women's *sıcaklık halvet* (Z17), and space is spanned with six-lobed-dome. In the southern *halvet* (Z16), belt of Turkish triangles were used for the transition from square to dodecagon plan and space was spanned with a semi-circular dome. (Figure 42)

Square planned men's main *aralık* space (Z10) is covered with flat vault. Opening in Z11, Z12 and Z13 spaces are covered with depressed-profiled vaults. *Aynalı* vault/*cavetto* vault was used in Z09 space. Barrel vault was also used in water depots (Z18-Z19) of the public bath. This vault was supported with a support arch in between two water depots. (Figure 42)

The main structure of transition elements is built by bricks in the dimensions of 27.5x27.5x4.5-5 cm. Bricks are used horizontally in belts of Turkish triangles, pendentives and rings, while they are used vertically and horizontally in muqarnas. Final shapes of muqarnas are given by stucco. Use of shaped stone blocks is observed only in the pendentives of Z05 space. (Figure 42)

Full and half-length bricks (dimensions: 27.5x27.5x4.5-5 cm) were used as the main construction material in domes and vaults. Only in Z02 space muqarnas dome, shaped stone blocks were used. (Figure 42)

There are drums on the lower levels (approximately one third of the dome height) of the outside of domes. These drums are laid by repetition of one brick and one cut stone courses. Cut stones are surrounded by vertical bricks. (Figure 25)

<u>*Openings:*</u>[43]

Cupola openings, which are placed at the crown of domes, are circular, hexagonal and octagonal in the plan (Figure 42). *Oculi* are circular and hexagonal.

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[43] "*Cupola*" is a light structure on a dome, vault or semi-dome constructed as a dome-shaped recess (Davies, Jokiniemi, 2008: 106; Ching, 1995: 61). A cupola opening could be closed by a *cupola* or lantern in Ottoman public baths. Lanterns are usually used on *soğukluk* main spaces.

"*Oculus*" (pl. *oculi*) is used to describe a circular opening in a dome, vault or semi-dome, especially that in a Roman building (Davies, Jokiniemi, 2008: 254). In classical and Byzantine architecture, "*opaion*" is used for a roof lantern or oculus in a dome (Davies, Jokiniemi, 2008: 256). While "oculus" usually refers to a circular opening especially placed at the crown of a dome (Ching, 1995: 61), the term also used as describing all type of the lightening openings placed on domes, vaults and semi-domes.

Cylindrical baked clay pipes narrowing outwards are used in the empty spaces formed inside brick bond in the circular *oculi*. However, there are no traces on how these openings had been closed with (semi)transparent materials.

Finishing Techniques:

Pink coloured lime plaster of 1.5-2 cm thickness and lime wash were used on the interior surfaces of transition elements and upper structures. There is no information on the finishing using on the outsides of upper structures. Only, the use of *kirpi saçak* comprised of four courses of bricks was determined above main walls and drums (Figure 25, Figure 43).

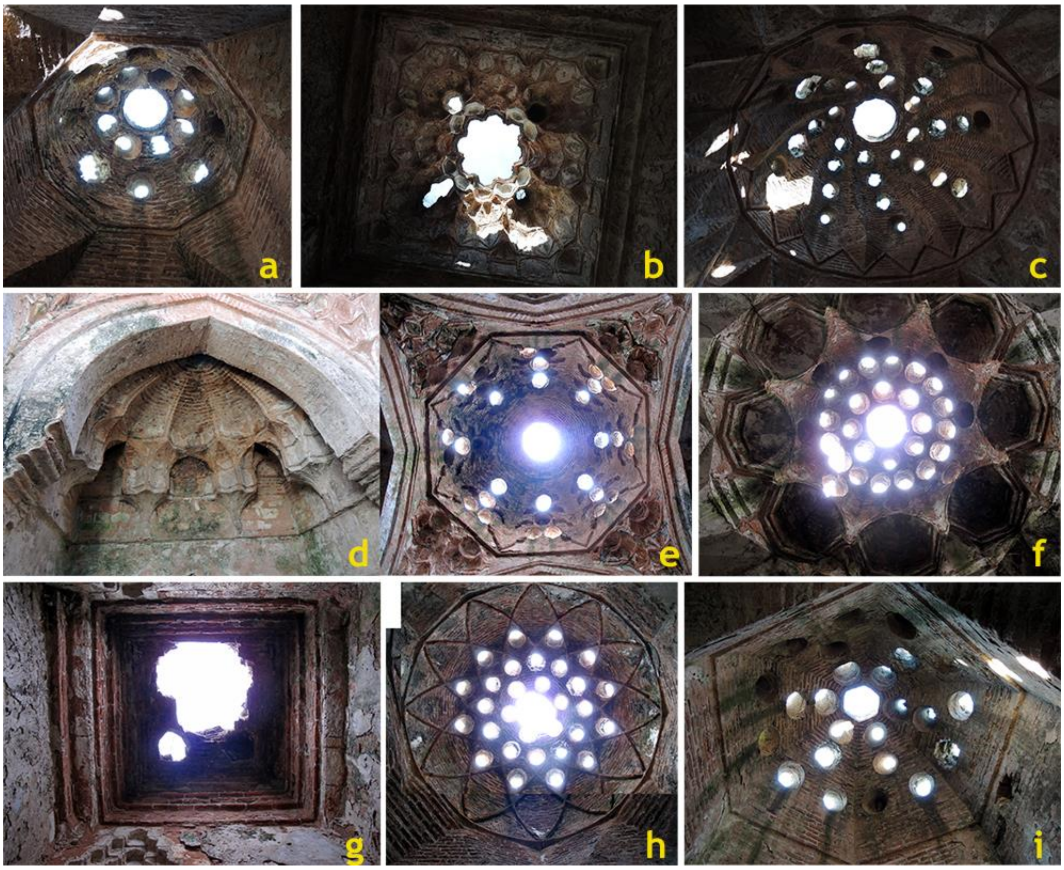

Figure 42. Examples of transition elements and upper structures from the *Gazi Mihal Bey Hamamı* (a.Z01, b.Z02, c.Z03, d.Z04, e.Z05, f.Z07, g.Z10, h.Z15, i.Z17)

The term used for *lantern* is "*aydınlık feneri*", for *cupola* "*çok gözlü ışık kubbesi*" and for *oculus* "*ışık gözü*" in Turkish (Önge, 1995: 63-65).

Figure 43. *Çörten* and *kirpi saçak* details in the south façade of *Gazi Mihal Bey Hamamı*

d. Installation Systems:

There are traces of clean water distribution and heating systems of *Gazi Mihal Bey Hamamı*. However, there is no information about the discharge of wastewater in the building.

<u>*Clean Water Distribution System:*</u>

Water depots of *Gazi Mihal Bey Hamamı* lay throughout *sıcaklık halvet*s on the west edge of the building. Information on the connection of water from urban water network, cold water depot, copper caldron and its pit is not available to examine because of the soil deposits.

Traces on the building reveal that the cold water *pöhrenk*[44] line extends through a channel on the same height with lower level of water control windows, lying the length of the west wall and reaches men's section bathing spaces. This line is connected to bathing spaces cold water system with vertical connecting *pöhrenk* lines on the level of *kurna*s, leaning downwards (Figure 31). Hot water *pöhrenk* line, on the other hand, is connected to the bathing spaces hot water system at two points on water depot floor level, by connecting *pöhrenk* lines under the water control windows by crossing through the wall thickness.

Pöhrenk lines that carry cold (upper) and hot (lower) water, extends in a channel of 45 cm height and 25 cm depth, made inside main walls, approximately 55

[44] Armenian originiated "*pöhrenk*" (poğrag, poğrank, փողրակ) (Kouyoumdjian, 1970: 849), was used in the texts of Deşişî Mehmed Efendi in the1580s and Evliya Çelebi in the 1680s, means *künk* used for terra-cotta water pipes and water distribution. For detailed information, see: Hrachia Adjarian, 1913. Հայերէն Գաւառական Բառարան (Armenian Dialectal Dictionary),Tiflis.

cm above floor level (Figure 31, Figure 44). The upper side of this channel is limited by stone courses used in alternating walls.

Inner surfaces of this channel, which was built together with the main walls of the building, are covered with 5cm thick pink coloured, brick-pieced *horasan* plaster, then *pöhrenk*s interlocked by applying *lökün* on the edges are placed inside the channel. Spaces are filled with pink *horasan*, the front side of the channel is closed by vertically placed bricks. (Figure 44)

*Kurna*s of this public bath did not exist today. However, there is information on *kurna*s, *kurna* niches and *kurna aynası* on Z02 *halvet* (Figure 36).

Figure 44. Water channels and pöhrenks used in the *Gazi Mihal Bey Hamamı*

<u>*Heating System:*</u>

Külhan of the *Gazi Mihal Bey Hamamı* is under Set Boyu Street. There is no information on *külhan* in the literature. Also, *külhan* furnace and *tüteklik* chimneys could not be followed due to collapses and deposits.

However, at spaces where the *cehennemlik* level can be followed, details on the circulation of fumes directed from the *külhan* furnace to the *cehennemlik* and its discharge from the building can be observed. Approximately 40 cm wide fumes flow openings were built in the foundation walls, crossed by stone lintels, and foundation walls continued on the lintels (Figure 27b-c). Some of these stone lintels are used in the form they were taken from the bed, while some were roughly shaped.

Tüteklik fumes chambers built as 30 cm wide niches are followed in Z03 and Z06 spaces (Figure 26). Their depths are approximately 60 cm, although it varies according to the thickness of the wall. Niche openings are passed by stone lintels or brick corbel arches.

There are *tüteklik* chimneys vertically lying along the wall length, right behind the water channels. *Tüteklik*s are bonded into the chimney by using a pink lime plaster, and the front side of the chimney is closed by masonry walls.

Figure 45. *Tüteklik*s and *tüteklik* chimneys used in the *Gazi Mihal Bey Hamamı*

3.3. Beylerbeyi Hamamı

Beylerbeyi Hamamı is situated at Mirimiran District on Hükümet Street, across *Beylerbeyi Camii*, *Beylerbeyi Türbesi* and *hazire* (burial site) found at the end of Saraçhane Bridge (Figure 12). The building is placed at 51L-IV Plot, 223 Block, 14 Lot. The empty area, placed 51L-IV Plot, 223 Block, 13 Lot, located adjacent to the public bath lot, must have belonged to a *külhan* courtyard and/or an auxiliary building of the bath. The public bath, registered with the A120 inventory number, is placed in "the interaction and transition zone" of Edirne Conservation Development Plan approved in 2007 (Figure 12).

Public bath was founded by *mir-i miran*/*beylerbeyi* (state governor) Yusuf Sinaneddin Paşa, one of the commanders of Murad II, in 1428-1429[45] and devoted to *Beylerbeyi Camii* (Abdurrahman Hıbri, 1996: 46; Ahmet Badi Efendi, 2014a: 262).

Beylerbeyi Hamamı was originally built as a double public bath. However, it was damaged- most probably due to earthquakes in the 16th century- and was not used for a long time. Authentic *soğukluk* space of the public bath was covered with a dome, but this dome collapsed in the 17th century, and the space is covered with a timber roof (Abdurrahman Hıbri, 1996: 46). At the beginning of 17th century, men's section of the public bath was repaired and opened for use by Ekmekçioğlu Ahmet Paşa (Abdurrahman Hıbri, 1996: 46; Ahmet Badi Efendi, 2014a: 262). It served as a public

[45] There is no primary document for the construction of the public bath, nor a separate waqf document; however, it is thought to be built in 1428-1429, relying on the *Beylerbeyi Yusuf Sinaneddin Paşa Vakfı*, which the public bath was devoted to. (Abdurrahman Hıbri, 1996: 46).

bath until the end of the 19th century. It was seriously damaged during Balkan Wars (1912-1913) in the 20th century (Peremeci, 1939, 96). *Soğukluk* section of the building was completely destroyed (Peremeci, 1939, 96). Sources (Abdurrahman Hıbri, 1996: 46; Ahmet Badi Efendi, 2014a: 262) state that there was a *şadırvan* in this space; but today it cannot be followed. Serious structural damage is present in other spaces, especially in upper structures. It was not used since the beginning of the 1900s when damaged seriously.

The file of *Beylerbeyi Hamamı* (file no. 22.00.42) in Edirne KVKBK reveal the information that the public bath was registered as cultural property in need of protection due to its historical and architectural value at July 5th, 1958 with 962 numbered decision, which was given upon investigation started by the application of the public bath's owner to demolish the building in order to sell the construction materials. On December 1st, 1972, the owner again made a request for demolition, but the request was denied on the basis that there was no reason to reconsider the registry decision on December 22nd. However, new construction permission was given to the area where men's *soğukluk* and whole women's section must have been placed; this suggests that the public bath lot was divided before registry.

A list of buildings to be expropriated by VGM was prepared by 10.02.1993 dated and 1334 numbered decision of Edirne KTVKK. *Beylerbeyi Hamamı* also took place on this list. However, expropriating was not done.

Today, the public bath is going through a fast extinction process due to man-made damages, structural problems especially on the upper structure, and material loss occurring all through the building.

3.3.1. General Description of Beylerbeyi Hamamı

Beylerbeyi Hamamı extends in the northeast-southwest direction (Figure 46). The standing bathing spaces of the public bath are 27x16.5 metres in area. Water depots in the size of 5.5x26 metres are located on the northeast side of the bathing spaces.

Northwest and southwest façades and some spaces in northwest part were not examined due to the late Ottoman period constructions, also soil and garbage deposits.

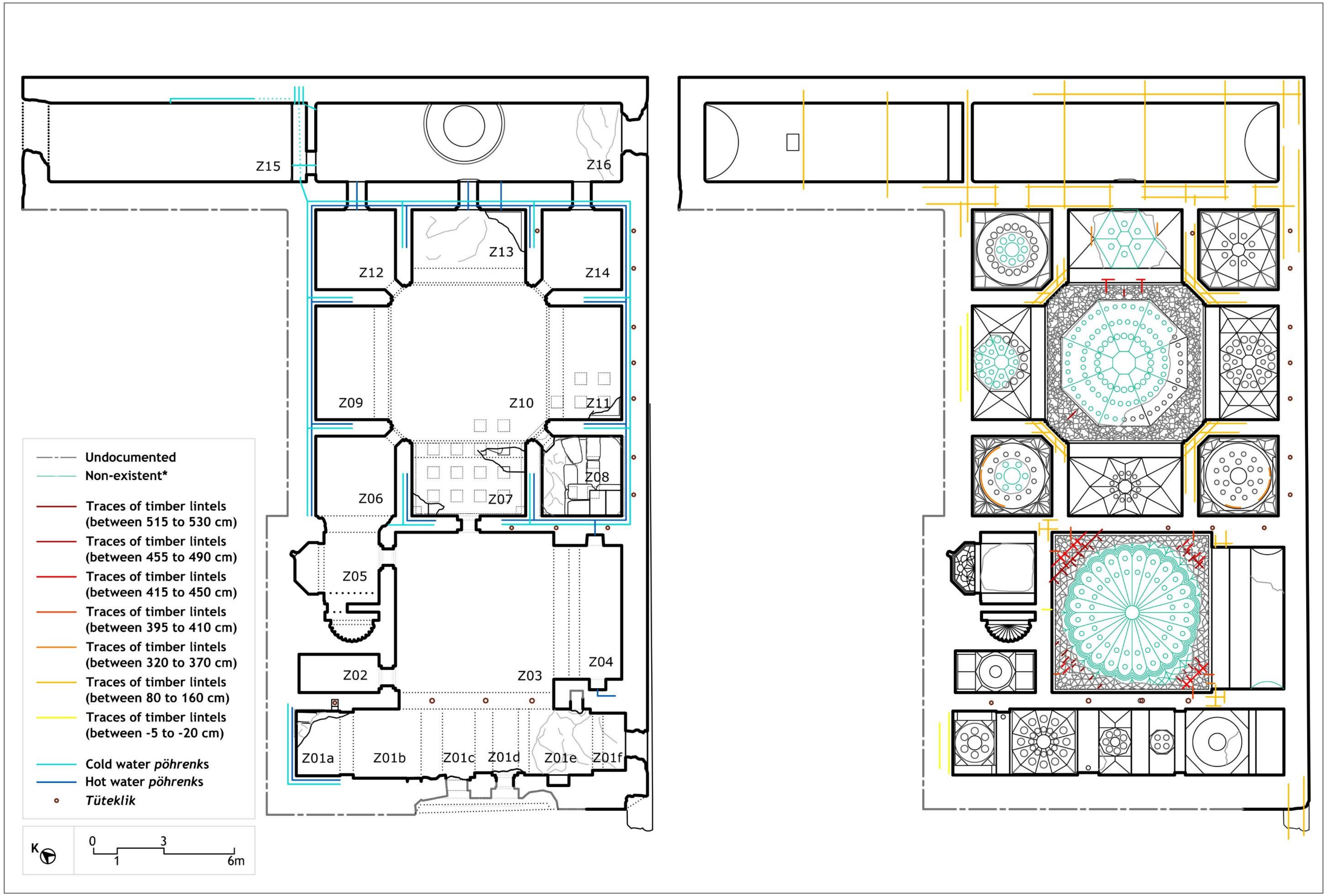

Figure 46. The plan and reflected ceiling plan of Beylerbeyi Hamamı (according to new information gathered from site surveys, redrawn based on Büyükdığan, 1989: 319 and İlter Büyükdığan Photograph Archive)

a. Exterior description:

Northwest and southwest façades were not examined because of the new construction on areas that used to be a part of the public bath's lot, originally. However, information can be revealed from old photographs and written sources. Dome beginning of women's section *halvet* of *sıcaklık* at the northwest façade can be followed in photos belonging to the 1980s (Büyükdığan, 1991: 28-30). *Soğukluk* and *ılıklık* partition wall on the southwest façade is built by rough cut stone and brick masonry system (Figure 47). Differentiation on the upper level of the rectangular area specified by cut stone covering indicates an upper structure placed on this area. There are two door openings in this cut stone covered rectangular area. Profiled cut stoned are used on door openings. Brick masonry system found on the upper levels of the wall is an exceptional practice for the structure, hence it can be said that this brick masonry part belongs to a comprehensive repair dated to the beginning of 17th century (Figure 47).

At the south corner of the building, two vaults vertical to each other, probably connected to the foundation system, can be followed on southwest and southeast façades (Figure 48). At the same time, borders of the *soğukluk*, which did not exist today, can be deduced from the traces at this corner. 110 cm thick masonry wall with timber lintels of southeast wall, extending towards the southwest direction, must be the southeast border of the *soğukluk* space (Figure 48).

Southeast wall of the public bath reaching up to five metres high is built by repetitions of three brick and one rough cut stone courses alternating wall technique (Figure 49). Rough cut stones are surrounded by two vertical bricks. Spaces on the upper level of the wall, where vertical brick number decreased to one must be the renewed areas during comprehensive repairs in the beginning of 17th century. Lintel and *tüteklik* chimneys also can be followed along the wall where there is an extensive material loss. Although it does not survive today, plaster used on the exterior façade can be followed from photographs dated to 1987 (Figure 50).

There are hot and cold water depots' exterior walls, partially buried under soil deposits on northeast façade (Figure 51). Only 1.5 metres of the depot walls can be observed. There are traces of 15x15 sized timber lintels spanning along the length of the alternating wall built by three brick and one rough cut stone courses. In addition, the location of the *külhan*, which did not reach today, can be determined in the area built by the brick bond system.

Northeast lot of the public bath is also empty. This area should probably be the auxiliary building and/or wood storage lot. However, there was no information on these parts.

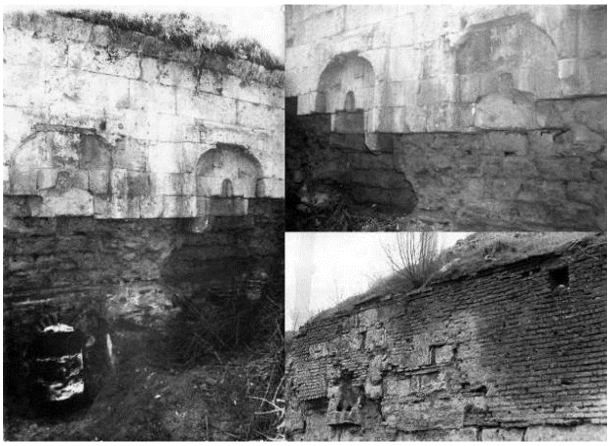

Figure 47. The south-west façace of the *Beylerbeyi Hamamı* (Source: İlter Büyükdığan Photograph Archive, 1986)

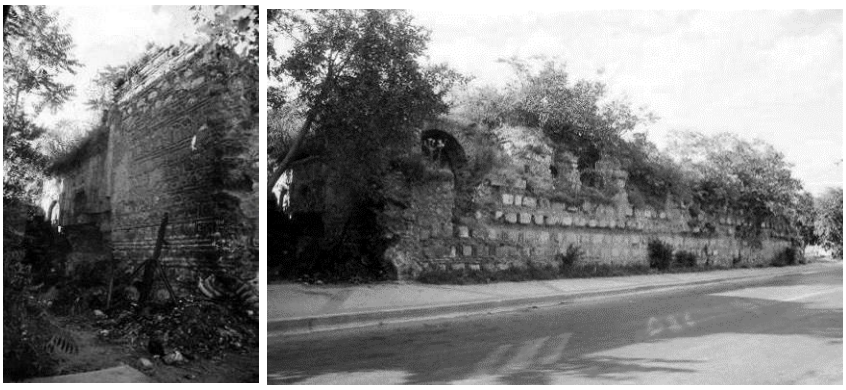

Figure 48. The south corner of the *Beylerbeyi Hamamı* (Source: Neriman Şahin Güçhan Photograph Archive, 1999)

Figure 49. The south-east façade of the *Beylerbeyi Hamamı*

Figure 50. Plaster remains on the south-east façade of the *Beylerbeyi Hamamı* (Source: İlter Büyükdığan Photograph Archive, 1986)

Figure 51. The north-east façade of the *Beylerbeyi Hamamı*

b. Interior description:

Only one section of this building, which was constructed as a double public bath stand today (Figure 46). A public bath of this size must have had a dome covered *soğukluk* (Kuban, 1976: 456); however, there is no trace of such space. Traces of *soğukluk* space that must be at the southwest end of the building cannot be followed because of the new constructions on the original lot of the public bath.

Two openings at this façade open to the *aralık* space (Z01) with the elongated rectangular plan (Figure 46, Figure 47). Six different upper structure systems were used in this area, which is divided into six. A furnace and symmetrical to it, a niche are observed on the *soğukluk* wall at the southeast end of *aralık.* Changes on the wall masonry system and water channels on the northwest wall denote a comprehensive repair. Traces on the structure denote a wall in which *tüteklik* chimneys located on the northeast. However, the wall is collapsed until upper structure's spring line so information on details for passing to other spaces cannot be obtained.

Ilıklık main space (Z03), which has an almost completely collapsed upper structure, is entered through *aralık* (Figure 46, Figure 52). There is an *eyvan* (Z04) on the northeast, and two *halvet*s (Z02, Z03) on the southeast of *ılıklık* main space; the entrance of the *halvet*s cannot be studied as they are closed by deposits. Two niches and *pöhrenk* line transmitting water to the niches and forms on top of the *halvet* door, which are completely disharmonious, attract notice (Figure 53).

A door on the northeast wall of *ılıklık* opens to *sıcaklık* spaces (Figure 46). *Sıcaklık* is comprised of main space (Z10), four *eyvan*s (Z07, 09, 11, 13) and four *halvet*s (Z06, 08, 12, 14). Quoting the typology of Semavi Eyice (1960: 106-115, 120), (a) "cross-axial plan with four *eyvan*s and four corner *halvet*s" plan type was used (Figure 1, Figure 46).

Southwest, southeast and northeast *eyvan*s and south *halvet* are important information sources for floor and *cehennemlik* systems. The only space where details on *kurna*s can be obtained is south *halvet*. Upper structures of the spaces except for *halvet*s and southwestern *eyvan* are almost completely demolished.

There are the hot water depot (Z16) lying along the men's *sıcaklık* and cold/reserve water depot (Z15) after the hot water depot at the northeast end of the building (Figure 46). The area of cold water depot gives information about the plan scheme of women's sections, which did not survive today. Location of *külhan* can only be estimated relying on the traces on hot water depot.

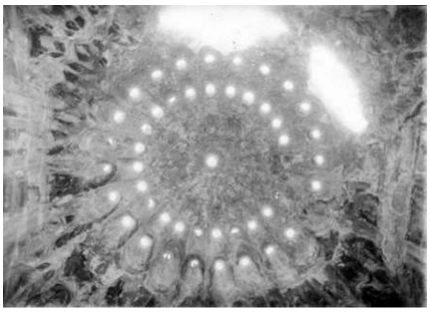

Figure 52. The transition element and dome used in the Z03 space of *Beylerbeyi Hamamı*, 1986 (Source: İlter Büyükdığan Photograph Archive) and 2014

Figure 53. The door opening between the Z02 and Z03 *ılıklık* spaces of the *Gazi Mihal Bey Hamamı* (Source: İlter Büyükdığan Photograph Archive, 1986) (left) and the ornamental works on its façades (Source: Neriman Şahin Güçhan Photograph Archive, 1999) (right)

3.3.2. Construction Techniques and Building Materials of Beylerbeyi Hamamı

Some of the upper structures of *Beylerbeyi Hamamı* cannot be studied in detail due to deposits. Among the standing parts of the building, information on load-bearing system, pavement and covering materials and architectural elements can be obtained

a. Foundations:

Information on floor and foundation system can be obtained from Z01, Z07, Z08, Z11 and Z13 spaces. It can be said from the traces that the floor pavement continues in other spaces; however, because of the deposits resulting from the demolition of upper structures, information could not be gathered from these spaces.

There is an 8 cm in depth and 10 cm in length (2 bricks course) recess on the alternating walls of Z01 space north corner, at a level located 50 cm below the water channel level (Figure 54). A marble plate of 9 cm wall thickness and 58 cm width is placed inside this groove. However, no information was found on *cehennemlik* footings, beams or floor beams carrying the pavement stone.

Foundation walls of Z07 *eyvan* are built by three brick and one stone courses alternating system with 4-4.5 cm lime mortar (Figure 55). Foundation walls start 50 cm below water line lower level and are wider than superstructure walls. This enlargement is 10 cm in longer sides (approximately one third brick length) and is 18 cm in shorter sides (approximately two third brick length). At the corners, this enlargement reached up to 40 cm with the use of flagstone. 45x45 cm *cehennemlik* footings are placed at 45 cm distance from each other and from the foundation walls. *Cehennemlik* footings (as long as the one metre that can be followed) are built by one brick and one half and brick course repetitions with 4-4.5 cm lime mortar in between.

70x100x11-14 cm flagstones are placed on top of *cehennemlik* footings and foundation wall in the northeast-southwest direction and used as beams (Figure 56). Flagstones of 6-to-9 cm varying thicknesses are placed on beams and foundations, in the vertical direction to the above-mentioned beams, and are used as floor beams. Floor beams formed an almost continuous surface, and floor level is adjusted by placing bricks and brick-pieced *horasan* plaster. Floor pavement is completed by placing 9cm thick, 70x100cm sized marble plates on plaster. South corner of Z11 *eyvan* and east corner of Z13 *eyvan* are followed to have similar floor and foundation systems with that of Z07 *eyvan* (Figure 54).

The thicknesses of foundation and superstructure walls of Z08 *halvet* are in same thickness, different from the Z07, Z09, Z11 and Z13 *eyvan*s. Isosceles triangle planned brick masonry modules with longer side curved inwards are used at the corners of this space for supporting floor pavement (Figure 57, Figure 58). 45x45 cm sized brick *cehennemlik* footings are built in the same was as *eyvans*'. Beams are generated by placing 54/58x130x11-12 dimensioned flagstones on brick masonry modules and *cehennemlik* footings in the northwest-southeast direction. There are grooves 10 cm in depth and in width continuing along the northwest and southeast foundation walls on the same level as the upper side of the beams. Floor beams of 60-65x117-120x6-7 cm dimensions are generated by placing flagstones perpendicular to and on beams, and embedding into the grooves. The level is adjusted by covering the floor beams with brick-pieced *horasan* plaster and pavement is completed by placing 70x120x4-5 cm sized cut and polished marble plates onto the *horasan* layer.

Openings:

In all the spaces where it is possible to follow *cehennemlik* level, 40-50 cm wide openings crossed by stone lintels are noticed on foundation walls, which provide a flow of hot fumes under floor level (Figure 55). Some of the flagstones are used as they are taken from the bed, some are roughly shaped.

A fume flow opening 80 cm in width can be followed under the door of Z08-Z10 partition wall (Figure 58). The opening is crossed by flagstones of 10 cm thickness and 102 cm length used as lintel approximately 70 cm below floor level. Brick masonry is used onto these stones until the general pavement level is reached (8 courses of brick), and the pavement is completed by placing 12 cm thick polished marble plates/pavestones on this brick masonry unit.

Figure 54. Foundation and floor systems used in Z01, Z11 and Z13 spaces of the *Beylerbeyi Hamamı*

Figure 55. *Cehennemlik* footings, the stone beam system (left and right-top) and the fumes flow opening (right-bottom) used on the Z07 *eyvan* of *Beylerbeyi Hamamı*

Figure 56. Stone plates used as beam and floor beams in the floor system of *Beylerbeyi Hamamı* Z07 *eyvan*

Figure 57. The cehennemlik section and floor system used in the Z08 *halvet* of the *Beylerbeyi Hamamı*

Figure 58. The corner support unit (left) and fumes flow opening under door used in Z08 *halvet* of the *Beylerbeyi Hamamı*

b. Masonry Walls:

Partition walls of the building are 75 cm, main walls are 110 cm, and the wall between water depot and *sıcaklık* spaces is 120 cm thick (Figure 46). Plaster thickness varies between 3 and 4.5 cm. Single type bricks of 27,5x27,5x4-4.5 cm dimensions, rough-cut stone and cut stone are used on the main walls that are built by masonry system with timber lintels. Use of bricks with 2-3 cm wall thickness is also observed at walls where local tissue inconsistent with the whole building is used, which indicates Ottoman period interventions (Figure 59). Documented masonry wall techniques in the building can be examined under four groups.

The first group is the alternating walls built by rough cut stone and brick in all walls of the building (Figure 49, Figure 59). It is built by repetition of three brick and one rough cut stone surrounded by vertical bricks courses. In limited number of spaces where different systems like openings and lintels are necessary, it is observed that bricks are used in two or four courses instead of three. In this system, bricks are used in full or half-length. The lengths of rough cut stones used in this system vary between 14-65 cm and width 25-30 cm.

The second group consist of the wall used in *soğukluk-aralık* transition wall. On this wall, the same system as in group one is used, but the *soğukluk* side of the wall is covered with cut stones (Figure 47).

The third group is the walls in which only bricks are in size of 27.5x27.5x4 are used. This system is locally used in the areas where the *aralık* window and niche openings are located and upper levels of door openings formed in *halvet*s of *sıcaklık* chamfered corners.

The fourth is the masonry wall system built of brick and rough cut stones. The only example of this type is the partition wall located between water depots (Figure 60). It is highly possible that this wall belongs to an Ottoman period repair, as the area is commonly intervened and there is not another example of this type.

In some parts, there are local wall bonds constructed with 2-3 cm thick bricks used as patches are also noticed (Figure 59). As it is obvious that these parts were done as repairs in other masonry bonds due to deformations/collapses, it is not considered as a separate group.

Traces of timber lintels, which did not exist today, can be observed in collapsed parts (Figure 46). The traces of two lintels (one line only in the west wall of water depot) placed into the walls at the same level and lying along the walls, also *puştuvan*s connecting these lintels in the masonry system, give information about the location and size of the structural timbers used in the building.

The first one is the lintel traces are in size 10x10 and 15x15 cm (Figure 46-timber traces level 1, Figure 48) that can be followed along the *sıcaklık* and *soğukluk* walls, placed 15-30 cm above the water channel (see. Chapter 3.3.2.d). The second one is the 15x10 cm lintel traces (Figure 46-timber traces level 2) followed in all *sıcaklık* and *ılıklık* walls, placed along the spring line of arches, so 135-155 cm above the water channel.

These lintels are also connected to lintels and *puştuvan*s of varying sizes as 10x15, 15x15, 15x18, and 18x18-19 cm, that placed along water depots' walls (Figure 61). According to traces, there were single line of lintel into the northeastern wall and two lines of lintels (with the distance vary between 35-65 cm) into the southwestern wall in water depots, placed 135-185 cm above water distribution system in building, so 50 cm below of the spring line of water depot vault (Figure 46-timber traces level 2). These three lintel lines must have been connected to *sıcaklık* space lintel system. Also must have been connected to each other by *puştuvan*s placed perpendicular to lintels and ended into the wall thickness. At the same time, some of the *puştuvan*s are continuing as lying in open between the long walls and bind them to each other.

Figure 59. Traces of interventions on masonry walls of the south-east façade of *Beylerbeyi Hamamı*

Figure 60. The partition wall used between hot and cold water depots of the *Beylerbeyi Hamamı*

Figure 61. The south-west wall of the hot water depot of *Beylerbeyi Hamamı*

<u>*Arches, Openings and Niches:*</u>

Arches

The transition between spaces at north and south edges of *aralık* (Z01) and openings at the sides of *ılıklık* and *sıcaklık* main spaces are spanned by arches. The one used in the *aralık* north edge (Z01a-b) is a simple *Bursa* arch crossing 276 cm opening, with 57 cm thickness and formed by a flat profile between two semicircular arches (Figure 62). This arch is built with two brick and one half brick courses placed in a shifting manner. The one in the south edge (Z01e-f) is a 45 cm thick single centred arch crossing 243 cm opening. This arch is built by one brick and one half-brick courses with shifting joints.

570 cm opening between *ılıklık* main space and *eyvans* (Z03-04) is spanned with two adjacent arches. Arch on the *eyvan* side is 45 cm thick, approximately 110 cm high, two-centred ogee arch. One in the *ılıklık* side is a 60 cm thick, 220 cm high,

two close- centred and surbased arch with the *göçük aynalı* profile (Figure 62). "*Bursa kemer"* definition can also be used for this arch.

The rising between the visual start line and spring line of the arch is done with three courses of cut limestone block in 20 cm length, which connected to main wall with timber lintels (with 6x9.5 cm cross-sections) (Figure 46-timber traces level 2) and to each other with metal clamps (in size of 21x6x1.5 cm with 0.7 cm thickness) and pins (in 0.7 cm thick and 16 cm length) (Figure 63). The opening between *aralık-ılıklık* is covered with 60 cm thick arch. Again, this 60 cm thick arch is used in *ılıklık* main space northeast and northwest sides; however, different from others, opening below the arch is covered with masonry system. There are traces of 15x15 cm sized timber lintels along the spring line level of 60 cm thick arch (Figure 46-timber traces level 2).

Surbased drop arches of 60 cm thickness and 180 cm rise are used to cover 485 cm wide openings between *sıcaklık* main space and *eyvan*s (Figure 62). Rising between visual start line of the arch and spring line is built by three courses of cut limestone blocks of 20 cm length, as in *ılıklık* arches, which is connected to the main wall with timber lintels and to each other with "U" shaped metal clamps and dovetail shaped timber clamps (Figure 63). U shaped metal clamps are in the dimensions of 19x4.5x1.5 cm with 0.75cm thickness. Only traces of dovetail clamps reached to present day (Figure 63). The groove carved on the stone blocks for connection is 22 cm in length, wide sides on two ends are 11 cm, narrow part in the middle is 5 cm in length and 2cm in depth (Figure 63).

There is semi-circular profiled with one centre support arch between hot and cold water depots (Figure 60). A 26 cm wide projection is applied on the visual start of arch using 14 cm thick flagstone. 60 cm thick arch placed on this flagstone is built by two brick and one half-brick courses with shifting joints. This arch is connected to the main *hatıl* system of the building by timber lintel and *puştuvan* passing on the upper level of flagstone (Figure 46-timber traces level 2).

Doors:

Observable door openings of standing parts of *Beylerbeyi Hamamı* are crossed with arches. These doors can be grouped into two according to the arch forms and their construction techniques.

The first is the southerly *soğukluk-aralık* door opening and is in 74 cm width (Figure 64). Brick masonry system is used around the opening. At the beginning of the arch, a 9 cm projection is made to the springer brick, so the distance crossed by the arch is decreased to 56 cm. The arch used in the opening can be defined as two-crossed-centred ogee arch. The northerly *soğukluk-aralık* door also carries traces of a similar form; however, deteriorations on the arch prevent making a precise definition (Figure 64).

The second one is the *halvet* doors of *sıcaklık* space. Profiled stones and appropriately placed bricks are used on the sides of these 65 cm wide openings (Figure 65). Top of the opening is covered with two-crossed-centred ogee arch. There are traces of similar form on the doors located between *ılıklık*-Z02 and *ılıklık*-Z05 spaces; however, the authentic arch form of these doors cannot be observed due to repair plasters (Figure 65).

Windows:

There are three water control windows between hot water depot and *sıcaklık* spaces with 63 cm width and 80 cm height (Figure 61, Figure 66). All windows have identical size and form and deterioration of plaster layers on the window opening of Z12 space, increase the readability of construction techniques and arch form. According to the information obtained from this window, window openings are built by brick masonry system and the opening is covered with cross-centred ogee arch, in the same way with the second door type of *Beylerbeyi Hamamı*.

Niches:

There are four niches on the building. The one on the southeast wall of *aralık* is almost completely buried under deposit, hence, there is no information other than the existence of this niche. 90 cm wide niche on the *aralık* southwest wall can be defined as a furnace niche relying on its chimney spanning the length of the wall

(Figure 67). The original level of this niche cannot be determined due to deposits but it is understood that it was filled up to spring level during its use. Arch if this niche has a form comprised of concave-convex springs.

The other two niches are placed on the short side of Z04 eyvan. These two niches are almost identical and have 70 cm width, 108 cm height and 45 cm depth (Figure 67). Niche openings are covered with cross-centred ogee arch, similar to Type 2 doors and water control windows of *Beylerbeyi Hamamı*. However, during the use, raised opening inside the arch is filled up to spring level and a flat profile look is given. Single line water reaches to these *ılıklık* niches with strengthen the possibility of *kurna* presence on them; however, in the current situation, there is no information proving this.

Figure 62. Arches used in the *Beylerbeyi Hamamı* (from left to the right; Z01a, Z03 and Z10)

Figure 63. Traces of iron and timber clamps used on the spring line of the Z09 space arch of *Beylerbeyi Hamamı*

Figure 64. Door openings used between the *soğukluk* and *aralık* spaces of *Beylerbeyi Hamamı*

Figure 65. Door openings of the Z08 *halvet* (left) and the Z02 *halvet* of *Beylerbeyi Hamamı* (Source: Neriman Şahin Güçhan Photograph Archive, 1999) (right)

Figure 66. The water control window located between the hot water depot (Z16) and the Z12 *halvet* of *Beylerbeyi Hamamı*

Figure 67. The coffee fireplace niche of *aralık* (left) and the *kurna* niche of *ılıklık* (right) in the *Beylerbeyi Hamamı*

Finishing Techniques:

In *Beylerbeyi Hamamı*, cut stone covering are used on the main walls of the *soğukluk* northeast wall (Figure 47) and plaster in all other spaces as wall finishing techniques. Plaster use in outer façade can be followed in photographs dated to 1987 (Figure 50), although it did not reach today. There is no information on the physic-mechanical properties of this plaster.

According to the survey study on the interior wall surfaces of *Beylerbeyi Hamamı*, one type lime-based plaster and three type lime-based plaster with brick dust and pieces (*horasan*) are noticed. The lime plaster is varying thickness from 1 to

3 cm and *horasan* in four different colours: light pink close to white, light pink, pink, and red. Differences among the plasters with respect to their physical properties and application thicknesses result from the level of application and date of application. Plaster changing lines can be followed in all spaces and observed 15 cm above water line channels in *aralık*, *ılıklık* and *sıcaklık* spaces and on the level of vault spring line in water depots. The same alignments were continued to be followed during the repairs done in different periods.

Application of lime plaster of 2.5 cm thickness on 0.5 cm pink *horasan* was detected in *aralık.* This layer is painted with the white lime wash.

Four different plaster types were detected in *ılıklık* space. In some spaces, the old plaster is removed before repair plaster application, while new layers are applied on the old plaster in the areas where old plaster probably hold onto wall surface firmly. In order for the strong adsorption/adhesion of plaster layers, notches were made on old plaster surface with nails, even in some spaces, nails are hammered on old plaster layer so that they make projections. The information gathered from limited areas where all layers can be followed, reveals that the undermost layer, meaning the oldest layer, is 2-2.5 cm thick pink *horasan*; the second is 2 cm thick red *horasan*; third is 1.5 cm thick light pink close to white; and the last, top layer is lime plaster with straw addition. The first two layers have a very strong mechanical connection; therefore, they are thought to be applied at the same period (Böke et al., 1999). Presence of lime wash or chalk remains on second, third and fourth layers indicates they were applied at different periods. There are red and yellow washes and blue floral ornaments at some spaces on the white lime wash.

There are four different plaster types on *sıcaklık* spaces (Figure 68). These are (from the undermost to the top layer); 1.5 cm thick red *horasan*, 2 cm thick light pink *horasan*, 1.5 cm thick pink *horasan* and 1.5 cm thick pink *horasan* with straw pieces (Figure 69). Plaster changing line is obvious in *sıcaklık* spaces. Plaster colours do not change distinctively above and below the plaster changing line. However, plaster on the upper level is applied as projected nearly 1.5 cm and used as drip edge (Figure 70).

Wash traces and chalk remains, proves interaction with water, is observed between all layers which show that these plasters were used in different periods.

Chalk layer is not observed only on the top plaster, the newest repair plaster (Böke et al., 1999). This plaster contains straw pieces visible to the naked eye different from other layers, and it is not an appropriate solution for areas in contact with water or vapour directly.

There are black spots on second layer *horasan* and wash in *sıcaklık* Z08 *halvet*. There is chalk layer on these spots, indicating that the spots were present when the building was used as a public bath. The fact that spots are not monolith but rather in the form of regular pieces strengthen the possibility that these spots are indeed painted traces. However, because of the plaster layer covering them, they can be observed only in a limited area hence a certain comment cannot be made.

Three layers of *horasan* plaster are observed in lower levels of water depot (Figure 71). The undermost layer is 2.5 cm thick red *horasan*, the second layer is 2 cm thick pink *horasan*, and the third layer is 1.5-2 cm thick pink *horasan*. All palsters used in lower level of water depot have high endurance and there is no straw in the repair plasters. There is 1.5 cm thick pink plaster application on the upper level of water depot. This *horasan* has high endurance compared to plasters of the public bath but has lower endurance than plasters on lower levels of water depot plaster changing line.

Figure 68. Plaster layers used in the Z07 *sıcaklık* space(left and middle) and notces on older plasters found in the Z08 *sıcaklık* space of *Beylerbeyi Hamamı*

Figure 69. The repair plaster with straw addition determined in the Z12 *halvet* of *Beylerbeyi Hamamı*

Figure 70. The plaster changing line determined on the Z08 *halvet* of *Beylerbeyi Hamamı*

Figure 71. The plaster changing line (left) and notches on older plaster layers determined in the cold water depot (Z15) of *Beylerbeyi Hamamı*

c. Transition Elements and Upper Structures:

Primary building material used in *Beylerbeyi Hamamı* upper structures and transition elements is brick. Brick dimensions are 27.5x27.5x4-4.5 cm, similar to the foundation and main walls. As in foundation and main walls, full (27.5x27.5x4-4.5) and half (13x27.5x4-4.5) length of these bricks are used in transition elements and upper structures. Different from vertical load-bearing elements, there are additional three different brick types in these parts.

The first two are star-shaped bricks so that two or three triangles are shaped on the front surface of full-length brick (Figure 75). The third type is regular trapezoid shaped half brick obtained by beveling one of the front surfaces at 45 degrees angle. Also fine-cut limestones with their shaped front surfaces, as half six pointed star-shaped, used in transition elements are interesting (Figure 75).

The long rectangular plan scheme of *aralık* is divided into six with arches upper structure level. The upper structure of Z01f is completely destroyed; Z01c and Z01 are partially demolished.

In Z01a space, rectangular formed plan is transformed to square plan and narrowed by using one-centred arches and two-crossed-centred ogee vaults placed on the 15 cm projected flagstones at the space corners (Figure 46, Figure 72). In *aralık* spaces, pendentives are used to transform from tetragon to equilateral decagon plan scheme. Rigns built by three brick courses are projected 5 cm for narrowing the span and transformation into circular plan. The circular space opening is covered with semi-circular dome. Openings left on the dome for *cupola* and six *oculi* surrounding the dome are circular in shape.

Z01b space with square plan scheme is transformed to octagonal plan by pyramidal pendentives. The ring formed by placing 5 cm projecting three brick courses on top of these elements made to convert the plan into twelve equilateral polygons (dodecagon). The opening is covered with twelve-lobed-dome. The opening left on the dome for one *cupola* on the top and twelve *oculi* placed in two levels are also circular in shape. (Figure 46)

Rectangular plan scheme of Z01c space is converted to octagonal by using cross vaults at two narrow sides (Figure 46, Figure 73). 3 cm projected single brick course used to convert to circular plan and the space is covered with semi-circular dome with six circular *oculi* and one circular *cupola* openings.

Flat profiled vaults are used to cross rectangular plan scheme of Z01d space (Figure 46, Figure 73). The opening left at the centre of the vault for a *cupola* is first converted to circular plan with brick courses, then covered with a small dome contained four circular *oculi* openings. It is observed that a second upper structure is used on top of this after leaving some empty space, but details of this second layer could not be followed. According to traces and information gathered former studies, this upper structure system must have been changed at a late period intervention.

Squinches are used to convert square formed Z01e space to circular form for the upper structure (Figure 46). There are no *oculi* openings on the standing parts of the dome, also there are no traces indicating a presence of a *cupola* opening.

Ilıklık of the public bath is comprised of two *halvet*s and one *eyvan*. Z02 *halvet* could not be documented due to deposit; upper structures of Z03 space, Z04 *eyvan* and Z05 *halvet* are almost completely demolished.

Muqarnas used as transition elements to the upper structure in *ılıklık* main space (Z03) are interesting in terms of their construction techniques (Figure 74). Muqarnas sequences are formed on six levels and the main form is made by the use of roughly shaped bricks placed at varying angles. Brick infrastructure first to fifth muqarnas courses are connected to building walls by using timber lintels placed at 45 degree angle (Figure 46- timber traces level 3-7). These lintels are supported by *puştuvan*s placed perpendicular to lintels with the numbers of two, two, four, four and six, from bottom to top respectively (Figure 46- timber traces level 3-7, Figure 74).

There are no traces of any mould on muqarnases. The planned form must have been achieved with this stages: the main form was built by brick masonry with timber lintels (1), geometry was enriched by lime-based plaster with brick pieces (2), nails were hammered in accordance to the form planned so that 2-3 cm stays in the open (3), then applied stucco in layers and shaped (4).

It is understood from written sources (Büyükdığan, 1989: 319) that twenty four pieced ribbed dome was used as the upper structure of this space (Z03), which is not present today. Some dome pieces are found on the ground, and these pieces reveal that dome thickness started with two bricks, narrowed through upper levels, and decreased to one and a half brick thickness at *cupola* opening.

Z04 *eyvan* with rectangular plan scheme is covered with *aynalı* barrel-vault with depressed profile (Figure 74). It is understood from the parts reaching today that circular form is preferred in *oculi*.

The upper structure of Z05 *halvet* cannot be followed due to collapse. However, star-shaped bricks, used in transition elements, that appeared as a result of demolitions are important documents. Two specialized areas, narratively big scaled niches, located in this space are covered with semidomes. Half octagonal planned space on the northwest side is covered with eight pieced lobed semidome, rectangular planned space on the southwest is covered with twentyfour-lobed-semidome. There are no separate arches at the front of semidomes, therefore muqarnas courses and rib forms are easily followed from the façades (Büyükdığan, 1992: 4).

Corner chamfered square planned *sıcaklık* main space (Z10) contains muqarnas pendentives as transition elements (Figure 75). The main structure of 7-course muqarnas is built by limestone blocks and bricks. Front faces of the limestone blocks are sculptured to be three-pointed star-shaped. In the main form, the first course comprised of these carved limestone blocks, form of the stones are continued by bricks on the upper courses. Plaster and stucco layers were applied on main geometry, made by stones and bricks, and the planned form must have benn achieved by this way. In order for the plaster and stucco to adhere to load-bearing system strongly, forging nails are used to function as reinforcement, in the same way followed in *ılıklık* muqarnas.

Structural timber is used in the *sıcaklık* main space (Z10) muqarnas, as in the *ılıklık* main space (Figure 46). Traces of *puştuvan*s in 6th and 7th courses of muqarnas and lintels on the 7th course can be followed currently (Figure 46).

The plan of the *sıcaklık* main space (Z10) is converted to octagonal from a square form with muqarnas and suitable base for eight-lobed-dome is achieved (Figure 46, Figure 76). Old photographs reveal that there are traces of *oculi* in three different levels and of an octagonal *cupola* opening at the top of the dome. On the lines of openings, there are 40, 32 and 24 *oculi* from bottom to top respectively. On the *oculi* levels, roughly shaped isosceles trapezoid bricks (Figure 76) are used to form spaces narrowing outwards and similarly shaped *oculus künk*s are placed inside the spaces. Two different layers are used on levels where there is no *oculus*. A full layer is built using half bricks in the outer part. Hollow cube lines, built by placing vertical bricks are used inner part.

The transition from square plan to twelve equilateral polygonal plan is achieved by belt of Turkish triangles with *badem*s, and then ring built by two courses of bricks is used to raise the system and circular plan is obtained above the belt of Turkish triangles in Z06 and Z08 *halvet*s. Brick masonry dome is built on the ring. There are two oculi lines; twelve circular *oculi* on the lower level and six circular *oculi* on the upper level of the dome. The transition from square to twelve equilateral polygonal plan in Z12 *halvet* is achieved by pyramidal pendentives, then circular plan is achieved by ring and two *oculi* lines are formed with eighteen circular openings on the lower, eight circular openings on the upper line. In each of three domes, necessary space for circular *cupola* opening is left empty. In Z14 *halvet, the* transition from square to octagonal plan is achieved by pendentives, then opening is spanned with eight-lobed-dome. There are eight *oculi* on a single level of the dome, and an octagonal *cupola* opening at the top.

Cross vaults, built by horizontal and vertical bricks, are used in the upper structure of *eyvan*s (Figure 46). At the geometrical centre of vaults, octagonal (in the northwest (Z09) and southeast (Z11) *eyvan*s), hexagonal (in the northeast *eyvan* (Z13)), star (in the southwest *eyvan* (Z07)) planned spaces are formed, and are spanned with appropriate shaped lobed domes (Figure 77, Figure 78). There are varying numbers of circular *oculi* and *cupola* openings shaped similarly to domes are present in these systems.

Lintel traces are noticed at Z06 and Z08 *halvet* dome spring line and at the transition of cross vaults and octagonal space in Z13 *eyvan* (Figure 46- timber traces level 4, Figure 79). However, the system could not be documented in detail for security reasons.

The most simple upper structure system in *Beylerbeyi Hamamı* is the barrel-vault used in water depots (Figure 60). Vault starts by making 5cm projections from the main walls and is supported by a support arch at the intersection of hot and cold water depots. There is trace of a top window on the cold water depot vault, however, details are not followed due to demolitions.

Openings:

Openings formed for *cupola*s and *lantern*s are related to dome shape in some cases, while they are circular, hexagonal and octagonal independently from dome shape; in other cases, *oculi* are circular planned (Figure 52, Figure 73, Figure 77, Figure 78). There is no information on *cupola*s or *lantern*s. *Oculi*, on the other hand, are formed in two main stage: some spaces left empty when the dome is built according to planned oculi diagram, then baked clay cylindrical *oculi künk*s narrowing outwards, with 1 cm thick, placed inside the spaces with lime mortar. There is no information on how the spaces left for daylighting are covered and how upper structure-covering relation was done.

Finishing Techniques:

Aralık upper structures are covered of 0.5 cm thick pink *horasan* and on top of it 1 cm lime plaster. 1.5 cm thick pink *horasan* in two layers, belonging to different periods, are observed in *Ilıklık* and *sıcaklık* spaces. As in main walls, repair plasters were adhered to the old plaster, by notching the old one.

There are three layer plasters on Z12 *halvet*, at the very bottom 2 cm thick pink close to white coloured *horasan*, on top of it two layers of 1 cm thick lime plasters. The lower layer is also notched in order to strengthen the adhesion of new layers.

In almost all interior façades of transition elements and upper structures, nails are hammered so that sticking out approximately 1-2 cm. Plasters are applied on this surface by adhering to the nails.

Deposits and plants above the upper structure do not permit a detailed study, no information could be gathered about covering used for exterior surfaces of upper structures.

Figure 72. The transition element of the Z01a *aralık* space (left) and the plate stone used on the spring level (right) in the *Beylerbeyi Hamamı*

Figure 73. Upper structures of the Z01c (left) and the Z01d (right) *aralık* spaces of *Beylerbeyi Hamamı*

Figure 74. The timber traces embedded into the Z03 pendentive (left) and the vault of Z04 sapce of *Beylerbeyi Hamamı*

Figure 75. The star-shaped limestone blocks and bricks used in the transition elements used in the *sıcaklık* main sapce (Z10) of *Beylerbeyi Hamamı*

Figure 76. The upper structure and the trapezoid shaped half-length bricks in the *sıcaklık* main space (Z10) of *Beylerbeyi Hamamı*

Figure 77. The composite vault of the Z07 *eyvan* of *Beylerbeyi Hamamı*

Figure 78. The composite vault of the Z11 *eyvan* of *Beylerbeyi Hamamı*

Figure 79. Traces of timber lintels used on the arch spring level in the Z10 *sıcaklık* main space (left), the composite vault in the Z13 *sıcaklık* space (middle) and the spring level of support arch located between the hot (Z16) and cold (Z15) water depots (right) of *Beylerbeyi Hamamı*

d. Installation Systems:

Soil and collapse upper structure deposits on floor pavements of *Beylerbeyi Hamamı* prevent gathering information on how the wastewater is discharged from the building. However, information on the clean water distribution and heating systems can be obtained from the standing parts of the building.

<u>Clean Water Distribution Systems:</u>

5 water lines are detected that connects water from urban network to building, comprised of 10x14x41 cm sized *pöhrenk*s. The first two are located in the centre of cold/reserve water depot northeast wall, other three connections are found on the hot water corner of the same wall (Figure 80).

The first line directly opens to cold water depot, while the second line spans through the wall towards hot water depot. Although, this line is closed in an unknown dated repair. Among the other three lines, the first one extends along support arch with %8 declining level and reaches to the north corner of Z12 *halvet*, and connected directly to the cold water distribution system in the building. There is no information on where the two other *pöhrenk*s connect to (Figure 46).

There are two *pöhrenk* lines on the wall between water depots. One of them is on the east of the wall, 125 cm above the depot floor level; the other is on the west of the wall, 30 cm above the depot floor level. The first one must have been used for direct distribution of water from the city network to hot water depot, while the second one must have been used for providing water from cold/reserve water reserve when necessary.

Water is heated in this depot by the help of a copper caldron placed circular pit/hole above the *külhan* furnace (Figure 81). Heated water is transferred to the hot water distribution system in building that passes through Z12 *halvet* by a *pöhrenk* line embedded the wall thickness at 24 cm above the depot floor, on the mid-level of water control window opening to Z12 halve;, and through Z13 *eyvan* by *pöhrenk* line at 20 cm above the depot floor, on the mid-level of water control window opening to Z13 *eyvan* (Figure 61, Figure 80). It is possible that a similar connection is used for Z14 *halvet*, however, no clue could be found supporting or disproving this idea because of the deposit.

There is another *pöhrenk* line filled with a lime-based mortar extending from hot water depot to *sıcaklık* (Figure 80). This line reaches to Z13 *eyvan seki* level with a 10^0 incline from depot floor level.

Two *pöhrenk* lines, the upper one for cold and lower one for hot water, embedded into the water channels, which are approximately 53 cm high and 30 cm deep (Figure 82, Figure 83). These channels built inside main walls, as a continuous niche lying along the walls, and beginning approximately 50 cm above the floor level of bathing spaces (Figure 82, Figure 83). Upper levels of these channels are crossed with flagstones of 6-to-9 cm varying thickness.

*Pöhenk*s are placed inside the channel by using pink coloured *horasan* mortar approximately 4 cm thick with 0.5-2 cm brick pieces (Figure 82). L or T shape *pöhenk*s are used at the corners and junction points (Figure 84). Also, traces of *lökün* is detected at junction areas of *pöhrenk*s' inner faces.

One course brick or brick pieces are used between hot and cold water *pöhrenk*s. Pores are filled by the use of pink coloured *horasan* with brick pieces (max. 0.5cm) and the front side of the channel is closed with half brick masonry. Only in Z11 *eyvan* and *aralık* northwest wall, pink mortar is used together with brick pieces reach to 7cm in length (Figure 83).

Both water lines continue through *sıcaklık* spaces, while only hot water line continues through *ılıklık* and *aralık* spaces (Figure 46).

*Kurna*s of *Beylerbeyi Hamamı* did not reach today. However, there are traces on how the *kurna*s are mounted to the building on the southeast wall of Z08 *halvet* (Figure 57).

Figure 80. Tree *pöhrenk*, which are connect water from the urban water supply network to the *Beylerbeyi Hamamı* (left) and *pöhrenk* connections from the hot water depot (Z16) to the *sıcaklık* spaces (right)

Figure 81. The circular copper caldron pit located in the hot water depot floor level of *Beylerbeyi Hamamı*

Figure 82. The water channel and *pöhrenk*s in the Z08 *halvet* of *Beylerbeyi Hamamı*

Figure 83. The intervention traces and repair mortar in the water channel of Z11 *eyvan* of *Beylerbeyi Hamamı*

Figure 84. The L shape *pöhrenk* at the Z11 wall corner of *Beylerbeyi Hamamı*

Heating System:

Külhan of *Beylerbeyi Hamamı* could not be followed to the present day. However, its location can be understood from the traces on northeast façade of the building (Figure 51). A circular pit 175 cm in diameter where the copper caldron is placed on it can be observed on the water depot floor adjacent to exterior façade align the *külhan* (Figure 81). The fumes of burnt wood inside the pit are directed to *cehennemlik*s of Z12, Z13 and Z14 spaces via channels present on the periphery of the pit. The fumes are limited by the exterior foundation walls and floor pavements, which are built air-proof, and are spread all through *cehennemlik* section by 40-50 cm openings built on the interior foundation walls.

There are traces of fumes discharge system on Z07, Z08 and Z13 spaces. *Tüteklik* fumes chambers of 32-34 cm width and 32-38 cm depth can be observed in these spaces. These niches are covered with corbel arches formed by 3-5 cm projecting bricks (Figure 85). *Tüteklik*s placed into vertical chimneys that start from the fumes chamber and continue vertically throughout the walls and other superstructures provide fumes discharge from the building (Figure 82, Figure 85).

Tüteklik chimneys are found 45 cm inside of the superstructure walls. These chimneys are in 19x19-18cm dimensions and placed with 210 cm distances (Figure 46, Figure 82, Figure 85, Figure 86). Pink coloured lime mortar is used to embed *tüteklik*s into these chimneys. The front surface of these chimneys closed with half bricks at the water line levels and with the alternating wall on the other parts, in accordance with the rest of the wall façade (Figure 82, Figure 85, Figure 86).

There is an opening for entering to the *cehennemlik* located on the same height with *cehennemlik* level and at the geometrical centre of water depots (Figure 87). The opening is crossed by a brick arch and closed by rubble stone masonry system.

Figure 85. The *tüteklik* chimney and *tüteklik* fumes chambers in the Z07 and Z08 spaces of *Beylerbeyi Hamamı*

Figure 86. The trace of a repair on the *tüteklik* chimney in the Z01a space of *Beylerbeyi Hamamı*

Figure 87. The brick arch used to build a controlled access to the *cehennemlik* space of *Beylerbeyi Hamamı*

3.4. Tahtakale Hamamı

Tahtakale/2. Murad Hamamı is located in the Fındık Fakih District, on Saraçlar Street, at the intersection of Terziler and Fatma Sultan Streets (Figure 12). The building is placed at 76 Plot, 527 Block, 11 Lot. The district and the public bath are called *Tahtakale* at Ottoman era, as they are located next to Byzantine fortification walls (Abdurrahman Hıbri, 1996, 46; Ahmet Badi Efendi, 2014a, 261). There is *Ali Paşa Çarşısı* at the west, *Lari Çelebi Camii* at the north of the public bath. *Hacı Osman Çeşmesi* is located approximately 65 metres south of the public bath, on Saraçlar Street. *Tahtakale Hamamı* with A97 inventory number is within "the urban protected" area according to Edirne Conservation Development Plan approved on October 05, 2007 (Figure 12).

Tahtakale Hamamı is constructed in 1434-1435 and devoted to *Darülhadis Camii* of Murad II (Peremeci, 1939, 95). *Darü'l-hadîs Vakfı* is among the major Ottoman waqfs in Balkans. Hence, *Tahtakale Hamamı* is the most extensive public bath with a comprehensive program built in Edirne during Ottoman era.

Waqf records state that monthly rent of the public bath was approximately 2.200 *akçe* in 1490 and 1.400 *akçe* in 1592 (Orbay, Oruç, 2012: 5). Orbay and Oruç (2012: 5) explain this situation with decline in district population and/or newer public baths driving more attention.

According to the studies of Orbay and Oruç (2012: 10); rental continued similarly in 1594, it increased in accordance with the inflation in 1595, and no significant difference was observed in 1596. During 1599-1600, not only the public bath but also rent income of all waqf buildings decreased significantly (Orbay, Oruç, 2012: 11). The rent income increases in 1603-1604 (Orbay, Oruç, 2012: 11), and it significanşty increases in 1605-1607 and 1637-1638 (Orbay, Oruç, 2012: 13).

The public bath is also known to be repaired in 1576-1577 (Günalan, 2005: Appendices)[46], and 1592 (Orbay, Oruç, 2012: 8). The public bath was repaired for 2.3 times of the annual revenue in 1605-1606, and 2.9 times of the annual reveue in 1637-1638 (Orbay, Oruç, 2012: 12).

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[46] 1576-1577 dated MAD No: 7534, Page no: 681, Decision no: 2055: "Verdict to Edirne kadı about the repair of public bath at Tahtakale bend of Daru'l-Hadis Vakfı in Edirne, belonging to deceased and forgiven Sultan Murad Han..." (Günalan, 2005: Appendices).

An earthquake, damaging many buildings in central settlement of Edirne occurred in 1633 (Ambraseys, Finkel, 2006: 56). Increased repair expenditure in 1637-1638 indicates the public bath was also damaged seriously. High repair expenditure is observed in these years not only in public bath but also in most of the buildings of *Medrese-i Darü'l-hadîs Vakfı* (Orbay, Oruç, 2013: 13).

A fire started at *Ali Paşa Çarşısı* burnet down *soğukluk lantern*s of public bath in 1898 (Ahmet Badi Efendi, 2014b: 775).

Edirne Eski Eserleri Sevenler Kurumu, a non-governmental organization dealing with cultural heritage of Edirne, decided to ask for financial support from higher authorities in order to repair the public bath in 1945 congress (Demiray, Oğuz, 1945, 1).

Owners of the public bath made a petition on 13 April 1962, stating that they are aware of the values of the public bath that must be protected, however, thay cannot afford the high expenses of conservation, hence they want to transfer the property of public bath to the public. GEEAYK evaluated the petition at the same date and reported the situation to VGM with 221 numbered decision. However, expropriate was not done. *Tahtakale Hamamı* Conservation Project is approved by 14.07.1979 dated and 11271 numbered decision of GEEAYK.

At the same time, GEEAYK stipulated that II. *Bayezid Külliyesi Şifahane lantern* must be taken as an example for men's section *soğukluk* dome *lantern* and *soğukluk* domes must be covered with tiles. On the contrary, *soğukluk* dome *lantern*s of the public bath can be considered as qualified late period additions and that intervention caused loss of important architectural elements (Figure 88). Photographs took by Oral Onur dated to 1905 present in the examination report prepared by Council of Conservation (Çetin, 1979, 1), it is understood that the *soğukluk* domes are covered with lead and the other parts with tile.

Edirne KTVKBK decided to start a legal investigation on the unauthorized changes made on men's *soğukluk* and *aralık* spaces with 26.03.2004 dated and 7950 numbered decision. Edirne Museum Directorate made an explorative excavation on these spaces in the same year and detected traces of authentic *şadırvan* and *seki*s (Figure 89).

The criminal case against the managers for crime against the 2863 numbered legislation resulted so that the managers were found guilty by High Criminal Court. Interventions unsuitable to building integrity were removed, and conservation project, which was approved in 2008, was applied in 2010.

In 2011, owners of the public bath informed Edirne KTVKBK that they rented the public bath to be used as a restaurant, but unauthorized alterations against rental contract were made.

After assessment of the situation, prosecution filed a public case against public bath managers for crime against the 2863 numbered legislation and the managers were found guilty.

Today, only the men’s *soğukluk* of the public bath is used for commercial purposes. Other spaces are not used for any purposes. Entering to women’s section is unrestrainedly left open and this situation poses risk for the building.

Figure 88. Lanterns of the men’s (left) and women’s (right) *soğukluk* spaces of the *Tahtakale Hamamı* before the 1970 repair (Source: Edirne KVKBK Archive)

Figure 89. The traces of *şadırvan* placed in the men’s *soğukluk* space (left and middle) and the *kurna* in the *sıcaklık* main space of the *Tahtakale Hamamı* (right) (Source: Edirne KVKBK Archive)

3.4.1. General Description of Tahtakale Hamamı

Tahtakale Hamamı area is approximately 55.5x28.5 metres, in the north-south direction. *Soğukluk,* bathing spaces and water depots of the double public bath are still standing (Figure 90). *Külhan* and *külhan* courtyard did not reach to present day. However, almost all façades are covered with historical structures, most of which are registered. Only south façade bearing the water depots and *soğukluk* domes can be followed.

Construction technique and authentic systems cannot be followed on the building that was repaired in the recent era. Photographs and drawings of pre-repair were used for basic architectural features and construction techniques.

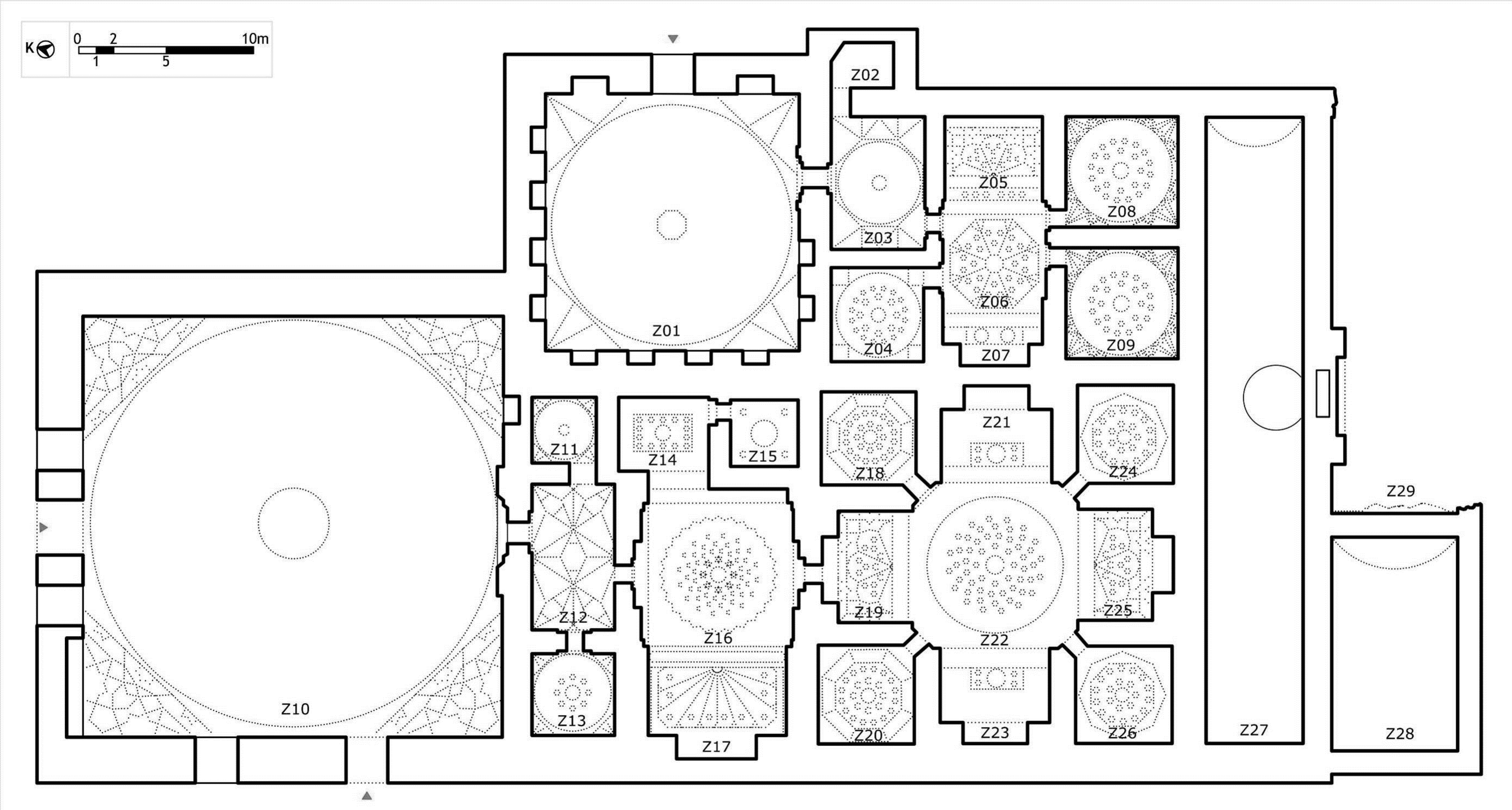

Figure 90. The plan and reflected ceiling plan of *Tahtakale Hamamı* (according to new information gathered from site surveys, redrawn based on Büyükdığan, 1989: 320-321 and İlter Büyükdığan Photograph Archive)

a. Exterior description:

North, east and west façades of *Tahtakale Hamamı* are almost completely surrounded by historical commercial buildings (Figure 91). Only entrance doors and *soğukluk* domes are followed on these façades.

There are men's *soğukluk* (Z10) original door on the north, women's *soğukluk* (Z01) original door on the east and a late period intervention men's *soğukluk* entrance door on west façade of the building (Figure 92).

On the north façade, where men's *soğukluk* main entrance door and close surrounding are observable, 4.5 brick thick arch is found on door and window (Figure 92). Cut stone masonry wall was used underneath this arch and repetition of three brick and one cut stone courses alternating wall above. However, there are no pre-repair photographs of this façade which went through comprehensive interventions.

There is cold water depot (Z28) main wall in the south end of east façade (Figure 93). It is understood from the façade filled up to half-height by late period interventions, that the water depot is placed on a vault. The space formed beneath the vault must have been used as storage area. Another important detail on this façade is the traces of brick arch and transition element and/or upper structure observed on the outer level of the arch (Figure 93). These traces must belong to squinch or cross vault. The area where the traces thought to belong to the upper structure is built by brick masonry using successive stone-brick alternating wall (Figure 93). The number of units used in this system show differences indicating that this part must have gone through repairs at different periods. North wall of the cold water depot extends towards the east and approximately 15x15 cm sized timber lintels and *puştuvan*s are used inside.

There are exterior walls of the cold and hot water depots on the south façade of the building (Figure 94). Stone-brick alternating system is used on this façade. The repetition number of the stones and bricks differ locally. This tissue indicates that the south exterior wall of the building repaired in different periods. In addition, traces of timber lintels and *puştuvan*s can still be observed today in this wall (Figure 94).

Brick bonds of *külhan* at the geometrical centre of hot water depot south wall can also be followed (Figure 94). However, late period interventions destroyed the readability of *külhan* and chimney system.

Only upper levels of main walls and drums of domes can be followed on west façade (Figure 91). It is understood from the pre-repair photographs that two or three brick and one cut stone courses are used in the authentic wall system. Partial rubble stone and brick masonry walls indicate late period interventions.

Figure 91. The west façade of *Tahtakale Hamamı*, the 1970s (Source: Edirne KVKBK Archive)

Figure 92. The north façade (left), east façade (middle) and west façade (right) of *Tahtakale Hamamı*

Figure 93. The trace of an upper structure on the cold water depot exterior wall (left and middle) and the vault placed under the cold water depot (right) of *Tahtakale Hamamı*

Figure 94. The trace of *külhan* chimney on the south façade (left) and the traces of timber lintels (Source: Edirne KVKBK Archive, 1995) (right) in the *Tahtakale Hamamı*

b. Interior description:

Tahtakale Hamamı constructed as a double public bath. *Soğukluk*s on the north; men's bathing spaces on the west; women's bathing spaces on the east; water depots, and traces of *külhan, külhan* courtyard and wood storage on the south of this building could be observable (Figure 90). Today, there are three entrances to the building (Figure 90). Both of them are the authentic doors of men's and women's *soğukluk* doors. The third one located on the west of men's *soğukluk* is a late period intervention.

Men's *soğukluk* space (Z10) is entered through the authentic door on the north edge of the building (Figure 90, Figure 92). This space is used as a shop after repairs and the authentic details lost readability because of the indoor exhibition furniture. However, excavations at 2004 reveal traces of a *şadırvan* at the geometrical centre of the space and of *sekis* lying along the length of main walls of the space (Figure 89).

The door on the south of *soğukluk* space opens to *aralık* main space (Z12) and by using doors located at the west and south of this space entered to *aralık halvet*s

(Z13-11). The other door located at the south of the *aralık* space opens to *ılıklık* main space (Z16). There are an *eyvan* (Z17) at the west and two *halvet*s of *ılıklık* (Z14-15) at the east of this space. The door on the north of *ılıklık* main space (Z16) opens to *sıcaklık* spaces. *Sıcaklık* is comprised of the main space (Z22) with four *eyvan*s (Z19-21-23-25) and *halvet*s at floor corners (Z18-20-24-26). According to the typology of Semavi Eyice (1960: 106-115, 120), (a) "cross-axial plan with four *eyvan*s and four corner *halvet*s" plan type is used on the men's section of *Tahtakale Hamamı* (Figure 1, Figure 90).

Original door openings on the east of the public bath open to women's *soğukluk* (Z01). The door on the south of *soğukluk* opens to women's *ılıklık* (Z03). There is a *ılıklık* cell (Z02) on the east of this space. This cell built as projected on the east façade. According to this scheme and also the dimension of the space, it can be said that the cell must be built as a toilet. The door located on the south of *ılıklık* opens to women's *sıcaklık* spaces. Women's *sıcaklık* main space (Z06) have two *eyvan*s (Z05-07) at west and east, and three *halvet*s (Z04-08-09), two on the south and one on the northwest of the space. One of the *halvet*s (Z04) is smaller than the others. It is known that this *halvet* was used as *mikvah/mikveh* space a part of Jewish bathing ritual, until 1970 (Akçıl, 2010, 438). According to Semavi Eyice's plan typology (1960: 106-115, 120), "the type of plan that has elongated rectangular *sıcaklık* with a domed central space and two *halvet*s" (e) plan type was used at this section (Figure 1, Figure 90).

The hot water depot (Z27) lies along the men's and women's *sıcaklık* spaces on the south of the building. There is no transition between *sıcaklık* spaces and hot water depot, today. The water control window(s) that is supposed to be between *sıcaklık* and hot water depot, must have been closed during repairs.

The cold water depot (Z28) is located on the south of the hot water depot, bordered by the west wall. This depot is built on a vault and beneath the vault is functioned as a semi-open storage/depot space. Traces of one brick arch and triangular prism units formed by projected bricks on the arch are followed. In addition, it is understood that the south wall of the cold water depot extends towards east. These information indicate that the area on the south of hot water depot and west of cold water depot could be a closed or semi-open *külhan* courtyard (Z29).

Authentic doors of the building and authentic windows at *soğukluk* spaces can be followed. Although the authentic details of *seki*s on bathing spaces are lost due to inappropriate repairs, their dimensions can be understood. *Çırakman*s[47] *(*specialized niches for *kandil*s*/*oil-lamps) indicate that the public bath was also used during times when daylighting was not available.

It is observed that water distribution was provided to all bathing spaces; however, there is no information on details.

3.5. Yeniçeriler Hamamı

Yeniçeriler Hamamı is located in Meydan District (Muradiye-Küçük Pazar Neighbourhood), at Çöplüce Hendek Street (Figure 12). It is placed at 116 Plot, 367 Block, 2 Lot. *Yeniçeriler Çeşmesi* is located at the northeastern corner of the public bath lot (Figure 95, Figure 96).

Yeniçeriler Hamamı, registered under A11 inventory number by Edirne KVKBK, is built at the first half of the 15th century (Erken, 1973: 411) as a single public bath. Gökbilgin (1952: 253-255) states that *Yeniçeriler Hamamı* was founded by one of the Murad II's commanders *mir-i miran* (*beylerbeyi*, state governor) Yusuf Sinaneddin Paşa. However, Günalan (from 2005, Appendices: MAD year: 973-974, no: 2775, page no: (8)12, edict no: 23) has documented that there is information on the repair of *Yeniçeriler Hamamı* between 1565-1567 from MAD of same years. Information from these records reveals that *Yeniçeriler Hamamı* was built by Murad II, and was devoted to *Uzunköprü*[48] *Muradiye Camii*, which also belonged to waqf of Murad II (Günalan, 2005: Appendices).

The public bath is located between *Selimiye Camii* and *Muradiye Camii*. It is thought to be named as *Yeniçeriler/Yeniçeri Hamamı* because *Yeniçeri Odaları* was in the close neighbourhood and *yeniçeri*s (janissaries) used this public bath frequently (Ahmet Badi Efendi, 2014a, 263).

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[47] The origin of "ç*ırakman*" is based on Farsi words "*çıra*" and "*çırak*", which mean oil-lamp and flaming torch (Bozkurt, 2010: 328).

[48] Uzunköprü, was built by Murad II at the Ergene River barrier with the name of Ergene in 1427. *Uzunköprü Muradiye Camii*, built in the area by Murad II has also some waqf properties at Edirne central settlement (Günalan, 2005, Appendices).

According to the file of *Yeniçeriler Hamamı* (file no. 22.00.1407); the public bath is registered as "1st Group Cultural Property in Need of Protection" by 13.11.1976 dated and 9514 numbered decision of GEEAYK. 04.07.2003 dated and 7697 numbered decision of Edirne KTVKBK continued the registry.

