CONSTRUCTION TECHNIQUES OF TRADITIONAL UÇHİSAR HOUSES

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

BY

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IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF MASTER OF SCIENCE
IN
RESTORATION IN ARCHITECTURE

DECEMBER 2014

Approval of the thesis:

CONSTRUCTION TECHNIQUES OF TRADITIONAL UÇHİSAR HOUSES

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

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ABSTRACT

CONSTRUCTION TECHNIQUES OF TRADITIONAL UÇHİSAR HOUSES

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M.S. in Restoration, Department of Architecture

Supervisor: Ins.Dr. Fuat Gökçe

December 2014, 189 pages

The aim of this study is to create comprehensive and reliable information about construction techniques of Uçhisar houses within construction processes.

In order to that purpose, studies about history and general features of Cappadocia and Uçhisar were reviewed. In Cappadocia region, the development of residential settlements through history was surveyed from the previous studies. Gathered information from literature survey and site survey were assessed together and traditional houses which are representation of authentic houses of Uçhisar were selected and investigated. Each structural and architectural element were drawn in detail, analyzed, and classified by their similarities and differences. Relationship between rock-carved places and masonry structures were investigated. Within the scope of thesis, used materials of houses and local discourses were other important concerns. Via the information came out regarding the study, a basic construction processes of traditional Uçhisar house was identified.

Keywords: Traditional House, Construction Technique, Uçhisar

ÖZ

GELENEKSEL UÇHİSAR EVLERİNİN YAPIM TEKNİĞİ

Tongal, Pınar Başak
Yüksek Lisans, Restorasyon, Mimarlık Bölümü
Tez Yöneticisi: Dr.Fuat Gökçe

December 2014, 189 Sayfa

Bu çalışmanın amacı Uçhisar'da bulunan geleneksel konutların yapım sürecini anlamak ve yapım tekniği ile ilgili güvenilir ve bütüncül bilgi toplamaktır.

Bu amaca bağlı olarak, Kapadokya ve Uçhisar'ın tarihi ve genel bölgenin genel özellikleri üzerine araştırma yapılmıştır. Kapadokya bölgesindeki yerleşim biçimlerinin tarih içerisindeki gelişimi geçmiş çalışmalardan araştırılmıştır. Kaynaklardan ve arazi çalışmalarından elde edilen bilgilerin beraber değerlendirilmesi sonucunda, Uçhisar'da özgünlüğünü koruyan geleneksel konutlar tespit edilmiş ve çalışılmıştır. Strüktürel ve mimari tüm elemanların detayları çizilmiş, analiz edilmiş ve bezerlikleri ve farklılıklarına göre sınıflandırılmıştır. Kaya oyma mekanlar ve yığma yapılar arasındaki fiziksel ve strüktürel ilişki irdelenmiştir.

Yapılarda kullanılan malzemeler ve yerel söylemler bu çalışmanın bir diğer önemli araştırmasıdır.

Çalışma sonucunda elde edilen bilgiler ışığında, geleneksel Uçhisar konutunun temelden çatıya kadar süren yapım aşaması oluşturulmuştur.

Anahtar Kelimeler: Geleneksel konut, Yapım tekniği, Uçhisar

To My Lovely Family…

ACKNOWLEDGMENTS

Firstly, I would like to thank to my supervisor Ins.Dr.Fuat Gökçe for his support and guidance. I also thank to Assoc. Prof. Dr.Neriman Şahin Güçhan, Ins. Dr. Nimet Özgönül, M.Arch Kemal Nalbant and M.Arch Yavuz Özkaya for their valuable criticism and suggestions.

I want to express my appreciations to Sema Project, especially to Doğan Zilan Özcan, for their support and laser scanner measurements of the studied houses. I also want to thank to Zeynel Şimşek, Kürşat Demirel and Hasan Baş for their helps and supports during site-survey.

I would like to thank to Gökhan Bilgin for his helps during measurements of houses and for his valuable friendship. I also would like to thank my friends, Vacide Betül Kurtuluş, Aynur Uluç and Beril Güner, for their supports and invaluable friendship. For his help, I would like to thank to Cem Abidoğlu. And I wanted to thank to my brother, Önder Şafak Tongal for his helps in formatting of the thesis text.

Most importantly, I would like to thank my parents Ayşe Tongal, Şefik Tongal, and my brother Önder Şafak Tongal. I am grateful for their patience, support, trust, and complimentary love they have given me all my life and during this study.

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CHAPTER 1

INTRODUCTION

1.1 DEFINITION OF THE PROBLEM

Cappadocia is a unique region with its geographical features, natural formations and historical environment. It is a volcanic region that kept combination of rock carved places and masonry constructions prevalently. It has a distinctive traditional architectural style which represents the history of the settlement through successive periods. However, after Cappadocia region became ‘Tourism Development Area’ in 1973, it attracted tourists from all over the world that caused touristic facilities with different needs. As a result of this, many traditional houses are transformed into hostels, restaurants etc. As far as rapid evolution of tourism sector houses were started to be renovated and lose their original details. This effect caused by the development of tourism quite apparent in many parts of Cappadocia.

Nowadays, with the development of technology, contemporary construction methods have been begun to use instead of traditional methods and the profession of masons passing from father to son could not be continued. Since the mason proficiency disappears over time, construction techniques that developed over years within the experiences of masons and local discourses will be forgotten. One of the other problems is that researches about Cappadocia are mostly focused on history of region and its unique natural features. Other publications are mostly concentrate on tourism sector emphasizing natural beauties, rock-carved religious buildings, cultural habits which are influences to provoke economy. Another type of researches is on geographical features of the region. However, these studies seem to have weak relationship to workability of materials and working phases. It may be reasoned with the fact that this relationship is not easily describable. These measurable geological classifications and analytical explanation do not provide assistance to the restoration applications. Moreover, unfortunately, there are not many systematically studies about the construction techniques in detail about region houses.

Uçhisar which selected as a case study for the thesis is one of sub-region in Cappadocia. Even though tourism sector rapidly has changed entire view of city, Uçhisar is a region where traditional architectural structures of Cappadocia are represented (Figure 1. 1, 1.2, 1.3). However, in Uçhisar, many houses have been evacuated in *Aşağı* district regarding the possibility of destruction of the rock carved places. Another group of traditional houses are renovated under influence of tourism sector and some other houses were abandoned because they were demolished in time and did not meet the needs of contemporary life. Thus, traditional structures have been started to demolish or lost authentic details. Since there are limited researches about Uçhisar houses, caused problems during applications of preservation and restoration works. Via interviews, architects that are working in Uçhisar, mostly faced problems during application phase that contemporary material types and local materials incompatibility.

Documentation and analyses of the traditional construction methods, materials with their sources that local people provided from and the architectural plans of traditional buildings is an important study to contribute to further conservation studies with reliable information. Only in this way proper maintenance of existing traditional structures can be ensure within their authenticity.

1.1 AIM OF THE THESIS

The basic aim of this study is to investigate traditional Uçhisar houses with their all components and collecting reliable information about the construction techniques with respect to local discourses, in order to generate a guideline to frame technical base of the conservation works. It is important to present the experiential view in order to understand phases of construction techniques of traditional Uçhisar houses, within the used materials. Besides, it is crucial to understand the mason's response to materials that used in buildings, especially the rock, although it may not be analytically demonstrable.

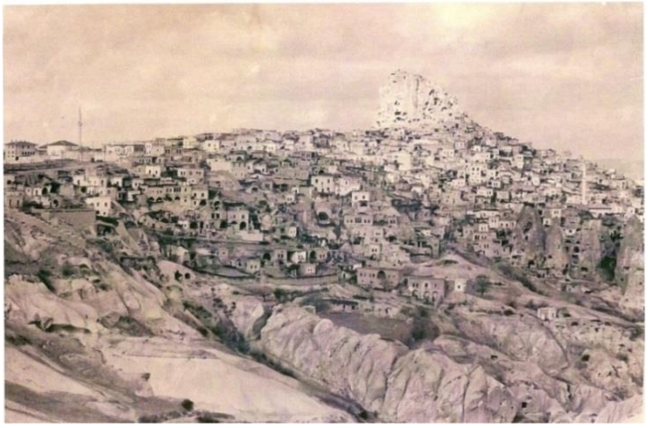


Figure 1. 1 Old view of Uçhisar (Uçhisar Municipality)

Figure 1. 2 View of Uçhisar – 1996 (Murat Gülyaz)

Figure 1. 3 Current view of Uçhisar - 2012

Adhering to these objectives, within the scope of this thesis, existed traditional buildings that are standing with their entire authenticity have been analyzed in detail, starting from ground to the roof. Studied buildings are chosen from the historical fabric areas that representation of traditional houses which are spread to different zones around city centre. Partially demolished houses were mostly preferred to understand structure systematically from ground to roof. Moreover seriously damaged houses in the site helped to understand construction elements in detail. Within the scope of this thesis, in addition to analyze different construction techniques, it is objected to examine local construction materials according to their type and usage purpose.

1.2 METHODOLOGY

The method of this study consists of collecting the written and visual source in the literature, pre-site survey, site survey, documentation and analysing of collecting data of structural techniques and finally the conclusion step.

Firstly, the written and visual sources about features of Cappadocia region, including especially Uçhisar and general development of settlement, as well as the dwelling scheme in the history and rock carving methods are reviewed.

After literature survey was completed, pre-site survey was conducted to Uçhisar between 25.05.2012 and 01.06.2012. During pre-site survey traditional settlement of Uçhisar was photographed and analyzed. In this process, stone mason Hasan Baş gave information about materials, construction tools and general construction techniques that are used in traditional houses. In the following days, other traditional settlement, Ürgüp, Göre, Ortahisar, Mustafapaşa and İbrahimpaşa were visited in order to have a better understanding of Uçhisar houses within Cappadocia settlement. After observing of collected data and information gained from site-survey, representation of traditional house examples which keep authentic details were chosen to study in detail. Partially demolished houses are mostly preferred to understand structure systematically from ground to roof. Other houses taken seriously damages in city helped to understand. construction elements. At the end of the pre-site survey the buildings that would be investigated were chosen and method of field survey was determined.

Secondly, site-survey was done between 13.06.2013-19.06.2013 to define construction techniques of Uçhisar houses in more detail. According to plan of site survey, from foundation to roof all the system section and details of structure were documented by drawings, sketches and photographed. In order to understand vertical and horizontal relation between rock-cut places and built-up places, nine of the houses were measured with 3D laser scanner[1]; but 1/5, 1/10 details were measured by hand measurement. Other ruined houses that were chosen documented by photogrammetric survey and necessary details were sketched. During survey another interview with rock mason Mehmet Şişik was made about rock carving processes in the region. The masons that were interviewed with during study are examples of the tradition from father to son in their field. However, in accordance with the conservation plan imposes restrictions on opening new rock carved places in the region, the rock mason does not practise his profession.

After site survey all documents that were gained on field survey were drawn systematically including site plan, plan levels, schematic structural system drawings and other details that are needed to be explained in more detail, in AutoCAD 2010. Plans, system details and other details of buildings were drawn and survey sheet for each houses were prepared. From the data of 3D laser scanner (point cloud) ortophoto[2] of building's architectural elements, detail of façade elements were prepared. (Figure 1. 4) Construction materials, construction tools, rock carving and masonry methods within all components analysed regarding the literature survey, observations and information gained from interviews.

Under the light of gathered information and the technical necessities 3D model of three studied buildings were prepared in Sketchup program in order to understand

[1]3D laser scanners create "point clouds" of data from the surface of an object. In other words, 3D laser scanning is a way to capture a physical object's exact size and shape into the computer world as a digital 3-dimensional representation. (ww.laserdesign.com/learn_more.aspx)

[2] Laser scanner data consist of set of points in 3D coordinate system that are defined as X,Y,Z coordinates.

entire architectural construction of Uçhisar houses holistically (see app. B). At the end of the 3D modeling, a typical construction scenario of an Uçhisar house was framed, as an outcome of the study (Figure 1. 5).

