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BAHÇEŞEHİR UNIVERSITY

CONSERVATION PROBLEMS OF SEMIZ ALI PAŞA MADRASA AND DISCUSSION OF ITS CURRENT STATE

Master Thesis

MOUHANAD ABOUDAN

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ABSTRACT

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Semiz Ali Pasha Madrasa is one of the notable monuments of the 16th century. It was well-financed and designed with strict regulation by the architect Sinan; the master architect of the Ottoman Empire. It is considered as a good example of educational building's architecture in Istanbul during the 16^{th} century. that era in Istanbul. The madrasa is located in Karagümrük ,Fatih quarter within the historic peninsula of Istanbul. The madrasa was founded in 1558 by Semiz Pasha ,which is one of the Ottoman Grand Viziers of sultan Suleiman the magnificent . as one of many historical buildings established by him in Istanbul and other cities of the empire.

Madrasa has a "U" plan shape and it consists of; main classroom (Dershane), and fifteen cells surrounding the courtyard except for the northeastern side of the madrasa .The madrasa was an educational institute until the Foundation of the Republic, after that it was used as a public kitchen by Red Crescent until 1958. After the last restoration in 1960, it was used as a health centre. At the present it is used as a headquarters of science and human foundation.

Semiz Ali Pasha madrasa should be preserved for the coming generations because it is one of few madrasas in Istanbul that maintained its original architectural and structural form without any major alteration, and relatively in a good condition, despite the fact that the building has been exposed to deterioration as a result of neglection, wrong intervention and lack of maintenance.

The aim of this thesis is to make a comprehensive research about Semiz Ali Pasha Madrasa including a historical research, and complete survey of architectural and structural features; the current situation of the building in detail and suggestions for possible future interventions such as conservation, reuse... etc of the building. and to give an initial reference for future studies in this field as well.

Keywords: Madrasa, Heritage, Architecture, Conservation, Deterioration

ÖZET

SEMIZ ALI PAŞA MEDRESESI KORUMA SORUNLARI VE MEVCUT DURUMUNUN İRDELENMESI

MOUHANAD ABOUDAN

Mimarlık Kültürel Mirasın Korunması Yüksek Lisans

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Semiz Ali Paşa Medresesi 16. yüzyılın en önemli eğitim kurumlarından biridir. Osmanlı İmparatorluğu'nun baş mimarı Mimar Sinan tarafından yapilmiştir. Medresenin planı 16. yüzyıl İstanbul'unu yansıtan önemli bir eğitim binası olarak dikkat çekmektedir ve yeri, İstanbul tarihi yarımadadaki Fatih civarındaki Karagümrük'tedir. Bu medrese 1558'de ''Muhteşem'' lakaplı Sultan Süleyman'ın veziri Semiz Ali Paşa tarafından yaptırlıştır. Semiz Ali Paşa İstanbul dışında farklı şehirler de de bir çok yapı yaptırmıştır.

Medrese incelediğinde ''U'' şeklinde dikdörtgen bir planı olduğu görülür. Ana dershane ve on beş oda, medresenin geometrik yapısına uygun olarak sadece kuzeydoğu tarafı hariç olmak üzere sıralanmıştır. Medrese idari amaçlı kullanana dek eğitim binası ve daha sonra Kızılay tarafından 1958'e kadar ana mutfak, 1960'daki son restorasyondan sonra ise sağlık merkezi olarak kullanılmaktayken günümüzde ise insan ve bilim vakfının ile ilgili idari merkezi olarak kullanılmaktadır.

Semiz Ali Paşa Medresesi, gelecek nesiller için de korunması gereken özgün mimarisi korunumş çok önemli birkaç medreseden biridir. Medresenin formu‹ İstanbul'daki, pek çok müdahele ve yanlış bakım büyük değişikliklere uğramamış ve asıl yapısını halen korumaktadır.

Bu çalışmada; Semiz Ali Paşa Medresesi ile ilgili detaylı tarihi incelemeler, mimari ve yapısal özellikler, yapının mevcut durumu hakkında detaylı araştırma ve bulgular ila gelecekte yapılabilecek çeşitli çalışmalara yönlendirici bilgiler bulunmaktadır.

Anahtar Kelimeler: Madrasa, Miras, Mimarlık, Koruma, Bozulma

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1. INTRODUCTION

Istanbul is the largest city in Turkey and one of the oldest continuously inhabited cities in the world, the strategic location of Istanbul in the heart of the old world between two continents Asia and Europe was the reason why it was a capital of many ancient empires starting from the Roman Empire until the Ottoman reign. Due to the sequence of these cultures gave Istanbul a distinguished historical background and a richness of its historical monuments such as Romanian walls, Byzantine churches and the mosques, madrasa and bazar of the Ottoman Empire and the cultural variety Istanbul is a bridge that connects the east and west of the world and is one of the most charming cities around the world (Kutlu, 2012).

Most of the historical monuments nowadays in Istanbul belong to the Ottoman Empire such as mosques, madrassas, khans, Bazars and hammam. One of these monuments is Semiz Ali Pasha madrasa that was built in the 16th century by architect Sinan, the most distinguished architect of the Ottoman Empire.

1.1 DEFINITION OF THE PROBLEM

This study, about Semiz Ali Pasha Madrasa which was built by Sinan, the master architect of the Ottoman Empire, is so important because it gives a good example and a clear idea about educational buildings architecture in Istanbul during the 16th century since it has a common plan scheme for madrasas in that era.

This madrasa is one of few madrasas in Istanbul that maintained its original architectural and structural form without any major alteration and relatively in a good condition despite the fact that the building been exposed to a number of disasters such as earthquakes and repeated fire incidents.

There are a multitude of studies related with Sinan's works and Ottoman architecture, including studies on madrasas. However, Semiz Ali Pasha is not studied and researched significantly. Due to this fact, it is possible to say that this study about Semiz Ali Pasha madrasa tends to be a base for other comprehensive studies. It provides information about the architectural features of the madrasa including its current situation and its deterioration on the architectural and constructional level, and it would help in any future restoration project of the madrasa. Due to the similarities of structure and constructing materials of madrasas in Istanbul, it may benefit other studies about different madrasas in the same era, which have yet to be written.

1.2 SUBJECT AND PURPOSE OF THE THESIS

This research about Semiz Ali Pasha Madrasa aims to highlight the education buildings in Ottoman Empire, especially the architectural features of Istanbul madrasas in the 16th century, which mostly are built by architect Sinan. Additionally comprehensive research is done to give view of the of madrasas' architecture and pave the way for understanding to the main subject of study about Semiz Ali Pasha Madrasa.

This research presents architectural description of Semiz Ali Pasha Madrasa by giving a study about the architectural details of the madrasa elements, starting of its inscriptions down to the functional elements such as classroom, students rooms etc. It also helps to give a clear understanding of the16th century madrasa architecture in Istanbul.

The study also aims to present holistic understanding of Semiz Ali Pasha Madrasa and its structural system by giving information about the materials used in the construct process and details about the vertical, horizontal and transfer structural elements of the madrasa.

Examination of the current state of the madrasa by illuminating the structural, non-structural damage and the causing factors of its deterioration such as the natural and human effects.

The main aim of this study is to make a comprehensive research about Semiz Ali Pasha Madrasa including research of the existing references and acquired information directly from the current users to state. The current situation of the building and propose suggestions for possible future interventions as conservation, reuse etc of the building. Additionally to give an initial information as a reference for future studies in this field.

1.3 METHODOLOGY

This thesis intends to be a research, which surpass gathering of existing information and provide collection of data from site and observation, for proposing its subject given in chapter 1.2.

Methodology of this study is based on literature review and qualitative data collection in the field. This methodology is achieved by the steps below.

a. Use of historical resources

In order to understand the architectural characters in the period of constructing the Madrasa of Semiz Ali Pasha, the thesis investigates the social, economic, political life in the Ottoman Empire and focuses on education in the 16th century in Istanbul especially the work of Sinan, the famous architect behind the Madrasa of Semiz Ali Pasha.

b. Use of the existing information gathered from the reports

Previous reports and work done on the Madrasa explain some details and provide plans and sections that were previously prepared for this building.

c. Observation and site assessment

Constant visits to the site of the Madrasa permits the identification of the current usage, materials and condition of the structure. This allows an assessment on the current problems of the building and a more updated data and description of its different elements, sections and their situation. Obtaining of contemporary photographic records is included as well.

d. Use of archival documents and photos

This includes photographic records that mostly date back to 1958, will be used in the thesis to compare with the present status of the building and to figure out the changes and interventions since that date.

e. Use of references

To generally understand properties of the used materials, structural behavior and structural elements of historic buildings. Additionally, to understand the effects of other natural exposures and their potential effects on the structure in order to understand madrasa building.

f. Use the recommendation of international organizations

Most importantly, the recommendation of UNESCO and ICOMOS, and their possible applicability on the Madrasa will be evaluated.

g. Conduct an evaluation and possible recommendations

After gathering all the needed information, the thesis will suggest a proposal with few possibilities to conserve and improve the Madrasa of Semiz Ali Pasha.

2. EDUCATIONAL BUILDINGS IN ISTANBUL IN THE 16TH CENTURY

2.1 ARCHITECTURAL, SOCIAL, ECONOMIC AND POLITICAL SITUATION

The 16th century is known as the golden age of the Ottoman Empire, where it witnessed great and many developments, especially in the social, political, economic, and architectural fields. These developments were directly related to the riches of the empire at that period.

The Ottoman Empire has adapted Islamic principles since its establishment in all fields such as administrative, social life, architecture etc. However, in the 16th century, the Islamic nature and authority of the Empire has flourished due to the expansion that included sacred Islamic cities such as Mecca and Medina. Another reason was that the Ottoman Sultan became the caliphate of the Muslims (Katipoglu, 2007, p. 10).

The Ottoman Empire was subjected to the dominant constitutional legislative system relied on Islamic religious laws. Later on the Sultanic law, '*Kanun'* was integrated to the existing legislative system by the sultans. This was mostly notable with Sultan Suleiman the Magnificent who established laws to regulate the empire and people's matters, also to increase the leading power in the Ottoman Empire. Sultan Suleiman worked on integrating the men of religion '*ulema'* in the political role, so there would be a religious power for his reign (Katipoglu, 2007, p. 7).

During the 16th century, the Ottoman Empire's architecture was at its peak considering it the golden age of the empire on several levels such as politics, economy, and social life among other aspects. In addition, the religious system had a huge impact on the architecture at that time because of the relation between architecture and the political conditions in that era (Katipoglu, 2007, p. 12).

It could be stated that conquering new lands especially since Sinan, who was the official architect of the sultan gave the Ottoman Empire various architectural characteristics, starting from Balkan, to the Middle East. Sinan was assigned to several regions of the Ottoman Empire and introduced new and various approaches to Ottoman Architecture and its many important religious buildings. Important monuments of the Ottoman Empire, such as Suleymaniye, Sehzade and Selimiye Mosque were built during this century.

The economic situation of the Ottoman Empire was at its best condition during the first half of the 16^{th} century, since the Ottomans dominated a lot of lands, marine routes, and trade roads. Many of the cities they controlled were situated on the Silk Road, which provided the empire with many riches. However, in the second half of the 16th century the economy started to fall back due to the spread of Mexican silver in Europe, which caused the drop of the Ottoman silver value. This caused the prices to rise in the Ottoman Empire, which made the economy drop. In addition, the increase of corruption, bribery, and embezzlement between the empire officials led to a worst economic decrease (Katipoglu, 2007, pp. 9-10).

The Ottoman Empire expanded dramatically in the 16^{th} century, especially during Sultan Suleiman's reign. Numerous invasions occurred and lead to take over vast lands under the Ottoman's rule, which started from Balkan to Vienna's walls. In addition, some Arabian lands were taken over during Selim I^{st} reign. That was under the Mamluk's rule, which extended from Levant to Cairo and to the holy Islamic lands, Makkah and Al-Madinah. It enriched religious authority within the Ottoman Empire in addition to filling the treasury. The Ottoman's political power and military force increased during Sultan Suleiman's reign since they had taken over trade routes, particularly sea routes. They also concentrated on increasing the Ottoman Empire's political power in relatively distant lands, such as supporting the Dutch rebels against their Spanish overlords. They also gave military support to local rulers in the Indian coast and Indonesia, against the Portuguese navy, in order to limit their control over sea routes and to increase Ottoman power over these distant lands. The Ottoman Empire's expansion continued after the death of Sultan Suleiman, but with decreased speed. By the end of the 16^{th} century, other lands had been taken in by the Empire, such as Azerbaijan and Cyprus (Quataert, 2005, pp. 20-24).

The Ottoman Empire reached its golden age during the 16^{th} century and it was able to improve many aspects such as social, economic, architectural and political issues, mainly as a result of the huge expansion that the Ottoman Empire witnessed during that period as well as the flow of great treasures from its conquests.

The Empire enlarged its borders and its power in terms of military, economy and political role around its geography, however, in the end of the 16th century, signs of the Empire's downfall became apparent due to several reasons, one of them is the decreased pace of conquests.

2.2 EDUCATION SYSTEM IN THE OTTOMAN EMPIRE DURING THE 16TH CENTURY

Until the 19th century, the educational system in the Ottoman Empire consisted of several forms of educational institutions. Formal education included *Sıbyan* schools for elementary education, madrasas for higher education, military educational institutions, in addition to *Enderun* schools, which provided education to prepare the state's staff. Informal education consisted of mosques and prayer rooms, dervish lodges, *Ahi* associations, palaces, and libraries that provide parallel, informal education for all of the public. All of the educational institutions were sponsored by "foundations" except for *Enderun* and military educational institutions, which were founded by the empirical governance (Sonmez, 2013, pp. 163-164).

The education during the early Ottoman period gave teachers the freedom to teach in their own way and the freedom to choose the secondary subjects within a frame set by founders of the foundations *"Waqf*s" endowments (Agoston and Masters, 2009, p. 47).

The education during the Ottoman Empire has developed in parallel with the development and expansion of the Empire. In the early years of the Empire's attention the focus was on the Islamic sciences. However, with time, the rational sciences gained more importance, and specialized schools were erected in the 16t^{h} century.

During Sultan Suleyman’s reign (16thcentury), the interest in rational sciences increased as a result of the evolution of the educational system. The best example which demonstrates that is the Suleymaniye complex, which consisted of a number of schools with different educational stages. It included two specialized schools; *Tarüttıb*, the school of medicine, and *Darülhadis*, which taught the teachings of the prophet Muhammad by the best known tutors in the Empire.

The madrasas improved after the Ottomans conquered Istanbul. Rational teachings such as logic, philosophy, mathematics, and astronomy science gained the same importance as religious sciences (Agoston and Masters, 2009, pp. 199 -200).

One of the main reasons of consideration 16th century as the golden period of the Ottoman Empire is the fact that education was spread across the Empire. Just in the 16th century, more than 189 madrasas were built, 142 of them were built in Istanbul, the capital of the Ottoman Empire .there were only 40 schools that were built in the 14th century, and 97 from the 15th century (Agoston and Masters, 2009, pp. 199 -200).

a) Primary Schools (Sıbyan Mektepleri):

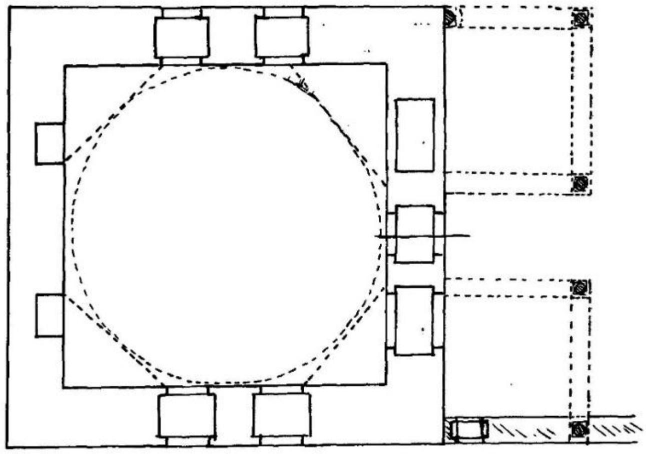
Typically, Sibyan Mektebi was established by sultans or charities and operated through WAQF. Primary schools provided education for children aged five and up and its purposes were to teach them to read, write, do basic math, in addition to teaching the principles of Islam, such as teaching them passages from the Quran. Generally, the teachers were religious functionaries such as a prayer leader (Imam), or the principal of the mosque (Agoston and Masters, 2009, p. 199).

The primary school, *Sıbyan Mektebi*, was established during the Seljuk period evolving by the time ended until the Ottoman era (Demirtaş, 2007, p.173). *Sıbyan Mektebi* was considered as one of the most important institutions of the Ottoman Empire; due to the fact that most of the people received their education from it (Sonmez, 2013, p. 163).

Primary schools by that time had many names such as “Sıbyan Mektebi, Mekteb, Küttap, Darüttalim, and Darülilim” (Sonmez, 2013, p. 164).

Sıbyan Mektebi was one of the most popular educational institutions because it was prevalent in all of the cities and villages of the Ottoman Empire (Sonmez, 2013, p. 164). They were either located within a külliye (mosque complex), or as separated buildings (Figure 2.1) (Agoston and Masters, 2009, p. 199).

Figure 2.1: Yavuz Sultan Sibyan Mektebi



Resource: http://i0.wp.com/www.erhanuludag.com/tr/wp-content/uploads/2014/11/1.jpg

b) Higher education schools (Madrasa):

Madrasa is an Arabic common word that means School or a place for learning. The word was used by Ottomans to refer to different types of educational Institutions (Ahunbay, 2000, p. 338).

The madrasa is one of the most popular educational institutions in the Ottoman Empire, which was considered as an upper level education that follows the *sybian mektebi* **.**The madrasas were considered as the higher education system in Ottoman Empire and many madrasas were established and funded by the sultans, nobles or Waqfs. It should be noted that sometimes Wakfs provided scholarships in form of pocket money for students. (Saoud, 2004, p. 17).

The first madrasa can be traced to the *Nizamiyah* that was built in Baghdad in the 11^{th} century. The school offered food, dwelling, and free education. Madrasas curricula varied from place to place, and they were always religious in character. Madrasas spread rapidly throughout the Muslim world until the era of Western colonial rule during 19^{th} and early 20^{th} centuries, where secular institutions replaced religious schools in the Islamic world (Blanchard.2008, p. CRS_2). For the Ottoman Empire territories, Madrasas continued to be the conventional educational institutions until the dispersion of the empire in 1924 (Saoud, 2004, p. 17).

The first Ottoman madrasa that was built in 1331 by Sultan Orhan Izink was the first of the early stage type of Ottoman madrasas had continued until Istanbul was conquered in 1453. From 1331 until 1453, 84 madrasas were founded, and the main purpose of the madrasa in this period was to teach Islamic principles and applied sciences as secondary subjects. The sequence of the focus of teaching as firstly Islamic principles and secondly applied sciences was a continuation of the previous Seljuk period (Agoston and Masters, 2009, p. 199).

Madrasas provided rooms for students where usually every one or two students had a room. It also had a public kitchen where these students could get free food. In some cases teachers "muderris", the doorkeeper, and the cleaner had rooms as well. Founders of the madrasas usually donated valuable books that librarians took care of and kept with loan records and other manuscripts in bookcases inside the classrooms. (Ahunbay, 2000, p. 339). The Plan of the Ottoman madrasas was inherited from the Persian- Seleucid madrasa, however, it evolved by reducing proportions and simplifying the forms. (Vimercat, 2013, p. 89).

Madrasas began to be constructed in complexes, which consists of eight upper-level madrasas and eight preparatory madrasas. The upper-level madrasas taught the principles of hikmet (science and wisdom) in order to improve the student's capabilities of virtue, talent, religion, and sharia (canon law) (Agoston and Masters, 2009, p. 199).

Madrasas in the Ottoman Empire can be divided into two types: common and specialized madrasa such as "Darul Kurra". The first one, the common madrasa, is the ordinary madrasa that could be seen everywhere. The quality of education in the ordinary madrasa depended on the quality of its staff of teachers, which as well is depended on better funding. Therefore, more sufficient madrasas were usually found in the large and important cities of the Empire like Istanbul, Edirne, and Medina.

Students received a certificate that allowed them to go to the next educational stage. High school level students were called as "*Softa*", while students with higher education were called "*danismend*"after finishing their studies, "*Danismend*" could become judge as "*kadi*", "muftis " as religious leader" or teacher in madrasa as "*muderris*".

The second type of madrasa is specialized school such as *''Darul Kurra*" and medical school ,were "*Darul Kurra*" that trained students who finished "*Sibyan Mektebi*" to become *Imam*s and *Muezzin*s for mosques (Ahunbay, 2000, pp. 338- 339).

c) Palace School (*Enderun Mektebi*):

Enderun Mektebi is considered as one of the most important educational institutions since it provided specific education for the children of the elites of the Empire such as the kids of administrators and military personnel. In addition to the elite's children, children of the *devşirme* system were brought to be educated in the palace school in order to prepare them for the future governmental positions. Children of the *devşirme* system were typically the children of Christian families in the Balkans and sometimes sons of war-captures. Both the *devşirme* and the elites' children were taken and recruited to be initial administrator and military personal for the Ottoman Empire (Agoston and Masters, 2009, p. 198, 199, 531). The children were raised to be loyal to the sultan and to protect the Empire as well. The *Enderun Mektebi* was located inside the complex of the sultan palace (Figure 2.2) (Agoston and Masters, 2009, p. 452).

Figure 2.2: Enderun Mektebi in Topkapi Palace Istanbul

Resource:httpsupload.wikimedia.orgwikipediacommonscc9Enderun_library_Topkapi_40.JPG

2.2.1 Architectural Characteristics of Madrasa Buildings in the Ottoman Empire

In this section "architectural characteristics", we show the architectural development of the ottoman madrasas along several centuries, divided into two sections; the first is the early ottoman madrasas plan that is mainly derived from the Seljuk's with some ottoman characteristics, the second is the period from the (16th to the 19th century).

That era includes the classical period of the ottoman architecture (16th to 17th century) especially during architect Sinan's period where geometric plan shape "U" has been adapted as a main plan for the ottoman madrasa along with some exceptions such as the geometric plan shape "L" madrasas.

This period is special with its higher number of madrasas inside of the complexes such as the Suleimanya complex after the end of the classical era western architecture started to influence the ottomans gradually whereas at the end of the ottoman era during the beginnings of the 20th century the madrasas became nothing of ottoman but the name.

2.2.1.1 Early Ottoman Madrasas of the 13th - 15th Century

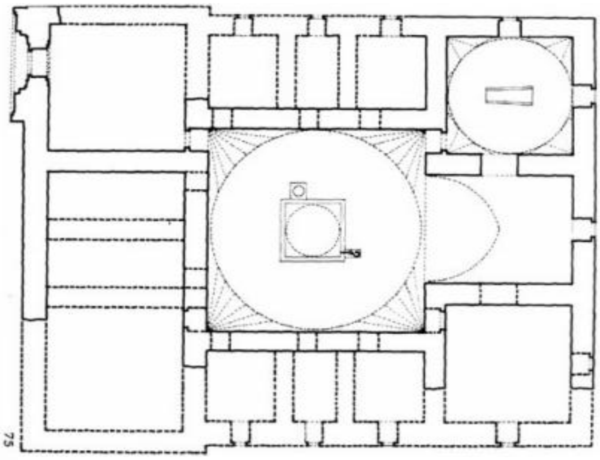
The early madrasa type for Ottomans followed the Seljuk plan, which had an open courtyard with *iwans* opened to it in its first stage. In its second stage, it had an *iwan* and an enclosed plan. Gradually this plan evolved until it was abandoned in the end of the 15th century and the new plan scheme of a courtyard and cells surrounding was adopted.

The new model adopted later by Ottomans had an open courtyard and cells surrounding it. In comparison to the enclosed Seljuk model, the closed main classroom "*dershane*" with a dome replace the *iwan* in the Seljuk model. (Ahunbay, 2000, pp. 341-342, Saoud, 2004, p. 18).

The early Ottoman madrasas, which belong to 14th and 15th centuries, followed the Seljuk type in Anatolia, which was common as well as in the Islamic east, especially in Persia. This type consisted of a courtyard that the *Iwans* were open to it.

In the 13th century at the end of the Seljuk's Era, there was a shift towards a newer enclosed type, where the open courtyard was covered with a dome that had windows. The example of this newer type could be stated as Karatay Madrasa in Konya in 1252(Figure 2.3) (Saoud, 2004, p. 18).

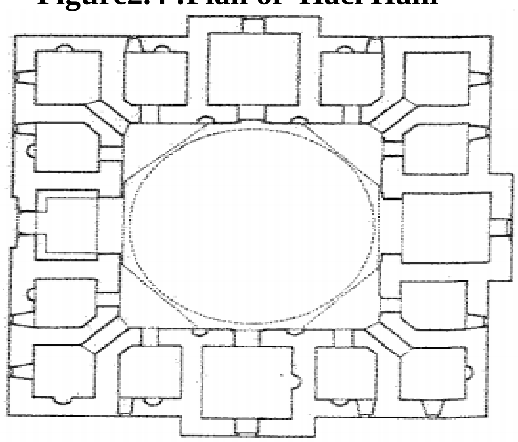
Figure 2.3: Plan of Karatay Madrasa



Resource:http://www.muslimheritage.com/ImageLibrar y/madrassa1red.png.png

It should be noted that the usage of the enclosed *iwan* plan scheme of the Seljuks continued till a number of years for mosques and madrasas in the Early Ottoman era before it was abandoned. An example is the *Haci Halil Pasha* madrassa in *Gumus* that was built in1415 (Figure 2.4), this madrassa has a central covered space in addition to the *iwan* facing the entrance, however the two *iwans* on the sides are replaced by two covered square rooms (Saoud, 2004, p. 18, Ahunbay, 2000, p. 343).

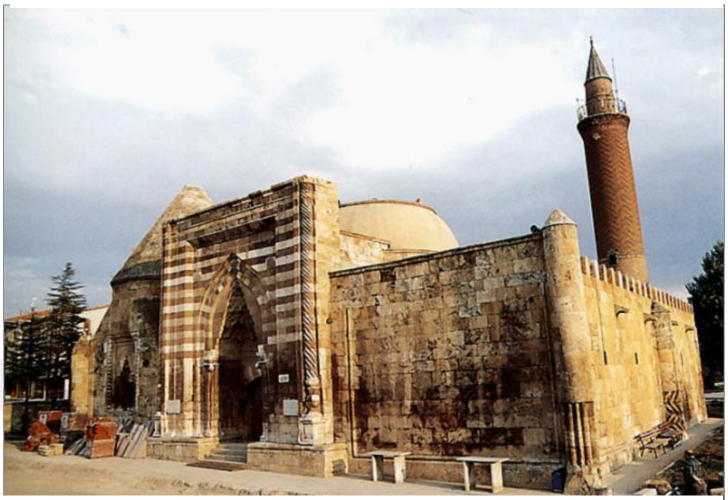
Figure2.4 :Plan of Haci Halil



Resource:http://www.islamicmanuscripts.info/refer ence/articles/Cicek-2000Civilisation-4/Cicek-2000-Civilisation-4-1-338-345-Ahunbay

The Cacabey madrasa Kirsehir, which was built in 1272, has a similar plan to the formerly mentioned Karatay madrasa, however, instead of the dome with windows, it had an incomplete dome (Figure 2, 5), and this can be attributed to the desire of abandoning the closed plan scheme and going back to the open courtyard.

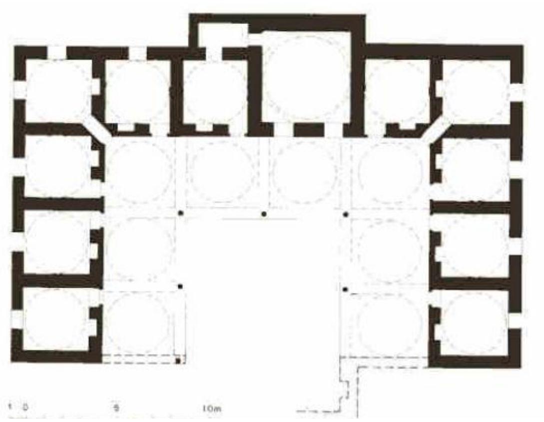
Figure2.5: Cacabey Madrasa



Resource:http://admin.gateofturkey.com/api/data/GetHeaderImage /3856/K%C4%B1r%C5%9Fehir-cacabey-med.jpg

Suleyman Pasha Madrasa in Iznik, which was built in 1331, is considered as the oldest surviving madrassa in the Ottoman Empire. It has a "U" shaped plan that consists of a large room used as a main classroom *"dershane"*, and 12 cells located on the three wings and opened toward the courtyard. Moreover, the corridor that is connecting the main classroom "*dershane*" to one of the cells, which is the cell of the teacher is a particular element for early Ottoman madrasas and cannot be seen in later madrasa designs (Figure 2.6).

Figure 2.6: Plan of Sultan Suleiman



Resource:http://www.muslimheritage.com/ImageLibrary/ madrassa2red.png

Each of the cells, the main classroom *"dershane"* and the arcades of the madrasa had domed roofs. Other elements such as the fountain and the ablution place "*Sadirvan*", seems to have existed but were removed during the time. This design type of madrasa that consisted of a courtyard and cells surrounding was used later for many other madrasas in the Ottoman Empire. (Saoud, 2004, pp. 18-19, Ahunbay, 2000, p. 342, 343).