A list of structures to be expropriated by VGM was prepared by the 10.02.1993 dated and 1334 numbered decision of Edirne KTVKK. *Yeniçeriler Hamamı* is also listed here. 29.09.2010 dated examination of KVKBK reported that public bath was damaged due to illegal excavations and water leaking from urban water supply network lying down under *soğukluk* space. As a result, expropriate decision of the bath according to the 15th clause of 2863 numbered legislation is repeated. However, the expropriate of the public bath is yet not completed and it is under private ownership.

It is observed that the public bath has been repaired partially at different periods by the use of modern materials and techniques. However, there are no documents on these repairs. Today the public bath is unprotected against external effects and this situation increases the existing structural problems.

Figure 95. The *Yeniçeriler* Fountain (left) and the *Yeniçeriler Hamamı* (right) (Source: Google Earth Pro, v. 7.3.0)

Figure 96. The *Yeniçeriler* Fountain, 1987 (Source: İlter Büyükdığan Photograph Archive)

3.5.1. General Description of Yeniçeriler Hamamı

The public bath is located on an area of 18x15.5 metres extends in the north-south direction (Figure 97). Bathing spaces and water depots are still standing. However, only wall traces of *külhan* and *soğukluk* spaces remain today.

Some parts of east façade, hot water depots and original floor levels of bathing spaces cannot be studied due to soil deposits. The cold water depot is almost completely buried underground. Therefore, information can be gathered only on main wall upper levels.

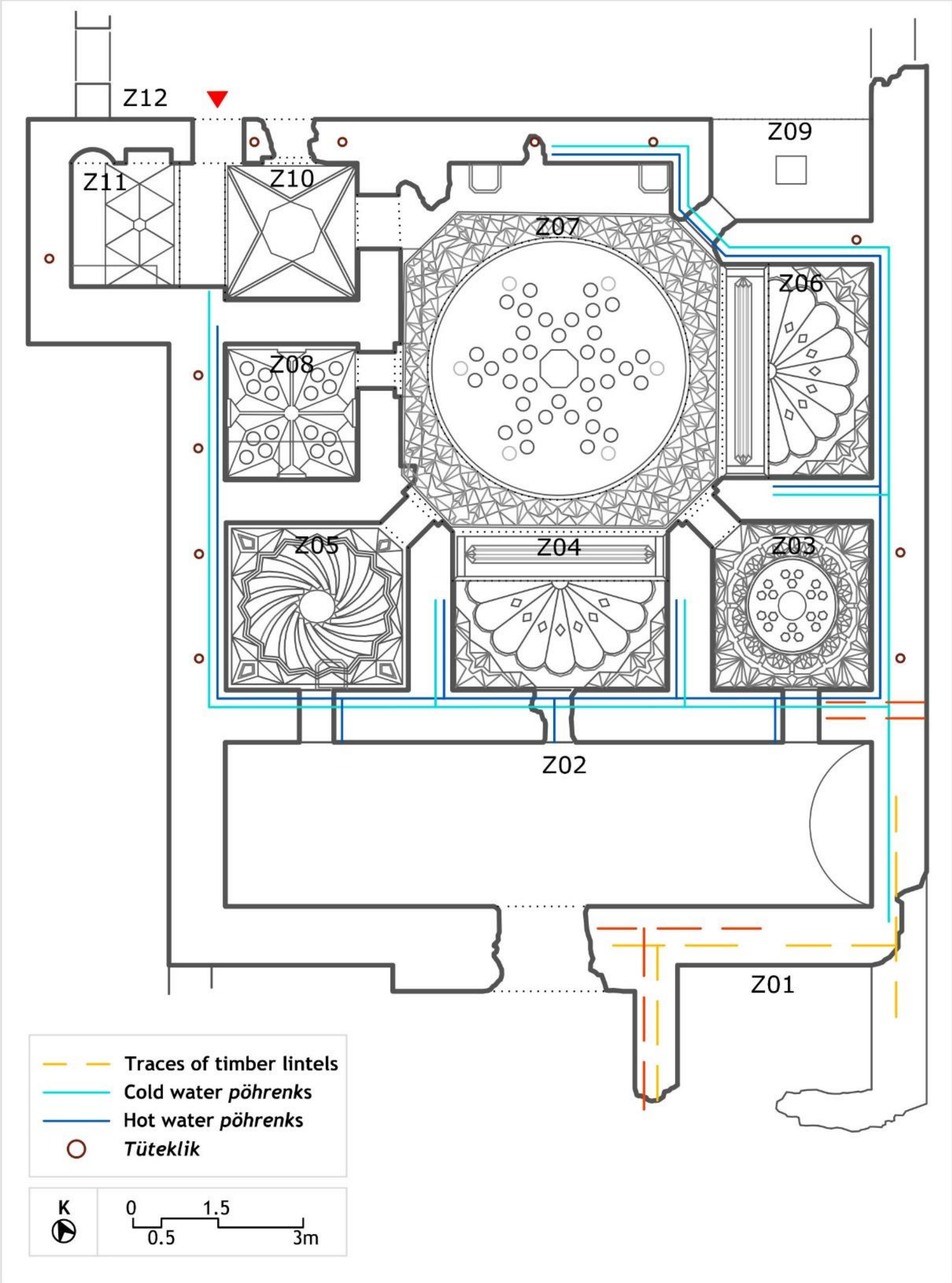

Figure 97. The plan and reflected ceiling plan of *Yeniçeriler Hamamı* (according to new information gathered from site surveys, redrawn based on Büyükdığan, 1989: 317-318 and İlter Büyükdığan Photograph Archive)

a. **Exterior description:**

There is *ılıklık*-*soğukluk* partition wall on the north of the public bath (Figure 97, Figure 98). This wall is 15.5 metres in width and 6 metres in height. There are traces of *soğukluk* main walls on the east and west edges of the wall. Towel drying niche (Z09) thought to be belonging to the *soğukluk* (Z12) and vaulted upper structure on the south end, and two arched doors on the west end opening to Z10 and Z11 spaces of *ılıklık* (Figure 97, Figure 98). The door on the east, with *yaşmak* and vapour release chimney on top, has the characteristics for main entrance for bathing spaces (Figure 98).

*Pöhrenk*s embedded in the lower levels of *eyvan* of *ılıklık* (Z11) main walls are noticed on the east end of the wall, which is an important detail about the wastewater drainage system (Figure 98).

The wall is built with repetitions of two brick and one stone courses, cut stones are surrounded by single vertical brick (Figure 99). Only one exception is observed on the upmost course; brick is used as three courses between the cut stones (Figure 98). This local difference in the masonry bonding indicates an early period repair.

West façade of the public bath is almost completely standing except *soğukluk* (Z12). The only part of the *soğukluk* main wall on the north end remained today (Figure 95, Figure 99). This wall is built by brick masonry system, on the contrary to the rest of the building. It can be said that *soğukluk* wall had gone through repair and renewed by considering the construction technique and variation in materials. There are also traces of 10x12 cm sized *puştuvan*s on this wall, at two different levels.

The main walls of bathing spaces and hot water depot are continuing on the south of the *soğukluk* wall (Figure 100). This wall is built by repetition of two brick and two cut stone courses. Cut stones are surrounded by double vertical bricks. It is observed only in Z08 *halvet* that, an area of three metres width is built by brick masonry system along the wall (Figure 99). It is understood from the materials and technique used that this part had gone through repair around the same time as the *soğukluk* main walls.

The traces of *tütekli*ks and chimneys appeared on the main walls of bathing spaces due to collapses. There is also traces belong to *kirpi saçak* used on the upper levels of Z11 main walls.

Hot water depot (Z02) west wall is completely collapsed or remained underground. Cold water depot (Z01) west wall is buried underground to the level of its half-height. Vault forming a semi-open space under cold water depot can be partially observed.

Main walls of cold and hot water depots and *külhan* are present at the south façade of the building (Figure 97, Figure 101, Figure 102). The wall is built by repetition of two brick-one cut stone surrounded by single vertical bricks courses. There are also levels where four courses of brick and two courses of cut stone are used. *Külhan* is built by forming 30 cm enlargement on the hot water depot main wall. *Külhan* is collapsed at the chimney level, but the enlargement on the wall and beginning of *külhan* arch reached today (Figure 102).

East wall of the cold water depot is collapsed and the traces are buried under soil deposit. The partition wall of hot-cold water depots is observed on south façade (Figure 101, Figure 102). This wall is built by the same technique to that of hot water depot main walls. Another detail observed on this façade is the timber lintel traces at two different levels of cold water depot west wall appeared after collapses (Figure 102). These lintels are approximately 15x15 cm in size and are located in the middle of masonry wall thickness. Single course of *kirpi saçak* is also observed on Z05 *halvet* dome drum, on this façade (Figure 102).

The large part of the east façade is unable to document because of the soil deposit. Timber lintel traces of approximately 15x15 cm in size crossing from the middle of cold-hot water depot partition wall on the south edge, *tüteklik* traces on Z03 *halvet* main wall and *çörten* traces on Z06 *eyvan* main walls on this façade are very important details (Figure 103).

Machiel Kiel took a photograph of the *Selimiye Camii* on the top of *Yeniçeriler Hamamı* in 1971, and from this photograph, it can be seen that upper structure is covered with slates or another type stone plate (Figure 104).

Figure 98. The north façade of *Yeniçeriler Hamamı* (left) and the wastewater discharging channel on the north wall of *ılıklık* space (right)

Figure 99. The partition wall located between the *soğukluk* and *ılıklık* spaces (left), the west wall of *soğukluk* space (middle) (Source: Duygu Ergenç Photograph Archive, 2012) and the repair on the west wall of the Z08 *halvet* (right) (Source: İlter Büyükdığan Photograph Archive, 1999) of the *Yeniçeriler Hamamı*

Figure 100. The west façade of *Yeniçeriler Hamamı* in 1971 (left) (Source: Machiel Kiel Photograph Archive) and in 2012 (right) (Source: Google Earth Pro)

Figure 101. The west (left) and south façades (middle, right) of the cold water depot (Z01) of *Yeniçeriler Hamamı*

Figure 102. The south façade of *Yeniçeriler Hamamı*

Figure 103. The east façade of *Yeniçeriler Hamamı*

Figure 104. An image of the *Süleymeniye Camii* from the *Yeniçeriler Hamamı,* photographed by Machiel Kiel in 1971, which also represents the stone plates used as dome covering materials (Source: Machiel Kiel Photograph Archive)

b. Interior description:

Bathing spaces and water depots of *Yeniçeriler Hamamı*, which is constructed as a single public bath, exist today (Figure 97). Only wall traces and an *eyvan* belonging to timber-roofed (Ahmet Badi Efendi, 2014a, 263) *soğukluk* reached to the present day (Figure 98, Figure 99).

There are traces of *soğukluk* main walls on the north of the lot where information on the width of the *soğukluk* can be determined (Figure 97). Vault covered *eyvan* (Z09) in the shape of a large-scaled niche, placed on the northeast corner of building's standing parts is thought to be towel drying area (Erken, 1973: 411) (Figure 98). There is a window, which appears to be changed as followed from the traces, on the southwest corner of the *eyvan* (Figure 105). At the same time, direct connection of this *eyvan* to bathing spaces is not suitable with respect to architectural necessities. Therefore, the window must be a late period intervention.

Two doors on the north of the building between *soğukluk*-*ılıklık* spaces provide passing to bathing spaces (Figure 98). The west of them opens to *ılıklık eyvan* (Z11). There are two authentic niches on the north wall of *eyvan*. Drainage channel on the north wall of this *eyvan* is the only trace about drainage system belonging to the building. Door with *yaşmak* and vapour release chimney on the north façade is the main entrance door for *ılıklık* spaces (Figure 98). This door opens to *ılıklık* main space (Z10).

The arched door on the east wall of *ılıklık* opens to *sıcaklık* main space (Z07). There is a large-scaled niche on the north; two *eyvan*s on the east and south (Z06-04); one *halvet* on each corner at west, southeast and southwest (Z08-03-05) of the *sıcaklık* main space (Z07). According to the typology of Semavi Eyice (1960: 106-115, 120), (a) “cross-axial plan with four *eyvan*s and four corner *halvets*” plan type was used (Figure 1, Figure 97).

There are water control windows opening to the hot water depot on the south walls of southern *eyvan* (Z04) and *halvet*s (Z03-05) (Figure 105). There are traces of clean water distribution system in all *sıcaklık* spaces. In addition, *kurna* traces are observed in some spaces. Brick masonry *seki*s are found in *ılıklık eyvan* (Z11), *sıcaklık* main space (Z07) and *sıcaklık* west *halvet* (Z08). However, the building material and techniques differ from the rest of the building, hence it is thought that these *sekis* are late period additions.

Hot water depot (Z02) extends along *sıcaklık* spaces south wall. There are traces of *külhan* arch and *külhan* chimney in the middle of south hot water depot wall (Figure 102). Cold water depot (Z01) is on the south of hot water depot and east of *külhan* (Figure 97, Figure 101, Figure 102). Depot is buried under soil deposit and only north and west walls can be partially followed. It can be said according to traces that a semi-open area was formed at the lower level of the vaulted structure placed the cold water depot on it (Figure 101). This semi-open space must have been used as storage area.

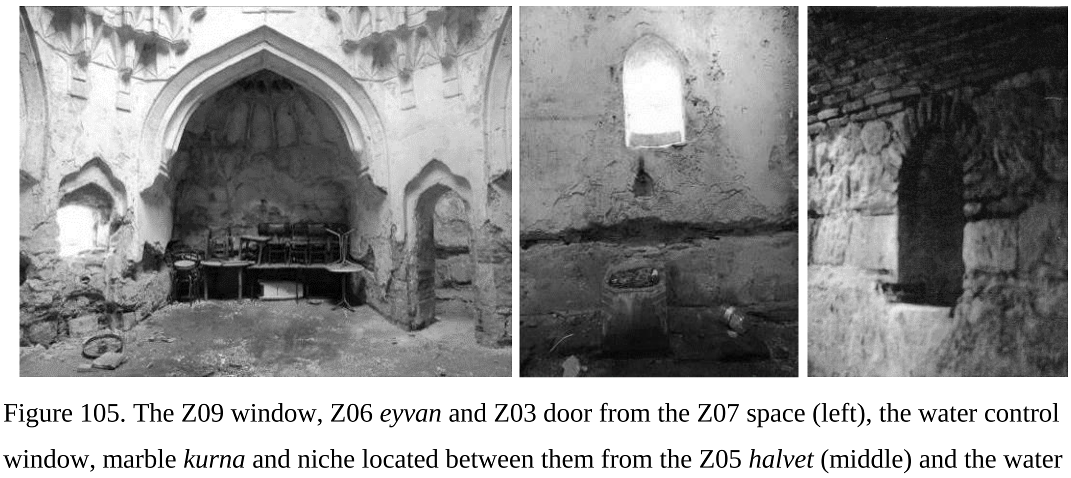

Figure 105. The Z09 window, Z06 *eyvan* and Z03 door from the Z07 space (left), the water control window, marble *kurna* and niche located between them from the Z05 *halvet* (middle) and the water control window from the hot water depot of *Yeniçeriler Hamamı* (Source: İlter Büyükdığan Photograph Archive) (right)

3.5.2. Construction Techniques and Building Materials of Yeniçeriler Hamamı

A detailed study of the upper structure of *Yeniçeriler Hamamı* could not be done due to the structural problems and security reasons. However, it is seen that upper structure covering did not exist today. It was not possible to study foundations, *cehennemlik* and floor system as floor level are covered with cement. Information on walls, installation systems and finishing techniques can be obtained from still standing parts of the building. However, readability of most of the authentic details is lost because of the alterations using modern materials.

a. Masonry Walls:

Main walls and hot water depots' walls of *Yeniçeriler Hamamı* are approximately 100 cm, and partition walls are 75-80 cm thick (Figure 97). Mortar thickness is approximately 3 cm. Rough cut stones and bricks with 27,5x27,5x4-4.5 cm dimensions and half-lengths of these bricks are used in masonry system with timber lintels. Use of 3 cm thick bricks is also observed in altered and repaired wall parts applied when the public bath was in use.

Single type of wall technique is used in the building. Walls are built by repetition of two brick and one cut stone courses, stones are surrounded by single vertical bricks (Figure 98, Figure 99, Figure 101, Figure 102, Figure 103). Exceptionally, one course of brick bond is used in the beginning level of transition elements, three courses of brick in *çörten* level and three brick courses in timber lintel level of cold water depot west wall (Figure 98, Figure 101).

Timber lintels of approximately 14x14 cm inside the walls are followed on the partition wall of hot-cold water depots (Z02-Z01) and west wall of cold water depot (Z01) (Figure 101, Figure 102, Figure 103, Figure 106). One of the traces in approximately 140 cm, the second one is 255 cm above the floor level of bathing spaces.

Figure 106. Traces of timber lintels on the partition wall located between cold and hot water depots (left) and the exterior wall of the cold water depot of *Yeniçeriler Hamamı* (right)

<u>*Arches, Openings and Niches:*</u>

Arches:

A depressed arch, crossing 220 cm opening between Z10-Z11 spaces and four two-centred ogee arch crossing 380 cm opening at the sides of Z07 space are used (Figure 97). Arch is approximately 80 cm thick. Late period repairs made it impossible to read the building materials and construction techniques of the arches.

Doors:

Reliable information cannot be obtained on construction techniques used in door openings due to late period interventions. However, it can be said that three types of door openings were followed, from the traces.

The first one is the pointed arch door crossing 80 cm opening and providing a transition between Z07 and Z08 spaces (Figure 107). Cut limestone blocks and 2-3 courses of brick bond were used on the door opening sides, coherent to the alternating wall system used in walls. The technique used in door arches cannot be followed. Trefoil pointed arches are used on *alınlık*s above door openings (Figure 107). Z07-Z10 door opening has similar properties, however, this architectural element has almost completely lost its authentic qualifications due to late period interventions.

Second door type has same properties as the first type and provides a transition between Z07 space and Z03 and Z05 spaces (Figure 107, Figure 108). Different from the first door type, these doors are not at the sides but at the chamfered corners of the space. Z07-Z09 door, which was converted to a window with an intervention, also belongs to this group (Figure 105).

Third door type provides a transition between Z10-Z12 spaces and used as the main entrance to bathing spaces, and it crosses approximately 100 cm opening (Figure 98, Figure 109). Different from other doors, there is a vapour release chimney starting in the door arch and extending upwards.

Apart from the above mentioned door types, there is another door opening between Z12-Z11 spaces. However, it can be said that this door is a late period intervention, from the traces (Figure 107).

Windows:

There are two water control windows of 63 cm width and 110 cm height between the hot water depot (Z02) and *sıcaklık halvet*s (Z03, Z05) (Figure 97, Figure 105). Alternating wall bond technique is used up to spring level. Window openings are built by half-brick and two-crossed-centred ogee arch profile is used.

Niches:

There are niches with 19x26x6 cm dimensions between the lower level of water control windows and *kurna*s (Figure 105). Information on the construction technique of these niches cannot be obtained.

A niche with arch profile same as authentic doors and windows is detected at the north wall of Z11 space. However, there is no reliable information on the form and construction technique as it is changed a lot by interventions.

Figure 107. The doors providing the access from the Z07 *sıcaklık* main space to the Z05, Z08 and Z10 spaces (left) and from the Z07 to Z10 spaces of *Yeniçeriler Hamamı* (right)

Figure 108. The door located between the Z07 and Z05 *sıcaklık* spaces of *Yeniçeriler Hamamı*

Figure 109. The main entrance door of bathing spaces from the *soğukluk* and the vapour release chimney of *Yeniçeriler Hamamı*

Finishing Techniques:

There are traces of partially lime-based plaster on the exterior of main walls on the eastern façade of *Yeniçeriler Hamamı*. Thi thickness of the plaster, however, cannot be read.

Lime-based plasters containing varying ratios of brick particles and dust, and lime wash are used on the interior façade. The plasters cannot be followed on many spaces due to cement intervention plasters, but still, it can be followed that three different colours of lime plaster and limewash are used.

There are traces 2.5-3 cm thick light pink lime plaster, and 0.5 cm thick white coloured lime plaster on it on *soğukluk* (Z12) walls. Dark red coloured lime wash is applied on top of the plaster layers (Figure 110).

In the bathing spaces, use of 0.5 cm thick white lime plaster and lime wash on top of 2-2.5 cm dark pink coloured lime plaster is followed from the floor to plaster changing line placed at approximately 40 cm above the water line. Wall surfaces above the plaster changing line are covered with 0.5 cm thick white lime plaster and lime wash on top of 3-3.5 cm thick pink lime plaster (Figure 111).

It is detected that two plaster layers dated different period are used on top of each other at Z07 *sıcaklık* space and Z08 *halvet* (Figure 111).

Figure 110. The pink horasan used on the Z12 wall of *Yeniçeriler Hamamı*

Figure 111. The plaster layers used on the interior surfaces of the Z05 space (left), Z08 space (middle) and Z07 dome (right) in the *Yeniçeriler Hamamı*

b. Transition Elements and Upper Structures:

Belt of Turkish triangles are used to convert square planned Z03 *halvet* space to circular plan, and the opening is spanned with helical ribbed dome in *Yeniçeriler Hamamı*. In Z05 *halvet*, belt of Turkish triangles are used to convert square plan to circular plan, the area is narrowed using muqarnas and the space is covered with dome. Muqarnas is used to convert square planned Z07*sıcaklık* main space to circular plan, the opening is also narrowed by using muqarnas and the opening is covered with dome (Figure 112).

Rectangular planned Z04 and Z06 *sıcaklık eyvan*s are converted to half-octagonal plan with muqarnas and the opening is covered with nine-lobed-semidome (Figure 113).

The two-layered upper structure is used in Z08 *sıcaklık halvet*. There are half-six-pointed star planned consoles extending from sides to centre as the first layer (primary/inner wall). Top of the space is covered with *aynalı* vault starting at the level where consoles ended at the second layer (secondary/outer wall). Main upper structure of the space is the second layer and the first layer contains consoles functions only to carry its own load and transfers to the masonry walls (Figure 114).

A barrel vault is used in long rectangular planned hot water depot (Z02), while a semi-cross vault in rectangular planned Z09 space (Figure 98) and a star vault with octagonal openings in square planned Z10 space (Figure 115). In Z11 space, the opening is spanned with composite vault (Figure 115). Six-lobed-dome is used at the centre of cross-vaults extending from narrow sides to the centre.

Transition elements, domes and vaults of *Yeniçeriler Hamamı* are built by using the bricks with 27.5x27.5x4 cm dimensions and their half-lengths (Figure 112, Figure 113, Figure 114, Figure 115). Use of stone material is observed only in first (primary-inner) layer of Z08 *halvet* upper structure (Figure 114). The consoles of the first layer built with three pointed star-shaped limestone blocks of 27.5 cm length and 35 cm height, and three courses of diagonal bricks placed between the stone units. Fourteen courses of bricks are bond, in accordance with the planned form on these consoles. The bricks are placed so that they make 3 cm to 10 cm increasing projections on top of each other at every course. Diagonally placed 55x110x3 cm (approximately two brick size x four brick size= 55x110 cm) dimensioned flagstones are used at the very top in a way to transfer its load to the wall (Figure 114). The system is completed by placing, two courses of 55x55x3 cm sized flagstones matching with a three-pointed (a half six pointed) star/arrowhead form.

Pink coloured *horasan* mortar of varying thicknesses from 3 to 5.5 cm is used between masonry units in transition elements and upper structures. 1-1.5 cm thick light pink lime plaster and 0.5 cm thick white coloured lime wash is used on interior surfaces (Figure 111). On Z07 space dome, the coexistence of notches on an older plaster layer and a plaster layer belong to a later period is observed (Figure 111).

The use of drums built by cut stones and bricks is observed around all domes. There are also observed traces of *kirpi saçak* used on the upper level of Z05 and Z11 drums (Figure 116).

There are *çörten* traces on the upper level of walls on eastern façade of the building (Figure 103). However, the details of the system are not readable because of the collapses and soil deposits.

A photograph dated to 1971 reveals that the upper structure of public bath is covered by flagstones and holes suitable for *oculi* openings are carved on them (Figure 104).

Figure 112. Transition elements and domes used in the Z03, Z05 and Z07 spaces of *Yeniçeriler Hamamı*

Figure 113. The semi-dome used in the Z06 space of *Yeniçeriler Hamamı*

Figure 114. The two-layered vault system used in the Z08 space of *Yeniçeriler Hamamı*

Figure 115. Vaults used in the Z10 and Z11 spaces of *Yeniçeriler Hamamı*

Figure 116. The details of drums and *kirpi saçak* located on drums of the Z05 (left) and Z11 domes (right) of *Yeniçeriler Hamamı* (Source: İlter Büyükdığan Photograph Archive, 1999)

c. Installation Systems:

Details of the drainage system in bathing spaces cannot be followed as the authentic floor of *Yeniçeriler Hamamı* is covered with cement. This intervention also prevents much information on the *cehennemlik* level and heating system. Late period interventions on walls destroyed the traces of clean water distribution system, as well.

Clean Water Distribution System:

The cold water depot (Z01) is almost completely collapsed and there are deposits on water depot (Z01, Z02) floors, hence transfer of water from urban network to the building cannot be followed.

However, *pöhrenk*s and water channels in which the *pöhrenk*s are placed, extending along the bathing spaces, can be followed. These channels are a 25x40 cm space formed inside the walls, adjacent to interior façades, and starts approximately

85 cm above the authentic floor level. *Pöhrenk*s are placed inside the channels, hot water line to the bottom, and cold water line to the top. The hot water line is approximately 85 cm and the cold water line is 105 cm above the floor level.

Traces on the east wall of Z03 *halvet* reveals information on how the water is transferred from cold water depot (Z01) to cold water *pöhrenk* system of the bathing spaces. Water line exits from cold water depot at an undetermined height reaches to Z03 *halvet* east wall and continues along the wall length. This line is approximately 220cm above the authentic floor level at the southeast corner of Z03 *halvet.* Two connecting *pöhrenk* lines extending downwards for approximately 110 cm are attached in an almost vertical angle, to the water line coming from cold water depot. These connections provide water-transferring from cold water depot to cold water *pöhrenk* system of the building/bathing spaces (Figure 117).

At the same time, water is heated at hot water depot (Z02) and transferred to hot water *pöhrenk* system of the bathing spaces by the use of connection lines. Connection *pöhrenk*s embedded inside the hot water depot-*sıcaklık* partition wall at a level close to depot probable floor level. This detail is followed in Z03 *halvet* (Figure 118). Similar connections must be used in Z04 *eyvan* and Z05 *halvet*. However, collapses and late period interventions destroyed the details on these spaces.

*Pöhrenk*s used in the public bath are in 12x14x32 cm dimensions. T (Z02-Z03 connection etc.) and L (in the space corners etc.) shape *pöhrenk*s are used at special connection points (Figure 118). It is detected that nails are used between hot and cold water lines when the *pöhrenk*s are placed in channels located in Z03 and Z04 walls. These nails are hammered to the wall with 26-to-55 cm varying distances and are not completely buried inside the wall, rather a 10-12 cm of them remains outside (Figure 119). There are three marble *kurna*s on *Yeniçeriler Hamamı*, but they must not belong to this building (Figure 120).

Figure 117. The vertical and horizontal water channels in the east wall of the Z03 halvet of *Yeniçeriler Hamamı* (left) and the detail of the vertical channel (right)

Figure 118. The T shape *pöhrenk* used for water transfer from the hot water depot to the water distribution system within the building (left) and the L shape *pöhrenk* used at the corner (right) of the Z03 *halvet* of *Yeniçeriler Hamamı*

Figure 119. The nail used under the hot water *pöhrenk* placed in the water channel of the Z03 *halvet* of *Yeniçeriler Hamamı*

Figure 120. *Kurna*s placed in the *sıcaklık* spaces of *Yeniçeriler Hamamı*

3.6. Mezit Bey Hamamı

Mezit Bey Hamamı is located in Sabuni District, at the intersection of Talat Paşa Street and Kıyık Street, between *Eski Camii* and *Selimiye Camii* (Figure 12). The public bath is placed in the 23 Plot, 408 Block, 20 Lot. The building, registered with an A86 inventory number, is located in "the urban protected area" by Edirne Conservation Development Plan enacted in 2007 (Figure 12).

Peremeci (1939, 97) states that the public bath is founded by Mezit Bey[49] and devoted to *Mezit Bey Camii* (Ayverdi, 1989a, 468). Mezit Bey is known to pass away in 1442 (Ahmet Badi Efendi, 2014a, 228). In addition, it is also known that *Mezit Bey Camii* was built in 1440-1441 and *Mezit Bey İmareti* in 1441-1442 (Ahmet Badi Efendi, 2014a, 117, 228). *Mezit Bey Hamamı* construction must have completed between 1440-1442.

File of the public bath at Edirne KVKBK is not available. However, it is known that the public bath has gone through a comprehensive repair at the 1990s. The single public bath belongs to private property and is still being used as a public bath. Ahmet Badi Efendi (2014a, 263) states that a timber roofing system was used on the *soğukluk* space. The roof system was renewed during the repairs, but timber roofing in accordance with the older system is preferred.

3.6.1. General Description of Mezit Bey Hamamı

All parts of the public bath, lying in the northeast-southwest direction, still stand today (Figure 121). The public bath extends a rectangular area of 11.5x23.5 metres size.

However, because of the recent alterations and the fact that it is still in use today, information on authentic construction techniques and authentic architectural elements cannot be obtained. Visual documents belonging to the building taken before the repairs are also very limited.

[49] In some documents, it is stated that; Peremeci said that Mezit Bey Hamamı is founded by Mezit Bey in 1942 but Mezit Bey is passed away at that time, so this building must have been constructed at an early date. However, Peremeci (1939, 97) said that this building is founded by Mezit Bey who passed away in 1942. This type of misquotations must have been as a result of misunderstanding.

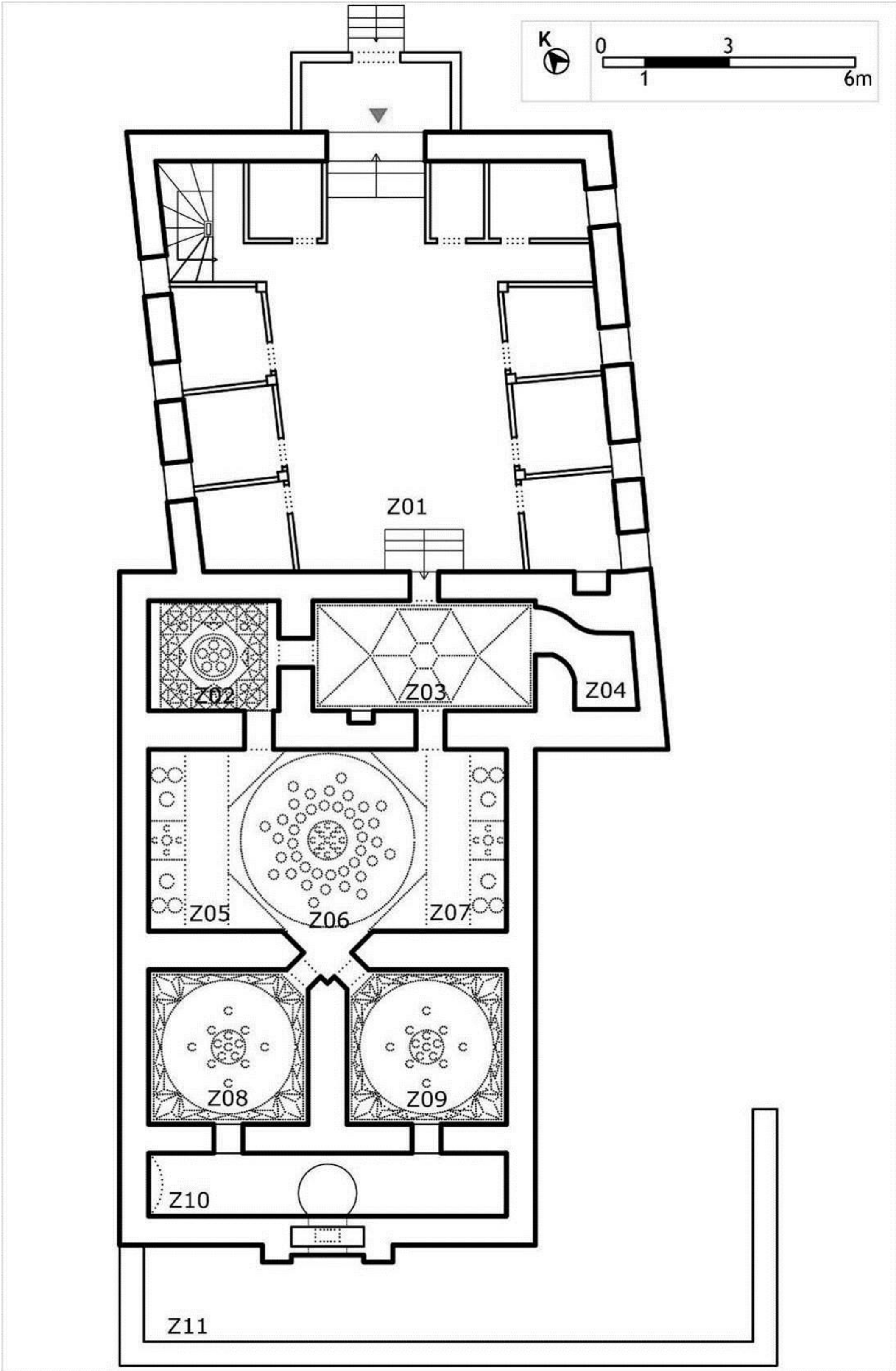

Figure 121. The plan and reflected ceiling plan of *Mezit Bey Hamamı* (according to new information gathered from site surveys, redrawn based on Büyükdığan, 1989: 324 and İlter Büyükdığan Photograph Archive)

a. Exterior description:

There is *soğukluk* on the northeast edge of *Mezit Bey Hamamı* (Figure 122). There is no information on the construction technique of walls because of the cement-base plaster layer applied on them in recent times.

Soğukluk, ılıklık, sıcaklık and water depot main walls are present on the northwest façade. However, the façade cannot be followed because of the commercial buildings placed its surroundings. It is seen that *soğukluk* is built by rubble masonry system from a photograph dated to 1971 (Figure 123). However, the resolution of the visual document is very low to follow any construction detail. The same photograph reveals that there are three windows and chimney at the upper levels of *soğukluk* northwest façade (Figure 123). This situation implies that *soğukluk* was heated by a different system unlike the other spaces. It also observed in the same photograph that there are totally six chimneys, two *tüteklik* chimneys for each bathing space, approximately 60 cm in length (Figure 123).

It is observed that the bathing spaces and depot walls on the southeast façade of the building are built by repetition of two brick and one cut stone courses (Figure 124). Authentic texture cannot be followed today due to wrong interventions.

There are water depots and *külhan* on the southwest edge of the building (Figure 122, Figure 125). It is understood that the *külhan* was functioning at the 1990s from the photographs taken during repairs.

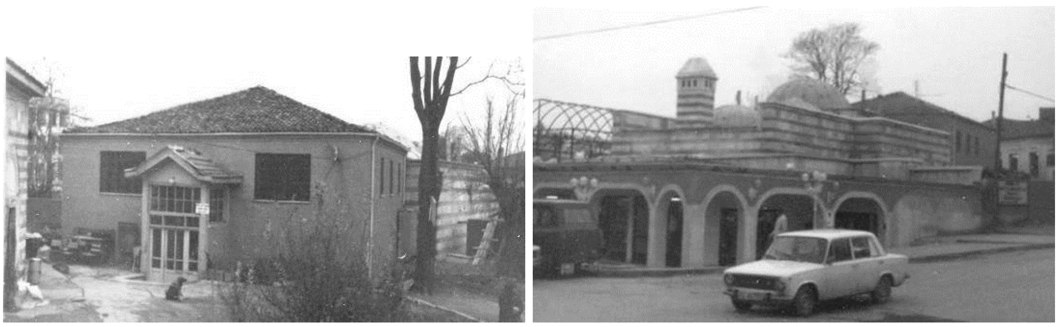

Figure 122. Images of the *Mezit Bey Hamamı* photographed from north (left) and south (right) (Source: İlter Büyükdığan Photograph Archive, the 1990s)

Figure 123. The north-west façade of *Mezit Bey Hamamı*, 1971 (Source: Machiel Kiel Photograph Archive)

Figure 124. The south-east façade of *Mezit Bey Hamamı*

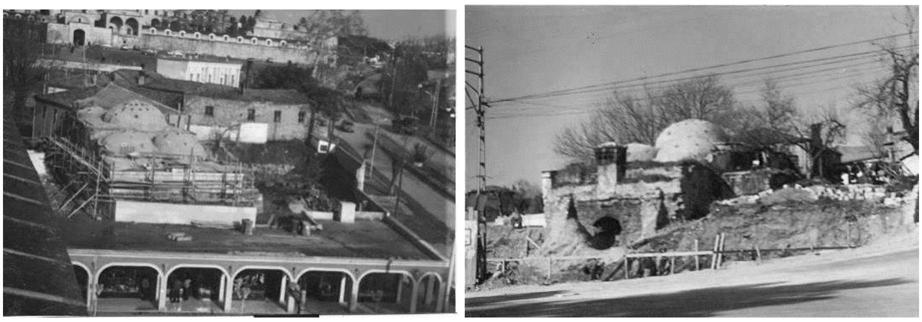

Figure 125. The south-west façade of *Mezit Bey Hamamı* (Source: İlter Büyükdığan Photograph Archive, the 1990s)

b. Interior description:

The public bath, built as a single bath, has a door on the northeast wall that opens to *soğukluk* space (Z01). The door at the southwest of this space opens to *ılıklık* main space (Z03). There is a *ılıklık* cell (Z02) at the west, toilet (Z04) at the east of *ılıklık* main space. *Ilıklık* main space is spanned with composite vault.

Two doors, one each at the southeast walls of Z02 and Z03 spaces provide entering to *sıcaklık* spaces. *Sıcaklık* is comprised of one main *sıcaklık* space (Z06) with *eyvan*s (Z05-07) on both sides and two *halvet*s (Z08-09) on the southwest of this space. According to the typology of Semavi Eyice (1960: 106-115, 120), “the type of plan that has elongated rectangular *sıcaklık* with a domed central space and two *halvet*s” (e) is used for this building (Figure 1, Figure 121).

Pendentives with muqarnas are used as transition element in *sıcaklık* main space, which is covered by dome with a circular planned *cupola* opening at the centre. Flat profiled vaults are used in *eyvan*s. *Halvet* located northwest of the sıcaklık main space, on the other hand, is covered with muqarnas dome. Domes with circular planned *cupola* openings and belt of Turkish triangles with *badem* are used in southwestern *halvet*s.

Two water control windows on the partition wall open to water depot (Z10) that extends along *halvet*s of the *sıcaklık* section. This space is spanned with a vault. As the building is still used as a public bath, the water depot was not examined.

Külhan is on the geometric centre of the hot water depot, on the southwest wall. Top of the *külhan* courtyard (Z11) is covered by a late period intervention and the courtyard is used as a storage area.

3.7. Topkapı (Alaca) Hamamı

Topkapı Hamamı is situated in Kaleiçi where the Byzantine settlement was placed, in Mumcular District and Topkapı Hamam Street (Figure 12). The building is placed at 17 Plot, 182 Block, 23 Lot. It is located to the east of the Old Bulgarian School. The building, with inventory number A136, is also called *Alaca Hamam*, most likely, because of the white limestone rows on its alternating walls. It is placed in “the interaction and transition zone”, by Edirne Conservation Development Plan approved in October 2007 (Figure 12).

During the Murad II era, a new door is opened on the Byzantine fortification walls near city armoury and a public bath is constructed across this door (Figure 6). Because of the presence of armoury, door and the public baths are named *Topkapısı* and *Topkapı Hamamı* (Abdurrahman Hıbri, 1996, 15).

According to the 80.5x46 cm sized inscription panel of the public bath protected in the Edirne Museum, the public bath is founded by Murad II (Onur, 1972, 11; Dijkema, 1977, 25), at 02.06.1440-21.05.1441, as a part of *Üç Şerefeli Camii Vakfı.* While Rüstem Paşa charged as vizier (1544-1561), expenses of the public bath were known to be afforded by *II. Bayezid Vakfı* (Abdurrahman Hıbri 1996: 24). Three massive floods, which occurred in 1509, 1657 and 1844, damaged a large area (Ahmet Badi Efendi, 2014b: 458; Osman, 1998, 23). It is highly possible that *Topkapı Hamamı*, 430 metres away and seven metres above the Tunca River (level of Gazi Mihal Bridge), was affected by these floods. 1733-1734 and 1745 fires caused damage in close surrounding of the public bath (Gökbilgin, 1994, 427; Peremeci, 1939, 26); 1902 fire in Kaleiçi caused the almost complete destruction of many buildings in this area (Akansel, 2004, 200).

The earliest description of a major repair of *Topkapı Hamamı*, translated from Ottoman Turkish to modern languages, is about the repair in 1576-1577 (from Günalan, 2005, Appendices: MAD year:984, no: 7534, page: 1276, edict no: 3750). According to the account books of this waqf, repair expense was above average in 1598 and 1608; very high in 1632,1637, 1639 and 1640 (Orbay, 2011: 161-162,164). The unexpected increases in the repair expenses must be due to earthquake, fire and floods mentioned above. For example, high expenses for the repair were done in 1637, 1639 and 1640, shortly after 1633 earthquake (Orbay, 2011: 164). Monthly income of the public bath was approximately 670 *akçe* in 1490, 230 in 1598, 420 in 1607, 750 in 1609, 720 in 1616, and 1255 *akçe* in 1632 (Orbay, 2011: 159-163).

Although there is no detailed information on the situation of the public bath in 17^{th}-18^{th} centuries, it is known to be used for the same purpose until the end of 19^{th} century (Ahmet Badi Efendi, 2014a; 261). At the beginning of the 1900s, after Balkan Wars the building was left empty and dragged in a fast destruction process due to external factors, neglect and removals of construction materials to use in other structures (Peremeci, 1939: s. 95).

Information taken from the files of the public bath (file no. 22.00.327 and 22.00.36) in Edirne KVKBK, the public bath transferred to a private ownership in an unknown date, and the owner applied to MEB-EEMGM on 03.09.1960 for destruction request. Ali Saim Ülgen and Semavi Eyice made a field study on 06.06.1961 upon this request and reported that the public bath must be protected because of its high aesthetical and historical values in the report prepared by Eyice (1962), within that context, *Topkapı Hamamı* and the lot where the public bath is located in is registered by MEB-GEEAYK with 07.07.1962 dated and 1592 numbered decision. According to the information on the report, traces of *soğukluk* space (Peremeci, 1939: 95), which was destroyed at the beginning of the 1900s, was still readable in 1961, *ılıklık* and *sıcaklık* spaces at the north were standing with all architectural elements (Eyice, 1962).

However, "Historical Monument" annotation was not added to the registered lot's land register section, and the lot was excreted by 12.11.1969 dated and 2277 numbered decision, and sold to different people (Türkdoğan, 1985). After excretion, the public bath lot was divided into five parts, and for two of them (17 Plot, 182 Block, 19 and 20 Lots) construction permission is given by 15.07.1972 dated and 6505 numbered decision. The other three lots (17 Plot, 182 Block, 21, 22 and 23 Lots) were designed and registered as a historical building for the second time with 4.05.1978 dated and 10370 numbered decision, and "Historical Monument" annotation was added on the land register sections with 14.05.1978 dated and 10370 numbered decision. [50]

The Ministry of Culture and Tourism- İstanbul Regional Council of Immovable Cultural and Natural Assets, under the Directorate of Semavi Eyice, ruled that *Topkapı Hamamı* should be conserved and used either with original function or with a new function by 25.07.1986 dated and 2431 numbered decision. However, the public bath emptied after Balkan Wars is still devastated today and it lost the static balance. The building is fast losing integrity due to comprehensive structural problems, serious material loss, biological formations and man-made damages.

3.7.1. General Description of Topkapı Hamamı

The existing part of the *Topkapı Hamamı* extends 28x13 metres in area and it is lying in the north-south direction. It is built as a double public bath, but only some parts of *sıcaklık* spaces and water depots reach today (Figure 126).

Among the standing parts of the public bath, east and south façades and the space located on the southeast corner cannot be examined due to housing, soil and garbage deposits.

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[50] Lot numbering system is changed today and the understandability of the past lot combinations and fragmentalizaitons is decreased. Lot numbers are given as the way they were in 1969 in the text. Lot numbers used today are as follows according to the maps used; 182/33 (old 19), 182/29 (old 20), 182/28 (old 21), 182/27 (old 22), 182/23 (old 23).

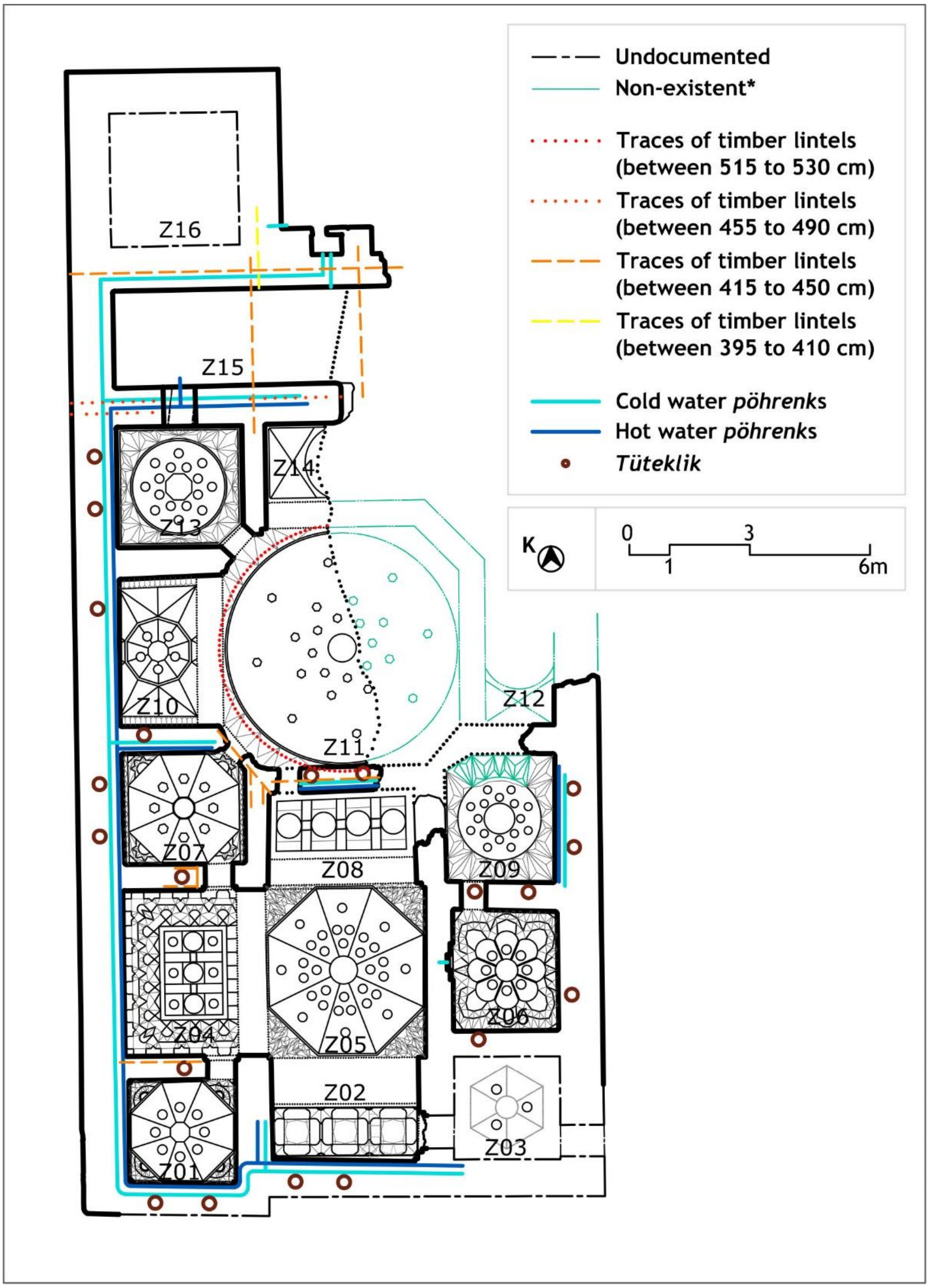

Figure 126. The plan and reflected ceiling plan of *Topkapı Hamamı* (according to new information gathered from site surveys, redrawn based on Büyükdığan, 1989: 322 and İlter Büyükdığan Photograph Archive)

a. Exterior description:

The south and east façades cannot be studied because of new buildings constructed on the lot which originally belonged to the public bath, building areas of these new structures being too close to standing parts of the public bath and surroundings of the public bath being used as garbage disposal area. On the north façade, only cold/reserve water depot main wall levels and standing part of the hot water depot can be followed due to collapses and deposits (Figure 127). On this façade, *maksem*, at the intersection of hot and reserve/cold water depots is remarkable because of its documentary value for water installation system of the building and connection to urban water network (Figure 128).

West façade of the public bath, almost completely standing, reaches up to four metres high (Figure 129). Main walls are built by alternating wall technique with successive repetitions of two brick and one rough cut stone courses. Rough cut stones are surrounded by vertical bricks. Changes in the masonry bond that begins approximately 40 cm below hot water depot vault level and continues on the upper levels indicate a comprehensive repair. At the same time, on the north façade, remaining empty areas of two timber lintels of 16x16 cm size used along the wall in Z13-Z15 partition wall and at the lower border of Z13 dome and *tüteklik* chimneys are also important traces helping to understand the structure.

Figure 127. The north-east view of *Topkapı Hamamı* (from left to the right: Z09 *halvet* of men's *sıcaklık*, Z11 main space of women's *sıcaklık*, Z14 *eyvan* of women's *sıcaklık*, Z15 hot water depot and Z16 reserve/cold water depot)

Figure 128. The *maksem* located on the north façade and between the hot and cold water depots of *Topkapı Hamamı* (top), *pöhrenk*s located between the *maksem* and the hot water depot (left-bottom) and the *pöhrenk* placed in the water channel into the north wall of hot water depot to transfer water to cold water system within the building (right-bottom)

Figure 129. The west façade of *Topkapı Hamamı*

b. Interior description:

The *Topkapı Hamamı* was constructed in *Kaleiçi*, an area with densest urban tissue during the 15th century including the old Byzantine settlement. An atypical plan scheme was applied in this public bath, most probably because of the limits of the building lot (above). Instead of side by side located *sıcaklık* spaces adjacent to hot water depot/water depots scheme, a scheme where only women's *sıcaklık* section adjacent to hot water depot (Z15) is applied. As a result of this, men's *sıcaklık* section remains distant to the main heating source, which must have been caused heating problems. Abdurrahman Hıbri (1996, 45) mentions that the public bath was not preferred especially in winter because of the coldness of men's section in the 17th century.

Soğukluk and *ılıklık* spaces did not stand today. However, according to the report of Eyice dated to 1962, it is understood that foundation traces of *soğukluk* space was observable at that time and indicated a timber roofing system.

Today, space on the southeast corner of the public bath that extends in the north-south direction (Z03), must be a transition space between *ılıklık-sıcaklık* where the entrance to men's *sıcaklık* is provided (Figure 126). However, it cannot be studied as the entrances of this space are closed by deposits.

Men's main *sıcaklık* space (Z05) is surrounded at three sides by Z02, Z04 and Z08 *eyvan*s (Figure 126).

There are two *halvets* entered through west *eyvan* on the southwest (Z01) and northwest (Z07) corners of main space. However, Z07 *halvet* opens to men's *sıcaklık* with a door on the south wall and with a door –later closed- on the east wall; and opens to women's *sıcaklık* with a door on the northeast corner. Only the arch form of the south door is similar to the other arch forms used as the same function in the building; hence it is thought that only the south entrance is authentic and the others are added in different periods. Even so, this situation brings the possibility that *Topkapı Hamamı* is converted to a single bath at an unknown period.

Today, the transition to spaces located at the east (Z06) and northeast (Z09) of men's *sıcaklık* is provided through women's *sıcaklık* (Figure 126). However, door opening used for passing from Z09 space to Z06 space indicates alterations. Presence of a *tüteklik* chimney above the door and a hole carved on the flagstone located on the floor level at the same line with *tüteklik* are supported the idea that this door is opened after the construction (Figure 130). Similarly, wall bonding system used in Z06 space west wall is different from the rest of the structure and is quite unqualified. From these traces, it is highly possible that Z06 and Z09 spaces were part of men's *sıcaklık* originally (Figure 126). According to the traces founded in the Z06 space, this space must have been used as *mikvah* authentically or after an intervention.

Entering to women's *sıcaklık* must be through east (Figure 126). However, a large part of the eastern *eyvan* (Z12), and the entire of the *halvet* that is supposed to be in the northeast is collapsed, therefore no information on the entrance is found. There is an *eyvan* (Z10) on the west, an almost completely collapsed *eyvan* (Z14) on the north, and a *halvet* (Z13) at the northwest corner of women's *sıcaklık* main space (Z11).

According to the typology suggested by Semavi Eyice (1960: 106-115, 120) (a) "cross-axial plan with four *eyvan*s and four corner *halvet*s" plan type is used on men's and women's sections of *Topkapı Hamamı* (Figure 1, Figure 126).

There are the hot water depot (Z15) and the reserve/cold water depot (Z16), filled with soil, on the north of the building (Figure 126).

It is known that at the beginning of the 1960s, *kurna*s were dismantled and still placed in the building (Eyice, 1962), however, no traces are observed today. The architectural elements that can be followed today are limited to doors, windows and niches. Door openings except for Z07 and Z06 *halvet* doors show similarity with respect to dimensions and forms. There were two water control windows on the partition wall located between the hot water depot and the women's *sıcaklık*. However, one of them, which opening to Z14 *eyvan*, is almost completely collapsed and the other one, which opening to Z13 *halvet*, is closed when the public bath was in use. A window located on the upper level of men's and women's *sıcaklık* partition wall is an intervention supporting the possibility of conversion of the double public bath to a single public bath, at an unknown period. There are three niches, on the same line with the upper level of door openings, in Z01 and Z07 *halvet*s and in Z04 *eyvan*. It is understood that these niches were *çırakman*s used to place artificial lighting elements like oil-lamps from the lampblacks on the inner surface of these niches.

Figure 130. The door opened after construction located between the Z09 and Z06 spaces of *Topkapı Hamamı* (left), the *tüteklik* chimney located above the door opening (right-top) and the carved hole on the floor pavement stone located on the floor level (right-bottom)

3.7.2. Construction Techniques and Building Materials of Topkapı Hamamı

Quite authentic and extensive information can be obtained on the load-bearing systems finishing techniques, installation systems and architectural elements used in bathing spaces and water depots of *Topkapı Hamamı*.

a. Foundations:

Floor pavement stones are not present but the *cehennemlik* level can be followed almost in all spaces on the photographs dated to the beginning of the 1970s (Kiel, 1971-1972). However, the floor level is raised 150-200 cm because of deposits currently. Only traces of the floor system and the upper part (approximately 40 cm) of foundation walls can be followed in Z07-09-13 *halvet*s (Figure 126, Figure 131). There is no information on *cehennemlik* footings.

Foundations are built by repetition of two brick and one stone courses alternating system with *horasan* mortar. Pavement levels are arranged by half-brick bonds on foundations in which point it is necessary. The full-length bricks used as masonry unit are in size of 27.5x27.5x4.5-5 cm.

Foundation walls start at original *sıcaklık* floor level, so 35 cm below *sıcaklık seki* level. It is observed that foundation wall is 10-15 cm thicker in both directions than superstructure wall alignments. Flagstones of 9 cm thickness, only the pieces of these stones reach today, are placed on these enlargements. These flagstones must have been used as beams by placing them on the foundation walls and *cehennemlik* footings. It is understood from the traces that floor beams are formed by placing 6-9 cm flagstones perpendicular to beams and on them. This surface is covered with a thick layer of *horasan* mortar. There are also two courses of brick bond at the bottom of walls where *seki*s are used (Figure 131). Floor pavement stones did not reach to present day. However, it is understood from the traces on *horasan* and wall plaster, that floor pavement is completed by adjacently placing 10 cm thick fine-cut stones on the mortar.

Openings:

There is a limited number of 40x40 cm sized openings continuing along the wall thickness at the *cehennemlik* level, used for fumes flow below the walls, observable on the foundation walls. These openings are crossed by roughly shaped stone lintels (Figure 140).

Figure 131. Traces of the floor system and marble plates used as wall covering material in the Z07 women's *sıcaklık halvet* of *Topkapı Hamamı*

b. Masonry Walls:

Partition walls that still stand today are 70 cm thick, while main walls and water depot walls are 80-110 cm. Masonry walls are built by using rough cut stones, cut stones, bricks with 27.5x27.5x4.5-5 cm dimensions and half-length bricks, with 2.5 cm thick lime-based mortar. These walls can be divided into three main groups according to their construction techniques.

The first group is comprised of alternating walls used in all outer walls and most of the partition walls (Figure 129). These walls are built by repetition of two brick-one rough cut stone surrounded by vertical bricks courses along the wall thickness. At the levels of transition elements or water lines, three brick courses used instead of two in order to achieve necessary height. Bricks are used either in full or in half-length, while the dimensions of rough stones vary between 15 and 45 cm in width and 20-25 cm in length. Cut stones of sizes up to 30x50 cm are used on the corners and opening sides.

The second group is the masonry walls built by rough-cut stones and bricks. This system, followed in some partition walls, is comprised of brick and rough stones up to 40x50 cm dimensions on the outside and relatively small stones and brick pieces on the inner sides. This technique was not used in structure general but only in some specific areas on a limited number of walls, this situation, brings the possibility of a period intervention.

The third group is brick masonry walls. This bonding system is detected in chamfered Z07 space northeast corner and southeast corner of Z13 space, where the door is placed (Figure 132). The total length of these walls, located between the door arches and transition elements, is approximately 160 cm in width on the outside and 75 cm inside; this situation, the relatively narrow dimensions of these areas, may have forced the use of this type of bonding system.

Figure 132. The door located between Z11 and Z13 women's *sıcaklık* spaces (left) and the projected phyllite plate used under the spring level of the arch located between the Z10 and Z11 women's *sıcaklık* spaces of *Topkapı Hamamı* (middle and right) on the *Topkapı Hamamı*

On the north façade of the building, some details are important such as 40 cm wide brick courses beginning on the spring line of hot water vault, the irregularity on the alternating wall (Figure 129) and partial use of vertical bricks on Z05-Z06 partition wall (Figure 133). These areas, different from the other techniques widely used in the building, hence the stone sizes getting smaller, brick thicknesses decreasing below 3.5 cm and unqualification of bonding are the signs of a comprehensive repair.

There are timber lintel traces of 16-18x16-19 cm dimensions that can be partially followed in *sıcaklık* spaces, just above the channel of clean water distribution system, comprised of one or two lines inside the wall (Figure 126, Figure 127, Figure 129, Figure 138). At the same level, the timber lintel traces with 16-18x18-19.5 cm dimensions continue along the water depot walls. Lintels are connected to each other by *puştuvans* perpendicular to the lintels placed inside the wall thickness with certain distances; the wall must be surrounded all around by lintels continuing throughout the wall.

It is understood from the traces on the hot water depot (Z15) that the lintels here are placed by a different system from the rest of the spaces. It is seen that some of the *puştuvan*s on the longer side of the water depot are used to connect timber lintels embedded on the parallel long walls. One in each three *puştuvan*, with 270-370 cm distance between each must be connected to the lintels on the other wall by lying along the space in the open placed parallel to the short wall of the water depot (Figure 126, Figure 127).

Traces on the north façade on the partition wall presents between Z13 and Z15 spaces reveal that, on the upper levels of the walls, two lines of lintels of 15x15 cm size, embedded inside the wall thickness where the system changed between walls and upper structure.

Arches, Openings and Niches:

Openings of 355-360 cm width in women's *sıcaklık*'s north, west and south sides and men's *sıcaklık*'s north and south sides; 410 cm width in men's *sıcaklık*'s east and west sides are spanned by ogee arches. Only the arch on the south side of men's *sıcaklık* is 140 cm thick, the rest are 60 cm thick. The spaces present under the arches on the north and east side of men’s *sıcaklık* are filled with masonry system. The other openings under the other arches are left empty and provide a transition to *eyvan*s.

A course of flagstones, used in arch springs, with 6-8 cm thickness are placed so that they make 25 cm projections from the vertical axes of walls (Figure 132). 60 cm arches starting by 10-15 cm recessed above the flagstones are built by two brick next to each other and successive one half brick-one brick-one half brick courses and 140 cm arch is built by four brick and one half brick courses with shifting joint alignments. Different from the walls, use of the bricks with 27.5x27.5x4.5-5 cm and 13.5x27.5x4.5-5 cm dimensions together with 24x27.5x4.5-5 and 13.5x24x4.5-5 cm dimensions are also seen on arches.

Pointed arches built by single half bricks are used to cross approximately 65 cm wide *halvet* door and water control window openings (Figure 132). The niche openings with 16x20x6 cm dimensions are spanned by symmetrical two half bricks, placed perpendicular to each other, stood on the side of the niches with approximately 45° angle so that they touch at the top. A circular appearance is given to triangular profile formed by these two bricks by plaster.

Finishing Techniques:

No traces of plaster use are observed on outer façades. In hot water depot, 1cm lime plaster is used on top of 3-3.5 cm thick pink *horasan*. Two layers of plaster with similar properties are observed on all *sıcaklık* walls interior surfaces. At the bottom/first layer is 3cm thick light pink *horasan* plaster. 1cm lime plaster is used on top of it and painted with lime wash. At some parts, 1.5 cm light pink *horasan*, 1cm lime plaster and lime wash is observed on the first lime wash layer, as a late period repair. All plasters are finished with a concave arc profile gradually narrowing on the lower level of the walls extending 3cm from wall to floor pavement.

Physical properties of different period plasters are quite similar. Different from other plasters, only in the west wall of Z06 space, use of light pink coloured lime plaster with straw pieces visible to the naked eye is observed.

There are traces of floral ornaments applied by two different tones of dark paint which belonging to different periods on the early period plaster and lime layers in the east wall of Z02 space and south wall of Z04 space (Figure 134).

Use of profiled, joggled, dark single coloured marble plates with 40x40x2 cm dimensions is observed as wall covering material on Z07 space wall surfaces (Figure 131). These plates placed on top of 3 cm *horasan* plaster below the water line. The backside of some marbles have a rough surface and there is no indication of metal etc. elements to fix them on to walls, hence it is thought that these marbles are fixed on the walls by *horasan* plaster.

Stucco is used on the walls only on the spring levels of arches in men's *sıcaklık*, on muqarnas providing a soft transition between arch-endings and wall surfaces (Figure 134).

Figure 133. The east wall of the Z05 *sıcaklık* main space located in the men's section of *Topkapı Hamamı*

Figure 134. Remains of floral ornaments belonging to different periods on the east wall of Z02 *sıcaklık eyvan* located in the men’s section of *Topkapı Hamamı*

c. Transition Elements and Upper Structures:

Topkapı Hamamı has a rich plastic effect with its transition elements and upper structure systems. Women’s *sıcaklık* main space (Z11), Z09 and Z13 *halvet*s are spanned with domes where the belt of Turkish triangles are used as transition elements. In men’s *sıcaklık* main space (Z05), Z01 and Z07 *halvet*s, pendentives are used for transition to octagonal form and spaces are covered with eight-lobed-domes. Muqarnas transition area and eight-lobed-dome are used together, even integrated, in Z06 *halvet* (Figure 135). Square planned *eyvan*s (Z02,04,08,10,12,14) and hot water depot (Z15) are covered with *aynalı* barrel-vault, barrel-vault with support arch, rib vault and composite vault (Figure 126).

Transition elements are used to transfer the load of dome and vaults to walls, to narrow the space plans and make them suitable to form designed for upper structure. The main structure of transition elements are built by horizontally and vertically used 27.5x27.5x4.5-5 cm and 24x27.5x4.5-5 cm sized bricks and half-length bricks, and 19-20x19-20x4-4.5 cm sized bricks (Figure 136). Bricks are placed parallel to wall alignments or diagonally to form the main geometry of planned form (Figure 136).

There is no connection trace on stucco ornaments indicating that it was directly applied to the brick main structure, meaning ornaments were formed in situ (Figure 134, Figure 135).

Domes of *Topkapı Hamamı* were built by using the three types of bricks in full and half size like transition elements (Figure 136). Domes start with one and a half brick thickness and narrowed towards upper levels, and end up with one brick thickness at the top. In women's *sıcaklık* main space dome, sides of the bricks with 27.5x27.5x4.5 cm dimensions used on the interior façade of dome are shaped to form a slightly concave arc. Mortar thickness varies between 2-to-6 cm, depending on the placement angle of bricks.

At the spring line of the women's main *sıcaklık* space dome, traces of timber lintels with a cross-section of 16x20 cm, appears to surround the dome all around (Figure 126, Figure 127). This timber element, placed at the beginning of the dome is formed by curved (in harmony with dome plan) timber elements connected to each other and must have been used as tension ring.

Another precaution against the disintegration tendency of the shell caused by tensile stress at the lower parts of the dome is the drums built by stone and bricks, so as to surround the dome's extrados (Figure 127, Figure 136, Figure 137).

Aynalı barrel-vault in hot water depot is built by one brick and one half-brick lines. There is an interesting dog paw trace of 8cm size on one of the bricks, most probably formed during the air-drying stage (Figure 136). Only one of the top windows used in the vault can be observed. Change in brick bonding system in the west edge of the vault indicates an early period repair.

The fairly rare[51] upper structure of *eyvan*s of men's *sıcaklık* section is quite valuable for their aesthetics and techniques, such that Eyice (1962) stated only these are enough to ensure a protection of this building (Figure 139).

In *eyvan* plans, targeted sized of rectangular is obtained by muqarnas and simple projections of no more than 10 cm, and then the areas are divided into three or four equal pieces (Figure 126, Figure 139). These divisions in the west (Z04) and north (Z08) *eyvan*s are formed by placing stone bolsters making 15 cm projections, then placing stone support arches comprised of two voussoirs and one stalactite keystone parallel to the short sides of the space (Figure 139). The formed rectangular openings are covered by depressed profiled vaults in one brick thick, and empty

[51] Litarature search considering the region and period, it is found that uppersturctures similar to that of *Topkapı Hamamı* men's section *eyvan*s are only found in Selanik *II. Murad/Bey Hamamı*, built again by Murad II in 1444; for the photographs see: Machiel Kiel Fotoğraf Albümü [http://www.nit-istanbul.org].

spaces are formed at the top of the vaults for *cupola*s. Also, *oculi* are used in west *eyvan* that has bigger divisions.

Vertical brick and on top of them horizontal bricks are placed on transition elements of the south *eyvan* (Z02) vault (Figure 139). The openings spanned by the use of flat vault; and suitable spaces for *cupola*s are formed by six courses of bricks in different directions, with an appropriate angle to form an equal octagonal inside.

Among the vaults built by bricks and few numbers of stone units, an exceptional application appears only in Z14 space rib vault as a result of collapses. Three white coloured blocks are used at the same alignment and symmetrical to the 10 cm projecting flagstone at the north end (Figure 138). Space formed by damage occurred on the flagstone on the south used in the original structure, must be altered with new units/white blocks produced in brick sizes.

Openings:

Cupola openings are related to the dome shape in some domes; however, in the circular, hexagonal and octagonal plan in others, independent of the dome shape. *Oculi*, on the other hand, are in the circular or hexagonal plan. In circular ones, cylindrical baked clay elements narrowing outwards (inner diameter 15, outer diameter 30 cm) are placed inside the space formed by brick bonding. There is no information on how these openings, formed for the daylighting system, are closed with glass elements.

Finishing Techniques:

2 cm thick light pink *horasan* plaster and a thin layer of lime wash are used on interior surfaces of transition elements and upper structures (Figure 136). On the upper structures known to be repaired, single plaster layer is found contrary to main walls.

The is no information on how the upper structures' extrados are covered. Only, it is known that two courses of *kirpi saçak* are used on the drum of women's *sıcaklık* main space dome (Figure 137).

Figure 135. The muqarnas dome used in the Z06 *halvet* of *Topkapı Hamamı*

Figure 136. The fallen part of the Z11 dome (top), the fallen part of the Z09 belt of Turkish triangles (left-bottom) and the dog paw trace on the brick used in the Z15 vault (right-bottom) of *Topkapı Hamamı*

Figure 137. The north-east view of *Topkapı Hamamı* in 1988; from left to the right: the main space of women’s *sıcaklık* (Z11), the north *eyvan* of women’s *sıcaklık* (Z14) and hot water depot (Z15) of the *Topkapı Hamamı* (Source: İlter Büyükdığan Photograph Archive)

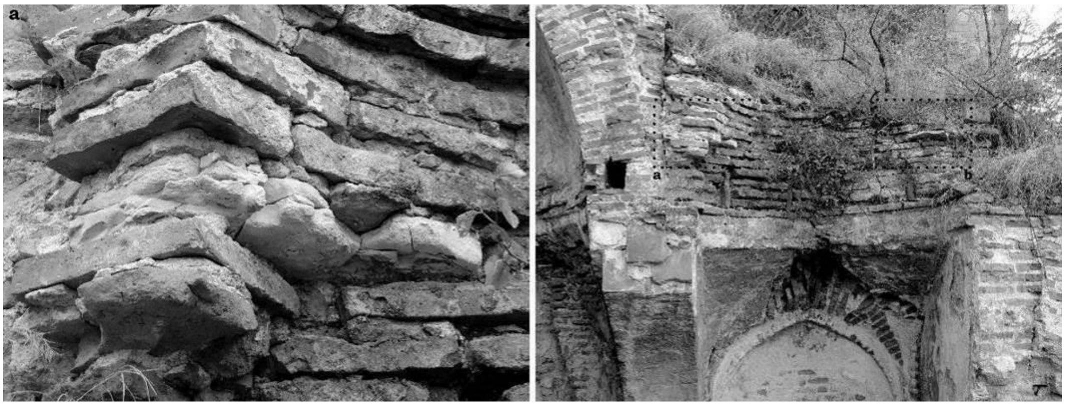

Figure 138. The stone plate used in the vault of the Z14 *sıcaklık eyvan* located in the women’s section of *Topkapı Hamamı* (b) and three white unit used as repair materials in the Ottoman period (a), which are located symmetrically

Figure 139. The vaulting systems used on the *sıcaklık eyvan*s of the men’s section of *Topkapı Hamamı*, from top to the bottom: the Z04, Z08 and Z02 *eyvan* vaults

d. Installation Systems:

There is no information on drainage system as pavement stones of *ılıklık* and toilet spaces of *Topkapı Hamamı*, spaces where water drainage from the building was done, did not reach today. However, there are many authentic details on clean water distribution and heating systems on the standing parts of the building.

Clean Water Distribution System:

There are traces of water line continuing along the wall thickness on the south end of the reserve/cold water depot east wall. However, soil deposits do not permit detailed study. Information was not found on hot water depot walls about the connection between two depots. The first space where information on how water is transmitted into the building is the *maksem* at the corner where depots intersect (Figure 126, Figure 128).

Maksem, at the water depots intersection, looks like a 75x225 cm sized tooth on the outside. There is a 75x60x75 dimensioned space plastered with approximately 3 cm thick pink *horasan* and three *pöhrenk* lines inside *maksem*. Water provided from the urban network is connected to the building via these three *pöhrenk* lines. The eastern *pöhrenk* transmits water directly to the hot water depot. Water is heated here, then connected to the hot water line of the public bath from Z13 space north wall by *pöhrenk*s spanning along the wall approximately 160 cm below the *maksem* level. Similar connections from the hot water depot to bathing spaces' hot water system must be used from various points on this wall. However, because of the soil deposit and demolitions, other parts of the partition wall could not be examined. Western *pöhrenk* coming from the *maksem* is connected to the bathing spaces' cold water system located at a level approximately 140 cm below, by spanning the cold water north and west walls horizontally (Figure 141) and continuing vertically on the northwest corner of Z13 space (Figure 140). The third one is transferring water from the *maksem* to cold/reserve water depot directly.

There are channels on the masonry walls, starting approximately 30 cm above *seki* level, with 40 cm height and 26-28 cm depth, top of which are covered with flagstones (Figure 140, Figure 141). There are hot and cold water *pöhrenk*s placed by approximately 5 cm thick pink *horasan*, inside these channels. It is observed that a course of brick is placed between the cold water (top) and hot water (bottom) *pöhrenk*s. The open front sides of the water channels are closed by vertical bricks with pink *horasan* and by this way, wall surface alignment is reached.

The *pöhrenks* with 10x14x41 cm dimensions are linked placing one within the other, *lökün* is used at connection points. Chalk layer resulting from the calcium in the water on the upper levels of the *pöhrenk* inner surface could be observed in all *pöhrenk*s (Figure 128).

Another important detail about the water installation system is the *pöhrenk* line filled with lime mortar embedded in the partition wall of hot water depot and (Z15) women's *sıcaklık* northwest *halvet* (Z13) (Figure 140). This downward line was placed at 28° angle, is connected to *halvet seki* level from depot floor level.

Figure 140. The north wall of the Z13 *sıcaklık halvet* in the women's section of *Topkapı Hamamı*: the vertical water channel used for transferring water from *maksem* to the cold water distribution system within the building (a), the horizontal water channel in which hot and cold water *pöhrenk*s were placed (b), the hot water connection *pöhrenk* located between the hot water depot and the hot water distribution system within the building (c), the water discharge *pöhrenk* placed between the hot water depot floor level and *sıcaklık seki* level (d) and the fumes flow opening at the *cehennemlik* level (e)

Figure 141. The cold water *pöhrenk*s placed in the water channel into the north and west walls of the hot water depot of *Topkapı Hamamı*, which transfers water from *maksem* to the cold water distribution system within the building

<u>*Heating System:*</u>

Külhan of *Topkapı Hamamı* is completely demolished. The floor of the hot water depot is covered with the collapsed pieces of the building and soil. There is no information on the *cehennemlik* plan, *cehennemlik* footings and *cehennemlik* pavement. *Cehennemlik* level can be followed only in a very limited area because of the deposits in the bathing spaces.

Fumes flow opening underneath wall can be followed on Z13 space north foundation wall (Figure 140). The opening of 40x50 cm size is crossed with roughly shaped stones. Fumes chambers that provide fumes access to *tüteklik* chimneys can also be followed in this space. Chambers is crossed by corbel arches, formed by bricks on the foundation wall making 2-3 cm projections towards the opening centre.

Tüteklik chimneys, 19-25 cm diametered circular spaces, are formed by roughly shaping the bricks and carving suitable holes on the flagstones on floor level (Figure 126, Figure 130). These chimneys continue throughout foundations and superstructures and are placed with 100-130 cm distances. *Künk*s are placed in chimneys and fixed with 4-5 cm thick pink *horasan*. Front façades of the chimneys are closed by masonry wall.

3.8. Kum Kasrı Hamamı

Kum Kasrı Hamamı is located in Yeni İmaret District, Edirne *Yeni Saray* Archaeological Site and placed at 51L-IVb Plot, 795 Block, 1 Lot (Figure 12). It is found in the northeast of Kum/Kum Kasrı Square of the palace complex (Figure 143, Figure 144) and registered with A167 inventory number.

As described in Edirne settlement history in detail (see Chapter 2.3), two palaces are built in Edirne during Ottoman era; *Saray-ı Atik* (first one) and *Saray-ı Cedîd-i Âmire* (second one). *Saray-ı Cedîd-i Âmire* is built west of Tunca River, at *Sarayiçi* location (Figure 142).

Saray-ı Cedîd-i Âmire construction started in 1450, during Murad II era, and new structures are added every year to this complex (Özer, 2013, 1). It is thought that *Kum Kasrı Hamamı* is built in Mehmed II era (1451-1481) (Erken, 1973, 417; Ayverdi, 1989b, 264). 1752 Edirne earthquake is known to cause structural damage to many structures of *Saray-ı Cedîd-i Âmire* (Ambraseys, Finkel, 2006: 116).

Public bath was known to be repaired in 1875 by *Vali Hacı İzzet Paşa* because of the possibility of a few-day visit from *Sultan Abdülaziz* (Ünver, 1940, 255). Near the end of 19th century during the Ottoman-Russian war, Russian army entered Edirne in 1877 and palace complex that was being used as armoury, was set on fire by Ottoman army (Ünver, 1940, 256'dan: Rıfat Osman, *Edirne Sarayı Cedidi Âmiresi*). Only limited number of structure among 70 different buildings, each given different functionalities, of palace complex reached to present day; *Kum Kasrı Hamamı* is one of them (Figure 145).

The public bath is known to be used for military purposes in the 1960s. During that period, *soğukluk* partition wall surface and floor are covered with cement mortar, floor pavements of *aralık*, *ılıklık* and *sıcaklık* are removed (Özer, 2013, 16). Photographs dated to 1970 reveal that repairs were done on the upper levels of main wall and upper structure with the cement-based material (Figure 144).

Property of public bath belongs to state treasury according to the information on public bath's file (file no. 22.00.1929) found in Edirne KVKBK. The public bath is within the borders of 1st degree Archaeological Conservation Area by 04.07.2003 date and 7697 numbered Edirne KVKBK decision. The public bath is registered as "1st Group Cultural Property in Need of Protection" by 04.07.2003 dated and 7697 numbered Edirne KVKBK decision. The council decided preparation of conservation projects of public bath with 05.11.1999 dated and 660 numbered principle decision. Architectural drawings, material and deterioration drawings, restitution project and conservation project were approved in 2010. Conservation project of the building was applied and landscaping was done in 2011.

Archeological excavations continue since 2009 by a team under the Directorate of Prof. Dr. Mustafa Özer in behalf of KTB and Trakya University in *Yeni Saray* Archaeological Site that involves *Kum Kasrı Hamamı* with Council of Minister's 11. 05. 2009 dated and 2009/14995 numbered decision and 21.07.2009 dated and 140216 numbered licence (Özer, 2013, 2).

Lüle, çini (glazed tile), *künk*, tile, iron, marble and stone archaeological objects are recorded in *Kum Kasrı Hamamı* during excavations. The archaeological excavations conducted around the public bath revealed the wall ruins placed 70 cm under the current ground level that belongs between the public bath and the *Kum Kasrı* and located on the northwest of the public bath (Özer, 2013, 15-16, 19) (Figure 143). In addition, a water distribution system on the ground level extending towards Tunca River was revealed (Özer, 2013, 15-16, 19) (Figure 143).