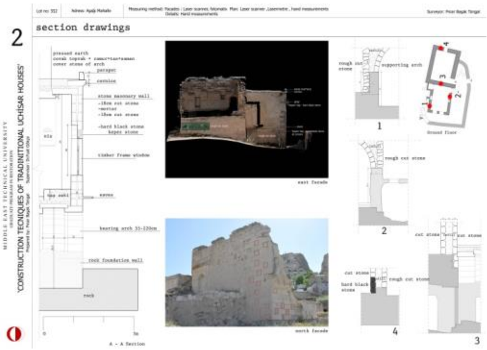
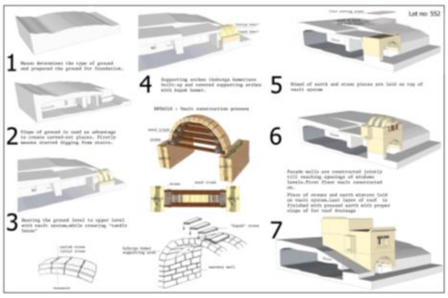


Figure 1. 4 Survey sheet including ortophoto of building



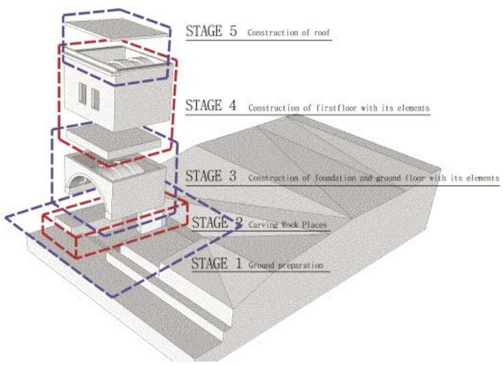


Figure 1. 5 A script of a building visualized within 3D models

CHAPTER 2

HISTORY & GENERAL FEATURES OF CAPPADOCIA & UCHISAR

2.1 GENERAL FEATURES AND HISTORY OF CAPPADOCIA

Cappadocia is a large plateau lie on volcanic area extending over the provinces of Kayseri, Nevşehir, Aksaray, Kırşehir and Niğde in Central Anatolia Region in Turkey. The region is limited from south to extending of Mt. Taurus, from west to Tuz Lake, and in east with Mt. Erciyes, in north with Kızılırmak River. Region is bounded by several volcanos, Mt. Hasan, Mt. Erciyes, Mt. Melendiz and Mt. Göllüdağ (Figure 2. 1).

Figure 2. 1 Cappadocia region borders (based on google earth map)

The boundaries of Cappadocia have been changed during ages, while the main part of region always remained same, consisting of Nevşehir, Aksaray, Kırşehir, Kayseri and Niğde. Comparing to today's definition of Cappadocia borders, in antiquity the region of Cappadocia had comprised large geographical area. Before 6 BC the region boundaries was reaching to the Black sea, while region had split in two parts. One, was called Cappadocia of Black sea or *Pontos* and the other one was called Big Cappadocia, which was covering borders of today's Kırşehir, Nevşehir, Aksaray, Niğde, Kayseri, Yozgat, Malatya, east of Ankara, south of Sivas and North of Adana (Andolfato and Zucchi, 1971).

The name of Cappadocia firstly mentioned in Persian inscription. The word is '*Katpatuka*' was on the inscription which is written on column from the period of Persian King I. Dareios (522-486 BC). '*Katpatuka*' means 'country of beautiful horses' in Persian language. On the other hand Historian Pliny the Elder's definition of region of the word Cappadocia came from the one of the tributary of the Kızılırmak River called *Kappadoks* (Sevin, 1998). Another assertion is made by Prof Dr. Bilge Umar. According to him in the book of *Kappadokia,* word of Cappadocia came from Anatolia. The name of Katpat, which is the main body of word, comes from the *Khepat* (Hetap) that the mother goddess of Hittie. –uka is a suffix which is used in the period to create folk and nation names. Thus, *Khepat-ukh* means '*Khepat* folk' or 'country of *Khepat* folk' in use of Persians.

Cappadocia geographical formations are shaped by tuff sediments which are unique example of differential erosion effects by water and wind[3] (Figure 2. 2). The volcanic mountains around Cappadocia region, especially Mt. Hasan and Mt. Erciyes, efficiently effected on geographical formations of the region. Approximately 25 million years ago, formation of geographical feature was started. During regularly eruptions of these volcanos around region, throughout the centuries , the lavas of mountains flow out and accumulated big amount of volcanic ashes and lava layers. These lavas spread out 170 km from north to south, 150 km from west to east area

[3] Göreme National Park and the Rock Sites of Cappadocia - UNESCO World Heritage Centre. (n.d.). UNESCO World Heritage Centre. Retrieved September 10, 2014, from http://whc.unesco.org/en/list/357/

(Tuncel, 1998). Geological rocks like tuff, tuffite, sandstone, basalt, clay, marl and volcanic ash were created by different hardness and thickness of ashes and lavas (Tuncel, 1998).

After volcanos were deactivated, the typical features of tuff sediments such as fairy chimneys, pillars, columns, towers, obelisks and needles were shaped by continuous with effects of wind, climate, rain and rivers.[4] While sharp heat changes and oxidation were became reason for colour variations in some part of hillsides; tuff sediments started to have different shapes by erosion under the effect of rock content's, wind and flood. (Tuncel, 1998).

Tuncel (1998), classified fairy chimneys by their shapes in four different types; capped, mushroom shaped, conical, columnar and pointed. Other kind of geographical formations are valleys which also brings hillside formations. Güvercinlik and Kılıçlar valleys are the sample of valleys. Among the people of region, high tuff structures, occurred by erosion of ignimbrites called as castle, and these castle are approximately 50 meters high from ground level. Uçhisar, Ortahisar and Ürgüp (old name Başhisar) three sample of these fortress (Tuncel, 1998) (Figure 2. 3)

According to topographical feature, the region is separated into four areas. First area is northwest side of the region which has 1500-1700 meters height above sea level. The area has curvy fundaments that are shaped by the erosion. Second area is geographically called Lakes and Plateau region, surrounded by Mt. Melendiz, Salt lake subsidence and alluvium plateau of west part of Aksaray. Third area is the first degree volcanic region, lied on 250km length, surrounded by the Erciyes, Dereli, Melendiz, Keçiboydoran and Hasan Mountains. Last area, the antic plateau lied on east of the Red River basin of the river valley extending to an altitude of 1000-1500m covered by tuffs and Acıgöl region (Binan, 1994).

Due to all unique natural formations and characteristic settlements of Cappadocia region, in 1970, by the General Directorate of Ancient Arts and Museum of Ministry,

[4] Göreme National Park and the Rock Sites of Cappadocia - UNESCO World Heritage Centre. (n.d.). UNESCO World Heritage Centre. Retrieved September 10, 2014, from http://whc.unesco.org/en/list/357/

the first study of planning was started. General Directorate of Ancient Arts and Museum of Ministry set the boundary of region in 1/25000 scale. *Decision no: A-69, July 10th 1976*, High Council of Immovable Monuments and Antiquities' approved established boundaries. According to that decision, Nevşehir province site boundaries included four districts, five towns and twelve villages. Included four districts were; Historical and Natural Site, Buffer Zone, Tourism Settlement, Existing Settlement (Coşkun, 2009).

Figure 2. 2 Tuff formations in Cappadocia
(Nevşehir Belediyesi)

Figure 2. 3 Mushroom shaped fair -Valley of Göreme chimneys
(Nevşehir Belediyesi)

In order to tourism potential of region, developing area for tourism with the light of conservation principles, authorization of plans was taken by Ministry of Tourism, in 1981 and were completed in 2003. In 1976 Özlüce Village, in 1981 Mustafapaşa and Göreme Valley and later in 1982 Uçhisar and Avanos added to boundaries of site and published in official newspaper no: 18225 - November 18th 1983.

UNESCO's list of "World Heritage", No: 357, December,6th,1985 ,Göreme Valley was enlisted as a cultural and natural heritage in UNESCO's list of "World Heritage". The entire territory between the cities of Nevşehir, Ürgüp and Avanos is designated as a 'National Park' under the Act No. 2873 with the decision of Council of Ministers on October 10th 1986. Enclosing Göreme, Çavuşin, Uçhisar, Ortahisar and Zelve Göreme Historical National Park area is 9.572 ha.

Decision no: 1112, November, 12th, 1999 Boundries of region was enlarged to four districts, nine towns and fifteen villages by Nevşehir Council for Preservation of Cultural Heritage. And in 2001, Ministry of Environment and Forestry gave start preparing of 'Göreme National Park Long Term Development Plan'. In 2005, the region was evolved to 'Cappadocia Culture and Tourism Conservation and Development Region' with the cancelation of boundary line of 'Tourism Area for Nevşehir and its Periphery', and the site was promulgated as 'Tourism Conservation Development Area', there with legal responsibility of region was taken under control by Ministry of Culture and Tourism.

History of Cappadocia

From the archeological findings, which are from Paleolithic Age in Cappadocia pre-history major on Neolithic age (8000-5500 BC), Calcolithic Age (5500-3000 BC) and Bronze Age (3000-1200 BC), understood that Cappadocia is inhabited from prehistoric times (Giovannini, 1971). During ages so many communities lived in Cappadocia (Table 2.1). These communities effect to the other nations, due to language, religious and sheltering issues. Between 3000-2000 BC (Bronze Age), Hattis, Luvis and Hurrians, had been existed on Anatolia. From the 1900 BC, scripture entered to Anatolia by Assyrians which is admitted of Historical ages in Anatolia. Assyrians era called Assyrians Commercial Colonies Era because of the Assyrians established first commercial colonies in region (1900-1800 BC). First examples of free zones – city states in Anatolia settled around 1900-2000 BC. After Assyrians' era Hittite Empire started to control region. According to tablets, first settlement area of the empire was established in Kuşara, close to today's Çorum and Neşa, close to today's Kayseri. Later they moved capital city to Hattuşaş near Çorum Hittite history can be divided in three main periods; first is The old Kingdom between 1800-1400 BC. Between 1400-1200 BC named as New Kingdom -The Great Hittite Empire and the last one is the neo Hittite City States dates between 1200 -717 BC. With the 'Aegean Emigration', in 1200 BC, biggest civilizations as like lost power and started to fall down in time. In mean time, Hittite Empire one of the most powerful empires started to fall in Anatolia by the effect of emigration results. Hittite Empire fall down; but many city states occurred in Anatolia. One of the city states was The Kingdom of Kabal wich was established between 900-680 BC in Cappadocia region.[5]

After the destruction of Hittite Empire into many city states, Phrygians established in Anatolia and Gordion, near Polatlı, was the center. Phrygians was destroyed by the Cimmerians who continued destroying many Ionian cities such as Miletus and Smyrna. Most parts of Anatolia were under the domination of the Persian Empire after Persians defeated Lydia. Domination of Persians between 547-331 BC was ended with collapsing by Alexander the Great who was the king of Macedonia in 331 BC. The name of Cappadocia for the first time was mentioned in Persian script as '*Katpatuka*' which means 'beautiful horse land'.

After destruction of Persians, the Kingdom of Cappadocia was settled until recognizing the domination of Romans and became one of the provinces of Romans in 17 AC (Elford, 1992). During Roman period Kayseri, Avanos and Kemerhisar were the important center of Cappadocia. With attacked of Sassanids who dominated in Iran and under threat of Goths who entered Anatolia from Thrace, Roman Empire

[5] KAPHİB,T.R. - Ministry of Culture and Tourism - General directorate of information-Destination Cappadocia

lost power and divided into two. Cappadocia was in the east part of the empire. In Roman period of Cappadocia, Christianity was sprawling fast and diversified because of the different interpretations. In order to defence and for praying Christians communities moved on and took refuge rock parts of Cappadocia. First rock monasteries built in these years. Göreme mentioned as ‘Korama’ and Zelve were the first settlements in area. Sassanies had conflict with Romans and attacked continuously. The people lived in Cappadocia, started to carve underground cities or hid in rock carved cells in order to protect themselves from raids of Arab and Sassanies armies (KMDR, 2002). Derinkuyu and Kaymaklı underground cities were dated this era. Another affair that accelerated carving out of rocky part of Cappadocia was Byzantine Iconoclasm. Iconoclasm which is the deliberate destruction was a period between 726 and 843. Emperor Leon III forbid the icons and paintings of churches. The supporter of the cross current moved in to rocky places and carved out many churches with icons, especially in Göreme. Another empire was the Seljuks which defeated Byzantine Empire in battle of Manzikert (Malazgirt) in 1071.

