Hürmet Çopuroğlu Eset

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MODULAR DESIGN APPROACH OF MASTER SİNAN'S SINGLE-DOMED PROVINCIAL MOSQUES

A THESIS
SUBMITTED TO THE DEPARTMENT OF ARCHITECTURE
AND THE GRADUATE SCHOOL OF ENGINEERING AND
SCIENCE OF ABDULLAH GUL UNIVERSITY
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
MASTER OF SCIENCE

By
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I hereby declare that all information in this document has been obtained in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all materials and results that are not original to this work.

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M.Sc. thesis titled "Modular Design Approach Of Master Sinan's Sıngle-Domed Provincial Mosques" has been prepared in accordance with the Thesis Writing Guidelines of the Abdullah Gül University, Graduate School of Engineering & Science.

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ACCEPTANCE AND APPROVAL

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ABSTRACT

MODULAR DESIGN APPROACH OF MASTER SİNAN'S SINGLE-DOMED PROVINCIAL MOSQUES

Hürmet ÇOPUROĞLU ESET
MSc. in Architecture
Advisor: Prof. Dr. Burak ASİLİSKENDER

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As there have been several researches on Master Sinan and his mosque architecture, there could be some more innovative interests and potentials on them, spatial configuration in particular. It cannot also be defined clearly how this configuration operates in rural mosques rather than the 'selatin' mosques due to the fact that they are more visible in the public space. Hence, 4-single domed, five dome double arcaded mosques of Master Sinan located at different regions of Anatolia have been selected within the scope of this thesis. The mosques examined are; Tekirdağ Rüstem Pasha, Diyarbakır Behram Pasha, İzmit Pertev Pasha and Kayseri Kurşunlu Mosques. In addition to these mosques selection from different regions, more than one were examined analytically thereby further strengthening the basis of comparison.

Architectural characteristics of these mosques were examined separately including support system design, changes related with environmental factors, dimensional characteristics, plan design, local effects. The data obtained as a result of these analyses were utilized for identifying the form of the spatial elements as well as their proportions. The parameters obtained from the analytical examinations were combined thus laying the foundations of the modular analysis method. The numerical parameters of the mosques obtained in accordance with this foundation along with the unit module were determined thus completing the modular analyses of these structures. The analyses were carried out for each mosque by first processing the proportional values in one and two dimensions as well as by considering the volumetric forms in three dimensions. Thus, the data acquired at the plan level were controlled at the cross-section and elevation planes in addition to evaluating different impacts. The findings acquired were assessed for all mosques separately and as a whole supported by figures and tables.

Keywords: *Architect Sinan Mosques, Provincial Mosques, Proportion, Modular Architecture*

ÖZET

MİMAR SİNAN'IN TEK KUBBELİ TAŞRA CAMİLERİNİN MODÜLER TASARIM YAKLAŞIMI

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Ağustos 2021

Mimar Sinan'ın cami tasarımındaki mekânsal kurgusunun nasıl olduğu ve nasıl gelişim gösterdiği bilinmemektedir. Daha fazla göz önünde bulunmasına bağlı olarak selatin camilerinden ziyade taşra camilerinde bu kurgunun nasıl işlediği de tam olarak tanımlanamamaktadır. Bu nedenle, bu tez çalışması kapsamında Mimar Sinan'ın Anadolu'nun farklı bölgelerinde bulunan tek kubbeli, beş göz çift revaklı 4 taşra cami seçilmiştir. İncelemeye alınan camiler; Tekirdağ Rüstem Paşa, Diyarbakır Behram Paşa, İzmit Pertev Paşa ve Kayseri Kurşunlu Camisidir. Farklı bölgelerde olmasının yanı sıra birden çok cami analitik olarak incelenerek karşılaştırma zemini daha sağlamlaştırılmıştır.

Bu cami örnekleri taşıyıcı sistem tasarımı, çevresel etkenlere bağlı değişimler, boyutsal özellikleri, plan tasarımı, yerel etkiler gibi yapıyı oluşturan ana faktörler üzerinden mimari özellikleri her cami için ayrıca incelenmiştir. Bu analizlerdeki elde edilen veriler üzerinden mekânsal öğelerin formu ve birbirleri ile oransal olarak nasıl bir arada bulunduğu tespit edilmiştir. Analitik inceleme sonucunda elde edilen parametreler bir araya getirilerek modüler çözümleme yönteminin altlığı oluşturulmuştur. Bu altlığa bağlı kalarak camilerden elde edilen sayısal parametreler ile birim modül tespit edilerek yapıların modüler çözümlemesi yapılmıştır. Çözümlemeler öncelikle her cami için tek ve iki boyutta oransal değerleri işlenerek üç boyuttaki hacimsel formlarda da ele alınmıştır. Böylece plan düzleminde elde edilen verilerin kesit ve cephe düzleminde de hem kontrolü hem de farklı etkileri değerlendirilmiştir. Bütün elde edilen bulgular her cami özelinde ve beraber ele alınarak çizim ve tablolarla desteklenmiştir.

Anahtar Kelimeler:*Mimar Sinan Camileri, Taşra Cami, Oran, Modüler Mimarlık*

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Chapter 1

Introduction

Master Sinan left his mark on the Ottoman Classical Period with countless works he completed throughout his life. He has works of art with different characteristics in many different cities but predominantly in Istanbul which is located at strategic locations of the city. Mosques have stood out among these works of art due to the spatial factors related to their design and their contributions to the users. In the meantime, it is also understood from the structures that there were aesthetic concerns in addition to structural concerns that were examined during the design stages. Sinan designed his mosques to make an impact on the silhouette of the city regardless of their location. For this reason, the mosques of Master Sinan supervene one another even when they have been built at different locations. The holism displayed by Sinan's mosques can be felt and understood by the users. In this regard, discussions and studies on Master Sinan have been ongoing since the Ottoman period.

While selecting the structures to be examined within the scope of the thesis study, it is aimed to be handled together with the observations made on site. However, because this process coincided with the epidemic period, the structures could not be examined in situ. Due to the ease of access to Kayseri Kurşunlu Mosque, the mosque was examined on-site and photographs were taken on-site.

Even though there are many debates on the number of works by Sinan, the information on the manuscripts from that period has more accurate and direct information. There are seven sources that have reached our day from that period that depict Sinan and his works. These manuscripts are Tezkiretü'l-Bünyan, Tezkiret-ül Ebniye, Tuhfetü'l Mi'mârin, Risâletü'l Mi'mâriyye, Adsız Risâle, Selimiye Risalesi and Padisahname. Many studies have been conducted for the classification and examination of Sinan's works based on these manuscripts.[1] It has been observed when classifying

[1] Many studies have been conducted on the manuscripts. Sinan's works have been classified and listed in one of these works by Necipoğlu entitled '*The Age of Sinan: Architectural Culture in The Ottoman*

the resources that there are many structures that have stayed intact until our day which have been repaired or of which there are uncertainties regarding whether they are the works of Sinan or not. As such, related studies mention different numbers and there is no definite finding.

In the 'Adsız Risale', the baths designed by Mimar Sinan are introduced. The three copies written by Risaletü'l Mi'mariye and Sai Mustafa Çelebi, which may have been written by Mimar Sinan, are mostly similar in content. Bu eserlerde Mimar Sinan'ın belli başlı yapılarının yapım sürecini ve yapıların listeleri bulunmaktadır. In these works, there are the construction process of the main structures of Mimar Sinan and the lists of the structures.

Another written source belonging to the period in which Sinan lived in the books belonging to the construction of the Süleymaniye Complex, which was turned into a book by Ömer Lütfi Barkan. In this work, the details of the building production process are given statistically together with the data of that period. These notebooks show which materials belonging to a sultan's complex were obtained from where and how, and how much they cost, according to the currency units of the period they were built. At the same time, it presents many details such as the qualities and dimensions of the building elements, the workers and the fields they work in, in tables. Barkan's work is one of the important sources that show how the work is controlled down to the smallest details [1].

It is observed under the domains that among all the mosques by Sinan those that are in and around Istanbul and especially those that have stood out are well known. Accordingly, the mosques that have been examined in previous studies have also been among the more popular mosques. It is easily discerned that the number of studies on the 'Rural' mosques is very low compared with the 'Selatin' mosques by Sinan which stand out with their grandeur. Discussing the design concept and the period when they

---

Empire' (Necipoğlu, 2005). Whereas Aslanapa focused on these manuscripts in his work entitled '*Master Sinan: Life and Works*' [43], Another study on the works of Sinan is '*Development of Turkish Architecture and Master Sinan'* in which they were examined periodically with visuals [44]. Similarly, Jale Nejdet
Erzen also published a study entitled '*Master Sinan Mosques and Kulliyes'* with a similar focus [45]. Kuban focused on the Selimiye mosque in his study entitled '*Sinan's Art and Selimiye'* [46]. These and others have been taken into consideration in a comprehensive manner in the book by Kuran entitled *Master Sinan* which has become the most important reference over the years. The *Master Sinan* book published by in 1968 includes a distribution of works by Sinan at different provinces based on registration records. The works mentioned in these manuscripts have been tabulated in the list of structures [42].

have been built will be better when considered together with all previous work on Sinan. It is considered that carrying out studies on the rural mosques instead of the widely studied selatin mosques of Master Sinan will make a greater contribution to literature. In the light of all aforementioned factors, the scope of the study was determined as the rural mosques in Anatolia that stand out with the modest identity of Master Sinan.

An extensive number of academic studies have been conducted on Sinan architecture and its well-known mosques most of which are located in Istanbul and Edirne as the royal capital cities of the Ottoman Empire. The aim of the present study was to focus on Sinan Mosques in Anatolia to further extend the academic interest in the field. Hence, it was aimed to bring forth the design concept as well as the mutual properties and different characteristics of the other mosques of Sinan. Similarly, rural mosques with a relatively modest scale were selected from among the mosques by Sinan rather than the grand mosques which have been studied a lot before. Accordingly, identifying on small scale the reflections of the common design aspects included by Sinan in large-scale mosques will help in bringing forth his mosque design concept. In this regard, it was considered to ensure that the mosques included in the study are examples outside Istanbul from different time periods.

The rural mosques of Sinan in Anatolia are rather small-scale mosques, comparing with similar examples in Istanbul or Edirne. This may be due to many different factors but one of the most important reasons for this can be the difficulties involved in construction supervision in the conditions of the Ottoman era. The number of mosques by Sinan with a single dome is stated in the manuscripts under the classification headings as 27. These mosques can also be classified based on the number of domes in the communion space. Mosques can be classified under 3 different domains as having three, five or nine domes. The Kurşunlu Mosque is located at Kayseri and the small number of studies on this mosque played an important role in the selection of the other mosque examples. It was necessary to evaluate this mosque considering the small number of studies on the mosque that is located in the city at the heart of Anatolia where Sinan was born and raised. Kurşunlu Mosque has five domes with two porticoes

and is one of the two mosques that Sinan built in his hometown.[2] Accordingly, examples of mosques by Sinan with a single dome, five domes double portico have been identified from among the classifications in the manuscripts. It was determined based on these lists that there are 6 mosques by Sinan with five domed double porticoed. These are Tekirdağ Rüstem Pasha, Halep Dukakinzade Mehmed Pasha, Diyarbakır Behram Pasha, Greece Trikkale Osman Şah Mosques, İzmit Pertev Pasha Mosque and Kayseri Kurşunlu Mosque. Of these mosques, 2 were excluded because they are located abroad [2]. The remaining 4 Sinan rural mosques were included in the spatial examination within the scope of the present study.

Mosques from four different regions were selected in order to be able to examine the uncodified norms by way of mosques with classical period monumental architecture. Examples of rural mosques selected according to the regions are; Diyarbakır Behram Pasha from the Southeastern Anatolia Region, Kayseri Kurşunlu from the Central Anatolia Region, Tekirdağ Rüstem Pasha from the Tracchia Region and İzmit Pertev Pasha Mosque from the Marmara Region. The rural mosques selected from different cities within this context were evaluated comparatively under the predetermined proportion and modular system heading in order to emphasize the numerical parameters in Sinan's design concept.

Many studies have been conducted on the works of art by Sinan built during his lifetime. There are also many written and visual sources on the mosques and other works by Sinan. However, the number of studies that can emphasize the spatial configuration of Sinan is limited. One of the primary reasons for this can be the fact that even though the works of art by Sinan built throughout his lifetime have reached our day, related data on these works have remained limited. It is necessary to examine the relationship that the user establishes with the space in order to understand the kind of biological configuration that is used during the design process for uniting space. The use of space changes regardless of time subject to its effect on people during the period of time that it was used. The common language of mathematics is required for understanding and explaining these changes. Better defined expressions can be attained

[2] There are two mosques in Kayseri which are said to be built by Master Sinan. One of these is the Kurşunlu Mosque whereas the other is the Osman Pasha mosque. Kurşunlu Mosque has reached our day and is currently in use while Osman Pasha Mosque has been demolished. As stated by Aptullah Kuran as well, there are no definitive sources indicating that the Osman Pasha mosque has been built by Sinan. However, there is also no information indicating that his aides were present during the construction or that it is not a Sinan structure (Kuran, 1988).

with specific boundaries and scales using numerical data. It is stated in the Dictionary of Artistic Concepts and Terms by Sözen and Tanyeli that an object or structure can be built only at a certain scale [3]. Similarly, Ching has indicated that a standard should be taken as a reference in order to define how large or small an object is from a dimensional point of view [4]. Tools that provide a ground for comparisons such as scale, proportion and modulus were and are still used in order to conduct a reading of a structure for the period of its construction.

The comparable correlation between two magnitudes or the whole and its parts with respect to quantity or degree is defined as a proportion [5]. Whereas proportion in architecture is used to define the numerical relationship between the parts or between the parts and the whole comprised of those parts [6]. It is known that proportional systems have been used throughout the history of architecture for the formal definition of structures. It is also observed that these proportional systems are used to define the boundaries of the established form in order to create the form in all parts of the structure [7]. It is seen when the history of architecture is examined that the first Roman architect, Vitruvius has defined the term module as a unit in his work entitled 'De Architectura' for arranging the sections of a structure [8]. Similarly, it is also mentioned in the proportional system of Le Corbusier subject to dimensions of the human body. The modular unit has brought about standardization with the popularization of the concept of modularity. It can be said that together with this standardization it has been sufficient to identify the module as a unit for describing all sections of the structure. The structure systematic can be disclosed using the module determined based on the units of length in the structure regardless of the period of construction. It is thus possible to define the path that the structure, the period and even the architect’s configuration has followed.

This study focuses on the modular design approach of the rural mosques from the Ottoman Classical period. However, it is not known for certain whether modules have been used in works from the Ottoman era. It is not possible to discern how and to what extent it has been applied during that period since no written manuscript on this subject has reached our day. Despite the lack of any documents on the principles of Ottoman architecture, modularity is observed in the works by Master Sinan. It has been observed especially in mosques by Sinan in accordance with the plan-based development. Even though there are a small number of written resources that have reached our day, studies

have been conducted that place the Master Sinan design configuration at the forefront. It is observed in studies from the 1960's up to the 2000s that they have focused on how geometrical proportioning has been used by Ottoman architects in shaping the structure. Structure interpretations were made based on the opinion that these structures have been constructed in accordance with a certain geometrical order. Mosque proportioning was made from the dimensions of the dome as a spatial element as a result of the study by Kuran on geometrical proportioning from a mosque example [9].

Master Sinan is the chief architect and the most important representative of the Classical period of Ottoman architecture. It is observed that the cover system is effective in the works by Sinan and especially the spatial configuration of his mosques. Accordingly, it can be stated when the works of Sinan are examined that his spatial design is comprised of the main place and the dome system that covers it. In the meantime, it is observed that the structure does not form based on the spatial configuration but that the structure is effective on the spatial design. It can be seen that user movements are taken as a basis when designing the architectural elements used in the closed and open spaces of Sinan’s mosques. It can be seen from spatial dimensions such as doors, windows and galleries that the bodily dimensions of the individuals praying at the mosque have been taken as basis in the design. This accordance between the designed structure and the user has been attained by way of an architectural understanding based on geometry. That is why those who lived in the same periods called Sinan the Euclides of his age. In this context, it is also possible to emphasize an almost visible numerical pattern in the domed space interpretations of Sinan renowned for his monumental scale mosques. The integration of the cubical form at different proportions with the semi-spherical dome placed on top can be seen in all mosque examples. Many studies have been conducted and are still being conducted in order to put forth this spatial context as well as its development.

Thus, the topic and scope of the study were expanded by studying this process and many other factors. The number of studies on the mosques of Sinan among the surveyed literature is relatively less compared with other studies. It was observed in these studies that the mosques have been reconsidered and interpreted based on a predetermined foundation. However, proportional comparisons are required in order to understand how the spatial configuration developed by Sinan when designing a mosque is shaped and

developed. Reconsidering the mosques by way of these reinterpreted proportional data enables the process to continue in a properly manner. Similarly, the number of studies depicting the architectural attributes of the mosques with some superficial analyses is quite high. However, it can be observed that studies that will emphasize the spatial configuration in that period of the mosques designed by Master Sinan will lead to new interpretations and comparison opportunities. In the meantime, the limited number of studies is an indication of the necessity for conducting such a study. The scope and structure of the study were planned and completed taking into consideration all these and similar factors.

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Chapter 2

Review of Master Sinan's Architecture

There are countless studies on Sinan and his works under many subjects such as history, architecture, sociology, culture and many others. The tendencies and differences among the subject formed the scope of this study. Hence, the surveyed resources were classified under different domains in order to determine the boundaries for the subject of the present study and to ensure that contributions are made to the studies under this subject title. Therefore, the foundations of the study were put forth by emphasizing the subject and scope of the surveyed studies. In this regard, priority was given during the survey to studies on the works by Master Sinan with predominance to mosques. Similarly, studies focusing on architectural characteristics from among the many under different conceptual domains on the mosques of Sinan were examined more comprehensively. The studies determined in accordance with these limitations were classified under three different domains. The first of these are the studies on Master Sinan mosques that are among the Ottoman classical period works of art. Whereas the other domain includes examples of studies on the spatial elements of Master Sinan mosques. The term spatial elements include sections of the mosque such as a main wall, *minbar*, roof, courtyard and portico. Another domain includes studies classified as those focusing on scale, proportion and modulus in the mosques of Sinan. The studies classified as such under 3 different subjects were thus easier to examine. They were also made comparable under both their own headings and with other domains thereby contributing to the study.

Studies on the mosques from among the works by Master Sinan were examined within the scope of the first domain. Over 100 studies were found from different disciplines on this subject. It was observed that these studies were examined that almost all have focused on mosques in Istanbul as well as nearby provinces[3]. The reason for

[3] The Majority of the works by Sinan are in İstanbul and this was considered as the reason why they have been included in these studies.

selecting examples from Istanbul is indicated in the study by Erzen on façades as the fact that the popular structures from the age of Sinan in Istanbul and nearby provinces have been subject to fewer impacts [11]. It can thus be concluded that studies have focused mainly on the mosques in Istanbul because many mosques have been built in Istanbul in the name of the important individuals of the Ottoman era. One of the examples studied under this domain is the article by Walter Denny in which he interprets the Ottoman period based on the spatial configuration of Sinan at the Kılıç Ali Pasha mosque [12]. Similarly, it is observed that the research article by Küçük examines the architectural properties of Istanbul and Tekirdağ Rüstem Pasha mosques [13]. Both studies have comparatively examined the figurative properties of the mosques designed by Master Sinan. Factors leading to the emergence of location, planning, material and façade characteristics based on similarities and differences along with the locations of the Master Sinan mosques within the scope of plan type development were also examined in this study. Erdem's thesis is another example of the examination of spatial characteristics in which it is observed that the spatial characteristics of the three most important Master Sinan mosques have been examined with regard to material, design and symbolic meaning [14]. The structural properties of Master Sinan's Şehzade, Süleymaniye and Selimiye mosques along with their internal space configurations, plan settlements, ornamentation program and material techniques have also been examined within the scope of the thesis. It was observed that previous studies have generally focused on the architectural and spatial reading of different Sinan mosques with a similar pattern. As is the case in these examples, there are also studies that examine Sinan mosques in a spatial context but which evaluate the mosques together with the surrounding structures. One of the studies that can set an example to this is the master's degree thesis study by Özhan in which the spatial development of Sinan's architecture is studied by way of kulliyes [15]. Kulliyes of Sinan in 6 different provinces were included in this study. It was observed that an analytical examination has been carried out on Sinan's kulliye architecture based on a theoretical and spatial configuration basis. Another study has focused more comprehensively on the Classical Period Ottoman Mosques with regard to ergonomics. In his master's degree thesis study, Çetinkaya focused on user requirements in Classical period mosque architecture based on the Rüstem Pasha Mosque example [16]. It was observed that the architectural elements of the Rüstem Pasha Mosque have been evaluated with regard to physical compatibility and ergonomics and that the measures taken have been scaled according to the units of

measure used for construction techniques in the 16th century. It can be observed when the examples evaluated under this domain are examined that studies on Master Sinan mosques have focused on the mosques with different scopes. It was identified that Sinan's mosques have been examined with regard to the primary sub-titles of conceptual, spatial, material, design, technique, symbolic, user requirements, structure configuration and typology.

Studies on the scale, ratio and modularity of Master Sinan mosques were examined in another sub-title when conducting the literature survey. Studies based on the concepts of scale, proportion and modularity are of special importance due to the limited documents on the period during which Sinan's mosques were built[4]. In this context, it was observed upon examining the studies on this subject that proportional analyses have been conducted by way of mosque-related concepts such as internal space, façade, structure, modularity, support dimensions, cover and geometrical patterns. It can also be stated that two types of Sinan mosques have been examined in these studies. One of these is conducting analysis by considering the mosque individually while the other is conducting the study with more than one mosque in accordance with the study scope. Among the studies in which only selected mosques have been studied, Sönmezer and Ögel examined the correlation between proportion and structure based on the Lüleburgaz Sokollu Mehmed Pasha Mosque example [17]. As is the case in other monumental architecture examples in Istanbul, it can be observed that the aforementioned study has focused on the structural attributes used in the Lüleburgaz Sokollu Mehmed Pasha Mosque. A proportional comparison was made figuratively based on the dimensions of mosques with a square plan. Whereas Köroğlu's doctorate thesis study is focused on the structural morphology of Kılıç Ali Pasha Mosque by Master Sinan [18]. It can be seen that the support system design of the Kılıç Ali Pasha Mosque has been examined in this study with an analytical approach subject to the modular system. An analysis has been conducted for discerning the commonalities or differences between the structuring of three different mosques with different modular system dimensions and periods. It was observed that a comparative analysis has also been conducted between the mosques based on the modular system

[4] There are many studies conducted at different periods on scale, proportion and modularity in Master Sinan mosques. One of these is the proceeding by Kuran in 1973 on the Proportion System of Sinan's Karapınar II. Selim Mosque (Aptullah Kuran, 1973). Another is the study by Söylemezoğlu in 1986 on Rüstem Pasha Mosque (Söylemezoğlu, 1986). Another is the study by Tuncer in 1999 during which a proportion study was conducted at the Azapkapı Sokullu Mosque (Tuncer, 1999).

developed subject to mosque dimensions. Köroğlu conducted another study in which modular system has been examined in double portico Sinan mosques [19]. Different from the thesis, Sinan's double portico mosque examples were classified typologically under different subjects in this article. It could be stated that while the manuscript has focused on the subject in a more comprehensive and historical manner, the thesis has conducted a modular analysis focusing on a single mosque. It can be observed when other studies by Buitrago and Huylebrouck are examined that a comparative study has been conducted between Sinan's Hagia Sophia and Selimiye mosques based on the concept of symbolic [20]. While modularity has been evaluated within its historical development process in the master's degree thesis study by Bomba examining the Şehzade Mehmet Mosque with regard to modularity [21]. The use of modules and proportional principles in mosque architecture has been examined within the scope of the thesis study. It was also observed that the implementation of the modularity and proportional relations assumed to be present in Şehzade Mehmet Mosque has also been examined within the scope of the thesis. While Köroğlu's thesis study has been conducted based on the pre-determined foundation and numerical data, Bomba's study is observed to advance on a historical foundation. The study by Sönemezer on the dimensional correlation between space and free vertical supports in Sinan's Istanbul mosques is another example in which more than one mosque have been examined [22]. In this study, Sönmezer conducted different structural analyses for examining the numerical expressions of the understanding of proportion in the domed spaces of Master Sinan mosques in Istanbul. Erzen's study on mosque façades is another example [11]. The age of Sinan was evaluated in a general manner in this study that focuses on the analysis of mosque façades. Whereas the systems of proportion in architecture were examined with a focus on the Ottoman period and Sinan mosques in Tuncer's doctorate thesis entitled, *'Interior Space and Proportion in Classical Period Ottoman Architecture'* [23]. It was observed that the study has been limited with the Sinan structures in Istanbul which have been evaluated in 4 groups classified as plans with wooden roofs, square domes, hexagonal and octagonal bases. Whereas Erarslan examined the correlations between support, cover and space-based on aspects of Master Sinan's mosques with hexagonal baldachin system [24]. It has been observed that the establishment of the central hexagonal baldachin system on which the dome rests in the selected Sinan mosques have been examined comparatively with the development of the surrounding side spatial organization. Whereas it has been observed that proportional

comparisons have been carried out in another study based on mosque porticos. Different from the other examples, Erdoğan examined the principles of proportion in Ottoman architecture with a focus on the imperial kulliyes of Bâyezid in the 2nd period [25]. It is seen that the objective of the aforementioned study was to reveal the proportional pattern applied on the porticos of imperial kulliyes during the Bâyezid the 2nd period.