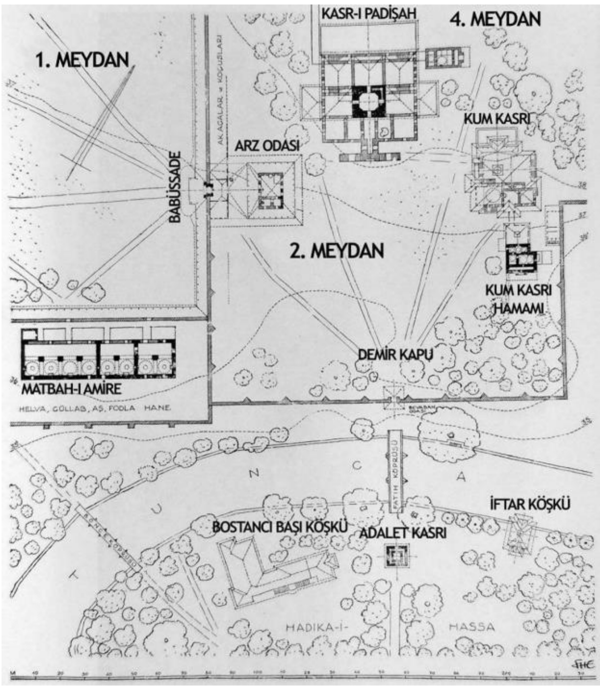

Figure 142. The site plan of *Yeni Saray* Archeological Site, in which the *Kumkasrı Hamamı* is located (Source: Kazancıgil, 1994, 22)

Figure 143. The west view of the *Kum Kasrı Hamamı* and the remains of the *Kum Kasrı* located north-west of the public bath (left) and the north view of the *Kum Kasrı Hamamı* (right) (Source: Özer, 2013, 39-photo 51, 40-photo 53)

Figure 144. The east view of the *Kum Kasrı Hamamı* (Source: Machiel Kiel Photograph Archive, 1970)

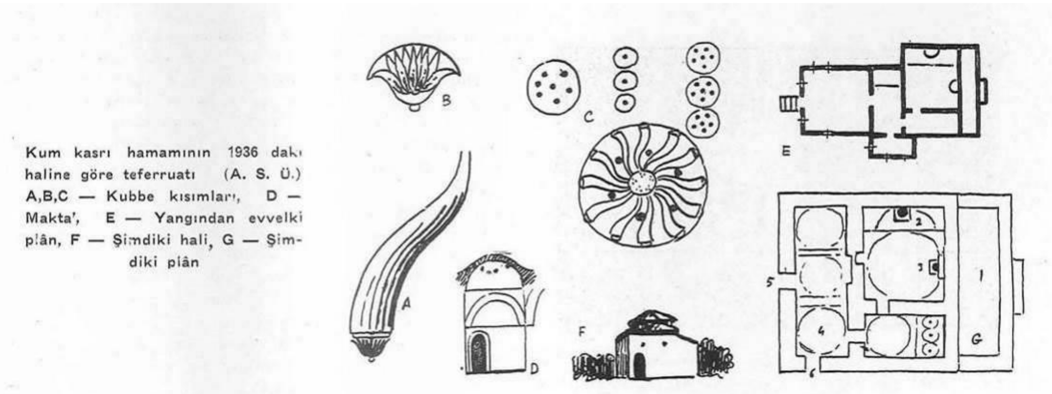

Figure 145. Drawings of the *Kum Kasrı Hamamı* prepared by Ahmet Süheyl Ünver in 1936 (Source: Ünver, 1940, 257)

3.8.1. General Description of Kum Kasrı Hamamı

The public bath stands an area of 24x12 metres in the northwest-southeast direction (Figure 146). Bathing spaces, water depots and *külhan* of the public bath is standing and ruins of *soğukluk* walls exist today.

Archeological excavation studies under Prof. Dr. Mustafa Özer's directorate revealed traces of architectural elements of *soğukluk* spaces', also authentic floor level of bathing spaces and water depots.

There is a ruin attached to the main wall of the public bath at eastern façade, built by brick masonry system and covered with barrel-vault. When the construction techniques are considered, it is thought that this structure was built in a later period and is not directly related to the public bath (Özer, 2013, 20). Özer (2013, 20) states that this space is a fountain and its depot. This structure is not examined in this study, as it does not have any direct connection to the public bath.

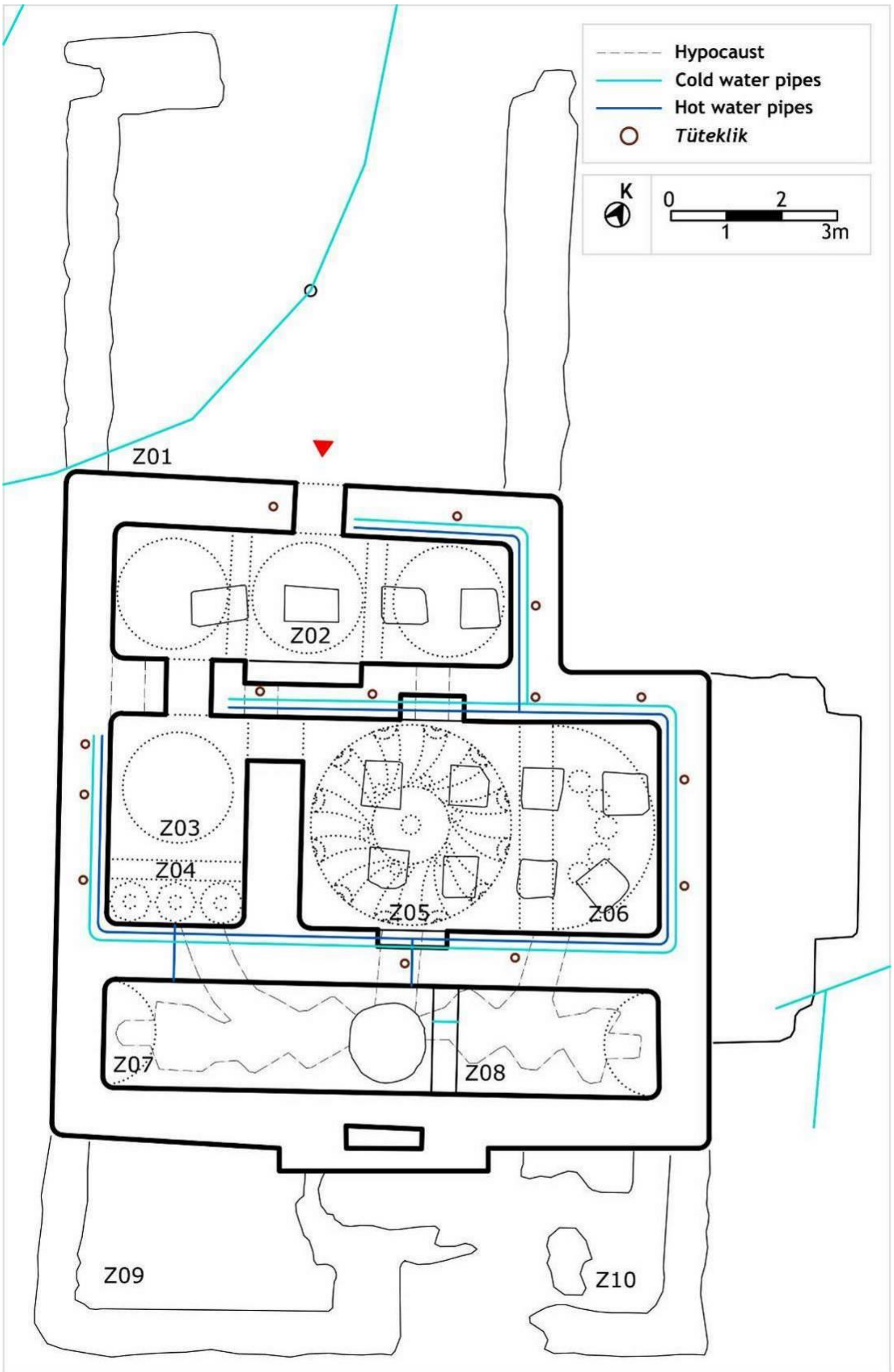

Figure 146. The plan and reflected ceiling plan of *Kum Kasrı Hamamı* (according to new information gathered from site surveys, redrawn based on Aydın, Aydın, 2010)

a. Exterior description:

There is *soğukluk-aralık* partition wall on the northwest façade of the building (Figure 147). This wall is approximately nine metres long and five metres high. There is an arched door opening at the centre of the wall. This door was closed until 2011 by a late period intervention and reopened during conservation studies. Traces of *soğukluk* main wall can be followed on two edges of the façade. The wall is built by one or two brick and one rubble stone courses on top of each other. Stone blocks are surrounded by single vertical bricks. Use of four courses of brick at the upper level of the door opening and at about one metre above is observed. In addition, use of cut stone on the upmost two courses of the wall and difference in the dimensions of stone units compared to rest of the building is noticed.

Aralık, *ılıklık* and water depot main walls, on the southwest façade of the building, are twelve metres long and six metres high and their main walls are built by repetition of two brick and one rubble stone courses (Figure 148). Stones are surrounded by single vertical bricks. Local areas where cut stones are used instead of rubble stones must belong to period interventions. At the lower levels of this façade, *cehennemlik* main walls of one metre are observed on photographs dated to 2009 (Figure 143). Ruble stone masonry system is used in *cehennemlik* walls. There is a door opening at the north end of the wall, which is considered as a period intervention (Özer, 2013, 17). There are traces of two *çörten*s at the north side of the wall, on the upper level (Figure 148).

Water depot main walls and *külhan* is observed on the southeast façade of the building (Figure 149). The wall is approximately twelve metres long and four metres high. First one metre length of the wall on the level of the *cehennemlik* section is built by rubble masonry system. Main walls of water depots are built by repetition of one brick and one rubble stone courses. There are some areas where cut stones are used, must be constructed while an intervention. Square formed window on the west end of the wall also indicates a period intervention. Two brick and one rubble stone courses are used on *külhan* walls, which make approximately fifty cm projection from the wall. There are two water drainage pipes/*künk*s/*pöhrenk*s at two sides of *külhan*, 110-125 cm below water depot floor level (Özer, 2013, 20). It is known that there is another pipeline at the upper level of these *pöhrenk*s; however, these pipelines cannot be observed due to soil deposits. Today, the *külhan* arch is closed by bonding up to the spring line.

Northeast façade of the building, twelve metres long and five metres high, includes water depot, *sıcaklık* and *aralık* spaces main walls (Figure 143). Three different bonding systems are used from bottom to top on the part of water depot and *sıcaklık* space main walls. These are, rubble masonry walls observed up to 2.5 metres height (1), approximately one metre high three brick-two rubble stone surrounded by single vertical brick courses alternating walls (2) and repetition of one course brick and one course rubble stone surrounded by vertical single brick alternating walls at the last one metre. This variation in wall bonding system indicates the wall has gone through comprehensive repairs and interventions at different periods. On the observable parts of *aralık* main walls, same wall bonding systems are used with that of northeast façade. In addition, 50 cm high *cehennemlik* main walls are built by rubble stone masonry system.


Figure 147. The north-east façade of *Kum Kasrı Hamamı* in 2009 (Source: Özer, 2013, 34-photo 34) (left) and in 2014 (right)


Figure 148. The south-west façade of *Kum Kasrı Hamamı* in 2009 (left) (Source: Özer, 2013, 34-photo 35) and in 2014 (right)

Figure 149. The south-east façade of *Kum Kasrı Hamamı* in 2014

b. Interior description:

There is *soğukluk* (Z01) at the northwest edge of the public bath. Wall ruins of this space are revealed as a result of 2009 archeological excavation studies. Traces of vertical *künk* system at the geometrical centre of the space strengthens the possibility of the presence of a *şadırvan* in this space.

The arched door on the *soğukluk-aralık* partition wall on the northwest façade opens to bathing spaces. Long rectangular planned *aralık* (Z02) is divided into three equal parts with three arches, pendentives are used as transition elements and openings spanned with semi-circular domes. Traces about the daylighting system cannot be followed due to interventions.

The door on the south edge of *aralık* (Z02) opens to *ılıklık* main space (Z03). There is *ılıklık eyvan* (Z04) at the southeast end of the space. The arched door on the northeast wall of *ılıklık* main space (Z03) opens to *sıcaklık* main space (Z05). There is *sıcaklık eyvan* (Z06) at the northeast of this space.

Many details on water distribution and heating systems can be followed in *aralık*, *ılıklık* and *sıcaklık* spaces. It is understood from these traces that all of these spaces (Z02-03-04-05-06) are hated by the fumes of *külhan* fire and hot and cold water is distributed to all these spaces. Traces of *kurna* can be observed in most of the spaces; however, *kurna*s and fountains are stolen after Balkan wars, after structures located in *Sarayiçi* are ruined (Kazancıgil, 1995, 139).

Water control window at the southeast wall of *sıcaklık* main space (Z05) opens to water depots (Z07-08). The space is divided into two with an approximately one metre masonry wall and west part is used as hot water depot (Z07) and east part is used as cold water depot (Z08). There is *külhan* on the southeast wall of the hot water depot and circular copper caldron pit at the geometrical centre of the water depot floor.

Archeological excavations reveal traces of walls belonging to two spaces (Z09-10) at the southeast of water depots. One of these spaces is determined to be a storage area in which woods to burn and transiently ashes from the *külhan* is placed. No information is given about the other space (Özer, 2013, 20).

3.9. İbrahim Paşa Hamamı

İbrahim Paşa/Kara İbrahim Paşa/Zen-i İbrahim Paşa Hamamı is situated in Kıyık District, on Araplar Street, near *Musalla Mezarlığı* (cemetery) and *Musalla Çeşmesi* (Figure 12). The building is placed at 50L-IIc Plot, 723 Block, 3 Lot and registered with A31 inventory number by Edirne KVKBK. The 1st, 2nd and 4th lots of 723 block, which are occupied by unauthorized residential, are under protection as public bath lots.

It is understood from the 1484-1485 dated endowment documents of waqf that Hundi Hatun, wife of İbrahim Paşa, one of the viziers of Mehmed II, founded the public bath on the second half of 15th century (Erken, 1973, 413; Kazancıgil, 1999, 59-62). Abdurrahman Hıbri (1996, 45) says that the public bath was built in 1462-1463. There is *Musalla/İbrahim Çeşmesi* one hundred metres southwest of the public bath and a masjid just west of the bath belonging to the same waqf. However, only part of the minaret pedestal reached today.

It is built as a single public bath and *soğukluk*, which did not reach today, is covered with timber roofing system (Ahmed Badî Efendi, 2014, 263). Sedat Çetintaş, appointed to the head of The Survey Office for Conservation of Monuments (*Abideleri Koruma Rölöve Bürosu)*, established under General Directorate of Antiquities and Museums (*Antikiteler and Müzeler Umum Müdürlüğü*) in 1936, prepared the architectural drawings of most important monuments in Edirne. In the report contains his studies of historical monuments of Edirne, he evaluates *İbrahim Paşa Hamamı* as a 3rd degree valuable monument that can be demolished in case of necessity (Çetintaş, 1938, 8).

According to the report of Eyüboğlu (1956), marble pavements, *kurna*s and *künk*s of the public bath were stolen at the 1950s (Figure 150). Photographs at the report appendix reveal that at those years, *soğukluk* was completely demolished, northwest *sıcaklık eyvan* main wall and water depot southwest wall are partially demolished (Figure 150). It is observed that the water depot vault partially collapsed in these years (Figure 150). This situation progressed in the 1970s and today the vault is completely collapsed (Figure 150, Figure 155, Figure 157).

As a consequence of public bath owners application to Board of Education (*Maarif Vekaleti*)-EEMGM for permission to pull the building down, Board of Education asked a report to be prepared for the public bath from GEEAYK by 29.03.1956 dated and 732.22-875 numbered official letter. GEEAYK decided to protect the public bath by 10.05.1956 dated and 502 numbered decision. *İbrahim Paşa Hamamı* is registered as "1st Group Cultural Property in Need of Protection" with 13.11.1976 dated and 9514 numbered decision of GEEAYK.

The demolition petition of owner given to Edirne KVKBK in 1997 reveals that unauthorized vernacular buildings constructed around the public bath. 5.09.1997 dated and 4217 numbered decision stated that 1, 2, 3 and 4 numbered lots of block 723 must be signed as public bath lot, the public bath must be protected and public bath lot must be cleared of other buildings.

Expropriate decision is taken for the public bath which belonged to private property by VGM in 1993. This decision was approved by 10.02.1993 dated and 1334 numbered decision of Edirne KTVKK. The expropriate process is not yet completed. There is no conservation study for the public bath and it is open to external factors. This situation worsens the existing structural problems and triggers new ones.

Figure 150. The north-west view of *İbrahim Paşa Hamamı* in 1956 (Source: Eyüboğlu, 1956, Appendices) (right) and in 1971 (Source: Machiel Kiel Photograph Archive) (left)

3.9.1. General Description of İbrahim Paşa Hamamı

Bathing spaces and water depots of the *İbrahim Paşa Hamamı* extends in the northeast-southwest direction (Figure 151). *Soğukluk* and *külhan* spaces; on the other hand, did not reach today, only partial wall ruins are followed.

Standing parts of the building situated on a rectangular area of 13,5x18 metres. Among these, the cold water depot and authentic floor levels of bathing spaces cannot be followed due to soil deposit.

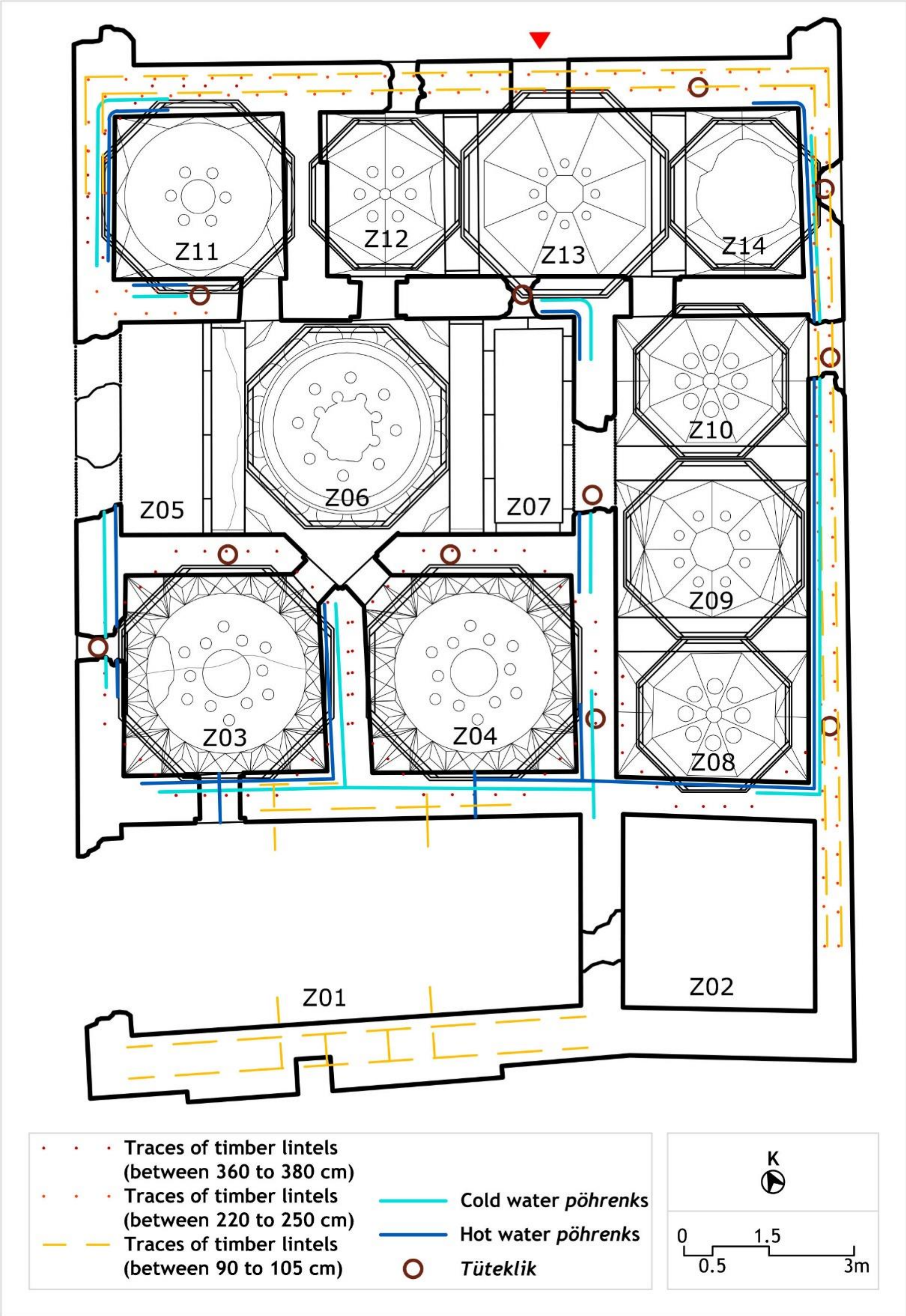

Figure 151. The plan and reflected ceiling plan of *İbrahim Paşa Hamamı* (according to new information gathered from site surveys, redrawn based on Aşut, 2012: 128)

a. Exterior description:

There is *ılıklık-soğukluk* partition wall on the northeast façade of the public bath (Figure 152). This wall is 13.5 metres wide and approximately four metres high. Entering to *ılıklık* and bathing spaces are provided through the arched door on this façade. Wall is built by repetition of one brick and one cut stone courses on top of each other. Cut stones are surrounded by single vertical bricks. Only bricks on the door are in three courses and two courses in following two lines. Traces of 15x15 cm timber lintels, each consisting of two courses, are followed approximately 50 cm above, 220 cm above and 110 cm below the door arch, continuing horizontally along the wall (Figure 152, Figure 153). Single *pöhrenk* line is observed to be raising 120 cm on the vertical at the east end of the wall. This detail is important for the water distribution system used in public baths. At two ends of the façade, alignment of *soğukluk* main walls, today demolished, can be followed (Figure 152, Figure 153).

There is a residential toilet noticed from an adjacent structure on the east side of this wall. Toilet does not have *hela* stone and whether the toilet drainage is authentic or cannot be determined. There is also a well three metres northeast of the entrance door.

Southeast façade of the public bath could not be documented because late period residential buildings are built attached to the main wall of the building. However, it is observed that same system is used in bond and lintel system of the eighteen metres long and approximately five metres high wall (Figure 153, Figure 154). Partial collapses on this wall reveal the presence of two *tüteklik* chimneys used in Z14-*ılıklık* and Z10-*sıcaklık* walls.

Water depots of the public bath are on the southeastern façade and cannot be documented in detail because of the surrounding late period buildings. Arch and chimney of *külhan* located at the geometric centre of hot water depot on the west can be observed (Figure 155). Information on the cold water depot main wall can only be gathered from photographs taken in 1988 (Figure 156), because of unauthorized constructions closing the front of the depot. Five metres high cold water depot is emptied by four metres wide vault beneath it. This space must have been used as storage area originally. Walls of the water depots are built by three brick and one cut stone courses repetitions. Cut stones are surrounded by single vertical bricks. Traces of vault above the depot, which did not reach today, can also be observed.

Masonry and lintel system used in 18.5 metres long and approximately 3.5 metres high northwest wall is same as that of the northeast wall (Figure 157). Start of water depot arch can be followed on this façade. Partial collapses reveal traces of *tüteklik* on Z03 wall and lintel on Z05-Z11 partition wall upper levels. Information on the covering materials and the *saçak* system cannot be obtained because of the collapses and biological formations on the upper level of main walls and upper structure.

Figure 152. The north-east façade of *İbrahim Paşa Hamamı*

Figure 153. The east view of *İbrahim Paşa Hamamı*

Figure 154. The south-east façade of *İbrahim Paşa Hamamı*

Figure 155. The south-west façade of *İbrahim Paşa Hamamı*

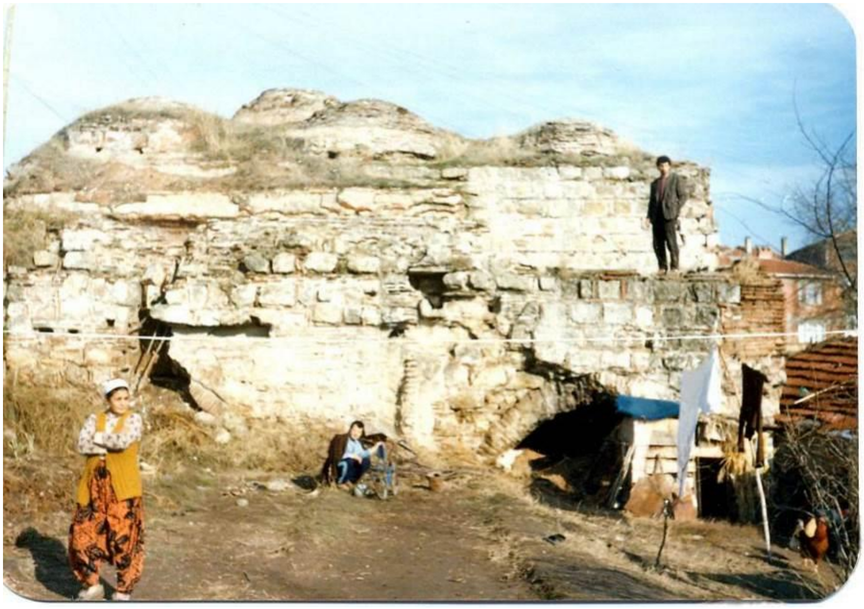

Figure 156. The south-west façade of *İbrahim Paşa Hamamı* in 1988 (Source: İlter Büyükdığan Photograph Archive)

Figure 157. The north-west façade of *İbrahim Paşa Hamamı*

b. Interior description:

İbrahim Paşa Hamamı is built as a single public bath and its bathing spaces and water depots reached to present day (Figure 151). It is understood from the wall traces on the northeast of the building that *soğukluk* main walls are built by masonry system. However, late period residential buildings constructed on public bath lot prevent observation of traces on the dimensions of *soğukluk* space.

An opening on the northeast wall, spanned by an arch, opens to *ılıklık* main space (Z13) (Figure 151). *Ilıklık* is composed of main space and *eyvan*s at two narrow sides (Z12-14). A door on the southeast of *ılıklık* main space (Z13) and Z12 *eyvan* opens to *sıcaklık* spaces. Rectangular planned *sıcaklık* (Z08-09-10), with *eyvan*s on two sides, is entered through *ılıklık* main space.

A second *sıcaklık* space is entered from *ılıklık eyvan*. There is one main *sıcaklık* space (Z06) with *eyvan*s (Z05-07) on two sides in this second *sıcaklık* space (Figure 151). Main walls of northwest *eyvan* are almost completely collapsed. A door on the northeast wall of main space (Z06) opens to the north *halvet* (Z11). Identical sized other two *halvet*s (Z03-04) are attached to the northwest wall of the main space. There is a water control window on the western *halvet* (Z03). In accordance with the typology suggested by Semavi Eyice (1960: 106-115, 120), “the type of plan that has elongated rectangular *sıcaklık* with a domed central space and two *halvet*s” (e) is applied (Figure 1, Figure 151).

Water distribution system can be followed partially in all spaces (Figure 151). Details of the hot water transmission to the clean water distribution system can be followed on Z03 and Z04 southwest walls, but cold water connection points cannot be detected.

Water depots extend along the Z04, Z04 and Z08 spaces (Figure 151, Figure 155, Figure 156). It is understood from the *külhan* traces that depot (Z01) aligned on Z03 and Z04 *halvet*s was used for hot water. The other depot on Z08 *eyvan* alignment must be used as cold water depot. This space cannot be investigated due to deposits. A large area formed at the lower level of cold water depot with the large vault must have been used as storage.

3.9.2. Construction Techniques and Building Materials of İbrahim Paşa Hamamı

Upper structure and coverings of *İbrahim Paşa Hamamı* could not be examined due to demolition and deposits. Information on load-bearing systems, floor systems and architectural elements can be obtained on the standing parts of the public bath.

a. Foundations:

Foundations and *cehennemlik* level cannot be observed due to soil deposit. Only in Z04 *sıcaklık halvet*, there are traces of *seki* covering (Figure 158). It is understood from these traces that *seki* level is approximately 45 cm below the water line and approximately 25 cm above the floor level of the space. Polished limestones in 7-8 cm thick are used as floor pavement elements. These pavement stones are placed on floor beams formed by 5-6 cm thick flagstones. Red *horasan* mortar with brick pieces is used between two flagstones. No traces are available on beams.

Figure 158. Traces of the *seki* floor pavement system used in the Z04 *halvet* of *İbrahim Paşa Hamamı*

b. Masonry Walls:

Main walls and water depot walls of *İbrahim Paşa Hamamı* are 85-100 cm, the partition walls are 75-85 cm thick (Figure 151). Mortar thickness varies between 2 to 4.5 cm. Rough cut stones and bricks with 27,5x27,5x4-4.5 cm dimensions are used on the masonry walls with timber lintels system. Also, use of 22x22x3 cm sized bricks is noticed on applications made at times the building was used as a public bath.

A single type of bond system is used on main walls. Walls are built by repetition of one, two or three brick-one cut stone with shaped front face courses and cut stones are surrounded by single vertical bricks (Figure 152, Figure 153, Figure 154, Figure 157, Figure 159, Figure 160). The number of brick courses is determined by the needs of spaces where openings and lintels are used. Five courses of brick are used only at one level of water depot walls (Figure 156).

Brick courses continue along the section. 27,5x27,5x4-4.5 cm sized bricks and their half-brick forms are used in authentic walls. Relatively bigger rubble stones are used at outer surfaces of the walls, smaller rubble stones and stone pieces are used between these big stones on the inner parts of the wall. Stones used on wall surfaces are 20-23 cm high and 10-45 cm long. Their depth varies between 10 and 45 cm. (Figure 159)

Traces of timber lintels, which do not exist today, can be observed on the collapsed parts of the walls (Figure 151, Figure 160). Traces of two lines of lintel placed along the wall and connected to each other by the use of *puştuvan*s, give information on the location and dimensions of structural timbers used in the building.

The first one is located on the south façade on hot water depot (Z01) main walls, 90-105 cm above authentic floor level (Figure 151, Figure 156). These lintels of 15x15 cm size extend along the wall, connected to each other by 12x12 cm sized *puştuvan*s at every 80 cm. This level cannot be observed due to soil deposit on north and west façades and due to late period residential buildings attached to building on the east façade.

The second one is 220-250 cm above the authentic floor level (Figure 151, Figure 152, Figure 153). It is observed that these 15x15 cm sized lintels continue all along the main walls, *soğukluk-ılıklık* partition walls and water depot walls. All lintels are connected to each other by 12x12 cm sized *puştuvan*s at every 80 cm. These lintels and *puştuvan*s are embedded approximately 15 cm inside the wall surface. Front façades are closed by half brick or stone bonds. On the water depot wall, one in every three *puştuvan* (at every 270-280 cm) placed perpendicular to the long side (parallel to the short side) continue on the open along the space and connect lintels extending along the parallel long walls to each other (Figure 161).

The third one is 360-380 cm above the authentic floor level (Figure 151, Figure 160). It is observed that 15x15 cm sized lintels at this level continue along the east and west façade main walls and north façade *soğukluk*-bathing space partition wall. The lintels are placed and connected to each other similarly to the ones at 220-250 cm level.

The fourth one is 510-525 cm above the authentic floor level (Figure 151, Figure 157). These lintel traces are followed along the north and south walls of Z05-06-07 spaces. There is no information on *puştuvan*s connecting these lintels, which are placed approximately 15 cm inside of the wall.

<u>Arches and Openings:</u>

Arches:

Approximately 60 cm thick arches are used between main spaces and *eyvan*s in *aralık*, *ılıklık* and *sıcaklık* sections; between Z12, Z13 and Z14; Z08, Z09 and Z10; Z05, Z06 and Z07 (Figure 151). These arches span openings of 290 cm in *aralık,* 340 cm in *ılıklık* and 380 cm in *sıcaklık.* Two-centred ogee arch profile is used in all of the arches.

Between main space and *halvet*s, approximately 290 cm above the authentic floor level, a flagstone of 5-8 cm thick and approximately 60 cm wide is placed so that it makes approximately 20 cm projection (Figure 162). Brick stones are built on these flagstones by bonding of two brick and one brick and two half brick courses with shifting joints. Bricks used in the arches are in 27.5x27.5x4-4.5 cm dimensions, identical to those in walls.

A specially shaped brick used only near the arch located between Z09 and Z10 spaces is noticed (Figure 163). This brick has 11.5x16.5x4 cm dimensions and a 3x3.5 cm wide hole is formed on the front face (Figure 163). It is thought that this brick was placed below flagstone perpendicular to the wall, and it must have been used in a stucco application to make the arch spring level-wall surface transition visually softer.

Doors:

Main entrance door of *İbrahim Paşa Hamamı* located on *soğukluk* main wall and Z10-Z07 door did not reach today. Whereas, doors between *soğukluk*-Z13, Z13-Z10, Z12-Z06, Z06-Z11, Z06-Z03 and Z06-Z04 still exist. Ogee arches are used in all door openings, as in other arched openings. Only in Z12-06 door, depressed arch is used (Figure 164). According to traces and comparison in the building, the arch profile has been changed during an Ottoman period interventions.

Z06 corners of Z03 and Z04 spaces are chamfered, Z06-Z03 and Z06-Z04 doors are placed on these chamfered corners (Figure 164). Entrances are enriched by portal used on the upper levels of this area.

When the wall is constructed, approximately 70-75 cm wide door openings are left empty. Door arches are built starting at the spring level, by two brick and one brick-two half brick courses with shifting joints (Figure 164, Figure 165). Bricks are in 27.5x27.5x4-4.5 cm dimensions, similar to bricks used in wall construction. Only in Z13-Z10 door arch, on the surface faces to Z13 space, specially shaped bricks of 20x27.5x4-4.5 cm dimensions with approximately 10x10 cm indentation at its corner (Figure 165). These brick are used to enliven the arch façade visually.

Windows:

The only window of the public bath is the water control window between the hot water depot (Z01) and *sıcaklık* west *halvet* (Z03). This window is approximately 70 cm wide and 126 cm high. Window openings are crossed by brick arches. Window opening enlarges on the water depot side at one stage, 17 cm upwards and 9 cm sideways. (Figure 166)

Figure 159. The masonry system used in the partition walls of the *İbrahim Paşa Hamamı*; the Z01-Z02 partition wall (left), Z05-Z11 partition wall (middle) and Z07-Z09 partition wall (right)

Figure 160. Traces of timber lintels embedded into the south-west exterior wall of *İbrahim Paşa Hamamı*

Figure 161. Traces of timber lintels and *puştuvan*s embedded into the hot water depot walls of *İbrahim Paşa Hamamı*

Figure 162. The arch and phyllite plate located under spring line of this arch used in the *sıcaklık* main space (Z06) of *İbrahim Paşa Hamamı*

Figure 163. The specially shaped brick used near the arch located between the Z09 and Z10 spaces of *İbrahim Paşa Hamamı*

Figure 164. Door openings used between the Z03, Z04 and Z06 spaces (left), the Z06 and Z12 spaces (middle) and the *soğukluk* and Z12 spaces (right) of the *İbrahim Paşa Hamamı*

Figure 165. Specially shaped bricks used on the door arch located between the Z10 and Z13 spaces of *İbrahim Paşa Hamamı*

Figure 166. The water control window located between the hot water depot (Z01) and *sıcaklık halvet* (Z03) of *İbrahim Paşa Hamamı*

Finishing Techniques:

There are no traces of finishing techniques used on the exterior façade of *İbrahim Paşa Hamamı*. Lime-based plaster with varying ratios of brick piece and dust and lime wash are used on interior façades.

Four different lime-based plaster is detected in the building, with respect to their general physical properties (Figure 167, Figure 178). The first one is 2-3 cm thick pink coloured lime plaster observed on the wall surfaces (Figure 167). The second one is the light pink plaster of approximately 1.5 cm thickness, found on top of the first one (Figure 167). The third one is approximately 0.5 cm thick dark pink plaster, it is applied on the second one and contains higher ratios of brick pieces and dust compared to other plasters, hence has a denser colour (Figure 167). Plaster layers applied on top of one another, belonging to different periods can be observed on some walls thanks to the notches made on lower/older layers.

Pink coloured fourth type of plaster is locally observed on different spaces. This plaster, different from others, contains straw pieces visible to the naked eye (Figure 178). Because of its physical properties, this plaster is not suitable to be used in spaces in contact with water and vapour.

Figure 167. The different plaster layers used on the interior wall surfaces of the *İbrahim Paşa Hamamı*; Type 1, 2 and 3 (left) and Type 4 (right)

c. Transition Elements and Upper Structures:

In Z03, Z04 and Z11 *halvet*s of *İbrahim Paşa Hamamı*, square to circular plan conversion is achieved by a belt of Turkish triangles, and in Z06 *sıcaklık* main space is achieved by three projection courses, then spaces are covered with semi-circular domes (Figure 151, Figure 168). In Z09 and Z13 spaces, pendentives are used to convert square plan to octagonal one, spaces are covered with eight-lobed-dome

(Figure 151, Figure 168). Rectangular plans of Z08, Z10, Z12 and Z14 spaces are converted to an octagonal plan by cross vaults on two ends, space is spanned with eight-lobed-dome (Figure 151, Figure 168).

There are traces of barrel-vault presence in rectangular planned hot water depot (Z01), which the upper structure is almost completely demolished (Figure 151, Figure 161). There is no information on the upper structure of square planned cold water depot (ZZ02) and rectangular planned Z05 and Z07 spaces.

Primary element used in the upper structure and transition elements of *İbrahim Paşa Hamamı* is brick. The full and half size of bricks with 27.5x27.5x4-4.5 cm dimensions are used in the entire upper structure. Only in Z13 space, trapezoid bricks, formed by chamfering a corner of a half brick, are observed among transition elements (Figure 169). Stone material use is observed only in Z05, Z06 and Z07 spaces (Figure 170). Flagstones are used in three staged transition element of Z06 space, at the same time, these flagstones are roughly shaped and functioned as base/template for the brick bond above it. Flagstones used in the second stage is continued along the wall length and also used in Z05 and Z07 transition elements.

Use of one layer of approximately 1.5 cm thick light pink coloured lime plaster and lime-based white wash is followed on interior façade of upper structures.

Dome drums, built of cut stone and brick, are observed on the peripheries of all domes (Figure 155, Figure 157). There are traces of timber lintels embedded in Z03, Z04 and Z11 dome drums, at 530-590 cm above floor level (Figure 171). Traces reveal that 14x14 cm sized timber lintels are placed suitably inside octagonal planned drums, and they are connected to each other by lap and half-lap joints.

Circular or octagonal *cupola* openings are used in all domes, coherent to the dome form. All *oculi* used in the building are circular planned. There is no information on how these openings were covered.

Figure 168. Transition elements and upper structures used in the Z04 (left-top), Z06 (right-top), Z08 (left-bottom) and Z09 (right-bottom) spaces of the *İbrahim Paşa Hamamı*

Figure 169. Trapezoid shape bricks used in the transition elements of the Z13 space in *İbrahim Paşa Hamamı*

Figure 170. Stone plates used on both of the transition elements of the Z05 and Z06 spaces in *İbrahim Paşa Hamamı*

Figure 171. The drum of Z06 space in *İbrahim Paşa Hamamı* and the traces of timber lintels embedded into it

d. Installation Systems:

There is no trace of the water drainage system of the building because the floor pavement stones are removed. Information can be gathered on clean water distribution and heating systems, from the still-standing parts of *İbrahim Paşa Hamamı*. Authentic details are detected especially for the clean water system.

<u>*Clean Water Distribution System:*</u>

The cold water depot (Z02) of the public bath is almost completely demolished and standing parts are buried under soil deposit. There is no information on how water connects to water depots from the city network and the relation between cold and hot water depots (Z02-Z01).

Bathing spaces cold water *pöhrenk*s is approximately 95 cm, hot water *pöhrenk*s is approximately 75 cm above the authentic floor level. There is no information on how the cold water connects to bathing spaces from cold water depot. Water heated in the hot water depot (Z01), is delivered to hot water distribution *pöhrenk*s via connection pipes passing from the centre of Z03 and Z04 *sıcaklık halvet*s southwest walls (Figure 151, Figure 172, Figure 173). Traces reveal that these connection *pöhrenk*s were originally placed almost flatly. These connection pipes were renewed during an early period repair and the angle of the *pöhrenk*s were increased (Figure 172). After the repair, the connection pipes started at about 24 cm above the depot floor and placed so as to make 7% declining angle, and connected to the hot water distribution system in building at about 16 cm above the depot floor.

There is another *pöhrenk* line between hot water depot-Z04 *sıcaklık halvet*. This line continues along the wall thickness and extends from depot authentic *seki* level with 16^{o} declining angle so that it starts about 10 cm above the depot floor level and ends 10 cm below (Figure 172). End of *pöhrenk*s is approximately 50 cm above the *sıcaklık halvet* (Z04) floor level. Inside the last *pöhrenk* is closed by filling with *lökün*.

Except for Z12 and Z13 *ılıklık* spaces, it can be followed that hot water line continues in all spaces (Figure 151). These *pöhrenk*s are in a channel 40-50 cm in height and 19-22 cm in depth, inside the main walls, starting approximately 75 cm above the authentic floor level (Figure 172, Figure 173, Figure 174, Figure 175). The upper level of this channel is closed by 7cm thick flagstones.

*Pöhrenk*s are placed inside the channels by approximately 5 cm thick lime-based and brick pieced pink mortar. Handprints from the application of mortar are detected on the channel extending along the Z08-09-10 southeast wall (Figure 175). There is one course of half brick between two *pöhrenk* lines (cold water *pöhrenk*s on the top and hot water at the bottom) (Figure 174). Front façade of this channel is closed by vertical bricks in some spaces, and by mortar filling in other spaces (Figure 174).

There is a special detail used in *İbrahim Paşa Hamamı* hot water system in the building, that is very rare, hence drives attention. This detail is observed at the end of hot water line that extends to the east wing of bathing spaces, at Z14 space east corner (Figure 176). Hot water line extends along the southeast wall and rises about 120 cm with 14^{o} slope in the northeast wall. End of this line is closed by *lökün* infill. From the traces, it is understood that this part of the water line has gone through several repairs and renewals (Figure 176).

Taps, *kurna*s and *kurna ayna*s of the public bath did not reach to present day.

Figure 172. *Pöhrenk*s placed into the partition wall of the Z01 and Z04 spaces of *İbrahim Paşa Hamamı*

Figure 173. The T shape *pöhrenk* used on the connection point which transfers water from the hot water depot to the water distribution system within the building of *İbrahim Paşa Hamamı*

Figure 174. Water channels of *İbrahim Paşa Hamamı* in which the hot and cold water *pöhrenk*s placed

Figure 175. Traces about the placing phase of *pöhrenk*s into the water channel used in the *İbrahim Paşa Hamamı*

Figure 176. The ending detail of hot *pöhrenk* line used at the corner of the Z14 space of *İbrahim Paşa Hamamı*

<u>*Heating System:*</u>

Külhan of *İbrahim Paşa Hamamı* cannot be examined, only *külhan* chimneys can be observed. Pit/hole of copper caldron in hot water depot (Z01), fumes flow/transition openings beneath the bathing spaces' walls and *tüteklik* fumes chambers cannot be documented because of soil deposits.

Cracks on the main walls of *İbrahim Paşa Hamamı* increased the readability of *tütekliks* (Figure 153, Figure 157). Presence of *tüteklik* chimney is detected in all walls including *ılıklık-soğukluk* partition wall, except for water depots-*sıcaklık* partition wall (Figure 151, Figure 153, Figure 157). These chimneys are placed behind the water channel and extend along the wall height (Figure 177). These circular chimneys of 17 cm diameter, are formed approximately 60-70 cm inside the walls by roughly shaped brick and rubble stones. At the water channel level, tetragonal planned holes of 27.5 cm width, 48 cm depth are formed. *Tütekliks*, used for discharge of fumes in *cehennemlik*, are placed inside these chimneys with a lime-based mortar.

Figure 177. The relation between *tüteklik* chimneys and water channels (left) and between *tütekliks* and *tüteklik* chimneys (right) of the *İbrahim Paşa Hamamı*

3.10. Abdullah Hamamı

Abdullah Hamamı is located in Hasanpaşa/Eskici Hamza District, on Abdullah Hamam Street, at 50L-Ic (75) Plot, 537 Block, 2 Lot (Figure 12). This public bath, with an A58 inventory number, is in "the interaction and transition zone" by Edirne Conservation Development Plan approved in 2007. There is *Elmas Mehmet Paşa Hemşiresi Çeşmesi* at approximately 50 m northwest, and *Dibek Çeşmesi* approximately 30 m southeast of the public bath.

Ahmet Badi Efendi (2014a: 263), says that the public bath, also known as *Yeşil Direk Hamamı*, belongs to *Sinan Vakfı*. Although, Peremeci (1939: 97) noted there is no information on the founder and construction date of the *Abdullah Hamamı*. On the other hand, Gökbilgin (1993, 107) says the public bath is constructed in 16th century by Şarabdar Abdullah Bey.

It is known that this building is constructed as a single public bath and *soğukluk* is covered with a timber structured roof (Ahmed Badî Efendi, 2014, 263).

There is no file for this public bath in Edirne KVKBK. However, it is known to be left empty for some time in the beginning of 20th century, then repaired in 1953 and used as a public bath, again (Kazancıgil, 1995: 163). *Abdullah Hamamı* among the rare Edirne public baths that reaches today with all of its structures standing. However, *soğukluk* section standing today must be rebuilt during 1953 repair (Figure 178).

Buildings to be expropriated are listed by 10.02.1993 dated and 1334 numbered decision of Edirne KTVKK. *Abdullah Hamamı* is also on this list, but the expropriate is not done. The building is under private property and used as storage.

Figure 178. The northwest façade of *Abdullah Hamamı*, the 1990s (Source: İlter Büyükdığan Photograph Archive)

3.10.1. General Description of Abdullah Hamamı

Abdullah Hamamı stands on an area of 16.5x33 metres and extends in the northwest-southeast direction (Figure 179).

The building is under private property and could not be studied because the owner refused to give permission. There is *soğukluk* main wall on the northeast façade, the only observable façade. This wall must have been rebuilt during the comprehensive intervention of the public bath dated in the mid-20th century. The wall is built by the use of alternating wall technique and brick bond is used in door and window openings. During this repair, timber roofing is used in the renewal of the upper structure, similarly to the authentic roof system.

Entering to *Abdullah Hamamı* constructed as a single public bath is through *soğukluk* main entrance door on the northwest façade. There are window openings at single level on northwest and northeast walls of *soğukluk* space (Z01). There are under-*seki* niches in *soğukluk* (Figure 180). A door on the southeast wall of *soğukluk* opens to the *aralık* space (Z03).

The door on the southwest of *aralık* opens to *ılıklık* space (Z02) which also includes toilets. Two different upper structure systems, one is dome and the other is vault, are used in this long rectangular planned space. The door on the southeast of *aralık* opens to *halvet* (Z05) where there is also a Jewish pool. *Halvet* is divided into two, one part is designed as *mikvah*, getting in and out of the pool is achieved by a three-step staircase.

A door on the southeast of this *halvet* opens to *sıcaklık* space (Z04) (Figure 181). There is an *eyvan* on the southwest, two *halvet*s (Z07-08) on the southeast and two small *halvet*s (Z05-06) on the northeast of *sıcaklık* space. According to the typology of Semavi Eyice (1960: 106-115, 120), (c) "*halvet*s arranged around a square planned main *sıcaklık* space in square plan type" is used (Figure 1, Figure 179). There is hot water depot on the southeast of Z07 and Z08 *halvet*s. Water control windows are present on the *halvet*s-hot water depot partition wall. Cold water depot (Z10) extends along the short wall of Z08 *halvet* and hot water depot (Z09).

Photographs dated to 1994 (İlter Büyükdığan Photograph Archive), there are Hebrew writings, inlaid *kurna*s, *kurna aynası* and *seki*s in *sıcaklık* main space (Z04) (Figure 182, Figure 183). Transition elements used between masonry walls and dome are belt of Turkish triangles and belt of Turkish triangles with *badem* (Figure 184). Many openings on the vaults and domes, also drive attention (Figure 185).

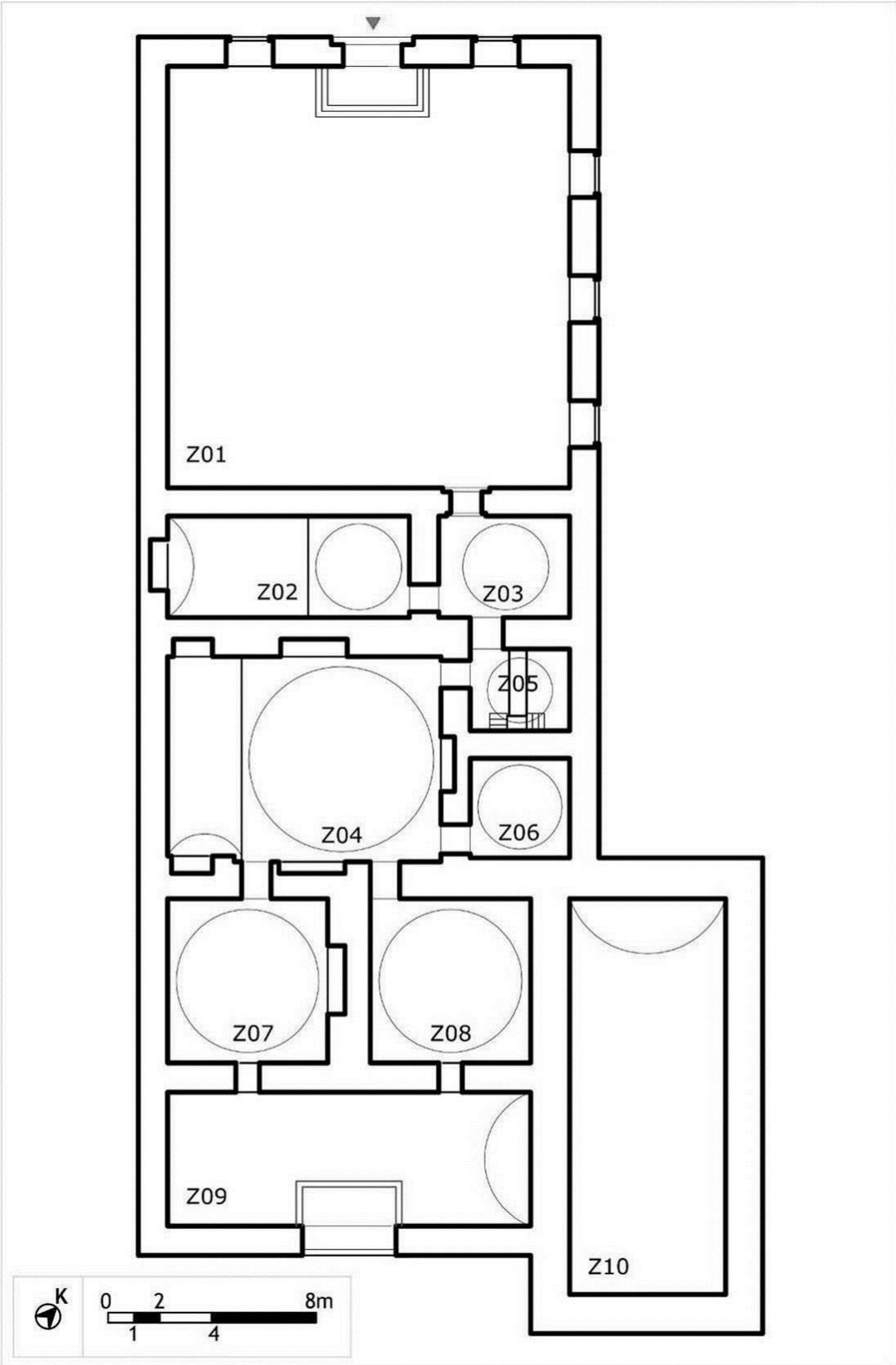

Figure 179. The plan and reflected ceiling plan of *Abdullah Hamamı* (redrawn based on documentation studies and drawings prepared by İlter Büyükdığan in the 1980s and 1990s)

Figure 180. The under *seki* niche located in the *soğukluk* space (left) and the niche located in the *sıcaklık* space of *Abdullah Hamamı*, 1994 (Source: İlter Büyükdığan Photograph Archive)

Figure 181. The *sıcaklık* main space (Z04) of *Abdullah Hamamı*, 1994 (Source: İlter Büyükdığan Photograph Archive)

Figure 182. The Hebrew writings used in the sıcaklık spaces of *Abdullah Hamamı*, 1994 (Source: İlter Büyükdığan Photograph Archive)

Figure 183. Sekis and the *kurna* used in the *Abdullah Hamamı*, 1994 (Source: İlter Büyükdığan Photograph Archive)

Figure 184. Different types of belt of Turkish triangles used in the bathing spaces of *Abdullah Hamamı*, 1994 (Source: İlter Büyükdığan Photograph Archive)

Figure 185. Upper structures used in the bathing spaces of *Abdullah Hamamı*, 1994 (Source: İlter Büyükdığan Photograph Archive)

3.11. Tahmis Hamamı

Tahmis/Boyacılar Hamamı is in Sabuni District, on *Tahmis Çarşısı* and Kuyumcular Street, at 22 Plot, 661 Block, 36 Lot (Figure 12). The public bath is in "the interaction and transition zone" by Edirne Conservation Development Plan approved in 2007 (Figure 12) The public bath is completely surrounded by commercial buildings; therefore, the public bath cannot be recognized from outside.

The public bath is constructed in 1525 and founded by Çoban Mustafa Paşa, who is also the founder of *İki Kapılı Han* (Peremeci, 1939: 97). It is built as a single public bath and its *soğukluk* is covered with a dome (Ahmet Badi Efendi, 2014a: 263). As a result of the 1752 earthquake, *soğukluk* dome collapsed, instead, a timber roofing is constructed.

There is no information on the public bath in its 22.00.370 and 372 numbered files found in Edirne KVKBK. There is information on the new buildings built around the public bath. However, buildings to be expropriated are prepared by VGM with 10.02.1993 dated and 1334 numbered decision of Edirne KTVKK. *Tahmis Hamamı* is also present in this list. However, expropriate is not done.

It is known that *Tahmis Hamamı* was partially demolished and empty at the beginning of 20th century (Peremeci, 1939: 97). Late period interventions can be observed on upper structure and main walls. Affect of cement-based repair materials on the buildings must be followed. Today, this public bath is under private property, neglected and empty.

Figure 186. The southwest façade of *Tahmis Hamamı*, the 1990s (Source: İlter Büyükdığan Photograph Archive)

3.11.1. General Description of Tahmis Hamamı

Bathing spaces and water depots of the *Tahmis Hamamı* extending in the southwest-northeast direction are still standing (Figure 187). *Soğukluk* and *külhan* spaces, on the other hand, did not reach to present day. Today, if close proximity of the public bath including the commercial structures is examined, it is highly probable that traces belonging to *soğukluk* can be found. Interior spaces of *Tahmis Hamamı* could not be examined as the owner did not give permission.

Standing parts of the public bath occupy an area of 14x17 metres rectangle. A door on the southwest façade opens to *ılıklık* space (Z02). The door on the northwest wall of this space opens to *ılıklık halvet* (Z01), the door on the northeast opens to *sıcaklık* main space (Z05). There are two small *halvet*s (Z03-04) at the northwest of *sıcaklık* main space (Z05). There is *mikvah* on the northern *halvet* (Z03). 2-steps staircase provides a transition to the pool. There are two *halvet* cells (Z06-07) on the northeast of *sıcaklık* main space (Z05). According to the typology of Semavi Eyice (1960: 106-115, 120), (c) "*halvet*-celled aligned around a square *sıcaklık*" plan type is used (Figure 1, Figure 187). Water control windows on the northeast wall of Z06 *halvet* provide passing to water depots (Z08-09).

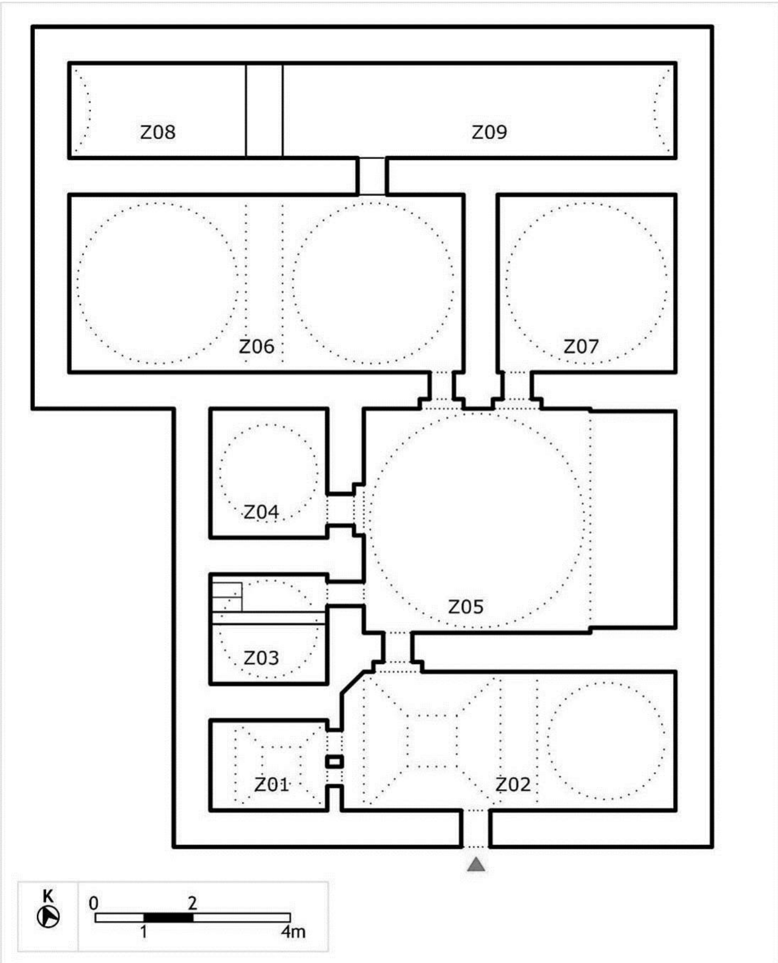

Figure 187. The plan and reflected ceiling plan of *Tahmis Hamamı* (redrawn based on documentation studies and drawings prepared by İlter Büyükdığan in the 1980s and 1990s)

3.12. Sokullu Mehmet Paşa Hamamı

Sokullu Mehmet Paşa Hamamı, which also named as *Üç Şerefeli Hamamı and Çifte Hamam*, is in Çavuşbey District, on Hükümet Street and Mehmet Paşa Hamam Street and placed at 67/1 Plot, 206 Block, 2 Lot (Figure 12). There is *Üç Şerefeli Camii* north of the public bath; and Taş Han, another Mimar Sinan building of 16th century second half, on the southeast. The public bath, registered with inventory number A107, is within “the urban protected area” by Edirne Conservation Development Plan enacted in 2007 (Figure 12).

The public bath is founded by Sokullu Mehmet Paşa, husband of Esma Han – daughter of Selim the 2nd, who was educated in Edirne *Acemi Oğlanlar Kışlası* (Peremeci, 1939, 95). The public bath is constructed by Mimar Sinan on the second half of 16th century (Önge, 1988, 405), and devoted to *Sokullu Külliyesi* in Havsa (Ahmet Badi Efendi, 2014a, 262).

Fire dated to 1733-1734 that affected a region located between the *Üç Şerefeli Camii* and *Ekmekçizade Ahmet Paşa Kervansarayı* (Gökbilgin, 1994, 427), may have also caused damage in the *Sokullu Mehmet Paşa Hamamı*. An earthquake is known to happen on July 13th, 1762 that caused structural damage on the *Üç Şerefeli Camii* and its *Külliye* (Ambraseys, Finkel, 2006: 130). This earthquake must have caused serious damage on *Sokullu Mehmet Paşa Hamamı*. The public bath must have gone through repair after this fire and earthquake.

An ownership changed occurred at the beginning of 20th century, since that date the public bath is under private property and it is known that the public bath was not in use in the 1930s (Peremeci, 1939, 95). *Edirne Eski- Eserleri Sevenler Kurumu* decided to ask help for the repair of the public bath from MEB, in their 1945 Congress (Demiray, Oğuz, 1945, 1). According to the information of public bath found in its file (file no. 22.00.8) in Edirne KVKBK, the public bath is expropriated on 10.07.1957 and its property is transferred to Directorate of Foundations. The public bath had gone through a comprehensive repair in 1960-1962 (Figure 188, Figure 189).

At the beginning of the 1960s, some of the historical commercial buildings attached to *soğukluk* of the public bath are demolished for road extension studies. In 1963, Rıfkı Melül Meriç, a GEEAYK member, suggested a renewal of marble pavements of women’s and men’s sections entrance, repair of undressing spaces and renewal of electric installation. It is decided by 05.03.1967 dated and 3423 numbered decision that some remaining repair of *Sokullu Mehmet Paşa Hamamı* must be completed and the building must be continued to be used as a public bath. The public bath is re-opened for use in November 1968. At the beginning of the 2000s, new repair of the worn out public bath come up to agenda. Architectural drawings of the public bath are approved by 15.11.2007 dated and 1690 numbered, restitution and conservation projects are approved by 24.01.2008 dated and 1754 numbered decisions.

Men’s and women’s sections of *Sokullu Mehmet Paşa Hamamı* are still in use in the present day.

Figure 188. The *Sokullu Mehmet Paşa Hamamı*, 1 October 1958 (Source: Edirne KTVKK Photograph Archive)

Figure 189. The *Sokullu Mehmet Paşa Hamamı* from east, 1971 (Source: Machiel Kiel Fotoğraf Albümü)

3.12.1. General Description of Sokullu Mehmet Paşa Hamamı

Sokullu Mehmet Paşa Hamamı extends 32x38 metres in area and lies in the east-west direction (Figure 190). Southern façade and the interior spaces of the public bath cannot be examined because of the historical commercial structures and public bath are actively in use, respectively.

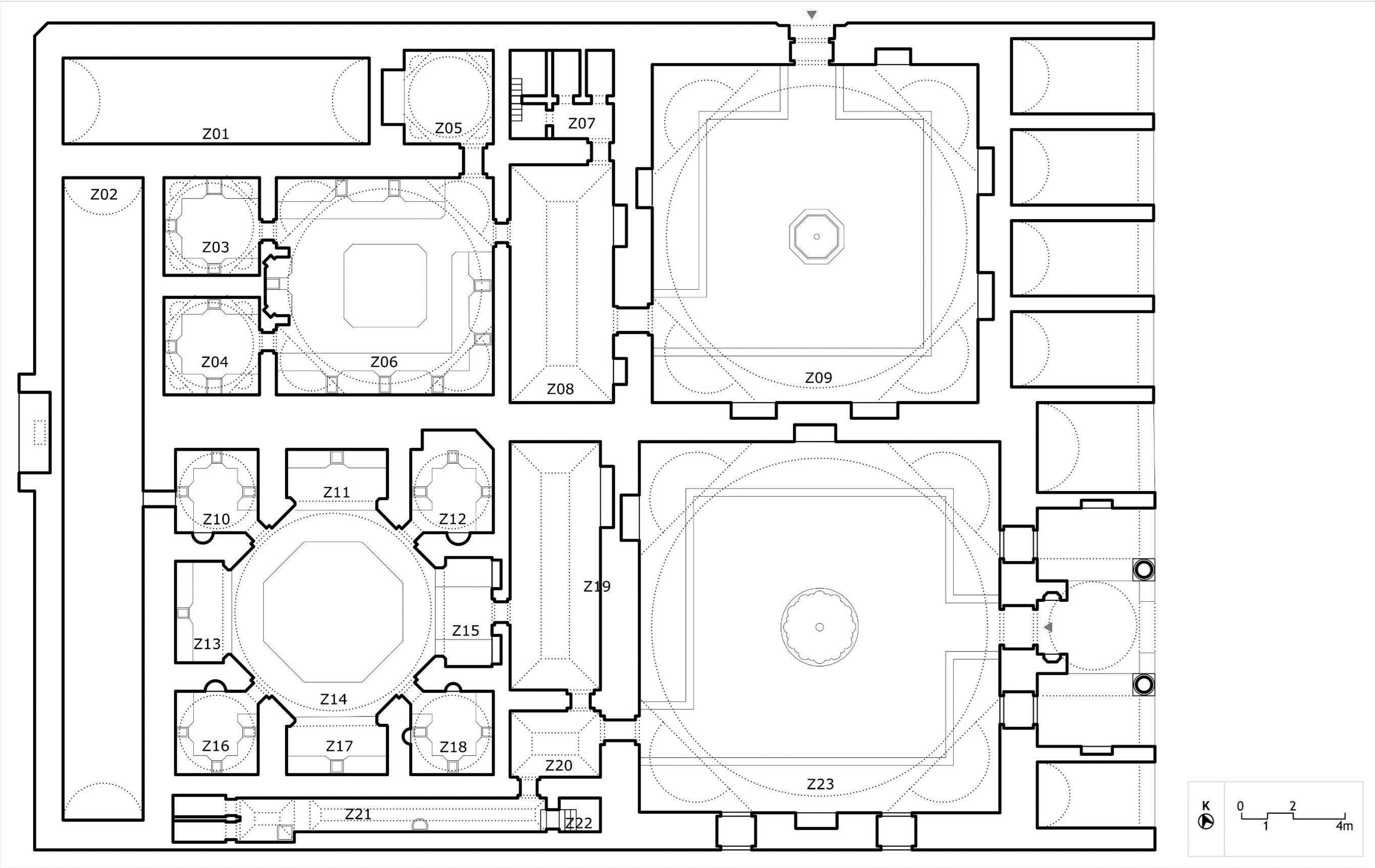

Figure 190. The plan and reflected ceiling plan of *Sokullu Mehmet Paşa Hamamı* (redrawn after drawings prepared by Ali Saim Ülgen in 1948 from www.archives.saltresearch.org; and İlter Büyükdığan in the 1980s and 1990s)

a. Exterior Description:

There are *soğukluk* main walls on the eastern façade of *Sokullu Mehmet Paşa Hamamı* (Figure 189, Figure 191) and main entrance door to men's *soğukluk* (Z23) on the south wall. The door opening of the portal is constructed with joggled cut stones. In front of this door, a semi-open entrance area is formed by two columns and 3-arched portico beared by side walls. There are arched windows on two sides of the door. There are commercial spaces, half of which was demolished for road extension, and rooms with fireplaces on top of them, on the north of the main entrance. Main walls of the public bath are built authentically by two brick-one rubble stone repetition. Two brick-one cut stone bond is used on the upper levels of the wall, which must belong to a repair.

There are women's *soğukluk* space (Z09), *ılıklık* spaces (Z05, Z07) and cold water depot (Z01) main walls on the north façade of the public bath (Figure 192), while women's *soğukluk* main entrance is located on the eastern façade (Figure 193). This entrance, which looks quite plain compared to men's entrance, is achieved by an arched door. There is a circular formed top window with *revzen* on the women's *soğukluk* main walls. Window opening is formed by repetition of two brick and one cut stone courses. Wall bonds similar to those in north façade are observed on main walls. Only in an area on the west end of the northern façade, on the cold water depot where corner chamfer is found, is built by cut stone masonary (Figure 193). Differentiation in the construction technique implies an unknown period intervention. The height of the cold water depot is quite high compared to other same-era public baths. This situation must also be a result of the period intervention.

There are cold water depot (Z01) and hot water depot (Z02) main walls on the west façade of the public bath. There are *külhan* furnace and arch at the centre of hot water depot (Figure 194). Authentic walls built by repetition of two brick and one rubble stone courses or two brick and one cut stone courses repetitions are followed on this façade.

It is understood that the upper structure has gone through comprehensive interventions. Two brick-one cut stone is used in dome drums. Lead is used as covering material in upper structures. *Soğukluk lantern*s also carry traces of period interventions.

b. Interior Description:

Sokullu Mehmet Paşa Hamamı is built as a double public bath and men's section is on the south while woman's section is on the north (Figure 187). The hot water depot (Z02) is on the west of *sıcaklık* spaces, cold water depot is at the northwest corner of the public bath.

A flamboyant door at the south end of eastern façade of the public bath opens to men's *soğukluk* (Z23). The door on the west of *soğukluk* opens to *aralık* space (Z20). From south of *aralık*, narrow-long-rectangular planned toilet and *tıraşlık* spaces (Z21, 22) can be reached. There is *ılıklık* space (Z19) at the north of *aralık*. The door on the west of *ılıklık* opens to *sıcaklık* spaces. *Sıcaklık* is comprised of a main space at the centre (Z14), four *eyvan*s (Z11, 13, 15, 17), and four *halvet*s (Z10, 12, 16, 18) at the corners. Water control window at the west of northwest *halvet* (Z10) opens to hot water depot (Z02). According to the typology of Semavi Eyice (1960: 106-115, 120), (b) "*sıcaklık* with a star-shaped plan type" is applied (Figure 1, Figure 190).

An arched door on the east end of northern façade of the public bath opens to women's section *soğukluk* (Z09). The door on the west of *soğukluk* provides a transition to *ılıklık* space (Z08). The door on the north of *ılıklık* opens to toilets and *tıraşlık*s (Z07), the door on the west opens to *sıcaklık* spaces. There is one *sıcaklık halvet* on the north (Z05), and two more on the west (Z03,04) of *sıcaklık* main space (Z06). According to the typology suggested by Semavi Eyice (1960: 106-115, 120), (c) "*halvet*s arranged around a square planned main *sıcaklık* space in square plan type" is used (Figure 1, Figure 190). Information on the transition to the cold water depot (Z01), located on the north end of hot water depot, at the northwest corner of *sıcaklık* main space, cannot be obtained.

Figure 191. The east façade and the main entrance door of the men’s section of *Sokullu Mehmet Paşa Hamamı*

Figure 192. The north façade and the main entrance door of the women’s section of *Sokullu Mehmet Paşa Hamamı*

Figure 193. The main entrance door of the women’s section of *Sokullu Mehmet Paşa Hamamı* (left) and the corner chamfer built on north-west corner of the cold water depot (right)

Figure 194. The *külhan* and *külhan* arch of the *Sokullu Mehmet Paşa Hamamı*

3.13. General Architectural Features of the 14th-16th Century Ottoman Baths in Edirne

Ottoman cities consist of neighbourhoods, self-sufficient through their physical and social infrastructures, located around an urban core including monuments, which will respond to general needs. The creation and sustainability of these urban cores and infrastructures were largely provided with the waqf system (Tabaklıoğlu, 2000: 157). Public baths, one of the most important income sources of the waqf systems, are an indispensable part of all urban cores.

It is seen that the public baths were named according to the district they were located in, their founders, qualifications of employees, any characteristics of its users, prominent or distinctive architectural features or elements, a special use ritual, or the social and/or historical value it attached for its users.

According to the information gathered from Evliya Çelebi's *Seyahatname*, public baths were used by non-Muslim and Muslim citizens together; whereas the designs of the buildings could be made in a religion-specific way for only a small number of public baths (Dağlı and Kahraman, 2011b: 225). For example, the construction of a public bath for the Muslim citizens was mentioned in an imperial order sent to *Musul Kadısı* in 1572-1573 (from Günalan, 2005, Appendices: *Kamil Kepeci Tasnifi* year: 980, no: 67, page: (132)262, edict no: 959).

However, this situation must have been a special application that was peculiar to the cities such as Damascus, Aleppo, and Mosul in which there were strong physical distinctions between neighbourhoods. In the period investigated in the scope of this study, like other Ottoman cities where central authority was strong and security problems were not experienced (Ergenç, 1984: 70), in Edirne as well, the neighbourhoods were areas where individuals and communities with different ethno-cultural backgrounds lived together, and naturally shared common public spaces together. The only situation in which these differences were reflected in the plans of Edirne public baths was that some spaces or units that were specific to the bathing rituals of different religions, like *misvah* used in *Beylerbeyi Hamamı* and *Topkapı Hamamı*, were added to the public bath plans.

It is inferred that in Edirne, the distances between the public baths built in newly-opened areas for settlement or the existing ones in the process of development areas, did not exceed 400 metres, and this distance decreased to 120 metres in the commercial city centre as in the distances between the *Ahi Çelebi Hamamı, Mezit Bey Hamamı* and *Tahmis Hamamı* (Figure 12). During the construction of public baths, water was supplied with the connections to the urban water network, and fountains were also built on these new water lines (Figure 11).

Regarding the findings, it is deduced that location selections of the public baths were determined based on the urban water network (Figure 11). The orientation of structures was determined according to the characteristics of the surrounding roads, and the slope of the terrain. The main entrances to the public baths were provided through the busiest road among the surrounding other roads. In double public baths, on the other hand, men's entry was provided from the busiest road, while that of women through a road, perpendicular or parallel to this road that is relatively less busy.

The sizes of the public baths, built as a part of a waqf and included among the urban income sources of the waqf, were determined according to the need of the region and to the budget allocated. Unlike the other Edirne public baths, the intense effect of the building lot boundaries and the surrounding construction are observed in *Topkapı Hamamı* built in Kaleiçi, where urban tissue was the densest in the 15th century. These constraints led to the use of an atypical plan scheme instead of main plan schemes that was followed in most of the double public baths (*Figure 126*). Consequently, the *sıcaklık* spaces of men's section, which was constructed to be adjacent to the hot water depot under normal circumstances, had to be located far from külhan. This construction, which caused heating problems at men's *sıcaklık* spaces, lead to *Topkapı Hamamı* not being able to attain the expected interest especially in the winter (Abdurrahman Hıbri, 1996: 45).

The public baths' authentic building lots include *soğukluk*, bathing spaces, water depots, *külhan* and *külhan* courtyard with(out) depots. The entrance courtyards located in front of the *soğukluk* in *Gazi Mihal Bey Hamamı*, *Tahtakale Hamamı*, *Yeniçeriler Hamamı* and *Sokullu Mehmet Paşa Hamamı* were located within the building lot of the public baths. It is seen that there are commercial small-sized structures, built adjacent to the outer walls of only *Sultan Selim Saray Hamamı* and *Sokullu Mehmet Paşa Hamamı*.

The public bath plans were organized in such a way that temperature that the spaces required would decrease from water depots towards the main entrance; *külhan*, water depots, *sıcaklık*, *ılıklık*, *aralık* and *soğukluk*. The *sıcaklık*, *ılıklık* and *aralık* spaces, under which *cehennemlik* sections were placed, were also heated by the fumes of fire that was made in the *külhan* furnace which allows the heating of the water in the depot. The *soğukluk* spaces, different from the other spaces, were heated by the movable heating systems independent from the structures.

The access into the *soğukluk* was provided with elaborated entrance doors through streets or entrance courtyards. The *soğukluk* spaces, also named as *soyunmalık* or *camekan*, were the spaces where users were welcomed and complete their preparations to having a bath. In the *soğukluk* spaces of Edirne public baths; there were public bath attendant's room, *peştemal* drying fireplace, coffee fireplace, *seki*s with under-*seki* niches and *şadırvan*. It is deduced from the Edirne public baths whose *soğukluk* spaces still stand today (S*ultan Selim Saray Hamamı, Tahtakale Hamamı, Mezit Bey Hamamı, Kum Kasrı Hamamı, Abdullah Hamamı* and *Sokullu Mehmet Paşa Hamamı*) that these places have almost the same size as all bathing places (Figure 15, Figure 90, Figure 121, Figure 146, Figure 179, Figure 190).

It is understood from historical sources (Ayverdi, 1989a: 377-381, 464-477; Abdurrahman Hıbri,1996: 45-46; Ahmed Bâdî Efendi, 2014: 263-268; Gökbilgin, 1993: 104-108; Eyice, 1994: 439; Kazancıgil, Gökçe, 2005: 93; Peremeci, 1939: 94-99); that these spaces in almost all Edirne public baths are originally covered with a dome; but the spaces were covered with timber roofing in the forthcoming periods since the majority of these domes which span very large distances; thus, underwent structural damages due to earhtquakes. The original *soğukluk* domes of only the *Tahtakale Hamamı* and the *Sokullu Mehmet Paşa Hamamı* reach to the present day.

Unlike other spaces, windows and top windows were used only on the *soğukluk*s' exterior walls. Daylighting of these spaces was supported also by *lantern*s with circular or polygonal plans and *oculi* located at the top of the domes. There are no original examples of window frames, *revzen*s and *lantern*s used in the 14th-16th century Edirne public baths.

There is a vapour release chimney at the arch of the door openings with *yaşmak* through which the transition between *soğukluk* and bathing spaces (*sıcaklık*, *ılıklık* and *aralık*) were provided (Figure 109). This type of doors are identified in *Sultan Selim Saray Hamamı, Gazi Mihal Bey Hamamı, Tahtakale Hamamı, Yeniçeriler Hamamı, Mezit Bey Hamamı, Sokullu Mehmet Paşa Hamamı* on the partition walls between *soğukluk* and bathing spaces. Thanks to this detail, vapour transition from bathing spaces to *soğukluk* space during door openings was prevented.

Access to the *ılıklık* spaces is provided from the *soğukluk* main spaces. In the *Sultan Selim Saray Hamamı*, *Gazi Mihal Bey Hamamı*, *Beylerbeyi Hamamı* and *Abdullah Hamamı*, as well as the man sections of the *Tahtakale Hamamı* and *Sokullu Mehmet Paşa Hamamı*, there are the spaces used as *aralık* between *soğukluk* and *ılıklık* or used only for circulation function. In early period examples, *aralık* spaces are functioned as a circulation corridor, and also involved specialized spaces for *hela* and *tıraşlık* (Önge, 1995: 22). These spaces, observed especially during the early Ottoman periods, gradually became smaller, transformed into a corridor with only a circulation function, and disappeared completely in the classical period Ottoman public baths. It is seen that in the public baths that did not contain an *aralık* space, the specialized spaces for *hela* and *tıraşlık* were constructed on the *ılıklık* sections.

In the Edirne public baths, *ılıklık* spaces, which had relatively low temperature due to its distance from the *cehennemlik*, occupy one half to one third of the total of bathing spaces. It is observed that *ılıklık* spaces with very rich contents were used especially in the *Gazi Mihal Bey Hamamı*, *Beylerbeyi Hamamı* and *Tahtakale Hamamı*. Relatively small spaces for the *ılıklık* were allocated only in *Sultan Selim Saray Hamamı* (one sixth ratio) and in *Yeniçeriler Hamamı* (one seventh). Niches, *seki*s, *kurna*s and *kurna aynası* were used in *ılıklık* spaces. In these spaces covered with vaults, semi-domes and domes; daylighting is provided through the *cupola*s and *oculi* located in the upper structure. There are also the *çırakman*s, a type of niches specialized in the usage of artificial lighting.

Another space, specialized further in functionality other than bathing, which is accessed through *aralık* or *ılıklık*, is *keçelik*. In *keçelik* spaces, wool, processed using hot water and basic ingredients, is transformed into felt. For this treatment, soaked wool blankets need to be crushed with physical strength. In the *keçelik* spaces where more than one person work together, there are large *seki*s that are almost one metre high, along the long sides of the space which has a long rectangular plan. In Edirne, the only *keçelik* space still stands today is the one in the men's section of *Gazi Mihal Bey Hamamı* (Figure 22). The lighting in this space, which is covered by a vault, is provided through the top windows on the vault. Out of the architectural elements in the *keçelik* space, only one niche has survived to date. There are no traces belonging to *seki*s where the felt was pressed.