After Manzikert victory Turk society moved on Anatolia. The Sultan Alparslan authorized Turcoman generals to establish their own principalities out of formerly Byzantine Anatolia. Danhmendis was one of them which placed in eastern Anatolia including Cappadocia (1086-1178). After Kose Dağ War between Seljucks and Mongols in 1243, Seljuck domination ended in Anatolia and after 1277 Mongols controlled the region. The Cappadocia region was under the control of by governors of few Eretnids. From 1328 to 1381, Eretnids ruled large region in Central Anatolia extending between Kayseri, Sivas and Amasya. Meanwhile Mongol Empire established civilization around Central Asia, Iran and Mesopotamia, Ottoman emirate and Karamanids a Turcoman principality were most competitors each other in Anatolia. In 1402 Ottomans and Mongols under the command of Tamerlane had Ankara battled. Ottoman armies were defeated; Mongols left administration of lands to Karamanids. In 1483, with the attack of Ottoman Empire which gained power in Anatolia, Karamanids was destroyed and after that Cappadocia was reign by the Ottoman Empire.

Table 2.1: Chronology of Cappadocia History

THE CHRONOLOGY OF CAPPADOCIA HISTORY	
3000-1750 BC	Assyrian Trade Colonies
1750-1400 BC	Hittite Kingdom
1400-1200 BC	Hittite Empire
1200-1100 BC	Arrival of Sea People to Anatolia
1100-950 BC	Phrygians
800 BC	Revival of Kingdom of Tabal
950-585 BC	Cimmerian-Scythian Invasions
585-334 BC	Achaemenid Persian Era
334-335 BC	Macedonian control during Alexander's Invasions
334 BC-17	Kingdom of Cappadocia
17-395	Roman Empire Period
395	Eastern Roman Empire (Byzantine) Period
1072	Arrival of Turkish Clans
1086-1175	Seljuk Era
1175	Seljuk Sultanate of Rum
1243	Battle of Kose Dag
1307	The end of Seljuk Sultanate of Rum
1318	Ilkhanid and Eretnid Governors' Administration
1340	Autonomous Eretnid State
1365	Karamanid
1398-1402	Ottoman Rule
1402	The Battle of Ankara, Ottoman Interregnum
1436	Murad II captured Cappadocia
1482	End of Karamanid Dynasty
1867	Nevşehir shire annexed to Niğde
1902	Nevşehir annexed to Ankara
1954	Nevşehir became a city

General Features of Cappadocia

Clearly understood from the historical development of Cappadocia, the region has been hosting people from different beliefs and culture that lived together at a time.

For instance, during Ottoman Empire period, the social structure of region was consisting of Muslim, Orthodox Greeks and Catholic, Protestant and Gregorian Armenians. However, after Ottoman Empire period, two important breakpoints were occurred on social structure of region. First one, the non-Muslim population of Cappadocia was immigrated to Greece, with the protocol in 1923 Lausanne Treaty which brought the decision of population exchange between Turkey and Greece (Geray, C., Keleş, R., Yavuz, F., Hamamcı, C., 1983). Another emigration to Cappadocia that effected social structure of region was occurred when industry of Kayseri developed with the help of government investments (Binan, 1994).

Socio - cultural aspects of economic structure of Nevşehir based on agriculture and tourism, and related is influenced by the dynamics. Because of the continental climate around region, not many types of farm products are produced; whereas wheat and potatoes are primary agriculture products. Husbandry is another dynamic in agriculture where the viniculture is the most important field (TUIK, 2013). Viniculture plays important role in wine producing industry. The vineyards in Cappadocia region are noted in rocky structures for producing wine. Rocky structure which is not rough can be easily carved and wine callers can be prepared in. Rock carved places are cool with a stable temperature that provides really good conditions for producing wines[6]. More than fifty percent of geographical landforms of area are plateau, occurred by lava of volcanic mountains spread out large area. However, against long odds, region does not have range land. This is the reason of why livestock does not have big percent of role on economic structure (TUIK, 2013). Since tourism industry rapidly accrued in region, old cultural traditions consist of pottery, carpet and rug weaving revived by local people, in order to contribute economic standards.

[6] KAPHİB,T.R. - Ministry of Culture and Tourism - General directorate of information-Destination Cappadocia

One of the traditions is carpet and rug weaving. Aksaray, Kayseri, Niğde and especially Nevşehir are almost naturel carpet weaving ateliers. Ürgüp and Avanos are known with carpet weaving, while the rug weaving is prevalence in Kozaklı and Gülşehir (TUIK, 2013). Historical and natural structure of Cappadocia region attracted people, since the region was became 'Tourism Development Area',in 1973. Then rapidly tourism became one of the important factors in economic structure of Cappadocia region. Another sharp tourism development occurred when the region was declared by the name of "Göreme Natural Park and the rock sites of Cappadocia" as world heritage site by UNESCO in 1985. After declaration of heritage site, tourism activities were fed with written and visual advertisement, movies and tv series in worldwide. World's attention and interest speed up on side. Just in Nevşehir, 5 museums , 13 historic sites, 350 churches and approximately 8 underground city that can be visited and 1 antique city (Sobesos) are enough to attract tourist to region (TUIK, 2013). People from all over the world has begun visit Cappadocia region not only for historical sites and geographical features, also having outdoor activities in unique nature of Cappadocia.

2.2 GENERAL FEATURES AND HISTORY OF UÇHISAR

As mentioned before Nevşehir province is one of the important center of Cappadocia region. Uçhisar, study case of the thesis, is a town of Nevşehir province, that set on 7 km far from Nevşehir city center within 3874 population (Türkiye Istatistik Kurumu, 2013). Town is placed between in east with Mt. Kermil Mountain and in south with Mt. Akdere (Mt. Uçhisar). Mt.Oylu and Mt.Kepez are other mountains around Uçhisar. Uçhisar is hillside settlement having typical geographical features of Cappadocia with fairy chimneys, while covered with large area of valleys as another naturel value. Pigeon valley is the biggest valley, 4km distance connecting Göreme and Nevşehir-Ürgüp highway, in Cappadocia region. The name of the valley comes from pigeon feeders (Figure 2. 4). The people carved-out pigeon houses on slope of the valley and fed pigeons in there. Ordure of birds were collected, in order to use as fertilizer in gardens and vineyards.

Placing in Middle Anatolian climate line that continental climate is efficient, winter is cold, summer is hot-dry, and autumn and spring are rainy in Uçhisar. The strong north wind and south wind which is the most intensity wind (*Kıble* and *Lodos*) have been effective on tuff sediments shaping phase (Figure 2. 5). Town has highest fair chimney in

Figure 2. 4 Uçhisar view from the valley – 2012

Figure 2. 5 Fairy chimneys in historical part of the city- Panoramic image

region, ‘Uçhisar Castle’. Uchisar Castle has two, close and sharp erosion columns. The bigger one is known as *Ağanın Kalesi*, while the relatively smaller one is called *Çavusun Kalesi*. The castle almost resembles a skyscraper

with its outstanding heights of 50 meters from the south and 100 meters from the north. It also hosts for plenty of carved-out and a big cister. Cevizli fairy chimneys when looked down to the north, Nevsehir and Oylu mountain on the west, new settlement of Uchisar right in front, and the top of Hasan mountain from the southwest part can be seen from Uchisar castle. It has been carved and a lot of rooms, houses, shelters, storages, cisters, graves, cellars are built in since Roman era, so that it has been a very important defense spot during Arabic invasions. Several big cannon balls which are used to protect ones from the attackers have been found in the castle. With its uses as an observation deck and as a defense spot, Uchisar castle was also pretty important at the era of Seljuks and principalities.

Beside castle, three tuff creations, called Tığraz castle, Black castle and Quran castle another impressive examples of fair chimneys. After Uçhisar castle, second biggest fair chimney, placed in hillside settlement is Tığraz Castle. It is placed in Güvercinlik Valley as an underground city, having warehouse, tunnel and cellars. Because of the black coloured volcanic formation top of the chimney, other castle is called Black Castle. The other chimney is called Kuran (Quran) Castle. The region of the name comes from the old tradition that in the respect of Arabic language (Quran language), Arabic written documents such as receipts or Islamic faith books had been collecting in this fairy chimney instead of throwing them away[7]. However, today none of them left behind.

Other formations most seen in region are valleys, Kermil (Gemil), Güvercinlik, Karankemer and Bağlıdere valleys. Around town beside natural values, there are also many cultural and historical buildings and other types of architectural belongings such as fountains, churches, mosques. Being a sub-region of Cappadocia, Act No. 2873 with the decision of Council of Ministers enacted on October 10th 1986, Uçhisar became a part of Historical National Park area. The Conservation

[7] Ministry of Culture and Tourism - General directorate of information-Destination Cappadocia

Development plan of Uçhisar that had started to the preliminary research process by the date 30.06.2006, was approved by Environmental Planning Ministery in 2014 (Figure 2. 6).

Like its geology, it is not possible to separate the history of Uçhisar from Cappadocia history. As in geology thereof, Uçhisar occupies a special and important place in the history of Cappadocia. Throughout history Uçhisar had been border region of civilisations which were ruling over this region. It was locating in the eastern border of Seljuk, in the western border of Kadi Burhanettin Princedom, and eastern border of Karamanoğulları. It is foreseen that the city is called Uçhisar, due to it used to be take place in borderline of nations.

There are a lot of rock carving spaces such as storehouse, tombs and cellars dated from Roman Empire. City was used as a centre of protection and defence due to its position during the Seljuk, Princedoms and Ottoman periods. The roots of castle observed in the Uçhisar go back to the Hittites. There were two another castles in region. One was in Ürgüp and one was in Ortahisar, which create a protection and defence line with Uçhisar. There was a dense population living in Uçhisar, which was a “border princedom” in that period.

It is known that Uçhisar surrendered to Bayezid II, once the Ottoman State occupied the region from 1398. In the very first census held in 1530, it was found out that 3000 people lived in Uçhisar. In the 16th century, Uçhisar was the centre of a small town to which 34 villages and 19 hamlets were annexed, including the present provincial centre Nevşehir and the present town centre Gülşehir. In the 17th and 18th centuries, the Ottoman Grand Vizier Damat İbrahim Paşa made investments in Muşkara annexed to Uçhisar and made it a prosperous place and changed its name to Nevşehir. At present, Uçhisar is one of the most popular districts of Nevşehir and Cappadocia region (Uzunçarşılı, 1974).

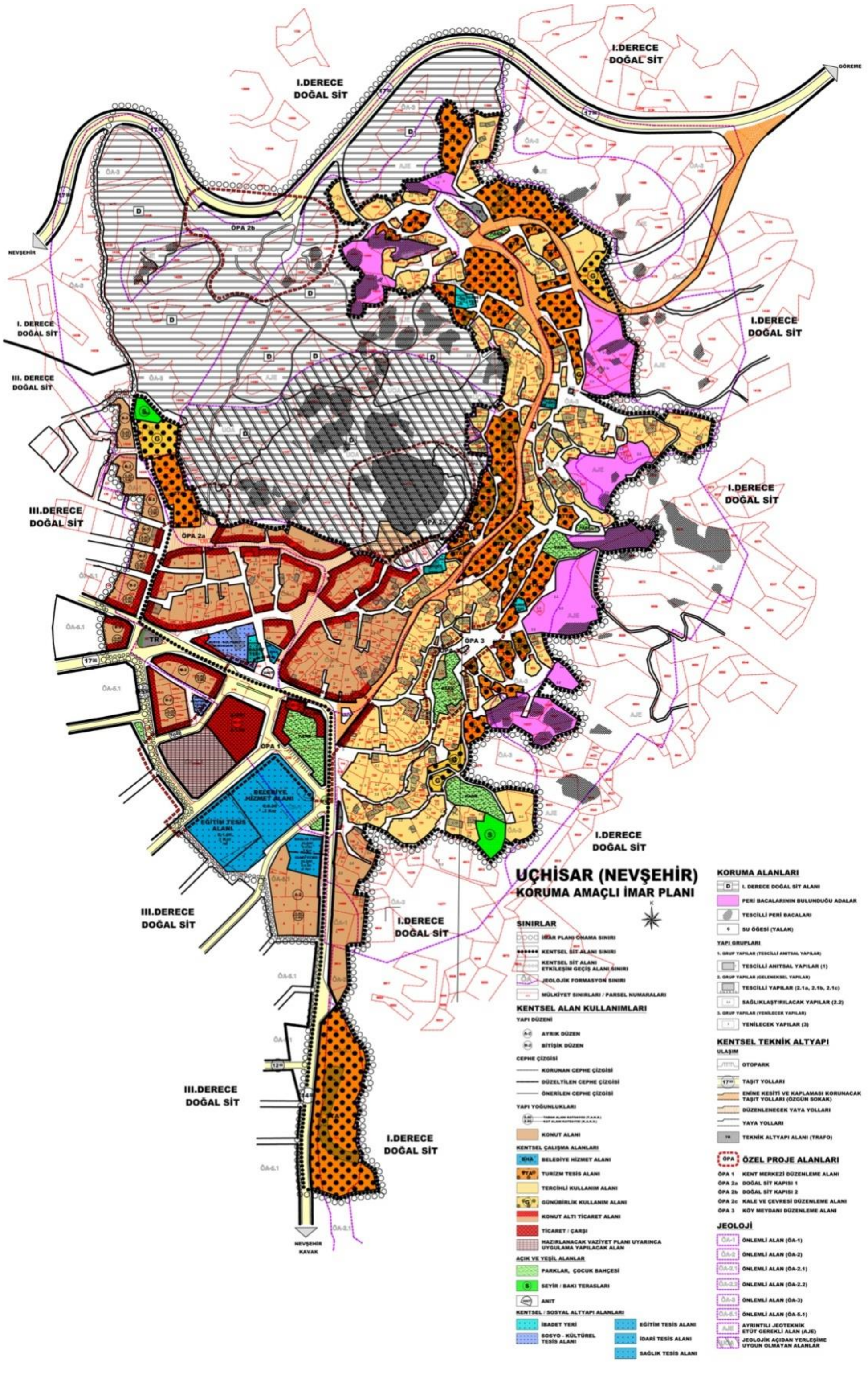


Figure 2. 6 Uçhisar Conservation Map

2.3 GENERAL FEATURES OF TRADITIONAL HOUSES IN CAPPADOCIA WITH EMPHASIS ON UÇHISAR

In context of the thesis, this part of study is based on quality works already carried out about the Cappadocia region settlement and housing. The underlying studies were fed with field work and observation of author.

