CONSTRUCTION TECHNIQUES OF TRADITIONAL SİVRİHİSAR HOUSES

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ABSTRACT

CONSTRUCTION TECHNIQUES OF TRADITIONAL SİVRİHİSAR HOUSES

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The aim of this thesis is to investigate and document the construction techniques of the traditional houses in Sivrihisar and to create a reliable and comprehensive information about construction techniques specific to the region. For this purpose, firstly literature review was done about conservation, the importance of authenticity and documentation, and about traditional houses in Turkey. In addition, literature and archive researches were done on the history and general characteristics of Sivrihisar, conservation works in the region, and the characteristics of traditional houses in Sivrihisar. For the field survey, 28 traditional houses, which have retained their characteristics in Sivrihisar, were selected. Out of 28 traditional houses, 14 of them were surveyed partially, and 14 of them were investigated in detail from ground to roof. Structural and architectural elements of 28 houses were investigated by sketching, measuring and photographing. After that, data collected from site survey was documented and drawings of 14 houses were prepared. Each building system elements of 28 houses were analysed and classified according to their similarities and differences by comparative assessment. Building parts from foundation to roof and the transitions between the systems were analyzed and defined. In addition, a code system was applied to the system section drawings of 14 houses. The data collected and analysed was tabulated. Thus, usage frequency of building elements and their classifications were presented on section drawings and tables systematically. At the end of the study, a general evaluation was made about the characteristics and construction techniques of traditional Sivrihisar houses.

Keywords: Traditional House, Construction Technique, Sivrihisar, Documentation

ÖZ

GELENEKSEL SİVRİHİSAR EVLERİNİN YAPIM TEKNİĞİ

Pehlivan, Ezgi
Yüksek Lisans, Kültürel Mirası Koruma
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Bu tezin amacı Sivrihisar geleneksel konutlarının yapım tekniklerini araştırmak ve belgelemek, bölgeye özgü yapım teknikleri ile ilgili güvenilir ve kapsamlı bilgi oluşturmaktır. Bu amaçla öncelikle, koruma, özgünlük ve belgelemenin önemi, ve Türkiye'deki geleneksel konutlar hakkında literatür taraması yapılmıştır. Ayrıca, Sivrihisar'ın tarihi ve genel özellikleri, bölgedeki koruma çalışmaları ve geleneksel Sivrihisar evlerinin karakteristik özellikleri üzerine literatür ve arşiv araştırmaları yapılmıştır. Arazi çalışması için Sivrihisar'da karakteristik özelliklerini koruyan 28 geleneksel konut seçilmiştir. Toplam 28 geleneksel konuttan, 14 tanesi kısmen, 14 tanesi temelden çatıya kadar detaylı olarak incelenmiştir. 28 evin yapısal ve mimari elemanları eskiz, ölçüm ve fotoğraflama yapılarak incelenmiştir. Daha sonra, arazi çalışmasından toplanan veriler belgelenmiş ve 14 evin çizimleri hazırlanmıştır. 28 konutun her bir yapı sistemi elemanı karşılaştırmalı değerlendirme yapılarak benzerlik ve farklılıklarına göre analiz edilmiş ve sınıflandırılmıştır. Temelden çatıya yapı elemanları ve sistemler arasındaki geçişler analiz edilmiş ve tanımlanmıştır. Ayrıca 14 evin sistem kesitlerine geliştirilen bir kod sistemi uygulanmıştır. Toplanan ve analiz edilen veriler tablo haline getirilmiştir. Böylece, yapı elemanlarının kullanım sıklıkları ve sınıflandırılmaları sistem kesitleri ve tablolarda sistematik olarak sunulmuştur. Çalışma sonunda, geleneksel Sivrihisar evlerinin özellikleri ve yapım teknikleri hakkında genel bir değerlendirme yapılmıştır.

Anahtar Kelimeler: Geleneksel Konut, Yapım Tekniği, Sivrihisar, Belgeleme

To my mother and father…

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INTRODUCTION

Cultural and historical heritage that include the archaeological sites, ruins, monuments, traditional buildings, urban and rural settlements reflect the knowledge of past and all aspects of society. Since they are our inherited assets, they provide information on collective identity as much as local materials, architecture and construction techniques. Tangible heritage that display the cultural identity integrate the past to future. Venice Charter states that protecting the historic monuments, which are the historic evidence of old customs, is the common responsibility of public to carry their authenticity to the future generations (ICOMOS, 1964).

Conservation of architectural heritage deals with built environment taking into consideration its cultural and social context. An architectural historian Alexander Halturin mentions that "*Historic buildings are a concrete expression of people's cultural heritage. They are products of human activity, which reflect sociological trends, national character, and 'the spirit of the time'*" (as cited in Stubbs, 2009, 4). In addition, Stubbs expressed architectural conservation that is considered as prevalent activity in the field of cultural heritage conservation as a discipline deals with "*the documentation and preservation of all forms of human culture, including tangible artifacts such as architecture, archaeological sites, cultural landscapes, arts and crafts, and other objects of material culture*" (2009, 21). Therefore, conservation of architectural heritage should consider preserving the sense of place that is constituted by the physical integrity of place, and its cultural and social meaning. Architectural heritage should be conserved to sustain and bring the distinctiveness and uniqueness to future. Conservation approach of each property alters according to its specific condition. However, conservation approach to the all architectural heritage must follow the same basic principles. These principles are listed as following by Fielden:

- Condition of building must be recorded before any intervention,
- Materials and techniques to be used during the treatments must be recorded,
- Any intervention must respect the historical evidence of building and any historical features must not be damaged, falsified, or removed,
- Any intervention to be applied must be at minimum,
- Any intervention must respect the aesthetic, historical, and physical integrity of historical building (2003, 6).

Although there is no single approach for the conservation of traditional buildings, all buildings are unique and need special intervention depending on the particular investigation and evaluation for a building together with general philosophical aspects of conservation. In order to determine and implement the efficient interventions to be applied to architectural heritage, first, the building must be analysed and understood in every aspect. At this stage, first step of the conservation of architectural heritage is documentation of the buildings and description of qualities and characteristics. Recording the buildings' physical condition, features, and characteristics together with all of their components and structure is essential in order to define the significance of object. Historical significance of architectural heritage is connected with the degree of authenticity, and values that are the main characteristics of a property. In Nara Document, it is stated that determination of authenticity of a building that is related with both its material and shape depends on the credible sources of the building's values and correct understanding of them (ICOMOS, 1994). In addition, it is mentioned that judgment of authenticity is linked to variety of sources of information that contain form, and design, materials, and substance, use and function, traditions and techniques, location and setting, sprit and feeling, and other internal and external factors. Identification and the description of values based on the documentation continue with the assessment of values that leads the determination of significance. Besides, ICOMOS Nara document (1994) states that heritage properties should be evaluated within their cultural context since the evaluation of values and authenticity is not based on predetermined standards. Therefore, values-based approach to conservation includes the recognition of various types of values and their requirements for proposed interventions.

Conservation action that involves interventions at different scale and intensity aims to safeguard the values and lifespan of historic property. It is stated that conservation mainly aims to protect the buildings, historic sites and cities considering the preservation of the authenticity and integrity of cultural property (Fielden, Jokilehto, 1993, 62). Conservation of architectural heritage aims to provide the viability of building structure and protect the buildings against the environmental threats such as earthquake, wind, fire, vandalism. It concerns preservation of the building fabric and its physical environment. During the conservation treatments in any level, authenticity that is related with the construction materials, structures and architectural techniques should be preserved as a treatments strategy. Maintaining the authenticity of historic building means to preserve the harmony of building in terms of texture, colour, form, and technique. In addition, it provides to keep the maximum amount of historical materials. Any treatment should respect the historical material, original design, and workmanship in structural system and material. Therefore, conservation treatments should consider the integrity of buildings in terms of physical, material, structural, aesthetic, design, and historical aspects.

According to ICOMOS Charter - Principles For The Analysis, Conservation And Structural Restoration Of Architectural Heritage (2003), it is essential to have well knowledge of material and structural characteristics of a building and comprehend this information. For this purpose, any intervention for the conservation of architectural heritage should be based on primarily reliable and comprehensive information on materials, construction techniques and characteristics of architectural structures that are previously collected and analysed.

1.1. Review of Studies on Traditional Houses in Turkey and Definition of the Problem

A considerable amount of architectural heritage that expresses different architectural characteristics in accordance with the local resources and region-specific cultural features exist in Anatolia. Traditional houses occupy an important place in the context of Anatolian architectural heritage in Turkey. According to statistics about conservation of immovable cultural property in overall Turkey (see Fig.1.1), which is required to be protected, out of 108.813 cultural properties, 69.104 dwellings have been listed as examples of civil architecture by the year-end of June 2018 (http://www.kulturvarliklari.gov.tr).

Figure 1.1. Statistics of immovable cultural property in overall Turkey by the end of June 2018 (http://www.kulturvarliklari.gov.tr)

Studies on traditional houses in Anatolia started firstly in the 1920s. Tanyeli (1999b) states the term of "Turkish House" was firstly mentioned by Arseven in 1928 (as cited in Sarıalioğlu, 2008, 1-20). Concept of "Turkish House" and plan typology of "Turkish House" was introduced by Eldem in 1954. Eldem defines the "Turkish House" as a type of a house that emerged in Anatolia and spread to the lands of the Ottoman Empire, especially Anatolia and Rumelia (1954, 11-215). According to Eldem, different plan types of "Turkish House" were developed depending on the different climate, nature and folklore in different regions (1954, 12-216). In addition, Eldem considers the plan of the house as the most important and common characteristics of "Turkish house" in these different plan types of traditional houses located in different regions. Eldem determines the plan typology of the "Turkish house" depending on the location of sofa in the upper floor that is accepted as main floor and defines the main elements of house as rooms, sofas and outbuilding, and stairs.

Starting from Eldem (1954), many studies have been carried out to determine the classification and characteristics of traditional houses in Anatolia that are called as "Turkish House", "Ottoman House", "Turkish Hayat House" in different studies.

The study that emphasized the origin of the Turkish house in studies following the Eldem was made by Aksoy in 1961. According to Aksoy (1963), the origin of the Turkish house is related to the nomadic tradition and "oba" is considered as the first dwelling unit in the evolution of Turkish house (as cited in Sarıalioğlu, 2008, 50-52). In addition, Aksoy (1963) states the typology of traditional houses varies depending on climate, topography, and materials that are related to physical features (as cited in Sarıalioğlu, 2008, 53-54). Aksoy (1963) emphasizes the concept of "orta mekan" as a main element of plan, following the Eldem's plan typology and mentions that plan types differ according to the nomadic Turkish tradition and cultural effects of Anatolia (as cited in Arel, 1982, 25).

Another study that relates to the origin of the Turkish house with the nomadic Turkish tradition was done by Küçükerman in 1973. Küçükerman emphasizes that the social structure in the transition from nomadism to settled life constitutes the Turkish house and tents in nomadic life have developed and formed as living units (1973, 14). According to Küçükerman, rooms play a fundamental role in the formation of the Turkish house and he accepted that the Turkish house was mainly composed of rooms and sofa, the common area between rooms (1988, 53-63). In addition, he stated that climatic and historical differences in different regions of Anatolia were effective in the formation of the Turkish house (1988, 39).

Another and the most important approach that determines the plan typology according to the room has been made by Kuban in 1975 (as cited in Asatekin, 1994, 73). In addition, Kuban is divided Anatolia into 7 groups according to traditional houses located in different parts of Anatolia. Kuban suggests that "Turkish-Anatolian house" developed from a common scheme consisting of 3 basic elements; room, eyvan (the space between the rooms), courtyard or sofa in different regions of Anatolia (Kuban, 1982, 188-189). This common scheme affects the development of the plan type from the simplest to the most advanced, in accordance with regional conditions, social, cultural and economic tradition as well as the Turk-Islam family structure and social structure. Additionally, Kuban called the traditional houses in Anatolia as "Turkish Hayat House" in 1995 and claims that room is the fundamental element of the house and plan typology is determined with the repetition of rooms.

As mentioned above, Kuban divided Anatolia into 7 regions according to different cultural and historical background in different regions. According to Kuban, there is no homogenous structure style in Anatolia due to the diversity of historical and cultural texture of Anatolia and variety of the regional building traditions (1982, 186). Among the seven region so determined, he mentions that the real representatives of the Turkish-Anatolian house developed in Anatolia are the last group defined as traditional houses constructed with *hımış* technique that is composed of timber structural system and mudbrick infill (1982, 186).

In addition, Eriç (1979) classifies the various factors that shape traditional houses as natural environment, social and traditional life and local materials. He divides the Anatolia into three different regions considering the climatic zones while defining the natural factors. Also, social structure and traditions are defined as important factors to form the traditional houses. According to Eriç, the construction material is effective in shaping the traditional houses with differentiation of the use of materials depending on the regional differences (1979, 43).

Apart from that, in the study of Kazmaoğlu and Tanyeli (1979), two main regions are defined in Anatolia as Authentic Anatolian Synthesis Region and Transition Zone according to socio-cultural differences and then these two regions are sub grouped into four and five respectively in terms of physical features. In the study mentioned, timber framed houses are associated with “Authentic Anatolian Synthesis” region, masonry houses built with stone or mudbrick with “Transition Area”. According to Kazmaoğlu and Tanyeli (1979), Authentic Anatolian Synthesis Region is considered as a region that contains the Anatolian-Turkish houses in the context of this classification. In this typology, timber framed houses constructed with *hımış* technique are defined as the most common group seen in the “Authentic Anatolian Synthesis” that is divided into sub-regions (Kazmaoğlu and Tanyeli, 1979, 33-35).

Arel uses the term “Ottoman House” for traditional houses considering the influence of historical and cultural structure of Ottoman period on the design of traditional houses depending on environmental conditions (1982, 80-81). On the other hand, in 1984, Eldem refered the term “Ottoman house” with the book named as “Türk Evi Osmanlı Dönemi”. Although the people had been from the various neighboring countries of the Ottoman Empire, different climatice and topographic conditions were effective in the formation of “Ottoman House”, Eldem claims that the main element, which combines these effects and forms the “Ottoman-Turkish House”, is the Turkish ethnicity and Turkish life style (as cited in Sarıalioğlu, 2008, 37-38).

The typology studies on traditional houses in Anatolia are divided into three groups by Asatekin according to their methods of analysis (1994, 68; 2005, 390). The first group analyses the traditional houses according to the plan types of piano nobile that is the first floor of the house. In this group, the arrangement and location of the sofa or room defines the plan typology. Among these studies, Eldem (1954, 1984) and, Aksoy (1963) classify the plan typology of “Turkish House” according to location of sofa, while Küçükerman (1973), Kuban (1975, 1995) and Tanyeli (1979) accepts the room as the main unit of house and makes classification of the plan typology according to the room. The second group of studies includes the studies that classify the traditional houses in accordance with the construction techniques and materials depending on the material with reference to Eriç (1979), Tanyeli and Kazmaoğlu (1979), Kuban (1975, 1995). The use of material and construction techniques are defined by the influence of “*climatic conditions, flora of the region, technical limitations and/or traditions*” (Asatekin, 1994, 74). Accordingly, traditional houses are divided in two groups as houses constructed with load bearing system and constructed with timber frame and infill system. In the third group, the basic purpose of studies is to define the architectural features according to regional characteristics with reference to studies of Aksoy (1963), Kuban (1975), Eriç (1979), Tanyeli and Kazmaoğlu, (1979), and Eldem (1984). In this group of studies regional differences depending on the climatic conditions, material use, different cultural background and socio-cultural differences are used as the distinctive criteria of the classification by different scholars.

In addition, the typology studies on traditional houses in Anatolia are divided into three groups by Şahin Güçhan (1995, 104-105; 2018, 2). In the first group of studies, the Turkish/Anatolian houses are defined according to ethnic identity and spatial order in connection with the arrangements of room and sofa with reference to studies of Eldem, (1968), Küçükerman (1973) and Kuban (1982). The studies in the second group make classifications on different traditional house types considering the materials, structural systems, climatic conditions that vary depending on the regions where the houses are located with regard to Aksoy (1963), Kuban (1966), Eriç (1979), Kazmaoğlu and Tanyeli (1979). In the second group, traditional houses are divided into two groups as timber framed houses and masonry according to construction techniques and materials. In the third group, studies classify traditional houses with a focus on the historical and cultural interaction with reference to studies of Arel (1982), Cerasi (1998, 2001) and Tanyeli (1996). Şahin Güçhan states that the studies following Eldem have added the concepts of "nomadic life", "tent tradition", "oba düzeni", "privacy" as ethnic and religious criteria to the Turkish house typology, and later new concepts such as "material and building tradition" and "locality" (1995, 107).

Traditional houses in Anatolia, have been shaped according to regional differences. The timber skeleton system with various infill materials is used to define the "Turkish House" by Günay (as cited in Asatekin, 2005, 393). The timber frame structure that is the advanced type of post and lintel system reinforces the structure against the lateral forces with its diagonal elements and is used mostly in traditional houses in Anatolia (Yavuz, 2018, 200).

In the construction of traditional houses in Anatolia, timber framed system and masonry system are used together generally. Timber framed houses are defined in 3 sections; masonry base, timber frame section and timber roof by Şahin Güçhan (1995, 173; 2018, 12). Masonry base section is generally composed of ground floor and foundation, which are formed with stone or mudbrick and stone (Şahin Güçhan, 2007, 846). In upper floors, timber framed structure is used. Timber framed system can be filled with various materials that are easily accessible in the region or it can be built by coating without infill materials. Infill materials used between the timber elements are determined in accordance with local material types and mudbrick, brick, and stone can be used as infill materials or timber framed system can be covered with wood lath by using *bağdadı* technique. When timber framed systems are filled with mudbrick infill, it is called the term of *hımış* (Kuban, 1982, 186; Yavuz, 2018, 206); however, some scholars used the *hımış* for the timber framed systems filled with mudbrick, brick, and also stones (Aksoy, Ahunbay, 2005, 48; Şahin Güçhan, 2007, 848). In this study, timber framed system with mudbrick and brick infill is called as *hımış* system. In the Anatolia, among the filling materials used in the timber framed system, mudbrick is the most commonly used infill material, followed by brick and stone respectively (Yavuz, 2018, 206-207). Construction of traditional houses are completed with a roof section that is generally a hipped or gable roof consisting of a timber roof structure set on top of timber framed upper floor.

As mentioned above, traditional houses reflect different architectural characteristics and construction techniques in different regions of Turkey. The architectural and technical characteristics of traditional houses are shaped by natural resources and culture of the region and therefore the use of material and construction techniques differ in different regions of Turkey. These traditional houses, which constitute the important examples of vernacular/rural architecture and reflect the skills of past, require intervention to sustain their values, authenticity and life span as all cultural properties.

The traditional architecture reflects the socio-cultural characteristics of the region through the physical structure created by the use of local resources. Conservation treatments of traditional buildings should consider maintaining the construction materials and construction techniques by respecting the traditional character of dwellings. As stated in the Built Vernacular Heritage Charter (ICOMOS, 1999), research and documentation on vernacular structure, that includes a full analysis of its form and structure is the principle for the conservation treatments. Besides, it is stated that understanding the timber construction, its structure and all details is the principle for the conservation of timber structures and the condition of the structure and its components should be documented before any intervention in ICOMOS Charter- the Principles for the Conservation of Wooden Built Heritage Charter (2017).

However, traditional buildings face different challenges threatening their existence due to the needs of developing the modern world and socio-economic and cultural changes. Function change, status of occupancy, changes in physical environment, changes to the socio-cultural and socio-economic conditions of environments and inhabitants, intrinsic material problems, lack of maintenance, and environmental reasons such as weather, earthquake, etc. expose the traditional buildings to severe problems that endanger the values and life span of buildings. Moreover, these problems may cause the complete destruction of buildings. Further, improper interventions and lack of regular maintenance on traditional buildings cause significant problems. Improper interventions are often the interventions made with incompatible materials and construction techniques and do more harm rather than curing the problems. These unacceptable interventions due to the unawareness about conservation can cause acceleration of the deteriorations or damage of the traditional houses instead of repairing them as well as interfere with the authenticity of the structure, loss of values and alterations in structure. In the case of abandoned houses and/or lack of regular maintenance, traditional houses face serious problems due to the lack of care and generally they are either restored or reconstructed in the end. As a result, restoration and/or reconstruction may cause changes or alterations that lead to the loss of values or unacceptable results.

In order to prevent improper conservation practices and all other factors damaging the traditional houses, using local materials and structural techniques in conservation of traditional buildings as well as raising the public awareness on conservation are essential. It is necessary to understand the material types and construction techniques of building elements in order to treat the problems efficiently. Since the building materials, construction techniques and each building element may vary depending on the location, and time, their documentation is the primary action of conservation. For that purpose, the architectural features, construction materials and construction techniques of traditional houses, which are the distinctive characteristics of houses, should be identified with an extensive documentation.

In ICOMOS Built Vernacular Heritage Charter (1999), it is stated "*The continuity of traditional building systems and craft skills associated with the vernacular is fundamental for vernacular expression, and essential for the repair and restoration of these structures. Such skills should be retained, recorded and passed on to new generations of craftsmen and builders in education and training*". Additionally, in the ICOMOS Charter-"the Principles for the Conservation of Wooden Built Heritage" for the conservation of specifically timber structures, it is stated that the character defining features should be determined for intervention plan of traditional houses (ICOMOS, 2017). These features may include one or more of the structural system, construction materials, non-structural elements, surface features, decorative details, traditions and techniques in the mentioned Charter (ICOMOS, 2017). Accordingly, a credible framework that includes the distinctive and unique architectural characteristics and construction techniques of vernacular buildings required for effective conservation works should be obtained.

In this context, Sivrihisar, which, as a traditional settlement in central Anatolia, still preserves its traditional characteristics, is chosen for the case study of the thesis. Sivrihisar has been the subject of different studies in the field of architecture, urban and regional planning, history, art history, engineering etc. within the scope of master's and PhD thesis. Among these studies, those relating to the historical Sivrihisar settlement and its traditional structures generally examined the settlement and traditional houses in a general framework or on a single building scale. Furthermore, all of these studies have not examined the construction technique of Sivrihisar traditional houses in detail and systematically. In addition to these, the most noticeable studies that are related with architecture[1] and, urban and regional planning[2] have been used as sources in this thesis. Thus, this study aims to determine the construction techniques of traditional houses in Sivrihisar in order to fill the previously mentioned gap in the studies.

Sivrihisar traditional houses still largely preserve their architectural features; however, they have various problems that threaten their existence. In Sivrihisar there are many evacuated traditional timber framed houses due to the ownership and occupancy problems. In addition, abandoned houses have been damaged due to lack of care over time and even some houses are about to collapse. In addition, in the traditional timber framed houses of Sivrihisar, it is observed that there are improper interventions that may cause the buildings to lose their original features.

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[1] MS thesis "Geleneksel Sivrihisar Evleri" prepared by Fisun Özcuşa at Gazi University in 1986; MS thesis "The Restoration Project of Zaimoğlu Konağı in Sivrihisar" prepared by Gözde Uslu at METU in 2003; MS thesis "The Role of Kudeb in the Local Authorities in the Maintenance and Simple Repair Process of Cultural Heritage Case Study: Sivrihisar" prepared by Kevser Çeltik Şahlan at METU in 2007; the studio study "A Project For Preparation of Sivrihisar Conservation and Management Plan" prepared at METU in 2009.

[2] MSc. thesis "Kentsel Gelişme ile Ulaşım Etkileşimi" prepared by Erman Aksoy at Gazi University in 2005.

In particular, spatial changes and/or changes in unused architectural elements in order to adapt to modern living conditions damage the authenticity of traditional houses in Sivrihisar. Also, improper interventions on the floors and plasters applied with incompatible materials on outer walls cause deteriorations and even destruction of original details of traditional timber framed houses (see Fig.1.2, Fig.1.3). Furthermore, in recent restoration applications, it has been seen that a part of the structure has been reconstructed and the result does not fully reflect the original construction techniques (see Fig.1.4, Fig.1.5). Therefore, Sivrihisar traditional timber framed houses have been damaged and have lost their characteristics over time. For this reason, traditional houses in Sivrihisar should be protected against the threats caused by modern life and its effects, improper interventions, and unconsciousness about conservation activities.

Figure 1.2. Stone wall surfaces covered with cement based plastered (left, Camikebir N. b.block-lot: 196-1; right, Kubbeli N. b.block-lot: 186-9)

Figure 1.3. Ceiling covered with linoleum (left), ceiling covered with plywood and screed applied to the flooring seen from ceiling (right) (left, Demirci N. b.block-lot: 443-13; right, Cumhuriyet N. b.block-lot: 433-3)

Figure 1.4. A traditional house at Hisar Street during (left) and after (right) the restoration application (Kılıç N. b.block-lot: 170-19)

Figure 1.5. A traditional house at Uzun Street before (left) and after (right) the restoration application (Yenice N. b.block-lot: 10-7)

1.2. Aim and Scope of the Study

The aim of this thesis is to achieve reliable and comprehensive information about construction techniques of Sivrihisar traditional houses by examining the traditional houses in Sivrihisar extensively in terms of construction materials and construction techniques. In this way, it is possible to obtain essential and reliable guidance for all kinds of future conservation interventions.

Within the scope of the thesis, Sivrihisar is chosen as the case study area, yet it has the traditional settlement that still conserves its characteristics and traditional houses. Thus, Sivrihisar traditional timber framed houses are chosen for the case study. Traditional houses in Sivrihisar, which have still readable authentic features, were examined from ground to roof and original details of traditional houses were documented and analyzed. Out of the 28 traditional houses, 14 of them were detailed and 14 of them were partially surveyed and documented. Abandoned and ruined houses were chosen to investigate partially in order to observe the original details and understand the structure. By this means, the characteristics of traditional buildings, their authentic materials and construction techniques were determined.

Comprehensive and reliable information on construction techniques and architectural characteristics of traditional houses is an important and necessary guide in terms of determining correct and effective methods for intervention decisions in conservation. In addition, this identified knowledge about construction techniques and architectural features of traditional dwellings provides crucial data in terms of transferring information to the future generations as well as understanding traditional houses and conservation of traditional houses. Accordingly, appropriate and compatible interventions in accordance with traditional houses can be applied on the basis of this reliable information and effective conservation practices can be applied to sustain the values and authenticity of traditional houses. In this respect, architectural characteristics and construction techniques of traditional houses in Sivrihisar are documented and analyzed in order to provide essential and reliable information to use future conservation works.

1.3. Methodology

The method of this study consists of mainly six stages; i.e., research stage composed of literature survey and archive survey, investigation and survey stage including preliminary site survey and site survey, documentation of collecting data from site survey, analysis of documented data, evaluation, and conclusion stages (see Fig.1.7).

At the beginning of the study, a research including the literature and archive survey was carried out to understand the importance of preserving traditional buildings, authenticity and documentation, and the use of construction techniques and material in traditional houses of Anatolia in general, the study area and, its traditional houses. A literature survey was done by collecting the written and visual data related with conservation theory and authenticity in the context of conservation theory. International charters and recommendations, books and articles about conservation were investigated to determine the meaning, principles and importance of conservation of the traditional houses and authenticity of traditional architecture. Another literature survey was performed about traditional houses in Anatolia in general and concerning the material and construction techniques in order to understand the historical traditional houses, different approaches of analyzing and classifications of traditional houses. For this purpose, written sources; books, articles and thesis prepared by different scholars were collected and reviewed. All this information is used in the introduction and problem definition sections (see Chapter 1.1) in the first chapter in order to understand the construction technique of traditional houses and, the use of materials, to assess conservation problems, and to comprehend the importance of the issue in conservation considering the authenticity and documentation. Besides, information gathered from literature survey on conservation theory, international charters and traditional houses of Anatolia was used in the parts needed in the study, except for the first chapter.

Literature survey on general features of Sivrihisar settlement, history and architectural features of Sivrihisar settlement, and traditional houses of Sivrihisar was also done and written sources; books, articles, encyclopedias, thesis as well as online sources; governmental websites, non-governmental and governmental reports and publications were reviewed. In addition, the archive survey was carried out to collect information on Sivrihisar settlement and traditional houses in Sivrihisar. Conservation activities in Sivrihisar were investigated and related written and visual documents were collected through archive and literature survey. Cadastral plan and Conservation development plan of Sivrihisar were obtained from Sivrihisar Municipality. Registration cards of buildings, council decisions and measured drawings of selected traditional houses were collected from Eskişehir Regional Council for Preservation of Cultural Heritage. An archive survey was conducted in two steps before and after the site survey. While the archive survey managed before field survey provided preliminary preparation for the site study, the archive survey run after the field study was performed to support the data obtained from site survey. All these data obtained from literature and archive survey related with the features of Sivrihisar settlement in general, its history, history of conservation activities in the region and its traditional houses were used in the second chapter to understand the Sivrihisar settlement, and architectural characteristics of traditional houses in Sivrihisar.

After the research stage consisting of literature and archive survey, which is the first stage of method of the study, was completed, the second stage of investigation and survey, started with the preliminary site survey conducted in May-October 2014. A pre-site survey was managed to understand the traditional settlement, its features, and its traditional buildings in general. Before the pre-site survey, preparatory studies, whereby the traditional buildings in general and in Sivrihisar settlement are researched, were accomplished. During the pre-site survey, 11 neighborhoods within the boundaries of the conservation development plan (see App. A) were visited and characteristics of the traditional settlement, architectural features of traditional houses, materials and construction techniques were inspected by the visual survey, taking photographs, and notes.

According to information gathered from the pre-site survey, the traditional houses that reflect the authentic details and characteristics of traditional Sivrihisar houses located in the borders of the conservation development plan were selected for further investigation. Traditional houses to be studied in detail were chosen considering the different building materials and construction techniques. Traditional houses that were examined are mainly determined considering the following items:

- Traditional houses designed as residential buildings originally that are abandoned or still in use as residential buildings.
- Traditional houses that have the original and readable construction techniques and materials.
- Traditional houses that have not been intervened significantly and still conserve their authentic structures, materials, exterior and interior architectural elements on large scale. In the case of, traditional buildings that have undergone any intervention and/or addition, attention has been paid to the fact that the intervention or addition can be read clearly and easily and that the houses which still preserve observable and authentic structural and/or architectural elements.
- Traditional houses, which partially collapsed and/or are in the ruined condition but, still provide original details on building materials, structures and construction techniques.

The site survey, as a part of the investigation and survey stage, was carried out in three steps to examine the construction techniques of the chosen traditional houses in detail.

The site survey was conducted firstly between 19.10.2015 and 25.10.2015, secondly between 04.10.2016 and 9.10.2016 and lastly between 19.02.2019 and 26.02.2019. In the field study done in October 2015, 6 of identified abandoned traditional houses were investigated in detail. In the site survey performed in October 2016, 9 of abandoned traditional houses were partially investigated, since some houses were partially/almost completely demolished and/or accessibility to some houses was limited due to the locked doors. In addition, the implementation of the restoration project of a house, which was surveyed in 2015, was observed. With the observation of the restoration application, some of the structural elements that could not be seen in the previous site survey were inspected. Also, 6 surveyed traditional houses in 2015 were monitored to document any changes that would be occurred in one year due to the external factors and vandalism. In the field study carried out in February 2019, 8 of identified traditional houses were investigated in detail with a similar method used in 2015. Additionally, 5 of abandoned traditional houses were partially examined to the extent that the physical condition of the buildings allowed. Furthermore, the traditional houses investigated in 2015 and 2016 in previous site surveys were monitored and any new information that have come to light over time in relation with building materials, construction techniques and architectural elements was documented. As a result, in this study, a total of 28 traditional houses in different conditions were investigated.

During the three-step site survey, 14 traditional houses were examined in detail, and 14 traditional houses that were abandoned and partially or almost completely demolished were examined. In the site survey, plan drawings in all level and system sections of traditional houses were investigated in detail by the use of sketch drawings, photographs, and measurements. System sections of traditional houses were taken from the parts where horizontal and vertical connections changes and give more detail on original building materials, structural and architectural elements of buildings. So that system sections were drawn in where the construction techniques changes and system details of houses were documented from the foundation to roof. In addition, point details of some architectural elements such as doors, windows, niches, etc. were drawn and measured in detail. All measurements were taken by using conventional techniques with tape measure and laser meter during the site survey. Besides, every part of traditional houses, and architectural and structural elements were photographed in detail and systematically.

In partially surveyed houses, some architectural elements and spaces were investigated because of the damage of building or lack of access to the building. Some of these houses were examined from exterior, while others were from exterior and interior. Building parts that were examined in detail were sketched, measured and photographed. Investigation of the ruined houses was preferred to understand the system of the structure and to observe the original details.

After the site survey, measured drawings of two houses (Lot number:170-44 and Lot number:11-16) that were prepared by Architect Zeynep Kutlu and Architect Gürem F.Özbayar Sargın, were obtained from Kök Mimarlık. Also, measured drawings of one traditional house that was restored in 2016 and whose project was prepared by Mahya Yapı Tasarım were obtained from Sivrihisar Municipality.

In the course of site survey, local craftsmen who have worked in the construction of traditional buildings, and have knowledge on traditional construction methods of houses in Sivrihisar were tried to be reached. Although there have been masons working in the renovation of traditional houses, the old craftsmen who know and apply traditional construction techniques have not been reached.

Following the completion of the investigation and survey phase, in the third step, the documentation of the collected data from the site survey was done in digital platform. In this way, all drawings of houses were prepared in the digital platform by using sketches, measurements and photographs collected during the site survey. In the case of two of surveyed houses, Elmas Street, 11-16 and İsmet Çağlar Paşa Street, 170-44, drawings of houses are drawn based on the data obtained from site survey and the measured survey drawings prepared by Kök Architecture Restoration. In addition, drawings of a house located at the address of Hisar Street, 170-19 were made on the basis of the data obtained from site survey and the measured survey drawings prepared by Mahya Yapı Tasarım.

For the documentation of collected data, site plan in 1/500 scale, all plan level drawings in 1/200 scale, system sections in 1/50 scale were drawn in AutoCAD 2016 software. In addition, drawings of some architectural elements and point details were prepared in 1/50 and 1/20 scale. Thus, building system details were documented from foundation to roof. All these drawings of houses and photographs showing the related details of drawings were used to produce survey sheet of 14 houses surveyed detailed (see App. B).

During the documentation process in a digital platform, all readable data were drawn in appropriate layers. Legend of layers was added to the every survey sheet of houses. When the parts of structure or material were not observed directly and/or detailed but presumed, they were drawn with a dashed dot line type in the layer of unmeasured/estimated structure. In other words, the building parts/elements that can not be seen directly (foundations, roof structures, layers of floor, girders under the floor covering) are drawn with layer of unmeasured/estimated structure. In addition, when structural elements of some building parts (timber beam, lintel, sill) are observed and measured, but they are covered partially with the plaster or cladding, then these parts were drawn with dashed line in the same layer of readable data.

After documentation of the collected data in the site survey, in the fourth stage, the analysis of collected data, drawings of houses were analyzed together with the information obtained during site survey observations and data obtained from the literature survey. In the analysis stage, each building system element was classified according to material type, construction technique and structure. In this way, all structural (horizontal and vertical) and architectural elements, horizontal and vertical connections were defined according to their similarities and differences by comparative assessment of 28 surveyed houses. Accordingly, each building system element was described under its own heading in accordance with the classifications and typologies identified in the third chapter.

Following the classification of each building system elements, a coding system was developed and this system was added to the system section drawings of surveyed houses prepared in AutoCAD software. In this way, typology classifications of the building elements that are used in 14 houses surveyed in detail were shown on the system section drawings easily and systematically for the sake of readability. A coding system used in the MS thesis of Filiz Diri (2010) was improved and adapted to the timber framed traditional houses in the Sivrihisar. In this system, buildings were divided into sections based on their floors such as foundation, basement floor, ground floor, mezzanine floor, first floor, and roof. Each section was indicated with the abbreviation of the section names beginning with the initial letter such as “Fn, B, G, M, F and R”. Later on, each building section was subdivided into three parts, and represented by numbers 0 to 2. According to coding, G0 was used to express the connection detail between the lower and existing sections. The numbers 1 to 2 used in coding were used as follows; G1 was used to express the vertical load bearing elements of ground floor, while G2 for the architectural elements of floor. Thereafter, the coding was made with the initial letter (lower case) of building element and the number according to the name and type of building element such as G1-m_{1A} for the masonry wall type-1A used in ground floor or G2-w_1 for the window type 1 of architectural element used in the ground floor.

After the addition of coding system to the system section drawings, survey sheet of 14 houses studied in detail were prepared. The survey sheet of 14 traditional houses which give systematically the information obtained as a result of documentation of collected data and analysis of the documented data were prepared by using site plan, all plan levels, system sections and photographs (see Fig.1.6).

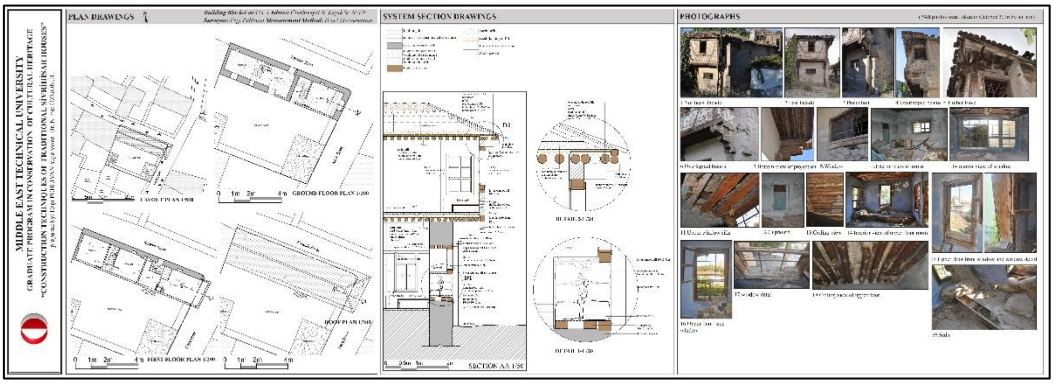


Figure 1.6. Example of survey sheet

In the fifth stage, evaluation phase, a table that shows the typology of structural and architectural elements used in the 28 traditional houses studied was prepared (see Fig.4.3-4.4). Thus, all load bearing elements and architectural elements used in the 28 traditional houses surveyed are seen in the comparison table and, detail types of each building element and the frequency of use of these details were determined. In addition, a table that includes the coding information of building elements and connection joints and that belongs to 14 houses studied in detail was formed with the results obtained with the implementation of the coding system (see App. C). In this way, which construction technique and material type used are defined and seen systematically in 14 houses and in the building elements of these houses. Accordingly, all the data obtained on construction techniques of Sivrihisar traditional houses from the drawings prepared, typology classifications done, and tables prepared were evaluated in this section. Additionally, the construction process of two houses were explained briefly with the light of information obtained.

In the last part, the conclusion phase, the importance of determining the construction techniques of buildings for the conservation of traditional houses was emphasized and the main results achieved at the end of this study were indicated. In addition, the subjects not covered by this study were mentioned as well as the study areas where this study can be used were expressed.

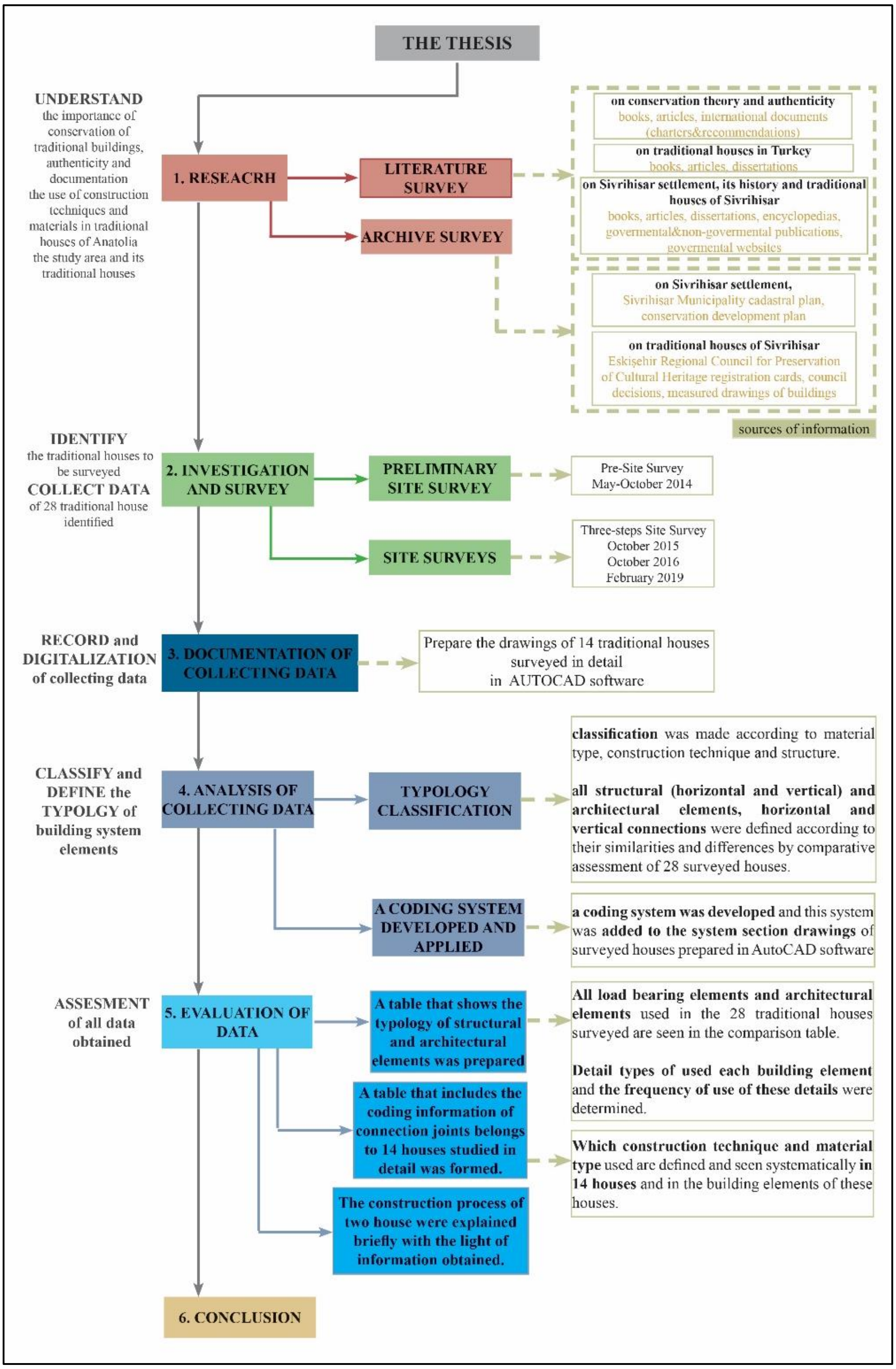


Figure 1.7. Methodology of the study

CHAPTER 2

GENERAL FEATURES AND HISTORY OF SİVRİHİSAR AND THE CHARACTERISTICS OF TRADITIONAL SİVRİHİSAR HOUSES

2.1. General Information on Geographical Features, Demographical and Social Structure of Sivrihisar

Sivrihisar is a town of Eskişehir located at the intersection of Ankara, Eskişehir and İzmir highways in the northwest of Central Anatolia (see Fig.2.1). The town is located at a 100km distance to Eskişehir, 135 km to Ankara, 120 km to Afyonkarahisar and 448km to İzmir. It is surrounded by Mihalıççık at north, Beylikova at northwest, Mahmudiye and Çifteler at west, Emirdağ and Çeltik at south and Ankara and Günyüzü at east (see Fig.2.2).

Figure 2.1. Location of Eskişehir region in Turkey map (based on Google Earth Map)

Figure 2.2. Borders of Sivrihisar region in the city of Eskişehir (http://www.eskisehiri.com, last visit April 2019)

Sivrihisar is situated on the Çal Mountain, the northern slope of Sivrihisar Mountains that is at the southeast of Eskişehir. It is the biggest town of Eskişehir with respect to its surface area that covers an area of 2987km2. Geometrical coordinates of Sivrihisar are 300 26’ 23” Northern latitude, 310 31’ 48” Eastern longitudes and the altitude above the sea level is 1050-1070m. (see Fig.2.3)

Figure 2.3. Location of Sivrihisar region (based on Google Map)

Sivrihisar Mountain lies in the southeast to northwest direction; from starting southeast of Eskişehir in the arch of Sakarya River and reach out to the Türkmen Mountain. The highest point of Sivrihisar mountain is Çal Mountain (Çürükçal) that is at the east of Sivrihisar and 7km far away to the town center is about 1690m high. Other important hills of Sivrihisar Mountains are Akyokuş Hill, Adatepe, Boztepe, Üçtepe, Yumrukçalı Hill, Samıçlı Hill, Büyelik Hill, and Arayıt Mountain. ("Sivrihisar", 1981-1984, 2815)

The most important geomorphological formation of Sivrihisar is the granite rocks of Sivrihisar Mountains that lies at the north of Sivrihisar town center in the direction of east and west. The highest point of Mountain that is around middle of granite rocks, the area of Justinianus Castle that is called today as Yazıcıoğlu Castle. (Keskin, 2001, 14; "Sivrihisar", 1981-1984, 2815-2819)

Sakarya River is an important water source of Sivrihisar. Sakarya River that arises from Sakaryabaşı area in the Çifteler town and joins firstly Bardakçı Su and, then Seydisu and Sarısu, occupies the area as an arch of 50 km in Sivrihisar. Another water source, Porsuk Creek flows at the north of the town, around Biçer Village and joins Sakarya River around Beylikköprü. Besides, Pürtek Creek that emerges with the unity of Karaburhan Creek, and Hortu Creek joins Porsuk Creek around İlören. The water of these creeks is used for the agricultural irrigation during the summer. In addition, there are two geothermal sources in the Sivrihisar-Gümüşkonak (Yörme) geothermal area. (Keskin, 2001, 15; Eskişehir Valiliği Çevre ve Şehircilik İl Müd., 2009, 6).

One of the biggest wetland of Turkey, Balıkdamı is located within the boundaries of Sivrihisar. It is located in the Sakarya River among the Ahiler, Kurtşeyh, Ertuğrul, Göktepe villages. Balıkdamı wetland is 30km far away from Sivrihisar, and 120km far away from Eskişehir. Balıkdamı that is 2nd degree natural site was listed as wildlife conservation area in 1994. It contains most of small pond and large reeds. In addition, numerous plants, 9 species of fishes, 39 domestic and 97 migratory bird species live in this area. The wetland covers 14.148,65 hectares in total. The area of 1470 hectares is located on Sakarya river and 33, 00 hektares is located in the conservation area. (Eskişehir Valiliği Çevre ve Şehircilik İl Müd, 2018, 85-86)

In Sivrihisar, characteristics of terrestrial climate are observed; winters are generally cold and snowy, summers are dry and hot. The temperature difference is high between day and night. It is rainy mostly in spring and autumn. In winter, winds blow from north and southeast and in other seasons wind blows from southwest. The dominant wind direction is on the west and average velocity of wind is 2.7m/sn. Considering the data of 2018 obtained from General Directorate of Meteorology, the average annual temperature is 10.9 0C, while the coldest month is January and the hottest month is July considering the data of 2018. Annual rainfall is 418 kg/m2. Depending on characteristics of terrestrial climate, Sivrihisar occupies large steppes. In the wetland areas, poplar and willow trees can be observed. (Keskin, 2001, 15)

Sivrihisar is located within the 3rd degree earthquake zone (see Fig.2.4). At the north and west of town, active faults lay in the southeast-northwest direction. There were 15 earthquakes in 2 to 3 magnitude (Guler&Canbaz, 2017). In the boundaries of Sivrihisar, there are various mineral deposits such as sepiolite reserves, complex ore deposits that contain fluorite, barite, rare earth elements and thorium, perlite deposits, kaolin beds, marble beds. Marble beds in Dümrek, İstiklalbağı, Zey villages and gypsum beds in Gülçayır and Demirci villages are still being operated. Kızılcameşe and Beypınar areas, Also, the Sivrihisar-Kaymaz gold deposit that was explored in 1997 by a private company and strontiumbeds in Yenidoğan, coal in Zey village, uranium and thorium beds in Kızılcaören village, sepiolite beds in some lowland villages are awaiting exploitation. (Bebka, 2012, 10-11; as cited in Keskin, 2001, 139)

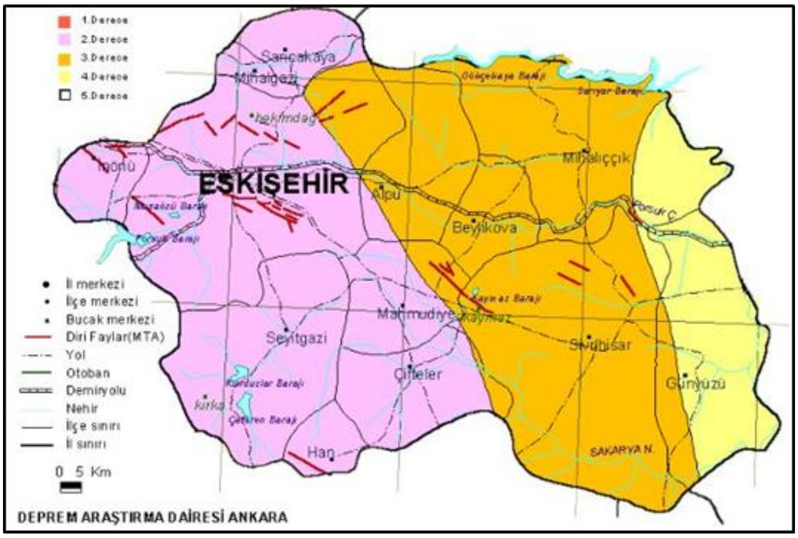


Figure 2.4. Eskişehir earthquake map (http://www.e-sehir.com, last visit April 2019)

Sivrihisar is the most populous town of Eskişehir among the 14 towns. Sivrihisar consists of 78 neighborhoods[3]; 13 of which are in the center and 65 of which are previous villages. The population of center of Sivrihisar is counted respectively 5989 in 1927, 6615 in 1950, 7186 in 1960, 7442 in 1965, and 8429 in 1970 (see Table 2.1). It became over 100.000 as 100.0083 in 1985 in the center. The population of town center increased until the year 2000 and decreased after 2000 to 2012; whereas the population of rural areas decreased over years (see Table 2.1). This indicates that population of Sivrihisar migrate to big cities such as Eskişehir, Ankara, İstanbul, Bursa. Moreover, according to data of 2018 obtained from TUIK, despite the decrease

[3] In 2012, local government system was reorganized in Turkey. According to amendment of law no.6360 which was adopted in 2012, the boundaries of 13 metropolitan municipalities were changed to provincial borders. The village and municipalities within the boundaries of town of the provinces has been abolished. Villages and municipalities as neighborhoods joined to the municipality of the town to which they belong. Accordingly, Sivrihisar consists of 78 neighborhoods; 13 of which are in the center and 65 of which are previous villages.

in the population of the town, it is observed that Sivrihisar receives immigration from various provinces especially from the east of Turkey.

The population of Sivrihisar is 20.746 that is made up of 10.527 men and 10.219 women according to the database of Address based population Registration System (ABPRS) by the end of 2018. In Sivrihisar, according to 2018 ABPRS data, approximately 45% of population (9269 people) live in the town center and 55% of population (11.477 people) live in rural areas (see Table 2.1). In addition, 45% of population (4371 people) living in the town center domicile in the neighborhoods that are within the Conservation Development Plan.

According to data of 2018 obtained from Central Distribution System (MEDAS), the number of literate people is 18.671, the number of illiterate people is 666, while number of people with unknown literacy status is 130; literacy rate is 96% in the town. In the area, 46% people are primary school graduates, 24% are secondary school graduates, 20% are high school graduated and 10% of people are hold graduate and undergraduate degrees.

In Sivrihisar, 76% of the population deal with agriculture and animal husbandry that are the backbone for the economy of Sivrihisar, whereas 21% of population work for service industry, art craft and commerce and 3% of population work in the manufacturing industry (Ortek Proje, 2016, 3). Agricultural area of Sivrihisar in 2018 is mentioned as 1.367.334 decares according to the data released by Turkish Statistical Institute. Wheat, barley, rye, white beet, chickpea, dried beans,and potato are the most produced goods in addition to some vegetables and fruits in Sivrihisar. In animal husbandry, mostly ovine animals such as sheep, goat, Angora goats, merino sheep are raised in addition to the cattle breeding. Furthermore, beekeeping activities in the region have decreased considerably compared to previous years. (Bebka, 2012, 7-10; Keskin, 2001, 136-139)

Table 2.1. *Population of Sivrihisar between 1965 to 2018 (www.tuik.gov.tr)*

Year	*Total Population*	*Town Centre*	*Rural Areas*
2018	*20.746*	*9269*	*11.477*
2017	*20.449*	*9317*	*11.135*
2012	*22.712*	*9.820*	*12.892*
2010	*23.488*	*9.817*	*13.671*
2007	*25.406*	*10.293*	*15.113*
2000	*31.583*	*10.574*	*21.009*
1990	*37.297*	*10.490*	*26.807*
1985	*53.175*	*10.083*	*43.092*
1980	*55.961*	*9.541*	*46.420*
1975	*54.307*	*8.713*	*45.594*
1970	*56.366*	*8.429*	*47.937*
1965	*53.608*	*7.442*	*46.166*

2.2. History of Sivrihisar

Sivrihisar is an old settlement called Palia or Spania (Spalia) situated at the 4 km north of the Persian Royal Road that is running from Ephesus to Susa, the ancient capital of Iran, known to be dominated by Phrygians (1200-700 B.C.) in ancient times. Sivrihisar is about 16km away from the ancient city of Pessinus, one of the Phrygian cities, that located on Persian Royal Road in old ages. Today, it is situated onto Sivrihisar-Konya Çeltik road and there is a village of Ballıhisar on the city of Pessinus. Sepetçioğlu mentioned that King of Midas built up the first temple of mother goddess Cybele in

Pessinus after he established the city in 7. B.C (Mutlu, 2017, 5). In Anatolia, the mother goddess was an important image of worship dating from 6. B.C. Pessinus was an important cult center due to the presence of temple of Kybele until the mother goddess Kybele was transferred to Rome in B.C.205. After that, Pessinus lost its importance as a cult center, despite the fact that mother goddess belief continued in the region. Area was dominated Phrygia, Lydia, Persians, Alexander the Great, and Roma, respectively and it was developed significantly in Byzantine period ("Sivrihisar", 2009, 37: 289). The region was dominated by Christian belief in 4th century A.D. After the Christianity ruled the district, the cult of Cybele was banned; Pessinus and its area completely lost its importance (Doğru, 1997, 7).

In 6th century, the emperor Justinian, the 1st of Byzantine, reconstructed the new city with the antique stones carried from Pessinus, on the area of antique city of Hittites, Palia, and called Justinianopolis (Doğru, 1997, 8). Justinianopolis, Sivrihisar today, developed with the advantage of being on military and trade road and castle that was built by Justinian, the 1st ("Sivrihisar", 2009, 37: 289). In the Byzantine period, the city became center of archbishopric firstly, and later center of metropolitan bishop (Parla, 2005, 6).

Sivrihisar came under domination of Seljuk Empire as a result of conquest of Ankara in 1072 by Seljuks and most of Oğuz Türkmen Clan tribes were settled in the area. Anatolian Seljuk Empire was established with conquest of Iznik that was the first capital of Empire in 1075 and Sivrihisar became an important Beylik of Empire although the capital was moved to Konya due to the invasion of İznik by Byzantine in 1096 (Keskin, 2001, 20; Parla, 2005,6-7). In 11th and 12th centuries, under the rule of Seljuk Empire, Sivrihisar was one of the stops of the caravans and postal roads of the period (Aksoy, 2005, 63). Therefore, it was an important trade center with the caravanserais established for security reasons.

After the collapse of Seljuk and control of Mongol/Ilkhanid on Anatolia, Sivrihisar was under the possession of Karamanid Dynasty until the conquest of Ankara by Orhan Gazi in 1354. However, after the death of Orhan Gazi, the city was dominated by Karamanid dynasty again for a while. In 1363, the city became part of Ottoman land by the attack of Murad, the 1st, on Anatolia. However, in 1402, Sivrihisar was given to the Karamanid Dynasty by Timur upon the defeat of Beyazıd, the 1st, at Battle of Ankara. The city was conquered by Mehmet, the 1st, in 1415 and Sivrihisar with together some other towns were annexed to Ottoman Empire as a result of a treaty ("Sivrihisar", 2009, 37: 289, Parla, 2005, 6-9; İnancık, 2018).

In 15th and 16th centuries, Sivrihisar continued to be a trade centre. At that time Sivrihisar had a castle, inn (han), caravanserai, hammam, market place, bazaar, madrasah and was a physically and socially developed city (Doğru, 1997, 29). According to Land Registry Books (Tapu Tahrir Defterleri), Sivrihisar was mentioned as a town that belonged to Sanjak of Hüdavendigar (Bursa) of Ottoman Empire in the 15th and 16th centuries and as a subprovince in 1530. Although Sivrihisar had been the district of Hüdavendigar until the regulation of the system of administration division system made in 19th century, following the Ottoman Reform Edict (1839), it became the district of central subprovince of Ankara province following the relevant regulation (Doğru, 1997, 14-15; "Sivrihisar", 2009, 37: 290). In the Ankara Yearbook (Salname) of 1907, Sivrihisar was stated as a subprovince of Ankara, surrounded by Konya province at south, Hüdavendigar (Bursa) province at west, Mihallıccık subprovince at norh and Haymana subprovinces at east (Emiroğlu, Yüksel, Türkoğlu&Çoşkun, 1995, 131). Sivrihisar was detached from Ankara province and added to Eskişehir province that was stated to be a sanjak after leaving from Kütahya sanjak in 1915. After the World War I, Sivrihisar was under the invasion of Greek army in 17 July 1921 and gained its independence on the 1st of September, 1922.

In addition, it is reported that 110 Armenians lived in Sivrihisar during the first years of Ottoman Empire however, there is no definite information about the first settlements of the Armenians (as cited in Erşan&Yetim, 2011, 82). During the Ottoman period, the first accessible information about the population of Sivrihisar dates back to the 15th century. In 1486, 25 neighborhoods existed in total, 24 Muslim and 1 Armenian, in Sivrihisar and the total population consisted of 587 households and 3100 people. The most populous zone was the Armenian neighborhood with 91 households, while the most crowded Muslim neighborhood consisted of 38 households. The number of neighborhoods of Sivrihisar remained the same in 1521, the number of households reached 621 and the population reached about 3500. The most populous neighborhood was still Armenian neighborhood that had 116 households. (Doğru, 1997, 21; "Sivrihisar", 2009, 289-290)

According to information gathered about census of 15th century of Sivrihisar, there was an increase in the population of Sivrihisar from 1468 to 1521; however, the number of people living in rural areas decreased .While the number of villages was 140 in 1486, the number of villages decreased to 108 in 1521. It is observed that the number of villages diminished to 56 and the population in the rural areas declined in the late 17th century. On the other hand, the population of Sivrihisar increased rapidly in the 19th century and the population rose to 34.903 by the year 1893. ("Sivrihisar", 2009, 289-290) According to Ankara Yearbook (Salname) of 1907, there were 128 mosques and masjids, 20 madrasahs, 1 church, 109 Ottoman primary schools (sıbyan mektebi), 32 dervish lodges (tekke), 600 stores, 8 inns (hall), 30 coffeehouses (kahve), 1 library and 6700 households (Emiroğlu, Yüksel,Türkoğlu, & Coşkun, 1995,132).

In 19th century, immigrants who migrated from the Crimean, Caucasian, Romanian, Bulgaria and Bosnia to the Ottoman Empire territorys were settled in the center of Sivrihisar and the surrounding villages ("Sivrihisar", 2009, 290). It is mentioned that

Armenians came from the Crimea and the Caucasia as immigrants during the Crimean War of 1853-1856 and settled in Sivrihisar (Keskin, 2001, 50; Özalp, 1960, 11). Apart from that, there is various information provided by travelers visiting the Anatolia about the life of Armenians in Sivrihisar. Accordingly, J. Macdonald Kinneir, a traveler visiting the Anatolia in the beginning of 19th century, states that Sivrihisar is a town of 1500 Muslims and 400 Christian people and that there is an old Armenian Church and another traveler G.Perrot indicates that there is an Armenian Church and Armenian school in Sivrihisar (as cited in Erşan&Yetim, 2011, 82). In addition, other travelers, Human and Puchstein reports the population of Sivrihisar around 1882 as 10.000 household composed of 2000 Turkish houses and 800 Armenian houses that forms the Armenian neighborhood at the northwest of town (Alkaya, 2006, 152). Furthermore, Şemseddin Sami mentions that in his book named as Kamusü'l-a'lam (1889-1898) the total population living in Sivrihisar is 34.902, of which 4000 are Armenians by the end of the 19th century (Erşan&Yetim, 2011, 83; Alkaya, 2006, 153). In 1915-1916, Armenians deported to Syria and Iraq (Alkaya, 2006, 169). According to Uslu's interview with the mayor of the period (2003), there are no Armenians living in the Sivrihisar today, and their houses were demolished by the municipality in 1947 (2003, 16).

In Sivrihisar, which is an important settlement since Byzantine period to Ottoman period, it is possible to observe many historical artefacts belonging to different periods. Castle of Sivrihisar that was built among the steeps of mountain by Justinian, the 1st, is a significant artifact of Byzantine period with the ruins thereof reaching the present day. The castle was used actively during the Ottoman period as previous ages. It was destroyed four times. First, it was damaged in the time of the Ilkhanid period. Then, Timur used the castle as a military quarters and destroyed it while he leaving the castle. After that, the castle was used by people who took refuge in the castle due to the attack of Karamanid dynasty. In 1689, the castle was repaired by Yazıcı İbrahim Ağa and used as a dwelling until the 1852 (Doğru, 1997, 8-20; Özalp, 1960, 30-32).

Lastly, for the fourth time, the castle was demolished in 1852 by Yazıcıoğlu İbrahim Ağa when he left the castle (Özalp, 1960, 32). After the destruction of castle, today it is observed that there are ruins of a cistern, grain storehouse, and some storage.

Sivrihisar was dominated by Seljuk Empire from 11th century to 14th century. During this period, many historical artefacts were built in and around Sivrihisar. One of the most important artefacts reaching today is Great Mosque (Ulucami) in Sivrihisar. Great Mosque is a rare and one of the most important example of Seljuk Architecture with its timber posts not only in Sivrihisar but also in Anatolia. According to the first inscription of the mosque, it was built by Emir Cemaleddin Ali Bey during the reign of Alaeddin Keykubad in 1232. Later, it had taken its present appearance with repair made by the son of Abdullah, Eminuddin Mikail Bey who is the regency of Gıyaseddin Keyhusrev III in 1274 ("Sivrihisar Ulucami", 2012, 42: 116). Great Mosque is the biggest mosque with 67 timber posts in Anatolia. Mosque has a rectangular plan located in the east west direction. Timber posts connect to the beams of timber ceiling and carry the timber ceiling of mosque. 63 posts are placed in the main area of mosque, and 4 posts are in the Sölpük Masjid that was added to east elevation. (Altınsapan, 1988, 12-18) Great Mosque is added to UNESCO World Heritage Tentative list in 2015 as a result of application made by Municipality of Sivrihisar.