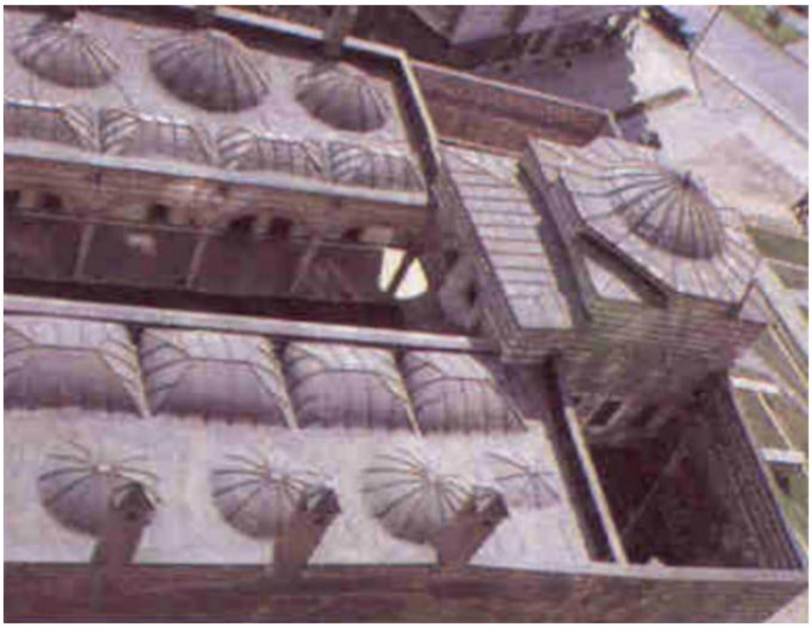
A particular early Ottoman design, which is the only of its kind, is Hudavendigar mosque and madrasa in Bursa that was built in 1365 (Figure 2.7). The mosque was on the ground floor and the cells of the madrasa were on the first floor. The mosque was most likely used for classes since there was no classroom "*dershane*" (Ahunbay, 2000, p. 343).

Figure 2.7: Hudavendigar Mosque Istanbul

Resource:http://archnet.org/sites/1909/media_contents/7460

Since 15th century, the "U" shape plan that surrounded three sides of the courtyard has evolved. The new plan had cells that surround the courtyard from three sides in addition to a fourth side that the main classroom "*desrhane*" was occupied. Mehmed Efendi madrasa in Istanbul (Figure 2.8) could be given as an example of this type. The arcades, main classroom *dershane* and cells had domed roofs. Every cell had a window and a chimney for winter, and the madrasas had common lavatories and central fountain in the courtyard. The exterior façade of these madrasas was simple while the inside walls that were open to the courtyard were decorated with tiles, bricks, and ornaments (saoud, 2004, p. 19).

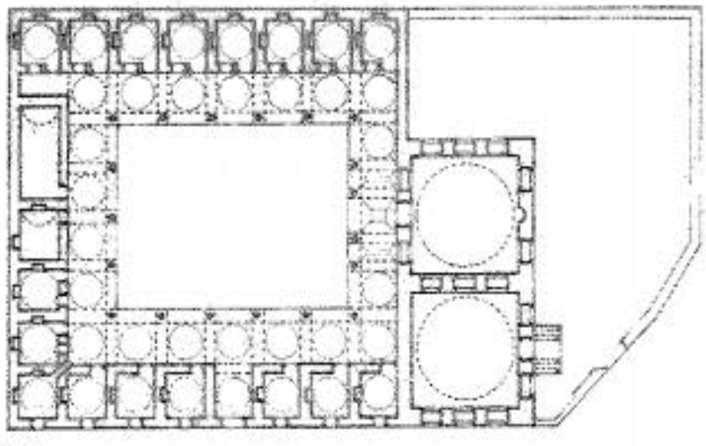
Figure 2.8: Mehmed Efendi Madrasa



Resource: Ahunbay, Z., 2000. Ottoman Medreses. Istanbul Technical University. Faculty of Architect, pp. 342-243, Istanbul

Some madrasas of the 15th century had unique features like two main classrooms in comparison to other madrasas which has only one, such as the madrasa of Celebi Mehmet in Merzifon that was built in 1418 which (Figure 2.9).

Figure2.9 :Plan of Celebi Mehmet Madrasa



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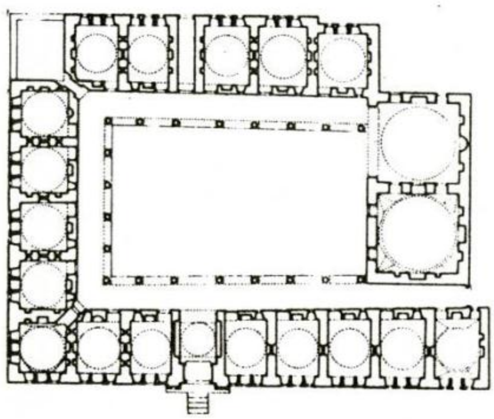
Another madrasa type with similar distinguished design of the 15th century which had an iwan and a main classroom of equal size such as Saatli madrasa in Edirne (1437-1447) (Figure 2.10).During the 16th century the the size of the iwan compared to the main classroom decreased, and it became connected to the arcades (Ahunbay , 2000, p 343).

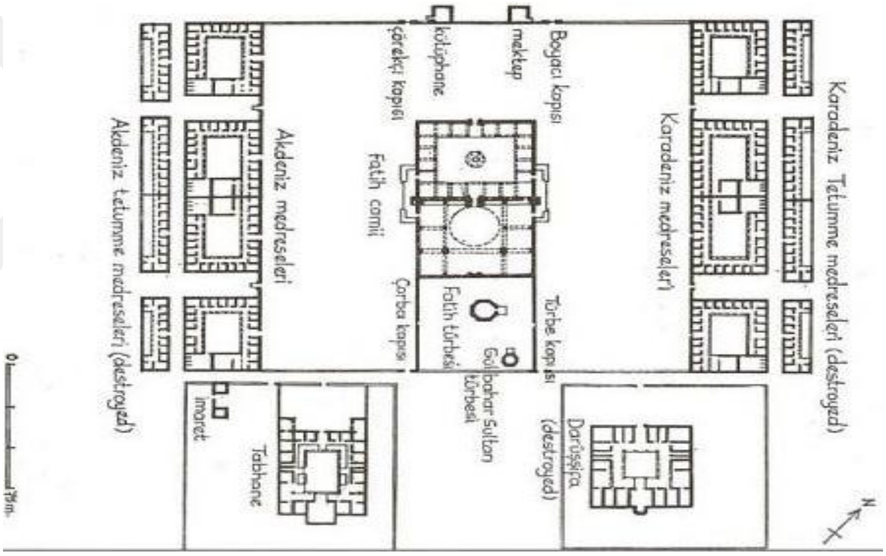
Figure2.10:Plan of Saatli Madrasa



Resource:: ERGÜN ÇAĞIRAN İstanbul, 2010 NİŞANCI MEHMET BEY MEDRESESİ p11.

Madrasas in the Ottoman Empire were not only constructed individually, but also within complexes, defined as *külliye*. Some madrasas within those complexes offered higher education, which would be considered as the same as the university level of education today. Fatih *Külliye* building complex could be given as an example built in 1471, and the madrasas in that complex were considered to provide the highest level of education during the 15th century (Figure 2.11). The complex includes eight madrasas; each madrasa has one main classroom, known as *dershane*, 19 domed cells, and 2 iwans, surrounding a rectangular courtyard. Each of those madrasas have the same plan scheme. The madrasas of Fatih attracted a large number of scholars from all sides of the Ottoman Empire (freely, Sumner, 2010, pp. 237-238, Ahunbay, 2000, p. 342).

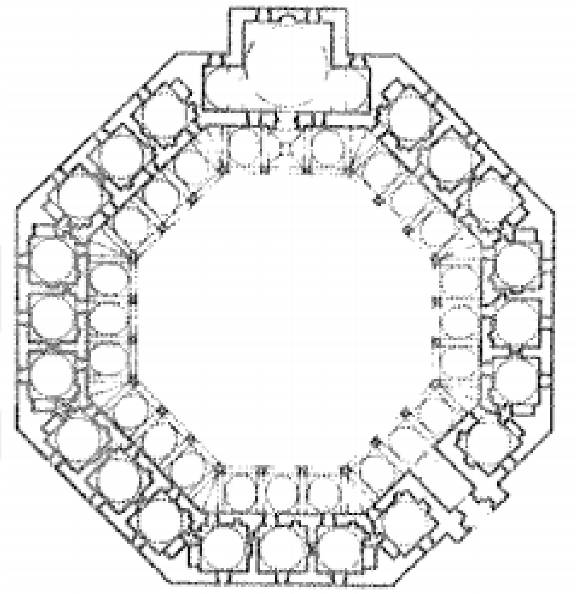
Figure2.11 :Plan of Fatih Complex in Istanbul



Resource:http://www.islamicmanuscripts.info/reference/articles/Cicek-2000Civilisation-4/Cicek-2000-Civilisation-4-1-338-345-Ahunbay

Generally, Ottoman madrasas in the 15th century had certain plan geometries. The "U" plan design seemed to be the most common. The end of the 15th century, new plan designs started appearing like octagonal courtyard madrasas. The first Ottoman madrasa with the octagonal courtyard shape was *Kapita* in Amasya that was built in 1488.This madrasa had a main classroom "dershane" and cells surrounding an octagonal courtyard (Figure 2.12). Mimar Sinan used this plan later in the 16th century for Rustem Pasha Madrasa. (Ahunbay, 2000, p. 344).

Figure2.12 :Plan of Kapita Madrasa in Amasya



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2.2.1.2 16th _19th Century Classical Ottoman Madrasas

Many of the important buildings such as madrasas in the Ottoman Empire were built in the 16th century, which is considered as the Classical Period of the Empire and its architecture, due to the stability, financial blooming, the rich *vakifs*, and the central power of the Empire back then. Resources indicates that 189 schools were built in that century while 113 madrasas were built in Istanbul by itself, which is an indication of the wealth of the city and its cultural development (Agoston and Masters, 2009, pp. 49-50, 200, Ihsanoglu, 2004, p. 11).

The architecture of that period is best represented by the work of the chief architect of the Empire Mimar Sinan, such as Suleymaniye building complex (Figure 2.13), which was the biggest complex and had the biggest number of different specialty madrasas such as medical "*tip*", "*darülkurra*" and *"Darülhadis"* madrasas (Agoston and Masters, 2009, pp. 49-50, 200, Ihsanoglu, 2004, p. 11).

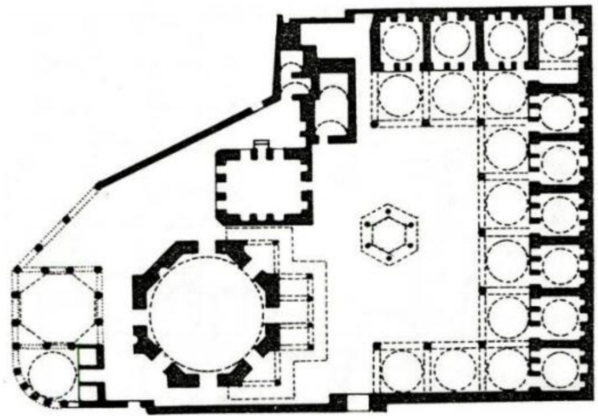
Figure2.13: The Suleymaniye Complex Istanbul

Resource:https://hist106spring2012.files.wordpress.com/2012/03/picture18.jpg

Mimar Sinan planned according to the pre-existing styles; however, he introduced his personal touch and few modifications such as creating a common courtyard for the madrasa. Sinan used in his work 6 different plans including the "L" shape design, the octagonal plan design, and the "U" shape among other plans that this research will discuss in details in the following chapter (Ahunbay, 2000, p. 344, Gunay, 2006, pp. 33-34).

Generally, in the end of the 16th century, because of financial restrictions, the sizes of the complexes in that era became smaller to include small number of buildings surrounding a madrassa. In the 17th century, new structures that included a madrasa, a *sebil* and a tomb formed a new type of complexes such as Merzifonlu Kara Mustafa Pasha complex (Figure 2.14).

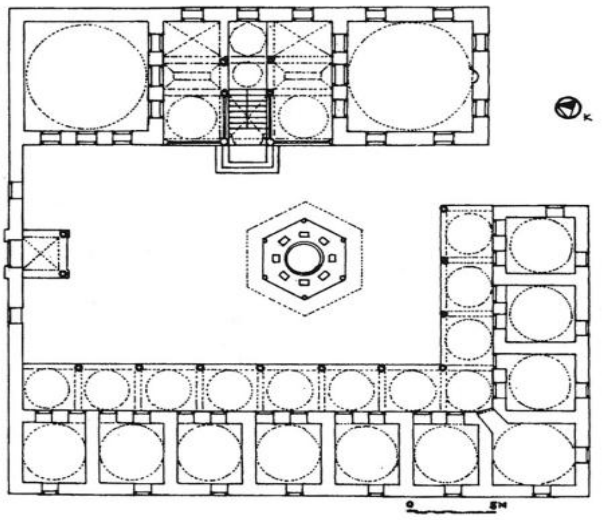
Figure2.14 :Plan Merzifonlu Kara Mustafa Pasha Complex 1690 Istanbul



Resource: ERGÜN ÇAĞIRAN İstanbul, 2010 NİŞANCI MEHMET BEY MEDRESESİ p16.

The 18th century witnessed new typologies of madrasas that had two-storeys, which included a primary madrasa and a library. In some cases in the 18th century types, libraries in madrasa were just as big as the classroom such as Fezullah Efendi madrasa (Figure 2.15) in Istanbul. This was because of the big interest of books in the city (Ahunbay, 2000, p. 344).

Figure2.15 :Plan of Fezullah Efendi



Resource: Ozakin, R & Erdem, A., 2008. Istanbul – Fatih, Millet Library / Feyzullah Efendi Madrasah restoration, p.1142.http://www.hms.civil.uminho.pt/sahc/2008/CH121.pdf

The baroque style influence on the Ottoman architecture in the 18th century can be noticed in the carvings on the exteriors of the *sebils* and primary schools attached to complexes. Madrasas of the 18th century remained plain in general and decorations were used moderately on the main entrance, jambs and lintals of the classrooms and the capital of columns surrounding the courtyard.

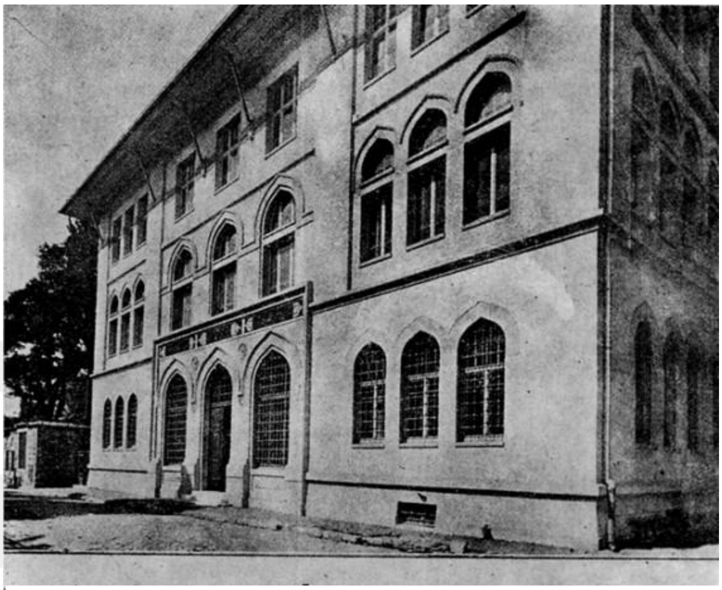
In addition, structure wise for the madrasas of the 18th century, columns became more slender, an example is the Madrasa of Kabasakal (Figure 2.16).

Figure2.16 : kabasakal Madrasa Istanbul

Resources: http://eenusa.smugmug.com/Other/Miscellaneous/Blog-Uploads-2010/IMG3895/885191650_vpdvD-M.jpg

In the end of the 18th century, traditional madrasas approach was left due to several reasons, the main one was the influence and preference of the European architectural approaches, this is visible in "Medresetul Kuzat" which had European-like design ideas (Figure 2.17) (Ahunbay, 2000, pp. 344-345).

Figure2.17 : Medresetul Kuzat



Resources: http://www.tunahan.org/images/foto_galeri/7_1.jpg

Therefore, to summarize, the early madrasa models for Ottomans followed the Seljuk plan, which had an open courtyard with Iwans opened to it in its first stage. In its second stage, it had an *Iwan* and an enclosed plan. Gradually this plan evolved until it was abandoned in the end of the 15th century and the new plan scheme of a courtyard and cells surrounding it was adopted.

The new model adopted later by Ottomans had an open courtyard and cells surrounding it. In comparison to the enclosed Seljuk model, the closed main classroom "dershane" with a dome replace the *Iwan* in the Seljuk model. (Ahunbay, 2000, pp. 341-342, Saoud, 2004, p. 18).

The Ottoman madrasas followed the Seljuk plan in its beginnings until the 14th century, and then it took different forms of its own in the latter centuries.

The 15th century Ottoman schools developed new design plans as well in addition to the common "U" plan, such as the octagonal and "L" shaped plan.

Moreover, the 15th century included the complexes that included madrasas next to other buildings. The 16th century had an increasing number of schools due to the wealth of the Empire, and the Classical Ottoman period style was in its rise with Great Architect chief Sinan as the architect of this. Sulemaniye complex that was built in the 16th century by Sinan was the biggest complex and could be considered as the most important education place of the Empire. In the end of the 16th century and due to financial restrictions the complexes' scales shrank and the number of madrasas in the complex. In the 17th century, next to the madrasa a sebil and a tomb of the founder can be seen in many cases. In the 18th century, the baroque style had its influences on educational buildings with the decorations that could be seen in several buildings. Elements like the columns became more slender and the libraries became as big as the main classroom in several cases. In the end of the 18th century, the madrasas abandoned the Ottoman traditional style to adopt a new European influenced style; at this point, the Ottoman madrasa only kept the name and abandoned almost all of its other architectural educational elements.

As a conclusion, almost all of the traditional Ottoman madrasas in their different stages and designs included cells for student dwellings and a main classroom "*desrhane*" surrounding a courtyard or a common space, for the lectures, the main architectural characteristic was domed roof structures.

2.2.2 Ottoman Madrasa in 16th Century in Istanbul

The 16th century, especially during the period of Suleiman the magnificent, was considered as the golden age of the Ottoman Empire regarding various fields, particularly the architectural aspect.

It is also considered the classical period of Ottoman architecture. It was best represented by architect Sinan, the chief royal of the Ottoman Empire (between 1538 and 1588). He has built more than 400 architectural monuments such as madrasas, mosques, etc. His approach had the huge impact on Ottoman architecture on followed centuries (Agoston and Masters, 2009, p. 50, Özgüleş, 2008, p. 3).

Architect Sinan adopted the Ottoman madrasa plan geometry, which was derived and developed from the Seljuks' open courtyard plan type. He added his own touch with minor changes to the plan, giving it a unique ness.

He also combined the mosque and the madrasa with a common courtyard. In some of his plans he separated the classroom (*dershane*) from the students' cells with narrow passages, whereas in some cases he made the madrasas courtyard founded on different levels (Gunay, 2006, pp. 33-34).

Generally, Mimar Sinan's madrasas are distinguished with six main plan geometries; which include:

1. Madrasas, where the courtyard is surrounded by an arcade (series of columns) on four sides, with rooms located on three sides. Examples include: Haseki Madrasa, Uskudar – Mihrimah Sultan Madrasas, Semiz Ali Pasha Madrasa, Sehzad, and Sulymaniye Evvel and Sanni Madrasas.

2. Madrasas, where the courtyard is surrounded by an arcade on four sides, with rooms on three sides and a mosque on the fourth (madrasas sharing a courtyard with a mosque). This plan was often used by Sinan. Examples include: Besiktas-Sinan Pasha, Topkapi-Kara Ahmed Pasha, Edirnekapi- Mihrimah Sultan, Kadriga-Sokollu Mehmed Pasha, and Eyup-Zal Mahmud Pasha's upper madrasas.

3. Madrasas, where the courtyard is both arcaded and surrounded by rooms on three sides. Examples include: Yavuz Sultan Selim (Halicilar Kosku), Suleymaniye Salis and Rabi Madrasas, Ayasofya-Kapiagas Cafer Aga (Sogukkuyu) Madrasa, and Uskudar-Atik Valide Madrasa.

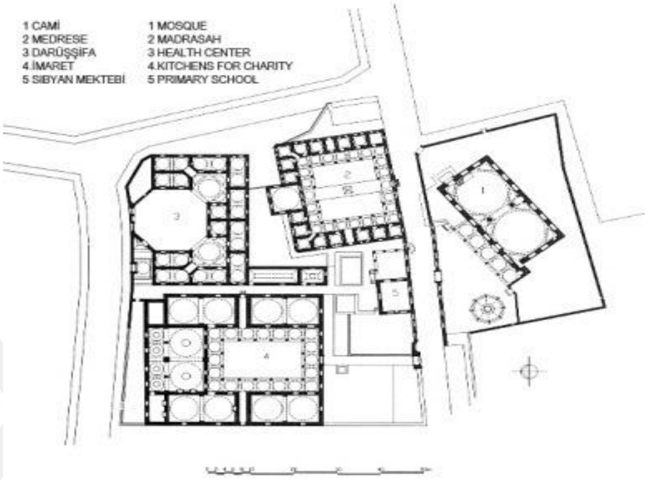
4. Madrasas, where the rooms are located on two sides of a courtyard, which is surrounded by arcades on four sides. Examples include: Eyup-Sokollu Mehmed Pasha Madrasa.

5. Madrasas, where the arcade and the rooms form the shape of an 'L.' Examples include: Uskudar-Semsi Ahmed Pasha and Eyup –Zal Mahmud Pasha's lower madrasa.

6. Madrasas, with an octagonal courtyard. Examples include: Cagaloglu-Rustem Pasha Madrasa (Gunay, 2006, pp. 33-34).

1.1 Haseki Madrasa (1540): The madrasa consists of sixteen cells and a main classroom surrounding the courtyard with arcades on each side of it (Figure 2.18). Each cell has its own fire stove and a small window. There are domed cells on three sides of the courtyard with a main classroom situated opposite of the entrance. The entrance is in the inner court of the complex and includes a small garden (Mitademo, 2011). The madrasa is also distinguished by its beautiful architectural features and ornaments such as its twenty granite columns and inscribed faience panels (Freely, 2011, p. 220, Gunay, 2006, p. 158).

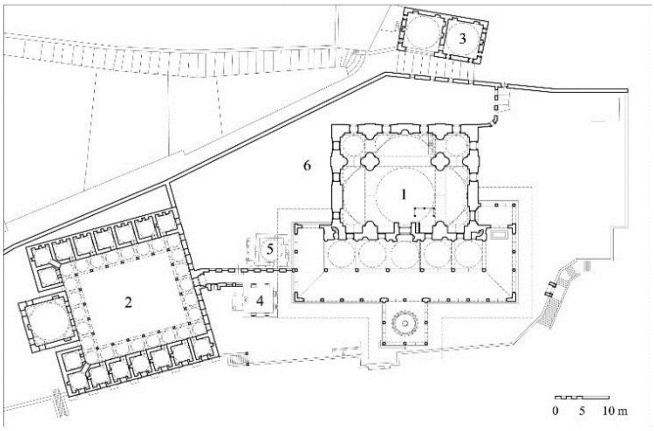
Figure 2.18: Plan of the Haseki Complex in



Source: *http://archnet.org/sites/1990/media_contents/49237.-*

1.2 Uskudar - Mihrimah Sultan Madrasas (1548): The madrasa consists of sixteen cells and has a main classroom situated on three sides of the arcaded courtyard. The plan of the madrasa is symmetrical and it has a "U" shape plan geometry (Figure 2.19).The main classroom (*dershane*) is located on the eastern side of the madrasa. Each side of the classroom contains two narrow passages. On the opposite side there is a passage connecting the madrasa and the courtyard of the mosque (Ahunbay, 1988, p. 247, Gunay, 2006, p. 187).

Figure 2.19: Plan of the Mihrimah Sultan



Source: http://archnet.org/sites/2768/publications/1457

1.3 Suleymaniye Evvel and Sanni Madrasas (1552-53): The Evvel (first) and Sanni (second) Madrasas in Sulaymaniye are located across from the mosque on the southwestern side of the complex. They are completely symmetrical to one another and are therefore known as twin buildings.The classroom (*darshane*), cells, and arcade surround the rectangular courtyard and both of the madrasas have the same ‘U’ shape plan geometry (Figure 2.20) (Ahunbay, 1988, p. 249). They also have a few differences from other madrasas as there is no arcade on the northern side but the three cells are opened, as a new kind of arcade, while the arcade on the southern side is cut by the classroom. Each of the madrasas entrances are on the sides of a long narrow alley, between the two madrasas, facing each other (Sumner and Freely, 2010, pp. 205-206).

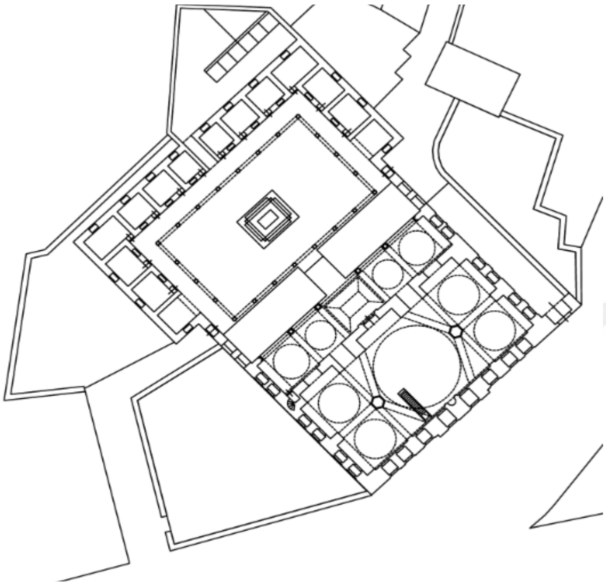
Figure 2.20: Sulymaniye Complex: Evvel and Sani Madrasas in Istanbul

Source: http://www.mustafacambaz.com/details.php?image_id=17512#

2.1 Sinan Pasha Madrasa Besiktas (1555): Originally, the Sinan Pasha Complex consisted of a mosque, madrasa, and twin hammams. This was Sinan’s first attempt to design a mosque coupled to a madrasa (Gunay, 2006, p. 179). The madrasa has ‘U’ type plan geometry and consists of fourteen cells but it does not contain a classroom (Figure 2.21). This madrasa is one of the few madrasas in which the arcades are not domed but instead have sloping wooden roofs. The courtyard contains a fontain "*şadırvan*" in its center and it is surrounded on three sides by the madrasa’s cells' arcades and the mosque.

The madrasa’s scale is not appropriate for the building. The interior and courtyard appear to be heavy as well. A conceivable explanation for that occurrence may be that Sinan was copying an older building on a smaller scale (Freely, 2011, p. 282, Aslanapa, 1989, p. 204).

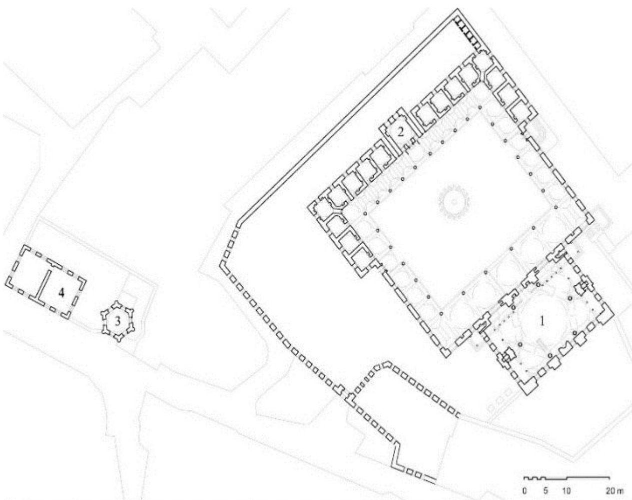
Figure 2.21: Plan of Sinan Pasha Madrasa



Source*: http://archnet.org/sites/2023/media_contents/49285*

2.2 Topkapi-Kara Ahmed Pasha Madrasa (1560): The madrasa consists of sixteen cells and one main classroom (*dershane*). The classroom is separated from students' rooms by two narrow side passages, which lead onto a garden (Figure 2.22) (Gunay, 2006, p. 143).

Figure 2.22: Plan of Kara Ahmad Pasha Madrasa in Topkapi Istanbul



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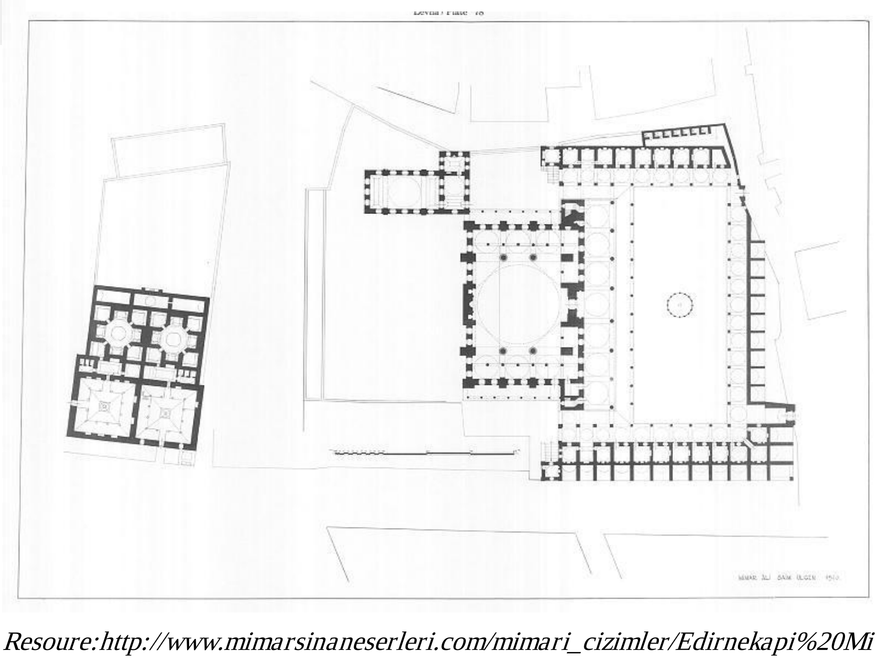
It also shares the same axis with the prayer room, and it is located along the north side of the courtyard. The cells are arranged around the courtyard from three sides; five cells on each side of the main classroom (*dershane*) and three cells in the east and west sides of the madrasa. The madrasa is distinguished by its domed arcades, which surround the courtyard and cells. (Freely, 2011, p. 283).