Ongoing turf wars during historical background, safety needs, and defensive requirements became first important factor together in formation of traditional settlements in Cappadocia with benefits of topographic features of region on establishing settlements. Uchisar, Ortahisar and Ürgüp (Başhisar) were formed as important defensive points of the region. Under the respect of from that point, Binan (1994) grouped region's traditional settlement types under three main headings (Figure 2. 7).

Underneath cities; low natural defensive qualities places underlying lowlands with multilayered settlements. Derinkuyu and Kaymaklı are example of underneath cities in region. These settlements can be developed on one level or more levels that overlay each other. All of the rooms and facilities are carved underneath, thus the connections between rooms and roads are made by tunnels. To isolate and defend large sectors of the underground system "millstone-doors" were used. These doors could only be open from inside.

Settlements established on valley slope; settlements excavated into rock slopes of valley regarding defensive requirements. The rooms are connected to each other with horizontal tunnels. They may be arranged more than one level that connect by vertical shafts. On the external surface of rock may be placed small windows. The roads that developed outside of the settlements lead to the other settled areas. Göreme, Ürgüp, Çavuşin, and Zelve are accepted in this type of settlement.

Settlements established on giant tuff rocks; are dug inside big fairy chimneys called as castle on purpose of defencing with high defensive qualities. Uçhisar and Ortahisar are example of third type of historical settlements

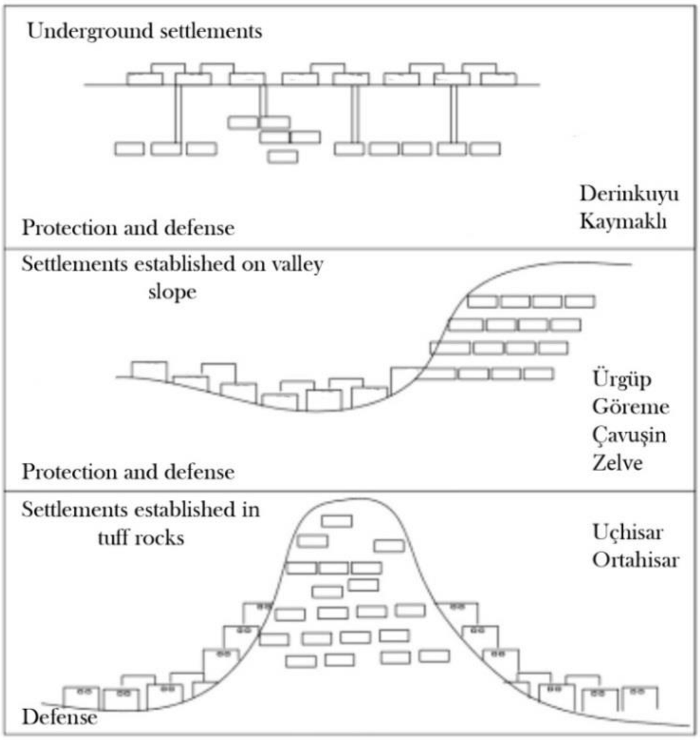


Figure 2. 7 Cappadocia settlement types (Binan, 1994)

Concerning effects of defensive behavior on Cappadocia settlements, the book 'Place Making' published by David Stea and Mete Turan, Cappadocia houses mainly grouped as carved-out places and built-out places. While carved-out places, negative places, created by carving rock formation as subtractive places; built-up places, positive places, constructed as additive places (Figure 2. 8). According to this model of places, carved out places are more depth, with less covered area on surface, strong defense organism and well- camouflaged places. On the other hand two or more storey dwellings with more area covered on surface were social status and social prestige indicator. Both, in terms of size and decorative elements show of social status within that community of dwelling owners. However, even though carved-out places represent low level of social status than built-up housing, depending on the topography of settlement a significant pattern of carved-out places for defensive purposes and transitions between each other, could be said that carved-out places for housing differentiate in terms of the establishment of the caves. Considering the historical process of places, when the spaces that spill out of the rock carving sites along with the start of the articulation of masonry buildings was begun. It was the first steps to be taken for the development of traditional construction methods in the region (Figure 2. 9).

Carved-out places ❯ Negative space → Substractive space

Built-out places ❯ Pozitive space → Additive space

Figure 2. 8 Cappadocia analysis space (Stea -Turan, 1993)

Earliest sample of housing are carved out places that are followed by mixed construction technique. Development of place reaches up the last stage with masonry houses. In this context, the formation of tissue in Cappadocia Erençin (1979) assigns the traditional houses into three main categories, depending variation of materials and layout patterns.

Rock-carved houses; places are generated by carving out , vertically or horizontally as far as rock formation allows, valley slopes or in fairy chimneys. These are the earliest samples of housing. Under need of more spaces new places can be carved connecting to existing places.

Masonry houses; stone masonry buildings, two or three storied which are not physically in relation with carve-out places.

Mixed technique of rock-carving and masonry houses; places are created by built-up masonry structures addition to the main rock-cut space. In this type of housing built-up part of house established under need of enlarging spaces. While addition part can be built in front of the main rock structure; some can be established on top of rock places as a second storey.

In masonry buildings construction systems of Cappadocia, as well as seen in Uçhisar, rib vault, became most characteristic traditional superstructure (Figure 2. 10). This system, different from common vault, the built-out units are composed of the stone masonry walls spanned with a vault superstructure created by a set of arches placed 60-70 cm far from each other. Than gaps between the arch systems is closed with another set of arches . From the source of L'art de batır chez les Romains, in roman baths similar rib vault system can be seen in the drawings. This vault system is also seen in Romans that can be assumed, it may arise with cultural ineffective during the period of Romans ruled over the region (Figure 2. 11-2.12).

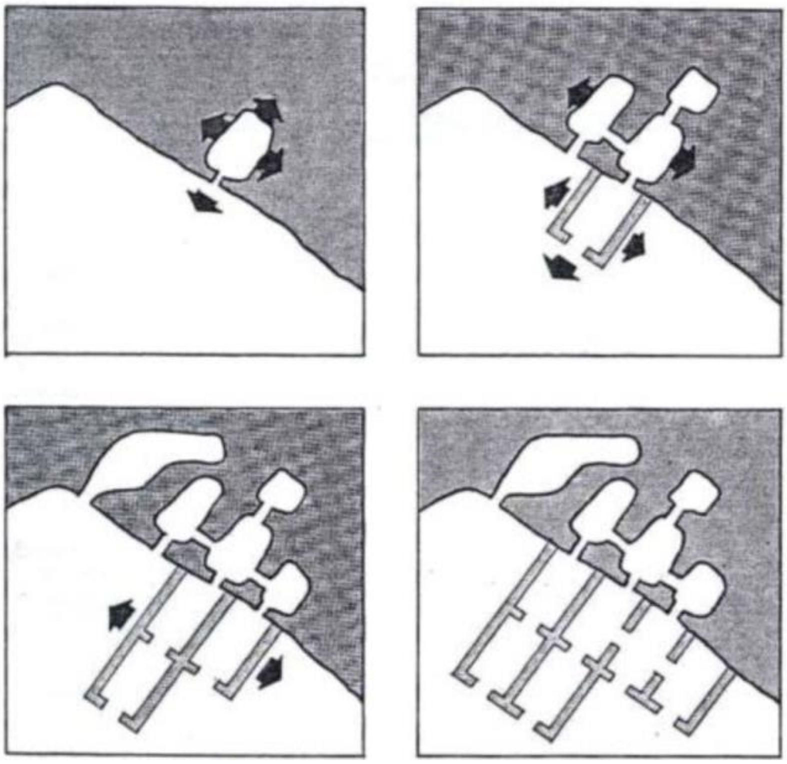


Figure 2. 9 Cappadocia organizational development scheme of space
(Stea-Turan, 1993)

Figure 2. 10 Rib vaults used in Cappadocia

Figure 2. 11 Rib vault system used in Cappadocia

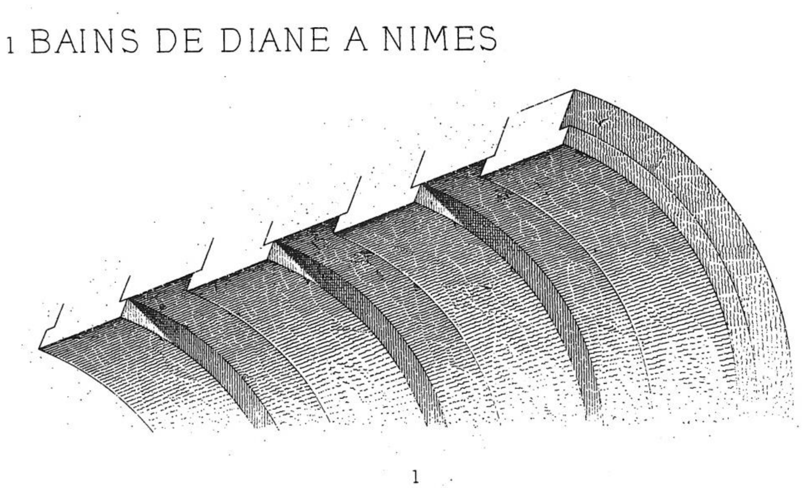


Figure 2. 12 Vault system that is used in Roman bath structure (Choisy,1873)

Just as in Cappadocia, Uchisar pattern of village shaped was shaped with the effect of geography and the defense behavior. Defining Uçhisar traditional pattern and housing, under the light of generally settlement pattern and housing features of Cappadocia, Uchisar castle - one of the main reason is being defense center in Cappadocia region- and its surrounding are first settled area in city. The castle carved as vertical and horizontal conjunct spaces which eligible to have specialization defense. Up to dates of 15th century the castle was used for the purpose of defense. Over time, expanding and increasing population in the region, rock carving sites spread to south-eastern facade of the castle, to the slopes against the Pigeon Valley area. Another leap has been in the north-western fairy chimneys. From at the end of 16^{th} century, carved out of rock venues extended out since masonry structures began to articulate to the rock carving places. With spread up settled areas, street pattern started to shape as parallel to the castle.

Masonry structures and carved rock spaces shaped in a way that geography of area allows and under the need of more places opened new rock venues developed and intricate landscape planning format. Today these intricate structures of rock urbanization caused a problem while the ownership of a masonry building on the lot belongs to an owner, the ownership of the rock-cut space spanned under that masonry building in neighbour lot belongs to other person. This problem has been resolved today by taking certificate of consent from the neighbours.

Houses in traditional settlement of city generally have courtyards surrounded by high level walls for privacy settings of routine daily life. Walls of the courtyards can be built with rough cut stone or cut stone. Entrance of courtyard is generally formed by double winged with arch. Courtyard is an essential component of plan typologies. Because rock carved places such as kitchen, storage, stable and toilets which constitutes of each house’s origin opened directly or indirectly to courtyard. Built on slope of hillside buildings which brings gradual structuring, connection between upper and lower level provides through courtyards by stairs. Toilets are kept in courtyards.