Some of other important artefacts of Seljuk period that are still in use today in Sivrihisar can be listed as Minaret of Kılıç Mosque dated in 1175, Haznedar Masjid built in 1271, Hoca Yunus Tomb built in 1276, Akdoğan Masjid built in 1073, and Alemşah Tomb built in 1328. Besides, some important artefacts of the Ottoman Period that are currently accessible are Kurşunlu Mosque built in 1492, Balaban Mosque from 14^{th}, Hızırbey Masjid (Kubbeli Masjid) built in 1438-1439, Yeni Mosque (Aziz Mahmud Hüdai Mosque) from 15th century.

In addition, in Sivrihisar, there are many hammam buildings that are in ruined condition and cannot used today such as Küçük Hammam built in 1349, Kumacık Hammam with an unknow, construction date (estimated to be before 1407), Yeni (Çifte) Hammam built in 1724, and Gavur(Armenian) Hammam built in 1868). Seydiler hammam dated from the 14th century is the only hammam building still in use today. (Keskin, 2001, 269-282; Sayan, 2009, 48-49).

Apart from that, the Armenian Church (Surp Yerotutyun) built in 188 at the south of Castle and Clock Tower that was built in 1899 on the rocks of Mountain are other important historical artefacts in Sivrihisar. Additionally, most of fountains built in Seljuk and Ottoman period are still observed in Sivrihisar although most of them lost their originality.

2.3. History of Planning Activities and Conservation Studies

Planning activities in Sivrihisar started in 27.07.1970 with the Development Plan approved by the Ministry of Development and Housing. According to this plan, historic city centre has been preserved and the city centre has been moved to the south. In addition, the sloping lands in the east and west have been reserved for new settlements. However, an additional Development Plan was prepared in 1980 by General Directorate of Provincial Bank due to the fact that new settlement areas were filled in a short time. In that plan, new settlement areas have been identified in the south of Sivrihisar and a small area in the northwest was arranged for new settlement development. (Özcuşa, 1986, 175-177)

After that, in 1988, 1/1000 scale Implementation Development Plan of Sivrihisar was approved and it was revised in 1995 and 1996. According the plan of 1988, historic city centre was preserved as in the previous plan and the new development areas were arranged at the south, on the Ankara-Eskişehir highway and the Atatürk Boulevard. With the revision of Development plan, the area between highway and the traditional city centre especially reserved for development residential areas. Besides, along the two sides of the Atatürk Boulevard that is a main road between historic city centre and highway were planned for educational, military, governmental usage and for four storey residential buildings. Additionally, small non-residential development area, green areas and sport fields were proposed at the south of highway, throughout the road and housing zone was planned in just behind these areas. In the development plan, an area that would be announced later as an urban protected area was determined as an urban area; however, no conservation principles was determined. (Ortek Proje, 2016, 4-7; AKS Planlama, 2011, 24-120)

When the upper scale and sub scale plans related to Sivrihisar were examined, it was seen that there was a 1/100.000 scale Eskişehir Environmental Plan (see Fig.2.5) that also included the Sivrihisar settlement as the upper scale plan and 1/1000 Implementation Development Plan of Sivrihisar as the sub scale plan. However, it was understood that there was no other upper scale Master Plan, and all applications were carried out with 1/1000 scale Implementation Development Plan of Sivrihisar. After that, 1/5000 scale Master Plan prepared by Ortek Proje was approved in 2016.

Conservation activities in Sivrihisar started with the announcement of 7 tumuluses as a 1st degree archaeological site by Gayrimenkül Eski Eserler ve Anıtlar Kurulu in 1982. Later on Zaimoğlu Konağı was register as a civil architecture building to be protected in 1984. After that, Sivrihisar was declared as an urban protected area of 58 hectares with the decision No: 2276 of Eskişehir Regional Council dated 31.01.2003. Before the declaration in 2003, two more military buildings as examples of civil architecture and 9 monumental buildings were registered. In accordance with the decision of 2003, 20 traditional civil architecture buildings and 32 monumental buildings were registered. Then, the border of urban protected area was redefined under the decision No: 4627 dated 16.12.2010.

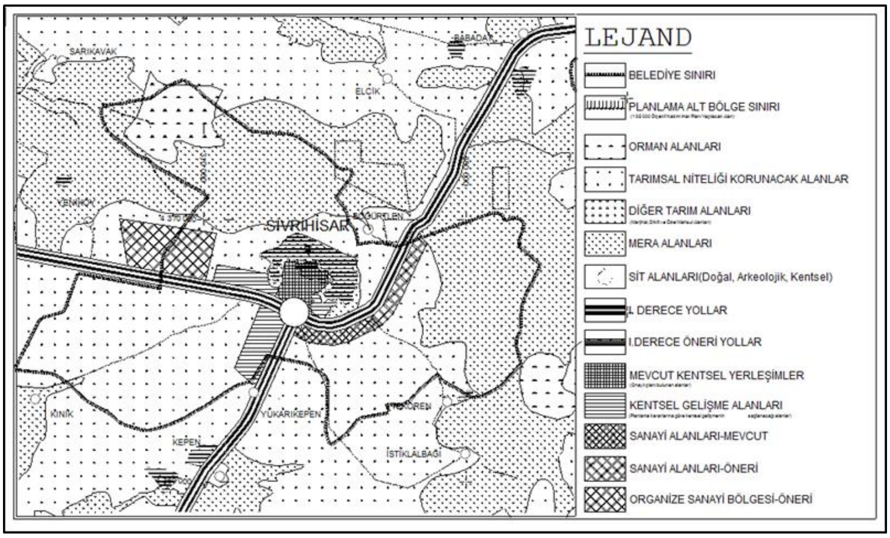


Figure 2.5. Environmental Plan in 1/100.000 scale, plan decisions for Sivrihisar settlement and its surroundings (Atn İmar, 2016, 6)

Conservation Development Plan (KAIP-Koruma İmar Planı) of Sivrihisar prepared by AKS Planlama was approved under the decision No:4720 of Eskişehir Regional Council on 23.02.2011 and revised with the decision No:331of Eskişehir Regional Council dated 15.02.2012. However, Conservation Development Plan required another revision due to the some problems encountered in the practice and the revised Conservation Development Plan prepared by ATN İmar was approved under the decision No:4379 of Eskişehir Regional Council on 16.08.2016 (see Fig.2.6). Conservation Development Plan has been approved as a 1/5000 scale Master Development Plan and 1/1000 scale Implementation Development Plan (Ortek Proje, 2016, 10)

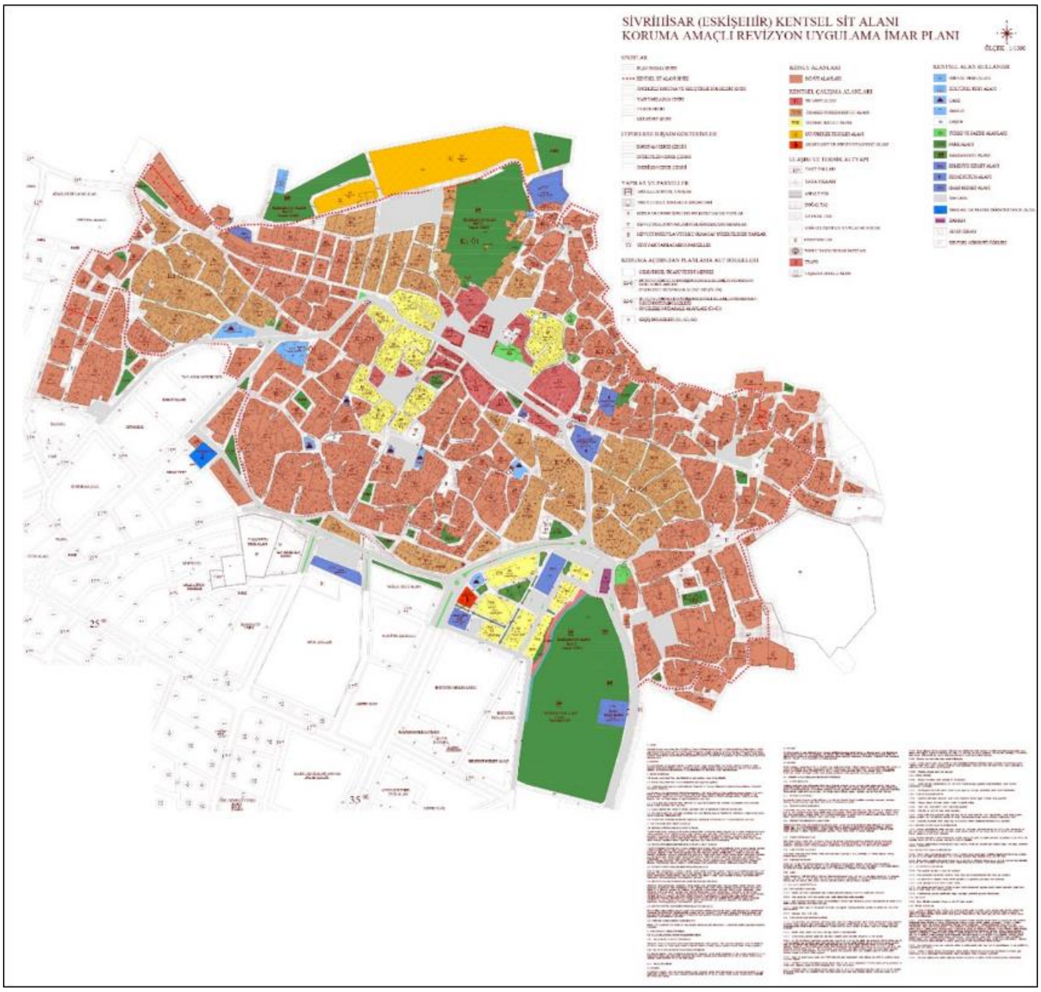


Figure 2.6. Conservation Development Plan (ATN İmar, 2016)

The size of revised Conservation Development Plan of 2016 area is 90.9 ha. According to the revised Conservation Development Plan, residential areas occupy largest area with 29.01 hectares. Residential-tourism-commercial areas occupy an area of 10.78, while commercial areas and residential commercial areas cover 2.21 hectares and 3.55 hectares, respectively. Monumental building areas including the religious buildings, Mausoleum, bath and fountains cover 0.8, 0.31, 0.06 and 0.02 hectares, respectively. Besides, governmental agency and municipality areas cover 0.45 and 0.81 hectares, respectively while recreational areas, parks and squares cover 8.01, 1.71 and 7.73 hectares in the given order. In addition, social facilities, cultural facilities and administrative facilities, and also roads and the others cover 0.25, 0.21, 0.23, 21.93 and 0.22 hectares, respectively. (ATN İmar, 2016, 16-17)

In the Conservation Development plan of 2016, conservation areas are defined into two groups. In the first group, the region that consists of traditional houses dating back to 15th -19th centuries, monumental buildings, traditional streets and square is defined as an authentic conservation area. Decisions regarding the areas within the 1st region are considered as priority intervention area. In this region, different areas are determined for the street rehabilitation, protection, development, and refunctioning. In the second group, the region that consists of traditional houses dating back to 19th century, traditional streets and square is defined as a partially authentic conservation areas. In this group, the areas are considered as secondary intervention areas. In addition, the buildings are grouped into five as listed monumental buildings (group I listed buildings), listed civil architecture buildings (group II listed buildings), the buildings to be protected for mass and façade features, the buildings that are not suitable with the authentic pattern to be improved, and the buildings that are not cultural property. According to principles of Conservation Development Plan of 2016, approval of Eskişehir Regional Council will be obtained for the repair and restoration of Group I. and Group II. listed buildings and for the simple repair of Group I listed buildings. In addition, permission of KUDEB will be obtained for the maintenance and simple repair of Group II listed buildings and for the repair of unregistered buildings.

With the approval of Conservation Development Plan of 2016, 11 districts of Sivrihisar; Camikebir, Cumhuriyet, Demirci, Elmalı, Gedik Karabaşlı, Karacalar, Kılıç, Kubbeli, Kurşunlu, and Yenice remain in the borders of urban protected area (see App. A). Today, street rehabilitation projects that were proposed in the Conservation Development Plan have been continuing in Sivrihisar.

2.4. Traditional Settlement Pattern of Sivrihisar

In Sivrihisar which is located at the northern slope of Sivrihisar Mountain, the oldest settlement was developed organically from the slope of mountain to the Sakarya plain. The settlement development continued in Sivrihisar especially from Byzantine period until today. During the Anatolian Seljuk period, the Turkish tribes inhabited neighborhoods built around castle of Sivrihisar. Therefore, old neighborhoods that were located at the slope and around castle were taken the name of Turkish tribes who settled the area. In Sivrihisar, neighborhoods were developed around a masjid or mosque. Neighborhoods could also get their names from the people who built a mosque or masjid in the area, as well as from the people who had a mausoleum in the borders of neighborhood. At that time, some of these neighborhoods were built to the Byzantine neighborhoods, whereas some of them were the newly established neighborhoods (Doğru, 1997, 22). In addition, some neighborhoods were formed by professional and well-educated people who migrated from Semerkant, Taşkent, Belh, Merv to Sivrihisar with the Mongol invasion (Doğru, 1997, 26). These neighborhoods have taken their names from these occupational groups. Immigrants who had professions also contributed to socio-economic development of region through establishment of workshops and commerce houses. In addition, Armenian neighborhood was formed around Armenian Church by the non-muslim people living in Sivrihisar. Some of old neighborhoods disappeared as a result of combination of small neighborhoods over time. Name of some neighborhoods were used as a street name and the names of some of them are replaced by other names today.

In Sivrihisar, the traditional settlement was established at the slope of Sivrihisar Mountain, and expanded around the castle and Ulucami to the south. Today, the traditional settlement is surrounded by ridges of Sivrihisar Mountain in the north, Zafer Avenue, Süleyman Demirel Avenue, Prof.Dr. Mehmet Kaplan Avenue extending in the east-west direction in the south. The part to the south of urban protected area developed as a new settlement on the west and east of Atatürk Boulevard that is the main road extending north south direction connects the old settlement to the highway. The other main roads, Ordu and Eskişehir Avanues extending east-west direction along the commercial centre within the urban protected area.

Main roads surrounding the urban protected area in the south, passing through the urban protected area and connecting the urban protected area with the highway, are the main road axes of Sivrihisar with dense vehicle traffic. In the traditional settlement areas, the streets are generally narrower and with less vehicle traffic. Even though it is very rare, there is traditional stone cladding that can be observed in the historic settlement area. Traditional narrow streets covered with stone pavements have slope towards to the middle from two sides to provide water flow. In addition, cobblestone, and interlocking concrete paver pavement, asphalt and earth are observed in the settlement.

In Sivrihisar, traditional settlement that is composed of narrow streets has been developed mostly in an organic pattern. In the traditional settlement pattern, small squares formed at the junctions of narrow streets developed in an organic order are observed. Generally a fountain is seen in these squares and a mosque or masjid around which the neighborhood develops. Only in Gedik neighborhood that is located at the southwest of Armenian Church, grid plan is observed. In addition, it is known that Armenian neighborhood, which has no buildings left had grid plan.

The commercial centre of traditional settlement is developed around Grand Mosque (Ulu Camii), and Yeni (Çifte) Hammam, then it is expanded linearly along Ordu and Eskişehir Avenues. In the commercial centre area, there are Şadırvan square, Kağnı bazaar, and shops around them. In addition, there are shops along the Ordu Avenıe that extends in the east-west direction around Ulucami and then goes south towards the border of the urban protected area.

In Sivrihisar majority of the buildings are traditional houses despite existence of both traditional and modern buildings. The new buildings within the urban protected area are especially observed on the Süleyman Demirel Avenue and Zafer Avenue which forms the border of urban protected area in the south. There are also new buildings along the Ordu and Eskişehir Avanues, which are the main roads connected to the Süleyman Demirel and Zafer Avenues in the south passing through the urban protected area. In Sivrihisar, administrative buildings are situated in the urban protected area, whereas education and healthcare facilities are located at the southwest and south of town, outside of the urban protected area. In the urban protected area of Sivrihisar, most of monumental buildings; mosques, masjids, hammams can be considered as the social facilities. Green areas of Sivrihisar are limited with tea gardens, playgrounds, and trees.

2.5. General Architectural Characteristics of Traditional Houses in Sivrihisar

In this section, previous studies related to traditional Sivrihisar houses were examined and general information about architectural features, construction materials and construction techniques of traditional houses in Sivrihisar were collected and compiled. In addition, observations and data collected during the field survey also contributed to this review. In this study, previous studies[4] on Sivrihisar houses were

[4] MA thesis "Geleneksel Sivrihisar Evleri" prepared by Fisun Özcuşa at Gazi University in 1986; MS thesis "The restoration project of Zaimoğlu Konağı in Sivrihisar" prepared by Gözde Uslu at METU in 2003; the studio study "A Project For Preparation of Sivrihisar Conservation and Management Plan" prepared at METU in 2009.

taken into consideration. Mainly, G. Uslu's thesis and the studio study prepared at METU were taken as the main reference in this section.

Traditional timber framed houses in Sivrihisar are built by using two different systems together; masonry and timber framed systems. In Sivrihisar houses, stone masonry system is used in foundation walls, basement and ground floor walls and timber framed system with brick/mudbrick infill is used in the upper floors as a construction method. Depending on the ground on which the buildings are constructed, foundation depth generally varies by digging until it reaches a rocky ground. Foundation walls and ground floor walls are built with rough-cut stone, by placing bigger stones at external facades and filling the inner space with the smaller stones (Uslu, 2003, 210). Rough-cut stones are used as a main structural material, and mud-based mortar is used as a binding material.

The upper floor walls are formed by timber framed system. Timber framed system is filled with bricks or mudbricks and bind with mud mortar. Main post and beams constituting the post and lintel system have thicker cross sections; of 20x20 cm and 25x25 cm in square form and 25-35 cm or more in log form (Uslu, 2003, 210). The main structural elements of timber-framed structure have cross section around 10x10 cm, 10x15 cm, 15x15 cm, and 15x20 cm; and the secondary elements are approximately 5x10 cm and 10x10 cm (Uslu, 2003, 210-211). The arrangement of brick/mudbrick infill varies with simple, diagonal, herringbone, etc. and ornamented compositions are observed in some cases.

In Sivrihisar houses, pressed earth or stone pavement are used as floor covering in ground floor and basement floor. In courtyard and *taşlık* space, stone pavement is used originally. Flooring used in upper floors in rooms, is formed by placing the floor girders that approximately 12-15 cm in diameter perpendicular to each other. On top of double girder layer, *kamış* (reed) infill and earth infill as a levelling layer which provides insulation are situated. In some cases, a rush mat is set down on the beams before the *kamış* infill. Timber girders are set on the levelling level and then floor coverings are placed perpendicular to the girders.

Timber ceilings are formed with timber structure as flooring construction. Ceilings may be covered with timber coverings or left blank. Timber beams, *kamış* infill or a rush mat can be observed on the ceilings without coverings. Ceilings with timber coverings may have also ornamented ceiling roses. Timber floor and ceiling coverings that are 25-30 cm width (in maximum 50-60 cm width) and 2.5-3 cm thickness are nailed to the beams (Uslu, 2003,211).

In Sivrihisar houses, roofs are mostly hipped roofs and generally composed of four surfaces. Some buildings, especially adjacent ones may have hipped roofs with three and two surfaces. While gable roof is very rare in Sivrihisar, no flat earth roof is observed. In some houses, entrance of house and balconies are covered with small gable roofs. Over and under roof tile is used as a roof cladding originally in Sivrihisar houses. However, Marseille terracotta tiles that were added through the repairs lately are seen mostly today.

Roof structure is formed with timber elements; ridge, rafters, posts and purlins and constructed on top of girders of upper storey ceiling. Roof ridge is supported by king posts and corner posts that are placed on roof girders. When it is required because of the higher posts, braces, which are placed between posts, held up these posts. Afterwards, the timber roof structure is covered respectively with timber roof boards and roof tiles. Roof board is an element placed under the roof covering in order to have smooth surface. Additionally, it transfers the load of cladding and live loads to rafter. In Sivrihisar houses, roof boards are used with 2-2.5 cm thickness and nailed to rafters.

In the settlement of Sivrihisar, mostly two storey traditional houses are observed, although the height of houses varies from one storey to three storeys. In some houses, a basement floor was constructed in accordance with the topography and in some of them mezzanine floor is observed. In Sivrihisar, only one building with attic, which Özcuşa also mentioned in her thesis, was observed among the houses examined within the scope of the site survey. In Sivrihisar houses, upper floors are used in summer, whereas the ground floor and mezzanine floors are used during the winter in general (Uslu, 2013, 182).

In Sivrihisar, the traditional settlement that was generally developed organically, the building-lot relation can vary depending on the shape, size and location of building lot and building. It can be observed the building lot can be adjacent or corner lot. Arrangement of the building in the building lot can vary; building may be occupied by the lot completely with no courtyard or building may be located in the lot together with the courtyard. The building and courtyard are arranged in the lot according to size and shape of main building and building lot (see Fig.2.7).

Courtyard can be placed at the rear of parcel and main building is located at the front side of lot, covering the street façade completely. In this way, there is a direct relation between the building and street, and access to the building is through the street. Conversely, the main building is placed at the rear side and courtyard is located at the front side of the parcel covering the street façade completely. In this case, the street façade of the parcel is covered with courtyard walls. So that the building and street connection is provided through the courtyard. In another form of building-lot relation, building can be located on one side of lot covering a portion of street façade, and so that street façade is composed of courtyard wall and a façade of building. In addition, courtyard can be situated at the rear and side of the lot, and building is settled to parcel with L shape. In this case, street facade may consist entirely of the main building, or street façade is composed of main building and the courtyard wall. Besides, main building that is located in the lot with rear and front courtyard is observed.

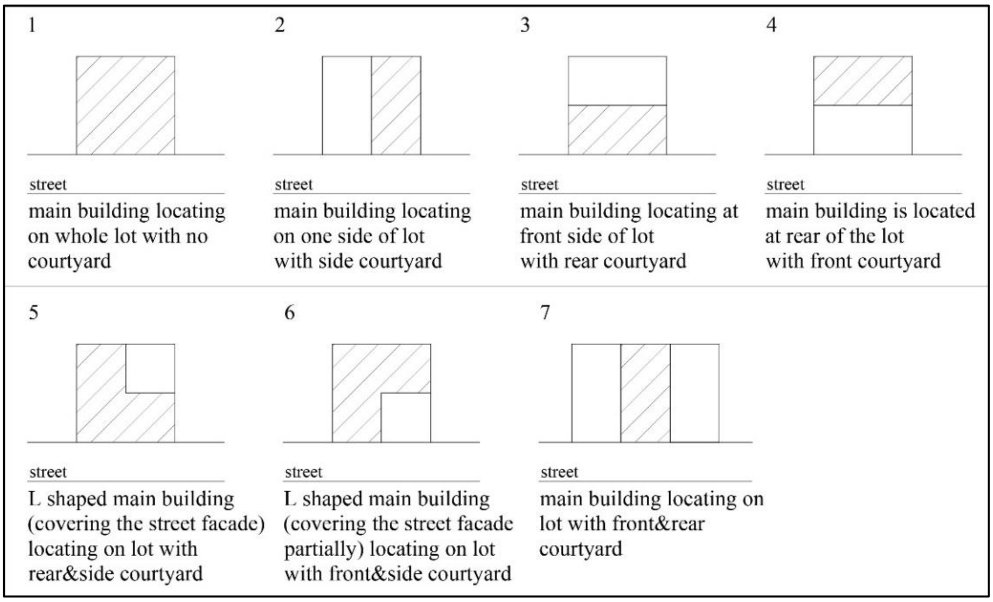


Figure 2.7. Building lot relation considering the location of main building (image was produced by the author[5])

As mentioned above, main entrance from the street can be provided directly via main building facing the street, through the courtyard located between the main building and street or both of them. The access from the street to the courtyard or main building is provided via a single or double wing door made of timber. The courtyard that is an important unit of traditional Sivrihisar houses is surrounded by high walls. The rubble

[5] The image was produced by the author based on the information gathered from Uslu (2003) and the studio study at METU (2009) and site survey done in the context of this thesis.

stone masonry walls that close around the courtyard reach about 2-2.5m high (Uslu, 2003, 183). In Sivrihisar traditional houses, the original floor covering of the courtyard is stone pavement, however in most of traditional houses today the stone pavement has either disappeared or altered.

Service spaces such as *tandır evi*, *çamaşır evi*, etc. are located in the courtyard. In some houses, some service spaces are placed in *taşlık* that is a circulation area covered with stones. *Taşlık* can exist on ground floor or basement floor in accordance to topography. *Taşlık* and courtyard are usually separated from each other by wall and a timber door. In some cases, *taşlık* and courtyard are in continuation of each other and are not separated by a wall. Specialized service spaces and architectural elements located in *taşlık* and/or courtyard are listed as *tandır evi*, *şaraphana*, *çamaşır evi*, *çamaşır taşı*, izbe, *harç evi*, and well.

Well is an important element that is seen almost in every house in Sivrihisar. Well is placed usually in courtyard as well as on *taşlık*.

Tandır evi is a specialized unit placed in courtyard as a separate structure or on *taşlık*. It contains fireplace and/or *tandır*, *hülle* (the ventilation channel of fireplace), a niche for *çıra*, and cupboards (Uslu, 2003, 189).

Şaraphana that is the basin used for grape molasses and wine making is placed usually on *taşlık*. Dimensions of the *şaraphana* made with mudbrick infilled timber structure change between 1.50x2.00 m and 2.00x2.50 m and depth of the basin is around 1.0-1.2 m (Uslu, 2003, 185).

Çamaşır evi is a semi open space placed in courtyard or on *taşlık*. It includes the architectural elements of fireplace and *çamaşır taşı* that is a granite block stone in rectangular or square form. (Uslu, 2003, 189)

Storage areas that are *izbe* and *harç evi-kabak evi* are cool and dark spaces, located on ground floor or basement floor. *İzbe* is a storage area to stock firewood, coal, tools, *tezek* and unused materials; *harç evi-kabak evi* is a storage area to dry and stock food such as fruit, meat, etc (Uslu, 2003, 191).

In the traditional Sivrihisar houses, the plan layout of house is arranged according to "sofa" that is the common space located in the upper floor of house, that is accepted as the main floor. Sofa is the main space of the house and used as a circulation and common gathering area. According the arrangement of sofa in the plan scheme, the plan typology of the houses is determined (see Fig.2.8). In Sivrihisar, mainly two plan types are observed according to location of sofa in the main floor: houses with exterior sofa and houses with interior sofa.

In Sivrihisar houses with exterior sofa, sofa is located in the plan organization with one side facing the courtyard. In the oldest types, courtyard façade of sofa is open and defined with timber posts. In the course of time, although open facing part of sofa was closed, there are still houses with exterior sofas that still have open facade facing the courtyard. Depending on the size of the house and the need for use, the rooms are placed on one side of sofa to be opened to the sofa. Houses with exterior sofa may vary with regard to arrangement of rooms as I type and L type (with corner sofa).

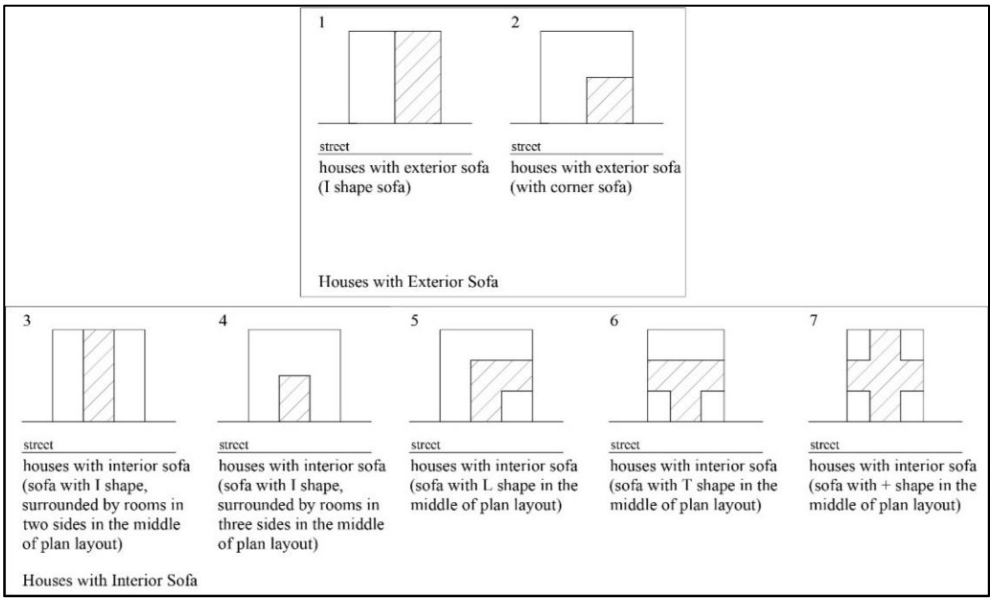


Figure 2.8. Plan typology of houses considering the location of sofa in the main floor (image was produced by the author[6])

In the houses with interior sofa, rooms are placed at two sides of sofa. Plan type diversify according to layout of rooms considering the location of sofa. Most common type is the one called "*karnıyarık*" that consist of sofa in the middle and rooms at two sides of sofa. In some houses, room or "*eyvan*", a semi open space, is added to sofa. In this case, *eyvan* can be used as an area to locate the staircase.

Sofa is a roaming area that provides common space for household and located in one side or the middle of the rooms according to the layout of the house. Although sofa is generally placed in the upper floors in the houses, it is seen in the ground floor in single storey houses. In the sofa of traditional houses in Sivrihisar, interior windows and cupboard windows are observed on the inner walls of sofas. In addition, *sedir* that is a seating unit made of timber is placed in front of the street façade in the upper floor sofas.

[6] The image was produced by the author based on the information gathered from Uslu (2003) and the studio study at METU (2009) and site survey done in the context of this thesis.

The rooms are specialized main units for different daily activities such as living space, sleeping area, etc. in traditional houses. As mentioned before, generally service spaces are placed around sofa or *taşlık* on ground floor or basement floor. On the upper floors, there are rooms that which open to sofas, mostly for the living-sleeping area.

Rooms differ according to their function and activities in the spaces. The rooms vary especially considering the diversity and decoration of architectural elements. According to importance of the room, ornaments of architectural elements are detailed and improved. Ceiling and flooring of the room (horizontal surfaces) and walls with different architectural elements (vertical surfaces) are indicated the order of the importance of the rooms (Uslu, 2003, 187).

Architectural elements such as cupboards, *yüklük* (built-in cupboard), shelves, timber cornices, *seki*, *sedir*, doors and windows are observed in the rooms. Some rooms are designed with all of these architectural elements, while some rooms have a simpler design. Especially *yüklük* in the main room is decorated with carvings, while others have simples designs. In some cases, *yüklük* is arranged together with the room door, so as to completely cover the single wall of the room as service wall. Besides, some built-in cupboards are designed with *aynalık* and *lambalık* in addition to panelled wings of cupboard. Other than the built-in cupboards, cupboards that can differ with drawer, shutter, and window are observed in the rooms. In addition, a horizontal timber cornice placed at the bottom of architectural elements such as cupboard and window surround all walls of room and called as *sandalye çakması* (Uslu, 2003, 187).

The other important architectural elements of the room are niches, timber and gypsum shelves and *sedir*. In traditional houses of Sivrihisar, different types of niches are seen in the basement, ground floor or upper floors, plastered and timber coated, with and without arches. Timber *sedir* units are located in front of the windows on the wall facing the street façade, especially in the main rooms that is projected towards street. *Sedir* elements can be shaped in accordance with room size and shape in simple I shape, L shape, or curvilinear shape located at corner.

In Sivrihisar houses , g*üsülhane*, the bath unit is placed generally in the *yüklük*. In addition, *güsülhane* can be placed on the floor, in the *sedir* or on the wall as a separate partition as well as being placed inside the *yüklük*.

Moreover, there are two types of washbasin inside the houses which can be classified into two group according to their materials and shape (Uslu, 2003, 209). They can be formed by timber and marble. Location of washbasin is usually arranged near the window in the sofa of the house.

In the traditional houses of Sivrihisar, the rooms have interior windows on the façade that is facing the sofa. In traditional houses, room doors are seen as panel door and batten door. In ground floor and basement floor, especially in the service rooms, the doors are designed as a simple timber batten door. In the upper floors, the panel doors which are predominantly seen in the main room can be considered as significant examples of timber carving and ornamentation in Sivrihisar. In addition, some room doors in ground and upper floors can be single or double winged door with arched door frame.

In Sivrihisar houses, the fireplace that is an important architectural element can be located in kitchens, *tandır evi*, rooms, courtyards and *güsülhane* in ground or upper floors. Fireplaces with arched openings have flat or protruding front faces. Some fireplaces are built with together small niches located next to them.

Staircases are the important architectural elements that connect the ground floor and upper floors. In Sivrihisar houses, there are staircases placed inside the house as well as open staircases leading from courtyard to upper floor. The stairs in Sivrihisar houses are generally made of timber; however, stone stairs are also observed. Especially, the stairs leading down to the basement floor and in some cases first few steps of timber staircase leading up from the ground floor to the upper floor are observed as stone (Uslu, 2003, 209). Staircases can be straight, L shape or double wing staircases. Staircases in Sivrihisar houses are constructed with timber boards, which are located onto timber stringers at two sides of step, or boards, which are, embed into opened holes on stringers (Uslu, 2003, 209). In addition, in some of houses, especially in the houses where the upper floor is used as summer room, the stair opening is closed with timber cover.

Façade arrangements of traditional buildings in Sivrihisar vary according to the existence of projection, location of projection and entrance of the house. In addition, some houses have a balcony rarely on street and/or courtyard facades. In Sivrihisar houses, the projections can be in different arrangements on the street facades according to the plan scheme of a house. Projections can be arranged along the entire façade, on one side or both sides of the entrance, and as a projection of a room on the street or courtyard façade. In projections, generally, two windows are placed on the front façades of projections and a window is placed on side walls. Projections are constructed by extending the floor girders towards the street. Extended flooring of projections is supported by overlapped beams and/or bracing elements. In most of houses, timber posts are used together with the bracing or overlapped elements. Load is transferred from beams to the timber posts or the main posts in the walls. Also, bracing elements transfer the load to the lintels in the walls or to the ground through timber posts. In some cases, timber floor beams seen at the bottom of projection are covered with timber boards, and in others, timber girders and beams are not covered, and are left blank.

Entrance of the houses can be through courtyard door and/or building entrance door. Courtyard doors of houses are generally simple and single winged batten doors made of timber. However, in some of houses double winged batten doors and panelled doors can be observed. Double winged doors are used as courtyard doors for the entrance of animals and vehicles. On the other hand, main entrance doors of the traditional houses are generally double winged panelled and batten door, although single winged entrance doors are also observed. Building entrance doors can vary with respect to existence of top windows, stairs, pediment and entrance niches. At the entrance of the houses, the entrance may have top windows, and top and side windows. In some of the houses, entrance doors can be placed at the higher level of street and accessed by stone stairs. Also, in some houses, a niche is created on the entrance façade, so that access to the house is ensured through entrance niche with the entrance door and the staircase. In addition some houses in Sivrihisar have a pediment at the building entrance.

In Sivihisar houses, the doorknob, lock systems and hinges of doors are made of iron. Authentic doorknobs of entrance doors vary from simple to ostentatious style and they can be observed still in some traditional houses of Sivrihisar. In addition, in some houses it is observed that bolt and lock of entrance door are connected by a rope and pulley wheel that allow opening of door from the sofa of upper floor.

Exterior windows that are the important elements of facade in Sivrihisar houses are sized and positioned according to the requirements of spaces. Basement and ground floor windows, especially in the service spaces are designed in smaller size rather than the windows in the upper floors. Windows in the rooms are usually arranged in rectangular form in 1/2 and 2/3 width to height ratio (Uslu, 2003, 194). Windows in square and rectangular size are planned in two types; sash and casement windows. Small windows generally in square form are placed on higher levels of ground floor and upper floors walls as a top window. Moreover, some of small windows located on the walls of service spaces such as storage, *tandır evi* on the ground and basement floors are planned without glass and covered with timber or iron railings. Timber railings that can be in lattice pattern or simple are generally set on the windows of service spaces. When it is in lattice pattern, it is usually covered the half of window. Iron railings that can be simple or ornamented can be situated in front of the windows of ground or upper floors.

The eaves of Sivrihisar traditional houses are formed by extending rafters around 50-60 cm or supported with bracing elements (Uslu, 2003, 196). The width of timber eaves may vary according to roof plan of house. Bottom side of eaves is generally uncovered, so rafters and floor girders can be observed from outside. However, some of them are covered with slatted timber boards.

In Sivrihisar houses, a timber cladding that is called '*yelkovan*' and covers the surface of tiles is used traditionally for rainwater drainage. "*Yelkovan*" that is 3 cm thickness and 15 cm high is placed at approximately10 cm away from the eave fascia and is fastened through wedges (Uslu, 2003, 197). Thus, rainwater flows through the joints of tiles at sloping roof and then fall over the *yelkovan*. It also prevents slipping of roof tiles.

2.6. Materials Used in Traditional Houses in Sivrihisar

Stone: Stone is one of the main materials used in the construction of traditional houses in Sivrihisar. Stone type is commonly granite and it is obtained from the quarries of Sivrihisar Mountains nearby the town, Yazıcıoğlu Hills (Uslu, 2003, 210).

Rubble stone is used as a structural element of the load bearing system in the foundation walls, basement and ground floor walls of traditional houses. Bigger stones are used at exterior face of stone masonry walls and smaller stones are used at the inner part of the masonry wall. Stone is also used in the pavement of courtyards, and *taşlık*. In addition, rough cut stone, reused stones and marble are used in some traditional houses. Especially, marble and reused stones are used for the construction of stairs in the entrance of houses and as a step in space.

Timber: Timber is one of the main construction material of traditional houses in Sivrihisar. It is used as structural element and also decorative purposes. In the traditional houses of Sivrihisar, pine, poplar, willow, and juniper are used as timber types. They are obtained from the forests of Sündiken Mountain around Mihalıççık (Uslu, 2003, 210).

Timber in different dimensions and form is used mainly in the stone masonry walls as timber lintel and tie beams, and as main structural elements of timber framed walls. In addition, timber is used as main timber girders, and timber posts in the main structure of houses, in the construction of floor as timber floor beams and in the roof structure. Furthermore, especially processed timber is used in the construction of architectural elements; windows, doors, ceilings, floor coverings, staircases, cupboards, built-in cupboards, and *sedir*.

Mudbrick: Mudbrick is used as an infill material of the timber framed walls in traditional houses of Sivrihisar. Mudbrick is the mixture of clayey soil and water that is combined with straw, animal hair or some similar organic materials. The mixture is moulded into desired form and dimension, and then dried under the sun. Arrangement of mudbricks in framed system is observed as vertically and diagonally. Mudbricks formed in the 11-16 cm width, in the 22-27 cm length and in 6-9 cm thickness and joints varying between 3 and 4 cm are observed in the traditional houses of Sivrihisar.

Brick: Brick is used as an infill material of timber framed walls in Sivrihisar traditional houses. Bricks are composed in various patterns such as simple, diagonal, herringbone, etc. The size of bricks used in the framed system is observed as 21-26 x 9-15 x 3-4 cm and the joint thickness is seen around 2-4 cm.

Mortar-Plaster: In Sivrihisar houses, mud-based mortar is used as a binding material in the construction of stone masonry wall and timber framed walls. Mud-based mortar is composed of clayey soil, sand, silt, water and straw. In addition, lime-based mortar is used on the timber framed walls with brick infill without plaster, especially in case of decorative brick arrangement is seen.

As plaster, mud-based plaster and lime-based plaster are used originally. Mud-based plaster is used on the stone masonry walls and timber framed walls as rough plaster. Lime-based plaster is used on the stone masonry walls and timber framed walls as fine plaster and on it whitewash is applied thereon.

In addition, the laboratory analysis must be done to determine the combination of mortars and plasters. Today, most of houses are plastered with cement based plaster that is not compatible with the authentic features.

Metal: The metal that is generally obtained from the iron mine is used functional and decorative purposes. Metal is used for doorknobs, and hinges of windows, doors, and cupboards, window railings, and stair balusters.

CHAPTER 3

CONSTRUCTION TECHNIQUES USED IN TRADITIONAL SİVRİHİSAR HOUSES

Sivrihisar traditional houses are constructed with *hımş* technique that is used widely in Anatolia. *Hımış* technique is the hybrid construction system consisting of a masonry base section that is formed by the foundation and ground floor walls, and timber framed section in upper floors (Şahin Güçhan, 2018, 1). In Sivrihisar houses, foundations, basement floor walls, if exists, ground floor exterior walls and some of ground floor interior walls are built with using rubble stone masonry system. Timber framed system with brick/mudbrick infill is used for upper floor interior and exterior walls, projections and in some of ground floor exterior and interior walls. Construction of traditional house in Sivrihisar is completed by placing the hipped or gable roof over top of timber framed upper floor walls.

In this section, construction techniques used in the traditional Sivrihisar houses are given by defining the each building system element under its own heading in according to typology classifications identified. For this purpose, the collected data of 28 traditional houses in Sivrihisar obtained from the site survey was documented and then analysed.

Site survey was performed in three-step; in 2015, 2016, and 2019. In the site survey, 14 traditional houses which have readable and original details and materials were investigated in detail and traditional houses partially collapsed and/or in ruined conditions were inspected partially in the extent of the accessibility limitation (for further information see Chapter 1.3.Methodology). During the site survey, all traditional houses were investigated by sketching, taking measurements and photos. For the traditional houses surveyed detailed, plan drawings in all level and system sections were drawn in detail. System sections were taken were the construction system changes to collect the information of system from foundation to roof. For the traditional houses surveyed partially, available building parts were investigated in detail by sketching, taking measurements and photos.

After site survey, documentation of the surveyed houses based on the data collected from site survey was done by the author using AutoCAD software. Site plan in 1/500 scale, all plan level drawings in 1/200 scale, and system section drawings in 1/50 scale of surveyed houses are prepared by considering the all data obtained containing measurements, sketches, photographs. System sections of 14 surveyed houses detailed were drawn and building details were measured and drawn from foundation to roof. Thus, all drawings of houses and photographs of related building details were used to produce the survey sheet of 14 surveyed houses detailed.

The address information and the building block-lot information of the houses surveyed detailed are as follows (for the location of studied houses see App. A);

1. Cumhuriyet Neighborhood Karanlık Street N:4/4, Building block-lot: 433-3,
2. Cumhuriyet Neighborhood Karanlık Street N:2, Building block-lot: 433-2,
3. Camiikebir Neighborhood Haşhaş Street N:4, Building block-lot: 196-1,
4. Camiikebir Neighborhood Kartal Street N:10, Building block-lot: 188-4,
5. Demirci Neighborhood Değirmen Street, N:7, Building block-lot: 444-15,
6. Demirci Neighborhood Kutluçeşme Street, N:2, Building block-lot: 443-13,
7. Demirci Neighborhood Düden Street, N:4/5, Building block-lot: 448-2,
8. Gedik Neighborhood Esen Street, N:22, Building block-lot: 362-19,
9. Kılıç Neighborhood Hisar Street, N:33, Building block-lot: 170-19,

10. Kılıç Neighborhood İsmet Çağlar Paşa Street N:34, Building block-lot: 170-44,
11. Kubbeli Neighborhood, Horoz Street N:30, Building block-lot: 186-36,
12. Yenice Neighborhood, Elmas Street N:6/8, Building block-lot: 11-16,
13. Yenice Neighborhood, Üçpınar Avenue N:44-44B, Building block-lot: 521-7,8
14. Yenice Neighborhood, Üçpınar Avenue N:50, Building block-lot: 521-12

The address information and the building block-lot information of the partially surveyed houses are as follows (for the location of studied houses see App. A);

1. Camikebir Neighborhood, Acem Street, N:4/1, Building block-lot: 198-11
2. Elmalı Neighborhood, Çağlayan Street, N:2, Building block-lot: 229-6
3. Elmalı Neighborhood, Demirci Street, N: 23, Building block-lot: 228-17
4. Elmalı Neighborhood, Kıvrım Street, N: 2A, Building block-lot: 230-1
5. Gedik Neighborhood, Esen Street, N:3, Building block-lot: 354-9
6. Gedik Neighborhood, Ali Dede Street, N:8, Building block-lot: 362-9
7. Karabaşlı Neighborhood, Ceylan Street, N:22, Building block-lot: 367-13
8. Karabaşlı Neighborhood, Pazar Street, N:10, Building block-lot: 371-36
9. Kubbeli Neighborhood, Horoz Street, N:1, Building block-lot: 185-11
10. Kubbeli Neighborhood, Horoz Street, N:18, Building block-lot: 186-40
11. Kubbeli Neighborhood, Mavikadın Street, N:23/A, Building block-lot:186-9
12. Kubbeli Neighborhood, Mavikadın Street, N:21, Building block-lot:186-10
13. Yenice Neighborhood, Muhtar Kemal Çakır Street, N: 14, Building block-lot: 12-29
14. Yenice Neighborhood, Muhtar Kemal Çakır Street, N: 16, Building block-lot: 12-30

After the documentation phase, documented data of traditional houses were analyzed with together the information achieved during the investigation of houses. All building elements of 28 surveyed houses were analysed and classified according to their similarities and differences by comparative assessment. Thus, all structural elements, architectural elements and horizontal and vertical connections were defined.

After the classification of building elements, a coding system was assigned to each detail of system sections (see Fig.3.1, Fig.3.2). A coding system that was defined in the MS thesis of Filiz Diri (2010) was developed and adapted to timber framed traditional houses of Sivrihisar. According to coding system, building is divided into sections with respect to floors and floors of houses are coded with the abbreviation of the each floor section. In each floor section, connection detail, vertical load bearing elements and architectural elements are represented by numbers 0 to 2. Differentiation of the detail is described with the initial letter of building element and number written on the right bottom of code in accordance to the name and type of building elements.

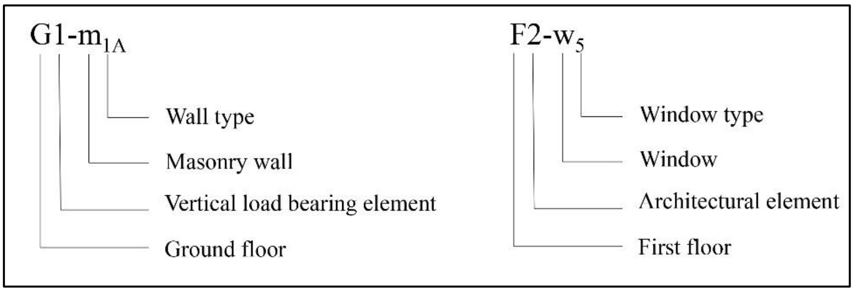


Figure 3.1. Example of codes

A coding system was added to the system section drawings of 14 houses surveyed detailed. In this way, typology of building elements used in the 14 houses were seen easily and systematically. After the application of coding system to the system section drawings, survey sheet of 14 houses surveyed detailed were prepared (see App. B).

The information on the details of construction techniques that was determined through analyzing the documented data of 28 houses studied are given in the order from foundation to roof and then architectural elements under the following titles:

- Foundations
- Walls
    - Masonry walls
    - Timber framed walls with infill
- Timber Posts
- Floor Structures
- Roofs and Its Elements
- Horizontal and Vertical Connections
- Architectural Elements
    - Projections
    - Staircases
    - Openings
        - Doors
        - Windows
    - Coverings
        - Floor Coverings
        - Ceiling Coverings
    - Interior space components
        - Fireplaces
        - Niches
        - Cupboards
        - Sedir
        - Shelves

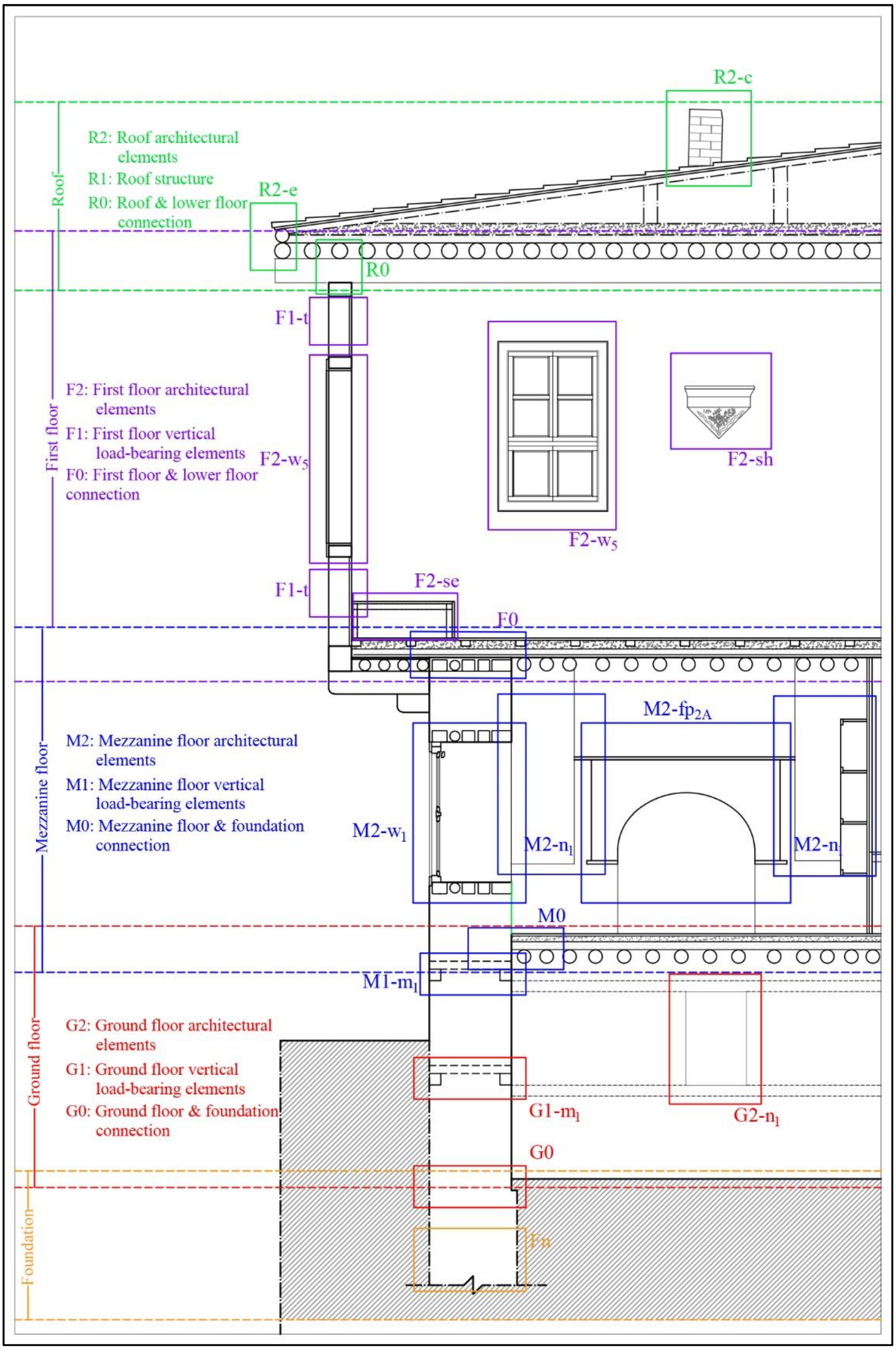


Figure 3.2. Code system assigned to the system section drawing

3.1. Foundations

In Sivrihisar that is settled on the slopes of Sivrihisar Mountain, it is observed that the natural slope of the land is generally used in the construction of traditional houses. Although the foundations could not be observed in every traditional houses studied due to accessibility limitations, the foundation and/or ongoing foundation walls could be observed in some of houses studied. Therefore, foundations could only be inspected only in 4 houses and the ongoing foundations walls in 6 surveyed and 4 partially surveyed houses could be examined especially thanks to the buildings constructed with basements (see Fig.3.3.-3.4).

The stone masonry foundation walls, which continue on the foundation, go up to the ground floor walls by creating “sous basement” level in accordance with the topography in some houses. In between the stone masonry foundation walls and ground floor walls, a timber lintel that is in 10-20 cm cross section is used. The ground floor walls that continue above the foundation walls can be stone masonry walls or timber framed walls with mudbrick infill. When the ground floor walls are continued as stone masonry walls, timber lintel used between the “sous basement” level and ground floor walls are generally in 10-15 cm thickness (see Fig.3.5). In the houses surveyed, it was observed that the distance of “sous basement” (plinth courses) from entrance level to the timber lintel level where the ground floor walls started changes between 25-150 cm according to the slope of the land. When the ground floor walls are timber framed wall with mudbrick infill, a timber beam that has 15-20 cm cross section is used as a foot plate of timber framed system (see Fig.3.6). A timber beam used between the stone masonry foundation wall and ground floor wall is located around 20 cm to 150 cm above the ground level. Only in one house, it is observed that timber framed wall with mudbrick infill is built on the stone masonry foundation wall without timber foot plate (see Fig.3.7).

Figure 3.3. Ongoing foundation walls in the basement floor (left, Kubbeli N. b.block-lot: 186-40; middle, Camikebir N. b.block-lot: 198-11; right, Kılıç N. b.block-lot: 170-19)

Figure 3.4. Ongoing foundation walls with timber lintel in the basement floor (left, Cumhuriyet N. b.block-lot: 433-2; right, Camikebir N. b.block-lot: 198-11)

Figure 3.5. Timber lintel between the foundation wall and ground floor wall (left, Camikebir N. b.block-lot: 196-1; right, Karabaşlı N. b.block-lot: 367-13)

Figure 3.6. Timber beam as a foot plate of timber framed wall located on stone masonry foundation wall (Cumhuriyet N. b.block-lot:433-3)

Figure 3.7. Timber framed wall located on stone masonry foundation wall without a timber foot plate (Gedik N. b.block-lot:362-19)

Stone masonry foundation walls in Sivrihisar consists of rubble stones and mud mortar. The thickness of stone foundation walls changes 60 to 120 cm. Depth of foundation walls changes in accordance to topography and condition of the ground. Although limited investigation could be made at the foundation level in houses surveyed, it was stated in the literature that the ground was excavated until reaching the rocky base and large foundation stones were placed on the base found (Özcuşa 1986, 193). In addition, since the rocky ground is generally reached at the depth of 60-150 cm, it is referred that foundation depth may be around 60-150 cm (Sayan 2009, 180).

Foundations of Sivrihisar traditional houses surveyed can be categorized into 3 groups according to their construction techniques and material types.

Type 1, Continuous Foundation: The foundation walls of this type, which are rubble stone masonry, continue on the same axis of ground floor walls (see Fig.3.8-3.9-Fig.3.12).

The depth of foundation walls was observed to vary between 50-95 cm, but the depth of walls depends on the characteristics of land. The thickness of walls changes between 60-120 cm. The thickness of foundation walls can continue with the same thickness along the rising wall and the thickness of walls can decrease gradually at one level as it rises from the foundation to the ground floor level.

Figure 3.8. Continuous foundation with gradually decreasing width at one level at one side (Yenice N. b.blok-lot: 521-12)

Figure 3.9. Continuous foundation with gradually decreasing width at one level at one side (Gedik N. b.blok-lot: 362-19)

Type 2, Composite Foundation: This type of foundation is consist of continuous foundation walls located under the external ground floor walls, and separate timber posts located on stone base in the ground floor especially houses with the *taşlık* and exterior sofa.

Timber posts that are used as vertical elements to transfer the loads from upper floor to the ground. Timber posts are seen generally in the street façade of semi open sofas in ground floor and upper floor, in the street facades under the projections, and in *taşlık* and sofa. If there is a *taşlık* space in the ground floor and there is no partition wall, then the upper floor walls are supported by separate timber posts located in the ground floor. Continuous foundation may be extend under the timber posts or timber posts can be located on separate stone bases. Thus, the timber posts located on separate stone bases in the ground floor and support the upper floor with together the continuous foundation walls of exterior edges of houses can be defined as composite foundations (see Fig.3.10).

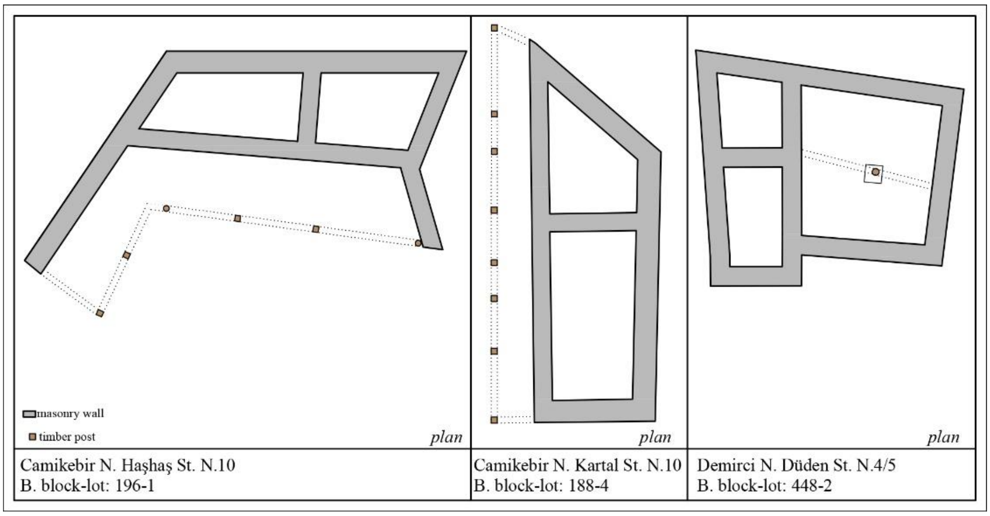


Figure 3.10. Drawing of composite foundation example (left, Camikebir N. b.blok-lot: 196-1; middle, Camikebir N. b.block-lot: 188-4; right, Demirci N. b.block-lot: 448-2)

Type 3, Rocks used as a part of Foundation: In this type of foundation, rocks are used as a part of foundation of houses. The ground floor stone masonry walls are constructed on top of the rock and rise up on their axis (see Fig.3.11-3.13). There is no special connection between the rock and ground floor wall joint.

Figure 3.11. Rock as a part of foundation under the masonry wall and stone base (left) and stone masonry wall of ground floor (right) (Yenice N. b.blok-lot: 12-30)

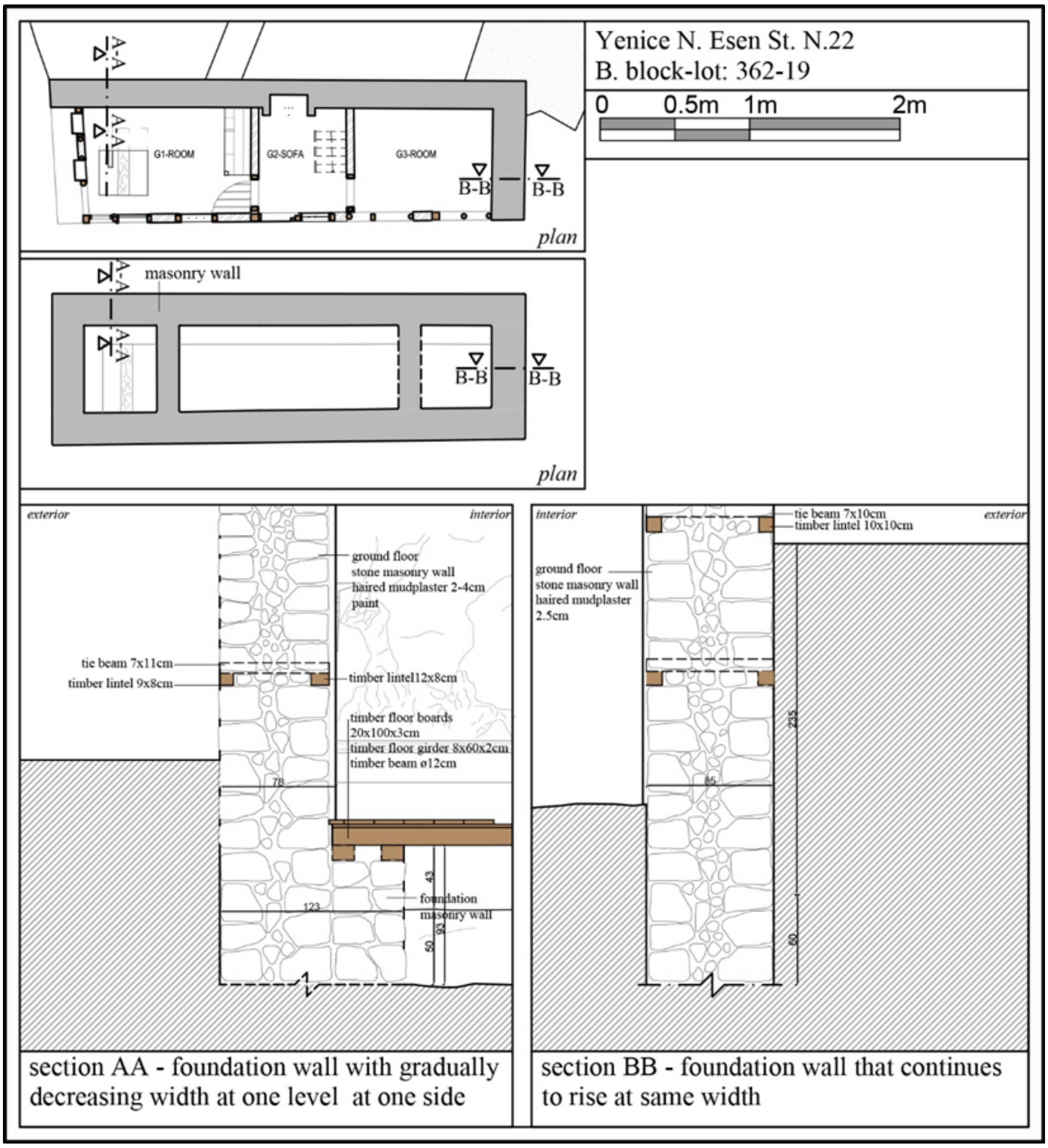


Figure 3.12. Drawing of continuous foundation (Yenice N. b.blok-lot: 362-19)

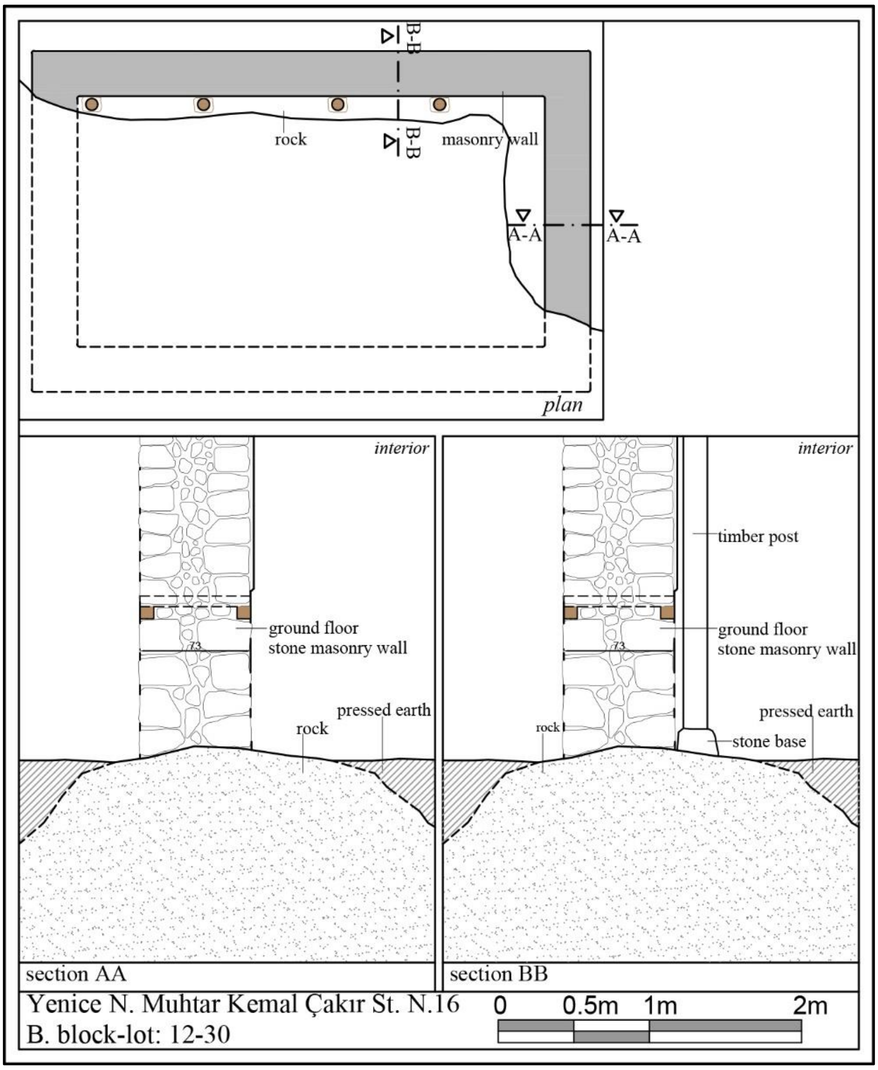


Figure 3.13. Drawing of rock used as a part of foundation (Yenice N. b.blok-lot: 12-30)

3.2. Walls

Walls that are the vertical structural elements in traditional house of Sivrihisar can be classified according to construction technique, materials and location of the wall. In Sivrihisar houses, masonry walls are used generally in ground floors and timber framed walls are used generally in upper floors.