2.3 Edrinekapi Mihrimah Sultan Complex in Edrinekapi (1570): The complex is composed of a mosque, a madrasa, mektep, a turbe, a hamam, and a group of shops. The cells of the madrasa, which are proceeded by arcades, surround its courtyard from three sides. The courtyard contains a fountain in its center (Figure 2.23). The row of cells that are facing the mosque are irregular because of the ancient Theodosian walls of the city. There is some speculation, which indicates that there might have been a main classroom "*dershane*" in the center of that row. The complex was damaged and altered because of the earthquakes of 1766 and 1999, due to this fact certain information related with this is not found (Gunay, 2006, p. 123, Freely, J & Sumner, B, 2010, pp. 351-352).

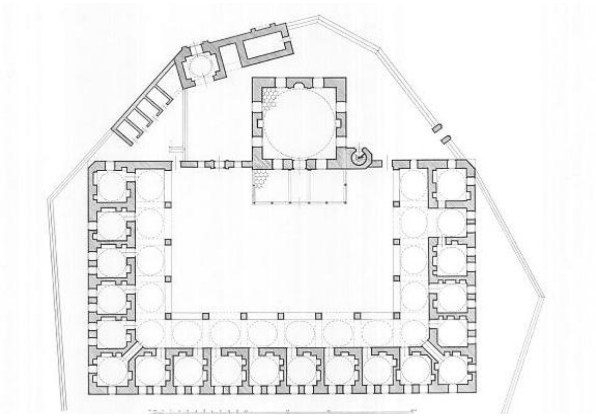
Figure 2.23: Plan of the Mihrimah Complex



Resoure:http://www.mimarsinaneserleri.com/mimari_cizimler/Edirnekapi%20Mihrimah%20Camii/slides/Levha078_Istanbul_Edirnekapi_Mihrimah_Camii_Vaziyet_Plani.jpg

3.1 Yavuz Sultan Selim Madrasa, also known as Halicilar Kosku Madrasa, was built in 1549. The madrasa consists of twenty cells, which surround the courtyard from three sides. There is one mainclassroom "*dershane*" located on the northern side (Figure 2.24). Unlike the side of the classroom, arcades proceed the cells from all three sides. Unique to this madrasa, the entrance is located behind the main classroom. The main classroom was turned into a Masjid in 1563.A minaret was later added but it had collapsed lately (Gunay, 2006, p. 150, Freely, 2011, p. 235).

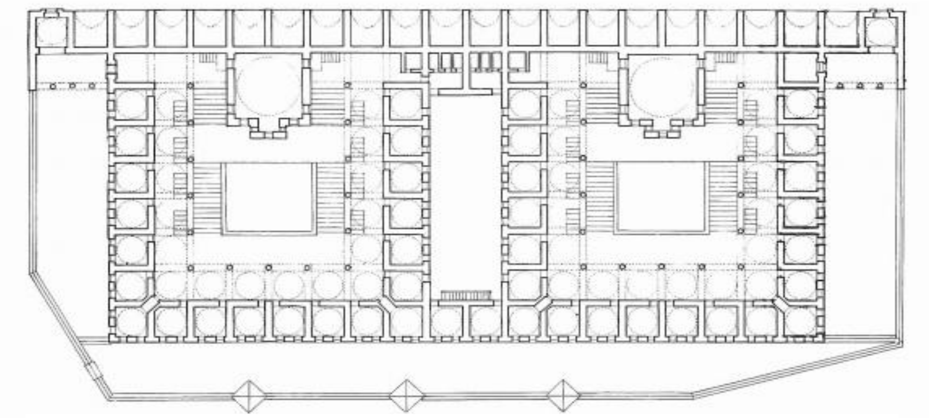
Figure 2.24: Plan of Yavuz Sultan Selim Madrasa



Resoure:http://mimarsinaneserleri.com/mimari_cizimler/Diger %20Mimar%20Sinan %20Eserleri/slides/ Levha192_Yenibahce_Sultan_Selim_Medresesi_Plani.html

3.2 The Suleymaniye Salis and Rabi madrasas, which mean the third and fourth madrasas, were built in 1558 in the Suleymaniye *külliye* complex. The complex had the largest number of madrasas in the Ottoman Empire. The twin madrasas are located on a slope facing the golden horn (Gunay, 2006, p. 81). The cells, the arcades in front of the cells, and the courtyard are situated on five different levels (Figure 2.25).

Figure 2.25: Plan of Salis and Rabi Madrasas of Suleymaniye



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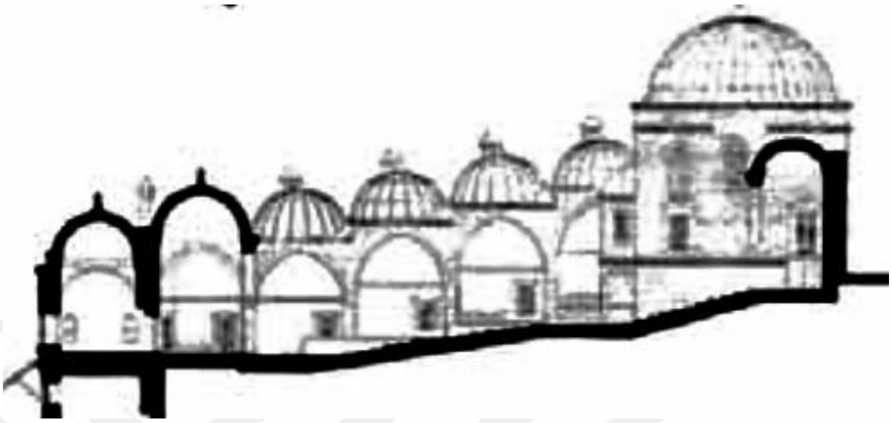
Each one of the twin madrasas has a ‘U’ shape plan scheme and they have a symmetrical design. In each madrasa, there are fifteen cells; in front of them arcades surrounding a courtyard and all of them are distributed on five different gradual levels (Figure 2.26).

Figure 2.26: Section of Salis and Rabi Madrasas of Suleymaniye



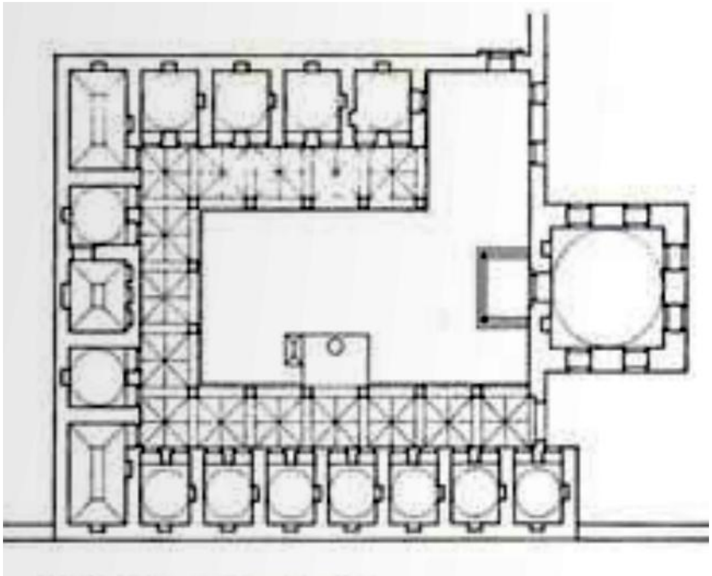
Resoure: http://www.immimarlik.com.tr/Resimler/SiteIcerik/Suleymaniye.pdf

The main classroom "*dershane*" is located on the upper level (Freely, J & Sumner, 2010, p. 204). In between the twin madrasas, there is a courtyard that provides light and air for the cells which are adjacent to it, and it has a fountain in its center. The topography of this madrasa allowed its courtyard to have level differences on the side, which in turn gave it a unique design. The twin madrasas are located on the northern side of the Suleymaniye mosque, and their entrances stand on Sinan Street (Gunay, 2006, p. 81, Im Mimarlik, 2014, Ahunbay, 2012, p. 139, Freely, J & Sumner, B., 2010, p. 204).

3.3 Ayasofya-Kapiagas Cafer Aga Madrasa, also known as Sogukkuyu Madrasa, was built by Sinan in 1560. The madrasa is built on a slope, therefore a vaulted substructure is erected to support the madrasa and its courtyard. The madrasa and its courtyard both create the second level of the building, while the first level is occupied by shops. The first and second levels of the madrasa are not connected by stairs.

The madrasa has a ‘U’ shape plan scheme, where the cells proceeded by arcades surround a courtyard from three sides. The fourth side of the courtyard stands the main classroom (*desrhane*), by itself (Figure 2.27). The entrance of the madrasa is on the street, which is parallel to the west end of Hagia Sophia (Gunay, 2006, p 104, Freely, 2011, p 299, Freely, J & Sumner, B., 2010, p 32).

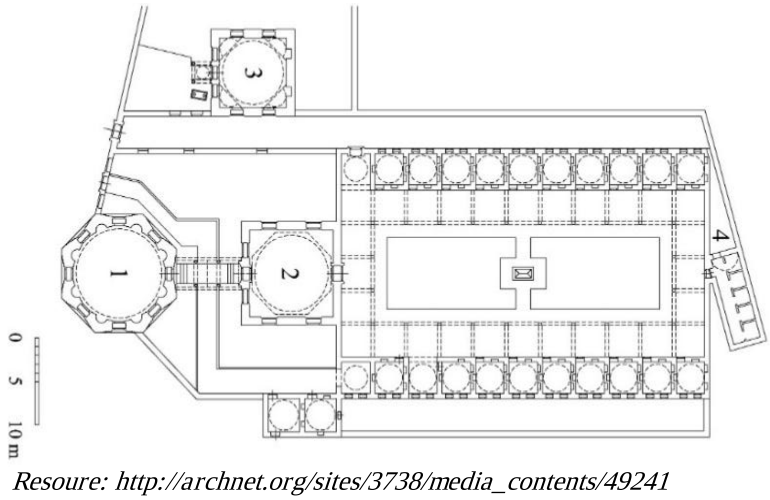
Figure 2.27: Plan of Cafar Aga Madrasa in Istanbul



Resoure: Freely, J., 2011. A History of Ottoman Architecture. Bosporus University. WIT Press, pp. 299, Istanbul.

4. 1 Eyup-Sokollu Mehmed Pasha Madrasa, which was built in 1569, is a part of Sokollu Complex. The complex contains of a madrasa, a tomb, Koran school "Darul Kurra", and a fountain which is surrounded by a wall. The madrasa has a long and narrow rectangular courtyard, with ten domed cells proceeded by arcades on each of the two long sides of the rectangle. In addition, there are two larger independent cells which are used as service rooms. They are both located outside of the madrasa's rectangular courtyard (Figure 2.28). A main classroom (*dershane*) is situated on the short side of the rectangle. It has a square shaped plan and is covered with a dome. It is connected to the tomb (*turbe*), with a roofed passage .The classroom and the tomb are both on the same axis. They both have identical doors (Gunay, 2006, p. 134, Freely, 2011, pp. 302-303, Archet, 2013).

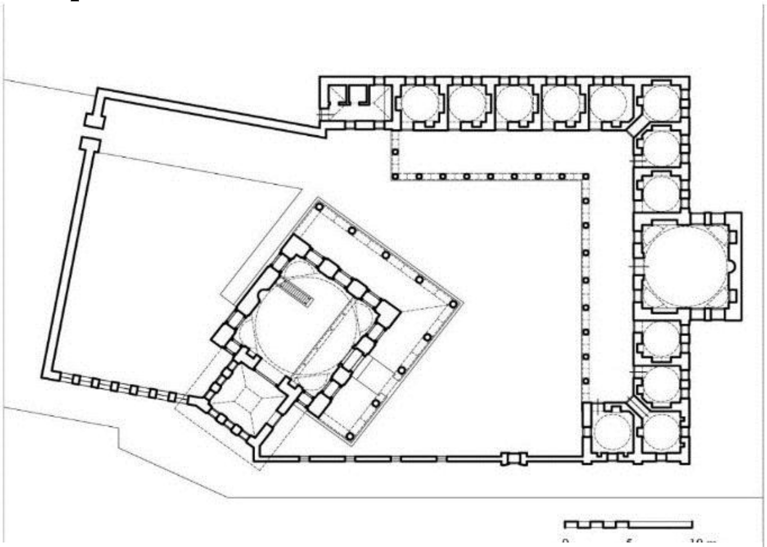
Figure 2.28: Plan of Eyup- Sokollu Mehmed Pasha Madrasa



Resoure: http://archnet.org/sites/3738/media_contents/49241

5.1 Semsi Ahmed Pasha Complex (1580): is considered one of the smallest complexes that was built by architect Sinan. It consists of a madrasa, a mosque and a tomb. The madrasa has an ‘L’ shape plan scheme and it consists of a main classroom and twelve domed cells proceeded by arcades. The third side of the madrasa encompasses a wall with window openings (Figure 2.29). The main classroom (*dershane*) is located in the center of the western wing, and it is distinguished by its huge dome which is located on an octagonal drum. The madrasa is parallel with the sea, while the mosque is oriented towards Mecca, which creates a fifty-three degree angle between them. This established a unique feature for this madrasa and for Sinan's work. (Gunay, 2006, p. 191, Katipoglu, 2007, p. 71, Freely, J & Sumner, B., 2010, pp. 375-376, Freely, 2011, p. 298, Archet, 2013).

Figure 2.29: Plan of Uskudar-Semsi Ahmed Pasha Complex Istanbul



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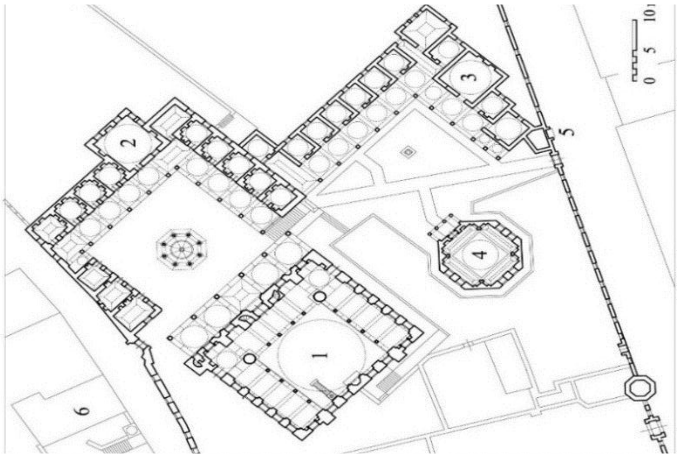
5.2 Eyup –Zal Mahmud Pasha’s lower madrasa, which was built in 1580, is part of the Zal Mahmud Pasha’s Complex. The complex consists of a mosque, a tomb, and two madrasas; lower and upper once. The lower madrasa has an ‘L’ shaped plan. It consists of a main classroom, and eleven cells. Seven cells are located in the northern wing, whereas the eastern wing contains four cells and the main room. The cells in the northern wing have the very similar dome sizes, while the cells in the eastern wing have larger domes, which vary in size (Figure 2.30).

There is a fountain located in the southeastern corner of the madrasa. Moreover, a staircase leads to the upper madrasa (Kuran, 1973, pp. 73-74). The rooms on the eastern wing have different sizes to adapt to the course of the street, which runs adjacent to this wing (Gunay, 2006, p. 133).

Figure 2.30: Plan of Eyup –Zal Mahmud Pasha Lower Madrasa



Resoure:http://archnet.org/system/media_contents/contents/49282/original/IMG14059.jpg?1398873151

6.1 Cagaloglu-Rustem Pasha Madrasa (1550): Rustem Pasha Madrasa (Figure 2.24) is built on a slope that faces towards the Golden Horn. Sinan built this madrasa in 1550 after improving upon the similar octagonal plan of the Kapiagasi Madrasa in Amasya, which was built in 1489 (Figure 2.31). However, regarding Rustem Pasha Madrasa, the outside of the building has a square plan while the inside courtyard is octagonal.

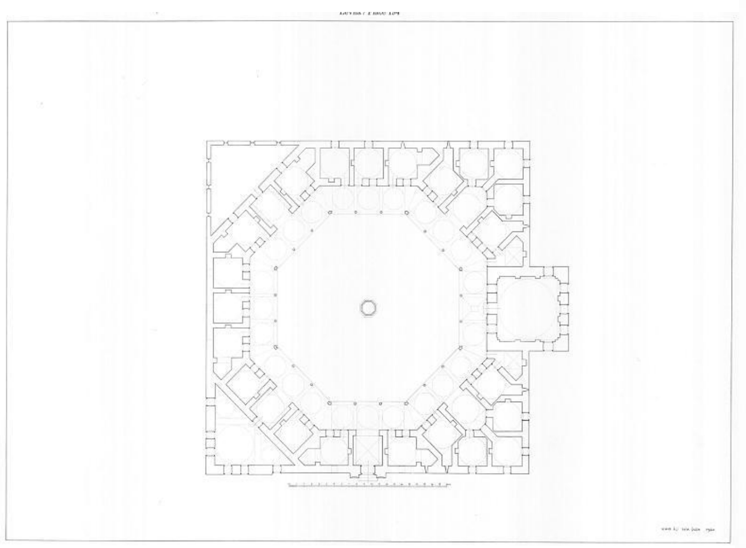
Figure 2.31: Photo of the Rustem Pasha Madrasa

Resoure: Arther

The cells are proceeded with an arcade of twenty-four domes, which surround an octagonal courtyard. There is a fountain in the middle of the courtyard. The classroom is a large domed room, which bulges out of the rectangular plan of the madrasa as an apse. In addition, the classroom is not on the same axis as the entrance of the madrasa (Figure 2.32).

The corners of the madrasa's squared plan each contain additional rooms; one of which contains a bath and lavatories. The corner rooms are accessible through iwans which are opened to the courtyard (Gunay, 2006, p. 103, Freely, 2011, p. 241, Ahunbay, 1988, p. 248).

Figure 2.32: Plan of Rustem Pasha Madrasa's



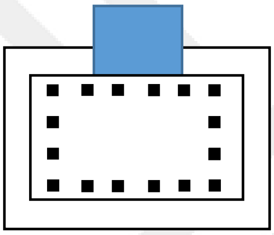
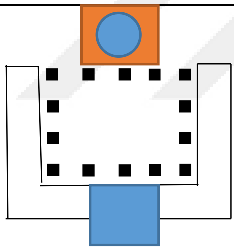
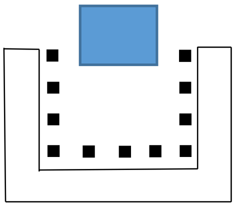
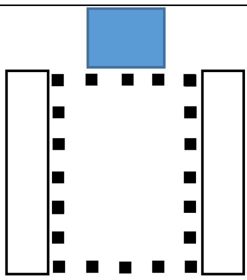
Resoures:http://www.mimarsinaneserleri.com/mimari_cizimler/Diger%20Mimar%20Sinan%20Eserleri/slides/Levha194_Rustem_Pasa_Medresesi_Plani.jpg

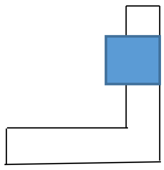
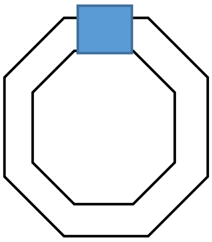
Mimar Sinan's works are considered the best representation of the Classical Ottoman architecture. His work on Ottoman madrasas added and developed on the open courtyard Seljuk plan scheme, and added his personal touch, rather than just copying them. Most of Sinan's designs depended on the 'U' shaped plan scheme, however, this did not stop him from innovating and using other scheme plans such as the 'L' shape plan among others. Moreover, Sinan took some challenges by building his madrasas on irregular terrains, such as the Salis and Rabi madrasas which he built on a slope.

These, in addition to several other reasons, including the huge number of buildings and madrasas that he built, made Sinan the most significant architect in the history of the Ottoman Empire. Furthermore, this lays the argument that 16^{th} classical century architecture is hugely represented by his work and that his work is the foundation of what is known today as classical architecture, and the architectural lines of the golden era of the Empire.

As a result of the study of 16th century ottoman madrasa main geometrical table: 16^{th} century madrasa's typology:

Table 2.1: 16^{TH} Century Madrasa's Typology

	Rectangular shape madrasas, where the courtyard is surrounded by an arcade (series of columns) on four sides, with rooms located on three sides such as Semiz Ali Pasha Madrasa
	(U) Shape madrasas, where the courtyard is surrounded by an arcade (series of columns) on four sides, with rooms on three sides and a mosque on the fourth such as Semiz Ali Pasha Madrasa Sinan Pasha Madrasa Besiktas
	(U) Shape madrasas, where the courtyard is both arcaded and surrounded by rooms on three sides such as Yavuz Sultan Selim Madrasa
	Madrasas, where the rooms are located on two sides of a courtyard, which is surrounded by arcades on four sides such as Eyup-Sokollu Mehmed Pasha Madrasa.

	(L) Shape madrasas, where the arcade and the rooms form the shape of an "L." such as Semsi Ahmed Pasha madrasa.
	Octagon shape madrasas, with an octagonal courtyard. Such as Cagaloglu-Rustem Pasha Madrasa.

Source: The Author

3. DETERIORATION AND DAMAGE ON MASONRY HISTORIC MONUMENTAL BUILDINGS

3.1 CAUSES OF DETERIORATION

Historical monuments are vulnerable to several impacts that may result from deterioration and decay. The structure and materials of a building can become damaged due to induced natural impacts and human impacts.

Causes of deterioration and decay could be listed as:

- Natural factors: including botanical, biological and chemical factors.

- Human causes.

- Weakness of the original structure.

When more than one of those factors leading to deterioration occur in a building, it deteriorates more rapidly and the level of deterioration worsens (Feilden, 1982, p. 2).

3.1.1 Natural Impacts

Natural impacts are considered as one of the main reasons of deterioration and decay in historical buildings. They include:

- Natural disasters: such as earthquakes, tornadoes and fires etc.

- Water: which can appear in various forms such as rain, snow, frost, and ground water. It contributes toward forming moisture, which causes many problems in buildings.

- Biological organisms: such as fungi, algae, etc.

- Soil type: there are many types of soil and some of them negatively affect the buildings.

3.1.1.1 Disasters

Disasters are any impact or action of nature that has catastrophic consequences, which have the ability to affect historical monuments greatly because they could cause massive unforeseen destruction. If a natural event occurs frequently it could cause even greater damage to the historical monument (Feilden, 1982, p. 113).

Tsunamis, volcanic eruptions, floods, landslides, tornadoes, and earthquakes are all natural impacts that may result as a disaster capable of immense destruction. Earthquakes are considered to be the most destructive natural disasters (Feilden, 1982, p. 113).

Floods can cause damage to the structure of a historical monument. They usually occur suddenly and there is no way to track them (Feilden, 1982, p. 113).

The damage and deterioration caused by earthquakes to historical monuments depend on the current state of the building, its material and workmanship quality, and the soil the building is established on.

Despite that, some historical monuments have survived for decades, but the constant exposure to earthquakes over the years ultimately led them to have weakness in their structure, causing them damage (Kaptan, 2010, p. 8).

3.1.1.2 Water and Humidity Problems

Water is one of the main causes of deterioration and structural decay to historical monuments. It could cause damage to the building's structure such as generating cracks. It also provides a convenient environment for molds, bacteria, and algae.

Water has various forms such as rain, snow, ice, and groundwater. In addition, it is the source of humidity issues.

Rain and snow change the porosity of the materials either by damaging their surface or by penetrating through cracks.

Water which contains acid makes igneous rocks and sandstone vulnerable to scaling by stimulating it to produce a clayey substance. When water freezes, it can also cause decay in historical buildings. It is especially seen when water freezes within cracks. The frozen water expands and grows in the cracks, leading to vast damage. Groundwater could also cause humidity problems inside the building due to capillary action. Water is the main cause of molds, bacteria and algae, which cause decay to historical monuments (Croci, 2000, pp. 45-46).

When the temperature increases, it increases the evaporation of the water in the capillary channels and ultimately forms salt. When the temperature decreases, water freezes and causes deterioration to the building materials (Kaptan, 2010, p. 9).

Moisture (high water content) is one of the main causes of decay in historical monuments. It is caused by the condensation of water vapor in the air (humidity) which is increased when the surface is colder than the surrounding temperature (Croci, 2000, p. 43).

Moisture can cause damage and decay to historical buildings in various ways by producing fungi, bacteria, salt crystallization, acidic attacks, and frost. In addition, it causes deterioration to metallic elements and also causes rusting.

Moisture can aid in the formation of several different types of salts. It is considered to be very destructive because it can produce a combination of harmful substances such as sulfates, nitrates and chlorides. They can cause damage in the structure of historical buildings such as white veil over surfaces, efflorescence, and disintegration (Croci, 2000, p. 44) (Feilden, 1982, p. 115).

Moisture can seepage into the building's structure from penetrating rain or through the surfaces of a building (walls and roofs) to its masonry. An excessive quantity of moisture may occur due to a rising amount dampness (capillary action). It can especially occur from groundwater, which causes humidity in the buildings' walls (Croci, 2000, pp. 43) (Kasmo. 2008, p. 53).

Lack of moisture can negatively affect the buildings' materials as well. It could cause shrinkage or even brittle the mortar.

Wooden elements are affected by moisture because it creates a suitable environment for insects, leading to decay as well as distortion. Too much moisture also causes humidity issues inside wooden pillars and beams facing the wind. It can cause them to crack and form fungi (Kaptan, 2010, p. 11) (Croci, 2000, pp. 43-53).

3.1.1.3 Biological Impacts

There are many botanical biological impacts that may cause damage and decay to historical building such as bacteria, lichens, algae, mosses, fungi, mold, acids (such as the excrement of birds which can cause chemical corrosion), and plants (especially their roots which can cause cracks in historical buildings due to their mechanical action) (Croci, 2000, p. 45, Feilden, 1982, p. 131). While lichens and mosses cause decay as they grow on the building's materials, such as bricks and stones, the damage increases with the more lichens and mosses spread throughout the materials. In addition, they produce acids, which cause cracks due to chemical reactions with the materials (Feilden, 1982, p. 131, Kaptan, 2010, pp. 13-14).

Wet surfaces are considered to be more vulnerable to decay because moisture is a favorable environment for the growth of lichens and mosses (Feilden, 1982, p. 131, Kaptan, 2010, pp. 13-14).

Trees and plants which can negatively affect buildings include creepers and ivy, among other types. They grow alongside the structures, especially on the walls, causing them decay and deteriorate in multiple ways (Figure 3.1).

Figure 3.1: Plants and Trees on Siyavuşpaşa Madrasa in Istanbul

Source: http://www.hayalleme.com/wp-content/uploads/2010/02/siyavupasa_medresesi.jpg

Ivy can cause disintegration of blocks. While it grows, its roots divide into the masonry. Its branches could also penetrate into some material, such as plaster or brick, and remove them by pulling the weak surface. Other plants, such as sedum, can cause decay in materials such as mortar by producing toxins in it. Some plants should be kept away from gutters because they have the ability to develop blockages, which cause decay in the structure (Feilden, 1982, p. 131).

Tree roots could cause a variety of Damageand may cause decay to the building such as creating blockages or causing too much moisture when they reach the rainwater drains. In some cases they break because of the roots, since the water can leak under the buildings foundation in sandy types of soil.

On the other hand, trees which are rooted in clay soils could cause massive damage to the foundation of historical buildings when they absorb moisture during the summer. When that happens, it causes the ground to shrink and moves the building's foundation (Feilden, 1982, p. 131).

Algal deposits could cause damage, but on the other hand it produces acid which could provide a protective layer, shielding the surface from the effect of wind (Feilden, 1982, p. 131, Kaptan, 2010, p. 14). Fungus can cause serious damage to the buildings' materials. It can be visibly seen in the shape of spots and patches on the materials. Fungi do not need sunlight to grow, and instead they just need an adequate amount of water and oxygen (Figure 3.2).

Figure 3.2: Spots and Patches on a Wall Due to Fungus

Source:http://alteredstates.net/barry/newsletter438/blackmoldonthewalls.jpg

Minute fungi causes wood to decay and rot, which in turn contributes toward providing a suitable environment for insects. (Feilden, 1982, pp. 132-133).Insects such as beetles, carpenter bees, woodworms, and termites can cause massive damage. They weaken the wooden materials by attacking structural timbers and creating several small holes in them (Figure 3.3) (Feilden, 1982, p. 135, Croci, 2000, p. 53).