In brief, studies on scale, proportion and modularity have been evaluated in a comprehensive manner and some of these studies have been examined. It was observed that related studies on this subject were examined that the studies have been conducted mostly on examples selected from Istanbul and the surrounding cities. The reason for this can be indicated as the fact that Istanbul was located at a very strategic location during the Ottoman era. It was also observed that the mosques selected in the examined studies are better known compared with the relatively rare-known mosques of Master Sinan. In addition to the popularity of these examples, it was also observed that selatin mosques with larger scales and mosques with similar dimensions have also been selected. This similarity was the result of the ease of access due to the fact that more information is available on these mosques. It was observed upon examining the studies that the mosques examined based on the concepts of scale, proportion and modularity have also been examined together with historical and mathematical data in addition to architecture. Historical data have been used comprehensively with architectural data in some studies while various other studies have been limited to only structural information. It has also been seen in some examples that foundations have been laid that will contribute to the operation of the construction process during the period in question coupled with structural information. The mosque examples considered in this manner are limited only to one or two.

Previous studies on the spatial elements in Master Sinan mosques have also been examined in order to contribute to this study. It was observed that those studies on Sinan mosques were examined in this section that either the mosque spatial elements have been examined by themselves for the mosque in general or that all spatial elements have been considered for the mosque in question. Accordingly, the aim of this section was to emphasize the spatial elements in the mosques of Sinan to carry out a comparison by way of previous studies in the literature. Many studies have been found

but only some have been examined in a comprehensive manner[5]. Döngel focused on the wooden doors and windows of Master Sinan mosques in Istanbul [26]. This thesis study examined the wooden doors and window internal shutters of the Classical Period Mosques in Istanbul with regard to material, decoration and construction technique. Doors from among the mosque spatial elements have been examined in this study while it has been observed in the doctorate thesis by Özyalvaç that the focus is on the pointed arches in the mosques [27]. In this thesis, Özyalvaç carried out an analytical assessment on the formation of the double centered arches of Sinan's mosques in Istanbul. The types of arches and the variables evaluated during their design have been examined within the scope of the thesis study. The focus of the thesis study carried out on the mosques in Istanbul was on the pulpits of the mosques. Oral conducted a doctorate thesis study in which Sinan's understanding of art has been examined by way of the pulpits in Master Sinan's mosques in Istanbul [28]. It is observed that the mosques located at the Fatih, Beyoğlu, Eyüp, Üsküdar and Beşiktaş districts of Istanbul have been studied in a comparative manner. The open spaces of the mosques and restricting elements have been examined in another study focusing on selected mosques in Istanbul. Över conducted a master's degree thesis study in which the open areas of mosques were analyzed by way of architectural elements in 18 Istanbul mosques [29]. A typological examination was also conducted on the architectural elements of the open spaces of Master Sinan's mosques in Istanbul. Mosque courtyards were examined in another study in which a general analysis has been conducted on Ottoman architecture without limiting itself only to İstanbul. Demirel carried out a master's degree thesis study in which the courtyard structuring in the selatin mosques of the Ottoman period has been examined with regard to the roles they play in social and public life [30]. It was observed that the study has focused on the emergence, development and transformation of the concept of a courtyard in the Ottoman period selatin mosques. Similar to the scope of this thesis, another study has focused on the hipped roof mosques and masjids of Master Sinan. Şeker carried out a master's degree thesis study in which the mosques and masjids of Master Sinan were examined within the context of architecture, patronage and urban topography [31]. The development and changes in Anatolian mosques and masjid structures are illustrated. Different from these studies, it has been observed that Özgünler conducted a study focusing on the use of natural stones

[5] One of the studies carried out during the 9os is that of Sönmez on the dimensioning of the lower row windows (N. Sönmez, 1999).

in historical structures [32]. Ahi Çelebi Mosque constructed by Sinan in Istanbul during the 16th century was selected in this proceeding with white-colored limestone (Kufeki) and green colored volcanic tuffs (Od taşı) used in the construction. A characterization method that can be applied to the volcanic tuffs used in historical structures has been suggested in the study. The essentials of the study based on previous studies have been set forth comparatively with regard to some selected examples. Previous studies have examined architectural elements in the Master Sinan mosques such as door, pulpit, portico, arch, hipped roof, open area, courtyard and main wall (Table2.1).

Table 2.1 Keywords of previous academic works on architect sinan

Reviewed Concepts	Reviewed Years	Location of Mosques	Key-concepts
Studies on Master Sinan Mosques	2005-2020	İstanbul, Tekirdağ, Edirne, Kırklareli Hatay, Konya, İzmit	*Architect Sinan *Mosque Complexes *Sinan Mosque Architecture of the Classical Period *Mosque * Typology *Mosque Architecture of the Classical Period
Studies on Scale, Proportion And Modularity İn Master Sinan Mosques	1973-2018	İstanbul, Lüleburgaz	*Architect Sinan Mosques *Modular System *Mosques *Rate *Module *Modularity *Structural Systems *Hexagonal Baldachin
Studies on Spatial Elements İn Master Sinan Mosques	1999-2017	İstanbul, Tokat, Edirne, Amasya	*Architect Sinan *Mosques *Pointed Arches *Stoa *Proportion *Hipped Roof *Open Area *Minbar *City courtyard

It was observed when the academic works were examined that they review Sinan Mosque Architecture under three different concepts, and analyzed them based on many factors such as history, architecture, social, cultural and spatial concepts. The mosques selected in these studies have been examined with regard to a single mosque or more than one mosque independent of the study topic. Comparisons have been made with other Sinan mosques in various sections of studies considered individually. However, it

has been seen that studies with more than one mosque selected provide greater opportunities for comparison compared with other studies. In this regard, the aim of the thesis study was to create an environment for the comparison of more than one mosque.

It can be observed that the mosques examined in those works selected under the different subjects are generally selatin mosques in Istanbul. In addition to the recognition of these mosques, Sinan's rural mosques were also included in the study. Thus, the data collected from the selatin mosques were compared with the data from rural mosques thereby aiming to put forth the architectural design of Sinan. A total of 4 rural mosque examples in Anatolian cities were selected for their modest characteristics alongside the Selatin mosques for comparative analysis. Attention was given to ensure that these mosques are stylistically comparable. In the meantime, different construction periods of the mosques allowed for the analysis of Sinan's Mosque architecture systematics. In addition to the comparative analysis of the typological and architectural characteristics of the structures, the already existing data were also reevaluated and analyzed. Thus, it was aimed to make general inferences by making the current situation reinterpretable.

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Chapter 3

Modular Design Approach of Master Sinan Mosques

The proportion has been used throughout history in architecture in order to obtain certain forms and to define the boundaries of the forms generated as such [7]. The dimensioning of structures and their comparison with other similar structures can be defined by way of units of length. This unit of length varies subject to the structure type, location of the structure, the scope of the topic to be examined and many other factors. The module dimension is determined based on the repetitions in the selected unit of length. There have been many examples of structures designed based on the unit module and related studies are ongoing.

A modular approach is the type of design conducted within certain limits the examples of which have been examined previously. In the meantime, it is also observed that traditional structure types have also been constructed in a systematic manner. It is known that these structure types are designed not randomly but based on certain standards and many studies have been carried out on this subject. However, there are a limited number of references indicating that the Ottoman architectural structures have developed with regard to unit module. Necipoğlu asserts that 15th-16th century structures have been constructed using modular plans drawn on grid paper [33]. Accordingly, the modular design configuration in Sinan's mosques has also been widely studied. It is observed that these studies have been conducted in order to put forth the systematic measurement pattern in Sinan structures. It is seen when the dates of construction are examined for Sinan mosques that mosques have been constructed in the same years in different cities. It is also known that he has not taken part in the construction of various structures such as the Kayseri Kurşunlu Mosque but examined the process remotely [7]. Sinan's conceptual design can be seen in mosques built by or analyzed remotely by Sinan. The open-semi open-closed space transition circulation can be seen clearly upon examining the selatin and rural mosque examples. Similarly, this transition between

spaces is also reflected in the interior space. This proportional reading can be seen not only in the examined mosque but also in other Sinan mosques. The presence of such similarities may indicate that Sinan has proceeded in a systematic manner when designing a structure.

Many studies before have been conducted on the modular design of the grand selatin mosques and many more are being conducted. The number of studies on rural mosques that stand out with their modest characteristics is quite limited compared with the large-scale mosques. Seeing the reflections of the similar design configurations of Sinan mosques at smaller scales will further strengthen the view that there is a systematic design understanding. Attention was also given to select rural mosques from different periods and cities in order to carry out a comparative analysis within the scope of this thesis. The mosques selected are Tekirdağ Rüstem Pasha from the Tracchia region, Diyarbakır Behram Pasha from the Southeastern Anatolia region, İzmit Pertev Pasha from the Marmara Region and finally Kayseri Kurşunlu Mosque from the Central Anatolia region. The fact that the mosques included in the study are located in different regions enables us to emphasize the mosques as well as the differences or similarities in their design configurations.

Data for the mosques of Sinan located in four different regions from four different time periods were accessed by way of an extensive literature survey. Four mosques were examined in the plan, cross-section and façade level in order to read the data for the architectural space in three dimensions. The drawings for each of the mosques at these planes were obtained from *Vakıflar Bölge Müdürlüğü* (Regional Directorate of Foundations) archive. The obtained numerical data for the three planes can be used to define the spatial dimensions of the architectural elements in both the main place and the communion. While the position and data such as width and height for these architectural elements in two dimensions are considered at the plan level, data such as the position and height in three dimensions are obtained from the cross-section and façade planes. In this way, it was possible to extend the comparison of the mosques from two dimensions to a volumetric comparison.

A systematic design pattern can be seen when the floor plans of the selected mosques are compared side by side. A broad examination will reveal that the selected rural mosques are comprised of a central space surrounded by main walls and a semi-

open communion enabling the passage to the central space. Accordingly, the mosques were classified into 2 regions as the central space and communion which were then examined both separately and together (Figure 3.1). Thus, the architectural elements in closed, open and semi-open spaces were examined in a more detailed and comprehensive manner. The comparison was broadened by way of sub-domains domains thereby making it open to interpretation.

The floor plan for similar spatial separations in the central space and communion can be read from the floor plan operating pattern. It is observed that the floor plans for the four rural mosques are examined that the passage to the closed interior of the mosque is through the semi-open porticoed communion. The semi-open communion area is surrounded by supporting columns from where a transition is possible to the interior porticoed space. Access from the five-domed double porticoed space to the closed central space is through the main gate. This axis of passage is present in all four rural mosques and similar design principles can be observed. While the main walls surrounding the central space act as supports, point-bearing columns are present at the communion area. Similarly, the *mihrab* wall of the central space is right across the entrance with window gaps at the end spots of the wall. These and other similar attributes can be seen in the rural mosques. It is thus possible to state that Sinan's rural mosques display a modular system structure due to these common aspects in the formation of their spaces and structural formations.

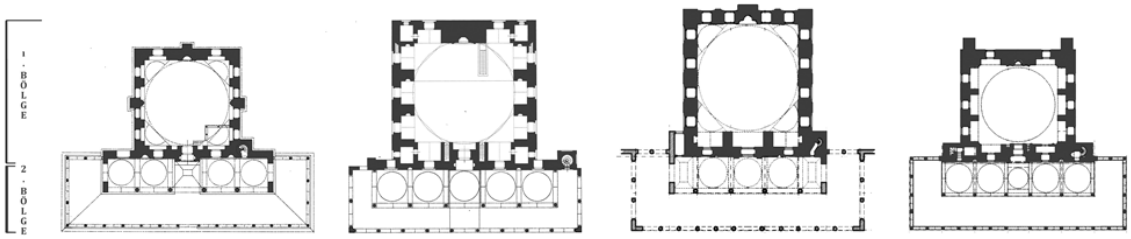


Figure 3.1 Regional separation for rüstem pasha mosque, behram pasha mosque, pertev pasha mosque, kurşunlu mosque by way of floor plans (*Vakıflar Bölge Müdürlüğü,* 2020)

First, the rural mosques for which floor plans have been obtained were abstracted in order to define the modular systems of the rural mosques further. Floor plan abstraction was conducted on the selected four mosques in order to emphasize the bearing elements and the spatial architectural elements. Four mosque floor plan abstractions were criticized subject to the positions of the point and holistic bearing

elements at the central and communion areas. Thus, the empty-full balance at the plan scale comprised of bearing walls and columns along with the magnitudes of the elements were made easier to read. Afterward, reference directions were formed in order to emphasize the similarities in the floor plans despite their differences in size. The modular system infrastructure was designed with these reference lines. These directions make the spatial separation of the mosques easier: Thus, providing a reference for the unit module to be determined. For this reason, the axes that the directions of the mosques pass through in these two regions were shaped based on several criteria. The following five criteria were used for determining these reference directions in the vertical and horizontal axes;

- Directions of the mainline surrounding the central space
- Beginning and ending points of the mihrap wall at the central space
- The gap left on the surface by the main gate
- The direction of the bearing wall dividing the central space in half
- The direction on the surface due to the communion area and the consecutive columns of the interior and exterior portico.

These determined directions were placed on the four mosque plans (Figure 3.2). While three directions are found in the central space in the horizontal plane as the interior and central axis main walls upon placing the determined reference directions for each mosque separately, it was observed that two directions are formed from the interior and exterior portico column lines for the communion area. Whereas there were four reference directions in the vertical plane of interior main wall, mihrap endpoints and main gate lines. It was observed based on the predetermined headings that the number of applied reference directions is the same for each of the four rural mosques. Accordingly, it is seen and verified that the mosques have been designed based on the same principles.

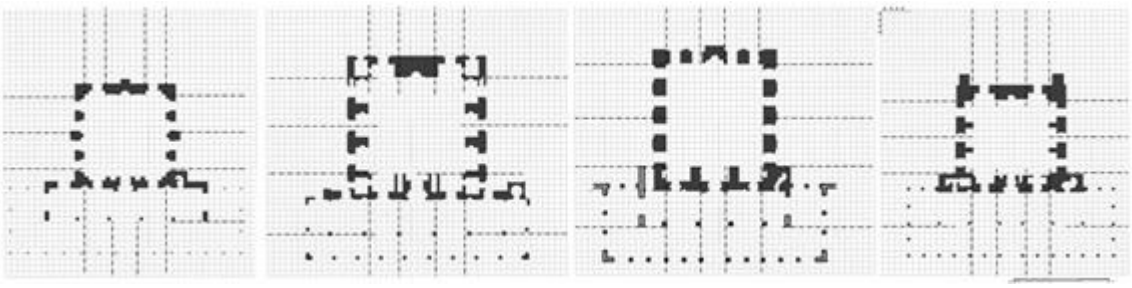


Figure 3.2 Abstracted floor plans for Rüstem Pasha Mosque, Behram Pasha Mosque, Pertev Pasha Mosque And Kurşunlu Mosque the determined boundary directions

The base module was determined based on the main headlines along with the pre-determined reference directions. It was observed in the floor plans together with the reference directions applied on the abstracted floor plan that the bearing main walls and columns play an effective and significant role in the formation of space in these four mosques. Therefore, the thickness of the continuous main walls surrounding the central space of the four mosques was selected as the common region. The shaping of the majority of the reference directions subject to the main wall boundaries was effective in forming a framework. The continuous wall line on main walls that extend inwards or outwards has formed a reference for the unit module. These main wall lines were imprinted on the floor plans together with the reference directions (Figure 3.3). The determining unit module made comparison easier while also increasing the readability of the size proportions.

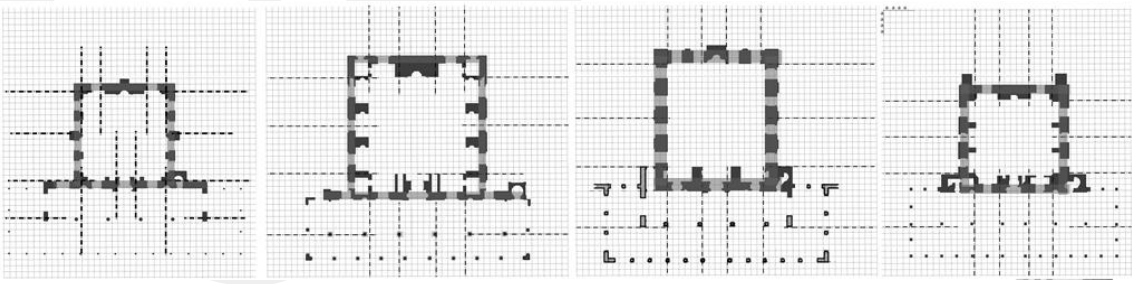


Figure 3.3 Rüstem Pasha Mosque, Behram Pasha Mosque, Pertev Pasha Mosque And Kurşunlu Mosque abstracted floor plans and continuous main wall

The unit module was determined according to the numerical values obtained from the floor plan using the main wall thickness which was used as a reference for many of the mosque architectural elements. The floor plans, obtained from the *Vakıflar Bölge Müdürlüğü* (Regional Directorate of Foundations) , have a scale of 1/100 and the actual

dimensions of the elements were determined based on the scaled figure. It can be seen when the figures are examined that the main wall thickness varies between 2 meters. Whereas the scale for the Pertev Pasha mosque is close to 2 meters, they are about 1 meter for the other mosques. Accordingly, it was verified from the drawings obtained that the main wall thickness varies between 1 to 2 m in all of the four mosques. The smallest common denominator of 1 meter among the four mosques was determined as the unit module. The value of 1 meter forms the basis not only for main wall thickness but also for the other architectural elements. “a” unit module was appointed as 1m in order to express this value more easily. The A-A unit module was taken as the basis for an easier expression of the modular system of rural mosques (Figure 3.4).

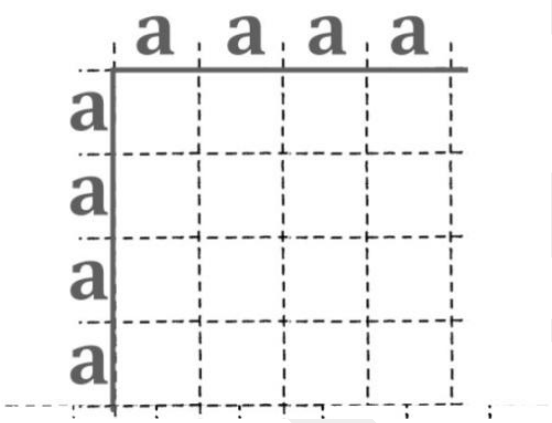


Figure 3.4 A unit module

The A-A unit module was duplicated along the horizontal and vertical axes and placed under the mosque drawings. It was arranged to overlap the pre-determined reference directions while being placed on the floor plans for the four rural mosques selected. Thus, the reference directions were made more dominant and the modular system was revealed. This also simplified the process of dimensioning the floor plans overlapped with the unit module and thus the dimensions of the desired location could be given. In addition, the prepared foundation was used not only on the planned plane but also on the cross-section and façade planes. Similar to the floor plan, reference directions were determined for the cross-section and façade planes as well. These determining reference directions were overlapped with the unit module thus laying the foundation. Its use as a foundation in all three planes provides an opportunity for comparison among different planes (Figure 3.5).

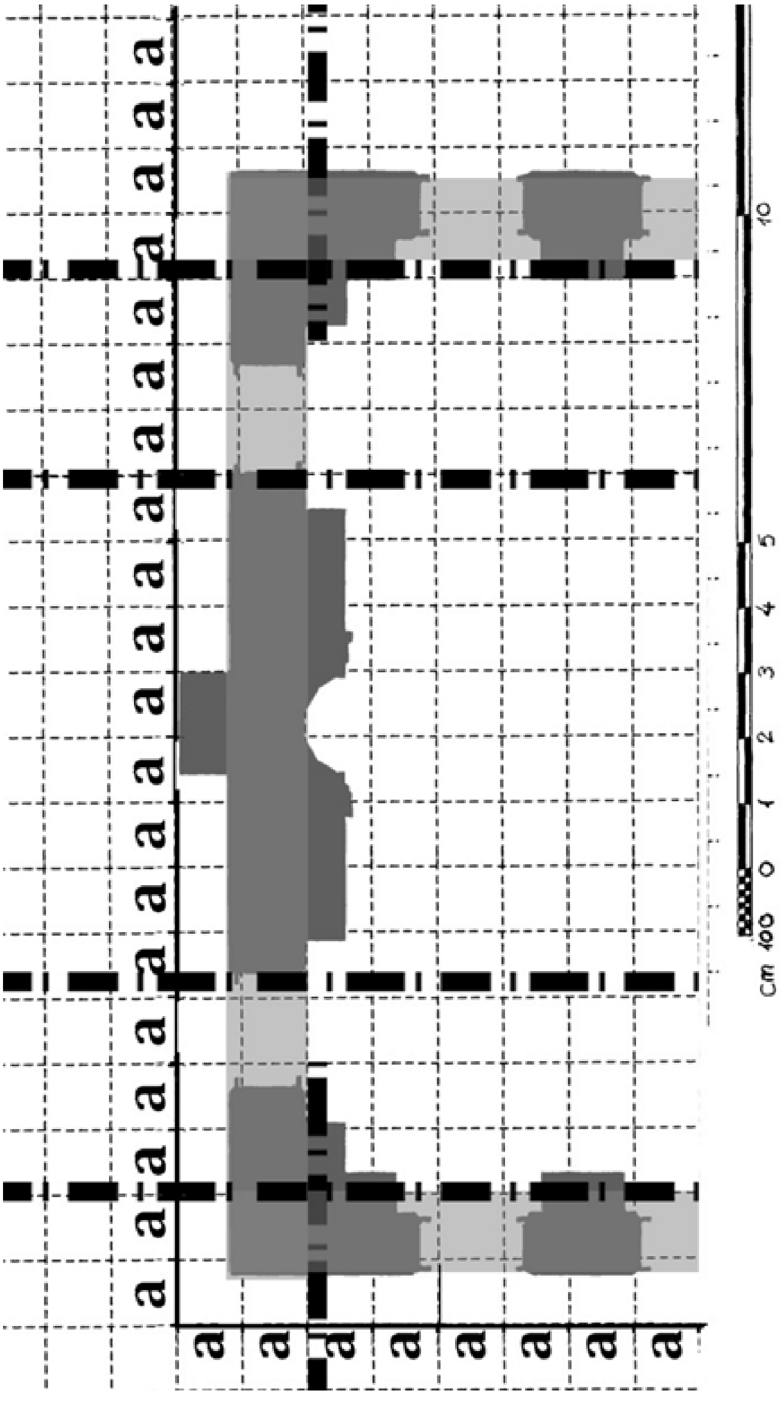


Figure 3.5 Rüstem Pasha Mosque floor plan detail A-A unit module foundation display

The floor plans were made more readable by placing a unit module foundation according to the pre-determined boundary direction references. The value of the architectural element to be examined was dimensioned based on its values in the unit module after placing the foundations in the abstracted plans. As an example, the section from the start of the wall to the end was marked and presented with values such as 3a,

4a, 5a while giving the mihrap wall thickness. Architectural elements common to the four rural mosques examined were identified during the dimensioning process. Attention was given when identifying the elements that they are present in all mosques and that they are comparable. These architectural elements were classified under the following categories based on their presence in the 1st and 2nd region:

- Thickness of the main wall surrounding the main place
- Window opening
- Main gate opening
- Mihrap opening
- Interior and exterior portico bearing column thickness
- Interior and exterior portico – distance to main gate

These category headings were illustrated by forming a conceptual schema on the Rüstem Pasha Mosque floor plan (Figure 3.6). Both interior and exterior space dimensioning were also carried out for both regions in accordance with these domains. After giving the dimensions of the elements, the general magnitudes of the mosque were also dimensioned. Comparison criteria were identified based on the floor plan together with the completed dimensioning. These architectural element values were first considered separately for each mosque. Afterwards, comparison opportunities were presented according to the pre-determined classification categories. It was observed that the scaled plans were combined that the domains considered separately within the scope of the subject have been placed on the drawings in stages. Thus, the examined elements were expressed in a more holistic manner thereby making it easier to reach the desired scales.

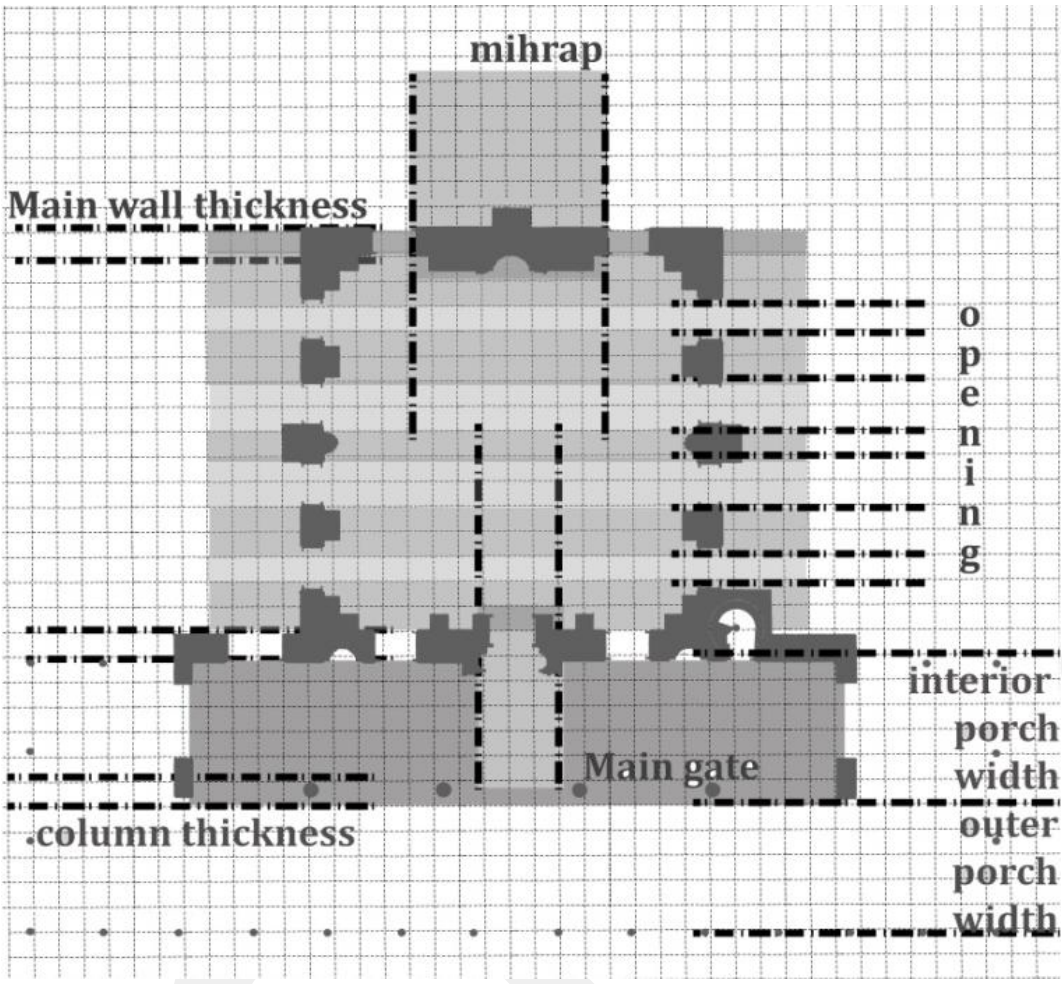


Figure 3.6 Conceptual diagram based on Rüstem Pasha Mosque floor plan

Comparison based on the floor plans is limited with a single plane. Cross-section and visual aspect drawings were also included for the comparison of the z plane data of the mosques. Hence, while for example, the main gate thickness dimensions are comparable in terms of width-height at the floor plan, cross-section and aspect data can be used for height comparison as well. Data such as width, opening, the thickness can be evaluated together with the height data on the cross-section and aspect drawings. In this case, new sub-domains domains emerge such as interior window opening and its data in addition to main wall thickness or height.