3.2.1. Masonry Walls

Stone masonry system is used in the construction of courtyard walls and foundation, basement and ground floor walls in Sivrihisar houses. Stone masonry walls used in the foundation and ground floor, which forms the masonry base section of the Sivrihisar houses, are mostly observed as exterior walls of houses. Stone masonry walls with timber lintels are used as exterior walls on the ground floors, but they are also seen as interior walls in the ground floors in some cases. In addition, the stone masonry walls, which are mostly used on the ground floor and basement, are observed along the entire building height in some houses (see Fig.3.14).

For the construction of masonry walls, rubble stones, timber lintels and tie beams are used. Stones used in masonry system are granite that is obtained from the quarries around Sivrihisar (Uslu, 2003, 148). Masonry walls are built with rubble stones irregularly, not in special order. In houses surveyed, all masonry walls are built as un-coursed rubble masonry (see Fig.3.15-3.16). In some houses, small stone pieces, brick pieces and white stone pieces are observed among the arrangement of rubble stones (see Fig.3.15). Thickness of rubble stone masonry walls in houses surveyed changes 60-84cm. 107 cm thick stone masonry wall was observed only in one house. In according to thickness of the wall, big rubble stones used as at outer façades of wall are around 20-30 cm and inner part of double skin masonry wall filled with small stones is around 10-20cm.

According to construction techniques, one type of stone masonry walls is observed (Type 1). Stone masonry walls with timber lintels are built as double skin masonry; bigger rubble stones are used at two exterior side of stone masonry walls and smaller stones are used to fill the inner area between two sides. As a binding material, mud-based mortar is used. (see Fig.3.17)

Figure 3.14. Stone masonry wall with timber lintel continue along the building height (Gedik N. b.blok-lot: 354-9)

Figure 3.15. Examples of un-coursed rubble stone masonry walls (left, Camikebir N. b.blok-lot:198-11; right, Yenice N. b.block-lot: 12-29)

Figure 3.16. Examples of un-coursed rubble stone masonry walls (left, Camikebir N. b.blok-lot:188-4; right, Elmalı N. b.block-lot: 229-6)

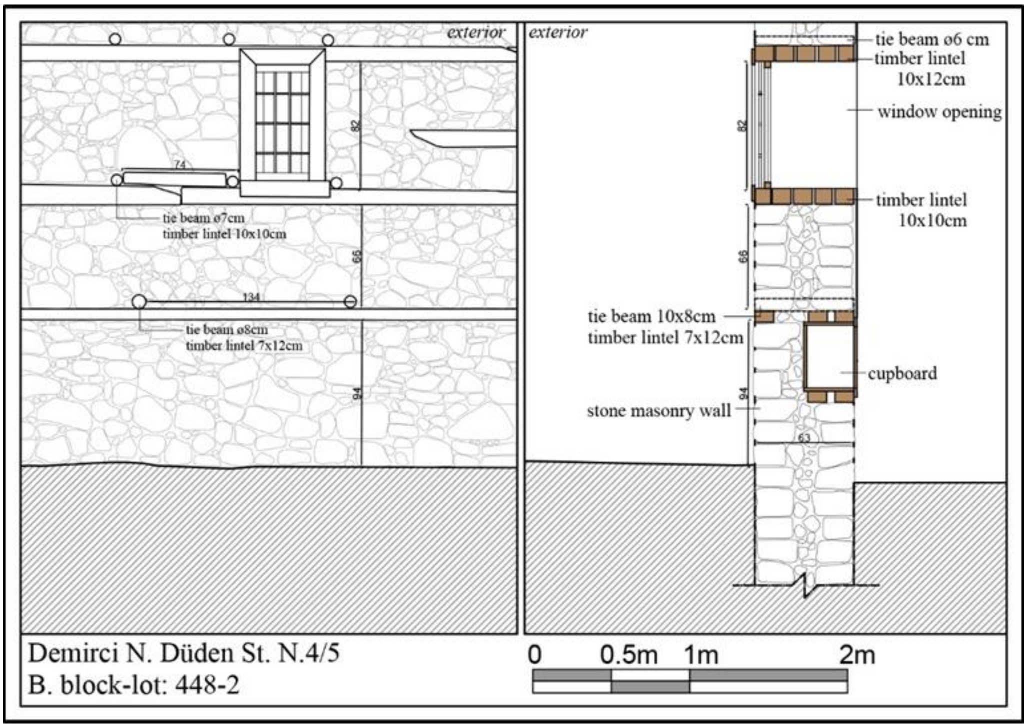


Figure 3.17. Drawing of stone masonry wall with timber lintels (Demirci N. b.block-lot: 448-2)

Timber lintel used between foundation wall and stone masonry ground floor wall is 10-15 cm thick, and located at 25-150 cm high from the ground, as mentioned before. In other words, timber lintel used in stone masonry walls of basement and ground floor walls are located above the ground level. Timber lintels are used at both exterior and interior faces of walls at distance of approximately 100cm to each other and they are connected to each other with timber tie beams (see Fig.3.18-3.19). Timber lintels used in masonry walls have square, rectangular or rounded cross sections and dimension changes in between 7x10 cm, 10x10 cm, 12x18 cm and 16x18 cm. It was observed timber lintel with dimension of 4x9 cm in only one house. The distance between timber lintels change between 40-185 cm. In case, distance of two lintels is around 100 cm and more, 1-3 cm changes rectangular timber are observed in between two lintels.

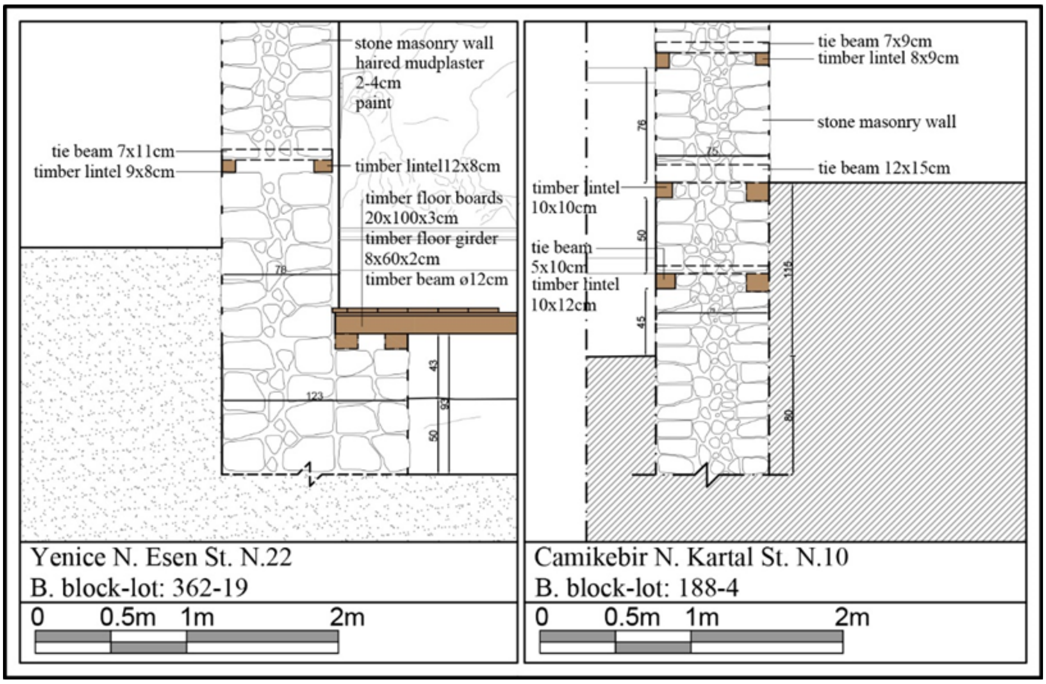


Figure 3.18. Sections of stone masonry walls (left, Camikebir N. b.block-lot: 188-4; right, Gedik N. b.block-lot: 362-19)

Figure 3.19. Stone masonry wall with timber lintels and tie beams (Gedik N. b.block-lot: 362-19)

Timber lintels located at two side of wall are continued along the façade of wall. When another piece of lintel needs to be added to extend the timber lintel along the wall in the façade, the ends of two timber lintels are chamfered at the junction point and fastened to each other with nails (Fig.3.20).

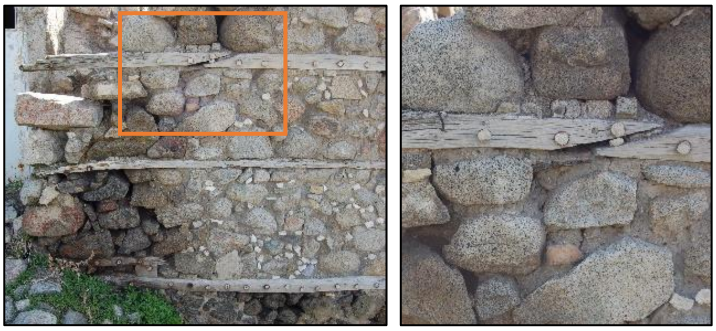


Figure 3.20. Timber lintels on the façade of stone masonry wall (left), connection of two pieces of timber lintel (right) (Camikebir N. b.block-lot: 198-11)

Timber lintels placed at both sides of wall, inner and outer, are connected by timber tie beams (Fig.3.21). Tie beams that are in square, rectangular or rounded form changes between 6 cm to 12 cm. Connection of timber lintel and tie beam is done with nails.

Figure 3.21. Timber lintels and tie beams of stone masonry wall (left, middle,Camikebir N. Acem St. N:4/1 b.block-lot: 198-11; right, Gedik N. Esen St.N:22 b.block-lot: 362-19)

In case, two stone masonry walls are perpendicular to each other, connection of timber lintels of two walls are observed in two ways. In general, two timber lintels that are perpendicular to each other can be overlapped and fastened with nails. Two timber lintels are fastened with nails by using half lap joint, while two lintels of walls perpendicular to each other are on the same level. (see Fig. 3.22)

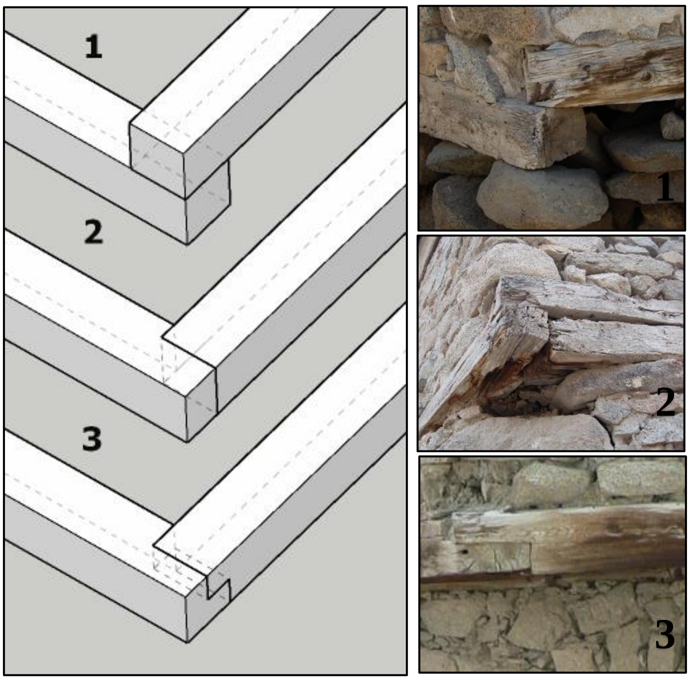


Figure 3.22. Junction detail of timber lintels of two stone masonry wall perpendicular to each other (left, prepared by the author; l, Elmalı N. b.block-lot: 230-1; 2, Karabaşlı N. b.block-lot: 367-13; 3, Camikebir N. b.block-lot: 186-9)

According to finishing layer of stone masonry walls, they can be divided into 2 groups as without plaster (Type 1A) and covered with mud-based plaster (Type 1B).

In ground floors, exterior and interior facades of stone masonry walls are generally covered with haired mud plaster, however stone masonry walls without plaster are also observed. Haired mud plaster, which is used for coating, is formed by the mixing mud and straw (see Fig.3.23). In case of covered masonry walls, thickness of mud plaster is observed around 2-4cm. In addition, when the stone masonry walls are covered with mud-based plaster, it is seen that crown caps are nailed on the timber elements of the wall on façade to create a surface holding the plaster better.

Figure 3.23. Stone masonry wall covered with mud plaster and whitewashed (Cumhuriyet N. b.block-lot: 433-2)

In the stone masonry walls in basement and ground floors, deterioration of plaster at the lower level of walls are observed especially on the interior facades of plastered masonry walls with mud-based plaster (see Fig.3.23). In addition, in some of houses, which have basement floor especially, exterior facades of stone masonry walls are covered with cement based plaster at the level of “sous basement”. Therefore, an original solution related with the using material as plaster to prevent the rising damp problem of stone masonry walls was not observed.

Figure 3.24. Examples of corner chamfer (left, Cumhuriyet N. b.block-lot: 433-3; right, Camikebir N. b.block-lot: 186-9)

In some houses surveyed that are located at the corner of street, connection of two masonry walls at ground floor are chamfered at the junction of streets (see Fig.24). Chamfered corner of the walls raises up 200cm, after that intersection of two exterior walls are continued as perpendicular angle.

3.2.2. Timber Framed Walls

Timber framed system is the load bearing system used for the construction of both exterior and interior walls in traditional Sivrihisar houses. Timber framed section, which is placed on the masonry base section of traditional houses, is observed mostly on the upper floors in Sivrihisar houses. However, timber framed walls used especially on the courtyard facades are observed in the ground floors.

The main structural elements of frame system consist of horizontal timber elements (as foot and wall plates), vertical elements (as main timber posts) and diagonal elements (as timber braces). Main timber horizontal elements placed at top and bottom border of frame system are generally in square or rectangular forms. In the houses surveyed, the thickness of timber foot plates changes 10-25 cm (vary from 11x13 cm to 20x20 cm), and the thickness of timber wall plates changes 10-20 cm (vary from 10x20 cm to 20x25 cm). (see Fig.3.25)

Timber posts, which are one of the main elements of framed system, are used generally in the form of logs. The use of timber posts in square and/or rectangular form can be observed in the main timber posts used in the corners at the junction points of timber frame walls. Cross section of the timber posts changes between 10 to 20 cm. Timber posts are placed at intervals ranging from 50-180 cm. In the case of placement of a window and/or door in the timber framed system, spacing of the posts decreases according to arrangement of architectural elements. The timber framed system is divided vertically with timber posts and horizontally with the timber sills of architectural elements. The intervals of the timber posts are arranged in accordance to the dimension of the architectural elements located on the timber framed wall and dimension of the infill materials. (see Fig.3.25)

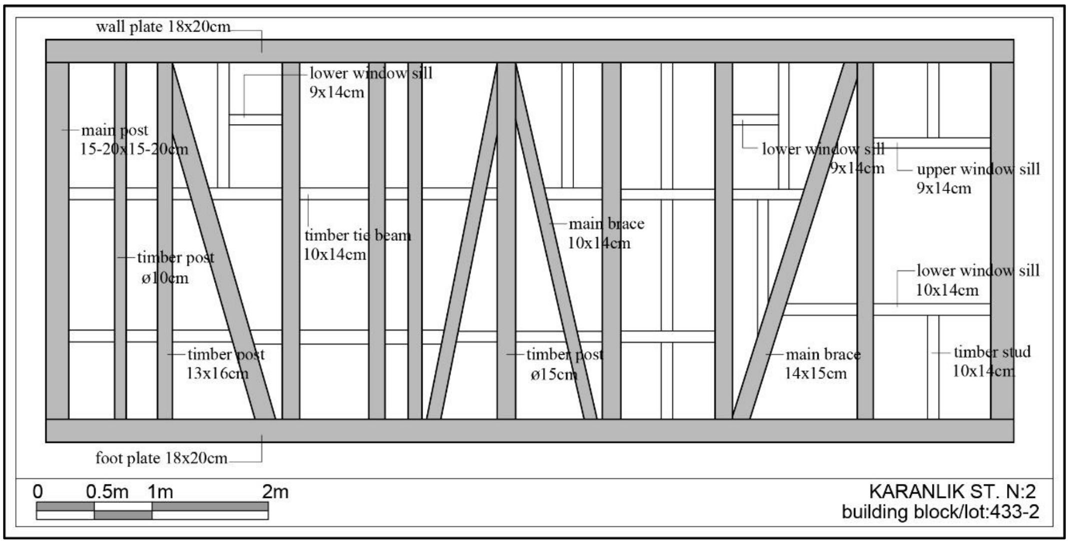


Figure 3.25. Drawing of timber framed wall of a house surveyed (Cumhuriyet N. b.block-lot: 433-2)

Diagonal timber elements that are used as another main structural element of framed system are placed between timber posts and connected to foot and wall plates. The main primary bracing elements are used to support the main posts. In addition, all vertical elements are connected to each other with corner and secondary braces that reinforced the system against the lateral forces applied by earthquake forces (Şahin Güçhan, 2007, 848). In the houses surveyed, timber braces are generally in log forms and have diameters ranging from 10 to 17 cm. However, use of timber braces in rectangular form are also observed in the system especially where windows are placed. In addition to the main structural elements of frame system, secondary timber elements are used to support the main elements. Studs, tie beams and timber bracing elements that are secondary elements of frame system have in smaller cross sections and their thicknesses varies from 5 to10 cm.

Connection of all timber elements in frame system is made with using nails. No lap joints were observed. Connection of main bracing element with main post and wall plates is done by chamfering the upper part of braces at one side or beveled the two sides of brace in appropriate to the connection corner and fastened to the main post with nail. Two types of approach were observed in the junction of the lower part of braces with the foot plate; the lower end of brace is placed adjacent to timber post and the lower end of brace is placed with a space between the post. The connection of the lower part of brace with the foot plate is done by cutting the bottom of brace diagonally in accordance with the base and fixing it to the foot plate with nail. (see Fig.3.26-3.29)

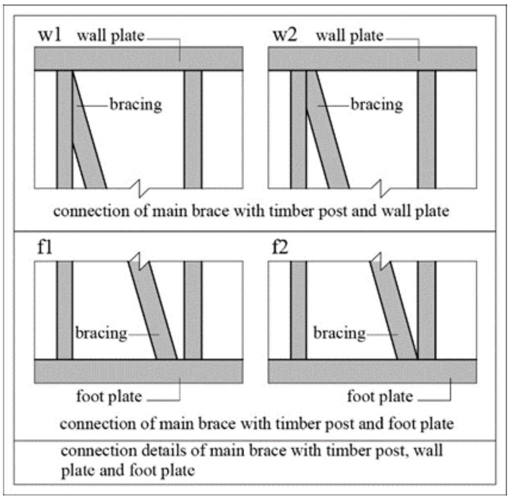


Figure 3.26. Connection detail of braces with timber post, wall and foot plate (prepared by the author)

Figure 3.27. Connection detail of main braces with timber post, wall plate, and foot plate (Cumhuriyet N. b.block-lot: 433-2)

Figure 3.28. Connection detail of main braces and timber post with foot plate (Demirci N. b.block-lot: 448-2)

Figure 3.29. Connection detail of main braces with timber post, wall plate and foot plate (Cumhuriyet N. b.block-lot: 433-2)

In Sivrihisar traditional houses, timber framed system is built with *hımış* technique. Timber framed system that is generally used for the construction of upper floor walls can be divided into 2 groups considering to their construction technique, infill materials. In Sivrihisar, one type of timber framed wall is observed according to construction technique and this technique is divided into 2 sub groups according to the filling materials.

Type 1, Timber framed wall with mudbrick/brick infill: In this type of timber framed walls, the gaps between the load bearing elements of system is filled with using two different masonry infill materials. Accordingly, this type can be divided into 2 groups depending on the infill materials as follows; Type 1A, timber framed wall with mudbrick infill and Type 1B, timber framed wall with brick infill. (see Fig.3.30-3.31)

Figure 3.30. Timber framed wall with brick infill (Cumhuriyet N. b.block-lot: 433-2)

Figure 3.31. Timber framed wall with mudbrick infill (Kılıç N. b.block-lot: 170-44)

Mudbrick or brick infill materials are placed in the gaps between the timber elements of skeleton system by using mud mortar as a binding material. The dimension, placement and arrangement of infill materials vary. When mudbrick is used as an infill material, mudbricks are laid mostly in a horizontal way. However, mudbricks arranged vertically and diagonal are also observed depending on the gaps between the timber structural elements of skeleton system. In the case of using brick as an infill material, forms and/or their combinations are diversified such as simple, diagonal, herringbone, etc. When brick infill is used in decorative arrangement for ornamentation, lime mortar is used in joints in order to highlight the composition of bricks. (see Fig.3.31-3.32)

Dimension of mudbricks used in the timber framed system ranges 22-27 x 11-16 x 6-9 cm. Joint thickness used in the bonding of mudbricks varies from 3 to 4cm. Dimension of bricks in timber skeleton system varies 21-26 x 9-15 x 3-4 cm and joint thickness varies in between 2-4 cm.

Figure 3.32. Timber framed wall with herringbone brick composition (left) and alternate use of brick in horizontal and diagonal order (right) (Kubbeli N. b.block-lot: 186-40)

Timber framed walls with infill materials are divided into 3 groups according to their finishing.

Type I, Without plaster: In this type, timber framed walls are not covered with any plaster. In particular, timber framed walls with brick infill are left uncoated and lime mortar is used for pointing. Therefore, different brick arrangements and lime mortar joints are observed on the facade. (see Fig. 3.33)

Figure 3.33. Timber framed wall with brick infill without plaster (Cumhuriyet N. b.block-lot:433-2)

Type II, Covered with mud plaster: In this type, timber framed walls in Sivrihisar houses are covered with mud plaster and then whitewashed. Covering with mud plaster can be observed on the exterior and/or interior façades of the houses. Mud plaster is used as rough plaster with a thickness of 2-3 cm. Lime plaster also can be used after mud plaster as a fine plaster. In the houses surveyed, it is observed that the exterior façade of timber framed walls are covered with mud plaster or left uncoated in some cases (see Fig. 3.34-3.35). When the timber framed walls are covered with mud-based plaster, crown caps that are nailed on the timber elements of the wall on façade in order to create a surface to hold the plaster are observed (see Fig.37). In addition, timber framed walls that are covered with cement based plaster by a lately interventions are observed.

Type III, Covered with timber lath (*bağdadı*) technique: In this type of covering, timber framed wall surfaces are covered with timber laths and then plastered. Timber lath (*bağdadı*) technique is formed by nailing timber laths onto timber framed system elements horizontally, leaving regular or irregular gaps between them (Yavuz, 2018, 2015). *Bağdadı* technique is often used on walls without infill materials to create a rough surface to better hold the plaster. Among the houses surveyed, this type of technique was only observed only in the construction of the attic storey walls of a house. However, it was not observed whether the timber framed wall was constructed with any infill material, or without infill, due to the limited access. (see Fig. 3.36)

Figure 3.34. Timber framed wall with mud brick infill covered with mud plaster (left),covered with mud plaster and whitewashed (right) (left, Elmalı N. b.block-lot: 229-6; right, Kılıç N. b.block-lot:170-44)

Figure 3.35. Timber framed wall covered with mud plaster and whitewashed (walls with mudbrick infill at lower floor, with brick infill at upper floor) (Kılıç N. b.block-lot:170-44)

Figure 3.36. Timber framed wall covered with timber lath and then plastered (Kubbeli N. b.block-lot: 186-36)

Figure 3.37. Timber framed wall with brick infill covered with mud plaster and crown caps nailed to timber elements of frame system (Camikebir N. b.block-lot: 196-1)

3.3. Timber Posts

In Sivrihisar houses, timber posts are used as vertical structural elements to transfer the load of upper floor to the ground. Timber posts can be observed on the street façades under the projections, on the façade of semi open sofas in ground and upper floors, and mostly in *taşlık* and sofa. (see Fig.3.38-3.39, 3.47-3.48)

The height of timber posts varies between 205-265 cm depending on the space they are used and the floor height of the space. In addition, timber posts with 360 cm high are observed in one house surveyed, rising from ground and reaching to the mezzanine and first floor, respectively. Timber posts can be in square, rectangular or circular form and their thickness varies between from 13 to 23 cm.

Figure 3.38. Timber posts used in the street façade under the projection (left, Camikebir N. b.block-lot:196-1; middle, Cumhuriyet N. b.block-lot: 433-3; right, Yenice N. b.block-lot: 11-16)

Figure 3.39. Timber posts used in ground floor (Cumhuriyet N. b.block-lot: 433-2)

Timber posts used in ground floor is set on the stone base located on the ground (see Fig.3.46). A large single piece of stone, ranging in size from 30-50 cm, is usually used as a plinth of a timber post. Timber post used in the ground floor are observed in the *taşlık* space, on the façade of open sofas or under the projections on street facades. On top of timber posts in ground floor, timber girders are placed with or without bolster. In some cases, timber posts are used in upper floors and they are observed on the facades of open sofas. They are placed on timber girders, and wall plate is located on top of timber posts. Timber posts are set at 85-135cm intervals on the timber girders.

Timber posts located in ground floor or upper floors can be classified into 2 groups in terms of their connection details.

Type 1, Simple connection: In the first type, timber girders are directly placed on top of timber posts without any timber elements in between (see. Fig 3.40-3.42). This type of connection is observed on the posts located in *taşlık,* on the street façade under the projection and on the façade of semi open sofas. Also, it was observed that timber post used under the projection on the street façade was supported with timber braces in a house surveyed. (see.Fig.3.41).

In addition, it was observed that the timber posts with simple connection located on the semi-open sofa of a house surveyed were covered with two different techniques. In the first one, all four surfaces of timber posts are covered single timber boards. In the second one, timber posts are covered with using *bağdadı* technique (timber lath). In this way, timber posts are coated with timber laths in horizontal and/or diagonal way are nailed on the timber posts and covered with mud-based plaster. (see Fig.3.40)

Type 2, Timber post with bolster on top: In the second type, a timber bolster is used in between timber girder and timber post. Timber bolster can have in different cross sections and they are nailed to girder. When timber bolster is used, timber bracing elements that are nailed to girder can be observed as diagonal timber elements at two sides of post. (see Fig.3.43-3.45)

Figure 3.40. Type 1 – timber post in *taşlık* (left, Cumhuriyet N. b.block-lot: 433-2), timber post in semi-open sofa (right, Camikebir N. b.block:196-1)

Figure 3.41. Type 1 – timber post with timber braces under the projection on the street façade (Camikebir N. b.block:196-1)

Figure 3.42. Type 1 – timber posts covered with timber laths and single timber board used on the façade of semi open sofa (Kubbeli N. b.block-lot: 186-9)

Figure 3.43. Type 2 - timber post with bolster on top (left, Kubbeli N. b.block-lot: 186-36; right, Kubbeli N. b.block-lot: 170-44)

Figure 3.44. Type 2 - timber post with bolster on top (left, Camikebir N. b.block:196-1; right, Kubbeli N. b.block-lot: 186-36)

Figure 3.45. Type 2 - timber post with bolster on top (Demirci N. b.block-lot: 448-2)

Figure 3.46. Stone base of timber post (Demirci N. b.block-lot: 448-2)

Figure 3.47. Timber posts with connection detail Type1 and detail Type2 used on ground and upper floor (Kubbeli N. b.block-lot: 170-44)

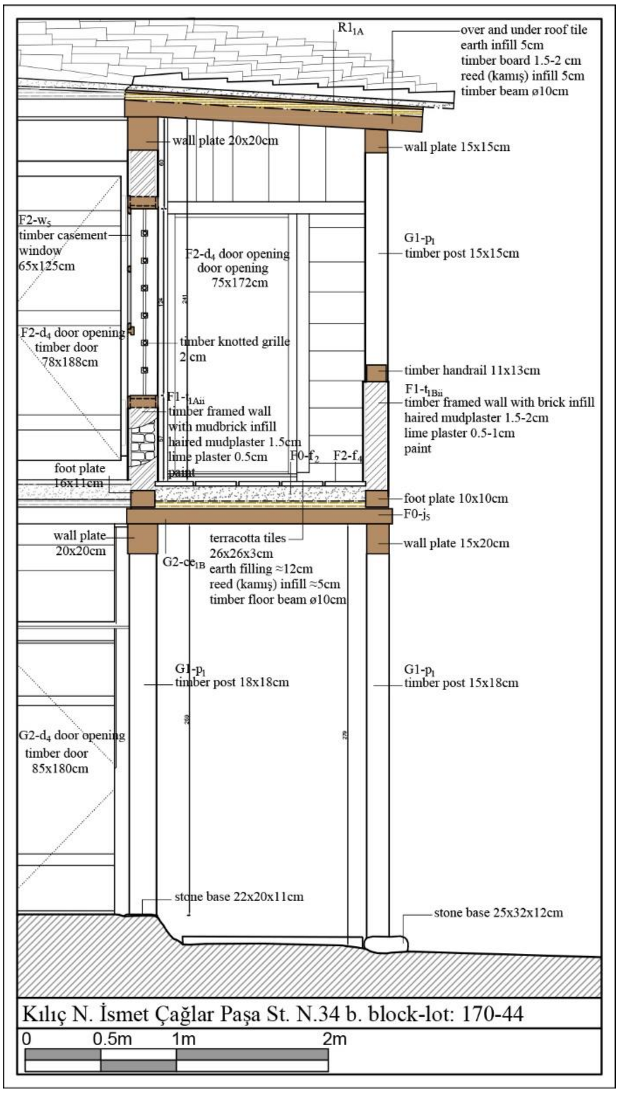


Figure 3.48. Drawing of use of timber posts in ground and upper floors (Kubbeli N. b.block-lot: 170-44)

3.4. Floor Structures

Floor structure is constituted by placing the timber floor beams and floor coverings. Floor construction in traditional houses of Sivrihisar varies according location of floor and covering material. In the floor construction of ground floor and upper floors, two types of construction techniques are observed; simple flooring (Type1) and flooring composed of layers (Type2). They can be investigated according the location of flooring and both flooring types can be observed in lower and upper floors.

In the ground floor and basement, floor pavement is observed as pressed earth, stone pavement and timber covering. In *taşlık* and service spaces, stone pavement and pressed earth are used as a floor covering. In case living spaces in ground floors, timber floor covering is observed.

In the floor construction of ground floor, two types of construction techniques are observed; simple (Type1) and flooring composed of layers (Type2).

Type 1, Simple flooring composed of timber floor beams and timber floor covering boards: Simple floor structure used in the ground floor is constructed with timber floor beams and timber covering boards. During the field study, this type of flooring is observed in the traditional houses with and without basement floor. In the buildings without basement floor, observation of timber floor construction could be performed limited due to the accessibility. Therefore, simple flooring composed of timber floor beams and timber floor covering in the ground floor without basement floor can be observed in two of surveyed houses.

In the first example of simple flooring observed on the ground floor, floor beams with a diameter of 10-15 cm are placed parallel to the short edge of space, leaving a gap around 20 cm between pressed earth and floor beams. However, no clear information could be observed about the location of where the floor beams are placed and fit. In this case, it is assumed timber floor beams are located on to wall plates of stone masonry foundation walls at two sides of spaces. On top of the timber beams, floor girders are nailed. Timber floor boards are placed on floor girders perpendicular to the timber beams and nailed to the girders. A timber plinth is placed at the edges of spaces where the wall and timber flooring met. (see Fig.3.49-3.50)

Figure 3.49. General view of simple timber flooring in the room of ground floor (left), timber floor boards and timber floor beam seen through the drilled hole (middle) , air gap between timber floor beam and pressed earth (right) (Yenice N. b.block-lot:11-16)

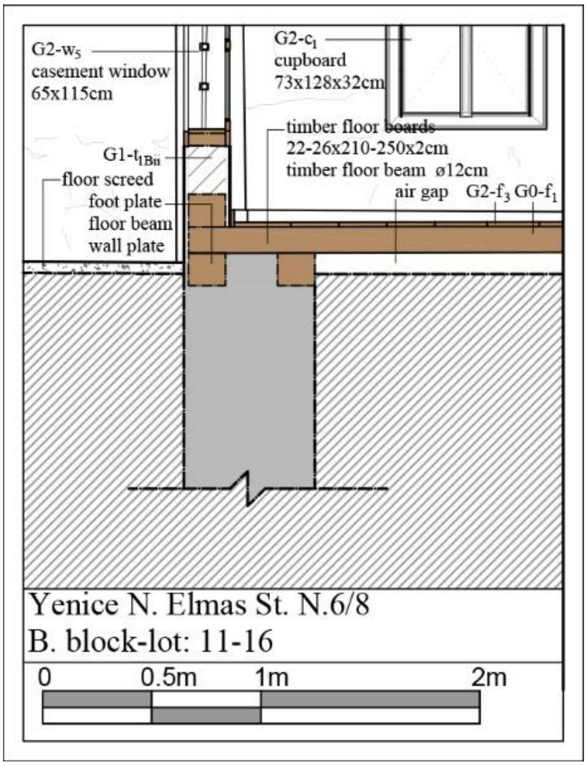


Figure 3.50. Drawing of simple flooring (Type 1) consists of timber floor beams and timber floor boards in the ground floor without basement (Yenice N. b.block-lot:11-16)

In the second example of simple flooring seen in ground floor, it is observed floor beams with 12 cm diameter are located on the masonry wall that is continued through the foundation level. Stone masonry foundation wall on one side of room is enlarged around 50cm below the ground floor level. Although the connection of the floor beam and enlarged stone masonry wall could not be seen, it is observed that the other end of the floor beam sits on the wall plate of stone masonry foundation wall opposite edge of space. So that, after floor beams are located on the wall plates of masonry walls parallel at the short spans of the space, timber floor boards are placed perpendicular to the floor beams and nailed. In some cases, timber girders are placed in between the timber floor beams and boards. (see Fig.3.51-3.52)

Figure 3.51. Simple timber flooring in the room of ground floor, view of enlarged stone masonry wall and wall plate of stone masonry foundation wall (Gedik N. b.block-lot:362-19)

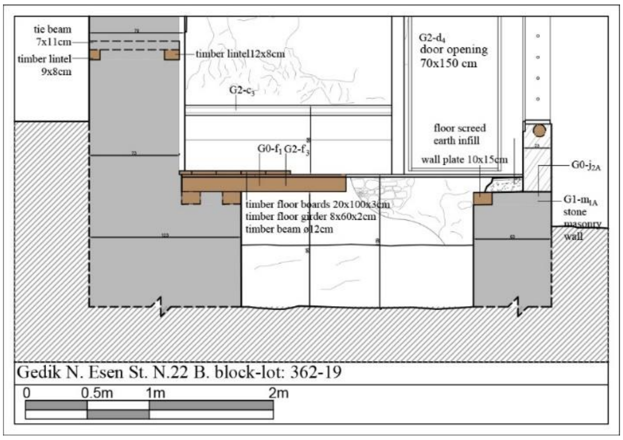


Figure 3.52. Drawing of simple flooring (Type 1) in the ground floor without basement (Gedik N. b.block-lot:362-19)

Simple floor structure is observed also in the ground floor of a house studied that has basement floor. In this case, timber floor covering of hall in the ground floor is located and nailed directly on the timber floor beams that are observed in basement floor. Timber floor beams are placed on the girder located on top of timber posts that are located in the stone masonry wall. Here, it is assumed that stone masonry wall is built later in between the timber posts as a later intervention. (see Fig. 3.53)

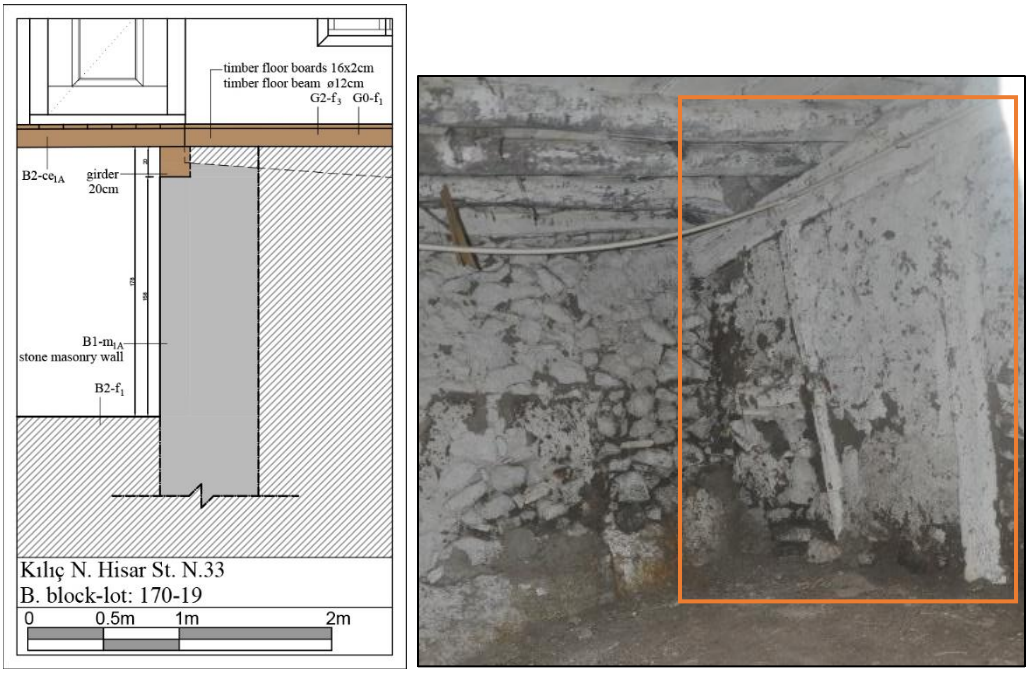


Figure 3.53. Drawing of simple flooring (Type 1) in the ground floor with basement (Kılıç N. b.block-lot:170-19)

Type 2, Flooring composed of timber floor beams, and layers of reed infill, earth infill located on floor beams: In the second type, the timber flooring of ground floor is constituted with layers of timber floor beams, reed (kamış) infill, earth infill, floor girders and floor covering boards, respectively. This type of flooring is observed generally in the ground floor of houses with basement floor.

It was observed, timber floor beams that has 10-15 cm diameter are placed on wall plates of stone masonry walls, parallel to the short edges of the space. Wall plates that are in rectangular or square forms have cross section varies from 15 to 28 cm. After floor beams are placed on wall plates, reed infill around 5-10 cm and earth infill around 10 cm are set on timber beams, respectively. If timber floor boards are used as floor covering, timber girders that vary 5x5 cm and/or 5x10 cm are located on earth infill that is pressed at one level. After timber girders are placed at 30-50 cm intervals, gap between the girders are filled with the earth infill. Then, timber floor boards are placed on perpendicular to the girder and nailed on them. (see Fig.3.54-3.55)

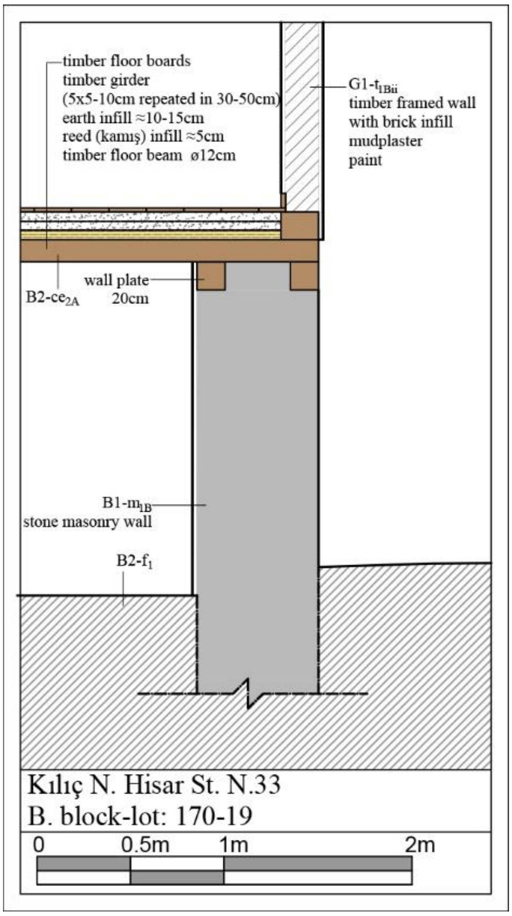


Figure 3.54. Drawing of flooring (Type 2) in the ground floor of house with basement (Kılıç N. b.block-lot:170-19)

Figure 3.55. Timber floor beams that are located on wall plate of stone the masonry wall; interior view (left), exterior view (right) (Kılıç N. b.block-lot:170-19)

In some houses surveyed, timber floor beams carried by timber girders set on the timber posts adjacent to the stone masonry wall of basement are observed. It is estimated that these were added subsequently, possibly as a result of converting the space of house on the ground floor. (see Fig.3.56-3.57)

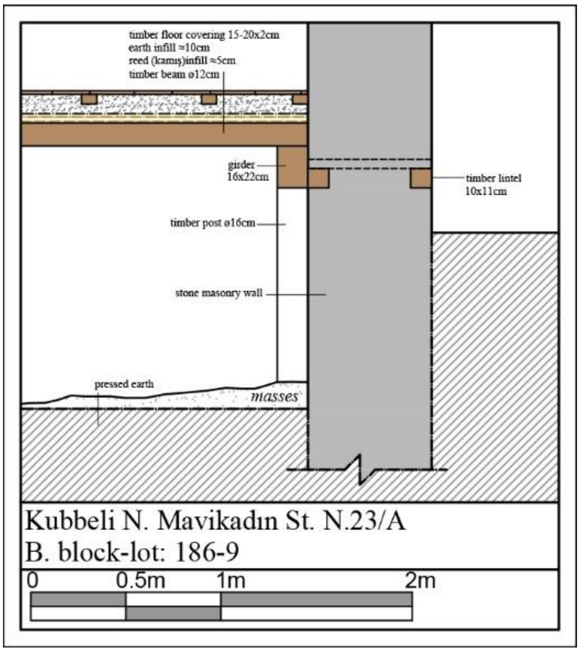


Figure 3.56. Drawing of flooring supported by timber girder located on the timber posts adjacent to the basement floor wall (Kubbeli N. b.block-lot:186-9)

Figure 3.57. Timber floor beams supported by girder located on timber posts adjacent to the basement floor wall (left, middle, Kubbeli N. b.block-lot:186-9; right, Kubbeli N. b.block-lot:186-40)

In the construction of the upper floors, two types of construction techniques that are mentioned in the beginning of this section are used as simple (Type1) and layered flooring composed of layers (Type2). In both of them, timber floor beams are located at around 5-40 cm intervals according to the clear span of space and load to be carried. In the upper floors, floor coverings vary according to material types as timber floor and terracotta tiles.

Type 1, Simple flooring composed of timber floor beams and timber floor covering boards: In first type of floor construction used on upper floors, simple one, timber beams with diameter 10-15 cm, laid on parallel to short span of the space. The distance between floor beams are around 20-40 cm. Two side of timber beams set on wall plates of the wall and nailed to on them. In some cases, connection of timber floor beam and wall plate is done by using lap joints (see Fig.3.59). Timber floor boards are located perpendicular to the beams and nailed to them. A timber plinth is placed at the edges of spaces where the wall and timber flooring met. In some houses, small timber girders are placed in between floor boards and timber floor beams. This type of floor construction is used generally in sofas. However, it is also observed in the flooring of a room in a house surveyed. (see Fig.3.58-3.62)

Figure 3.58. Simple timber flooring (Type 1) used in the sofa on the first floor (left, Demirci N. b.block-lot: 444-15; right, Kubbeli N. b.block-lot: 186-36)

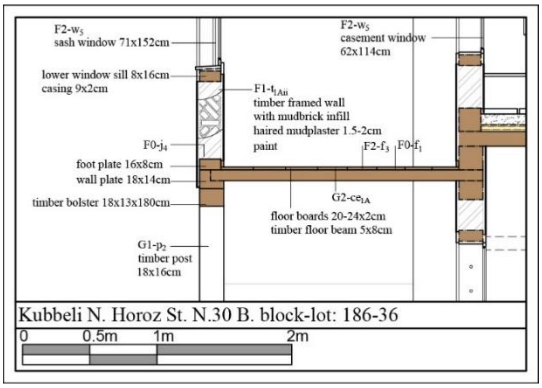


Figure 3.59. Drawing of simple timber flooring used in the sofa (Kubbeli N. b.block-lot: 186-36)

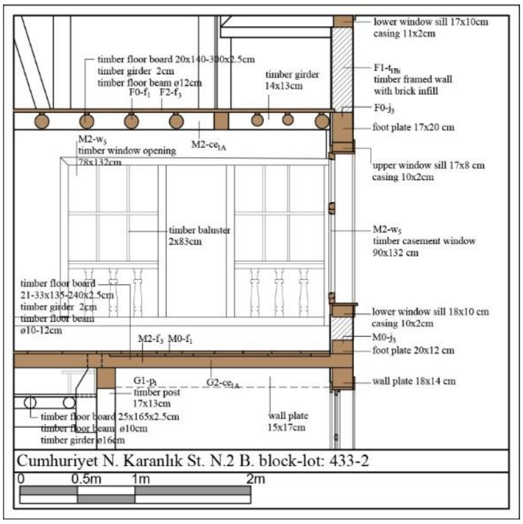


Figure 3.60. Drawing of simple timber flooring used in the sofa on the first floor and mezzanine floor (Cumhuriyet N b.block-lot: 433-2)

Figure 3.61. Simple timber flooring (Type 1) used in the sofa on the first floor (Cumhuriyet N. b.block-lot:433-2)

Figure 3.62. Simple timber flooring (Type 1) used in the sofa on the mezzanine floor (Cumhuriyet N. b.block-lot:433-2)

Type 2, Flooring composed of timber floor beams, and layers of reed infill, earth infill located on floor beams: In second type of floor construction used on upper floors, timber floor beams with 10-15 cm diameter, set on the wall plates of walls at the two sides of space. The distance between floor beams are around 5-20 cm. Then on top of timber beams, reed (kamış) infill approximately in 5-10 cm thickness is placed. In some cases, matting of straw that has around 1 cm thickness is set down on the beams before locating the reed infill. Earth infill around 10-15 cm thickness is set on the reed infill. On top of earth layer, timber boards or terracotta tiles are placed in accordance to the floor covering material. (see Fig.3.63-3.65)

When timber floor boards are used as floor covering, at first, earth is pressed and levelled and then timber girders are located on earth infill every 30-50 cm. Then spaces between timber girders are filled with earth to constrict them. Timber boards are located on perpendicular to timber girders that are around 5x5 cm and/or 5x10 cm, and nailed to them. A timber plinth is placed at the edges of spaces where the wall and timber flooring met. This type of floor construction is generally used in rooms, however it is also observed in the sofas. (see Fig.3.66-3.70)

Figure 3.63. Flooring (Type 2) used in the room in first floor (Gedik N. b.block-lot:362-19)

Figure 3.64. Timber flooring (Type 2) used in the room in first floor (Kubbeli N. b.block-lot:186-36)

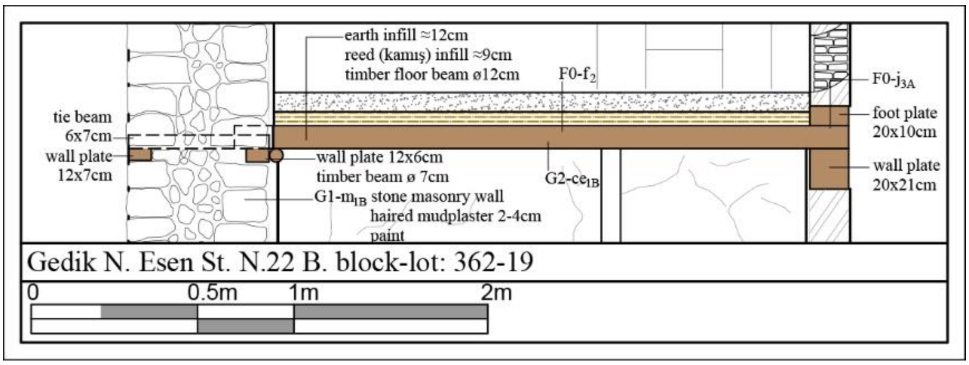


Figure 3.65. Drawing of flooring (Type 2) (Gedik N. b.block-lot: 362-19)

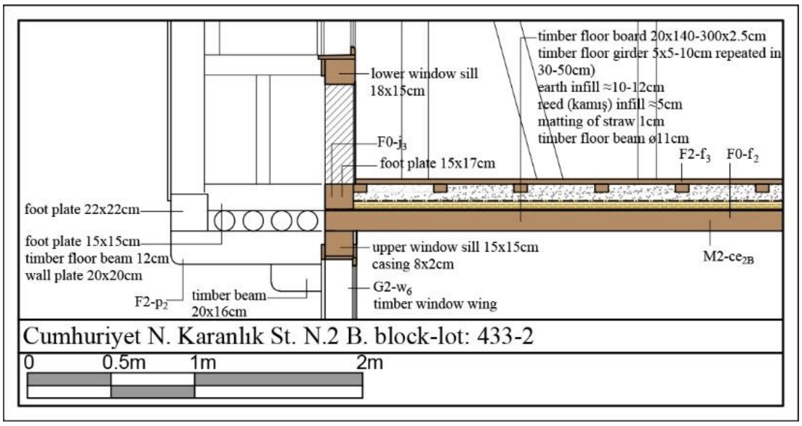


Figure 3.66. Drawing of timber flooring (Type 2) used in a sofa in first floor (Cumhuriyet N. b.block-lot: 433-2)

Figure 3.67. View of timber floor boards of flooring of Type 2 used in the room (left, Yenice N. b.block-lot: 521-12; right, Kubbeli N. b.block-lot: 186-36)

Figure 3.68. View of timber floor boards of flooring of Type 2 used in the sofa and earth infill of flooring seen in the room (Cumhuriyet N. b.block-lot:433-2)

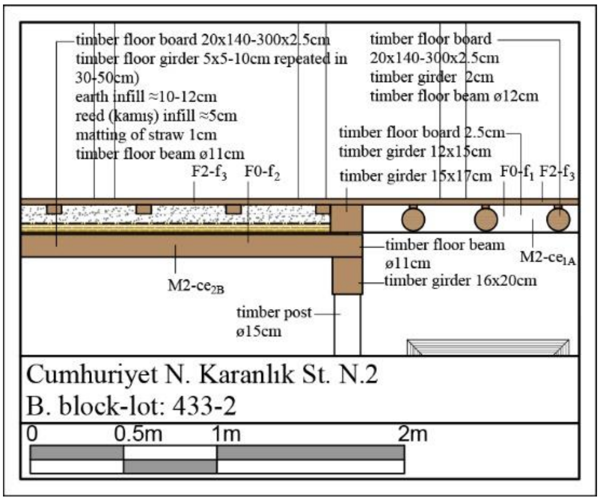


Figure 3.69. Drawing of timber flooring Type 1 and Type 2 (Cumhuriyet N. b.block-lot:433-2)

Figure 3.70. Ceiling view of Timber Flooring Type 1 and Type 2 (Cumhuriyet N. b.block-lot:433-2)

In the case of using terracotta tiles as a floor covering in upper floors, after timber floor beams are placed on the wall plates of the walls, reed infill around 5 cm and earth infill around 8-12 cm are set on floor beams, respectively. Terracotta tiles in square form are placed on earth infill and installed. The content of mortar used as a binding material, could not be determined. Dimension of terracotta tile is around 26x26x4 cm. This type of floor construction is observed both in rooms and in sofas. (see Fig.3.71-3.72)

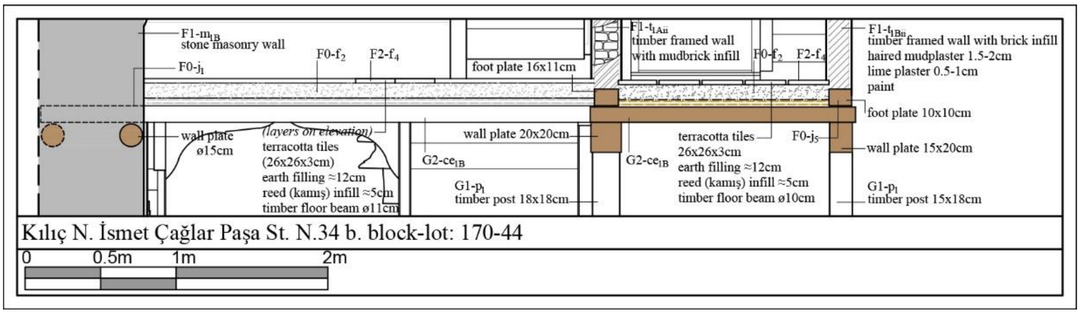


Figure 3.71. Drawing of timber flooring of Type 2 with terracotta tiles used in room and sofa (Kılıç N. b.block-lot:170-44)

Figure 3.72. View of layers of flooring, Type 2, with terracotta tiles used in room (Kılıç N. b. block-lot: 170-44)

3.5. Roof and Its Elements

The roof of houses examined are formed in square or rectangular form according to plan of upper floor of the building. In Sivrihisar houses, roofs are generally hipped roof composed of four or three surfaces. In some houses surveyed, one side sloping roofs are observed. In addition, L shaped roofs formed by the combination of two roofs with two surfaces and three or four surfaces are seen. As a roof covering, over and under tiles are used originally. However, marseille tiles added later for repair are also observed. No flat roof is observed in the houses surveyed and service spaces of houses. In one house, “cihannuma” that is covered with hipped roof composed of 3 surfaces was observed as the attic floor (see Fig.3.73). However, further investigation could not be done due to the limited accessibility.

Figure 3.73. A view of cihannuma; exterior (left), interior (right) (Kubbeli N. b.block-lot: 186-36)

During the site survey, roof was the most difficult part of the houses to be investigated due to the accessibility problem. Accordingly, limited information could be obtain about roof construction of houses. Demolished roofs, visual survey, literature survey, measured survey drawings and limited measurements are the main sources to define the roof structure. According to construction technique, roofs can be classified into 2 groups.

Type 1, without timber roof structure: In the first type of roofs, a timber roof structure, which is located on the upper floor structure, is not observed. These type of roofs are built generally as one side sloping roofs. In four of houses surveyed, partially demolished roof with one side sloping surface was observed. In these examples, it is observed roof is constituted with reed infill, and earth infill laid on the timber floor beams. Over and under roof tiles are placed on the earth infill of roof floor structure directly without any intermediate element. With reference to this information, it is assumed that these roof was constructed as flat roof and later on slight slope was given to the roof with the reed and earth infill. Then, roof tiles were located onto this structure. (see Fig.3.74-3.77)

Figure 3.74. View of roof, Type 1 composed of reef infill, earth infill and over&under roof tiles on top of them (Kılıç N. b.block-lot:170-44)

Figure 3.75. View of timber floor beams and reed infill on top of beams in the roof, Type 1 (Kılıç N. b.block-lot: 170-44)

Figure 3.76. View of roof, Type 1 (Gedik N. b.block-lot: 362-19)

Figure 3.77. View of roof, Type 1 (left, Kubbeli N. b.block-lot: 186-36; right, Cumhuriyet N. b.block-lot: 433-2)

Type 2, with timber roof structure: In second type of roof, timber roof structure, which is located on the earth infill of floor structure previously built as flat roof, is observed. Timber roof structure consists of rafters, roof ridge, purlins, angle rafters and timber posts are set onto floor structure. When timber roof structure is placed on the earth infill of floor, timber roof elements are located on a timber base, timber girders or timber wedges that have cross section around 5 cm. Connection of timber elements are made with nails. No joints connection is observed in the roof structures. (see Fig.3.78-3.79)

Roof rafters that have approximately 5-12 cm cross section are observed in rectangular, square or log form. Rafters are situated at around 30-40 cm interval. They are placed on the roof ridge with the same slope as the roof and purlins, which are located on the earth infill. Depending on the height of roof, roof ridge is supported by king post and corner posts. Roof slope is determined according to angle rafter. Timber elements; roof ridge, posts, purlins are in square or rectangular form. Roof ridge, and roof posts have cross section of 10-15 cm, and purlins have cross section of 5-10 cm. After that, timber roof boards put on rafters perpendicular to their direction and nailed on them. Roof board is an element placed under the roof covering in order to have smooth surface. Additionally, it transfers the load of cladding and live loads to rafter and then to the upper floor wall plates and posts. In Sivrihisar houses, roof boards are used in 20-25 cm size and 2-2.5cm thickness.

Figure 3.78. Timber roof structure located on earth infill of flooring (left, Kılıç N. b.block-lot: 161-1; right, Elmalı N. b.block-lot: 230-1)

Figure 3.79. Timber roof ridge, king post and timber roof boards of timber roof structure located on earth infill of flooring (Camikebir N. b.block-lot: 198-11)

Roofs can be divided into 3 groups in terms of number of slopes surface.

Type A, One side sloping roof: Roofs in Type 1 are always built as the one side sloping roofs. These type of roofs are mostly used for services spaces as much as main buildings. (see Fig.3.80)

Type B, Gable roof with two surfaces: This type of roofs are the gable roofs composed of two sloping surfaces and L shaped gable roofs composed of two gable roofs with two surfaces. The empty area between the two sloped surfaces at the narrow sides of roof are covered with timber planks or closed with the masonry walls (see Fig.3.81).

Type C, Hipped roof with three or four surfaces: This type of roof examples are the hipped roofs composed of mostly three or four surfaces. In addition, L shaped hipped roofs composed of two hipped roofs with three and four surfaces also observed. (see Fig.3.82)

Figure 3.80. One side sloping roof (Gedik N. b.block-lot: 362-19)

Figure 3.81. Example of gable wall (Yenice N. b.block: 521-7-8)

Figure 3.82. Hipped roof and collapsed one side sloping roof (Kılıç N. b.block-lot: 170-44)

Eaves: In Sivrihisar houses, width of roof eaves varies from 25 to 150 cm. The width of eaves is shaped according to the plan of the house and expands accordingly, when there is a projection on the upper floor. Roof eaves are made of timber elements. They can be covered with timber cladding boards or not covered. These two type of eaves can be observed both on street façade and courtyard façade. With respect to construction techniques, eaves can be categorized mainly into 2 groups.

Type1: In the first group of eaves, timber cladding is not used on the front and bottom of the eaves. (see Fig. 3.83-3.85)

Type 2: Second group of eaves are covered with eaves fascia and soffit boards, which cover the front and bottom of the eaves. In the second group, two types of eaves are observed; eaves covered on front side (Type 2A) (see Fig. 3.86-3.87) and eaves covered both bottom and front side (Type 2B) (see Fig. 3.88-3.89).

Figure 3.83. View of eave that is not covered-Type1 (Demirci N. b.block-lot: 448-2)

Figure 3.84. View of eave that is not covered-Type 1 (Cumhuriyet N. 2 b.block-lot: 433-2)

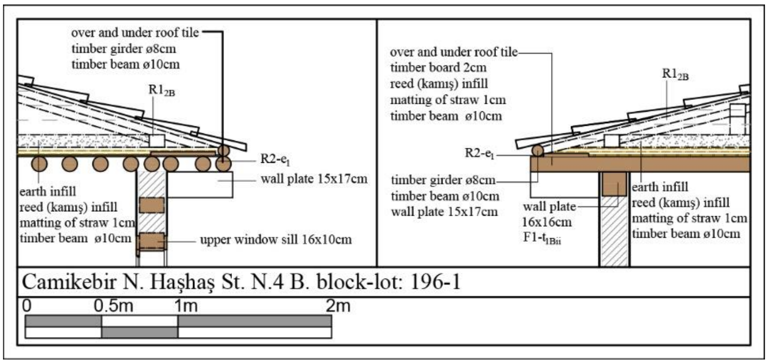


Figure 3.85. Section of timber eave that is not covered-Type 1 (Camikebir N. b.block-lot: 196-1)

Figure 3.86. Timber eave covered with eaves fascia board-Type 2A (Kubbeli N. b.block-lot:186-36)

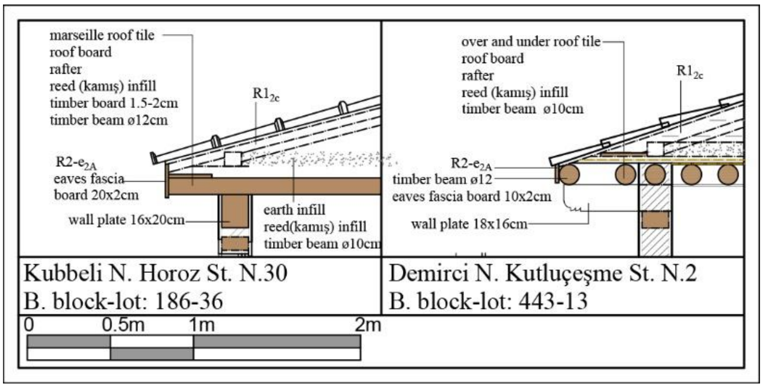


Figure 3.87. Section of timber eave covered with eaves fascia board-Type 2A (Kubbeli N. b.block-lot:186-36; Demirci N. b.block-lot:443-13)

Figure 3.88 Timber eave covered with eaves fascia board and soffit board-Type 2B (Kılıç N. St. b.block-lot: 170-19)

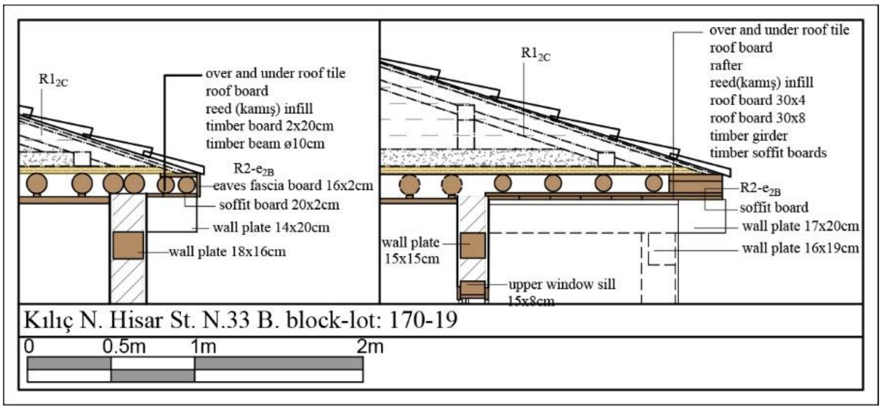


Figure 3.89. Section of timber eave covered with eaves fascia board and soffit board-Type 2B (Kılıç N. b.block-lot: 170-19)

Drainage system of traditional buildings is generally solved with conventional techniques. Inclined roof with together an eave fascia, which is one of the common system used as drainage system in traditional houses is also used in most of Sivrihisar traditional houses. Roofing drain is constituted by eave fascia attached to end of rafters. Eave fascia provide to course rainwater coming through the roof tiles. In addition to this, gutters and downspouts that are observed in Sivrihisar houses are added to the traditional buildings in recent years as rainwater drainage system.