Figure 3.3: Insect Damage (Termites) on Wood

Source:http://i.milliyet.com.tr/YeniAnaResim/2015/07/26/fft99_mf58 82737.Jpeg

The situation could be even more threatening when the insect's eggs hatch in large numbers, spreading the decay throughout the wood.

The effect on the structural materials will vary between the types of each insect. Each type of insect will respond differently to each chemical treatment (Feilden, 1982, p. 135).

3.1.2 Human Induced Impacts

Human induced impacts are considered to be worse than natural impacts and they inflict greater damage and deterioration to historical buildings.

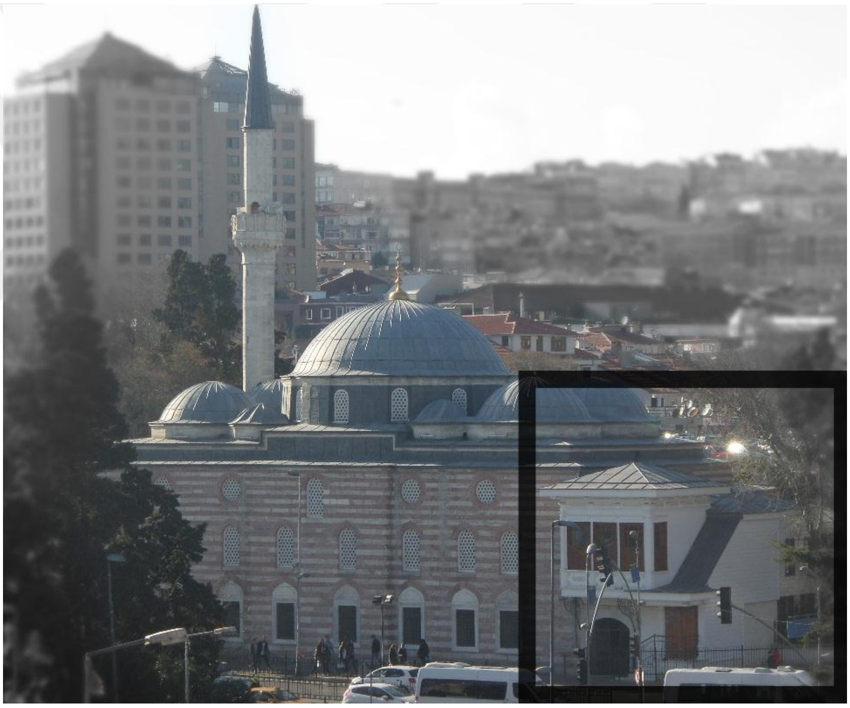
Human induced causes include inappropriate interventions, the use of wrong materials, incorrect cleaning methods, vandalism, fire, ignorance of periodic maintenance, negligence, and also indirect action such as air pollution (Kasmo, 2008, p. 54 ,Croci, 2000, p. 47 ,Kaptan, 2010, p. 15).

3.1.2.1 Inappropriate Interventions

The removal, addition, and modification of structural elements such as the removal of walls, slabs, or staircases could cause cracks and even put the building at serious risk. Those actions could alter the reciprocal support of the structure such as arches and columns. It could change the balance of horizontal forces and ultimately cause severe Damageto the structure.

Increasing the weight of a structure changes its structural behavior. Some cases could include adding construction elements such as an attic or a projection (Croci, 2000, p. 43) (Figure 3.4).

Figure 3.4: Oriel Addition at Sinan Pasha Mosque in Istanbul



Source: The Author

Creating holes and intervals in the walls for electrical wiring and water pipes could produce different kinds of cracks, crushing, and decay. Other actions such as excavations and the demolition of adjoining buildings could change the weight of the building and its effect to the soil and modify boundary conditions (Croci, 2000, p. 43).

Harsh methods of cleaning could enable decay. Using rough cleaning techniques such as brushing and blasting can weaken the surface. (Croci, 2000, p. 47).

3.1.2.2 Vibration

The effects of vibration are considered to be one of the negative effects of human interventions on historical buildings.

Generally, vibration doesn't have an immediate impact on historical buildings. It is usually a slow process that takes long time. It depends on natural conditions and any technological effects (Kaptan, 2010, p. 18).

Vibration is considered very dangerous due to the fact that severe damage is caused on the long-term, making it hard to measure its effects. It is also hard to know if the damage is caused by the vibration or because of the age of the building. When the two factors are combined the process of deterioration is sped up, but when vibration affects historical monuments it causes damage which cannot be undone. There are many causes to vibration which exist such as the growth of cities, traffic (e.g. trains and vehicles) loud noises, and massive machines such as cranes.

The most common cause of vibration is that which is transmitted through traffic, especially through heavy vehicles. They pass vibrations to adjacent buildings while passing along the street. Vibrations do not just damage the substructure of the building, they also damage the building as a whole (Kaptan, 2010, p. 18 ,Feilden, 1982, pp. 154-155).

Vibrations can have a greater effect on materials when they come along with other effects such as the change in temperature or humidity. It can cause cracks and decay in addition to the effects from vibration, which weakens the foundation by affecting the subsoil. In some conditions it could cause compaction in non-cohesive soils while it could also cause massive damage in cohesive soils such as silts. (Feilden, 1982, p. 155).

Constructing new buildings which have the capability of avoiding Damagecaused by vibrations are more important than limiting the damage by intercepting the causes (Feilden, 1982, p. 154).

3.1.2.3 Air Pollution

Atmospheric pollution, or simply, air pollution is caused by industrial activities such as burning fuel and the use of factories. The effects of pollution are global.

Air pollution is mainly caused by dust and grit from the smoke of vehicles and industrial chimneys due to soot and gases such as carbon dioxide and sulfur dioxide (Croci, 2000, p 45, Feilden, 1982, p. 160).

Smoke is considered to be one of the effects which causes decay to historical buildings. It is a result of the incomplete combustion of fuels. Usually it arises from burning inside power stations and vehicles. When its carried with the wind it could make layer of tarry soot which is an acid (absorbed sulfur dioxide) and could cause deterioration, especially to metal materials (Figure 3.5) (Feilden, 1982, pp. 109-110).

Figure 3.5: Effect of Air Pollution on a Historical Building Istanbul

Source: The Author

Gases such as carbon dioxide and sulfur dioxide cause damage to historical buildings by corroding stones and metallic elements. When those gases are combined with other factors such as sun rays and global warming they cause damage to the structure’s surface and its materials (Kaptan, 2010, p. 18, Feilden, 1982, p. 163, Croci, 2000, p. 45).

Carbon dioxide is produced naturally and also from vehicles. It integrates with oxygen in the air and darkens the surface of buildings. On certain materials that dark layer can detach from the surface of a building and peel off over time. The combustion of fuel contributes with rain to form acid rain, which could penetrate limestone and cause it to disintegrate.

Sulfur dioxide is produced naturally and from man-made creations as well, such as diesel vehicles. This gas has an effect on metals such as iron and causes them to deteriorate. (Kaptan, 2010, pp. 18-19, Fielden, 1982, p. 163).

Particulates such as solid particles, which settle in still air, are dust, sand, or grit.

Dust, sand, and cobbles each have an effect on historical buildings and they can gradually cause a large amount of damage to them over time. Dust could deteriorate both the exterior and interior elements of historical buildings. Historical buildings could become completely destroyed in cases where they are under constant effect from dust-laden winds.

Sand and pebbles could also cause historical buildings to erode, especially when they are carried by the wind. The wind increases the abrasion of exterior materials when small pieces of cobble frequently hit the surface. Over time it could cause large holes to appear in the facade (Figure 3.6) (Feilden, 1982, pp. 109-111).

Figure 3.6: Building Decay Caused by Pebbles in Hungary

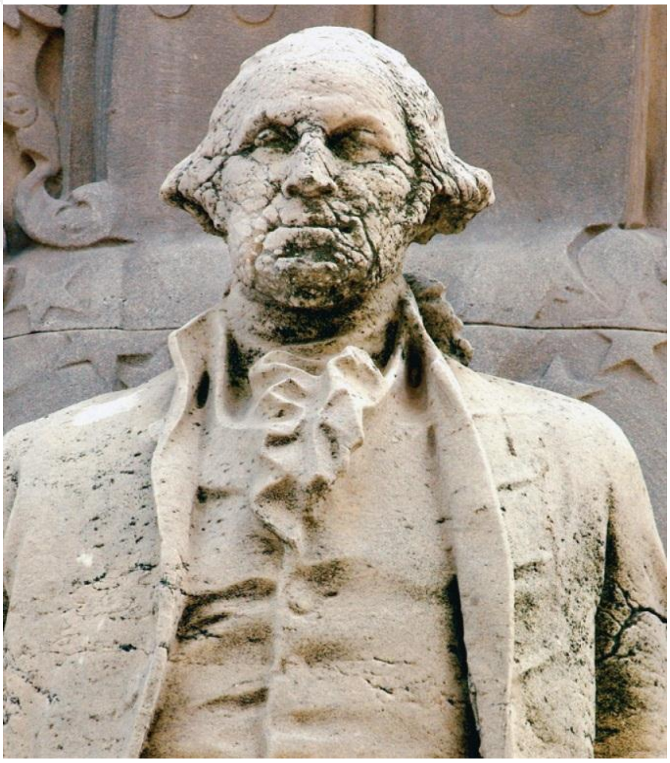
Source: http://untappedcities.wpengine.netdna-cdn.com/wp-content/uploads/2012/03/03-Building-Close-up-of-decay.jpg

The wind is considered as a contributing factor of the deterioration of historical buildings and it occurs as a result of different atmospheric pressure. It causes salt crystallization within walls as a result of evaporation. Later on, the salt breaks down and creates cavities within the walls (Fielden, 1982, p. 107-109, Croci, 2000, p. 45).

High winds intermixed with heavy rainfall could cause internal decay, which penetrates deeply, creating cracks and fissures and causing the materials to become porous (Fielden, p. 109).

Acid rain is considered as one of the causes of deterioration, especially to statues. Acid rain contains sulfate which harms surface materials such as limestone, marbles and sandstone (Figure 3.7) (Fielden, 1982, p. 160).

Figure 3.7: Damage of Acid -Containing Water



Source:http://2012books.lardbucket.org/books/principles-of-general-chemistry v1.0/section_08/48f34caee678e5f862723ef602d2675f.jpg

3.1.2.4 Lack of Periodic Maintenance

The lack and ignorance of maintenance on historical buildings could cause various Damage. It may weaken the structure and accelerate any compounding effects that cause deterioration.

There are factors that can lead to the ignorance of maintenance of historical buildings such as the economic state, legal reasons, and property issues. Usually, massive deterioration can occur in historical buildings if they are used as a shelter by the homeless (Figure 3.8) (Kaptan, 2010, p. 19, Kasmo, 2008, p. 55).

Figure 3.8: Damage in a Building Used as a Homeless Shelter

Source: The Author

3.1.2.5 Vandalism

Vandalism is a threat to historical buildings. It can cause massive damage to them and in some cases it could even lead to the destruction of the whole building.

There are several types of Damagecaused by vandals which can occur on the structure of historical buildings. They can include activities such as marking graffiti on the walls, stealing (doors, wood, and bricks), breaking glass, and arson.

3.1.2.6 Armed Conflicts

Vandalism due to war is seen as the worst form of vandalism. It could cause massive damage and destruction to historical buildings because of bombing, shells, and explosions. There are many instances of vandalism which occurred due to war.

One example is the Mostar Bridge, which was destroyed by shells. Another example is Khusruwiyah Mosque in Aleppo, which was completely destroyed from explosions (Figure 3.9) (Kaptan, 2010, p. 19, Croci, 2000, p. 54).

Figure 3.9: The Entire Demolition of Khusruwiyah Mosque

Source: http://arabweek.com.lb/images/stories/2868/general/syria-heritage1.jpg

3.2 DETERIORATION AND DAMAGE TYPES

Historical buildings could suffer from deterioration and Damagein all of their structural elements such as walls, arches, vaults, columns, domes, floors and roofs. The deterioration occurs due to external factors such as earthquakes or by several other natural effects which could damage the structure.

External factors could affect the masonry structures because they place stress on it, weakening its materials.

The damage received by the materials depends on the load impact and also the properties of the materials (Croci, 2000, pp. 54-57).

Generally, most common deterioration and damage types that could occur in all structural elements, could be listed as:

- Cracks.

- Crushing.

- Slippage.

- Permanent deformations.

a) Cracks

Cracks are considered to be the most common kind of damage found in a building's structure because they could occur in all structural elements such as columns, domes and arches, and it is usually visible on the surface of the materials or between adjacent elements. Cracks can be caused from earthquakes, unbalances in the distribution of forces, soil deformation, among several other reasons. Since there are no specific patterns of cracks for every single cause, it is hard to detect the problem in order to solve it. Strong tension can cause a great deal of stress over the structure. If it exceeds the structures' ability to withstand the forces then it can cause the building' materials to crack. Those stresses could lead to much greater damage if they occurred in a building which was already suffering from substantial weaknesses such as cavities and cracks.

An increment of those forces could cause more cracks in the materials and even cause the cracks to become deeper. In some cases, it might also cause the building to collapse. Usually, cracks first begin to appear depending on the kind of material and structure. Generally, it's far more likely for cracks to appear within the weaker zones of the structure (Croci, 2000, pp. 54-56, Kaptan, 2010, p. 22).

b) Crushes

It could occur in different structural elements such as columns, and when the stress from compression reaches the materials or as result of the force of gravity. Crushing causes swelling, crusting, flaking, disintegration and cracks the materials. The types of Damageobserved depend on the type of materials (Croci, 2000, p. 57).

Initially, increasing compression and stress leads to tiny cracks which appear parallel to the direction of the stress but the persistence of the stress could cause transversal swelling. Flakes become detached and the internal nucleus could suddenly crumble.

The phenomena of crushing is considered to be exceptionally dangerous because it could cause a great amount of damage to an entire building without giving any visible warning signs (Croci, 2000, pp. 54-55, 56-57, Kaptan, 2010, pp. 22-23).

c) Slippages

slippage a common damage which could occur in structural elements especially in arches and domes which usually occurs as a result of displacement and the force of gravity, props, and the vertical tensile stress which in some conditions cause thoese elements to collapse.

d) Permanent deformation

Permanent deformation is related to the effects of bending which is caused by a shift in the center loads or horizontal thrusts such as arches and beams. Soil deformation could be considered as a factor too (Croci, 2000, p. 55) (Kaptan, 2010, p. 23).

3.2.1 Damage to Columns

Columns, which are considered to be vertical structural elements, usually consist of one piece or many pieces placed above each other (figure 3.10).

Figure 3.10: 1) Columns consist of one-piece in Istanbul Sultan Ahmed Mosque

2) Columns consist of many pieces in Athens

Source: 1) http://theworldinlight.com/images/Athens-Greece/greek-columns-8077-large.jpg

2) http://www.mccullagh.org/db9/d30-33/blue-mosque-columns.jpg

The type of damage found on columns depends on the column’s construction type. Earthquakes, for example, might cause columns which consist of one piece to fall apart, while in columns which consist of many pieces, earthquakes might cause the columns' parts to slip gradually, causing them to fall apart in the end but at a slower pace than columns consisting of only one piece (Kaptan, 2010, p. 23).

The force of gravity is a contributing factor to the amount of pressure on the columns. It increases the vertical force on a column which can cause it to crack and yield damage to the column. The movement of soil produces effects on the foundational level of the column. It could rotate the column, therefore it has the potential to cause cracks, and in more dire cases it could even cause the column to fall apart.

Gradually over time, wooden braces usually become deteriorated. In some cases they could decay and rot away, or ın some other cases the infestation of insects might damage the columns. Therefore the columns might not have the ability to endure the horizontal thrust of it. Metal braces also corrode along with time and the damage might reach the structure and rupture it (Figure 3.11).

Figure 3.11: Damage of the Metal Braces on Column

Source: Anitsal Yigma Binalarda Risk Duzyinin Tespitine İliskin bir Öndegerlerndirme Yontemi, KAPTAN, P 24

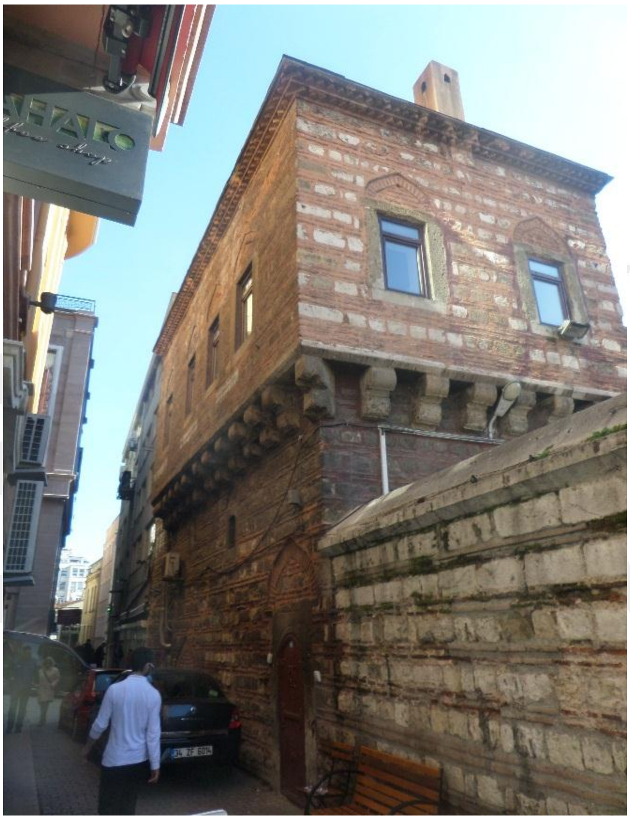
In order to hold together columns which consist of many pieces, metal clamps might be used, which are usually made of iron.

Metal clamps or rings in one piece columns should be able to hold the base and upper part of the column together. Those clamps help the columns to resist slipping and avoid separation between their blocks, but the rings and metal clamps would also deform the columns as they move and cause them to crush (Kaptan, 2010, pp. 23-24).

4.2.2 Damage to Walls

Walls are considered one of the vertical structural elements. In most cases, the walls are made of stone or bricks and mortar (Figure 3.12).

Figure 3.12: the Brick Masonry Structure in Istanbul



Source: The Author

The stacking in the masonry is an important factor of resistance. The tensile's vertical force on walls is relatively related to the wall slenderness, which is the ratio of the thickness of the wall to its height.

The effect caused by forces on the masonry of the wall could move the part of the wall which are stacked in blocks and cause them to crack. The Damageobserved on the walls can vary according to the load and direction of the force on the wall (Kaptan, 2010, p. 25).

3.2.3 Damage to Arches and Lintel

Arches are usually made of stone, bricks and mortar. The arches of a structure could become damaged due to an increase of vertical forces or the movement of props.

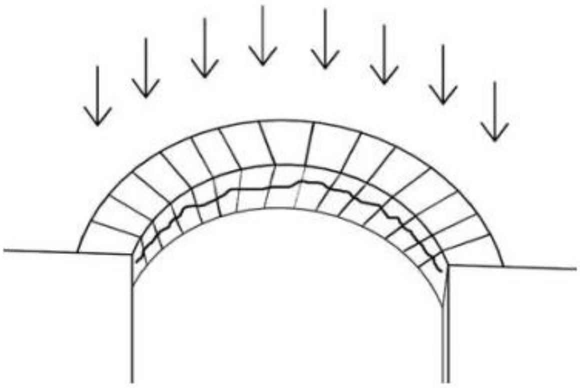
The displacement of supports is considered the main cause of damage in arches because it causes outward movements of the walls and also bad linkage of the anchorages. Generally, the distortion of the arch's axis is related to cracks and slippage from out of the arch's blocks (Figure 3.13) (Croci, 2000, p. 60).

Figure 3.13: Slippage between the Blocks in Arch in Syria

Source: http://www.abc.net.au/news/image/6827472-3x2-940x627.jpg

The weight load due to the force of gravity has an effect on the lower face of the arch which is parallel to the line of the arch by increasing its cracks (Figure 3.14).

Figure 3.14: Cracks in Lower Face of Arch

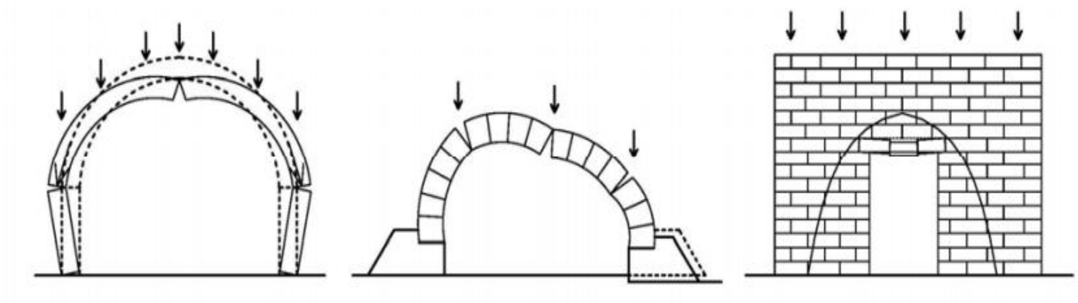


Source: Anitsal Yigma Binalarda Risk Duzyinin Tespitine İliskin bir Öndegerlerndirme Yontemi, KAPTAN, P 36

When a wall starts to fall apart close to one of its openings, it could tear down the whole wall and even cause gaps on the lintel or arch as the result of the extinction of the thrust bearings.

In that case the lintel could collapse with its arches due to the movement of the flat stones on the arch or joints on arch (Figure 3.15) (Croci, 2000, p. 60, Kaptan, 2010, pp. 36-37).

Figure 3.15: Damage Patterns in Arch due the Movement



Source: Anitsal Yigma Binalarda Risk Duzyinin Tespitine İliskin bir Öndegerlerndirme Yontemi,Kaptan ,P 36

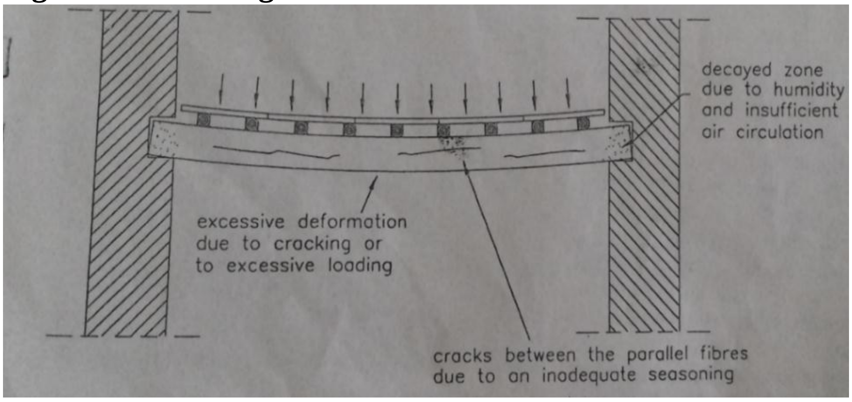
3.2.4 Damage to Floors and Roofs

There are various types of floor and roof elements used in masonry buildings such as vaults, domes, blocks, stone, wooden and volts beamed floors.

The vertical and horizontal forces are considered to be the main causes of Damagein the floor and roof elements, however, those Damagevary according to the geometry of the elements.

Wooden floors are usually affected by creep phenomena. They can cause Damage, deformation and displace the wood through time. The level of severity of this kind of damage depends on the quality of the timber and the damage could increase by linear cracks parallel to the beams. In addition, the inherent weakness of the wood and the increase in tensile stress might cause massive damage to the beams (Figure 3.16) (Croci, 2000, p. 58).

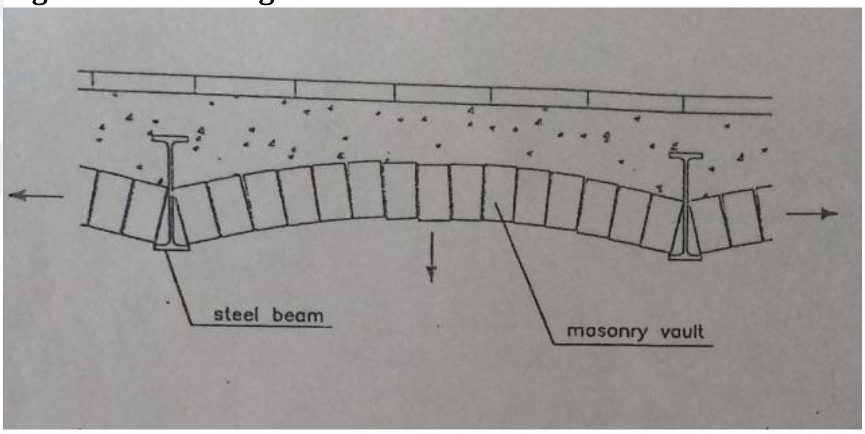
Figure 3.16: Damage of Timber Beam



Source: the conservation and structural restoration of architectural heritage, giorgio croci p59

Steel flooring consists of steel beams and brick vaults (Figure 3.17), thus the steel floor could receive massive damage when cracks happen in the vaults and parallel to the beams as result of transversal movements (Croci, 2000, pp. 58-60).

Figure 3.17: Damage of Steel Beam



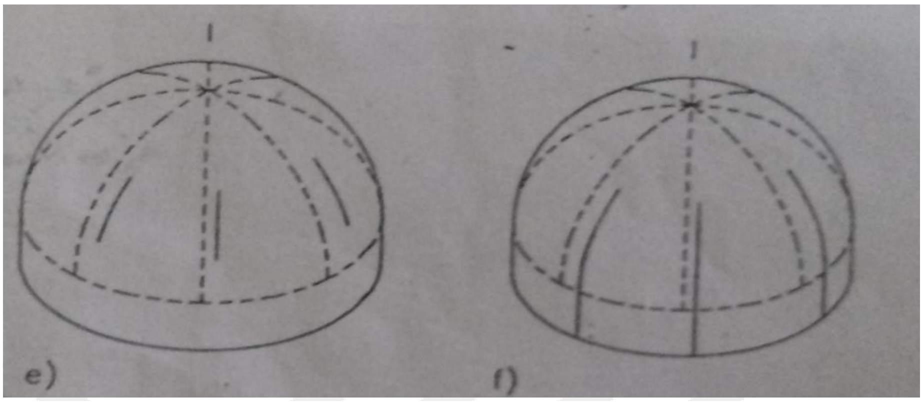
Source: the conservation and structural restoration of architectural heritage, giorgio croci p60

3.2.5 Damage to the Domes

Generally, domes are built of brick or stone. The pressure coming from the top of the dome also affects the lower part of the dome and pulls it, therefore, the damage seen in most domes appear in that part (tensile region). However, increasing the thickness of the dome could raise the resistance of it to the forces of the tensile applied on the dome (Kaptan, 2010, pp. 41-42).

The domes could cause several Damagewithin themselves such as cracks and slippage between blocks (in dry stone domes) as a result of the vertical tensile stress on the dome (Croci, 2000, p. 62). Cracks seen within a dome appear as a longitudinal line and they correspond to the stress caused by the tensile. Those cracks can vary according to the shape of dome and weight of the chandelier. However, those cracks are larger close to the springers more than other parts of the dome (Figure 3. 18) (Croci, 2000, p. 62).

Figure 3.18: Cracks Patterns in Dome with and without Drum



Source: the conservation and structural restoration of architectural heritage, giorgio croci p61 , E) vaulting cracks patterns in a dome with and efficient drum F) vaulting cracks patterns in a dome without and efficient drum

Imperceptible cracks usually appear in central areas of the low-rise dome and they are not visible because they are usually hidden under the plaster (Croci, 2000, p. 62).The effects of forces on the dome, such as the tensile vertical forces on the domes, lead to the emergence of cracks. The greatening of those forces could spread the cracks in different directions (Kaptan, 2010, pp. 41-42).

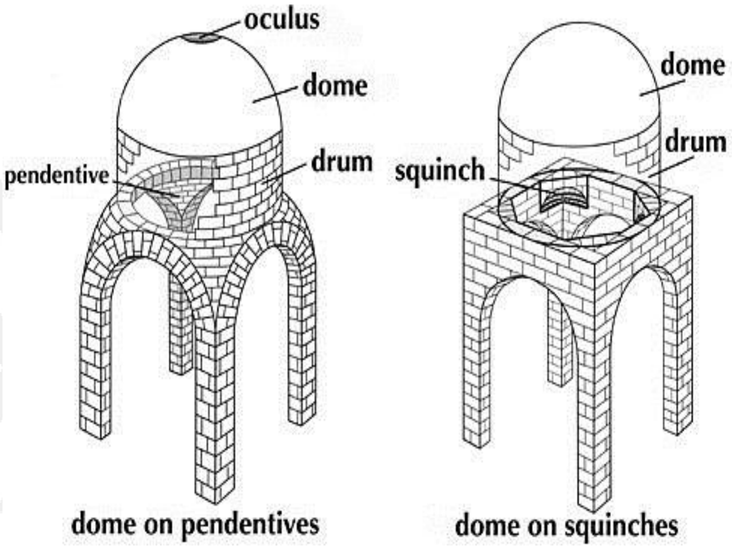
The force of gravity has an effect on the dome and could cause it to crack when the vertical forces are perpendicular to the base of the dome. In addition, those cracks separate the parts of the domes' arches and cause the dome to lose its stability (Figure 3.19) (Kaptan, 2010, pp. 41-42).

Figure 3.19: Damage of Dome Semiz Madrasa Istanbul

Source: the Authors

The settlement of the soil and the forces of earthquakes effect the dome and cause circular cracks, parallel to the base of the dome (Kaptan, 2010, pp. 41-42).The transition elements such as pendentives, squınches and triangulation, provide a flexible transition from a circle plan to square plan. Usually, those transition elements have clear geometric forms (Figure 3.20) (Kaptan, 2010, pp. 41-42).