The transition to the *sıcaklık* spaces is provided through the *ılıklık* spaces. The *sıcaklık* spaces, occupy the largest space among the bathing spaces, consist of main *sıcaklık* spaces, *eyvan*s and *halvet*s. The plan schemes used for public baths in Edirne are observed to vary based on the dates they were built in. According to the typology suggested by Semavi Eyice (1960: 106-115, 120); (a) "cross-axial plan with four *eyvans* and four corner *halvets*" and (e) "the type of plan that has elongated rectangular *sıcaklık* with a domed central space and two *halvets*" (Eyice, 1960: 108-110, 112-114, 120) were used in the public baths built in the 14th and 15th centuries (Figure 1, Figure 15, Figure 22, Figure 46, Figure 90, Figure 97, Figure 121, Figure 126, Figure 146, Figure 151).

The only exceptional example in this case is the women's section of the *Gazi Mihal Bey Hamamı* where (f) "the plan has *soğukluk, sıcaklık* and *halvets* of the same size" (Eyice, 1960: 114-115, 120) type was used (Figure 1, Figure 22). (b) "*sıcaklık* with a star-shaped plan type" and (c) "*halvets* arranged around a square planned main *sıcaklık* space in square plan type" (Eyice, 1960: 110-112, 120) were used in the public baths built in the 16th century (Figure 1, Figure 179, Figure 187, Figure 190).

The sıcaklık space is quite similar to the *ılıklık* spaces in terms of the basic architectural features and the diversity of architectural elements. However, unlike the *ılıklık* spaces, floor heating *seki*s were used along almost the entirety of the walls excluding the walls with doors. In addition to the common architectural elements of the *ılıklık* and *sıcaklık* spaces, there are upper niches on the *kurna* and *göbek taşı* located in the geometrical centre of the main space in the *sıcaklık*. In addition to this, window opening was used only in the wall between the *sıcaklık* and hot water depot, among all bathing spaces. These water control windows are usually found in the *sıcaklık halvets*.

The upper structures in the *sıcaklık* spaces include examples of vaults, half-domes and domes, which are of high importance in terms of architectural style and construction technology of their era. The daylighting in these spaces is provided through the *cupola*s and *oculi* on the upper structures; artificial lighting is provided through the purpose-built niches and oil lamps placed in *çırakman*s.

The hot water depots are accessed via water control windows, located on the walls between the hot water depots and the *sıcaklık* spaces. A staircase is only used for transition to the hot water depot of *Sultan Selim Saray Hamamı*.

Three types of water depot were used in the public baths in Edirne. In the first type, the cold and hot water depots were built in the same space, separated from each other by a masonry wall constructed under a support arch (Figure 22, Figure 46, Figure 121, Figure 146, Figure 187). As well as the areas covered by the two depots are very close to each other, the hot water depots are larger. The water depots, which have a long rectangular plan were covered with barrel vaults, and top windows were used in the vaults. In the geometric centres of the hot water depot floors, there is a circular pit/hole of copper caldron adjacent to the exterior long wall. There are no remaining original examples of the copper caldron placed on these holes.

In the second type, the depots were constructed in a similar way to the first type, but as two separate spaces (Figure 179, Figure 190). The cold water depot was located either in parallel to the behind of the hot water depot, or perpendicular to its side. Similar to the first type, the volumes of the two depots are very much alike, but the hot water depots are larger.

In the third type, the depots were arranged in the same way as the depots in the second type, but the cold water depots were placed on a vault (Figure 15, Figure 90, Figure 97, Figure 126, Figure 151). The space that formed under these vaults was used as storage.

Quite a little information concerning the connections of public baths with urban water supply network could reach the present day. Only in the *Topkapı Hamamı maksem was used*, through which the water was purified and distributed, during water transfer to the depots.

The entrances to the *külhan* courtyards located behind of the buildings were provided through a secondary, non-busy road. In the *külhan* courtyards, there are enclosed spaces and/or semi-open spaces where the woods to be burned in the *külhan* and the ashes coming out from the *külhan* were stored for a certain period of time.

The access to the *külhan*, which is located in the middle of the long-exterior wall of the hot water depot, was provided through this courtyard. By lowering the courtyard floor level in the section where the *külhan* furnace was located, the *cehennemlik* level laying under the bathing spaces was reached.

CHAPTER 4

CONSTRUCTION PROCESS AND TECHNIQUES OF THE 14th -16th CENTURY OTTOMAN BATHS IN EDİRNE

The construction process of the public baths starts in line with the requirements. They are composed of processes that cannot be clearly differentiated since these processes involve the revision of previous stages by feedback and provide basis for the following stages like feasibility, design, scheduling, resource procurement, application, and maintenance. At the same time, an inspection mechanism takes an important part in all these processes.

In this section, information gathered from the studied buildings and literature survey is presented on authentic construction processes and techniques of the 14th-16th century public baths in Edirne. The relationship between the 14th and 16th century Edirne public baths and their predecessors, as well as their significance among the other public baths constructed during the same period are also evaluated. For this purpose, some details of other public baths, which are important to assess the significance of studied public baths, are also included.

Thus, in this chapter, the evaluations related to the construction processes, building materials, selection and supply of building materials, supply of workforce as well as construction techniques are presented in detail for the public baths of Edirne as one of the most complex examples of Ottoman architecture.

4.1. Pre-Construction Process

Information regarding the process of preparations for the construction of Ottoman public baths can be obtained through the account-books kept during construction of large-scale imperial buildings, waqf records and *risale*s that architects had drawn up. In addition to these, information regarding the construction preparations of dynastic buildings can be acquired from *ferman*s (imperial order) and miniatures.

When the need for a public bath arises, the process of constructing a public bath begins after the founder of the building receives permission from whoever is authorized for the architectural activity in the settlement (Orhonlu, 1981: 13) and once an architect who is deemed fit for the job is employed by this same person. If the founder of the building is the *Sultan*, he informs *Mimarbaşı* about the situation via a *ferman* (from Dündar, 2000: 156: Küçükdağ, 1997: 29). Within the first few days of the construction of dynastic buildings, a *bina nazırı* (inspector/superintendent) is also employed for each building (Kuban, 1981: 275).

It is a known fact that very successful staff members high in number consisting of architects and craftsmen took part in the rapid structuring process of Edirne between the 14th and and 16th centuries. Documentation regarding the existence of a special organization for authorized construction works also dates back to the second half of the 15th century (Turan, 1963: 160). While the date of establishment for *Hassa Mimarlar Ocağı* that was governed by *Şehreminliği* after the 19th century is unknown, it is believed that the reason for this kind of an institutionalization was to allow rapid construction of İstanbul during Mehmed II period (Turan, 1963: 159; Sönmez, 1988a: 251-254).

First and foremost, *Hassa Mimarları* were responsible for all the construction works and maintenance processes for the buildings ordered by the *Sultan* and other members of the dynasty. Their main responsibilities included construction of public buildings and city infrastructure in İstanbul, inspection of buildings in İstanbul and establishing the necessary physical structuring during army campaigns. Their other responsibilities consisted of maintenance for the religious buildings belonging to minorities, determination and control of salaries for builders and construction workers, inspection of dimensions for building materials and market research for their prices. (Turan, 1963: 163-176)

With this institutionalization, standardization became in construction practices and maintenance works (Aktüre, 1987: 103). In *Hassa Mimarlar Ocağı,* which consisted of 40-43% non-Muslim architects during the late 16th century and 17th centuries, this percentage surprisingly decreased to 5% in the late 17th century. The total number of commissioned architects went up to 43 until 1633-34 with a steady growth, though it was reduced to 34 in 1664-65 (Turan, 1963: 159-160). Considering the registered number of architects, it is not possible for *Hassa Mimarları* to be responsible for all settlements within the Empire's territories. However, a major settlement such as Edirne, which never lost its significance for the dynasty and is situated in the close surrounding to İstanbul, must have been under the control of the *Hassa Mimarlar Ocağı* even if it was not their priority area of responsibility.

In addition to *Hassa Mimarlar Ocağı*, *eyalet mimarları* (state architects), *şehir mimarları* (city architects) and *vakıf mimarları* (waqf architects) are known to have been commissioned for central locations outside İstanbul according to records from the 17th century onwards (Turan, 1963: 176, Orhonlu, 1981: 12, 28). *Şehir mimarı* was not commissioned for every city, since *eyalet mimarları* were given commission for certain states. However, multiple *şehir mimarları* at a time were known to be commissioned on a regular basis for Edirne (Orhonlu, 1981: 14, 18). The most senior of city architects held the title of *Edirne Mimarbaşı* (Chief Architect of Edirne) who was commissioned by *Hassa Başmimarı* (Chief Architect of *Hassa*) and was responsible for the supervision of privately-owned constructions, salaries of builders and construction workers, measurements of building materials and their control (Orhonlu, 1981: 18, 20). In addition, the private sector architects and builders who worked in large central locations such as İstanbul and Edirne had to obtain a licence from *Ser-mi-maran-ı Hassa*, as proof of their professional competency for the job (Turan, 1963: 177).

After receiving their commission, the architect had to assemble a technical team in accordance with the requirements of the building project and a suitable site had to be selected for the public bath. While the main criterion for this selection was "the public need", the final decision for the building site should have depended on many variables such as the topographical features and the firmness of the ground. For instance, the topographical superiority of the ground is known to be of importance for the selection of building site for the *Süleymaniye Camii* in İstanbul (Meriç, 1965: 59). Another factor is observed in the case of site selection for the *Sultan Ahmet Camii*. It is known that the initial building site was abandoned later on in order to refrain from damaging the urban tissue in the area (Barkan, 1972: 51).

As it was with other Ottoman cities, Edirne was governed by a *kadı*. The evaluation of requests for building projects, supervision of building activities, inspection of account-books kept by waqf clerks, control of maintenance for waqf buildings in Edirne were all within the jurisdiction of *Edirne Kadısı* (Yiğit, 1999: 162-163). *Edirne Mimarbaşı* on the other hand, served as a deputy of *Edirne Kadısı* for matters related to settlement structures, especially for building and maintenance activities for dynastic buildings (Yiğit, 1999: 159; Tabaklıoğlu, 2000: 157).

After deciding on a building site for a public bath, a permit request would be submitted to *Divan-ı Hümayun* whom would task the *Edirne Kadısı* for the inspections required, and then the permit would either be issued or not based on the results (Dündar, 2000: 162-164). Especially for public baths, even if the founder of the project was a member of the dynasty, an inspection would be carried out regarding whether the new building would cause any loss of income for the existing public baths, and the building permit would not be issued if there was a risky situation (Dündar, 2000: 162, 165).

After obtaining permission for the selected building site, an outline drawing of the site would be prepared by a "*mühendis*"[52] or "*mesahacı*" (topographer, surveyor) (Orhonlu, 1981: 12; Crane, 1987: 96; Tanyeli, Tanyeli, 1993: 126). In this system, *mesaha* was based on measuring the area of a site by *zira/arşın* (Gökyay, 1976: 180). Horizontal measurements would be taken with a tool made of a silk thread on which each unit measurements were marked with knots (Tanyeli, Tanyeli, 1993: 126; Tanyeli, 2017: 21), and vertical measurements were taken with *havay-ı terazi* (a simple bubble level).

The project would be prepared and drawn up[53] by a team of architects and their technical staff assigned or suggested by *Hassa Mimarlar Ocağı* (Figure 195, Figure 196). These projects would mainly consist of basic floor plans. The plans would be

[52] "*Mühendis*" means "engineer" in modern Turkish. The word " مُهَنْدِس" which was created as a result of a foreign word making its way into Arabic language and therefore into Ottoman language, that was also used in forms of "*muhandis*", "*mühendis*" and "*mühendiz*" (Elmalı, 2005: 327) in Ottoman literature means both builder and a worker who takes measurements - as in a topographer (Ca'fer Efendi, (1614), 2005: 108). Sufficient information is not available on whether there is a specific difference in meaning for the words "*mühendis*" and "*mesahacı*" that were used to describe the person who takes measurements of the building lots.

[53] For examples of 15th and 16th century project drafts, see: Topkapı Palace Museum Archives E.9495-E.9595.

drawn on specially-made squared paper. The paper was made by applying vertical and horizontal pressure for the paper on a plate called "*mıstıra tahtası*" on which thin threads would be strained across with even spacing (Tanyeli, Tanyeli, 1993: 127) (Figure 196).

Akıncı (1997: 16), points out that these non-detailed drawings (Figure 195) were adequate for the time they were produced in; that it is almost certain for the builders of the era did not need many details other than the main measurements. The drawings, which were made on equally-sized squares on the paper, are thought to be also helpful in calculating the approximate cost of buildings.

It is a known fact that small models were also made for certain imperial structures, some of which were prepared by a direct order of *Sultans* (Kuban, 1981: 274) (Figure 197). In the 16th and 17th centuries, it is observed that models for significant buildings, castles and special-functioned spaces were exhibited in circumcision ceremonies, celebrations for recent conquests and various other festivals (Figure 197).). It is known that during a parade in 1720, public bath employees made a three-dimensional public bath model and *tellak*s demonstrated how they work on the model, together with the battle scenes re-enacted on a model castle carried by elephants (And, 1982: fig. 26, 56) (Figure 197). This example shows how architectural models became a part of social life and a visual attraction for large masses.

The terms "*resm*", "*kar-name*" and "*mücessem-i tersim*" are known to have been used for the project works (Öngül, 1994: 129; Dündar, 2000: 166). Barkan (1972: 52) notes that "*kar-name*" should be simple sketches or model drafts, while Akıncı (1997: 17) points out that "*kar-name*" should mean plan drawings and "*resm*" might have been models or façade drawings. On the other hand, other art historians believe that "*resm*" and "*kar-name*" were used to describe quite similar concepts, while "*mücessem-i tersim*" holds a meaning that is different to both. Önge (1988: 33) states that "*mücessem-i tersim*" might have been used for models or model drawings, whereas Kuban (1995: 144-145) says it indicates perspective drawings. Dündar (2000: 166) claims that it meant both models and perspective drawings up until the 19th century. It is seen that for plan drawings the terms "*resm*" and "*musattah*" were used, while for façade and perspective drawings “mücessem” was used in the 19th century Ottoman architecture (Dündar, 2000: 166).

Hassa mimarları, *eyalet mimarları, şehir mimarları* or private sector architects would calculate the estimated cost based on the project approved by *Divan-ı Hümayun* or the *kadı*s. Throughout the building process, an account-book of expenses were held by the executive architect somebody else who was tasked specifically for this job. Accordingly, the cost would be relayed to the revenue office (*defterdarlık*) at the end of the construction for a final inspection and the revenue office would control both the initial and final inspections (Turan, 1963: 167-168). Inspection of the building costs, which were updated during and after the construction, and account-books of construction contain vital and detailed information.

If the founder of a building was a member of the dynasty, these account-books would be presented to *Divan-ı Hümayun*. Then, the budget to cover the costs would be relayed to the *Defterdarlık* and the final findings would be presented to the *sadrazam* (the grand vizier). (Turan, 1963: 163-164, 176)

For every kind of construction work, soil mechanics had to be checked out before the construction process begins. The carrying capacity of the soil, on which the entire weight of the massively heavy public baths was built with the masonry system, along with the possibility of ground collapse and the existence of underground water streams had to be inspected for. Otherwise, issues with the soil that is impossible to solve with the technology of the time, would not allow the structure to stand for too long.

After completing the final inspections, the site is prepared for construction. This preparation encompasses expropriation of privately-owned buildings within the site by purchasing them and assembly of the required structures and modules, along with an improvement of the roads in the area (Barkan, 1972: 51).

In the next stage, builders and workers for the construction are recruited. For the public baths constructed in Edirne, these builders were supplied from Edirne, though if necessary the workforce was supplied by contacting officials in the close surroundings. If the project belongs to a member of the dynasty, the records of *Hassa Mimarlar Ocağı* should have also been used. These records included information of architects, master-builders, builders (*taşçı, duvarcı, dülger, demirci, kurşuncu, camcı,* *nakkaş, lağımcı, kaldırımcı*, etc.) (Barkan, 1972: 94) in İstanbul and other provinces. According to the records these skilled workmen were transferred from a settlement to another, where necessary (Turan, 1963: 168; Barkan, 1972: 95).

Such a case is known for the *Sokullu Mehmet Paşa Hamamı*, which was built by Mimar Sinan (Figure 189). It is known that 67 architects were registered in Edirne in 1519, whereas 112 architects, timber craftsmen (*harrat, dorudgar, neccar*), timber construction craftsmen (*dülger*), wall builders (*benna*), tile craftsmen etc. were registered in 1570 (Dimitrov, 2012: 64). However, these numbers did not suffice for an imperial building like the *Sokullu Mehmet Paşa Hamamı*. By a decree on March 20th 1568, the *kadı* of Karasuyenicesi and Gümülcine were informed that 50 *benna* and *neccar* were needed for the construction of the public bath and that they were required to be sent to Edirne together with their working tools necessary for the construction (from Dündar, 2000: 172: BOA, MD 7, row: 1109: 386).

The records reveal that building projects belonging to state officials and the buildings or structures that benefit the public such as water canals were prioritized, and the builders and workers already working on other active projects were transferred to these constructions when deemed necessary (from Dündar, 2000: 172: BOA, MD 52, row: 764: 287; BOA, MD 52, row: 569: 218; BOA, MD 21, row: 553: 231; etc.).

The Ottoman construction records are inadequate to determine the architects by name, only a few of them were mentioned. These records show that the following architects worked in Edirne in the 16th century: *Mimar Sinan*, *Mimar Hüdaverdi* (named in records dated at: 1525-1526), *Kara Hasan* (named in records dated at: 1572), *Hüseyin Çavuş* (named in records dated at: 1584, 1590) and *Ahmed Halife* (named in records dated at: 1590) (Dündar, 2002: 235, 247, 250-251, 256).

Although mostly freelance workers worked in constructions of public baths, it is known that military personnel, convicts and (or) captives also worked directly in construction or in the process of preparing building materials and the fees paid to these captives were on par with what was paid to the freelance workers (Barkan, 1972: 112). For instance, an imperial edict dated 1572 states that *forsa* (war captives who row aboard ships or convicts) were sent to Edirne for the maintenance of the Palace and for the construction of a public bath, and after a while some of the captives who were working in the construction of the *Selimiye Camii* were transferred to İstanbul in order to work on another construction (from Yiğit, 2010: 251: 16th century MD No: 26, p.203, c.565; No:26, p.168, c.449). It is seen that captives were used for the cutting and transportation of Marmara marbles during the construction of the *Selimiye Camii* (from Yiğit, 2010: 251: 16th century *MD* No:10, p.174, c.262 and No: 10, p.113, c.180). The same practice should have also been carried out for public waqf baths belonging to the dynasty.

Meanwhile, the acquisition of the building materials was scheduled. The most important part of this stage is identifying the source for the building materials and adjusting the budget. For the public baths in Edirne, the financial works of constructions (such as daily wages of workers, expenses for materials) were authorized by the *bina emini*. The *bina emini* was specifically commissioned by the *kadı* for waqf constructions especially belonging to the members of the dynasty. Along with the *bina emini*, accountable disbursing officers were also assigned (from Yiğit, 2010: 234: 16th century MD No: 7, p.354, c.1028 and No:39, p.64, c.155).

A document dating back to 1565-1567 gives information regarding the employed *bina emini* for the constructions of public baths in Edirne. This edict demanded the assignment of a *bina emini* for the construction of a public bath in Edirne belonging to *Sultan Bayezid Vakfı* (from Günalan, 2005, Appendices: MAD year: 973-974, no: 2775, page: (947)1832, edict no: 4082).

In the construction of buildings that belonged to state officials, the regional *kadı* and *Hassa Harc-Emini* or the *Şehremini* were appealed to for the procurement of the necessary building materials, the *kadı* of the neighbouring areas were also appealed to in situations where the resources were insufficient (Dündar: 2000: 174). For instance, the records show that *Şehremini* of Edirne was also responsible for the procurement of building materials for construction activities in İstanbul where necessary (from Yiğit, 2010: 235: 16th century MD No: 60, p.43, c.103). It is also known that the officials who did not lend help even though they could meet the demand were reported to *Divan-ı Hümayun* in order for the issue to be resolved through legal action (from Dündar: 2000: 175: BOA, MD 31, row: 277: 115).

In situations where there were problems with the procurement of building materials for privately-owned constructions, these people would request assistance directly from the *kadı* or *Divan-ı Hümayun* (from Dündar: 2000: 177: BOA, MD 22, row: 4: 1; BOA, MD 61, row: 89: 33).

It is widely known that *Hassa mimarları* would inspect building supplies arriving at the construction sites. They were responsible for and even inspect the stores where building materials were made or sold, including lime quarries, glazed tile workshops, stone quarries and they would calculate the unit prices (Turan, 1963: 175). Information gained from related sources show that these materials or products would be paid in advance; however, when payments were delayed, appeals to the *kadı* or *Divan-ı Hümayun* would be made (from Dündar: 2000: 177: BOA, HH 8572).

Transportation of building materials, which are explained in detail in Chapter 4.2, was as important as the procurement. Therefore, sources for procurement that can be found in the close surroundings should have been prioritized. For example, even in the construction of imperial buildings in İstanbul, stone quarries close to the Sea of Marmara would be used, along with *küfeki* acquired from the vicinity of İstanbul, marble from the Island of Marmara, while terra-cotta/baked clay and lime-based materials would be produced nearby (Faroqhi, 1997: 158).

After the completion of all preparations, lasting months after constructional activities began, the official construction would be given a start. Especially official starts for the construction of dynastic mosques as the founder of the building places the foundation stone in the *mihrab* on a date when *yıldıza bakanlar* (a type of astrologist, fortuneteller or spiritual advisor) deemed auspicious/propitious (Gülersoy, 1990: 31). In time, this practice has turned into a tradition where state officials would attend, treats were offered and animal sacrifices were made (Öngül, 1994: 130-136).

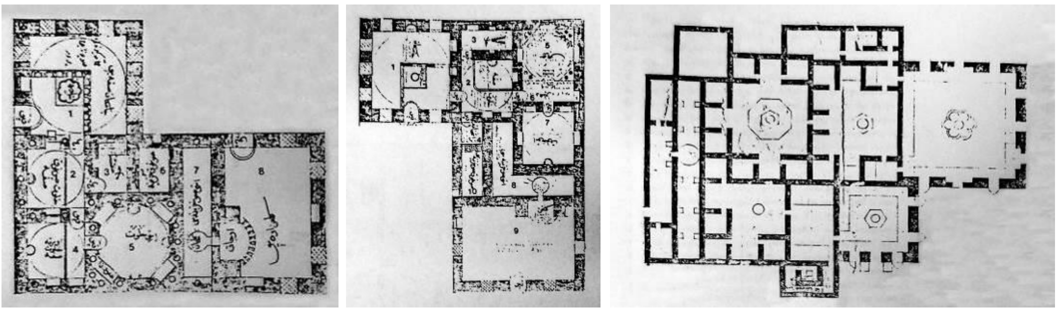

Figure 195. The plan drawings of Ottoman baths from the last quarter of the 16th century (left), last quarter of the 16th century (middle), second half of the 15th century (right) (Source: from Necipoğlu Kafadar, 1986, 225-226, 228: Österreichische Nationalbibliothek, Vienna, Cod. 8615, fol. 151r, 153r and Topkapı Palace Museum Archives, İstanbul, num. 9495/7)

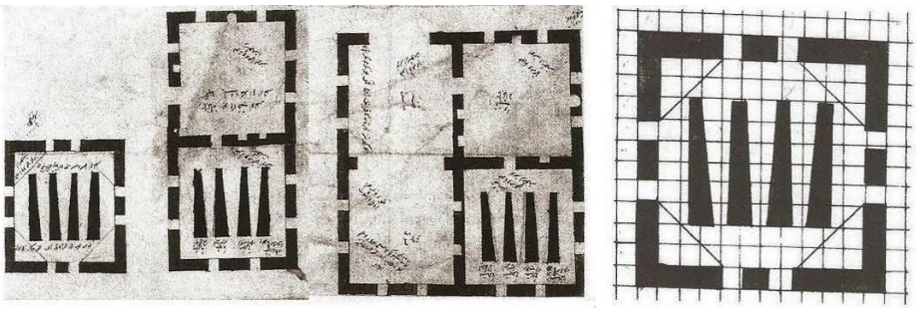

Figure 196. Three variations of the *Çorum Abdal Ata Türbesi* constructed in the end of the 15th century or the beginning of the 16th century; the project (left) and the project with blind grid shown in ink (Source: from Necipoğlu Kafadar, 1986, 230: Topkapı Palace Museum Archives, İstanbul, n. 9495/11; Ünsal, 1963) (right)

Figure 197. Drawings of the models took place in 1582 festivals which presented in *Surname-i Hümayun*: the model of the *Süleymaniye Camii* (left), a public bath and *tellak*s (middle), a citadel (right) (Source: And, 1982: 78, fig. 26, 56)

4.2. Building Materials

Stone, timber, terra-cotta, metal, and plaster based building materials were used in the construction of public baths built during the 14th and 16th centuries in Edirne. Information on general properties and variations of these building materials are gathered directly from these buildings (*Gazi Mihal Bey, Beylerbeyi, Yeniçeri, Topkapı and İbrahim Paşa Hamam*s) are presented in Chapter 3. The information obtained from literature survey integrated with the case studies are also presented in this chapter.

Glass materials are known to have been used for *soğukluk* windows of public baths and the oculi of upper structures. However, glass was inevitably left out of this study, since there were not any original materials in the still existing buildings examined.[54]

4.2.1. Stone

One of the major building material used in the construction of public baths is undoubtedly stone. Transportation of building stones was as important as their procurement. Therefore, stone quarries in the close surroundings or with easy access were preferred in Ottoman era, just like it was in the early eras of Anatolian architecture (Naumann, 1991: 39), with the exception of extremely special buildings or extremely special circumstances. In Anatolian Seljuk era constructions, it is a known fact that stones were dug from quarries with a maximum distance of ten kilometres to the construction sites were preferred in order to cut down the transportation costs (Erguvanlı, 1981: 288). Ease of processing and mechanical strength of stones were also among main reasons of preference.

The central settlement of Edirne lies on formations of limestone and clastic rocks (pebble, sandstone, siltstone etc.) (MTA, 1964). Ergene, Danişment and Thrace Formations, in which terrestrial clastic sedimentary rocks located on volcanic rocks, and also Keşan Formation, which is located south of Keşan, are areas all of which surround the central settlement and are quite rich with sandstone sources (Şengüller, 2013: 111-112; Kılıç, 2009: 48-54).

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[54] For the architectural use of glass in these centuries, see: Bakırer, 1986 and Dölen, 1986

North and northeast of the central settlement are surrounded by the Istranca Massif, located on the northern Thrace (Figure 198). This massif is known to be home to granitoid, metagranit, sandstone, andesitic tuff, phyllite, slate, basalt, conglomerate, gneiss, mica-schist sources along with neritic (fossiliferous) limestone, continental limestone and marble sources (Okay, Yurtsever, 2006: 2).

Studies with further details are available on possible and potential stone sources within Turkey's borders, especially Istranca and Sakarya Zones located north of the central settlement of Edirne, along with Soğucak Formation and Çanakkale Formation located south of it (Figure 199). According to these studies, marble sources located on the North of Demirköy (Edirne), between Kofçaz-Demirköy (Kırklareli) and on Island of Marmara; continental limestone sources between Edirne-Lalapaşa and Vize-Saray settlements; neritic limestone sources around Sarayakpınar, Lalapaşa, Süloğlu, Kırklareli and Erikli along with in between Pınarhisar-Kıyıköy-Saray and Saray-Çatalca, are found (Sayar, Erguvanlı, 1962: 10-11; MTA, 1964 and Türkecan, Yurtsever, 2002) (Figure 199). Neritic limestone, claystone and sandstone sources are also found in the Mezardere/Yenimuhacir Formation located between Enez and Keşan (MTA, 1964; Türkecan, Yurtsever, 2002; Küçükkaya, 2009: 52) (Figure 198, Figure 199).

Moreover, just like in all eras and cultures, building stones from older structures and ruins were also recycled in the Ottoman-era Edirne. This highly economical and rational solution was even adopted in the construction of highly important buildings during the Byzantine and Principalities eras quite often, as not only marble or similar stones but also simple building materials such as bricks were reused (Ousterhout, 1999: 140).

These spolia were not only used as they were found but also cut and reshaped. In Dernscwam's (1992: 211) notes dating from 1555; detailed information is given regarding construction of special water canals into where the stones would be reshaped, cutting of the marble using crosscut saws by the directives of the architect and transportation of these stones to the construction site. Thus, it can be said that the Ottomans used structures and ruins that remained from previous eras, as individual stone quarries. The systematic operation of this process shows that recycling/reusing was adopted quite often and the use of spolia in Ottoman structures was actually quite common than it is observed and thought.

The availability of a stone type is the most important selection criterion. In addition, there are some other important criteria in the choice of a building stone: weathering properties, seasoning, appearance, porosity and water absorption capacity, ease of quarry, capability for sculpturing, compactness and weight, and agents of destruction of stone types (Purchase, 1904: 162). There are, however, few studies focusing on these subjects.

Five different types of stones were identified that were used in the construction of public baths in Edirne dating from the 14th-16th centuries: limestone, slate, phyllite, marble and sandstone.[55]

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[55] Dr Geological Engineer Duygu Ergenç was consulted for the determination of stone types.

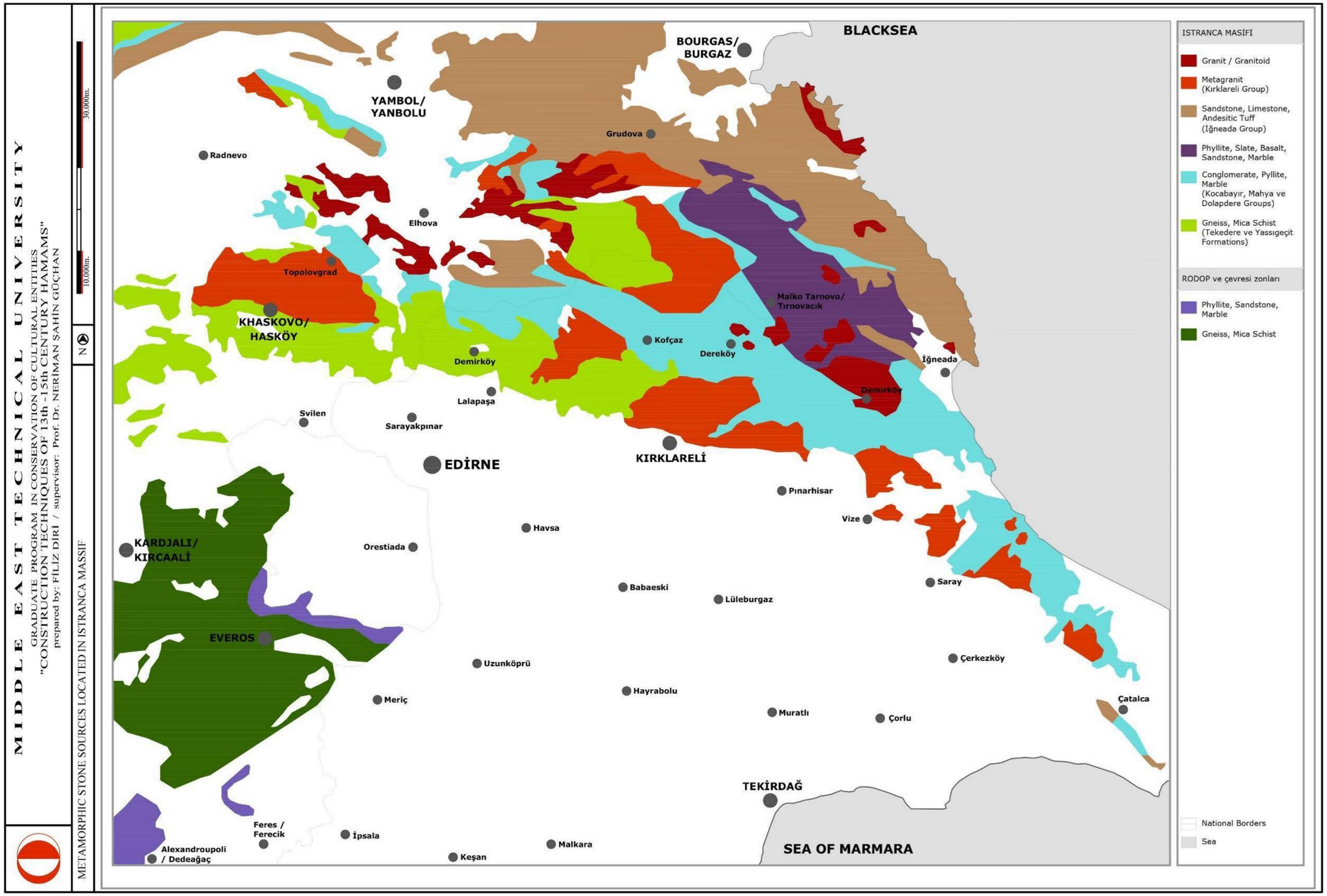

Figure 198. Metamorphic stone sources located in Istranca Massif and Rodop surrounding (redrawn after Okay, Yurtsever, 2006: 2)

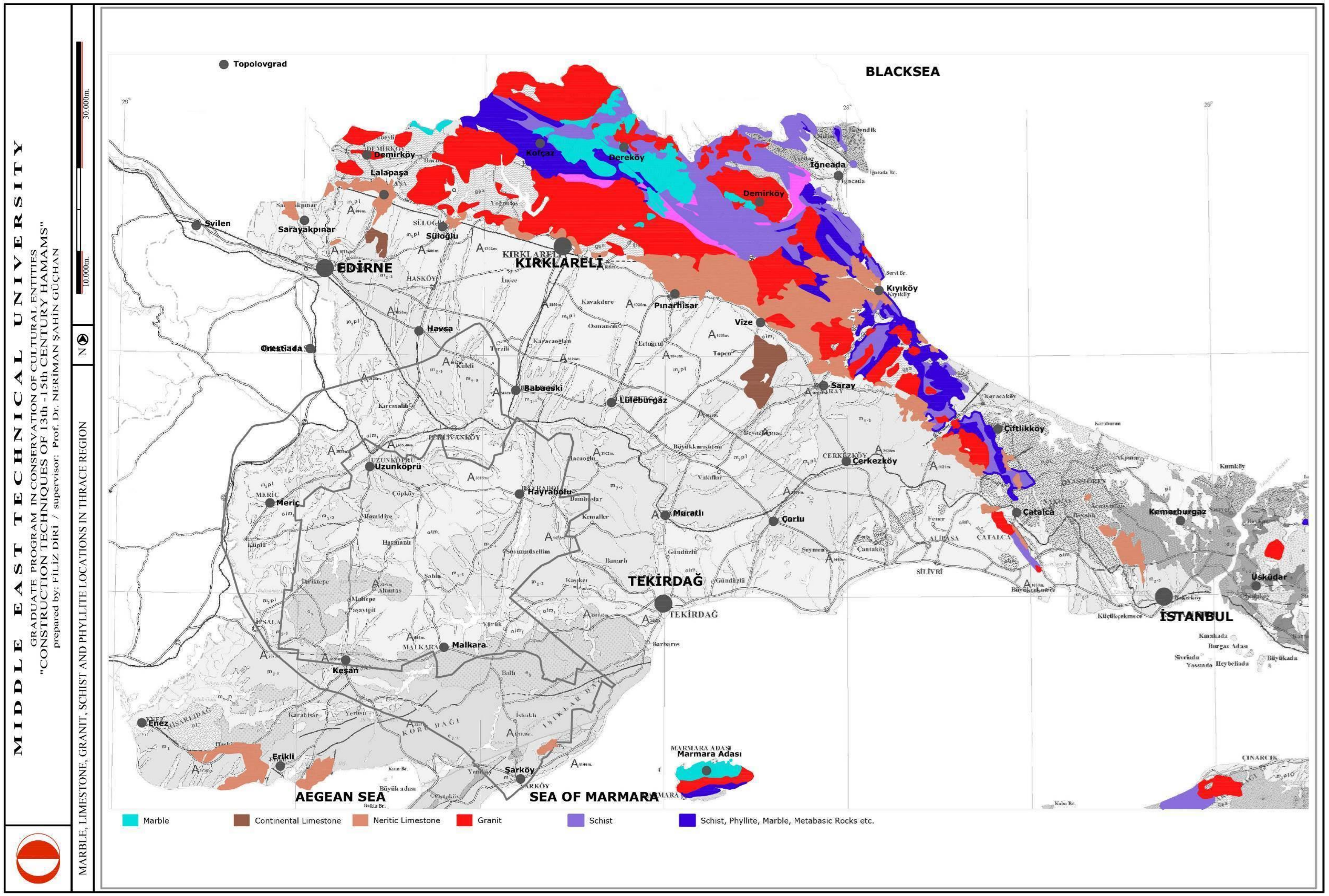

Figure 199. Marble, limestone, granitoid, schist and phyllite sources locations in Thrace Region according to litology maps (redrawn based on MTA, 1964 and Türkecan, Yurtsever, 2002)

Limestone:

Used in all components of public baths from the foundations to the upper structure, the primary building stone is neritic limestone, which is also known as "*küfeki*" (Ca'fer Efendi, (1614), 2005: 103) and "*maktralı kalker*" in literature. Limestone is known to have been used and preferred as a building stone since the ancient Roman period due to its ease of quarrying and processing features (Sayar, Erguvanlı, 1962: 21). Widely used in the early Ottoman architecture, it makes up 90% of the building stones that were used even in the constructions by Mimar Sinan in the 16th century in areas close to limestone quarries, such as İstanbul (Erguvanlı, 1981: 292).

Other than its aesthetic aspects gained from containing fossils, this sedimentary rock with its off-white colour has a quite high mechanical durability due to its high calcium carbonate content and it is also very resistant to deterioration.[56] However, due to its inclination towards disintegration, separation and dissolving due to humidity, it should be used with care alongside water in areas of high humidity (Sayar, Erguvanlı, 1962: 21).

According to the information gathered from the account-books kept during construction and from the studied structures themselves,limestone was provided from quarries called "*kahreng-i miri*" that belonged to the state or was operated privately (Barkan, 1972: 351; Nayır, 1975: 97). On the few detected samples, names were inscribed on the stones referring to the stonemason or the quarry, or symbols such as drills, bows, forks, fish, hooks etc. can be observed (Nayır, 1975: 98). Even though no definitive conclusion can be made through an extremely limited amount of samples, the existing information shows that most of the private quarries were operated by non-Muslim citizens (Akıncı, 1997: 32).

The account-books kept during constructions also include information regarding the identification of limestone. It is seen that the stones were first designated by their size and then where they would be used. By the order of their size,

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[56] Fossiliferous neritic limestone: with average pourousness (12-15%), unit weight 25-27kN/m3, water absorption capacity 6%, unilateral compressive strength 30-35 MPa, tensile strength 5 MPa (Arıoğlu and Arıoğlu, 2005, 164-170; Siegesmund and Dürrast, 2014, 62).

the limestone would be named *seng-i büzürk* or *dergah* (freestone), *seng-i kalıp* (dimension stone), *seng-i çap*, *seng-i zira* (ashlar course stone), *seng-i helik* (rubble stone), *kemer tabanı* (impost), *seng-i pehlu* (jamb), *seng-i harpüşte* (capstone), *seng-i minare* (minaret stone), *seng-i kaldırım* (pavement stone), *döşeme-i yufka* (thin pavement), and *seng-i kapak* (sewer cover stone) and by the order of their purpose they would be named *kemer* stone (voussoir), *köpri/köprilik* stone (architrave) (Aktuğ Kolay, 1996: 95), minaret footing, *pahlu* stone, *süve*/jamb stone, mid and small *süve*, *şerefe* stone, *taban* stone and fragment stone (Barkan, 1979: 68; Yücel, 1992: 154; Aktuğ Kolay, Çelik, 2008: 501). The stones requested from quarries would have certain size standards. Stones that were cut and had their front edges processed would be sent to the construction sites, where they would be sculpted into their final size and elaborated by the workers on the construction site (Akıncı, 1997: 31).

The largest neritic limestone quarries around Edirne, which are known to have been used by the Ottoman Empire as well, are located in Pınarhisar (Sayar, Erguvanlı, 1962: 27). Pınarhisar neritic limestone with its white-cream colour, porous structure and high amount of fossilized content was also named "*bademli küfeki*" due to the fossils in it. Mimar Sinan is known to prefer these stones as main building stones, while some of the limestone used in the construction of the *Selimiye Camii* was brought from the quarries of Lalapaşa-Taşlımüsellim Village that are located ten kilometres from Edirne (Sayar, Erguvanlı, 1962: 27; Çengelci, 2008:23).

In public baths of Edirne, stones extracted from neritic limestone quarries located in and around Sarayakpınar, Lalapaşa, Süloğlu, Kırklareli, and Erikli along with the area between Pınarhisar-Kıyıköy-Saray and Saray-Çatalca should have been used. Used in the foundations, walls, transition elements and upper structures, these stones are divided into four groups based on their shapes.

The first group consists of rough-cut limestones used in the foundations and walls. Their dimensions varied between 10-65 cm horizontally and 20-30 cm vertically. Stones used for the early Ottoman period repairs are observed to feature smaller dimensions.

The second group consists of cut limestone that was shaped in a way that would form regular quadrangular prisms. These components were the main building materials used in walls and drums. Cut limestones were also used in corners and openings of walls that were built with rough-cut stones. Components used in walls and drums share similar dimensional properties with rough-cut stones. The ones that were used for wall corners and openings reached 55x55 cm in dimension.

The third group consists of limestones that were used as springers, voussoirs and keystones in the arches of doors and niches, which are only observed at the *Gazi Mihal Bey Hamamı* (Figure 33, Figure 36, Figure 200). These units were shaped in accordance with the arch profile and the location of use. Their thickness varies between 27.5 cm and 43 cm.

The fourth group consists of limestones specially shaped for unique forms used as arch springers, on sides of door openings, as door *yaşmak*s, in transition elements and in upper structures. These stone blocks were shaped in forms of regular quadrangular prisms with circular niches within, cogged rectangles and stars (Figure 75, Figure 109, Figure 114, Figure 200, Figure 201, Figure 202, Figure 203). In the *Topkapı Hamamı*, limestone blocks with very rare shapes produced specially for the *eyvan* vaults of this building (Figure 139).

Front façades of some of these specially-formed stones were sculpted elaborately and finely (Figure 28, Figure 30, Figure 75, Figure 139, Figure 202, Figure 203). In addition, the smooth front façades of these stone blocks were placed in such a way that they would be projected 3-4 cm from the surface they are used in (walls, transition elements, domes). This construction detail shows that plaster was not used on the front façades of these stone blocks since plaster was finished with the projecting sections of them. Hence, their clear-sculpted front façades were left exposed, used without plaster.

Front façades of certain specially-formed stone blocks are roughly shaped, not elaborated (Figure 200, Figure 201). On these front façades, there are some nails and similar metal elements nailed in a projecting manner, as well as notches made with similar pointed tools (Figure 200). From these traces, it is understood that plaster was used on their front façades and some of these blocks were even elaborated visually by using gypsum and plaster (Figure 201).

Most of the paving stones of the public baths in Edirne did not survive to present day. However, it should be noted that limestone that was cut parallel to the bedding plane with polished surfaces was often used as paving stones. Even though there were not any samples detected, a similar practice might have been carried out for the public baths in Edirne.

Sandstone:

Use of the greenish gray-beige coloured sandstone in the foundations of public baths in Edirne is observed very often (Figure 204). It is also found in the authentic *külhan* furnace floor of the *Beylerbeyi Hamamı* (Figure 204). These stones that were rarely used in authentic walls, were mainly used as a kind of infill material for filling up the space in the middle of walls in between larger limestone blocks, rather than as a part of the main load-bearing system (Figure 205). The rubble stones, which are known to have been paid by their weight in the Ottoman era, should have been used in the foundations of structures, courtyard walls and also as landscape elements (Aktuğ, 1995: 83). It is often observed that during maintenance in Ottoman era, sandstone blocks were used to replace the deteriorated limestones (Figure 205).

There are sandstone sources, around Tekirdağ-Keşan-Malkara in the close surrounding of Edirne, which was formed as a result of the merging between sand grains and a natural type of binding material. The largest sandstone quarry in this area, that is known to have been used in the Ottoman era, is located in Tekirdağ-Karansıllı/Karamürselli Village (Sayar, Erguvanlı, 1962: 27). Another sandstone quarry that is known to have been used by the Ottomans is situated east of Keşan. These sandstones, quarried from the east of Keşan, can easily be dug out from here due to the presence of thin marly (calcareous soil) layers between sandstone deposits in 2-10 metres thick (Sayar, Erguvanlı, 1962: 27). The ease of quarrying might have been the cause of preference of this particular quarry even though it is situated further away from the central settlement in Edirne, compared to the other.

Phyllite and Slate:

Another type of building stone used in the construction of public baths is foliated flagstones, which are also known as *kayrak*, *kayağantaş* or *arduvaz* in literature. The literature refers to these types of flagstones as "*kayrak*", which means "slate", in general (Siegesmund and Török, 2014, 26). In fact, the components used as flagstones in many buildings in Edirne are slates, but mostly "phyllite", a name derived from the Greek term "*phyllon*" (leaf). Phyllites are a type of foliated metamorphic rock that are formed as a result of slate going through a metamorphosis.

As a matter of fact, slate sources in the close surrounding are only identified around Tırnovacık (Malko Tarnovo), located 87 kilometres from Edirne. However, phyllite sources are found both in that area and around Kofçaz, between İğneada-Çatalca and around Everos, located 58 kilometres southeast of Edirne as well. (Figure 198, Figure 199)

Most of the flagstones used in public baths of Edirne are phyllite, which are also commonly found around Edirne (Figure 198, Figure 199). Due to its high resistance to heat, mechanical strength and its own form, phyllite was especially utilized up to the water canals, above the higher level of water lines, and as beams and floor beams in the floor systems of bathing sections in public baths (Figure 27, Figure 28, *Figure 55*, *Figure 56*, Figure 57, Figure 58). Phyllite was also used both as a base and load-bearing element on the spring lines of arches that are projecting out from wall surfaces, projections of transition elements and projections of upper structures (Figure 114, *Figure 132*, *Figure 138*, *Figure 140Figure 141*, Figure 162, Figure 168, Figure 170). A photograph of the *Yeniçeriler Hamamı* (Figure 104), from the 1970s reveals that it was also used as a covering material on the upper structures for a period of time.

Marble:

Marble was utilized as wall covering and floor pavement material in constructions of public baths in Edirne. Marble is a highly sought-after building material with its low porousness, water resistance, 2,5 g/cm^3 density and high compressive strength (Moncmanová, 2007, 240). As with other quarries, the mine quarries were operated either by the state or by private ownership. If operated by the state, these procedures were carried out with workers and a certain budget was sent by the state if required (Barkan, 1972: 353-354; 1979: 39-40).

Marble quarries that are the closest to the central settlement in Edirne are located within the borders of Kırklareli (Figure 199). Various types of marbles, known as *Vize pembe, Vize platin, Kurudere Leylak, Sazara sedef, Trakya beyazı, Şükrüpaşa beyazı* and *Dereköy çimen yeşili,* are known to be dug out from the marble quarries within Kırklareli (Vize, Sergen, Kanlıdere, Kurudere, Pehlivanbayırı, Sazara, Sarpdere, Yıldırım Pınarı, Üsküp, Mağra Kaynağı, Palamuttepe, Şükrüpaşa, Taşlıtepe, Dereköy, Ömerin Tepe, Demirköy) (Bilgin, Çakır, 1998: 26). Public baths in Edirne should also have also made use of marble that was extracted from these sites.

The account-books kept during constructions show that marble was processed both as rough-cut stone blocks and as semi-processed building components (arches, jambs, stair steps, paving stones, column heads, etc.) based demand. These components were shaped into their final form by the construction workers (Barkan, 1972: 353-354; 1979: 39-40).

Marble plates with 6-9cm thickness (the thinnest samples are 4 cm and the thickest are 12 cm) and with dimensions of 58-70x100-120cm were generally used in most public baths floor pavements of which have survived to the present day. For some public baths with no surviving pavements, literature also reveal the use of marble plates. Nevertheless, it should not be ignored that the literature refers to many stones, surfaces of which can be polished (such as limestone) are referred to as “marble” and there are not any detailed research or experimental studies available on most of these components.

Marble was also used as wall covering material in the *Topkapı Hamamı*. Different from the off-white coloured and regular rectangle-shaped marble plates used in floor pavement, marbles with dark-gray colour, profiled and with dimensions of 40x40x2cm were used on the wall surfaces (Figure 131).

The *kurna*s and railings on the sides of *seki*s are known to be made of light gray or off-white coloured marble (Figure 19, Figure 105, Figure 120, Figure 183).

Figure 200. The limestone voussoirs used on the door arch located between the Z01 and Z03 spaces of the *Gazi Mihal Bey Hamamı*

Figure 201. The fine-cut limestone units used at the spring level of arches on the *sıcaklık* main space (Z10) of the *Beylerbeyi Hamamı*

Figure 202. The fine-cut limestone units used in the pendentive in the *sıcaklık* main space (Z05) of the *Gazi Mihal Bey Hamamı*

Figure 203. The fine-cut limestone units used in the corbel dome of the *ılıklık halvet* (Z025) in the *Gazi Mihal Bey Hamamı*

Figure 204. The fumes flow openings into the foundation wall of the *Gazi Mihal Bey Hamamı cehennemlik* section (left) and the detail of the copper caldron pit of the *Beylerbeyi Hamamı* (right)

Figure 205. Sandstones used during maintenance in exterior wall of the *Gazi Mihal Bey Hamamı* (left) and *Yeniçeriler Hamamı* (right)

4.2.2. Terra-cotta

Alluvium gathered from Tunca and Meriç Rivers have a high potential of containing clay, which is the main substance in the production of terra-cotta (MTA, 2010). Especially Tekirdağ and Kırklareli have soil that is suitable for terra-cotta production. Generally, brickyards must have been established on the riversides or around the rivers in order to cut down on transportation costs. Considering the space needed for brickyards and the air pollution they cause, it can be suggested that these workshops were located out of settlements or in low-population areas (from Ousterhout, 1999: 128: Theocharidou, 1988: 97-112). Likewise, a 14th century Byzantine text states that brickyards must be located at a distance of 25-40 feet to settlements, based on the direction of the prevailing wind (from Ousterhout, 1999: 128: Harmenopoulus, 1971: 116).

Records dating back to the 14th-15th centuries offer quite limited information regarding the production of terra-cotta (Aktuğ Kolay, 2010: 144). Foremost brickyards such as Cisr-i Mustafa Paşa (Svilengrad - Bulgaria), Dimetoka (Greece), Pınarhisar (Kırklareli) and Tekfurdağ (Tekirdağ) are known to be existed in the 16th century (Altınay, 1935: 108-109).

It can be suggested from written sources that bricks, tiles, and *künk*s were all made in the same brickyards and they were priced by individual units (Barkan, 1979: 157, 159, 162). In the Ottoman period, as it was in the Byzantine period (Ousterhout, 1999: 128), the ancient Roman methods of brick production were utilized (Adam, 2005: 58-63). The baked brick technique is known to be acquired by the Greco-Roman world as well by the ancient Mesopotamian culture, where it was first used (Robertson, 1929: 235). Although bricks were used in earlier dates during the Hellenistic period, the bricks used at that time were either dried under the sun or baked at very low temperatures (Robertson, 1929: 235).

Firstly clay-clayed soil is acquired, put into a shallow pit and tamping with water by using hoes or feet, is left to ferment for one night-one week, shaped with wooden moulds, dried in open air and baked at 450-800˚C for permanent firmness (Adam, 2005: 59-63). Vitruvius (Morgan, 1914: 43) states that the most suitable seasons for brick making are spring and autumn because in these seasons bricks can dry in a more homogeneous way; however, micro-cracks are formed on their outer surfaces in summer because the surfaces dry a lot faster, which reduces the durability of the bricks. Tekçam (2007: 235) defines brick as a building component produced by mixing, moulding, drying and baking of clay, clayed soil, silt, silica sand and water.

Brick:

Among other components, brick has the most important role in the formation of the distinctive appearance of Byzantine architecture (Van Millingen, 1912: 27; Kahya, 1996: 171; Ousterhout, 1999: 169). It is observed that in Anatolian Seljuk architecture, bricks were used not only because of geological circumstances as it is in Iran, Turkestan, and Khorasan but as a design choice made consciously out of admiration (Bakırer, 1972: 187-188, 201; 1995: 171). Bricks are among the primary building materials along with limestone used in the construction of public baths in Edirne built during the 14^{th}-16^{th} centuries.

During the Ottoman period, brickyards operated both privately and by the state. The bricks made by privately operated brickyards were named "*tuğla-i harci*", while the bricks made in the state-operated brickyards were named "*tuğla-i miri*" (Barkan, 1972: 384). For constructions in the Ottoman Empire, bricks were provided by three different methods (Barkan, 1972: 381; Nayır, 1995: 102):

- directly ordered from the producers who own the brickyards,
- purchased from private persons, contractors, and merchants,
- produced in brickyards rented by the state.

Terra-cotta materials were bought with prices that had been agreed upon by the producers or the merchants, based on the content type and were identified per unit (Barkan, 1972: 382). The sources show that production of terra-cotta as an industry was highly organized in the Ottoman Empire.

Vitruvius (Morgan, 1914: 43-44) states that six types of bricks were used in the Hellenistic and Roman architecture: (1) "*Greek Lydian*" with a large rectangular shape, 1.5x1 foot in size (2) half-length "*Greek Lydian*", (3) "*Pentadoron*" large, thick and square in shape, 5x5 hand spans in size, used in public buildings, (4) half-length "*Pentadoron*", (5) "*Tetradoron*" small, thin and square in shape, 4x4 hand spans in size, used in other buildings, and (6) half-length "*Tetradoron*". Unglazed bricks used in Anatolian Seljuk architecture are generally grouped according to their sizes and shapes: whole bricks, half bricks, quarter bricks and minaret bricks (Bakırer, 1980: 148-150).

In Ottoman architecture, information regarding different types of bricks produced in this century can be obtained from the texts of the 16^{th} century. Bricks are first grouped by their size. Bricks are produced in three sizes: "*tam*", (full-length), "*yarım*" (half-length) and "*battal*" (over-length) (Barkan, 1972: 382, 384; Nayır, 1975: 103-104). However, it is also observed that the bricks vary according to their main forms, the edge ratios and the places of use. In addition, the qualitative differences between brick types can also occur.

The bricks used in the domes are "*tuğla-i kubbe*" and "*tuğla-i nime*", which is produced in half size (Aktuğ Kolay, 2010: 148). "*Tuğla-i kubbe*" is a type of brick that is controlled the most and the most expensive type of brick because of its size (Barkan, 1972: 382; 1979: 165-166). Some of the dome bricks in the construction of the *Süleymaniye Camii* in İstanbul were supplied from the brickyards in Gelibolu and Hasköy; and the producers worked under the strict control of the head workmen and officers sent from İstanbul. Furthermore, it was also requested that a certain amount of bricks to be sent to İstanbul separately as samples (Barkan, 1972: 382; 1979: 156).

The term "*tuğla-i çarşu*", on the other hand, was used to mean "*tuğla-i çar köşe*" (four-cornered brick), in other words a square brick (Aktuğ Kolay, 2010: 147). This square-shaped, flat and large brick type used in the Byzantine period takes its origins from the Roman tradition, but different sizes and length-thickness ratios are observed in each period (Kahya, 1996: 171). Likewise, Arseven (1943: 372), stated that this brick, which is 6x6 *parmak* (19x19 cm) in size and described as "*tuğla-i çarşu*", "*tuğla-i miri çarşu*" and *tuğla-i harci çarşu*" in the records, was used both by the Byzantine and Ottoman Empires . Kahya (1992: 46-48), however, found out that the sizes of the square bricks used by the Ottomans in the early periods were 27.5-29.5x27.5-29.5x3.5-4.5cm, while the size of Byzantine bricks in İstanbul was 30-40x30-40x3.5-5cm.

When the construction and repair records of İstanbul *Süleymaniye Camii*, Edirne *Üç Şerefli Camii*, İstanbul *Ayazma Camii* are examined, it is concluded that square bricks were used in large dome footings, large-scale drums and small-sized domes. Since these *tuğla-i çarşu*/square bricks were ordered simultaneously with *tuğla-i kubbe*/dome bricks, the production of dome bricks was strictly supervised but the same care was not given to square bricks (Aktuğ Kolay, 2010: 148).

"*Tuğla-i topaç*" is relatively thicker compared to other brick types and has the lowest price among all brick types. While the sizes and means of production of other types of bricks were kept under control throughout history, this care was not paid for *topaç* brick. This might suggest the possibility that the *topaç* brick was used as an infill material. (Aktuğ Kolay, 2010: 148)

"*Tuğla-i yaşmak"* used in the niches and furnaces, "*tuğla-i eğri*" and infill bricks named as "*pre*", as well as "*tuğla-i döşeme*" and "*tuğla-i şeşhane*" used as floor pavements are among other brick types used in 16th century Ottoman constructions (Barkan, 1972: 383; Nayır, 1975: 103-104).

Most of these terms had continued to be used in the following centuries. However, it is observed that brick terminology has begun to change from the mid-18th century. The brick type defined as "*mir-i tuğla*" in the written sources until that century was defined as "*beylik tuğla*" ("*beylik çarşu tuğla"*, "*harci çarşu tuğla"* and "*beylik ma'a topaç tuğla*") in the account-book of the *Ayazma Camii* and in the later records (Eldem, 1977: 153; Aktuğ, 1986: 73; 1995: 83; Aktuğ Kolay, 2010: 146-147). Similarly, for the half-length brick, the terminology "*kuzu tuğla*" began to be used instead of "*tuğla-i nime*" (Aktuğ, 1995: 83; Aktuğ Kolay, 2010: 146). At present, "*kuzu*" (lamb), meaning half or small size, is still used for construction materials. Some terms, on the other hand, are used only in the 16th-century records and not used in the 17th century and later. For instance, "*tuğla-i bazari*" and "*tuğla-i bazari çarşu nime*" are found only in the 16th-century construction terminology (Barkan, 1979: 162-167; Aktuğ Kolay, 2010: 147).

The bricks used according to their shape and dimension in the construction of public baths in Edirne in the 14th to 16th centuries are divided into twelve groups (Figure 206):

A1- Full-length brick with a square shape, 27.5x27.5x4-4.5cm in size,

A2- Brick with a concave arc shape on the front side, 27.5x27.5x4-4.5cm in size, A3- Brick with smooth trapezoidal shape, 27.5x27.5x4-4.5cm in size (Figure 76),

A4- Brick with a triangular groove on the front side, 27.5x27.5x4-4.5cm in size (Figure 75, Figure 207),

A5- Bricks with two triangular grooves on the front side, 27.5x27.5x4.5cm in size (Figure 207),

A6- Brick with a half star-shape on the front side, 27.5x27.5x4-4.5cm in size (Figure 207),

B1- Half-length brick with a rectangular shape, 13.5x27.5x4.5cm in size,

B2- Brick with smooth trapezoidal shape with a 45-degree-angle one of its front edges, 13.5x27.5x4.5cm in size,

B3- Brick with a 3x3.5cm groove on the front side, 11.5x16.5x4-4.5cm in size (Figure 163, Figure 208),

C1- Full-length brick with a rectangular shape, 24x27.5x4-4.5cm in size,

D1- Half-length brick with a rectangular shape, 24x13.5x4-4.5cm in size,

E1- Full-length brick with a rectangular shape, 27.5x20x4-4.5cm in size,

E2- Brick with a 10x10cm groove on one of its front corners, 27.5x20x4-4.5cm in size (Figure 65, Figure 165),

F1- Bricks with a square shape, 20x20x5-5.5cm in size.

One of the primary construction material of Edirne's public baths is brick, along with limestone. In all the public baths studied in detail within the scope of this thesis, A1 and B1 type bricks were used (Figure 206, Table 2). It is observed that these bricks were roughly shaped by breaking/hewing on inner sides of the walls, *tüteklik* canals, muqarnases used in transition elements, thickening lower parts of the domes and drums located on *sıcaklık's* main spaces.

Along with these bricks, on which the fractures took place during hewing on the edges except for the front sides, there are also specially formed bricks with smooth edges (A2-3-4-5-6, B2-3, and E2) that were definitely shaped/moulded prior to firing. These bricks with different sizes and forms and were shaped in a particular way were used in *Beylerbeyi*, *Topkapı* and *İbrahim Paşa Hamam*s (Figure 205, Figure 206, Figure 207). These bricks must have been prepared in a brick quarry based on the special demands of architects.

A3, A4, A5 and A6 type bricks, used only in the transition elements and upper structures of the *Beylerbeyi Hamamı* (Figure 206, Figure 207, Table 2) must have been shaped by cutting with a secondary mould during the drying phase after moulding the square plan bricks 27.5x27.5x4-4.5 cm in size (A1 type). Only the A2 type bricks, which were used in the *sıcaklık's* main dome of the woman section of the *Topkapı Hamamı*, must have been shaped with a similar process.

Similarly, bricks of B2 type, used in the transition elements of the *Beylerbeyi Hamamı* and the *İbrahim Paşa Hamamı,* and B3 type, used rather rarely in transition elements with muqarnases, must have been shaped by cutting during the drying phase of B1 type bricks (Figure 206, Table 2). B3 type bricks, whose front sides were shaped specifically, were used by breaking or hewing their lateral or backsides in accordance with the sizes needed (Figure 208).

Measurements of E1 and E2 types of bricks used in door openings and door arches of both of these public baths are also quite similar (Figure 65, Figure 165, Figure 206, Table 2). After giving the initial form with the moulds prepared for E1 types, some bricks must have been reshaped/remoulded during the drying phase suitable for the E2 type.

These bricks might also be shaped in moulds prepared directly and especially after the tamping and fermentation phases. However, the bricks with sharp edges (A4, A5, B2, and B3) are rather difficult to take out from the moulds, so the waste rate increases (Figure 206). In fact, after the ceramic mud is moulded in square or rectangular plans, mud loses certain amount of water but not dried completely. To change the form by cutting/slicing the unit is far more easier and accurate by this method.

When the second option is preferred, the parts that are cut out can also be recycled by adding it into the moist ceramic mud again as it has not yet been fired. C1, D1 and F1 types of bricks with a square or rectangular plan, on the other hand, are used only in the transition elements, domes, and drums of the *Topkapı Hamamı* (Figure 206).

There are a rather low number of laboratory analyses concerning the construction materials of Edirne public baths. The academic studies that have been conducted reveal that the bricks used in Ottoman public baths have a low weight per unit of volume (1,8 g/cm^3) and high porosity (33%-37%) values (Uğurlu Sağın, Böke, 2013: 74). According to analyses conducted on the bricks of the *Saray Hamamı* and the *Beylerbeyi Hamamı* in Edirne, while the brick pieces and brick dust are used in the mortar and plaster have a good pozzolanicity due to amorphous clay minerals, the bricks used in the domes are poor in terms of amorphous material and pozzolanicity (Böke et. al, 2006: 1121; Uğurlu Sağın, Böke: 2013: 75).

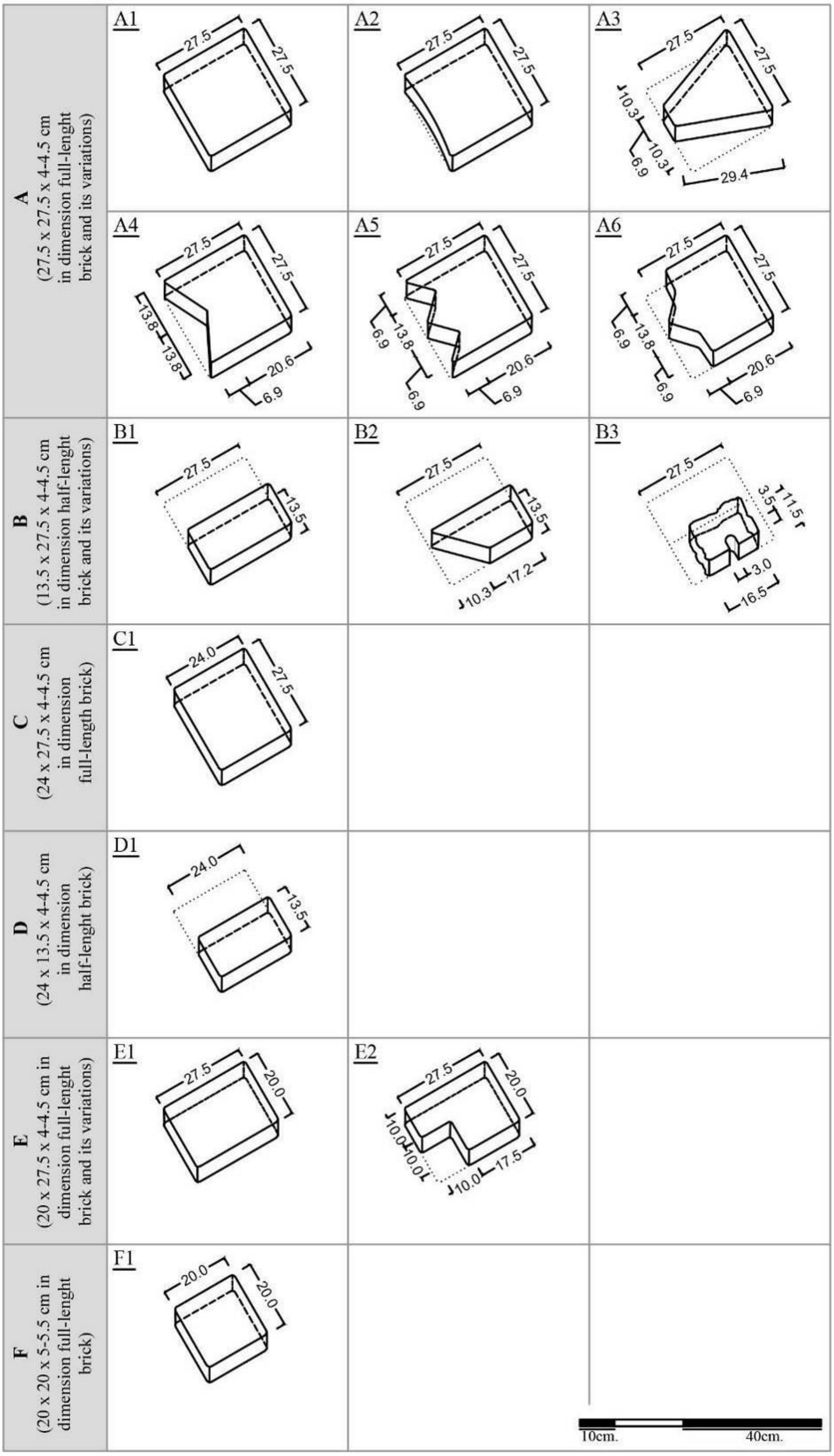

Figure 206. The brick typology

Figure 207. Different type of bricks used in the transition elements and upper structures of the *Beylerbeyi Hamamı* bathing spaces (from left to the right: Type A4, Type A5 and Type A6)

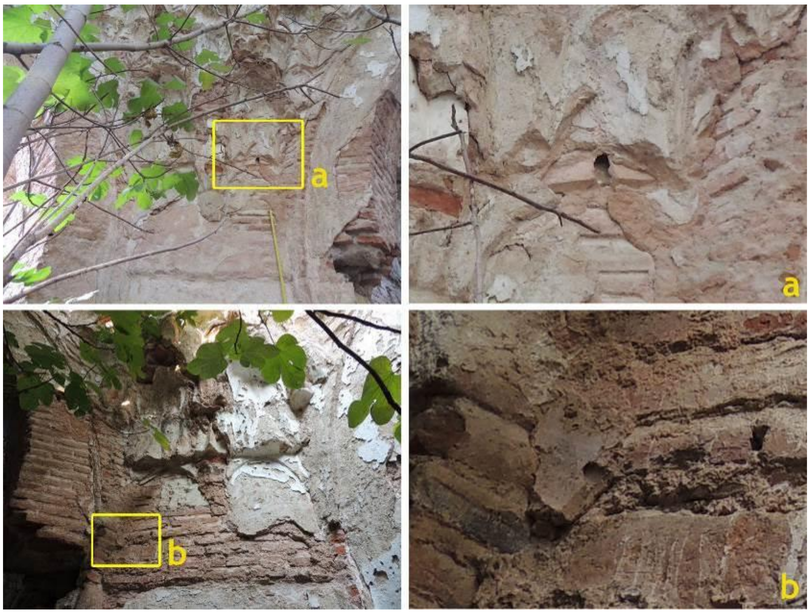

Figure 208. Type B3 bricks used for strengthening the adhesion between wall surfaces and plasters placed in the transition element of the *Beylerbeyi Hamamı sıcaklık* main space

Table 2. Brick types and studied Edirne public baths where these bricks are detected (see Figure 206)

	A1	**A2**	**A3**	**A4**	**A5**	**A6**	**B1**	**B2**	**B3**	**C1**	**D1**	**E1**	**E2**	**F1**
Gazi Mihal Bey H.														
Beylerbeyi H.														
Yeniçeriler H.														
Topkapı Hamamı														
İbrahimPaşa H.														

Tile:

The tiles continue to be produced with the same technique in the Ottoman period as in the ancient periods. Although, there were variations in types and sizes of tiles over centuries.

The information concerning the use of tile in the domes of the public baths of the 16th century can be obtained from the photographs of the *Amcazade Hüseyin Paşa Hamamı* in Lepanto/İnebahtı (Nafpaktos-Greece) taken in the 1970s (Kiel, 1995: 379) and the Ottoman Bath in Keşan (Figure 209). The use of tile covering is observed in the photographs of the *Tahtakale Hamamı* in the following years as well (Figure 91).

Two different types of tiles were discovered among the collapsed parts of the *Beylerbeyi Hamamı.* However, there are not any information related to the location and time in which these tiles were used. When the types of tiles used by Byzantine and Ottoman Empires are evaluated (Özyiğit, 1990: 178), these tiles noticed in the *Beylerbeyi Hamamı* and sized approximately 15x35cm, should have been produced after the first quarter of the 20th century.

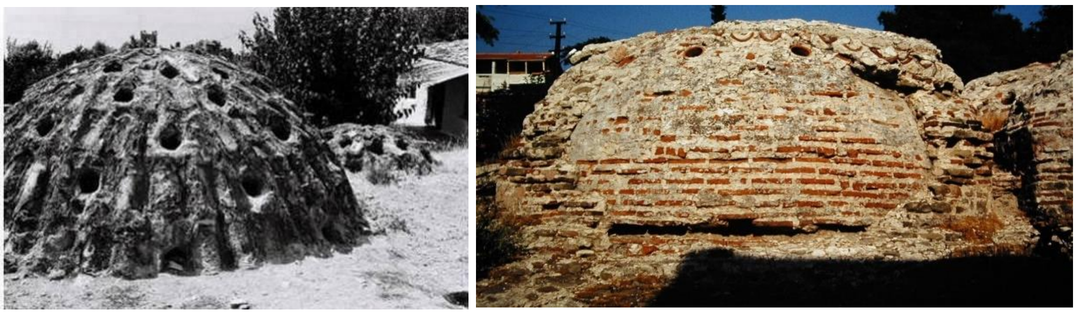

Figure 209. Use of tiles as dome covering material in Lepanto/İnebahtı *Amcazade Hüseyin Paşa Hamamı* (Source: Machiel Kiel Photograph Archive) (left) and the Ottoman Bath in Keşan (Source: Gülsün Tanyeli Photograph Archive) (right)

Terra-Cotta Pipe:

The terra-cotta pipes, used for the transmission of liquids in the Ottoman period, should be produced in the same brickyards with bricks and tiles. These pipes are generally named as "*künk*". The *künk*s used for water transmission and water canals composed of these *künk*s can be called as "*pöhrenk"*, and the pipes and chimneys used for the transmission of smoke can be named as "*tüteklik"*.

The word "*künk*" should have derived from "*cuniculus*" (plural: *cuniculi*) used for underground water and drainage channels in the ancient Rome. Pliny (1875: 109) remarks that the word "*cuniculus*" takes its origins from Hispania. Meanwhile, the systems similar to this one are called as "*qanat*" in Syria and its surrounding (Wilson, 2008: 291). There are various definitions used for *künk*s in Ottoman sources: *künk-i üç parmak, künk-i altı parmak, künk-i eski bezirlik, künk-i altı parmak-ı yol, Arnavud künkü, paşa künkü,* etc. (Sönmez, 1997: 69).

*Künk*s were used for four different functions in 14th and 16th-century public baths in Edirne. According to these functions, *künk*s are used in the; (1) water distribution systems, (2) fumes discharge systems, (3) *oculi* openings and (4) transition elements.

In the public baths, same types of *künk*s were used as water pipes (1), smoke pipes (2) and in the transition elements (4) (Figure 210). However, these *künk*s may vary from one public bath to another. Two different types of *künk* were discovered in the buildings that have been examined in detail. The first of them are the ones that were used in the *Beylerbeyi* and the *Topkapı Hamam*s sized 10x14x41cm with wall thickness ranging between 0.65-1.5 cm. As the heads of these *künk*s are 10 cm and the internal spaces are 8.7 cm in diameter. Since these measurements are very close to the three *parmak* (finger) length (9.3 cm), it reminds of the possibility that these *künk*s might be type of *künk* that was described in the historical sources as *künk-i üç parmak.* The second type is, on the other hand, the *künk*s that were used in the *Yeniçeriler* Hamamı and *Gazi Mihal Bey Hamam*ı sized 12x15x32cm with a thickness ranging between 0.8-1.5 cm.

Circular holes are also identified on some of the *künk*s used as water pipes (Figure 44, Figure 211). These holes are located at the possible tap connection points. Smooth-sided holes look like opened at the air-drying stage of these *künk*s; however, their locations differ from one *künk* to another. It is also clear that, if the holes were opened before the construction, arranging holes in accordance with tap points is almost impossible. I-shaped *künk*s had to be placed in the water channels and tap connection points were marked on them. The holes must have been carved and fixed in the channels (Figure 44, Figure 211).

In the *künk*s that were only used in water transmission lines, apart from the single-arm I-shaped *künk*s, two more *künk* types were also used. Two-arm L-shaped *künk*s and three-arm T-shaped *künk*s were used for corner turns and junctions (Figure 212).

In the *oculi* openings (3), on the other hand, three different types of *künk*s were observed. The first of these is 22x22x44 cm, the second 22x31x44 cm, and the third 22x44x50 cm in dimension with 1cm thickness.

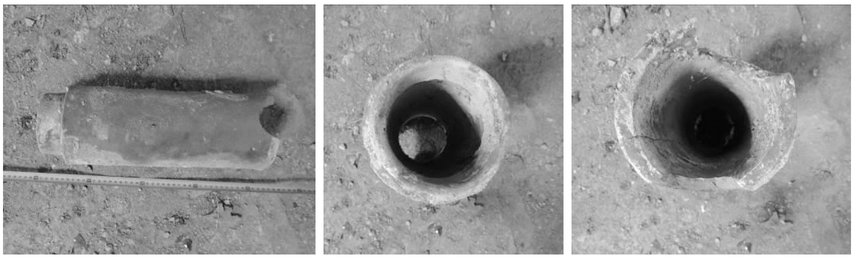

Figure 210. A *pöhrenk* used in the *Beylerbeyi Hamamı*

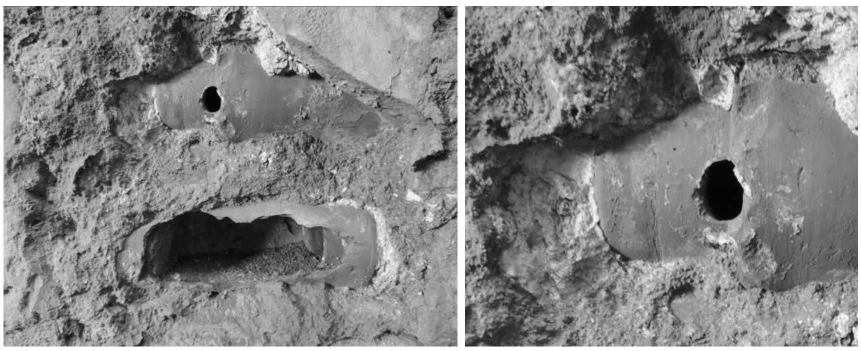

Figure 211. A *pöhrenk* with circular tap connection hole found in the Z16 *halvet* of women's section in the *Gazi Mihal Bey Hamamı*

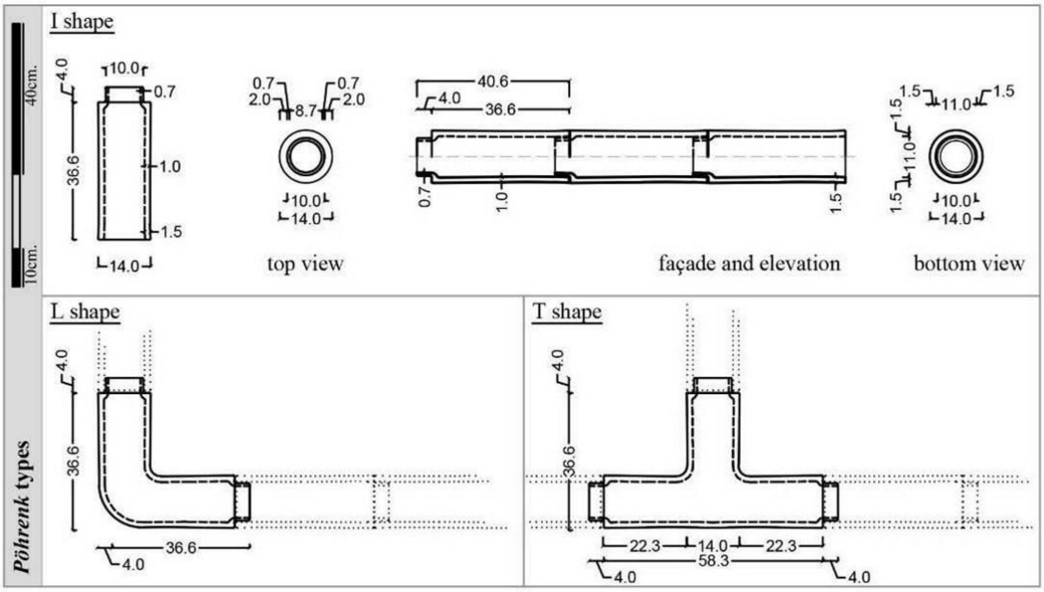

Figure 212. Drawings of I, L and T shape *künk*s used as terra-cotta water pipes (*pöhrenk*s) found in the Beylerbeyi Hamamı bathing spaces

4.2.3. Timber

Timbers purchased for Ottoman constructions were named according to their functions, sizes, qualities, the regions from which they were supplied, and the types of trees they were made of.