Chimneys: Chimneys of traditional Sivrihisar houses that are in square and rectangular form are made of brick masonry. Chimneys can be divided into 2 groups as chimneys of stoves (Type1), chimneys of fireplaces (Type 2). Chimneys of stoves are located close to the exterior walls of the main building. Chimneys of fireplaces are observed in the main building as well as in the "*tandır evi*" in courtyard (see Fig.3.91-3.92). So, chimneys of fireplaces are classified into 2 groups considering the their locations; chimneys of fireplaces located in the main building (Type 2A), and located in the *tandır evi* (Type 2B).

Chimneys of stoves that are made of brick masonry in square or rectangular form with caps made of terracotta in half cylinder form are placed at the locations close to the exterior walls (see Fig.3.90). Chimneys with one and two flues are observed in houses surveyed. Stove chimneys are later added to the buildings compared to the fireplace chimneys.

Chimneys of fireplaces are bigger than stove chimneys in dimension. Their caps that are made of masonry brick with three or four side openings in rectangular or triangular shape are situated on the chimney shaft made of brick. They are covered with terracotta tiles in hipped roof form. Also, cap as hipped roof with terracotta tiles are located on the chimney shaft made of brick masonry and has openings at four sides. (see Fig.3.91-3.92)

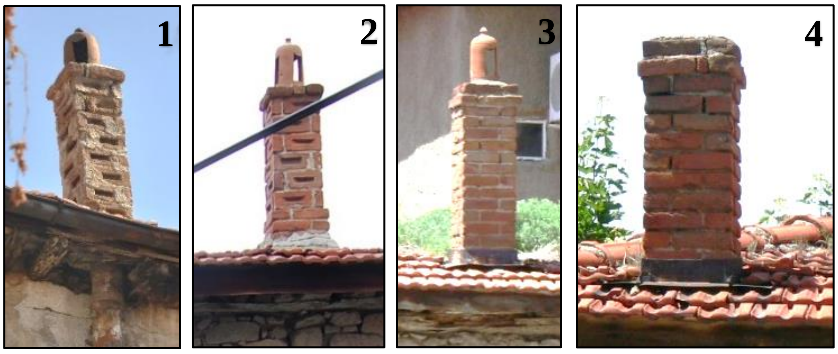


Figure 3.90. Examples of stove chimneys (1, Demirci N. b.block-lot: 443-13; 2, Kubbeli N. b.block-lot: 186-9; 3-4, Kubbeli N. b.block-lot: 186-36)

Figure 3.91. Examples of fireplace chimneys in main building (left, Demirci N. b.block-lot:443-13; middle, Yenice N. b.block-lot: 12-29; right, Yenice N. b.block-lot:12-20)

Figure 3.92. Examples of fireplace chimneys made of brick masonry in *tandır evi* (left, Cumhuriyet N. b.block-lot: 433-2; right, Yenice N. b.block-lot: 11-16)

3.6. Horizontal and Vertical Connections

Combination of walls and floors can be in different details in Sivrihisar houses according to horizontal and vertical load bearing systems. Foot and wall plates are the timber beams used for the conduction of loads at where the walls and floor beams are connected. Cross section of wall plates and foot plates varies from 10 to 20 cm in general, and dimensions up to 25cm were also observed.

Timber floor beams that are located at parallel to the short span of the space have 10-15 cm diameter. The number and spacing of timber floor beams vary according to the load they distribute. Timber floor beams are generally placed at intervals around 5-20 cm if flooring is constituted of floor beams, and layers of reed infill and earth infill (Type 2). However the distance between the floor beams was increased up to 40 cm in case of using timber flooring constituted by timber board and timber floor beams (Type 1).

Connection of timber structural elements are fasten by using nails. In some cases, lap joints are observed at the connection points. Timber elements are overlapped or half lapped and nailed to each other. (see Fig.3.106)

Detail 1, Connection detail of transition from masonry to masonry: In the case of stone masonry wall continues through the entire building height, the timber beams are located into stone masonry wall so that the wall plate supports the timber floor beams. In the houses surveyed, stone masonry walls are built with same thickness along the height of the building. For the connection of masonry walls and floor, timber floor beams are placed onto wall plate of lower floor stone masonry wall and on top of floor beams masonry wall of upper floor is constructed.

Two types of connection are observed at the continued masonry wall and floor junction. Floor beams can be inserted into stone masonry wall along the wall thickness (see Fig.3.93-3.95) or approximately wall plate thickness (see Fig.3.96-3.97). Both, floor beams that vary 10-15 cm in diameter located onto wall plate of masonry wall. Floor beams are overlapped onto wall plates and nailed.

Figure 3.93. Connection detail 1, view of floor beams inserted into wall along the wall thickness (Kılıç N. b.block-lot: 170-44*)*

Figure 3.94. Connection detail 1, view of floor beams inserted into wall along the wall thickness (left, Karabaşlı N. b. block-lot: 367-13; right, Kubbeli N. b. block-lot: 186-40

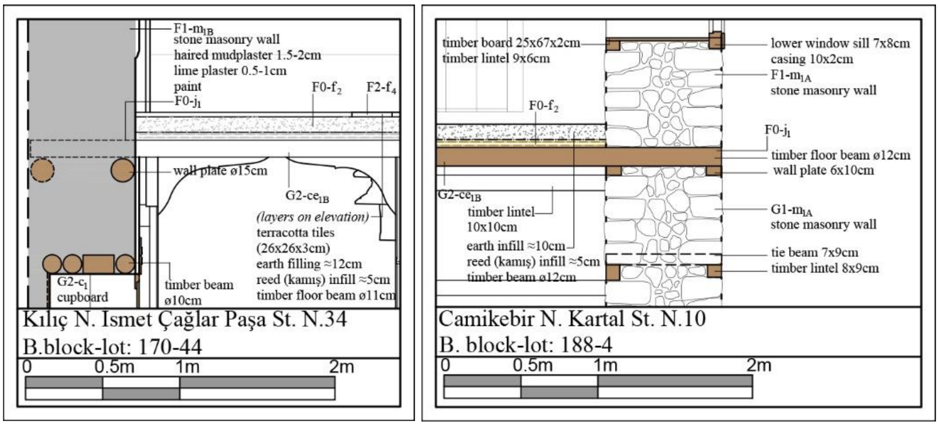


Figure 3.95. Connection detail 1-section drawing of floor beams inserted into wall along the wall thickness (left, Kılıç N. b. block-lot: 170-44; right, Camikebir N. b. block-lot: 188-4)

Figure 3.96. Connection detail 1-view of floor beams inserted into wall approximately the thickness of wall plate (Gedik N. b.block-lot:362-19)

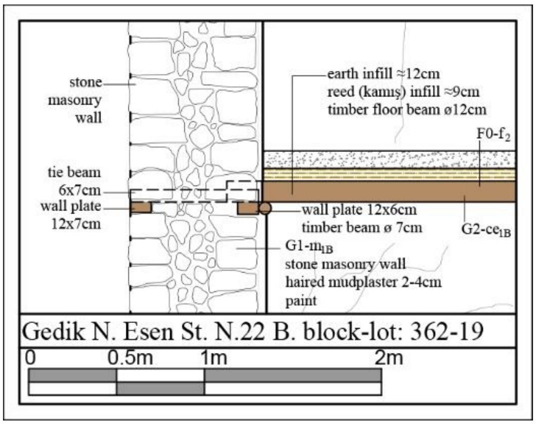


Figure 3.97. Connection detail 1-section drawing of floor beams inserted into wall along the wall plate thickness (Gedik N. b.block-lot:362-19)

Detail 2, Connection detail of transition from masonry to timber frame:

In the case of timber framed walls are constructed on top of stone masonry wall, there are two types of connection details considering the existence of projection. When there is no projection, floor beams are placed on the wall plate of masonry wall. Timber wall plates are placed on the stone masonry wall of ground floor along the inner and outer side of wall. Timber framed wall of upper floor is erected on top of foot plate located on the floor beams that is put on wall plate of lower floor (see Fig.3.98-3.100). In one example, floor beams extend over the stone masonry wall along the wall thickness, not directly on the wall plate and timber framed wall of upper floor is built on the foot plate located on the floor beams (see Fig. 3.101-3.102).

Figure 3.98. Connection detail 2, view of timber floor beams located on the wall plate of masonry wall in lower floor and foot plate located on the floor beams, corner post located on the foot plate (Kılıç N. b.block-lot:161-1)

Figure 3.99. Connection detail 2, view of timber floor beams located on the wall plate of masonry wall in lower floor and foot plate located on the floor beams, timber posts set on the foot plate (left, Elmalı N. b. block-lot: 230-5; right, Yenice N. b. block-lot: 8-8)

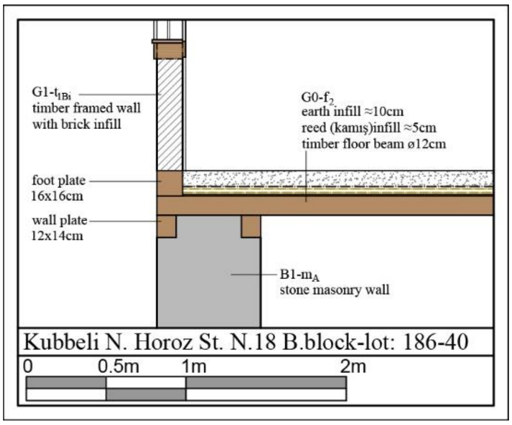


Figure 3.100. Connection detail 2, section drawing of floor beams located on the wall plate of masonry wall and foot plate located on the floor beams (Kubbeli N. b.block-lot:186-40)

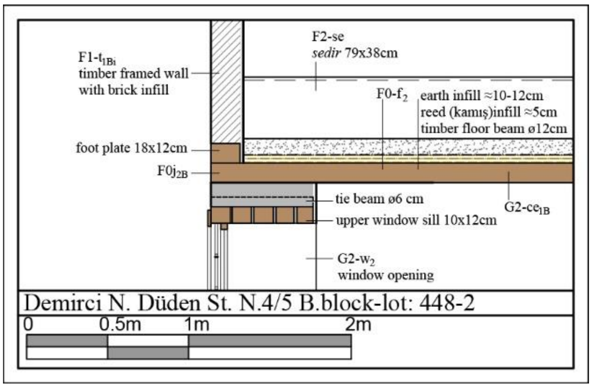


Figure 3.101. Connection detail 2, section drawing of floor beams located over the masonry wall along the wall thickness and timber framed wall built on the foot plate (Demirci N. b.block-lot:448-2)

Figure 3.102. Connection detail 2, view of floor beams located over the masonry wall and timber framed wall of upper floor built on the foot plate (Demirci N. b.block-lot:448-2)

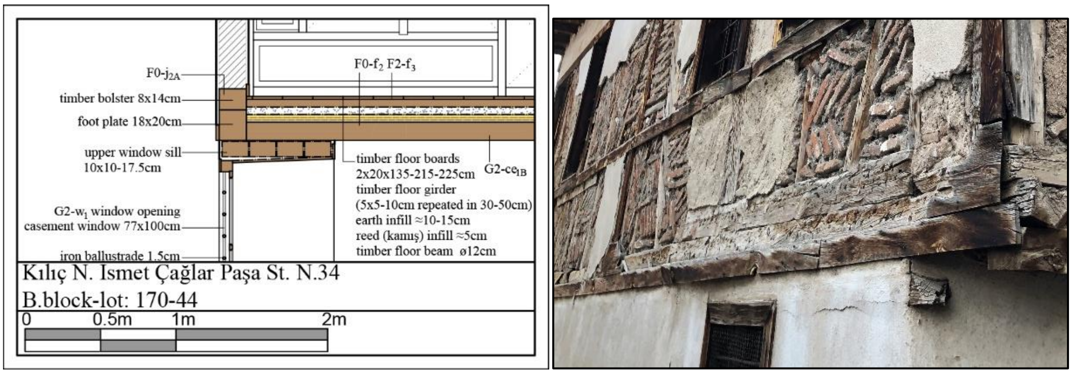


Figure 3.103. Connection detail 2, section drawing of floor beams located at the same level with the foot plate; timber post of timber framed wall located on the bolster on top of foot plate (Kubbeli N. b.block-lot: 170-44)

In some examples, it was observed timber floor beams are set with the same level as foot plate of upper floor timber framed wall. In this case, two types of detail are observed. In the first one, wall plate and foot plate can be overlapped and floor beams are located with the same level as foot plate and an intermediate timber element, a bolster, is used in a particular region of the framed system (see Fig.3.103). In the second one, when there is a transition from foundation masonry wall, only one plate is observed in the transition of systems. Foot plate is located in between the upper and lower floor walls (see Fig. 3.104-3.106). So that, foot plates located on top of masonry walls perpendicular to each other, connected by using lap joints (see Fig. 3.104-3.105).

Figure 3.104. Connection detail 2, connection of timber foot plates by half lap joints and nails (Kılıç N. b.block-lot: 170-44)

Figure 3.105. Connection detail 2, connection of timber foot plates by half lap joints and nails, (Demirci N. b.block-lot:448-2)

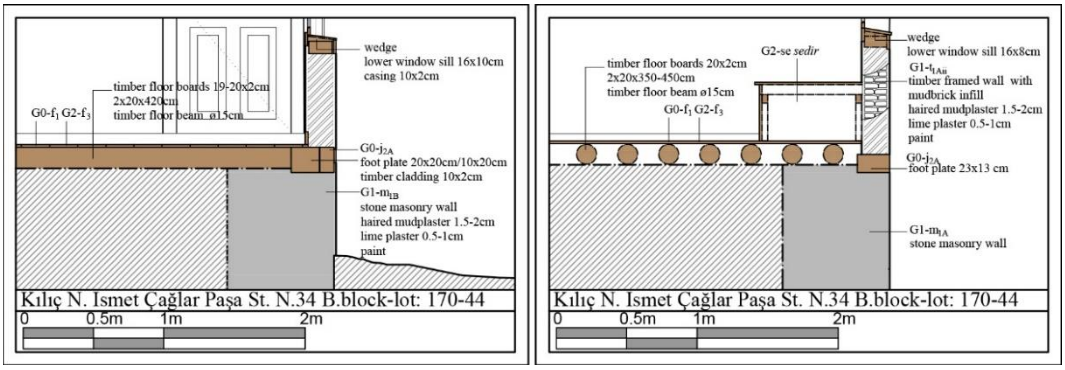


Figure 3.106. Connection detail 2, section drawing of floor beams located at the same level as the foot plate of upper floor (Kılıç N. b.block-lot: 170-44)

In the case of existence of projection, timber floor beams are placed onto wall plates of stone masonry wall. Upper floor timber framed wall is raised on the foot plate, located at the same level with floor beams (see Fig. 3.107-3.108). When the upper floor is projected, floor beams and also foot plate of upper floor wall is supported by timber beam or overlapped timber beams, inserted into masonry wall. In some cases, braces are also used to support the projection (see Fig.3.107).

Figure 3.107. Connection detail 2, view of timber floor beams located on the wall plate of masonry wall in lower floor and foot plate located on the floor beams, extending wall plate and foot plate to form projection (Demirci N. Demrci St. N:12 b.block-lot: 443-4)

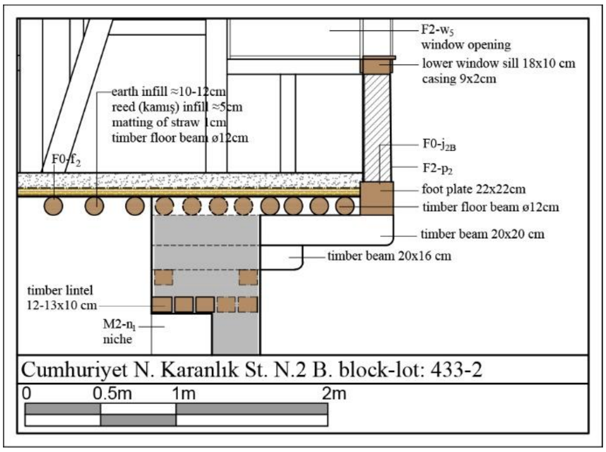


Figure 3.108. Connection detail 2, section drawings of floor beams on the wall plate of masonry wall and timber framed wall of upper floor located on the foot plate in case of existence of projection (Cumhuriyet N. b. block-lot: 432-2)

Detail 3, Connection detail of transition from timber frame to timber frame: In the case timber framed wall is used both for the construction of lower and upper floor walls, upper floor is built in the same vertical line of lower floor. Timber floor beams are located on the wall plate of lower timber framed wall and on top of timber floor beams, foot plate of upper floor wall is placed (see Fig.3.109-3.111). Timber posts of upper floor wall are set on the foot plate that is located on floor beams. When upper floor construction is projected, upper floor wall is placed onto foot plate that is located at the same level of timber floor beams (see Fig.3.112-3.113).

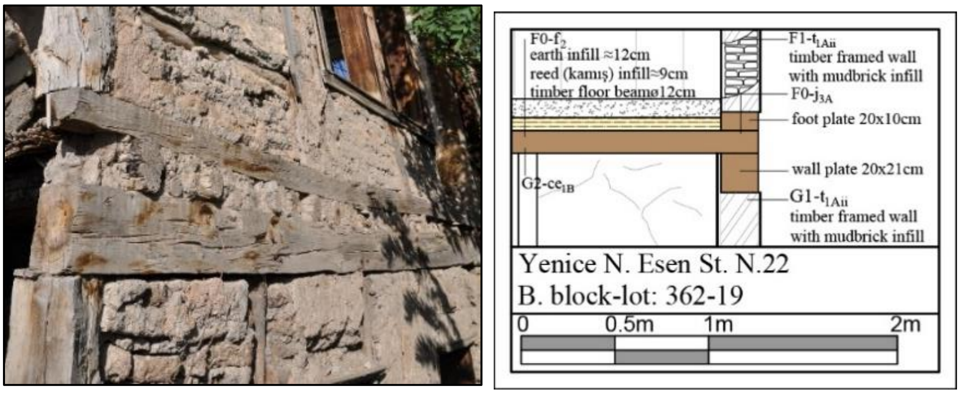


Figure 3.109. Connection detail 3, section drawing of floor beams located on the wall plate of lower floor wall and foot plate of upper floor wall located on the floor beams (Gedik N. b.block-lot:362-19)

Figure 3.110. Connection detail 3, View of timber floor beams located on the wall plate of lower timber framed wall and foot plate of upper floor wall located on the floor beams (Karabaşlı N. b.block-lot: 367-13)

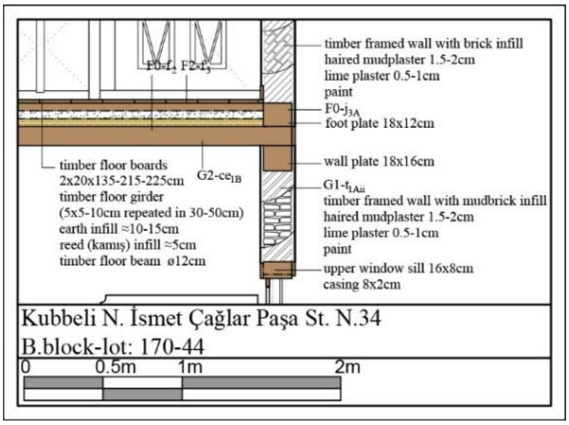


Figure 3.111. Connection detail 3, section drawing of floor beams located on the wall plate of lower floor wall and foot plate of upper floor wall located on the floor beams (Kılıç N. b.block-lot: 170-44)

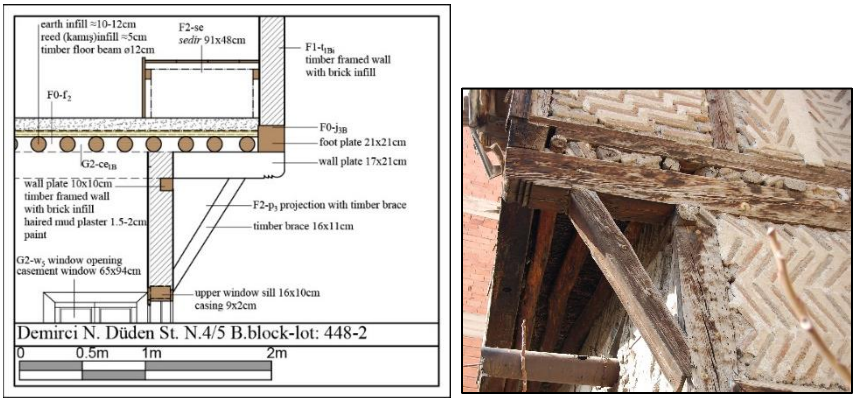


Figure 3.112. Connection detail 3, detail of use of timber framed walls in both floors in case of existence of projection (Demirci N. b.block-lot: 448-2)

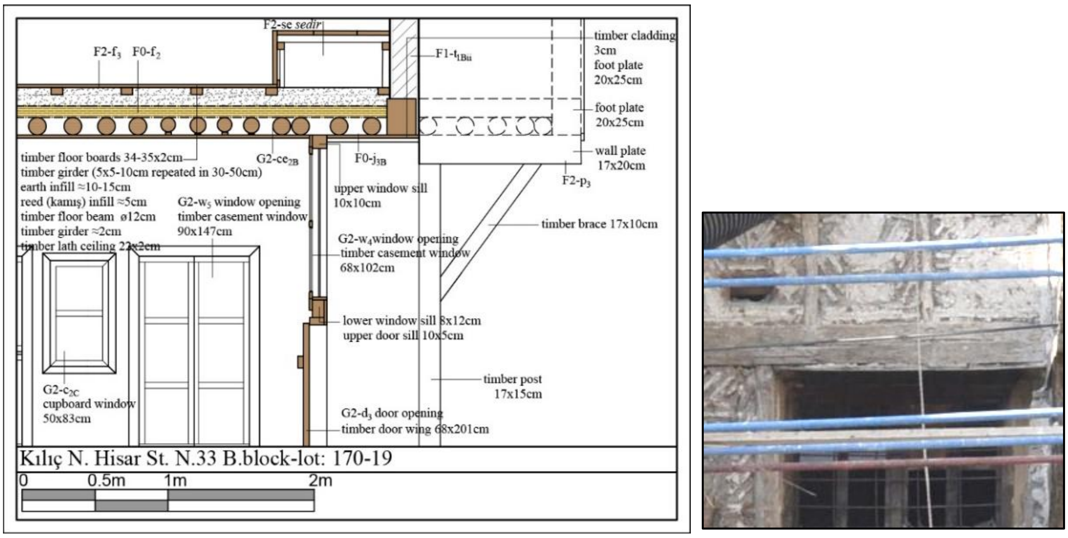


Figure 3.113. Connection detail 3, detail of use of timber framed walls in both floors in case of existence of projection (Kılıç N. b.block-lot:170-19)

Detail 4, Connection detail of transition from timber post to timber frame: In the case of lower floor is a timber post and upper floor is timber framed walls, upper timber framed wall is constructed in the same line of the lower timber post. Two type of connection are observed in the houses surveyed.

In the first one, timber floor beams are placed onto wall plate of timber post and foot plate of upper floor wall is set on floor beams (see Fig.3.114-3.115). Then, timber posts of upper floor wall are placed onto foot plate. In the second one, timber floor beams are arranged at the same level of wall plate and one side of floor beam is connected with the wall plate by using half lap joint (see Fig.3.116). Timber bolster can be used under the timber wall plate of lower timber post.

Figure 3.114. Connection detail 4, view of timber floor beams located on the wall plates of timber post (Kılıç N. b. block-lot: 170-44)

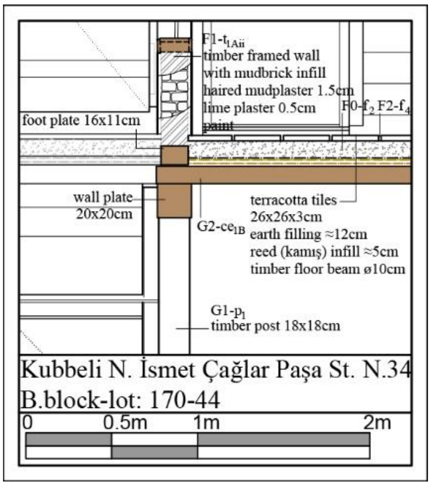


Figure 3.115. Connection detail 4, section drawing of floor beams located on the wall plate of lower floor wall and foot plate of timber framed wall on floor beams (Kılıç N. b. block-lot: 170-44)

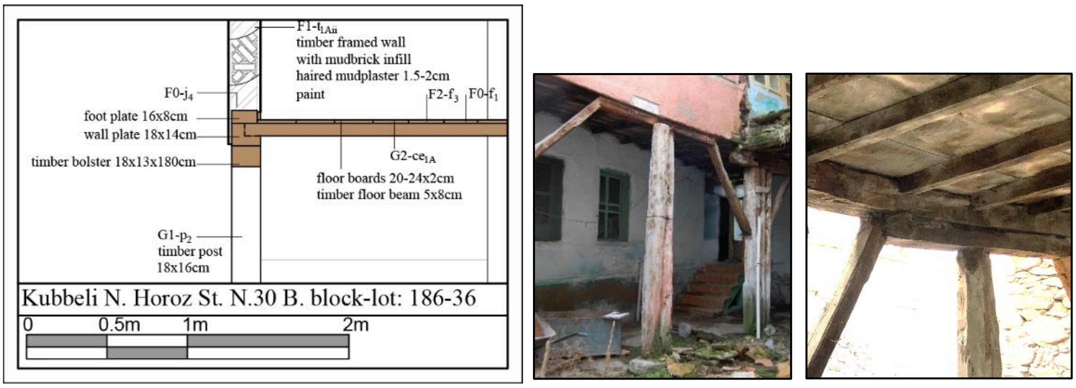


Figure 3.116. Connection detail 4, section drawing of floor beams located at the same level of wall plate of timber post and connection of wall plate and floor beam wit using half lap joint (Kubbeli N. b. block-lot: 186-36)

Detail 5, Connection detail of transition from timber post to timber post: In the case of timber posts are used in both floors, timber posts of upper floor is located in the same line of the lower posts. Lower timber posts are usually thicker than the upper posts placed on the same line. Two types connection details are observed in this type of transition. The timber floor beams are located on the wall plate and timber foot plate is located on the floor beams. Upper floor timber post is set on the timber foot plate. In second detail, timber girder is located on the timber post of lower floor and timber post of upper floor is placed on the foot plate that is put on top of floor girders. (see Fig.3.117-3.118)

Figure 3.117. Connection detail 5, view of timber posts used in both floor (Kubbeli N. b.block-lot: 186-9)

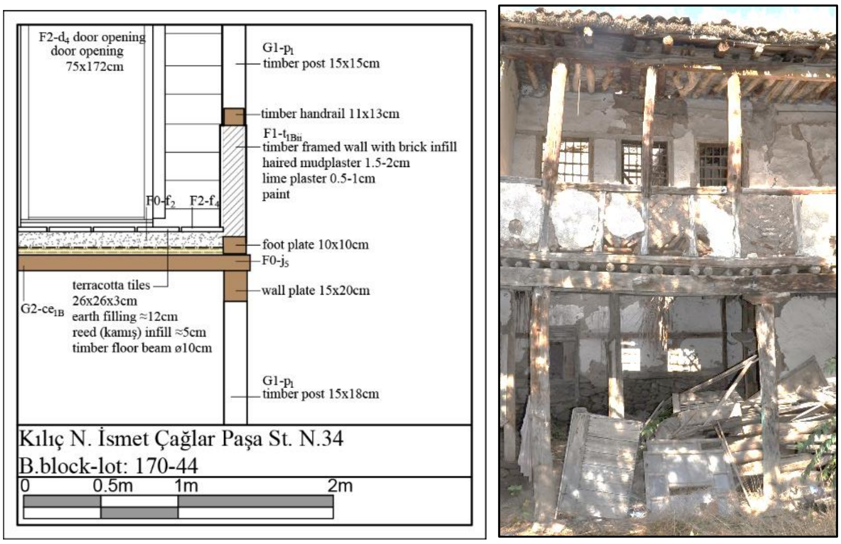


Figure 3.118. Connection detail 5, section drawing of floor beams located on the wall plate of lower timber post and foot plate of located on floor beams (Kılıç N. b.block-lot: 170-44)

Detail 6, Connection detail of transition from masonry /timber frame/ timber post to timber eave: Timber eaves constituted by extending the floor beams are located directly on the wall plate of the upper floor wall, whether a stone wall, timber framed wall or timber post is used in upper floor. Timber floor beams located on the wall plate of upper floor wall transfer the load to wall plate. (see Fig.3.83-3.89; Fig.3.119-3.120)

Figure 3.119. Connection detail 6, timber floor beams located on the wall plate of upper floor wall (left), connection of timber floor beam and wall plate (right) (Gedik N. b.block-lot:362-19)

Figure 3.120. Connection detail 6, timber floor beams located on the wall plate of upper floor timber posts (Kılıç N. b.block-lot: 170-44)

3.7. Architectural Elements

3.7.1. Projections

In Sivrihisar houses, projections are used in the main room or in the sofa of houses and can be considered as part of floor construction. Projections are arranged on the main façade and/or side façade of the buildings in general. When main façade of buildings are considered, façades that are designed with two projections at two sides, with a projection at one side, a projection along the façade can be observed in Sivrihisar.

Projections can be divided into three groups according to their forms; rectangular, trapezoid and triangular projections. In the first one, rectangular projection is formed by extending the floor construction towards the street. In the second one, trapezoid projection is formed by extending the both sides of flooring evenly towards the street. The last one, triangular projection is formed by extending the flooring only one side towards the street. (see Fig.3.121)

Figure 3.121. Projection types according to their forms, respectively; rectangular, trapezoid, triangle (left b. block-lot: 229-6; middle b. block-lot: 186-9; right b. block-lot: 228-17)

In Sivrihisar houses projections can be categorized into three groups according to their structural system; simple projections (Type1), projections with overlapping beams (Type2), projections with bracing elements (Type3).

Type 1, Simple projection: Simple type of projection is constituted by extending the floor beams towards the street around 40-100 cm. In this type, one timber beam with dimension 20x20 cm-20x25 cm supports the projected part of the floor. In some cases, a timber post is placed under the timber beam. (see Fig.122-124)

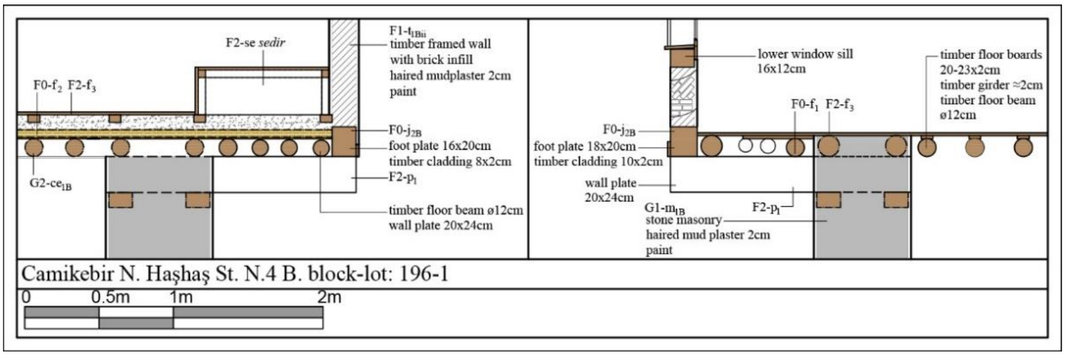


Figure 3.122. Section drawings of projection supported with a beam; simple projection, Type1 (Camikebir N. b.block-lot: 196-1)

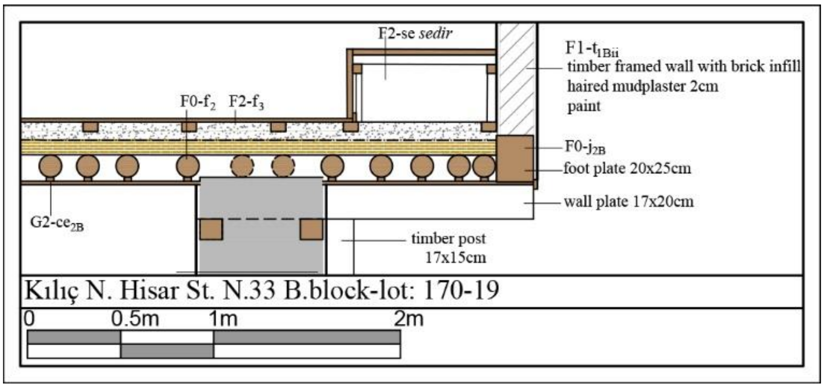


Figure 3.123. Section drawing of projection supported with a beam and timber post; simple projection, Type1 (Kılıç N. b.block-lot: 170-19)

Figure 3.124. Examples of projection supported with a beam; simple projection, Type1 (Camikebir N. b.block-lot: 196-1)

Type 2, Projection with overlapped beams: Projection with overlapped beams is constructed by supporting the projected floor beams with overlapped timber beams. Two or three beams that changes 15-25 cm thickness, can be used as overlapped elements. In some examples, load is transferred to the timber post that is placed under the overlapped beams. In addition, timber bolster can be observed in between the overlapped beams and timber post. (see Fig.3.125-3.128)

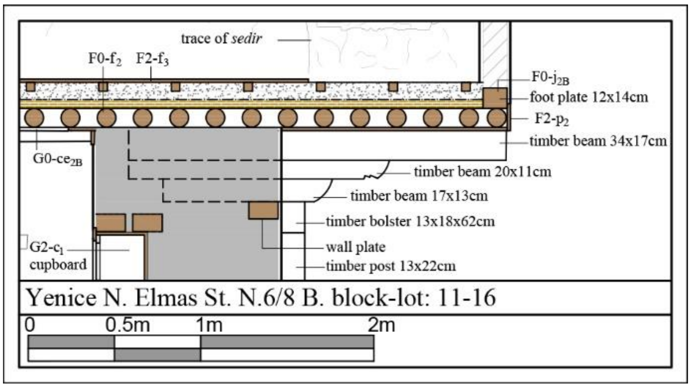


Figure 3.125. Section drawing of projection supported with overlapped beams and timber post; projection with overlapped beams, Type2 (Yenice N. b. block-lot: 11-16)

Figure 3.126. Example of projection supported overlapped beams, Type2; exterior view (left, middle), interior view of overlapped beams (right) (Yenice N. b. block-lot: 11-16)

Figure 3.127. Examples of projections with overlapped beams and post; Type2 (left, Cumhuriyet N. b. block-lot: 433-3; right, Karabaşlı N. b. block-lot: 367-13)

Figure 3.128. Examples of projections with overlapped beams, Type 2 (Cumhuriyet N. b. block-lot: 433-2)

Type 3, Projection with timber brace: Projections with bracing elements is designed with one or more timber braces. Extended part of the floor is supported with timber beam, and timber beam is supported one or more timber braces. In some cases, system is strengthen by using timber post that transforms the load to the ground. (see Fig.3.129-3.131)

Figure 3.129. Examples of projections with timber brace, Type3 (left, Demirci N. b.block-lot: 443-13; right, Kılıç N. b.block-lot: 170-19)

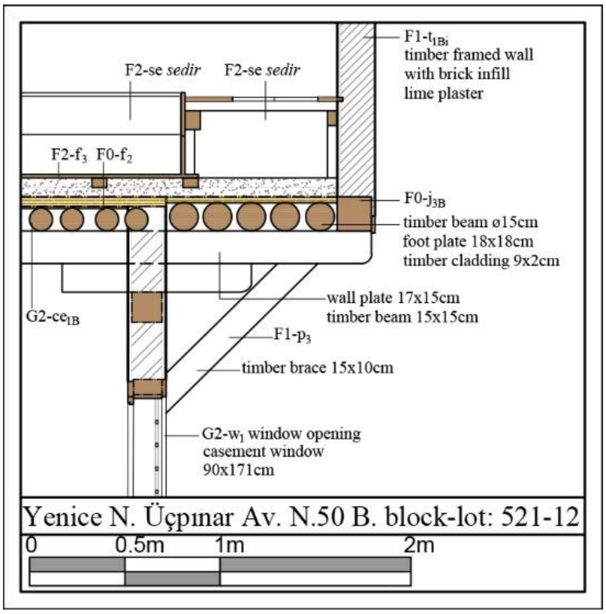


Figure 3.130. Section drawing of projection supported timber brace, Type3 (Yenice N. b. block-lot: 521-12)

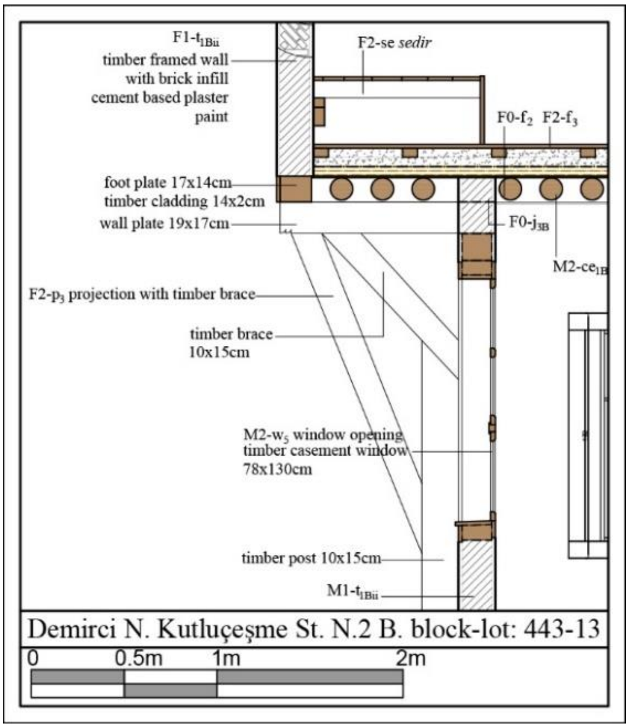


Figure 3.131. Section drawing of projection supported timber brace, Type3 (Demirci N. b. block-lot: 443-13)

3.7.2. Staircases

Staircases are the vertical circulation elements that provide the connection between the building floors. Stairs in Sivrihisar houses are used at the entrance of building and inside the building for the connection of floors. There are straight, L shaped, U shaped staircases. In Sivrihisar houses, there are two types of stairs made of stone and timber considering the material types.

Type 1, Stone Staircase: Stone staircases are generally observed at the street or courtyard entrance of buildings (see Fig.3.132-3.133). In the houses surveyed, stone stairs with one to six steps used to reach the entrance of building from outside are observed. Stone stairs are also observed in the *taşlık* space (see Fig. 3.134). When stair provides connection to basement and upper floors from *taşlık*, it is observed that first two or three steps of stairs can be made of stone. In addition, a stone step that is placed due to the necessity of level difference in the space is observed in the *taşlık* space (see Fig.3.135). In this case, reused stones are used as a step.

Figure 3.132. Stone stair used at the street entrance; Type1 (Kılıç N. b. block-lot: 170-19)

In the construction of stone stairs, rubble stones, rough-cut stones and mud mortar are used. The steps consist of large single stone blocks or multiple stone blocks placed on rubble stone masonry. Some of the stones used in stairs are reused marble stone blocks. Width of stone stair is observed around 80-165 cm. Width of steps changes between 25-45 cm, and height of riser varies between 10-35 cm. First step of stone stairs have mostly around 10 cm height.


Figure 3.133. Stone stair used at the courtyard entrance; Type1 (Demirci N. b. block-lot: 448-2)

Figure 3.134. Stone stair provide access to the basement floor from *taşlık*; Type1 (Yenice N. b. block-lot: 521-12)


Figure 3.135. A reused stone step used at the courtyard entrance (left) and in *taşlık* (right) (Cumhuriyet N. b. block-lot: 433-2)

Type 2, Timber Staircase: In Sivrihisar houses, timber stairs are used in the *taşlık* and/or sofa of houses for the vertical circulation between the ground floor to upper floors. The form and number of steps are arranged according to floor plan and height. Timber stairs used in traditional houses are generally one handed and placed adjacent to the building wall. The width of timber staircases ranges from 75 to 100 cm, however examples of stair widths up to 125 and 150 cm have also been observed. Width of steps varies between 20 cm to 33 cm and height of risers changes between 15 cm to 22 cm. Timber stair boards that are the timber steps of stair have 2-4 cm thickness. In some of staircases lead to upper floors, there is a timber cover that close the stair opening.

Timber staircases are classified into two groups in terms of their construction techniques. Timber stairs are constructed with timber risers and steps that are connected to the timber stringers. In the first type (Type 2A), timber step boards are located on stringers and nailed to it (see Fig.3.136-3.137; Fig.3.139-3.141). In the second type (Type 2B), timber step boards are placed into opened grooves on stringers (see Fig.3.138).

Figure 3.136. Timber step boards that are located on stringers (left), connection detail of stringer and timber beam (right)-Type2A (Kılıç N. b. block-lot: 170-44)

Two stringers are placed at two edges of stair are supported by a timber base or stone base at the level where stair is start. At the upper floor, stringers are placed onto timber beam of upper floor. In some examples, timber posts are supported the timber beams that are connected to the stringers (see Fig.3.139). Timber risers and threads are nailed and risers are nailed to the stringers after they are located onto stringers. In case of existence of grooves, timber threads are inserted into grooves of stringers.

Figure 3.137. Upper connection detail of stringer (left), timber step boards are located on stringers (right)-Type2A (Kubbeli N. b. block-lot: 186-9)

Figure 3.138. Timber step boards are placed into opened grooves on stringers-Type2B (Yenice N. b.block-lot: 12-30)

Figure 3.139. Lower connection of stringers supported by timber posts (Kubbeli N. b.block-lot:186-36)

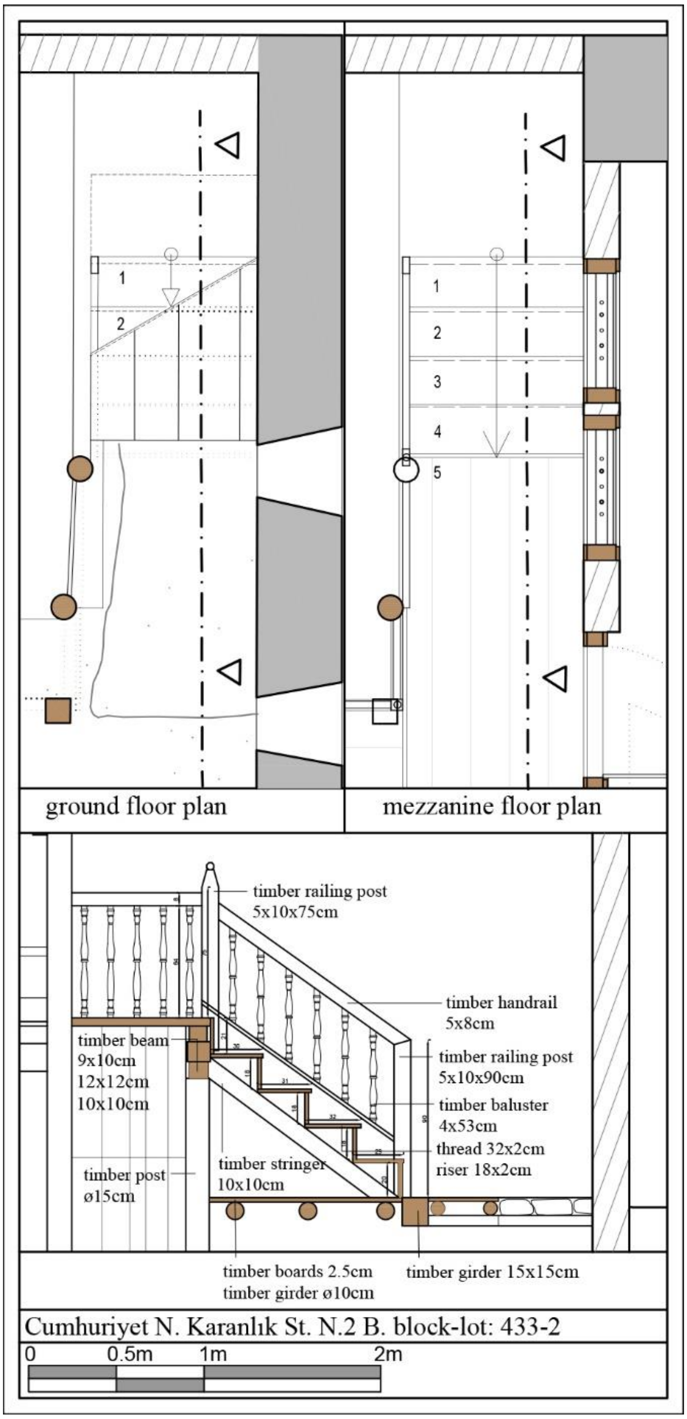


Figure 3.140. Stair composed of timber step boards that are located on stringers, example1-Type2A (Cumhuriyet N. b. block-lot: 433-2)

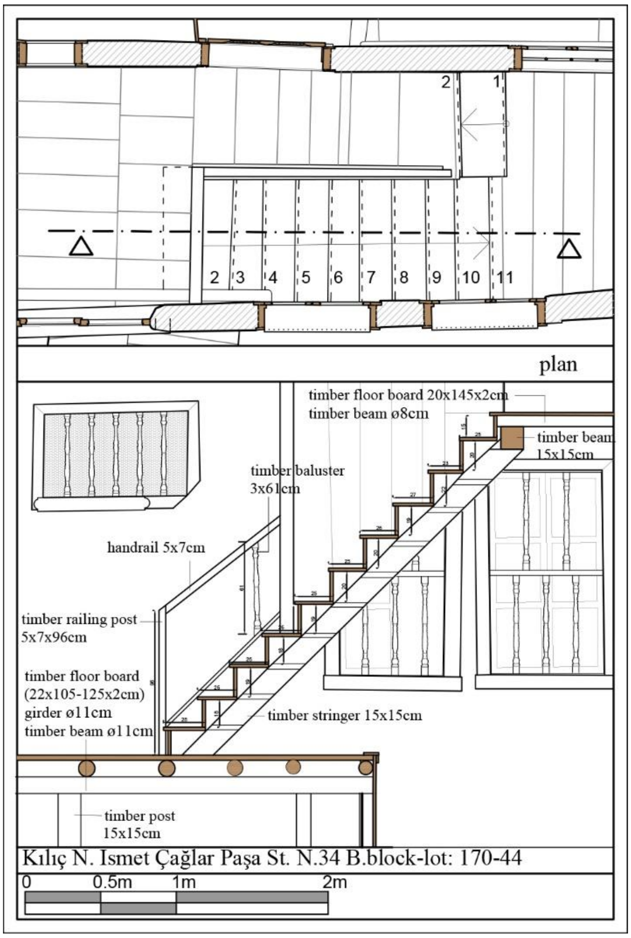


Figure 3.141. Stair composed of timber step boards that are located on stringers, example2 (Type2A) (Kılıç N. b. block-lot: 170-44)

Timber handrails are located generally at one side of staircases, while other sides are reclined to walls. Timber hand rails that have 4-9 cm are supported by timber railing post. Railing posts that are around 5-10 cm are placed onto landing or ground and nailed. Timber balusters are placed in every 11-15 cm between the two railing posts. They have having 2-4 cm cross sections and they can be rectangular or profiled as well as simple or carved. In some cases, simple metal balusters are observed in the staircases. Height of handrail posts varies between 75-98 cm, and height of balusters varies 50-65 cm. (see Fig.3.142)

Figure 3.142. Handrail and baluster examples (left, Cumhuriyet N. b. block-lot: 433-2; middle, Yenice N. b. block-lot: 521-8; right, Demirci N. b. block-lot: 444-15)

3.7.3. Openings: Doors and Windows

3.7.3.1. Doors

In Sivrihisar houses doors can be categorized mainly into two groups according to their locations; exterior and interior doors. Exterior doors are the timber elements that provide access to the house from the street or courtyard. Interior doors are the timber elements that allow passage between spaces within the house. Both interior and exterior doors are made of timber originally in Sivrihisar houses.

Exterior and interior doors are classified in terms of their location and construction techniques. Exterior doors are used for main building entrance and courtyard access. In Sivrihisar, double wing doors are mostly observed as exterior doors, but single wing exterior doors are also seen. Considering the construction techniques, exterior doors can be located on masonry walls or timber framed walls as panel or batten doors. In some cases, framed batten doors that have the front face framed with timber boards are also seen (see Fig.3.151-3.152). Doors located on the masonry wall are observed as courtyard entrance or doors with single and double wing that provide direct access to the house.

Interior doors in Sivrihisar houses can be located on masonry walls and timber framed walls as panel and batten doors. In some cases, framed batten interior doors are also observed. In addition, door frame of opening is constructed in two different ways; rectangular and arched. Interior doors constructed as batten doors are located on masonry stone walls in basement and ground floors (see Fig.3.144) and timber framed walls in ground and upper floors (see Fig.3.154, Fig. 3.157). Dimension of batten interior doors opening varies 65-75x163-188 cm, and dimensions of door wings are 69-95x166-188 cm. When batten doors have arched frame, opening dimensions ranges between 77-83x152-172 cm and door wings are 83-90x167-177 cm. Height of arched frame changes from 180 cm to 234 cm.

Interior panel doors located on timber framed walls are observed in ground and upper floors and used as room doors (see Fig.3.155-3.156, Fig.3.159, Fig.3.161). Panel door openings changes between 75-85x167-198 cm and dimensions of single door wings are around 78-87x172-207 cm. When opening has an arched frame, dimension of arched frame is around 100x180-197 cm. In this case, door opening is 70-80x165 cm and single door wing is 80-90x180-185 cm. Double wings panel doors with arched frame are also observed (see Fig.3.161)

Doors can be divided into six groups according to their construction techniques.

Type 1: These type of doors are the single wing doors located on the stone masonry walls. They are mostly used for the direct access to main building and courtyard entrance, and also they are used for the entrance of service spaces in the basement and ground floor.

Door openings used for single wing exterior doors are observed as 78-88x166-190 cm. Single wing exterior doors used in surveyed houses have 80-90 cm wide, 167-189 cm high. Timber door posts located at both sides of door opening and timber frame of door is constituted by putting timber door sill on door posts. Used door posts vary 6-10x9-13 cm, timber door sills change 5-13 cm. Dimension of door openings used for the service spaces vary 65-92x153-183 cm and dimensions of single door wing are 69-95x166-188 cm.

Single wing doors are constructed as paneled and batten doors. For the construction of batten doors, battens in between 20-35 cm width are placed side by side and fasten to the timber ledged in dimension 5-10cm. Timber ledges that are placed at the back side of door are used at bottom, top and middle part of door wing. Connection is made with using nails. Panel doors are constituted of horizontal timber elements called rails, vertical timber elements called stiles and timber panel board. Rails and stiles are formed the frame of door and nailed onto panel board. Front face and rear face of panel door are differ. At the rear face, timber rails and stiles are observed. (see Fig. 3.143-3.145)

Type 2: These type of doors are double wing doors located on stone masonry walls as main entrance to the building and courtyard entrance. Double wing doors are observed constructed as batten, and panel doors. Dimension of door wings in total are 125-170x160-200 cm. Timber thresholds are around 8-10x13-14 cm. In case door are batten doors; timber ledges that vary 5-10 cm are located at the back side of door wings, and nailed onto batten boards laid alongside. Timber batten boards range in 20-30 cm and timber boards used for framing are around 10x1.5 cm. They are located at bottom, top and middle of door wings to form a timber frame and nailed on the timber battens. When it is panel door, rails and stiles are nailed onto panels. (see Fig.3.146-3.148)

Type 3: These type of doors are the double wings doors built with top window that are located on the stone masonry walls. Doors built with top windows can be constructed as timber batten, and paneled doors. In one example, the front face of timber batten door is framed with timber boards. Dimension of door openings change between 135-170x194-220 cm. Timber thresholds are around 8-10x10-12 cm. Timber posts located at two sides of timber door frame are around 10-12x10-12 cm. Timber door sill around 5-7x10-12 cm are placed at top of door frame. For the construction of top window, lower window sill around 8-12 cm can be placed on door sill or upper door sill is used as lower sill of window also. Dimension of top window opening change between 60-170x45-100 cm. (see Fig.3.149-152)

Type 4: These type of doors are the single wing doors located on timber framed walls. Single door openings are around 77-80x170 cm. Timber posts used at the two sides of door frame have cross section around 8-12 cm, door sills are around 8-10 cm and timber thresholds are around 10-12 cm. (see Fig.3.153-3.159)

Type 5: These type of doors are the double wing doors located on timber framed doors. Double wing door openings changes around 115x169 cm, and double wing door wings are126x177 cm in total. Timber door posts change are around 8-12x10-12 cm, timber thresholds are around 7-10x10-12 cm. Timber door sills are 8-10x10-12 cm. (see Fig.3.160-3.162)

Type 6: These type of doors are the double wing timber doors built with top windows located on the timber framed walls. In this type, door openings are around 125-200x180-220 cm, and double wing door wings are around 130-210x187-220 cm in total. Timber door posts change are around 10-13x12-17 cm, timber thresholds are around 10-17x8-10 cm. Timber door sills are 12-15x12-17 cm. In case, there is a top window on double wings door, a timber framed wall raised on top of door sill for 30-70 cm then, timber top window is placed. In some examples, lower window sill is placed on top of the door sill. (see Fig.3.163-3.164)

Figure 3.143. Exterior single wing batten door located on stone masonry wall; Type 1, exterior façade (left), interior façade (right) (Cumhuriyet N. b. block-lot: 433-3)

Figure 3.144. Examples of interior single wing batten doors located on stone masonry wall used in the service spaces; Type 1 (Cumhuriyet N. b. block-lot: 433-2)

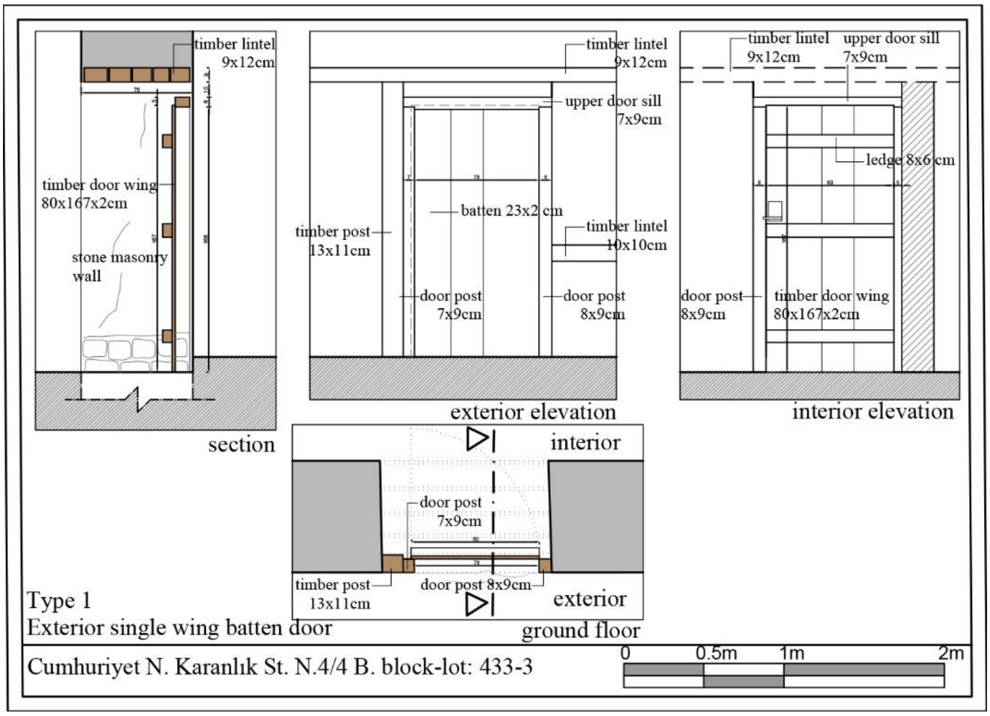


Figure 3.145. Drawing of exterior single wing batten door located on the masonry wall; Type 1 (Cumhuriyet N. b.block-lot:433-3)

Figure 3.146. Exterior double wing batten door located on stone masonry wall; exterior facade (left), interior facade (right); Type 2 (Demirci N. b. block-lot: 444-15)

Figure 3.147. Exterior double wing panel doors located on stone masonry wall, exterior façades; Type 2 (Yenice N. b. block-lot: 11-16; right, Camikebir N. b. block-lot: 507-1)

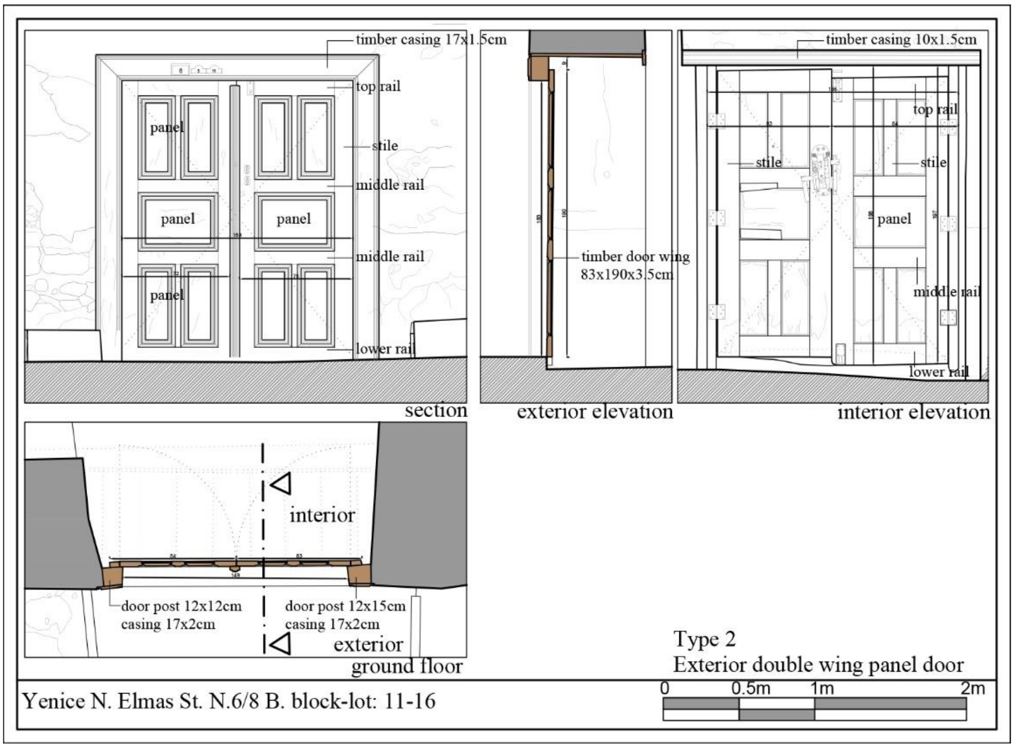


Figure 3.148. Drawing of exterior double wing panel door located on stone masonry wall; Type 2 (Yenice N. b. block-lot: 11-16)

Figure 3.149. Exterior double wing batten door with top window located on stone masonry wall, Type 3; exterior façade (left), door post&door sill detail from exterior (middle), interior facade (right) (Demirci N. b.block-lot: 448-2)

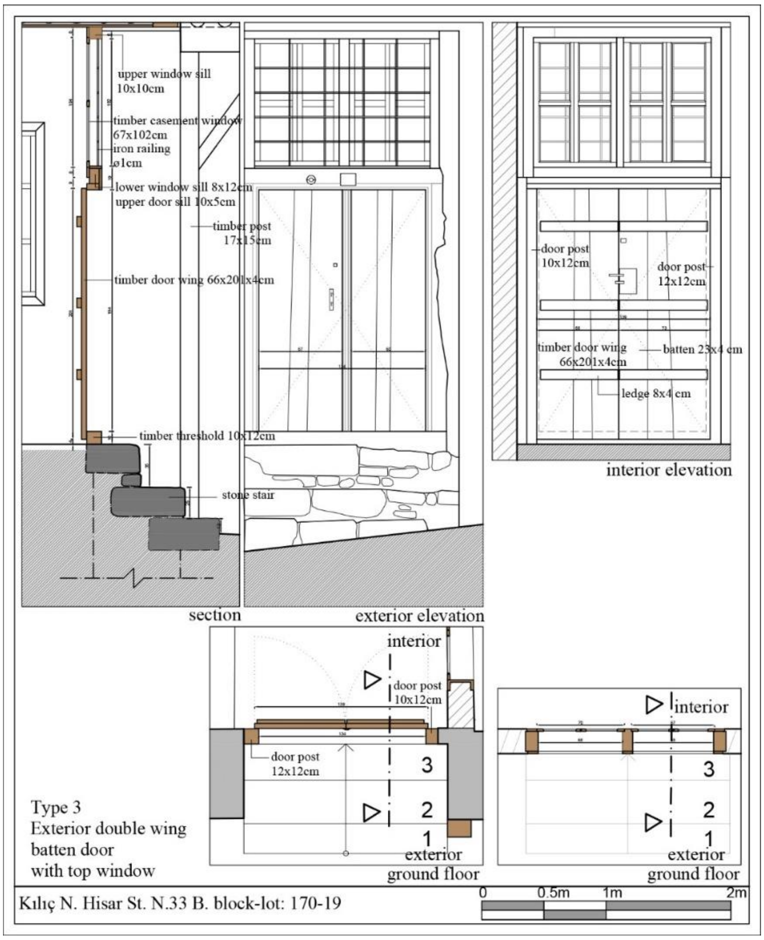


Figure 3.150. Drawing of exterior double wing batten door with top window located on stone masonry wall, Type 3 (Kılıç N. b. block-lot: 170-19)

Figure 3.151. Exterior double wing framed batten door with top window located on stone masonry wall, Type 3; exterior facade (left), interior facade (middle), exterior façade detail (right) (Camikebir N. b. block-lot: 196-1)