Figure 3.20: Transition Elements of the Dome (Pendentive and Squinches)



Source:https://arsartisticadventureofmankind.files.wordpress.com/2014/10/12-trompas-vs-pechinas.jpg?w=863

4. CASE STUDY: SEMIZ ALI PAŞA MADRASA

4.1 HISTORY

Semiz Ali Pasha born in Brazza Town in Herzegovina with a Christian background, was recruited as a *Devşirme* from his town in Herzegovina, he is one of the Ottoman Grand Viziers of sultan Suleiman the magnificent (1561-1565), considered one of the most important governors in the Ottoman Empire because of his wisdom, political ingenuity, fairness, equity and openness to new ideas (Necipogli, 2014, p. 325).

Semiz was Beylerbey(governor) of Egypt state from 1549 to 1554.He was the second Vizier of the Ottoman Empire, and kept his position as the grand vizier of Ottoman Empire until his death in 1565, right after the death of Rustem pasha in 1561 he was appointed as the grand Vezir ,then he tried to make a treat with the Portuguese for dividing the leverage of the trade sea roads but it didn't work out, also Semiz tried in his era to establish Ottoman suzerainty over Indian Muslims (DKIC, 2012, pp. 42-63, Casale, 2010, p. 114, 117, 123).

There are many historical buildings founded by Semiz Ali Pasha such as Semiz Ali Pasa Madrasa and Mosque in Istanbul and Ali Pasha Bazaar in Edirne.

The madrasa is Mimar Sinan's work and it has an inscription, which shows that the madrasa was built in 1558 /966.

Semiz Ali Pasha Madrasa also known as Cadid Ali Pasha was one of the notable foundation of the 16 century. It was good financed and was designed with strict regulated the architect Sinan the master Architect of Ottoman Empire which enabled it to be one of the well-known madrasas in Istanbul (Ahunbay, 1994, p. 391).

4.1.1 Intervention and Restoration Works

In 1792 was the first addition to the madrasa by adding a new room, so now the madrasa consist of 16 rooms surrounding its courtyard.

The madrasa included many interventions during the history. Especially in the 19^{th}century, in the Sultan AbdulMecid reign at 1845, 1847 and 1868 the madrasa was restored. Also in 1876, some sections of classrooms, *sardirvan* and laundry room was restored. Also in that year the lead of the dooms of classrooms and some rooms of madrasa where restored. Due to the 1908 earthquake madrasa experienced damage. In 1914 the laundry room, ablutions room and some other parts were ruined. (Kutukoglu, 2000, pp. 248-249).

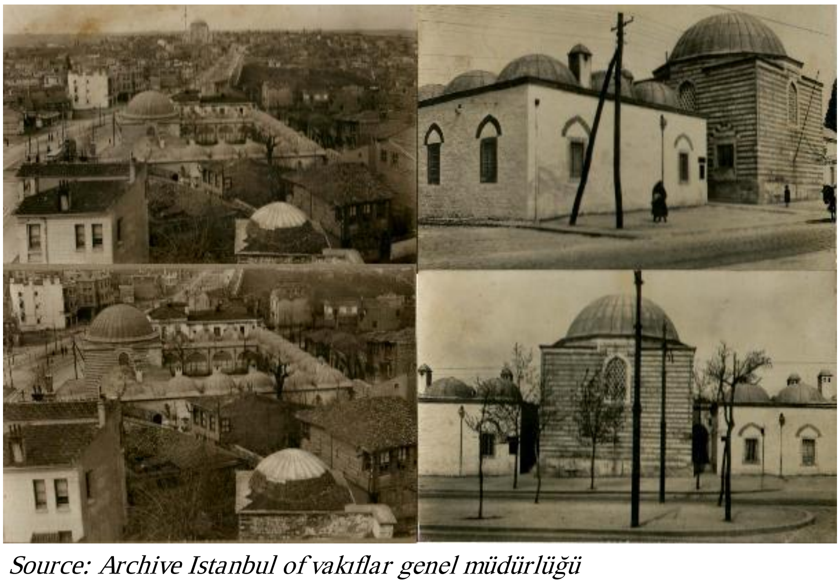
The last restoration has been done during 1958-1961(Kutukoglu, 2000, p. 250), In that restoration a staircase that leads to the basement was added and new entrance was opened on the new road and the chimney of students' rooms was closed as well. However, the original layout of the courtyard and the fountain does not exist in the present day.

The madrasa has been used for education until the Foundation of the Republic. After that it was used as a public kitchen by Red Crescent until 1958. After the last restoration in 1960, it was used as health centre, at the present it is used as a cultural centre (Goncuoglu, 2011, p. 405, Ahunbay, 1994, p. 392).

From the documents in 1792, there were 14 students in madrasa, which were called (Talaba), in Arabic, in 1869, the number has increased to 36 students and 1 teacher so it was 37 people but in 1914, the number decreased to 20 (Kursun, 2008, p. 127).

Figure 1, shows the oldest photos of madrasa, which belong to 1940. The photos are from south façade of madrasa, which is opened to Fevis Pasha Street on two sides (photos in the left side) and the roof of madrasa (photos on the right side) (Figure 4.1).

Figure 4.1: Madrasa in 1940



Source: Archive Istanbul of vakıflar genel müdürlüğü

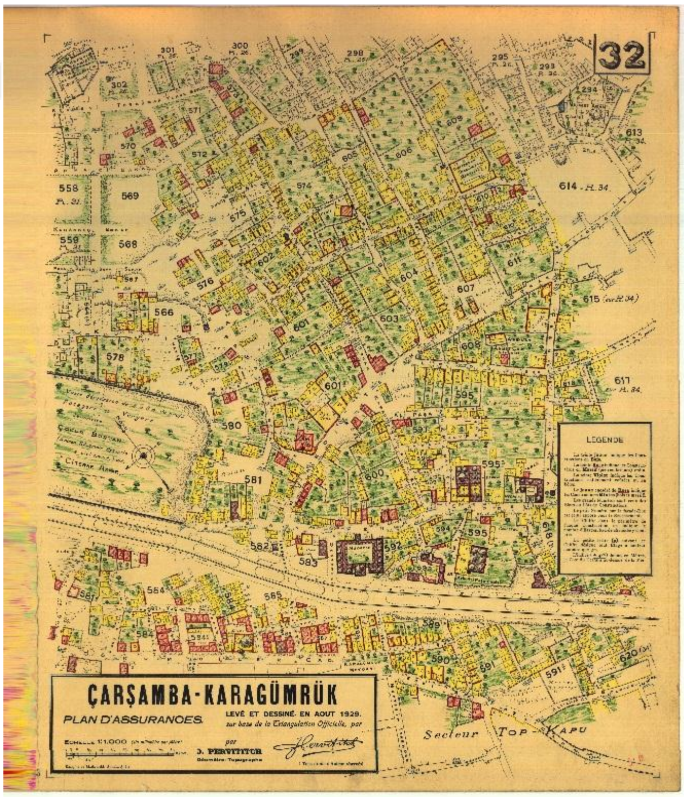
4.1.2 Niegobrhood of Madrasa

In 1558 during the reign of the first Suleyman, his grand vizier Semiz Ali Pasha ordered to build the madrasa in *Karagumruk*, Faith-Istanbul without building the *Kulliye* complex (Ahunbay, 1994, p. 391).

The madrasa is located in historic peninsula, *Fatih* region and it is near to Edirne's gate, which is one of the most important gates in Istanbul during Ottoman Period. In addition to that, *Karagumruk* was a gate to import and export because this area was the only place for interned goods from other cities in the Ottoman Empire and the authority in that period took fines on goods, which imported from Edirne gate (Goncuoglu, 2011, pp. 382-383).

Figure 2, shows the old map (*Pervititich* map) of *Karagumurk* that belongs to 1929 where the location of madrasa in its neighbourhood are addressed. "*Karagumruk*" region has many historical sites that belongs to Ottoman period such as eleven mosques, eight *Tekke* and one Armenian Church (Figure 4.2) (Goncuoglu, 2011, p. 388).

Figure 4.2:Site Plan of Madrasa and Niegobrhood



Source:.jacques pervititch sigorta haritalarinda istanbul, p76

The main entrance of the madrasa was located on the most important road in old Istanbul, which was named Nişanca Street but its name now has changed to Hasan Fehmi Pasa Street .By the development of the city, Fevzi Pasa Street became the main street while Hsan Fehmi Pasa Street became bystreet. As a consequence, the madrasa's back door became the main entrance till the present day(Ahunbay, 1994, p. 391).

Figure 4.3, shows the old map that belongs to 1913, where the location of madrasa on Hsan Fehmi Pasa Street and the important buildings around this region are addressed (Figure 4.3).

Figure 4.3:Site Plan of Madrasa and another Important Building around it

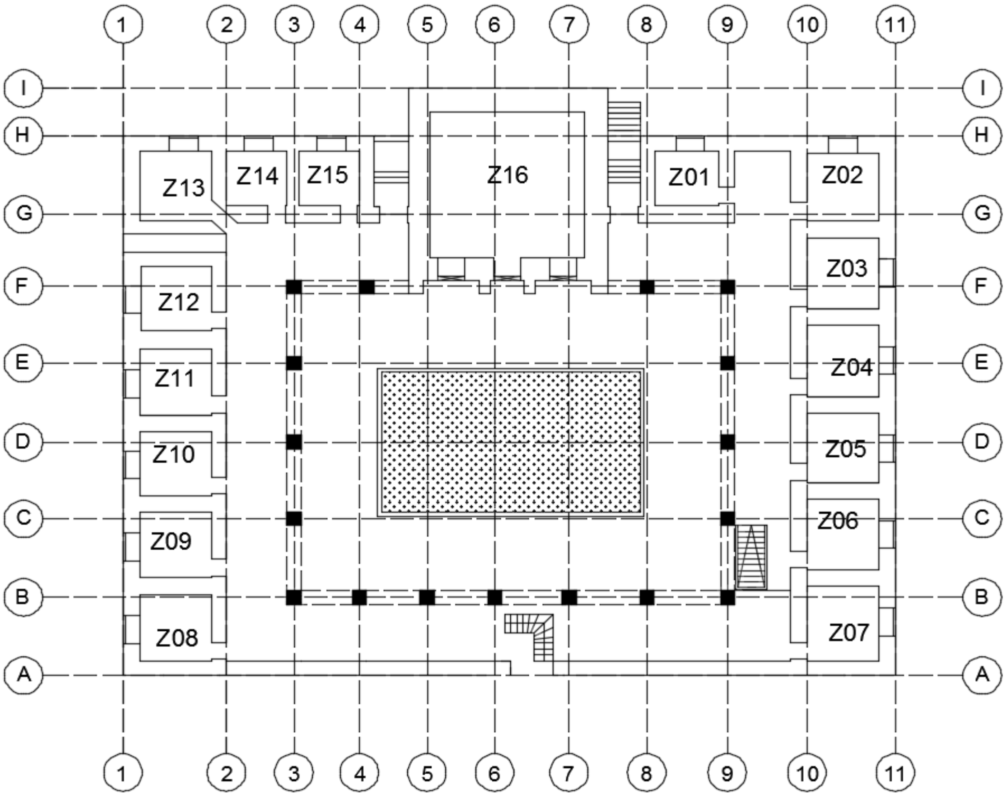
Source: Alman Mavileri,1.dünya savaşı 1914

4.2 ARCHITECTURAL DESCRIPTION OF SEMIZ ALI PAŞA MADRASA

a) Geometry of the Building

Semiz Ali Pasha madrasa was built in 1558 by architect Sinan as madrasa for Islamic religion Education, The madrasa has a "U" plan scheme with three entrances. The madrasa has a main classroom (Dershane), with huge dome and fifteen cells, the cells surround the courtyard except for the northeastern side of madrasa (Kursun, 2008, p. 127).the axial system shown in Figure 4.4 is given to define and indicate the current state of the structural component of madrasa in further chapters (Figure 4.4).

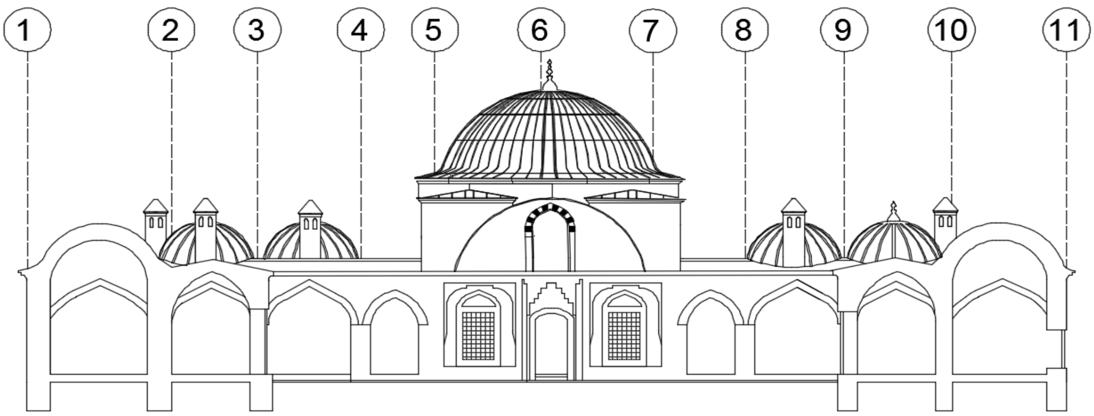
Figure4.4:Plan Geometry of Madrasa



Source: The Author

Figure 4.5 shows the section geometry of madrasa with following the axial system (Figure 4.5).

Figure 4.5:Section Geometry of Madrasa



Source: The Author

b) Decorative Features _Non-Structural Parts

Several elements are used to decorate the different parts of the building. They were mainly located on the interior facade of main classroom while the exterior walls remained bare of decorations.

The first element is the lotus unit these units are in different sizes and arrangements. The most elaborated use of the lotus units was in the muqarnas squinch located above the classroom's main gate. In addition, lotus units on the main classroom's entrance are visible too, they are located at the bottom and on both sides of classroom's entrance, and it has a Muqarnas shape too (Figure 4.6).

Figure 4.6: Lotus Unit on the Entrance of Classroom

Source: The Author

The forth element is the columns mined in stone. They were on the sidewalls of the classroom gate mined in the limestone. (Figure 4.7).

Figure 4.7: Column Mined in Stone

Source: Author

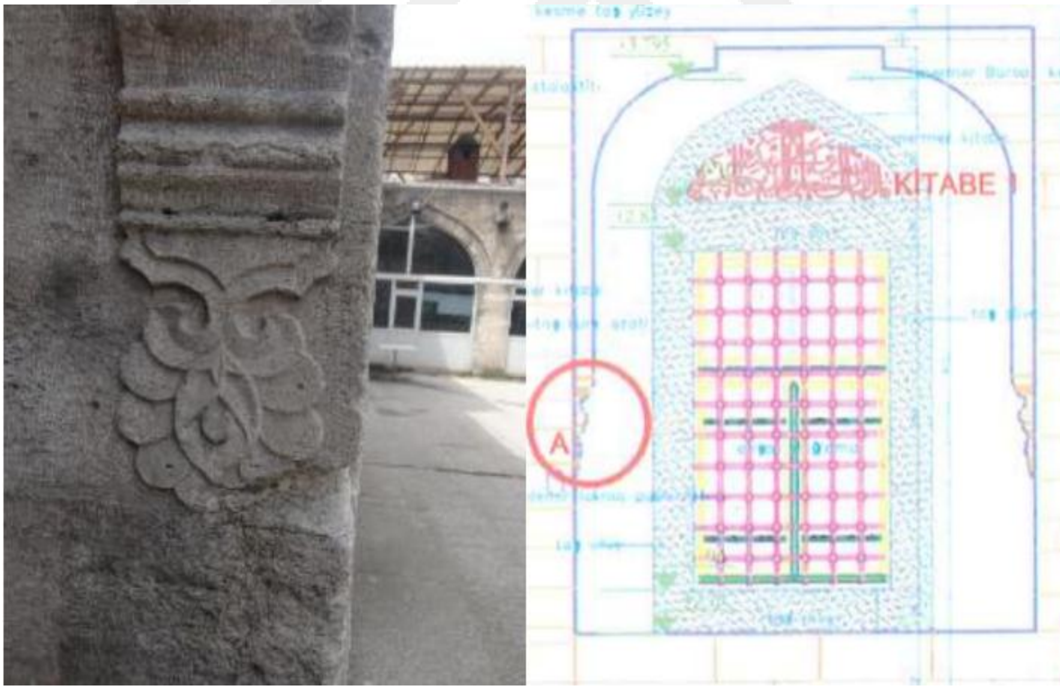
The third element is the geometrical patterns. They founded on the marble jambs surrounding the entrance door and they have triangles pattern (Figure 4.8).

Figure 4.8: Geometrical Patterns

Source: Author

The second element is the floral patterns reliefs carved on white limestone. These reliefs decorate the side wall of bursa arch (Figure 4.9).

Figure 4.9: Flower Inscription and Location of it in Bursa Arch



Source: 1..Author

2. Bilim ve Insan Vakfi Resorasyon Hazirlik Calismalari Raporu

The last element is the windows cells. They are on the classroom widows, they have six-party cell's shape and the blanks are vitrified (Figure 4.10).

Figure 4.10: Cells of Window

Source: Author

4.2.1 Architectural Drawings

Architectural drawing are obtained from restoration work report of the foundation of sciences and humanities.

4.2.1.1 Site Plan

The madrasa was built on an important location in (Nisanca Caddesi), which used to be the entrance road of Istanbul. The madrasa is close to Edirne's gate and it is near to Faith Sultan mosque, it is about 150 meters away from it (Fevzi Pasha Street)**.**

The main entrance of the madrasa was located on one of the most important roads of Istanbul, it's called Hsan Fehmi Pasa street . But as the city developed, Fevzi Pasa Street became the main street and Hsam Fehmi Pasa Street became a bystreet. As a consequence, the madrasa’s back door became the main entrance and that door (the old main entrance) today is closed (Ahunbay, 1994, p. 391).

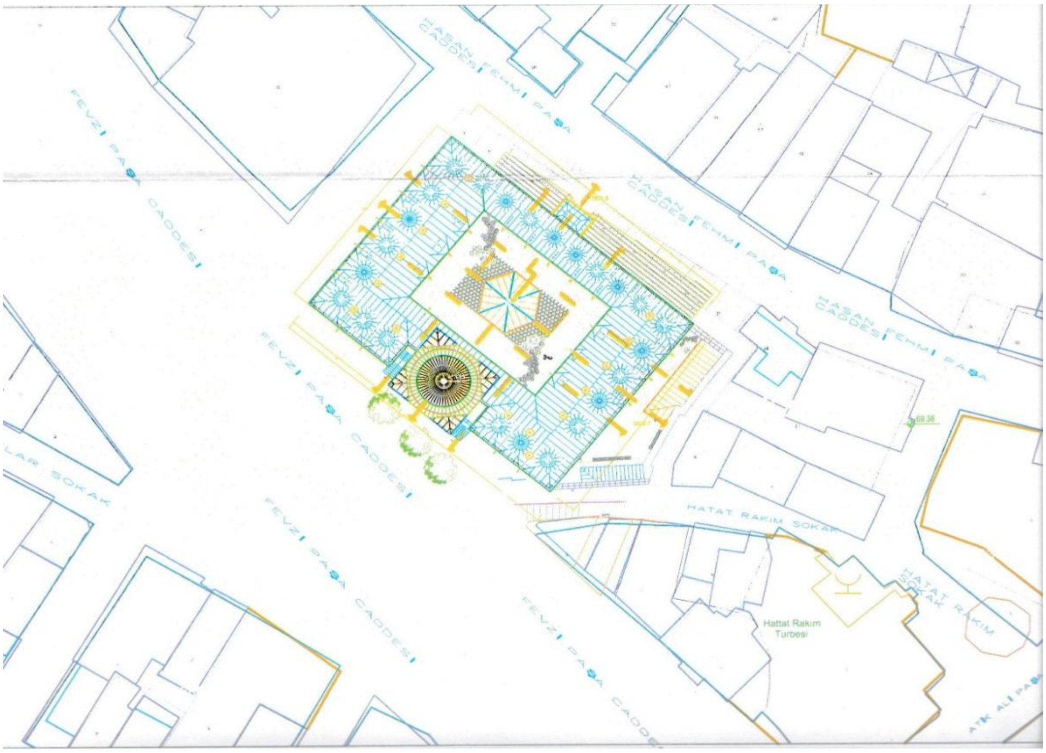
The location of the madrasa at the southern side of Feviz Pasa Street which is the main street now and the new entrance of the madrasa is located on it, also the northern entrance is located on Hasan Fehmi Street. In addition, there is a side road on the western side of madrasa linking Feviz pasha and Hasan Fehmi Street. In addition, on the eastern side of madrasa there is Narrow Street called Hatta Rakim Street, which is now a sidewalk. Figure 4.11 shows the location of the madrasa and the adjacent buildings around it (Figure 4.11).

Figure 4.11: Site Plan of Madrasa

Source: Google Earth

In Figure 4.12 shows the architectural draw of site plan of madrasa and elements surrounding it such buildings (Figure 4.12).

Figure 4.12: Site Plan of Madrasa



Source: Bilim ve Insan Vakfi Resorasyon Hazirlik Calismalari Raporu

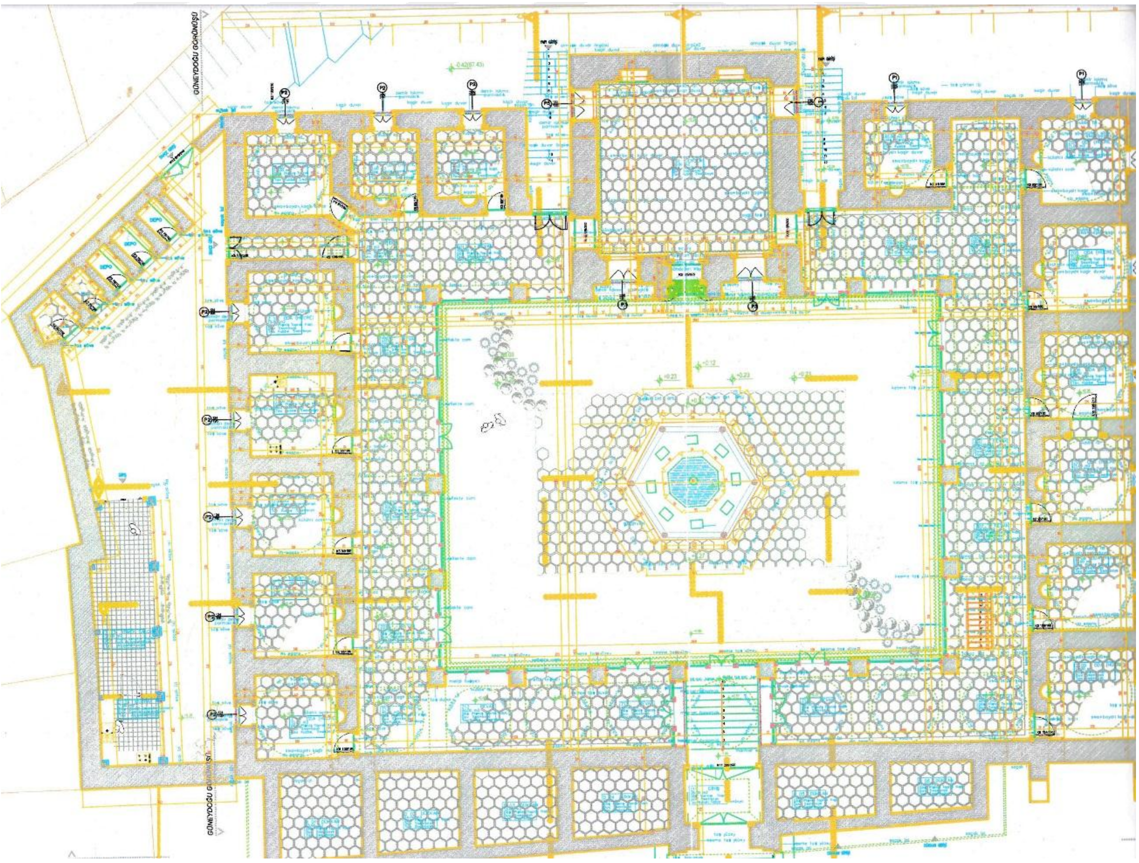
4.2.1.2 Floor Plans

The first floor has three entrances; two narrow entrances lead to Fevzi Pasa Street and one large entrance lead to Hsam Fehmi Pasa Street.

The floor plan: has rectangular shape with dimensions of (3750 cm x 2780 cm), the courtyard rise 159 cm from the madrasa's street while the arcades, cells and main classroom rise 181 cm from the street of madrasa .The arcade surrounds the courtyard and it has 17 columns. The northwestern arcade of madrasa has stairs that leads to the basement while in the southeastern arcade there is narrow passage between the thirteenth and fourteenth cell lead to the garden, the dimensions of the passage (530 x 110)(Figure 4.12).

The main classroom has a square plan too, six windows and three entrances; one main entrance that leads to the courtyard and two side entrances on each side both of them lead to the arcade Z16(Figure 4.4)(Figure 4.13).

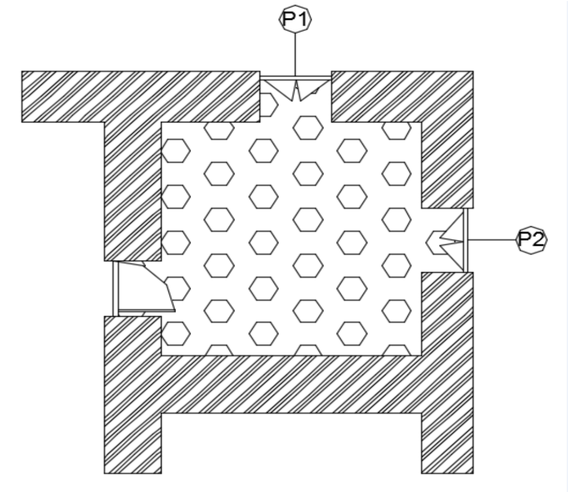
Figure 4.13: Floor Plan of Madrasa



Source: Bilim ve Insan Vakfi Resorasyon Hazirlik Calismalari Raporu

The garden has an irregular shape and surrounded by walls. All the cells share an equal area and have a square plan (Figure 4.12). Each cell has one door and one window except for the cell that has two windows Z02 (H10H11G10G11) (Figure 4.4) (Figure 4.14).

Figure 4.14: the Corner Cell (Z02)



Source: Bilim ve Insan Vakfi Resorasyon Hazirlik Calismalari Raporu

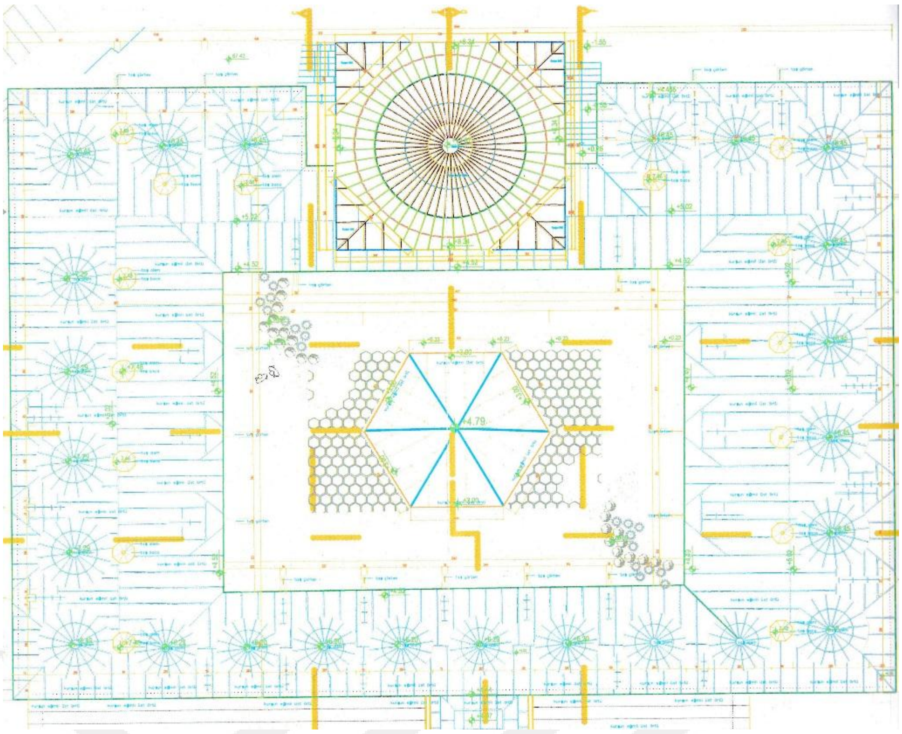
4.2.1.3 Roof Plan

The roof of madrasa has equal height except the roof of the main classroom also the height of top of domes is equal except from the dome of classroom and northern arcade domes of madrasa.

The cells' roof of the madrasa has flat surface, its height is+502cm .While the arcade roof has a slight slope towards the courtyard with height of (+452cm), except for the roof of northern side which is still has the same height (+452cm). This slope is helpful for the water's flow decline.

The height of the domes of the cells is almost the same, which is (+645cm), while the level of the northern arcade's domes is lower than cells' domes level, their height (+620cm). The roof of main classroom has a height of (+745cm) and the height of the dome's drum (+835cm). The height to the highest point main classroom is (+1187cm) .The roof of main classroom has a height of (+745cm) and the height of the dome's drum (+835cm). The height to the highest point main classroom is (+1187cm) (Figure 4.15).