Behram Pasha Mosque was taken examined at the cross-section plane as well in addition to the abstracted floor plan analysis. Drawings at a scale of 1/100 were obtained from the Regional Directorate of Foundations. First, the drawing was abstracted to emphasize the mosque bearings on the cross-section. While the floor plan provides an opportunity for single dimension comparison, the main space and

communion space forms a comparison opportunity in a different plane together with the cross-section. It was utilized to emphasize the bearing wall, columns and domes, in particular. Different from the planned plane, the domes are also at work here. The plans abstracted based on these domains were overlapped together with the A-A unit foundation. Here, the surface elevation line for each cross-section was accepted as the horizontal reference direction. In addition to the horizontal reference direction, the boundary lines of the spatial fractions indicated on the floor plan as regions 1 and 2 were also accepted as vertical reference directions. Accordingly, cross-sections were organized for the 4 mosques (Figure 3.7).

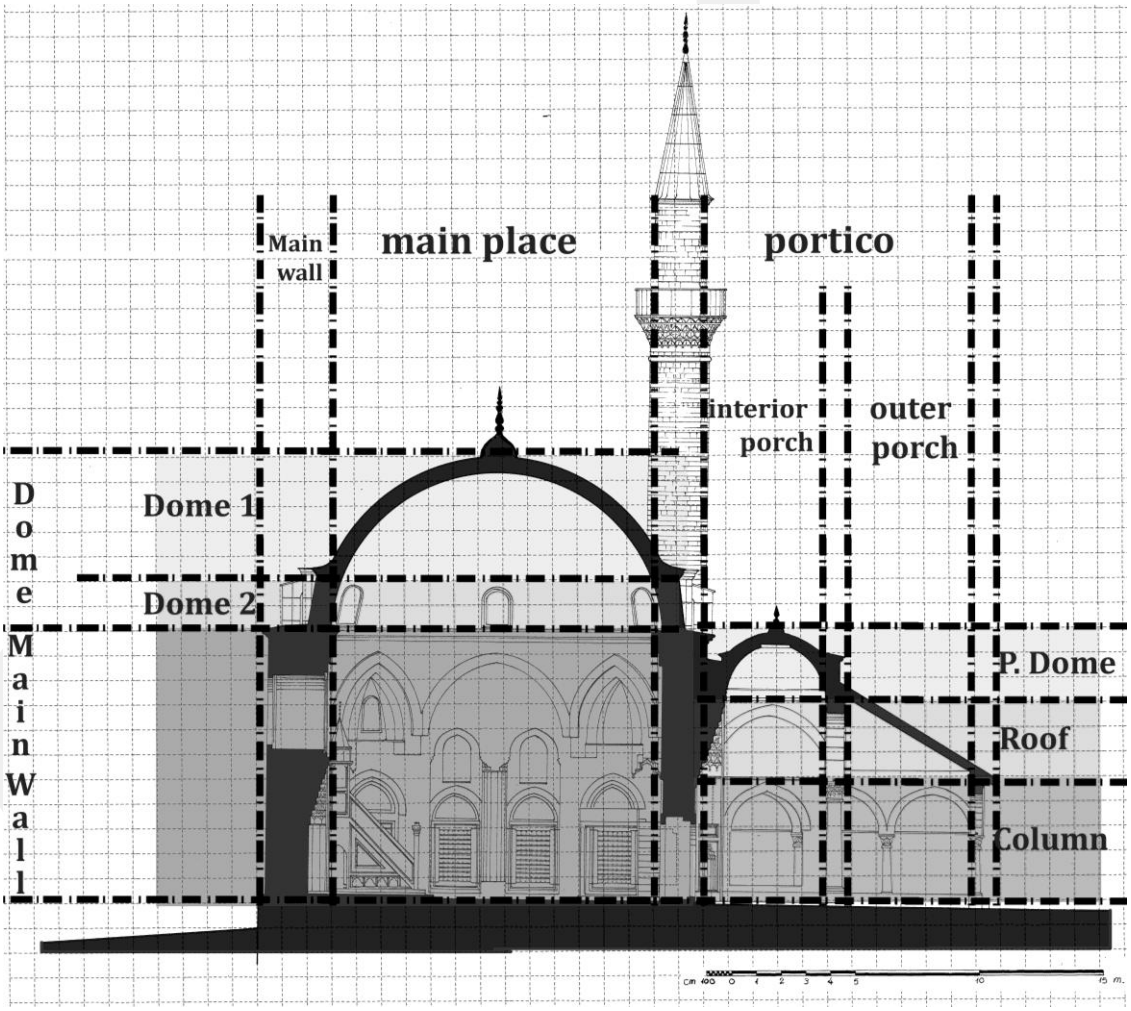


Figure 3.7 Rüstem Pasha Mosque diagram with cross-section

Dimensioning was performed in order to carry out a comparison for the cross-section plane. Sub-domainsdomains were determined similar to those of the floor plan during dimensioning. The sub-domainsdomains were evaluated one by one and together based on the main space and communion space. The sub-domainsdomains to be examined at the cross-section plane were determined as:

- Main space main wall thickness-height
- Dome height
- Interior portico dome height
- Exterior portico hipped roof height

The conceptual scheme was prepared based on these domains using the Rüstem Pasha Mosque cross-sections drawings. Dimensions were carried out for each mosque cross-section subject to the schematic system. Thus, the areas to be compared were made more distinctive and the data acquired were presented in an easily comparable format.

Façade plane was the final plane of analysis. As was the case for the other drawings, façade drawings were obtained from the Regional Directorate of Foundations. Similar to the cross-section plane, the height data are also used for this plane together with the width-height data. However, while only opening data such as sectional window, door and portico are accessible in the cross-section plane, all opening values can be accessed for the façade plane. Thus, the proportional values for the closed-semi-open-open surfaces can be obtained from the façade drawings. The façade drawings accessed for each mosque were examined by analyzing the data. First, the façade drawings were placed on the module foundation along the surface elevation reference direction. Whereas it was placed in the vertical axis according to the exterior measurement unit lines for the main wall and portico lines. Contrary to the plan and cross-section planes, the mosque façades are not abstracted and they have been dimensioned based on the already existing measurements.

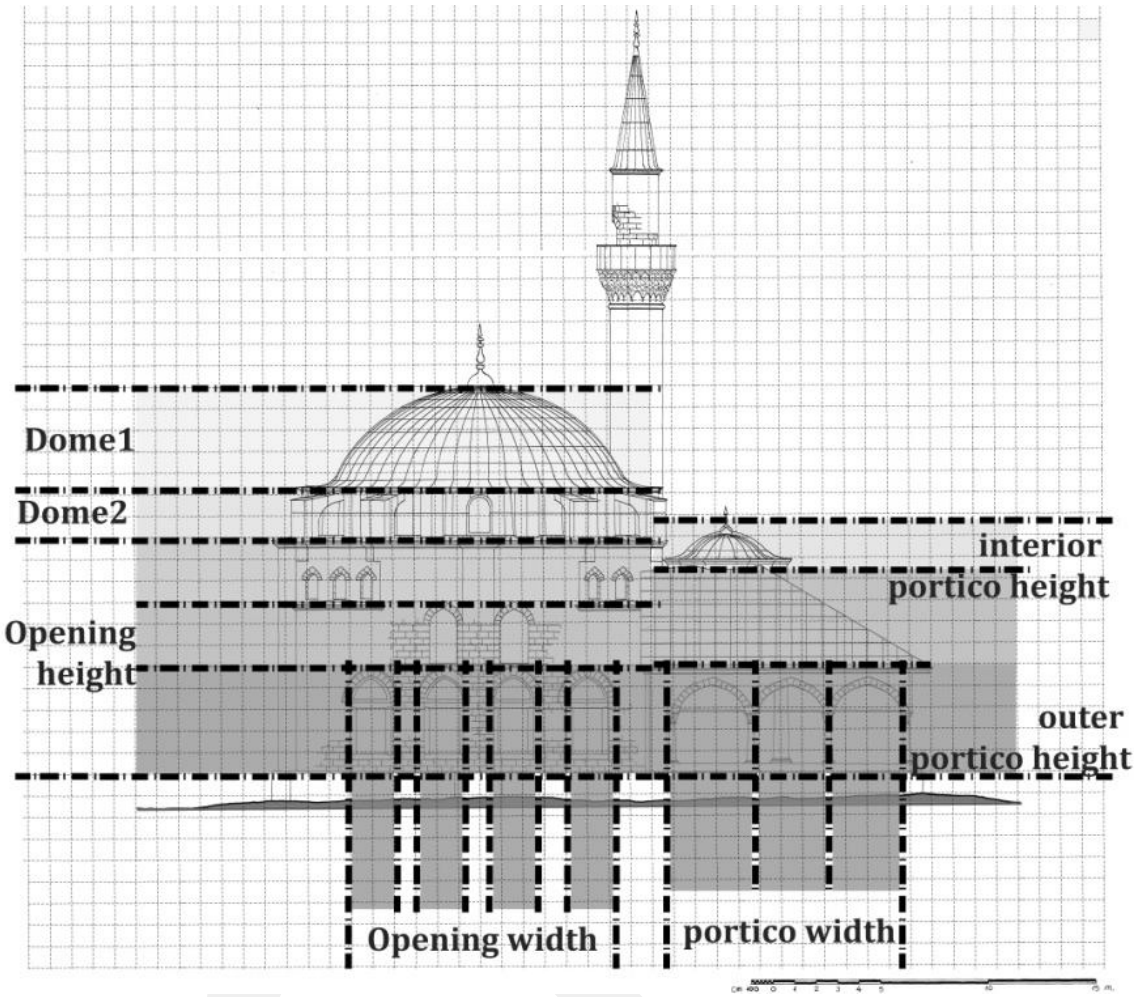


Figure 3.8 Rüstem Pasha Mosque appearance conceptual schema

Similar to the other planes, sub-domains were identified while dimensioning at the façade plane. Thus, dimensioning boundaries were determined and defined. The following sub-domains were thus determined;

- Main wall window height
- Dome rim height
- Dome height
- Interior-exterior portico openings
- Interior-exterior portico column heights

The conceptual schema was based on the Rüstem Pasha façade drawings. Dimensioning was conducted using the façade drawings subject to the sub-domains to

be examined. The determined data were evaluated for each mosque among themselves and comparatively with each other by way of dimensioning (Figure 3.8).

3.1 Tekirdağ Rüstem Pasha Mosque (1553)

One of the 6 mosques designed by Master Sinan for Rüstem Pasha is the Rüstem Pasha Mosque with a single dome, 5 domes and double porticos. The mosque was built in 1553 during the time that Rüstem Pasha was alive. Rüstem Pasha Mosque has been constructed in the form of a kulliye with double Turkish baths, bedesten, caravanserai, madrasah and imaret but only the mosque, double Turkish bath and bedesten have reached presently. The kulliye in Tekirdağ is located at the commercial harbor region along the Rumeli road system. It has been planned to adapt to the sloped topography descending down to the sea at the harbor region. The Rüstem Pasha mosque remaining intact at the kulliye is the first rural mosque designed by Master Sinan outside Istanbul [34] (Figure 3.9).

Figure 3.9 Tekirdağ Rüstem Pasha Mosque exterior photo (*Vakıflar Bölge Müdürlüğü*, 2020)

Tekirdağ Rüstem Pasha Mosque has two porticos with a monospace interior arrangement. The entrance to the courtyard of the mosque surrounded by mosques is from the Northern main gate. The marble mosque fountain can be seen after entering from the courtyard main gate. The semi-open communion space is accessed from the courtyard. The exterior portico section of the communion space is surrounded by a total of 22 columns. There is a passage to the interior portico surrounded by the exterior portico from 3 directions. The interior portico is connected to the main space by way of the northern main gate. The mosque main space is surrounded on all four sides by main walls similar to the classical rural mosque examples. It can be seen that cut limestones have been used in the main walls and that different stone types have also been used in the other architectural elements (Figure 3.10-3.11).

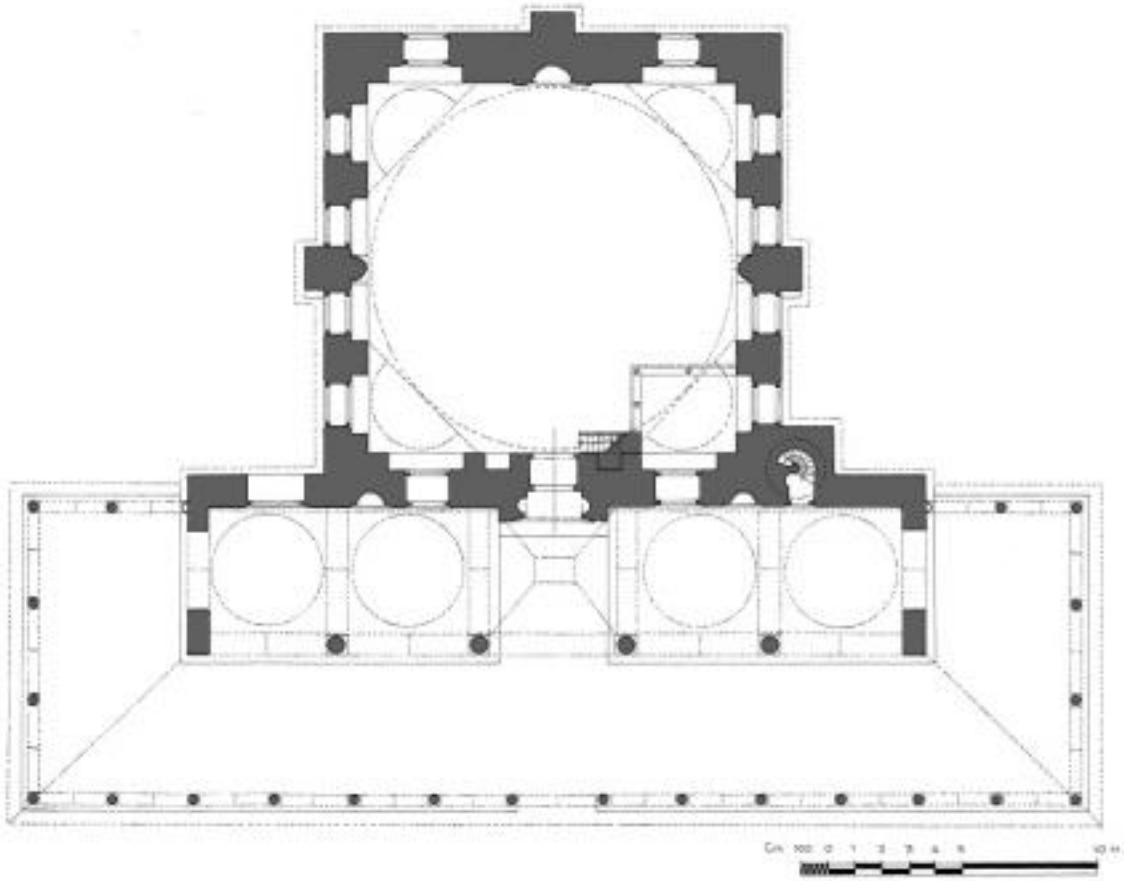


Figure 3.10 Tekirdağ Rüstem Pasha Mosque floor plan (*Vakıflar Bölge Müdürlüğü*, 2020)

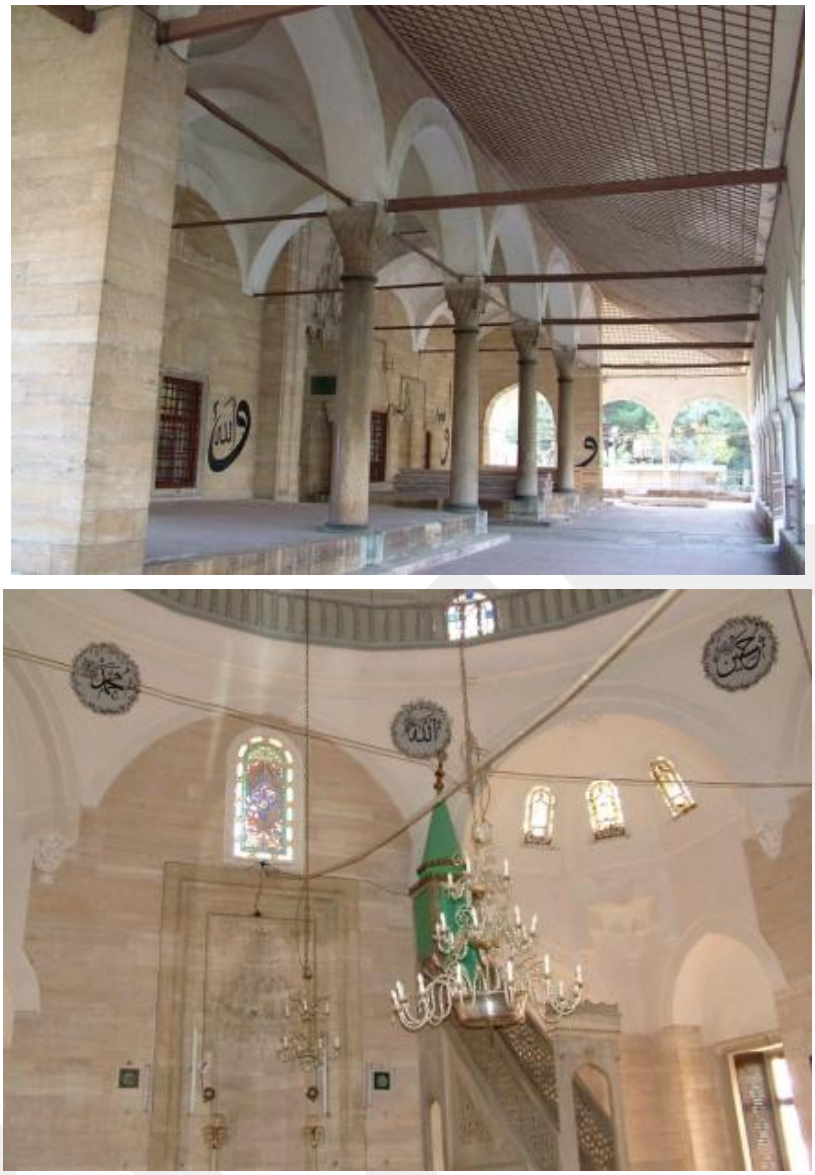


Figure 3.11 Tekirdağ Rüstem Pasha Mosque interior space photo (*Vakıflar Bölge Müdürlüğü*, 2020)

The mosque consists of the square planned main space covered by a single dome, the 5 domes double porticoed communion space that is used as a transition space and the minaret with a single balcony. This combination forms the foundations of Sinan's rural mosque architecture. The topside of the main space surrounded by the main walls made of cut limestone is covered by a lead coated dome that enables passage by way of squinches. The structure is well-lit and spacious thanks to the windows on the main walls. There are rectangular windows on the northern wall opening up to the communion space. The interior portico is supported at the corners by 'I' shaped and noktasal columns. There is a cavetto vault at the center with double domes covering the interior portico on the sides. Whereas the exterior portico with a wooden roof surrounds

the interior portico in a u-shape. The material used on the arches in the porticoed space is limestone however it is seen as alternating because two colors have been used for painting [35].

Tekirdağ Rüstem Pasha Mosque Modular Analysis

Rüstem Pasha Mosque is a rural mosque in Tekirdağ designed by Sinan. As explained in detail in the previous sections, it is considered among the 5 domed double porticoed rural mosques of Sinan due to its plan formation and the many common factors it includes. As was the case for the other studies, this mosque was also analyzed in 2 spaces within the scope of the study as 1st region main space, 2nd region communion space. The abstracted floor plan was placed on the unit module foundation in accordance with the pre-determined directions. Different color tones were used for increasing the readability of the sections. Scaling was made in accordance with the architectural elements determined on the formed plane. It can be observed when this scaling was considered that the main space between the corner main walls is square with dimensions of 13a-13a. Whereas the main space exterior dimensions are 17a-17a in square form. The thickness of the 4 walls is observed to display continuity in “a” units. The window openings on the North-South main walls are 2a units. While window openings with a and 2a unit values can be seen on the West-East main walls. The main wall at spaces with a unit value of 2a is thinner. It can be observed when the width of the mihrap is examined as another architectural element that it is located at the center of the kiblah wall of 7a thickness. Similarly, the thickness of the main gate located at the center of the northern main wall is 3a units. Based on these values, the ratio of the mihrap width to the main gate width is calculated as 2,3 (Figure 3.12) (Table 3.1).

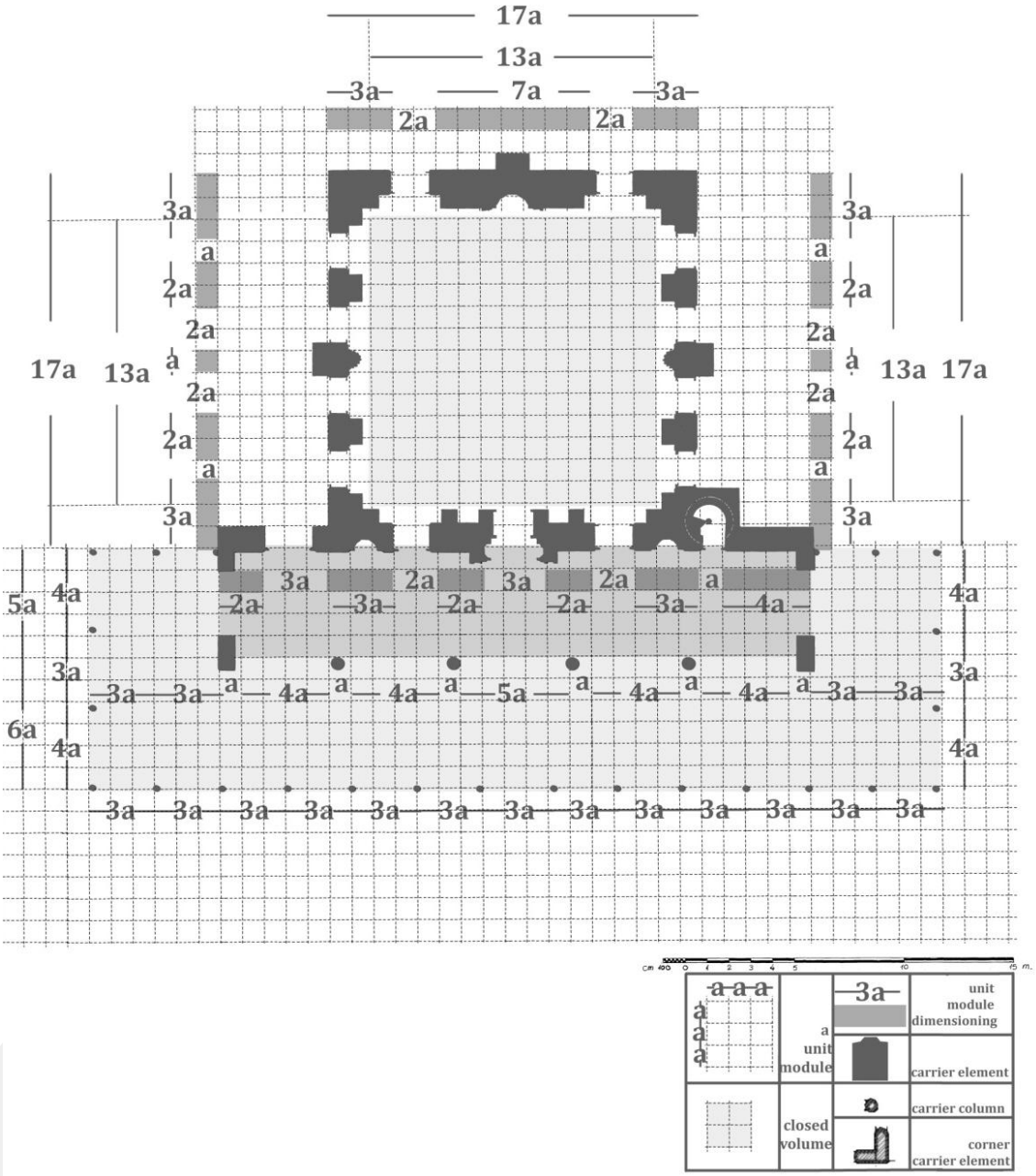


Figure 3.12 Tekirdağ Rüstem Pasha Mosque floor plan modular analysis

Table 3.1 Tekirdağ rüstem pasha mosque floor plan elements

Tekirdağ Rüstem Pasha Mosque Floor Plan Dimensioning	Main Wall Thickness	Mihrap Width	Window Opening	Main Gate Door Opening	Interior-Exterior Portico Column Thickness	Interior-Exterior Portico Column Width
VALUES	a*	7a	a-2a	3a	a**	5a-5a

*thickness on the axis following the main wall
**thickness of columns

It can be observed when the 2nd section of the mosque is examined that two of the interior portico sections are comprised of 6 carrier columns of which 2 are in rectangular form with a unit distance of 4a between them. Whereas the exterior portico section is surrounded by 24 noktasal carriers which are arranged in the northern section with a unit distance of 3a. Interior portico area vertical width is 5a units whereas the exterior portico area is 6a units in length. Based on these values, the ratio of the exterior portico width to the interior portico width is calculated as 1,2. While all point carriers at the portico section are ‘a’ unit, the ‘l’ carrier column width at the interior portico is ‘a’ unit in length.