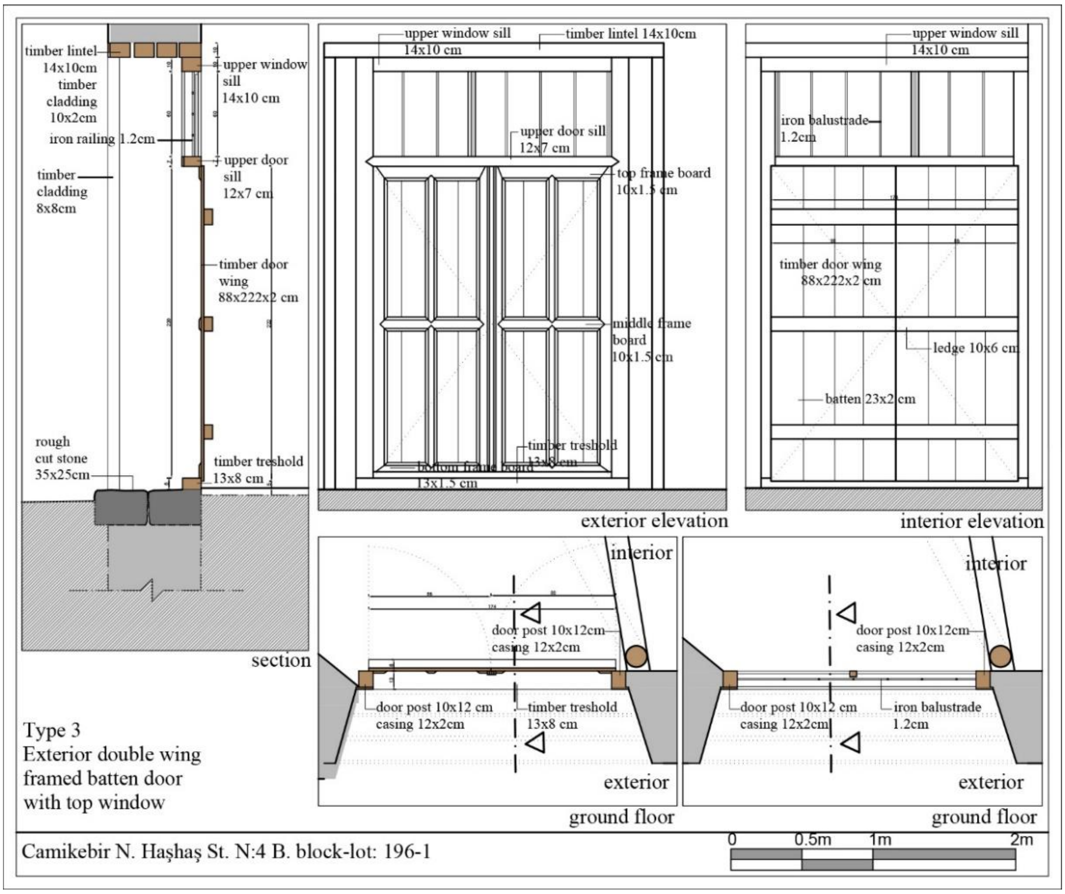


Figure 3.152. Drawing of exterior double wing framed batten door with top window located on stone masonry wall, Type 3 (Camikebir N. b. block-lot: 196-1)

Figure 3.153. Exterior single wing batten door located on timber framed wall, Type 4; exterior façade (left), interior façade (right) (Demirci N. b. block-lot: 448-2)

Figure 3.154. Example of interior single wing batten door located on timber framed wall, Type 4; exterior view (left), interior view (right) (Cumhuriyet N. b. block-lot: 433-2)

Figure 3.155. Example of interior single wing panel door with arched door frame located on timber framed wall, Type 4; exterior view (left), interior view (middle), detail from exterior view (right) (Cumhuriyet N. b. block-lot: 433-3)

Figure 3.156. Example of interior single wing panel doors located on timber framed wall, Type 4; exterior view; (left, Demirci N. b. block-lot: 448-2; middle, Yenice N. b.block-lot: 521-7-8; right, Cumhuriyet N. b. block-lot: 433-2)

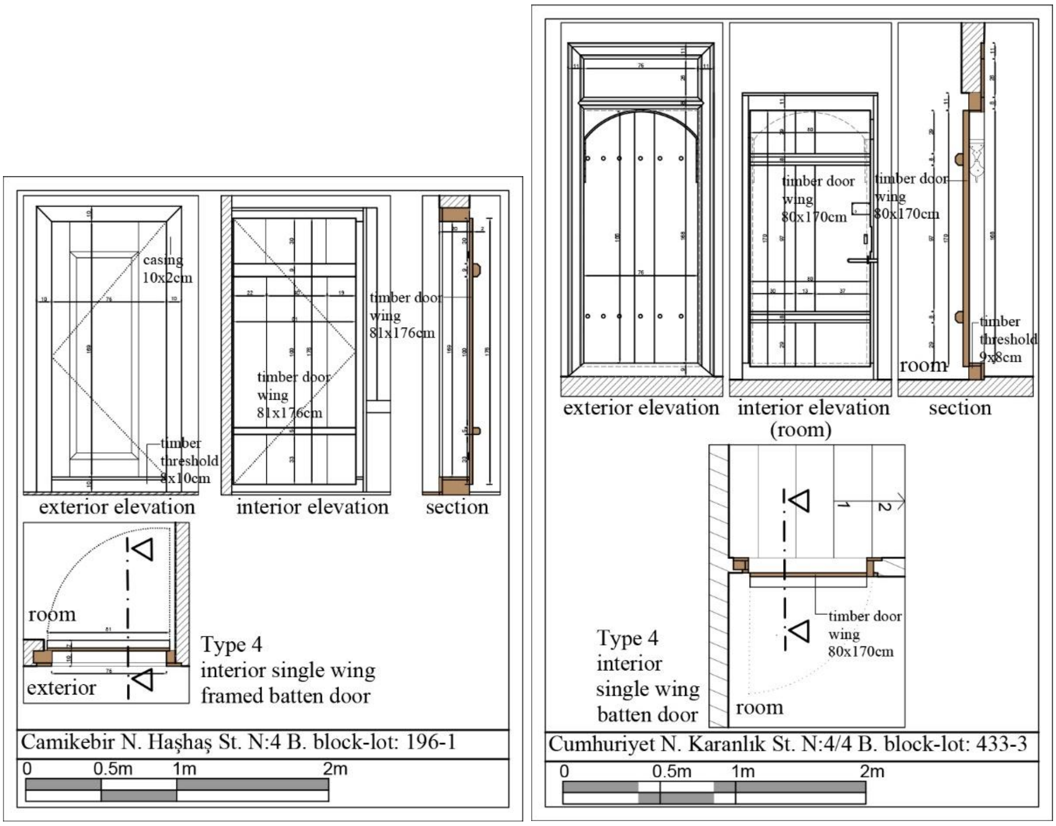


Figure 3.157. Drawing of interior single wing framed batten door located on timber framed wall (left); Drawing of interior single wing batten door with arched door frame located on timber framed wall (right) Type 4 (left, Camikebir N. b. block-lot: 196-1; right, Cumhuriyet N. b. block-lot: 433-2)

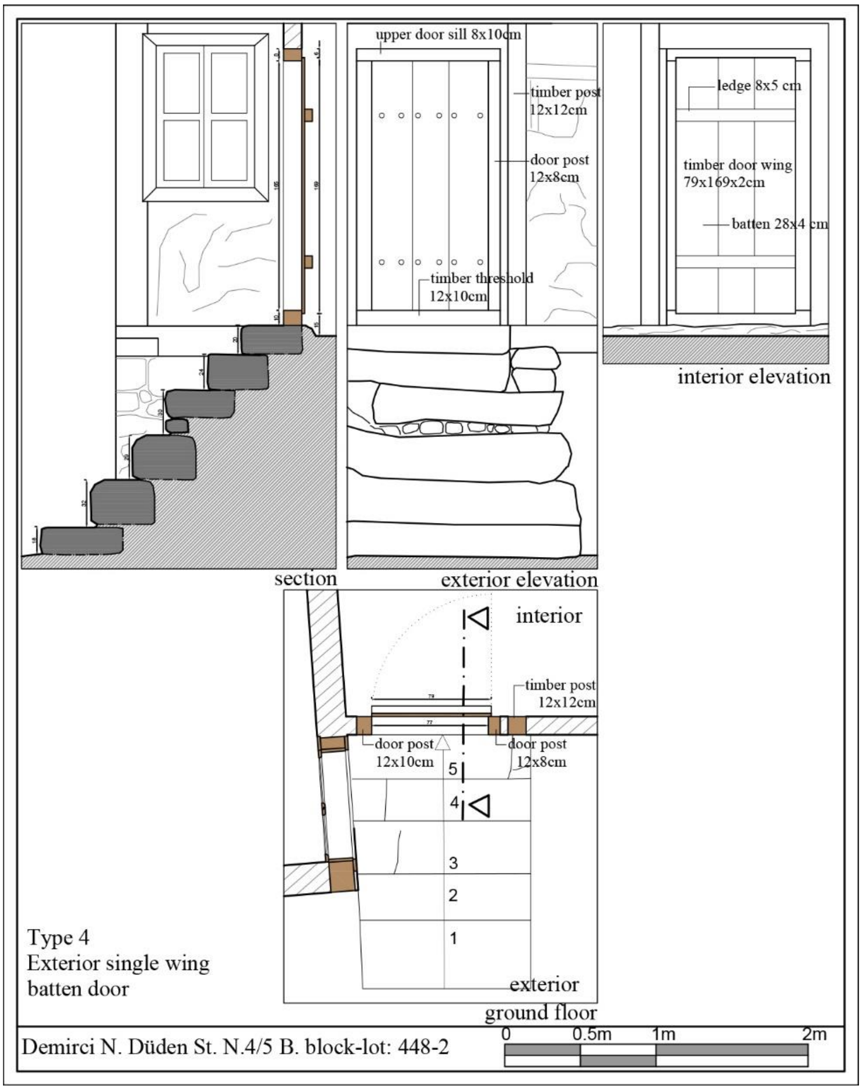


Figure 3.158. Drawing of exterior single wing batten door located on timber framed wall, Type 4 (Demirci N. b. block-lot: 448-2)

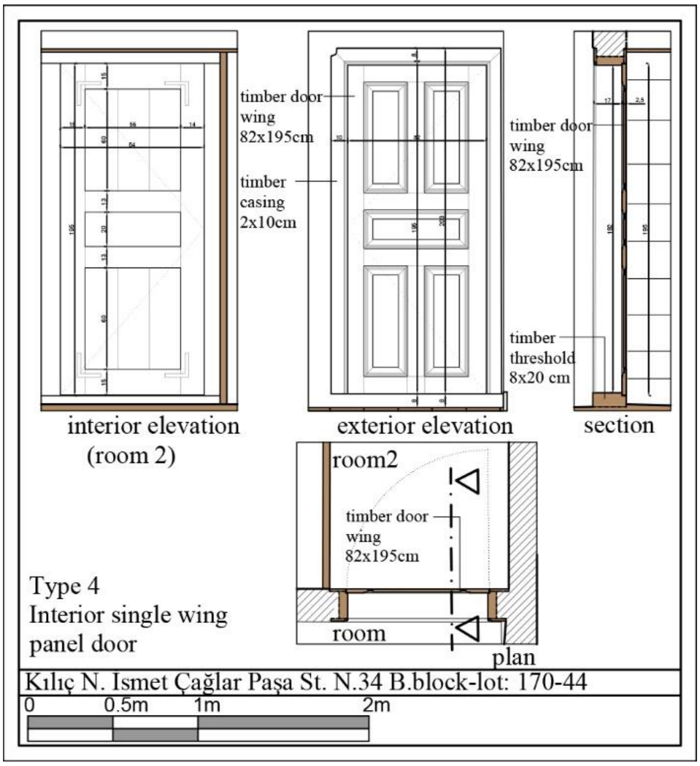


Figure 3.159. Drawing of interior single wing panel door located on timber framed wall, Type 4 (Kılıç N. b. block-lot: 170-44)

Figure 3.160. Exterior double wing batten door located on timber framed wall, Type 5; exterior façade (left), interior façade (right) (Cumhuriyet N. b. block-lot: 433-2)

Figure 3.161. Interior double wing arched panel door located on timber framed wall, Type 5; exterior view (left), interior view (right) (Cumhuriyet N. b. block-lot: 433-3)

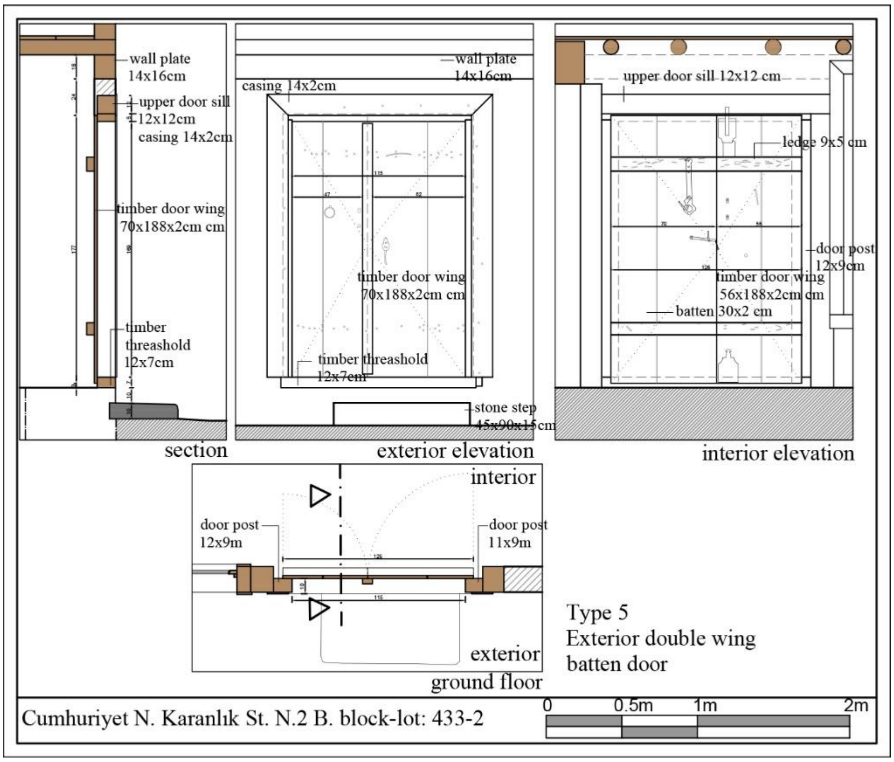


Figure 3.162. Drawing of exterior double wing batten door located on timber framed wall, Type 5 (Cumhuriyet N. b. block-lot: 433-2)

Figure 3.163. Exterior double wing batten door with top window located on timber framed wall, Type 6; exterior façade (left), interior façade (right) (Cumhuriyet N. b. block-lot: 433-2)

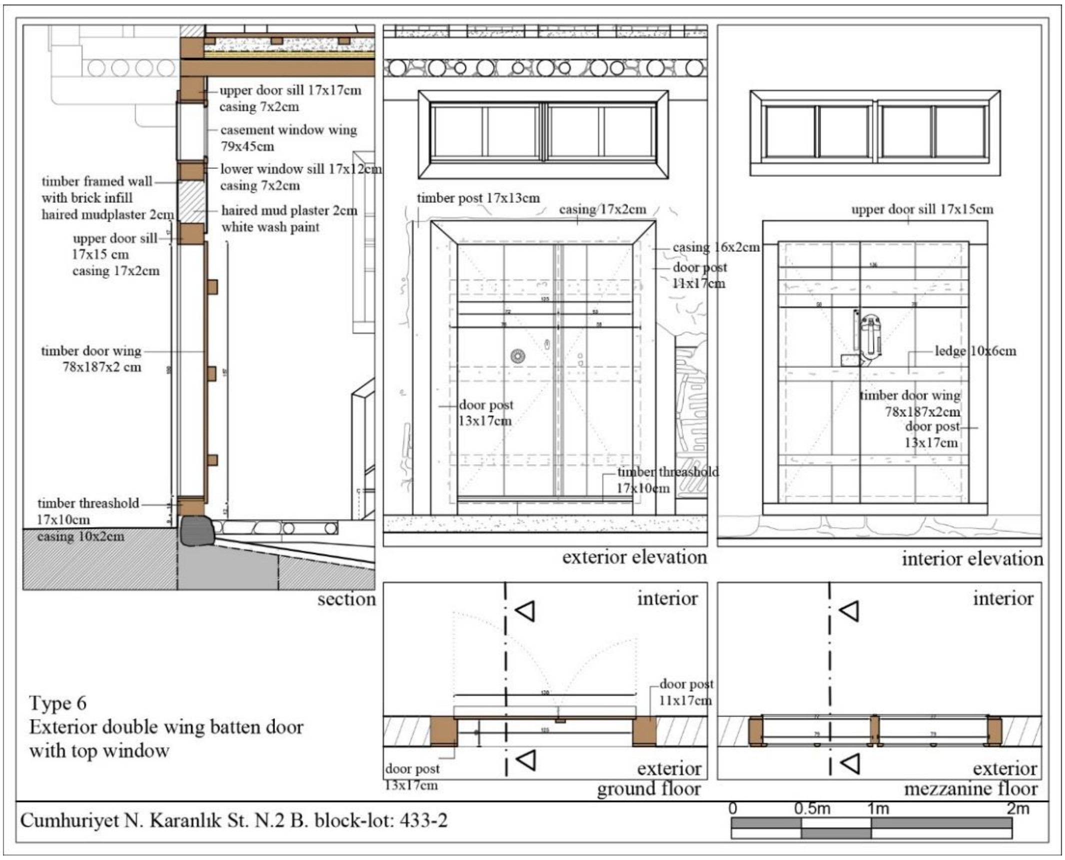


Figure 3.164. Drawing of exterior double wing batten door with top window located on timber framed wall, Type 6 (Cumhuriyet N. b. block-lot: 433-2)

3.7.3.2. Windows

Windows are the architectural elements that provide air and light access to the inner spaces of houses. Windows can be classified according to their locations, opening sizes, materials, and construction techniques. In Sivrihisar houses, windows are divided into two groups in terms of their construction techniques and locations; windows located on stone masonry walls and timber framed walls.

Windows located on stone masonry walls are observed on the exterior walls and also interior walls of houses. These windows are divided into four groups according to their sizes and locations.

Type 1: These windows located on stone masonry walls are rectangular in shape (in 2/3 ratio) and located in basement, ground and upper floor walls. Their sizes vary between 77x110 cm to 90x138 cm. They are placed at exterior walls of houses 56-118 cm above the floor of rooms. They are located at the stone masonry walls that have 60-75 cm thickness. While the window opening is left on the stone walls, timber sills that are around 10-15 cm thickness are placed at bottom and top level of the opening. There are 4 or 5 timber sills located side by side according to thickness of stone masonry walls. In some houses, top sides of opening is covered with timber boards in 2 cm thickness, while in some of them, timber sills at top side of opening is left open. In surveyed houses, it was observed bottom part of some openings are altered and covered with cement mortar. However, bottom parts that are covered with timber boards and mud mortar were observed also. In addition, there are windows that have 85-87x155 cm dimensions with the constructed next to each other. Total dimension is 225x155 cm and they are located around 48 cm above the ground. (see Fig.3.165-3.168)

Type 2: These windows that are in 1/2 ratio are similar with Type 1, and placed on the both interior and exterior stone walls. Dimension of window openings located on exterior walls varies between 30x65 cm to 56x125 cm. Window openings are placed above 45-80 cm the ground. Dimension of window openings located on interior walls varies between 30x65 cm to 40x86 cm and they are placed 65-180 cm above the ground. Window openings at interior stone walls are generally placed in the service spaces of basement floor, and bottom parts of the opening are generally not covered with timber boards. Bottom parts of openings on exterior walls were observed as covered with timber boards and mud mortar. (see Fig.3.169-3.171)

Type 3: These types of windows are in rectangular form and observed on external stone masonry walls. Two examples of this type of window are observed; one is used in the room and other is used in the *güsülhane*. The window located in the room of ground floor has dimension of 75x118 cm and it is placed at around 115 cm above the ground. Other example that is observed in *güsulhane* located in the stone masonry wall of ground floor has dimension of 30x55 cm and set at approximately 180 cm above the ground. (see Fig.3.172-174)

Type 4: These types of windows are the ones located stone masonry walls as a top window of entrance doors, top window located above the niche on right, left side, or located above the middle of two lower niches or windows. (see Fig.3.175-3.178)

When they are top windows of entrance doors, their sizes vary from 60x45 cm to 168x60 cm, 140x102 cm. They are divided into two in terms of their construction techniques. In first group, window opening was constructed on the structure of the entrance door. Window frame is built with same thickness of upper door sill. Upper door sill is used as lower window sill or window sill is placed on the upper door sill.

Both is observed in the surveyed houses. In second group, window opening is constructed on the entrance door by keeping the stone masonry wall thickness same. In this case, lower window sill of opening is located on the upper door sill. Four timber sills around 10-13 cm are placed next to lower window sill in accordance to thickness of stone masonry wall. At the top of window opening, upper window sill and 4 more timber window sills that are around 8-10 cm are located. Size of window opening is 60x45 cm in one surveyed house and located at 205 cm above the ground.

When top window is located above the niche on right or left side or located above the middle of two lower niches, cupboards or windows, lower window sill is the same timber sills used for the upper sill of niches or windows located at below the top window. These timber sills have 10-12 cm cross section. These window openings are located 170-179 cm above the ground. Also, in one house, a window opening placed at 350 cm above from the ground at street level is observed.

Windows located on timber framed walls are observed on the exterior walls and also interior walls of houses. These windows are grouped into two according to their sizes and locations in themselves.

Type 5: These type of windows that are in rectangular form in 1/2 and 2/3 ratio are located on the timber framed walls at ground and upper floors. Two sides of window openings are arranged between the timber posts of timber framed system. Horizontal timber elements of timber framed system are placed at top and bottom of the window opening. These horizontal elements, lower and upper window sills are around, 8-10cm. Casement and sash windows are both observed at the window openings of the timber framed walls. (see.Fig.3.179-3.181)

In case of use of casement windows in the openings, width of window openings are around 65-90 cm and heights are around 95-175 cm. When sash window is used in the openings, width of openings change 55-90 cm and height of opening is around 120-170 cm.

Type 6: These types of windows are located as top window on the timber framed walls at ground and upper floors. Top windows are observed above the window and located above the upper part of the wall alone. They are rectangular shaped windows, close to the square form generally. (see Fig.3.182-3.184)

When they are observed as top windows above the windows, dimension of them are around 33-40x45-65 cm. They are located 160-170 cm above the ground. When they are observed as top windows at upper part of walls, they are around 35x50 cm and located 150 cm above the ground.

Figure 3.165. Window opening located on stone masonry wall; Type 1 (Kılıç N. b. block-lot: 170-44)

Figure 3.166. Window opening located on stone masonry wall; Type 1 (Camikebir N. b. block-lot: 196-1)

Figure 3.167. Window opening located on stone masonry wall; Type 1 (Camikebir N. b. block-lot: 188-4)

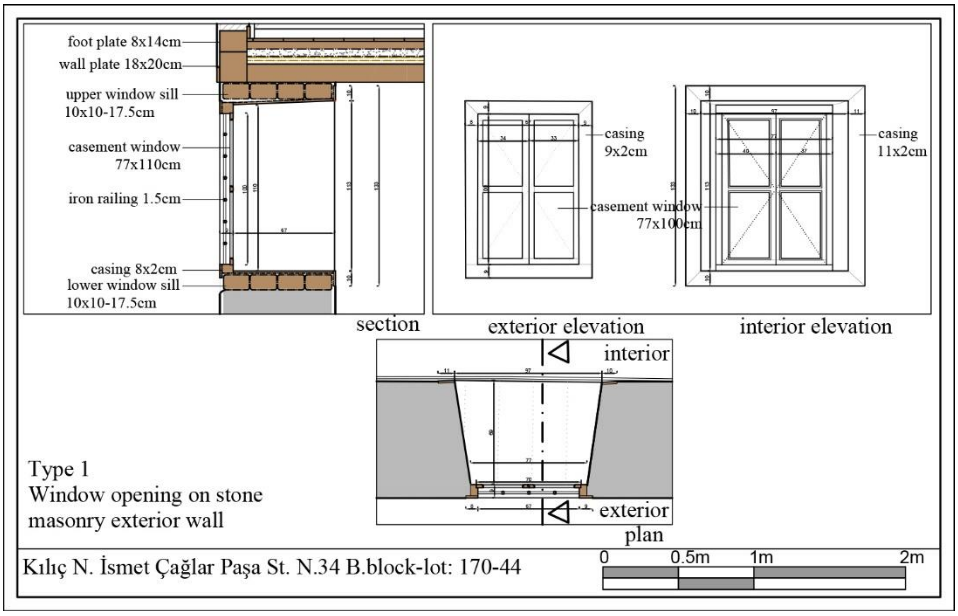


Figure 3.168. Drawing of window opening located on stone masonry wall, Type 1 (Kılıç N. b. block-lot: 170-44)

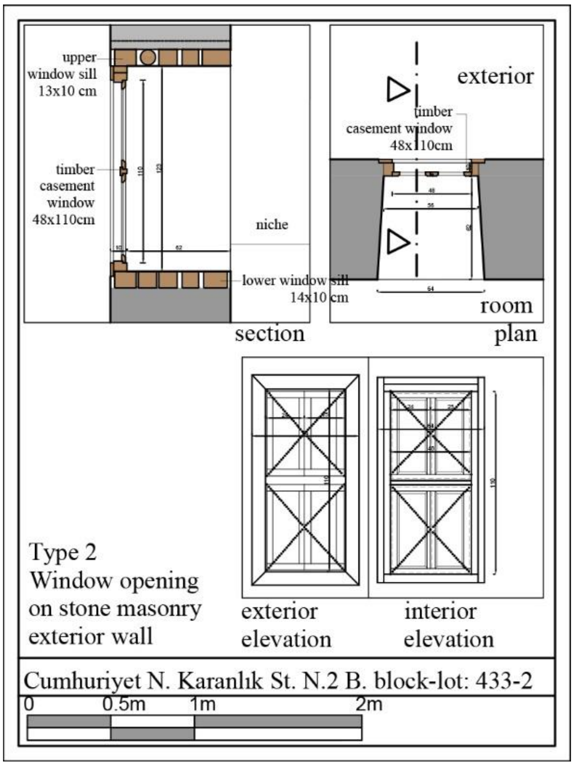


Figure 3.169. Drawing of window opening located on stone masonry wall, Type 2 (Cumhuriyet N. b. block-lot: 433-2)

Figure 3.170. Window opening located on stone masonry wall; Type 2 (Cumhuriyet N. b. block-lot: 433-2)

Figure 3.171. Window opening located on masonry wall; Type 2 (Demirci N. b. block-lot: 448-2)

Figure 3.172. Window opening located on stone masonry wall; Type 3 (Cumhuriyet N. b. block-lot: 433-3)

Figure 3.173. Detail of window opening located on stone masonry wall; Type 3 (Cumhuriyet N. b. block-lot: 433-3)

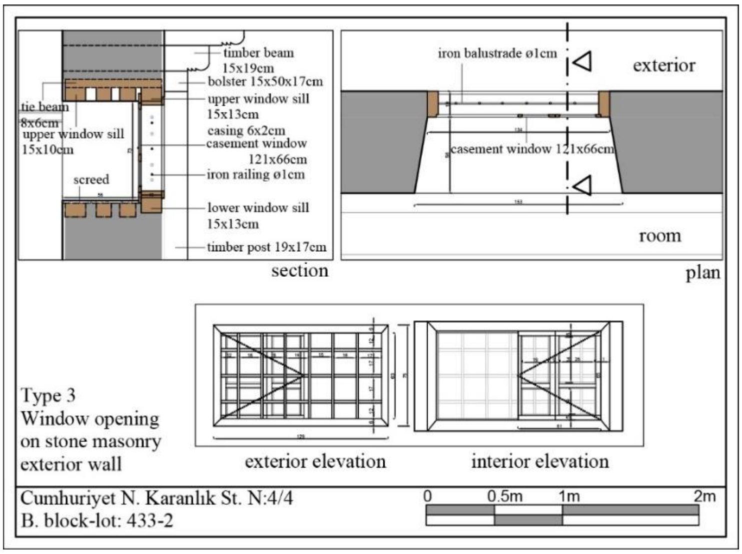


Figure 3.174. Drawing of window opening located on stone masonry wall; Type 3 (Cumhuriyet N. b. block-lot: 433-3)

Figure 3.175. Top window opening located in the middle and above two windows on stone masonry wall; Type 4 (Cumhuriyet N. b. block-lot: 433-2)

Figure 3.176. Top window opening located in the middle and above the two niches on stone masonry wall; Type 4 (Cumhuriyet N. b. block-lot: 433-2)

Figure 3.177. Top window opening located in the middle and above the two cupboards on stone masonry wall; Type 4 (Kubbeli N. b. block-lot: 186-36)

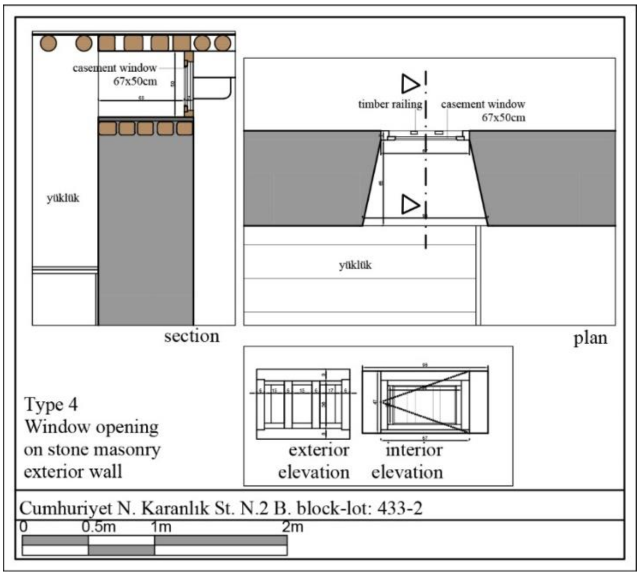


Figure 3.178. Drawing of window opening located on stone masonry wall, Type 4 (Cumhuriyet N. b. block-lot: 433-2)

Figure 3.179. Window opening located on timber framed wall; Type 5, Casement windows, (left, middle, Camikebir N. b. block-lot: 196-1; right, Cumhuriyet N. 4 b. block-lot: 433-3)

Figure 3.180. Window opening Type 5, Casement Windows (Demirci N. b. block-lot: 448-2)

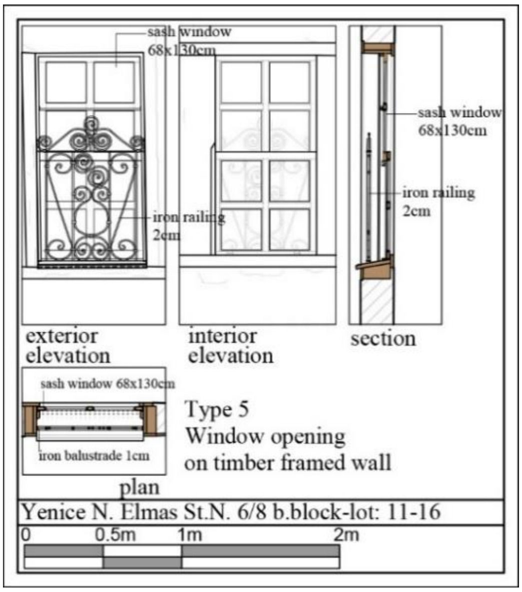


Figure 3.181. Drawing of window opening Type 5 (Yenice N. b. block-lot: 11-16)

Figure 3.182. Top window opening on timber framed wall; Type 6 (Camikebir N. b. block-lot: 196-1; Kılıç N. b. block-lot: 170-44)

Figure 3.183. Window opening with top window on timber framed wall; Type 6 (Cumhuriyet N. b. block-lot: 433-3)

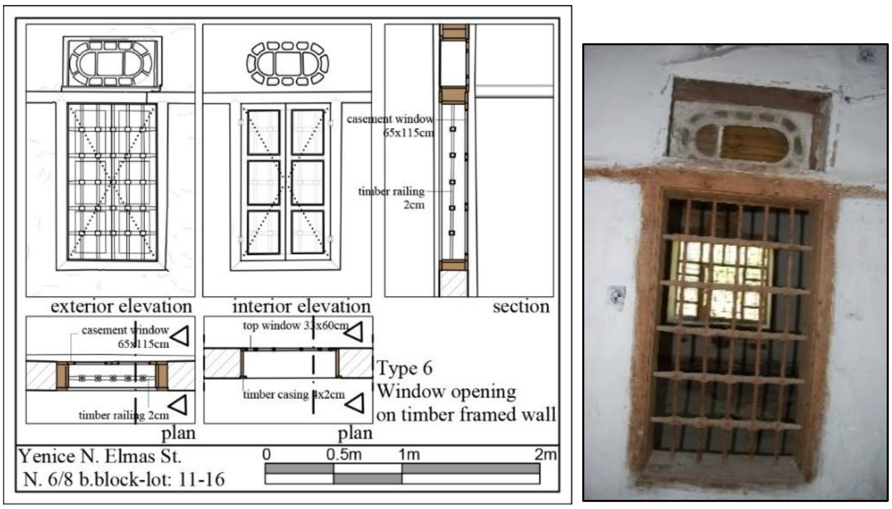


Figure 3.184. Drawing of window opening located on timber framed wall; Type 6 (left), Window opening with top window (right) (Yenice N. b. block-lot: 11-16)

Casement Window: Casement windows are used in the openings located on both stone masonry and timber framed walls. They are used both in ground and upper floors. Casement windows having different units are used in window opening Type 1, 2, 3, 4, 5, and 6. (see Fig.3.185)

Timber casement window frames used in the houses are composed of 4-12 cm wide and 4-6 cm wide horizontal and vertical timber elements. Casement units are consist of 2-2.5 cm thick and 4-5.5 cm wide elements. Casement windows divided into two units vertically, and horizontally divided into two, three, four units and single casement windows are observed in surveyed houses.

Sash Window: Sash windows are used in the openings located timber framed walls in both ground and upper floors. They are observed in the window opening Type 5. Two main sash window units are formed by using 2-2.5 cm thick and 4-5.5 cm wide elements. Sash window units are divided into two horizontally and vertically. (see Fig.3.186-3.187)

Timber and iron railings located in front of the window wing are observed in both ground and upper floors of windows. Iron railings having 0.5-0.6 cm diameter are placed vertically and horizontally perpendicular to each other. The gaps between the iron bars varies between 11-18 cm. They can be arranged in the form of a grid or diamond. In addition, ornamented iron railings are observed. They can be formed by welding or joggling. Iron railings are used with both the sash and casement windows. In some examples, iron railings are elevated towards to street. (see Fig.3.188)

Timber railings are used with the casement windows in ground and upper floors. They are used with interior and exterior windows. They are formed by timber horizontal and vertical elements having 2-4.5 cm cross sections. These timber elements can be in rectangular shape and circular. They can be formed by using "*lokma"* that is the timber element around 3-4.5 cm. Horizontal and vertical circular timber elements with diameter 2-2.5 cm are combined with using *lokma*, at the connection points. In addition, profiled timber bars around 2-4 cm are used as balustrades. They can be located vertically without any horizontal timber element in the window frame. Also, a horizontal timber element located at approximately half level of window height connected the vertical timber bars located at above and below this horizontal element. (see Fig.3.189-3.190)

In addition, timber lattices that are covered around half of window opening are observed in front of the windows. Timber laths around 1.5-2 cm are arranged perpendicular to each other in two rows and they are used in angle of 45. In one house, both timber lattices and iron railings located with together in front of the window opening are observed (see Fig.3.191).

Figure 3.185. Examples of casement windows (left, Demirci N. b.block-lot: 448-2; right, Kılıç N. b.block-lot: 170-44)

Figure 3.186. Examples of sash windows located on sofa (left, middle, Kubbeli N. b. block-lot: 186-36; right, Demirci N. b. block-lot: 444-15)

Figure 3.187. Example of double sash windows located on sofa (Demirci N. b.block-lot: 443-13)

Figure 3.188. Examples of iron railing (Yenice N. b. block-lot: 11-16)

Figure 3.189. Examples of timber railings formed by using *lokma* (left, (Yenice N. b. block-lot: 11-16; right, Kılıç N. b. block-lot: 170-44)

Figure 3.190. Examples of timber railings (left, middle, Cumhuriyet N. b. block-lot: 433-2; right, Camikebir N. b. block-lot: 196-1)

Figure 3.191. Timber lattices and iron railings located in front of the window opening (Demirci N. b. block-lot: 448-2)

3.7.4. Coverings: Floor and Ceiling Coverings

3.7.4.1. Floor Coverings

In Sivrihisar houses, floor construction varies according to the space function and material usage. Four type of floor coverings are observed according to material types; pressed earth (Type 1), stone pavement (Type 2), timber (Type 3) and terracotta tile (Type 4).

In the basement and ground floor, three types of floor covering are observed; pressed earth, stone pavement and timber covering. Floor is covered with pressed earth in especially service spaces; storage, *izbe*, *tandır evi*,etc (see Fig.3.192). Stone pavement is used in *taşlık* space of ground floor and courtyard. However, stone pavement consist of big rough stone pieces in *taşlık* can be observed in three surveyed house; others were altered and covered with cement screed in time. In addition, it is observed stone pavement was intervened with floor screed in some places of *taşlık* in one of surveyed house (see Fig.193). In case of existence of living space in ground floor, timber is used for the floor covering.

Figure 3.192. Pressed earth floor of entrance (left), of *izbe* (right) in ground floor (left, Cumhuriyet N. b. block-lot: 433-3; right, Cumhuriyet N. b. block-lot: 433-2)

Figure 3.193. Stone pavement intervened with floor screed in *taşlık* space (Yenice N. b. block-lot: 521-12)

In the upper floors, floor coverings vary according to material types; timber floor and terracotta tiles. In the timber floor construction of upper floors, two type of construction techniques are observed; simple flooring (Type1) and timber flooring consists of layers (Type2) (for further information see Chapter 3.4). Timber beams are located at 5-40 cm according to the clear span of space and load to be carried. Dimension of timber boards used for coverings changes 20-40 cm and thickness of boards vary in between 2-3 cm. (see Fig.3.194-3.196)

In some houses that have simple timber floor structure, a rectangular formed hole placed on the timber flooring of sofa in first floor is observed. A hole that is covered with grids made of iron is seen in three surveyed houses. Two of peep holes are bigger and have 75x64 cm and 75x87 cm in dimension. One peep hall is smaller and has 20x22 cm in dimension. A peep hole is located on floor of sofa to observe the entrance of house in ground floor. In addition, it is used to open the entrance door from first floor with the rope that follows the route from entrance door to the hole. (see Fig. 3.196-3.197)

Figure 3.194. View of timber floor covering constructed with simple timber flooring used in the sofa (Cumhuriyet N. b.block-lot:433-2)

Figure 3.195. Bottom view of simple timber flooring -Type 1 (left), bottom view of flooring consist of layers – Type 2 (right) (Camikebir N. b. block-lot: 196-1)

Figure 3.196. View of simple timber flooring (Type 1) with peep hole (Camikebir N. b.block-lot: 196-1)

Figure 3.197. Example of simple timber flooring (Type 1) with peep hole (left, Yenice N. b. block-lot: 521-7-8 ; right, Yenice N. b.block-lot:521-12)

In the case of using terracotta tiles as a floor covering in upper floors, terracotta tiles in square form are installed placed on earth infill. Dimension of terracotta tile is around 26x26x4 cm. This type of floor construction is observed in both rooms and sofas. (see Fig. 3.157)

Figure 3.198. View of terracotta floor covering used in the sofa (Kılıç N. b.block-lot:170-44)

3.7.4.2. Ceiling Coverings

In Sivrihisar houses, ceilings can be observed in two forms; covered with timber boards or left blank. Variation of ceilings are seen according to function of spaces and location of spaces in the house.

Type 1, Flooring without covering at ceiling area: In basement and ground floor, that is service spaces the timber floor beams are not covered and left blank. When timber covering boards are not used at ceilings, two type of ceiling is observed according to floor construction.

If floor is constituted with timber beams and timber floor coverings (Type1-simple timber flooring) and ceiling is not covered (Type 1A), then timber beams and timber floor boards can be observed at ceiling area. This type of floor construction and ceiling are observed especially in sofa and/or *taşlık* space.

If floor is composed of timber beams, reed and earth infill (Type2-timber flooring composed of layers), then timber beams and reed infill between the beams can be observed by looking at the ceiling area (Type 1B). Matting of straw, used between floor beams and reed infill is rarely observed in ground floor and basement floor. (see Fig.3.199-3.200)

Figure 3.199. Timber ceiling that is not covered in hall, timber floor beams and timber floor boards (left, Type 1A) and timber ceiling that is not covered in kitchen in ground floor, timber floor beams and reed infill (right, Type 1B) (left, Yenice N. b. block-lot: 521-7-8; right, Camikebir N. b. block-lot: 188-4)

Figure 3.200. Timber ceilings that are not covered with timber boards in upper floor (Type 1B); without matting of straw (left), with matting of straw (right) (left, Demirci N. b. block-lot: 448-2; right, Camikebir N. b. block-lot: 196-1)

Type 2, Flooring covered with timber ceiling boards at ceiling area: In upper floor of houses, floor beams are generally covered with timber ceiling boards whereas floor beams that are left open are still observed. However, matting of straw around 1 cm thickness is laid on the floor beams before the reed infill is placed. It is observed very rarely, matting of straw is nailed underneath the timber floor beams instead of timber ceiling covering boards. (see Fig.3.201)

Use of timber ceiling boards can be vary from simple to ornamented according to importance of space in upper floors. Ceilings covered with timber boards may be simple (Type 2A), may decorated with timber laths and "*göbek*" (Type 2B), and more ornamented with ceiling roses, "*göbek*" and ornamentations (Type 2C). In addition, corbelled ceiling (Type 2D) can be observed.

Type 2A, Simple ceiling covering: In case of using timber ceiling boards after floor is constructed, timber boards having 15-30 cm width and around 2 cm thickness, are arranged side by side and nailed to timber beams. Timber girders with 2-3 cm thickness are placed in between the timber beams and timber boards. In this type of covering, timber laths that are in 2-5 cm width and 1.5 cm thickness are set on the connection point of two covering boards, parallel to the covering boards. (see Fig. 3.202)

Type 2B, Ceiling covering decorated with laths and *göbek*: This type of ceiling is composed of timber covering boards and laths that are used parallel to the boards. In addition, a frame can be observed at the borders of ceiling constructed by timber boards. Also, ceiling constructed with timber covering and timber laths, can be decorated with ceiling roses,”*göbek*” located at the centre of the ceiling. (see Fig.3.203)

Type 2C, Ceiling Covering decorated with laths, *göbek* and ornaments: This type of ceiling covering is composed of timber boards, timber laths, and decorated with *göbek* located at the centre of ceiling and also some ornamentations by use of profiled laths and boards. Different ornamentations can be observed at the corner of the ceiling and at the frame of ceiling. This type of ornamented ceilings are used in the main room and sofa, according to importance of space. (see Fig.3.204)

Type 2D, Corbelled Ceiling: In one surveyed house, ceiling of upper floor that is constructed with overlapped timber beams is observed. Timber beams are set on the corner of rectangular shaped ceiling area as diagonal line, thus an octagonal shape is formed. Then timber beams are placed on four diagonal lines of octagonal shape to create a rectangle. Dimension of main timber beams in rectangular shaped used for overlapping varies between 15-20 cm. In the house surveyed, timber covering boards of ceiling could not observed at the bottom of the ceiling formed by overlapping beams due to their destruction. (see Fig.3.205)

Figure 3.201. Timber ceiling covered with timber boards; use of timber girders in 2-3cm thickness (left) and use of timber boards (right) (left, Kubeli N. b. block-lot: 186-36; Cumhuriyet N. b.block-lot: 432-14)

Figure 3.202. Timber ceiling covered with timber boards; Type 2A (left), timber ceiling covered with timber boards and timber laths, Type 2A (right) (left, Yenice N. b. block-lot: 11-16; right, Kılıç N. b. block-lot: 170-19)

Figure 3.203. Timber ceiling covered with timber boards, timber laths and göbek at the center; Type 2B (Kılıç N. İsmet Çağlar Paşa St. N:34 b.block-lot: 170-44)

Figure 3.204. Timber ceiling covered with timber boards and timber laths, decorated with *göbek* and ornamentations; Type 2C (Yenice N. b. block-lot: 521-12)

Figure 3.205. Timber ceiling constructed with overlapped beams; detail of ceiling without timber covering boards that are lost; Type 2D (Cumhuriyet N. b. block-lot: 433-2)

3.7.5. Interior Space Components

3.7.5.1. Fireplaces

Fireplaces are the architectural elements located in a room of ground floor, kitchen, in *taşlık*, in a room of upper floors and in *tandır evi* in the courtyard of houses. In addition, in some houses, *tandır* without chimney located on the floor of space is observed (see Fig.3.206).

Fireplaces constructed with using bricks were built as a part of stone masonry walls. In Sivrihisar houses, fireplaces used in the houses can be divided into two group as constructed with plain (Type1) (see Fig.3.207) and projected front face (Type2) (see Fig.3.208-3.210, Fig.3.213). In addition, it is observed that front face of fireplaces whether projected or not, can be extended to the ground from the springing line of arch (Type 1A and Type 2A) or extend up to around 60 cm above the ground (Type 1B and Type 2B). In some examples, fireplaces are seen to be raised 10 cm to 20 cm above the ground (see Fig.3.209).

Figure 3.206. Tandır located on the floor of the room (Yenice N. b. block-lot: 11-16)

Figure 3.207. Fireplace with plain front face; Type 1A (left); Type 1B (right) (left, Kubbeli N. b. block-lot: 186-36; right, Yenice N. b. block-lot: 521-12)

Figure 3.208. Fireplaces with projected front face and arched shaped opening; Type 2A, (left); Type 2B, (right) (left, Camikebir N. b. block-lot: 196-1; right, b. block-lot: 433-2)

Figure 3.209. Fireplace with projected front face and raised from ground (Type 2B); general view (left); close view at the bottom part of fireplace (right) (Kılıç N. b. block-lot: 170-44)

Figure 3.210. Fireplaces that have projected front face with arched shaped openings, Type 2B (left, Yenice N. b. block-lot: 12-30; middle, Cumhuriyet N. b. block-lot: 433-2; right, Demirci N. b. block-lot: 444-15)

In the construction of fireplaces, simple or projected, while masonry wall is built, the niche of opening is left in consideration of the bricks walls of fireplaces to be built. Then arch of fireplace opening is constructed with using bricks and mud mortar. Brick masonry is raised on the timber lintels of stone masonry walls. Depth of brick frame of fireplace varies between 40 cm to 65 cm. Springing line of the arch, whether the fireplaces have projected front face or not, is about 60 cm from ground. However, it was observed that the height of springing line can be reached to 105 cm from ground. Width of opening changes in between 95 cm to 185 cm. When front face of fireplace is projected, timber boards with 2-5 cm thickness is placed at the bottom of brick arch, at the level of springing line. The dimensions of the visible part of this timber board that is inserted to the masonry wall changes between 15-30 cm. Accordingly, depth of projected part of brick frame is around 20-25 cm. Height of arch is observed between 65 cm to 110 cm. On top of the brick frame of opening, a timber board or stone with width of 18-27 cm and 2.5-4 cm thickness is placed. In some examples of fireplaces, a niche called for *çıralık* under the arch of fire places is located. The dimensions of chimney shaft of the fireplaces in rectangular form vary between 20-30 cm to 40-50 cm in accordance to dimension of fireplaces. (see Fig. 3.211-3.212)

Figure 3.211. Fireplaces with plain front face made of brick (Type 1B) (left); timber boards located on the timber lintels of masonry wall at the springing line level of arch (middle, right) (Yenice N. b. block-lot: 521-12; right, Camikebir N. b. block-lot: 186-10)

Figure 3.212. Details of fireplace; projected front face of fireplace made of brick and covered with mud plaster (left); arched opening of fireplace (middle); chimney shaft of fireplace (right) (Camikebir N. b. block-lot: 186-10)

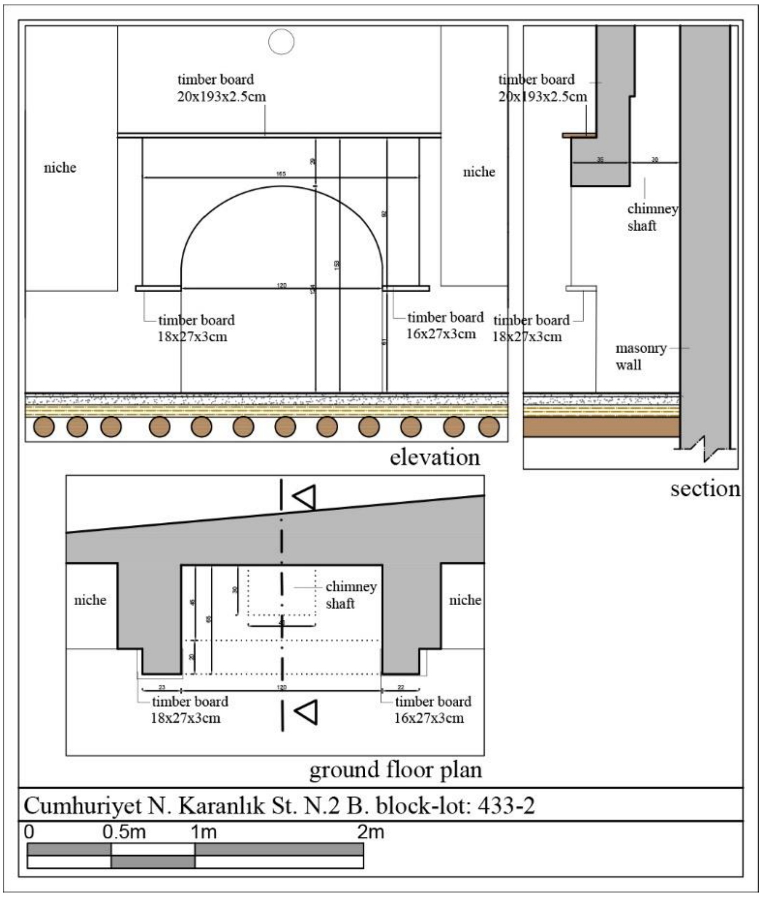


Figure 3.213. Drawing of fireplace with projected front face and arched shaped opening; Type 2B (Cumhuriyet N. b. block-lot: 433-2)

3.7.5.2. Niches

Niches are the architectural elements built on stone masonry walls and also timber framed walls to store the small things. They are built in rectangular and they can be used in ground floor, sofa, upper floors, or service spaces.

Niches can be divided into two according to their construction techniques; niches on masonry walls, niches on timber framed walls.

Type 1, Niche located on Masonry Wall: Niches built on stone masonry walls can be placed in ground and upper floors. They are shaped in rectangular forms. In the construction of niches on stone masonry, timber sills that has 10-15 cm cross section are first placed at bottom level of niche opening. At two side of opening, tie beams that have 5-10 cm cross section located on the timber sills are placed. Niche on the stone masonry wall is completed by putting timber sill on top level of niche. Dimension of these lintel varies between 10-15 cm. These niches are covered with mud plaster and then painted (Type1A). In addition, niches covered with timber boards (Type1B) are also seen. In some cases, niches built on stone walls start directly from ground, not a certain height from the ground. Width of niches changes in between 52 cm to 70 cm, but niches have 82 cm and 118 cm wide were also observed in the basement and *tandır evi* of two different houses. Height of niches varies from 82 cm to 125cm . Depth of niches changes in between 30 cm to 50 cm. In one house niche with 65 cm depth was also seen. (see Fig.3.214-3.217)

Figure 3.214. Niche located on the stone masonry wall, Type 1A (left, Kubbeli N. b. block-lot: 186-36; middle, Cumhuriyet N. b. block-lot: 433-2; right, Camikebir N. b. block-lot: 188-4)

Figure 3.215. Niche located on the stone masonry wall and covered with timber boards, Type 1B (left, Kılıç N. b. block-lot: 170-4;right, Kubbeli N. b. block-lot: 186-36)

Figure 3.216. Timber lintels located at bottom and top level of niche Type 1A (Cumhuriyet N. b. block-lot: 433-2)

Figure 3.217. Timber lintels and tie beam located at bottom level of niche Type 1A (Cumhuriyet N. b. block-lot: 433-2)

Type 2, Niche located on Timber Framed Wall: Niches built on timber framed walls are located in exterior and interior walls of ground and upper floors. Niche is built in the frame that is formed with the timber upper and lower sills, posts and studs of timber framed system. Depth of niches are around 15-18 cm. Width of niches changes between 44 cm to 75 cm,and height of niches varies between 75 cm to 130 cm. Niches on timber framed walls are covered with timber boards at three sides; bottom, top and back side of niche. Timber boards with 2 cm thickness are nailed to timber frame of niche. This type of niches can be grouped into three; simple niches (Type 2A), niches with arches (Type 2B) and niches with arches and windows (Type 2C). Simple ones are built in rectangular shaped with timber board shelves and/or drawer. In the second one, niches are built in rectangular shape and top level of niche is finished with an arch. In the third one, niches built on interior walls have square and rectangular shaped windows. In some cases, shelfs, drawers or an arch can be added. Dimension of windows are arranged around 40 cm-45 cm. (see Fig.3.218-3.221)

Figure 3.218. Niche located on the timber framed wall, Type 2A; (left, middle, Kılıç N. b. block-lot: 170-19; right, Yenice N. b. block-lot: 521-12)

Figure 3.219. Niche with arch located on the timber framed wall Type 2B; (left, Demirci N. b. block-lot: 448-2; right, Kılıç N. b. block-lot: 170-19)

Figure 3.220. Niche with arch and window located on the timber framed wall (left, Camikebir N. b block-lot: 196-1; right, Kılıç N. b. block-lot: 170-19)

Figure 3.221. Niches with window located on the timber framed wall (Yenice N. b block-lot: 521-12)

3.7.5.3. Cupboards

Cupboards are the architectural elements that are built with the addition of timber wings to the niches covered with timber boards. Cupboards are grouped into three according to their construction techniques; cupboards on masonry wall, cupboards on timber framed wall, and built-in cupboards.

Type 1, Cupboard located on Masonry Wall: Cupboards on the stone masonry wall are constructed with the same technique of niches on masonry wall. After the construction of niche, interior faces of niche; two side faces and back faces of niches, are covered with the timber boards that are around 2 cm thickness. A timber frame of casing is covered on the front face of niche. Then timber wings are added to the front face of niches. Cupboards on stone masonry walls are observed in both ground and upper floors. They have 50-75 cm width and 85-125 cm high. Depth of the cupboards are about 30 cm. (see Fig. 3.222)

Figure 3.222. Examples of cupboard located on stone masonry wall (1-2, Kubbeli N. b. block-lot: 186-36; 3-4, Cumhuriyet N. b. block-lot: 433-3)

Type 2, Cupboard located on Timber Framed Wall: Cupboards on the timber framed wall are constructed with the same technique of niches on timber framed wall. After the niche covered with timber boards on timber framed wall is built, then the timber frame of casing is covered on the front façade of niche. After that, timber wings are placed on the front façade. Cupboards on timber framed walls can have shelves and/or drawer, arches and windows just like in niches. Accordingly, they can be grouped into three; simple cupboards (Type 2A), cupboards with arches and windows (Type 2B). Depth of cupboards are about 15-18 cm and dimension of cupboards changes between 45-75 cm to 80-125 cm. (see Fig. 3.223-3.224)

Figure 3.223. Cupboards on the timber framed wall, front face (left), rear face (right) (Gedik N. b. block-lot: 362-19)

Figure 3.224. Examples of Cupboards on the timber framed wall (left, middle, Demirci N. b. block-lot: 443-13; right, Yenice N. b. block-lot: 521-7-8)

Type 3, Built-in Cupboard: Built in cupboards are the architectural elements constructed along the one façade of the room. They are located adjacent to the wall and rise up to the ceiling. Built in cupboard (*yüklük*) constructed with the horizontal and vertical timber elements that form the scaffolding of the *yüklük*. These timber elements changes between 4 cm to 10 cm. Facades of timber scaffolding are covered with the timber boards in 2-4 cm thickness. Timber wings are located on front façade of *yüklük*. In some examples, shelves, drawers are placed at one or two sides of yüklük. Depth of built in cupboards varies from 74 cm to 147 cm. In addition, built in cupboards can be designed together with the room door. (see Fig.3.225-3.227)

Built in cupboards are used to store the blanket, pillow, etc. Storage area stars at the level of 60-65 cm above the ground. Built in cupboards can have one or more separate storage partitions. In some of them, there is a separate partition used for the bathing, *güsulhane*. Besides, *güsulhane* can be built as a particular space on the masonry wall or timber framed wall. In some that places, small window is placed on the exterior façade of *güsulhane*.

Figure 3.225. Examples of built in cupboards-*yüklük* (left, Cumhuriyet N. b. block-lot: 433-2; right, Demirci N. b. block-lot: 443-13)

Figure 3.226. Examples of built in cupboards-yüklük (left, Cumhuriyet N. b. block-lot: 433-3; right, Cumhuriyet N. b. block-lot: 433-2)

Figure 3.227. Examples of built in cupboards (left, Yenice N. b. block-lot: 521-7-8; middle, Demirci N. b. block-lot: 448-2; right, Demirci N. b. block-lot: 443-13)

3.7.5.4. Sedir

Sedir is the timber architectural element of the room and sofa, for the use of sitting purpose. They are generally located under the window facing the street. They can be designed straight or in L shape. Their height varies between 30-40 cm and their width changes from 75 cm to 125cm. Timber beams that have 5-10 cm thickness are located under the timber boards, parallel to the length of *sedir*. Timber post around 10-12 cm support the timber beams and timber beams are connected to each other with another timber element in 5-10 cm. Front façade of *sedir* is also covered with the timber boards. Timber boards used for the construction of *sedir* have 2-3 cm thickness. (see Fig.3.228-231)

Figure 3.228. Example of L shaped *sedir* (Yenice N. b. block-lot: 521-12)

*Figure 3.229.*Example of I shape *sedir*; detail of *sedir* (Yenice N. b. block-lot: 521-12)

Figure 3.230. Detail of *sedir* (left, Demirci N. b. block-lot: 443-13; right, Yenice N. b block-lot: 521-12)

3.7.5.5. Shelves

In Sivrihisar houses, two types of shelves are observed as timber and gypsum.

Type 1, Timber Shelves: Timber shelves are designed in rectangular or triangle shape. Triangle shaped shelves are generally located at the corner of the room above the windows or cupboards. (see Fig.3.232)

Figure 3.231. Examples of timber triangle shelves located corner above the cupboard (left), above the window (middle and right) (left, Kubbeli N. b. block-lot: 186-36; middle, Cumhuriyet N. b. block-lot: 433-2; right, Demirci N. b. block-lot: 443-13)

Type 2, Gypsum Shelves: Gypsum shelves are used on the facades of rooms. They have approximately 55 cm in width, and have 45 cm in total height. Gypsum shelves that have different ornaments have projected parts of 15 cm at the upper level. (see Fig.3.233)

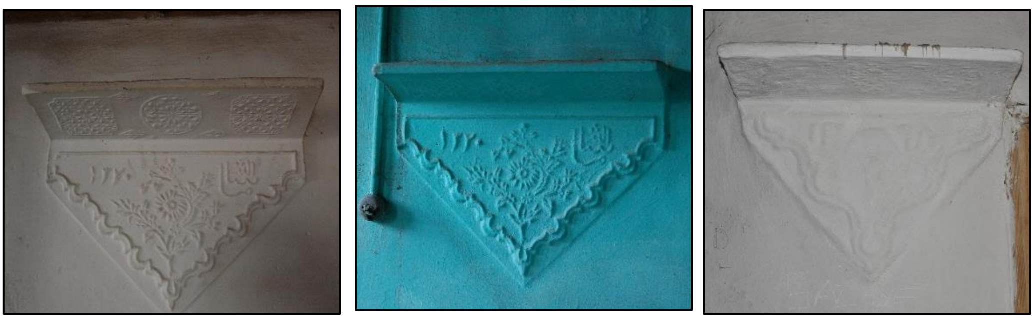


Figure 3.232. Examples of gypsum shelves (left, Demirci N. b. block-lot: 448-2; middle, Demirci N. b. block-lot: 443-13; right, Cumhuriyet N. b. block-lot: 433-2)

CHAPTER 4

EVALUATION OF THE STUDY

Results of the study methodology's of fourth stage, "the investigation and site survey", were given in chapter three with detailed description of the analysis of the information obtained from the 28 houses studied in the site survey. In chapter three, typology of structural and architectural elements was defined by comparing the similarities and differences of data collected from 28 traditional houses investigated. After defining the typology of building system elements, a code system was applied to section drawings of 14 houses surveyed in detail and survey sheet of 14 houses were prepared (see App.B).

In the evaluation phase, the information obtained in the analysis phase about the typology classification of building system elements is tabulated and a comparison table is created (see Fig.4.3-4.4). The table presents the typology of structural and architectural elements of 28 traditional houses studied systematically. By this means, detail types and frequency of use in the traditional buildings are determined. In addition, a table showing the codes of detail types used in 14 houses studied is prepared (see App.C). So the types of building elements used in 14 houses and their frequency of use are seen on the codes table easily and systematically. Therefore, an evaluation of information obtained from the analyses phase and two tables prepared are given in this chapter.

A general evaluation is focused on to give the conclusive remarks on structural, architectural elements of traditional houses in Sivrihisar and to explain briefly the construction process of a traditional house in Sivrihisar.

The conclusive remarks on the building system elements of traditional houses in Sivrihisar that are obtained from the studies can be summarized as follows:

- Sivrihisar is a town of Eskişehir where many traditional houses built on a Sivrihisar mountain slope are settled organically.

- Traditional houses of Sivrihisar are generally built as two storey, however one storey and three storey houses are seen too. Some houses have basement floor in accordance with the topography. In addition, some houses have an mezzanine floor while, attic (cihannuma) is seen only in one house in Sivrihisar. Among the 28 houses in question, 7 of houses have basement floor and 2 of houses have mezzanine floor.

- The traditional houses in Sivrihisar are hybrid structures that are built by using *hımış* techniques. They are constructed using stone masonry system on foundation, basement and ground floor, timber framed system with mudbrick and brick infill on the upper floors.

- Three different types of foundation system are used. Continuous foundations (Type1), composite foundations (Type 2) and rocks used as a part of foundation (Type 3) are used depending on the condition of ground and plan scheme. Among the houses studied, Type 1 is observed in 4 houses, while each one of Type 2 and Type 3 is seen in 1 house.

- Masonry walls are constructed with rubble stones, timber lintels and tie beams using the bigger stones at exterior sides and smaller stones to fill the inner area.

They are built as un-coursed rubble masonry walls. In 7 of houses that are located at the corner of the streets, masonry walls with chamfered corner are used.

- Stone masonry walls are divided into two groups in terms of finishing layer; without plaster (Type 1A) and covered with mud plaster (Type 1B). In most of houses, 19 of studied houses, stone masonry walls covered with mud plaster are used, while 13 of houses have masonry walls without plaster. 14 of houses have both plastered and unplastered stone masonry walls. In 7 of houses, interior facades of stone masonry walls in basement/ground floors are not covered with plaster.