It is observed that the timber elements were defined with the names such as "*direk*" (square post), "*sütun"* (post), "*çubuk/çûb"* (raw or rough cut log), "*taban*" (wall plate), "*vergeh/virke/varke/verke*" (beam), "*mertek"* (rafter), "*elvah"* (covering board), "*sütun-u dolap"* (the posts used in the water wheels for water evacuation in foundation pits), "*sütun-u dolma"* (stakes nailed to the ground with certain intervals with the purpose of consolidating the ground) according to the position they were used for and their functions (Altınay, 1935: 64; Barkan, 1979: 101-115;Aktuğ Kolay, 2006: 24-41).

This terminology created according to function also involves a developed sizing system. In other words, these terms not only indicate the position of use, but also the sizes of the timber. For instance, it is identified that the cross sections of posts, named as *sütun* in *Nahr Defteri* that dates back to 1640, ranges between 7x7 *parmak* to 10x10 *parmak* (21.7-31 cm), and their lengths between three *zira* and fifteen *zira* (2.27-11.37 metres) (Kütükoğlu, 1983: 294-295).

It is observed in the records regarding constructions that sizes of some of the timber elements were indicated particularly and described in detail. For example, in a text written for Mimar Sinan, the sizes of fir beams desired for the construction were explained; and it was demanded that the beams and posts below these sizes were not to be used (Altınay, 1935: 64). Additionally, the qualities of the timber elements were described as *âlâ* (fine), *vasat* (average) and *hurda* (low) (Barkan, 1979: 101-115).

The timbers were defined according to the regions they were supplied from such as "*sütun-u Bartın*", "*elvah-ı Ereğli*", "*elvah-ı İznikmid*", "*taban-ı Karasu*", "*taban-ı Üsküdar*", *taban-ı Rumeli*", *mertek-i Samanlu*", "*çubuk-ı Karadeniz*", "*çubuk-ı Üsküdar*" etc.; and according to the types of trees, they were made of such as "*çubuk-ı verdinar*" (fir-tree log), "*mertek-i kayın*" (fagus rafter) and so on (Altınay, 1935: 64; Barkan, 1979: 101-145).

The forest lands of Edirne are situated at higher altitudes. There are oak, alder, poplar, locust, ashen and linden in the region between Lalapaşa-Muhittin Baba hillside and the area between Uzunköprü-Hacıdağ; larch, maritime pine, stone pine and mostly Calabrian pine in Keşan, Enez, İpsala and a small part of Gelibolu (EÇŞM, 2015: 72). 40 percent of the land of Kırklareli consists of forest lands; especially the slopes of Yıldız Mountains facing the Black Sea are covered with thick Fagus forests, and the parts from the foothills of the mountain to the coastline are covered with oak and alder forests (KÇŞM, 2011: 16, 47). İğneada and its surroundings are covered with a type of forest called "Longos" consisting of elm, walnut, ashen, white alder, and linden and willow trees (KÇŞM, 2011: 47).

Broad-leafed oak and alder, with high mechanical resistance, as well as coniferous pine were obtained from the close surroundings should have been used for the timber as load-bearing elements in Edirne public baths. It is known that coniferous trees were especially preferred for constructions. However, since there are not any surviving timber elements in Edirne's public baths that are examined, the type of trees used for their construction cannot be identified. Poplar, Fagus, and trees similar to these should have been used in elaborated architectural elements.

Timber load-bearing elements that are part of masonry systems were used as lintels on the walls due to their tensile strength (Figure 213), and as supports in projections like muqarnas due to their resistance against sagging (Figure 74).

A large amount of timber offered in the initial phases of the construction mentioned in the account-books kept during construction indicates that these timbers were used in the building foundations and falsework (Aktuğ, 1986: 72; Akıncı, 1997: 42). Timber scaffoldings that enables to work in certain heights as the construction continues are formed at different levels as timber frame structures and working platforms (Figure 214).

The records concerning the construction of İstanbul *Nur-u Osmaniye Camii* and the account-books of İstanbul *Ayazma Camii*, revealed that the main scaffolding was made of "*beyağı mane"* (7.5-9 metres in length)*, "seray manesi", "ağa tahtası"* and *"çam tahtası"* (Aktuğ, 1995: 81). Moreover, the floor beams upon which the working platforms were placed were made of "*koğuş tahtası*" (Aktuğ, 1995: 81); the working platforms were made of "*topaç*" and "*üstüvar omurgası*" (Kuban, 1982: 130).

In addition, there are also timber elements relatively larger in size and embowed with a slight slope, are named as "*çapa eğrisi*" in the account-books; whereas timber elements smaller in scale are named as "*hers eğrisi*" and "*teknelik kalas*" (Aktuğ, 1995: 81). These bent timbers should have been used as centring ribs in the constructions of domes, vaults, and arches (Aktuğ, 1995: 81).

The timbers used in falseworks might have been stored after dismantling at the end of the construction to be re-used in other constructions, yet there is not enough information related to this subject. Additionally, there is also the possibility that the centrings of domes and vaults were used in the same or different constructions as structural elements, such as timber tension rings (see. Chapter 4.3.4).

It is known that in certain Ottoman public baths, *soğukluk* spaces were directly built with timber frame system. However, the authentic *soğukluk*s of all public baths built in Edirne in the 14th-16th centuries could not survive today. Likewise, information related to timbers used in foundations could not be obtained. On the other hand, a great number of traces belonging to lintels and *puştuvan*s used in masonry walls, transition elements, and upper structures were identified (Figure 22, Figure 29, Figure 46, Figure 61, Figure 74, Figure 79, Figure 97, Figure 106, *Figure 126*, *Figure*

127, Figure 151, Figure 152, Figure 160, Figure 161). Based on the traces within the building, it is understood that timber elements were approximately 6x9.5, 9.5x15.5, 12.5x12.5, 15.5x15.5, 18.5x18.5, 15.5x21.5, and 21.5x21.5 cm in size and were used in the studied public baths.

It is also known that, timber was used as clamps for the masonry walls without mortar in order to interlock cut-stone blocks, especially in the ancient periods (Figure 215). Traces indicating the use of dovetail-shaped timber clamps in Edirne in 14^{th}-16^{th} centuries were also identified (Figure 63). According to these traces, the timber clamps were 22 cm in length, 11 cm in width on both sides, 5 cm in width in the middle, with 4 cm thickness.

Figure 213. Traces of timber lintels and puştuvans used in the buildings of Edirne *Yeni Saray*

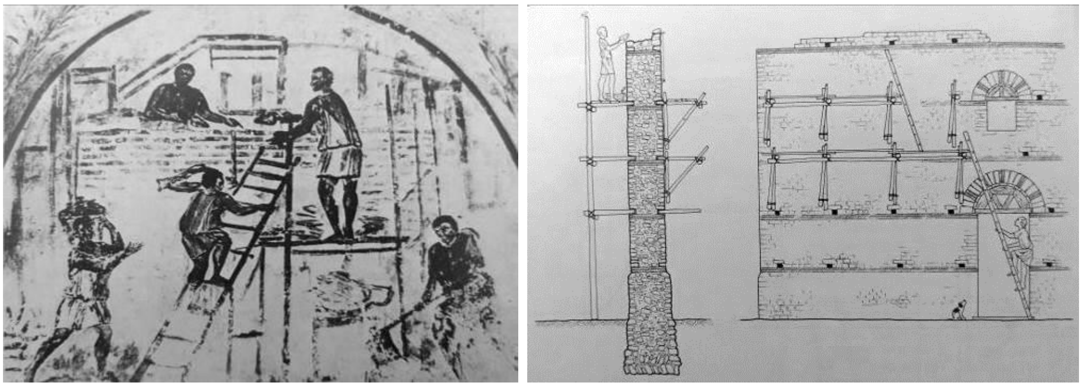

Figure 214. The fresco on Via Latina, near Rome, presents scaffolding used in the construction of the Trebius Justus Tomb (left) and the schematic drawing of scaffolding and putlogs (right) (Source: Adam, 2005: 83-84)

Figure 215. Wooden clamp and traces from the temple at Thebes (left) and the pyramid of Senwosret (right) (Source: Arnold, 1991: 126-127)

4.2.4. Mortar, Plaster and Stucco

In the public baths built in the 14th-16th centuries in Edirne, the use of lime mortar and plaster in different colours are observed depending on the contents of the mixture (Figure 38, Figure 68, Figure 70, Figure 71, Figure 110, Figure 111, Figure 167, Figure 175). Gypsum, on the other hand, was used in muqarnases and for partial repairs.

Lime-Based Mortar and Plaster:

While the use of lime in mortars is encountered in prehistoric periods and in the ancient Greece, it was never a significant component of the Hellenistic architecture (Robertson, 1929: 233). In fact, lime mortar was a significant building component of Roman architecture, in which it was improved and reinforced its strength (Robertson, 1929: 233). It is known that this tradition was maintained in the Byzantine and Ottoman periods; however, the mortars used in these periods had relatively weaker strength compared to the Roman period (Aktuğ Kolay, 1999: 16).

Lime mortars served as binders keeping masonry units together in the Ottoman public baths and their mechanical and physical qualities show variations depending on their component's physical properties and rates (Çizer et. al, 2004: 471). In this hydraulic[57] mortars, lime was used as binding material and aggregates were used as

[57] This type of brick-lime mortars and plasters were preferred since ancient times because of their hydraulic properties and in different cultures, these mortars and plasters were named as *horasan* (Ottoman), *surkhi* (India), *homra* (Arabic countries), *cocciopesto* (Roman), etc. (Güleç, A., Tulun, T. 1997. Physico-chemical and petrographical studies of old mortars and plasters of Anatolia, Cem. Concr. Res. 27 (2), p. 227- 234; Spence, R. 1974. Lime and surkhi manufacture in India, Appropr.

infill materials. These mortars are waterproof and the aggregates are pozzolanic (Böke et. al, 2008: 874).

By heating limestone, quicklime is obtained, as a result of calcination of the stone and separating the carbon dioxide gas from the stone. The quicklime then reacts with the moisture in the air and water and turns into calcium hydroxide, thus forming hydrated lime (Böke et. al, 2004: 90). As it directly affects the quality of lime, it is extinguished with water whose temperature is especially watched out; and it is known that since the Roman period it has been used after kept waiting without exposure to air for years in order to increase its elastic property and its capacity to hold water (Peter, 1850: 107; from Böke et. al, 2004, 90: Cowper, 1998).

Aggregates that do not react with lime (aggregates obtained from stone quarries, rivers and seas) as well as pozzolans that react with lime (tuff, trass, opal, brick-tile dust or pieces, etc.) were added to the lime to prepare the mortar (from Böke et. al, 2004: 90-91: Lea, 1999). Lime mortars to which brick and tile pieces and dust were added as pozzolanas were used in the Byzantine and Ottoman architecture. These mortars are named as "*horasan*" in the Ottoman period (Ersen, Güleç, 1991: 57). It is also mentioned in written sources (from Sayre, 1972, 192: Sickels, 1981, 27; Neuburger, 1930; Hodges, 1964) that fibre reinforcements and protein-based additives (natural resin, eggs, beeswax, rice, malt, barley water, sour milk, cotton, animal hair, straw, etc.) were added to the mortar with the purpose of improving its mechanical qualities.

According to the account-books kept during the construction of the *Süleymaniye Camii İmareti* in İstanbul, there were two sorts of lime (*gec*) purchased; which are "*gec-i Rumeli*" and "*gec-i Anadolu*" (Barkan, 1979: 169-171). While their physical differences are unknown, it is understood that the lime brought from Rumelia was more expensive than the Anatolian lime (Barkan, 1979: 259, 267).

It is known that terra-cotta products have been used in lime mortars since ancient period, and this usage became widespread with the use of terra-cotta in lime plasters as aggregates in the Roman period (Moropolou et. al, 2005: 295-296). This

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Technol. 1, p. 6- 8; Lea, F.M. 1940. Investigations on pozzolanas, Building Research, Technical Paper No. 27, p. 1-63; Massazza, F., Pezzuoli, M. 1981. Some teachings of a Roman concrete mortars, in Mortars, Cement and Grouts Used in the Conservation of Historic Buildings, ICCROM, Rome, p. 219-245: from Böke, 2002: 1457).

mixture was widely used in Ottoman architecture and was named as *"horasan"*. *Horasan* mixtures that were used as lime-based mortar and plaster were sold by weight (Yücel, 1992: 136). Thus, they should have been sold as a dry mix with similar properties, although the ingredients of the mixtures differed among sellers (Nayır, 1975: 106). It is observed in the account-books of the *Süleymaniye Camii* in İstanbul that *horasan* was purchased in large amounts (Barkan, 1972: 171).

In the account-books kept during the construction of İstanbul *Ayazma Camii*, lime and *horasan* that were purchased and used in plasters and joints were shown under the same heading. Both were sold by weight; *kantar* and *okka* were used for the measurement of lime, and *küfe* for horasan (Barkan, 1979: 259, 267). Two different kinds of *horasan* were used: "*kaba*" (rough) and "*ince*" (fine) (Aktuğ, 1995: 84). Aktuğ (1995: 84) states that rough *horasan* bought in large amounts should have been used as mortar in main walls while fine *horasan* bought in lesser amounts (approximately as much as 1/4.6) should have been used in joints. The fine horasan bought in the following phases, as much as 1/4.5 of the amount bought at the beginning of the construction, should have been used for the construction of interior walls and plasters (Ersen, Güleç, 1991: 67-71).

In the account-books of *Ayazma Camii*, there are some materials, purpose of which cannot be understood, such as "honey for plaster" or "iron powder" (Aktuğ, 1995: 86). Among these, beeswax, *kafur* (an odorous substance obtained from camphor tree) for beeswax, *rugan-ı zeyd* (a sort of polish obtained from olive oil) and flax straw are assumed to be added to the horasan mixture used in the formation of fine plaster (Aktuğ, 1995: 86). Moreover, Evliya Çelebi stated that scented components such as musk, amber, spruce, etc. were added to the lime plasters used in the public baths to attain fine scents in these spaces (Kahraman, 2010a: 780-781; Dağlı and Kahraman, 2011b: 477).

In Edirne's public baths, off-white lime mortar with a low rate of brick-tile aggregate was used in *soğukluk* walls. As the other Ottoman baths (Ersen and Güleç, 1991, 61; Böke et. al, 1999, 9; Çizer, 2004, 50), in bathing spaces and water depots, on the other hand, *horasan* with different shades of pink colour was used to prevent water penetration. *Horasan* mortar, including brick-tile dust and pieces, can also involve organic additives such as fibre and egg white. Alkaline minerals in baked clay harden with the pozzolanic reaction by merging with water and lime. Enriched in hydraulic properties, the mortar turns into a material that is waterproof with high vapour permeability and resistance; and is especially preferred in building parts that contact directly with water.

For instance, the laboratory analyses of the mortars of the *Beylerbeyi Hamamı* indicates that the mortars used in the walls of *ılıklık* space have a low weight per unit of volume (1,4-1,7 g/cm3) and high porosity (%28-38) values (Böke et. al, 1999, 7; 2006, 1118). Pink and dark red coloured *horasan* was used inside the *maksem*, water depots and water canals. High amount of brick-tile dust additive, which causes its colour to darken, increases carbonation and pozzolanic reactions as it has a high specific surface area; it also increases mechanical resistance, hydraulicity and waterproofing qualities of the mortar (Rogers, 2011, 134).

Within the scope of a research project, the plasters used in the *Sultan Selim Saray Hamamı* and the *Beylerbeyi Hamamı* in Edirne have been examined and the following results about the physical and mechanical characteristics of these plasters have been obtained (Böke et. al, 1999: 55-56):

- The authentic plasters and qualified repairs have high mechanical strength.
- Most of the authentic plaster and qualified repair samples include fibrous additive materials like straw etc., yet these pieces are so small that they are invisible to the naked eye and their levels in the mixtures are rather low.
- In some plasters which is not appropriate to contact with water or vapour that was used only in unqualified late-period repair, there are pieces of straw that are large enough and visible to the naked eye.
- The ratio of lime and brick dust and pieces used in the plasters show variations in different spaces and different heights of the same spaces. This variation indicates that the *horasan* plasters prepared for the public baths do not depend on a single mixture recipe, but rather it changes according to the factors such as the function of the space, relationship between working point and water, quality of the raw material, the way of preparation, granulometry of the brick and sand, accumulation of knowledge of the builder, etc.

The plasters that still exist today on the exterior façades of the public baths examined in detail within the scope of this thesis (*Gazi Mihal Bey*, *Beylerbeyi*, *Yeniçeri, Topkapı and İbrahim Paşa Hamam*s) are on a quite limited scale and damaged. Detailed observations could not be carried out on these off-white coloured plasters. However, it is known that pozzolanic *horasan* plasters that are waterproof but high in vapour permeability were used on the exterior façades of Ottoman public baths (Böke et. al, 2006; Reyhan et. al, 2013, 37).

Information concerning the plasters used in *aralık* and *ılıklık* interior spaces only through the *Beylerbeyi Hamamı* can be obtained. On the interior walls *aralık*, three overlapping lime-based layers on top of each other were detected: 2.5 cm thick lime plaster, 0.5 cm pink *horasan* plaster and limewash.

On the interior surfaces of *ılıklık* spaces, four different types of plasters were identified. Among these, the first three types of plasters, which were authentic or compatible with bathing function, are layered as follows: 2-2.5 cm thick pink *horasan*, 2 cm thick red *horasan* and 1.5 cm thick light pink *horasan*. Due to the calcification formed upon the second and third layers during the buildings usage as a public bath, the first two layers should have been applied in the same period, while the third layer should have been a repair.

On the other hand, white, light pink, pink, dark pink and red coloured lime-based plasters were identified on the interior walls of *sıcaklık* spaces. Plaster thicknesses vary between 0.5-3cm. Pink or red coloured *horasan* with 1.5-3cm thickness, applied as the first layer, is thought to be authentic. Onto this layer, 1-2 cm thick light pink or pink coloured *horasan* was applied below the plaster changing line, while 1-1.5 cm thick pink, light pink or off-white coloured *horasan* was applied upon this line.

It is observed that on the water depots below the plaster changing line 2.5-2.5 cm thick dark pink or red coloured *horasan* was applied, and 1-2 cm thick pink *horasan* was used upon that. Relatively thicker and darker coloured plasters were used in water depots, unlike other spaces. In the water depots, the remaining plaster above the plaster changing lines are not sufficient in amount or quality.

On the interior surfaces of transition elements and upper structures, 1-2 cm thick pink *horasan* and upon that 0.5 cm thick lime plaster was applied.

Lökün:

Another lime-based product used frequently in public baths is "*lökün*". *Lökün,* whose main ingredients are lime, linseed oil and shredded cotton (Arseven, 1950: 1244), is a waterproof material used at special points such as combining *pöhrenk*s to each other or connecting *lüle*s and taps to *pöhrenk*s, where water leak needs to completely be prevented (Figure 44, *Figure 128*, Figure 172, Figure 176).

Along with this, the account-books of İstanbul *Ayazma Camii* reveal that *lökün* has another use that is not widely known. A specific mortar containing marble lime, *rugan-ı bezir* (linseed oil), *bünye-i cam* (silica-sand) and flax fibre in small pieces were used on the cut-stone bonds of the exterior façade and on top of the walls (Aktuğ, 1995: 84).

In the Edirne public baths that were examined in detail, *lökün* was used for two different functions. The first of these, as mentioned frequently in sources and historical records, is the use of *lökün* on the interlocking points of *pöhrenks* in order to prevent water leak. The second is the use of *lökün* for filling the end points of *pöhrenk* lines or clean water lines, needed to be opened and reclosed periodically for maintenance.

Stucco:

Stucco, obtained from gypsum, is used for muqarnases, decorations and mouldings (as the only ingredient or mixed with aggregate and lime), due to its faster hardening and higher shapeability than lime (Sönmez,1997: 24).

Although it is water resistant due to recrystallization, the plaster's deterioration is fast and high in contact with water (Middendorf, 2002, 167; Rovaníková, 2007, 227). Hence, it is more appropriate to use it in places that are not in direct contact with water. As a matter of fact, in Edirne public baths, the use of gypsum is detected on muqarnases of the transition elements and upper structures, which are in contact with vapour but have not direct contact with water (Figure 62, Figure 65, Figure 75, *Figure 133*, *Figure 134*, *Figure 135*, Figure 139).

There is an application that is open to discussion in the Z14 space of the women's section of the *Topkapı Hamamı*. White units/blocks prepared by moulding and drying gypsum or a mixture of lime-gypsum is used for filling a possible loss of material/unit of vaulting system (*Figure 138*). These units, which do not contain aggregates visible to the naked eye and whose main components are gypsum and/or lime, must have been preferred as partial repairs due to ease of moulding, low cost, and fast drying properties, though this is not an appropriate application.

Ornamental works:

In Edirne public baths examined in detail, various decorations are documented, which were used by lime-based thin plasters in different colours (Figure 39) and paints (Figure 40, Figure 41, *Figure 134*, Figure 182). According to the historical sources, these paints included materials such as colourant of different shades of red, white, yellow, etc., mastic, yellow glue, black glue, *rugan-ı neft-i Acem* (a sort of polish made of turpentine oil and glue from Iran), *rugan-ı neft* (turpentine oil), *rugan-ı ardıç* (a sort of polish produced by using the fruit of juniper tree), polish earth; which were applied to the surfaces with sable-hair brushes (Aktuğ, 1995: 86). Due to the glues added to the paints dissolved in water, they stuck better to the wall (Arseven, 1952: 2278); the intensity of the paint was reduced with turpentine oil where necessary (Arseven, 1950:1501); the paint was shined through the oils added to the mixture, and a varnished appearance is achieved by applying the mastic dissolved in alcohol on the decorations (Aktuğ Kolay, 2000: 214).

4.2.5. Metal

The use of metal as structural elements in Ottoman period begins with iron clamps and pins, originated from the ancient Greek architecture (Tanyeli, 1990: 111; Cooper, 2008: 240-241). Clamps are placed inside the cavities opening to the upper surfaces of cut-stones and fasten the subsequent ones in the same course. After the iron clamps are placed within the cavities suitably carved for them, the remaining space within the cavity is filled with molten lead, in other words, all the iron clamps were sealed in molten lead (Barkan, 1972: 361). Pins, on the other hand, are placed in cavities carved on the opposing faces of the stones symmetrically between the stones placed on top of the other and connect the stones to those below them. After placing the iron pins, molten lead is poured within the cavities, like the clamps. The ductile properties of the lead allow it to make fractional and organic movements within the cavity during vibrations like an earthquake (Cooper, 2008: 243).

It is known that the use of iron was limited only with clamp and pin in the Ottoman Empire before the 1450s, and these details were used only in a very limited building groups, while the use of iron clamps became more widespread towards the end of 15th century (Tanyeli, Tanyeli, 1989: 13). Nevertheless, after the 1550s, iron clamps and pins began to be used widely in the Ottoman architecture. A new type like "*Frengi*" (European) clamps, which are longer than 75 cm, was started to be used in addition to the Ottoman clamps, which are normally 50 cm in length (Tanyeli, Tanyeli, 1989: 14).

Tanyeli and Tanyeli (1989: 14) suggest that clamped walls were preferred for two reasons: (1) masonry walls with clamps should have been working more successfully against tensile stress, (2) fastening together the cut-stones used in the inner and outer layers by iron clamps should have allowed these layers to function as a formwork during the construction stage, thus making it possible to continue building up a wall before the infill materials harden, in other words, it should have allowed the construction to progress much faster.

In the 14th-16th century Edirne public baths, the use of iron and timber clamps were observed only in the *Beylerbeyi Hamamı* (Figure 216, Figure 217). Cut-limestone blocks used at the spring lines of arches between the *ılıklık-sıcaklık* spaces and *eyvan*s were fastened to each other with iron clamps and pins. Like the other Ottoman structures from the same period, molten lead was poured into cavities after the clamps were placed (Figure 216, Figure 217). The U-shaped metal clamps used in the *Beylerbeyi Hamamı* are 19x4.5x1.5cm (Figure 217) and 21x6x1.5cm (Figure 216) in size and 0.75cm in thickness. In addition, pins are approximately 0.7cm thick and 16 cm in length (Figure 216).

Apart from this, iron is the basic material of forged nails, having different functions and numerous types. Different types of nails were mentioned in the account-books of İstanbul *Ayazma Camii* such as *mismar-ı mahlut* (mixed nails), *mismar-ı yeni kalıb, mismar-ı tahta* (timber nail), brad nail, and *mismar-ı oluk* (used in gutters) (Aktuğ, 1995: 82; Tanyeli, 2017: 129).

The nails used for aligning the systems like water lines, plaster changing lines, etc., which need to be placed on a horizontal line for precise measurements also plays a structural role in Edirne public baths. It serves both as reinforcement for thick plaster layers and as load-bearing elements for both *künk*s and projected brick and stone units. The functions of the nails have been examined in detail in the related chapters (see. Chapter 4.3.2, 4.3.3, 4.3.4, 4.4.1). Iron was also used as an important material in various stages of construction such as window bars, door and window knobs (Akıncı, 1997: 46).

Iron is a very complex material that has been studied since the ancient periods, due to the large variation in the melting and solidification temperatures depending on the mineral diversity in the iron mines (Plini, 1961: 235; White, 1984: 125). It is known that in the mid-16th century, there were significant iron production centres in the surroundings of Kiğı-Erzincan and Bilecik (Tanyeli, 1990: 7). There are not any information on the to what extent the iron produced in Kiğı was used in the construction sector during the Ottoman Empire period; however, it is believed that the iron produced here might have been used in the constructions in the eastern Anatolia and the Arabian Peninsula (Tanyeli, 1990: 8). It is thought that the iron production centres around Bilecik entirely served for military purposes, while a small amount of these products was used in the constructions in the central and western Anatolia (Tanyeli, 1990: 9).

Tanyeli (1990: 11) states that in the Ottoman Empire, the three main components of iron production, namely ore, charcoal and water power (whose flow rate remains stable in any season) were in Rumelia due to its climate and topography despite the existence of various iron production centres in Anatolia (Figure 219). The ease of transportation of products from that region to İstanbul suggests that the Rumelia mines should have been preferred and operated intensively (Tanyeli, 1990: 11). The iron production centres of Rumelia are located in a region of about 200 km long in Bulgaria and Bosnia: Eğri Palanga (Kriva Palanka), Kratova, Dobniçe, Klisura, Köstendil, Radomir, Samakov, Sofya, Etrebolu, Tatarpazarı and Filibe (Plovdiv) (Tanyeli, 1990: 11, 147) (Figure 219).

According to the information obtained from the account-books kept during the *Süleymaniye Camii* construction in İstanbul, the most significant source for supplying iron was the mines in the Samakov region of today's Bulgaria (Barkan, 1972: 362) (Figure 219). The iron products were directly bought from Samakov and/or the iron craftsmen in İstanbul; or taken as raw iron, and it was processed by the iron craftsmen working in *hadadlar karhanesi* (metal working shop) on construction sites (Barkan, 1972: 365, 369). The iron used as building material, in İstanbul the Büyükçekmece Köprüsü (1556-1574), Kılıç Ali Paşa Camii (1580-1581), Nur-u Osmaniye Camii (1748-1755), Laleli Camii (1760-1763) and Yeni Fatih Camii (1767- 1771) constructions, were brought from here (Akıncı, 1997: 48).

Another main centre for iron production in Rumelia was Demirköy town, known as Samakocuk, of Kırklareli (Tanyeli, 1990: 16, 147) (Figure 219). However, the earliest documents on iron production here date back to the end of the 17th century, and although it is known that iron production was common before that date, its beginning cannot be determined (Tanyeli, 1990: 17). The iron used in the structures built in Edirne during the 14th-16th centuries should have been brought from Samakov (Xanthi-Macedonia), about 150 km southwest of Edirne (Figure 219).

During the Ottoman period, iron mines were operated by private individuals/companies, often forged by privately owned enterprises, and the state was involved in the processing of iron to be used in construction only in special cases (Tanyeli, 1990: 18, 20). It is known that the state rather preferred to purchase iron elements such as clamps, pins, and nails, which can even be produced in a small metal workshop (Tanyeli, 1990: 20, 28).

Lead had a very limited usage as the iron clamp and pin cavities in the Ottoman monuments until the 16th century (Figure 217). From the 16th century onwards, the need for lead in constructions also increased with the use of lead as dome and vault covering material (Akıncı, 1997: 47). Akıncı (1997: 47) indicates that since the 16th century mosques in Anatolia were called "*kurşunlu*" (lead-covered), the use of tile as covering material was still widespread in the 15th century, and the lead was not used extensively except in the capital cities. However, the use of lead as a covering material should have begun much earlier and used more widely in Edirne, since the city was the most important stop for iron and lead transport from the Balkans to Anatolia.

It is understood from the documents dating back to the 16th century that the lead, sold by weight, was used as raw lead and lead sheet (Aktuğ, 1986: 74). The raw lead was bought as ingots, then melted and poured into clamp and pin cavities. The lead sheet, on the other hand, was used for roofs covering and etc.

Faroqhi (1997: 160) notes that lead, which is usually found with silver in nature (White, 1984: 124), was mostly supplied from the Balkans during the Ottoman period. However, after silver began to be imported in abundant quantities from America in the 16th century and becoming less expensive in the Mediterranean region, the quarries in Balkans were not profitable anymore. She also adds that, for this reason, most of the lead mines in the Balkan Peninsula were abandoned and the local production of lead declined in the following centuries (Faroqhi, 1997: 160).

It is known that the lead was used in the construction of the *Selimiye Camii* were brought from Novabırda/Novabiri mines (Barkan, 1972: 370). The lead used in Edirne public baths should also have been brought from here or from the other mines located in this region.

Within the public baths studied in detail within the scope of this thesis, the lead was determined only in clamp and pin cavities in the *Beylerbeyi Hamamı* (Figure 217). However, authentic lead coating material could not be identified in the 14th-16th century Edirne public baths.

Another metal used in the public baths is copper. There were not any authentic examples of a copper caldron placed above the *külhan* furnace, which was used for heating hot water, identified in the Edirne public baths. Copper caldrons used in the *Sultan Selim Saray Hamamı*, *Mezit Bey Hamamı* and *Sokullu Mehmet Paşa Hamamı* were replaced during maintenance works (Figure 218). Although there are not any information concerning the supply of copper used in Edirne monuments during the Ottoman period, George Keppel, who came to the city in the 19th century, stated that the copper mines around Edirne were among one of the most worldwide efficient mines during this period (Mangaltepe, 2012: 226).

Evliya Çelebi indicated that lead caldrons were used in the water depots instead of copper ones in some of the public baths of Egypt (Kahraman, 2011b: 285). However, this controversial information, if correct, must be a very rare use of lead since the copper is more convenient in terms of its physical properties than the lead.

The melting temperature of lead is 327.46°C, while that of copper is 1084.62°C. Therefore, lead is easier to process. However, copper is the second highest metal with thermal heat conductivity after silver (silver 407 W / mK, copper 353-386 W/mK, copper 30-35 W/mK). Brinell hardness of copper is 6-22 times higher than that of the lead (copper 235-878 MPa, lead 38.50 MPa). Another important factor is the relation of metals with water. Copper does not react with water, yet when it oxidizes on exposure to the atmosphere, a thin film layer occurs on its surface and it protects the metal underneath. However, lead interacts with water more easily, and its endurance weakens with oxidation as a result of this interaction.[58]

Figure 216. Iron clamps and pins used to bind fine-cut limestone units to each other, which placed on the spring level of arches in the *ılıklık*'s main space (Z03) of the *Beylerbeyi Hamamı*

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[58] MSc Metallurgy Engineer Uğur Akyıldız was consulted for the comparison of physical properties of different metals.

Figure 217. Iron clamps and traces of dovetail timber clamps used to bind fine-cut limestone units to each other, which placed on the spring level of arches in the *sıcaklık*'s main space (Z10) of the *Beylerbeyi Hamamı*

Figure 218. The copper caldron and *külhan* fumes channels, which transfer fumes from *külhan* hearth to the *cehennemlik* space, located under the hot water depot of the *Sokullu Mehmet Paşa Hamamı*

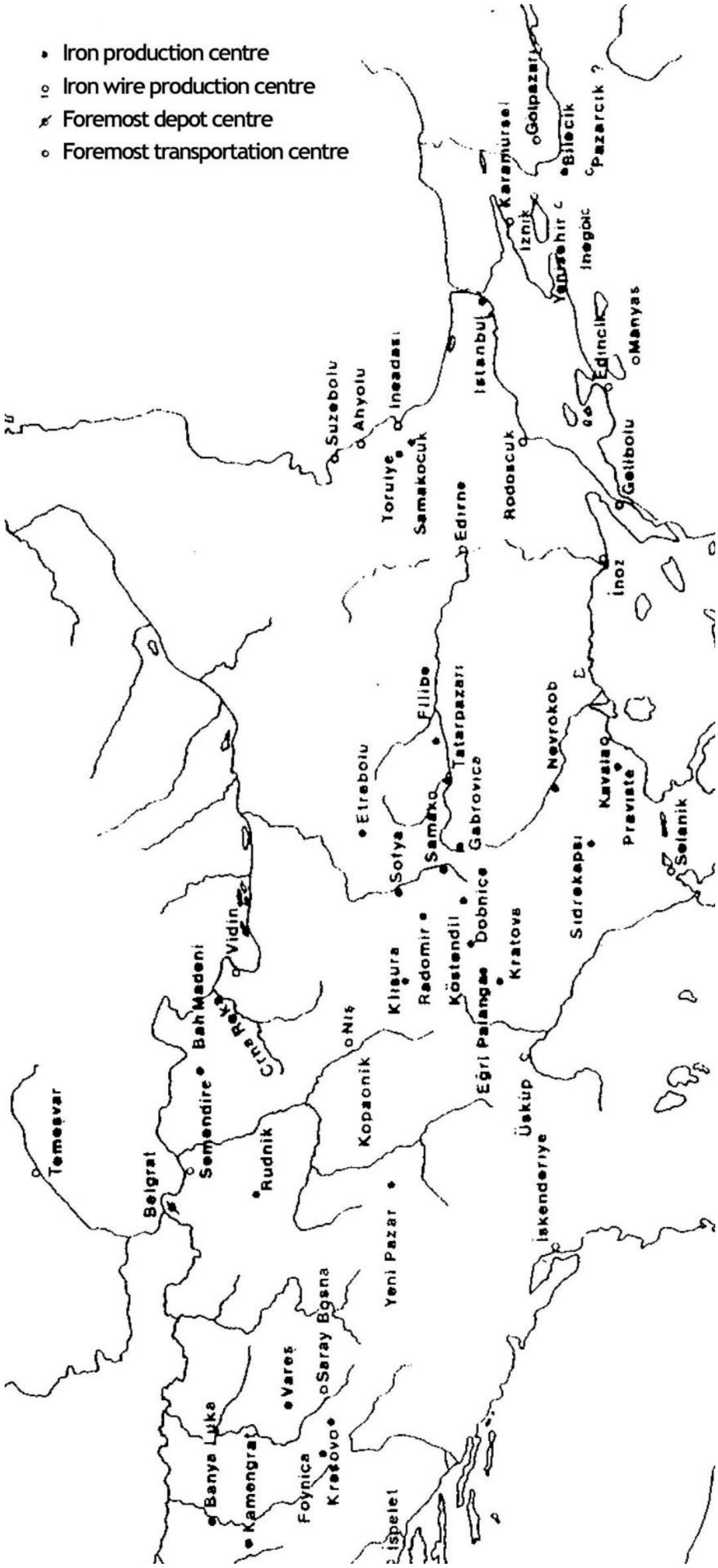

Figure 219. Iron production, storage and transportation centres located in Edirne and its surroundings in the Ottoman period (Tanyeli, 1990: 147)

4.3. Construction Techniques of Load-Bearing Systems, Architectural Elements and Finishings

In the Ottoman period, once the work on pre-construction preparations and material-work force procurement were completed, the official construction would be given a start. In this chapter, construction techniques of load-bearing elements, architectural elements and finishings used in the 14th-16th century Edirne public baths, which is studied in detail (*Gazi Mihal Bey Hamamı, Beylerbeyi Hamamı, Yeniçeriler Hamamı, Topkapı Hamamı* and *İbrahim Paşa Hamamı*), are described and evaluated from foundation up to the upper structure, where system sections change, under related headings. When different techniques and systems are identified, information on the construction processes is also given under related headings. By using this method, it is aimed to understand and explain how the construction techniques and processes of the 14th-16th centuries Edirne public baths are carried out under period-specific constraints and possibilities.

4.3.1. Foundations and Floors

Foundation works, which is known to begin before the official ceremony, starts clearly by defining the borders of the building to the lot. After necessary measurements are done, the area for the foundation excavation is marked on the building lot with the help of batter boards named as "*düzen ipi*" (Crane, 1987: 99).

Foundation Excavation and Foundations:

Foundation excavation continues in the defined area until firm ground/ bedrock is reached. The information on how this method was carried out in the Ottoman period can be obtained from the foundations of *İstanbul Yeni Camii*, a 16th-century building. According to the written sources (Peynircioğlu, et al., 1981: 40), during the foundation works of this building; (1) foundation excavation is continued until bedrock/firm ground is reached, (2) emerging soil water is drained by water pumps, (3) above the bedrock a layer consisting of silt with sand, approximately twenty metres thick sand and pebble layer, and ten metres thick infill layer are applied respectively, (4) foundations are constructed on this filled ground.

The depth of the foundation excavation and the foundation type differ according to the physical and mechanical properties of the soil. If the firm ground is reached at a suitable depth, foundations are built as a continuous foundation with or without separate footings in accordance with the building plan. When the firm ground is not reached at a suitable depth, firstly soil must be improved since one of the most important problems to be solved at the foundation stage is the risk of land subsidence and soil movement after the building is constructed.

Two basic solutions were used in Ottoman constructions, if the firm ground is not reached at a suitable depth. The first method is constructing new buildings on the foundations of former buildings, which had already compressed the soil around. This method had also been used in the periods earlier than the Ottoman (Ousterhout, 1999: 164). This technique was preferred in the 15th century *İstanbul-Tahtakale Hamamı*. Subsidence and movement tendency of the public bath construction area are high due to the presence of approximately 40-45 metres clay with silt and filling layers (Aktuğ, Ersen, 1991: 25). Existing foundation walls remains of a building from the Byzantine period is used as a part of the foundation system and thus, the public bath was constructed directly on these remains (Aktuğ, Ersen, 1991: 26).

The second method is to strengthen the soil. The soil is strengthened by fixing timber piles with certain intervals into the ground, before the foundation walls are built (Akıncı, 1997: 54) (Figure 220). Piles are reinforced with iron elements on the tips (head and end) and are called as "*âhenk-i kazık baş*" or "*âhenk-i çenber kazık*" (Barkan, 1979: 275). It is known that in some foundations, 3-6 metres long piles and rubble masonry walls are used, whereas cut stone foundation walls with iron clamps are used to strengthen the soil in certain bridges (Barkan, 1979: 255; Sönmez, 1988b: 56).

Foundations are the load-bearing elements that transfer the dead load of the structure and loads of snow, wind, earthquake and etc. to the ground. Expanding the foundation area, transferring the loads to the ground through a wider surface, is quite important to increase the strength of the building. In order to increase the surface area transferring the building load to the ground without increasing the thicknesses of the main walls, the foundation walls are started to be built thicker. As the foundation wall raises, its thickness narrows down in one or more stages.

Another system used to increase the surface area of load transfer to the ground is the timber grid system. In this system, timber lintels are placed in a thick *horasan* forming a strong layer almost like a plate, which continues along the foundation alignments, and foundations are built on this layer.

It is known that in the construction of the *Süleymaniye Camii* in İstanbul, (1) a pit approximately six metres in depth is excavated until firm ground is reached, (2) a sand filling layer is formed, (3) a layer of at least 20 cm thick *horasan* with timber lintels inside is formed, (4) foundations are built by rough cut stone masonry system with *horasan* mortar that were narrowed upwards in stages (*ampatman*) (Aksoy, 1976: 26-27, 31-36; Peynircioğlu, et al. 1981: 39). Timbers of eight *arşın* (6.064 metres), ten *arşın* (7.58 metres) and twelve *arşın* (9.096 metres) length bought at the beginning of the construction (as noted on the account-books kept during construction) should have been used in the preparation of this grid system that continues along the foundation (Aktuğ, 1995: 80).

Apart from *ampatman* and grid system, brick vaulting underneath the foundation walls is another system used to strengthen the foundations. In this vaulted system, the building load is collected on vaults and distributed to several vault footings. By this way, the transfer of load to the ground is balanced and transfer area is increased. It is known that the foundations of most of the monuments in İstanbul was built on a vaulted substructure in the Byzantine period (Ousterhout, 1999: 165).Therefore, Ahmet Efendi (1918: 8) states that the infrastructure of the *Nur-u Osmaniye Camii* in İstanbul was strengthened by forming a kind of cistern-like substructure by constructing vaults under foundations (Figure 220).

Kuban and Akıncı (1992) identified that this system was also applied in the foundations of the late-Roman *Valens* Aqueduct and in the Byzantine period fortification walls. Drawings of Akıncı (1997: 56) provide detailed information on the foundations of *Fatih Külliyesi Akdeniz Başkurşunlu Medresesi*, in which a similar technique was applied. In this system; (1) firm ground is reached, (2) brick relieving arches and vaults are built, (3) a one and a half metres thich layer is formed with rubble stone and *horasan* infill, (4) foundation walls are built by rough cut stone with *horasan* (Akıncı, 1997: 56) (Figure 221).

There is also detailed information on the foundations of the *Nur-u Osmaniye Camii* (Figure 220). Although this is an 18th-century building, its foundation techniques are similar to the *Sokullu Mehmet Paşa Camii* and the *Rüstem Paşa Camii*, both built in the 16th century, in İstanbul. The foundation system of the *Nur-u Osmaniye Camii* was built as follows; (1) 16.5 metres depth excavation is done, (2) after underground water level is reached, excavation continued further for 1.5 metres, (3) 2.63 metres long timber piles are pounded so that it penetrates main land, (4) a layer is formed on these piles with rubble stone and *horasan* mortar, (5) a vaulted structure is built on this layer, (6) foundations are built on this substructure (Peynircioğlu, et al., 1981: 40-41; Kuban, 1981: 277-278, 291) (Figure 220).

In the *İstanbul-Tahtakale Hamamı* foundation walls, *ampatman*s in different widths are used according to the thickness of walls. Byzantine remains are left in between the foundation walls to ensure the stabilization of the soil and this area is compressed by soil enriched with pebble, rubble stone and similar elements. (Aktuğ, Ersen, 1991: 25-26)

Researches of Aktuğ and Ersen (1991) also reveal the traces of timber lintels and *puştuvan*s used inside foundation walls. Holes with 16x16, 20x20 and 24x24cm dimensions, belonging to timber elements were detected on foundation walls, first one being found 20-70 cm above *ampatman* level, repeating in every 150 cm and continuing along the wall length (Aktuğ, Ersen, 1991: 26). Although lintels used in the foundations did not reach today, the resins found inside the empty lintel holes indicate that pinewood was used as lintel (Aktuğ, Ersen, 1991: 26).

Separate foundation footings are also used together with continuous foundations. These footings could either be placed on artificial layers as seen in many cases or could be directly placed on bedrock, independent of the main system, as in the case of main dome footings of Hagia Sophia and the *Süleymaniye Camii* in İstanbul (Peynircioğlu, et al. 1981: 39).

In Edirne 14th-16th century public baths, where the soil water level is high, the foundation pits must be dried. In order to drain the water that will rise again without harming the building foundations, slightly inclined layers with different water permeabilities should have been used inside the dried pit. On these layers, either directly the foundation walls (Figure 222) or a vaulted system before the foundation walls (Figure 49, Figure 223) are built.

It is identified in the *Gazi Mihal Hamamı* that the foundation walls are narrowed at two stages with *ampatman*s (each 10 cm at 85 cm and 105 cm depth), and a floor is formed with compressed soil (Figure 222). The *ampatman* application level and the wall one metre above, are built by rubble stone masonry system with lime mortar (see. Chapter 4.2.4). Upper levels of foundation wall are built by alternating rows of brick and stone masonry. Mortar thickness varies between 2 and 3.5 cm.

The thickness of the foundation walls varies according to the thickness of the main walls and partition walls to be built on them. Upper levels of the foundation walls are built either with a same thickness or 10-18 cm wider than these walls (Figure 26, Figure 54, Figure 56, Figure 131). Timber lintels should have been used inside foundation walls, but there are not any traces regarding these elements.

In the construction of public bath foundations, some special solutions are mandatory since this section has a special function as the *cehennemlik* space different from other types of structures. At this level, underneath the bathing spaces, openings/canals in the foundation walls are formed for the circulation of the fumes coming from *külhan*. On top of the fumes flow openings, approximately 40-50 cm wide canals, are spanned with phyllite lintels, roughly shaped or used in the shape it was mined from the quarry (Figure 222). Only the fumes flow openings below the doors have chamfered corners are 80 cm in width (Figure 58, Figure 222).

The floor level is elevated in order to let the fumes expand along bathing spaces at the *cehennemlik* section. In order to support the elevated floor, *cehennemlik* footings are used between foundation walls. These footings are placed with 45-50 cm intervals among each other and from the foundation walls. Square planned footings with 45x45 cm dimensions are built by alternating rows of one brick and one half brick line with 3-3.5 cm lime mortar (see. Chapter 4.2.4) (Figure 26, Figure 27, Figure 55, Figure 222, Figure 224, Figure 225, Figure 226). In some spaces, because of the space dimensions, the first line of *cehennemlik* footings is built attached to the foundations (Figure 222). Such applications must have been preferred to balance the load distribution and not to change the dimensions of *cehennemlik* footings and equal distance system between footings.

Supports are used at the space corners in order to provide a safe basis to lay pavement stones. These corner supports are brick masonry units, with isosceles triangle-shaped plan, 55 cm in long side and 25-30 cm in short sides, and their long sides are curved inwards (Figure 27, Figure 54, Figure 57, Figure 58, Figure 225). These units are not used in two situations. First one is the spaces with 2.5 metres or shorter width. As the spanned opening is short, supports are not necessary for footings. The second one is the spaces where some of the *cehennemlik* footings are built attached to the foundation walls due to space dimensions (Gazi Mihal Hamamı, Z03). In these spaces, corner supports are again not necessary.

Spaces for entrance niches of *tüteklik* chimneys were also formed inside foundation walls (Figure 222). Detailed information on these elements is given in heating system section (see. Chapter 4.4.3).

Floor Pavements and Sekis:

In Edirne public baths, a suitable basis for floor pavements is formed by two layers of the beams. Flagstones of approximately 55-70x100-130 cm dimensions with varying thickness of 8-14 cm are put on *cehennemlik* footings and/or foundation wall and used as beams. Flagstones of 54/58x130 cm dimensions were also used as beams depending on the space dimensions on the Z08 space of the *Beylerbeyi Hamamı*. (Figure 26, Figure 27, Figure 54, *Figure 55*, *Figure 56*, Figure 57, Figure 158, Figure 222, Figure 225, Figure 226)

Flagstones of 5-9 cm thickness and 90x100-110 or 60-65x117-120 cm dimensions are used as floor beams by being placed on beams and foundations (upper levels of beams are reached by placing two or three courses of brick on foundation walls), perpendicular to beams and almost attached to each other. On foundation walls of some spaces, there are approximately 10 cm grooves along the walls at the same level with the upper side of the beams. Floor beams on these spaces are placed so that they fit in the grooves and are put on the beams. (Figure 26, Figure 27, *Figure 55*, *Figure 56*, Figure 57, *Figure 131*, Figure 158, Figure 222, Figure 225, Figure 226)

Floor beams constitute an almost continuous surface and target level is arranged by using bricks and *horasan* with brick pieces (see. Chapter 4.2.4) placed on floor beams. It is identified that this layer is at least 5 cm thick (Figure 26, Figure 27, *Figure 56*, *Figure 131*, Figure 222, Figure 226). Floor pavement is completed by placing polished stone blocks with 4-6, 7-8 or 9-10 cm thickness and approximately 70x100-120 cm dimensions without any joints. (Figure 26, Figure 27, *Figure 55*, *Figure 56*, Figure 57, Figure 222, Figure 225, Figure 226)

One of the most ornamented elements of public bath interiors is floor pavements. Historical records also mention coloured marble pavements of many public baths. According to Evliya Çelebi, haematite, porphyry, *zenburi* (honey-combed marble), *ferah* stone, *yemani* (yemeni agate), *Nişabur firuze* stone are among these pavements stones (Dağlı and Kahraman, 2012: 154).

It is known that marble is generally used in the floor pavements of public baths. However, in some public baths, polished limestone blocks and slate are also used as pavement stones. According to Evliya Çelebi, use of tar as a floor covering material is also observed, most probably due to its low cost, as in the case of a small public bath in Akka (Dağlı and Kahraman, 2011b: 152). Marble blocks are used as floor pavement in Edirne public baths. However, it should be also noted that polished neritic limestone, another stone used for the same purpose, is often mistaken for marble.

Two different systems are used in order to increase the floor level in spaces where *seki*s placed. These systems differ not according to the height of the *seki*s, but rather according to the space on which they are located. *Seki*s in *ılıklık* spaces are formed by 4-6 brick lines constructed on floor beams (Figure 222). *Seki*s in *sıcaklık* spaces, on the other hand, are formed by increasing the *cehennemlik* elevation, by rising *cehennemlik* footings (Figure 26, Figure 27, Figure 55, Figure 222, Figure 225, Figure 226). By this way, *sıcaklık seki*s could benefit from the heating system underneath. *Göbek taşı* (central platforms) is also built by using the second system, but there are not any information noticed on their construction technique details in the studied public baths.

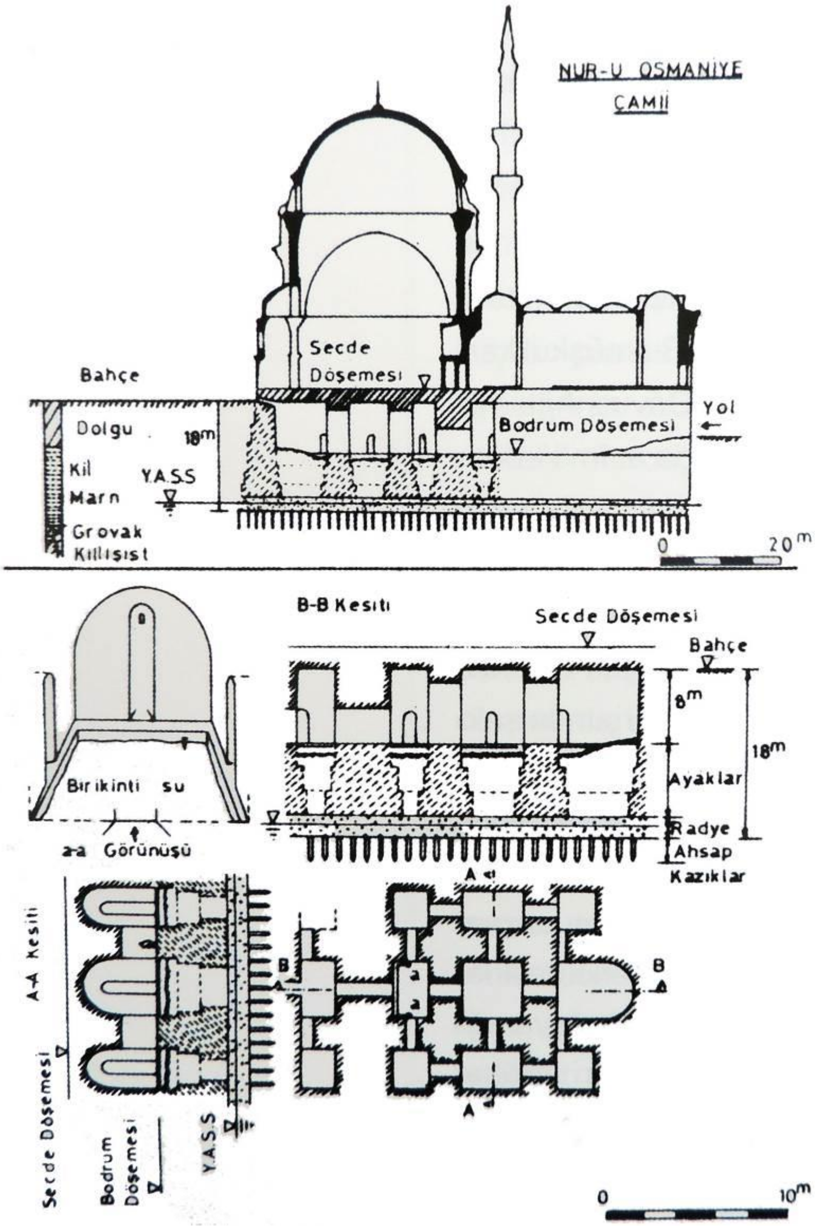

Figure 220. Section and detail drawings of the substructure and foundation systems used in the İstanbul *Nur-u Osmaniye Camii* (Source: Aksoy, 1982)

Figure 221. Examples of vaulted substructures used under foundation walls in the *Fatih Külliyesi Akdeniz Başkurşunlu Medresesi* from the 15th century (left), Üsküdar *Atik Valide Külliyesi* Medresesi

from the 16th century (middle) and use of ampatman in the foundation walls of *Ayvansaray Hacı Hüsrev Camii* from the 17th century in İstanbul (right) (Source: Akıncı, 1997: 57-59)

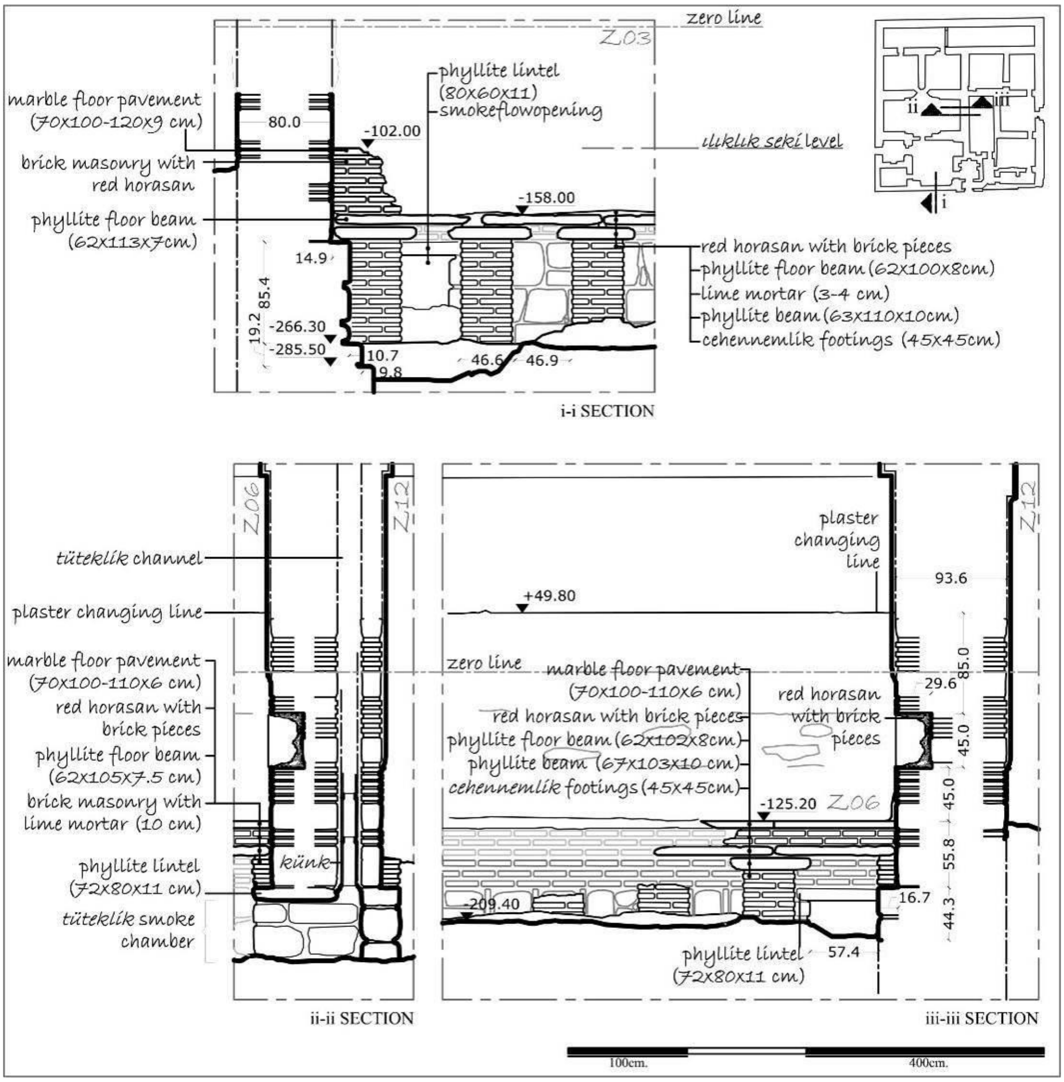

Figure 222. The *cehennemlik*, *tüteklik* fumes chamber, *tüteklik* chimney, floor pavement and clean water channel details used in the ılıklık main space (Z03) and *sıcaklık eyvan* (Z06) of the *Gazi Mihal Bey Hamamı*

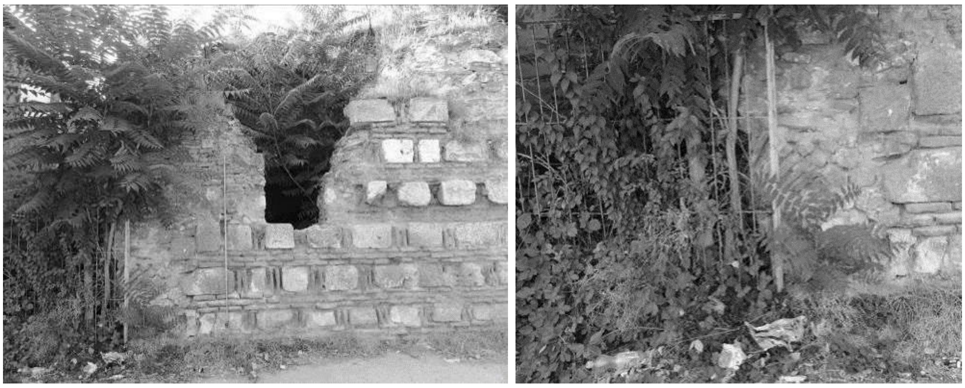

Figure 223. The vaulted substructure used under foundation walls of the *Beylerbeyi Hamamı*

Figure 224. Foundation walls and footings used in the *cehennemlik* section of the *Sultan Selim Saray Hamamı*, the 1990s (Source: İlter Büyükdığan Photograph Archive)

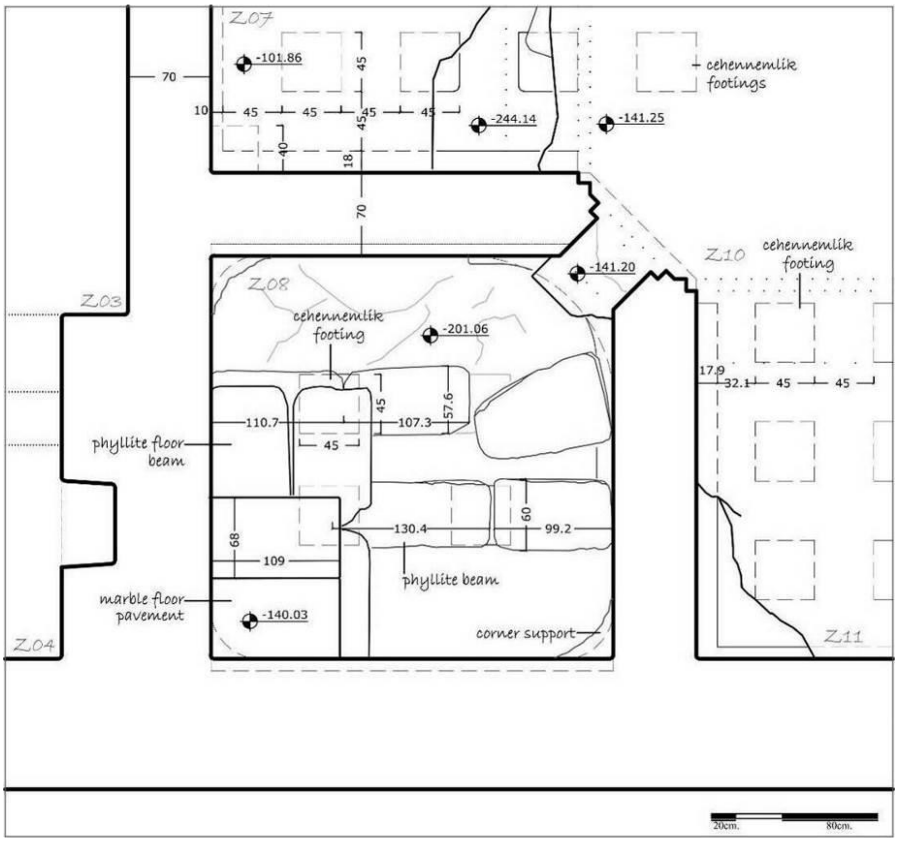

Figure 225. The *cehennemlik* and floor pavement detail from the *sıcaklık halvet* (Z08) of *Beylerbeyi Hamamı* (detail from the *Beylerbeyi Hamamı* Plan – Appendix B- Figure 285)

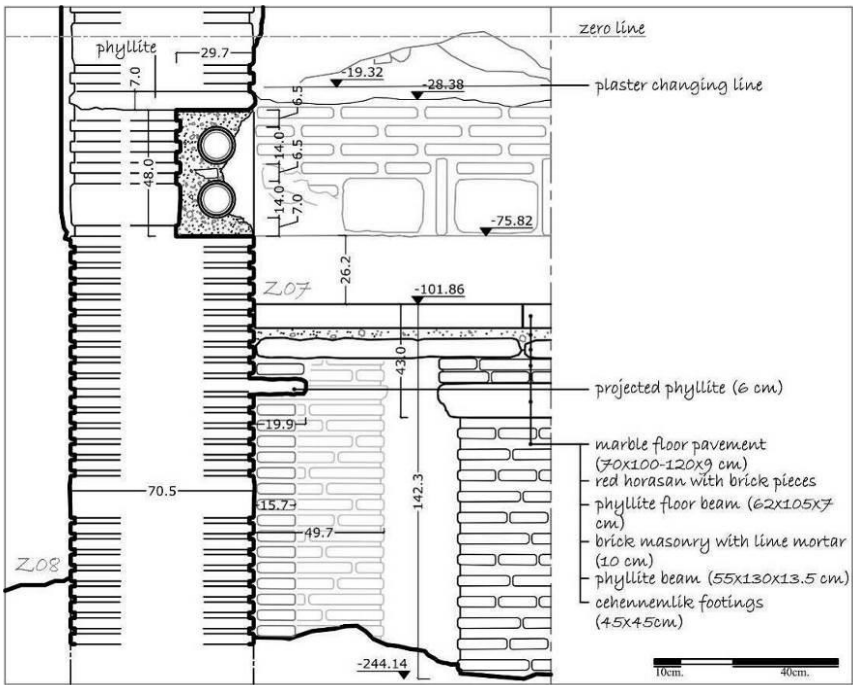

Figure 226. The *cehennemlik*, floor pavement and clean water channel detail from the Z07 *eyvan* of the *Beylerbeyi Hamamı* (Figure 286- D-D Section)

4.3.2. Masonry Walls

Two different types of wall techniques are generally used as main walls and partition walls in Ottoman public baths. The first one is the timber frame system known to be used only in the partition walls of *soğukluk* spaces. However, it is left beyond the scope of this study since authentic *soğukluk* spaces of the 14th-16th century Edirne public baths could not survive present day. Masonry system is used in all the other main walls and partition walls.

It is observed that stone and bricks are the primary construction materials used in walls since the ancient Roman period. Rough-cut and cut stones and bricks are also used in Edirne public baths. Four types of masonry walls are identified in the 14th-16th century Edirne public baths: masonry walls with alternating rows of stone and brick, brick masonry walls, rubble stone masonry walls and rubble stone-brick masonry walls. However, only the first type is an authentic wall system. Main wall construction technique used in these public baths is alternating rows of brick and stone masonry.

It is known that wide and thin bricks are the primary materials in wall construction of monuments during the early Byzantine monuments, whereas wall construction with alternating rows of brick and stone is used as the primary technique in later periods (Van Millingen, 1912: 27). This wall system is the successor of *opus mixtum* used in the late Roman period (Ousterhout, 1999: 169). It is known that, this system was also used in the early Ottoman architecture[59]. The related studies were based on the façade arrangements and there are not any detailed study about the construction details, but similar solutions should have been used with the late Byzantine examples.

The numbers and ratios of brick and stone courses show differences in Byzantine monuments built with this system. Similarly, in some buildings walls comprise only of horizontal stone and brick courses, while in others stones are surrounded by vertical bricks, called "*cloisonne masonry*". However, the real differentiation in this technique is the use of horizontal brick courses either only on

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[59] For detailed information on masonry walls with alternating rows of stone and brick in the early Ottoman architecture see. Batur, 1970 and Ersen, 1986.

wall façades or along the wall thicknesses. For example, Byzantine churches in Cappadocia, bricks are used only on wall façades, stone masonry system is used inside the walls (Ousterhout, 1999: 187). However, in the similar buildings from the same period in İstanbul, there are not any differentiation between the façade and interior of the wall, the brick courses continue inside the wall thicknesses (Ousterhout, 1999: 187).

Interruptions are made in certain intervals on inner and outer layers of the masonry system by continuing the brick courses along the wall thickness. These brick courses prevent separation of two layers by moving independently from each other due to vertical loads. At the same time, this technique increases the elasticity of the system, preventing the formation of structural cracks due to horizontal loads.[60]

In the public baths that are studied in detail within the scope of this thesis, material continuity is achieved throughout the wall thickness with alternating wall system in which horizontal stone and brick courses continue along the wall thickness, similar to Byzantine era churches (Figure 227). Rough-cut or cut stones are surrounded by vertical bricks, in most of these walls (Figure 13, Figure 25, Figure 49, Figure 50, Figure 88, Figure 98, Figure 99, Figure 129, Figure 141, Figure 153, Figure 154, Figure 157, Figure 159).

When the masonry walls with lime mortar (see. Chapter 4.2.4) are built on foundations, corner stones are placed at first, followed by the construction of the space between these stones. Rubble or rough-cut stone masonry walls are constructed by 50-80 cm long phases, each of which are called as *savak* (Diri, 2010: 95). Wall levelling is also done at every stage. Brick courses are used as *savak* levels in alternating rows of brick and stone walls, and levelling is achieved by making small changes in mortar thicknesses. Two timber lintels parallel to each other are placed inside the bricks or generally on the brick courses at every two or three *savak* level. The wall rises by repeating this process.

As the wall level rises, scaffoldings are formed by placing timber beams inside the wall and timber posts on the floor (Kolay, 1999: 20). Working platforms are formed inside this skeleton at required levels (see. Chapter 4.2.3) (Figure 214). Putlog

[60] MSc Civil Engineer Mete Işıkoğlu was consulted for the comparison of structural behaviour of different masonry systems.

holes remained on the walls after the scaffoldings are dismantled and filled in the studied public baths. Therefore, information on which level the scaffolding beams started to be used and their repeat distances could not be identified.

Most of the walls are built by repetition of two or three courses of brick and one course of cut or rough-cut stone. In few walls, the number of brick courses decrease to one and/or number of stone courses increases to two. Relatively bigger stones are used on the outer façade of the walls, smaller rubble stones and stone pieces are used in the interior walls remained in between the bigger stones (Figure 227). The number of brick courses continuing along the wall thickness show differences than the rest of the wall at the levels where door openings, water lines, *çörten*s and timber lintels are used (Figure 43, Figure 101, Figure 152, Figure 153, Figure 156).

A single type of bricks and half bricks of 27,5x27,5x4-4.5 cm dimensions are used in authentic walls. Dimensions of rough-cut stones change between 14-65 cm in width and 20-30 cm in length. The thickness of lime mortar used in walls changes between 2 and 5 cm.

Brick pieces are identified at bed joints where the mortar thickness increases in the *Gazi Mihal Bey Hamamı* (Figure 228). These pieces are not present in the mortar mixture, but rather they are embedded inside the bed joints after mortar is applied. Mortar thickness should have been increased in order to decrease the cost and accelerate the construction process. However, the mortar gains resistance as it dries. In order to continue construction, especially at areas, workers should have waited for longer times than the normal to let the mortar dry, where mortar thickness is equal to unit material such as brick. Therefore, to shorten waiting period, brick pieces must have been used as a support element in mortars that are not dried enough (Figure 228).

Wall thicknesses change according to whether they are main walls or partition walls and according to the load they must support. This load is limited to the load of the wall itself, the load of transition elements, upper structure and dead load such as snow etc., in most of the spaces. Different from the others, in water depots, the load of water inside the depot make it necessary to increase the wall thickness. Studies reveal that the ratio between wall thickness and height is very important for earthquake endurance, which show that masonry walls with height/thickness ratio smaller than eight are more efficient against earthquake loads (Arun, 2005: 87). In Edirne public baths, this ratio changes between three and eight, and decreases to two in water depots.

The thicknesses of main walls and water depot walls in the studied public baths vary between 100-125 cm, and decrease to 85 cm in few examples. Partition walls between men's and women's section have thicknesses between 80 and 110 cm. The thicknesses of other partition walls vary between 75 and 90 cm. (Figure 15, Figure 22, Figure 46, Figure 90, Figure 97, Figure 121, *Figure 126*, Figure 146, Figure 151, Figure 179, Figure 187, Figure 190)

Openings are formed as the walls are constructed in necessary locations. Openings for doors, windows and *pöhrenk* channels are spanned with stone and/or brick arches or stone lintels, and masonry wall construction continues in these systems.

Cut stones of 30x50 cm are used at all wall corners, on *soğukluk* window openings and door openings (Figure 33, Figure 65, Figure 165). Specially shaped cut limestones are partially used on one side of the walls where portals are placed (Figure 16, Figure 17, Figure 28). In addition, use of shaped cut limestones is observed in the corner chamfer at the northwest corner of the *Sokullu Mehmet Paşa Hamamı* (Figure 193).

Bricks are used on the sides of water control windows and niches (Figure 35, Figure 66, Figure 67, Figure 166). Similarly, the area between the door arches and the transition elements is constructed with brick courses at the chamfered corners of *ılıklık* and *sıcaklık halvet*s (Figure 132). Such applications, using only brick masonry system, must have been preferred at narrow spaces like these where the total width is not enough for alternating masonry mainly used in walls (approximately 160 cm outside, 75 cm inside).

Use of only brick or rubble stone masonry techniques are not observed in the entire structure or in an entire wall, rather they are observed partially in a limited number of walls (Figure 17, Figure 24, Figure 59, Figure 229). In these walls, different from rest of the structure, stone dimensions get smaller and brick thickness decrease below 3.5 cm. In addition, the quality of craftsmanship decreases. These types of wall structure indicate comprehensive repairs in the Ottoman period.

The rubble stone and brick masonry system is used only in partition walls located between hot and cold water depots, below the supporting arch (Figure 60). These walls, which must be pulled down and rebuilt partially and/or completely during periodic maintenance and repairs, also indicating Ottoman period interventions.

Figure 227. Masonry walls sections constructed by alternating rows of brick and stone used in the *Beylerbeyi Hamamı* (left), *Topkapı Hamamı* (right) and *İbrahim Paşa Hamamı*

Figure 228. Use of brick pieces in alternating wall joints in the *Gazi Mihal Bey Hamamı*

Figure 229. Traces of Ottoman period interventions in masonry walls of the partition wall located between the Z01a and Z02 spaces of the *Beylerbeyi Hamamı* (left) and between the Z15 and Z16 spaces of the *Gazi Mihal Bey Hamamı* (right)

Timber Lintels and Puştuvans:

Traces of timber lintels and *puştuvan*s embedded in the masonry walls can be observed in the collapsed parts of the 14th-16th centuries Edirne public baths examined in detail (Figure 29, Figure 48, Figure 94, Figure 101, Figure 106, Figure 152, Figure 160, Figure 161, Figure 213, Figure 233, Figure 234, Figure 235). First examples of timber lintel use inside masonry walls dates back to 2500-2200 BC (Mielke, 2009: 85-89; Aktuğ Kolay, 1999: 15) (Figure 230, Figure 231). This system is not used for a long time since then, but its application gain wide prevalence in the Byzantine period (Ousterhout, 1999: 192-194) (Figure 232).

Ousterhout (1999: 210) states that mortar thicknesses increased in the late Byzantine period to accelerate construction. On the other hand, this method increases the fluidity of the structure as a result of a phenomenon called “plastic flow of mortar”, which occurs during the time when mortar has not reached to its final hardness; and thus timber lintels were used inside the walls to keep the structure stable (Ousterhout, 1999: 192-194, 210-211).

In addition to this argument, there is also some evidence suggesting that these timber lintels, known to increase the elasticity and endurance of masonry systems against horizontal loads, continue to function as important structural elements throughout the lifetime of buildings. Timber lintels placed inside masonry systems has a connecting role between walls in different directions and between masonry units, providing integrity within the wall thickness.

Timber lintels and *puştuvan*s used in the 14th-16th century Edirne public baths did not survive until today. However, the remaining traces reveal the positions, dimensions and also connection details of these timber structural elements (Figure 29, Figure 61, Figure 106, Figure 152, Figure 160, Figure 161, Figure 233, Figure 234, Figure 235). Two lines of timber lintels embedded in the masonry system and lying along the walls, surround the entire building. Timber lintels in the same wall and at the same level are connected to each other by *puştuvan*s, placed perpendicular to the lintels at every 80-120 cm. (Figure 22, Figure 46, Figure 97, Figure 126, Figure 151, Figure 234)

Remaining holes of rotten and destroyed timber lintels and *puştuvan*s inside the walls reveal that lap joint, plain lap joint, cross-lap joint, half-lap joint and beveled half-lap joint details are used when connecting timber elements to each other (Figure 236, Figure 288). Nails might also have been used at connection points, especially in lap joint detail. However, despite the holes were specifically examined for this purpose, there were not any nails found during the site survey.

Lintels and *puştuvans* must have been used at the starting levels of masonry walls[61]; however, there are not any traces supporting this argument. The traces in the public baths examined in detail show that lintels are used first at 100-140 cm above original floor level and repeated at every 2-3 *savak* level, meaning at every 110-160 cm. Especially lintels are certainly used at the arch and spring lines of the upper structure (Figure 235, Figure 236). According to how an arch functions, vertical loads from above create a thrust along the arch thickness. As a result of this effect, a sliding tendency occurs on arch hinges below the spring line. Timber lintels, used in all arch and the beginnings of upper structure, must be a precaution against this sliding risk.

Lintels and *puştuvan*s are placed approximately 15 cm inside the wall faces and their faces are closed either with stones or more commonly with half bricks, burying timbers inside the walls. Indeed, in many buildings, lintels are observed behind the brick courses of alternating walls (Figure 233). Using brick or stone units to close the faces of lintels placed on top of brick courses depends on the masonry wall construction system (Figure 233). Dimensions of square or more commonly

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[61] For detailed information on timber elements embedded into masonry walls at this level see. Peker, et al, 2016: 24-25, 34-35, 40-41, 76.

rectangular sectioned lintels are identified as 10x15, 15x15, 15x18, 18x18-19, 20x20 cm, while dimensions of mostly square sectioned *puştuvan*s are 10x10, 12x12 and 15x15 cm in cross-section (Figure 234).

Most of the water depots have a narrow-long rectangular plan where hot and cold water depots are placed end to end. The total length of the depots, with its supporting arch and partition wall in between, is three or four times of its width. Hot and cold water depots are also built apart from each other in some public baths. In these structures, length of the elongated rectangular plan of hot water depots is approximately five times of its width. Special solutions are developed for water depots because of the geometry of the space and the water load collected in these spaces. (Figure 15, Figure 22, Figure 46, Figure 90, Figure 97, Figure 121, Figure 126, Figure 146, Figure 151, Figure 179, Figure 187, Figure 190)

Water depots have a narrow and elongated rectangle plans and are not supported vertically. Hence they have less stability against out-of-plane lateral forces compared to square or square-like-rectangular spaces. Overturning risk in an out-of-plane direction increases further because of the horizontal load transferred through vaults to masonry walls.

In the water depots some of the *puştuvan*s, which normally connect lintels located on the same wall at the same level, must be extended between long walls. These timber elements must be lying in the open along the space and used as timber ties, which connect lintels imbedded in the long walls of the depots (Figure 22, Figure 46, Figure 61, Figure 126, Figure 151). These ties resist the thrust created by the vault on the long walls, connecting walls that are weak against out-of-plane lateral movement, hence strengthen the system structurally.

The number of *puştuvan*s in hot water depot were more, probably because of considering the dynamic load resulting from heated water. Traces reveal that one in every three *puştuvan*s (240-360 cm) are used to connecting long walls parallel to each other in hot water depots (Figure 22, Figure 46, Figure 151).

During wall construction, extended *puştuvan*s, which used as timber ties, must also have functioned as scaffoldings for the centring when vaults are constructed. Yavuz (2001, 368), states that such elements should have been initially used to support centrings during vault construction. There should be certain extended *puştuvan*s/timber ties left untouched after the construction was completed, and when the high earthquake resistance of these system was recognize, they started to be used as structural elements. In addition to that, the author states that, after some time, by the experience gained from timber ties, iron ties[62] might have taken their place (Yavuz, 2001, 368).

Although there are not any information on the beginning of their use, these timber ties were almost certainly used as scaffolding beams during construction. They are placed just under the spring line, because of this function. Primary success (and perhaps the reason from the very beginning) is its resistance to thrust applied by vault on long walls, at the first hinge level. Otherwise (if the tie levels are further below), out-of-plane shear loads on the walls created by thrust, would cause an overload of the wall parts between tie and springer and result in structural problems.

Details of timber lintel and *puştuvan* connections can only be observed in the *Beylerbeyi Hamamı*, among the examined Edirne public baths in detail (Figure 288).