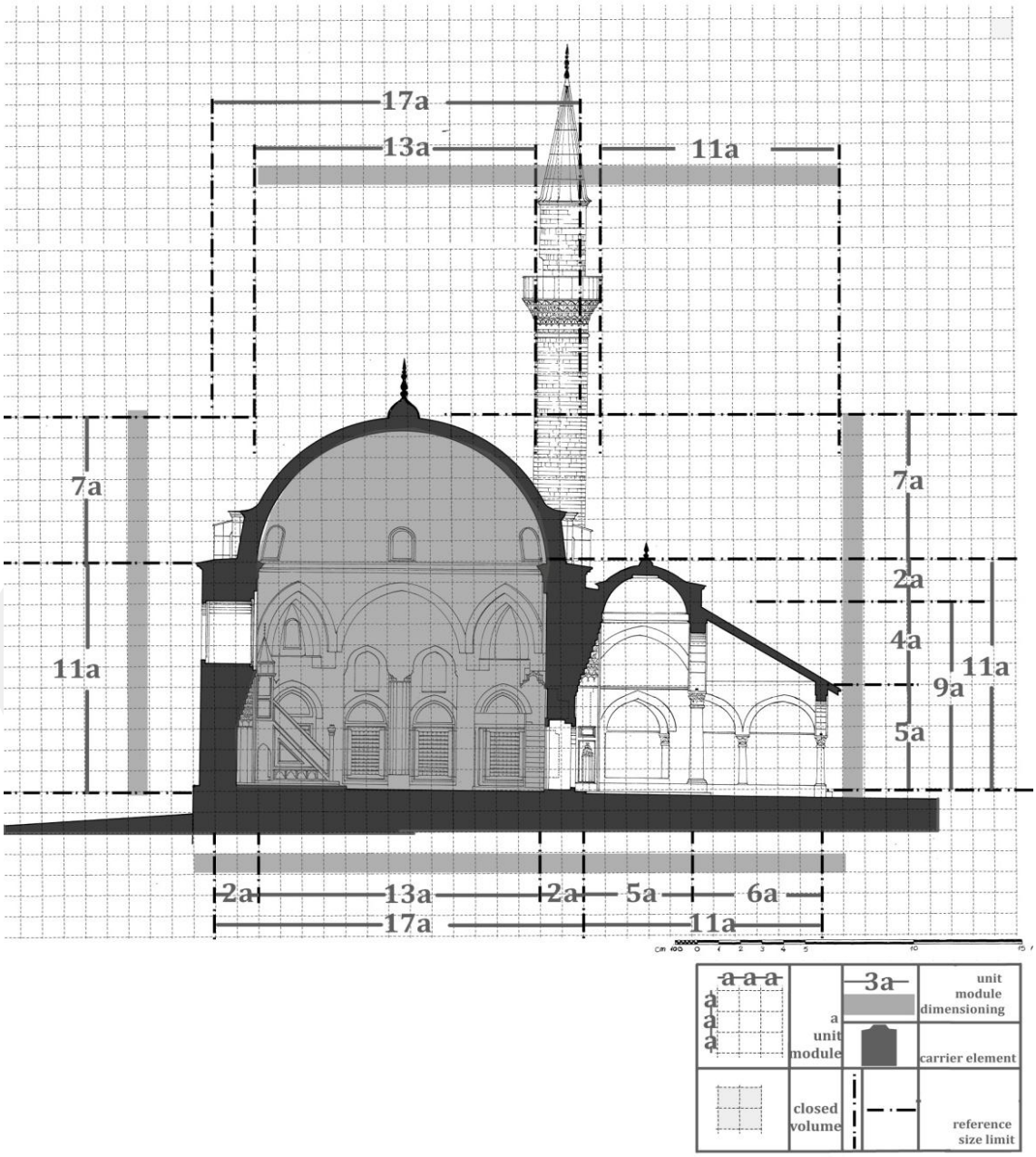


Figure 3.13 Tekirdağ Rüstem Pasha Mosque cross-section analysis

Table 3.2 Tekirdağ Rüstem Pasha Mosque cross-sectional modular analysis

Dimensioning of Tekirdağ Rüstem Pasha Mosque Cross-Section	Main Wall Height	Dome Height	Interior portico space (dome-column) height	Exterior portico space (sloped roof-column) height
VALUES	11a	7a	11a (2a-9a)	9a (4a-5a)

The vertical section taken from the main gate entrance was abstracted placed on A-A unit module and dimensioned (Figure 3.12). The measurement values were tabulated based on the determined domains (Table 3.2). Accordingly, the main wall height at the main space is 11a units with the height of the dome following the main wall 7a units in length. It is observed that the architectural elements examined on the plan plane are in accordance with the dimensions at the cross-sectional plane. The main wall thickness is 2a units since the cross-section line passes through the location of the mihrap and the main gate. Whereas the interior portico column and exterior portico space height are 9a units in the communion space consisting of 2 sections. While the interior portico dome height is 2a units, the exterior portico sloped roof height is 4a units in length. In addition, it is observed that the interior portico space height is 11a units as is the main wall height.

Table 3.3 Tekirdağ Rüstem Pasha Mosque façade modular analysis

Tekirdağ Rüstem Pasha Mosque Façade Dimensioning	Main Wall Window Height	Dome Rim Height	Dome Height	Exterior-Interior Portico Openings	Exterior-Interior Portico Height
VALUES	4a-3a	2a	5a	3a	9a-11a

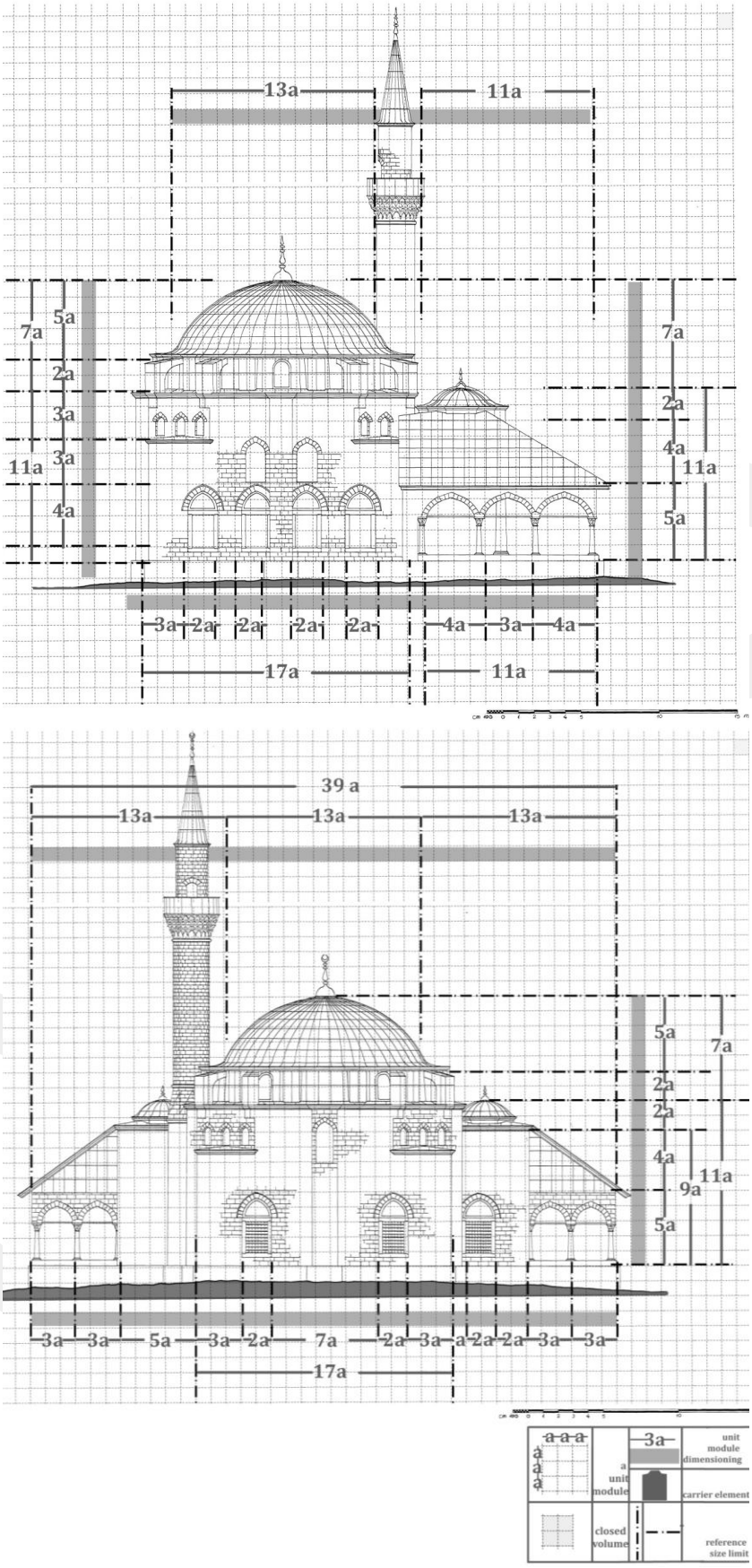


Figure 3.14 Tekirdağ Rüstem Pasha Mosque eastern and southern façade modular analysis

Different from the plan and cross-section, the mosque drawings were not abstracted for the façade plane but they were dimensioned after placing on unit foundation (Figure 3.12). The values obtained by dimensioning were tabulated based on the determined façade domains and thus made more readable (Table 3.3). It was observed that these data were examined that the windows at eye level on the main wall are 2a units in width and 4a units in height. Similarly, the windows above eye level were a unit in width and 3a units in height. While the height of the dome rim is 2a units as another architectural element that starts where the main wall ends, it is observed that the dome height is 5a units. In addition, the distance between the portico carrier columns is 3a units as seen in the plan plane. While the exterior portico height is 9a units, it was observed that the interior portico height is 11a units.

3.2 Diyarbakır Behram Pasha Mosque (1564)

As indicated on the inscription on the main gate of the mosque at the Behram Pasha quarter of Diyarbakır, construction for the mosque started in 1564 and ended in 1572. The mosque was ordered to be built by Behram Pasha who was the governor of Diyarbakır. As stated in *Tuhfetü'l-mi'mârîn*, the structure was constructed by Master Sinan. It is among the important rural mosques of Sinan, however it is stated in only one reference that it has been constructed by Sinan. Since the Turkish bath has also reached our day, it is understood that the structure also has a kulliye in addition to the mosque. It is one of Sinan's rural mosques with a single dome and minaret and five domed double porticos. The minaret of the mosque was partially damaged in 1928 which was repaired in 1929 (Regional Directorate of Foundations). The material used in the mosque construction is double colored stone which was frequently used at the Southeastern Anatolia Region during the time of its construction. As indicated in the foundation antiquity slip, thin free stone was used in the construction of the main walls. This stone is also observed in the construction of the walls surrounding the main space and the communion space of the mosque. Even though regional stones have been used in the construction process based on the conditions of the period it was built in, the material has brought life to the mosque façade. In the meantime, the use of regional stones leads to forming a completeness with the other structures in the region thus emphasizing the architecture of the region [36] (Figure 3.15).

Figure 3.15 Diyarbakır Behram Pasha Mosque exterior photos (*Vakıflar Bölge Müdürlüğü*, 2020)

The mosque consists of 2 sections as the main space and communion space which can be defined as forming the style of Sinan with regard to rural mosques. The main space has been surrounded on all four sides with thick main walls and is covered with a squinched cover system. As is the case in some rural mosques, the main walls are thicker and advance towards the main space. Some small niches appear at sections towards the main space where the wall thickness decreases. These niches are located on all 4 façades and provide alternative spaces (Figure 3.16-3.17). The mihrap on the kiblah wall divides the main wall into two equal parts and continues with window openings. Different from the other rural mosques, gaps have been formed here at the

center of the thick corner walls and 4 rectangular gaps have been obtained. There are small mihrap niches inside these gaps. The main space dome sits on the interior of these thick corner walls. Hence, the main dome sits on octagonal legs on the sixteen cornered rim. There are stucco decorated small window openings on each of the faces that surround the dome. Two free-standing pillars support the dome at the sections of the rim joining the four corners [36].

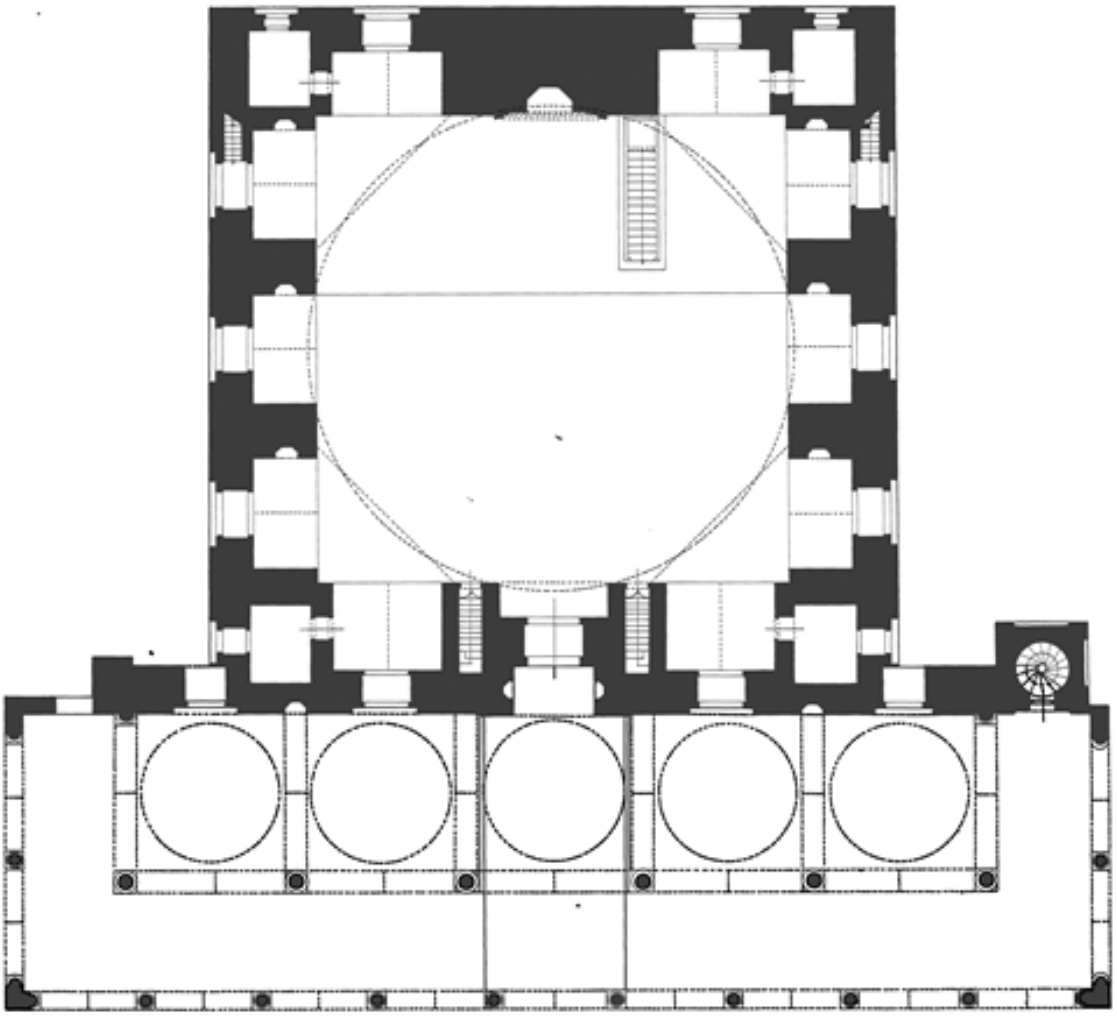


Figure 3.16 Diyarbakır Behram Pasha Mosque floor plan (*Vakıflar Bölge Müdürlüğü*, 2020)

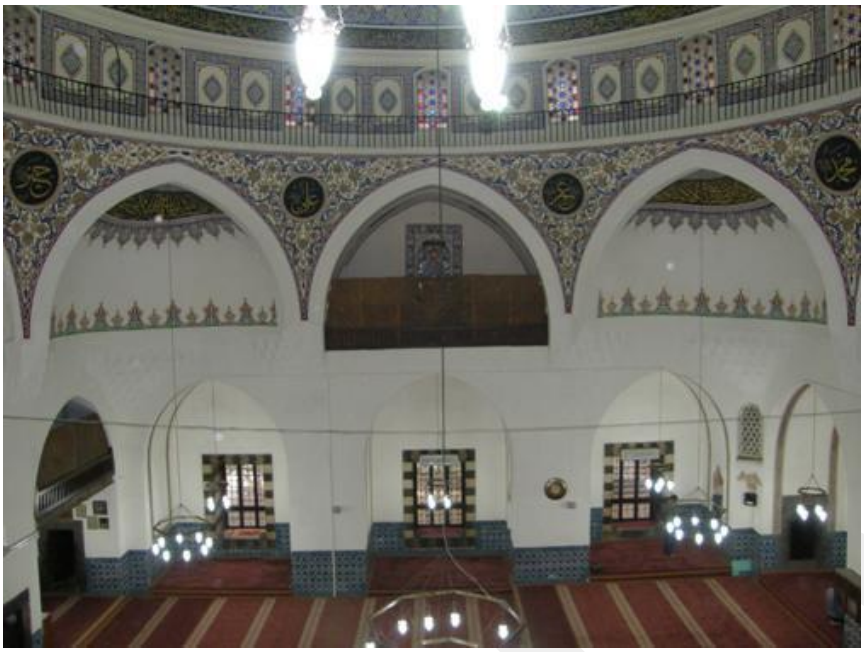


Figure 3.17 Diyarbakır Behram Pasha Mosque interior space and dome photos (*Vakıflar Bölge Müdürlüğü*, 2020)

While the main space of the mosque is a closed space surrounded on four sides by the main walls, the communion space is a semi-open area. This design of the structure provides an alternative against the seasonal changes that may occur. Thus, it can be stated that the mosque located in the Southeast has been designed by examining the climate data. It can be observed when the location of the communion space of the Behram Pasha mosque is examined that it is among Sinan's 5 dome double portico mosques (Figure 3.18).

Figure 3.18 Diyarbakır Behram Pasha Mosque communion space photos (*Vakıflar Bölge Müdürlüğü*, 2020)

The communion space is formed with the 5 domed porticoed area and the exterior portico area with the surrounding columns. The corners of the exterior portico are surrounded by L bearing and the column is carried by 10 bearing columns. Whereas the cover system of this transition space is a sloped roof. As is the case in the main space, double colored stone has been used in the communion space as well.

Diyarbakır Behram Pasha Mosque Modular Analysis

The Behram Pasha mosque in Diyarbakır is among the 5 domed double porticoed mosques of Master Sinan in Anatolia. Behram Pasha Mosque consists of a main space and communion space as is the case in other rural mosques as well. The mosque has been analyzed by considering it in 2 sections as was the case for the other mosques included in the study. The module comprised of 'a' units developed to emphasize the modular system was placed on the floor plane as a foundation. This placement was done in accordance with the predetermined directions. The points left by the corner rectangular carriers of the Behram Pasha Mosque in the interior space have determined the boundaries of the main space. The walls are observed to extend towards the interior space by about 4a units at sections where the mihrap wall and the main gate are present. The interior dimensions were given with reference to the end points of these niches. Accordingly, it is observed that the main space of the mosque is comprised of a 17a-17a unit module area excluding the sections formed by the niches. While the interior space area is in the shape of a square, the exterior dimensions shift towards a rectangle. The exterior façade dimensions are 23a-25a. Accordingly, while the interior space dimensions of the Behram Pasha Mosque form a square, the exterior space dimensions resemble those of a rectangular space. While the mihrap divides the main space into two equal parts at the kiblah wall, the main gate separates the space at the northern façade. Whereas the mihrap is 9a units in length, the main gate length is 3a units. The mihrap and wall ending locations continue with window openings and have a length of 2a units. There are window openings of 2a units in length at the niche areas along the Eastern and Western façades. The window opening on all 4 façades is 2a units in length (Figure 3.19) (Table 3.4).

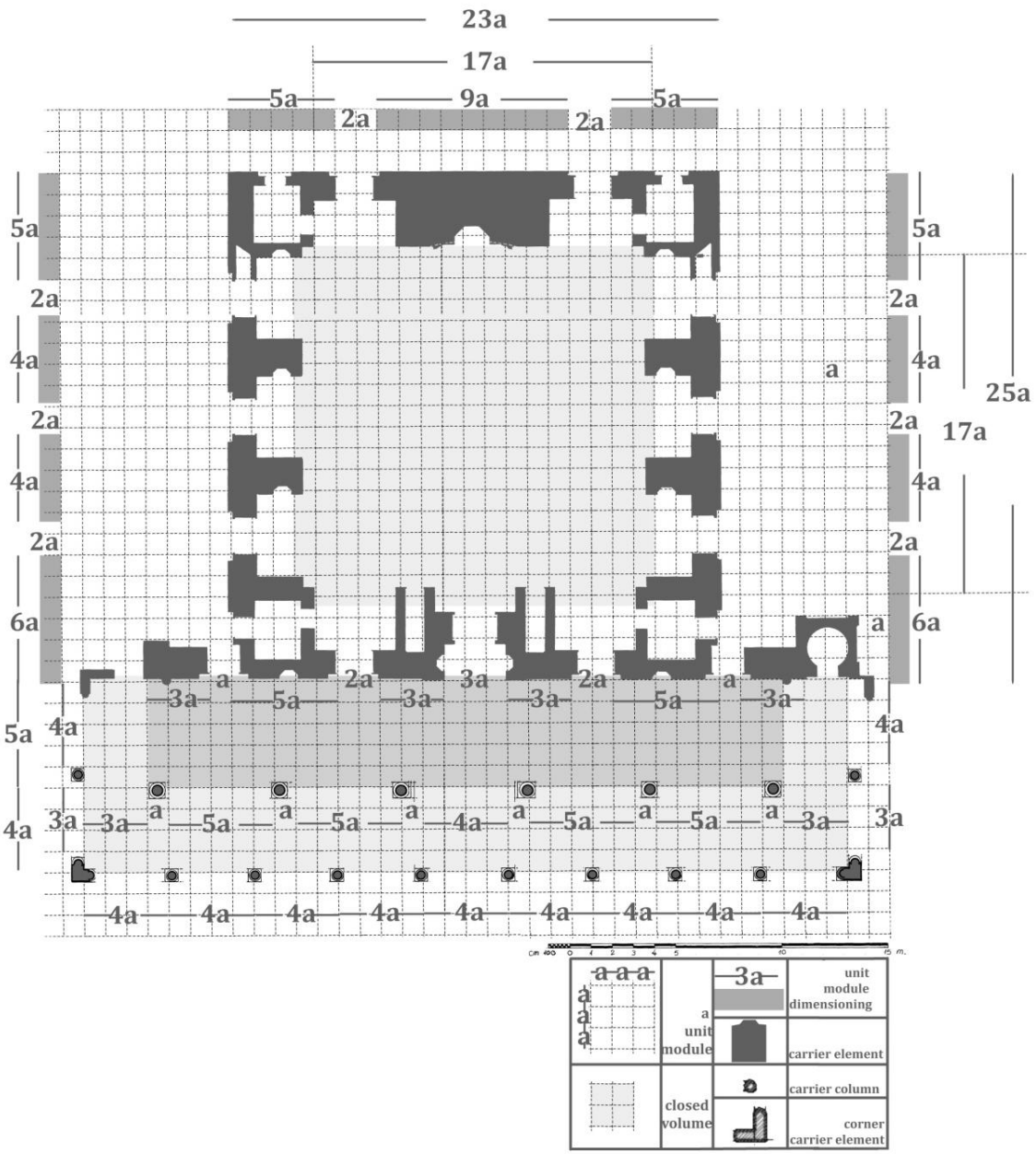


Figure 3.19. Diyarbakır Behram Pasha Mosque modular analysis

Table 3.4. Diyarbakır Behram Pasha Mosque façade modular analysis

Tekirdağ Rüstem Pasha Mosque Floor Plan Dimensioning	Main Wall Thickness	Mihrap Width	Window Opening	Main Gate Door Opening	Interior-Exterior Portico Column Thickness	Interior-Exterior Portico Width
VALUES	a*	9a	2a	3a	a**	4a-4a

*thickness on the axis following the main wall
**thickness of the noktasal columns

The communion space which is the 2nd section of the mosque is located between the northern façade and exterior portico columns. The corner columns surrounding the exterior portico are L shaped in form and identify the boundaries of the communion space. Comprised of 5 domes, there are 6 columns at the porticoed section which cover a space of a units in length. Whereas there are 12a unit length columns between the two L columns at the exterior portico section. It was observed that the distance between the two columns is generally 4a. It is stated that the dimensions of the main gate are important with regard to the formation of this distance. The ratio of the interior portico to the exterior portico was calculated as 1,25.