- Timber framed walls used in both ground and upper floors are constructed with two types of infill materials. Timber framed walls with mudbrick infill (Type 1A) are used in 21 houses, timber framed walls with brick infill (Type 1B) are used in 15 houses and 9 of houses have both types of timber framed walls.

- Timber framed walls are divided into 3 groups according to finishing layers. The most frequently used one is the timber framed walls covered with mud plaster (Type 1B) and it is seen in 24 of houses. While 7 of houses have timber framed walls without plaster (Type 1A), 6 of houses have both types of timber framed walls. Timber framed system that is covered with horizontal timber laths-*bağdadı* system (Type C) is seen rarely, only in 1 one house.

- Timber posts that are the vertical load bearing elements are used in ground and upper floors are seen generally in *taşlık* space and on the façade of open/semi-open sofas. Timber posts that are located on the stone base have two types of connection details. The most seen detail is simple connection (Type 1) used in 15 of houses studied. 8 of houses have timber post with bolster top on (Type2) and 3 of them have timber post in Type 2 with timber braces.

- Roofs are divided into 2 groups according to construction techniques. Most of houses; i.e., 22 of them, have roof with timber roof structure (Type2), and 5 of them have roof without timber roof structure (Type1). In addition, roofs are divided into 3 groups by their sloped surfaces. As the most frequently used roof, hipped roof (Type C) is used in 21 of houses studied, while 4 of houses have gable roof (Type B) and 5 of houses have one side sloping roofs (Type A). In addition, 3 of houses have both one side sloping roof and hipped roof and 1 of houses has roof formed with gable and hipped roof.

- Eaves made of timber are divided into two groups according to their construction techniques. The most common type is timber eave without covering (Type 1). Timber eave covered with eaves fascia (Type 2A) is seen in 13 houses and eave covered with fascia boards and soffit boards (Type 2B) is seen rarely, in 1 house.

- Projections are divided into 3 groups according to their structural systems. Projections supported with braces (Type 3) are the most common type used in traditional houses. As projections supported with overlapped beams (Type 2) are used in 6 of houses, the least common type, simple type projections (Type 1) is used in 3 of houses.

- Staircases are divided into two according to construction materials; stone (Type 1) and timber (Type 2). While the stone stairs are used to reach entrance of houses from the street or courtyard and/or to reach the basement from the *taşlık* space, timber stairs are used to provide transition between the floors in the *taşlık* and/or sofa inside the house or in semi-open sofas in the houses with exterior sofa. As the most common type, timber staircases (Type 2) are used in 18 of houses and stone staircases are seen in 7 of houses. In addition, timber stairs are divided into two groups in terms of the construction techniques. 17 of 18 timber staircases are constructed by locating timber boards on stringers (Type 2A), while timber stairs constructed by inserting timber boards into opened grooves of stringers (Type2B) are used rarely. Also, 7 of houses have both stone and timber staircases.

- Fireplaces that are used in the kitchen, *tandırevi*, *taşlık* and room are divided into 2 groups. Fireplaces are constructed with plain front face (Type 1) and projected front face (Type 2). They are constructed with brick masonry as a part of masonry walls. The most frequent type, Type 2 is used in 16 of houses. In addition, *tandır* located on the floor of a room is observed rarely.

- In Sivrihisar houses, flooring structure is divided into 2 groups according to construction techniques. Simple flooring (Type 1) is composed of timber floor beams and timber floor covering boards. The second type of flooring is composed of timber floor beams and layers of reed and earth infill located on beams (Type 2). Type 1 that is used mostly in the sofa and *taşlık* is seen in 13 of houses, while Type 2 that is used mostly in rooms is observed in 25 of houses.

- Floor coverings are divided into 4 groups according to materials and construction techniques. In basement and ground floors, earth (Type 1), and stone pavement (Type 2) are used as floor covering. In the studied houses, 13 of houses have earth floor covering, 3 of houses have stone pavement. Most of stone pavement that is used in *taşlık* is altered today. In upper floors, timber covering (Type 3) and terracotta tiles covering (Type 4) are used. The most frequently used one, the timber floor covering, is observed in 18 of houses.

- Ceilings are divided into two groups according to construction techniques; ceiling that is not covered with any boards (Type 1) and covered with timber ceiling boards (Type 2). Ceiling of Type 1 is divided into 2 groups according to the floor construction technique. In the studied houses, 13 of houses have ceiling composed of timber floor beams and covering boards (Type1A) and 25 of houses have ceiling structure composed of floor beams and reed and earth infill (Type1B). Ceiling of Type 2 is divided into 4 groups in terms of the use of covering boards. While simple type covered ceiling (Type 2A) is used more in houses, ceilings ornamented with timber laths and *göbek* (Type 2B) and ceilings decorated with laths, *göbek* and ornaments (Type 2C) are not seen in all houses. Corbelled ceiling (Type 2D) is observed rarely, only in one house.

- Doors are divided into 2 groups according to locations and construction techniques; exterior doors and interior doors. Exterior doors are mostly built as batten doors, and interior doors are constructed as batten and paneled doors. According to construction techniques, door are divided into 6 groups. Doors located on the masonry walls with single wing (Type 1) and double wing (Type 2) are the most common types used as especially exterior doors in the houses. Also double wings door on the masonry walls are built with top windows (Type 3) are used as exterior doors. Single wing doors (Type 4) located on the timber framed walls are the most common used doors, when double wing doors (Type 5) and double wing doors with top windows (Type 6) located on the timber framed walls are used less frequently.

- Windows are divided into 2 groups according to their construction techniques, forms and sizes. Type 1 and Type 2 that are rectangular shape located on the masonry walls and the windows used as top window on the masonry walls are the ones used more with almost same frequency. In addition, rectangular windows located on the timber framed walls are used mostly in upper floors are the most common type of windows. Window profile types are grouped into two as casement and sash windows. While casement windows are the most used profile types, sash windows are also used quite frequently.

- Niches are divided into 2 groups according to construction techniques. Niches located on the masonry walls (Type 1) and on timber framed walls (Type 2) are seen almost in the same frequency. The predominantly used niches on masonry walls, the niches covered with mud plaster (Type 1A) are seen in 12 of houses studied. Niches located on timber framed walls are grouped in terms of the form of niches. Simple type of niches (Type 2A) and niches with arches and windows are seen approximately the same number, the niches with arches (Type 2B) are observed less frequently.

- Cupboards are divided into 2 according to construction techniques. The most common type is the built-in cupboards constructed adjacent to the wall and it is used almost every house. Cupboards located on the masonry walls (Type 1) are used both in ground and upper floors. Cupboards located on timber framed walls (Type 2) are divided into 2 groups. Simple cupboards (Type 2A) and cupboards with arches and windows (Type 2B) are seen almost in the same frequency.

- Two main types of materials are used as construction materials. Rubble stone is used for the construction of masonry walls with together the timber lintels and tie beams. Timber is used mainly for the structural elements of timber framed walls, while mudbrick and brick are used as infill materials. Timber is also used for the construction of architectural elements and finishing.

The construction process of a traditional house in Sivrihisar is briefly explained as follows (see Fig.4.1- 4.2):

Foundation:

In the construction process of a house, the first stage is the preparation of the ground for the foundation on which the building will sit. For this purpose, the foundation pit on which the structure will rise is excavated to the level until a sturdy rocky ground is found (see Fig.4.1, step 1; Fig.4.2, step 1). Due to the topographic characteristics of the region, the foundation level varies.

Three types of foundations can be used in the construction of traditional house in Sivrihisar. Foundation types are used according to ground floor layout of the house. Continuous foundation types (Type1) continue on the same axis under the masonry walls the ground floor plan. Composite foundation types (Type2) are used when timber posts with stone base are used in the *taşlık* and under the exterior sofa in the ground floor plan. Thus, combination of continuous foundation walls under the ground floor masonry walls and timber posts with stone base located in ground floor is defined as composite foundation. When the rocks are used as a part of foundations (Type 3), stone masonry walls are built on the same axis as the rocks.

Foundation walls are constructed by using rubble stones and mud mortar. The thickness of stone masonry foundation walls changes between 60 and 120 cm. The depth of foundation walls varies depending on the soil types and topography due to the excavation of soil until the hard stable or rocky ground is found.

Basement and Ground Floor:

Stone masonry foundation walls that continue on the foundation go up to the ground floor walls. In cases where the basement is built by taking advantage of the slope in the topography, the foundation walls rise to the basement floor and then to the ground floor as stone walls of the same thickness (see Fig.4.1, step 2; Fig.4.2, step 2). In some examples, the foundation walls extending towards the ground floor walls form a "sous basement" level depending on the topography. When the ground floor walls settle on the continuous foundation walls, a 10-20 cm thick timber is used between them. When the ground floor walls are continued as stone masonry walls, a timber lintel used between continuous foundation walls and the ground floor walls is generally 10-15 cm thick.

According to construction techniques, one type of stone masonry walls (Type1) is used in Svirihisar houses. Stone masonry walls used for the basement and ground floor walls are constructed by rubble stones and mud mortar with using timber lintels and tie beams. The stones used in the masonry walls are generally granite and obtained from the quarries near Sivrihisar. Rubble stone masonry walls are built as un-coursed rubble masonry. The thickness of stone masonry walls varies between 60 and 84 cm. Stone masonry walls used in basement and ground floors can be left uncoated (Type1A) or covered with mud plaster and whitewashed (Type1B).

For the construction of stone masonry walls, bigger rubble stones are used at the exterior façade of wall and inner space is filled by using smaller stones. Timber lintels are located at inner and outer sides of the walls and they are connected with tie beams.

Timber lintels of 7-16x10-18 cm are placed at intervals between 40-185 cm. Connection of timber lintels and tie beams are done by using nails. In the junction of stone masonry walls perpendicular to each other, timber lintels of two masonry walls can be overlapped and fastened with nails or they can be placed at same level, fastened, by using half lap joint, and nailed.

If there are architectural elements such as niches (Type1) or cupboards (Type1) on the basement or ground floor walls made of stone masonry, timber sills are placed on the upper and lower level of niche opening during the construction of the walls (see Fig.4.1, step 3). Upper and lower timber sills of niche placed along the depth of niche are 10-15 cm in size. Timber sills located side by side are connected to each other by a timber tie beam placed on both sides of niche perpendicular to sills. The number of timber sills varies between 2 and 4 according to the depth of niche. After the niche opening is formed by placement of timber sills and tie beams, the inner surface of niche opening can be covered with mud mortar (Type1A), with timber boards (Type1B) for niche making and also with timber boards and covers for cupboard (Type1) making.

In order to construct openings such as doors (Type1, Type2, Type3) or windows (Type1, Type2, Type3, Type4) on the stone masonry wall of basement and ground floor, firstly the opening and the timber frame of opening are formed. In case of doors, door sills are located at upper level of door opening and timber posts are located at two sides of opening. A timber threshold is placed at the lower level of posts where the timber posts sit directly on the ground. Upper door sills can be covered with timber boards or left as they are. In case of windows, window opening is formed by placing sills at the upper and lower level of opening and timber posts at two sides of opening. Timber sills at top and bottom of the window can be covered with timber boards.

Timber framed system is used generally in upper floor walls, however in some houses it can also be used in ground floors. When timber framed walls are built on the ground floor on top of the stone masonry foundation walls, foot plate of the timber framed system is located on the wall plate of stone masonry wall of basement or foundation walls. Wall plates are located on the outer and inner sides of masonry wall. In some houses, timber floor beams are placed on the same level as foot plate of upper floor and only one plate is observed in between the masonry wall and timber framed wall of upper floor (see Fig.4.1, step 5; Fig.4.2, step 3). In this case, foot plate of upper floor is located in between two structures and lap joints are used for the connection of the timber elements perpendicular to each other at same level. Timber framed walls are composed of structural horizontal, vertical, diagonal timber elements and infill materials. Timber posts that are vertical elements are located on the foot plate of ground floor wall and timber wall plate is placed on the timber posts. In between the timber posts, timber braces are placed diagonally. Secondary timber elements; i.e., studs, tie beams, timber bracing elements are located if necessary in the frame system. Timber framed walls are constructed with two different infill materials as timber framed wall with mudbrick infill (Type 1A) and timber framed wall with brick infill (Type 1B).

In the case of placement of niches (Type2), cupboards (Type2), windows (Type5, Type6) or doors (Type5, Type6) on the timber framed wall, timber posts are arranged at two sides of opening of the architectural element. When the architectural elements are niches, cupboards, or windows, opening is limited with the sills located at upper and lower level of opening and posts at two sides. For the construction of door openings, door sills located at the upper level of opening and posts are placed at two sides of opening.

Timber posts, which are used in ground floors, are placed in accordance to ground floor plan scheme. Timber posts in ground floor can be placed inside the building in *taşlık* space or outside of the building under the exterior sofa or projection. (see Fig.4.1, step 4).

Timber posts are placed on the stone base on the ground. Two different connection details are observed. In the first connection detail (Type1), there is a timber girder located directly on the timber post, without any timber elements. In the second one (Type2), timber bolster is used in between the timber post and girder. In some cases, timber braces also observed in this type.

Floor Construction:

After the ground floor walls, masonry walls and/or timber framed walls, and timber posts of ground floor are constructed, the construction of the flooring begins. Timber floor beams are placed on the wall plates of ground floor walls whether it is masonry wall or timber framed wall. If there is a timber post on the ground floor, then one side of the timber floor beams is placed directly on timber post or timber bolster used between the beam and post. (see Fig.4.1, step 6; Fig.4.2, step 4).

Timber floor beams that are in a 10 to15 cm diameter are placed parallel to the short edge of the space. Distance between the floor beams varies depending on the floor type. If simple flooring composed of timber floor beams and timber floor covering boards (Type 1) that is used mostly in the space of sofa, is used, floor beams are placed with 20-40 cm spacing. Then, timber floor covering boards are placed perpendicular to the floor beams. In some cases, timber girders with 2-3 cm thickness are placed in between the floor beams and covering boards. If flooring composed of timber floor beams and layers of reed infill, earth infill (Type2) that is mostly used in the rooms, is used, floor beams are placed with 5-20 cm spacing. After that, reed infill around 5-10 cm and earth infill around 10-15 cm are placed on the floor beams (see Fig.4.1, step 7; Fig.4.2, step 5) and then floor covering is applied.

If projection is built on upper floor, then the floor beams are extended towards the street. According to the projection type, extended floor beams are supported by prolonged a timber beam (Type1), overlapped beams (Type2), and braces (Type3).

Upper Floor:

If the stone masonry wall rises along the entire building height, then the stone masonry wall continues to the upstairs. Stone masonry walls are built on the floor beams placed on the wall plates of lower floor masonry wall. Connection of lower floor masonry wall, upper floor masonry wall, and floor beams (Connection Detail 1) is done in two ways. Floor beams can be extended along the wall thickness and be placed on the wall plates of lower floor wall. In second way, floor beams can be inserted into the wall about the thickness of the wall plate and located on the wall plate of lower floor wall (see Fig.4.6, step1). If architectural elements such as niches (Type1), cupboard (Type1) and windows (Type1, Type2, Type3, Type4) are placed on the stone masonry wall, their openings are arranged by locating the upper and lower sills and timber posts that are limiting the opening frame.

When a timber framed wall is built on the upper floor, on the stone masonry wall of lower floor, then the foot plate of upper floor wall is placed on the floor beams that is located on the wall plate of stone masonry wall of lower floor. (Connection Detail 2). (see Fig.4.1, step 8).

When a timber framed wall is used in both ground and upper floors, then the foot plate of upper floor wall is located on the floor beams which is put on the wall plate of timber framed wall of lower floor (Transition Detail 3). (see Fig.4.1, step 8; Fig.4.2, step 6).

When a timber framed wall is built on the timber post of lower floor, then the foot plate of upper floor wall is located on the floor beams. Floor beams put on the wall plate of timber posts of lower floor or one side of floor beams are connected to the wall plate by using half lap joint. (Connection Detail 4)

If there is a projection in the upper floor, foot plate of upper floor wall is placed on extended floor beams after the construction of projection. Timber posts of timber framed system are located onto foot plate with intervals ranging between 50-180 cm and nailed. At top of the timber framed system, timber wall plate is located. Timber wall plate and foot plate are connected to each other by using timber posts and timber primary bracing elements. The spacing of the timber posts is adjusted depending on the architectural elements to be left on the timber framed system and dimension of the infill materials. Wall plate and foot plate are the main structural elements of frame system at horizontally and timber posts are the main structural elements of system in the vertical. In addition, studs, tie beams and timber bracing elements are placed as the secondary elements of system. Timber elements of frame system are connected by using nails and no lap joint is used. (see Fig.4.1, step 8; Fig.4.2, step 7).

Timber framed wall is classified into two according to infill materials; timber framed walls with mudbrick infill (Type 1A) and brick infill (Type 1B). Mudbrick infill is located between the gaps of structural timber elements of system by arranging horizontally, vertically and diagonally and bind with mud mortar. When brick infill is used, arrangement of bricks are varies such as horizontal, vertical, diagonal, herringbone, etc. Mud mortar is also used as a binding material when brick infill is used in the frame system. However, especially when decorative brick arrangement is used, lime mortar is used for pointing.

When architectural elements such as niches (Type2), cupboards (Type2), windows (Type5, Type6) and doors (Type5, Type6) are located on the timber framed wall, timber posts are arranged according to width of the opening. Then the timber sills are located at upper and lower level of niche, cupboard or window to limit the opening. For door opening, door sill is located at upper level of the opening and a timber threshold is placed at lower level of opening.

When timber post is used in both ground and upper floors, then the upper floor timber post is placed on the foot plate located on the wall plate of lower floor or girder put on the timber post of lower floor (Connection Detail 5).

Timber posts used in the exterior sofas can be coated or left as they are. They can be covered with timber boards at four surfaces and they can be covered with timber laths by using *bağdadı* technique.

Roof:

After the construction of upper floor walls, first the ceiling beams are located on the wall plates of upper floor walls parallel to the short edge of the space. Then, reed infill and earth infill are located on top of floor beams, before the construction of roof. Roof is shaped in accordance with plan scheme of the houses. In Sivrihisar houses, the roofs are least accessible parts, making it one of the most difficult to examine. However, the construction of roofs is described with limited information obtained from mostly demolished roofs and observations of repaired roofs. Accordingly, two types of roof construction are observed in the surveyed houses in Sivrihisar. The first type of roof is roof without timber roof structure (Type1). This type of roof is formed by mildly beveling the flat roof consisting of reed and earth infill layers placed on floor beams at a later stage. Roof tiles are located on the earth infill without any intermediate element. The second type of roof is the roof with timber roof structure (Type2) located on the earth infill of floor structure. Timber roof structure is composed of timber elements; rafters, roof ridge, purlins, angle rafters and timber posts. After timber roof structure is formed then roof boards are located on the roof rafters perpendicular to them. Then, the over and under roof tiles are placed on the roof boards. (see Fig.4.1, step 9-10; Fig.4.2, step 8).

Roofs can be classified into three groups in terms of slopes of surfaces as; i.e., one side sloping roof (Type A), gable roof with two surfaces (Type B) and hipped roof with three or four surfaces (Type C). The original roof covering is over and under roof tiles, some of houses have Marseille tiles added later for the repair.

As roof elements, eaves are grouped into two according to construction techniques. Eaves are divided into two types according to construction techniques. In the first type, timber eaves are not covered with any cladding at front and bottom side (Type1). In the second type, eaves are covered with eaves fascia at front side (Type2A) and with soffit boards at bottom side and with eaves fascia at front side (Type2B).

Architectural Elements and Finishing:

During the construction of masonry walls and timber framed walls, openings of such architectural elements; windows, doors, niches and cupboards are left. After the construction of ground and upper floor walls and roof structure, construction of the architectural elements, and infill materials of timber framed system are installed and then finishing of the external and interior surfaces of walls are completed. (see Fig.4.1, step 11; Fig.4.2, step 9).

For windows and doors, timber claddings are completed, then iron or timber railings are added. Timber stairs are built into the stair opening left on the floor structure. Niche openings are covered with plaster or timber covering boards. Cupboards are completed by using timber boards and covers. Floor coverings (stone pavements, timber floor boards, terracotta tiles) and ceiling coverings are installed. If building has a built-in cupboard, it is built along the wall right next to the entrance of the room. *Sedir* is constructed as straight or L shaped in front of the window of the room or sofa. On the wall of the room, timber and/or gypsum shelves are placed.

Interior surfaces of timber framed walls are covered with mud-based rough plaster, lime-based fine plaster and paint. Exterior surfaces of walls are covered with plaster or left blank when decorative brick arrangements are used, especially in timber framed walls with brick infills. Lime-based mortar is used as pointing in decorative brick arrangements, while mud based mortar is used as binding in the timber framed walls.

1-Foundation pit is excavated to the level until a rocky or steady ground is found.

2-Stone masonry foundation walls are constructed by using rubble stones in basement and ground floor. Timber lintels are located at inner and outer sides of stone wall and and tie beams are placed on lintels to connect them. Niche, door, fireplace openings are left on the stone wall. Timber sills that come to the top and bottom of the openings are located side by side along the wall thickness.

3- Stone masonry walls of ground floor is continued to construct, by placing the bigger stones at exterior side of walls and filling the inner side with smaller stones. Stone masonry walls of ground floor are constructed with timber lintels and tie beams. Wall plates are located on the exterior and interior sides of stone masonry wall. Opening such as windows doors and niches in the stone masonry wall are limited with the timber sills placed at above and below the openings and timber posts placed at edges of openigns.

4-After stone masonry walls of basement floor are constructed, timber floor beams are placed on wall plates of basement floor walls. Floor structure of ground floor, in the case of basement floor, is constructed by laying the reed and earth infill onto timber floor beams. Timber posts are set on the *taşlık* space on stone base.

5- Timber framed walls of ground floor are built by using timber posts, braces and studs. Timber posts of timber framed wall are located on foot plate and on top of posts, wall plate is placed. Also, timber bolster and wall plate is put on top of timber post in *taşlık*. After the construction of ground floor walls, construction of floor structure in first floor is started. Timber floor beams are located on wall plate of ground floor and foot plate of upper floor wall is located on floor beams.

6- For the floor construction of first floor, timber floor beams are placed on the wall plates of ground floor walls. Floor beams have around 12-15cm diameter and located parallel at the short span of the rooms and sofa. Stair opening is left when locating the timber floor beams of sofa. For the construction of projections, floor beams are located on top of the wall plates extended towards to courtyard. Then, on top of floor beams, foot plate of upper floor wall is located.

7- Floor consruction of rooms at first floor is completed by laying the reed and earth infill on timber floor beams. For the floor construction of sofa, floor beams are located on the wall plates of ground floor. parallel to short span of space. Stair opening is left on the floor structure of sofa.

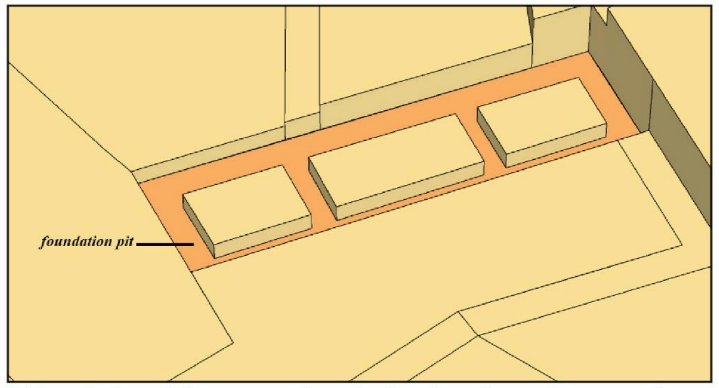
8-Timber framed wall of upper floor is constructed. Timber posts are placed on foot plate. On top of timber posts, wall plate is located. Distance between timber posts are arranged according to windows and niches located in the timber framed system. Accordingly, horizontal, vertical and diagonal elements of timber framed system are located. In additon, timber braces to support the projected floor are installed.

9- After construction of upper floor walls, timber floor beams are located on the wall plates of upper floor walls. After that, reed and earth infill is laid onto timber floor.

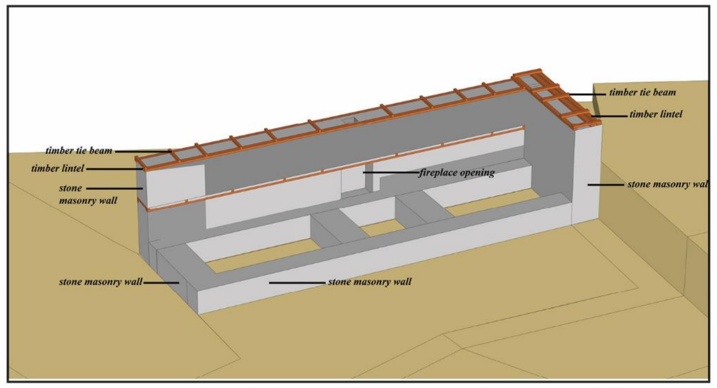
10- Timber roof structure is installed on top of earth infill. Timber eaves are covered with eaves fascia.

11-Roof boards and over and under roof tiles are installed respectively, on top of timber roof structure. Floor and ceiling coverings and architectural elements are completed. Infill materials of timber framed walls are installed and finishings of wall surfaces are completed.

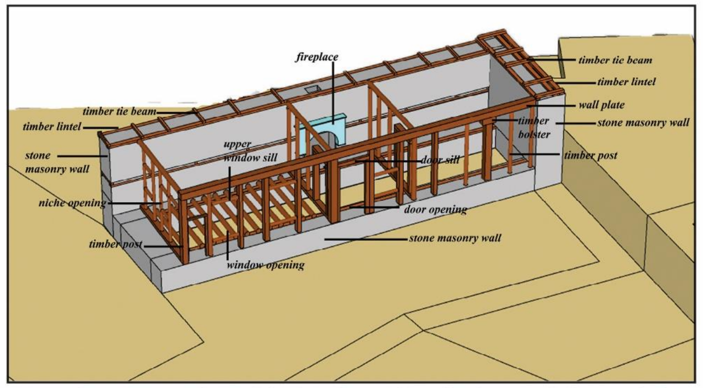
Figure 4.1. Construction process of a traditional house (448-2) in Sivrihisar



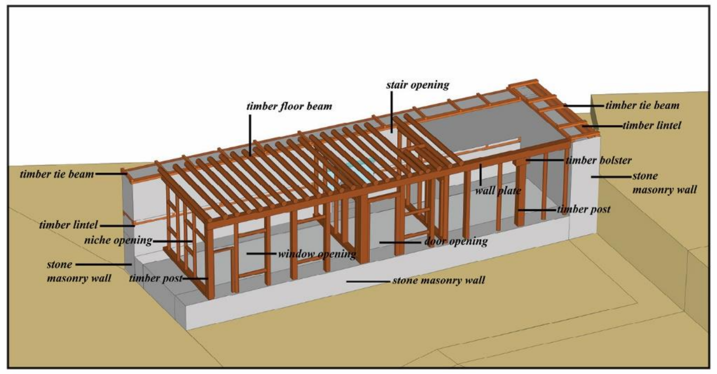
1-Foundation pit is excavated to the level until a rocky or steady ground is found.



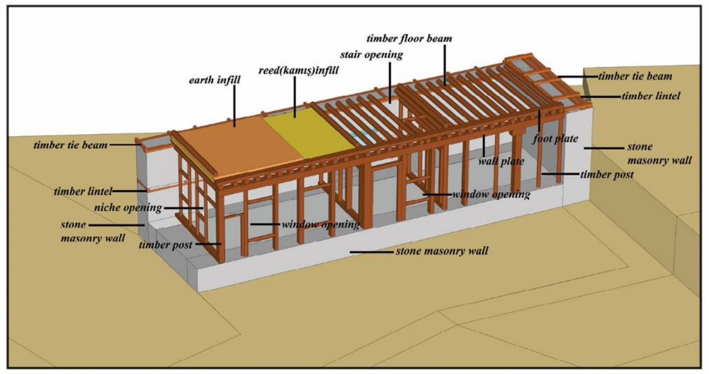
2-Stone masonry foundation walls constructed. On top of them, ground floor stone masonry walls are constructed with using timber lintels and tie beams.



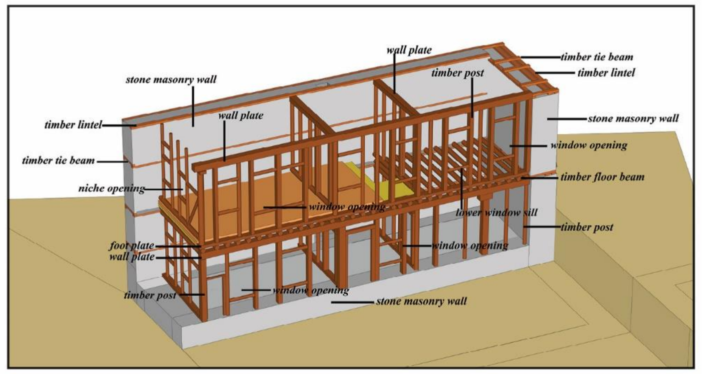
3-For the construction of timber framed wall of ground floor; Timber posts are located on foot plate, then, wall plate is put on top of posts.



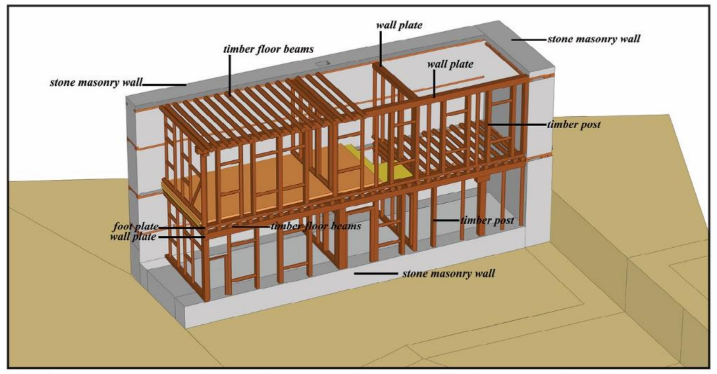
4-After ground floor walls are constructed, timber floor beams are located on the wall plates of ground floor walls.



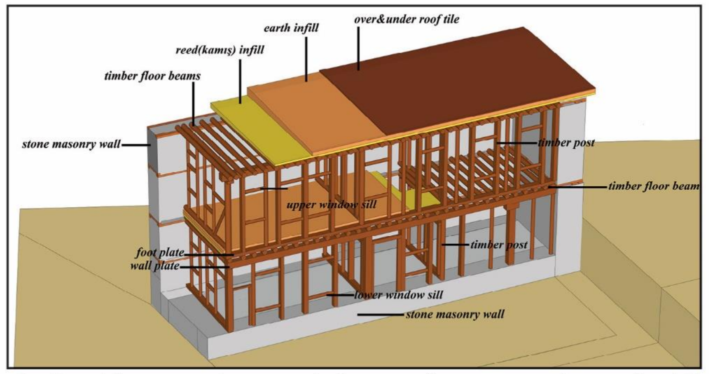
5- Floor construction is continued with laying the reed infill and earth infill on top of floor beams. Stair opening is left on flooring.



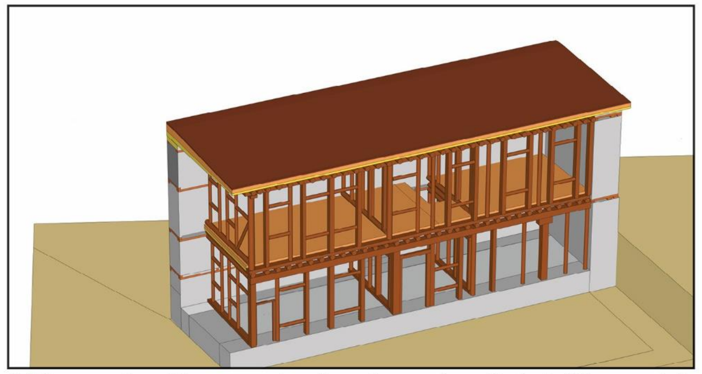
6-Stone masonry wall of upper floor is contiued with using rubble stones, lintels and tie beams. For the timber framed wall of upper floor, timber posts are put on the foot plate located on the floor beams and wall plate is set on the timber posts.



7- After construction of upper floor walls is completed, timber floor beams are located on the wall plates of upper floor walls.



8- In this example, no timber roof structure is used. After flat roof is constructed by using reed and earth infill on top of floor beams, a slight slope is given to the earth infill and roof tiles are laid on the earth infill directly. Timber eaves are not covered with any covering boards at fascia and soffit.



9-Floor and ceiling covering boards are installed. Infill materials of timber framed system and finishing of wall surfaces of timber framed walls are completed. Architectural elements, such as doors, windows, cupboars, built in cupboards are completed.

Figure 4.2. Construction process of a traditional house (362-19) in Sivrihisar

	building block-lot	FOUNDATION			BASEMENT	MEZZANINE	MASONRY WALLS				TIMBER FRAMED WALLS						TIMBER POSTS			ROOFS					EAVES			CHIMNEY			PROJECTIONS				STAIRCASES			FIREPLACES					FLOOR COVERINGS			
							Surfaces	1			1		Surfaces												1	2		1	2						1	2		1		2						
		1	2	3			Exterior / Interior	A	B	Corner Chamfer	A	B	Exterior / Interior	I	II	III	1	2	Braces	1	2	A	B	C		A	B		A	B	1	2	3	Post		A	B	A	B	A	B	tandır	1	2	3	4
DETAILED SURVEYED HOUSES	11-16	---	---	---	-	-	Ext. / Int.	- / -	■ / ■	-	-	■	Ext. / Int.	- / -	■ / ■	- / -	-	■	-	-	■	-	-	■	■	-	-	■	■	■	-	■	-	■	-	■	-	■	-	-	■	■	-	-	■	-
	170-19	---	---	---	■	-	Ext. / Int.	- / ■	■ / ■	-	-	■	Ext. / Int.	- / -	■ / ■	- / -	■	-	-	-	■	-	-	■	-	■	■	■	■	-	-	-	■	■	■	■	-	■	-	-	■	-	■	-	■	-
	170-44	---	---	---	-	-	Ext. / Int.	■ / -	■ / ■	-	■	■	Ext. / Int.	- / -	■ / ■	- / -	■	■	-	■	■	■	-	■	■	■	-	■	■	■	-	-	-	-	-	■	-	-	-	-	■	-	■	-	■	■
	186-36	---	---	---	-	-	Ext. / Int.	- / -	■ / ■	-	■	-	Ext. / Int.	- / -	■ / ■	■ / ■	■	■	■	■	■	■	-	■	-	■	-	■	■	-	-	-	-	-	-	■	-	■	-	-	-	-	■	-	■	■
	188-4	---	---	---	-	-	Ext. / Int.	■ / ■	■ / ■	■	■	-	Ext. / Int.	- / -	■ / ■	- / -	■	-	-	■	-	-	-	■	■	-	-	■	-	■	-	-	-	-	-	■	-	■	-	-	-	-	■	-	-	■
	196-1	---	---	---	■	-	Ext. / Int.	- / -	■ / ■	-	■	■	Ext. / Int.	- / -	■ / ■	- / -	■	■	■	-	■	-	■	-	■	-	-	-	---	-	■	-	■	■	■	■	-	-	-	■	-	-	■	-	■	-
	362-19	■	---	---	-	-	Ext. / Int.	■ / -	- / ■	-	■	-	Ext. / Int.	- / -	■ / ■	- / -	-	-	-	■	-	■	-	-	■	-	-	-	---	-	-	-	-	-	-	---	---	-	-	-	■	-	---	---	■	---
	433-2	---	---	---	-	■	Ext. / Int.	- / -	■ / ■	-	■	■	Ext. / Int.	■ / -	■ / ■	- / -	■	■	-	-	■	-	-	■	■	■	-	-	■	■	-	■	-	-	■	■	-	-	-	-	■	-	-	-	■	-
	433-3	---	---	---	-	-	Ext. / Int.	- / -	■ / ■	■	■	■	Ext. / Int.	■ / -	■ / ■	- / -	-	-	-	-	■	-	-	■	■	-	-	-	■	-	-	■	-	■	-	■	-	-	-	-	■	-	■	-	■	-
	443-13	---	---	---	-	■	Ext. / Int.	- / -	■ / ■	■	-	■	Ext. / Int.	- / -	■ / ■	- / -	■	■	-	-	■	-	-	■	-	■	-	-	■	-	-	-	■	■	-	■	-	-	-	■	■	-	-	-	■	-
	444-15	---	---	---	-	-	Ext. / Int.	- / -	■ / ■	-	■	■	Ext. / Int.	■ / -	■ / ■	- / -	■	■	-	-	■	-	■	■	-	■	-	-	■	-	-	-	■	■	-	■	-	-	-	-	■	-	-	-	■	-
	448-2	■	■	---	■	-	Ext. / Int.	■ / ■	■ / ■	-	-	■	Ext. / Int.	■ / -	- / ■	- / -	-	■	■	-	■	■	-	■	■	-	-	-	---	---	■	-	■	-	■	■	-	-	-	-	■	-	■	-	■	-
	521-7-8	---	---	---	---	-	Ext. / Int.	- / -	■ / ■	-	-	■	Ext. / Int.	- / -	■ / ■	- / -	-	-	-	-	■	-	-	■	■	■	-	■	-	-	-	■	■	■	-	■	-	■	-	-	■	-	-	■	■	-
	521-12	■	---	---	■	-	Ext. / Int.	- / -	■ / ■	-	■	■	Ext. / Int.	■ / -	- / ■	- / -	■	-	-	-	■	-	-	■	■	■	-	-	-	■	-	-	■	-	-	■	-	-	■	-	-	-	■	-	■	-
		3	1	/	4	2	Exterior / Interior	4 / 3	13 / 14	3	9	11	Exterior / Interior	5 / /	12 / 14	1 / 1	9	8	3	4	12	4	2	12	10	8	1	6	8	5	2	4	7	7	4	13	/	5	1	2	10	1	8	1	13	3
PARTIALLY SURVEYED HOUSES	12-29	---	---	---	---	-	Ext. / Int.	■ / ---	■ / ---	-	■	---	Ext. / Int.	--- / ---	■ / ---	--- / ---	---	---	---	-	■	-	■	■	-	■	-	-	■	-	-	-	-	-	---	---	---	---	---	---	---	---	---	---	---	---
	12-30	■	---	■	-	-	Ext. / Int.	- / ■	■ / ■	-	■	■	Ext. / Int.	- / -	■ / ■	--- / ---	■	-	-	■	-	■	-	-	■	-	-	-	-	■	-	-	-	-	---	---	■	■	-	-	■	---	■	---	■	---
	185-11	---	---	---	-	-	Ext. / Int.	■ / -	- / ■	■	■	---	Ext. / Int.	- / -	■ / ■	--- / ---	■	-	-	-	■	-	-	■	-	■	-	■	■	-	-	■	-	-	---	---	---	---	---	---	■	---	■	---	---	■
	186-9	---	---	---	■	-	Ext. / Int.	■ / ■	- / ■	■	■	-	Ext. / Int.	- / -	■ / ■	- / -	■	-	-	---	■	---	-	■	-	■	-	■	-	-	-	-	■	-	■	■	-	---	---	---	---	---	■	■	■	■
	186-10	---	---	---	---	---	Ext. / Int.	--- / ---	--- / ■	-	■	---	Ext. / Int.	--- / ---	■ / ■	--- / ---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	■	---	---	---	---	---
	186-40	---	---	---	■	-	Ext. / Int.	- / ■	■ / ■	-	■	■	Ext. / Int.	■ / -	■ / ■	--- / ---	■	-	-	---	---	---	---	---	---	---	---	---	---	---	-	-	■	■	-	■	-	---	---	---	---	---	■	---	■	---
	198-11	---	---	---	-	-	Ext. / Int.	■ / ■	- / ■	-	■	-	Ext. / Int.	- / -	■ / ■	--- / ---	■	-	-	-	■	-	-	■	-	■	-	---	---	---	-	-	-	-	■	■	-	---	---	---	---	---	■	■	■	---
	228-17	---	---	---	-	-	Ext. / Int.	■ / ---	--- / ---	-	---	■	Ext. / Int.	■ / ---	--- / ---	--- / ---	---	---	---	-	■	-	-	■	-	■	-	---	---	---	■	-	-	-	---	---	---	---	---	---	---	---	---	---	---	---
	229-6	---	---	---	---	-	Ext. / Int.	- / -	■ / ■	-	■	■	Ext. / Int.	- / -	■ / ■	- / -	-	-	-	-	■	-	-	■	■	-	-	---	---	---	-	-	■	■	■	■	-	---	---	---	---	---	---	---	■	---
	230-1	---	---	---	---	---	Ext. / Int.	■ / ---	- / ---	■	---	---	Ext. / Int.	--- / ---	--- / ---	--- / ---	---	---	---	-	■	-	■	-	■	-	-	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	354-9	---	---	---	---	-	Ext. / Int.	■ / ---	■ / ---	-	■	---	Ext. / Int.	--- / ---	■ / ---	--- / ---	---	---	---	-	■	-	-	■	■	-	-	---	---	---	-	-	-	-	---	---	---	---	---	---	---	---	---	---	---	---
	262-9	---	---	---	-	-	Ext. / Int.	- / -	■ / ■	-	■	-	Ext. / Int.	- / -	■ / ■	- / -	-	-	-	---	---	---	---	---	■	-	-	---	---	---	-	-	-	-	---	---	---	-	-	-	■	---	---	---	---	---
	367-13	---	---	---	■	-	Ext. / Int.	■ / -	- / ■	■	■	-	Ext. / Int.	- / -	■ / ■	- / -	■	-	-	-	■	-	-	■	■	-	-	■	---	---	-	■	-	■	---	---	---	---	---	---	---	---	---	---	---	■
	371-36	---	---	---	---	-	Ext. / Int.	■ / ---	--- / ■	-	■	---	Ext. / Int.	--- / ---	■ / ■	--- / ---	---	---	---	-	■	-	-	■	■	-	-	---	---	---	-	-	-	-	---	---	---	---	---	---	---	---	---	---	---	---
		1	/	1	3	/	Exterior / Interior	9 / 4	6 / 10	4	12	4	Exterior / Interior	2 / /	12 / 10	/ / /	6	/	/	1	10	1	2	9	7	5	/	3	2	1	1	2	3	3	3	4	1	1	/	/	4	/	5	2	5	3
		4	1	1	7	2	Exterior / Interior	13 / 7	19 / 24	7	21	15	Exterior / Interior	7 / /	24 / 24	1 / 1	15	8	3	5	22	5	4	21	17	13	1	9	10	6	3	6	10	10	7	17	1	6	1	2	14	1	13	3	18	6

--- could not surveyed
- not exist

Figure 4.3. Comparison table of the structural and architectural elements used in traditional houses of Sivrihisar

	building block-lot	CEILING COVERINGS 1 A	1 B	2 A	2 B	2 C	2 D	Peep hole	DOORS 1	2	3	4	5	6	arched	batten	panel	WINDOWS 1	2	3	4	5	6	casement window	sash window	timber railing	iron railing
DETAILED SURVEYED HOUSES	11-16	-	■	■	-	-	-	-	■	■	-	■	-	-	■	■	■	■	■	■	-	■	■	■	■	■	■
	170-19	■	■	■	-	-	-	-	■	-	■	■	-	-	■	■	■	■	■	-	■	■	-	■	■	-	■
	170-44	■	■	■	■	-	-	-	■	-	-	■	-	-	■	■	■	■	-	-	■	■	■	■	■	■	■
	186-36	■	■	■	-	-	-	-	■	-	-	■	-	-	■	■	■	-	-	-	■	■	■	■	■	-	-
	188-4	-	■	-	-	-	-	-	-	■	-	-	■	-	-	-	■	-	■	-	-	-	■	■	■	-	■
	196-1	■	■	-	-	-	-	■	■	-	■	■	-	-	-	■	■	■	■	■	■	■	■	■	■	■	■
	362-19	-	■	-	-	-	-	-	-	-	-	■	-	-	■	---	■	-	-	-	-	■	-	---	---	-	■
	433-2	■	■	-	-	-	■	-	■	-	-	■	■	■	-	■	■	-	■	-	■	■	-	■	■	■	■
	433-3	■	■	-	-	-	-	-	■	■	-	■	■	-	■	■	■	■	-	■	-	■	■	■	■	■	■
	443-13	■	■	-	-	-	-	-	-	■	-	■	-	-	-	■	■	-	■	-	■	■	■	■	■	■	■
	444-15	■	■	-	-	-	-	-	-	■	-	■	-	-	-	■	-	-	-	-	■	■	■	■	■	-	-
	448-2	■	■	-	-	-	-	-	■	■	■	■	-	-	■	■	■	-	■	-	■	■	-	■	■	■	■
	521-7-8	■	■	-	-	-	-	■	-	-	-	■	-	■	■	■	■	-	■	-	-	■	■	■	■	-	■
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		11	14	4	1	1	1	3	9	6	3	13	3	3	9	12	13	5	9	3	8	13	10	13	13	7	12
PARTIALLY SURVEYED HOUSES	12-29	---	---	---	---	---	---	---	■	---	---	---	---	---	---	---	---	---	---	---	■	---	■	■	---	---	■
	12-30	---	■	---	---	---	---	---	---	■	---	■	---	---	■	■	---	---	---	---	---	■	---	■	---	■	■
	185-11	---	■	---	---	---	---	---	---	■	---	■	---	---	-	■	■	---	■	---	---	■	---	■	---	■	■
	186-9	■	■	■	---	■	---	---	■	-	-	■	-	-	■	■	■	■	■	-	-	■	-	■	-	■	-
	186-10	---	---	---	---	---	---	---	■	---	---	■	---	---	---	■	---	---	---	---	---	■	---	---	---	■	---
	186-40	---	■	---	■	---	---	---	■	---	---	■	---	---	■	■	---	■	---	---	---	■	---	■	---	---	■
	198-11	■	■	---	---	---	---	---	■	---	---	■	---	---	---	■	---	---	■	---	---	■	---	---	---	---	■
	228-17	---	■	---	---	---	---	---	---	■	---	---	---	---	---	---	---	---	---	---	---	■	---	■	---	---	■
	229-6	-	■	---	---	---	---	---	---	■	---	■	---	---	■	■	■	■	-	-	■	■	■	■	---	■	■
	230-1	---	---	---	---	---	---	---	---	■	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	354-9	---	■	---	---	---	---	---	■	---	---	---	---	---	---	---	---	---	---	---	---	■	---	■	---	---	---
	262-9	---	■	---	---	---	---	---	■	---	---	■	---	---	---	---	---	---	---	■	---	---	---	---	---	---	■
	367-13	---	■	---	---	---	---	---	---	■	---	■	---	---	■	■	■	■	■	■	■	■	---	■	■	■	■
	371-36	---	■	---	---	---	---	---	---	---	---	■	---	---	■	■	---	■	---	---	■	■	---	■	---	■	■
		2	11	1	1	1			7	6		10			6	9	4	5	4	2	4	11	2	10	1	7	10
		13	25	5	2	2	1	3	16	12	3	23	3	3	15	21	17	10	13	5	12	24	12	23	14	14	22

	building block-lot	NICHES 1 A	1 B	2 A	2 B	2 C	CUPBOARDS 1 A	2 A	2 B	3 A	güsülhane	SEDIR straight	L shape	SHELVES 1	2	Güsülhane	Şaraphana	Washbasin	Balcony
DETAILED SURVEYED HOUSES	11-16	■	-	■	-	-	■	-	-	■	■	■	-	■	-	■	■	-	-
	170-19	■	■	■	■	■	■	■	-	■	■	■	-	■	-	■	■	-	-
	170-44	■	■	■	-	-	■	-	-	■	■	■	-	■	■	-	■	-	-
	186-36	■	■	■	-	■	■	-	■	■	---	■	-	■	-	-	-	-	-
	188-4	■	-	-	■	-	■	-	-	-	-	-	-	-	-	■	-	-	-
	196-1	■	-	-	-	■	■	-	-	■	-	■	-	-	-	■	■	■	-
	362-19	-	■	■	-	-	-	■	-	■	---	-	-	-	■	-	-	-	-
	433-2	■	-	■	-	-	-	-	-	■	■	■	-	■	■	-	■	-	-
	433-3	■	■	-	-	-	■	-	-	■	■	■	-	-	-	-	-	-	■
	443-13	-	-	-	-	■	■	-	■	■	-	■	-	■	■	■	-	-	-
	444-15	■	-	-	-	-	■	-	-	■	-	■	-	-	-	-	-	■	-
	448-2	-	-	-	■	■	■	■	-	■	■	■	-	■	■	-	-	-	-
	521-7-8	-	-	-	-	■	-	-	■	■	■	■	■	-	-	-	-	-	■
	521-12	■	-	■	-	■	■	■	■	■	-	■	■	-	-	-	■	-	-
		10	5	7	3	7	11	4	4	13	7	12	2	7	5	5	6	2	2
PARTIALLY SURVEYED HOUSES	12-29	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	-
	12-30	■	---	---	---	---	■	---	■	■	---	---	---	---	---	---	---	---	---
	185-11	---	---	---	---	■	■	---	---	■	---	---	---	---	■	---	---	---	-
	186-9	-	-	-	-	-	■	-	-	■	■	■	-	---	---	---	---	---	-
	186-10	---	---	---	---	---	■	---	---	---	---	---	---	---	---	---	---	---	---
	186-40	---	---	---	---	---	---	---	---	■	---	---	---	---	---	---	---	---	---
	198-11	---	---	---	---	---	---	---	---	---	---	■	---	---	---	---	---	---	-
	228-17	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	229-6	---	---	---	---	■	■	---	---	---	---	■	---	■	---	■	---	---	-
	230-1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	354-9	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	262-9	■	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	-
	367-13	---	---	■	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	371-36	---	■	---	---	---	---	---	---	■	---	---	---	---	---	---	---	---	---
		2	1	1		2	5		1	5	1	3		1	1	1			
		12	6	8	3	9	16	4	5	18	8	15	2	8	6	6	6	2	2

--- could not surveyed
- not exist

Figure 4.4. Continuation of *Fig. 4.3*, Comparison table of the structural and architectural elements used in traditional houses of Sivrihisar

CHAPTER 5

CONCLUSION

The construction techniques of traditional houses dated to the end of the 19^{th} century and the beginning of the 20^{th} century in Sivrihisar are examined with an aim to document and define the authentic details of construction techniques used in traditional Sivrihisar houses. For this purpose, selected traditional houses were investigated in detail from ground to roof. The information collected through the site survey was analysed and it was focused to understand the construction techniques used in the region and provide a reliable documentation on the construction techniques of traditional houses in Sivrihisar.

Research and documentation on traditional structure, which include full analysis of its form and structure, are the principle for the conservation treatments, as stated in Built Vernacular Heritage Charter (1999). Additionally, ICOMOS Charter- the Principles for the Conservation of Wooden Built Heritage Charter (2017) states that documentation of the historic timber buildings is necessary to understand and analyse the local construction and structural system of traditional buildings to identify the efficient intervention by choosing the compatible materials and technologies to be used in conservation studies.

Sivrihisar, which was chosen as a case study of this thesis, is an old settlement with traditional houses still preserving their authenticity in large scale. However, traditional houses are damaged by the proliferation of abandoned houses, lack of maintenance and care, and improper interventions. Changing living conditions and the desire to live in modern conditions lead to the abandonment of traditional houses in the region and thus to lack of proper maintenance. In addition, changes in the economic and social structure in the region due to the migration especially cause the use of traditional houses by people with lower income as tenants. The traditional houses that are put at the disposal of tenants generally do not recieve sufficient maintenance. Further, interventions to improve the living conditions in traditional houses and to maintain and repair the building damages generally cause significant deteriorations and increase of problems. In addition, restoration and street rehabilitation activities have been intensified recently in Sivrihisar in order to conserve the traditional houses. However, these conservation activities are not effective to preserve the authentic details of traditional techniques of buildings.

Local craftsmen who have knowledge about the construction process of traditional houses could not be reached during this study. However, it is important to reach the masters who worked in the construction of old traditional houses in the region in order to maintain and record the traditional construction techniques. The building structures and architectural elements of traditional Sivrihisar houses are grouped considering the similarities and differences of their materials and construction techniques. In addition, some parts of the houses; i.e., foundations, and roofs, could not be examined in detail due to the limited accessibility of building parts during this study.

Within the scope of the information briefly summarized above, the information and suggestions achieved at the end of this study can be listed as follows;

- Understanding the construction techniques of traditional houses and their authentic details is the important issue to achieve the efficient conservation of building values. It is also important to recognize and define the structural systems and construction techniques specific to the region in order to determine the effective interventions for the maintenance, repair and restoration of traditional houses in Sivrihisar. Thefore, any intervention or conservation activities for traditional Sivrihisar houses should focus on the preservation of the local techniques and authentic details used in these houses.

- Abandoned houses, lack of maintenance and improper interventions due to the lack of public awareness on conservation of traditional houses point out the importance of understanding and documentation of the local techniques of traditional houses in Sivrihisar in terms of the conservation of houses.

- The reason for the conservation activities are not effective enough to sustain the original details, may be that local construction techniques are not sufficiently understood and explored. Accordingly, the information that reflects the characteristics of region collected and documented in this study may be useful guide for the future conservation works and used to increase the public consciousness on conservation of traditional houses.

- This study can be used a resource by local authorities, the municipality, and KUDEB, to inform the masons working in repair. Further, the study can be used as a resource on construction techniques and original details of traditional houses in Sivrihisar for the preparation of the restoration projects and during the implementation of conservation and preservation studies.

- Further investigation on foundations and roofs will be advisable for a better understanding, if appropriate conditions exist for the examination of these parts.

- Furthermore, building materials of traditional houses in Sivrihisar can be investigated by laboratory studies. Further studies on building materials is quite important in terms of determining the properties of local materials. The examination of properties of building materials is also significant considering the effectiveness of interventions applied to the buildings.

- The study is prepared for understanding and documenting the local construction techniques of traditional Sivrihisar houses. This study can be expanded by examining more examples of traditional buildings to create a larger database on traditional houses in Sivrihisar.

- Similar studies on the documentation of construction techniques in different regions of Turkey are important and necessary to determine the similarities and differences of construction techniques used in different regions of Turkey.

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https//www.tuik.gov.tr

https://www.eskisehiri.com

https://www.e-sehir.com

APPENDIX A

A. Location of Houses Studied

Figure A.1 showing the location of 28 houses studied in Sivrihisar is given in the following page.

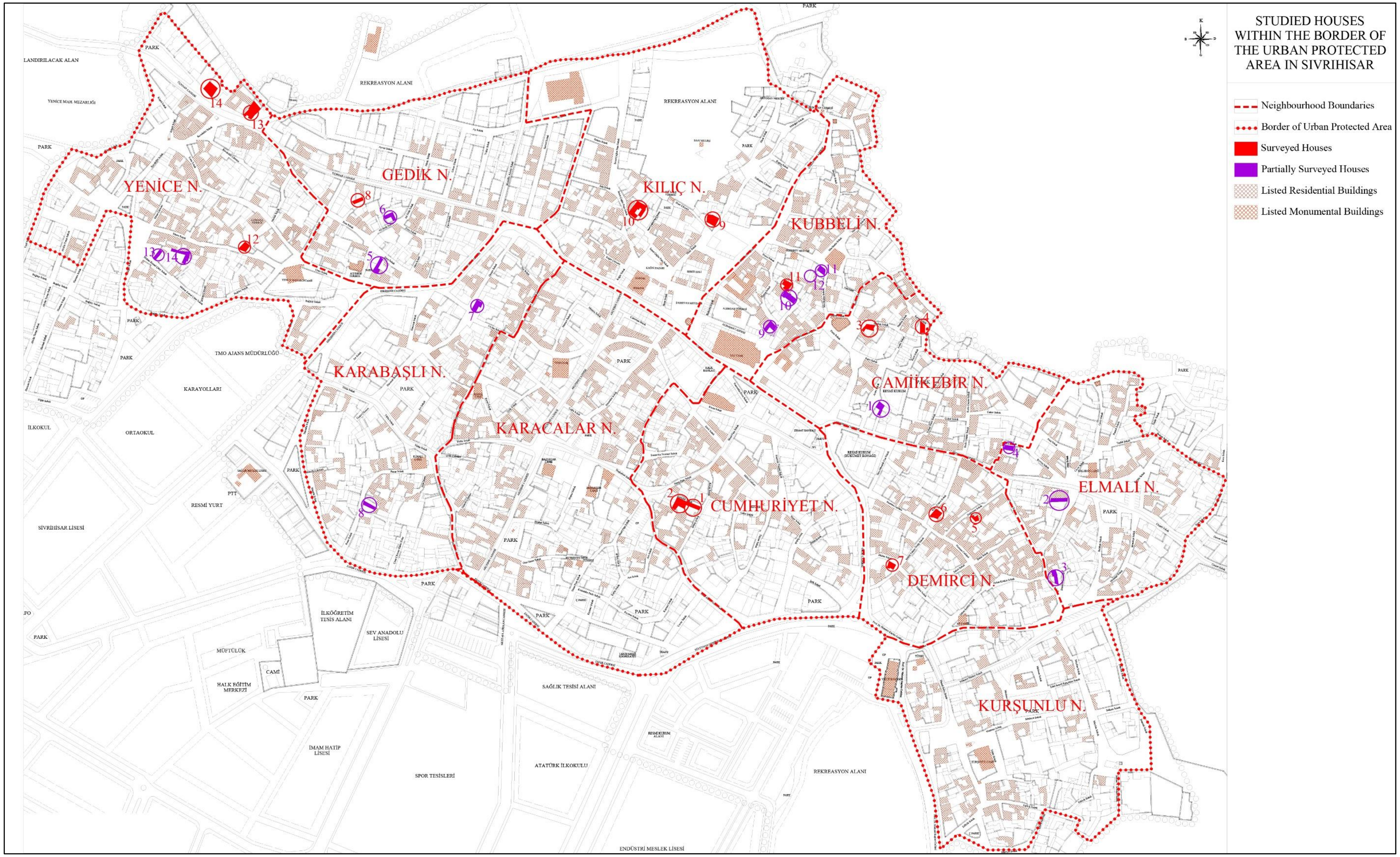


Figure A 1. Location of studied houses

APPENDIX B

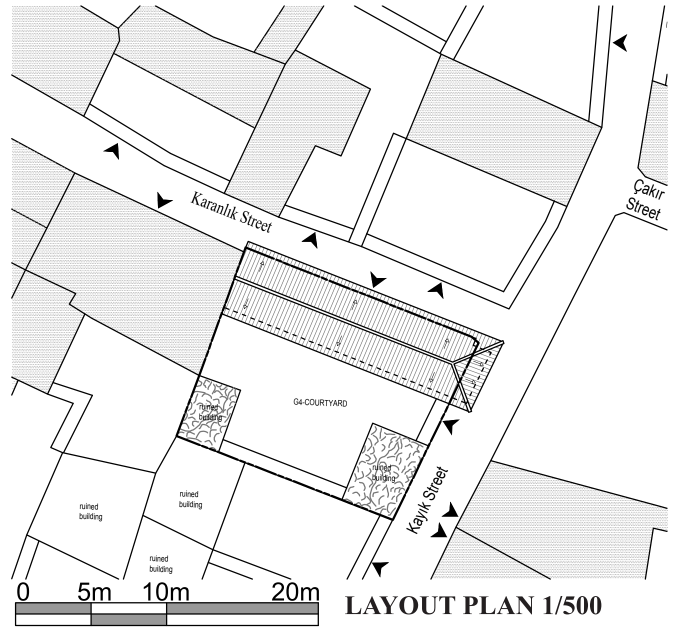
B. Survey Sheets of Houses Studied

Survey sheets of 14 houses studied are given from Figure B.1 to Figure.14 in the following showing pages.