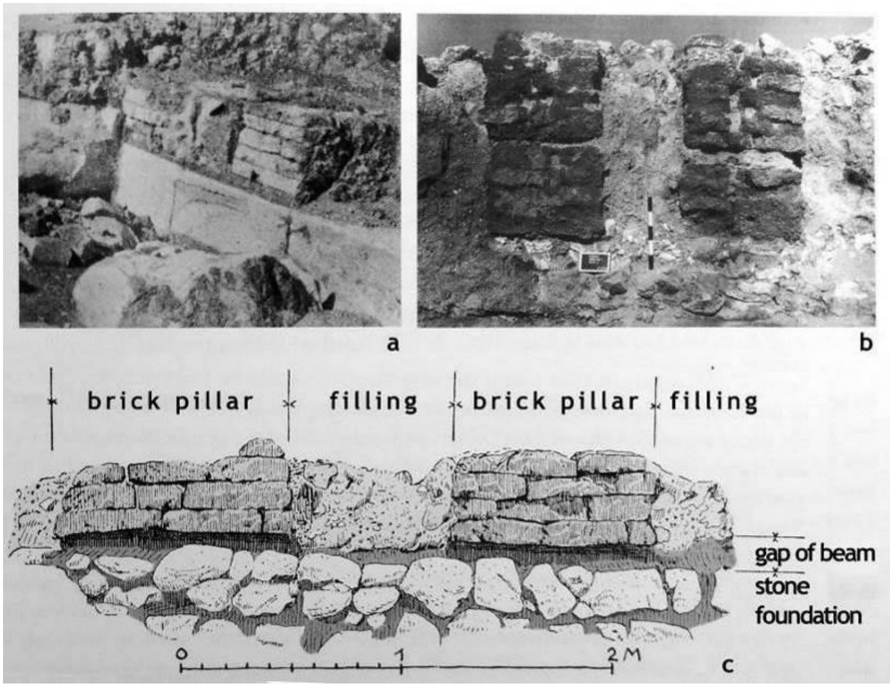

Figure 230. Hittite masonry walls with the traces of timber lintels from Boğazköy (a, c) and Kuşaklı (b) (Source: Mielke, 2009: 85)

[62] For detailed information about iron wall ties see: Tanyeli, 1990: 60-64; Tanyeli, 2017: 175-183.

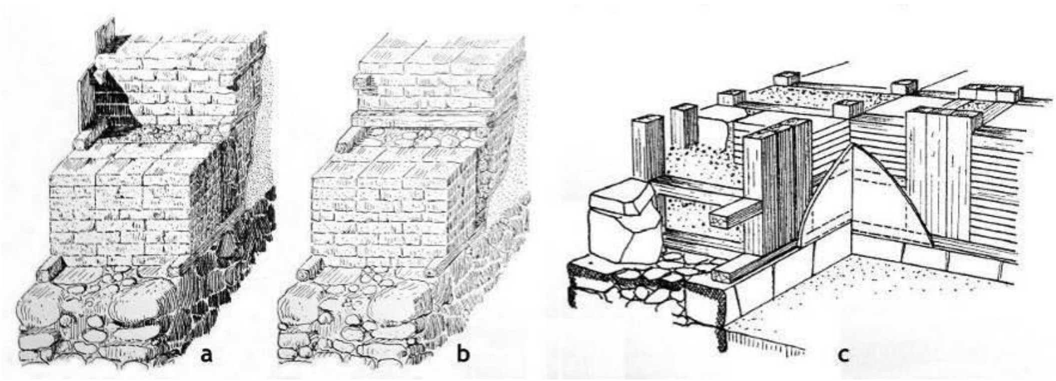

Figure 231. Reconstruction of the Boğazköy-Hittite masonry wall with timber lintels: from R. Naumann, 1938 (a), from R. Naumann, 1955 (b), from P. Neve, 1969 (c) (Source: Mielke, 2009: 89)

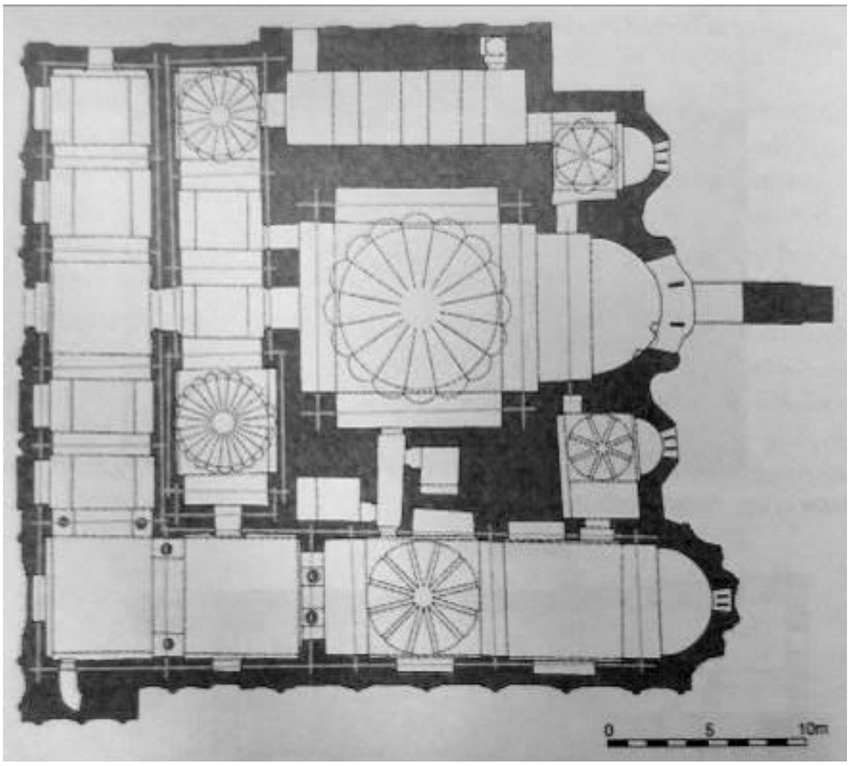

Figure 232. Timber lintels and tie beams from the İstanbul Chora Monastery, 14th century (Source: Ousterhout, 1999: 111)

Figure 233. Traces of the timber lintels and *puştuvan*s embedded in the north-east and south-east walls of the *İbrahim Paşa Hamamı*

Figure 234. Traces of the timber lintels and *puştuvan*s embedded in the hot water depot walls of the *Beylerbeyi Hamamı*

Figure 235. Traces of the timber lintels embedded into the masonry at the spring level of the dome of Z13 space in the *İbrahim Paşa Hamamı*

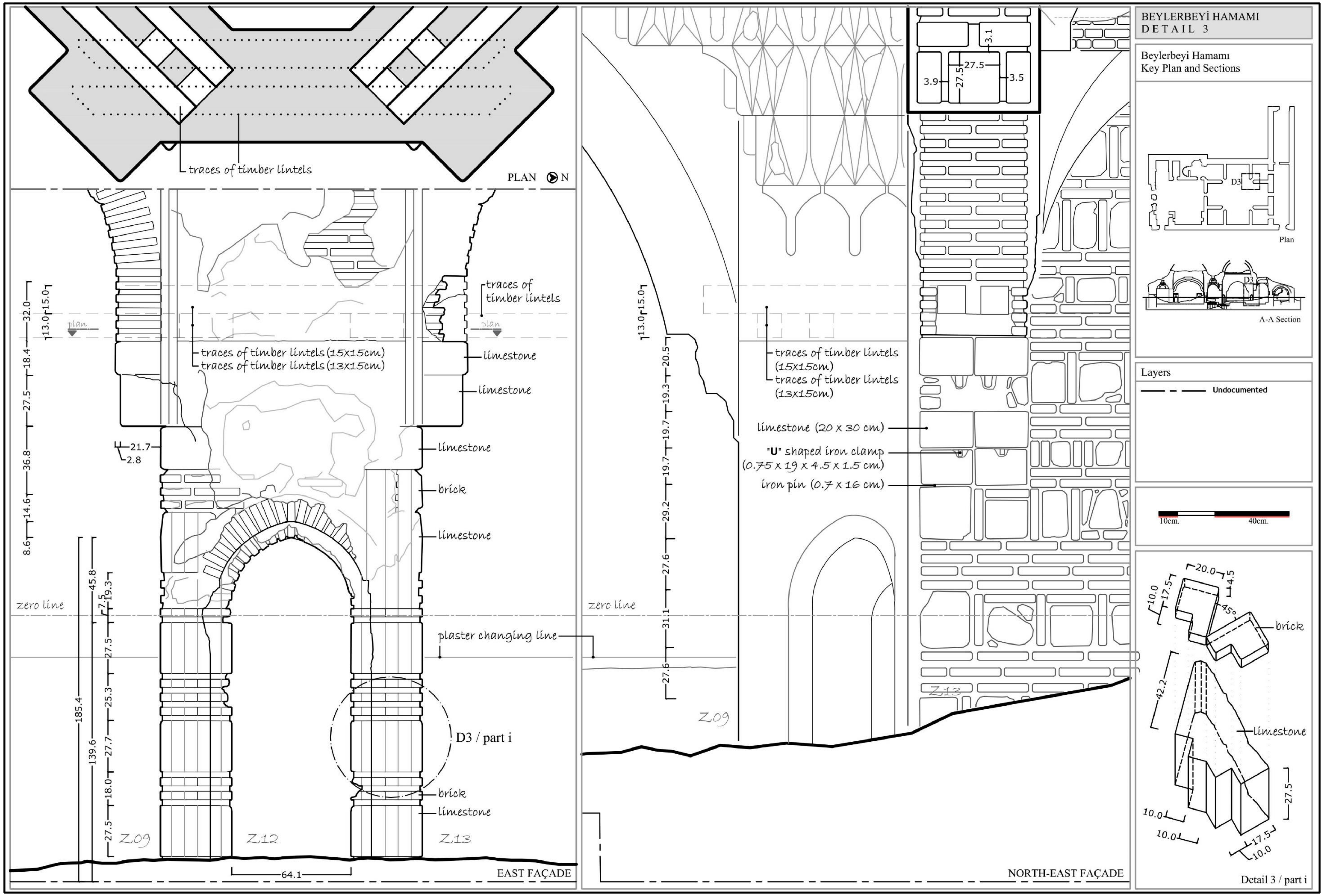

Figure 236. The door (Type 7) located between the Z12 *halvet* and the Z10 main space in the *sıcaklık* section of *Beylerbeyi Hamamı* and the traces of lintels and *puştuvan*s used at the spring level of the *eyvan* arches of Z09 and Z13 spaces

Arches, Openings and Niches:

Arches were used to span openings like doors or windows before the Roman period. In the ancient Roman and Byzantine architecture, together with this former functions, arches themselves were started to be used as primary load-bearing elements for large spans. Arches of the Hellenistic period were built without any mortar, by connecting cut stones to each other by clamps. The same technique had continued in the Roman period, but a thin layer of mortar had started to be used between stones. Arch construction with cut stones continued in a similar way during the Byzantine period, but thick mortar layers were also used in arches built by rubble stones and bricks. (Aktuğ Kolay, 1999: 42)

As in other early and the classical period Ottoman monuments, openings of masonry walls are spanned with brick and/or stone arches in the 14th-16th century Edirne public baths. These systems can be examined under four main headings: arches, doors, windows, and niches.

Arches:

Arches used to span long distances are first practiced in Egypt in the 6th century BC, and then in the ancient Greek architecture from the 3rd century BC onwards (White, 1984: 86). This tradition had been developed and used in the Roman, Byzantine and Ottoman periods as well. In Edirne public baths, arches are used for large spans between *sıcaklık* and *ılıklık* main spaces and *eyvan*s. Openings of architectural elements are also spanned by arches, which are described under the heading of architectural elements.

Three different forms are observed in the 14th-16th century Edirne public baths: pointed, shouldered (known also as Bursa type) and ogee arches. Studies on arch forms show that tensile strength of arches like pointed and ogee arches, with a relatively small radius of curvature, are higher (Silver, Mclean, Evans, 2013: 14).

Arch spans vary between 243-570cm, rises between 110-220cm and the thicknesses between 30-45x30-75cm. As the spanned distance increases, thickness of the arch increase as well.

Arches are built by the use of bricks and half bricks placed on top of each other with shifting joints so that joint lines do not overlap on top of each other. Different from the walls, the bricks with 27.5x27.5x4-4.5 cm dimensions and half-length of them, together with the bricks with 24x27.5x4-4.5 cm dimensions and half-lengths are used in the arches.

Transition between spaces is achieved by leaving the area underneath the arches empty (Figure 30, Figure 62, Figure 72, Figure 105, Figure 113, Figure 137, Figure 157, Figure 162, Figure 191). In these areas, first, the side walls or the corners/footings on which the arch will transfer load are built up to the spring line. Arches are built directly on the wall so that their springs stand inside the side walls (Figure 237), or they are placed on the projected units formed on the walls or footings. Bricks, cut-stone blocks or phyllite plates are used in these projections.

When brick is used (Figure 30), the area where the arch is to be placed is built by bricks positioned to make at most 5 cm projections at each line. When projections are made by specially shaped 20 cm length limestones, 5-10 cm projections are made at each line and stone blocks are connected to each other by iron or timber clamps (Figure 63, Figure 65, Figure 236). Most frequently used technique is one row projections made approximately by 10 cm thick phyllite plates placed on spring level. These phyllite plates are placed to make approximately 10 or 25 cm projections from the wall alignment. In 10 cm projections, arch starts at the same level with phyllite (Figure 72, Figure 162).

In all of these applications, either the existing scaffolding is used or a scaffolding is set on timber posts and suitable base for the arch form is made by centring (Figure 214). The brick arch is built on this base and wall, transition element or upper structure is constructed on the arch. After the arch can support itself, this centring is removed and used in the construction of other similar arches in the building.

Wall construction continues on top of the arch after it is erected. Aiming to distribute the dead load of the wall on arch equally, a uniform surface between wall and arch is obtained by placing one or two courses of brick parallel to the outer face of the arch (Figure 30, Figure 33-Type 4).

In examples making 25 cm projections, arch springs are recessed by 10-15 cm from phyllite alignment (Figure 132). This detail gives information about the differentiation of the falsework. In these examples, a timber beam or braces are placed to lie between phyllite plates on the side walls (Figure 239). When necessary, a beam might have been supported with timber posts, but the primary load-bearing elements are phyllite plates for this system. The basis for the arch form is made by placing skeleton and profiled ribs, formed similarly to others, on top of these main beams or braces, and the arch is built on this centring (Adam, 2005: 174-177) (Figure 214, Figure 239). Stucco ornaments are also observed on spring levels of some of these arches (Figure 29, Figure 107, Figure 136, Figure 201).

The area underneath a few arches are filled with masonry walls, and therefore these arches function as relieving arches (Figure 32, Figure 92, Figure 107, Figure 133, Figure 164). In such examples, the wall is constructed up to the spring level of the arch, the arch is erectes, and the arch rise is closed by masonry system respectively.

There is another relieving arch use, detected only in the *Gazi Mihal Bey Hamamı* among Edirne public baths. This arch is found in the Z04 *eyvan*, on the line where the water distribution system inside the building continues vertically. Although the channel's inside is filled with bricks and mortar after the *pöhrenk*s are placed, this system must have been used to decrease the load to be transferred to *pöhrenk*s. Top of the vertical water channel is covered by triangular arch formed by placing two stones of 21-27x31-33 cm size diagonally so as to touch each other end to end (Figure 31, Figure 238).

Figure 237. The arch used in the Z01 *aralık* space of the *Beylerbeyi Hamamı*, which is built directly on the wall so its springers placed inside the masonry walls

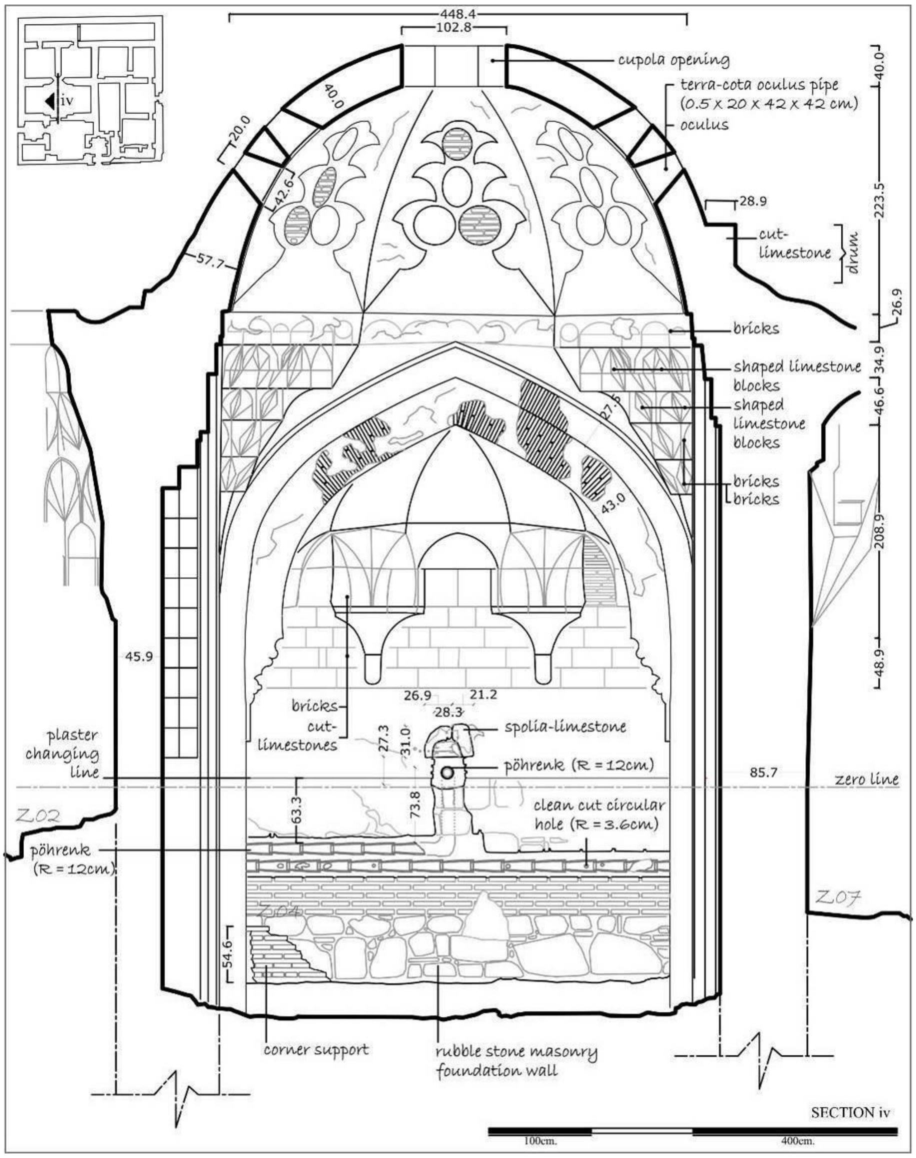

Figure 238. The Z04 *eyvan* of the *Gazi Mihal Bey Hamamı*

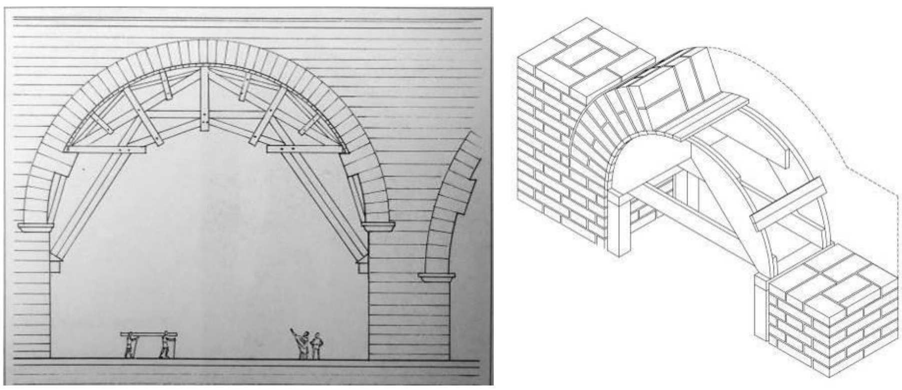

Figure 239. Schematic drawings of the centring arches with different dimensions (Source: Adam, 2005: 176; Davies, Jokiniemi, 2008: 473)

Doors:

Door openings of the 14^{th}-16^{th} century Edirne public baths can be examined under nine main groups according to their construction techniques and differentiation of their arches.

Among them, the first five door opening types are used only in the *Gazi Mihal Bey Hamamı* (Figure 33, Figure 240). Their width is 70-80 cm and height is approximately 175 cm. These door openings are built similarly and are classified according to the arch technique used. Type 1 is the door openings in which 45 cm one layered arches are built by one brick and one half brick courses and with a wedge shaped limestone as keystone (Figure 33, Figure 240).

Type 2 is 85 cm door openings with 3-layered arches, such that two layers at sides are built the same way as in Type 1 and layer in the middle is built with one brick and one half brick courses as voussoirs and also keystone (Figure 33, Figure 240). Type 3 are approximately 45 cm wide door openings with one layered arch built with one brick-one half brick and limestones shaped as key and springer stones (Figure 33, Figure 240).

Type 4 is approximately 85 cm wide door openings with 3-layered arches, such that two layers at sides are built the same way as in Type 3 and the middle layer is built by one brick and one half brick courses as voussoirs and also keystone (Figure 33, Figure 240). Type 5 is approximately 85 cm wide door openings with 3-layered arches, such that the two layers on sides are built by three wedge-shaped voussoir limestone (one of them is keystone) and the middle one is built by one brick and one half brick courses (Figure 32, Figure 33, Figure 240).

The arches of Type 6 door openings with varying spans of 65-75 cm and rises of 185-190 cm. Their door openings are spanned by one layered arches built by one brick and one half brick courses shifting on top of each other so that joints do not overlap on top of each another. Specially shaped limestone blocks and bricks are used at the sides of the openings, in line with the alternating wall system used in the wall (Figure 55, Figure 107, Figure 165, Figure 286-DD Section).

Type 7 has almost identical properties with type 6, but these door openings are located at the corners of spaces (Figure 32, Figure 65, Figure 107, Figure 108, Figure 132, Figure 164, Figure 236, Figure 241-Type 6 and 7 are the most frequently used door openings in inner spaces. These types are observed in all public baths except for the *Gazi Mihal Bey Hamamı*.

Type 8 is the door openings between *soğukluk* and bathing spaces (Figure 34, Figure 98, Figure 109). These door openings with approximately 90-100 cm in width, are built similarly. However, different from other seven types, timber door wings are used in door openings and vapour release chimneys are also used to prevent the release of vapour from bathing spaces to the *soğukluk* when the doors are opened. The vapour release chimneys are built either by a simple chimney system composed of *künk*s placed inside the arch and continuing upwards, as in the *Gazi Mihal Bey Hamamı* women's section (Figure 34), or by special chimney systems as in the *Yeniçeriler Hamamı* (Figure 98, Figure 109, Figure 242).

Type 9 is the main entrance doors of public baths. As in other Ottoman public baths (Eyice, 1997: 420), special attention is paid to ensure that the main entrance doors of Edirne public baths are elaborate. Some of the examples are the elaborated entrance doors of the *Sultan Selim Saray Hamamı* and the *Tahtakale Hamamı* and columned portico at the entrance of the *Sokullu Mehmet Paşa Hamamı* are examples of this kind. Door openings are in 125-135x275-285cm dimensions (Figure 15, Figure 90, Figure 190). Cut-stone arches are used only in these door openings (Figure 191, Figure 193, Figure 243). These *taçkapı* (portal) openings are spanned by depressed arches, built by profiled or simple two different coloured stones brought together with joggled joints or by the use of iron pin details without mortar (Figure 243). Timber door wings made by *kündekari* technique are used in the main entrance and the transition between *soğukluk and* bathing spaces (Type 7-8). However, since there are not any original examples survived today, these elements are not included in this study.

In all door types, some examples are visually enriched by portals and cut stone pediments and the first five types have limestone blocks on the spring line in which the cylindrical niches with 12x12-15 cm dimensions are carved (Figure 32, Figure 33, Figure 164, Figure 240, Figure 241, Figure 243).

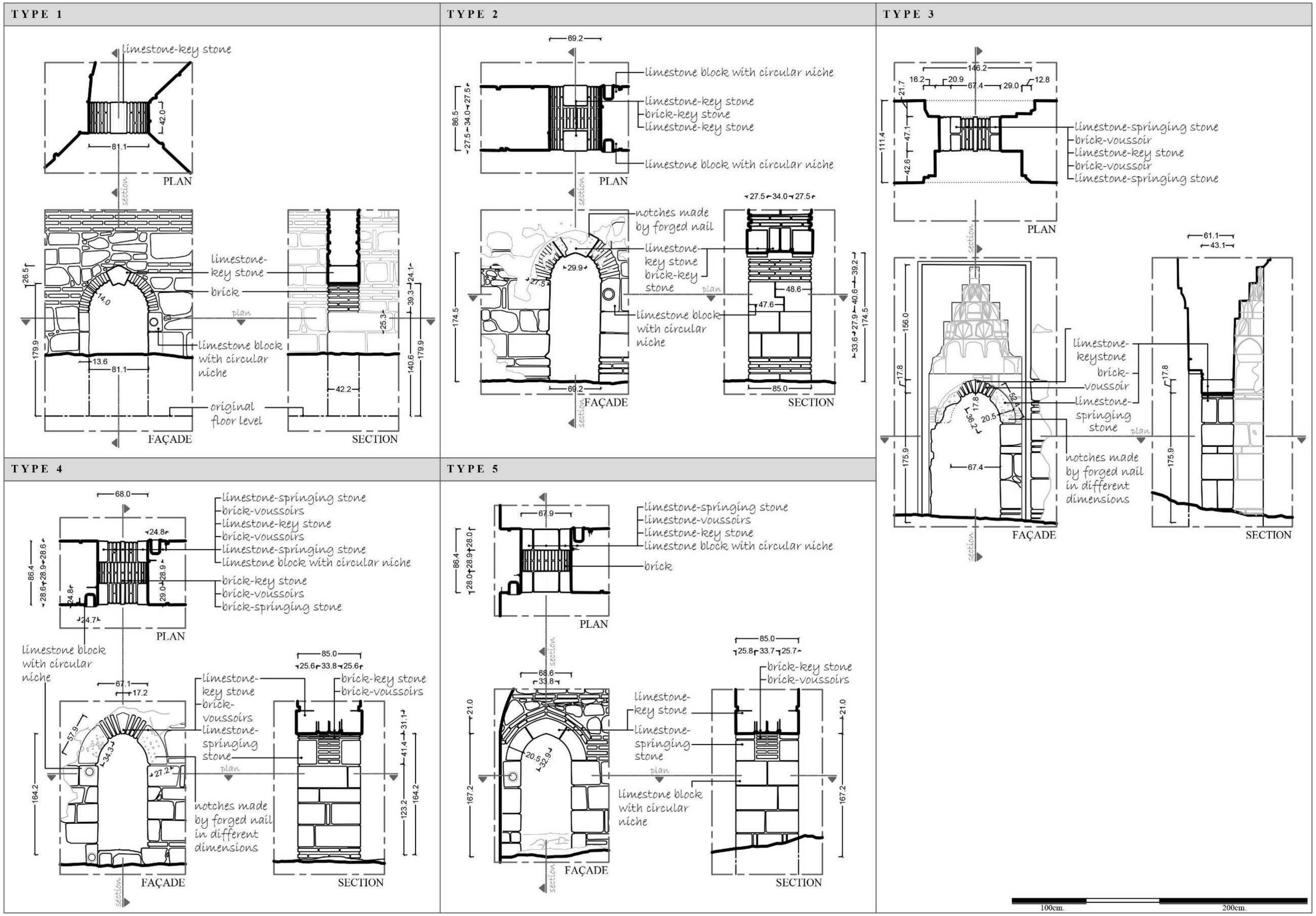

Figure 240. The door Type 1, 2, 3, 4 and 5 used in the *Gazi Mihal Bey Hamamı*

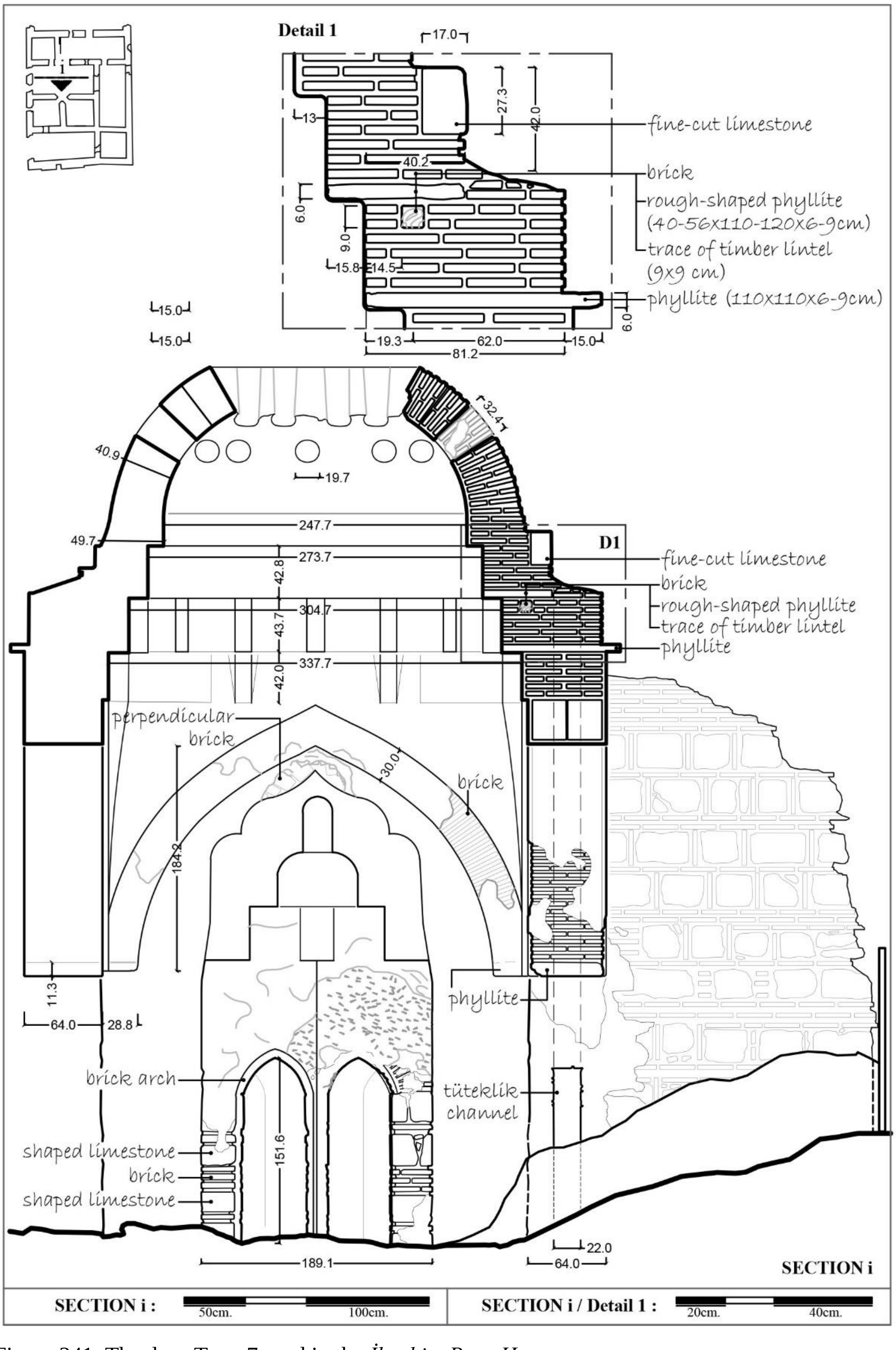

Figure 241. The door Type 7 used in the *İbrahim Paşa Hamamı*

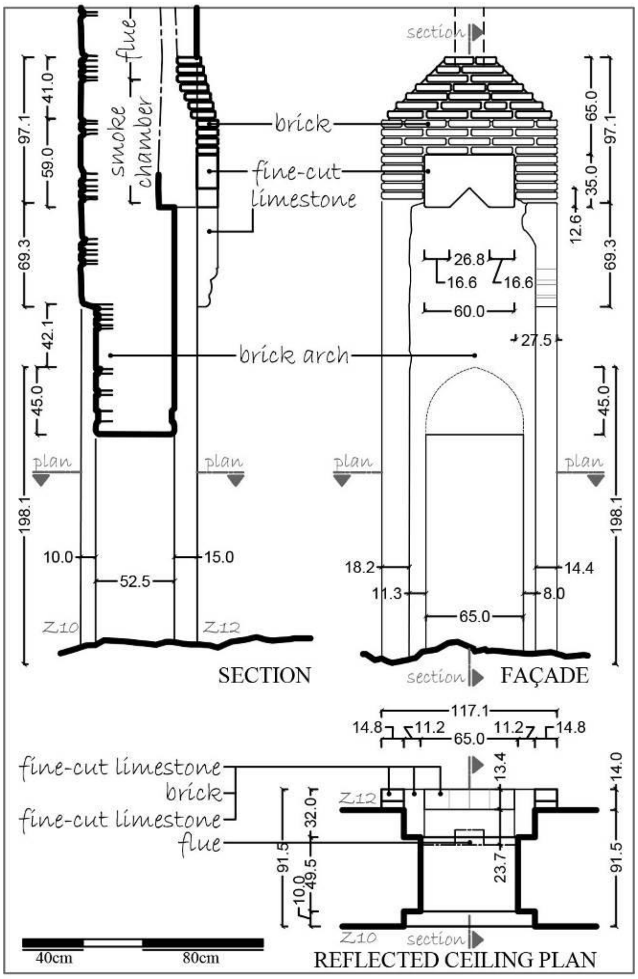

Figure 242. The door Type 8 used in the *Yeniçeriler Hamamı*

Figure 243. The door Type 9: The entrance doors of the men’s section of *Sultan Selim Saray Hamamı* in 1971 (left) (Source: Machiel Kiel Photograph Archive), the men’s section of *Tahtakale Hamamı* (middle) and the men’s section of *Sokullu Mehmet Paşa Hamamı* (right)

Windows:

In Ottoman public baths, due to the privacy required by the function, usual lightening windows and top windows are only used in *soğukluk* spaces. Other openings used for natural lighting are placed on the upper structures. In addition, there are window openings specific to Ottoman public baths and named as water control window openings, used between hot water depots and *sıcaklık* spaces. Within this scope, windows used in the 14th-16th century Edirne public baths can be examined under four main groups according to their construction techniques.

The first three groups are the windows found in *soğukluk* spaces, at three different levels, used for daylighting. Type 1 is the windows with arches of the *soğukluk* main space with 100-110x215-230 cm dimensions built by one cut stone-two brick line repetitions (Figure 16, Figure 17, Figure 191, Figure 244). Type 2 is *soğukluk* top windows found 4-5 metres above the floor level, built in the same way as type 1, but with dimensions down to 170 cm (Figure 17, Figure 244, Figure 245). Type 3 is top windows found approximately 7.5 metres above the *soğukluk* floor level, with approximately one metre height or diameter, built as arched or circular openings by repetition of one cut stone and two brick courses (Figure 193, Figure 245).

Timber window wings are used in type 1, while *revzen* is used in Type 2 and 3 windows (Figure 191, Figure 245). The *Sultan Selim Saray Hamamı*, *Tahtakale Hamamı,* and *Sokullu Mehmet Paşa Hamamı*, in which these window types are used, had gone through comprehensive repairs in recent times without a detailed documentation about structural systems. Therefore, information on the authentic construction techniques of windows cannot be obtained.

Type 4 is the water control windows used in all the partition walls between hot water depot and *sıcaklık* main space (Figure 35, Figure 66, Figure 105, Figure 166). These window openings of 63-70 cm width and 80-110-120-126 cm height are spanned by brick arches (Figure 35, Figure 61, Figure 66, Figure 80, Figure 166, Figure 246, Figure 288).

Figure 244. The window Type 1 and 2 in the *soğukluk* main wall of the women's section of *Sultan Selim Saray Hamamı*, the 1990s (Source: İlter Büyükdığan Photograph Archive)

Figure 245. The window Type 2 and 3 from the *soğukluk* spaces of *Tahtakale Hamamı* (left and middle) (Edirne KTVKBK, the 1980s), and the women's sections of *Sokullu Mehmet Paşa Hamamı* (right)

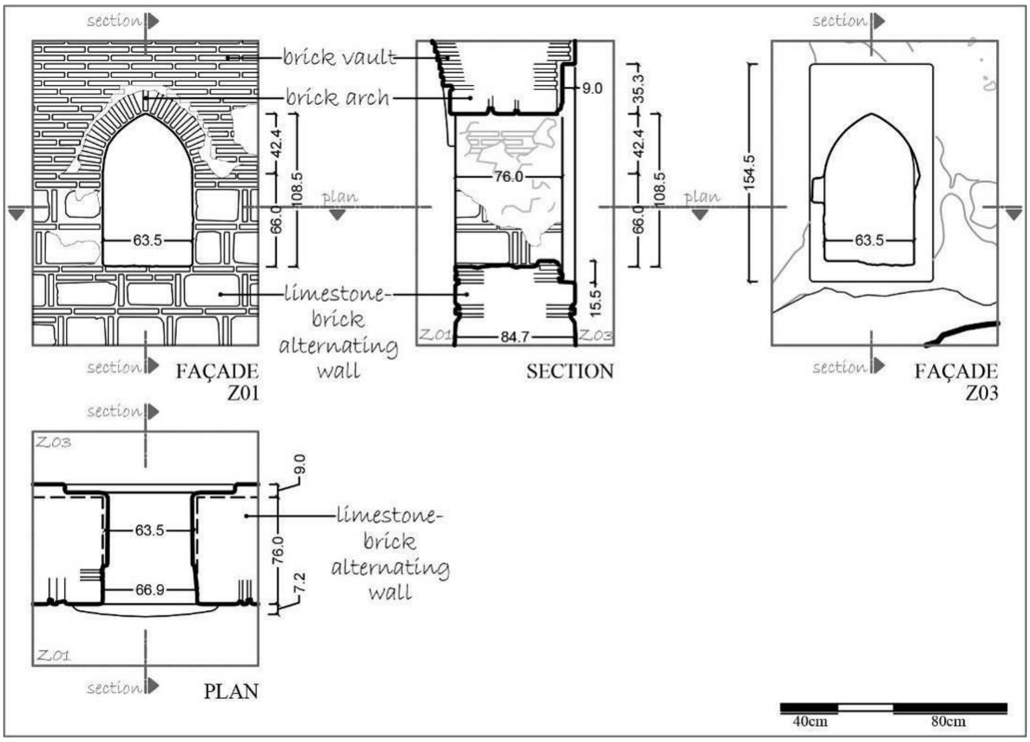

Figure 246. The window Type 4 of the *İbrahim Paşa Hamamı* located between the hot water depot (Z01) and the *sıcaklık halvet* (Z03)

Niches:

Niches used in the 14^{th}-16^{th} century Edirne public baths can be examined under six types according to their construction techniques.

Type 1 niches have approximately 40 cm depth, 40, 70 or 85 cm width and 70, 100 or 125 cm height, and are used in *keçelik*, *ılıklık* and *sıcaklık* spaces (Figure 36, Figure 247). They are built similar to Type 6 windows, have regular tetragonal plan scheme and niche openings are spanned with arches built with half-length bricks.

Type 2 niches have approximately 45 cm depth, 70 cm width and 105-145 cm height (Figure 36, Figure 67). They are built similarly to Type 1 niches, apart from the water distribution system connected to these niches (Figure 248).

Type 3 niches of 40x40x70cm dimensions are built with same technique as Type 1. However, different from type 1, these niches have cylindrical plan scheme (Figure 36).

Type 4 niche of 40x80x80cm dimensions are built with same technique as in Type 1. Different from Type 1 niches, this arch built by half bricks with a wedge-shaped limestone used as keystone (Figure 36). The only example of this type is found in Z09 space of the *Gazi Mihal Bey Hamamı*.

Type 5 niches, 6-12-20cm in depth, 19-23-30cm in width and 26-30cm in height, used between water control windows and *kurna*s in *halvet*s of the *Gazi Mihal Bey Hamamı* and the *Yeniçeriler Hamamı sıcaklık* spaces, and at door arch levels in *halvet*s of the *Topkapı Hamamı* men's section *sıcaklık* spaces. Niche opening in the wall is formed by two half bricks placed diagonally with approximately 45° angle. An arch appearance is given to the triangular profile formed by these two bricks with plaster (Figure 248). A similarly sized niche (Type 5) is also used in only the *eyvan* of *Topkapı Hamamı sıcaklık* space. The niche openings are spanned by 2-3cm projected bricks used in masonry wall (Figure 248).

These niches might have been used to put personal bathing items or as *çırakman*. According to Evliya Çelebi, daylight is used for public baths in daytime and oil lamps are used for illumination in the evenings and at nights (Dağlı and Kahraman, 2011b: 26; Kahraman, 2011a: 585). Some of these artificial illumination elements are hanged on the upper structures while the others are placed in oil lamp niches/*çırakman*s.

Type 6 is niches that are large in dimension with rich contents (Figure 37, Figure 249). They are observed in the *Sultan Selim Saray Hamamı*, *Gazi Mihal Bey Hamamı*, *Beylerbeyi Hamamı*, *Abdullah Hamamı* and *Yeniçeriler Hamamı* (Figure 249). Their width varies between 120 and 330 cm. Niche openings are spanned by brick arches and stone or brick portals (Figure 249). Most of them start at the floor level. In some cases, niche floor level is raised approximately 40 cm after the wall is built (Figure 249).

Figure 247. The niche Type 1 from the *Gazi Mihal Bey Hamamı* (left and middle: the Z10 *halvet* of *ılıklık* space; right: the Z12 *keçelik* space)

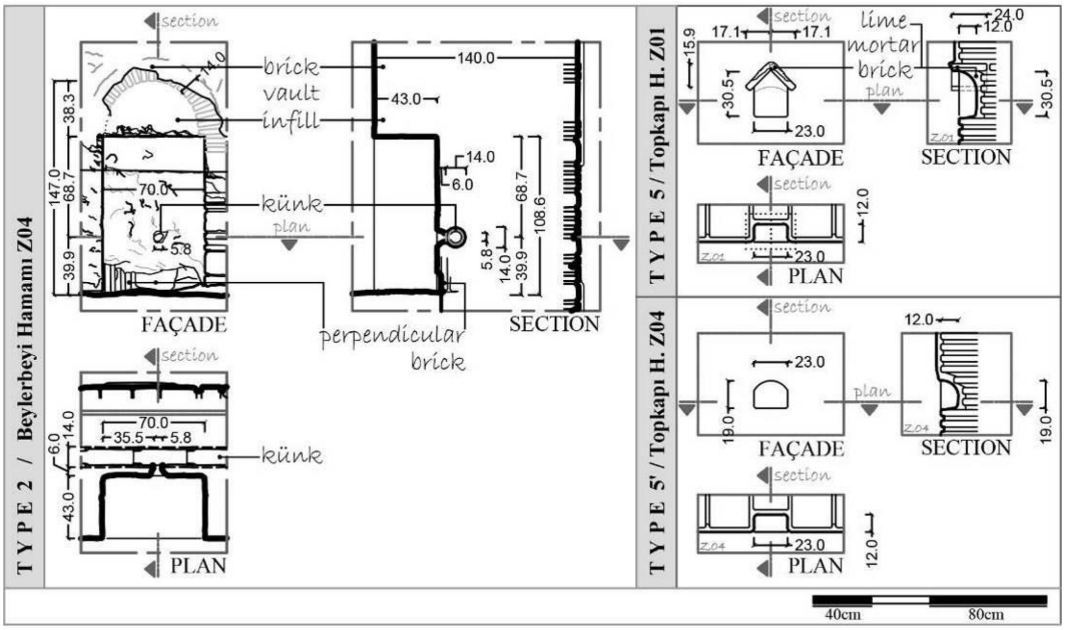

Figure 248. Drawings of niche Type 2 used in the Z04 space of *Beylerbeyi Hamamı* and Type 5 and 5’ in the Z01 and Z04 spaces of *Topkapı Hamamı*

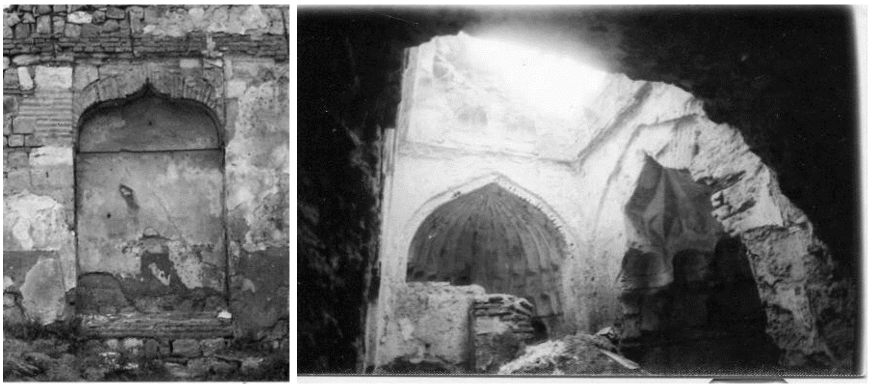

Figure 249. The niche located in the men’s *soğukluk* space of *Sultan Selim Saray Hamamı* in the 1990s (right) and niches located in the Z05 *halvet* of the *Beylerbeyi Hamamı* in the 1980s (Source: İlter Büyükdığan Photograph Archive)

Finishing Techniques:

There are traces of lime plaster on the exterior façades of the 14th-16th century Edirne public baths. However, these plaster remains do not give information about the physical and mechanical properties, layer number or ingredients of the plaster (see. Chapter 4.2.4).

In interior spaces, three types of finishing technique are used. The first one is the lime and *horasan* plaster application (see. Chapter 4.2.4). In this technique, two or three different plaster layers with 0.5-3 cm varying thicknesses are used on top of one another on the wall surfaces. Plaster thickness may reach up to 3.5 cm in water depots. Lime and *horasan* plasters contents and mixing ratios show differences according to the plaster layers and spaces where the plasters are used (see. Chapter 4.2.4).

Traces on the public baths reveal that before plaster application, all rough constructions, floor pavements, water and heating installations are completed. In order to prevent surface adherence problems and crack formations due to partial humidity differences, walls must be completely dried before plastering process. Plaster application should be comprised of the following stages:

(1) Surface must be made suitable for plastering after preparation of lime-based plaster and few weeks should pass for the plaster to ferment. It is observed that especially on limestone block surfaces, notches are made with sharp-tipped metal elements, even nails are hammered on the stones to make 2-3 cm projections in areas with thick mortar, in order to increase the adhesion of plaster.

(2) After a notched surface is formed on wall façade for the plaster to adhere, dirt, dust etc. on the surface and on the floor must be cleaned, which may interfere adhesion between surface and plaster.

(3) Joints of masonry walls must be removed to a small extent of mortar to provide some grooves work as mortices under the plaster.

(4) The wall is humidified by applying sufficient water. The most important purpose of this application is to ensure controlled drying of plaster along the wall, which consists of different materials with different water absorption capacities. Therefore, the amount of the water used is extremely important. If the wall surfaces is not adequately moistened, local cracks will be formed due to stresses in the areas where the plasters dry relatively earlier. However, if wetting happens instead of humidifying, mobile or still water layer acts as a barrier between plaster and wall surface and prevents adhesion of plaster onto the wall.

(5) Alignment may have been done by using timber laths in order to ensure the evenness of plaster thickness along the wall. However, even if laths were used, after plaster application, they must have been removed and the remaining empty areas should have been filled with plaster. For this reason, there are not any traces detected for this type of application.

(6) Plaster is applied onto the wall by different types of trowels and the evenness in thickness is ensured. The plaster is finished by extending it 3-4 cm at the corner towards the perpendicular walls and floor pavement by gradually thinning with a concave arc profile.

(7) Plaster must be waited to dry enough. Controlled drying must be achieved to prevent plaster crack due to partial drying speed differences as happens in upper levels and in brick courses. Plaster is humidified in gradually decreasing amounts to achieve this, and plaster surface is periodically brushed to prevent micro-cracks.

(8) The first layer/base coat plaster must not be dried completely but rather dried enough to achieve mechanical endurance. This level is very important because if it overdries, adhesion of second plaster layer onto the surface becomes harder. If it is not dried enough, a mechanical endurance of the plaster does not increase enough to support the second plaster layer.

(9) The base coat must be scratched in order for the second plaster layer/brown coat plaster to adhere. This process must be done at every plaster application on top of each other.

(10) In the *Gazi Mihal Bey Hamamı*, *Beylerbeyi Hamamı* and *Yeniçeriler Hamamı*, there is plaster changing line 10-60 cm above the vertical water channels (Figure 38, Figure 39, Figure 71, Figure 111, Figure 222, Figure 226, Figure 236, Figure 238, Figure 250, Figure 284, Figure 285, Figure 286, Figure 287). This change occurs between walls and upper structure on the public baths where plaster changing line is not observed. Contents of the two plasters used above and under plaster changing lines are different, as below of the line is in direct contact with water. After the base coat is applied, alignment laths or nails (Figure 38, Figure 250) pounded on the walls are used to provide flatness of the plaster changing line. Wall surfaces below the line are plastered at first.

(11) After the plaster at lower levels is dried enough, the area above the plaster changing line is plastered. These two plasters may be equal in thickness (Figure 38, Figure 39), also there are cases where the upper plaster layer is 0.5 cm thicker (Figure 70). In some examples, it is seen that plaster layer above the plaster changing line is finished by a concave drip edge detail (Figure 70).

(12) After the brown coat is dried enough, a third plaster layer/fine coat plaster, even in thickness along the wall, is applied. Ornaments made by plaster are also done at this stage (Figure 39). As in other layers, this plaster layer is also dried in a controlled manner.

(13) Lime wash and coloured decorations are applied on the fine coat (Figure 40, Figure 41, Figure 134).

In all public baths that can be studied in detail, repair plasters applied in 2-3 different periods are also identified (see. Chapter 4.2.4). During repairs, repair plasters are applied on plasters with strong adhesion onto the wall and do not show splitting tendency (Figure 39, Figure 40, Figure 68, Figure 71, Figure 111). Notches are made on the existing plaster layer with sharp-tipped tools in order to ensure adherence of repair plaster onto the existing one (Figure 38, Figure 39, Figure 40, Figure 68, Figure 71, Figure 111).

Second finishing technique used on the surfaces of 14th-16th centuries Edirne public baths is marble covering. Marbe covering elements of 40x40x2 cm dimensions are used below the water line in the *halvet* of the *Topkapı Hamamı sıcaklık* section (Figure 131). The back side of marble plates are left rough and are fixed onto the wall with *horasan*.

The third type is limestone covering. This technique is applied only around the doors openings (main entrance door and door between the *soğukluk* and bathing spaces) of *soğukluk* spaces (Figure 24, Figure 47, Figure 243, Figure 244). There are not any information on the details of this system, because these spaces lost their authentic features almost completely.

Figure 250. Nails used on the plaster changing line located in the *sıcaklık* spaces of the *Gazi Mihal Bey Hamamı*

4.3.3. Transition Elements

Transition elements are used to narrow down the space plan and make it suitable for the form designed for the upper structure. This necessity arose with the use of domes in the ancient Roman architecture. First used in Roman architecture, pendentives, as transition elements, has the same radius with domes (Hamilton,1956: 51). Hamilton (1956: 51) states that these are very important elements that indicate the emergence of “pendentive idea”; however, also notes that “true pendentives”, meaning pendentives built in radius independently of the dome radius, started to be used in the Byzantine architecture in the second half of the 6th century AC.

Pendentives were built by rough cut stone and brick in the early Roman architecture, whereas use of stones decreased gradually in the late Roman architecture, and were built by using only bricks in the Byzantine architecture (Aktuğ

Kolay, 1999: 57). Many different types of simple pendentives have been developed in later periods.

In the 14th-16th century Edirne public baths, in addition to pendentives, corbelling triangles, squinches (the first examples seen in Persian architecture) and belt of Turkish triangles (first seen in the 13th century Anatolian Seljuk architecture) (Aktuğ Kolay, 1999: 61) are also used. Conversion from square to circular, hexagonal, octagonal or dodecagonal plans is achieved by transition elements; dome spring line level is raised by circular rings. Muqarnas is also frequently used in transition elements and upper structures.

Walls are constructed up to the level, which transition elements begin, by alternating rows of brick and stone system. One or two lines of timber lintels are placed inside the wall, depending on the thickness of the wall (Figure 251). Space between the lintels, connected to each other by *puştuvan*s, is filled with stone-brick pieces and lime mortar.

When transition elements are at two sides of the wall at similar levels, the construction of transition elements starts at that level. When transition element is on one side of the wall, half the thickness of the wall is constructed as transition element and the other half as alternating rows of brick and stone wall. Brick courses in the alternating wall system continue all along the wall thickness. By this way, two different systems (transition element and masonry wall) are made to behave together (Figure 251).

Transition elements are shaped to transfer the load of the upper structure and their own loads onto the masonry walls. The main shape of transition elements is built by bricks and half-length bricks with 27.5x27.5x4-4.5 cm and 24x27.5x4-4.5 cm dimensions respectively , as well as bricks with 19-20x19-20x4-4.5 cm dimensions in horizontal and vertical alignments.

Bricks are placed parallel or diagonal to wall alignments, modules are formed by repetition of these units on top of each other, and main geometry of the form is achieved by shifting the modules. For example, in the belt of Turkish triangles, diagonally placed square and rectangular bricks are placed to make projections and/or recesses in certain ratios (0.5-5 cm) at every level and are slid at necessary points, so *badem*s and triangular prisms are formed (Figure 251). The main form of prismatic double-sided *badems* is achieved by repetitive recesses of diagonally aligned square bricks, either side by side or by skipping one line (Büyükdığan, 1989, 233). Pendentives and squinches are built similarly, by placing brick units to make 0.5-3cm projections at each course.

Use of roughly shaped bricks is frequently observed in Edirne public baths. Similarly, use of bricks with special forms, specially shaped limestone blocks and rough-cut phyllite plates are also observed (see. Chapter 4.2.1-4.2.2) (see. Chapter 4.2.1-4.2.2) (Figure 75, Figure 76, Figure 114, Figure 163, Figure 169, Figure 170, Figure 202, Figure 206, Figure 207, Figure 208, Figure 241).

Phyllite plates used in transition elements, providing projections larger than 5 cm, also functioned as a base for the form. Phyllite plates are used in the first course of projection, and bricks are placed on top of it suitable to the phyllite form (Figure 170, Figure 241). Phyllite plates determined in the *Yeniçeriler Hamamı* and the *İbrahim Paşa Hamamı* are placed to make projections of at most one third of their length (Figure 241, Figure 289, Figure 292). Phyllites placed on the partition walls of the *İbrahim Paşa Hamamı* Z05-Z06 and Z06-Z07 continue along the wall thickness and used in transition elements of two different spaces (Figure 241). The main aim of this system must have been to transfer the adjacent upper structure load to the wall/arch below evenly and to prevent vertical crack formations on the inner structure of wall/arch.

Specially shaped limestone blocks are used for the same purposes with phyllites. However, some of the limestones are cut very carefully and placed in such a way that the front faces are left without projections or plastering (Figure 202). Limestone blocks are supported by nails placed underneath, projecting 5 cm (Figure 202).

Muqarnas are especially observed in pendentives and their main form is achieved by bricks making projections or recesses at different angles. Shaped limestone blocks are also used together with bricks in the *Gazi Mihal Bey Hamamı* and the *Beylerbeyi Hamamı*. Relatively smaller sized forms, which are not suitable for brick and stone use, are made by the use of a dense mortar mixed with brick pieces. Nails are hammered in such a way that their tips project 2-3 cm, and the intended form is achieved by applying several layers of stucco on top of each other

(Figure 253). These nails increase the surface adhesion of stucco and plaster, and also reinforce stucco and plaster.

In the majority of muqarnas, where projections do not exceed 5 cm, a special solution for support is not required. In transition elements with projections more than 5 cm at one stage, stone blocks and plates are used to form base and primary load-bearing elements, as mentioned above. In some transition elements, although projections at each stage are within the mentioned limits, total projection distance and the dead load of the element necessitate a special load-bearing system.

Timber lintel traces are identified in the pendentives with muqarnas of Z03 and Z10 spaces in the *Beylerbeyi Hamamı*, where total projection length reaches 150 cm. It is understood from the traces that the lintels continue along the *muqarnas* and transfer the load of projection to the masonry walls. These lintels are supported by *puştuvan*s placed perpendicular to lintels and help transfer loads to walls. (Figure 46- timber lintel traces between 395cm to 530cm, Figure 74, Figure 252)

Two plaster layers are used on transition elements of the 14^{th}-16^{th} century Edirne public baths. The first one is 1.5-2 cm thick pink or light pink coloured *horasan* plaster, the second one is 0.5-1.5 cm thick pink close to white or white *horasan* plaster. Traces of repair plasters are also observed partially. Plaster repairs are done by similar techniques to that of walls (see. Chapter 4.3.2).

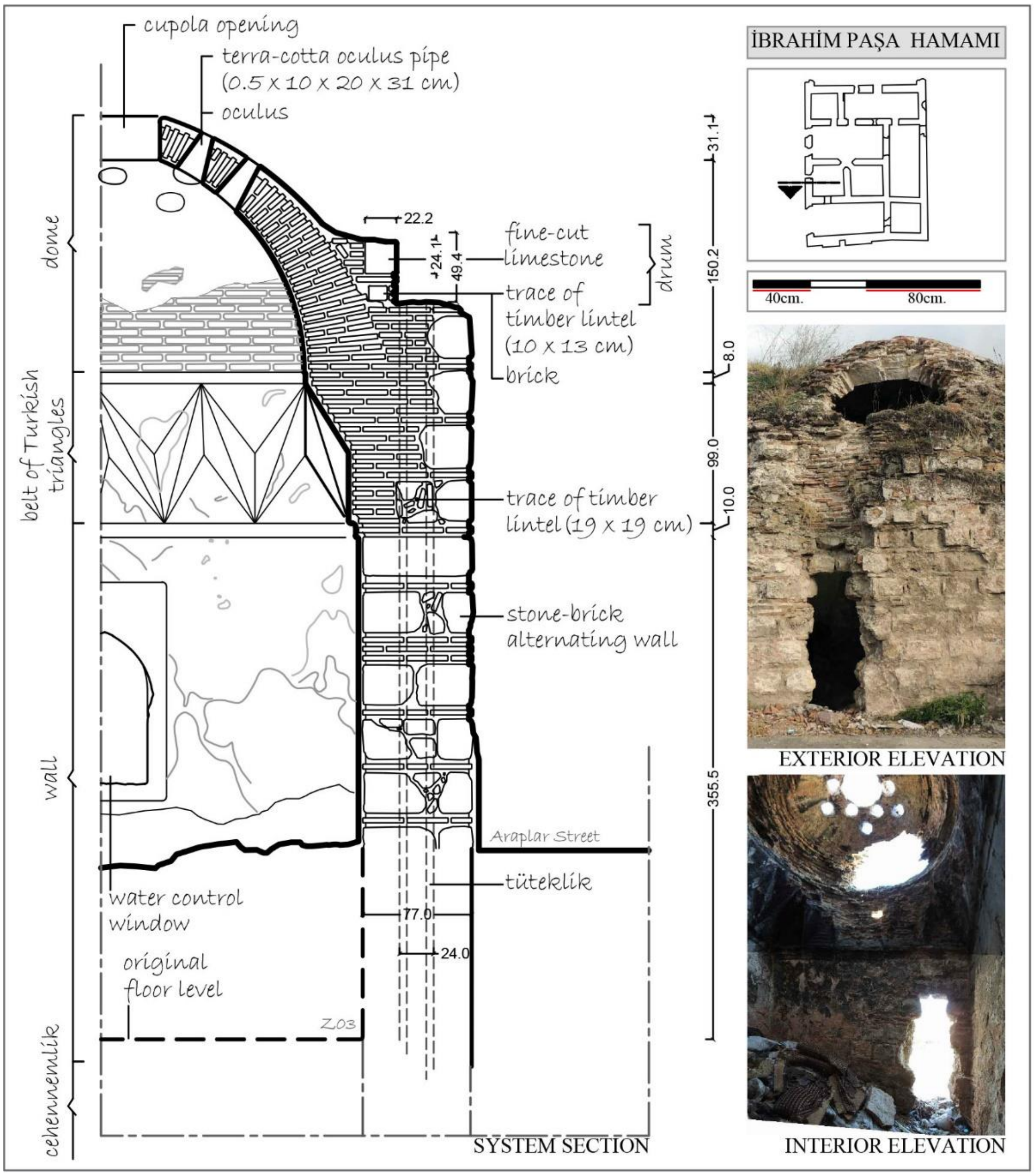

Figure 251. The system section of the Z03 *halvet* of *sıcaklık* in the *İbrahim Paşa Hamamı*

Figure 252. Traces of timber lintels and puştuvans embedded into the muqarnas located in the Z03 *ılıklık* main space of *Beylerbeyi Hamamı*

Figure 253. Projected nails used as reinforcements for stucco and plaster layers and also increase the surface adhesion of stucco and plaster layers on the transition elements and upper structures of the *Yeniçeriler Hamamı* (left) and the *Beylerbeyi Hamamı* (right)

4.3.4. Upper Structures

It is known that the *soğukluk* spaces of some of the 14th-16th century Edirne public baths (*Abdullah Hamamı, İbrahim Paşa Hamamı, Mezit Bey Hamamı, Tahtalı Hamamı, Topkapı Hamamı, Yeniçeriler Hamamı* and *Yıldırım Hamamı*) are covered with timber roofing. However, none of the authentic examples survived today. Therefore, timber roofs are not included in this study.

Authentic upper structures of studied public baths that still stand today are domes, semi-domes, and vaults. It is known that vaults were used over relatively small spans like hallways in the late ancient Greek architecture, they were also used in the ancient Egypt and Mesopotamia with great courage and awareness (Robertson, 1929: 231; Arnold, 1991: 200-201). However, as Robertson (1929: 231-232) said, advantages of arch and vaults were entirely realized in the ancient Roman period, from then on great importance was given to these structures together with domes.

While only stone units were used in vaults in the ancient Greek architecture; brick, production of which is more economical and easier than stone, had also started to be used in domes and vaults since the Roman period (Robertson, 1929: 232). In the ancient Greek architecture, vaults were built without centring, using cut-stone voussoirs, and in some examples, the stones were connected to each other with iron clamps (Boyd, 1976: 98 from Aktuğ Kolay, 1999: 83). In the ancient Roman architecture, vaults, and domes built by cut stone, rubble stone and brick with lime mortar (Adam, 2005: 177).

Ousterhout (1999: 201) states that in the late Byzantine period, masters focused on the construction process, perhaps even more than static principles, and tend to create fast and effective building systems. In this period, main construction material of vaults and domes became brick, which is easier to work with and provides homogeneity in the system (Ousterhout, 1999: 207-208). The thickness of the lime mortar used in vaults and domes also increased (Ousterhout, 1999: 210).

Vaults:

Vaults are used in the rectangular planned water depots and most of *eyvan*s of Edirne public baths. Vault covering square planned spaces is preferred only in the Z10 space of the *Gazi Mihal Bey Hamamı* and Z08 and Z10 spaces of the *Yeniçeriler Hamamı* (Figure 22, Figure 114, Figure 115). Seven main vault types are determined according to their profiles and construction techniques: flat vault, flat vault with supporting arches, depressed-profiled vault with stone supporting arches, barrel vault, *aynalı*/cavetto vault, combined vault and two-layered vault (Figure 15, Figure 22, Figure 46, Figure 90, Figure 97, Figure 121, Figure 126, Figure 146, Figure 151, Figure 179, Figure 187, Figure 190).

Flat vault (Type 1), is used in the *Gazi Mihal Bey Hamamı* Z10 and the *Beylerbeyi Hamamı* Z01d spaces (Figure 42, Figure 73). A flat area must have been formed by timber plates on the falsework at the level where vault begins. Vault is built on this flat surface by vertical bricks (Figure 42, Figure 73). While circular openings are formed on the vaults for *cupola* and *oculi.*

Flat vault with support arch (Type 2) is used only in the Z02 *eyvan* of *Topkapı Hamamı* (Figure 126, Figure 139, Figure 254, Figure 256, Figure 257, Figure 290). This rare vault type is aesthetically quite interesting and also from a technical viewpoint. Bricks approximately 30 cm in length or stone plates are placed vertically on top of eight projections formed by bricks and used as support arch (Figure 139, Figure 254, Figure 256, Figure 257, Figure 290). Vault is divided into three equal pieces by arches, octagonal spaces for *cupola* openings are formed with bricks placed by rotating 45^{o}. The material used in these 30x55 and 55x55cm sized units could not be identified. Considering the materials used for similar purposes in other buildings, it can be suggested that this material is phyllite. However, it is also possible that slate or bricks with larger dimensions could also be used.

Depressed-profiled vault with stone supporting arches (Type 3) is used in Z04 and Z08 *eyvan*s of the *Topkapı Hamamı* (Figure 126, Figure 139, Figure 255, Figure 258, Figure 290). A very rare construction technique is used in these vaults, the plan is divided into 3-4 equal parts with supporting arches lying parallel the short walls. After the wall is built, the plan is narrowed by simple projections or with *muqarnas*. Along with the rectangular plan, stone bolsters with 8 cm thick profile are placed so that they make 15 cm projections (Figure 139, Figure 255, Figure 258, Figure 290). Supporting arches put on top of bolsters are composed of two wedge-shaped voussoirs and one stalactite keystone. Depressed profiled vault is built on these supporting arches so that it transfers its load on walls and arches. When the vault is built, circular holes are formed in areas between supporting arches for *cupola* and *oculi* (Figure 139, Figure 258, Figure 290). Different from many other vault types, centring use should not be necessary for Type 2 and 3 construction because of their profiles and supporting arches.

Another important detail of Type 2 and 3 arches is the *künk*s used at wall corners, just before the vault spring line. As Gülsün Tanyeli[63] suggests, these *künk*s placed inside masonry walls should be details used to dry interior of the wall faster during construction.

Barrel vault (Type 4) is used in all rectangular planned water depots of Edirne public baths (Figure 103, Figure 161, Figure 284, Figure 285, Figure 286, Figure 287, Figure 289, Figure 290, Figure 292). In examples where vault length exceeds nine metres, upper structure is supported by supporting arches (Figure 42, Figure 60). Centring must have been used in the construction of these vaults, as in arches (Adam, 2005: 174-177) (Figure 239). Tetragonal holes for top windows is formed on vaults built by one or two vertical lines of brick (Figure 259).

Aynalı vaults (Type 5) are built similarly to barrel vaults (Type 4). However, in this type, bricks located on a specific part at the centre of the vault are placed perpendicular to the others (Figure 42g, Figure 74).

[63] Thesis Monitoring Jury, 06.06.2016

Most frequently used vault type in Edirne public baths is combined vault (Type 6). In this upper structure, cross, rib and star vaults are used together with domes and lobed domes (Figure 73, Figure 77, Figure 78, Figure 115, Figure 168). Vaults are built by placing horizontal and vertical bricks on centrings put on the walls. Circular, hexagonal and octagonal planned holes are formed on vaults for *cupola* and *oculi*.

In these vaults with a rich geometry, it is observed that vertical bricks are used in transition areas between cross or rib vaults and domes (Figure 78, Figure 79, Figure 260). The reason for this might be the fact that these areas are not part of the primary load-bearing system and/or vertical brick use may be more suitable for the geometry. However, this increases the head/bed joint ratio and decreases the resistance of system against the thrust created by a dome.

Indeed, in combined vaults of the *Beylerbeyi Hamamı*, at the level of dome spring line, traces of timber elements suggest that a tension ring against thrust are used (Figure 78, Figure 79, Figure 260). Traces of timber lintels embedded into vaults starting from the short side of Z11 and Z13 spaces and extended towards the centre are identified. However, these traces could not be documented in detail (Figure 46-timber traces level 4, Figure 78, Figure 79).

A two-layered vault (type 7) is used only in the Z08 space of *Yeniçeriler Hamamı* (Figure 114, Figure 261, Figure 289). Inner/First layer is built by four corbels/consoles starting from walls and extending towards the centre. Corbel footings are built with brick and half-six-pointed star-shaped limestones 27.5cm in width and 35cm in length. Arrowhead shaped corbel is formed on these footings constructed with bricks and flagstones with 55-110x55x3-4cm dimensions (Figure 114, Figure 261, Figure 289).

Corbels only bear their own load and transfer it to the walls (Figure 114, Figure 261, Figure 289). During construction, after the inner layer is completed, centring should have been put on it and cloister vault, which is used as outer/second layer should have been built using the centring. Both of the cloister and cross vaults produced because of two-barrel vaults placed at right angles; on the contrary, cloister vaults have concave groins, while cross vaults have convex groins (Curtis, 2011: 57). There are not any examples of this type of sytem with stunning plastic effect in the literature review (see. Chapter 3.5.2.b).

Similar material and techniques are used in the repairs after unit losses and local collapses in the Ottoman period. An exceptional application is identified only in the *Topkapı Hamamı*. On Z14 space cross-vault; symmetric to the plate stone (most probably a phyllite plate) projecting approximately 10 cm at the north end, three white coloured units are used on the south, at the same level (Figure 126, Figure 137, Figure 138). The space that is formed as a result of damage occurred on plate stone on the south in the authentic system should have been filled with new unit materials/white blocks produced in brick sizes (Figure 138). Even though the use of low endurance material at a projection elevation is inefficient in long-term, during routine maintenance and repair of the building, searching to a fast and cheap solution may have resulted in the preference of an easy-moulded and rapid-hardening stucco-lime mixture.