2nd floors are always configured keeping respect to view of the building that set on behind it. As a result of intricate and complexity of rock carved places typical plan schemes did not occur and different type of plan schemes can be seen in houses.

In Cappadocia, because of the nature, the stone is main used construction materials in the region that varies due to different content, in different localities. General character of stones produced from around Cappadocia used in buildings and provides warmer conditions to buildings in winter period and cooler in summer period. The other materials that are widely used in traditional Cappadocia houses are wood and iron. Cappadocia houses, especially focusing on Nevşehir houses, have two or three storeys constructed upon carved-out places which are used as storage, stable or '*tandır*' houses. Superstructure of spaces can be made of rib vault or timber beam system. Common known vault is also used another superstructure in region. Since buildings are set on slopes of valleys flat roofs are built on purpose of creating terraces; another roof structure type that used are hipped wooden roofs.

Talking about general units in Cappadocia houses, main units can be listed rooms, *sofa*-aiwan, kitchens, *tandır* room storage rooms, toilets, stable, feed, storage, hayloft.

<u>*Rooms*:</u> Room is the basic units of houses that can be placed in both upper and lower floors. The number of rooms in a house changes due to population of family and economic factors of family. Room could be either a unit in masonry structure; or dug in rock-cut buildings (Figure 2. 13). While courtyard and upper floor of house generally used in summers, ground floor rooms are generally used in winter, using *tandır* as heater addition to cooking. Rooms are also places where women weave carpet or rug; besides eating, sleeping or gathering places of family (Erençin, 1979). In the room, in order to help organizing daily life needs, some architectural elements such as *seki*, *pabuçluk, sedir, sergen, yunmalık,* fire place, cupboard, niche and lamp niche can be found.

<u>*Sofa-Aiwan:*</u> *Sofa* is a semi-open space opened from one side, covered with vault or '*hezen*' and closed from other three sides. Sofa can be built in ground floor and upper floor where some houses have more than one sofa in a house. Open side of the upper floor sofa façade can appear with one, double, triple, quarterly arch or hanging arch system (Erençin, 1979). The one placed in ground floor is used as *tandır* room during summer and named as 'summer kitchen' (Figure 2. 14).

Another type aiwan is closed or ended with an open balcony. In Uçhisar houses, opened aiwans are seen in bigger houses such as mansions that shows of economic status of owner, more modest houses do not have open aiwan in upper floor.
Kitchen: Places connected directly or indirectly to storages or *tandır* room. Different than contemporary kitchens, traditional kitchens does not include water installation. Water used to be carried in bowls from fountain of the city. The fireplace is the main element of the kitchen for cooking purposes.

Tandır Room: *Tandır* room is a vaulted room with *tandır* to use for cooking purposes which is placed in ground floor in front of the kitchen (Figure 2. 15).

The *tandır* is an Kitchen generally used during winter period, while the *tandır* room is take place of architectural element that is created by carving the ground in the room. The size of the *tandır* can be mentioned as 40x45x50cm (Erençin, 1979).
kitchen during summer time within all activities (Erençin, 1979). During summer time women are spent their day time mostly in *tandır* houses.

Storage Room: The places where food and other things are stored in houses. Generally rock-carved places are used for storages. Due to easy carving of rock, there are many sizes of niches and carved out cupboards on the walls. These places are generally connected to kitchen; but some of them are connected kitchen indirectly (Erençin, 1979).

Toilets: Toilets are built in courtyards above few steps from courtyard floor. Generally at least one wall of toilet leaning against the courtyard wall which gives opportunity to reach toilet reservoir from street (Binan, 1994). It is constructed with rough cut stone and covered with wooden beams.

Stable ,Feed Storage, Hayloft: If the house is on slope of hillside, stable is carved out to rock, just under rooms covering same size of upper room or even larger. In some examples, barn is just adjacent to a winter room separated with wooden panel. These type of rooms are called '*ahır oda'* (stable room) (Interview, 2012). Stable rooms are found as solution for cold winter to take advantage of warm temperature of animals. The landscape that not allow to carve, stables are constructed in masonry structure covered with *hezen* or vault system. Entrance of barn is through courtyard or directly from street (Binan, 1994). Another place which is connected with stable is feed storage to feed livestock. This place can be also carved to rock and/or built depending on how stable appears.

Figure 2. 13 Vaulted room – Rock-cut room

Figure 2. 14 Ground floor aiwan – Upper floor aiwan

Figure 2. 15 Tandır room and Tandır

CHAPTER 3

CONSTRUCTION TECHNIQUES USED IN TRADITIONAL UÇHISAR HOUSES

While understanding the traditional construction systems, one of the important issues that must consider is what kind of tools and materials used for buildings construction. These two issues give strong clues about geographical and geological properties of area, working style of craftsmen and construction methods.

3.1.1 TOOLS

In the process of rock carving and masonry construction, the tools that are used very identical. Tools, used in construction process can be listed as; pickaxe locally called *külünk*, bellow and anvil, wedge and sledge, robe and nails. Straightedge and plump attend to these tools during construction of masonry part. *Külünk* is local kind of pickaxe used for carving rock and breaking apart to stones. In order to digging easily, pickaxe needs to be cornered shape on edges (Figure 3. 1). The tip of the hammer starts to become dull after workingfor a length of time Then pickaxe is beat up with bellow on anvil to sharpen its tip to work fluently again. Today the head of the used *külünk* are manufactured as portable. When it loses sharpness, instead of beating it up, the head is removed and the new head insert to the body (Figure 3. 2).

3.1.2 MATERIALS

The selection of material is differs by considering compliance with function of structural elements that will be constructed, availability and accessibility of material in region. The working characteristic and potential of materials are other aspects of choosing materials that gained by masons within their experiences. Thus, in Uçhisar houses mainly used materials are rock and stone, as well as wood and iron are other used materials.

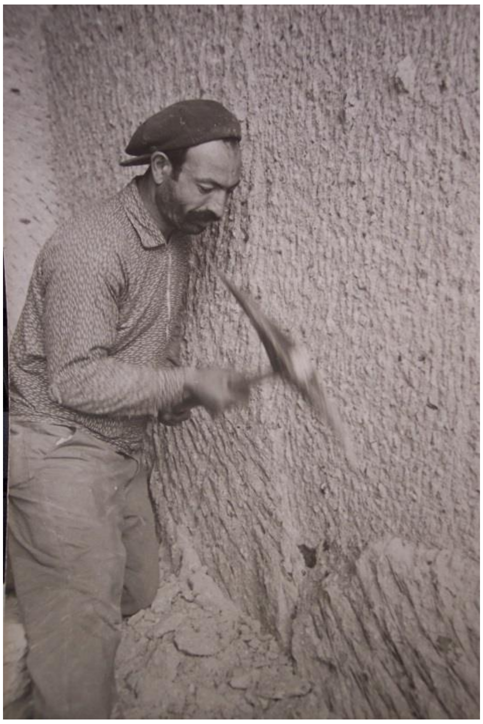


Figure 3. 1 Traditional '*Külünk*' (Hasan Baş)

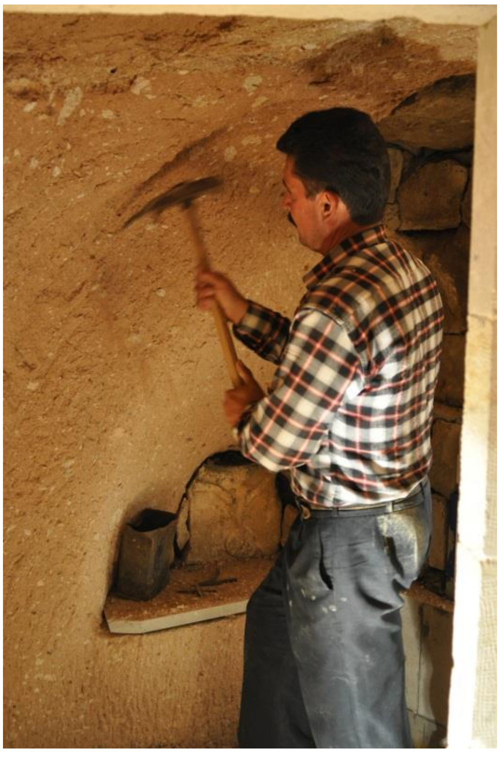


Figure 3. 2 New portable head '*Külünk*'

3.1.2.1 ROCK

In Cappadocia region and Uçhisar, rock is the main material used in creating places and constructing of buildings. While rock used to create the rock cut spaces, also emerges as the raw material of stone production, depending on rock types. There are different types of rock formations as mechanical character, water hold capacity, hardness and different colours depending on minerals contained by rock. These feautures are issue of other specializing fields.

Via the information gathered from interview with masons, it is may say that local masons, divide rocks two main groups differentiated by physical features which directly effects on workability of materials; '*tuff rock*' and '*stone type rock'*. Tuff rocks hold more water. They are soft material that easy to dig; thus that type of rock has proper conditions for carved-out places, especially using as storage to stock fruits. However, this type of rock is not assumed to have proper features shaped as stone block to use in long standing building structures. On the other hand, stone type rocks are hard to carve and shape which decreases working time; but provides rigid and durable stones. These stones are suitable for using in masonry structure system.

In Uçhisar, local masons determine rocks types as '*Sarı uşak'* and '*Kiste boğazı'.* '*Sarı uşak*' rock type is soft rock, eroded easily which seen mostly around Sarı Uşak district (Figure 3. 3). '*Kiste boğazı*' rock type has redish colour and describes as gravelly rock which is more rigid than '*Sarı uşak*' type of rock (Figure 3. 4).

However, according to mason, generally Uchisar rock types are not suitable for the production of stone due to its mechanical properties. That is why more durable and hard stone blocks used to be brought from the surrounding area. In the book of Fatma Gül Öztürk, the mason interviewed with author, describes Uçhisar rock formation as one of the most appropriate rock types in Cappadocia region using as storage because of the water humidity and named it 'enormous rock'.

Figure 3. 3 *'Sarı Uşak'* rock type

Figure 3. 4 *'Kiste Boğazı'* rock type

3.1.2.2 STONES

Cappadocia's geographical structure, as well as easy accessibility and easy process ability of tuff sediments, provides opportunities of using stone as most common masonry material in buildings. For the constructions, various type of rock are processed as stone block, depending on with what purpose that stone is used at which part of structure, such as sub-foundation, corner of the building or on arch structure. Stones that are extensively used in Uçhisar traditional houses are explained by local descriptions with local accent of region under the respect of interview with masons. Uçhisar Municipality's preliminary studies to preparation for 'Uçhisar Conservation Plan'cooperate with UTTA are also considered.

- *'Çavuşin' Stone;* This stone type take its name from a village in the district of Avanos in Nevşehir Province Because in old times village people who would built house brought stones from Çavuşin by using donkeys as transport vehicle (Interview, 2012) (Figure 3. 5). In study of Uçhisar Municipality it is mentioned under name of 'rough stone'. *Çavuşin* stone one of the volcanic stone type, lied under 1-2 meters down earth, is carved out as 40 x 90 x110 cm rough blocks (Uçhisar Municipality-UTTA, 2006).
  Çavuşin stone is easy to work on and light yellow coloured stone generally seen on façade of buildings, arches and vaults (Figure 3. 6). Due to the release of inner water of stone, stone cured less severe and becomes shock-resistant in time. This type of stone in region is used extensively, due to its thermal insulation feature. It provides comfortable indoor conditions; keeping places cooler in summer times, while keeping warmer in winter times
- *Gemil Mountain Stone*; Name of the stone comes from the Mt. Gemil where villagers had collected stones on its surface in the past. Stones are spread up on surface of Mt. Gemil with effect of water and rains. Without any extra handiwork process, they directly take place in building structure. These stones are not in regular shapes; they are rough shaped and have variable sizes. In wall of facades Mt. Gemil stones can be seen between cut stone rows in different size and colours called as locally *'Kafa Taşı'* (Figure 3. 7). In

some façade examples *kafa taşı* are made of *sarı uşak* or *kisteboğazı* rock pieces. (Interview, 2012).