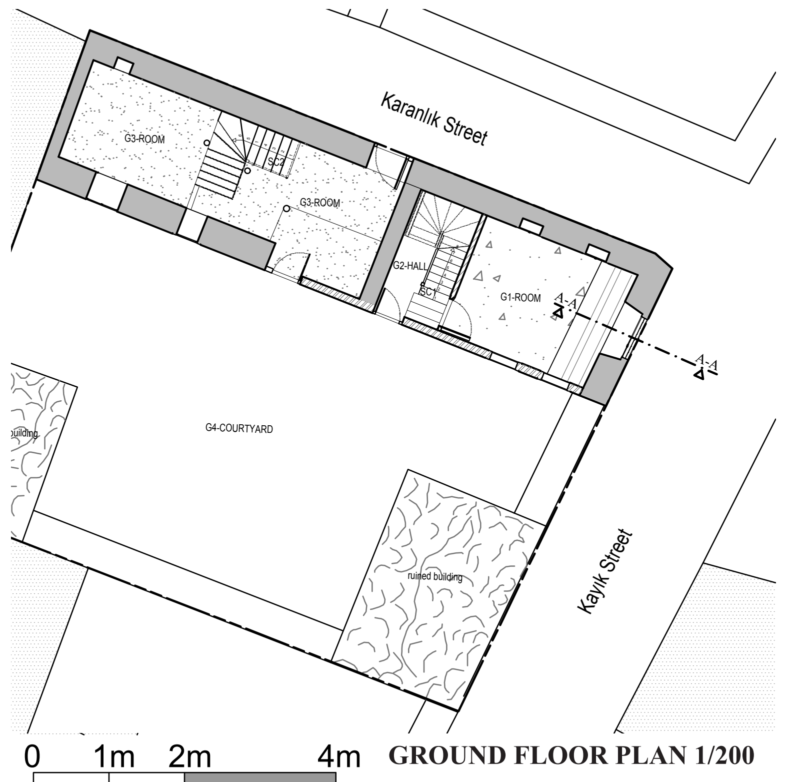
MIDDLE EAST TECHNICAL UNIVERSITY
GRADUATE PROGRAM IN CONSERVATION OF CULTURAL HERITAGE
"CONSTRUCTION TECHNIQUES OF TRADITIONAL SİVRİHİSAR HOUSES"
prepared by: Ezgi PEHLİVAN supervisor: Dr. Nimet ÖZGÖNÜL

PLAN DRAWINGS

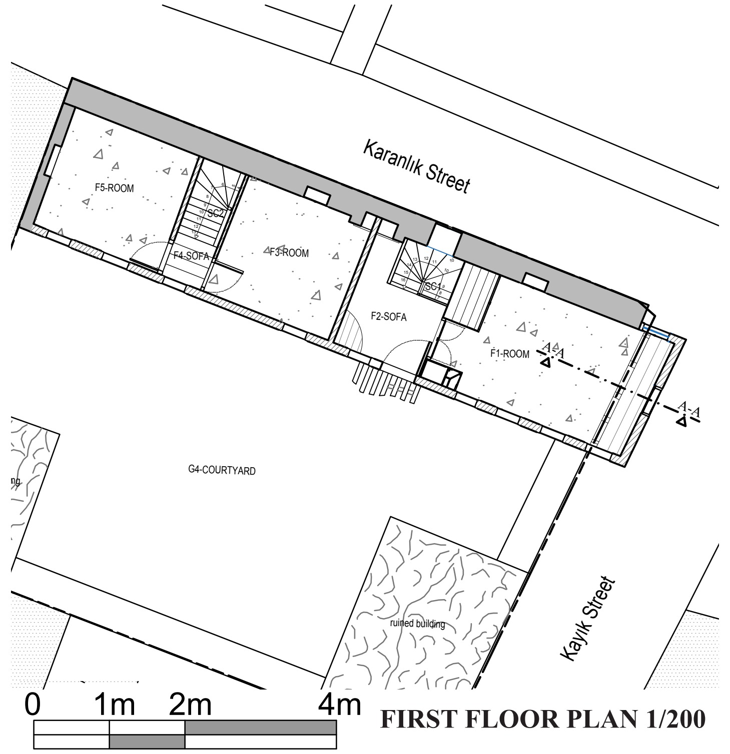
Building Block-Lot:*433-3* ***Adress:*** *Cumhuriyet N. Kayık St. N:4/4*
Surveyor: *Ezgi Pehlivan* ***Measurement Method:*** *Hand Measurement*



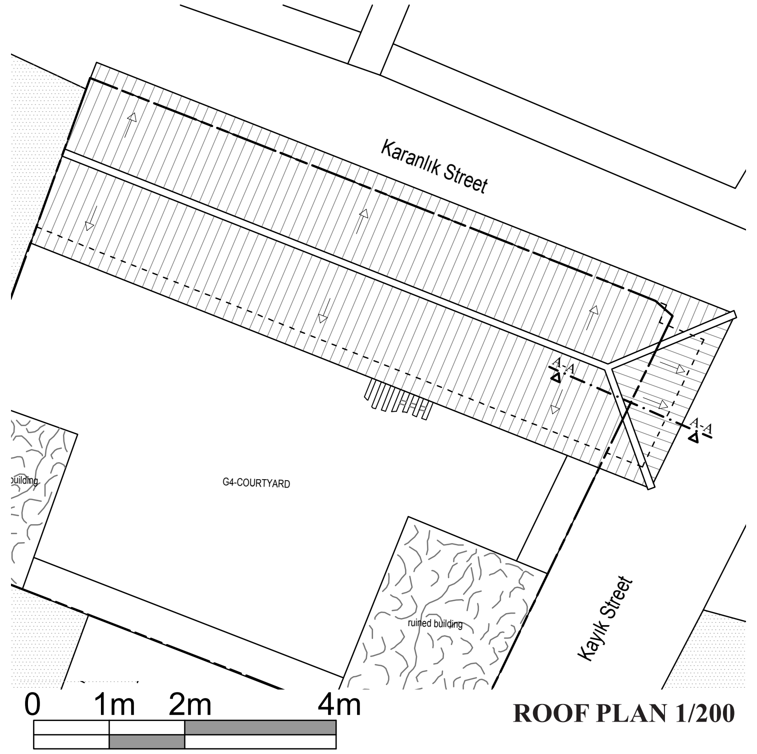
LAYOUT PLAN 1/500



GROUND FLOOR PLAN 1/200



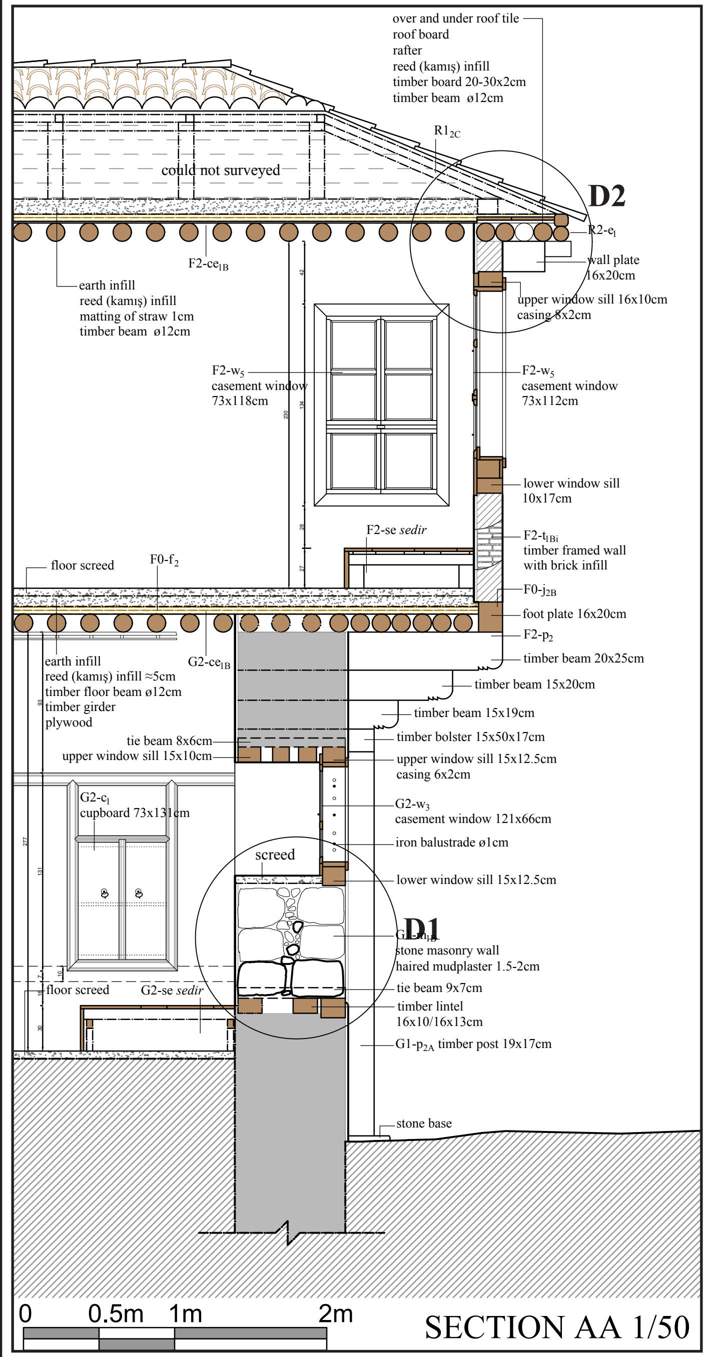
FIRST FLOOR PLAN 1/200



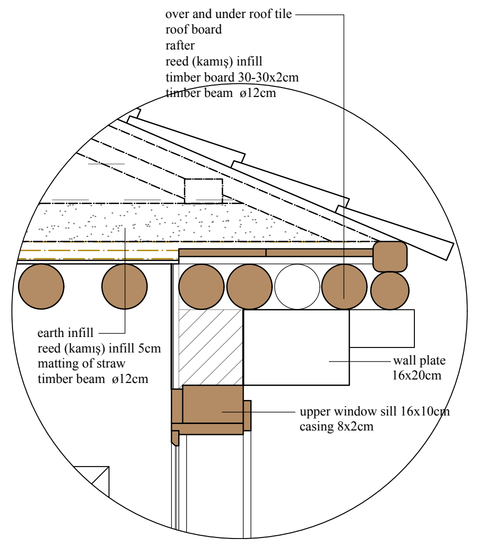
ROOF PLAN 1/200

SYSTEM SECTION DRAWINGS

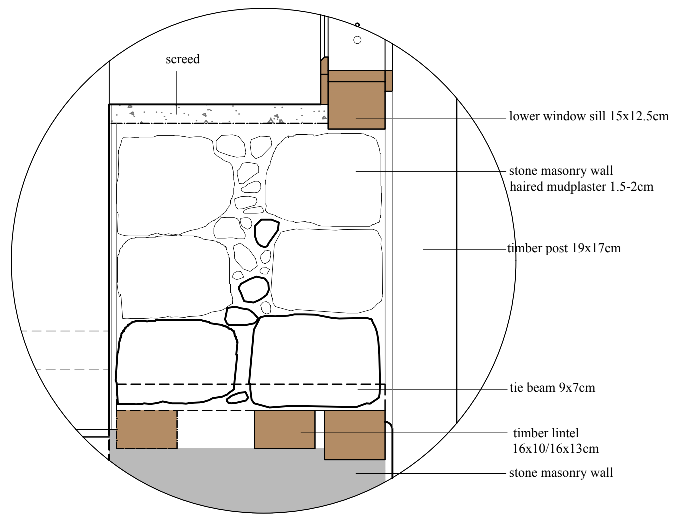
- building lot
- unmeasured/estimated structure
- stone masonry wall
- timber framed wall with mudbrick infill
- timber framed wall with brick infill
- timber structure
- earth infill
- reed (kamış) infill
- timber floor covering
- floor screed



SECTION AA 1/50



DETAIL 2-1 /20



DETAIL 1-1 /20

PHOTOGRAPHS

(*All photos were taken in October 2016 by the author.)

1.Northeast facade 2.East facade 3.Projection 4.Overlapped beams 5.Timber Eave 6.Overlapped beams 7.Bottom view of projection 8.Window 9.Interior view of room 10-Interior view of window 11.Upper window sills 12.Cupboard 13.Ceiling view 14.Interior view of upper floor room 15.Upper floor front window and window detail 16.Upper floor side window 17.window detail 18.Ceiling view of upper floor 19.Sedir

Figure B.1. Survey Sheet of House 433-3

MIDDLE EAST TECHNICAL UNIVERSITY
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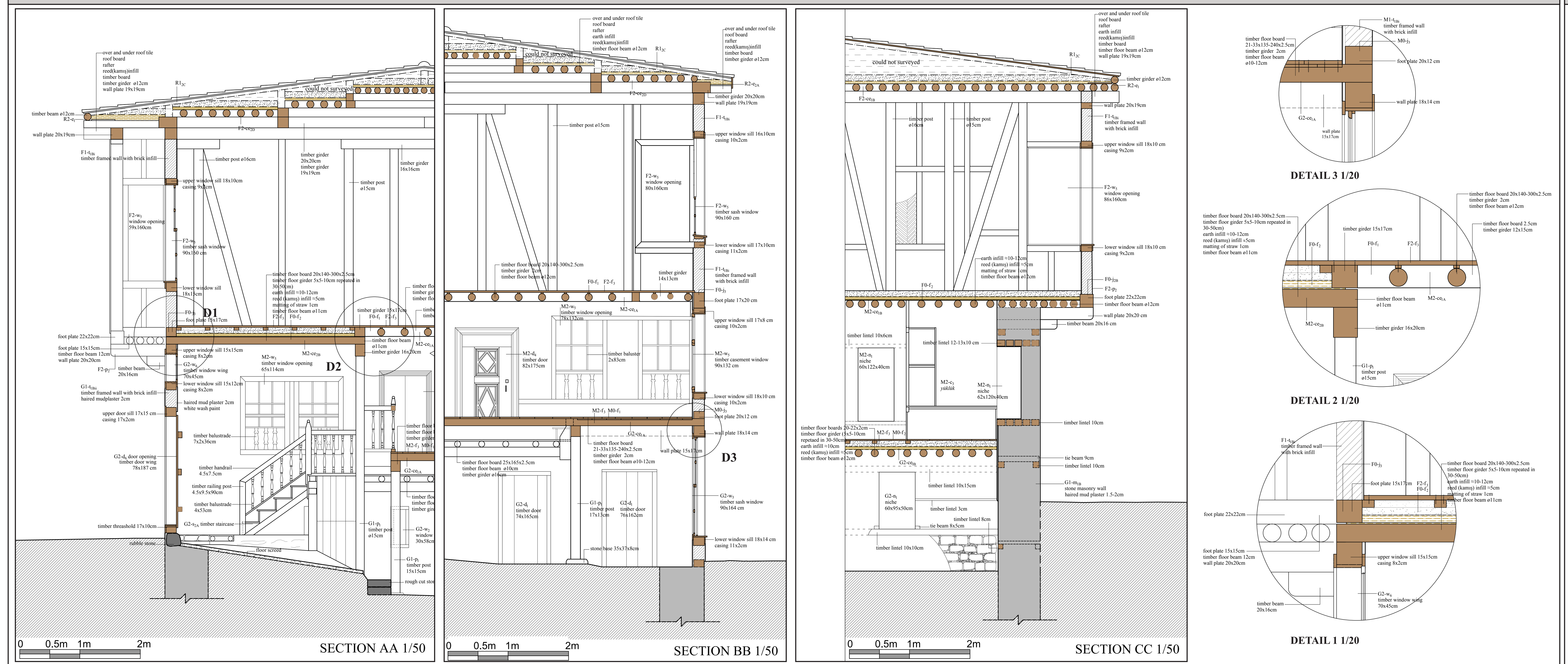
prepared by: Ezgi PEHLİVAN supervisor: Dr. Nimet ÖZGÖNÜL

PLAN DRAWINGS

Building Block-Lot:*433-2* ***Adress:*** *Cumhuriyet N. Karanlık St. N:2*
Surveyor: *Ezgi Pehlivan* ***Measurement Method:*** *Hand Measurement*

SYSTEM SECTION DRAWINGS



PHOTOGRAPHS

(*All photos were taken by the author in October 2015.)

Figure B.2. Survey Sheet of House 433-2

MIDDLE EAST TECHNICAL UNIVERSITY
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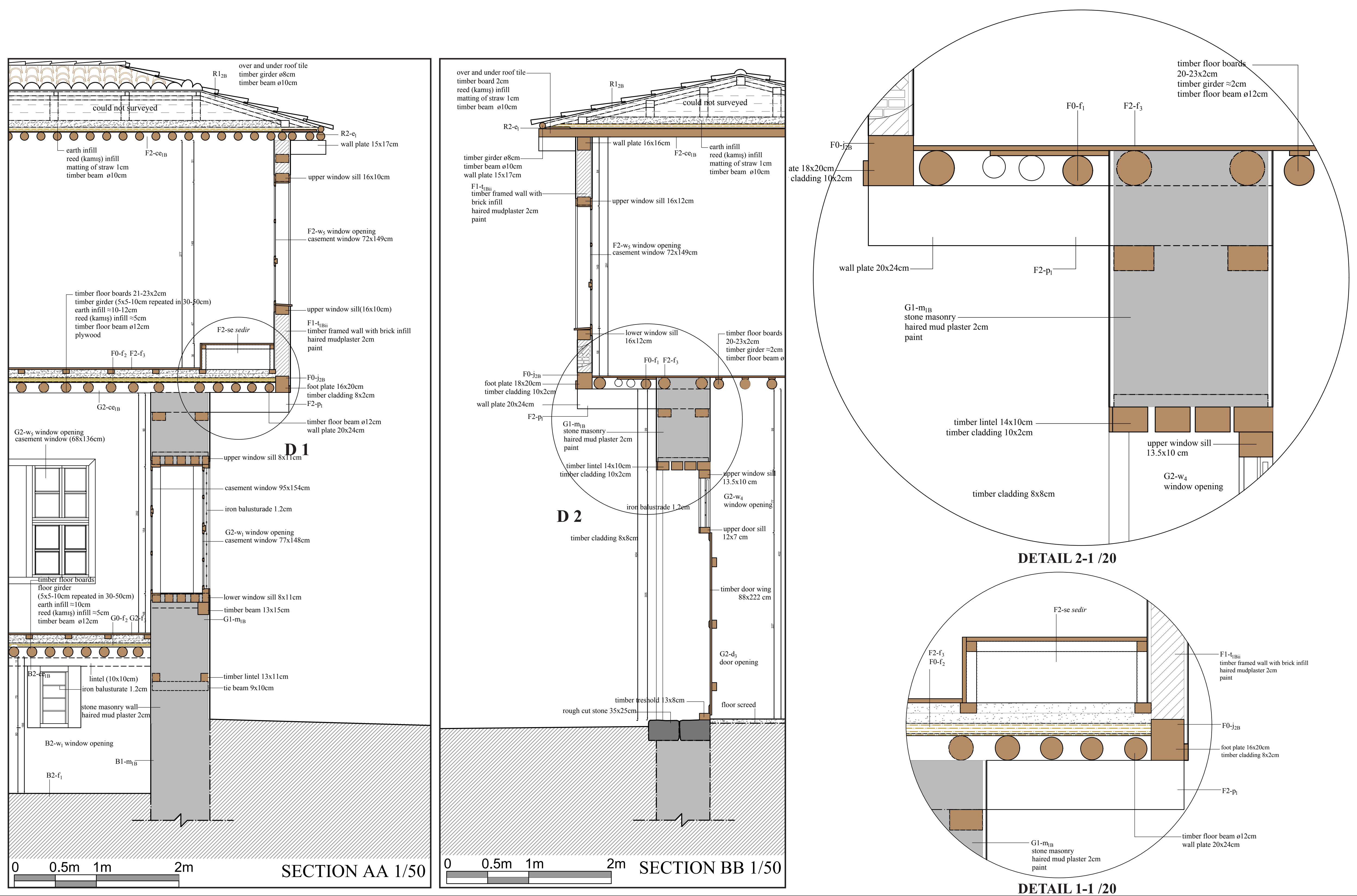
prepared by: Ezgi PEHLİVAN supervisor: Dr. Nimet ÖZGÖNÜL

PLAN DRAWINGS

***Building Block-Lot:**196-1 **Adress:** Camikebebir N. Haşhaş St. N:4*
***Surveyor:** Ezgi Pehlivan **Measurement Method:** Hand Measurement*

SYSTEM SECTION DRAWINGS



PHOTOGRAPHS

(*All photos were taken by the author in February 2019.
Photos taken at different time were indicated in bracket.)

1. Entrance facade (June 2015*)
2. Casement windows (June 2015*)
3. Casement windows
4. Timber framed wall detail
5. Window (June 2015*)
6.Grounf floor windows (June 2015*)
7.Timber eave
8.Timber eave
9.Timber post in taşlık
10.Ceiling of taşlık
11.Entrance door
12.Interior view of entrance door
13.Door sills and timber eave
14.Basement window
15.Courtyard facade of basement floor
16.Entrance facade of G2-room
17.Windows on entrance facade of G2-room
18.Courtyard facade of G2-room
19.Interior and exterior view of window
20.Entrance facade of F3-room
21. F3-room
22. Entrance facade of F2-room
23. Ceiling floor beams F2-room
24. Top window of F2-room
25. Timber floor covering boards of F2-room

Figure B.3. Survey Sheet of House 196-1

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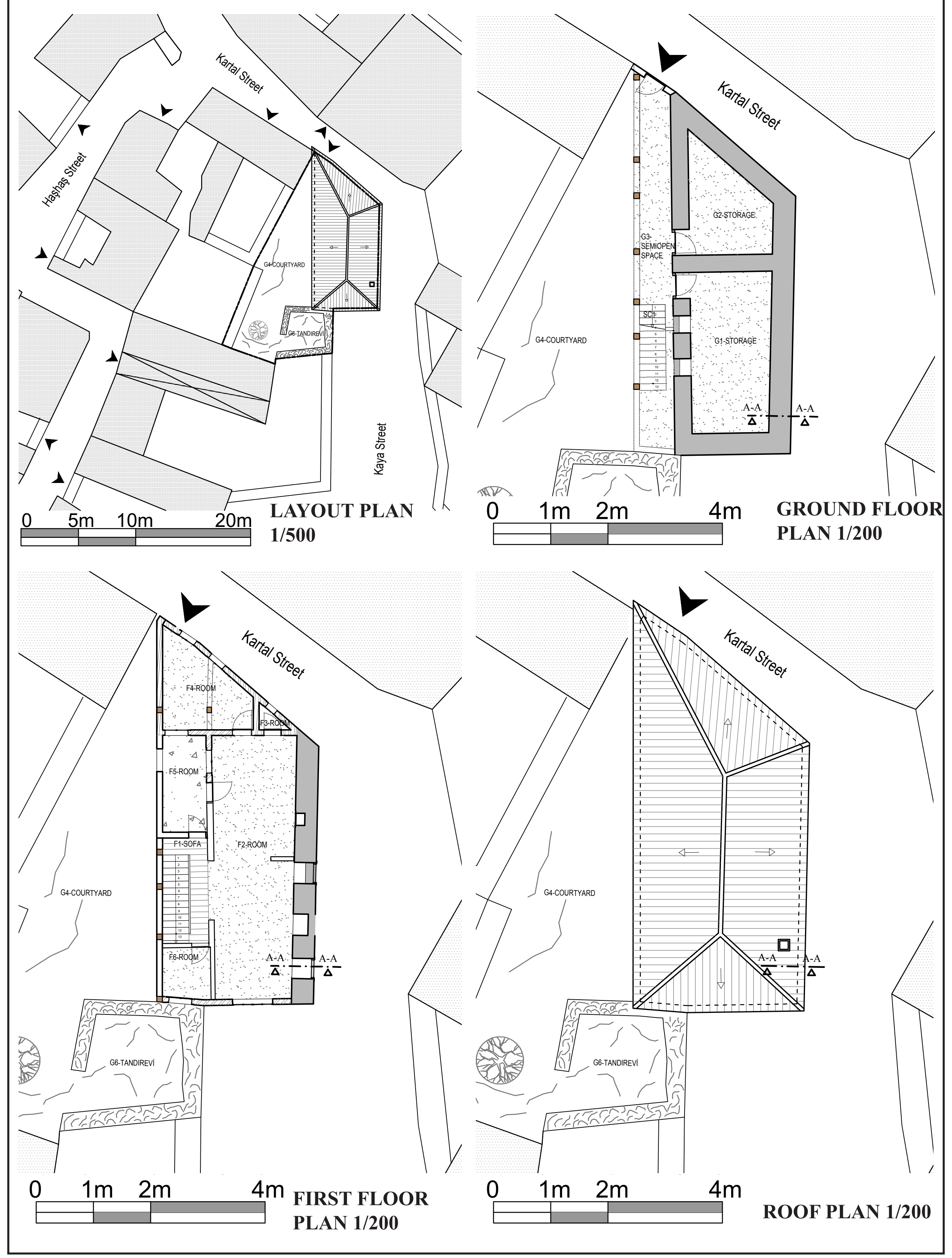
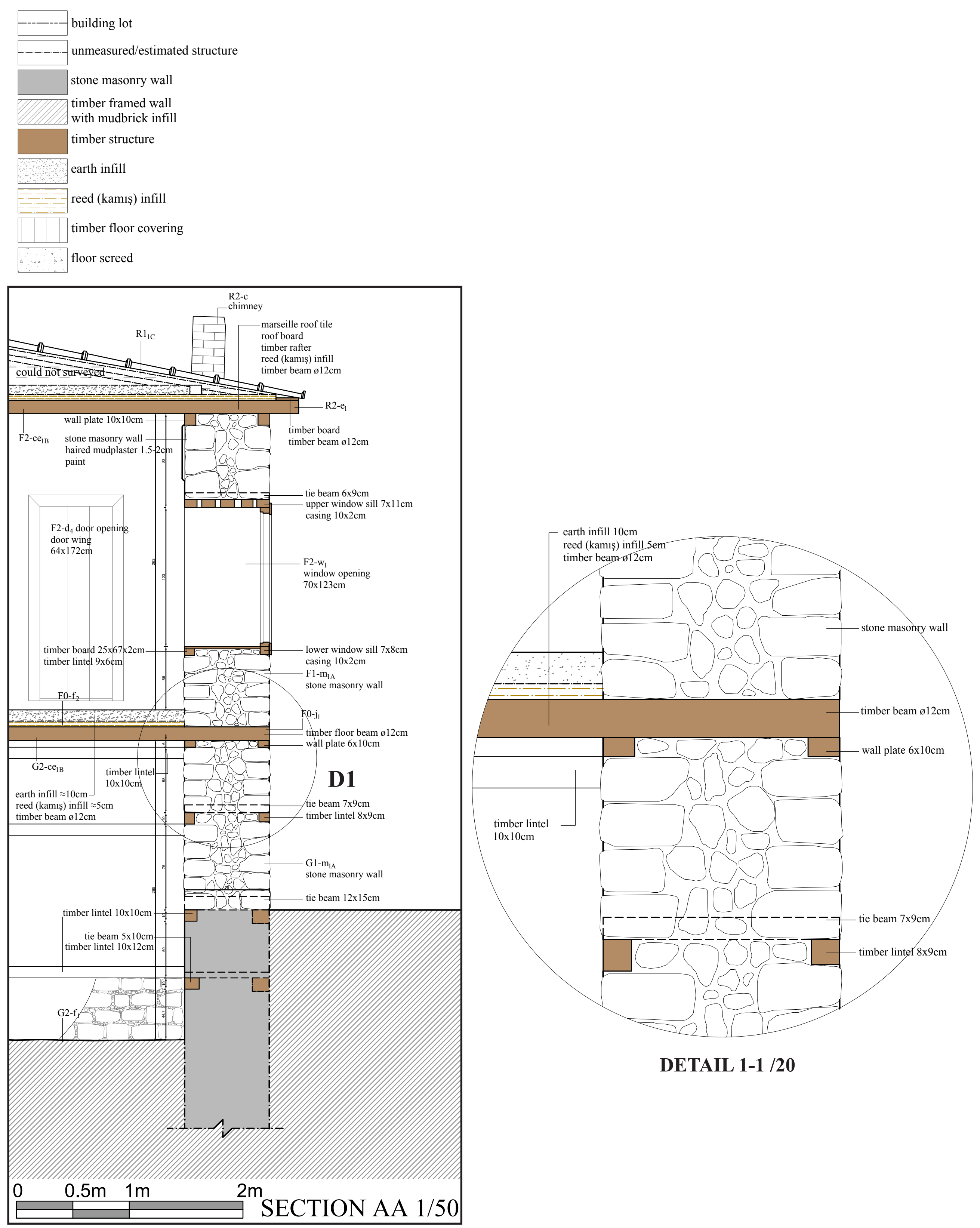
PLAN DRAWINGS ***Building Block-Lot:****188-4* ***Adress:*** *Camikebir N. Kartal St. N:10*
Surveyor: *Ezgi Pehlivan* ***Measurement Method:*** *Hand Measurement*



SYSTEM SECTION DRAWINGS



PHOTOGRAPHS (*All photos were taken by the author in February 2019. Photos taken at different times were indicated in bracket.)

Figure B.4. Survey Sheet of House 188-4

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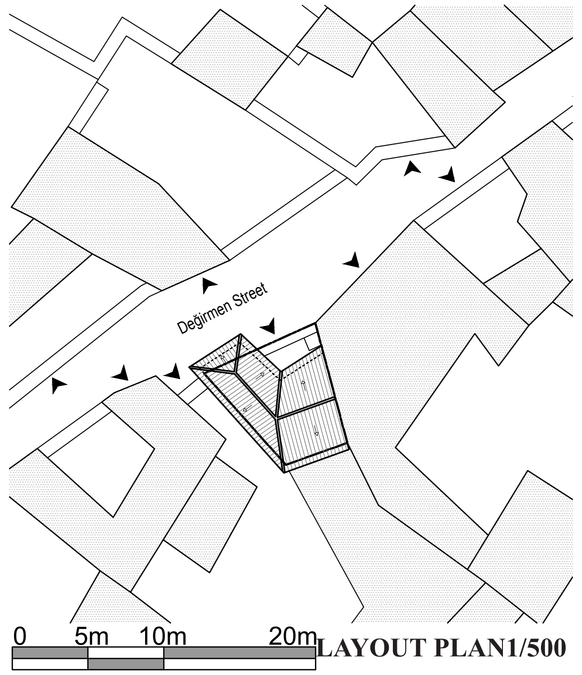
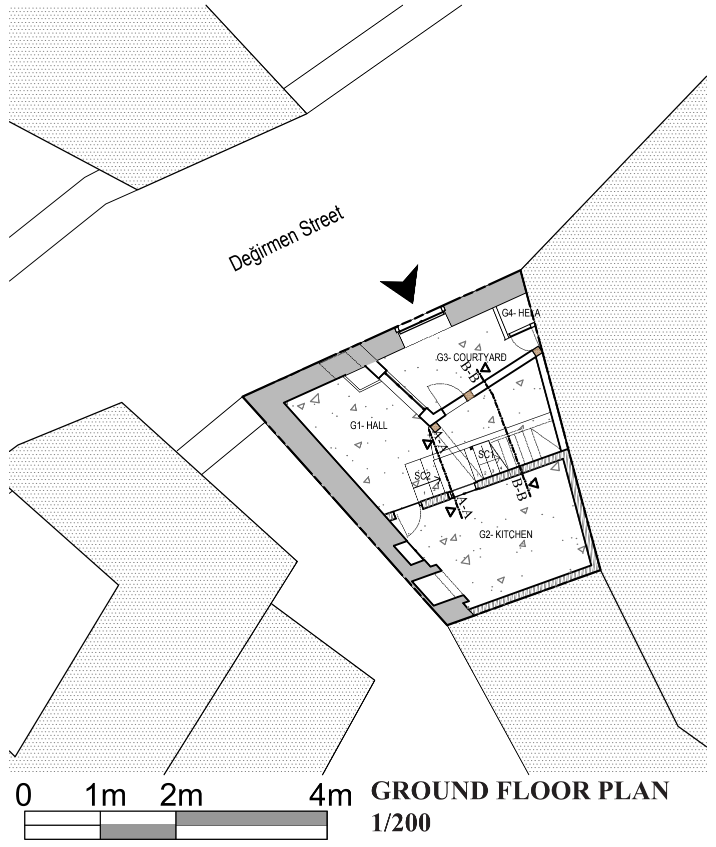
PLAN DRAWINGS

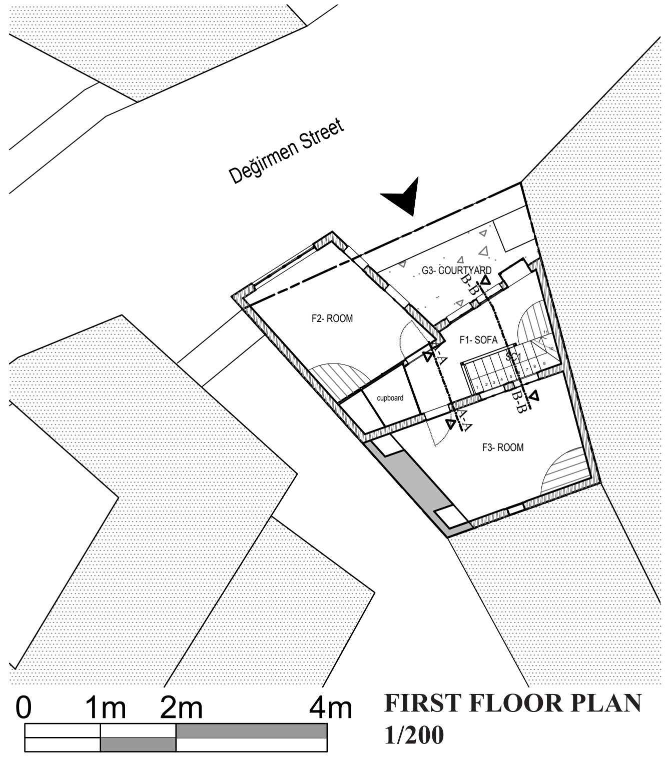
Building Block-Lot:*444-15* ***Adress:*** *Demirci N. Değirmen St. N:7*
Surveyor: *Ezgi Pehlivan* ***Measurement Method:*** *Hand Measurement*



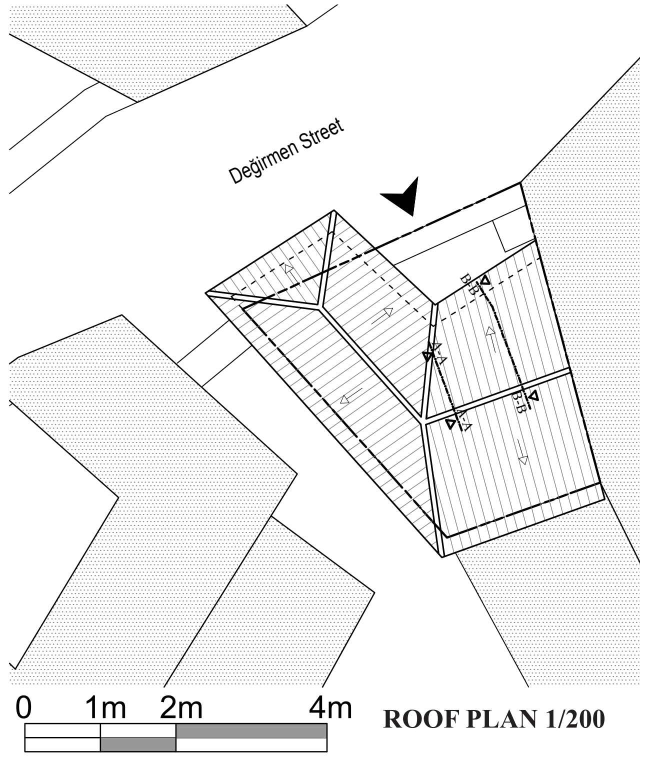
LAYOUT PLAN1/500



GROUND FLOOR PLAN 1/200



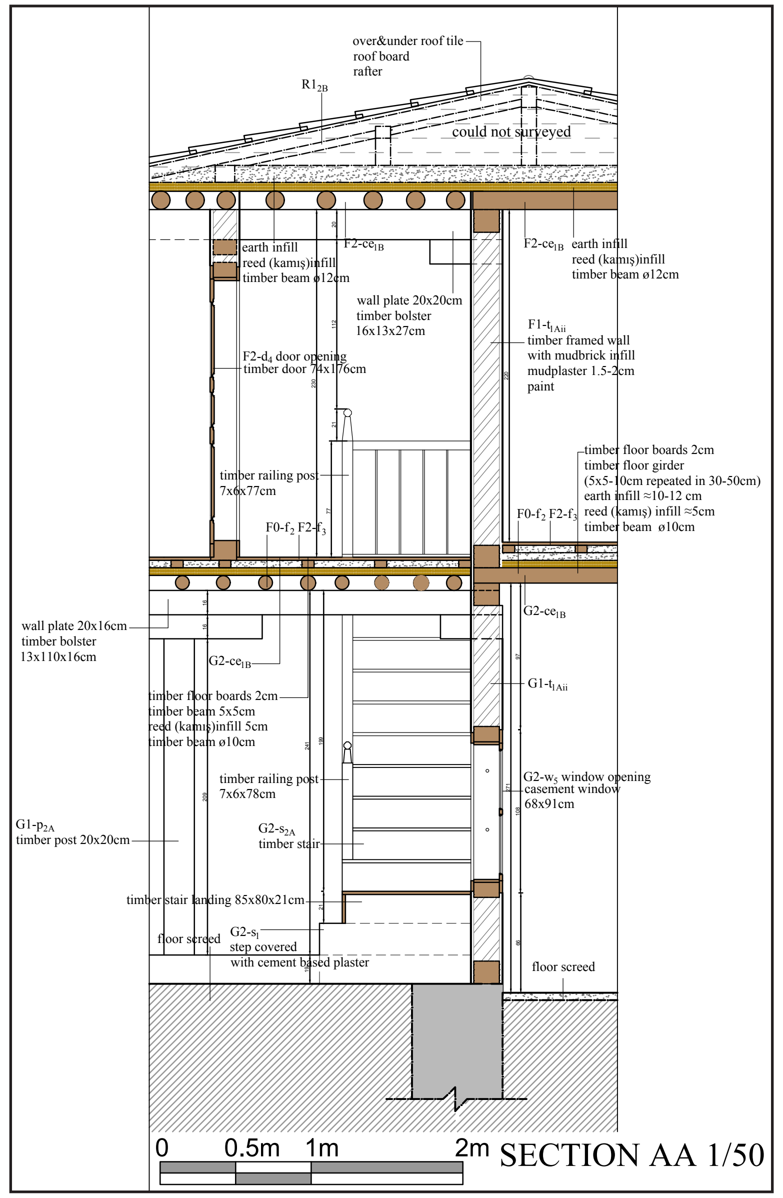
FIRST FLOOR PLAN 1/200



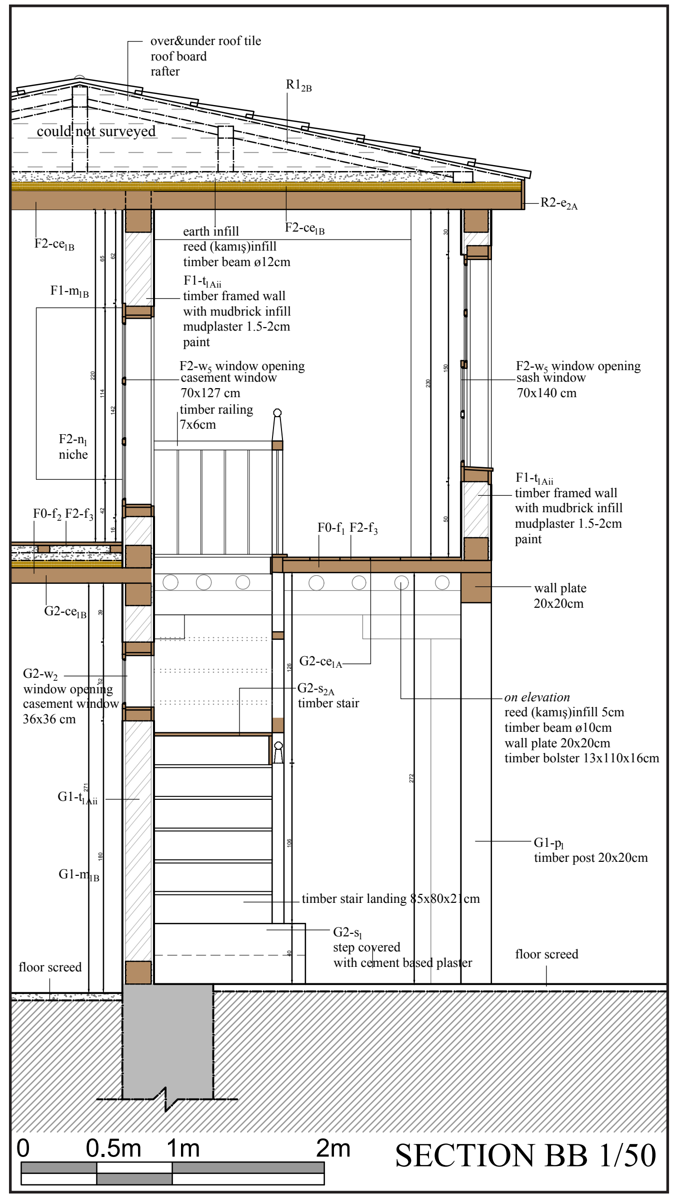
ROOF PLAN 1/200

SYSTEM SECTION DRAWINGS

- building lot
- unmeasured/estimated structure
- stone masonry wall
- timber framed wall with mudbrick infill
- timber structure
- earth infill
- reed (kamış) infill
- timber floor covering
- floor screed



SECTION AA 1/50



SECTION BB 1/50

PHOTOGRAPHS

(*All photos were taken by the author in February 2019)


1.Entrance facade


2.Entrance facade window


3.Timber post in taşlık


4.Timber staircase in taşlık


5. Timber beams of ceiling in taşlık


6. View of ceiling in taşlık


7.Timber handrail


8.Interior window


9.Ceiling view of room


10.Timber staircase


11.Timber handrail on sofa


12.Sofa


13.Entrance facade of sofa

Figure B.5. Survey Sheet of House 444-15

Figure B.6. Survey Sheet of House 443-13

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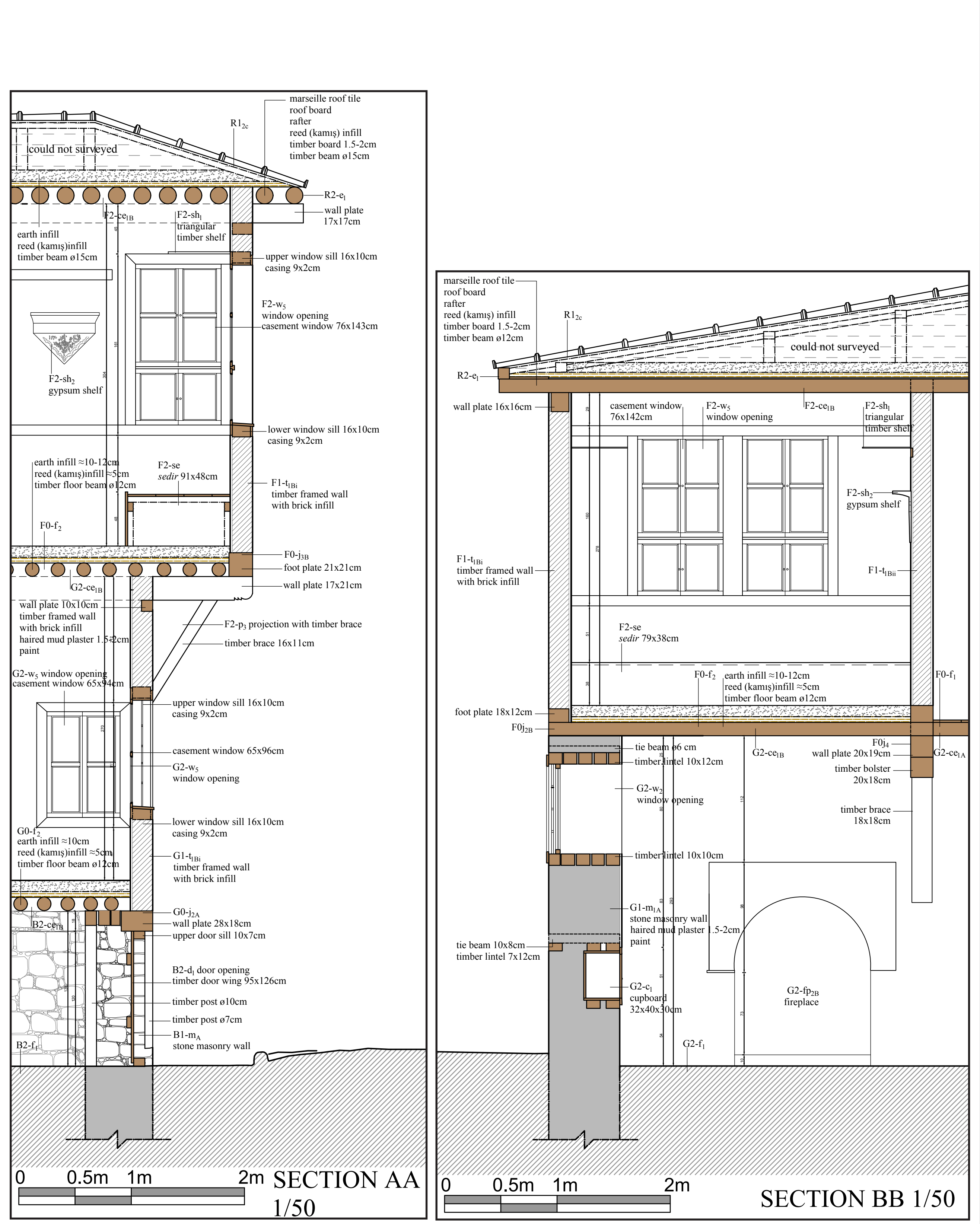
PLAN DRAWINGS

Building Block-Lot:448-2 ***Adress:*** *Demirci N. Düden Str. N:4/5*
Surveyor: *Ezgi Pehlivan* ***Measurement Method:*** *Hand Measurement*

SYSTEM SECTION DRAWINGS



PHOTOGRAPHS

(*All photos were taken by the author in February 2019)

1. Northeast facade
2. North facade
3. North facade windows
4. North facade window
5. North facade window
6. North-east facade connection
7. Timber eave
8. Taşlık
9. Taşlık
10. Timber post in taşlık
11. Window in taşlık
12. Fireplace
13. Basement floor
14. Basement entrance
15. Courtyard facade
16. Courtyard facade-basement entrance
17. Courtyard facade-projection
18. Side view of projection
19. Extreior view of window
20. Interior view of window
21. Casement windows
22. Casement windows
23. Room in first floor above taşlık
24. Window&sedir of room in first floor above taşlık
25. Window detail
26. Ceiling
27. Room in ground floor above basement
28. Room in first floor above basement
29. Gypsum shelf

Figure B.7. Survey Sheet of House 448-2

Figure B.8. Survey Sheet of House 362-19

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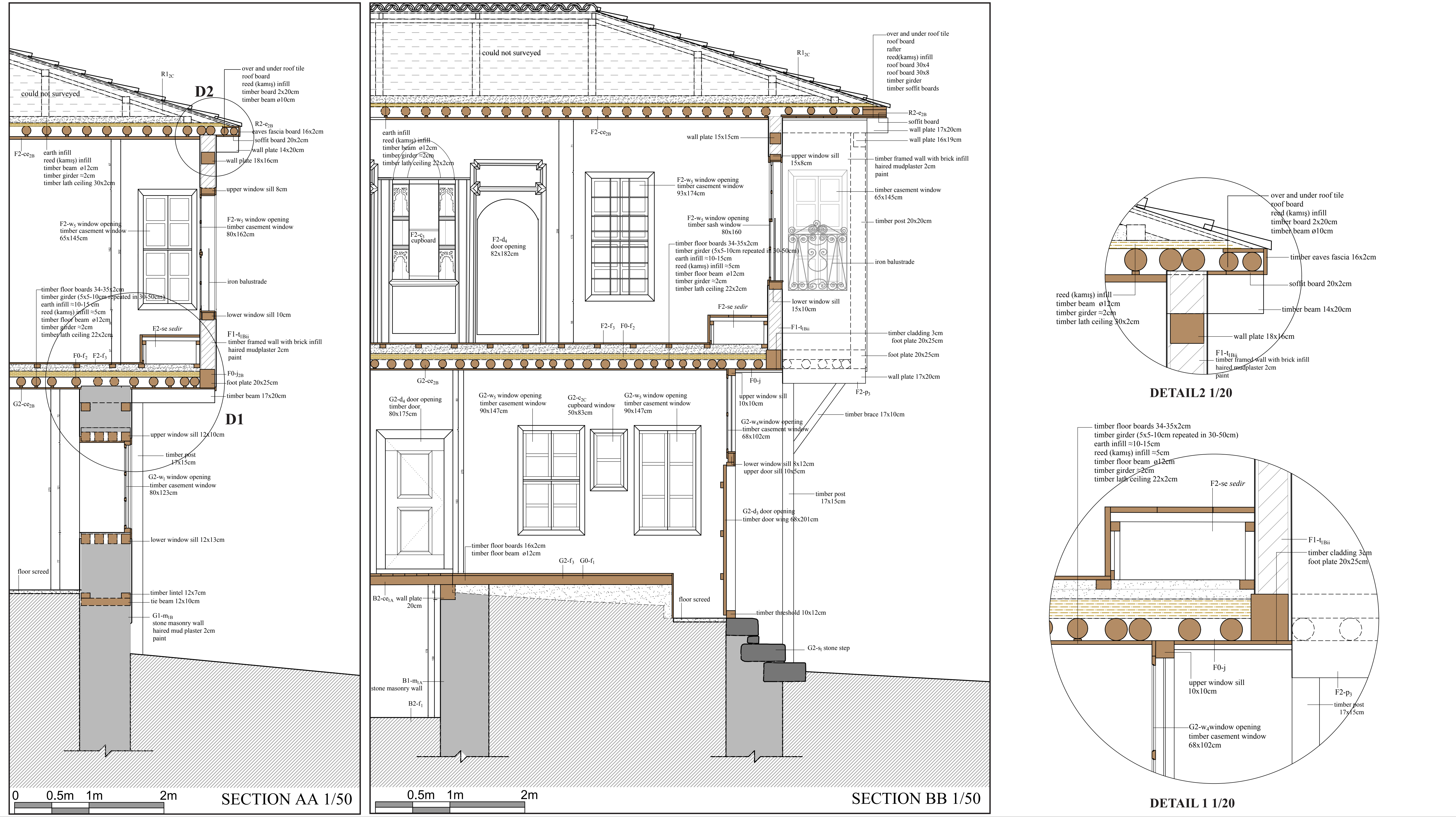
PLAN DRAWINGS

Building Block-Lot:*170-19* ***Adress:*** *Kılıç N. Hisar St. N:33*
Surveyor: *Ezgi Pehlivan* ***Measurement Method:*** *Hand Measurement*

(*Drawings were drawn based on the information obtained from site survey and measured survey drawings of Mahya Yapı Tasarım.)

SYSTEM SECTION DRAWINGS



PHOTOGRAPHS

(*All photos were taken by the author in October 2015. Photos taken at different time were indicated in bracket.)

1.East facade
2.Northeast view
3.East facade-projections
4. Eave covered with soffit boards
5. Projection
6.Eave detail

7. Entrance door
8. East facade (October 2016)
9. Side window
10.Basement
11.Entrance
12. Entrance(October 2016)
13. Entrance (October 2016)

14. North facade of entrance (October 2016)
15. Room
16. Room (October 2016)
17. North facade of sofa
18. Street facade of sofa
19. North facade of sofa (October 2016)

20. North and east facade of sofa (October 2016)
21. Street facade of sofa
22. Side window of projection
23. Room, north and east facade, side window (October 2016)
24. L shape sedir (October 2016)

Figure B.9. Survey Sheet of House 170-19

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"CONSTRUCTION TECHNIQUES OF TRADITIONAL ŞİVRİHİSAR HOUSES"
prepared by: Ezgi PEHLİVAN supervisor: Dr. Nimet ÖZGÖNÜL

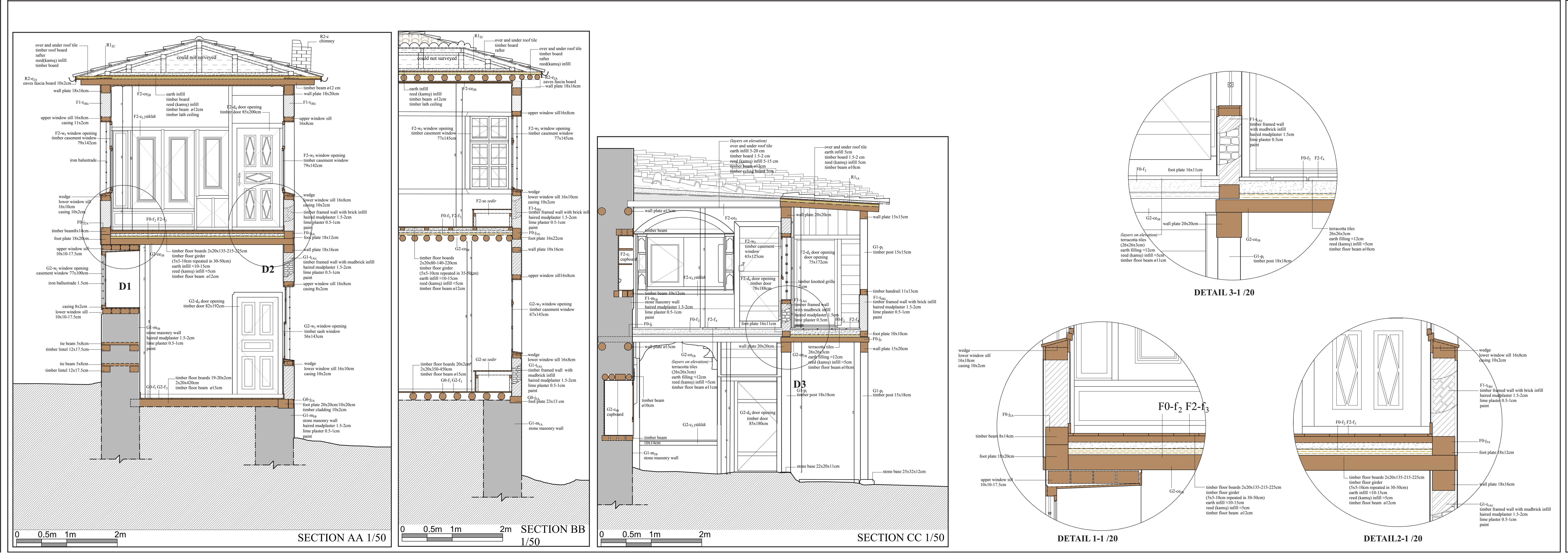
PLAN DRAWINGS

Building Block-Lot:*170-44* ***Adress:*** *Kılıç N. İsmet Çağlar St. N:34*
Surveyor: *Ezgi Pehlivan* ***Measurement Method:*** *Hand Measurement*

- building lot
- unmeasured/estimated structure
- stone masonry wall
- timber framed wall with mudbrick infill
- timber framed wall with brick infill
- stone step
- timber structure
- earth infill
- reed (kamış) infill
- timber floor covering
- floor screed

(*Drawings were drawn based on the information obtained from site survey and measured survey drawings of Kök Architecture Restoration.)

SYSTEM SECTION DRAWINGS



PHOTOGRAPHS

(*All photos were taken by the author in October 2015.)

Figure B.10. Survey Sheet of House 170-44

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"CONSTRUCTION TECHNIQUES OF TRADITIONAL SİVRİHİSAR HOUSES"
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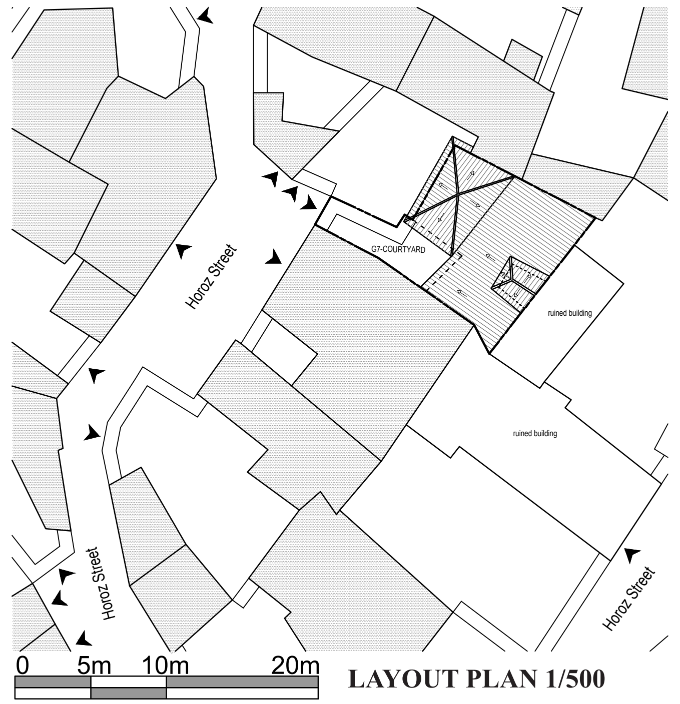
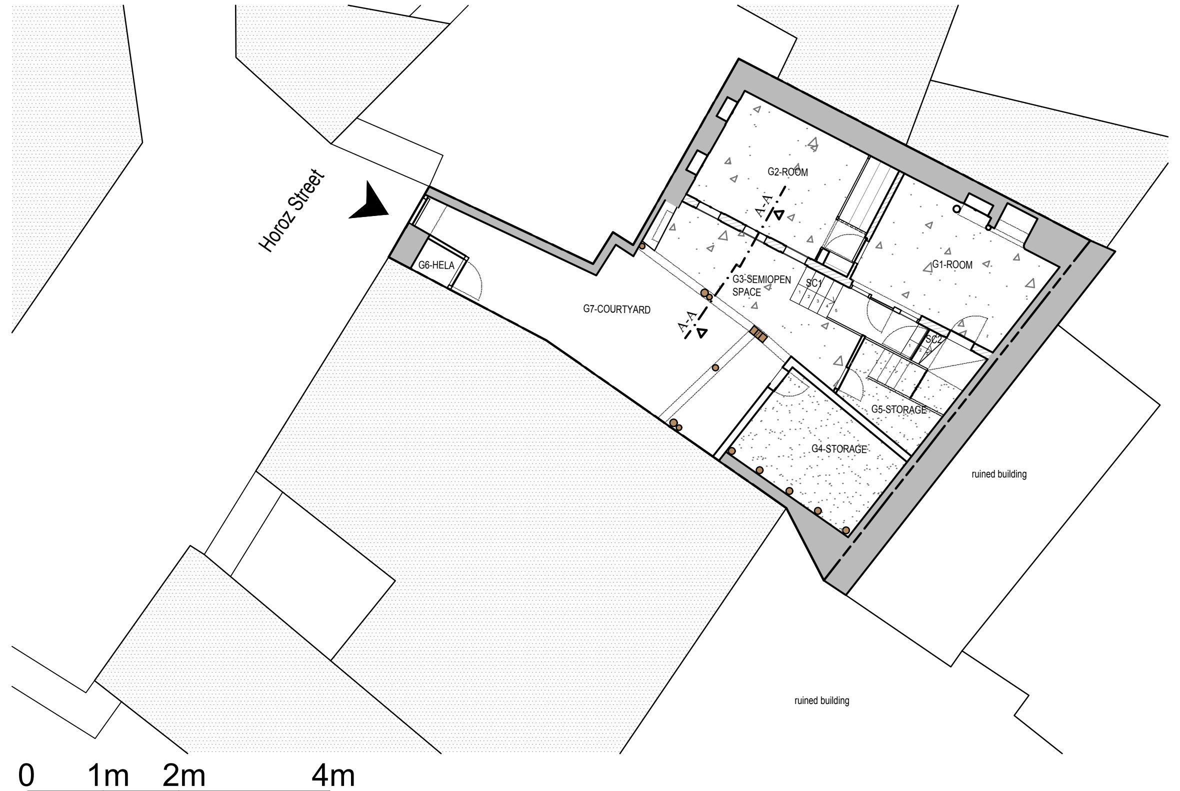
PLAN DRAWINGS

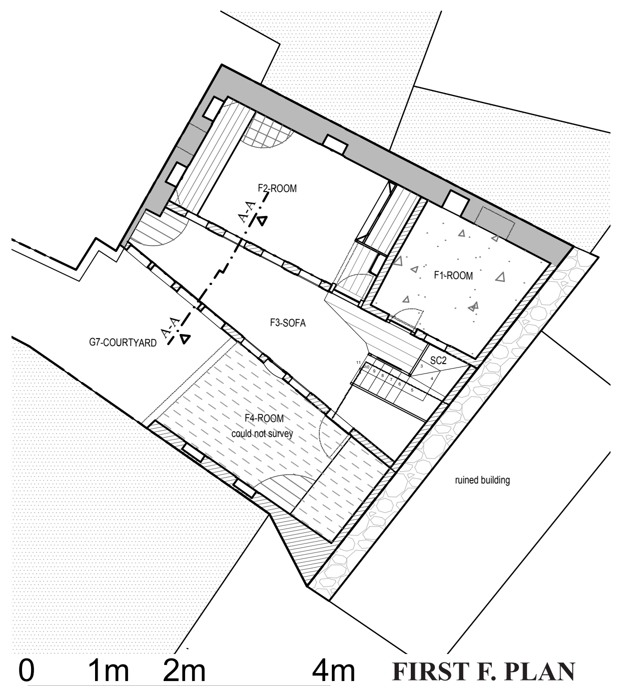
Building Block-Lot:*186-36* ***Adress:*** *Kubbeli N. Horoz St. N:30*
Surveyor: *Ezgi Pehlivan* ***Measurement Method:*** *Hand Measurement*



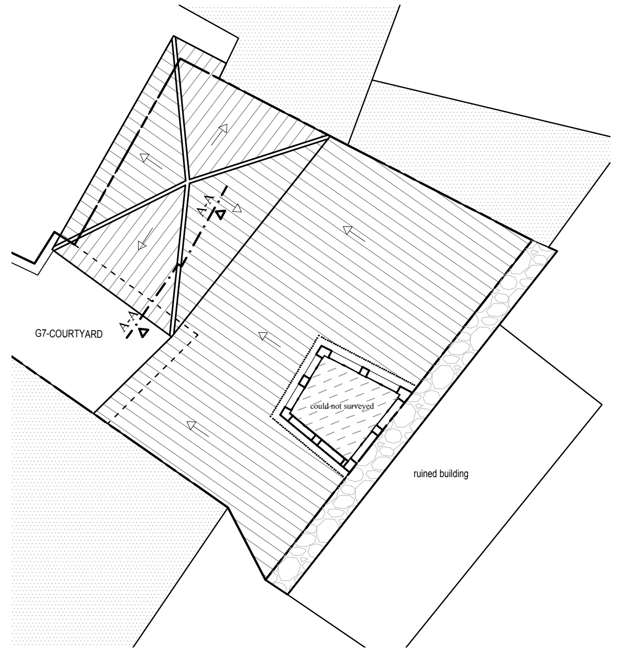
LAYOUT PLAN 1/500



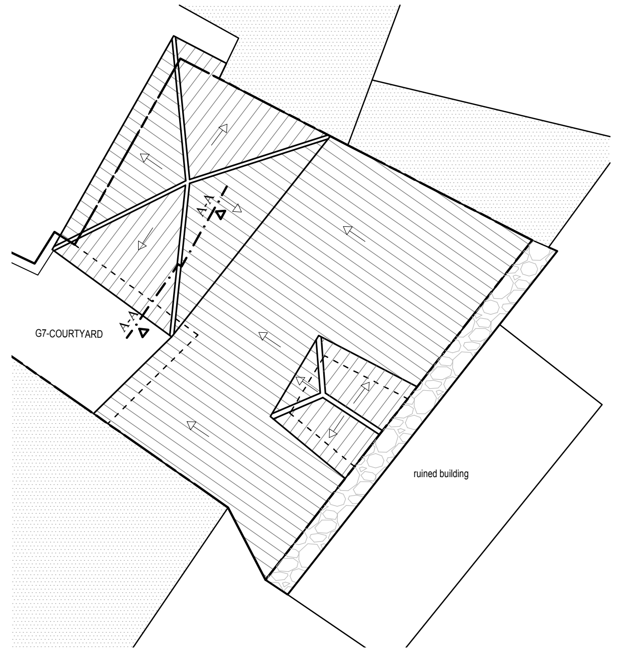
GROUND FLOOR PLAN 1/200



FIRST F. PLAN 1/200



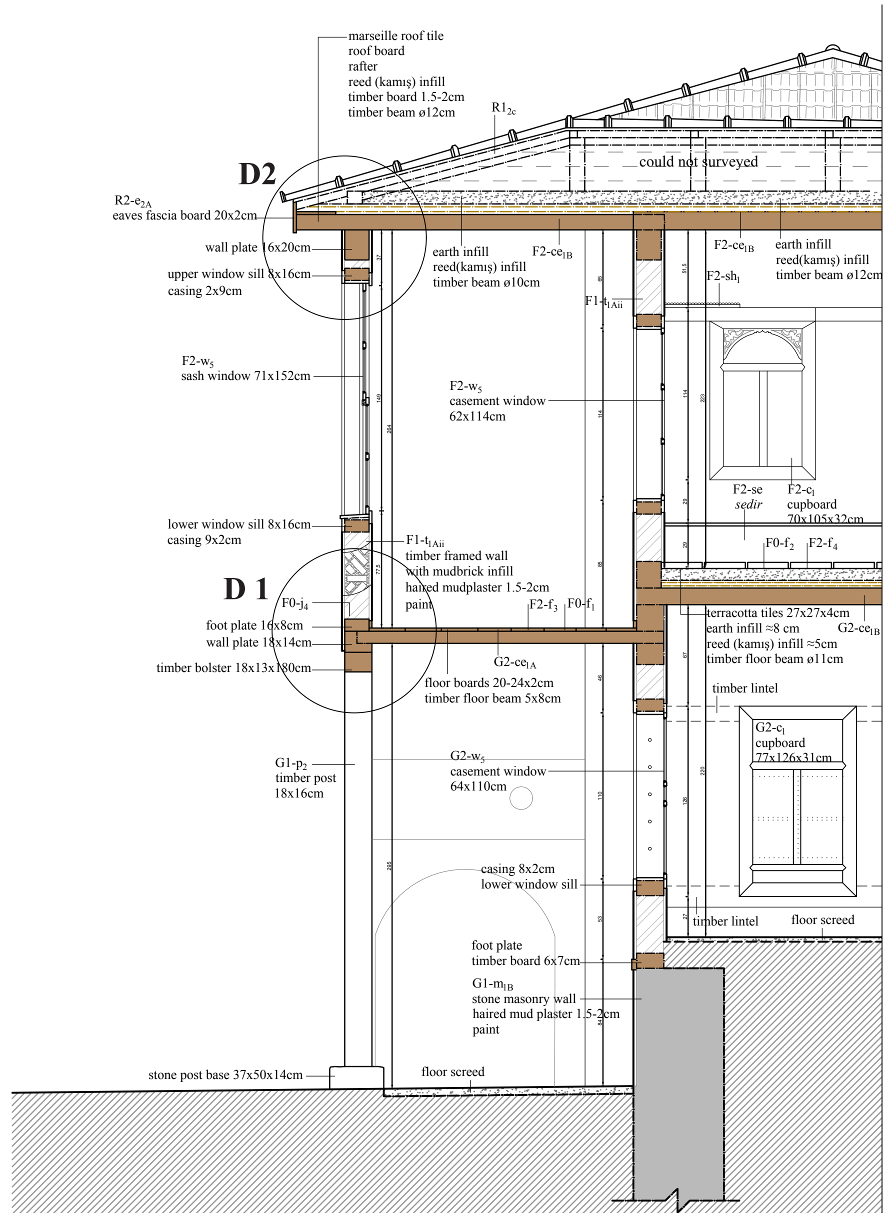
ROOF FLOOR PLAN 1/200



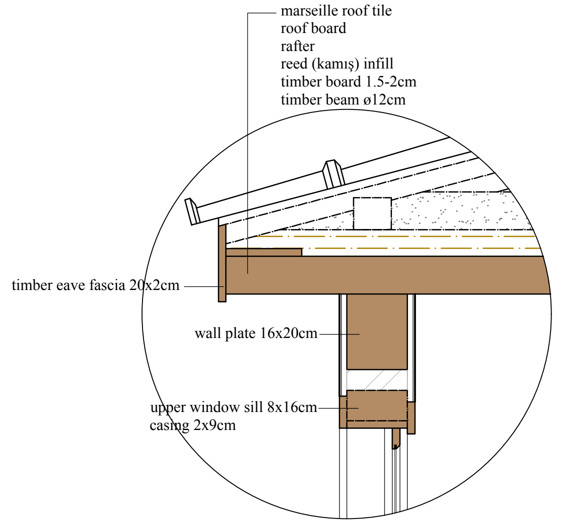
ROOF PLAN 1/200

SYSTEM SECTION DRAWINGS

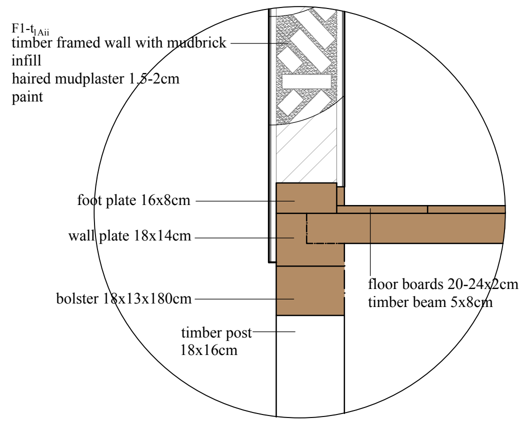
- building lot
- unmeasured/estimated structure
- stone masonry wall
- timber framed wall with mudbrick infill
- timber structure
- earth infill
- reed (kamış) infill
- timber floor covering
- terracotta tile
- floor screed



SECTION AA 1/50



DETAIL 2-1 /20



DETAIL 1- 1/20

PHOTOGRAPHS

(*All photos were taken by the author in February 2019. Photo taken at different time was indicated in bracket.)