Table 3.5. Diyarbakır Behram Pasha Mosque cross-section modular analysis

Tekirdağ Rüstem Pasha Mosque Cross-Section Dimensioning	Main Wall Height	Dome Height	Interior portico space (dome-column) Height	Exterior portico space (sloped roof-column) Height
VALUES	11a	12a	14a (4a-10a)	10a (a-9a)

The conceptual cross-section drawing was placed on the A-A unit model base in accordance with the pre-determined reference directions. Dimensioning was made based on the headlines determined for the cross-section plane which was then tabulated (Figure 3.20) (Table 3.5). The mosque main wall height is 11a units as was the case for Rüstem Pasha Mosque. Whereas dome height was 12a units in height together with the rim. While interior portico column height was 10a, dome height was 4a units. Exterior portico column height is 9a units while the sloped roof height is a XX units. The proportional data obtained from the floor plan can also be read on the cross-section plane.

Table 3.6. Diyarbakır behram pasha mosque modular analysis tabulation

Diyarbakır Behram Pasha Mosque Façade Dimensioning	Main Wall Window Height	Dome Rim Height	Dome Height	Exterior-Interior Portico Openings	Exterior-Interior Portico Height
VALUES	5a-2a	4a	8a	4a	10a-14a

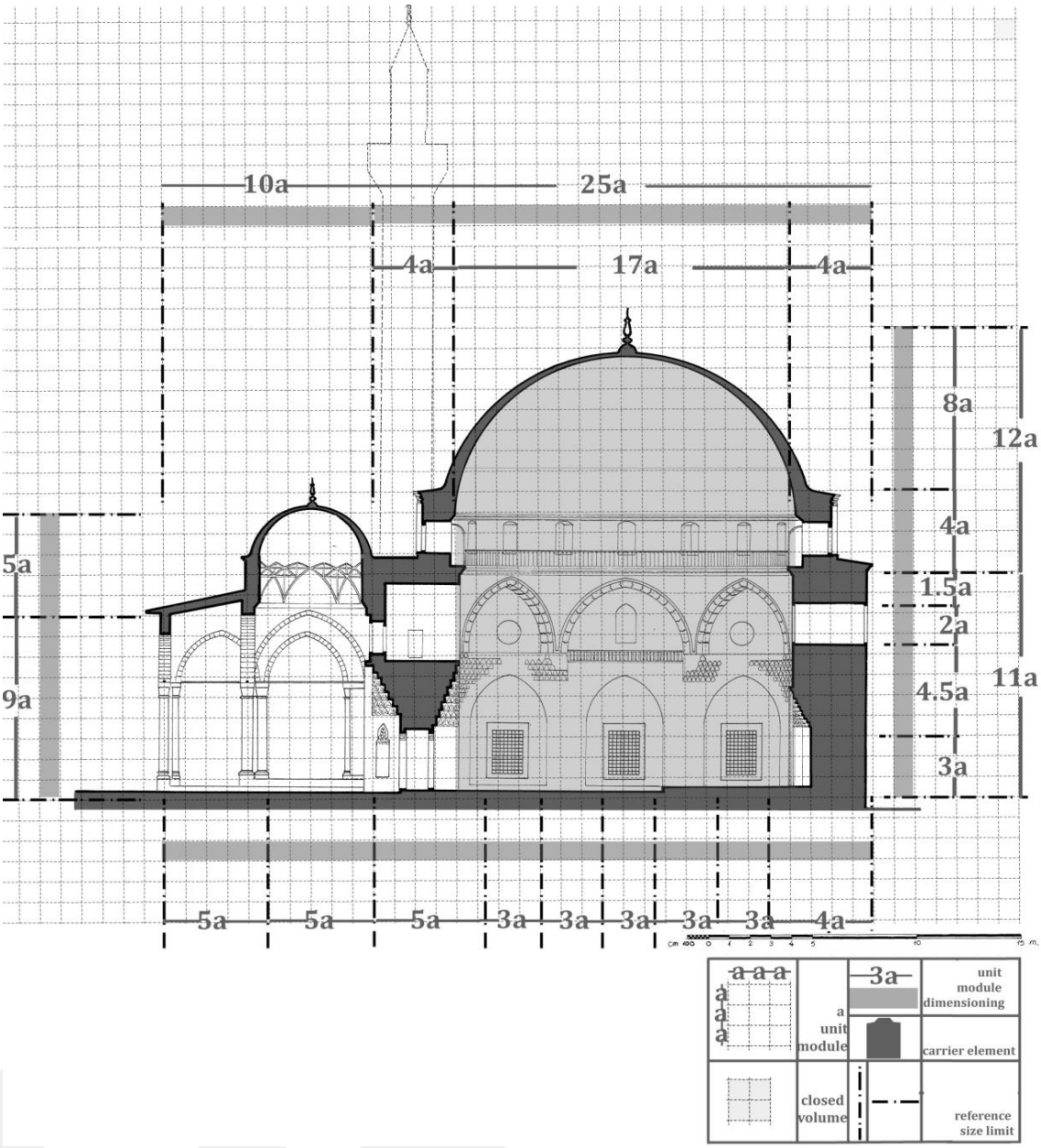


Figure 3.20. Diyarbakır Behram Pasha Mosque cross-section modular analysis

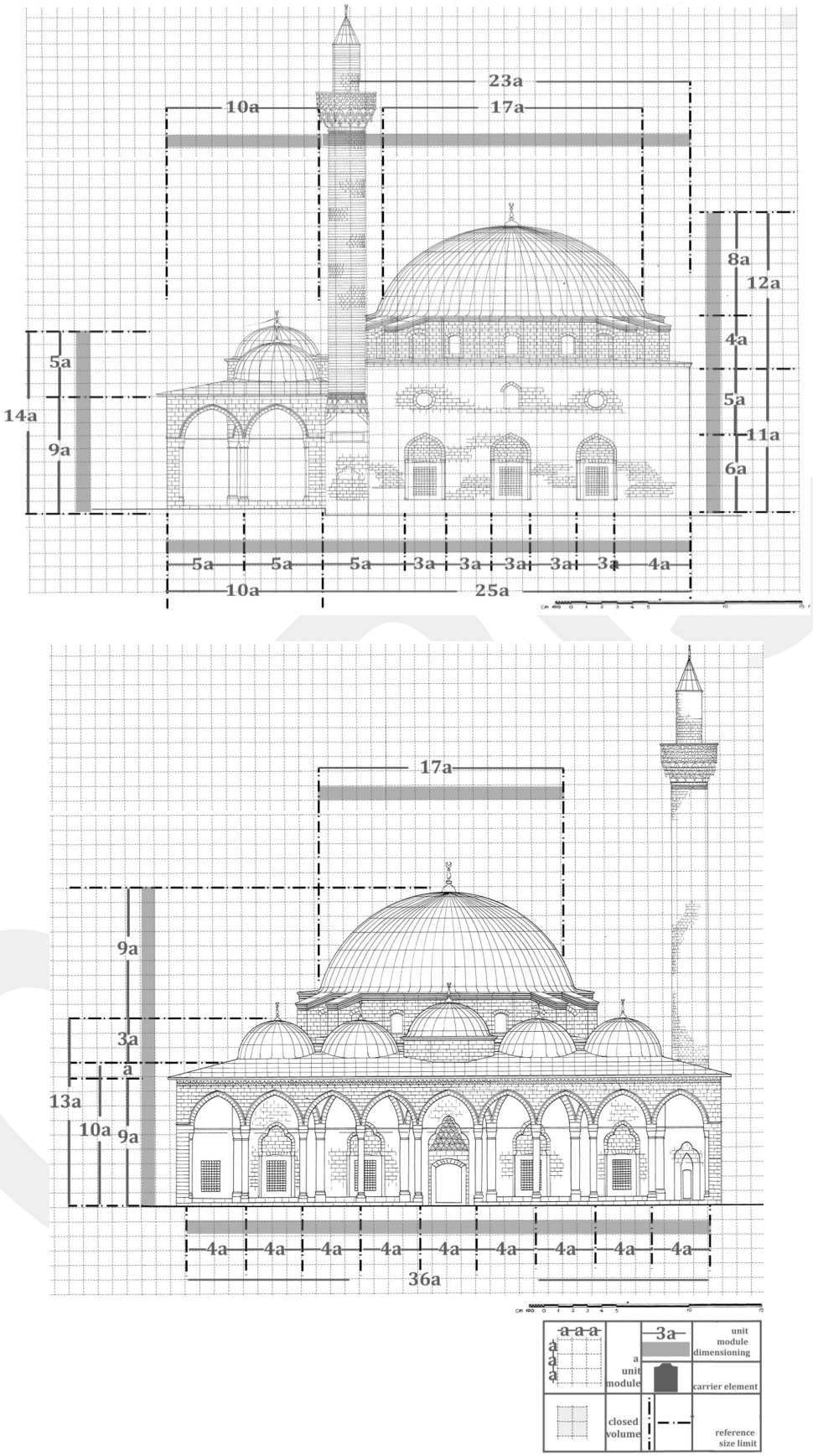


Figure 3.21 Diyarbakır Behram Pasha Mosque western and northern façade dimensioning

As indicated in other façade analyses, the façade drawings were dimensioned after placing without abstraction according to the reference directions. It can be observed when the window opening ratios of the eastern window are examined that the window ratios decrease as from the surface towards the dome. Window height along the eye line for Behram Pasha Mosque was 5a units while it was obtained as 2a units for windows that are higher up. It was observed that the dome rim height was examined that it is 4a units while the dome height is twice the value at 8a units in height. The exterior portico openings at the floor plan can be read from the northern façade drawing. The interval value is observed as 4a units in length for both façades. Interior and exterior portico end lines can also be read at the northern façade. Accordingly, interior portico height is 14a units while exterior portico height is 10a units (Figure 3.21) (Table 3.6).

3.3 İzmit Pertev Pasha Mosque (1579)

Pertev Pasha ordered the construction of the mosque located at the Yeni Cuma Quarter of Izmit. Pertev Pasha is also known as Yeni Cuma Mosque because of its location. Following the death of Pertev Pasha, Master Sinan was appointed to build the mosque which was completed in 1579. The kulliye comprised of mosque, caravanserai, Turkish bath, sibyan school and fountain-water reservoir and has been constructed on a flat surface. Of these, only the mosque, fountain and water reservoir have reached our day. However, the mosque and Turkish bath are also mentioned in Master Sinan biographies. The use of local stones generally prevalent in the rural mosques of Sinan is also present here and so cut stones have been used. Two colored stone has also been used for flat arches [37] (Figure 3.22).

Figure 3.22 İzmit Pertev Pasha Mosque exterior photos (*Vakıflar Bölge Müdürlüğü*, 2020)

Izmit Pertev Pasha Mosque is a provincial mosque with a square plan, 5 domes, double porticoed communion space, single dome and single minaret. The mosque has a rectangular plan that is close to a square and is covered with a dome supported by squinches placed on an octagonal rim. The mosque is located at the center of the courtyards on the northern and southern façades. The main space is surrounded by main walls made of cut stone. Different from the others, the northern wall that is thinner at the main space in this rural mosque example has been supported by 2 support columns. These supports that are connected by arches form 3 iwans at the entrance. These iwans have been separated from the main space by being elevated from the entrance elevation line. Passage from the octagular rim by way of squinches from the ending point of the mosque main walls is possible to reach the dome by way of pendentives.

Figure 3.23 Izmit pertev pasha mosque interior space photos (*Vakıflar Bölge Müdürlüğü*, 2020)

The lighting system that is frequently seen in rural mosques is also present here. There are window openings at 3 layers lined up along the dome rim at both the eye level and above the eye level on the main wall. The interior of the mosque is well-lit and spacious thanks to the sufficient window openings. There are ‘l’ formed legs at the interior portico corners of the communion space similar to the Rüstem Pasha mosque. Whereas it is supported by ‘L’ shaped corner stones at the exterior portico. The communion space is supported by noktasal columns between different forms at both the interior and exterior portico which is covered by 3 domes and 2 barrel vaults [38] (Figure 3.23-3.24).

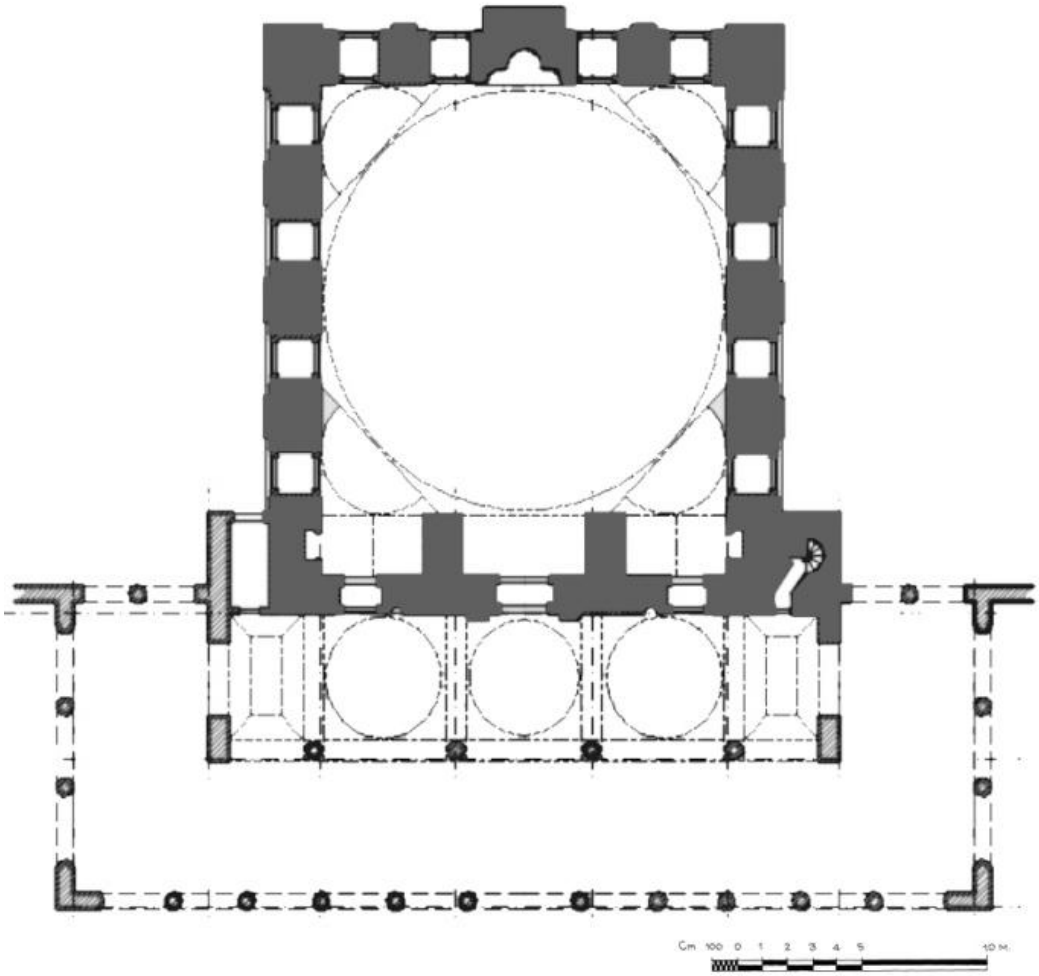


Figure 3.24 İzmit Pertev Pasha Mosque floor plan (*Vakıflar Bölge Müdürlüğü*, 2020)

Izmit Pertev Pasha Mosque Modular Analysis

The Pertev Pasha Mosque constructed by Sinan in Izmit has been examined by dividing it into two sections as was the case for the other rural mosques. The abstracted floor plan was placed on the A-A unit module according to the reference directions determined for the 4 mosques. Subject domains were identified after which dimensioning was completed accordingly. It can be observed when the analysis is examined that the main space in the area surrounded by corner main walls is 16a-17a units in length. Similarly, an examination of the exterior dimensions indicates a length of 20a-203a units. Accordingly, the exterior dimensions indicate a square space that is close to a rectangle. The main wall thickness was 2a units different from the other mosques. While it was a units in length in the other mosques, the value is 2a units for this mosque and the bearing main walls have been divided more frequently with

openings. While the window opening is 2a units in length on the Eastern-Western main walls, units of a and 2a can be seen on the Northern and Southern main walls. Similar to the window opening, the main gate is 2a units in length. Whereas the mihrap located on the kiblah wall has a value of 4a units and separates the wall into two similar to the other selected mosques. Based on the provided data, Pertev Pasha mosque mihrap width is twice that of the gate width (Figure 3.25) (Table 3.7).

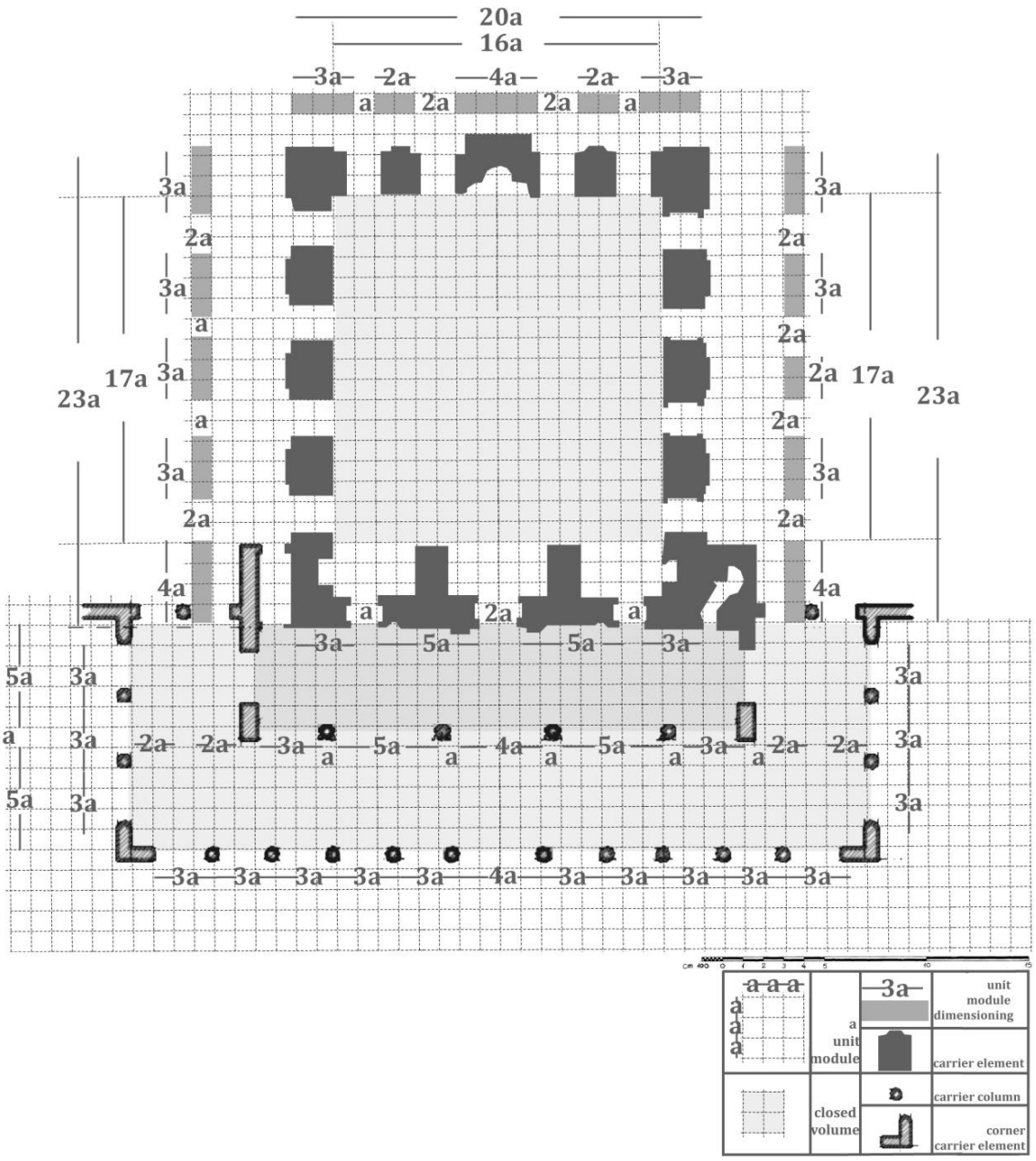


Figure 3.25 Izmit Pertev Pasha Mosque modular analysis

Table 3.7 Izmit Pertev Pasha Mosque façade modular analysis

İzmit Pertev Pasha Mosque Floor Plan Dimensioning	Main Wall Thickness	Mihrap Width	Window Opening	Main Gate Opening	Interior-Exterior Portico Column Thickness	Interior-Exterior Portico Column Width
DEĞERLER	2a*	4a	a-2a	2a	a**	5a-5a

*thickness at the axis following the main wall
**thickness of columns

It can be observed when the number of interior portico columns at the 2nd section of communion space is examined that the space is surrounded by 6 columns. Two of these are 'I' form bearing columns whereas the others are noktasal. There are 18 bearing columns at the exterior portico with 4 of those surrounding the corners in 'L' form. The noktasal supports in the 2nd Section are *a* units in length. The interior portico openings vary between values of 3-4-5 whereas the exterior portico opening values are 3-4. When one of the other domains, the portico thickness ratios is examined it can be observed that the values are 5a-5a with a ratio of 1 (Figure 3.25) (Table 3.7)

Table 3.8 İzmit Pertev Pasha Mosque cross-section modular analysis

İzmit Pertev Pasha Mosque Cross-Section Dimensioning	Main Wall Thickness	Dome Height	Interior portico space (dome-column) Height	Exterior portico Space (sloped roof-column) Height
VALUES	16a	8a	10a (2a-10a)	8a (2a-6a)

The abstracted floor plan was placed on the foundation for dimensioning. The acquired data were tabulated and examined as such (Figure 3.26, Table 3.8). While the main wall height was 11a for the previously examined mosques, it was 16a units for the Pertev Pasha Mosque. The height of the dome starting at the end point of the wall is half the value at 8a units. The data in the floor plan are read and verified at the cross-section plane. Accordingly, the main wall thickness is 2a units at the cross-section plane. While the interior portico space height is 2a units at the 2nd section of communion space, it is 8a units for the exterior portico. While the column heights are 10a units for the interior portico, they were 6a units for the exterior portico.