- *‘Kepez’ Stone;* Known as black stone, locally called ‘*Kepez*’ stone, has basalts stone properties which bring hardness and durability. Dark coloured stone has high tolerance to weather conditions and erosion. That is why *kepez* stone usually used the areas where the structural system must be strong and stand for long time; such as foundation walls, corner of buildings that side walls are joint to each other (Figure 3.9). In other sources *kepez* stone is mentioned with different variations, such as *Sulusaray kepezi*, *Yaprakseki kepezi*, *Kavak kepezi* (Alper, 1998).

- *‘Sal’ Stone;* this type of stone is harder than *Çavuşin* stone and more resistant to abrasion which is the reason to use this reddish coloured stone on courtyard covers and floor coverings (Figure 3. 9). The last product of stone before using it, 45-40 x 100-120 cm and thickness changes between 5-8cm (Uçhisar Municipality-UTTA, 2006). In Cappadocia region *sal* stone is called *ispile* stone as well.

- *‘Kevek’ Stone*; locally name of pumice, known as *Kayır* as well. It has high porosity and is a quite light stone (Figure 3. 10). This type of stone can be seen on flooring and covering system in order to take advantage of water holding capacity of its pores and heat insulation. Pores protect timber or other materials by absorbing water coming from ground or roof. In another words, this stone is used as naturel heat insulation system.

3.1.2.1 TIMBER

Cappadocia region has no large forest lands, so timber is not used as common material in buildings. However, timber is much flexible than stone and proper material to cross wider openings. Timber, as structural element, remarkable used to construct timber beam ceiling, locally called ‘*hezen*’. Other elements constructed with timber can be listed as ceiling coverings, roof, tie bars, and as architectural elements on windows, doors, cupboards, *sedir*, *seki*, *sergen*.

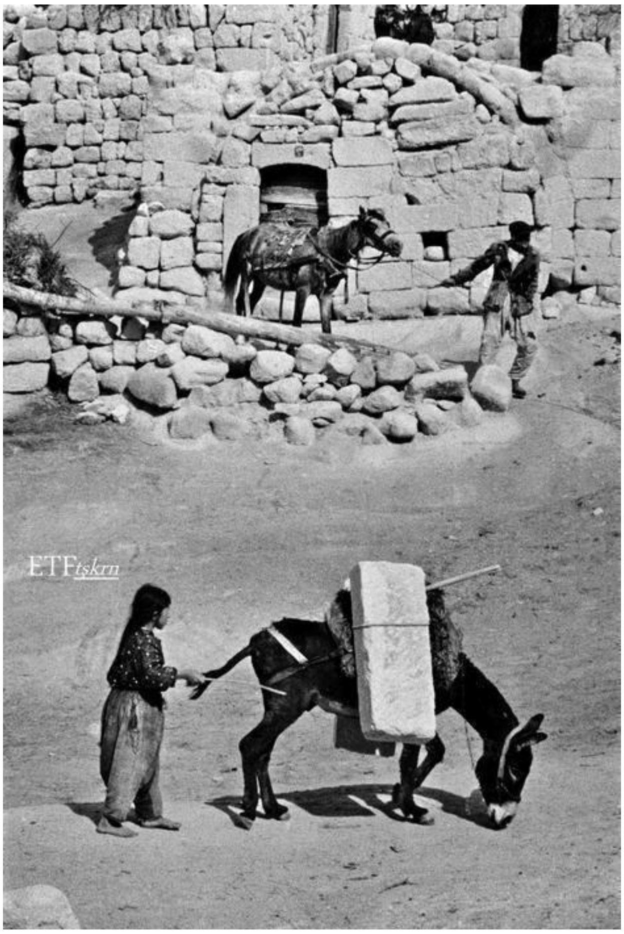


Figure 3. 5 Stones were carried by donkeys.
(http://www.eskiturkiyefotograflari.com/nevsehir01)

In traditional buildings populus trees were used for wooden superstructures (Figure 3. 11). The one, who would construct new building, acquired populous trees from valleys of Uçhisar. Another tree type which hardens over time as it dries, '*Katran*' , is way of calling Toros pine, were used on door and window cases and wings. This type of tree could not be obtained around Uçhisar. They used to be brought from periphery settlements in region, Kayseri (Binan, 1994) and Cappadocia (Interview, 2012). Timber can be used in it is natural shape or in geometrical shapes.

Figure 3. 6 Çavuşin stone usage on façade

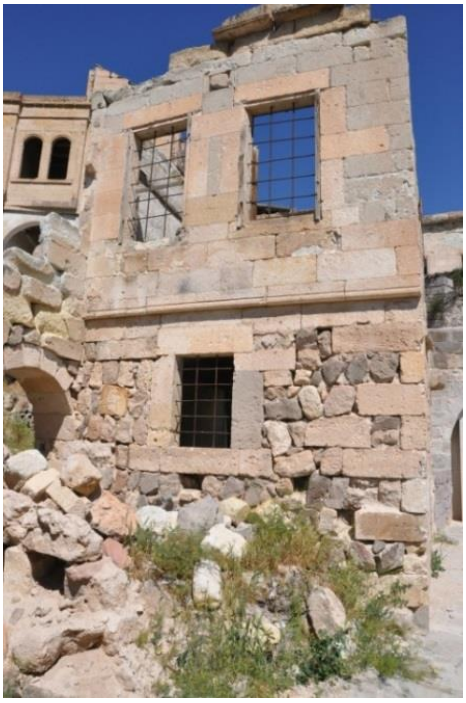


Figure 3. 7 Gemil Mountain Stone

Figure 3. 8 *Kepez* stone on corner and lintels

Figure 3. 9 *Sal* stone usage on courtyard and floor covering

Figure 3. 10 *Kevek* stone usage on timber beam ceiling

Figure 3. 11 Timber usage on ceiling and to span door opening

3.1.2.1 IRON

Iron, produced as cast iron, used for window railings, balcony and stairs balustrades, at door elements such as door latch and hinges, nails and doorknob (Figure 3. 13). Beside using in architectural elements, iron is used passing through inside the walls to provide durability as tie bar. Generally used in upper floor walls, especially upper part of wall that close to cornice of roof; but rarely it can be seen in lower part of the upper floor walls (Figure 3. 12)

Figure 3. 12 Iron tie-bar and window railings

Figure 3. 13 Iron door latch

3.1 CONSTRUCTION TECHNIQUES

As mentioned in ‘’CHAPTER 2’’, in Cappadocia region and Uçhisar, three different types of construction methods are used. These are rock-carving, masonry construction and mixed technique of rock-carving and masonry construction. During construction practice of each method, different stages of process, such as rock carving, stone producing and bonding materials to each other to create architectural elements, require skilled workmen in different fields. In the region mainly there are two types of masons that are rock mason and stone mason (Interview, 2012).

- *Rock mason*; are the person who cut out rock blocks by digging from rock masses and composes rock-cut places. If the rock blocks would be processed to shape as stone blocks which are used in masonry structures, stone mason takes place of rock mason. Even though many rock masons have knowledge of stone producing, unless it is necessary rock mason does not take part in stone producing process. This methodology of separating jobs between masons, decreases working period and increases work quality.
- *Stone mason*; who converts rock blocks into rock pieces, afterwards rock blocks come out from rock mass. To be used in buildings, rock pieces are roughly shaped in required measurements. Than rough shaped blocks, trimming into final shapes of stone with exact measurements and sized by another workmen, called ‘*çapcı*’.

  The person who leads to all construction process called ‘master mason’. Master, collimates walls of building, directs setting up vaults and be responsible of all stages of construction. At the end of rough work of construction, if building needs plaster, workmen called ‘puddler’ applies plaster layer (Interview, 2012).

3.2.1 ROCK CARVING

This part is intended to present rock carving methods viewed by the experienced local masons. This means the processed explanation is strictly from that point view. The following expression of rock carving from rock mason's point of view is based on a combination of personal experience and discussions with professional workers in Uçhisar and Cappadocia.

In Cappadocia, rock carving is priority utility of region's geological characteristic. Carved-out places are made opposite way of common built-up structures. Buildings are built up from nothing to thing; but carved out spaces are created from existing rock (Önür & Özkan, 1974). Rock carving has been using to create rock places from historic times up to today by passing from father to son. Thus rock carving methods developed under influences of long time historical experiences that learning, following and practising rock formation types of region and development of instinct of masons by considering need of rock carved places.

Primarily, in rock work, rock mason determined rock type through local definitions that described under the light of experiences gained by masons at region. After determining rock type, in order to understand whether rock is able to bear itself as a place, mason checks rock layers and cracks on rock surface. The mason listens sound of rock when hit by pickaxe and check amount of abrasion of rock surface.

Layers; can be seen in the rocks, formed at different times of the different rock mass consists of overlapping each other. While some layers can be hard and 'stone rock' type; some can be softer like tuff, soil or clay structure. In Cappadocia, masons use 'stone rock' definition for more sclerotic rocks beside soft tuff sediments. Masons assume increasing the thickness of the layers is greater of being connected well to each other, recognizing that decreasing thickness of layers - in places where layer thickness less than 1-1.5 m - carving –out place is avoided by assuming that probability of falling down of rock mass (Interview, 2012).

Cracks; on rock surfaces are other important considerations for rock carving. Cracks can be already seen on rock; while some of them can be occurred within time. However crack that lies on horizontal direction of vertical surface appears not to be too much trouble; vertically or diagonally moving cracks are considered to be hazardous case. If the cracks in the ceiling of space propagating to intersect with each other in over time, intersecting cracks may result by separating big part from the rock mass. This is accepted as a serious security issue by rock masons. Basically, in the process of checking rock mass quality by searching for cracks, the rock mason hits rock with a hammer while listening the sound that occurred. If the sound coming out is roughly, assumed that rock mass has no hidden cracks; while shrill sound gives clue of rock cracks (Interview, 2012).

Rock carving places are carved out in parts by more than once at a time depending on size of space to be carved. And the size of the rock mass to be carved at a time is determined depending on rock type. For example, soft rock structures are cut off smaller portions than rigid rock structure. In the process of rock carving, approximately 1.5 - 2 m3 volume masses are cut off from rock formation at a time. This takes 2-3 days with traditional methods. If the rock masses that broken from rock mass at a time rate with a rock team of 2-3 workers carving 2.5 metres high and 5 meters to 5 meters of a tank with traditional rock carving methods, the time of finishing work takes about 4-5 months (Öztürk, 2012). After mason determines and marks size of rock mass that would be cut off from rock formation, digging starts from top of the marked mass with *külünk*. Top of the rock mass excavated along the one’s arm length to work and arm’s diameters to fit in hole (Figure 3. 14). The same digging processes applied to both three side of the mass with *külünk*. Thus, the mass is going to be cut off is appeared to forward from rock formation. Lower part is dig after other sides, in case of falling down rock mass uncontrolled. During process to work with *külünk*, hitting the same spot constantly is important, so the digging process continues more efficient and faster. After these three steps named as ‘üst boşaltma’, ‘yarma’ and ‘alt boşaltma’; ‘breakout’ processes follows (Öztürk, 2012). All sides of the rock mass coming forward from rock formation are nailed in order and nails begin to beat with a hammer. Nails moves in rock by splitting between the rock mass that will be breakout and main rock mass to breakout the part over time. Beaten in a certain period of processes, rock block is periodically left to rest. Thus, to be notified before the block cut out and intended to be provided more controlled and safety fall (Öztürk, 2012). When the hammer hit nails the sound that comes out is controlled and speed of moving of nails in rock mass is monitored continuously. If nails got to move easily over rocks, that is believed rock mass has been started to come out from the rock formation (Interview, 2012). Depending on rock type, mass coming out from the rock may be shaped as stone, to be used on masonry buildings. In case of shaping rock mass as stone, processes continues by determining measurements of stone with '*arşın*'. Than same reasonable method with rock breakout is followed. Firstly rock is nailed in order to stone size and hit with hammer. By hitting continuously the same spot of rock is split on stone size over time. Unlike rock carving processes, in stone chipped processes nails got hit with a sledgehammer slower and lighter. Otherwise, the stone can be cleaved in an unwanted shape. Dust of rock and small pieces of rock left behind after carved-out and chipped stone are used to prepare '*şillez'* (local mortar) and filling material in double sided walls (for more information see 3.2.2.2 WALLS). Bigger size of rocks are used on courtyards walls or on walls of buildings called as *kafa taşı*. Ends of the rock carving, after becoming living in places, new spaces may be added within needs (Figure 3. 15). Intervention continues to living spaces during usage. In particular, the surface of the rock spaces, especially the room with *tandır*, is lime washed. After a period of living, rock surface is got blackened because of the smoke; thus, the surface is periodically cleaned by scraping by household (Figure 3. 16-3.17).