1.Northwest facade (June 2014*)


2.Southeast facade


3.View of sofa and room from courtyard


4.Sash windows on sofa facade


5.Timber post under sofa


6.Timber posts under sofa


7.Taşlık


8. Ceiling of taşlık


9. Timber eave


10. Room-northwest facade


11.Cupboard


12. Room-courtyard facade


13.Room-ceiling


14.Exterior view of window

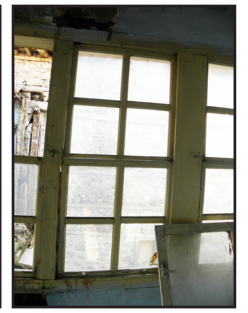

15.Exterior view of window


16. Sofa-sash windows


17. Sofa-interior windows


18. Sofa-timber floor boards


19. Sash window-exterior view


20. Sash window-interior view


21.Sofa


22.Room-northwest facade


23.Cupboard


24.Interior window


25.Interior window in sofa

Figure B.11. Survey Sheet of House 186-36

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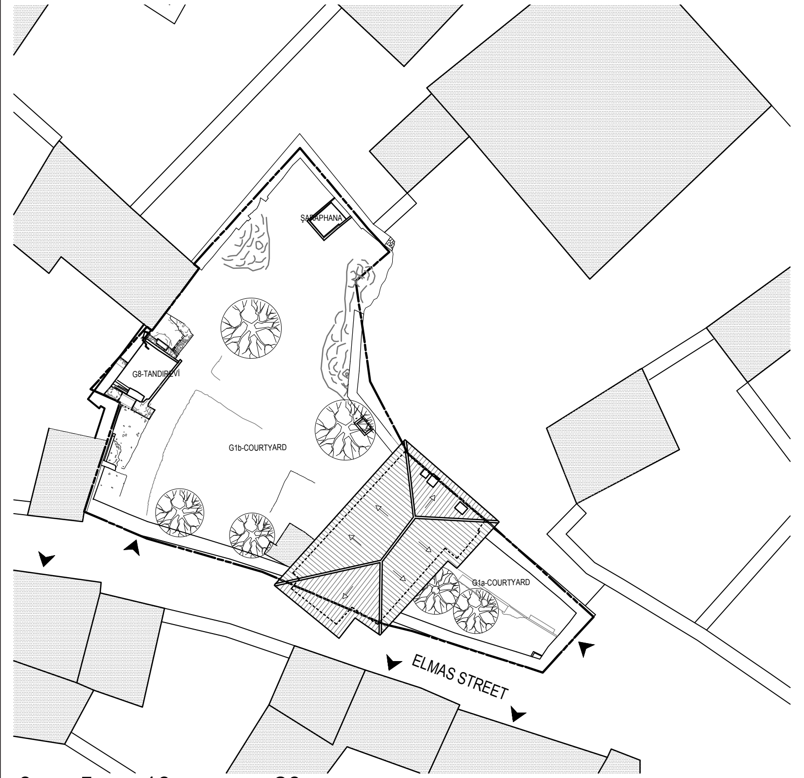
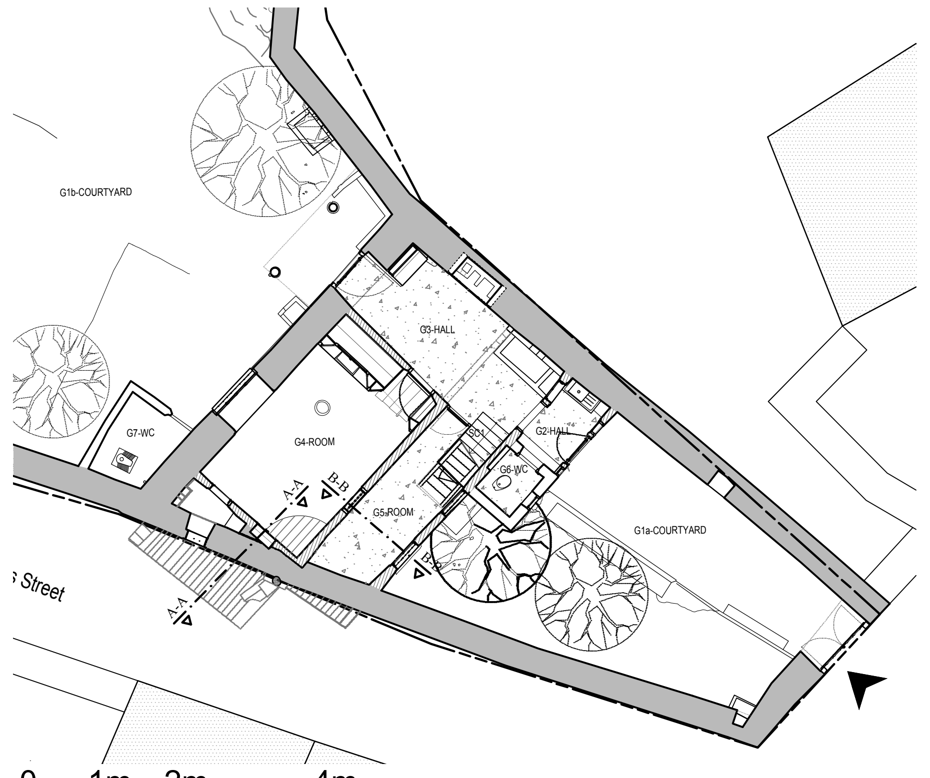
PLAN DRAWINGS

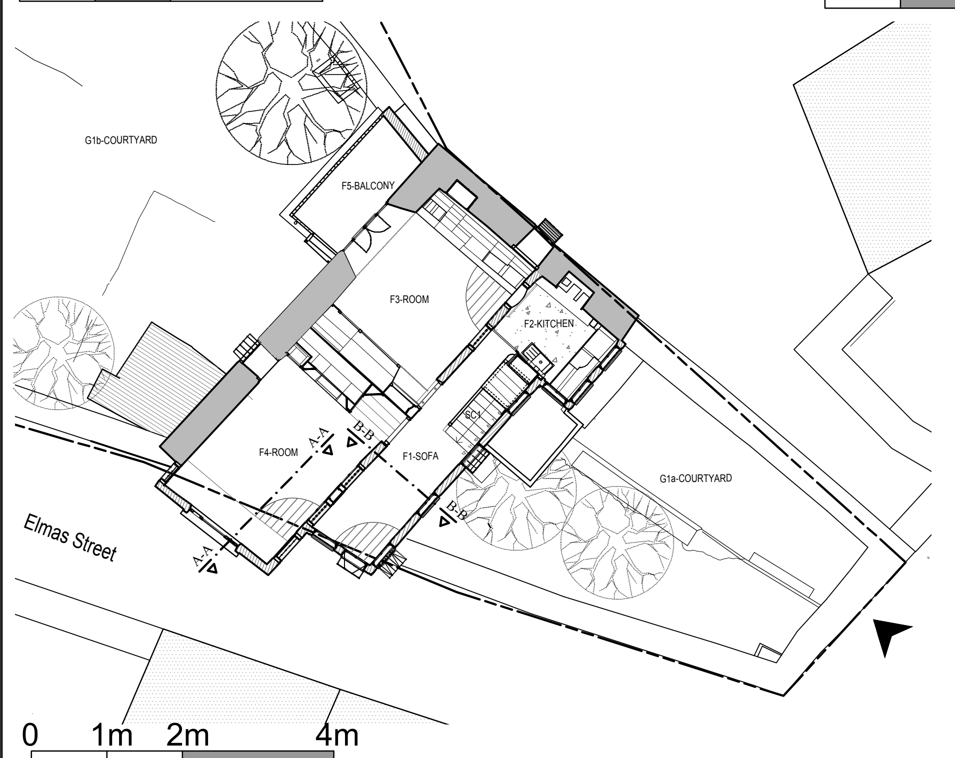
Building Block-Lot: *11-16* ***Adress:*** *Yenice N. Elmas St. N:6/8*
Surveyor: *Ezgi Pehlivan* ***Measurement Method:*** *Hand Measurement*



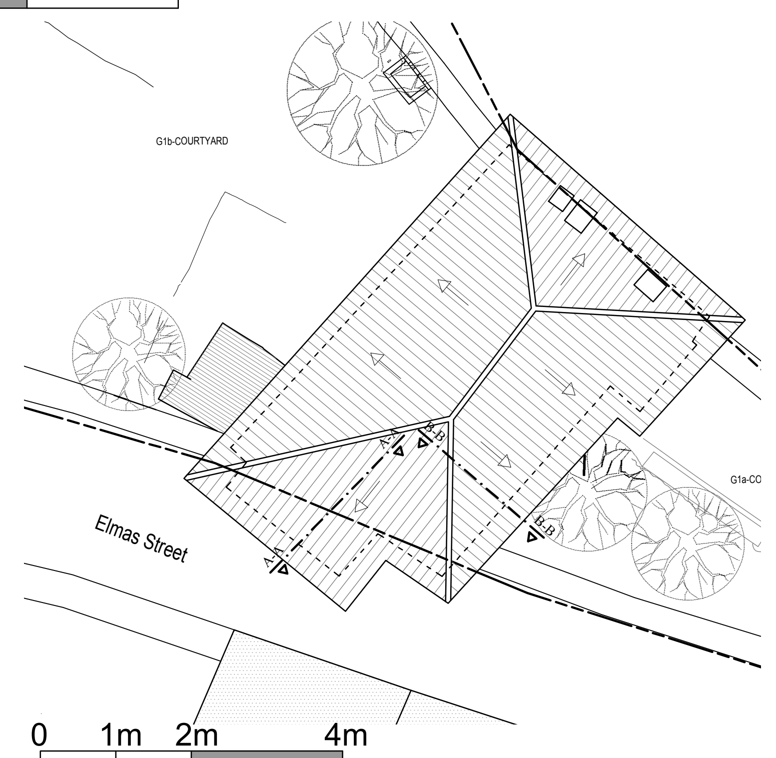
LAYOUT PLAN 1/500



GROUND FLOOR PLAN 1/200



FIRST FLOOR PLAN 1/200

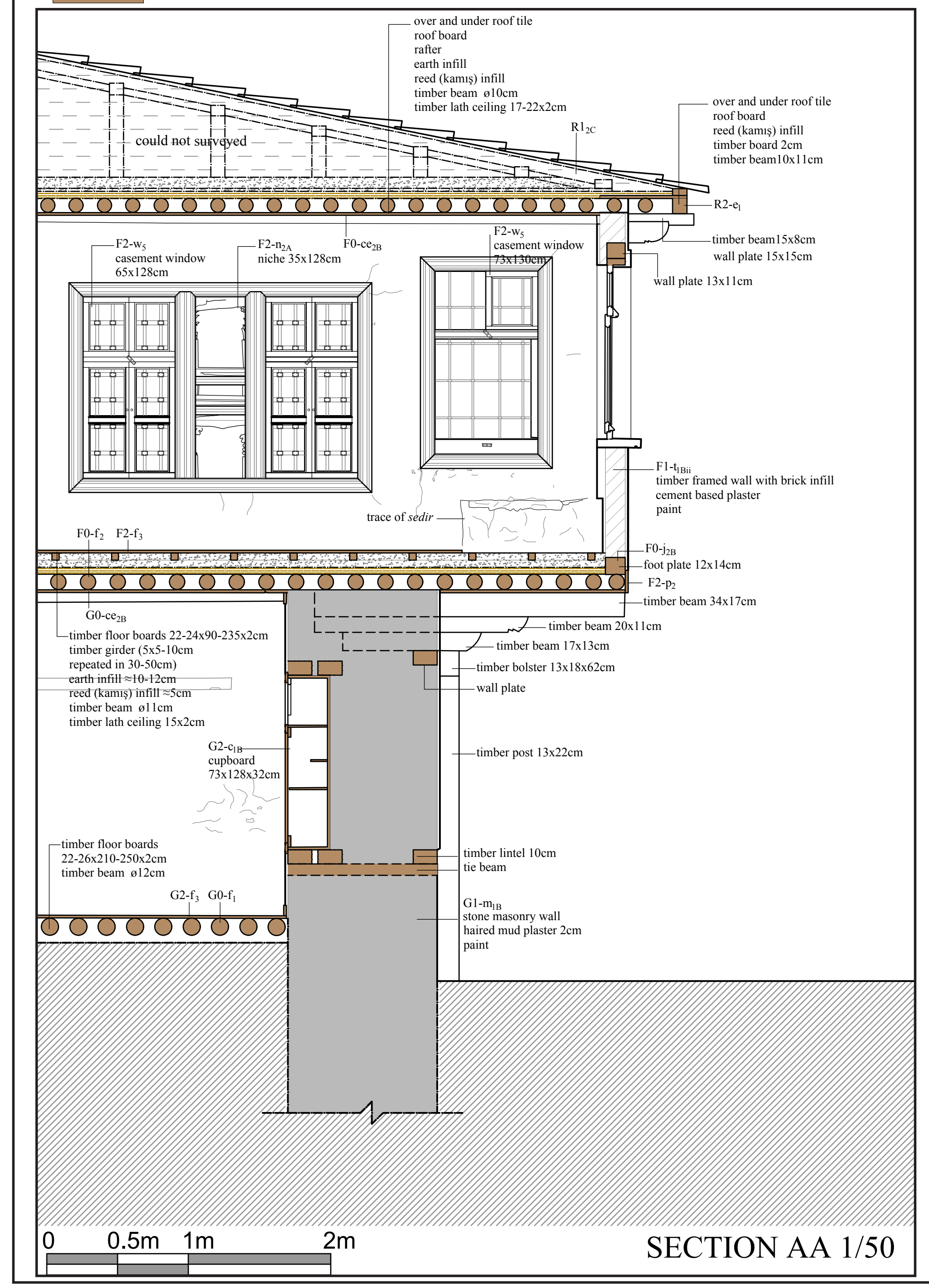


ROOF PLAN 1/200

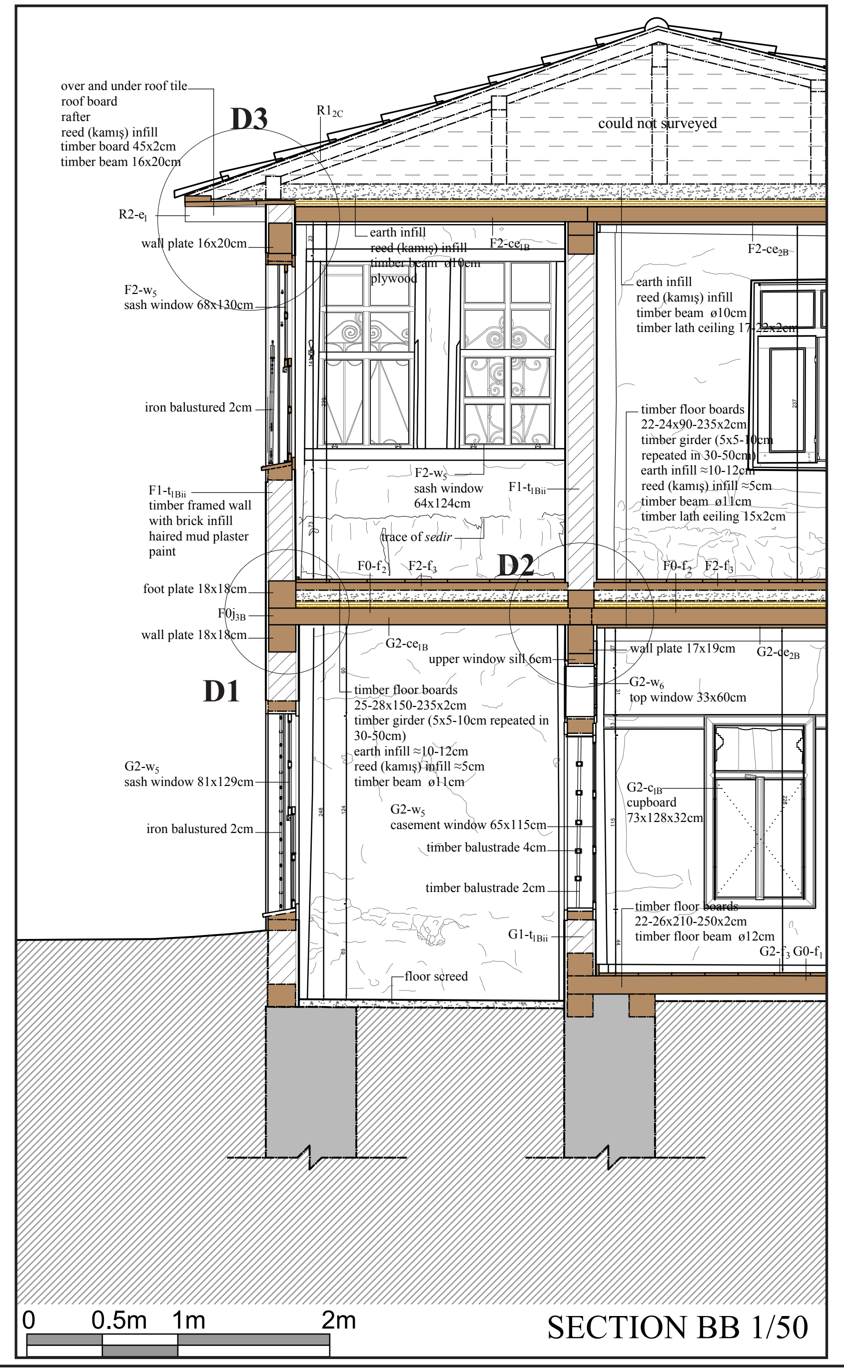
(*Drawings were drawn based on the information obtained from site survey and measured survey drawings of Kök Architecture Restoration.)

SYSTEM SECTION DRAWINGS

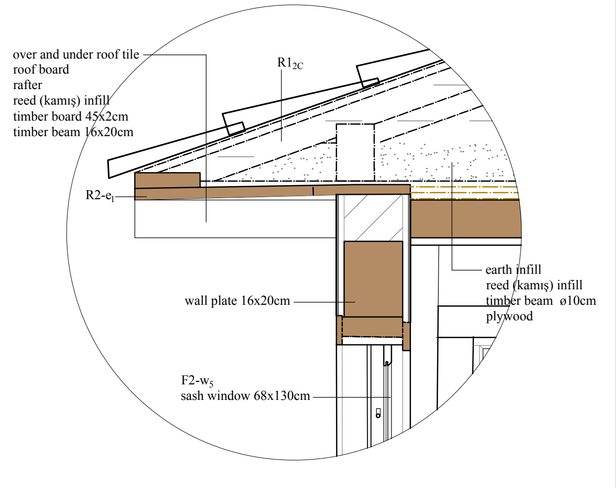
- building lot
- unmeasured/estimated structure
- stone masonry wall
- timber framed wall with brick infill
- timber structure
- timber structure
- earth infill
- reed (kamış) infill
- timber floor covering

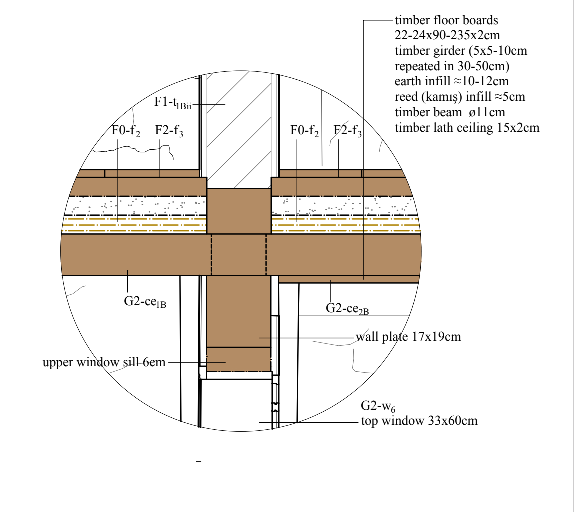


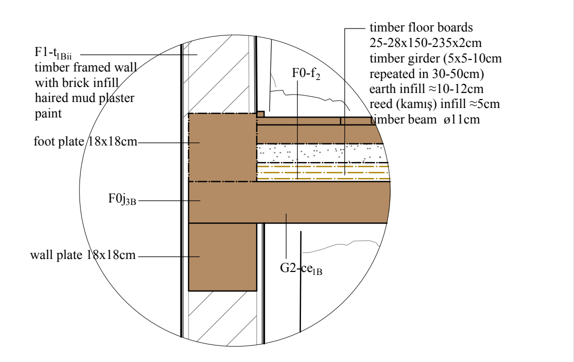
SECTION AA 1/50



SECTION BB 1/50


DETAIL 3-1 /20


DETAIL 2-1 /20


DETAIL 1- 1/20

PHOTOGRAPHS

(*All photos except the ones mentioned in brackets were taken by the author in February 2019.)


1.Street Facade


2.Street Facade


3. Projection


4. Projection detail


5. Projection-overlapped beams, bolster and post


6. Projection-side window


7. Triangle one side projection


8. Timber beam of projection


9. Sash windows with iron railing


10. Courtyard facade


11. Interior window

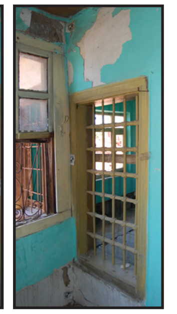

12. Interior window


13. Room ceiling


14. Room street facade


15. Sofa-street facade


16. Sofa-sash window


17. Sofa-interior window


18. Room-street facade


19. Projection-side window


20. Projection-side window


21. Projection-side window (retrieved from Yılmaz,Ö.2014*)

Figure B.12. Survey Sheet of House 11-16

MIDDLE EAST TECHNICAL UNIVERSITY
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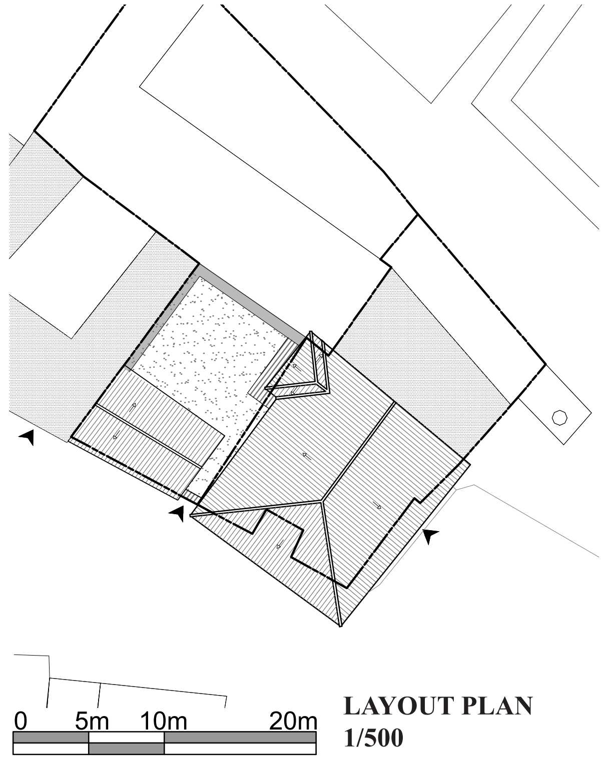
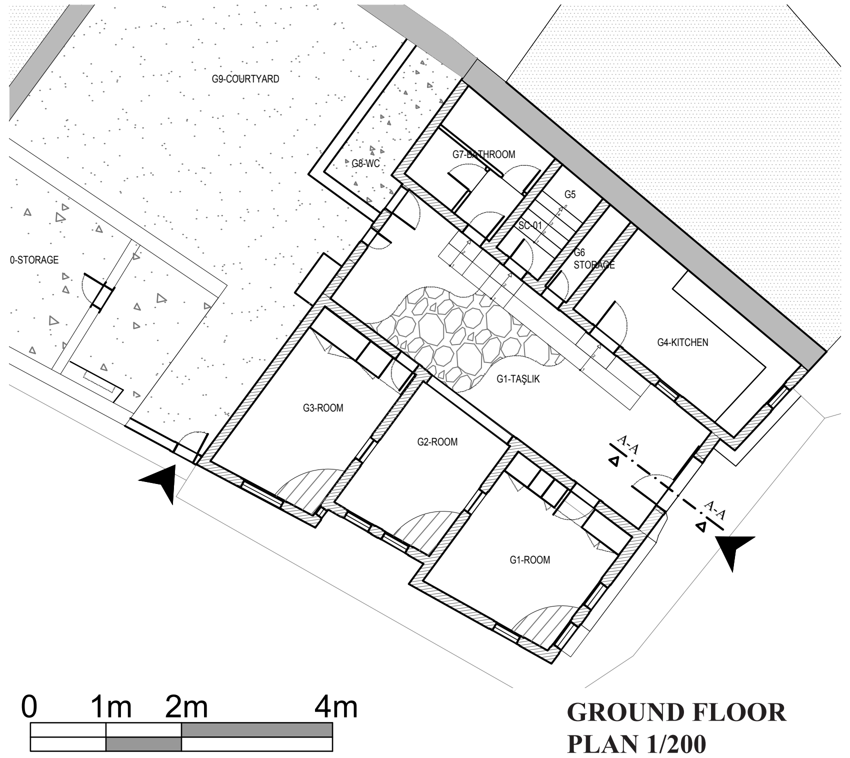
prepared by: Ezgi PEHLİVAN supervisor: Dr. Nimet ÖZGÖNÜL

PLAN DRAWINGS

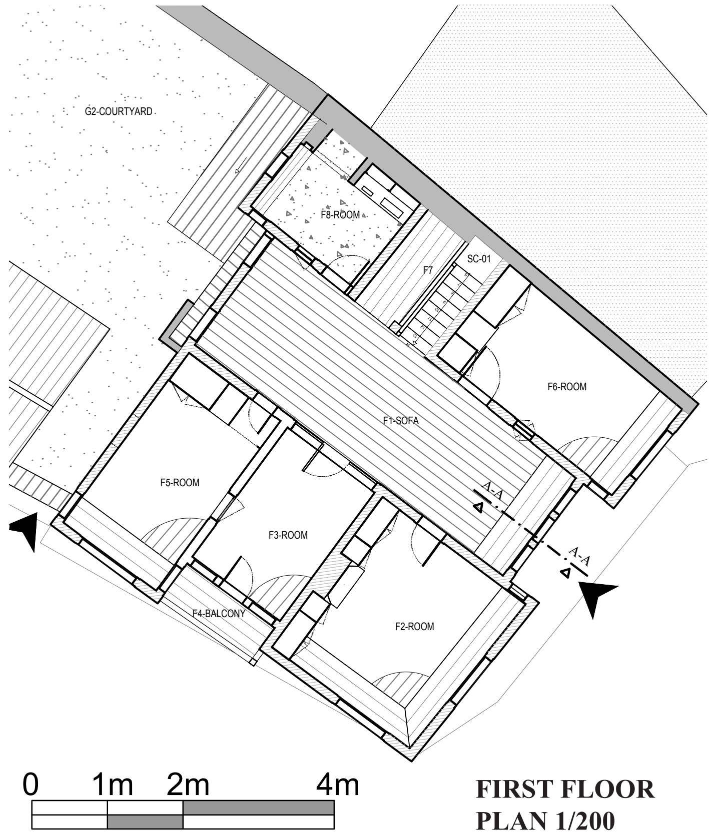
Building Block-Lot:*521-8* ***Adress:*** *Yenice N. Üçpınar Av. N:44/44B*
Surveyor: *Ezgi Pehlivan* ***Measurement Method:*** *Hand Measurement*



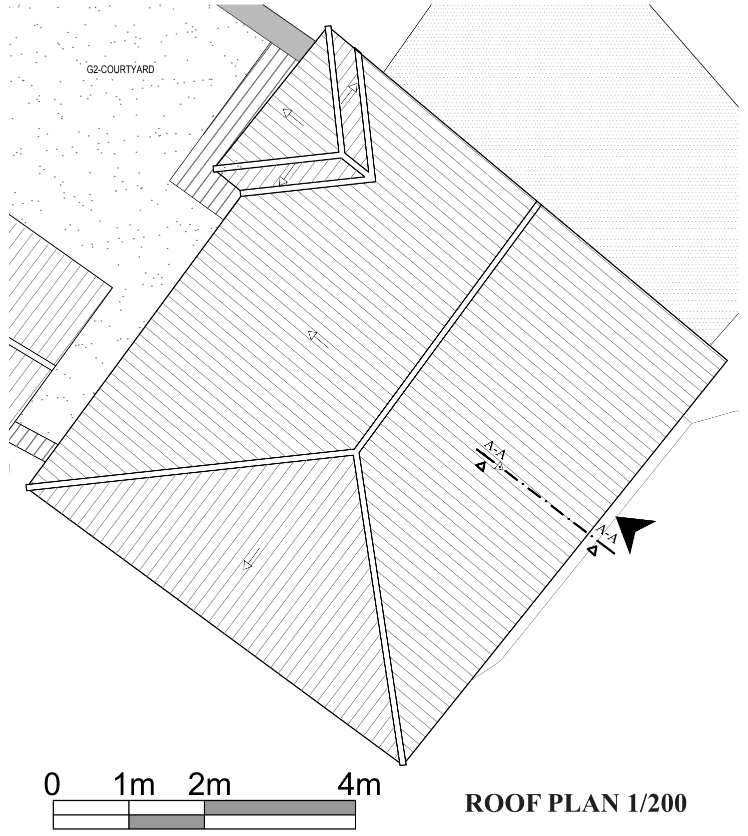
LAYOUT PLAN 1/500



GROUND FLOOR PLAN 1/200

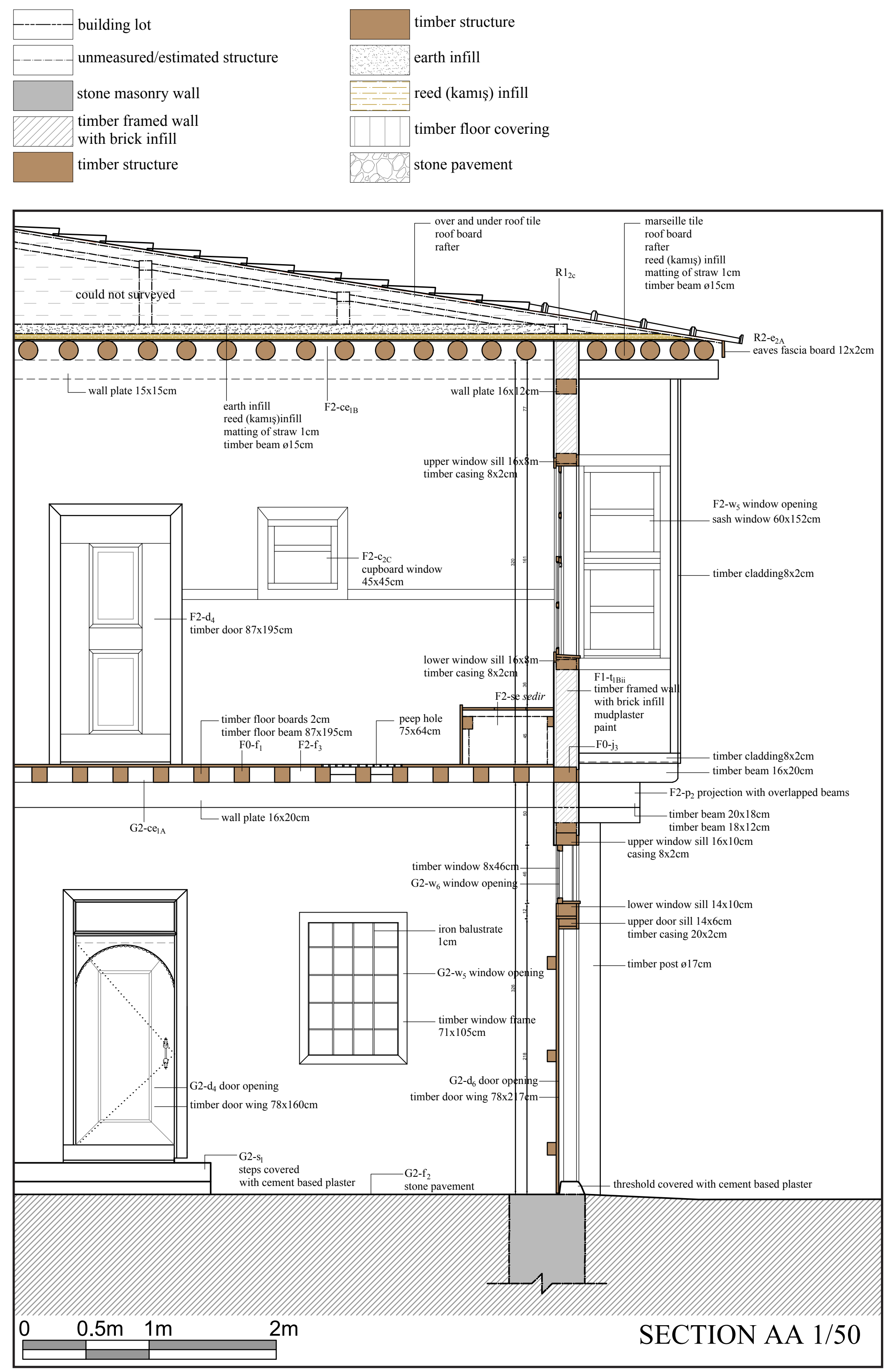


FIRST FLOOR PLAN 1/200



ROOF PLAN 1/200

SYSTEM SECTION DRAWINGS



SECTION AA 1/50

PHOTOGRAPHS

(*All photos were taken by the author in February 2019)

1. Entrance facade

2. Entrance facade

3. Entrance door

4. Sash windows

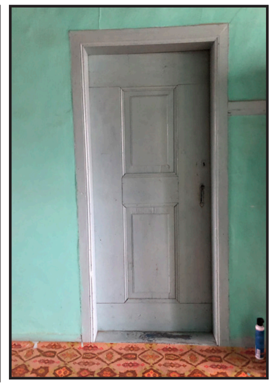
5. Taşlık

6. Interior view of entrance door

7. Door

8. Stone pavement and ceiling in taşlık

9. Sofa-entrance facade

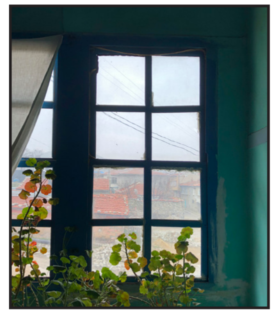


10. Sofa-dor

11. Room-projection side window

12. Room-cupboard

13. Sofa-sedir&sash windows



14. Sofa-sash window

15. Sofa-ceiling

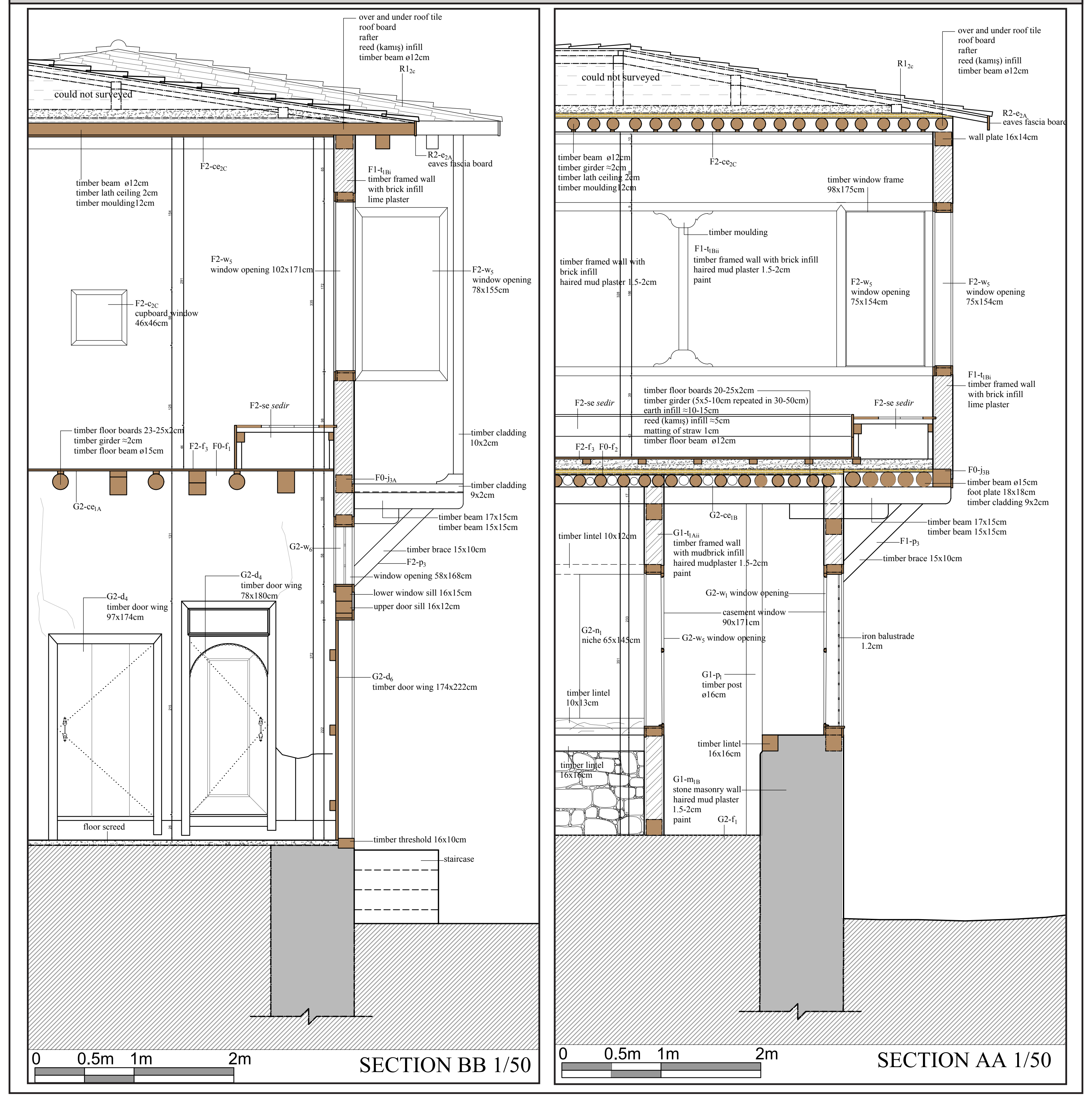
Figure B.13. Survey Sheet of House 521-7-8

MIDDLE EAST TECHNICAL UNIVERSITY
GRADUATE PROGRAM IN CONSERVATION OF CULTURAL HERITAGE
"CONSTRUCTION TECHNIQUES OF TRADITIONAL SİVRİHİSAR HOUSES"
prepared by: Ezgi PEHLİVAN supervisor: Dr. Nimet ÖZGÖNÜL

PLAN DRAWINGS

Building Block-Lot: *521-12* **Adress:** *Yenice N. Üçpınar Av. N:50*
Surveyor: *Ezgi Pehlivan* **Measurement Method:** *Hand Measurement*

SYSTEM SECTION DRAWINGS



PHOTOGRAPHS

(*All photos were taken by the author in February 2019)

1. Entrance facade
2. Entrance facade projection
3. Entrance facade projection and windows
4. Taşlık
5. Taşlık-doors of service spaces
6. Ceiling of service spaces
7. Barn-ground floor
8. Barn-ground floor
9. Barn-street facade
10. Room-northeast facade
11. Room-street facade
12. Room-L shaped sedir
13. Room-ceiling
14. Sofa-street facade
15. Sofa-ceiling rose
16. Sofa-peep hole
17. Niche with window, view from room and sofa
18. Sofa-I shaped sedir

Figure B.14. Survey Sheet of House 521-12

APPENDIX C

C. Showing the Codes of Detail Types of 14 Houses Studied

Figure C.1 showing the codes of detail types of 14 houses studied is given in the following page.

building block-lot	section of drawing	FOUNDATION	BASEMENT FLOOR									
			B0		B1	B2						
			B0-j	B0-f	B1-m	B2-f	B2-ce	B2-s	B2-d	B2-w	B2-n	B2-c
11-16	A	---	-	-	-	-	-	-	-	-	-	-
	B	---	-	-	-	-	-	-	-	-	-	-
170-19	A	---	-	-	-	-	-	-	-	-	-	-
	B	---	B0-j$_{1}$	-	B1-m$_{1A}$	B2-f$_{1}$	B2-ce$_{1A}$	-	-	-	-	-
170-44	A	---	-	-	-	-	-	-	-	-	-	-
	B	---	-	-	-	-	-	-	-	-	-	-
	C	---	-	-	-	-	-	-	-	-	-	-
186-36	A	---	-	-	-	-	-	-	-	-	-	-
188-4	A	---	-	-	-	-	-	-	-	-	-	-
196-1	A	---	B0-j$_{1}$	-	B1-m$_{1B}$	B2-f$_{1}$	B2-ce$_{1B}$	-	-	B2-w$_{1}$	-	-
	B	---	-	-	-	-	-	-	-	-	-	-
362-19	A	Fn$_{1}$	-	-	-	-	-	-	-	-	-	-
433-2	A	---	-	-	-	-	-	-	-	-	-	-
	B	---	-	-	-	-	-	-	-	-	-	-
	C	---	-	-	-	-	-	-	-	-	-	-
433-3	A	---										
443-13	A	---	-	-	-	-	-	-	-	-	-	-
	B	---	-	-	-	-	-	-	-	-	-	-
444-15	A	---	-	-	-	-	-	-	-	-	-	-
	B	---	-	-	-	-	-	-	-	-	-	-
448-2	A	---	B0-j$_{1}$	-	B1-m$_{1A}$	B2-f$_{1}$	B2-ce$_{1B}$	-	G2-d$_{1}$	-	-	-
	B	---	-	-	-	-	-	-	-	-	-	-
521-7-8	A	---	-	-	-	-	-	-	-	-	-	-
521-12	A	---	-	-	-	-	-	-	-	-	-	-
	B	---	-	-	-	-	-	-	-	-	-	-

building block-lot	section of drawing	GROUND FLOOR														
		G0		G1			G2									
		G0-j	G0-f	G1-m	G1-t	G1-p	G2-f	G2-ce	G2-s	G2-fp	G2-d	G2-w	G2-n	G2-c	G2-se	G2-sh
11-16	A	G0-j$_{1}$	G0-f$_{1}$	G1-m$_{1B}$	-	G1-p$_{2A}$	G2-f$_{3}$	G2-ce$_{2B}$	-	-	-	-	-	G2-c$_{1B}$	-	-
	B	G0-j$_{2A}$	G0-f$_{1}$	-	G1-t$_{1Bii}$	-	G2-f$_{3}$	G2-ce$_{1B}$ G2-ce$_{2B}$	-	-	-	G2-w$_{5}$ G2-w$_{6}$	-	-	-	-
170-19	A	G0-j$_{1}$	*	G1-m$_{1B}$	-	G1-p$_{1}$	*	G2-ce$_{2B}$	-	-	-	G2-w$_{1}$	-	-	-	-
	B	G0-j$_{1}$	G0-f$_{1}$ x	G1-m$_{1B}$	G1-t$_{1Bii}$	G1-p$_{2B}$	G2-f$_{3}$ x	G2-ce$_{2B}$	G2-s$_{1}$	-	G2-d$_{3}$ G2-d$_{4}$	G2-w$_{4}$ G2-w$_{5}$	-	G2-c$_{2C}$	-	-
170-44	A	G0-j$_{1}$ G0-j$_{2A}$	G0-f$_{1}$	G1-m$_{1B}$	G1-t$_{1Aii}$	-	G2-f$_{3}$	G2-ce$_{1B}$	-	-	G2-d$_{4}$	G2-w$_{1}$ G2-w$_{5}$	-	-	-	-
	B	G0-j$_{2A}$	G0-f$_{1}$	G1-m$_{1A}$	G1-t$_{1Aii}$	-	G2-f$_{3}$	G2-ce$_{1B}$	-	-	-	G2-w$_{5}$	-	-	G2-se	-
	C	G0-j$_{1}$	-	G1-m$_{1B}$	-	G1-p$_{1}$	x	G2-ce$_{1B}$	-	-	G2-d$_{4}$	-	-	G2-c$_{1B}$ G2-c$_{3}$	-	-
186-36	A	G0-j$_{2A}$	-	G1-m$_{1B}$	G1-t$_{1Aii}$	G1-p$_{2B}$	*	G2-ce$_{1A}$ G2-ce$_{1B}$	-	-	-	G2-w$_{5}$	-	G2-c$_{1}$	-	-
188-4	A	G0-j$_{1}$	-	G1-m$_{1A}$	-	-	G2-f$_{1}$	G2-ce$_{1B}$	-	-	-	-	-	-	-	-
196-1	A	G0-j$_{1}$	G0-f$_{2}$	G1-m$_{1B}$	-	-	G2-f$_{3}$	G2-ce$_{1B}$	-	-	-	G2-w$_{1}$ G2-w$_{5}$	-	-	-	-
	B	G0-j$_{1}$	-	G1-m$_{1B}$	-	-	*	G2-ce$_{1A}$	G2-s$_{1}$	-	G2-d$_{3}$	G2-w$_{4}$	-	-	-	-
362-19	A	G0-j$_{1}$ G0-j$_{2A}$	G0-f$_{1}$	G1-m$_{1A}$ G1-m$_{1B}$	G1-t$_{1Aii}$	-	G2-f$_{3}$	G2-ce$_{1B}$	-	-	G2-d$_{4}$	G2-w$_{5}$	-	G2-c$_{3}$	-	G2-sh$_{2}$
433-2	A	G0-j$_{2A}$	-	-	G1-t$_{1Bii}$	G1-p$_{1}$	x	G2-ce$_{1A}$	G2-s$_{2A}$ G2-s$_{1}$	-	G2-d$_{6}$	G2-w$_{2}$ G2-w$_{6}$	-	-	-	-
	B	G0-j$_{2A}$	-	-	G1-t$_{1Bii}$	G1-p$_{1}$	x	G2-ce$_{1A}$	-	-	G2-d$_{1}$	G2-w$_{5}$	-	-	-	-
	C	G0-j$_{1}$	-	G1-m$_{1B}$	-	-	G2-f$_{1}$	G2-ce$_{1B}$	-	-	-	-	G2-n$_{1}$	-	-	-
433-3	A	G0-j$_{1}$	-	G1-m$_{1B}$	-	G1-p$_{2A}$	*	G2-ce$_{1B}$	-	-	-	G2-w$_{3}$	-	G2-c$_{1}$	G2-se	-
443-13	A	G0-j$_{2A}$	-	G1-m$_{1B}$*	-	-	x	-	-	-	G2-d$_{1}$ G2-d$_{2}$	-	-	-	-	-
	B	G0-j$_{1}$	-	G1-m$_{1B}$*	-	-	x	G2-ce$_{1B}$	-	-	-	-	-	-	-	-
444-15	A	G0-j$_{2A}$	-	-	G1-t$_{1Aii}$	G1-p$_{2A}$	*	G2-ce$_{1B}$	G2-s$_{2A}$ G2-s$_{1}$*	-	-	G2-w$_{5}$	-	-	-	-
	B	G0-j$_{2A}$	-	G1-m$_{1B}$	G1-t$_{1Aii}$	G1-p$_{1}$ G1-p$_{2A}$	*	G2-ce$_{1A}$ G2-ce$_{1B}$	G2-s$_{2A}$ G2-s$_{1}$*	-	-	G2-w$_{2}$	-	-	-	-
448-2	A	G0-j$_{2A}$	G0-f$_{2}$	-	G1-t$_{1Bi}$	-	x	G2-ce$_{1B}$	-	-	-	G2-w$_{5}$	-	-	-	-
	B	G0-j$_{1}$	-	G1-m$_{A}$	-	G1-p$_{2B}$	G2-f$_{1}$	G2-ce$_{1A}$ G2-ce$_{1B}$	-	G2-fp$_{2B}$	-	G2-w$_{2}$	-	G2-c$_{1}$	-	-
521-7-8	A	G0-j$_{2A}$	-	-	G1-t$_{1Bii}$	-	G2-f$_{2}$*	G2-ce$_{1A}$	G2-s$_{1}$*	-	G2-d$_{4}$ G2-d$_{6}$	G2-w$_{5}$ G2-w$_{6}$	-	-	-	-
521-12	A	G0-j$_{2A}$	-	G1-m$_{1A}$ G1-m$_{1B}$	G1-t$_{1Aii}$	G1-p$_{1}$	G2-f$_{1}$	G2-ce$_{1B}$	-	-	-	G2-w$_{1}$ G2-w$_{5}$	G2-n$_{1}$	-	-	-
	B	G0-j$_{1}$	-	-	G1-t$_{1Bii}$	-	*	G2-ce$_{1A}$	G2-s$_{1}$*	-	G2-d$_{4}$ G2-d$_{6}$	G2-w$_{6}$	-	-	-	-

building block-lot	section of drawing	MEZZANINE FLOOR														
		M0		M1			M2									
		M0-j	M0-f	M1-m	M1-t	M1-p	M2-f	M2-ce	M2-s	M2-fp	M2-d	M2-w	M2-n	M2-c	M2-se	M2-sh
11-16	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
170-19	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
170-44	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
186-36	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
188-4	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
196-1	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
362-19	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
433-2	A	-	M0-f$_{1}$	-	-	-	M2-ce$_{1A}$ M2-ce$_{2B}$	M2-f$_{3}$	-	-	M2-d$_{4}$	M2-w$_{5}$	-	-	-	-
	B	M0-j$_{3}$	M0-f$_{1}$	-	M1-t$_{2Bii}$	-	M2-ce$_{1A}$	M2-f$_{3}$	-	-	M2-d$_{4}$	M2-w$_{5}$	-	-	-	-
	C	M0-j$_{1}$	M0-f$_{2}$	M1-m$_{1B}$	-	-	M2-ce$_{1B}$	M2-f$_{3}$	-	-	-	-	M2-n$_{1}$	M2-c$_{3}$	-	-
433-3	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
443-13	A	M0-j$_{2A}$	-	-	M1-t$_{2Bii}$*	-	M2-ce$_{1B}$*	-	-	-	-	M2-w$_{5}$	-	-	-	-
	B	M0-j$_{2A}$	M0-f$_{2}$	-	M1-t$_{2Bii}$*	-	M2-ce$_{1B}$*	M2-f$_{3}$	-	-	-	M2-w$_{2}$ M2-w$_{5}$	-	-	M2-se	-
444-15	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
448-2	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
521-7-8	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
521-12	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

building block-lot	section of drawing	FIRST FLOOR																ROOF			
		F0		F1			F2											R0	R1	R2	
		F0-j	F0-f	F1-m	F1-t	F1-p	F2-f	F2-ce	F2-p	F2-s	F2-fp	F2-d	F2-w	F2-n	F2-c	F2-se	F2-sh	R0-j	R1	R2-e	R2-c
11-16	A	F0-j$_{2B}$	F0-f$_{2}$	-	F1-t$_{1Bii}$	-	F2-f$_{3}$	F2-ce$_{2B}$	F2-p$_{2}$	-	-	-	F2-w$_{5}$	F2-n$_{2A}$	-	-	-	R0-j$_{6}$	R1$_{2c}$	R2-e$_{1}$	-
	B	F0-j$_{3B}$	F0-f$_{2}$	-	F1-t$_{1Bii}$	-	F2-f$_{3}$	F2-ce$_{1B}$ F2-ce$_{2B}$	-	-	-	-	F2-w$_{5}$	-	-	-	-	R0-j$_{6}$	R1$_{2c}$	R2-e$_{1}$	-
170-19	A	F0-j$_{2B}$	F0-f$_{2}$	-	F1-t$_{1Bii}$	-	F2-f$_{3}$	F2-ce$_{2B}$	F2-p$_{1}$	-	-	-	F2-w$_{5}$	-	-	F2-se	-	R0-j$_{6}$	R1$_{2c}$	R2-e$_{2B}$	-
	B	F0-j$_{2B}$	F0-f$_{2}$	-	F1-t$_{1Bii}$	-	F2-f$_{3}$	F2-ce$_{2B}$	F2-p$_{3}$	-	-	F2-d$_{4}$	F2-w$_{5}$	-	F2-c$_{3}$	F2-se	-	R0-j$_{6}$	R1$_{2c}$	R2-e$_{2B}$	-
170-44	A	F0-j$_{2A}$ F0-j$_{3A}$	F0-f$_{2}$	-	F1-t$_{1Bii}$	-	F2-f$_{3}$	F2-ce$_{2B}$	-	-	-	F2-d$_{4}$	F2-w$_{5}$	_	F2-c$_{3}$	-	-	R0-j$_{6}$	R1$_{2c}$	R2-e$_{2A}$	R2-c
	B	F0-j$_{3A}$	F0-f$_{2}$	-	F1-t$_{1Bii}$	-	F2-f$_{3}$	F2-ce$_{2B}$	-	-	-	-	F2-w$_{5}$	-	-	F2-se	-	R0-j$_{6}$	R1$_{2c}$	R2-e$_{2A}$	-
	C	F0-j$_{1}$ F0-j$_{4}$	F0-f$_{2}$	F1-m$_{1B}$	F1-t$_{1Aii}$ F1-t$_{1Bii}$	F1-p$_{1}$	F2-f$_{4}$	F2-ce$_{2}$	-	-	-	F2-d$_{4}$	F2-w$_{5}$	-	F2-c$_{1}$ F2-c$_{3}$	-	-	R0-j$_{6}$	R1$_{1A}$	R2-e$_{1}$	-
186-36	A	F0-j$_{4}$	F0-f$_{1}$ F0-f$_{2}$	-	F1-t$_{1Aii}$	-	F2-f$_{3}$ F2-f$_{4}$	F2-ce$_{1B}$	-	-	-	-	F2-w$_{5}$	-	F2-c$_{1}$	F2-se	-	R0-j$_{6}$	R1$_{2c}$	R2-e$_{2A}$	-
188-4	A	F0-j$_{1}$	F0-f$_{2}$	F1-m$_{1A}$	F1-t$_{1Bii}$	-	x	F2-ce$_{1B}$	-	-	-	F2-d$_{4}$	F2-w$_{1}$	-	-	-	-	R0-j$_{6}$	R1$_{1C}$	R2-e$_{1}$	R2-c
196-1	A	F0-j$_{2B}$	F0-f$_{2}$	-	F1-t$_{1Bii}$	-	F2-f$_{3}$	F2-ce$_{1B}$	F2-p$_{1}$	-	-	-	F2-w$_{5}$	-	-	F2-se	-	R0-j$_{6}$	R1$_{2B}$	R2-e$_{1}$	-
	B	F0-j$_{2B}$	F0-f$_{1}$	-	F1-t$_{1Bii}$	-	F2-f$_{3}$	F2-ce$_{1B}$	F2-p$_{1}$	-	-	-	F2-w$_{5}$	-	-	-	-	R0-j$_{6}$	R1$_{2B}$	R2-e$_{1}$	-
362-19	A	F0-j$_{1}$ F0-j$_{3A}$	F0-f$_{2}$	F1-m$_{1B}$	F1-t$_{1Aii}$	-	x	F2-ce$_{1B}$	-	-	-	F2-d$_{4}$	F2-w$_{5}$	-	-	-	-	R0-j$_{6}$	R1$_{1A}$	R2-e$_{1}$	-
433-2	A	F0-j$_{3A}$	F0-f$_{1}$ F0-f$_{2}$	-	F1-t$_{1Bi}$	-	F2-f$_{3}$ x	F2-ce$_{2D}$	F2-p$_{2}$	-	-	-	F2-w$_{5}$	-	-	-	-	R0-j$_{6}$	R1$_{2c}$	R2-e$_{1}$	-
	B	F0-j$_{3A}$	F0-f$_{1}$	-	F1-t$_{1Bi}$	-	F2-f$_{3}$	F2-ce$_{2D}$	-	-	-	-	F2-w$_{5}$	-	-	-	-	R0-j$_{6}$	R1$_{2c}$	R2-e$_{2A}$	-
	C	F0-j$_{2B}$	F0-f$_{2}$	-	F1-t$_{1Bi}$	-	x	F2-ce$_{1B}$	F2-p$_{2}$	-	-	-	F2-w$_{5}$	-	-	-	-	R0-j$_{6}$	R1$_{2c}$	R2-e$_{1}$	-
433-3	A	F0-j$_{2B}$	F0-f$_{2}$	-	F1-t$_{1Bi}$	-	*	F2-ce$_{1B}$	F2-p$_{2}$	-	-	-	F2-w$_{5}$	-	-	F2-se	-	R0-j$_{6}$	R1$_{2C}$	R2-e$_{1}$	-
443-13	A	F0-j$_{3A}$	F0-f$_{2}$	-	F1-t$_{1Bii}$*	-	F2-f$_{3}$	F2-ce$_{1B}$*	F2-p$_{3}$	-	-	-	F2-w$_{5}$	-	F2-c$_{2C}$	F2-se	-	R0-j$_{6}$	R1$_{2c}$	R2-e$_{2A}$	-
	B	F0-j$_{3B}$	F0-f$_{2}$	-	F1-t$_{1Bii}$*	-	F2-f$_{3}$	F2-ce$_{1B}$*	F2-p$_{3}$	-	-	-	F2-w$_{5}$	-	-	F2-se	F2-sh$_{1}$	R0-j$_{6}$	R1$_{2c}$	R2-e$_{2A}$	-
444-15	A	F0-j$_{3A}$	F0-f$_{2}$	-	F1-t$_{1Aii}$	-	F2-f$_{3}$	F2-ce$_{1B}$	-	-	-	F2-d$_{4}$	-	-	-	-	-	R0-j$_{6}$	R1$_{2B}$	-	-
	B	F0-j$_{3A}$ F0-j$_{4}$	F0-f$_{1}$ F0-f$_{2}$	F1-m$_{1B}$	F1-t$_{1Aii}$	-	F2-f$_{3}$	F2-ce$_{1B}$	-	-	-	-	F2-w$_{5}$	F2-n$_{1}$	-	-	-	R0-j$_{6}$	R1$_{2B}$	R2-e$_{2A}$	-
448-2	A	F0-j$_{3B}$	F0-f$_{2}$	-	F1-t$_{1Bi}$	-	x	F2-ce$_{1B}$	F2-p$_{3}$	-	-	-	F2-w$_{5}$	-	-	F2-se	F2-sh$_{1}$ F2-sh$_{2}$	R0-j$_{6}$	R1$_{2c}$	R2-e$_{1}$	-
	B	F0-j$_{2B}$ F0-j$_{4}$	F0-f$_{1}$ F0-f$_{2}$	-	F1-t$_{1Bi}$ F1-t$_{1Bii}$	-	F2-f$_{3}$ x	F2-ce$_{1B}$	-	-	-	-	F2-w$_{5}$	-	-	F2-se	F2-sh$_{1}$ F2-sh$_{2}$	R0-j$_{6}$	R1$_{2c}$	R2-e$_{1}$	-
521-7-8	A	F0-j$_{3A}$	F0-f$_{1}$	-	F1-t$_{1Bii}$	-	F2-f$_{3}$	F2-ce$_{1B}$	F2-p$_{2}$	-	-	F2-d$_{4}$	F2-w$_{5}$	-	F2-c$_{2C}$	F2-se	-	R0-j$_{6}$	R1$_{2c}$	R2-e$_{2A}$	-
521-12	A	F0-j$_{3B}$	F0-f$_{2}$	-	F1-t$_{1Bi}$ F1-t$_{1Bii}$	-	F2-f$_{3}$	F2-ce$_{2C}$	F2-p$_{3}$	-	-	-	F2-w$_{5}$	-	-	F2-se	-	R0-j$_{6}$	R1$_{2c}$	R2-e$_{2A}$	-
	B	F0-j$_{3A}$	F0-f$_{1}$	-	F1-t$_{1Bi}$ F1-t$_{1Bii}$	-	F2-f$_{3}$	F2-ce$_{2C}$	-	-	-	-	F2-w$_{5}$	-	F2-c$_{2C}$	F2-se	-	R0-j$_{6}$	R1$_{2c}$	R2-e$_{2A}$	-

* is used for the intervened building parts with cement based materials such as cement based plaster,and floor screed.
x is used for the demolished building parts
--- is used for the building parts could not surveyed
\- is used for the building parts that are not exist

Figure C 1. Table of Codes