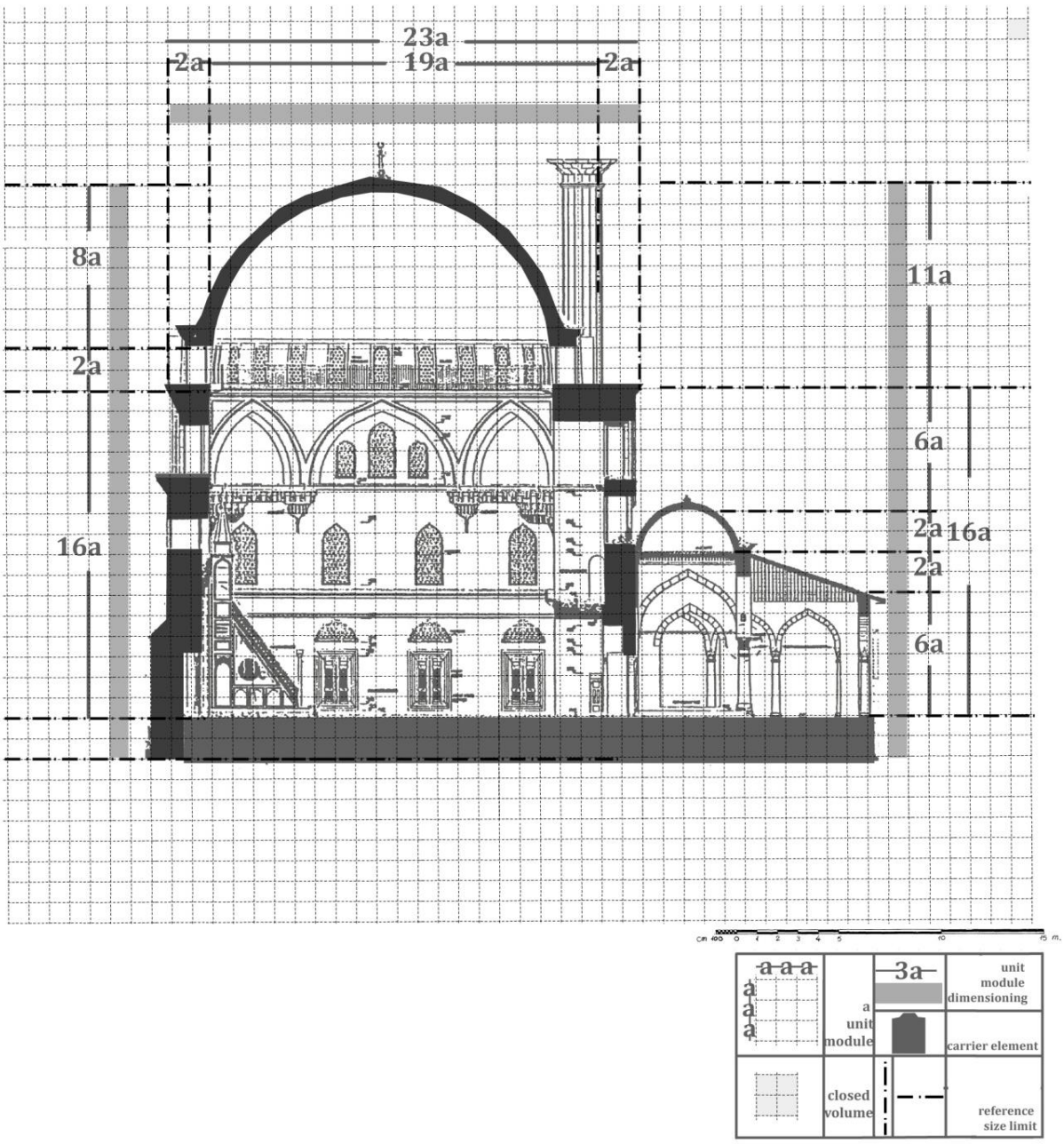


Figure 3.26 İzmit Pertev Pasha Mosque cross-section modular analysis

Table 3.9 Izmit Pertev Pasha Mosque façade modular analysis

Izmit Pertev Pasha Mosque Façade Dimensioning	Main Wall Window Height	Dome Rim Height	Dome Height	Exterior-Interior Portico Openings	Exterior-Interior Portico Height
VALUES	5a-4a	3a	8a	3a-4a	9a-11a

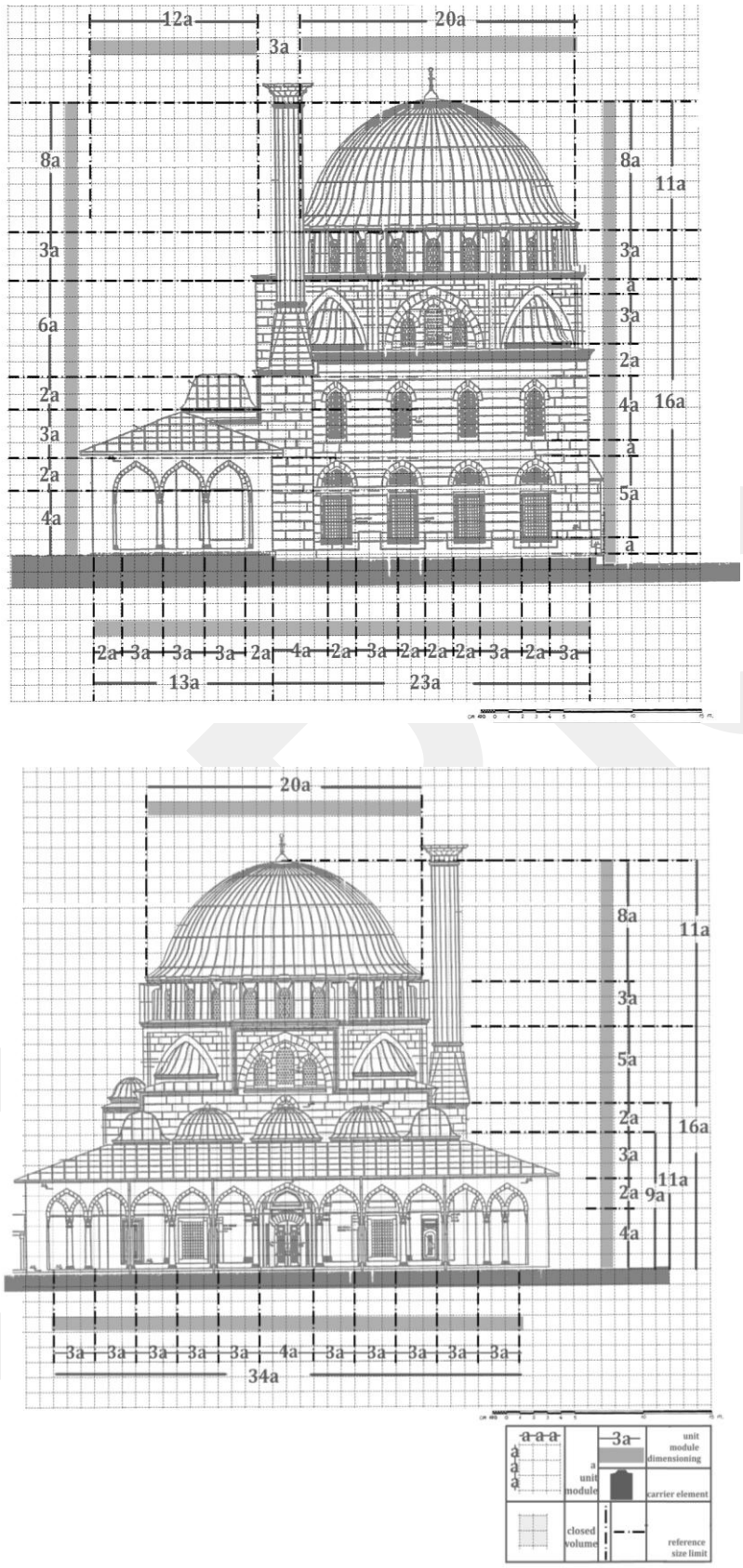


Figure 3.27 Izmit Pertev Pasha Mosque western and northern façade dimensioning

The façade section which is the last analyzed plane was placed directly on the foundation using the drawing after which dimensioning was made. These data were tabulated and thus made more readable. As observed in the other mosque examples, the window heights along the eastern main wall decrease as we move towards the dome. This value decreases from 5a units to 4a units for the Pertev Pasha Mosque. The dome rim height is observed to be 3a units. Whereas the dome height is 8a units. The exterior portico openings can be read on the northern façade drawing which are 4a and 3a units in length. It can be seen when we look from the same side that the exterior portico height is 9a units while the interior portico height is 11a units (Figure 3.27) (Table 3.9).

3.4 Kayseri Kurşunlu Mosque (1585)

Kurşunlu Cami is located at the park known as Master Sinan Park to the west of Kayseri Kocasinan district Cumhuriyet Square. The mosque is named after the lead cover of its dome as is the case in other Sinan mosques. In addition to Kurşunlu Mosque, it is also known as Ahmet Pasha Mosque. Consisting of an imaret, inn, school and Turkish bath, the mosque is the only structure of Hacı Ahmet Pasha Kulliye that has remained intact to our day. It is the only mosqe built by Master Sinan in Kayseri which has reached our day. It is indicated in the Tezkere't-ül Bünyan that Master Sinan has built two mosques in Kayseri which are Osman Pasha and Hacı Pasha Mosques. Accordingly, it is also stated that the Osman Pasha Mosque cannot be located and that the Hacı Pasha Mosque is actually the Kurşunlu Mosque. Different conclusions have been reached from the inscription text at the mosque which have not been finalized for sure. However, the date is indicated in the “Turkish Monuments at the Kayseri Province” written by Albert Gabriel as 1585 [39]. Similarly, the construction year is indicated as 1585 in the structure slip obtained from the Regional Directorate of Foundations. It is observed that different methods have been used in different resources for dating the structure. However, it is understood from the mosque lines that it is clearly a Classical Ottoman Period structure (Figure 3.28).

Figure 3.28 Kayseri Kurşunlu Mosque exterior space photos

It can be observed when the formation of the mosque is examined that it is comprised of a main space, communion space and courtyard as was the case for the other 4 rural mosques (Figure 3.29). This formation is in accordance with the Classical Ottoman plan understanding and the analyzed mosques have been designed based on this principle as well. Access to the mosque is through the open courtyard with 3 main gates from where one can reach the communion space to the south. From the communion space one can then proceed to the main space that is closed off with a main

gate. The mosque is constructed on a rectangular plan with dimensions of 15.10-15.45 cm that almost resembles a square. The dome rim is supported by pendentives on four columns hidden inside the main space wall. A lead coated dome has been placed on the rim of this dome. There are also buttresses outside that support the dome from each of its four corners. The material used in the construction of the mosque is the grey, brown colored cut stone that is specific to the region which has been used in the main walls surrounding the main space. While it has also been observed that marble material has been used for the columns in the communion space [40].

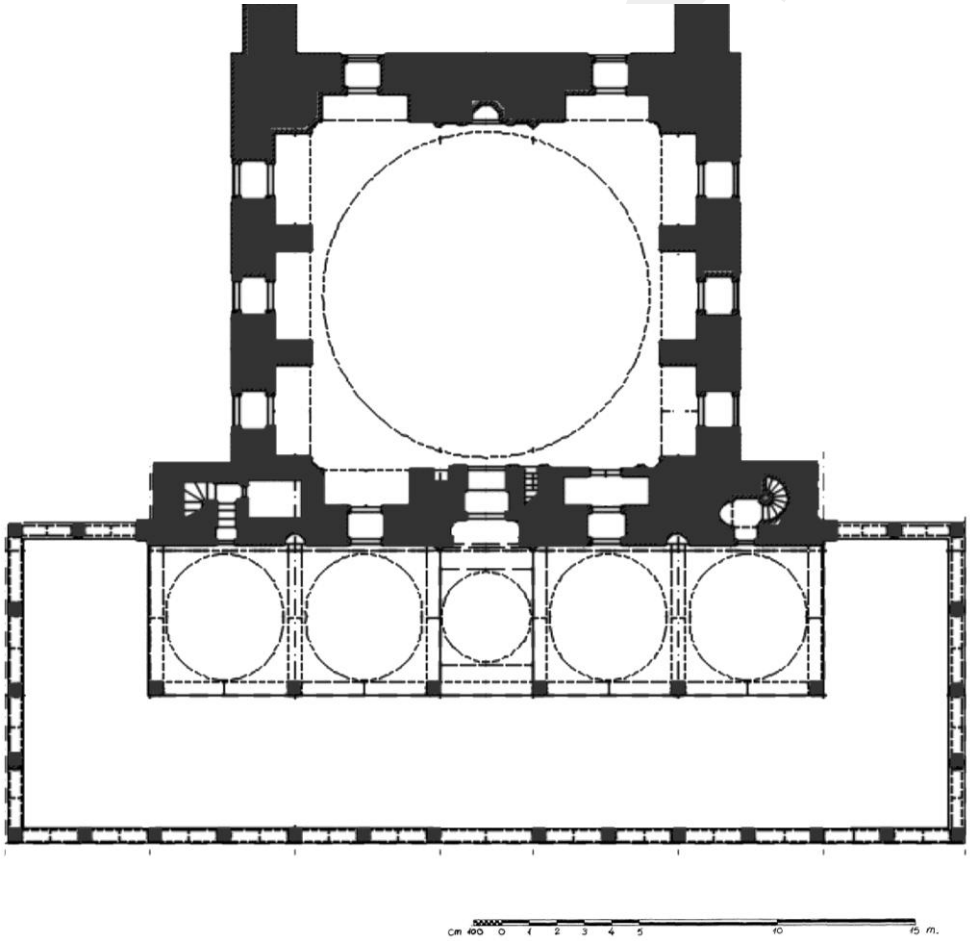


Figure 3.29 Kayseri Kurşunlu Mosque floor plan (*Vakıflar Bölge Müdürlüğü*, 2020)

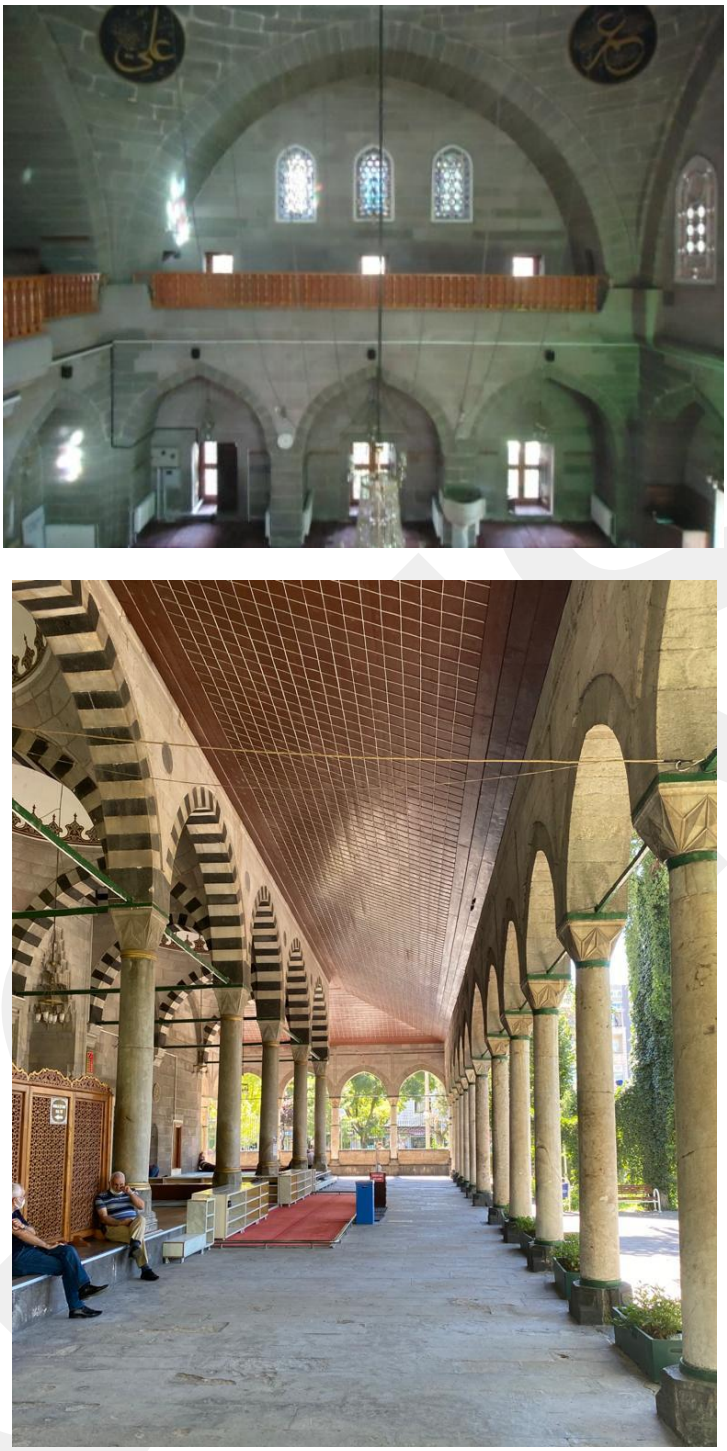


Figure 3.30 Kayseri Kurşunlu Mosque interior space photos

Similar to the other rural mosques included in the study, the communion space of the mosque is located between the courtyard and main spaces and has 5 domes and two porticos. It is observed that elevation difference has been used to attain the spatial divisioning between the porticoed spaces at the communion space. The narthex is covered by six marble columns and five domes carried by pointed arches. The dome at

the entrance from the five domes to the main space is larger than the others. The sides of this section of the communion space are open and hence the area falls under the category of semi-open spaces. Both the interior porticoed section and the main space have been surrounded in U shape at the exterior porticoed section of the communion space. The exterior portico space surrounded by 24 columned pointed arches is covered with a porch shaped hipped roof (Figure 3.30).

It can be observed when the lighting of the mosque is examined that sufficient light enters the closed main space. There are two windows on each of the southern and northern sides of the main space main walls and three each at the eastern and western sections. These windows are rectangular in form with pointed arch frontons and are located on each of the four façades. There are six additional windows on the upper part of the southern wall. Whereas the dome rim that supports the dome together with the main walls is surrounded with 12 windows. Accordingly, it can be stated that the space is well-lit thanks to the number of windows and the fact that the gathering place for women is galleried play [41].

Kayseri Kurşunlu Mosque Modular Analysis

Similar to the other mosques, Kayseri Kurşunlu Mosque was evaluated in two sections as the main space and communion space after obtaining its drawings from the Regional Directorate of Foundations. The floor plan was abstracted based on the determined attributes and this plan was used. The A-A unit module used as a foundation was placed under the floor plan abstracted based on the pre-determined reference direction boundaries. Dimensioning was made according to the domains to be used when performing the analysis using this drawing. The dimensions of wide spaces were provided during dimensioning along with sections of the space such as windows and doors. The aforementioned stages were completed in order after which they were displayed on a single plane with the legend (Figure 3.29). Colors at the same scale with different tones were used as was the case in the other three mosques in order to emphasize the stages conducted on the plan plane. Thus, the expression on the drawing plane was activated and made more readable.

It can be observed when the analyzed floor plan is examined that the main space surrounded on all four sides with the main walls has a square plan with dimensions of

12a-12a. With regard to its outer dimensions, it is a rectangular space resembling a square with a width of 18a and length of 20a. The fact that the corner main walls create a thread towards the outside at the starting and ending points of the mihrap wall plays an effective role in the fact that while the main space has interior dimensions of a square its exterior dimensions are rectangular. It was observed based on Diyarbakır Behram Pasha mosque that the expansion towards the inside at the mihrap wall and main gate takes place in the Kurşunlu mosque at the corner main walls. While there is an expansion of about 4a units towards the inside at the Behram Pasha mosque, the extension is 2a units towards the outside at the Kurşunlu Mosque. Accordingly, spaces of different forms were created based on interior and exterior space dimensions.

The analysis sub-titles identified within the scope of the study for the four rural mosques inference has been made together with the values for the Kurşunlu Mosque. The values have been classified based on the space elements that make up the main space and communion space. The first of the main space elements considered has a unit value of “a” similar to the main wall. Similar to the other two mosques, it was observed in the Kurşunlu Mosque that the thickness value is in 'a' unit. Accordingly, the modular foundation value was identified as 'a' units. One of the other measurement values is the mihrap width of 8a units located on the southern main wall. It is observed that the mihrap wall has expanded by 'a' unit towards the interior on the floor plan. It can be observed when the windows as the other measurement value are examined that there is a total of 12 window openings in the mosque with 6 along the eastern western façades and 6 along the northern and southern façades. The dimensions of the 12 window openings along the four façades were observed to be 'a' unit. The main door entrance is 2a units long, which is twice the value of the windows.

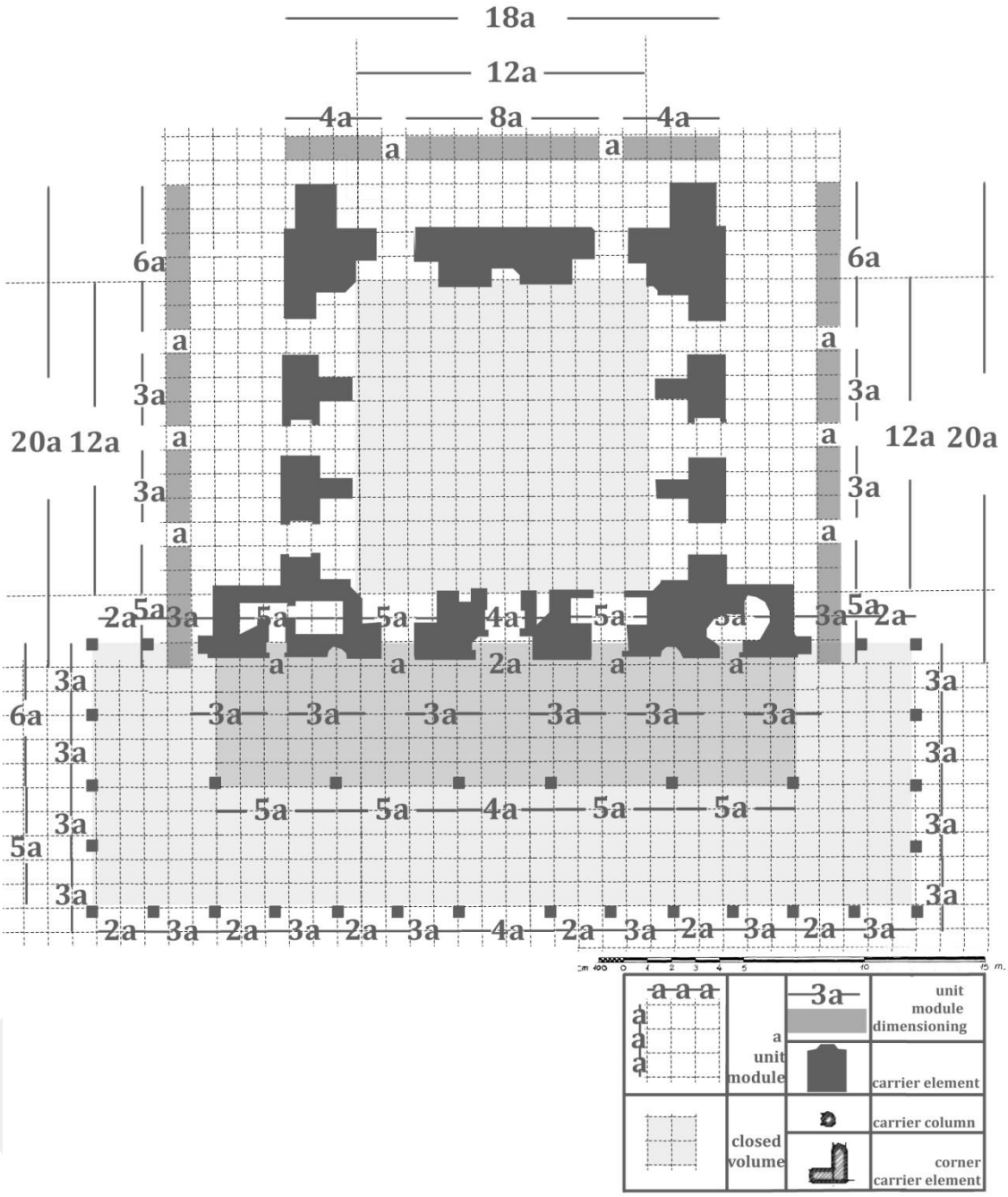


Figure 3.31 Kayseri Kurşunlu Mosque modular analysis

Table 3.10 Kayseri Kurşunlu Mosque façade modular analysis

Kayseri Kurşunlu Mosque Floor Plan Dimensioning	Main Wall Thickness	Mihrap Width	Window Opening	Main Gate Opening	Interior-Exterior Portico Column Thickness	Interior-Exterior Portico Width
VALUES	a*	8a	a	2a	a**	5a-5a

*thickness on the axis following the main wall
**thickness of columns

The sub-domains of the 2nd section of the communion space were shaped based on the spatial elements at the interior and exterior porticos. The number of interior portico columns is 6 and it is observed that the bearing columns surround the mosque. These columns are square bearings and are placed in an equivalent manner. Whereas there are 24 bearing columns at the exterior portico which have been placed parallel to the northern main wall of the mosque in equal dimensions. The columns at both the interior and exterior porticos have dimensions of a units and are located at the communion space with the same form and dimensions. The openings of the interior portico columns lined up parallel to the northern main wall vary between values of 3a-4a. Whereas the exterior portico openings lined up in a similar manner have values of 2a-3a. The width ratio of the portico is the last sub-domain examined at the floor plan plane. It can be observed that this ratio has a value of 5a-5a similar to the other mosques and that the ratio between them is 1 (Figure 3.33) (Table 3.10).