Figure 254. The flat vault with supporting arch used in the Z02 *eyvan* of *Topkapı Hamamı*

Figure 255. The depressed-profiled vault with stone supporting arches used in the Z08 *eyvan* of *Topkapı Hamamı*

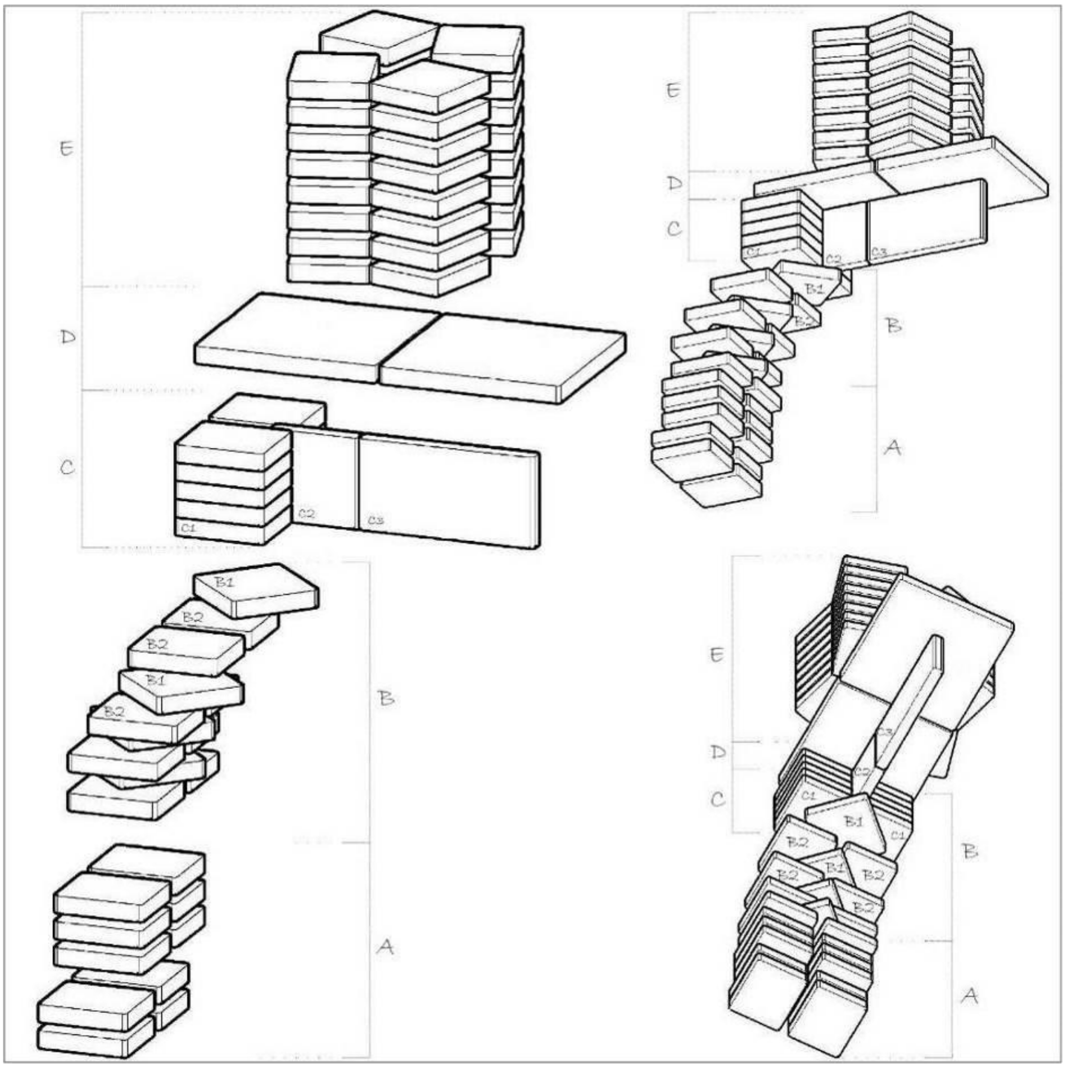

Figure 256. The schematic drawing of the system used on upper structure of the Z02 *eyvan* in the *Topkapı Hamamı* men's section

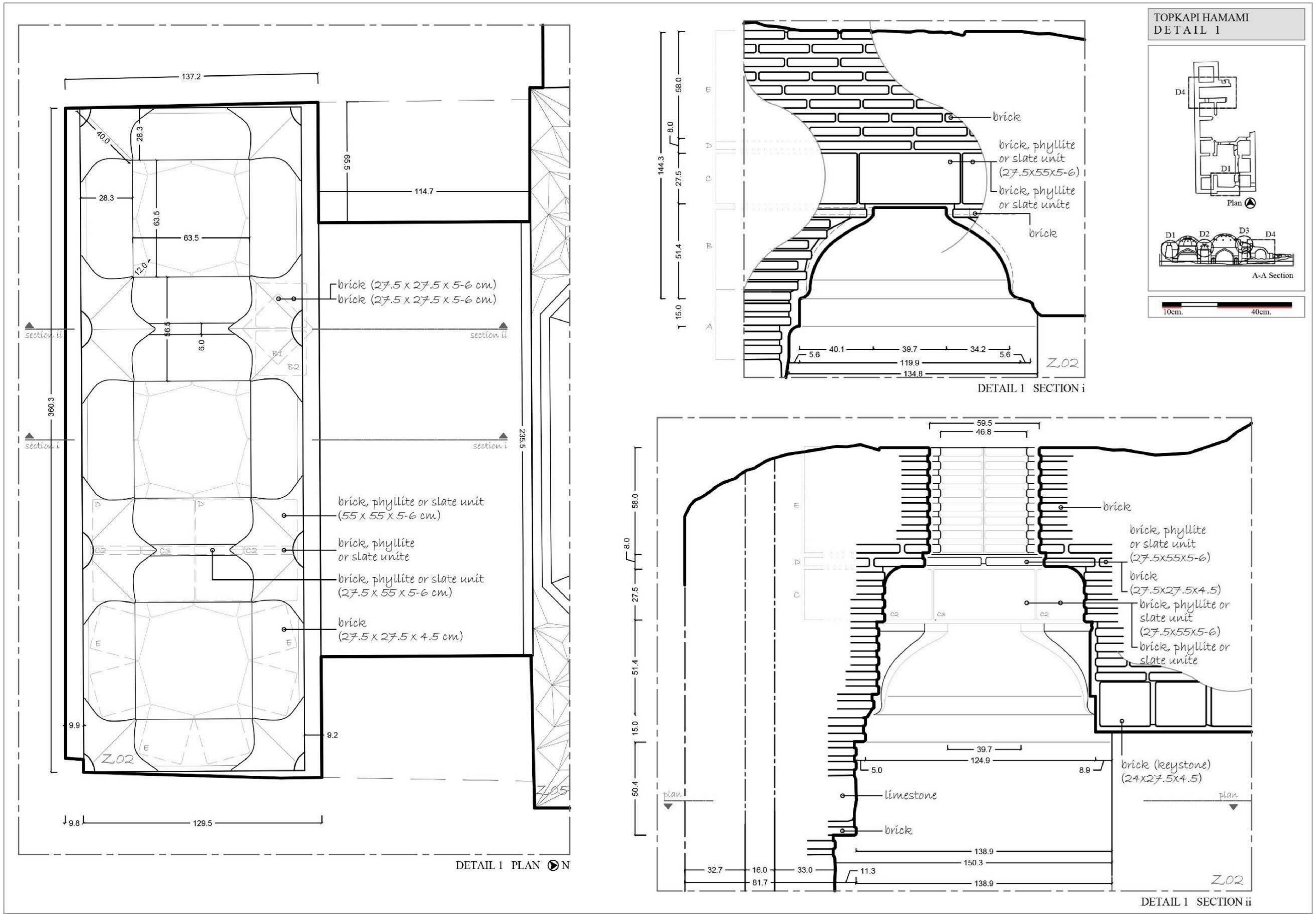

Figure 257. The upper structure of the Z02 *eyvan* in the *Topkapı Hamamı* men’s section

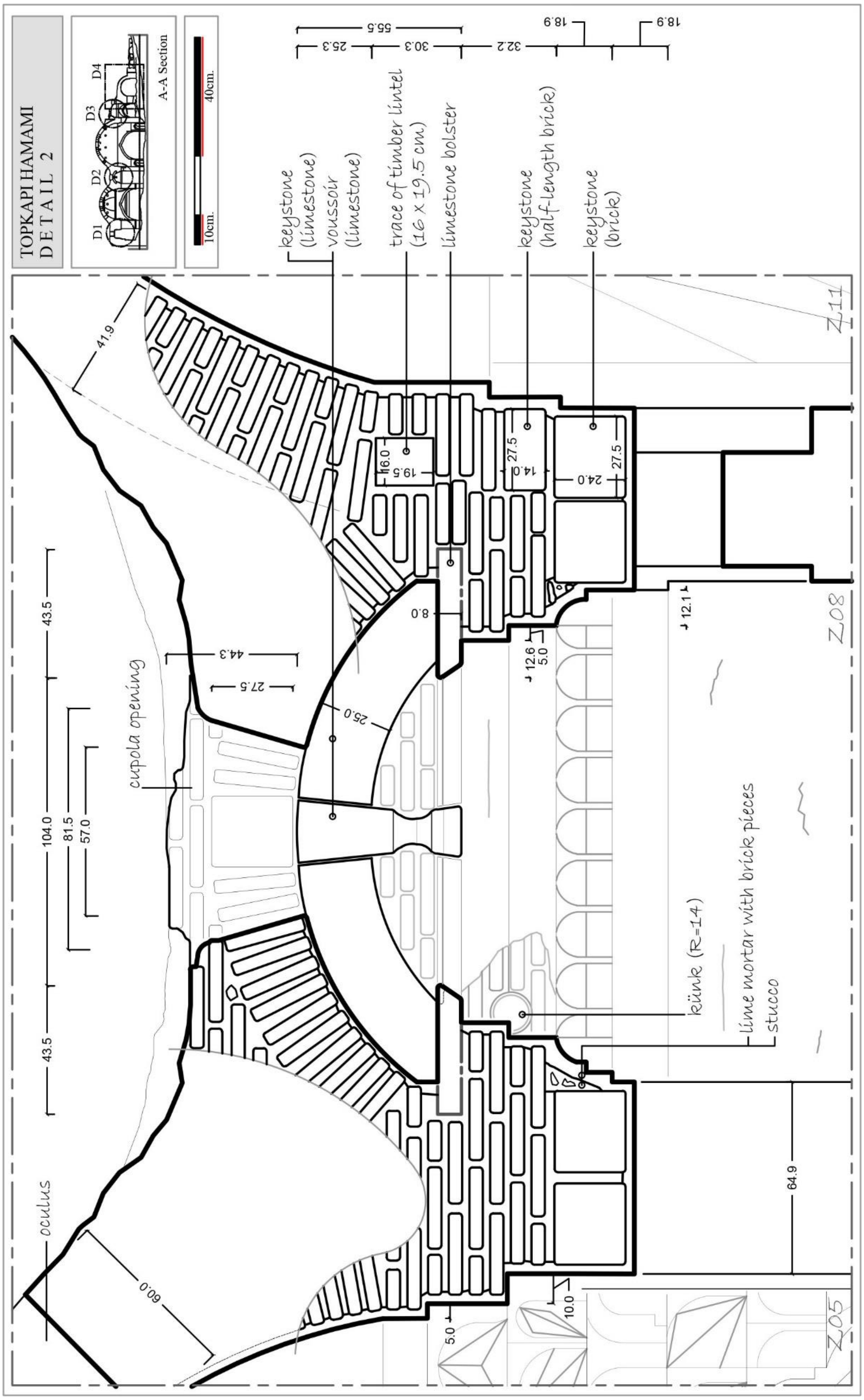

Figure 258. The upper structure of the Z08 *eyvan* in the *Topkapı Hamamı* men's section

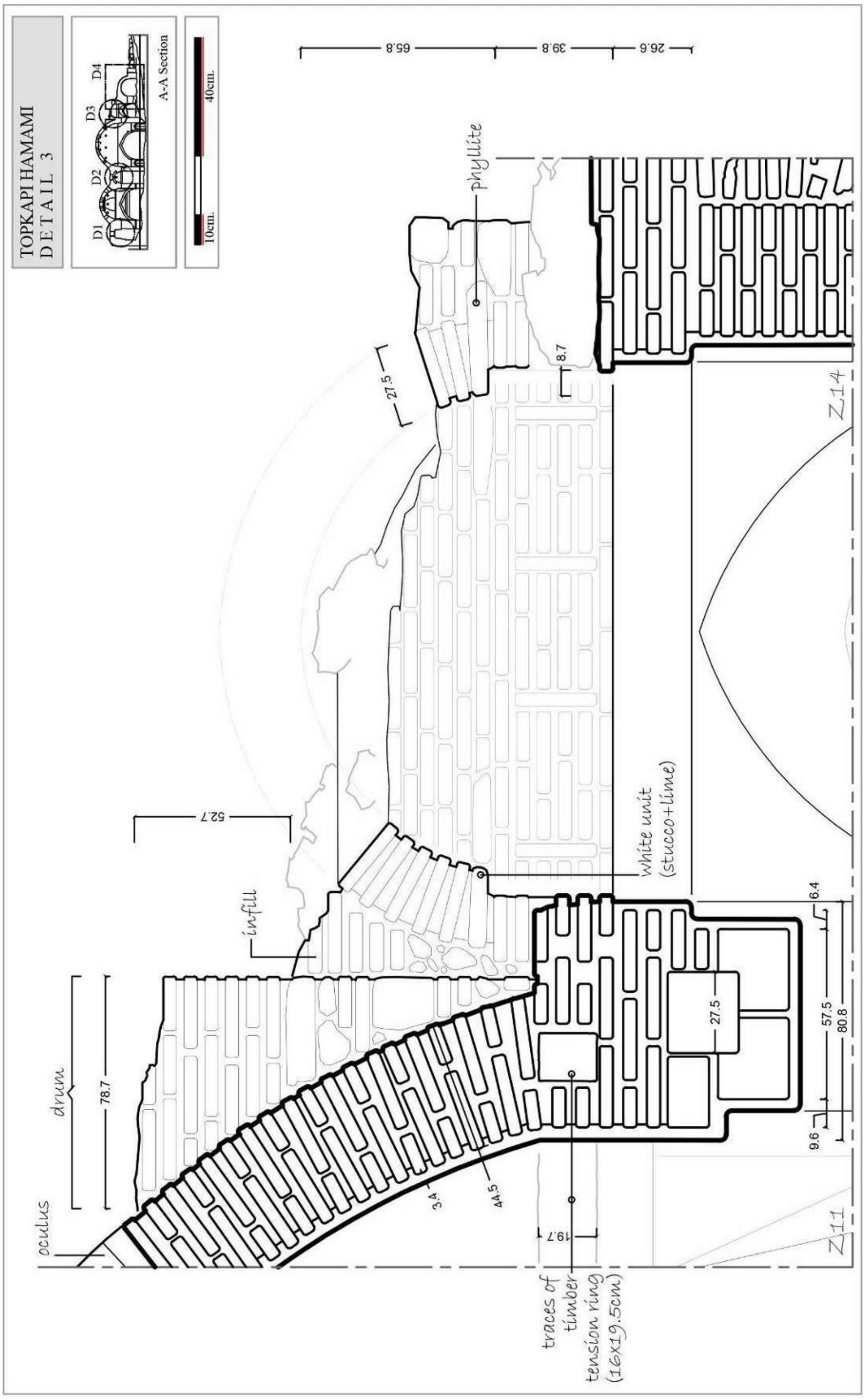

Figure 259. The upper structure of the Z14 *eyvan* in the *Topkapı Hamamı* women’s section and the partition wall located between the Z11 and Z14 spaces

Figure 260. Use of vertical brick in the combined vaults’ transition zones in the Z11 *eyvan* of *Beylerbeyi Hamamı*

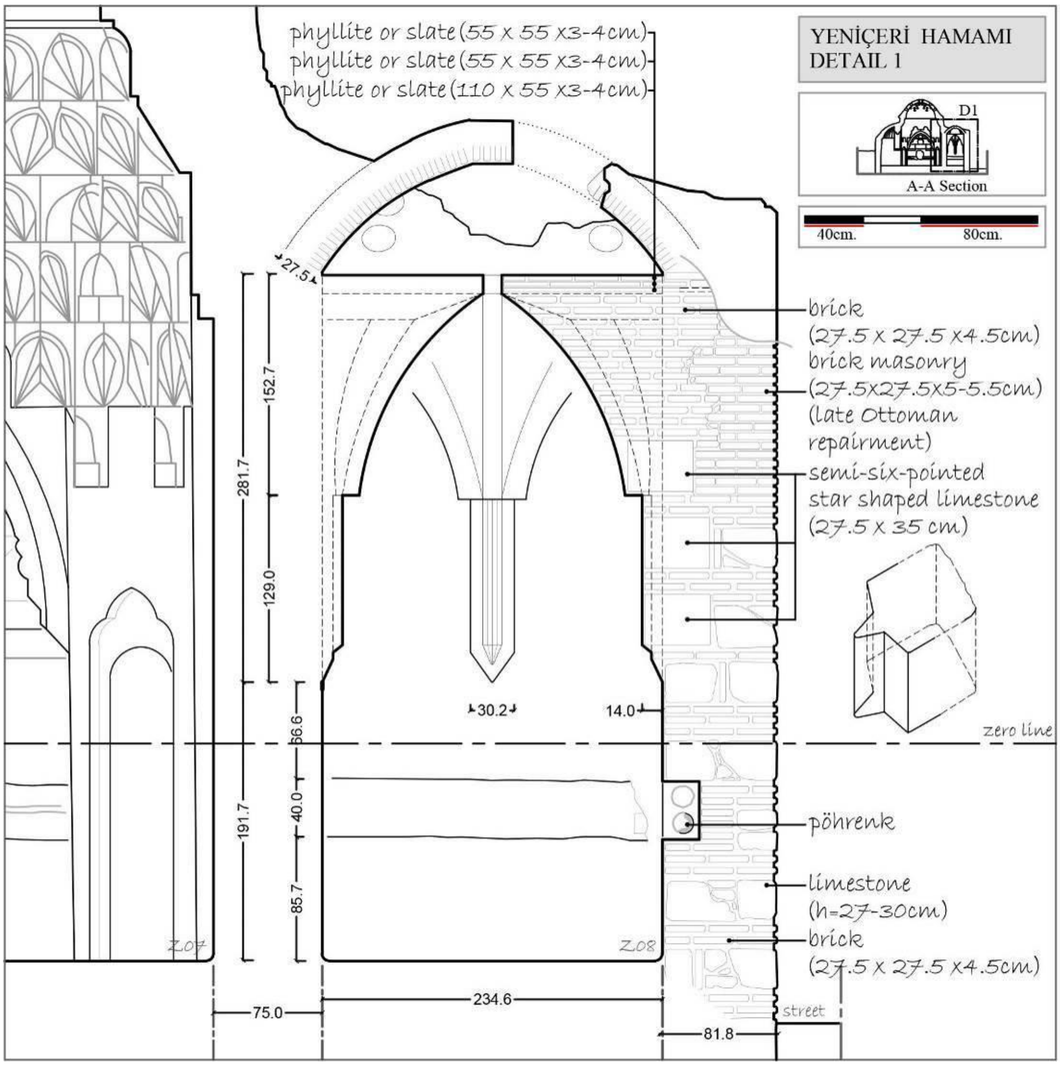

Figure 261.The two layered vault system used in the Z08 *halvet* of *Yeniçeriler Hamamı sıcaklık* section

Domes:

Spaces that are square and rectangular close to square in plan in Edirne public baths are converted to circular, hexagonal, octagonal or dodecagonal plans with transition elements, and spaces are covered with domes (Figure 15, Figure 22, Figure 46, Figure 90, Figure 97, Figure 121, Figure 126, Figure 146, Figure 151, Figure 179, Figure 187, Figure 190). Primary construction materials are bricks with 27.5x27.5x4-4.5cm dimensions (Figure 206-A1) and 14x27.5x4-4.5cm dimensions (Figure 206-B1) and half-length bricks (Figure 206). Only in Z11 dome of the *Topkapı Hamamı*, along with these bricks, bricks 24x27.5x4.5 cm (Figure 206- Types C and D) and 27.5x27.5x4-4.5cm in dimension with front faces shaped as a concave arc (Figure 206-A2) are also used. In addition, on the *muqarnas* dome used in the Z02 halvet of the *Gazi Mihal Bey Hamamı*, specially shaped limestones are used with bricks (Figure 42b, Figure 266). Domes start at about 1.5-2.5 brick thickness (approximately 45-75cm) depending on the span diametre, and thickness decreases upwards until the thickness of one brick is reached (Figure 251, Figure 284, Figure 287, Figure 289, Figure 291, Figure 292). Lime mortars of varying thickness from 2 to 6 cm are used between brick and stone units of the dome (Figure 251).

Construction of upper structures begins after the rough construction of walls and transition elements are completed. Domes can be built without using centring, only with main falsework as their form provides a stable structure. However, construction of domes in the *soğukluk* with diametres up to 26 metres and in *ılıklık* and *sıcaklık* main spaces with diameters usually between 4.5-7.5 metres might have necessitated the use of centring during construction because of the length of the spanned opening (Figure 15, Figure 22, Figure 46, Figure 90, Figure 97, Figure 121, Figure 126, Figure 146, Figure 151, Figure 179, Figure 187, Figure 190).

Authentic *soğukluk* domes of the *Tahtakale Hamamı* and the *Sokullu Mehmet Paşa Hamamı* still exist today. However, due to recent comprehensive repairs by the use of modern materials, information on the construction techniques of these domes could not be identified. Domes of *ılıklık* and *sıcaklık* spaces are studied in detail. Eight dome types are determined according to the construction techniques and forms: semi-circular, semi-circular with lamella trusses, ribbed, helical ribbed, lobed, two-layered lobed, depressed-profiled and muqarnas domes.

The semi-circular dome (Type 1) is the most frequently used dome type in the 14^{th}-16^{th} century Edirne public baths. This type of dome is used in the *Gazi Mihal Hamamı* Z01, Z14 and Z16; the *Beylerbeyi Hamamı* Z01a, Z01e, Z06, Z08 and Z12; the *Yeniçeriler Hamamı* Z05 and Z07; the *Topkapı Hamamı* Z09, Z11 and Z13; the *İbrahim Paşa Hamamı* Z03, Z04, Z06 and Z11 spaces (Figure 22, Figure 42a, Figure 46, Figure 97, Figure 112, Figure 126, Figure 151, Figure 168).

The arch profile is among the most important parametres that affect the structural behaviour of domes. Because of the semi-circular profiles of these domes, thrust line gets closer to intrados at the one third to one fourth rise of the dome, while it gets closer to extrados on the top point (Figure 262d). If the external loads exceed the load-bearing capacity of a dome, hinges occur in these risky points and result in structural damage (Figure 262c). Therefore, in order to prevent possible formation of hinges in the interior, precautions must be taken to increase the distance between intrados and thrust line.[64]

In the studied examples, drums lengthen up to one third to one fourth rise of the dome are used and dome base is enlarged as a precaution (Figure 88, Figure 102, Figure 103, Figure 116, Figure 137, Figure 157, Figure 171, Figure 188, Figure 238, Figure 241, Figure 251, Figure 284, Figure 289, Figure 290, Figure 292). Drums are built by bricks and limestones vertically surrounded by bricks, similar to alternating walls. In addition, at possible hinge levels, timber elements embedded inside the drums are used as tension rings (Figure 171, Figure 251).

The semi-circular dome with lamella trusses (Type 2) is used in the *Gazi Mihal Bey Hamamı* Z15 space (Figure 22, Figure 42h, Figure 263). Basic construction technique and profile of this dome is identical to Type 1. However, lamella trusses are used in dome's intrados (Figure 263). In this type of domes, voussoirs and trusses composed of vertical half bricks are built simultaneously. Trusses enrich the dome visually have only a half brick thickness, so they do not continue along the dome thickness. However, still, they might have a role in the equal distribution of load on the walls. This technique should be studied in detail. Type 2 domes have similar

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[64] MSc Civil Engineer Mete Işıkoğlu was consulted for the comparison of structural behaviour of different dome profiles and the timber structural elements embedded into upper structures.

structural behaviour to Type 1 domes in principle. Drums are also used in the dome's extrados, as in Type 1.

The ribbed dome (Type 3) is used in the *Beylerbeyi Hamamı* Z03 space (Figure 46, Figure 52). General information on this completely demolished dome can be obtained from old photographs. However, there are not any information obtained on the construction technique due to the debris on the dome ruin.

The helical ribbed dome (Type 4) is used in the *Gazi Mihal Bey Hamamı* Z03 and the *Yeniçeriler Hamamı* Z05 spaces (Figure 22, Figure 42c, Figure 46, Figure 97, Figure 112, Figure 263). Bricks make projections at certain areas in accordance with the planned form, in these domes. Dome thicknesses increase in these spiral areas (Figure 263). Semi-circular dome profile is used in this type, similar to Type 1. The effect of local increases of wall thicknesses on structural behaviour should be studied in detail. Drums are also used in the domes extrados, similar to Type 1.

The lobed dome (Type 5) is the second frequently used dome type in Edirne public baths. This dome type is observed in the *Gazi Mihal Bey Hamamı* Z05, Z07, Z08 and Z17; the *Beylerbeyi Hamamı* Z01b and Z14; the *Topkapı Hamamı* Z01, Z03, Z05 and Z07; the *İbrahim Paşa Hamamı* Z09 and Z13 spaces (Figure 42 e, f and i, Figure 133, Figure 168). Type 1,2,3 and 4 domes are theoretically composed of an infinite number of vault lobes, while Type 5 domes are composed of six, eight or twelve vault lobes (Figure 22, Figure 46, Figure 126, Figure 151). In these spaces, square plans are converted to polygonal plans with the help of transition elements, and domes are built according to this plan.

These domes have semi-circular profiles and resemble Type 1 domes in terms of structural behaviour. Because of the risks this profile carries, drums are also used in Type 5 domes, similar to Type 1.

The two-layered lobed dome (Type 6) is used only in the *Beylerbeyi Hamamı* Z10 *sıcaklık* main space (Figure 46, Figure 76, Figure 264, Figure 265). In this dome, at *oculi* level, suitable openings to place *oculi künk*s are formed with trapezoidal bricks (Figure 206-A3) narrowing outwards. On the other courses, where openings are not present for daylighting, a two-layered system is used (Figure 76, Figure 264, Figure 265). On the outer layer of these courses, a filled system built by half brick masonry is used. On the inner layer, hollow cubes built in front of the outer layer are used. These hollow cubes, in other words, caissons/coffers with closed front faces, built by the vertical bricks placed parallel or perpendicular to the outer layer (Figure 76, Figure 264, Figure 265).

In this dome, basically, the dome is relieved without changing the dome thickness. The reason for that is to increase the distance between the thrust line and extrados at the top point, also the thrust line and intrados at the spring level; in other words, to keep the thrust line within the dome borders (Figure 262c-d). In addition, drums are used in this semi-circular profiled dome, similarly to Type 1.

The depressed-profiled dome (Type 7) is used only in the *Topkapı Hamamı* Z05 and Z11 spaces (Figure 127). This dome type has almost identical construction technique to Type 1, but it shows completely different structural behaviour due to its dome profile. Because of its depressed profile, thrust line approaches to intrados at the dome base and to extrados at the top (Figure 262a-b).

There are traces of timber elements of 16x20 cm in cross-section surrounding the depressed profile dome used in the main *sıcaklık* space (Z11) of the *Topkapı Hamamı* women's section at the level of dome base and close to the intrados. Thrust load that would form on the inner side of dome basis is resisted by timber tension ring used at the hinge level. Also, drums are used as another precaution against that risk. (Figure 137, Figure 258, Figure 259)

Timber tension ring might be formed by a connected arc-shaped timber elements, bended suitably for the dome plan by being soaked in water. Arc-shaped timbers used as the tension ring might have been produced specifically for this purpose or arc-shaped timbers of centring (*çapa eğrisi*) used in dome-arch constructions might have been (re)used (see. Chapter 4.2.3). (*Figure 126*, *Figure 127*, Figure 290)

Muqarnas dome (Type 8) is used in the *Gazi Mihal Bey Hamamı* Z02 and the *Topkapı Hamamı* Z06 spaces (Figure 42b, Figure 135, Figure 266, Figure 267). A very rich visual effect is created by these muqarnas, which provide a visual integrity in transition elements and upper structures. Especially, the specially shaped limestones used in upper structures of the *Gazi Mihal Bey Hamamı* are quite unique (Figure 266). These stones are supported by nails because of their weight (Figure 203).

Muqarnas domes differ from all other dome types with respect to their main construction technique and structural principles. Rather than voussoir arch principle, corbel arch principle is used on the basis of these domes. The dome span is gradually narrowed by projected bricks and stones placed on top of each other. Only at the topmost level of the dome, bricks are rotated in accordance with the dome profile, used as voussoirs (Figure 266, Figure 267).

When the span/rise ratio of the dome is considered, drums are used in these semi-circular formed domes to prevent the disintegration tendency at the lower parts of the dome caused by tensile stress (Figure 267). However, changes caused by corbelled arch system in its structural behaviour is a subject that should be studied in detail.

In all of the public baths studied in detail, brick cut stone drums surrounding the dome base all around are used (Figure 25, Figure 88, Figure 102, Figure 103, Figure 116, Figure 137, Figure 155, Figure 157, Figure 171, Figure 188, Figure 238, Figure 241, Figure 251, Figure 259, Figure 267). At the changing level of these drums, timber elements with 10x13-14 and 14x14 cm dimensions are placed inside the drum, in accordance with the drum plans (Figure 171, Figure 251). These timber elements are fitted to each other with lap joint or half lap joint details. Tension ring is not identified only in drums of the *Topkapı Hamamı*, where depressed profile domes are used (*Figure 137*, Figure 259, Figure 267).

Semidomes:

Use of semi-domes at four corners of domed spaces is seen in different architectural styles. On the other hand, according to Kuban (1987: 73), the semidome is only used as a form of roofing in the Ottoman architecture.

Semi-domes are used as upper structures in the *Gazi Mihal Bey Hamamı* Z04-06 and the *Yeniçeriler Hamamı* Z04-06 spaces, among Edirne public baths (Figure 22, Figure 30, Figure 42d, Figure 97, Figure 113, Figure 284, Figure 289). Semi-circular plan scheme is formed by *muqarnas* pendentives in these *eyvans* with rectangular plans, and semi-domes are used as upper structures. Construction techniques similar to Type 3 and 4 domes are used. Diamond shaped holes are left for *oculi* in the *Yeniçeriler Hamamı* semi-domes (Figure 113, Figure 289).

Daylighting Elements:

It is known that *lanterns* are used at the top of *soğukluk* domes; however, there are not any authentic examples survived today. Circular, tetragonal, hexagonal and octagonal planned *cupola*s and *oculi* are used in upper structures of bathing spaces (Figure 42, Figure 52, Figure 77, Figure 78, Figure 112, Figure 114, Figure 115, Figure 133, Figure 135, Figure 139, Figure 168, Figure 238, Figure 241, Figure 251, Figure 257, Figure 258, Figure 261, Figure 263, Figure 264, Figure 265, Figure 266). Diamond-shaped *oculi* are used only in the *Yeniçeriler* Hamamı Z04 and Z06 semi-domes (Figure 113).

It is known that glass plates or moulded glasses are used on these openings. The moulded glasses are prepared in different curved forms and most common type is named as "*fil gözü*", meaning "elephant's eye" (Eyice, 1997: 416). Evliya Çelebi (Dağlı and Kahraman, 2011b: 84) mentions that some translucent and semi-precious stones like *billur* (crystal, cut glass), *necef* (crystallized quartz) and *moran* are used in some public baths like the *Kırım Mehmet Giray Hamamı*. It is also known that some of the coloured examples were imported from Venice (Kiel, 1976: 94). However, authentic glass or similar elements used in daylight openings are not observed in Edirne public baths.

Necessary openings for daylight are formed during the construction of upper structures. However, daylight openings area/upper structure area ratio is very important for architectural and structural purposes. It is understood that this ratio was paid attention, especially in domes. In relatively small spaces, this ratio varied between one third to one fifth, but decreases to one tenth in relatively larger *sıcaklık* and *ılıklık* spaces (Figure 15Figure 22Figure 46Figure 90Figure 97Figure 121Figure 126Figure 146Figure 151Figure 179Figure 187Figure 190). Especially the *oculi* openings, which carry the risk of decreasing structural resistance of the upper structure, are placed in such a way that they do not create low resistance areas or lines where structural cracks might be formed. In most of the domes, it is identified that the *oculi* openings located at different levels are not placed on the same line, but they placed in a shifting manner.

Inside the circular openings formed during upper structure construction, lime mortar is put and *künk*s are placed accordingly (Figure 268). Generally, *künk*s with

10x14x41 and 12x15x32cm dimensions, which are also used in water and heating installation of the building, are used. In addition to these, specially produced *künk*s for this purpose with dimensions of 22x22x44, 22x31x44 and 22x44x50cm are also used. These tapered cylindrical *künk*s narrowing outwards have approximately 1 cm wall thickness.

Çörtens:

Çörtens (a type of waterspout) are identified in the *Sultan Selim Saray Hamamı*, *Gazi Mihal Bey Hamamı*, *Yeniçeriler Hamamı* and *Kum Kasrı Hamamı* (Figure 17, Figure 25, Figure 103, Figure 148). However, information on construction techniques can only be obtained from the *Gazi Mihal Bey Hamamı* and *Yeniçeriler Hamamı*.

In these buildings, main walls are completed above the beginning level of the upper structure, niches with semi-open upper-surface for *çörten*s are formed at about every 500 cm at the upper levels of the wall (Figure 269, Figure 284, Figure 289). *Çörten*s are completed by placing specially shaped cut limestone units into the niches (Figure 43, Figure 269, Figure 270). Rain and snow water is directed to *çörten*s with slopes and gutters formed on the upper structure by mortar and covering materials. Fine-cut limestone units placed on *çörten* bases in order to make projections and by this way, water drainage is achieved without the contact of water with wall surface (Figure 43, Figure 269, Figure 270).

Finishing Techniques:

Two layers of lime-based plaster are used on the inner surface of upper structures of the 14th-16th century Edirne public baths. The number of plaster layers and their physical characteristics are same with those used in transition elements (see. Chapter 4.3.2, 4.3.3).

Different from walls and transition elements, plaster is identified on the inner surface of upper structures in only a few number of buildings and they are from two different periods. However, it is obvious that upper structures are the buildings parts that require maintenance and repair at most. There might be two explanations for this situation. First, it is known that new plaster is applied on top of the old layer only if the old one is strong enough. Plasters on these surfaces might not have enough strength. Second, surface adhesion of plasters become difficult on these surfaces due to gravity; hence, it is known that the plaster layers are kept as thin as possible. Therefore, during repairs, even the stable plaster layers might have been removed.

It is known that tile, plaster, slate and lead plates are used on the exterior surfaces of upper structures in Ottoman public baths. Authentic covering materials could not be detected in the Edirne public baths, which are studied in detail. When construction period and the area is considered, it can be said that tiles were probably used in most of the Edirne public baths (Figure 209). It is known that in these periods, lead plates were also used as covering material, although they were not as widespread as tiles. At the same time, slate used as covering material is observed only in a photograph of the *Yeniçeriler Hamamı*, taken in 1971 (Figure 104). (see. Chapter 4.2.1, 4.2.2).

Traces of *kirpi saçak* (saw-tooth eave) are identified in the *Gazi Mihal Bey Hamamı, Yeniçeriler Hamamı* and *Topkapı Hamamı* (Figure 43, Figure 116, Figure 137, Figure 270).

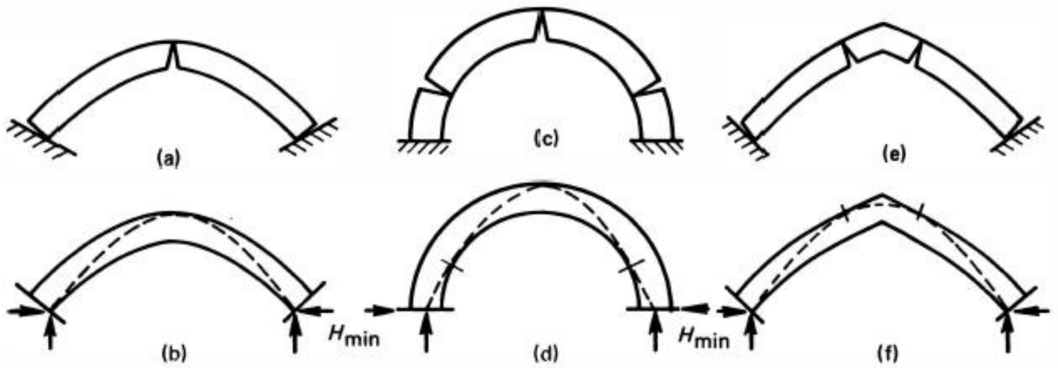

Figure 262. Geometrical safety factor of arches; shematic drawings, line of thrust and hinge mechanism of depressed-profiled (b), semi-circular (d) and pointed (f) arch; and risk zones under narrow thickness of depressed-profiled (a), semi-circular (c) and pointed arch (e) (Source: Heyman, 1982: 35)

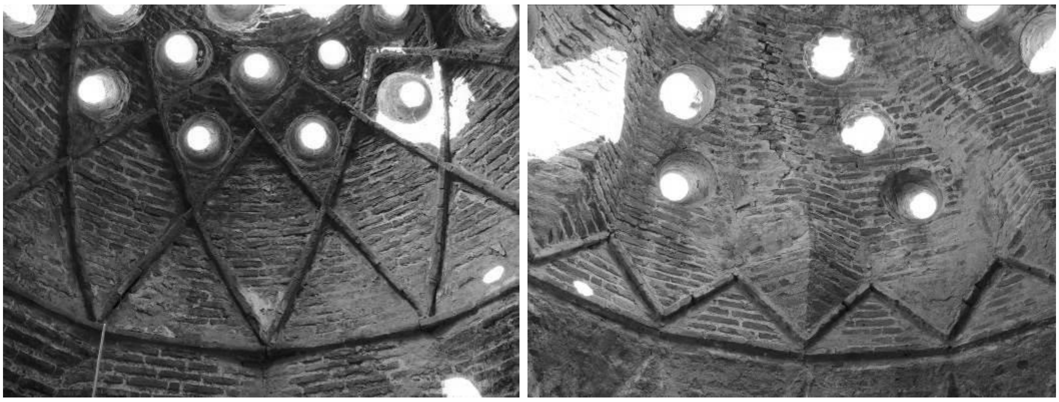

Figure 263. The semi-circular dome with lamella trusses (Type 2) of the Z15 space in the *Gazi Mihal Hamamı* women's section (left) and the helical ribbed dome (Type 4) of the Z03 space in the *Gazi Mihal Bey Hamamı* women's section (right)

Figure 264. The two-layered lobed dome (Type 6) of the Z10 *sıcaklık* main space in the *Beylerbeyi Hamamı* in 1972 (Source: Machiel Kiel Photograph Archive)

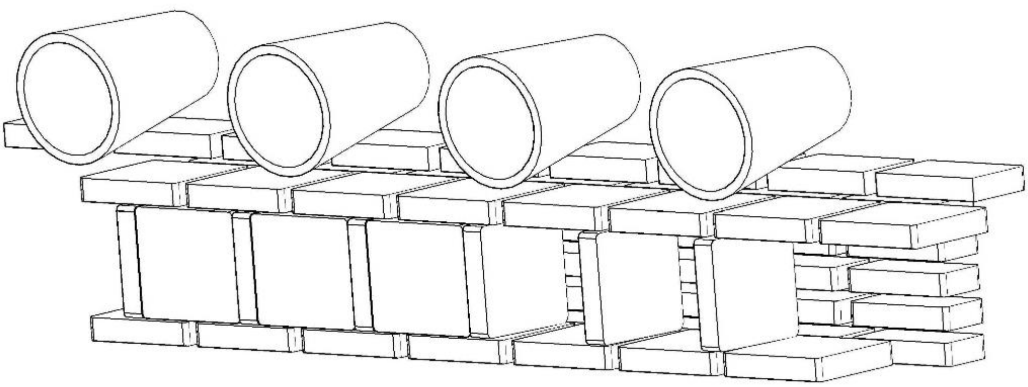

Figure 265. The schematic drawing of the system used on two-layered lobed dome (Type 6) of the Z10 space of *Beylerbeyi Hamamı*

Figure 266. The shaped limestone units used in the muqarnas dome (Type 8) of the Z02 space of *Gazi Mihal Bey Hamamı*

Figure 267. Exterior façades of muqarnas domes (Type 8) of the Z02 halvet of *Gazi Mihal Bey Hamamı* (left) and the Z06 *halvet* of *Topkapı Hamamı* (right)

Figure 268. *Oculi* openings and künks used in the dome of the Z03 space of *Beylerbeyi Hamamı*

Figure 269. Traces of çörtens used in the south wall of *Gazi Mihal Bey Hamamı*

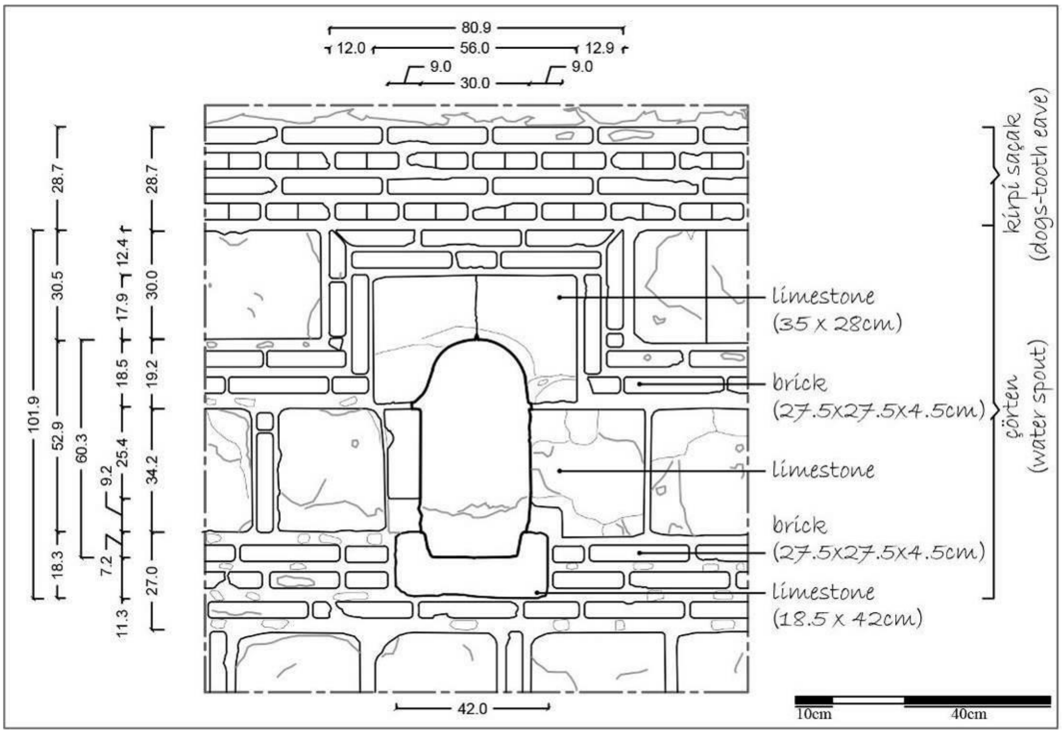

Figure 270. The detail drawing of the *çörten* used in the south wall of *Gazi Mihal Bey Hamamı*

4.4. Construction Techniques of Installation Systems

The most important characteristic of the Ottoman public baths, distinguishing them from other monuments, is their developed installation systems. Public baths have rich content of both water distribution and heating systems. These systems, known to be used since the ancient Greece, are interpreted by regional sources and the knowledge of master builders in Edirne public baths by using techniques improved throughout centuries. Installation systems used in the 14th-16th century Edirne public baths, which examined in detail, are presented under two heading: water and heating installations.

4.4.1. Water Installations

Water for public baths is generally supplied from urban water supply network. On the other hand, in some public baths, water is supplied by nearby rivers[65] and

[65] Water is suppllied to *Konya Sahib Ata Hamamı* from a water channel connected to Meram Stream (*Sahip Ata Irmağı, Şehir Irmağı*) (Önge, 1995: 41).

wells[66] through water wheels run by horses or cattles (Şener, 1978: 14; Önge, 1995: 41). According to Evliya Çelebi, in a few number of public baths, such as a small-sized public bath in Budin Ortahisar, the *Çarşı Hamamı* and the *Ayan Sarayı Hamamı* in Karaferya, it is known that water is supplied by *saka*s (Ottoman water-bearers) (Kahraman, 2010b: 315; 2011b: 192).

In fewer examples, along with the mentioned systems above, rainwater is also used. There are channels, carved on the stone blocks, on top of the hot water depot exterior wall of the *Seferihisar-Ermeni Hamamı*, a late-period Ottoman bath that directs rainwater collected from escarpments and over the public bath. It is known that a similar system is also used in the *Alanya-İç Kale Hamamı* (Önge, 1995: 41).

Water for Edirne public baths is supplied from urban water supply network (Figure 9, Figure 11). There are two known exceptions, first one is the *Sultan II. Bayezid Külliyesi Hamamı*, built between 1484-1488, where water is supplied from Tunca River by a big water wheel; however, this wheel is known to be demolished in 1677 (Ahmed Badi Efendi, 2014a: 265). The second one is Yıldırım Hamamı, which was located in the Yıldırım District. The water need was met through a wheel, but it was demolished in 1877-1878 (Ahmed Badi Efendi, 2014a: 265).

Water in urban water supply network is distributed to buildings in predetermined ratios. This is realized by water distribution (*taksim*) depots named as *maksem* or *maslak*, which contain *lüleli sandık*s[67]. *Lüleli sandık*s in *maksem*s assure proportional distribution of water among buildings, even if there is annual differences in water amount (see. Chapter 2.3.1).

Connection Between Urban Water Supply Network and Water Depots:

Connection of water from urban water supply network to public baths is done by the use of three different techniques. In the first one, water is first connected to small-sized *maksem*s, and then transferred to the building. These *maksem* units can

[66] Water is suppllied from a whell next to *külhan* furnace in Yenişehir Çarşı Hamamı. The source is still in use.

[67] "*Maksem*" is derived from "*maksim*" in arabic, which means "a space where water distributed". Water distribution centres/distribution depots in urban water network is called *maksem*. *Maksem*s are thought to be used by Romans for the first time, and are generally built as rectangular planned spaces covered with domes (Çeçen, 2003: 452). These structures are also called "maslak" (İnalcık, 2009: 439).

be in the size of a room or an architectural element. *Maksem* use is detected only in the *Topkapı Hamamı*, among the 14th-16th century Edirne public baths (Figure 128). Water from urban water supply network first reaches to this *maksem*, in the size of an architectural element, built adjacent to hot water depot and at the intersection of hot and cold water depots (Figure 126, Figure 128).

There is a niche/hole with 75x60x75cm dimensions inside this maksem 75x225cm in size (Figure 126, Figure 128). Three *künk* lines are identified in this niche. In addition, inner sides of the niche are plastered by 3 cm thick *horasan*, suitably for direct water contact. Water first reaches here, thereby preventing risks that might occur in water supply system of public bath due to pressure differences. Settled water is transferred from *maksem* to building by three *pöhrenk/künk* lines (Figure 126, Figure 128). Details of the *pöhrenk künk* line extended to cold water depot could not be documented due to soil deposits. One of the *pöhrenk lines* reaching to hot water depot directly transfers water to hot water depot, while the other one is connected to cold water distribution system within the building (Figure 126, Figure 128).

The second technique is to connect water from urban water supply network to cold water depot and then directed to hot water depot from the depot (Figure 97). In the third technique, water coming from the urban water supply network is divided into two separate lines and directly connected to cold and hot water depots (Figure 46).

Water storing and dividing within the building:

Water reaching to building from urban water supply network is divided into three, either directly or through cold/reserve water depot.

The first one feeds the cold water depot. Information obtained from the 14th-16th century public baths show that cold water depots are generally used as reserve water depots.[68] Water stored in these depots is transferred to hot water depot upon need through a *pöhrenk* line between cold and hot water depots (Figure 286). An

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[68] There are similar examples used before the Ottoman period. It is known that water coming from waqf water depot is fisrt collected in cold/reserve water depot, then transferred to hot water depot from there in 12th century *Mardin Sitti Radviyye Hamamı* (Önge, 1995: 41).

example of this detail is identified in the *Beylerbeyi Hamamı.* A *pöhrenk* line between cold and hot water depots, approximately 30 cm above the depot floor levels, must have been used to feed the hot water depot when necessary (Figure 46, Figure 286-EE and FF Sections, Figure 287-CC Section part iii).

The second water line is connected to cold water supply system within the building either directly or through *maksem* or cold/reserve water depot (Figure 22, Figure 46, Figure 97, Figure 126, Figure 141). This line continues inside a horizontal channel lying at the same level with a lower elevation of water control window and is connected to water supply system within the building. The connection is achieved at one point, as in the *Beylerbeyi Hamamı* and *Topkapı Hamamı*, or at multiple points as in the *Gazi Mihal Bey Hamamı* and *Yeniçeriler Hamamı*. There is 60-125 cm height difference between two water lines. Vertical water channels are used at connection points. In the *Gazi Mihal Bey Hamamı*, relieving arch is used above these vertical channels, in order to decrease the dead load on *pöhrenk*s. (Figure 31, Figure 117, Figure 140, Figure 238, Figure 291)

The third water line is connected to hot water depot either directly (Figure 46, Figure 60) or through *maksem* or cold/reserve water depot (Figure 126, Figure 141). There are pits where copper caldron sits on, in the middle of hot water depot floors located adjacent to the exterior wall (Figure 15, Figure 46, Figure 81, Figure 90, Figure 121, Figure 146, Figure 194). Copper caldron is known to be placed on this 140-175cm diameter circular pit (see. Chapter 4.2.5) (Figure 194, Figure 279). The diameter of this pit may reach up to 2.5 metres in large-scale public baths like *Sultan Selim Saray*, *Tahtakale,* and *Sokullu Mehmet Paşa*. However, there were not any authentic caldrons survived until today.

An authentic copper caldron example cannot be found not only in Edirne public baths, but also in almost all of the Ottoman public baths, in the literature review. There may be different explanations for this situation. First, although they are very suitable to be used in water depots (see. Chapter 4.2.5), it is known that copper caldrons also wear down and leak water in time, hence they are repaired or replaced periodically (Madran, 1975: 183; from Günalan, 2005, Appendices: *Kamil Kepeci Tasnifi* year: 960, no: 63, page no: (32)61, edict no: 115). In addition, it is understood from the historical records kept by Evliya Çelebi that stealing copper caldrons is among the most common thefts occurring in public baths (Dağlı and Kahraman, 2011b: 459).

A cylindrical space where the *külhan* furnace is located is found beneath the copper caldron pit (Figure 194, Figure 279). Water collected in hot water depot is heated by a *külhan* furnace, then connected to hot water supply system within the building through connection *pöhrenk* lines lying 10-25 cm above the depot floor level, along the wall thickness (Figure 22, Figure 46, Figure 97, Figure 126, Figure 146, Figure 151, Figure 272). These connections are found below the water control windows on the partition wall of the *sıcaklık*-hot water depot (Figure 35, Figure 61, Figure 80, Figure 105, Figure 108, Figure 140, Figure 172, Figure 173). Connecting *pöhrenk*s are placed with an inclination (approximately 7°) decreasing from depots to bathing spaces (Figure 22, Figure 46, Figure 97, Figure 118, Figure 126, Figure 151, Figure 172, Figure 173, Figure 272, Figure 286-EE Section, Figure 287-AA Section part ii, Figure 288- Detail 2, Figure 291)

Top windows at the vaults of hot water depots are covered with a plate/lid placed on top the window and not attached to the vault. Control of the water in hot water depot and transfer of vapour to bathing spaces are achieved by water control windows between *sıcaklık* spaces and hot water depot (see. Chapter 4.3.2, window Type 4) (Figure 35, Figure 61, Figure 66, Figure 80, Figure 105, Figure 166, Figure 246, Figure 288). It is known that iron window wing is used on these windows in some of the public baths (Önge, 1995: 45). However, such detail could not be identified in Edirne public baths. When water depots are too deep, masonry stairs are built in front of one of these windows (Figure 15).

Traces identified on the building reveals that water depots are under periodical and comprehensive maintenance. The first trace is the *pöhrenk* lines observed at the floor level of hot water depots in the *Beylerbeyi Hamamı*, *Topkapı Hamamı* and *İbrahim Paşa Hamamı* (Figure 61, Figure 80, Figure 140, Figure 172, Figure 285, Figure 286, Figure 288, Figure 291)

These *pöhrenks* are covered with plaster during the active use of public baths, but they can be observed now because of the plaster losses. These lines are found in the middle of the hot water depot and *sıcaklık* partition wall, and they lie from the hot water depot level to the *sıcaklık* space or to the *seki* floor level with a decreasing inclination of 10-16-28^0. These *pöhrenk*s are closed with *lökün* (Figure 80, Figure 140, Figure 172, Figure 287-AA Section part ii, Figure 288). Areas of the wall where these *künk*s lie along are covered with plaster as the rest of the wall. When the water inside the water depot must to be emptied, inside of these *pöhrenk*s must have been opened up, and after the repairs, refilled with *lökün* in a waterproof manner and then the wall surface is plastered.

Another system similar to this one is used in the *Kum Kasrı Hamamı* (Özer, 2013, 20). Water in hot water depot should have been drained to the exterior with pipes having outlets around *külhan* (Figure 149). However, this system could not be documented in detail or these documents have not published yet.

In addition, materials and workforce entrance and exit have to be achieved to water depots during repairs, which do not have any opening except water control window and top window.

The main wall is continued at one of the short sides of the hot water depots. Vault on this side is built so as to sit on half of the wall thickness and cannot be perceived from the exterior façade (Figure 49, Figure 129). On the other side, wall used at the vault rise is separated from the main wall of the façade. Vault on this side starts at the exterior border of the façade and built to transfer its load to side/long walls of the depot, and can be perceived from the exterior façade (Figure 271). This differentiation in the construction technique of one of the short walls is responsible for supporting only its own load. By this way, during repairs, this short wall must have been easily pulled down without causing any structural problems, to provide entrance and exit, and the wall was constructed again after the repairs.

Same differentiation is also observed in partition walls of adjacent water depots formed by the division of a rectangular planned space (Figure 22, Figure 46, Figure 60, Figure 146, Figure 271). A support arch is used beneath the vault of this space, and space is divided into two by a masonry wall under the arch (Figure 60, Figure 271, Figure 286-EE and FF Sections). These partition walls between hot and cold water depots, carrying only their own load, must also have been pulled down during repairs and rebuilt.

Cold and Hot Water Lines:

It is known that in the *Ani Menüçehr Hamamı*, Mardin *Sitti Radviyye Hamamı* and *Yeni Kapı Hamamı*, Kayseri *Birlik Hamamı* built in the 12th or 13th centuries, only the hot water system is used (Önge, 1995: 43). On the other hand, in Edirne public baths, two *pöhrenk* lines, top for cold and bottom for hot water are used (Figure 272, Figure 273). It is identified that in *ılıklık* and/or *keçelik* spaces of the *Gazi Mihal Bey Hamamı*, *Beylerbeyi Hamamı* and *Yeniçeriler Hamamı*, only hot water line continues (Figure 22, Figure 46, Figure 97, Figure 274).

In the 14th-16th century Edirne public baths, continuous niches functioning as channels are formed horizontally continuing along the walls during the construction of the masonry walls (Figure 31, Figure 57, Figure 140, Figure 222, Figure 226). These channels start at approximately 50-80 cm above the floor level of bathing spaces, and approximately 30 cm above the *seki* level. Their height varies between 40-53 cm and their thickness between 19 and 30 cm (Figure 82, Figure 140, Figure 222, Figure 226). Stone courses of the alternating wall or phyllite plates, 6-9 cm in thickness, are used at the upper level of channels (Figure 83, Figure 85, Figure 140, Figure 141, Figure 174, Figure 222, Figure 226). By this way, wall load that might sit on the *pöhrenk*s are transferred to the wall by stone units (Figure 226, Figure 272, Figure 273, Figure 275, Figure 276).

Pöhrenks must have been placed after the rough construction is completed and before the floor pavement is completed. First, inner surfaces of these channels are covered with approximately 4-5 cm thick, pink coloured *horasan* with brick pieces. Hand pressure is applied when the mortar is placed to prevent any gaps (Figure 175). Authentic mortars used for this purpose contain brick pieces with sizes not more than 2-3 cm. Size of brick pieces reaches up to 7 cm only in the *Beylerbeyi Hamamı* Z11 *eyvan* and *aralık* spaces (Figure 83, Figure 275). This inadequate detail, should have been applied in a later Ottoman-period repair.

Firstly, hot water *pöhrenk*s are placed and fixed in the channel by the help of lime-based mortar. *Pöhrenk*s must have been connected in a length to fit out the channel, then they must have been placed inside it. After one brick row with mortar or mortar with brick pieces (1-4 cm) are put on top of hot water *pöhrenk*s, cold water *pöhrenk*s are placed (Figure 82, Figure 226, Figure 272, Figure 273, Figure 275,

Figure 276). *Pöhrenk*s are placed to make the inclination of 1°, decreasing from water depots toward the *soğukluk* space. Water flow in *pöhrenk*s is achieved by this inclination and the water's own pressure.

A detail identified in the *Beylerbeyi Hamamı* and *Yeniçeriler Hamamı* show that between hot and cold water *pöhrenk*s, nails can also be used instead of bricks. These nails are hammered onto walls in 26-55 cm intervals and are not completely buried into the wall but rather projected 10-12 cm (Figure 119). Therefore, these nails are used both to align *pöhrenk*s in a certain inclination and act as a load-bearing element for the upper water line.

After the *pöhrenk*s are placed into the channels, gaps are filled with pink *horasan*. Lastly, the open faces of channels are closed by half bricks, single vertical bricks or *horasan* with brick pieces until the face of the wall. (Figure 44, Figure 82, Figure 174, Figure 222, Figure 226, Figure 261, Figure 273, Figure 276)

*Pöhrenk*s are used as water pipes. They are shaped with one end wider than the other, to be connected to each other end to end. The dimensions are 10x14x41cm or 12x15x32cm (see. Chapter 4.2.2) (Figure 210, Figure 212). At the corners of spaces and connection points of pipes, L or T shape *pöhrenk*s are used (Figure 84, Figure 118, Figure 173, Figure 212, Figure 272, Figure 275). *Lökün* is coated on the connection points in order to prevent water leakage (see. Chapter 4.2.4).

In all public baths, chalk deposits caused by calcium in the water is observed on the upper level of inner surfaces of *pöhrenk*s. The main water sources are provided from Taşlımüsellim and Sinanköy/Pravadi Villages, but water is also collected from many sources along the way. It is known that one of these two sources located at Hançerli Kemer Position has very hard water (Peremeci, 1939: 100).[69] There are not any detailed information on whether this situation caused any problems especially at taps where the water flow area gets narrower.

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[69] As the calcium ratio of this source is high, it is known to be disconnected from the main system and connected to the river in the 20th century by Health Director Osman Civelek (Peremeci, 1939: 100).

Cavitation control system in the hot water pöhrenks:[70]

A special detail used in hot water line of the *İbrahim Paşa Hamamı* draws attention. This detail is observed at the end of hot water line lying on the east arm of bathing spaces, at the corner of Z14 space. The hot water line lies along the southeast wall, then continues upwards with 14^o slope on the northeast wall approximately for 120 cm. End of this line is closed by *lökün* infill. Traces reveal that this part of the water system has been repaired and rebuilt many times. (Figure 176, Figure 277)

Every liquid has a vapur pressure and as temperature increases, vapour pressure increases as well. When the vapour pressure of the liquid is equal to the static pressure of the environment, the liquid begins boiling. For example, liquids heated in an open container, boil at the atmospheric pressure, which is the static pressure of the environment. This means that, when water is heated in an open container, liquid pressure gradually increases, at approximately 100^0C, when the vapour pressure is around 100 kPa (equal to open-air pressure), water begins boiling.

When a liquid flows in a closed pipe, static pressure inside the pipe changes according to the flow velocity of liquid and energy it loses during flow. If the flow velocity of water increases, the static pressure inside the pipe decreases. Friction, sharp turns and changes in pipe interior width also cause losing energy. This results in a decrease of static pressure inside the pipe. If the static pressure inside the pipe decreases below the vapour pressure of the liquid at that temperature at a point, the liquid starts boiling at that point. This situation occurring in flowing liquids inside closed containers is called cavitation.

As the static pressure decrease at the end points of the water line, hot water may start boiling at certain areas. This results in vapour release from the last tap(s). Water line level above the water level in water depot after the last tap may have the following reasons: (1) this area may function as a vapour collecting area, (2) static pressure of the water may be increased as it rises inside the pipe in an area near to the last tap, so cavitation is prevented by that way. (Figure 176, Figure 277)

This situation is observed only in hot water line, which supports the theory mentioned above. The vapour pressure of cold water is quite low compared to hot

[70] MSc Mechanical Engineer Osman Akdağ was consulted for the evaluation of this system.

water. Therefore, static pressure inside the pipe should be very low for the cold water to boil inside the pipe. It is less likely that water decreases to such low static pressure inside the systems used in the Ottoman public baths.

Further research should be conducted to determine and evaluate the physical and mechanical properties of the *pöhrenk*s in particular.

Architectural elements:

There were not any original taps identified in Edirne public baths. However, in all baths, circular holes on the *pöhrenk*s at tap connection points are observed (Figure 44, Figure 211, Figure 238). These smooth sided, regular-shaped holes with 2.5-4 cm diameter, must have been opened during the construction. Before *pöhrenk*s placed in water channels, they must be placed to determine the exact locations of taps and marked. Then these locations were carved to create circular holes 2.5-4 cm in diameter (Figure 44, Figure 211, Figure 238). Finally, the *pöhrenk*s must have been placed and fixed in the channels.

*Kurna*s of Edirne public baths studied in detail (*Gazi Mihal Bey Hamamı, Beylerbeyi Hamamı, Yeniçeriler Hamamı, Topkapı Hamamı* and *İbrahim Paşa Hamamı*) could not survive today. There are three *kurna*s in the *Yeniçeriler Hamamı*, however, it is not possible to identify whether they are in-situ (Figure 120). However, traces reveal information on the *kurna* niches, *kurna aynası* and relationship of *kurna*s with wall-floor pavement (Figure 36, Figure 57, Figure 276).

Another architectural element used in public baths is *şadırvan*s. Some of the water connecting to public baths is used for this architectural element. Elaborate plan and decoration elements were used in *şadırvan*s before the end of the 14th century, but they become simpler after that period (Önge, 1995: 43). The only authentic *şadırvan*s used in *soğukluk* spaces of the *Tahtakale Hamamı* and the *Sokullu Mehmet Paşa Hamamı* in Edirne still stand today (Figure 90, Figure 190). These *şadırvan*s with 2-3 metres width and 40-70 cm height are placed at the geometrical centre of *soğukluk* spaces.

Water need of these architectural elements should have been provided by an underground *pöhrenk* line. However, details of this system could not be identified. The only information on this water transferring system is seen in the *Kum Kasrı*

Hamamı (Figure 146). However, whether this line is designed as a separate line dividing at the point where water is connected to the public bath, or designed as a continuation of water supply system within the building could not be identified. Water springs out from a *lüle,* metal item, at the centre of the *şadırvan* pool, and flows into a water channel surrounding the *şadırvan*, then flows to wastewater channel on the floor pavement.

Public fountains attached to the exterior facades of public baths are observed especially in some large-scale Ottoman public baths. There are not any information regarding fountains in the public baths of Edirne (Figure 11). However, the fountains are built as separate structures from the public baths (see. Chapter 2.3.1) (Figure 95, Figure 96). Only an example of a fountain built adjacent to the exterior wall of the public bath is seen in the *Kum Kasrı Hamamı*. However, it is thought that this structure is not planned together with the public bath, rather built in a later period (Özer, 2013, 20).

There are not any information on *hela*, fireplace for making coffee and fireplace/unit for drying peshtemal/*futa* in the public baths studied in detail. Therefore, details like *hela* holes and stones in these spaces could not be observed.

<u>*Wastewater Disposal System:*</u>

It is known that in the 12th-13th century Anatolian public baths, wastewater is directed to one or multiple points by the slope formed on the floor, and transferred to wastewater channels by holes and *künk*s in these points (Önge, 1995: 45). Önge (1995: 45) states that wastewater is started to be drained out of the building via slope in the floor pavement and channels formed on the floor pavement stones since the 15th century.

Original pavement stones are completely destroyed in the public baths studied in detail. For this reason, information on how the wastewater was directed inside the building could not be obtained.[71]

There only information on the water drainage is obtained from the *Yeniçeriler Hamamı*. Traces reveal that the wastewater is directed to the *ılıklık* space with the

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[71] For a detailed study on waste water disposal systems of the Ottoman public baths, see: Dişli, 2008

slopes and channels on the floor pavements. Drainage of the water from the building is achieved by a *pöhrenk* line on the Z11 main wall, starting from space floor level and continues along the wall thickness with a decreasing inclination (Figure 98). The water line is placed in a 19x19 cm square sectioned channel formed inside the masonry wall by the use of bricks in order to prevent the wall load from damaging the *pöhrenk*s.

Figure 271. The exterior wall of the cold water depot of *Beylerbeyi Hamamı* (left) and the partition wall located between the hot and cold water depots of *Gazi Mihal Bey Hamamı* (right)

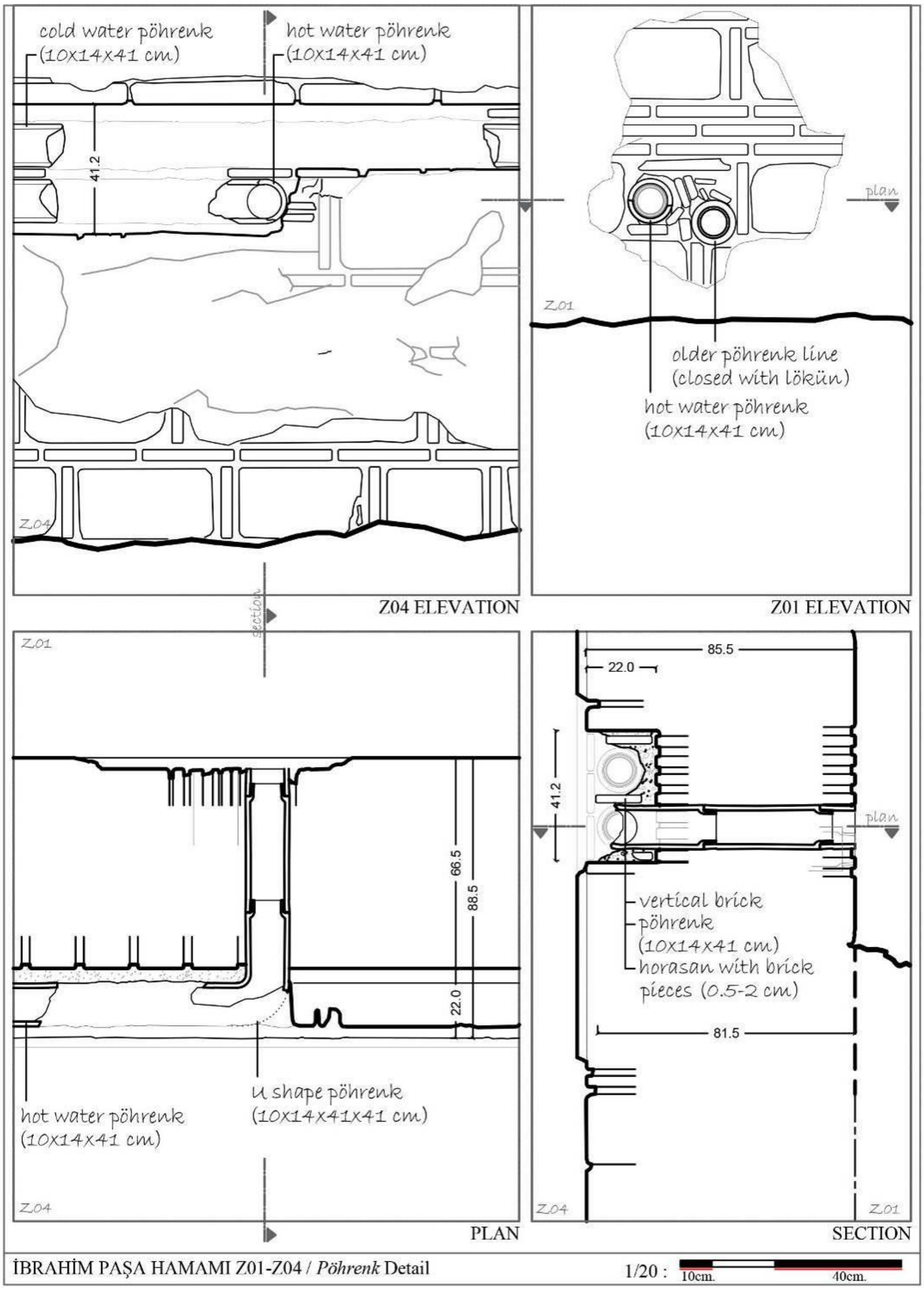

Figure 272. Hot water transferring detail between the hot water depot (Z01) and the *halvet* (Z04) of *İbrahim Paşa Hamamı*

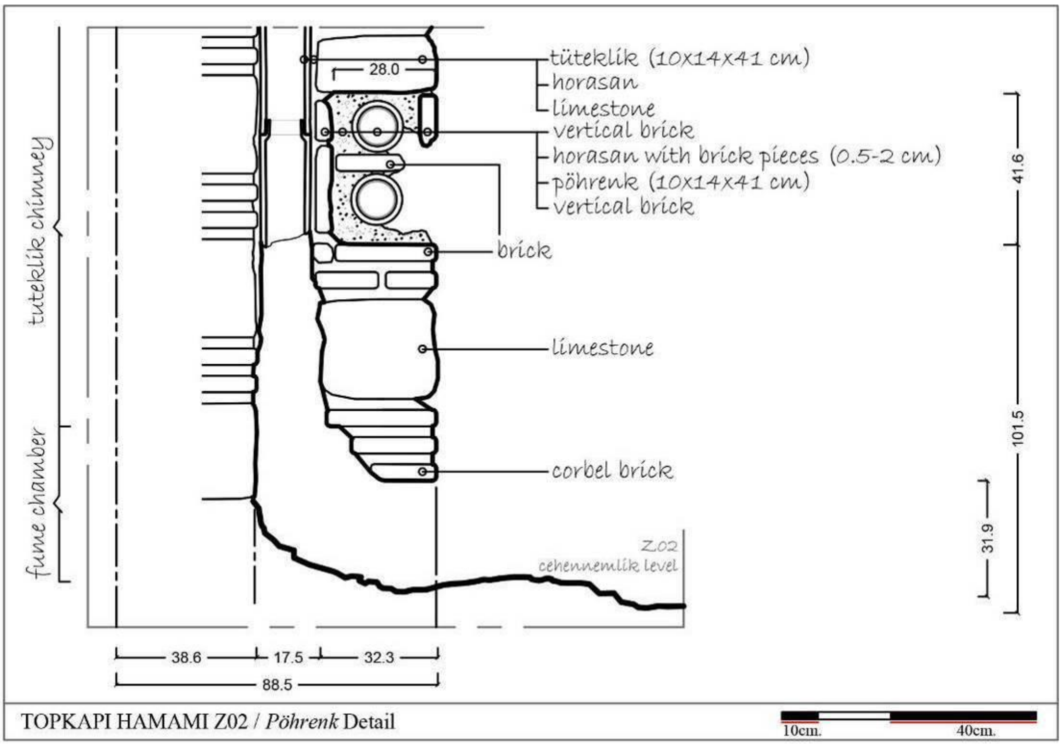

Figure 273. The *pöhrenk*, *pöhrenk* channel and *tüteklik* details used in the Z02 space of *Topkapı Hamamı*

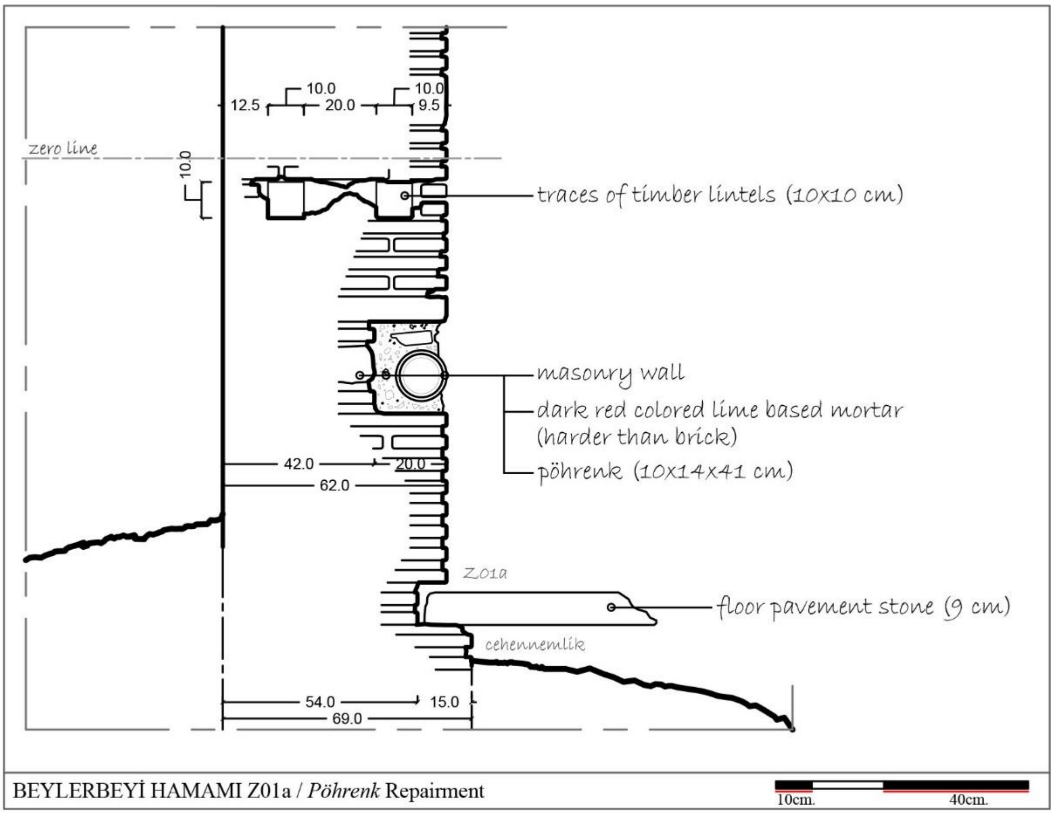

Figure 274. The *pöhrenk* repair detail used in the Z01a space of *Beylerbeyi Hamamı*

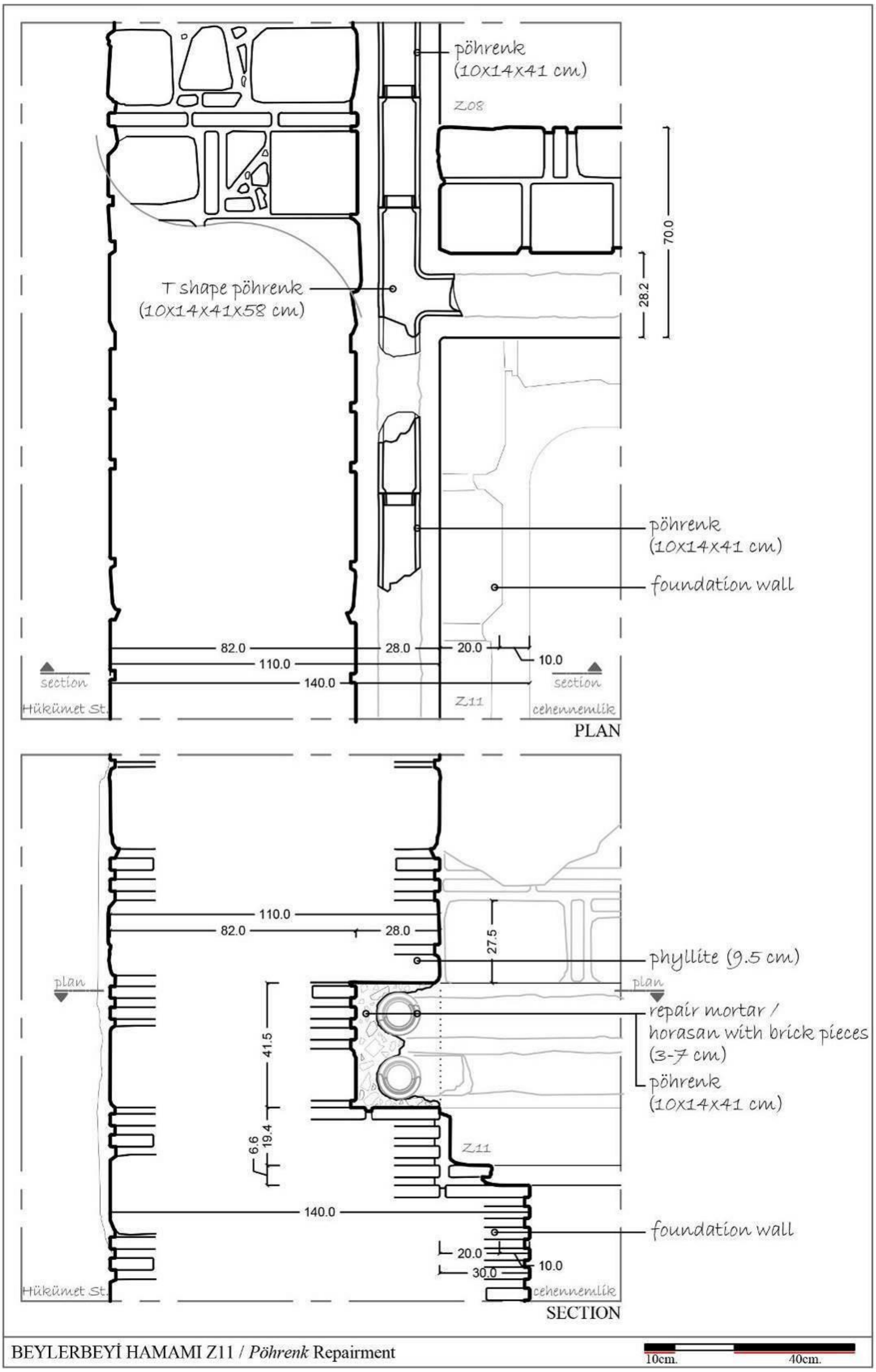

Figure 275. The *pöhrenk* repair detail and the use of the T shape *pöhrenk* located in the Z11 space of *Beylerbeyi Hamamı*

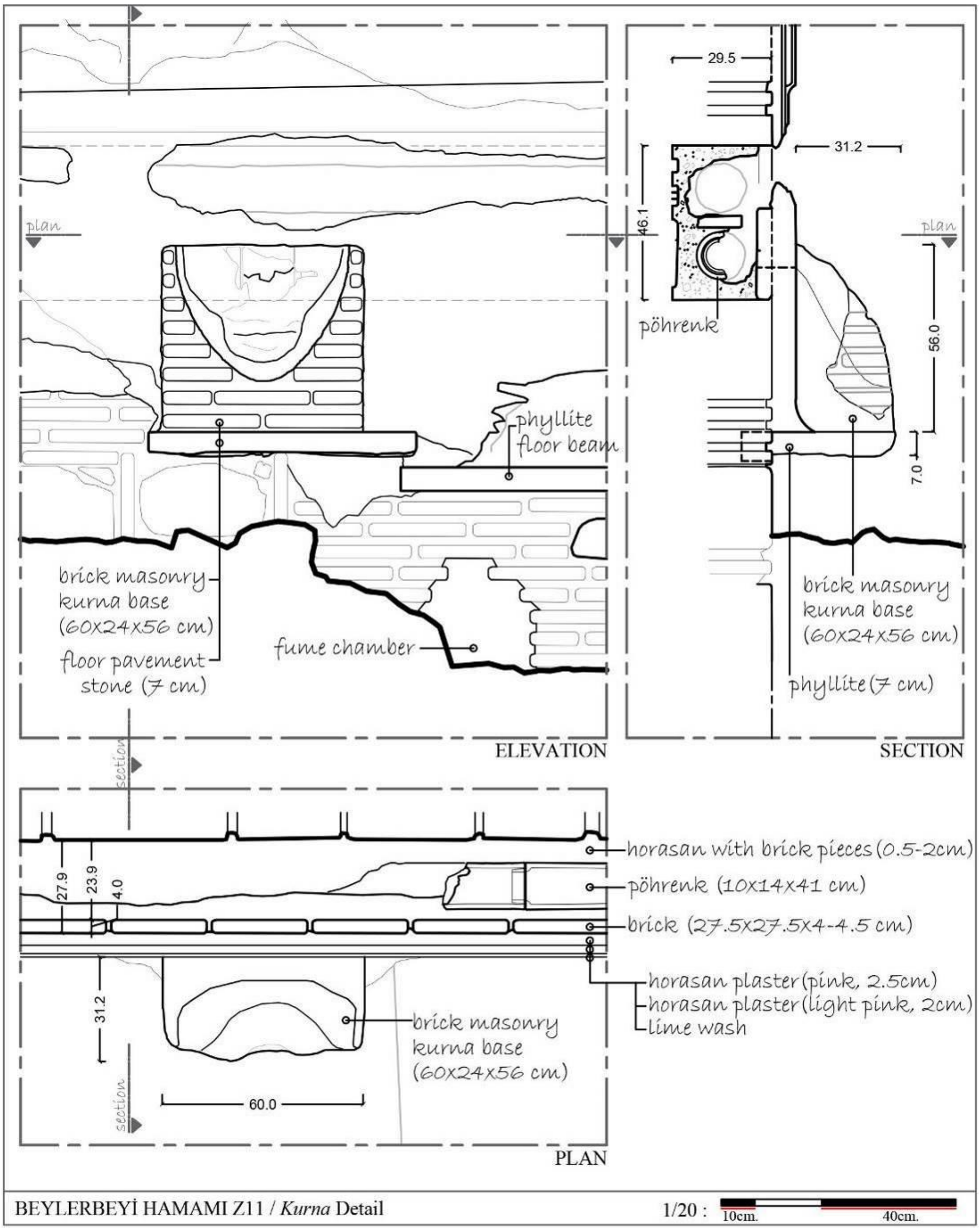

Figure 276. The *kurna* base detail used in the Z11 space of *Beylerbeyi Hamamı*

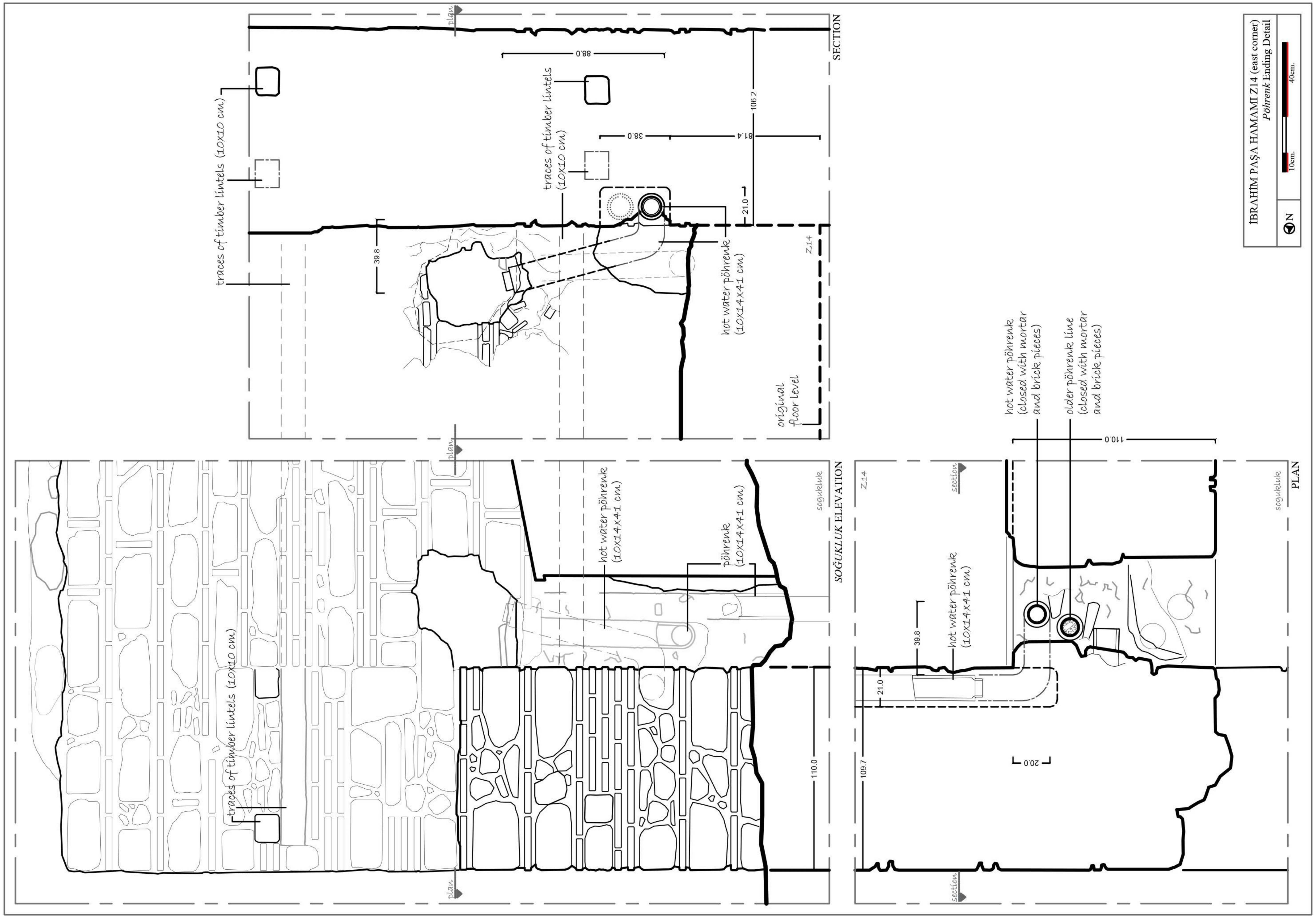

Figure 277. The *pöhrenk* ending detail detected at the east corner of the Z14 space of *İbrahim Paşa Hamamı*

4.4.2. Heating Installations

It is known that Ottoman public baths were generally used every day. Even so, although most of the public baths were not open at nights, they were still kept warm during the night. According to Evliya Çelebi, very few number of public baths (the *Gölikesri Hamamı* on the lakeside, the *Yeni Kale Büyük Varoş Hamamı* located near Tuna River, the *Vostiçse Hamamı* located near the sea) were closed for a month or few in summer and people bath in lakes or rivers during that period (Kahraman, 2010a: 801, 2011a: 371, 2011b: 279).

Two types of heating systems are used in public baths. The first one is the main system, and water in the hot water depot and all bathing spaces are heated with *külhan* (Figure 18, Figure 102, Figure 125, Figure 149, Figure 156, Figure 188, Figure 194). It is built together with the building. Different from all other spaces, *soğukluk* spaces are not heated by this system, but rather by movable systems independent from the building like braziers or heating stoves. In addition, the entire building components from the load bearing elements to the finishing elements were planned and shaped to increase the thermal performance of the Ottoman baths.[72]

As in all Ottoman public baths, Edirne public baths' main heating systems are comprised of a *külhan*, a *cehennemlik* and a *tüteklik* (fumes flue). Flame and fumes in the *külhan* furnace located beneath the copper caldron pit in the hot water depot heat the copper caldron, and water in the depot by heat flags (Figure 81, Figure 278, Figure 279).

Fumes ensued in the *külhan* furnace is transferred to the *cehennemlik* that lies along all bathing spaces via fumes channels located under the hot water depot floor. Fumes circulated along the *cehennemlik* are discharged from the building by vertical *tüteklik*s placed inside the walls. Fumes inside the *cehennemlik* sections and *tütekliks* heat bathing spaces of public baths under the floors and inside the walls. Transfer of water vapour and heat from the water in hot water depot to bathing spaces by water control windows should also contribute heating of these spaces (Önge, 1995: 93).

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[72] For a detailed study on thermal performance of the Ottoman public baths, see: Çiçek, 2008

Wood is used as fuel in the main heating system. This situation caused a great danger for forestlands. Moreover, İstanbul public baths caused a very serious harm for the forest that construction of new public bath in the city was forbidden by an imperial order (Eyice, 1997: 414; Yılmazkaya, 2002: 21). There are examples of using other fuels than wood in areas with insufficient forestland. According to Evliya Çelebi, some public baths in Diyarbakir and Arabia were heated by city garbage (Kahraman, 2010a: 54). He even mentions that bath attendants employed garbage mans to sweep the streets and collect the garbage and bring them to the public bath in Egypt (Kahraman, 2011b: 285).