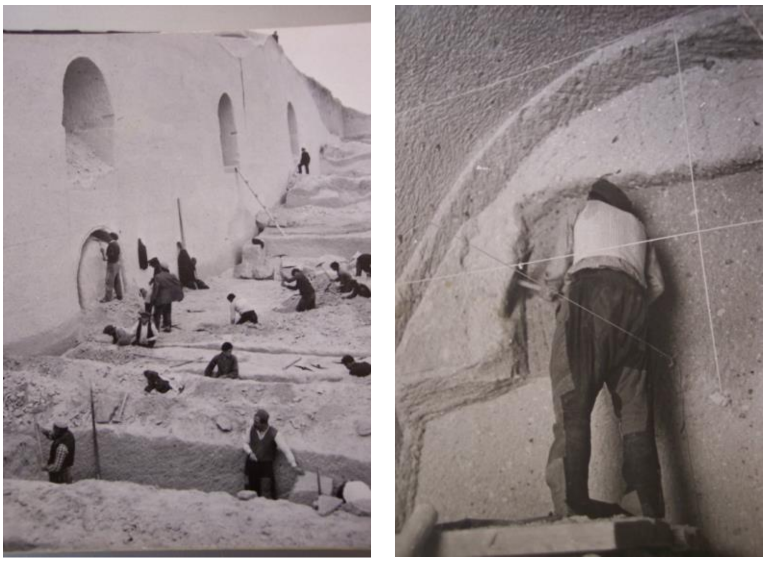


Figure 3. 14 Rock carving, Uçhisar 'Kaya Otel' (Hasan Baş)

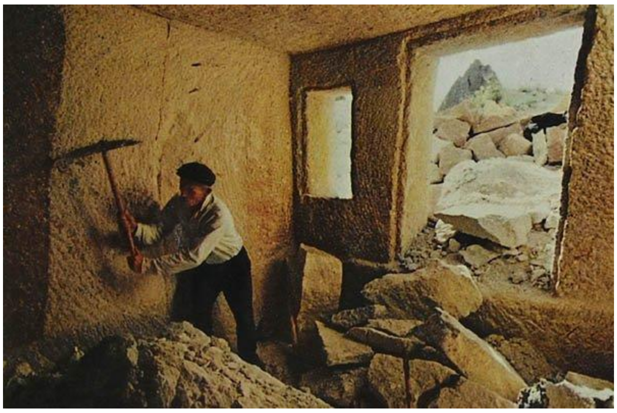


Figure 3. 15 Enlarging carved-out places , 1960’s (Hasan Baş)

Figure 3. 16 Woman applies lime wash to the rock cut space
(http://www.eskiturkiyefotograflari.com/nevsehir01)

Figure 3. 17 Women scrap blackened rock surface
(http://www.eskiturkiyefotograflari.com/nevsehir01)

3.2.2 MASONRY SYSTEM

In this part masonry buildings construction method are investigated and analyzed from foundation to roof with its all structural and architectural elements.

3.2.2.1 FOUNDATIONS

Foundation is a structural part of building, transferred its own weight and all other weights carried through structure to the ground.
As mentioned before, Uçhisar is based on rocky structure as result of geographical formation of region. To built-up foundation, it is assumed that rocky grounds have proper soil strength which gives important opportunities about long-lasting. In the region, main principles to produce the foundation is reaching to bedrock and setting foundation walls onto bedrock. According to condition rock and inclined level of the bedrock different solutions are produced. To provide transition to bedrock variations that applied to between bedrock and foundation were formed. In a house different types of foundations could be found in different part of plan, caused by changes of rock formation. However, limited information about foundations could be reached from site survey, because of the accessibility problem of foundations. All informations were examined under the context of foundation relation with rock ground and relation with inner and outer space levels consediring materials, width and height of foundation walls. All study was examined via informartions gained from site survey and interviews with masons.

As it is today, primarily, ground was prepared for construction before building the foundations walls. Methods that were used for preparing the ground depend on slope condition of the rock base. Those methods are studied mainly under two main groups.

<u>Preparing ground before construction</u>

Before starting to built-up foundation, master mason prepares the ground by considering the ground type of where building would be placed. In old traditions, first of all, master mason analyses the ground about how much carving required setting up foundations. In order to need of basement, rock condition and cracks are checked-up by mason (Interview, 2012). These kinds of predictions giving by mason progressed and improved by time, following by already built buildings and gaining experience from their duration. Rock carving method are discussed in more detail (for more information see 3.2.1 ROCK CARVING).

Via information noted during site survey and interviews, some traditional ways detected to prepare the ground before foundation established. These ways mainly depend on slope conditions.

- *Flat land;* Surface of the site that building would be constructed, brought to the same level by scraping high parts of rock ground. Than the walls of buildings directly set on that straighten rock base (Figure 3. 18). Another method used is digging rock base in order to shape rock wall acting as the foundation wall. Height of rock fundamentals change between 130-170 cm and walls of storey built on top of it. In some examples of vault covered rooms, through the room vaults are supported by rock wall instead of stone masonry wall. In another words, vault's supporter arches impost line set up on rock walls (Figure 3.19)
- *Low-slopped land;* Surface of the site that building would be constructed, brought to the same level by scraping high parts of rock ground and/or if needed, filling hollow parts with earth (Figure 3.19).
- *High-slopped land;* If the slope of building fairly steep, low part of the ground bearing by the arches or vaults system to upper level (Figure 3. 20-3.21). In some examples, rock ground shaped as leveled rock substructure rising through upper level

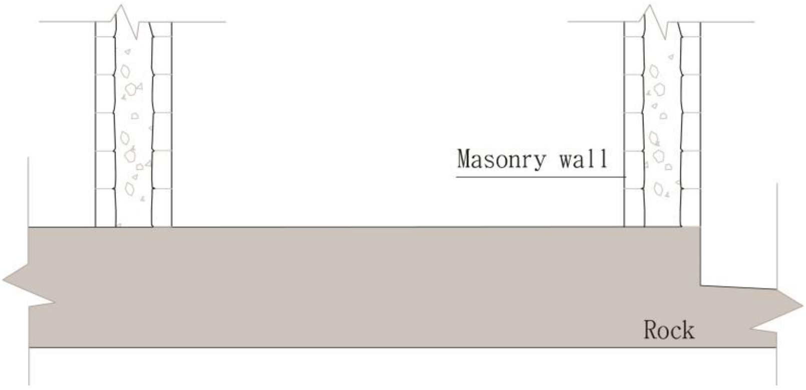


Figure 3. 18 Flat land preparation

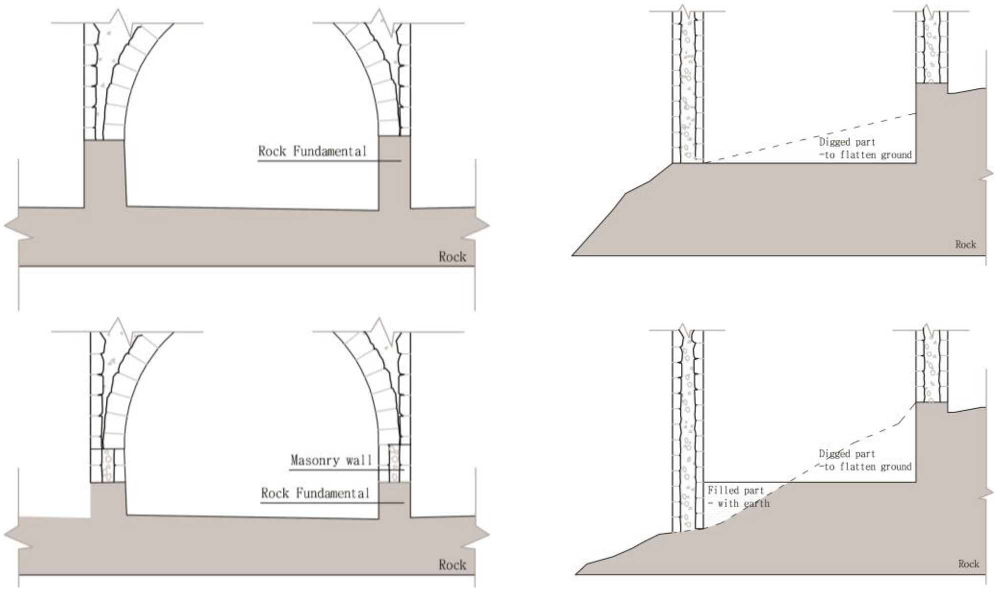


Figure 3.19 Flat land with rock foundation walls - Low-sloped land preparation

Figure 3. 20 Rock ground shaped leveled as rock substructure

Figure 3. 21 Bearing lower floor to upper floor

In some houses, the foundation walls are constructed, without any special jointing technique, directly set onto the rock surface (Figure 3. 22); while in some buildings, rock ground is used as foundation walls. Rock base is shaped by carving until rock appears proper high to use as substructure (Figure 3. 25). As a matter of course rock-carved places have rock foundation, this type also seen in masonry system. Some examples in masonry system, substructure rises at same level in each part or rock is carved as stepped where the highest step riches just under superstructure. Stepped type commonly preferred with houses established on steep slope where it avoids serious amount of stones usage (Figure 3. 20). Another benefit is taken advantage of rock strength for long durability. Thus, economical contribute by decreasing number of stones and lasting long term durability are the advantages of this variation (Figure 3. 23). When the rock does not use as substructure, depending on geographic condition of rock, various relations between rock and stone are applied. For instance, in some foundations, inner face and outer face of foundation walls are built in different levels. Average level of differences between inner and outer side is noted as 30-50 cm (Figure 3. 26). It is noted that outside single wall can be built two or three rows of hard stones to provide water proof, while from inside rock base can be seen in some houses (Figure 3. 24). In the houses that have rock carved basement, part of stone foundation wall takes place inner side of building that sit on 30-40 cm width of rock niche (Figure 3. 26). If the basement is not exist, inner wall directly sit on ground. In both cases, the other row of wall that faced with street set on rock foundation wall that can be seen along the façade of building (Figure 3. 28). Outside row of wall built in front of rock mass. Inner row of foundation wall constructed rock mass, while the outer row joint to rock mass. Difference between depth of inner wall and outer wall range is 90-140 cm (Figure 3. 27). As mentioned under ‘preparing ground before construction’ title, in low-slopped land surface of the site that building would be constructed, brought to the same level by scraping high parts of rock ground and if needed, filling hollow parts with earth. To need of filling ground, in order to flatten and enlarged plan surface, façade wall built in front of filled part to hold it as supporting wall. This method is also used in single sided wall of facades that placed 40-55 cm lower than inner ground of room (Figure 3. 29).