Table 3.11 Kayseri Kurşunlu Mosque cross-section modular analysis

Kayseri Kurşunlu Mosque Cross-Section Dimensioning	Main Wall Height	Dome Height	Interior portico space (dome-column) Height	Exterior portico space (sloped roof-column) Height
VALUES	14a	9a	12a (4a-8a)	8a (2a-6a)

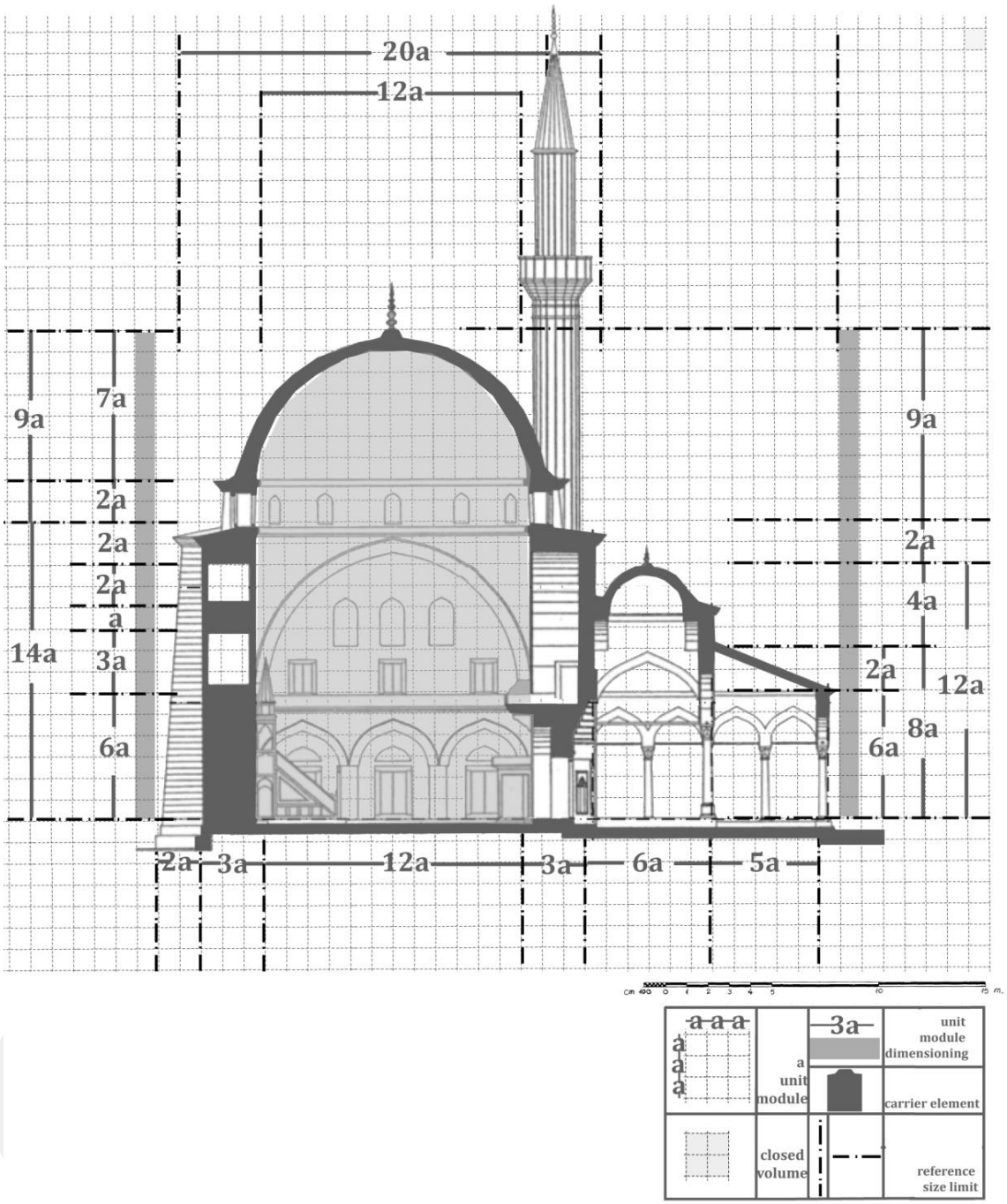


Figure 3.32 Kayseri Kurşunlu Mosque cross-section modular analysis

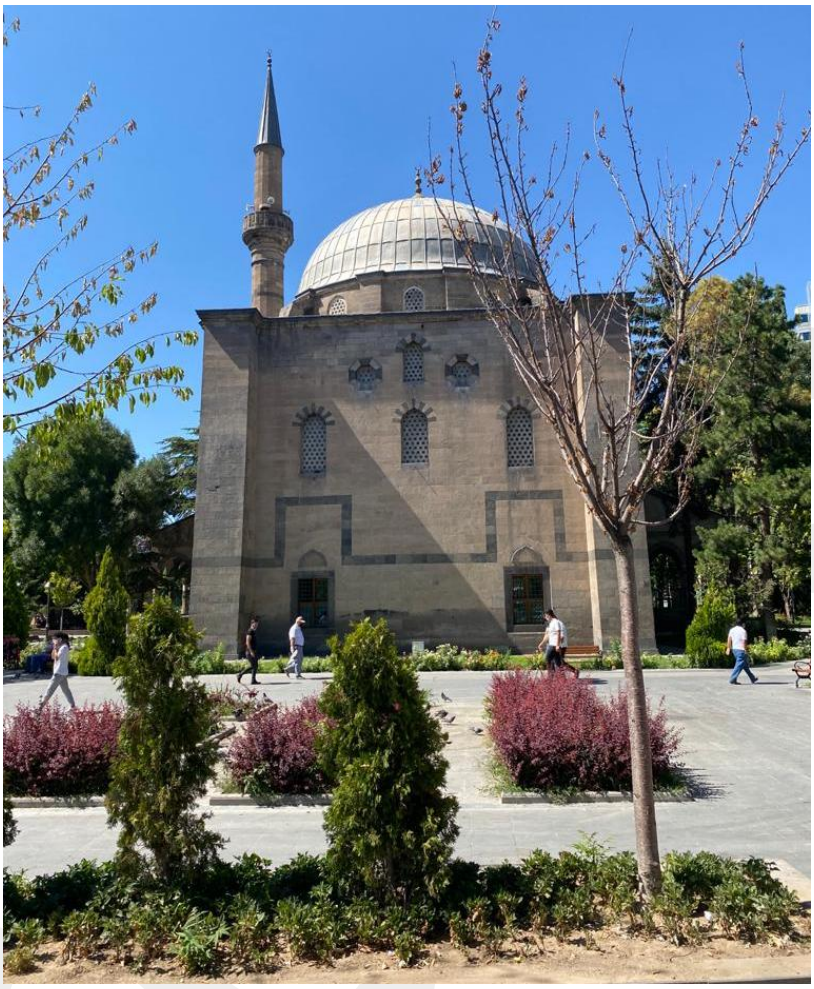
The cross-section plane is the second plane examined after the plan plane. Similar to the previous plane, the drawing obtained from the Regional Directorate of Foundations has been abstracted. The abstracted drawing was placed on the unit module foundation. The drawing is formatted so that the cross-sectional surfaces come to the fore. The dimensioning of the floor plane placed on the pre-determined foundation was conducted based on the identified domainss. The values obtained according to these domains were examined (Figure 3.32).

Similar to the floor plan, the 1st and 2nd section spatial elements have been presented in the table (Table 3.11). The first of these domains is the main wall height at the main space which has a value of 14a units. Another domain is the dome height from the ending point of the main wall. The dome rim that provides transition between the wall and the dome is also present in this rural mosque and has a height of 2a units. The h eight of the dome that follows the rim is 9a units including the rim. Whereas the height values for the interior and exterior porticos were examined for the 2nd section of the communion space. These values have been examined as sub-domains of dome-column, roof-column. According to these values, interior portico dome height is 4a units while the column height is 8a units. Whereas it is observed at the exterior portico that the sloped roof has a height of 2a units and that the column has a height of 6a units. The exterior portico height is calculated as 8a units by summing up these two values.

Since the façade drawings could not be obtained for the Kurşunlu Mosque, interpretations were made using the mosque photos (Figure 3.33). The façade at the main space main wall has been raised by a 3 layered window system as is the case in other mosques. The windows at the sub-basement elevation have been lined up parallel to the surface at the larger scale compared with the other windows. While the windows above the sub-basement elevation line at the eastern and western façades have a rectangular form, they are surrounded with a pointed arch at the southern façade. It is observed at the highest elevation line that the windows have a pointed and round form and that they are smaller compared with the other windows. In the meantime, it is also observed that frame like details made of dark colored cut stone are present at the ending points of the windows along the façades. The highest elevation line of the main wall has been finished with a molding detail. Access to the dome covering the main space is by way of the dome rim starting behind the main wall. The dome rim is surrounded by windows lined up along its perimeter. The lead covered dome rests on the area with dimensions of 12.75-12.75 cm at the end point of the rim [40]. Different from the other façades, access to the Northern façade of the mosque is through the porticoed areas and there is no direct access[6]. There is a monumental crown gate right at the midpoint of the

[6] This is one of the methods that Sinan utilizes in mosque design. This is a functional solution to meet the demands in mosques which are spaces for prayer. Subject to the location of the kiblah, the southern façade with the mihrap is the kiblah wall. Entrance to the mosques is through the northern façade with the kiblah located right opposite the entrance. Accordingly, the communion space is adjacent to the northern façade that provides transition to the main space. The northern façades of the mosques are generally spared for the porticoed space since the kiblah wall will be located right across

façade. There are windows near the crown gate at the top and bottom similar to the other façades. There are two smaller doors to the northwest and northeast directions that provide access to the gathering place for women and the minaret.



the main gate when we come to the gathering space from the courtyard before reaching the main space of the mosque. This can be seen in all of the four mosques designed by Sinan. This can also be seen in other Sinan mosques with communion space.

Figure 3.33 Kayseri Kurşunlu Mosque façade photos

Chapter 4

Comparison and Evaluation of the Modular Approach in the Rural Mosques of Sinan

The 5 domed double porticoed 4 rural mosque examples designed by Sinan located at different regions of Anatolia have been examined in detail in the present study. The rural mosques selected have been stylistically considered separately in addition to their historical backgrounds. In the previous section, the mosque drawings obtained from the Regional Directorate of Foundations were abstracted followed by dimensioning based on unit module. The identified sub-domains were tabulated for each mosque including their final dimensioning values. It was aimed to facilitate a proportional comparison by emphasizing the tabulated data. In this regard, the tables that were examined separately were combined to make a comprehensive comparison among the rural mosques of Sinan.

The domains identified for the 1st Section (main space) and 2nd Section (communion space) were examined separately during proportional comparison. This was followed by a repeated comprehensive comparison. Thus, the proportions can be compared by themselves for each section in addition to carrying out a holistic analysis. Therefore, inferences can be drawn for the rural mosques in general. The domains were reevaluated in pairs for the proportional comparison to be conducted based on the identified sub-domains. Width and length values at the plan plane in addition to width and height values at the cross-section and façade planes played an important role when identifying these paired comparison subjects. As an example, the ratio of the main wall height to the window height at the cross-section plane is considered for the ratio of the main wall thickness to the window openings at the plan plane. The domains for proportional comparison were selected based on their state of coexistence at the plane. Proportional comparison was conducted since the main wall and window opening ratios

were arranged along the plan plane as full-empty. Similarly, proportional comparisons were conducted for the interior and exterior porticoes at all planes.

Abbreviations were used on the plan in order to ensure that the sub-domains identified do not take a lot of space. Width (W) and height (H) were abbreviated according to their initials since the heights of architectural elements are considered at the plan plane while heights are examined for the cross-section and façade planes. Whereas domains with similar concepts were distinguished from each other by ordering the numerical data. As an example, the height of the main wall which is one of the main space domains was abbreviated as H.M.W. according to its initials. Similar domains such as the dome and dome rim located at the main space were ordered as D1-D2 according to the magnitude of the numerical data. Whereas the width of the interior and exterior porticos for the 2nd Section which is the communion space were abbreviated as W.I.P - W.O.P. As an exception, main wall thickness which is one of the domains of the main space at the plan plane was abbreviated as T.M.W. All domains were examined together with their abbreviations subject to their presence at the plan, cross-section and façade planes (Table 4.1).

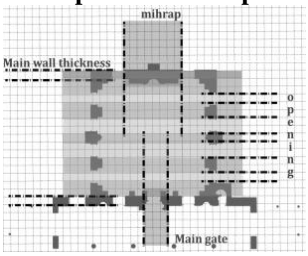
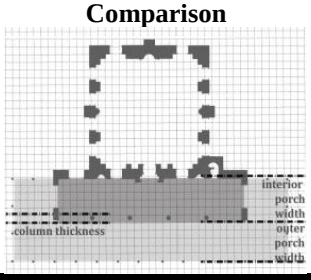
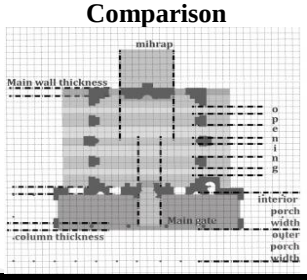
Table 4.1 Abbreviations for the identified comparison domains

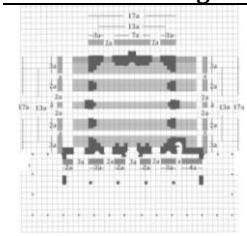
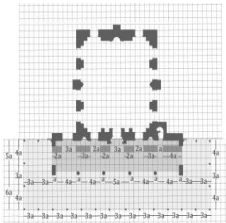
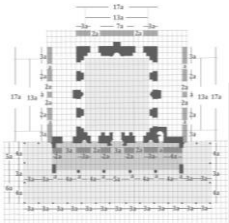
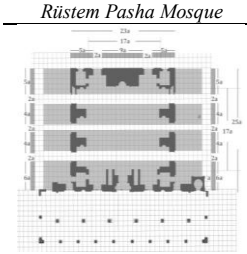
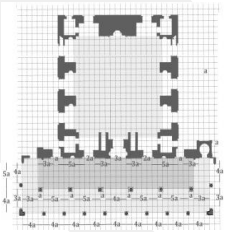
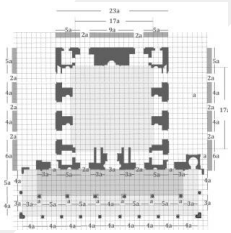
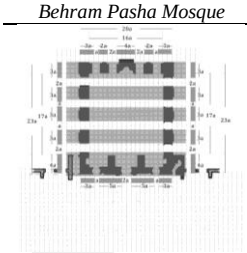
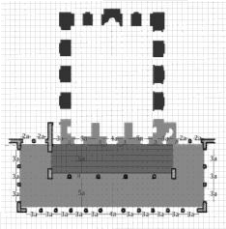
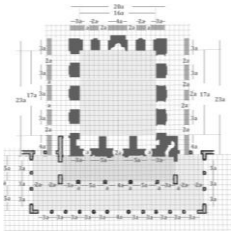
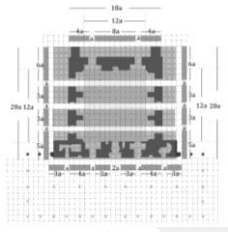
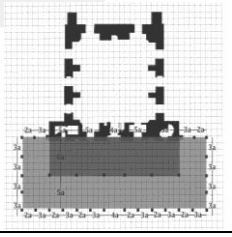
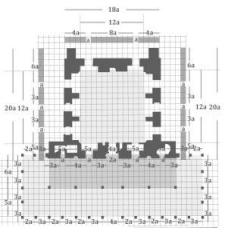
	Topics reviewed	Abbreviations
Plan	Main place Thickness	**T.M.S**
	Opening Width	**W.O**
	Main Gate Width	**W.M.G**
	Mihrap Width	**W.M**
	Interior Portico Width	**W.I.P**
	Outer Portico Width	**W.O.P**
	Main place Width	**W.M.S**
	Narthex Width	**W.N**
Section	Main place Height	**H.M.S**
	Dome Height	**H.D1**
	Dome Pulley Height	**H.D2**
	Interior Portico Height	**H.I.P**
	Outer Portico Height	**H.O.P**
	Portico Dome Height	**H.P.D**
	Portico Pitched Roof Height	**H.P.R**
	Narthex Height	**H. N**
Facade	Opening Width	**W. O**
	Opening Height	**H. O.**
	Interior Portico Width	**W. I.P**
	Interior Portico Height	**H.I.P**
	Outer Portico Width	**W. O.P**
	Outer Portico Height	**H. O.P.**

The rural mosques considered at the plan, cross-section and façade planes were examined separately according to the identified domains. The domains abbreviated to improve legibility were examined together with the dimension data for their own planes. The 4 rural mosques selected at the 3 planes of plan, cross-section and façade were considered together when preparing the comparison tables. Each plane was subject to a comprehensive analysis in different tables. The 1st section (main space), 2nd section (communion space) and both spaces as 1st-2nd sections were analyzed together with their sub-domains. The parts considered for each section were indicated clearly on the drawings. Scaling was made for each of the sections of each mosque which were made comparable. The data were organized based on the scale data on the drawings. The numerical value of each proportion obtained from each domain was inscribed. The approximate values of these data were also collected under the table. Thus, interpreting the data was simplified.

The identified sections were first examined for each of the four rural mosques based on the sub-domains. The identified sections were illustrated on the Rüstem Pasha Mosque floor plan in order to illustrate the locations that they represent on the floor plan. The abstracted floor plans were included in the table for the 1st Section after which the 2 domains were compared proportionally. The first of these is the ratio of the width of the main door to the width of the mihrap. A total of 4 different values were obtained for each of the 4 rural mosques as a result of the proportional comparison. Even though these values were not very distant from each other, it cannot also be stated that they are similar. Another domain was the ratio of the thickness of the main wall (T.M.W) to the width of the openings (W.O). The value of 1 was generally obtained for the data but values ranging between 0.5-2 were also obtained. It can be stated that the thickness of the main wall and window opening values have equal proportions for all the mosques included in the study except the Behram Pasha mosque (Table 4.2).

4.2 Proportional comparison table at the plan plane

Region 1 Proportional Comparison	Region 2 Proportional Comparison	Region1-2 Proportional Comparison
		

Region 1 Dimensioning	W.M.G/ W.M	T.M.S/ W.O	Region 2 Dimensioning	W.I.P/ W.O.P	Region 1- 2 Dimensioning	W.M.S/ W.N
 *Rüstem Pasha Mosque*	**3a/7a**	**a/a** **a/2a**		**5a/5a**		**17a/11a**
	0.42	1 -0.5		1		1.54
 *Behram Pasha Mosque*	**3a/9a**	**a/2a**		**4a/4a**		**25a/9a**
	0.33	0.5		1		2.77
 *Pertev Pasha Mosque*	**2a/ 4a**	**2a/a** **2a/2a**		**5a/5a**		**23a/11a**
	0.5	1-2		1		2.09
 *Kurşunlu Mosque*	**2a/ 8a**	**a/a**		**5a/5a**		**20a/11a**
	0.25	1		1		1.8
Approximate values	0.4 / 0.3	1 / 2		1		2
	0.25 / 0.5	0.5				3

The ratio of the width of the interior portico (W.I.P.) to the width of the exterior portico (W.O.P.) was examined for the region including the 2nd section which is the communion space. The distance from the interior portico columns to the main gate entrance and the distance from the outer portico columns to the interior portico columns

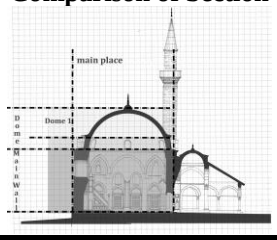
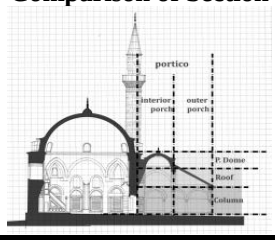
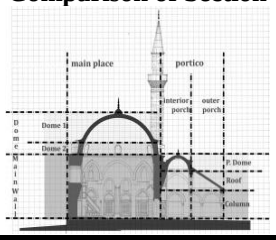
were compared proportionally under this domain. Values of 4a and 5a were observed in the dimensioning values on the floor plan. However, it is observed that all 4 mosques are divided into two equal parts when considered from a proportional perspective. Accordingly, the widths of the sections between the consecutive portico columns are equal for the 4 rural mosques included in the study.

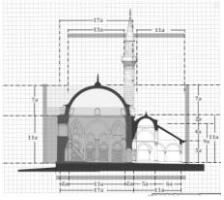
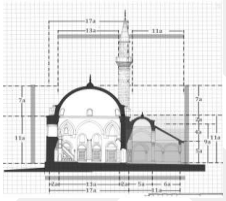
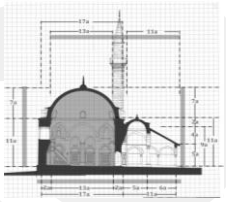
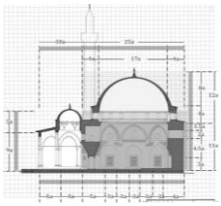
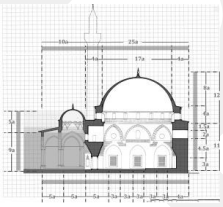
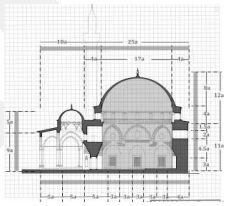
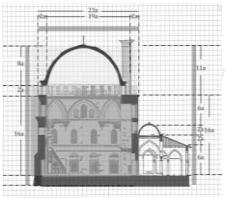
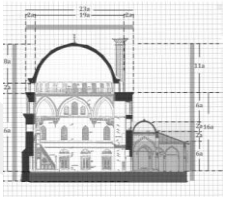
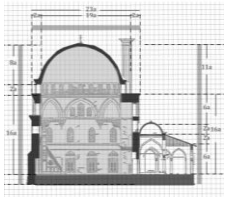
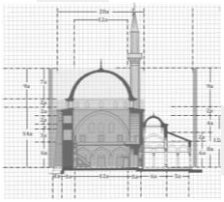
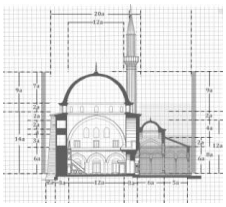
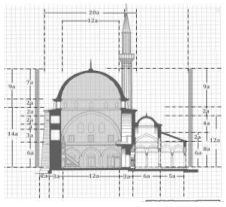
Finally, sections 1 and 2 were examined in a comprehensive manner. Here, domains for which proportional comparison can be made were first compared rather than the specialized domains. Accordingly, it is the ratio of the width of the main space (W. M.S.) in the floor plans to the width of the last congregation place (W.N.). The data were examined based on the dimensions on the floor plans. The values of the data were rounded up to the nearest integer with the approximate value provided below the table. Accordingly, the values of 1.54, 2.09, 1.8 were rounded up to the integer of 2 whereas the value of 2.77 was rounded up to 3. It can be stated that the while the main space of the Behram Pasha mosque is about 3 times greater than the communion space, it is 2 times greater in the other three mosques.

Mostly common points were obtained when the data were compared proportionally for the sections examined at the plan plane. However, no common value was obtained except the Behram Pasha mosque under two of the four proportional comparison domains.

The cross-section locations of the four rural mosques examined at the cross-section plane are comprised of cross-sections passing through both the main space and the communion space. Thus, the comparison of 2 sections along the identified 3rd section and the dimensioned cross-section drawings were combined in the table. The areas to be examined for each section have been schematically expressed on the Rüstem Pasha Mosque cross-section. The identified domains were tabulated together with the dimension values and the values determined were rounded up to the nearest integer and presented below the table.

Table 4.3 Proportional comparison table at the cross-section plane

Region 1 Proportional Comparison of Section	Region 2 Proportional Comparison of Section	Region1-2Proportional Comparison of Section
		

Region 1 Dimensioning	H.D2 /H.D1	H.D./ H M.W	Region 2 Dimensioning	H P.D/ H. P.R	H.O.P. /H I.P	Region 1- 2 Dimensioning	H.M.S/ H.N
 *Rüstem Pasha Mosque*	**2a/ 5a**	**7a/11a**		**2a/4a**	**9a/11a**		**18a/11a**
	0.4	0.63		0.5	0.81		1.63
 *Behram Pasha Mosque*	**4a/ 8a**	**12a/ 11a**		**2a/a**	**10a/14a**		**23a/14a**
	0.5	1.09		2	0.71		1.64
 *Pertev Pasha Mosque*	**2a/ 8a**	**11a/ 16a**		**2a/2a**	**8a/10a**		**26a/10a**
	0.25	0.6		1	0.8		2.6
 *Kurşunlu Mosque*	**2a/ 7a**	**9a/ 14a**		**2a/2a**	**8a/12a**		**23a/12a**
	0.33	0.6		1	0.66		1.91
Approximate values		0.6		1 2	0.7		2
		1		0.5	0.8		3

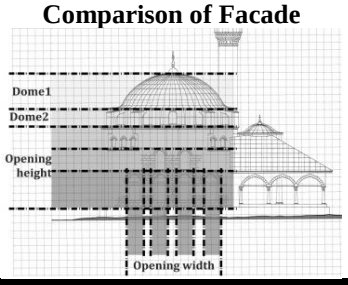
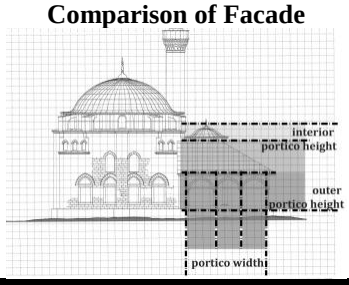
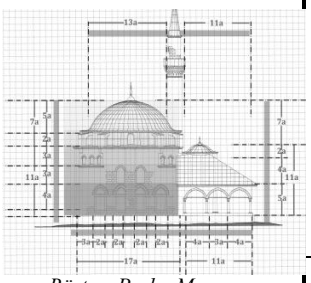
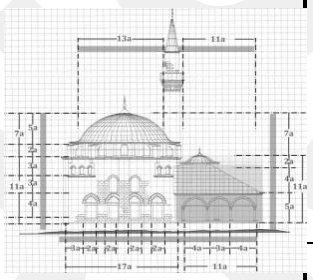
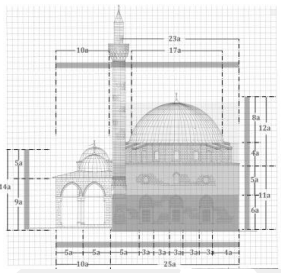
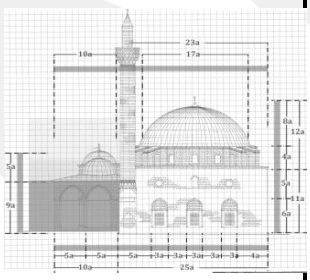
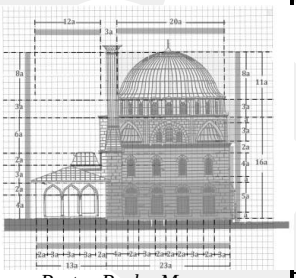
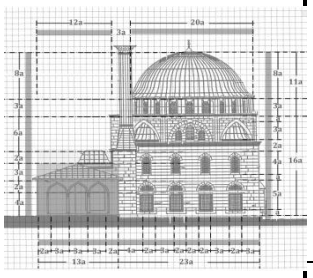
The values obtained by way of proportional comparison under 2 domains at the main space that is the 1st section were tabulated. The first of these is the ratio of the height of the dome rim (H.D2) to the height of the dome above (H. D1). Four different

values were obtained for each of the four mosques. However, dome height of 2a unit values were observed in all of the three mosques. Another domain that carries out a holistic comparison for the main space is the ratio of the height of the dome (H.D) to the height of the main wall (H.M.W). Two values are obtained here when the obtained results are rounded up to a integer. While the result for the Behram Pasha mosque was 1, it was 0.6 for the other three mosques. Accordingly, it was observed that while the main wall height is 10 units in all three mosques, dome height was 6 units.

Two domains were compared proportionally in the 2nd section which is the porticoed communion space. The first of these comparisons is the ratio of the height of the dome over the interior portico (H.P.D) to the sloped roof over the exterior portico (H.P.R). Three values of 0.5, 1 and 2 were obtained as a result of the proportional comparison. Even though a common value could not be obtained, it was determined that the height of the interior portico dome is 2a units in all four mosques. The second domain for the comprehensive analysis of the communion space was the ratio of the height of the outer portico (H.O.P) to the height of the interior portico (H.I.P). It was observed that the proportions were compared and rounded up to the nearest integer that Rüstem Pasha and Pertev Pasha mosques have a value of 0.8 while the Behram Pasha and Kurşunlu Mosque have a value of 0.7. A general opinion could not be formed despite the fact that the obtained results are close to each other.