Figure 4.15: Roof Plan of Madrasa

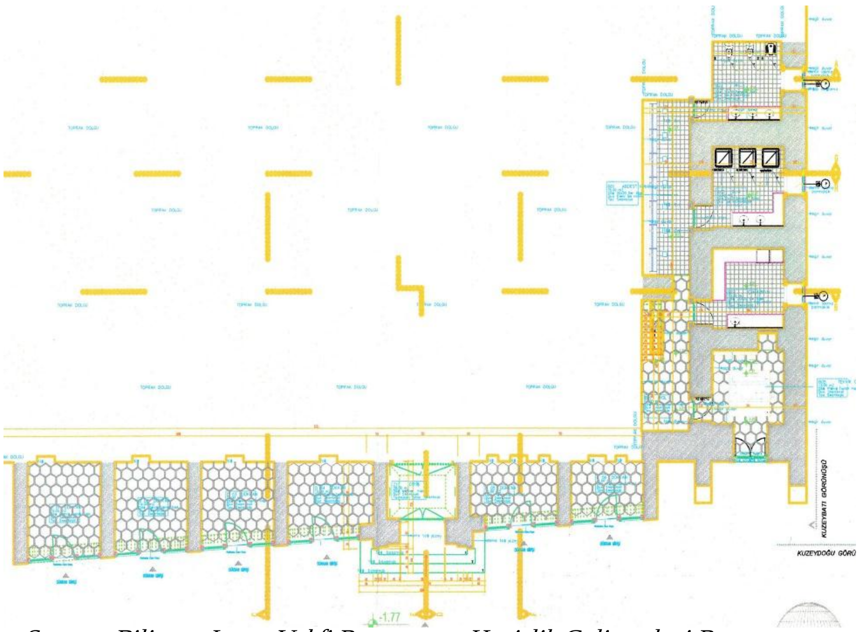


Source: Bilim ve Insan Vakfi Resorasyon Hazirlik Calismalari Raporu

4.2.1.4 Basement

The basement is used for service and it has a staircase leads to the northwestern arcade while its' door is located on the madrasa's northeastern facade corner. The basement decline from the madrasa's level (-221 cm), the ceiling's height (247cm), the corridor has a rectangular shape (165 cm x 1350 cm) and it leads to four rooms that have a square plan in the basement(Figure 4.16).

Figure 4.16: Basement Plan of Madrasa



Source: Bilim ve Insan Vakfi Resorasyon Hazirlik Calismalari Raporu

4.2.1.5 Sections

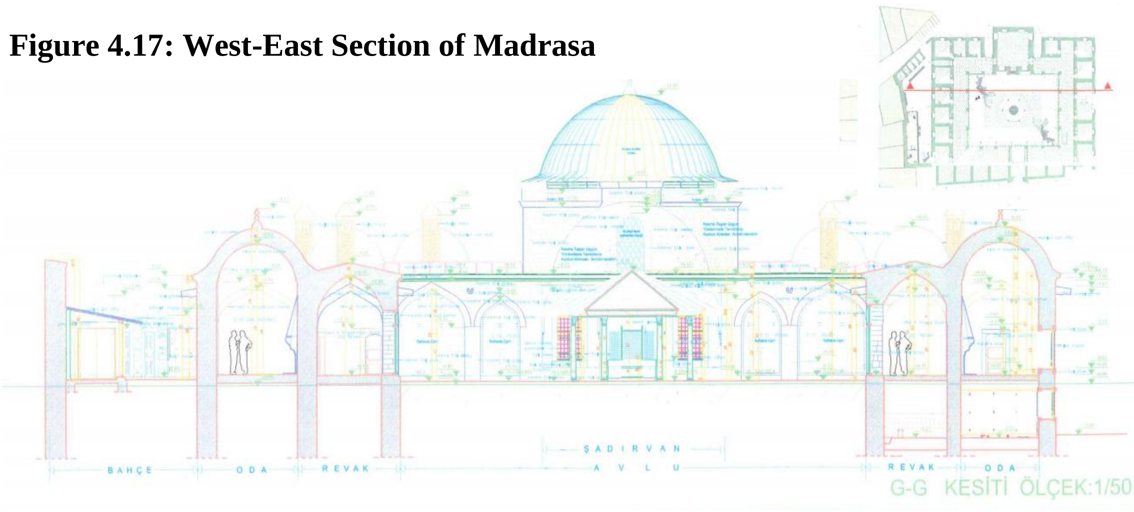
The thickness of the outer wall is between 80 to 90 cm while the interior wall 70to 80 cm, limestone considered as the main material of the interior wall and piers, while in the outer walls it includes bricks and limestone.

In the section, the main facade of the main classroom made of limestone and marbles surrounding the windows, and steps lead to main classroom.

In addition the sections show the basement which high (-221cm) from the level of street. The garden rise (+20 cm) from the level of street of madrasa, while the wall rise (344 cm) of the level of street of madrasa.

Dimensions: The cells and arcades that are located on the southeastern side of madrasa rise (45cm) from the madrasa's level. The highest point of the dome's interior surface rise (580cm) from the street of madrasa. The height of arcade ceiling rise (426 cm). The cells and arcades that are located on the northwestern side of the madrasa rise (35cm) from the madrasa's level. The height of the arcade ceiling (430cm). The middle part of the section that contain the classroom facade with two symmetrical arcades on each side overlook the courtyard, its' walls rise (452 cm) from the madrasa's level .the wall of classroom rise (831cm), while the top of it's dome rise (1187cm) from the from the street of madrasa (Figure 4.17).

Figure 4.17: West-East Section of Madrasa

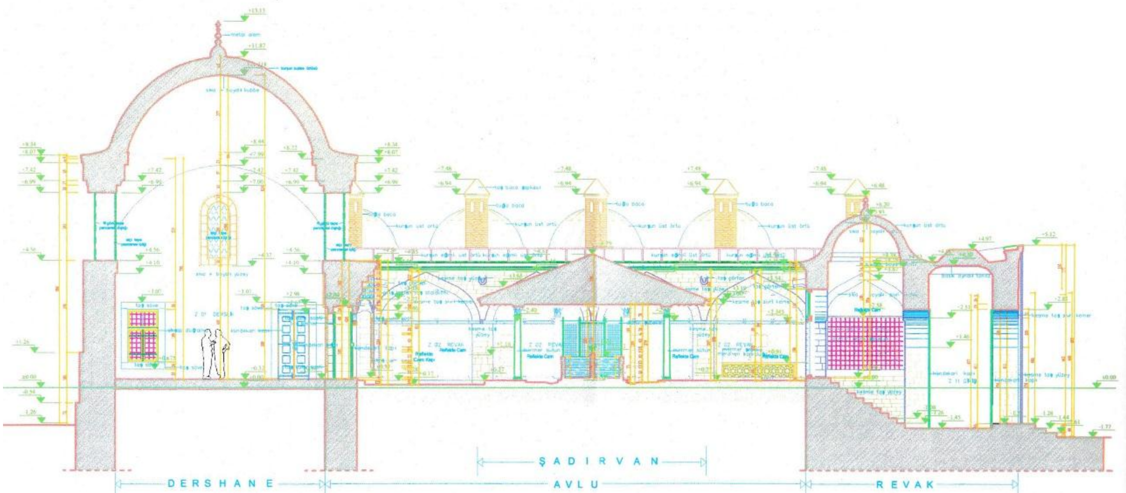


Source: Bilim ve Insan Vakfi Resorasyon Hazirlik Calismalari Raporu

The second section start from the classroom on the southwestern side until the northwestern side of madrasa crossing the courtyard of madrasa. This section shows that the dome rises (1122cm) from the street of madrasa, while the upper windows' height (456cm) from the street of madrasa. The center part of the section that crosses the courtyard faces the northwestern arcades, its' walls rise (452 cm) and this interior façade consists of 4 arches each of them rise (354 cm) from the madrasa's street. Above that façade there are 4 domes rise (645 cm) from the madrasa's street, while the chimneys' stacks rise (748cm).

The last part of the sections crossing the northwestern arcade of madrasa and leads to the back entrance of the madrasa .the arcade's stairs' highest step rises (31 cm) from the madrasa's street, while its' lowest step decrease (145- cm) from the madrasa's street, the ceiling rises (593 cm) from the madrasa's street. While the dome rise (620 cm) from the madrasa's street. The entrance arch rise (283 cm) from the (Figure 4.18).

Figure 4.18: North-South Section of Madrasa



Source: Bilim ve Insan Vakfi Resorasyon Hazirlik Calismalari Raporu

4.2.1.6 Facades

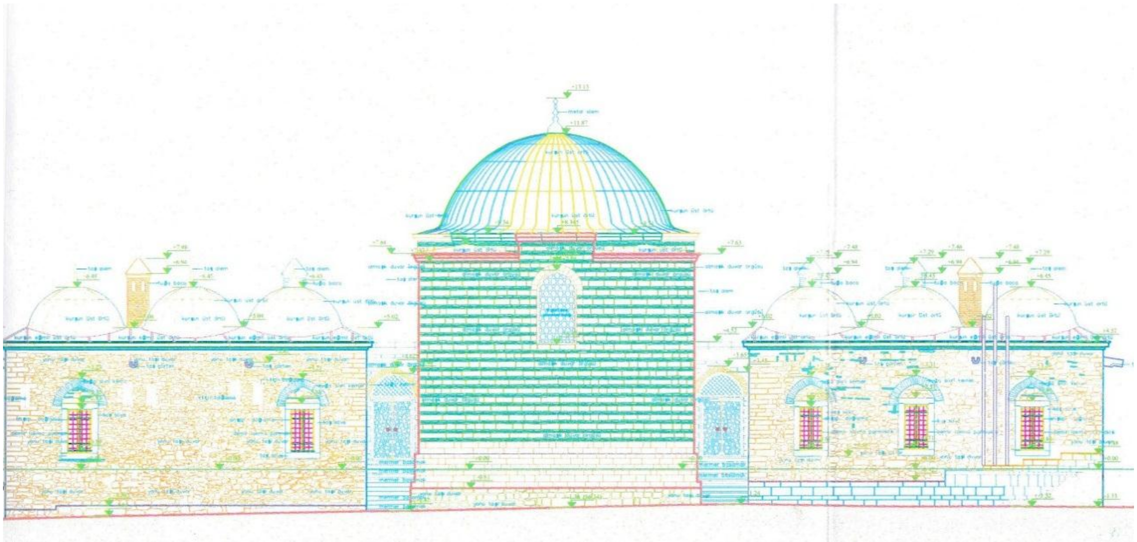
a) Southeastern Facades

Now days the southeastern facade of the madrasa is considered as the main facade, because Faviz Ali Pasha Street is now the main Street in *karagmurk*.

The Facade extends along the street with a length of (3920 cm), the facade is symmetrical and consist of three parts; the classroom in the center and the southeastern cells on each side of the classroom. In addition, there are two entrances to the madrasa located symmetrically on each side of classroom (Figure 4.18).

The windows, domes, chimney's stacks, and gargoyle on each side of the façade have equal dimensions. The dimensions of each window are around (92 cm x 154 cm), and their average height from the madrasa level (+46cm), the dimensions of the windows including stone jambs surrounding the window (116cm x 178 cm). Above the window, there is a sharp arch made of bricks, the average height of the crest is (325cm). The domes share the same size, and the highest point of all the domes from the madrasa's level (645cm) (Figure 4.19).

Figure 4.19: Mine Façade of Madrasa (southwest)



Source: Bilim ve Insan Vakfi Resorasyon Hazirlik Calismalari Raporu

The left part of southern facade raise from the street, (+6.25cm) and from the floor of madrasa (+4.51cm), and its length (+1307 cm). This part of the southeastern facade has two windows, three domes, two chimney's stacks, and one gargoyle.

There was gargoyles on each side of the façade and they are made of stone. The wall of each side façade is made of stone peppered with plaster

The roof on each side covered with traditional lime-based screeds, it used to be covered with traditional lead in the past. The chimney’s stacks is built of Bricks and the top of each one covered with traditional lead, every cell has a chimney's stack, and all of them share the same height from floor (748 cm).

The left side entrance on the southern facade located between the exterior wall of the classroom and the left part of the southern façade. The entrance has a marble staircase.

The height of the entrance wall is (452 cm), and it is made of alternating fabric shape of bricks and stones. The height of the entrance door is (345 cm), and the Width of it (142 cm).The door is made of iron and glass, above the door there is an arch made of bricks, its' height (365 cm).The center part of the southeastern facade is the exterior wall of the classroom (*Dershane*). Its' length (854 cm).

In addition, the height from floor of madrasa to the lowest level of the roof is (763 cm), and from the level of street (900 cm), while the height from floor to the roof of the dome of madrasa is (845 cm), and its' height from street (970 cm).Moreover, the height from the floor level of madrasa to the highest point of the dome (1187 cm), and from level of street to the highest point of the classroom's dome (1323 cm).

The window of the classroom is located on the exterior wall, it rises from floor of madrasa (-456cm).the dimensions of the window (243cm x 130cm). The window is covered with empty glass cells, also there is stone arch above the window, and its' thickness is around (43cm).

The roof of the classroom and its' dome are covered with traditional lime-based screeds, and covered with traditional lead.The wall of the center facade is made of alternating fabric shape of bricks and stones and it is located on the upper part of it, while the lower part of the wall is built of stones.

The right side entrance of the southern facade is located between the exterior wall of the classroom and the right part of southern facade, the entrance has a modern stone staircase except for the ninth deck, which is the last original marble part of the staircase.

The height of the wall of the entrance is (452cm) the wall of the entrance is made of alternating fabric shape of bricks and stones. The height of the door of entrance is (345 cm) and the Width of it 142 cm. The doors are made of iron and glass, above the door there is an arch made of bricks, its height (365 cm).The right part of southern facade raise from the street (+5.85 cm), and from the floor of madrasa (+4.52cm), its' length (1342cm). This part of the southeastern facade has three windows, three domes, three chimney's stacks, and one gargoyle. The wall of façade is made of stone peppered with plaster .

b) Northeastern Facades

The northeastern facade was the main facade of the madrasa; in the past it was located on Hasan Fehmi Pasha street, that used to be the main street until the end of the fifth decade of the last century.

The Facade extends along Hasan Fehmi Street with a length of (3916 cm), the height from the floor of madrasa (+4.51cm), while it rise from the street (663 cm).

The facade includes the main gate of the madrasa, which is located on the center of the northern façade of madrasa, there is a small door near the corner of the northeastern façade of madrasa overlooking the street and it leads to the basement. Also on each side of the door there are two Pillars stone-based bend on the wall .while the roof has ten domes and two chimneys stacks(Figure 4.20).

Figure 4.20: Northestern Façade of Madrasa

Source: Bilim ve Insan Vakfi Resorasyon Hazirlik Calismalari Raporu

The gate is located on the center of the northern facade, the gate entered by stairs that consist of two steps their height form floor 34 cm, and the height of each step 17 cm, the stairs are made of stone.

The door of the gate made of iron and glass. The dimensions of the door (215 cm x411 cm), we could observe that there are stone jambs surrounding the door around three sides of it, also the top of door has sharp arch.

There is a small door next to the corner of the northeastern façade of the madrasa leads to the street also to the basement of the madrasa, the dimensions of the small iron door 220cm x90 cm. In each side of the door there are two pillars stone based tendency on the wall and the height of each one is 555cm and from the Hassan street its height 344cm from, the width of the door 80cm ,those pillars made of stone with cement .

The roof of northeastern facade is made of traditional lime-based screeds, but in the past it was covered with traditional lead, and its' height (452 cm).

There are ten domes with the same size, and the height of all domes from level of madrasa is (620 cm), except for the two domes on the left and right corners on the northeastern façade, the height of those two domes is (645cm).

There are two chimney's stacks located on the each corner of the roof of the facade, and built of Bricks and the top of each one covered with traditional lead, every cell has a chimney’s stacks, and all of them has the same height from the madrasa's level (748 cm).

The façade's wall is made of limestone plaster; this wall has a lot of cracks and structural problems due to neglecting.

There were shops around the left and right sides of the main entrance of madrasa, but now days they are closed with a layer of bricks and cement.

c) Northwestern Facades

The northwestern facade is located on the side street that connects Fevzi Pasha Street with Hasan Fehmi Street.The Facade extends along the Street and its length (2878 cm), the height from the street of madrasa (451cm), while the height from the level of street on the northwestern facade (+628 cm)

the facade has a lot of elements and it has six windows with six domes over it , six chimneys stacks and six gargoyles, in additions there are three small windows located under the windows of the fourth, fifth and sixth cell.

This facade has two kind of windows; six upper windows in the cells of the northwestern facade, and three lower windows in the basement rooms. The size of those windows is smaller than the size of the rest windows in the cells.

All the windows on this façade have equal dimensions (92 cm x 152 cm) and the average rise of them from the madrasa's level (45cm). The dimensions of each window including the stone jambs surrounding it are (116cm x 176 cm). Above the windows, there is sharp arch made of bricks, the height of the crest is (330cm).

The three small windows are located under the windows of the fourth, fifth and sixth cells. Each window has equal dimensions (90 cm x 130cm), the average rise of each windows from level of street (65cm).The six domes have equal size, and the height of all domes from level of madrasa is (645cm).

There are six chimney's stacks next to each dome, those chimney's stacks built of Bricks and the top of each one is covered with traditional lead, every cell has a chimney's stack, and all of them share the same height from floor (748 cm) (Figure 4.21).

Figure 4.21: Northwestern Façade of Madrasa

Source: Source: Bilim ve Insan Vakfi Resorasyon Hazirlik Calismalari Raporu

The roof surface and the domes are covered with traditional lime-based screeds, but in the past, they were covered with traditional lead. The wall of the northwestern façade is made of stones peppered with plaster.

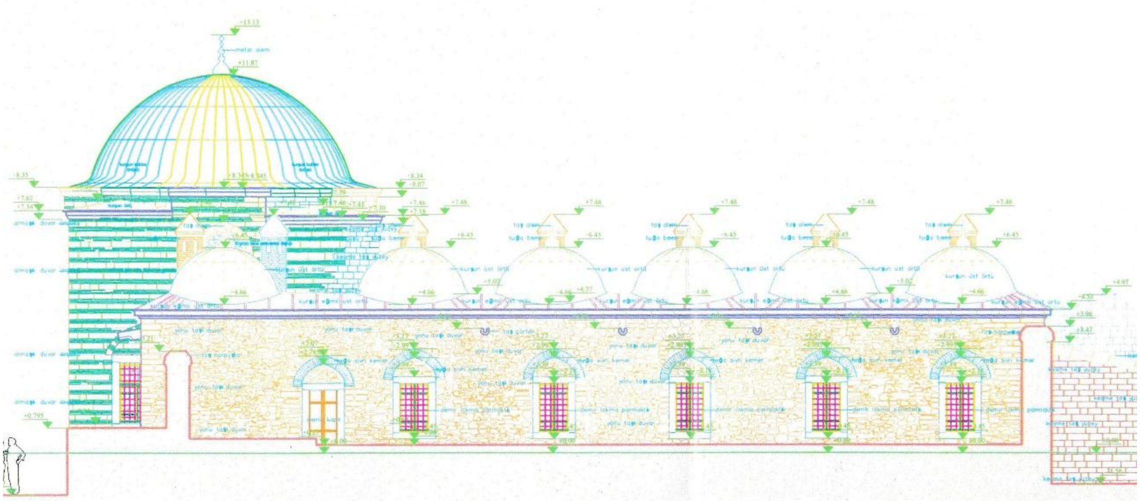
d) Southeastern Facades

The Southeastern facade is located on the backyard garden of madrasa. The length of the facade (2880 cm), the height from the street of madrasa (451cm)

The facade has many elements five windows, six domes above the roof, six chimneys' stacks, and five gargoyles; in addition to that, there is door to the left side of the facade.This facade has five windows in the cells of the southeastern façade.

Each window on this façade has equal dimensions (92 cm x 150 cm), rise from the madrasa's level (26cm). The dimensions of the windows with stone jambs surrounding it (116cm x 174 cm). Above the window, there is sharp arch made of bricks, the height of the crest is (327 cm) there are six gargoyles on the wall of the facade, the height of each gargoyles (398 cm), all gargoyles are made of stones. (Figure 4.22).

Figure 4.22: Southestern Façade of Madrasa



Source: Bilim ve Insan Vakfi Resorasyon Hazirlik Calismalari Raporu

There are doors next to the window of the thirteenth cell, made of iron and glass. The dimensions of each door (90cm x278cm), above the door, there is a sharp arch made of bricks, the height of the crest is (307 cm).

All of the six domes of this façade share the same size, and the height of all domes from floor of madrasa is (645cm). There are six chimneystacks next to each dome, those chimney's stacks are built of Bricks and the top of each of them is covered with traditional lead, every cell has a chimney's stack, and all of them has the same height from floor (748 cm).

Domes and roof surface are covered with traditional lime-based screeds, but in the past, it was covered with traditional lead. The wall of the Southeastern façade made of stones peppered with plaster.

4.2.2 Spatial Organization

4.2.2.1 The Main Class Room

The main classroom has a square plan (765 cm x 785 cm) that is covered with a hemisphere dome (with a diameter of 755 cm) that relies directly on the walls with pendentives being used as transition elements, and the total height from the ground to highest point of the interior dome is 1122 cm (Figure 4.23).

Figure 4.23: Dome of the Main Classroom (Dershane)

Source: The Author

Despite of the main entrance that leads to the main courtyard there are two more side entrances lead to the sides arcades. On the southwestern side there is one upper window, while on the opposite side, there are two lower windows and an upper one, all of them have view to the courtyard. The main facade of the classroom is on the same line as the porches, which gave the classroom facade an extraordinary design. (Ahunbay, 1994, p. 392).

Each interior wall of the classroom has upper glass windows located on the center of each wall between Wall arches with height of (456 cm) from the ground of the room; the dimensions of the arched windows (243 cm x 102 cm) (Figure 4.24).

Figure 4.24: Window of Classroom

Source: The Author

There are three entrances to the classroom, two-side entrances that lead to the arcades and one main entrance, which leads to the courtyard of madrasa, The dimensions of the gates (267 cm x 112cm), while the main entrance is distinguished from the other entrances with a stone arch above it. The door of the entrance is made of wood and it had erosion due to negligence.

4.2.2.2 Students' Rooms

There are fifteen cells distributing along the three sides of the madrasa above each cell there is a dome, all cells are open to the arcads which surround the courtyard of the madrasa, three cells on the southern side and six cells on each of the western and eastern side. All students' rooms in madrasa have similar plans and sizes except the cells in the southern side, which have smaller size than the other cells in the madrasa. All the cells have regular plans (rectangular or square).The average dimensions of the normal room are approximately (330x340 cm) cm and (260x270) cm to the 3 rooms on the southern side, also almost all rooms have the same height from the floor which is approx. (580cm)**.**

The rooms' walls built of limestone, plaster in white, each room has a chimney, and the floor of all cells covered with tiles.

There are three distinguished cells in the madrasa (second, thirteenth, and fourteenth cells):

-The cell Z02 **(**H10H11G10G11) that is located in the southwestern corner has two windows while the other cells have only one window (Figure 4.25).

Figure 4.25: The Cell (H10H11G10G11)

Source: The Author

Cell Z13 **(**H1H2G1G2) which is located on the corner of southwestern side of madrasa has a different feature which is its' entrance door that is placed with a degree of (45), while the other cells entrances are located in a straight shape (Figure 4.26).

Figure 4.26: Entrance of Cell (H1H2G1G2)

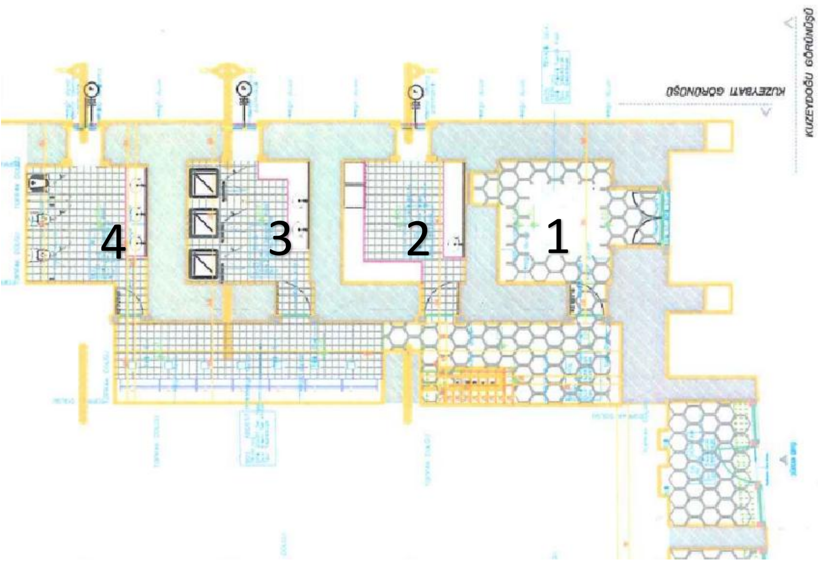
Source: The Author

Cell Z14(H2H3G2G3) which is located on the southwestern side of madrasa is the smallest cell in madrasa with dimensions of (256 cm x 251), also this is the only room that still have its' chimney's stack though all the other room have lost theirs'.

4.2.2.3 Services

The basement of the madrasa has a staircase leads to the northwestern arcade .there are four rooms. The storey height of the basement is (-221 cm) (Figure 4.27)

Figure 4.27: Plan of the Basement Rooms



Source: Source: Bilim ve Insan Vakfi Resorasyon Hazirlik Calismalari

a) First Basement Room (Figure 4.26).

The first room located on the northeastern corner of madrasa, and it is used for fuel and heating boilers storage.

The room has a square plan (343 cm x 316 cm), the height of the room from floor to roof is 236 cm, and the height of the room is (-221 cm) .the walls of this room built of white limestone and the floor of the room is paved with sand tiles.

This room has three doors one of them is the entrance on the corridor of basement (95 cm x 210 cm), the other door is opened to Hasan Fehmi Pasha Street, its dimensions (110 cm x 220 cm) and the last one leads to the other basement room. All doors are made of iron (Figure 4.28).

Figure 4.28: First Basement Room

Source: The Author

b) Second Basement Room (Figure 4.26).

The second room located on the northeastern side of madrasa.

the room has square plan(342 cm x 330 cm), the height of the room floor to ceiling is 236 cm , and the height of the room is -221 cm .the walls in this room are built of white limestone and the floor is paved with modern flagstones. In addition, it has two door one of them is a wooden door while the other made of iron (Figure 4.29).

Figure 4.29: Second Basement Room

Source: The Author

The room has one window overlooking the side street .the dimensions of the windows are almost the same as the other windows (92 cm x 120cm) but the height from the madrasa level is (-125cm). The walls of this room built of limestone and the floor paved with tiles.

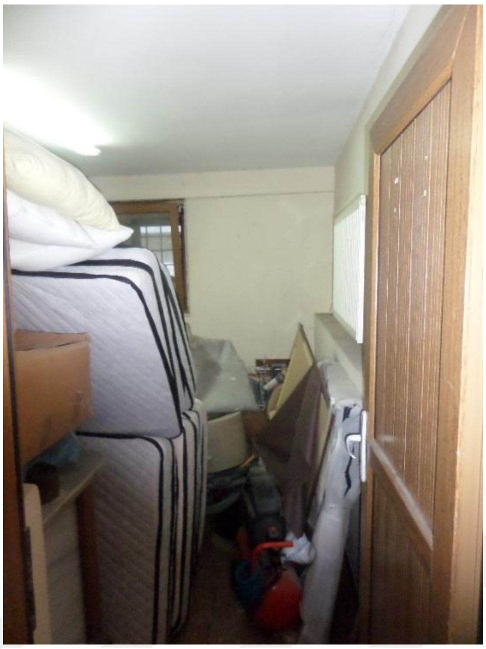
The entrance of the room is on the basement's corridor, its dimensions are 93 cm x 195 cm; the entrance has a wooden door, in additions, there is other door lead to the basement corridor and it is made of iron. The room has one window overlooking the side street .the dimensions of the window are almost same as the other windows (92 cm x 130 cm) but the height from the madrasa level (-125cm) (Figure 4.29).

c) Third Basement Room (Figure 4.26).

The third room located on the center of northeastern side of madrasa,

The room has square plan (328 cm x 334 cm), the height of the room is (237 cm), and the high of the room is -221 cm .the walls are built of white limestone and the floor is paved with modern flagstones. In addition, it has a wooden door. The entrance of the room leads to the basement's corridor (93 cm x 195 cm), the entrance has a wooden door. The room has one window overlooking the side street .the dimensions of windows are almost the same as the other windows (92 cm x 130 cm) but the high from the madrasa level (-123cm) (Figure 4.30).

Figure 4.30: Third Basement Room



Source: The Author

d) Fourth Basement Room (Figure 4.26).

The fourth room located on the center of northeastern side of madrasa. The room has a square plan (330 cm x 334 cm), and the high is -221 cm from the madrasa's street .the walls are made of white limestone and the floor is paved with modern flagstones. In addition, it has a wooden door (Figure 4.31).

Figure 4.31: Forth Basement Room

Source: The Author

The room has one window overlooking the side street. The dimensions of window are almost the same as other windows (88 cm x 100cm) but the high from the madrasa level is (-115cm).The entrance of room leads to the basement corridor (78 cm x 195 cm), the entrance has a wooden door (Figure 4.31).