Firewood used as fuel is stored in the *külhan* courtyard. *Külhan* courtyard might have been covered partially and used for firewood storage or a simple storage space might have been built for this purpose. Semi-closed space formed beneath the cold water depots might also have been used as storage (Figure 18, Figure 101, Figure 156, Figure 278). In addition to the firewood, another space or area in the *külhan* courtyard to temporarily store the ashes should be necessary before they are disposed to the city garbage.

An excavation study in the *külhan* courtyard of the *Kum Kasrı Hamamı* revealed a storage space, which is thought to be a firewood storage (Figure 146, Figure 149). In addition, ash layer detected at the floor level also indicates that this area might also be used to temporarily store the ashes. (Özer, 2013, 20)

Külhan:

Külhan is comprised of a *külhan* furnace and a transition space that provides access to *külhan*. Location of *külhan* is arranged so that its furnace and the *cehennemlik* floor are at the same level.

Külhan furnace is located at the centre of hot water depot, beneath the copper caldron pit. Six channels of approximately 15-20x15-20cm dimensions between the furnace and *cehennemlik* direct fumes arising here to the *cehennemlik* (Figure 194, Figure 279). The area between the *cehennemlik* floor level and the depot floor level beneath hot water depot is filled with stone, brick and pressed soil. However, borders of *külhan* furnace and channels are defined with bricks while this filling is finished, the interior of these borders are left empty.

When the *külhan* furnace is built, a recess is formed on the periphery of the furnace for the copper caldron to be settled and safely fixed (Figure 81, Figure 279, Figure 285-AA Section). According to this detail observed in the *Beylerbeyi Hamamı*, the diameter of the *külhan* furnace is enlarged 4 cm approximately 15 cm beneath the upper level of the furnace and is narrowed approximately 20 cm, 15 cm below this level (Figure 81, Figure 285-AA Section). A similar detail is also used in the *Sokullu Mehmet Paşa Hamamı*, copper caldron is fixed by settling on this recess (Figure 194). After the caldron is placed, spaces between the copper caldron and copper caldron pit are filled with mortar while water depot floor is plastered with *horasan*.

A tetragonal opening of 80-100x80-100 cm dimensions is formed on the long exterior wall of hot water depot to place wood inside the furnace (Figure 280). The opening is spanned by stone lintels. Also, a relieving arch with one and a half brick thickness is used inside the wall to decrease the load to be supported by this opening. The opening to place wood in the furnace is closed by a metal wing (Figure 280). A *külhan* chimney is used above the transition area in order to prevent the flames to blaze outwards when the wing is opened (Figure 125).

*Külhan*s are located approximately 200-250 cm below hot water depot floor and approximately 100-150 cm below *külhan* courtyard floor. 4-6 step staircases provide access to külhans from the courtyard. There is a transition space on this platform. The width of the transition space generally changes between 3.5-5 metres, depending on the *külhan* furnace size. This width reaches to 7.5 metres in the *Tahtakale Hamamı*. Transition space is attached to the long wall of hot water depot and in the middle of this wall. The wall enlarges 40-75 cm in this area. Alternating or rubble stone masonry system is used in transition space walls. The space is covered with two adjacent arches. Cut stone or brick is used in these arches. *Külhan* chimney settled on the inner arch is built by bricks. (Figure 280)

Cehennemlik:

In the examples studied in detail, the *cehennemlik* rises varies between 100cm and 140 cm depending on the scale of the public bath. This space lies along the entire bathing spaces (Figure 15, Figure 46, Figure 146). Fumes flow through openings on the hot water depot- *sıcaklık* partition wall at the end of channels providing fumes flow from the *kühan* furnace, so the building is heated under the floor (Figure 140). Accordingly, all the *cehennemlik* section is planned to enable fumes circulation. Detailed information on *cehennemlik* footings and fumes flow openings under the wall are given in Chapter 4.3.1.

Another subject concerning the *cehennemlik* is that regular maintenance is a necessity for this space. Especially it must be periodically cleaned because of the soot deposit resulting from fumes. However, in order to function properly, all *cehennemlik* spaces must be a completely closed system as an air-proof and water-proof space. Specific details are produced for maintenance of heating installations, as in water installations.

Such a detail providing controlled access to the *cehennemlik* is observed in the *Sultan Selim Saray Hamamı*, *Beylerbeyi Hamamı* and *Mezit Bey Hamamı*. In these public baths, an opening with approximately 40x40 cm dimensions is formed on the long exterior wall of hot water depot, providing entrance to the *cehennemlik.* The opening is spanned with a 170 cm brick arch. The dead load of the building is supported by the arch; hence, the partition wall beneath the arch is functioning as an infill material that bears only its own load. By this way, at maintenance periods (once in several years), the infill inside the opening is emptied providing access to the *cehennemlik*, afterwards, the opening is re-closed with a masonry wall. (Figure 87, Figure 285-CC Section, Figure 287-CC Section part iii)

Tüteklik:

*Tüteklik*s placed inside the walls generally with 100-130 cm, at most with 210 cm intervals, functions both for fumes discharging from the building and for heating of the building walls (Figure 22, Figure 46, Figure 97, Figure 126, Figure 146, Figure 151).

Tüteklik fumes chambers are built on the foundation walls aligned with the planned *tüteklik* positions. These niches have approximately 30 cm width and approximately 50-60 cm depth varying according to wall thickness. This depth enables *tüteklik*s chimneys to be placed behind the water channels and continue along the wall length without any interruption. The 20-30 cm portions of the upper inner side of *tüteklik* fumes chambers are left open for the continuation of *tüteklik* chimneys. On the other hand, upper outer sides of them are spanned with corbel arches by 3-5 cm projected bricks on the foundation wall. (Figure 85, Figure 222, Figure 273, Figure 276, Figure 281)

Tüteklik chimneys are formed continuously on a vertical line on *tüteklik* fumes chambers while masonry walls and uppers structures are constructed. Roughly shaped bricks and relatively small-sized stones are used to form these circular or tetragonal planned holes. These chimneys are approximately have 17-17cm, 19-19cm or 19-25x25cm dimensions. (Figure 45, Figure 85, Figure 130, Figure 177, Figure 222, Figure 251, Figure 273, Figure 276, Figure 282)

It is understood from the traces that the front faces of these chimneys are left open at the initial stage. 4-5 cm thick pink *horasan* mortar is applied inside the chimneys in phases and *tüteklik*s (fume *künk*s) connected end to end, with dimensions identical to those used in water lines, are placed inside the chimneys. Moreover, *tütekliks* must have been connected in stages outside of the chimney, and again placed inside of the chimney in phases. (Figure 45, Figure 85, Figure 130, Figure 177, Figure 222, Figure 273, Figure 282)

After the spaces left between *tütekliks* and chimney are filled by *horasan*, front faces of the chimneys are closed with masonry in line with the walls. At levels where water channels are used, the front face of *tüteklik* chimneys is closed by single vertical brick rows (Figure 85, Figure 177, Figure 273).

It is known that *tüteklik*s continues up to a height above the upper structure and used as chimneys (Figure 88, Figure 123). However, authentic chimneys cannot observed in Edirne public baths. Therefore there are not any information on the chimney heights. Tuncer (1978: 250) states that the public bath temperature is precisely adjusted by opening/closing the chimneys' top. Similarly, Önge (1995: 93) states that the fumes exiting from chimneys are carefully observed when the public bath is being heated; accordingly, some of the chimneys are closed by placing a stone on top of them and by this way fumes amount and pressure in the *cehennemlik* is adjusted.

Figure 278. The *külhan*, hot water depot, cold water depot and storage area underneath on the south-east of the *Sultan Selim Saray Hamamı* (Source: İlter Büyükdığan Photograph Archive, the 1990s)

Figure 279. The *külhan* furnace and fumes flow channels providing fumes transition from the *külhan* to the *cehennemlik* space used in the *Sultan Selim Saray Hamamı* (Source: Neriman Şahin Güçhan Photograph Archive, 1999)

Figure 280. The *külhan*, *külhan opening* (left) arches (middle) and *külhan* chimney (right) of the *Sokullu Mehmet Paşa Hamamı*

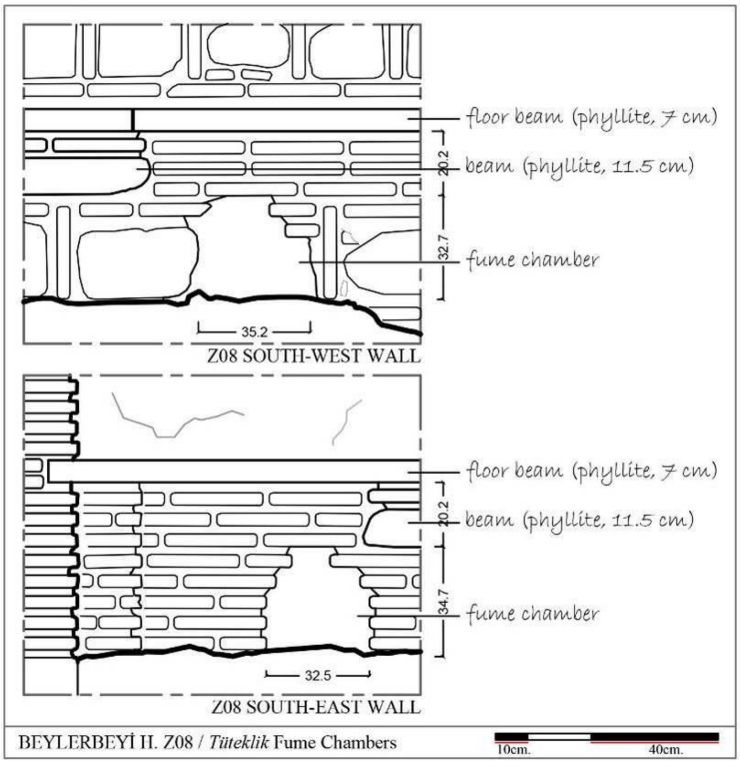

Figure 281. *Tüteklik* fumes chamber details used in the Z08 space of *Beylerbeyi Hamamı*

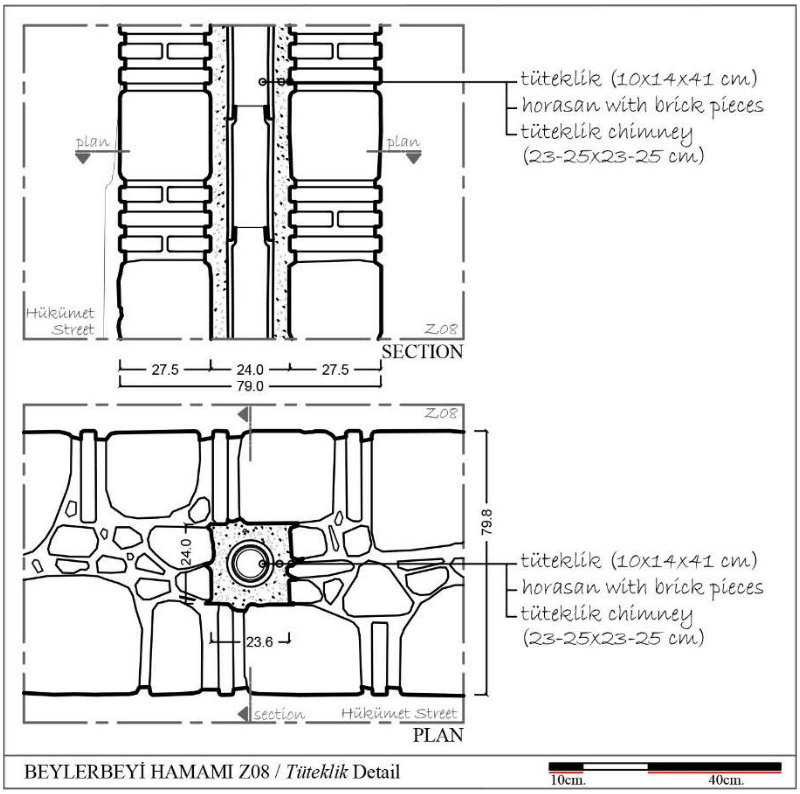

Figure 282. *Tüteklik* and *tüteklik* chimney details used in the Z08 space of *Beylerbeyi Hamamı*

CHAPTER 5

CONCLUSION

Edirne was an important centre and one of the three glorious cities of the Ottoman Empire along with İstanbul and Bursa. The 14^{th}-16^{th} century Ottoman public baths located in Edirne, which were studied within the scope of this thesis, were built in a period when Edirne was highly influential in policies and economics of the Empire, and in a rich socio-cultural environment that directly influenced the construction culture. In addition, these public baths were used as *non-confessional urban foci* (Kafesçioğlu, 2010: 108) in order to appeal to all religious and ethnic groups of the relatively young empire in the early Ottoman period, as mentioned before. In the light of these, the 14^{th}-16^{th} century Edirne public baths are one of the building types that represent the technical knowledge and sense of aesthetics of the Empire in the most successful way.

As a part of this thesis, the buildings demonstrating the most representative characteristics of the 14^{th}-16^{th} century Edirne public baths were examined in detail. These public baths, *Gazi Mihal Bey Hamamı, Beylerbeyi Hamamı, Yeniçeriler Hamamı, Topkapı Hamamı* and *İbrahim Paşa Hamamı*, were not repurposed in their later life for a use that is not in line with their original function, not subjected to any restoration work and/or significant repair, and not subjected to any partial cancellations and/or additions, which may affect the visibility of the authentic features. The information gathered from these buildings has great importance for a comprehensive understanding not only of the public baths but also the other building types constructed in the early and classic Ottoman period. Accordingly, this information could be used to develop sustainable conservation decisions by means of policies compatible with the authentic components of the buildings.

As mentioned in the Venice Charter (ICOMOS, 1964) and further detailed in the 11th ICOMOS General Assembly (ICOMOS, 1996), first and foremost, the buildings should be comprehensively documented and precisely understood in order to develop appropriate and sustainable conservation studies. It must be admitted that architectural heritage, even single buildings, cannot be considered in isolation. These public bath buildings should therefore also be considered in conjunction with their socio-cultural and economic meanings and as an important part of the urban tissues, waqf institutions, and water-related structure complexes.

The information about Edirne's urban history and waqf institutions are very useful sources to understand the construction and usage processes of the public baths. The relation between the public baths, settlement history and the water-related structures were also examined within the scope of the thesis. In addition, the construction dates and locations of the public baths, which are one of the inseparable parts of the urban cores/nuclei, represents the city's demographic structure and developments.

However, most of the historical records are not accessible or available at the present day. These records, which have great documental value to the architectural heritage, remained idle as objects of museums or archives for a long time. The information about the architectural heritage has not been brought to light except in a small number of studies mostly undertaken by a few individual researchers. It is imperative that this type of studies must become widespread. Also, most of the water-related sturctures could not survive to present day and the studies focussing on them are generally limited to their values of them in terms of architectural history perspective.

It is a huge loss, not only from a conservation of cultural heritage, but also art and architectural history point of view, that only a limited number of examples of these public baths reached to the present day and most of them are currently in ruins. It is quite difficult to document some of this information under existing conditions and some of the important details have already almost entirely been destroyed.

The building lots of these twelve public baths are protected by registration. The close surroundings of the *Sultan Selim Saray Hamamı*, *Tahtakale Hamamı*, *Mezit Bey Hamamı*, *Topkapı Hamamı*, *Tahmis Hamamı* and *Sokullu Hamamı* are part of the "urban protected area" and *Gazi Mihal Bey Hamamı*, *Beylerbeyi Hamamı* and *Abdullah Hamamı* are part of the "interaction and transition zone" according to

Edirne Conservation Development Plan, which was approved in 2007. The *Kum Kasrı Hamamı* is located within the borders of a 1st degree Archaeological Conservation Area since 2003. On the other hand, there is not any protection decision about the close surroundings of the *Yeniçeriler Hamamı* and *İbrahim Paşa Hamamı*.

In addition, the existing architectural drawings of these buildings contain information only on general physical features. The technical values of the Ottoman baths were ignored in most of the previous documentation efforts. This situation caused the construction details of the public baths, destroyed or repaired with materials incompatible to the authentic ones, to be permanently lost, because of the gaps in the existing legal framework.

The existing legal frameworks do not expect a documentation work to be specialized according to different building types for the conservation of "single buildings". For conservation projects, a similar documentation practice is deemed sufficient for all type of structures. However, different building types have outstanding architectural features unique to them. Due to the negligence of these building type specific values, most of the information that buildings can offer do not make its way into the architectural documentation. For instance, it is allowed to prepare architectural drawings for projects for the conservation of public baths without considering the installation systems properly, although these are one of the most distinctive features of this building type.

In fact, this situation is an important problem for not only the specific details or systems of building types but also the main construction techniques of entire building types. According to the TMMOB Chamber of Architects of Turkey's 28.12.2011 dates 42/31 numbered decision, which was prepared in the direction of the articles number 3386 and 5226, and the Law on the Conservation of Cultural and Natural Property number 2863, the phases of a conservation project is described (*Rölöve, Restitüsyon ve Restorasyon Projelerine İlişkin Teknik Şartname*).

Although in the 6th clause of this document, it is stated that the survey drawings must include the current states of the construction techniques, the scope and the boundaries of this type of drawings are not clearly specified. Therefore, unless the project owners have a particular sensitivity to this issue, the survey drawings documenting only the basic architectural features are accepted as sufficient, and the lack of information on the authentic construction techniques of the buildings is completely overlooked. In addition, most of the construction details is revealed during the conservation implementations. However, according to the 10th clause of this technical specification, only the photographic documentation of the new findings are legally sufficient.

The underlying reason for these problems is that the technical features of the buildings are not valued by the authorities. However, as especially the technical values of the Ottoman public baths cannot be denied, it is also clear that an appropriate and holistic conservation approach to these buildings cannot be developed without understanding these technologies correctly.

It should be taken into consideration while scoping survey drawings that the construction techniques are the inseparable parts of the architectural features of buildings. Indeed, as stated in the 11th ICOMOS General Assembly (1996: 4), the level of detail must be chosen according to the purpose of documentation. Undoubtedly, the protection of the problem-specific technical details, which are very valuable in terms of art, architectural and construction histories, must be the responsibility of the project owners and teams that undertake the conservation projects. However, these details are too valuable to be left to the discretion of individuals and must be protected by law.

5.1. The Newly Revealed Construction Details

The stereotypical architectural documentation methods based on the plan drawings from one or two different elevations and section drawings of the buildings are not enough to understand, analyse and explain the construction techniques and processes. Within the scope of this thesis, a new way of looking at the documentation of construction techniques has been developed in the phases of surveying and analysing the buildings. According to this method, which was firstly used by Şahin (1995), from the foundation level to the upper structure, each point where the construction techniques change is carefully documented. In this thesis, the 14th-16th century Edirne public baths examined in detail not only through different plan levels and sections, but also through system sections and detail drawings, as the construction techniques and processes of the buildings can only be analyzed with detailed system sections.

The data were obtained directly from the buildings by this method and evaluated based on the information gathered from the relevant literature. The readability of construction techniques is in general quite high in the buildings studied here in detail. For this reason, completion by using the historical documents was necessary only in a few limited areas, which revealed many new details about the construction techniques used in the 14^{th}-16^{th} century Edirne public baths. In fact, these details are important for the correct understanding and protection of not only this building type but also many buildings constructed in the same period with the masonry system. The most important ones of these newly revealed details related to the construction techniques can be summarized as follows:

- In all 14^{th}-16^{th} century Edirne public baths studied in detail, limestone blocks and phyllite plates were used with great courage and awareness. Different from the other buildings constructed in the 14^{th}-16^{th} century, stone materials used in all components from the foundation of the buildings up to the upper structures were finely or roughly carved. The stone units located in the transition elements and upper structures were used as both bases and load-bearing elements. Especially, the finely-cut limestone blocks used in the door and niche arches, transition elements and upper structures of the *Gazi Mihal Bey Hamamı* are technically and aesthetically quite remarkable. The front faces of these blocks were carved at varying levels according to whether the faces are plastered or not. The front faces of some of them were sculpted elaborately and finely, and these stone units were placed in such a way that they would be projected approximately 3-4 cm. This detail makes it clear that plaster was not used on the front façades of these blocks since plaster was not used at the projecting faces. Therefore, the clearly-sculpted front faces were left exposed. On the other hand, the front faces of the roughly carved stone blocks were plastered and the final shape was done by lime-based plaster or stucco layers.
- In addition to square and rectangular bricks (Figure 206-A1, B1, C1, D1, E1, F1), eight other special brick types (Figure 206-A2-6, B2-3, E2) were

identified in the site surveys. These eight types are considered to have been prepared in brick quarries according to the requests of architects. The sizes and smooth edges of these bricks indicate that they must be shaped/moulded prior to firing. They were most likely moulded as square and rectangular shape bricks, and then shaped for a second time by another mould in the air-drying phase. Especially in the *Beylerbeyi Hamamı*, these brick types were used in the door openings, transition elements and upper structures.

- The bricks were used as masonry system units to provide plain or special forms. In addition, another brick type was detected in the site surveys. This type of bricks (Figure 206-B3) must be used to increase the surface adhesion of thick plaster layers.
- In all 14th-16th century Edirne public baths studied in detail, the traces of timber structural elements were identified in the site surveys. These traces were founded in the main and partition walls, transition elements and upper structures. In addition, the traces indicate that the dovetail-shaped timber clamps were used in the *Beylerbeyi Hamamı* to interlock the cut-stone blocks located on the arches at springer level and on the sides of door openings.
- Forged nails with different functions and numerous types were identified in the site surveys. Firstly, the nails were used for aligning the systems like *pöhrenk*s and plaster changing lines, which need to be placed on a horizontal line for precise measurements. Secondly, they served as reinforcements for thick plaster and stucco layers. Lastly, they were used as load-bearing elements for horizontal cold water *pöhrenk*s and projected brick or stone units located in the walls, transition elements and upper structures. These elements were supported by nails, which were not completely buried/hammered into the wall but rather projected five to twelve cm. Nails might also have been used to connect timber lintels and *puştuvan*s, but despite the traces of timber lintels were specifically examined for this purpose, no nails found.
- The entire *cehennemlik* section was not readable in any public baths. However, it was identified that the foundation walls were constructed with rubble stone masonry up to a certain level, then the alternating rows of brick

and stone masonry system was used similarly to the walls of the superstructure.

- Written sources offer a lot of information about floor paving stones. However, there is not any detailed and comprehensive study on the basic design principles of the floor systems. In the Edirne public baths studied in detail, a dual beam system formed with flagstones (most probably phyllite plates), placed on the foundation walls and *cehennemlik* footings, was identified.

  Firstly, the flagstones of approximately 55-70x100-130 cm dimensions with thickness varying between 8 and 14 cm were placed on the *cehennemlik* footings and the foundation walls. These elements were used as beams. Secondly, the flagstones of 5-9 cm thickness and 60-90x100-120 cm dimensions were used as floor beams. They were placed on the beams and foundation walls, perpendicular to beams and almost attached to each other. An almost continuous surface was constituted with floor beams and achieved level was constituted by placing bricks and *horasan* with brick pieces on floor beams.

  Finally, the floor pavement was completed by placing polished stone plates (most probably neritic limestone plates) with four to ten cm in thickness and approximately 70x100-120 cm dimensions without any joints.

- The square planned brick masonry *cehennemlik* footings (45 cm), which support the elevated floor system, were placed in 45-50 cm intervals from each other and from the foundation walls. It is also noticed from the space dimensions that the first course of *cehennemlik* footings were built, attached to the foundation walls in some of the spaces examined within the scope of the thesis to balance the load distribution and so as not to change the dimensions between *cehennemlik* footings.

- In some spaces, according to the space dimensions and *cehennemlik* footings' locations, brick masonry units were used as corner supports to hold up elevated floor systems. These units constructed with isosceles triangle-shaped plan, 55 cm in long side and 25-30 cm in short sides, and their long sides were curved inwards.

- It is identified that there are two different techniques used for *seki*s and *göbek taşı* in order to increase the floor level. These systems differ according to their location. The *seki*s located in the *ılıklık* spaces were constructed using 4-6 brick courses placed on the floor beams. On the other hand, the *göbek taşı* and *seki*s located in *sıcaklık* spaces were formed by rising the *cehennemlik* footings. By this way, *göbek taşı* and *sıcaklık seki*s could benefit from the main heating system of the public baths. In other words, heating the *seki*s located in *ılıklık* spaces by underfloor heating systems was not considered necessary.
- Main wall construction technique used in the 14^{th}-16^{th} century Edirne public baths is alternating rows of brick and stone masonry. These walls constructed by repetition of two or three courses of brick and one course of cut or rough-cut stone. In the most of the buildings, the stone masonry units are surrounded by vertical bricks, called *cloisonné masonry*. In the public baths studied in detail, material continuity was achieved throughout the wall thickness with alternating wall system in which horizontal stone and brick courses continue along the wall thickness, similar to the late period Byzantine churches constructed in İstanbul. The brick rows, which continue along the wall thickness, prevent separation of two vertical layers of walls by moving independently from each other due to the vertical loads, therefore, strengthen the system. In addition, this technique increases the elasticity of the masonry walls, preventing the formation of structural cracks due to the horizontal loads.
- The masonry walls were constructed in stages and brick rows were used for levelling. The level of the door openings, horizontal water channels, *çörten*s and timber lintels were arranged by decreasing or increasing the number of brick rows than the rest of the wall at the levels where these elements are used.
- While the walls constructed in stages, wall levelling was also done at stages called *savak*. The brick courses were used as *savak* levels in alternating walls, and levelling was achieved by making small changes in mortar thicknesses. The wall rose by repeating these stages.

- Traces of timber lintels and *puştuvan*s embedded in the masonry walls can be observed in the collapsed parts of all the public baths studied in detail. The remaining traces reveal that these buildings were surrounded by two timber lintels, which were parallel to each other and embedded the masonry walls. These were placed on the brick courses at every two or three *savak* level (110-160 cm). It is understood that the timber lintels located on the same wall and at the same level were connected to each other by *puştuvan*s, which were placed perpendicular to the lintels at every 80-120 cm. Timber lintels were used especially in spring line of all the arches and the transition levels between walls, transition systems and upper structures, which are critical points in terms of the structural behavior of the buildings, most likely as a precaution against the sliding risk.
- According to Ousterhout (1999: 210), the mortar thicknesses increased in the late Byzantine period to accelerate construction duration, but, this method increases the fluidity of the structure because of the phenomenon called "plastic flow of mortar", which occurs during the time when mortar has not reached to its final hardness. The author also adds that timber lintels were used inside the walls to keep the structure stable (Ousterhout, 1999: 192-194, 210-211). In addition to this function, the timber lintels increase the elasticity and endurance of masonry systems against horizontal loads. Timber lintels embedded in the masonry walls have a connecting role between walls and between masonry units by providing integrity within the wall thickness.
- Especially the traces of the structural timber elements are very important. In the water depots, which have an elongated and narrow rectangular plan, some of the *puştuvan*s placed at the spring level, which normally connect lintels located on the same wall at the same level, must have been extended between long walls. These *puştuvan*s used as timber ties must have been lying in the open along the space and connect lintels embedded in the long walls of the water depots. These timber ties are used to resist the thrust created by the vault on the water depots' side walls by connecting the walls together, which are weak against out-of-plane lateral movement. Therefore, they strengthen the structural system. The number of timber ties of hot water depot is higher than

that in the cold water depot, possibly in order to accommodate the dynamic load resulting from the heated water. According to the traces noticed directly to the buildings, one in every three *puştuvan*s (240-360 cm) are extended and used as ties in the hot water depots.

- These elements were most likely used as scaffoldings for the centring during the construction. Some of these elements must have been left after the construction in some buildings/spaces and then the high earthquake resistance of them recognized (Yavuz, 2001, 368). However, there is nearly no information in written sources on this important technique.
- The traces of timber lintels embedded in the walls located at the starting level of the transition elements were identified in all of the public baths studied in detail. In addition to these, the traces of timber lintels and *puştuvan*s embedded in transition elements of *ılıklık* and *sıcaklık* main spaces were noticed in the *Beylerbeyi Hamamı*. The total projection length of these pendentives with muqarnas reaches 150 cm. Traces suggest that the timber lintels continued along the muqarnas and transferred the load of projection to the masonry walls and the lintels were supported by the *puştuvan*s, which were placed perpendicular to the lintels.
- In the combined vaults of the *eyvan* in *Beylerbeyi Hamamı sıcaklık* section, traces of timber elements embedded into the transition between cross-vaults and dome, at the starting line of the dome, were noticed. These elements must be used as a tension ring against thrust.
- One two-layered vault used in *Yeniçeriler Hamamı*, one flat vault with support arches and two depressed-profiled vaults with stone support arches in *Topkapı Hamamı* were noticed during the site surveys. According to the literature survey, there are not any contemporary examples similar to the two-layered vault. The other vaults used in *Topkapı Hamamı* are also very rare examples and used only in this public bath, the *Tahtakale Hamamı* and the Thessaloniki II. Murad/Bey Hamamı, all of which were constructed during the Murad II period and founded directly by Murad II. These unique vaults with a rich visual impact, have very interesting construction techniques. However, all of

them currently suffer from critical structural problems and are vulnerable to the external factors.

- The two-layered lobed dome located in the *sıcaklık* main space of the *Beylerbeyi Hamamı* is also a unique example. On the outer layer of this dome, a filled system built by half brick masonry was used. On the inner layer, hollow cubes/caissons/coffers were used in front of the outer layer and built by the vertical bricks placed parallel or perpendicular to the outer layer. Hence, the dome was made ligther without changing the dome thickness. In the literature search, considering the region and period, any contemporary examples similar to this dome were not found.
- In the main *sıcaklık* space of the *Topkapı Hamamı* women's section, the traces of timber elements of 16x20 cm in cross-section were identified. These traces suggest that the timber elements surrounded the depressed profile dome, used at the level of dome base and embedded close to the intrados. The location of these timber elements, used as a tension ring, is very appropriate to counteract thrust load, which would occur on the inner side of the dome base. This timber tension ring might was most likely produced specifically for this purpose with connected arc-shaped timber elements, which were bent based on the dome plan by being soaked in water, or arc-shaped timbers of centring used in dome-arch constructions might have been (re)used. The information gathered as part of this study is not sufficient to reach a certain conclusion yet.
- Depending on the dome profiles, thrust lines and possible hinge points, in other words the risky areas, change. According to traces gathered from directly the 14^{th}-16^{th} century Edirne public baths studied in detail, the locations of the timber tension rings, which were embedded into the domes and drums, indicate that the master builders and/or architects of this period were very experienced in and extremely conscious of the structural behaviour of masonry shells and possible risks associated with them.
- It was identified that three different schemes were used for the plans of the hot and cold water depots of 14^{th}-16^{th} century Ottoman public baths located in Edirne. In the most common scheme, the hot and cold water depots were built in the same space, with an elongated and narrow rectangular plan, and

the depot spaces were separated from each other with a masonry wall constructed under a supporting arch. In the second scheme, the hot and cold water depots were constructed as two separate spaces, with a narrow rectangular plan, and the cold water depot is located either in parallel or perpendicular to the hot water depot. In the third scheme, the hot and cold water depots were arranged in the same way as the depots in the second scheme, but cold water depots were placed on a vault and the space under these vaults was used as storage area.

- From the information gathered from the 14^{th}-16^{th} century public baths, it is obvious that the cold water depots were generally used as reserve water depots. These cold/reserve water depots were used to resettling the water before it was directed to the bathing spaces and/or hot water depots.
- According to the traces gathered from the buildings, water depots seem to have require periodical and comprehensive maintenance. These requirements had been predicted and specific solutions were developed for maintenance. The access of both building materials and staff into the water depots during maintenance was a critical requirement; however, the depots do not have any opening except for water control windows and top windows, which could not have been used for this purpose. Under these circumstances, one of the short walls and the partition wall were constructed as non-structural walls, which would be responsible for supporting only their own load. For this reason, these walls were constructed under a vault or a supporting arch to separate them from the main load-bearing system. By this way, during maintenance or repairs, these walls were easily pulled down without causing any structural problems. At the end of the maintenance and/or repair work, the walls were constructed again.
- Another maintenance-specific solution was noticed during the site surveys. A *pöhrenk* line, inside of which was filled with *lökün*, was placed between the hot water depot floor level and the floor level of the *seki* located in the *sıcaklık* with a decreasing inclination of 10 to 28^{o}. When the water inside the water depot had to be emptied, inside of these *pöhrenk*s were opened up, and after

the repairs or maintenance, refilled with *lökün* to provide waterproofness and then the wall surface is plastered.

- Different systems were used for the connection between the urban water distribution network and the public baths. Especially the *maksem* unit observed in the *Topkapı Hamamı* is a very important detail about the installation systems of the Ottoman public baths.
- Water collected and heated in the hot water depot was transferred to the hot water distribution system within the building through connection *pöhrenk* lines, which were placed 10-25 cm above the water depot floor level and extended along the wall thickness. These connections, which were found below the water control windows on the partition wall located between hot water depot and *sıcaklık* spaces, were placed with an inclination (approximately 7^{o}) decreasing from hot water depot towards the *sıcaklık* spaces.

  To transfer the water from the urban water network directly or through the *maksem* or the cold/reserve water depot to the cold water distribution system within the building, some connection water lines were used. There is 60-125 cm height difference between two water lines. The connection was achieved at one point or at multiple points by the use of vertical water channels. In the *Gazi Mihal Bey Hamamı*, relieving arch was used above these vertical channels, in order to decrease the dead load on *pöhrenk*s. In the other buildings, flagstones were used as lintels for this purpose.
- In the 14th-16th century Edirne public baths, stone courses of the alternating wall or phyllite plates, 6-9 cm in thickness, were used at the upper level of horizontal water channels, which were positioned horizontally along the walls during the construction. Thus, the dead load of the building sitting on the *pöhrenk*s was transferred to the walls.
- In all 14th-16th century Edirne public baths, two *pöhrenk* lines were placed in the water channels and the top ones were used for cold water, while the bottom ones for hot water.

- The open front faces of water channels were closed by half bricks, single vertical bricks or *horasan* with brick pieces. Thus, the *pöhrenk*s could be easily reached during repairs.
- The ends of cold and hot water *pöhrenk* lines were closed with the *lökün* fillings. It is known that this detail is commonly used in all public baths. On the other hand, a very important and unique detail was observed at the end of the hot water line located at the east corner of the *İbrahim Paşa Hamamı* bathing spaces. The hot water *pöhrenk*s lies along the southeast wall after the last tap point, then continues upwards with 14^o slope on the northeast wall approximately for 120 cm. In addition, end of this line was closed by lökün infill. This detail should have been developed to prevent cavitation in the closed pipe system. Nonetheless, it is not possible to come to a definite conclusion without detailed analyses, considering also the fluid behaviour and the mechanical properties of the *pöhrenk*s.
- Traces found in the *Yeniçeriler Hamamı* suggest that the wastewater was directed to the *ılıklık* space with the slopes and channels carved on the floor pavements. Drainage of the water from the building was achieved by a *pöhrenk* line extending from floor level to the street with a decreasing inclination.
- In the *cehennemlik* sections, which extend under the bathing spaces, openings/canals were formed in the foundation walls for the circulation of the fumes coming from *külhan*. The fumes flow openings, approximately 40-50 cm wide canals, were spanned with phyllite plates and another type of flagstones used as lintels, which were roughly shaped or used in the shape it was mined from the quarry.
- Fumes circulated along the *cehennemlik* level were discharged from the building by vertical *tüteklik*s embedded into the fumes chimneys constructed inside the walls. The *tüteklik* chimneys were placed behind the water channels so that the chimneys could continue along the length of the walls without interruption.

  The front faces of the fume chimneys were closed with masonry, while at levels where water channels were used, the front faces were closed by single vertical bricks. With this detail, specific points where intervention could be achieved easily in case a repair was required.

- Because of their functions, all of the *cehennemlik* spaces must have been a completely closed system as an air and waterproof space. However, this space must have been periodically cleaned because of the soot deposit. These requirements had been predicted before the construction and maintenance specific details were formed. One of the most important detail is the opening providing controlled access to the *cehennemlik* section. This opening, closed with a masonry infill wall under normal circumstances, with approximately 40x40 cm dimensions, was formed on the long exterior wall of the hot water depot and spanned with an approximately a 170 cm brick arch. Thus, the dead load was supported by this arch and the infill inside the opening was emptied during maintenance without causing any structural problems.

5.2. Further Research Topics

In this thesis, the academic researches conducted by historians, art historians and archaeologists were utilized as main sources of the settlement history and construction preparations. While these qualified research findings were extremely beneficial to the thesis, it is clear that studies on these topics are insufficient. Moreover, the Ottoman archival records, which have key importance for history studies, must soon be translated into modern languages and opened to academic researches.

These records also provide information about the Ottoman architectural metrology and units of measurement (Özdural, 1998: 101-110). This information has great importance to decoding the standardisation of building materials such as bricks and cut-stones. According to the findings and these records, the typology of primarily building materials used in the Edirne in the 14^{th}-16^{th} century was revealed within the scope of this thesis. It is also known that there could be a strong relation between the units of measurement and main design scheme of the buildings. This relation should be deciphered by detailed studies.

In addition to these, the Ottoman baths were designed and built by considering not only the construction processes, but also the operational phase. The special solutions developed for the regular maintenance of buildings and other specific details identified within the scope of the thesis are exceptionally valuable. These details are extremely important as they show the care that was paid to the whole life cycle of the building, from the initial stages of construction well into the operational life of the buildings. This approach and its tangible indicators are very important for the construction history. Thus, this topic should be studied in detail in accordance with the historical records.

Furthermore, the specialists from many different disciplines, such as civil, mechanical, metallurgy and geological engineering and chemistry were consulted for the related topics. However the arguments discussed within the scope of the thesis are based on techniques that have been documented for the first time by this thesis or that have not been examined in detail before. Therefore they should be studied with necessary scientific rigour and further analysed by a team specialized in relevant disciplines. This type of cross-disciplinary cooperation should be planned as a goal-oriented multidisciplinarity or a problem-oriented interdisciplinarity (Becker, at.al, 1997: 41-42).

Although the monumental buildings were constructed with high safety margins, protecting these structures depends largely on the precise understanding and analysing of their technical infrastructures. Unfortunately, several serious structural problems were noticed in most of the studied public baths. A large part of these damages resulted from the loss of the structural balance that the buildings had in their initial conceptions, due to the partial collapses within the buildings. If the balance problems are not solved immediately, these structural problems will soon become more serious.

As a result of this thesis, many important details, which are unique or quite rare, were identified. These details must be decoded comprehensively with necessary laboratory analyses by cross-disciplinary cooperation. Furthermore, sustainable conservation approaches must be produced by a holistic understanding of the building systems, construction techniques, material features, problem sources and potential risks. Accordingly, the following is needed in order to define the working principles of the 14th-16th century Edirne public bath buildings by using non-destructive investigation methods:

- the laboratory analyses to determine the stone types of stone blocks and flagstones; the mechanical characteristics of masonry units; thermo-physical properties of building materials; mechanical resistance, hydraulicity and waterproofing qualities of the lime-based mortars and plasters,
- the analyses on thermo-physical properties and microclimatic characteristics of the buildings to examine the performance of heating systems in terms of their energy consumption capacity, heating capacity and adequacy; the original water storage capacities, consumption capacities and discharge capacities of the buildings,
- the analytical modelling on heat and water vapour transfer calculations of building materials; working principles of water distribution systems of the buildings with their problem-specific details such as water pressure and cavitation by considering the physical features of building materials and fluid mechanics; and acoustic characteristics of these buildings by considering the physical features of building materials,
- the experimental works and/or analytical modelling of the structural behaviours of the buildings in the current situation under out-of-plane loads and the structural balance of the buildings in initial states,
- the analytical modelling of the performance of the timber structural elements embedded into the masonry shells such as the timber lintels, *puştuvan*s, and tension rings, which were used from the foundation level of the buildings to the upper structures, under out-of-plane loads,
- the modelling of the construction components and processes of the unique building parts that have been documented for the first time by this thesis such as the vault systems used in *Yeniçeriler Hamamı* and *Topkapı Hamamı* and the dome of *Beylerbeyi Hamamı*.

Only in this way, these multi-component structures could be read correctly with the advantage of interdisciplinary studies.

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APPENDIX A

GLOSSARY

Aralık	The warm area, which was an intermediary space between bathing spaces and *soğukluk*, of the Ottoman bath.
Cehennemlik	The underneath heating section of the Ottoman bath.
Cupola	"*Cupola*" is a light structure on a dome, vault or semi-dome constructed as a dome-shaped recess (Davies, Jokiniemi, 2008: 106; Ching, 1995: 61).
Çırakman	The origin of "*çırakman*", which means specialized niches for *kandil*s/oil-lamps, is based on Farsi words "*çıra*" and "*çırak*", which mean oil-lamp and flaming torch (Bozkurt, 2010: 328).
Ilıklık	The warm area of the Ottoman bath.
Keçelik	The traditional felt production area in the Ottoman bath.
Künk	The word were used for terra-cotta pipes in the Ottoman Empire. The word "*künk*" should have derived from "*cuniculus*" (plural: *cuniculi*) used for underground water and drainage channels in the ancient Rome. Pliny (1875: 109) remarks that the word "*cuniculus*" takes its origins from Hispania.
Lökün	*Lökün*, whose main ingredients are lime, linseed oil and shredded cotton (Arseven, 1950: 1244), is a waterproof material used at special points such as combining *pöhrenk*s to each other or connecting *lüle*s and taps to *pöhrenk*s, where water leak needs to completely be prevented.

Oculus (pl. oculi)	"*Oculus*" (pl. *oculi*) is used to describe a circular opening in a dome, vault or semi-dome, especially that in a Roman building (Davies, Jokiniemi, 2008: 254). In classical and Byzantine architecture, "*opaion*" is used for a roof lantern or *oculus* in a dome (Davies, Jokiniemi, 2008: 256). While "*oculus*" usually refers to a circular opening especially placed at the crown of a dome (Ching, 1995: 61), the term also used as describing all type of the daylight openings placed on domes, vaults and semi-domes.
Pöhrenk	Armenian originiated "*pöhrenk*" (*poğrag*, *poğrank*, փողրակ) (Kouyoumdjian, 1970: 849), was used in the texts of Deşişî Mehmed Efendi in the 1580s and Evliya Çelebi in the 1680s, means *künk* used for terra-cotta water pipes and water distribution.
Puştuvan	"*Puştuvan*", "*puştivan*" and "*puştivan*" terms are used as relatively short timber tie-beams, which connecting timber lintels placed into the masonry walls (Sönmez, 1997: 87).
Sıcaklık	The hot area of the Ottoman bath
Soğukluk	The disrobing area of the Ottoman bath
Tüteklik	The *künk*s used as the pipes and chimneys used for the transmission of fumes were named as "*tüteklik*" in the Ottoman Empire.

APPENDIX B

THE SOURCES OF INFORMATION ABOUT SYSTEM DETAILS AND DRAWINGS OF THE SURVEYED OTTOMAN BATHS

Figure 283-292 are given in the following pages.

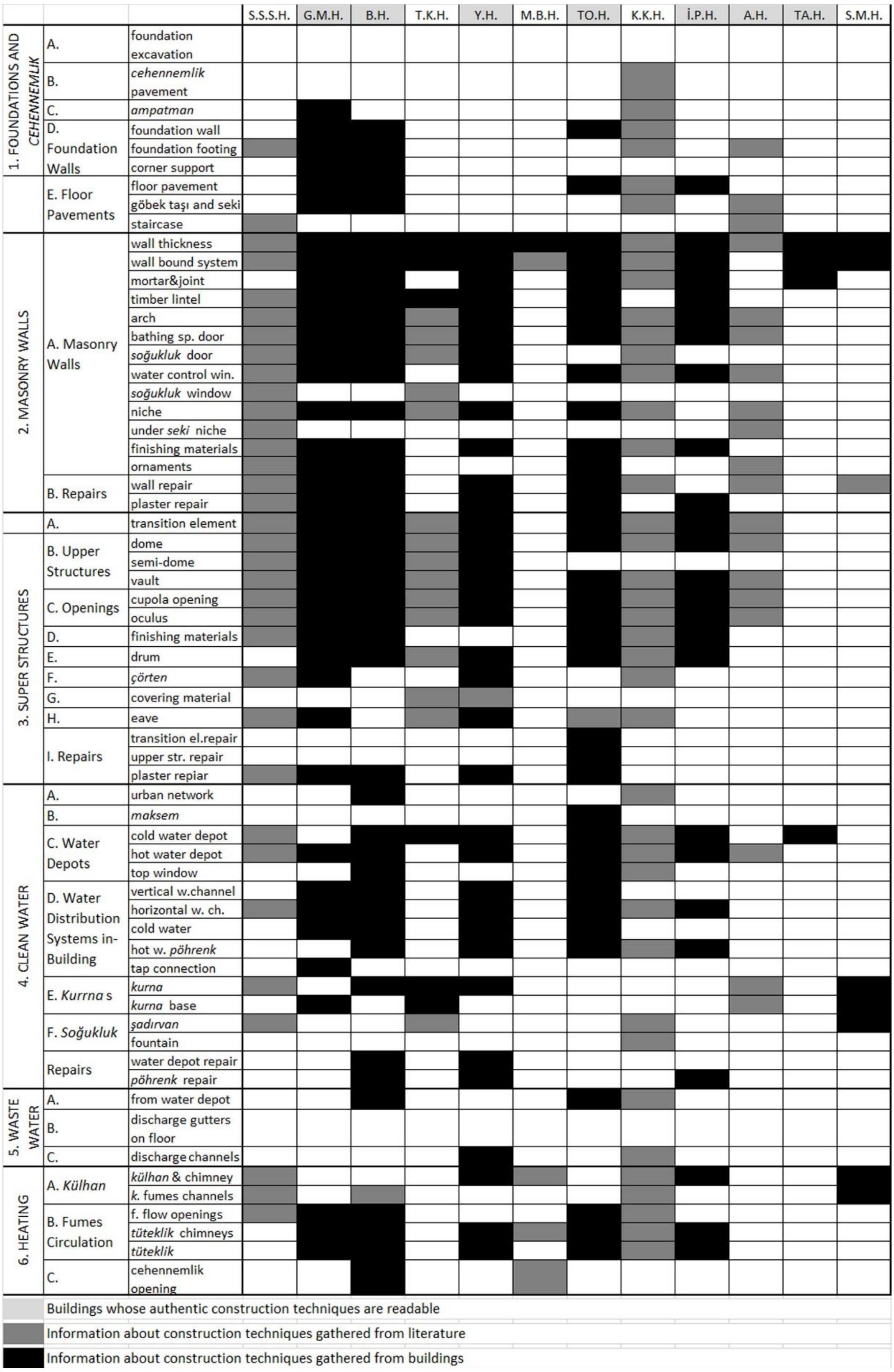

Figure 283. The sources of information about system details

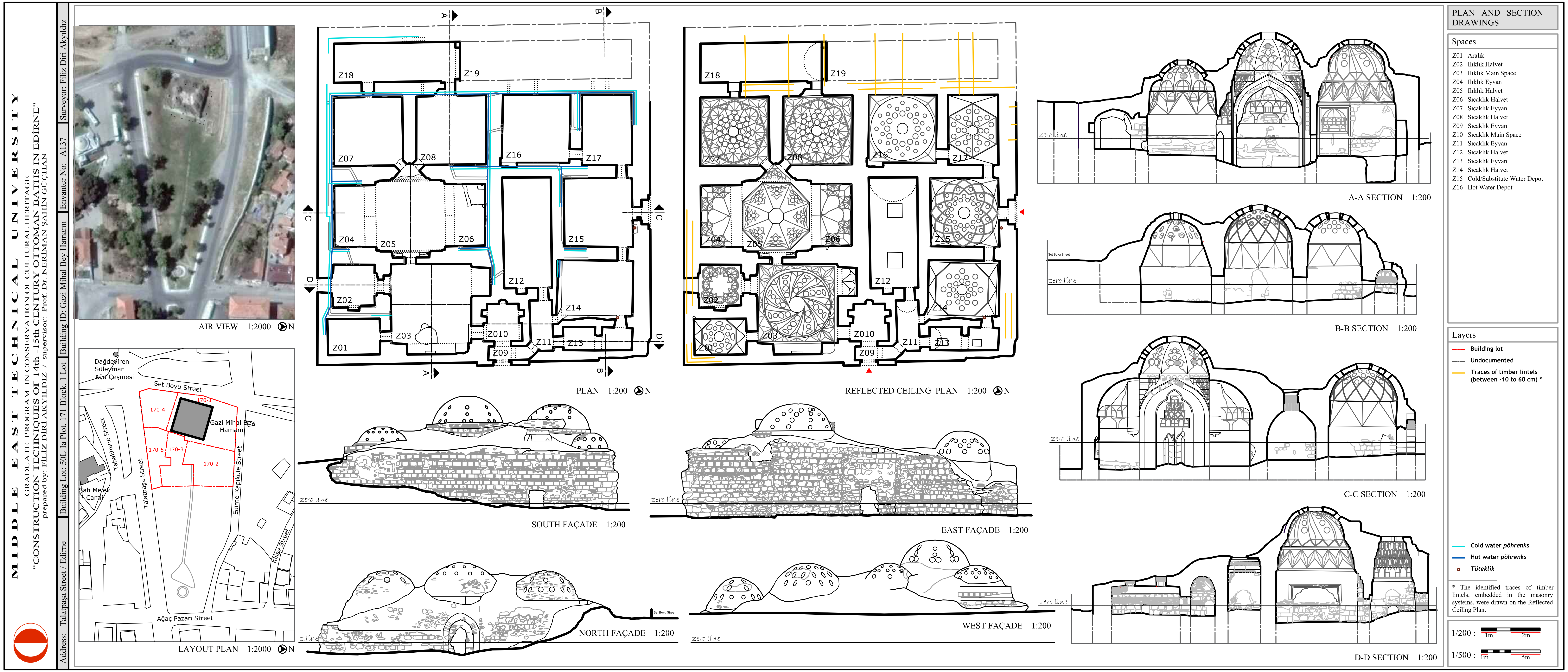

Figure 284. The site plan, plan, reflected ceiling plan, façade and section drawings of the *Gazi Mihal Bey Hamamı* (according to new information gathered from site surveys, redrawn based on: Büyükdığan, 1989: 315-316; Asrav, Bilgin, et al. 2012)

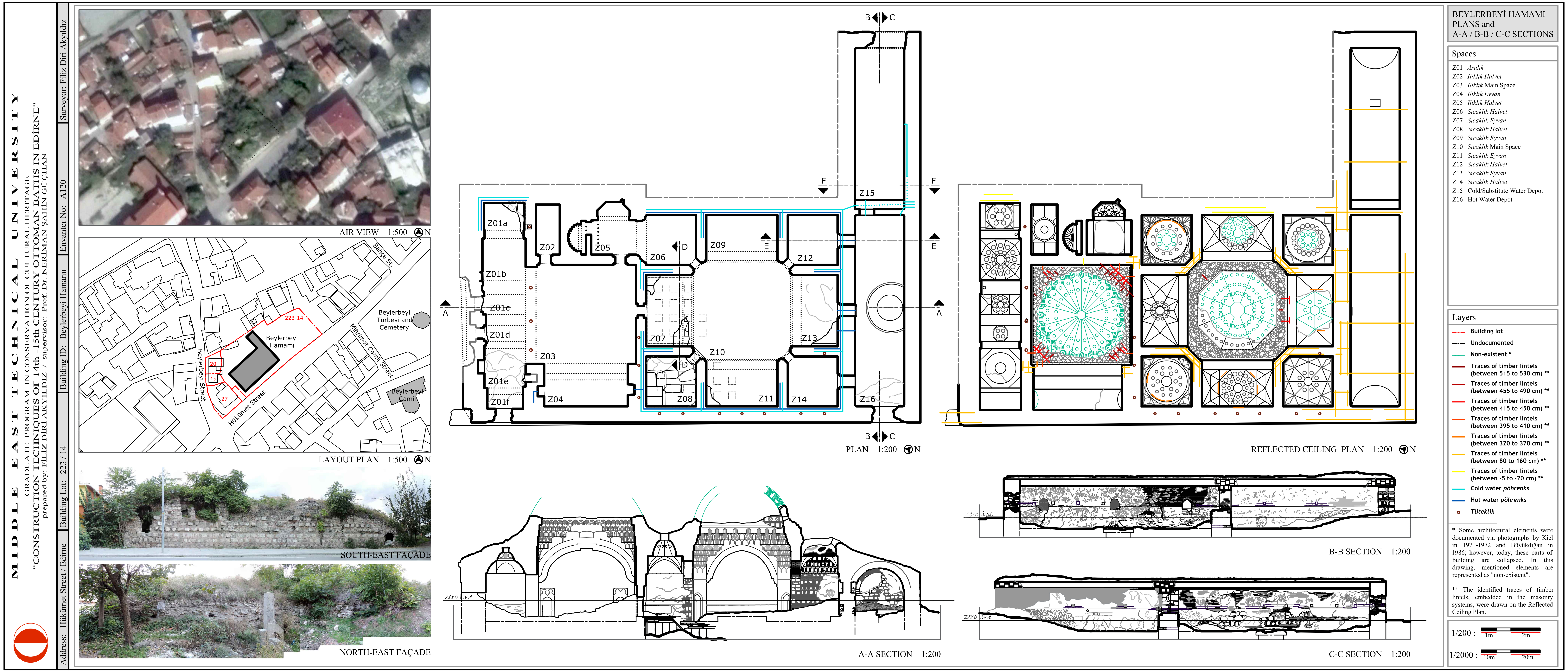

Figure 285. The site plan, plan, reflected ceiling plan, A-A section, B-B section, and C-C section drawings of the *Beylerbeyi Hamamı*

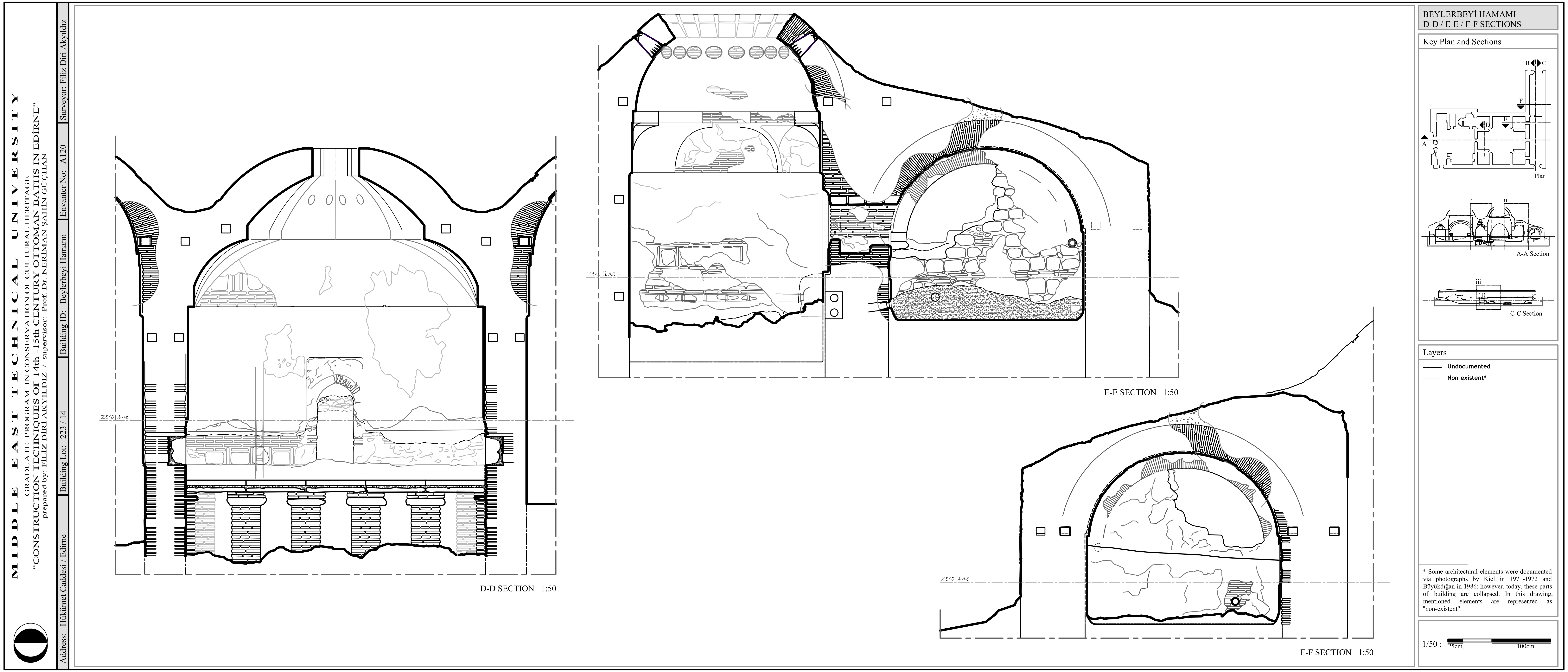

Figure 286. The D-D section, E-E section, and F-F section drawings of the *Beylerbeyi Hamamı*

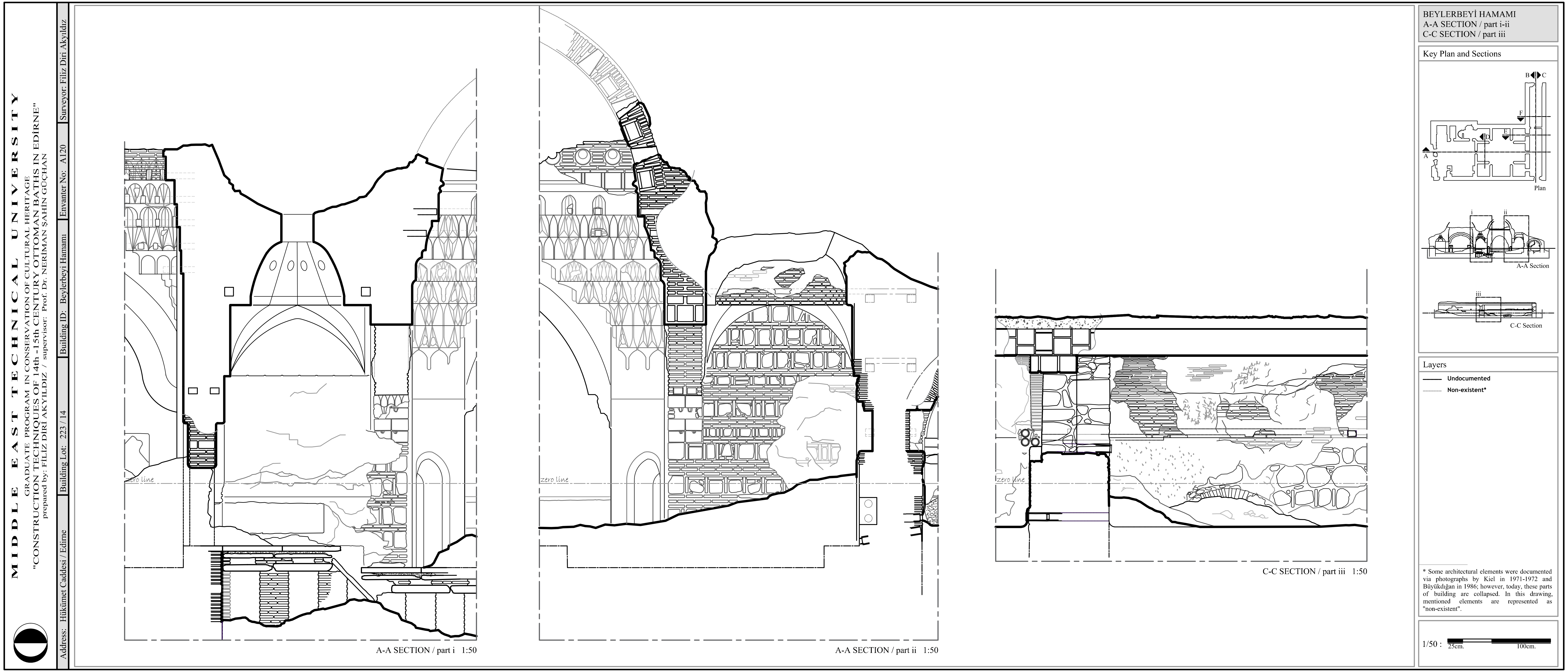

Figure 287. The detail drawings from A-A and C-C sections of the *Beylerbeyi Hamamı*

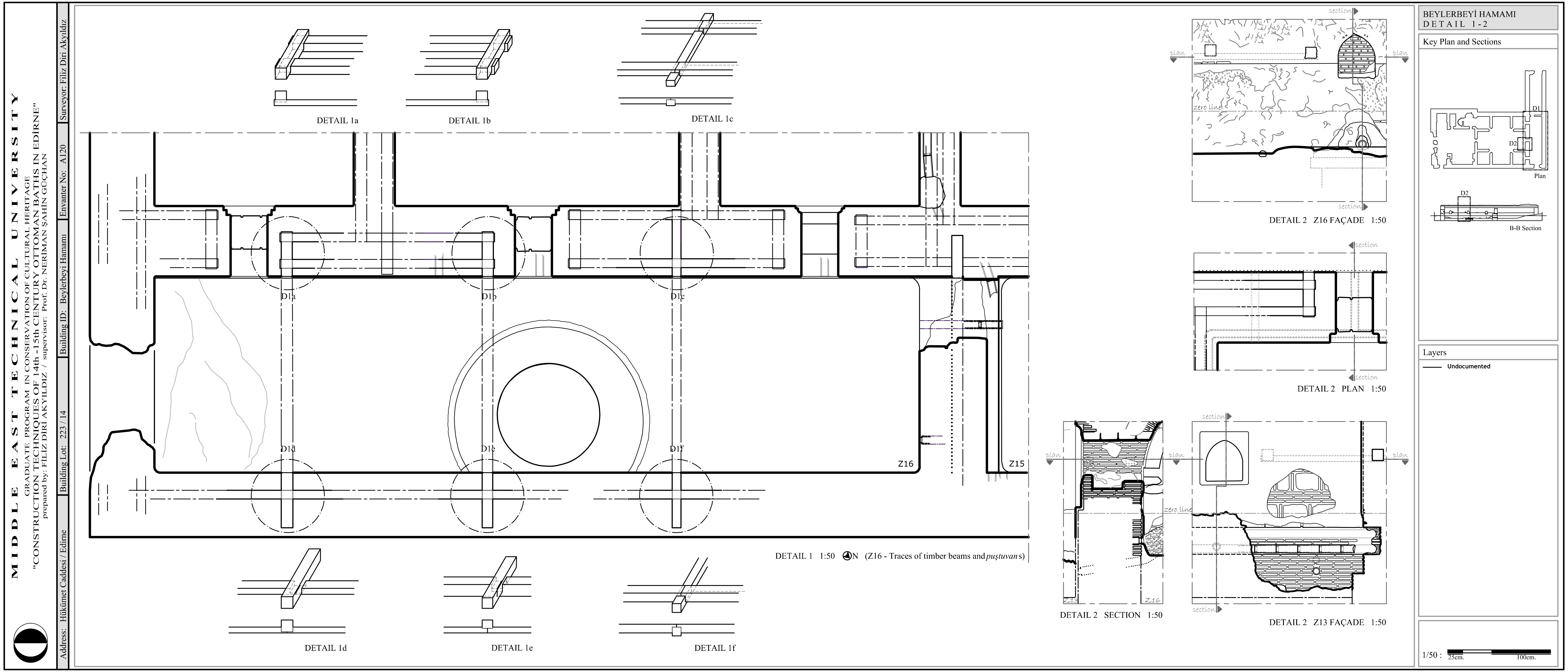

Figure 288. The detail drawings of the hot water depot of *Beylerbeyi Hamamı*

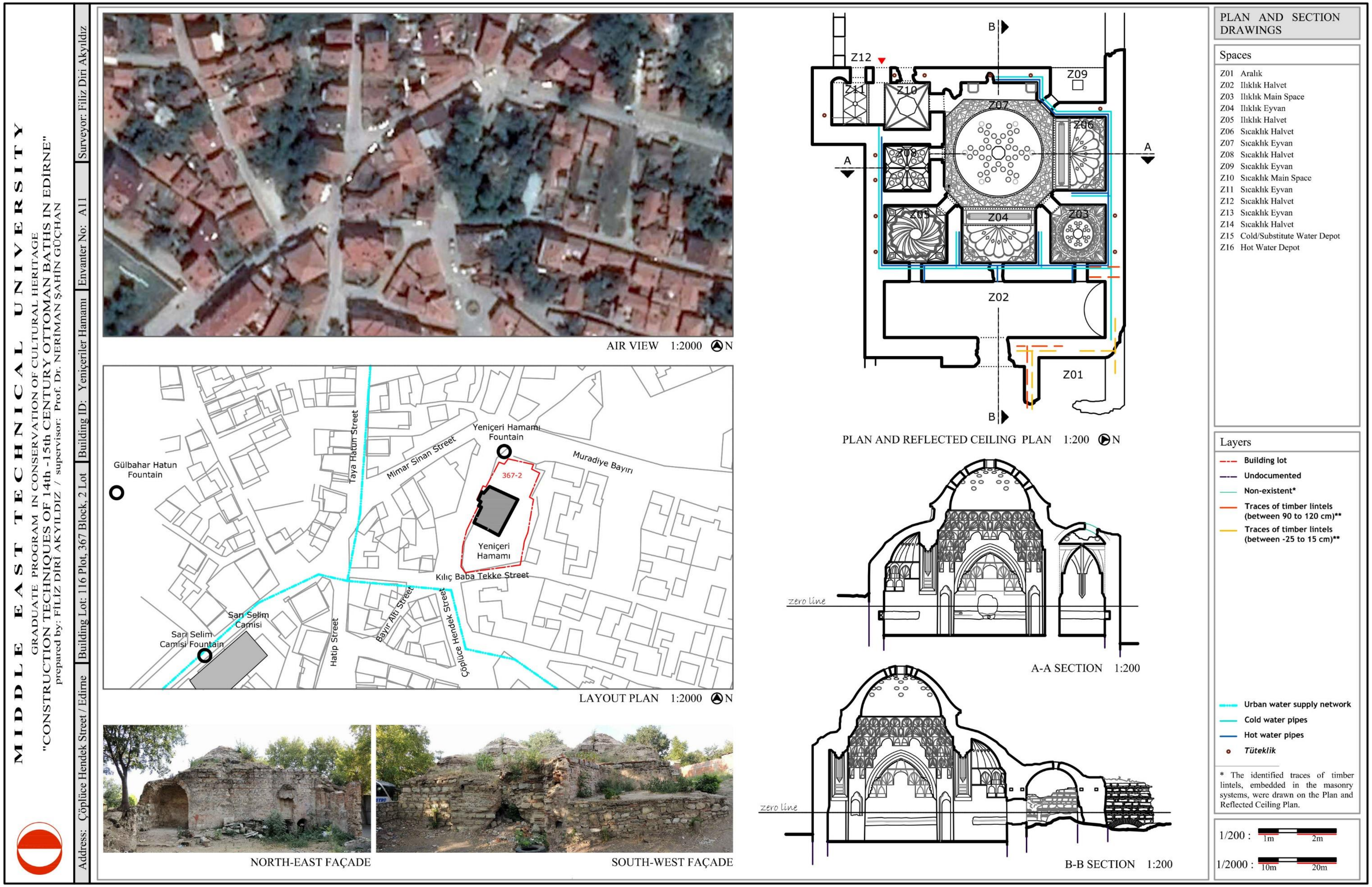

Figure 289. The site plan, plan, reflected ceiling plan, A-A section, and B-B section drawings of the *Yeniçeriler Hamamı*

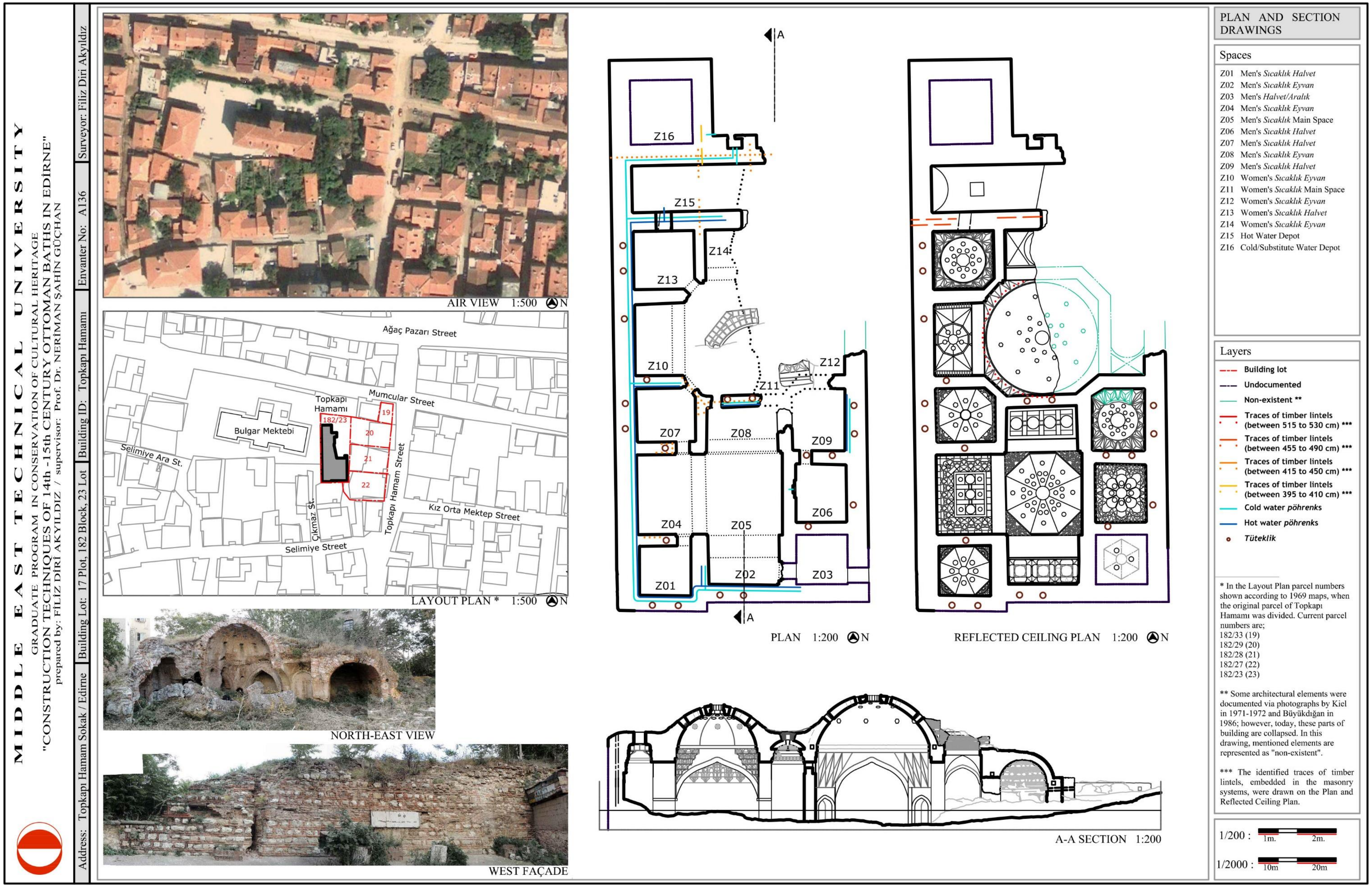

Figure 290. The site plan, plan, reflected ceiling plan, and A-A section drawings of the *Topkapı Hamamı*

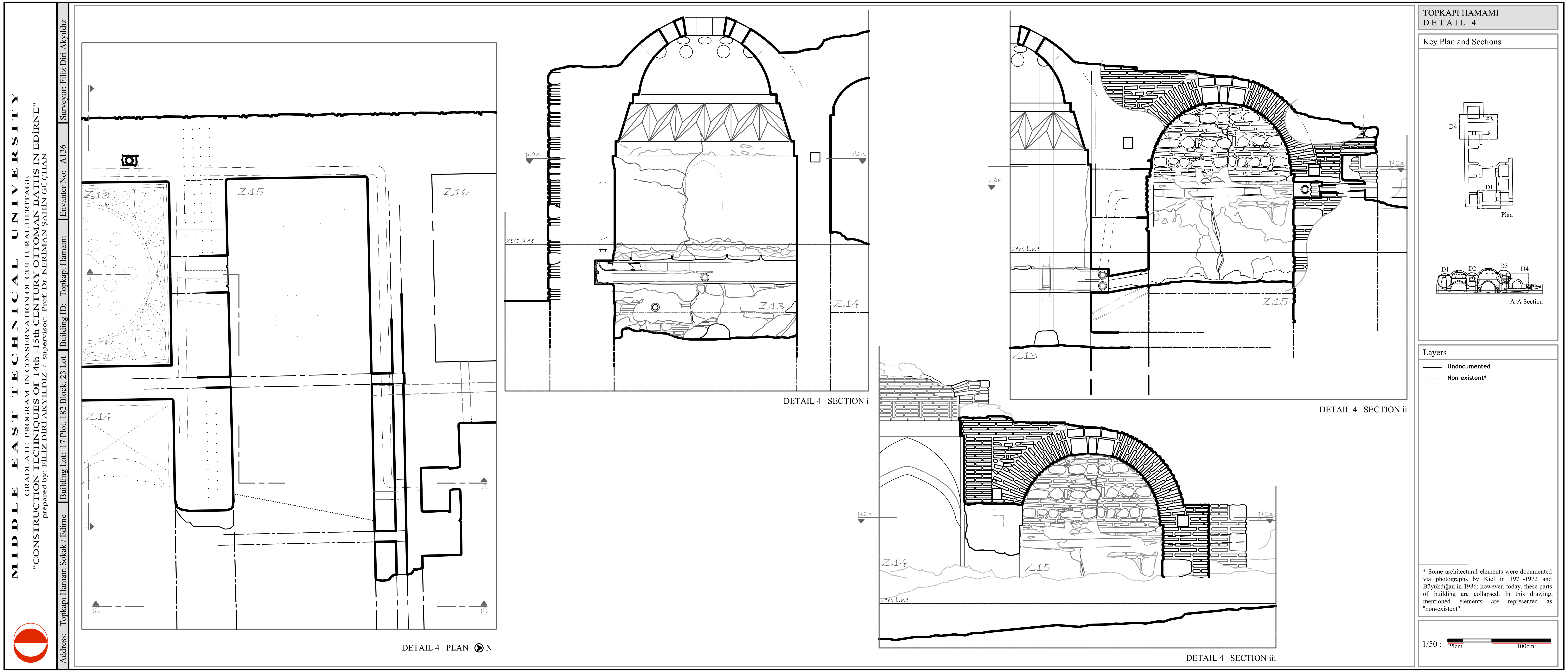

Figure 291. The drawings of Detail 4 of the *Topkapı Hamamı*

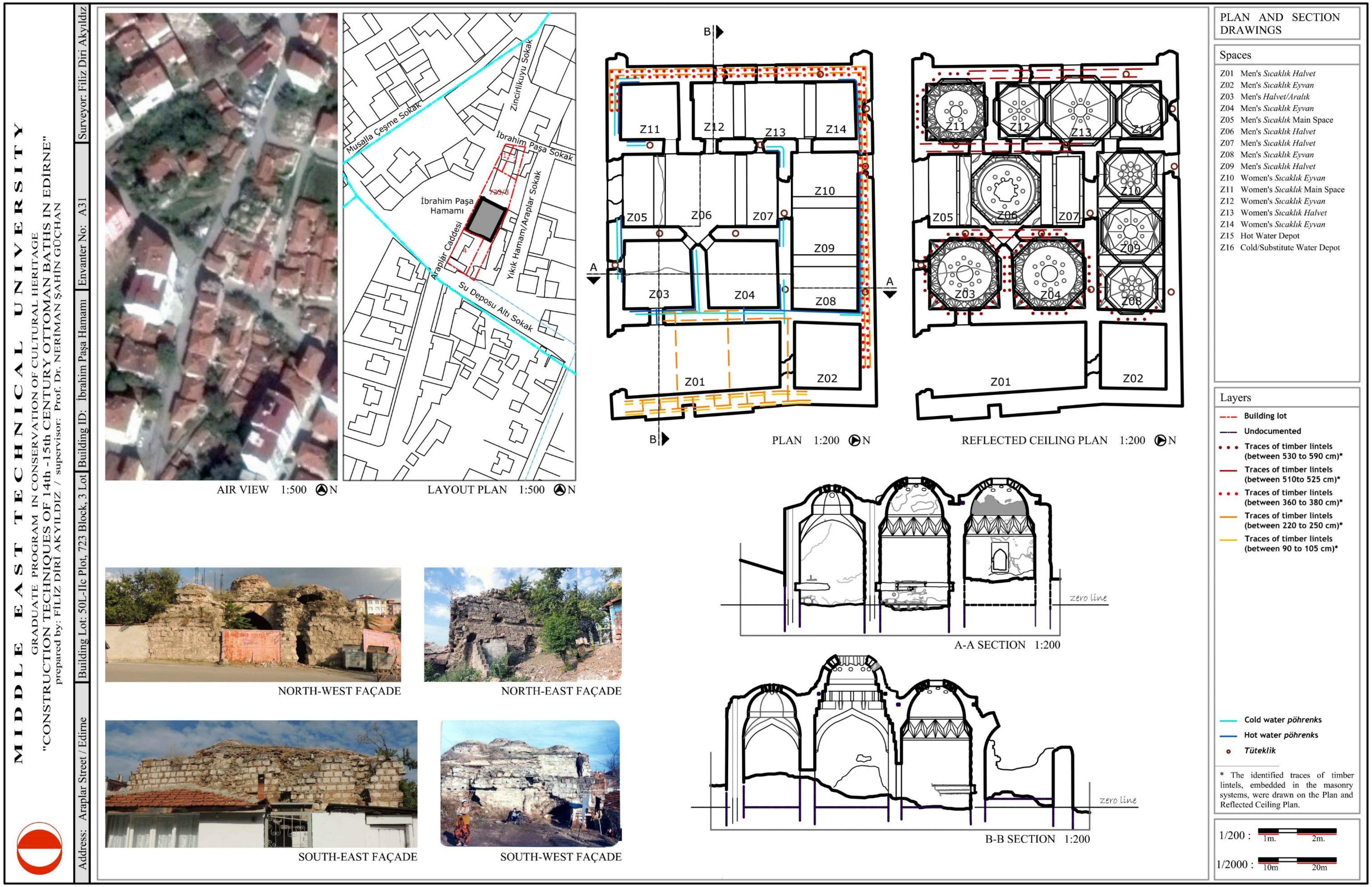

Figure 292. The site plan, plan, reflected ceiling plan, A-A section, and B-B section drawings of the *İbrahim Paşa Hamamı*

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