Similar to the plan plane, the two sections were examined under a comprehensive domain. While the width value in the plan plane, the ratio of the height of the main space (H.M.S) to the height of the last congregation place (H.N) in the section plane was examined. The dimensioned drawings were rounded up to the nearest integer after proportioniong. Accordingly, while the ratio of 3 units is seen in the Pertev Pasha mosque, the height ratio has reached 2 in other mosques. It can be stated that the main wall height is generally about twice 2 times greater than the dome for the mosques examined (Table 4.3).

Table 4.4 Proportional comparison table for the façade plane

Region 1 Proportional Comparison of Facade				Region 2 Proportional Comparison of Facade		
						
Region 1 Dimensioning	**W.O / H.O**	**H.O/ H.M. W**	**H.D2 / H.D**	**Region 2 Dimensioning**	**W.I.P. / H.I.P**	**W.O.P / H. O.P**
	**2a/ 4a**	**4a/ 11a**	**2a/ 7a**		**4a/ 11a**	**4a/ 9a**
Rüstem Pasha Mosque	0.5	0.36	0.28		0.36	0.44
	**3a/ 6a**	**6a/ 11a**	**4a/ 12a**		**5a/ 14a**	**5a/ 9a**
Behram Pasha Mosque	0.5	0.54	0.33		0.35	0.55
	**2a/ 5a**	**5a/ 16a**	**3a/ 11a**		**3a/ 11a**	**3a/ 9a**
Pertev Pasha Mosque	0.4	0.31	0.27		0.27	0.33
Approximate values	0.4 0.5	0.3 0.5	0.3		0.3	H=9

Finally, proportional comparisons based on the façade drawings were tabulated (Table 4.4). The operation at the plan and cross-section planes was observed when preparing this table. However, the values of only sections 1 and 2 were compared proportionally and examined since the height data were compared at the cross-section plane. Façade drawings including both sections were selected from the façade drawings

thereby providing the means for a more comprehensive comparison. The domains determined for each of the two regions have been illustrated schematically on the Rüstem Pasha façade drawings.

A total of 3 domains were proportionally compared at the 1st Section including the main space after which the data were tabulated. The first domain is the ratio of the width of the window openings (W.O.) to the height (H.O.). The window opening examined at the horizontal plane for the floor plan was considered here together with the height. Based on the obtained values, while the height was 10 units for the Pertev Pasha mosque while the width is 4 units. Whereas the height was 10 units for the other 3 mosques while the width was 5 units. Accordingly, it can be stated that the floor window height is about twice the width in the rural mosques examined. Whereas the second domain is the ratio of the window height (H.O.) to the height of the main wall (H.M.W.). Approximate values of 0.3 and 0.5 were obtained as a result of the proportional comparison. While the ratio of 0.3 was observed in the Rüstem Pasha and Pertev Pasha mosques, the ratio of 0.5 was obtained for the other two mosques. Hence, this domain did not include any generalizable factors. The ratio of the height of the dome rim (H. D2) to the height of the dome (H.D) was the last domain considered for this section. A result of 0.3 was obtained for all four mosques when the proportion based on the measurement data were rounded up to the nearest integer. Based on the acquired findings, while the height of the dome rim was 3 units for the rural mosques examined, dome height was 10 units.

Finally, two domains were examined for the 2nd section examined which were then examined. One of these domains is the ratio of the width between the interior portico columns (W.I.P) to the height from the floor to the dome (H.I.P). A ratio of 0.3 was obtained for each of the four mosques. It can be stated that if the interior portico width is 3 units for the four rural mosques examined, the height is 10 units. Whereas the final domain is the ratio of the width between the columns of the outer portico (W.O.P) to its height (H.O.P). Contrary to the other domain, a common value could not be obtained when the data were tabulated. Different values were obtained for all of the four mosques. However exterior portico height was obtained as 9a units for all.

The rural mosques examined in 3 sections on 3 different planes were compared both within themselves and between each other. Many different methods were utilized

simultaneously in order to make a general interpretation based on these comparisons. Characteristics were considered as common if they were present in at least three out of the four mosques. Analysis subjects with no common values were not evaluated. Net expressions cannot be used since the obtained data are approximate values, however it was aimed to bring forth a general interpretation to Sinan's rural mosques and particularly the four rural mosques examined. In conclusion, a total of 10 common domains were obtained for the four rural mosques as indicated below (Table 4.5)

- Main wall thickness is generally equal to the window openings. (Different from the rural mosque examples, main wall thickness is half of the window openings in the Behram Pasha Mosque)

- The distances between the portico columns at the communion space have equal values.

- The width of the main space is twice the width of the communion space.

(It is 3 times greater in the Behram Pasha Mosque.)

- Dome rim height is generally 2a units.

(It is 4a units in height in the Behram Pasha Mosque.)

- The ratio of the dome height to the main wall height is 3/5 units. (This value is close to 1 only for the Behram Pasha Mosque in all four mosques examined.)

- Interior portico dome height is 2a units.

- Window height is generally twice the width. (In the rural mosques examined, window height is 0.4 only for the Pertev Pasha Mosque.)

- The ratio of the dome rim height to the dome height is 3/10.

- The ratio of the width between the interior portico columns to the dome height is 3/10.

- The height of the exterior portico from the floor is 9a units.

Table 4.5 Result comparison table

	Rüstem Pasha Mosque (Tekirdağ-1553)	**Behram Pasha Mosque** (Diyarbakır-1564)	**Pertev Pasha Mosque** (İzmit-1579)	**Kurşunlu Mosque** (Kayseri-1585)
T.M.W/ W.O	**1**	**1/2**	**1**	**1**
W.M.S/W.N	**2**	**2**	**2**	**2**
H.D2	**2a**	**2a**	**2a**	**2a**
H.D/H.M.W	**3/5**	**1**	**3/5**	**3/5**
H.P.D	**2a**	**2a**	**2a**	**2a**
H.O./W.O	**2**	**2**	**2**	**2**
H.D2/H.D1	**3/10**	**3/10**	**3/10**	**3/10**
W.I.P/H.I.P	**3/10**	**3/10**	**3/10**	**3/10**
H.I.P	**9a**	**9a**	**9a**	**9a**

Proportional comparisons were made for the rural mosques subject to modular analysis. The data in all three planes were collected and tabulated. Numerical data were included in the tables based on the presence in the respective mosques. It was observed that while integer values are obtained for the width ratios for the 10 items at the plan plane, the height data generally did not come out as integers. In the meantime, it was also observed that the Behram Pasha Mosque is proportionally different from the other mosques. Even though values that are proportionally close to the common value have been obtained, certain domains were observed to differ. Accordingly, the presence of modular system was identified in Sinan's single dome five dome double portico mosques that were analyzed. The information was verified through the acquired numerical data.

Chapter 5.

Conclusion And Future Prospects

5.1 Conclusion

The rural mosques of Master Sinan are mosques that are relatively less known compared with the selatin mosques which has led to fewer number of studies. Sinan's selatin mosques have been built in and around Istanbul due to many commercial, social, economic and other related factors in addition to the strategic location of Istanbul. In addition, it has also played a distinctive role that Istanbul was the city which can provide rapid and easy solutions to problems related with the materials used in the construction of these largescale Ottoman classical period mosques, transportation and procurement. It is observed that the *selatin* mosque examples built in and around Istanbul are based on a configuration that can be defined as Sinan design. This design configuration can be recognized by way of many factors such as spatial formation, ordering of the transitions between the spaces, materials selected for dividing the spaces, window dimensions, distribution of light and sound inside the mosque or the shape of the dome. Accordingly, many studied have been conducted and are currently being carried out for emphasizing the design configuration of Sinan. However, the number of works in the examples of provincial mosques built outside of Istanbul, which was designed by Sinan, remains less. The rural mosques were located at spaces defined as the central points of Anatolian cities during the time of their construction. With regard to scale, they are much smaller compared with the selatin mosques. The design of the rural mosques that stand out with their modest identities have been made by Sinan and it is known that he has taken part in the construction of some of these mosques while the construction for others have been completed under the guidance of Sinan. Spatial reading through these rural mosques designed by Sinan will make a significant contribution to the interpretation of the larger scale works thus reinforcing efforts to bring out Sinan's architecture even further. In this context, the rural mosques of Sinan have been examined.

The number of written sources belonging to the period in which Mimar Sinan lived is less than today's sources. The primary resources that have reached our day are manuscripts on Sinan and his works. The data acquired from these manuscripts have been listed in Kuran's book entitled Master Sinan and the mosques by Sinan have been indicated subject to their provinces of registration based on the manuscripts. Even though the exact number is not known for sure, it is estimated that Sinan has built and repaired over 470 works during the classical Ottoman period [42]. The number of single domed mosques that have been attributed to Sinan is 27. These mosques can be classified into three groups as three, five and nine domed based on the number of porticos. Among these, there are 18 five domed mosques 6 of which have double porticos. These mosques can be listed in order of their construction years as; Tekirdağ Rüstem Pasha Mosque, Halep Dukakinzade Mehmed Pasha (Adliye) Mosque, Diyarbakır Behram Pasha Mosque, Greece Trikkale (Tırhala) Osman Şah Mosque, İzmit Pertev Pasha (Yeni cuma) Mosque, Kayseri Hacı Ahmet Pasha (Kurşunlu) Mosque. Of these 6 mosques, 4 are located in Anatolian provinces while 2 are abroad. A total of four mosques were included in the study in order to ensure a controlled execution and fast data acquisition. A total of four Sinan mosques with single dome, five domes and double porticos constructed at different Anatolian cities have been included in this study.

Attention was paid to ensuring that the number of rural mosques by Sinan included in the study is more than one and that they are selected from different cities. More than one examined rural mosques were included in the study in order to examine the systematic behind the Ottoman period works of art by Sinan and his design configuration. Thus, a framework for comparison was established by emphasizing the similarities or differences in the design configurations, techniques and aesthetic approaches utilized in the design by Sinan for mosques located at different cities. It was aimed to interpret the data for a large number of examples and to ensure that the acquired findings are more accurate. In the meantime, the mosques included in the study were selected from different time periods because we were of the opinion that examining the different domains used for identifying a structure as Sinan design through the analysis of different examples.

The four examined rural mosques included in the analysis were subject to an in-depth analysis with regard to different subjects such as history, materials and techniques utilized, spatial configuration, climatic, static, spatial elements and façade configuration. For these analyses, historical data were first provided after which the prominent aspects of the architecture of the mosque were illustrated through drawings and photographs. At first it was aimed to shoot the photos to be included in the study during on-site observations, however this could not be done due to the pandemic. Thus, photos obtained from the Regional Directorate of Foundations were used for the mosques included in the study. The axis utilized by Sinan in rural mosques with passage from the courtyard to the communion followed by the main space was examined and the architectural aspects of the mosques were thus analyzed in three stages which were evaluated together with the visuals. In this regard, the four single domed rural mosques of Sinan were considered separately. It was aimed to provide a foundation to the modular analysis through the detailed examination of the architectural attributes of the mosques.

It can be observed when the architectural characteristics of the structures are examined that the mosques are comprised of open, semi-open and closed spaces. The courtyard is located outside as open space where there is greenery in addition to various spatial elements such as fountain etc. Transition is made from the open space to the semi-open space and from there to the porticoed communion space surrounded by columns. This transition axis is a common attribute of Sinan's design configuration and can be observed in all of the four rural mosques included in the study. Accordingly, the mosques were examined separately and as a whole by way of these sections during the spatial analyses conducted. It was observed that the spatial forms were examined that the main space of the selected mosques are rectangular but resemble a square, while the communion space is positioned between a rectangular courtyard and main space. The communion space is located adjacent to the northern main wall of the main space with the porticoed space rising above the main wall. The reason for this is the presence of the main gate on the façade due to the fact that the kiblah wall and mihrap wall are located at the southern façade. Thus, the kiblah direction was kept in the direction of the entrance and the axis of all users is gathered in one direction. The main gate that verifies this central system is located at the center of the northern main wall. In this way, it is able to direct the functioning of both the main space and the communion space.

Similarly, the mihrap wall is located right across the main entrance gate in all four mosques and is located at the center of the southern main wall. It has been observed in the mosques included in the study that the window openings and the southern main wall continue at the starting and ending points of the mihrap wall. Moreover, while window openings are located along the same axis on the eastern and western main walls with the same dimensions, this systematic order was not observed in the northern and southern façades. In short, these conclusions were drawn when the architectural attributes of the four mosques were considered with regard to the main space.

While it was observed as a result of the spatial analyses conducted on the communion space that it is located in all four mosques in two sections: one with a portico and one without a portico. Subject to the classification of the mosques examined within the scope of the study, the porticoed spaces are five domed with two porticos. The porticoed space is located at the interior and is surrounded by noktasal bearing columns in different forms. The section outside the interior porticoed space is surrounded by sequential bearing columns from outside the perimeter of the main space of the mosques which are greater in number compared with the interior columns. While the interior porticoed space is covered with a dome, the outer portico space is covered with a sloped roof. In short, the interior and exterior porticoed spaces at the communion space are formally comprised of two nested rectangular parts. In addition, the bearing columns continue along the boundary directions of the rectangle contrary to the main walls in the main space. This in turn transforms the communion space into a semi-closed space that is different than the main space.

The analyses conducted are results obtained from the plan plane and it was identified as a result of a three-dimensional analyses that the mosques are made up of 3 layers. These layers are; main wall, dome rim and dome. It is observed that the dome rim continues onwards from the end point of the main wall at layers with different elevation levels which are completed at the end by the dome. The dome rim makes up the interphase in the transition from the main wall to the dome. It has been observed in the mosques examined that the window openings on the main walls are comprised of 3 layers. Here, the window dimensions decrease as we move upwards. Whereas formally the windows have rectangular dimensions at the ground level while at the intermediate level they are rectangular and surrounded by arches and in circular form at the final

layer. They are also surrounded systematically along the dome rim that starts at the end point of the main wall. There is no gap at the dome but it has been observed in some cases that it is coated with lead due to some periodical requirements. The domains obtained as a result of the spatial analyses on the four rural mosques included in the study have been listed. The results obtained from modular analyses were also included in order to reconsider the analyses based on the already present attributes and reinterpret them.

The data obtained as a result of examining the dimensions and forms of spatial elements such as the main wall, portico, column, structural openings and mihrap in the present study conducted to emphasize the spatial characteristics of Sinan's rural mosques have played an important role in directing the process. It was aimed to put forth the present order through the utilization of numerical data together with the interpretations based on the architectural characteristics of the selected mosques. Accordingly, a common foundation was developed which was analyzed for each mosque separately after which comparative analyses were conducted. This foundation plan was developed by utilizing the data in the 3 planes of plan, façade and cross-section.

The mosques were first separated into 2 sections of main space and communion space for further analyses after having access to their floor plans. It was observed that the main walls continuing in the main space is one of the important elements regarding the shaping of the space in all three planes. Accordingly, it was identified that the unit module of the foundation has been determined by taking as reference the direction that the continuous wall follows. This module has been defined as "a" and the foundation was formed by multiplying the "A-A" modular system. The separate reference directions were identified for each plane in order to place the developed foundation in the mosques in a systematic manner.

- The boundaries and dimensions of the bearing elements and

- The position and dimensions of the spatial elements

played an effective role in identifying these reference directions. The identified reference directions were evaluated separately under different domains in the plan, cross-section and façade planes after which they were included in all four rural

mosques. The domains to be used for comparison were then determined in order to compare the drawings placed according to these directions. Dimensioning was conducted based on the unit module on each plane subject to the domains to be considered. The mosques were examined based on both the interior and exterior surfaces during dimensioning. The analysis was made possible by rendering the analyzed mosques more legible through the common modular system.

The developed modular system was worked on each of the three planes of the four mosques included in the study after which each domain was evaluated separately. The numerical data obtained as a result of the modular analysis of the mosques were tabulated and presented for all mosques and planes. These data were not only evaluated separately for each mosque but were also combined. Sub-domains were generated while collecting the data in order to carry out propositioning using the identified domains. The mathematics of the order in the four rural mosques examined was uncovered due to proportional comparison. The common data observed in all mosques were tabulated after the propositional analysis. Thus, it was aimed to verify the spatial attributes that we consider as the rural mosque architectural configuration of Sinan through numerical data.

The results obtained from the proportional analysis of the mosques subject to modular analysis were tabulated and evaluated in three planes of plan, cross-section and façade. Since the plan plane enables comparisons in two dimensions, thickness and size proportioning was performed. Whereas three dimensions of the spatial elements were included in the cross-section and façade planes. The height data was naturally used in these planes. While the dimensions of elements such as walls, windows and doors can be proportioned in the plan plane, the heights of these elements could be proportioned in the cross-section and façade planes. That is, while the plans provide analysis opportunities at the x-plane, the planes of y and z were also included in the façade and cross-section planes thus enriching the comparison framework.

The data obtained as a result of the proportional comparisons at the plan plane were presented as a list of items. The common aspects present in at least three of the rural mosques of Sinan were combined when identifying these items. Thus, majority data were analyzed in order to talk about a design configuration for mosques. The results obtained from the plans of the four rural mosques of Sinan were as follows;

- The main wall thickness is generally equal to the window openings.

  (It is only half the value in Behram Pasha Mosque.)

- The sections between the sequential portico columns at the communion space have equal values.

- The width of the main space is twice that of the communion space.

  (It is 3 times only in the Behram Pasha Mosque.)

In addition, it was also observed in all of the four mosques that the interior space dimensions are square in size but that they resemble a rectangle when examined together with the exterior dimensions. This is considered to be due to the fact that the fragmental main walls in the main spaces of the mosques extend inwards in some examples and outwards in others. As a result of these extensions, while the main space interior dimensions are in the form of a square, they may resemble a rectangle when considered together with the exterior dimensions. These data obtained as a result of the comparisons were not included in the results section.

Many different results were obtained as a result of the proportional comparisons at the cross-section and façade planes. However, only the common factors observed in at least three of the four mosques were evaluated as a result which was also the case for the plan plane. These were classified under 5 different items as;

- The dome rim height is generally 2a units.

  (Only the Behram Pasha Mosque has a dome rim height of 4a units.)

- The ratio of the dome height to the main wall height is 3/5 units.

  (This value is close to 1 only in the Behram Pasha Mosque.)

- The interior portico dome height is 2a units.

- The ratio of the dome rim height to the dome height is 3/10 units.

- The height of the exterior portico from the floor is 9a units.

The data for the main space and communion space were evaluated and listed together. Contrary to the plan plane, the proportional data obtained here were not obtained as integer values. The inclusion of the height data played an important role in this.

While the data at the plan plane include width, thickness proportioning; the data for the cross-section and façade planes is the height proportioning. The common aspects of the width and height proportions of the analyzed mosques were identified and listed. These items were classified in 2 domains as;

- The height of the window is generally twice its width.

  (Different from this, the value is 0.4 for the Pertev Pasha Mosque.)

- The ratio of the width of the interior portico columns to the dome height is 3/10.

Proportional similarities were also observed for other spatial elements; however, they were not included in the findings since they were limited to the specific ratio.

5.2 Societal Impact and Contribution to Global Sustainability

The fact that the mosques examined within the scope of the study survive from the past to the present and are actively used in their surroundings make these structures monumental. The impact of such important values on the environment and the people who experience it has become more important. It is aimed to increase the sharing environment and awareness by ensuring the continuity of this value. In this context, provincial mosques, which can be defined as "rare" compared to other small-scale works, are discussed within the scope of the thesis. The impact of the works carried out through rural mosques and their contribution to sustainability will be greater than the scale of the building. It is aimed to highlight the knowledge of these mosque examples located in areas close to rural areas rather than metropolitan cities. In order to contribute to the sustainability of cultural heritage, the mosques were reviewed and re-examined with the parameters of the period we live in. Thus, the working floor was expanded and handled in a versatile way.

Data for the rural mosques of Sinan were presented in the present study and it was aimed to increase legibility through the mutual foundation in order to put forth the presence of the emerging design configuration. Numerical data such as proportions, module and modular systems were used in order to increase legibility. Comparison of mosque samples in terms of quality and quantity was made with these data. The use of these numerical methods has been applied in different studies until today and they continue to be applied. Accordingly, it is aimed to contribute to the sustainability of the method in historical buildings with the use of these methods. In the continuation of the study, the data in the mosques were revealed through the determined parameters. This numerical data was taken into consideration and how the design setup and functioning was interpreted.

The data obtained as a result of the study have put forth that the modular system has been used in the single domed five domed double porticoed mosques of Sinan. Analyses were conducted by way of the mosques subject to spatial reading and analysis with the numerical data subject to proportioning as a result of which the presence and general positioning of the data were examined. It was thus verified that the design is based on the modular system since common proportional values have been obtained as a result of these analyses. It was thus confirmed through the analyses carried out within the scope of the study that a design configuration is present for the rural mosque, selatin mosque and other works by Sinan.

5.3 Future prospects

Mimar Sinan designed and built numerous works during his lifetime. Among these works, especially the mosques are found in almost all of Anatolia. However, the 'selatin' mosques, which are larger in size than these works, are more known. For this reason, there are many studies on these mosques. It is located in the provincial mosques designed by Sinan on a smaller scale compared to the 'selatin' mosques. At this regard, it was aimed to highlight the existence of modest scale provincial mosques in important points of the city where they were built as part of the study. Thus, it is aimed to be beneficial in researches to be made through these provincial mosques.

The examples of mosques built in different periods and located in different cities, designed by the same architect, were examined together and separately. This provincial mosque data has been reconsidered and interpreted from a different perspective. Thus, the environment for comparison of the buildings whose architects are the same but different in environmental, cultural, economic and climatic terms was created. Based on the comments, Sinan's design and the fictional logic were investigated while designing. Thus, Sinan offers a suggestion for future research to reconsider the design fiction based on different factors. These recommendations, regardless of a single title, should be diversified and drawn in different directions.

Sinan's works, and especially his mosques, are a very comprehensive subject, but they are dealt with in many disciplines. Examining Sinan's provincial mosques through numerical parameters offers diversity depending on other branches and scopes. Modular analyzes made on mosque parameters can be developed and reconsidered in future research. At the same time, Sinan's other mosques and works can be further examined with modular analysis. With the data obtained here, comments on how Sinan's design setup is can be clarified.

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SELECTED PUBLICATIONS AND PRESENTATIONS

J1) Parlak Biçer, Z. Ö., Çopuroğlu, H., Hasözhan, M., Aksoy, Z., 2017, "A Study on the Analysis of the Kurşunlu Mosque and Works of Architect Sinan", Intercultural Understanding, Vol.:7, pp: …….., Mukogawa Women's University, Institute of Turkish Culture Studies, ISSN 2186-2559 (will be published)

J2) Parlak Biçer, Z. Ö., Çopuroğlu, H., Hasözhan, M., Aksoy, Z., 2017, "Geleneksel Yapı Malzemeleri Üzerinden Maliyet Hesaplama;Mimar Sinan Kurşunlu Cami", Erciyes Üniversitesi Fen Bilimleri Enstitüsü

J3) Parlak Bicer, Z. Ö., Çopuroğlu, H., Hasözhan, M., Aksoy, Z., 2017, "A Study On The Structural Analysıs Of Fıve Similar Mosques Of Archıtect Sınan" iste-c Proceedings Book, International Science and Technology Conference

J4) Parlak Bicer, Z. Ö., Çopuroğlu, H., Hasözhan, M., Aksoy, Z., 2017, "A Study On The Structural Analysıs Of Five Sımılar Mosques Of Archıtect Sınan" iste-c Proceedings Book, International Science and Technology Conference, iste-c 2017,

J5) Parlak Bicer, Z. Ö., Demirel, A., Özdemir, T., Çopuroğlu, H., Ulutürk, B., Dursun, H., Hancı, M. M., Yavilioğlu, R., Murakhas, E., 2016, "Mimari Bürolardan Hizmet Alan Müşterilerin Karşılaştıkları Mimari Bürodan Kaynaklanan Sorunlara Yönelik Alan Çalışması; Kayseri", iste-c Proceedings Book, International Science and Technology Conference, iste-c 2016, 13-15 July, Vienna, Austria, ISSN 2186-2559

J6) Parlak Bicer, Z. Ö., Çopuroğlu, H., Hasözhan, M., Aksoy, Z., 2017, "A Study on the Calculation of the Material Cost for Old Structures; Mimar Sinan Kurşunlu Mosque", The International Conference on Civil and Enviromental Engineering ICOCEE–CAPPADOCIA 2017, May 08-10, Nevsehir, TURKEY, pages:.2408-2423, round:white'>, page: 678-686, ISSN 2186-2559

J7) D1. Parlak Bicer, Z. Ö., Çopuroğlu, H., Hasözhan, M., Aksoy, Z., 2017, “A Study on the Calculation of the Material Cost for Old Structures; Mimar Sinan Kurşunlu Mosque”, Nevşehir Hacıbektaşi Veli Üniversitesi,

J8) Asiliskender, B.,Yöney, N., Çopuroğlu, H., Deringöl, T., “Hacı Kılıç (Sahabiye) Mahallesi’nde Konut; Vakıf Apartmanı”, Docomomo_Türkiye Ulusal Çalışma Grubu Türkiye Mimarlığında Modernizmin Yerel Açılımları Xıv

C1) International Science and Technology Conference, ViennA-Austria, " Mimari Bürolardan Hizmet Alan Müşterilerin Karşılaştıkları Mimari Bürodan Kaynaklanan Sorunlara Yönelik Alan Çalışması " ,(July 13-15, 2016)

C2) International Conference on Civil and Environmental Engineering, A Study on the Calculation of the Material Cost for Old Structures; Mimar Sinan Kurşunlu Mosque, (ICOCEE– Cappadocia2017)

C3) International Science and Technology Conference, America, " A study on the structural analysıs of fıve sımılar mosques of archıtect sınan " (Paper Submıssıon) (2017)

C4) Mukogawa Women's University, " A Study On The Structural Analysıs Of The Kurşunlu Mosque And Works Of Archıtect Sınan "