4.2.2.4. Courtyard

The courtyard of the madrasa has a rectangular plan (1559 cm x 2111 cm) and it's surrounded with the arcades from three sides, while the classroom is in the center of the forth side surrounded with an arcade on each side of main classroom, all of the arcade columns are made of limestone.

In the center of the courtyard, there is a rectangular raised bed garden made of cement and Filled with soil with few trees in it (1250 cm x 715 cm), some reference say that the courtyard is used to have a fountain for ablutions in its' center. In addition, a raised bed garden has the shape of a circle in the northwestern corner of the courtyard ،the courtyard raise (23 cm) from the street of madrasa and the floor of it made of cement (Figure 4.32).

Figure 4.32: Garden on the Center of Courtyard

Source: The Author

the northeastern arcade of madrasa that faces the classroom consist of six bays (the central bay is a side entrance) and it's covered with hemispherical domes، the width of the arcade (350 cm)، it rise one step from the courtyard (21 cm)، while it rise from the street of madrasa (44 cm).

(The dimensions of the arcade's sharp arches are almost same, the height to the top of each arch is (363 cm), and the width of each one is (272 cm).The roof rise from the madrasa's floor (452 cm). In addition, six domes share the same volume. The height to the top of each dome is (620 cm) (Figure 4.33).

Figure 4.33: Northeastern Arcade of Madrasa

Source: The Author

4.3 MATERIAL USED AND THE STRUCTURAL SYSTEM

4.3.1 Materials Used

The madrasa is built of several basic materials such as Limestone, Lime mortar, bricks and marble. The main material used in the construction of madrasa is limestone and it is used widely, in different shapes and sizes, in all parts of madrasa such as wall, arches of the arcade on the rest parts (Figure 4.34).

Figure 4.34: Limestone on Pier

Source: The Author

Lime mortars were used basically on the exterior facades of madrasa while the Lime-based plaster used widely to cover the surfaces of the walls of the cells and basement rooms and facades of madrasa such as .Lime based plaster used on the surface of the northeastern façade of the madrasa (Figure 4.35).

Figure 4.35: Lime Based Plaster on Northeastern Facade

Source: The Author

Bricks are part of the exterior main classroom wall, the entrance arches and arches above the windows structure (Figure 4.36).

Figure 4.36: Bricks on the Southern Facade

Source: The Author

The madrasa's entrances tares, windows' framings of the classroom are made of marble (Figure 4.37).

Figure 4.37: Marble on side Entrance

Source: The Author

4.3.2 Structural Elements

4.3.2.1 Vertical Structural Elements

Semiz Ali Pasha has various vertical constructional elements such as walls, piers, and arches.There are two types of walls; the first is outer walls, which are the main structural elements of madrasa, made of stone and brick while the other type is the interior walls of madrasa made of stone and the thickness of those walls is less than the façade walls.

While Piers are vertical elements located on the arcades of madrasa and those piers are made of limestone.

In addition, the arches of madrasa have two types; the first one is most common in madrasa, which is located on the arcades and made of limestone, while the other arcades of side entrances are made of bricks.

4.3.2.1.1 Walls

Generally, the outer walls of the madrasa are built from limestone and filled with lime-based mortar except the wall of northeastern façade and the exterior wall of main classrooms facade (*dershane*) that are made of bricks and stones .The thickness of the walls ranges from 70 cm to 95 cm and space in between filled with rubble of stone and bricks set in a mass of lime-based mortar

The wall of the northeastern façade is completely covered with lime-based mortar. While the exterior wall of main classroom facade (*Dershane*) are built from limestone and bricks, and it is built in fabric alternating shape from brick and stone while it built just from limestone in the lower part of this wall (Figure 4.38).

Figure 4.38: Center Part of Southern Facade

Source: The Author

The interior walls of madrasa such as the madrasa's entrance wall are built of limestone (Figure 4.7). While the interior walls of cells and arcade of madrasa are made of limestone and paved with white or yellow plaster (Figure 4.39).

Figure 4.39: Façade of Classroom

Source: The Author

4.3.2.1.2 Piers

Piers are vertical structural elements for arcades surrounding the courtyard of madrasa. All of the seventeen piers have a similar structure, a square plan, and are made of limestone. The arcade's piers share almost the same dimensions in average (75x75cm); the total height of each pier is (200 cm) (Figure 4.40).

Figure 4.40: Pier of Arcade

Source: The Author

4.3.2.1.3 Arches

Arches are structural elements of the arcades surrounding the courtyard. Arches of the arcades are built of limestone to support the cells' domes .all the arches share almost the same thickness, around (75cm), and the heights is around (346cm) while thespace between piers is around (330 cm) (Figure 4.41).

Figure 4.41: Archs of Arcade

Source: The Author

There are two arches on each side entrance built of limestone to support the interior side entrance arcades; each arch has almost the same thickness (75 cm) and height (310 cm). It rises (341 cm) from the street of madrasa (Figure 4.42).

Figure 4.42: Arch of side Entrance of Madrasa

Source: The Author

There are also two semi-circular arches on each exterior side entrance of madrasa, the arches are made of bricks and all of them have the same thickness(29cm), and an equal height of (288cm),it rise from the street of madrasa (335cm)(Figure 4.43)

Figure 4.43: Arch of the Extrior Entrance

Source: The Author

4.3.2.2 Horizontal Structural Elements

4.3.2.2.1 Domes

There are 25 domes placed over the classrooms, cells and the northeastern arcades. The largest dome is main classroom's dome, 15 of the domes are placed over the cells while arcade has 9 domes that are smaller than the cells' domes. All the rest on the vertical supports directly with pendentives being used as transition elements. The dome of the classroom has a diameter of (755cm), its height from the madrasa's level to the highest point of the dome (1187cm), the thickness of the dome is (65 cm).the dome is made of traditional lime-based screeds and covered with a traditional lead (Figure 4.23).

The cells' domes, with a diameter of (352-355 cm), have the height of each one as (645 cm), and the thickness of the dome is (38 cm) (Figure 4.44).

Figure 4.44: Domes of the Madrasa

Source: The Author

The domes of the northeastern arcade of madrasa share the same size and dimensions, the diameter of each dome is (368cm), the height to the top of each cell dome is (620cm), and the thickness of each dome is (29 cm).

4.3.2.3 Transition Elements

In the examined madrasa, transition elements from square plan to the springing level of the domes are determined as pendentives (Figure 4.45). This element were built of limestone and lime mortar as binding material with horizontal wide joints and vertical

Figure 4.45: Pendentives of the Cell

Source: The Author

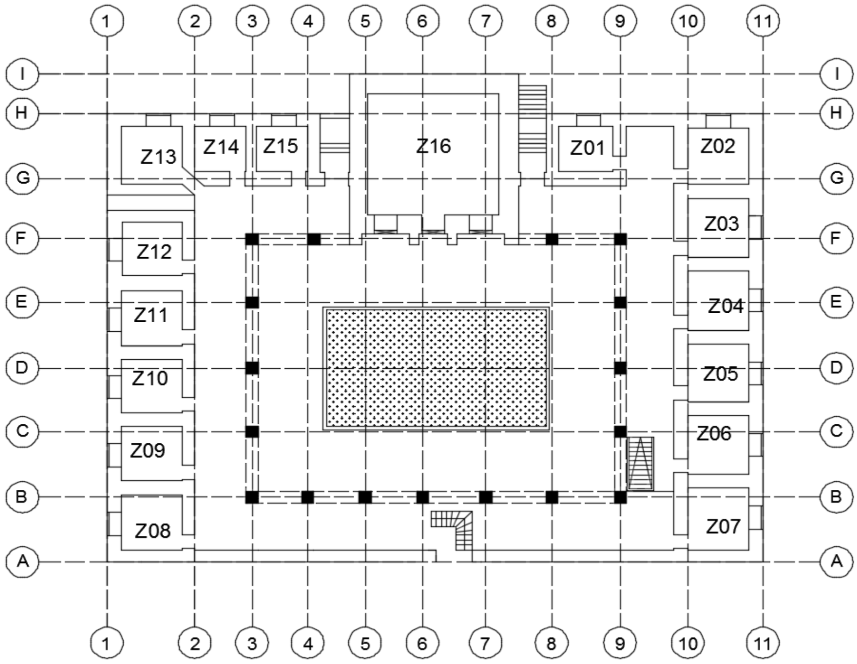
5. CURRENT STATE OF SEMIZ ALI PAŞA MADRASA

5.1 STRUCTURAL AND NON – STRUCTURAL DETERIORATIONS AND DAMAGE

5.1.1 Damage to the Domes

The madrasa has 25 domes, one big dome placed over the classroom while the other domes placed over the cells and the northeastern arcade of madrasa (Figure 3.4).

Figure 3.4: Plan of Madrasa



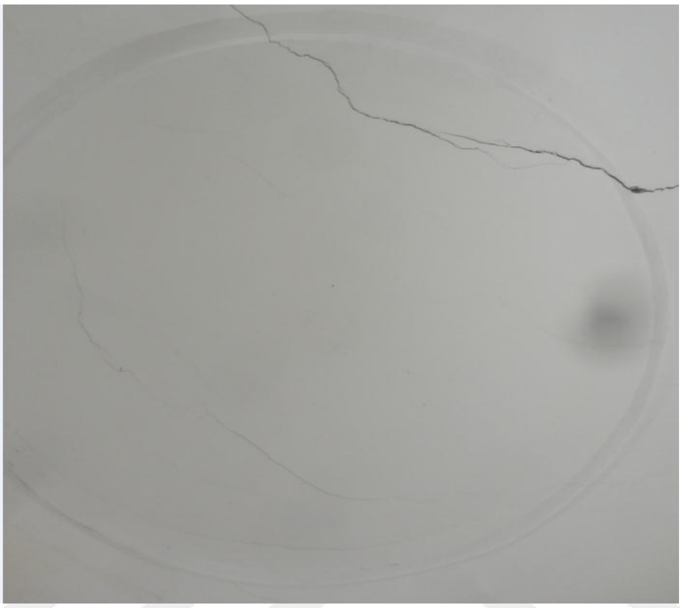
Source: The Author

Those domes suffer from different types of deterioration and damage such as, salt, flake and cracks, those damage occur as result of botanical grow, humidity, earthquake and air pollution, in addition to vandalism, since the lead domes were stolen and there is nothing to protect the dome from decay .The domes of Semiz Ali Pasha madrasa mostly suffer from radical cracks particularly (A8A9B8B9) and Z02 (H10H11G10G11) domes are damaged. In some domes parallel cracks are observed Z01 (H8H9G8G9) and (A7A8B7B8), another type of damage to the domes is flake, this damage type is observed in (A7A6B7B6), Z09 (B1B2C1C2) and Z12 (E1E2G1G2). Another type of damage of the dome is staining, this damage type is observed in Z09 (B1B2C1C2), Z12 (E1E2 G1G2), Z13 (G1G2H1H2), Z03 (G10G11F10F11) and Z06 (C10C11B10B11).

a) Domes of northeastern arcade:

This part of madrasa has 8 domes most of them suffer from several damage such as cracks and flake. The dome, which is located on the northern part of madrasa (A8A9B8B9), has one radial crack (Figure 5.1).

Figure 5.1: Damage of Dome (A8A9B8B9)



Source: The Author

The central dome of the northern arcade (A6A7B6B7) have some cracks especially on the edges and flakes where they spread widely (Figure 5.2)

Figure 5.2: Damage of dome (A6A7B6B7)

Source: The Author

b) Domes of cells of madrasa:

There are 15 cells in the madrasa each one of them covered with a dome; most of them suffer of damage such as cracks, and flake.

The dome Z08(B1B2C1C2) suffer from many Damage on the inner surface such as cracks, flakes and staining caused by salt and humidity (Figure 5.3).

Figure 5.3: Damage of Dome (B1B2C1C2)

Source: The Author

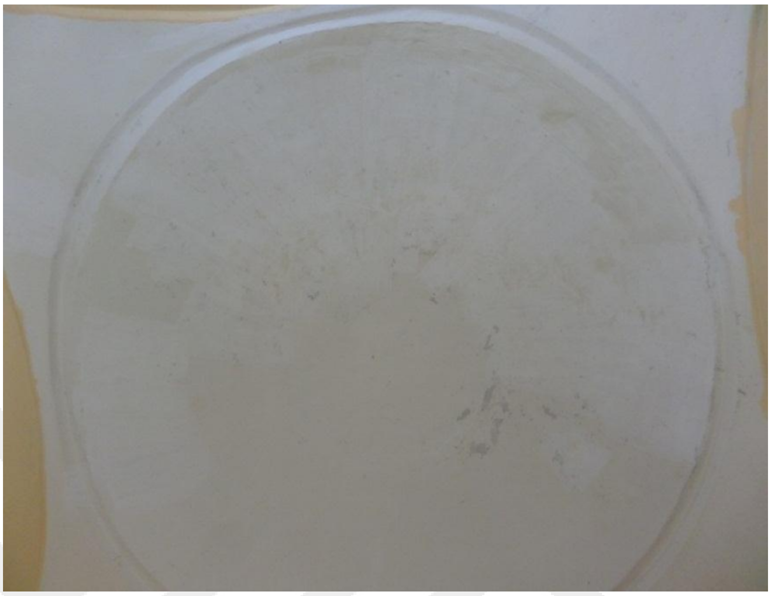
The dome Z12 (E1E2 G1G2) suffer from many damage on the inner surface such as flake, salt and staining caused by humidity (Figure 5.4).

Figure 5.4: Damage of Dome (E1E2G1G2)

Source: The Author

The dome Z13 (G1G2H1H2) suffer from staining and flake on the inner surface which is usually caused by salt and humidity (Figure 5.5).

Figure 5.5: Damage of Dome (G1G2H1H2)



Source: The Author

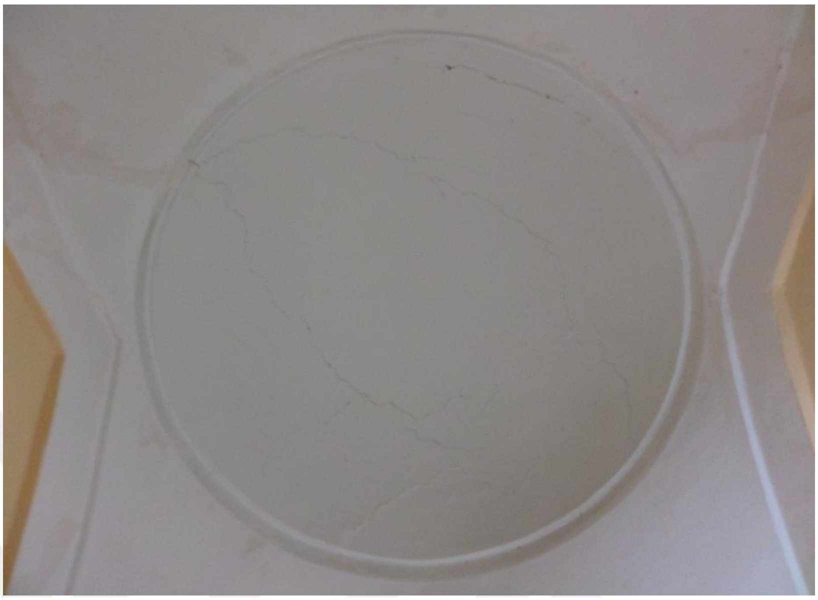
The dome Z16 (I5I7F5F7) is the biggest dome in this madrasa (classroom dome) Suffer from staining, cracks and flake on the inner surface which is usually caused by humidity (Figure 5.6).

Figure 5.6: Damage of Classroom Dome (I5I7F5F7)

Source: The Author

This dome Z01 (H8H9G8G9) has two huge diagonal cracks and some other slight cracks on the inner surface (Figure 5.7).

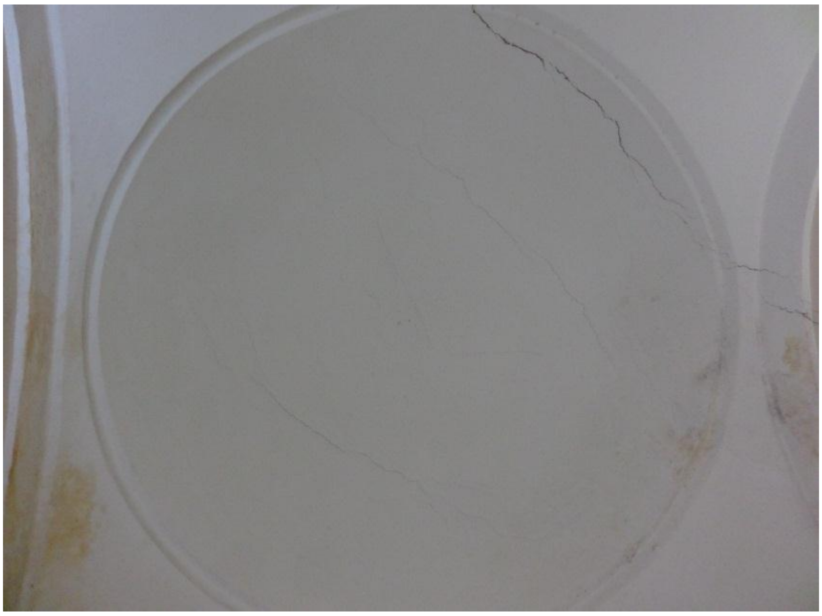
Figure 5.7: Damage of Dome (H8H9G8G9)



Source: The Author

The dome Z02 (H10H11G10G11) Suffer from staining and cracks on the inner surface, it has big crack and some other slight cracks (Figure 5.8).

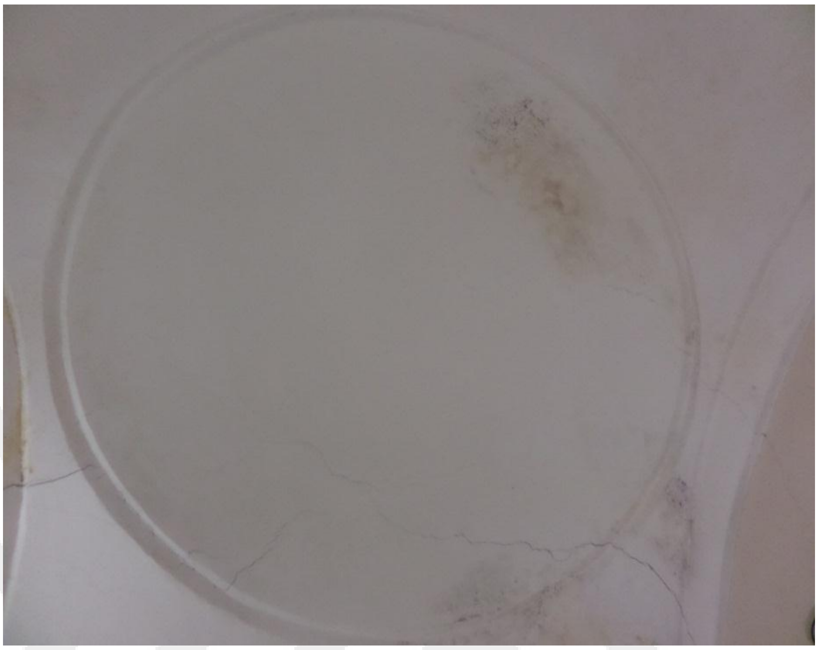
Figure 5.8: Damage of Dome (H10H11G10G11)



Source: The Author

The dome Z03 (G10G11F10F11) Suffer from staining and slight cracks on the inner surface (Figure 5.9).

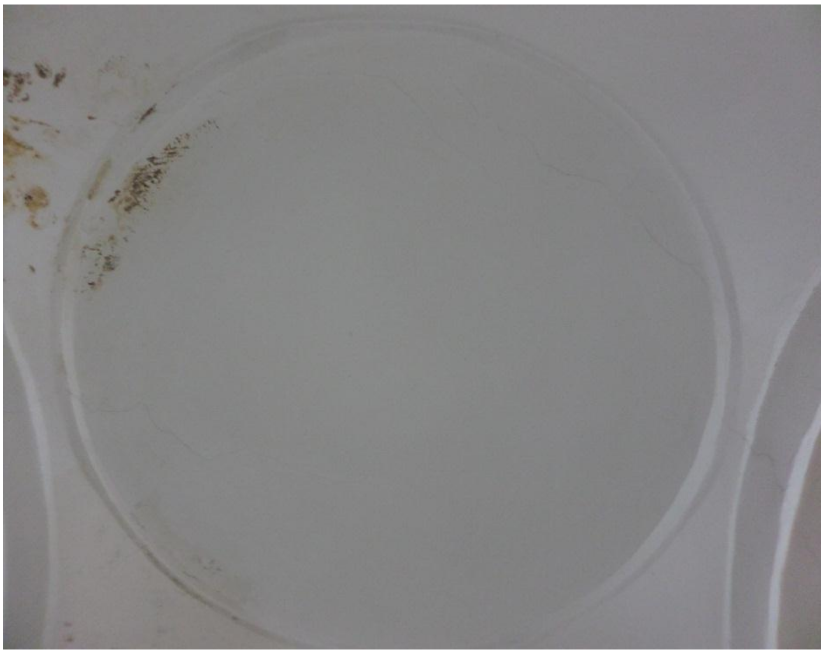
Figure 5.9: Damage of Dome (G10G11F10F11)



Source: The Author

The dome Z06 (C10C11B10B11) Suffer from staining and slight cracks on the inner surface (Figu.re 5.10).

Figure 5.10: Damage of Dome (C10C11B10B11)



Source: The Author

5.1.2 Damage to Cross Vaults of Arcade and Ceils of side Entrance

most of cross vaults of the arcades of the madrasa don't suffer of Damage except slight Damage of some cross vaults located in the southeastern portico on while the ceil of sides entrance suffer of massive Damage such as flakes, salt and staining etc.

The cross vaults (E9E10F9F10) Suffer of staining on the interior part of surface of it (Figure 5.11).

Figure 5.11: Damage of Cross Vault (E9E10F9F10)

Source: The Author

The ceil on the right side entrance (G4G5F4F5) Suffer of algae, staining and flakes on the interior part of surface of it (Figure 5.12).

Figure 5.12: Damage of Ceil of side Entrance

Source: The Author

5.1.3 Damage to the Arches

Arches of madrasa suffer of different kind of damage such as efflorescence, staining, flakes, cracks and disintegration. The arches mostly suffer from detach particularly (E8E10D8D10), (C8C10D8D10), (E7E8G7G8) and (C8C10D8D10) arches are damaged. In some arches flake is observed as well in (E8E10F8F10), (E8E10F8F10) and (C8C10D8D10). Another type of damage to the arch is staining, this damage type is observed in (E8E10D8D10), (E8E10F8F10) and (E7E8G7G8). In some arches cracks are observed as well in (E8E10F8F10) and (C8C10D8D10).

The arch (E8E10D8D10) Suffer on the interior face of detach and staining while its suffer on the exterior face of staining (layer of sooty) and flakes (Figure 5.13).

Figure 5.13: Damage of Arch (E8E10D8D10) 1. Interior Face of Arch 2. Exterior Face of Arch

Source: The Author

The arch (E8E10F8F10) Suffer on the interior face of detach, flakes and staining while its suffer on the exterior face of salt, staining and crack (Figure 5.14).

Figure 5.14: Damage of Arch (E8E10F8F10) 1. Interior Face of Arch 2. Exterior Face of Arch

Source: The Author

The arch (E7E8G7G8) Suffer on the interior face of staining while its suffer on the exterior face of algae, staining and detach (Figure 5.15).

Figure 5.15: Damage of Arch (E7E8G7G8) 1. Interior Face of Arch 2. Exterior Face of Arch

Source: The Author

The arch entrance door of madrasa (C8C10D8D10) Suffer on the interior face of many damage such as salting ,staining cracks detach and flakes while its suffer on the exterior face of salt ,detach, staining (layer of sooty) and flakes (Figure 5.16).

Figure 5.16: Damage of Arch of main entrance (C8C10D8D10) 1. Interior Face of Arch 2. Exterior Face of Arch

Source: The Author

5.1.4 Damage to the Transition Elements

in madrasa the pendentives is a main transition element and it's consider as a transition element from square plan to the springing level of the domes, those elements found in the cells and the main classroom some of them suffer from different sorts of Damage such as cracking , staining and flake **.**

The pendentives in madrasa mostly suffer from cracks particularly in (A2A3B2B3), (H8H9G8G9) and (G10G11E10E11) pendentives are damaged. In some pendentives staining is observed as well in (G10G11E10E11). Another type of damage to the pendentives is flake, this damage type is observed in (I5I7F5F7).

One of the pendentives in the room (G10G11E10E11) suffer from cracks, staining, and flake. While the second pendentive suffer from cracking (Figure 5.17).

Figure 5.17: Damage of Pendentive (G10G11E10E11)

Source: The Author

The arcade pendentives' (A2A3B2B3) suffer from cracking and staining (Figure 5.18).

Figure 5.18: Damage of Pendentive (A2A3B2B3)

Source: The Author

One of the pendentives in the main classroom (I5I7F5F7) suffer from massive damage such as detaching, staining and flake. While the other pendentives don't have inherent Damage (Figure 5.19).

Figure 5.19: Damage of Pendentives on the main Classroom (I5I7F5F7)

Source: The Author

One of The pendentives in the room (H8H9G8G9) suffer from massive vertical cracks while the other pendentives do not have inherent Damage (Figure 5.20).

Figure 5.20: Damage of Pendentive of Room (H8H9G8G9)

Source: The Author

5.1.5 Damage to the Inscriptions and non-Structural Elements

There are inscriptions on the main façade of the main classroom. There is Chapters of the Quran besides Muqarnas. Therefore, the inscriptions are on three parts, the first one is above the entrance door of the Classroom and the other two are on both sides of the entrance (figure 5.21).

Figure 5.21: Façade of Classroom (G4G8F4F8)

Source: The Author

In figure 22, we could notice the icons on both sides above the windows, those icons suffer of salting, flake and staining (figure 5.22).

Figure 5.22: Inscription above Windows(G4G8F4F8)

Source: The Author

The left Bursa arch (G4G6H4H6) suffered from damage such as salting, detaching and staining on both surfaces (Figure 5.23).

Figure 5.23: Damage of Bursa Arch (G4G6H4H6)

Source: The Author

In figure 6, the entrance of classroom has many Decorative elements and most of them suffer from many Damage , the marble elements surrounding the door of classroom suffer of staining and salting, while the muqarnas squinch suffered of detaching, fluorescence and staining(Figure 3.6).

Figure 3.6: Lotus Unit on the Entrance (G6G7F6F7)

Source: The Author

The small Inscriptions on the inside of bursa arch that has a flower shape suffered from detaching (figure 3.9).

Figure 3.9: Flower Inscription

Source: Authors

The upper window of classroom, which overlooks the street, has six-party cell's shape and the blanks vitrified. That window suffered from massive damage such as staining, detaching and missing pieces of glass (Figure 5.24).

Figure 5.24: Cells of Window (I5I7H5H7)

Source: Authors

The rain gutter (G2G3F2F3) suffered from damage such as salting, alga and staining and those damage occurred in most of the rain gutters of madrasa (Figure 5.25).

Figure 5.25: Damage of Rain Gutter (G2G3F2F3)

Source: Authors

The chimneys suffer from damage such as salting and staining and those damage occurred in most of the chimneys of madrasa (Figure 5.26).

Figure 5.26: Damage of Chimney's Stacks

Source: The Author

The marble surrounding the left window of façade of the classroom (G5G6F5F6) Suffer from salting, staining, cracks, detaching and flake (Figure 5.27).

Figure 5.27: Window of Classroom (G5G6F5F6)

Source: Authors

The stairs, which are located on the left side entrance on the southern facade (G7G8H7H8), Suffer from staining, detaching and florescence (Figure 5.28).

Figure 5.28: the Damage of Stairs of the Old Entrance (A6A7B6B7)

Source: The Author

The stairs, which are located on the right side entrance on the southern facade (I4I5G4G5) Suffer from cracking, detaching and florescence (Figure 3.37).

Figure 3.37: Left Side Entrance of Madrasa

Source: The Author

The interior side of the stones sounding the window (G8G9H8H9) Suffer from salting and staining. While the exterior side suffer from cracking, staining and flake (Figure 5.30).

Figure 5.29: Damage of Window (G8G9H8H9) 1. Exterior Face of Window 2. Interior Face of Window

Source: The Author

The interior side of the stones surrounding the window (E10E11C10C11) suffer from staining. While the exterior side suffer from staining (layer of sooty) and flake (Figure 5.31).

Figure 5.30: Damage of Window (E10E11C10C11) 1. Exterior Face of Window 2. Interior Face of Window

Source: The Author

The interior side of the stones surrounding the window (G3G4H3H4 does not suffer of any damage. While the exterior side suffer from staining flake and cracking (Figure 5.31).

Figure 5.31: Damage of Window (G1G2E1E2) 1. Exterior Face of Window 2. Interior Face of Window

Source: The Author

5.1.6 Damage to the Walls

Walls are the main structure elements of the madrasa and they suffer from different sorts of damage such as salt, flake, and cracks. Those damage occurred as result of botanical growth, humidity, earthquakes, fire, air pollution, neglection and interventions.

The walls mostly suffer from diagonal cracks particularly in Z01 (H10H11), Z02 (H10G10), Z8 (A1B1) and (H4H5G4G5) and (A8A10) walls are damaged. In some walls vertical cracks are observed as well in Z1 (G8H8), Z3 (G11F11), (A8A10) and (A6A7). Also in other walls horizontal cracks are observed (A6A7).

Another types of damage to the walls such as graffiti, lichens, fungi, detaching, staining and flake those damage types are observed in (H4H5G4G5), (D1F1), (A8A10) and (A6A7).

The wall of rooms Z1 (G8H8) suffer from vertical cracks (structural damage) which appear on the interior and exterior surface of the wall (Figure 5.32).

Figure 5.32: Damage of Wall (G8H8) 1. Exterior Face of Wall 2. Interior Face of Wall

Source: The Author

The wall of rooms Z01 (H10H11) suffer from diagonal cracks (structural damage) which appear on the interior and exterior surface of the wall (Figure 5.33).

Figure 5.33: Damage of wall (H10H11) 1. Exterior Face of Wall 2. Interior Face of Wall

Source: The Author

The wall of rooms Z02 (H10G10) suffer from diagonal cracks (structural damage) which appear on the interior and exterior surface of the wall (Figure 5.34).

Figure 5.34: Damage of Wall (H10G10)

Source: The Author

The wall of rooms Z3 (G11F11) suffer from vertical cracks (structural damage) which appear on the interior and exterior surface of the wall (Figure 5.35).

Figure 5.35: Damage of wall (G10F11) 1. Exterior Face of Wall 2. Interior Face of Wall

Source: The Author

The wall of rooms Z8 (A1B1) suffer from diagonal cracks (structural damage) which appear on the exterior surface of the wall. While it shows partially on the interior surface of the wall (Figure 5.36).

Figure 5.36: Damage of wall (A1B1) 1. Exterior Face of wall 2. Interior Face of Wall

Source: The Author

The exterior part of the arcade wall (A8A10) suffer graffiti, lichens, detaching, staining and (vertical and diagonal) cracks (structural damage), and the diagonal cracks appear on the interior part of the wall (Figure 5.37).

Figure 5.37: Damage of Wall (A8A10) 1. Exterior Face of wall

2. Interior Face of wall

Source: The Author

The exterior part of the arcade wall (A6A7) suffer from detaching and massive horizontal cracks (structural Damage) those horizontal cracks appear on the interior surface, which suffers from different Damage such as staining, detaching, and flake (Figure 5.38).

Figure 5.38: Damage of wall (A6A7) 1. Exterior Face of wall 2. Interior Face of Wall

Source: The Author

The wall of the northwestern facade (D1F1) suffer from staining, fungi, detaching and huge holes in it (Figure 5.39).

Figure 5.39: Damage of Wall (D1F1)

Source: The Author

The basement room (H4H5G4G5) suffer from various damage such as detaching, staining, flakes and missing part. Also there has been addition of pipes and heating boilers machine (Figure 5.40).

Figure 5.40: Damage of Basement Room (A10A11B10B11)

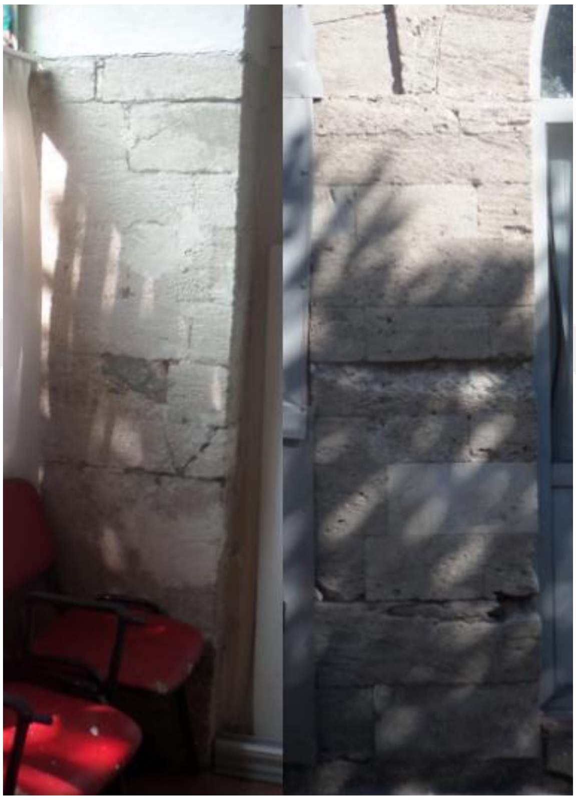
Source: The Author

5.1.7 Damage to the Pillars

The madrasa has 17 pillars and all of them surrounds the courtyard, most of the pillars suffer from slight Damage , except for some pillars that suffer from some Damage such as staining, flake, cracking and salting... etc. most of those Damage happen because of neglection, botanical growth, moose, earthquakes, fires and many other effects.

The Pillars (B4) suffer from inherent damage such as horizontal cracks and detaching (Figure 5.41).

Figure 5.41: Damage of Pillars (B4)



Source: The Author

The Pillars (B8) suffer from damage such as staining, cracks, and detaching (Figure 5.42).

Figure 5.42: Damage of Pillars (B8)

Source: The Author

5.2 INTERVENTION

1958 was the last time the madrasa were restored and the restoration process finished in 1960, and they added a staircase that leads to the basement, another entrance was opened on the new road also the portico of madrasa is fitted with glass and the chimney of students rooms got closed, (Goncuoglu, 2011, p. 405).The added staircase through the restoration process in 1958 which was located on the arcade and lead to basement (C9C10B9B10) (Figure 5.43).

Figure 5.43: the Stairs of Basement (C9C10B9B10)

Source: The Author

The intervention on the madrasa's courtyard through the restoration process in 1958, was covering the ground with a layer of concrete, adding basins for plants in the center area of the courtyard and small basins for the garden, and they fitted the portico of madrasa with glass (Figure 5.44).

Figure 5.44: Intervention of Courtyard

Source: Archive Istanbul of vakiflar genel mudurlugu

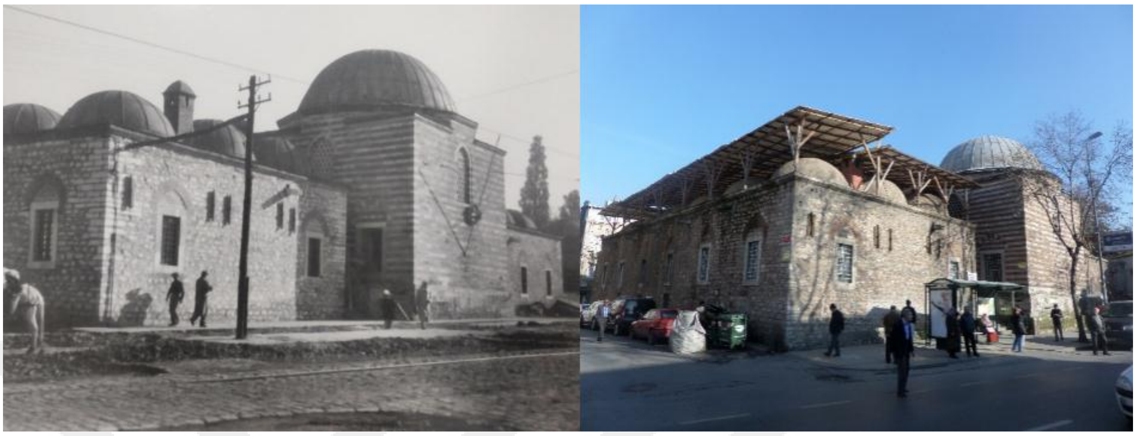
There was intervention to the side courtyard of madrasa, which is located on the south western façade that occurred through the restoration process in 1958, where they covered the ground with a layer of concrete on two levels (Figure 5.45).

Figure 5.45: Intervention of Side Courtyard

Source: Archive Istanbul of vakiflar genel mudurlugu

The main façade of madrasa, which is located on the new main road, was under intervention through the restoration process in 1958, where they removed the sidewalk, which increased the height of madrasa (Figure 5.46).

Figure 5.46: Intervention of Level of Main Façade



Source: Archive Istanbul of vakiflar genel mudurlugu

The addition of toilets on the side courtyard of the madrasa, which is located on the south western façade, occurred in the restoration process in 1958(Figure 5.47).

Figure 5.47: Addition of Toilets of Side Courtyard

Source: The Author

The addition of the partition, which is placed on the arcade (G4F4) made from metal and wood (Figure 5.48).

Figure 5.48: The Addition of Partition (G4F4)

Source: The Author

The addition of the partition, which is located on the arcade (A6B6) made from plastic and glasses (Figure 5.49).

Figure 5.49: The Addition of Partition (A6B6)

Source: The Author

The addition of wall, which is located under the arcade (G8F8) made of glasses and concert (Figure 5.50).

Figure 5.50: The Addition of Partition (G8F8)

Source: The Author

The addition of Pipes, electric wires and heating devices, that is located in the arcades of madrasa (Figure 5.51).

Figure 5.51: The Addition of Pipes and Electric Wires in Aracde

Source: The Author

Removing old staircase and adding new one (A6A7B6B7), located under the arcades of madrasa (Figure 5.52).

Figure 5.52: The Addition of New Staircase

Source: The Author

Addition of new tiles above the original tiles in most of madrasa (Figure 5.53).

Figure 5.53: The Addition of Tiles

Source: The Author

Addition of iron windows and doors (A10A11) which leads to the basement of madrasa (Figure 5.54).

Figure 5.54: The Addition of Door (A10A11)

Source: The Author

Removing all chimneys of madrasas cells except for one of them, which is located in room (H2H3G2G3) (Figure 5.55).

Figure 5.55: The Chimney of Room (H2H3G2G3)

Source: The Author

changing the room (E1E2G1G2) into a bathroom and adding toilets cabins, a sink and ceramic on the walls of the room (Figure 5.56).

Figure 5.56: The Addition of the Bathroom in Room (E1E2G1G2)

Source: The Author

The addition of a toilet, located in the basement of madrasa (A9A10B9B10) (Figure 5.57).

Figure 5.57: The Addition of Toilet (A9A10B9B10)

Source: The Author

All of the lead domes were stolen by thieves except for classrooms dome (Figure 3.44) (*Bilim ve insan vakifi restorasyon clasima raporu*).

Figure 3.44: The Remove of Lead of Domes

Source: The Author

5.3 DISCUSSION OF THE DAMAGE STATE

The madrasa suffers from many deteriorations and damage caused by environmental and human induced factors, which lead to various weaknesses to the structural and non-structural elements of the madrasa.

The deterioration of madrasa caused by environmental effects such as earthquakes (Istanbul earthquake on 1894), fire (Balata fire on 1729), moisture, acids, botanical such as (florescence, lichens and fungi), biological, chemical and insect attack. Also the human factors such as pollution, wrong interventions, vandalism and ignorance (Feilden, 2003, p. 2, Ahunbey, 1994, p. 391).

The environmental and human effects cause various damage of madrasa such as cracks humidity, salting, staining, botingal growing, detaching and flakes. Those damage did not cause threatening risk to the madrasa except in few parts of madrasa.

Cracks are the most common damage in the madrasa and it is spread in most of the elements of madrasa, such as the walls, and domes. In addition, it takes different types as diagonal, parallel, and vertical cracks. Most cracks are superficial except for few of them, which are mostly located in the southeastern walls of madrasa. Those cracks mostly exist as rustle of earthquakes, humidity, and negation.

Staining and flakes are considered common damage, and usually occur on the interior surface of the domes, walls, and non-structural elements such as inscriptions. Usually staining caused by humidity, water, and air pollution. Which could cause a layer of sooty on surface.

The uncovered surfaces of madrasa such as the roof and facades of madrasa, which weather affects, such as rain and wind, provides a suitable environment for botanical growing which could cause salting, cracking Damage and detaching.

Wrong interventions caused many massive damage to the madrasa, such as removing the lead covering the domes of madrasa, which caused many damage such as flakes. Also, the addition of a new staircase leads to the basement caused many cracks especially on the basement's wall. While adding new heating pipes and electrical wires made many holes on the building's walls.

Finally, despite those various damage, which spread all over the madrasas, the madrasa is still considered comparatively in a good condition because it's not under a serious threat. But inherent deterioration could collapse some parts or all of the madrasa.

Damage observed in the madrasa mostly are not to the structural elements and there is no continuation through the elements section. Repair and maintenance are necessary for preservation of the building.

6. DISCUSSION OF CURRENT STATE AND INTERVENTION OF SEMIZ ALI PAŞA MADRASA

6.1 CONSERVATION PRINCIPLES

International charters and laws have great importance in any restoration and preservation process since they provide specific recommendations about restoration and preservation set by specialists. Those charters could provide a frame for any restoration and preservation process to any historical monument located anywhere around the world. The most important charters are (The Venice Charter) / 1964 and (ICOMOS) / 2003. These provide the most vital restoration and preservation principles.

6.1.1 International Charter for the Conservation and Restoration of Monuments and Sites (The Venice Charter) / 1964

The Venice Charter is considered one of the most important charters in the field of conservation because it lays out the essential restoration and conservation guidelines of historical buildings. This charter was a result of the development of Athens Charter 1931.

The Venice Charter focuses on restoration and conservation principles through a number of definitions and recommendations about conservation and restoration of historical monuments.

a) Definitions

The Venice Charter depends on specific definitions to preserve and restore historical monuments. It emphasizes that historical monuments can include those found in urban or rural settings, which hold historical evidence of a historical event. These settings contain very important values, equal to the value found in historical buildings. It is not necessary for historical monuments to be ancient in order to be restored and preserved. It is about the cultural significance, so it could also include modest works of the past because those buildings could be culturally significant.

Fundamentally, the aim of restoring historical monuments is to protect them because without doing that the material could decay rapidly. It is necessary to use all of the available methods to conserve historical monuments because it is not possible to preserve them by solely using traditional techniques (ICOMOS, 1964).

b) Conservation

The Venice Charter provides a number of principles that are considered to be an essential resource for historical monument conservation. They emphasize that the conservation of historical buildings should be permanent. According to the Venice Charter, temporary conservation of historical buildings may backfire with the passing time. Repeated conservation efforts may cause permanent damage or loss to some historical parts of the building. In addition, the suitable usage of historical monuments in social activity is really helpful in conserving historical buildings. As stated by the Venice Charter, conservation buildings that are used in social activity would have more care more than buildings that are not used it in any social activity, provided they will not change the design or decoration of the building.

Preserving the setting of any historical monument is really important for conservation because according to the Venice Charter, any change in the setting of a historical monument could reduce the value of the monuments when the historical monuments are separated from the traditional setting. It does not allow the addition of new construction, so moving any part of the monument cannot be allowed unless it is an absolute necessity. This being since all of the parts of historic monuments are important, even the smallest of details such as items, painting and decorations. They should not be removed because they are an integral part of the monument "(ICOMOS, 1964).

c) Restoration

The Venice charter provides number of principles that are considered to be an essential resource for the restoration of historical monuments. They emphasize that in any restoration process of historical monuments, all contributions of all periods should be respected. The unity of one particular style is not necessary, therefore our intention should be to show all contributions at a certain building, from all periods. This gives a clear idea about the building’s evolution.

In the restoration process the replacement of missing parts should be integrated well with the building in whole, but at the same time, it should be distinguished from the original missing part. According to the Venice Charter, falsifying historical evidence is something which should be avoided. In addition, modern techniques should be used for conservation and reconstruction of monuments during the restoration process. Modern techniques are highly efficient concerning the restoration of monuments while traditional techniques of restoration are not adequate.

There should not be any additions to the structure of a historical monument because it could ruin the building's relationship with the surrounding environment and it could also eliminate the historical character of the building (ICOMOS, 1964).

6.1.2 Principles for the Analysis, Conservation and Structural Restoration of Arch. Heritage / 2003

This document is exceptionally important for conserving architectural structures of historical monuments because it provides a number of recommended contributions to solve specific problems. These are problems which experts could face during conservation and restoration works. In addition, its recommendations provide suitable and effective methods for analysis and repair of historical monuments.

The ICOMOS charter is considered a continuance and completion to the Venice Charter since it provides a more detailed collection of principles. Those principles start by providing general criteria about conservation and restoration reaching to more specific details such as researches and diagnosis which provide the needed approach to be taken during diagnosing and researching any historical monument. It also gives recommendations about the restrictions and remedial measures that should be followed during any restoration and conservational process.

a) General Criteria

The ICOMOS charter provides general criteria that is considered to be an essential resource for historical monument's conservation. It emphasizes that the value of architectural heritage does not depend on specific criteria because according to the ICOMOS charter, the criteria changes along with the culture which the architectural monument belongs to. Each and every part of a historical monument, whether belonging to the structure of inner or outer elements, is considered valuable and equally important.

According to ICOMOS, restoring a historic monument is not an objective but a way to accomplish a specific purpose. Therefore to achieve that purpose, a multidisciplinary approach should be taken since it is necessary for conservation and restoration of historical monuments. This approach should follow steps close to those used in medical approaches such as anamnesis, diagnosis, therapy, controls, searching for information in order to find out the causes of damage and selecting the best way to repair the damage systematically.

The general criteria of ICOMOS makes safety conditions a priority, therefore safety measures should be taken before making any changes to a historical monument. Any urgent measures should not be taken except if there are inherent threats. According to ICOMOS, keeping the fabric of building is a priority (ICOMOS, 2003).

b) Research and Diagnosis

The ICOMOS charter provides a number of important principles about research and diagnosis. This is considered to be an essential resource for the conservation of historical monuments. It emphasizes the presence of a multidisciplinary team, and the size of the team should be proportional to the scale of the problem regarding the historical building.

Providing and collecting all information such as the material and structure of the building and also the techniques used in construction help to make a coherent plan that would reveal the kind of problems the structure might be facing and which materials should be used in the conservation process.

Generally, the diagnosis depends on historical, qualitative and quantitative approaches; the qualitative approach depends on observing deterioration of the structure and material while the quantitative approach depends on material and structural tests. However, those approaches should be balanced with the evaluation of safety such as direct observation, historical research and structural analysis. Lastly, the collection of all information concerning the diagnosis and safety evaluation must be submitted in a report called "EXPLANATORY REPORT" before any intervention of the building (ICOMOS, 2003).

c) Remedial Measures and Controls

Intervention of any historical buildings should follow specific steps and guidelines. Therefore, before any intervention we should know the reasons behind the damages of the building. According to the ICOMOS charter, to insure the safety and durability of historical monuments it is better for interventions to be as minimal as possible. In order to achieve that it is better to use a gradual approach, starting from a minimal level of intervention, in case there is a difficulty evaluating the safety levels and the volume of the benefits of the interventions. Additionally, during the intervention process we should select specific techniques which will differ between different buildings.

Respect of the historical value and the techniques used in the original structure and preserving some evidence of the original elements should be taken into account during any intervention process. In addition, the original structural elements should not be modified or removed under any intervention. Therefore, according to the ICOMOS charter, new materials or elements used in a restoration process should be harmonious with the original materials and should have ability to be removed and replaced using better measures or acquired materials.

Maintenance is considered the best therapy to historical buildings, and in any therapy, the problems should be eliminated from their roots. The safety evaluation and an understanding of the structure should also be taken into account during the restoration process. In addition, according to the ICOMOS charter, during any intervention and restoration process the provisional safeguard systems should do its function and at the same time it should not cause any damage to the monuments. Any measures that could cause a loss of control during the restoration process should be avoided. However, if restoring the materials and structure could be difficult or cause damage to the monument then a better option would be to dismantle and assemble them.

All historical modifications and imperfections should be kept because according to ICOMOS, every historical element has a historical value. The only case where they should not be kept is if they could become a threat to safety. Finally, it is important to be sure of the efficiency of the results during and after any intervention process, and to check and monitor it. Those activities should be documented and saved as a reference for the condition of the structure (ICOMOS, 2003).

6.2 REVIEW OF REALIZED INTERVENTIONS

Semiz Ali Pasha madrasa was under several interventions, especially during previous restoration processes. Most of the restoration processes were non-thought out and led to opposite results. In the last restoration effort of the madrasa in 1958, many interventions took place which led to the manifestation of several damages in the madrasa. In addition, the interventions which occurred after the last restoration contributed to an increasing amount of damage in the madrasa.

The vast majority of interventions which occurred in madrasa do not abide by the provisions of the international treaties on restoration and conservation of the historical monuments such as the Venice Charter in 1964 and the ICOMOS charter in 2003.

Semiz Ali Paşha madrasa was under several improper interventions, such as adoptive re-use of the madrasa, serving new functions several times, theft, and the addition and removal of structural and non-structural elements. Therefore, it is necessary to take actions following the international charters of restoration.

It would be better to remove the inappropriate interventions of Semiz Ali Pasha madrasa, especially the additions which reduce the historical value. In addition, according to the Venice Charter and the ICOMOS charter, for historical monuments those additions should not have been added because they eliminate its historical character. So, according to those charters, room (G8G9F8F9), which is located next to the side entrance of the madrasa, is occupying a part of the arcade of madrasa and includes an additional glass partition and a wall that should be removed for not having historical value (Figure 6.1).

Figure 6.1: Room (G8G9F8F9) Present in Part of Arcade

Source: The Author

In addition, all of the interventions which occurred as a result of the last restoration process, such as the glass partitions which are fitted to the arcade of madrasa, need to be removed because those partitions are not original elements of the madrasa (Figure 5.114). It is necessary to remove the inner partition (Figure 5.119) (Figure 5.121), which separates the northwestern arcade to into three parts, and return that part of arcade to its original condition.

The courtyard of madrasa was covered with a layer of concrete. This intervention occurred during the restoration process in 1958. That layer of concrete should be removed because the material is incompatible. While for the same reasons, the added layer of concrete on two levels in the back garden of the madrasa and the added wet spaces (WC) need be removed (Figure 5.115) (Figure 5.117).

The plants' basins in the center of the courtyard, which were added during restoration in 1958 need to be removed because they do not have any historical value as well as their potential damage to the structure of the madrasa (Figure 5.114). According to the 11th article of the Venice Charter it is possible to remove some elements if they do not hold any historical value and the removal will not affect the original elements (ICOMOS, 1964).

The staircase (C9C10B9B10), which was added during the restoration process in 1958, is located on the northwestern arcade and leads to the basement. It should be removed because according to the ICOMOS charter, an addition which could cause deformity in the balance between the elements of the building should be removed (ICOMOS, 2003)(Figure 5.113).

Most of the tiles that cover the floor of the madrasa are set on top of its original tiles. So removing the new tiles is a necessity in that condition because they are hiding the old tiles, which have an important historical value. According to the Venice Charter it is necessary to show the historical details and elements of historical monuments (ICOMOS, 1964) (Figure 5.125).

All of the chimneys inside each cell of the madrasa were removed during the last restoration process in 1958 except in one room (H2H3G2G3) (Figure 5.127). According to Article 12 of the Venice Charter, the missing chimneys should be added which will integrate harmony with the other cells. Moreover, they should be distinguished from original chimneys (ICOMOS, 1964). All of the pipes, electric wires, and heating devices should be reconsidered so that they do not harm the structure (Figure 5.123).

The addition of a new staircase built with new materials (A6A7B6B7) to the old main entrance of madrasa, which is located on the northwestern side of madrasa, should be replaced with one made of materials that are similar to the original one (Figure 5.124). According ICOMOS the characteristics of materials used in restoration work should be compatible with the building's original materials (ICOMOS, 2003).

The new staircase on the right side entrance of the southern façade, which is located between the exterior wall of the classroom and the right part of southern façade, is made of concrete except for the last step, which is from the original staircase and is made of marble.

Therefore, according to the ICOMS charter, the modern staircase should be removed while keeping the original part of the stairs. The new stairs should be made of marble but distinguished from the original marble step of stairs according to Article 12 of the Venice Charter (ICOMOS, 1964) (ICOMOS, 2003) (Figure 6.2).

Figure 6.2: The Right Side Entrance of the Madrasa

Source: The Author

One of the interventions was stolen which caused a large amount of damage to the domes because of rain leaking. Article 12 of the Venice Charter emphasizes that "the replacement of missing parts should be integrated with the whole, however should be differentiated from the original missing part" (ICOMOS, 1964) (Figure 6.3).

Figure 6.3: The Lead of Domes 1. After Removal 2. Before Removal

Source: 1.The Author 2. Bilim ve insan vakifi restorasyon clasima raporu

Therefore, it is necessary to replace the lead covered domes with new ones that are distinguished from the original lead covering (*Bilim ve insan vakifi restorasyon clasima raporu*) (Figure 5.132). The steps that are located in front of the main façade should be removed because these steps do not have any historical value and they are deteriorating the façade (Figure 6.4).

Figure 6.4: The Stone Step on the Main Facade

Source: The Author

The addition of iron windows and doors that lead to the basement (A10A11) on the northeastern part of madrasa should be removed and replaced with a new gate made of materials compatible with the type of madrasa. According to the ICOMOS charter, any new materials that will be used should be harmonious with the original material of the historical building (ICOMOS, 2003) (Figure 5.126).

The added a wet space in the basement of the madrasa (A9A10B9B10) should be removed because according to the 11th article of the Venice Charter, additions with no historical values should be removed because they reduce the historical value of the whole building. (Figure 5.131) (ICOMOS, 1964).

That article applies to room (E1E2G1G2) as well because its function has been changed to a bathroom and there were additions of toilet cabins, a sink, and ceramic on the walls of the room.

According to Article 13 of the Venice Charter, the addition of new structures or changes to the function of the monument are not acceptable if they reduce the historical value of it, therefore that room should be turned back into its original function. (ICOMOS, 1964) (Figure 5.129).

The added door between the two cells Z3 and Z4 (F10F11E10E11) should be removed because it is not an original element (Figure 6.5).

Figure 6.5: The Addition of the Door between Cells Z3 and Z4 (F10F11E10E11)

Source: The Author

The added plastic roof in the room (A10A11B10B11) and the wooden roof in the room (A1A2B1B2) should both be removed because those roofs cover the original domes and they don't add any aesthetical or historical value to the building (Figure 6.6).

Figure 6.6: 1. The Plastic Roof in Room (A10 A11B10B11)

2. Wooden Roof in Room (A1A2B1B2)

Source: The Author

The side doors of the main classroom, which are opened to two sides of the arcades, were closed off. The right side door is covered with a metallic board (Figure 6.7), while the door on the other side is covered with a stone wall. It is necessary to reopen those doors. According to the ICOMOS charter, it is necessary to avoid any addition or alteration to any historical features. If there are any alternations to the buildings historical features it is necessary that it should be undone and returned to its original condition, therefore the two doors should be reopened. (ICOMOS, 2003).

Figure 6.7: Close of the Sides Doors of Main Classroom

Source: The Author

The madrasa's doors are made of different materials such as wood, metal and plastic. Most of them do not have any historical value, therefore according to the 12th article of the Venice Charter, the replacement of missing parts must integrate harmoniously with the whole building and must be distinguishable from the original. Consequently, the addition of new doors made of wood, would integrate more with the historical characteristic of the madrasa than the doors that exist now (ICOMOS, 1964) (Figure 6.8).

Figure 6.8: Doors of Madrasa

Source: The Author

Finally, the review of the realized interventions fundamentally depend on the global restoration and conversation charters for historical monuments such as ICOMOS and the Venice Charter. Any future interventions or restorations need to highlight the historical and cultural value of the madrasa (ICOMOS, 2003) (ICOMOS, 1964).

7. CONCLUSION

Semiz Ali Pasa madrasa is considered as a valuable example of Ottoman educational buildings’ architecture in Istanbul, built during the 16th century by architect Sinan. There was a common plan scheme for madrasas in that era. It is considered to be one of few madrasas in Istanbul that is maintained in its original architectural and structural form without any major alterations and it is in relatively good condition, despite the fact that this madrasa's structure suffered many damage due to neglect, lack of maintenance, improper interventions, earthquakes and repeated incidents of fire.

This madrasa is now being used as the headquarters of the Human and Science Foundation.

This study, about Semiz Ali Paşa madrasa starts by giving summary about the educational buildings in Ottoman Empire, especially the architectural features of Istanbul madrasas in the 16th century to provide comprehensive research that is done to give view of madrasas' architecture and pave the way for understanding the main case of study about Semiz Ali Pasha Madrasa. Also this study provides needed adequate information about the effects that have damaged the historical monuments such as natural and human effects in additionally to save detail explanation of the impact of those effects on the historical masonry monuments' and their structural such as the columns, walls etc.. to provide a better understanding on the structural and nonstructural damage and deterioration in Semiz Ali Pasa Madrasa.

Semiz Ali Pasha Madrasa is considered to be a madrasa that is insignificantly studied. This study about Semiz Ali Pasha madrasa could be a base for other comprehensive studies. It aims to provide coherent information about architectural descriptions and a comprehensive vision of all structural and non-structural elements of the madrasa. It provides an examination of the current state of the madrasa by highlighting precisely the deterioration and damage types in the structural and non-structural elements, and the causing factors of its deterioration such as natural causes, human causes and wrong intervention.

This study helps to a better understanding of the current state of the madrasa by including the realized works such as addition of stairs and glass partition, intervention need to be removed, revealing the original elements such as the original tiles of madrasa and re-adding elements such as the cells' chimneys and lead domes, those intervention could be explained as proper work.

This study aims to review the realized interventions and provide recommendations for possible future interventions, corresponding to the international treaties and conventions of conservation and restoration of the historical monuments. It also gives an initial information as a reference for future studies in this field and propose suggestions for possible future interventions including conservation and reuse of the building. In addition it tends to give an initial information as a reference for future studies in this field.

Ultimately, this study achieves to be a basic source and reference that could help in any future restoration project of Semiz Ali Pasha madrasa.

In conclusion this study has provided a profound study and a complete description of Semiz Ali Pahsa madrasa on architectural, historical and structural aspects and described the structural damages caused by natural and human factors in addition to reconsidering the current interventions in the madrasa by researching the needed information through historical references, reports, archives and the international charters also providing photos, observing and site assessment all of these factors were part of this study.

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