Figure 3. 22 Adjacent to the rock surface without any special jointing

Figure 3. 23 Rock used as foundation wall

Figure 3. 24 Rock base that appears inner side of building

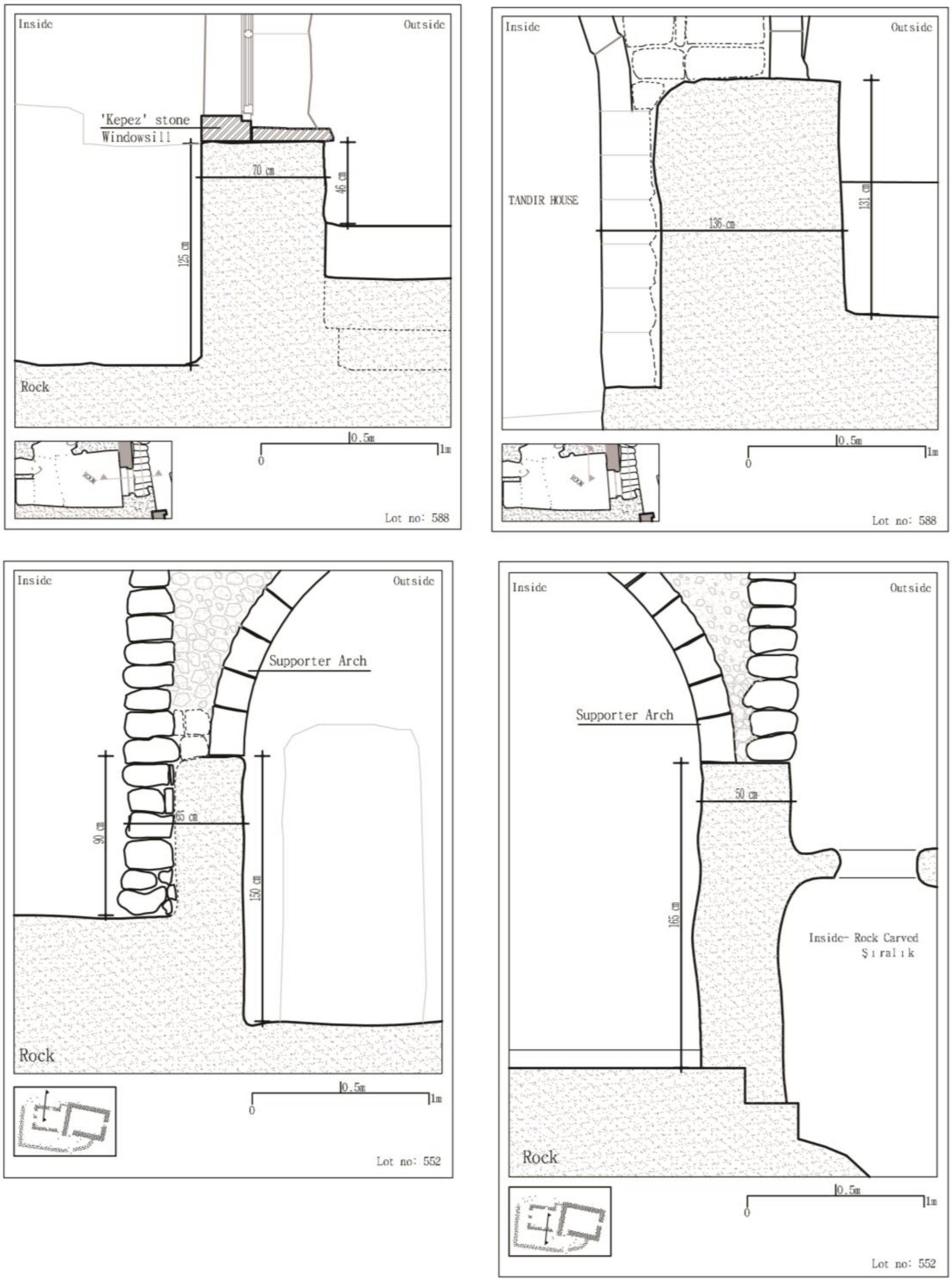


Figure 3. 25 Variations of rock as foundation wall

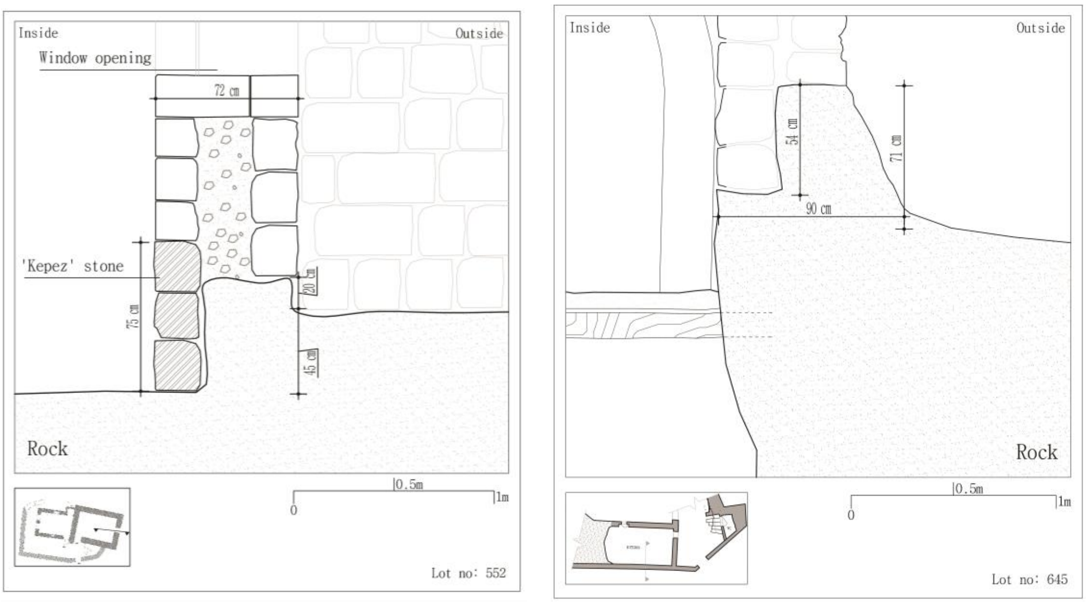


Figure 3. 26 Outer row of wall sit lower than inner row - Foundation with rock-cut basement

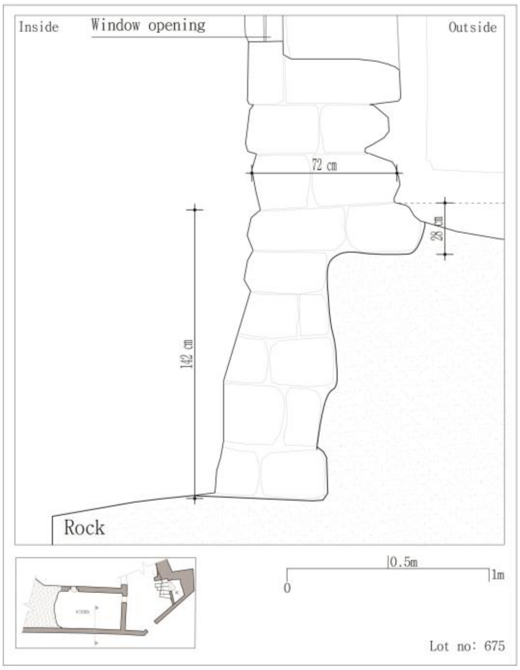


Figure 3. 27 Masonry wall placed in front of rock mass

Figure 3. 28 Rock appears on façade of building with rock basement

Figure 3. 29 Masonry wall placed in front of rock mass

3.2.2.2 WALLS

Wall is a bearing structure carries the weight and transmits to the foundation and/or at the same time take place as partition element in spaces.

Via collecting data from studied houses, it is observed that classifying walls can be made in different context. These are made by considering the place of wall in building and its function, under context of material's type and shape, and construction methods. As mentioned before, in Cappadocia and Uçhisar the masonry walls are constructed with stone that quarried from region. Stones are shaped as rough-cut stone and fine-cut stone; depending on which part of the building that stone is going to be used. To appraise wall materials according to in shapes, one type is rough cut stones that shaped roughly. They are used in service units, storages and courtyard walls; while also placed in main building walls. In some examples, main building's façade walls built up to curtain level with rough-cut stones. Lateral façade which does not face with main street and has rare openings is built up with rough cut stones all along both storeys. Sometimes ground floor walls are made of rough cut stone while having cut stones on the corner of the building (Figure 3. 30). Fine cut-stones are made by rock blocks that brought from quarry and reshaped elaborately. These stones are extensively used in various part of building walls (Figure 3. 30). Choosing material type of walls depends on characteristic of stones. Hard stones, such as *Kepez* stone (Black stone), usually used in subbasement level, corner of buildings; while more softer stones are placed in façade of buildings, separator walls or courtyards walls (for more information see 3.1.2 MATERIALS). Ground floor walls and supporter walls of superstructure of upper storey are built in two stone rows. Gap between stone rows is infill with mortars. Bigger gaps are filled with rock and stone pieces. After stone pieces added to gaps, squishy mud mixture belongs to region is poured on top of stone pieces. This local mortar is called ''*şillez*''. Thus, in the gaps stones cannot fit in, because of their irregular shapes. *Şillez is* full filled, so that all materials coalesce together. Stone and rock pieces are added in gaps before *şillez* in order to avoid more than necessary use of *şillez*. Forming of walls can be change during construction process by adding the architectural elements take place in buildings; such as window, cupboard and niche. Ornaments and decorations on building façade other diversities on wall row which changes section of the wall. In the upper storey of houses, in order to secure the wall and keep strength of walls, the iron tie bars and timber girder were detected in surveyed houses. Iron tie bars are mostly seen in upper storey above the window openings, closer to eave cornice of roof (Figure 3. 12). It is used in both double sided walls and single faced walls of upper storey. In some facades they take place right above the projections (Figure 3. 12). The iron bar goes along within one side of wall through the other side and fastened up with another 30-50 cm length of vertical bar in each side. These tie bars have 3 cm width and 0.5 cm thickness. For fastened the bar another 0.5 cm width bar is pulled vertically in the hole created at the edge of tie bar (Figure 3. 31, Figure 3. 32). Timber tie bars are not extensively used as much as iron tie bar. They are used between ground floor and first floor. Timber girder, continue all along the front and side walls and intersect on top of each other corner of the building (Figure 3. 32). In one example, two timber girders are used in same level, one placed outside of the wall, other one placed inner side of the wall (Figure 3. 33).

Figure 3. 30 Rough-cut stone lateral façade and cut stone corners
Cut stone used in main façade of building

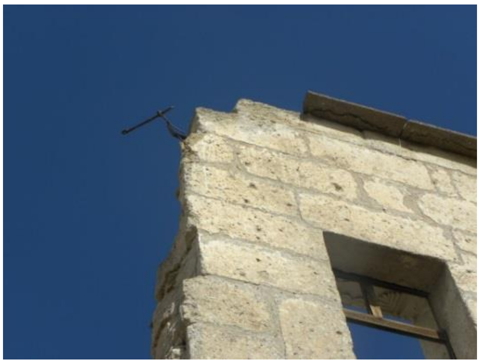


Figure 3. 31 Iron tie bars

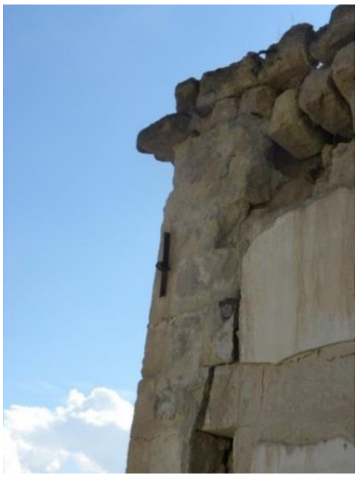


Figure 3. 32   Iron tie bar - Timber girder

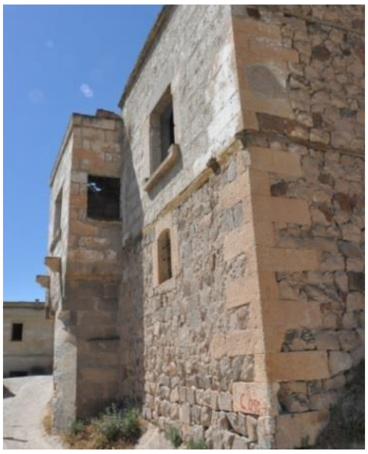


Figure 3. 33 Double use of timber girder

Apart from basic frame of construction process of walls that explained above, mainly three differentiated models of construction techniques of walls used in Uçhisar houses were noted.

Double Sided Wall

These types of walls are basically constructed by two stones rows. The thickness of stones changes between 18 and 28cm. Each stones placed vice versa 5-7 cm far from each other and create double sided stone rows. Then the gap occurred between two stone lines filled with mortar and small stone pieces. The thickness of walls of surveyed examples change between 38 and 62 cm. Stones used on wall, can be all cut stones (Figure 3. 34-3.35); while some samples built up with rough cut stones in both sides of wall rows. Rough cut made double sided wall rows are attach with mortars between them in irregular shaped (Figure 3. 36). This method of wall binding is mainly seen on ground floor walls. And it is noticeable that in some houses, at the middle of the façade wall row constructed with rough cut-stone and the inner row is built with cut-stone; while corners and nearby the corners both sides of wall are constructed with cut-stone to increase corner strength.

Double Sided Wall infilled with '*Şillez*'

This type of masonry wall has two stones rows as like first type. Difference between two types is construction methods that reflect to total thickness of walls. In studied buildings this type of wall thickness changes between 60 and 85cm. For the construction of masonry walls, 30-40 cm high wall is constructed up vice versa and far from each other. Stone pieces and rock pieces, obtained from preparation of ground before construction, put in gap between wall rows. Then special mixture '*Şillez*' filled on top of stone pieces (Figure 3. 37). This cycle continues till wall reach desired high. Rough-cut stone and cut-stone are used as material. The layer of the walls section can appear layered as rough cut stone-*şillez*-cut stone; cut stone-*şillez*-cut stone.

Single Faced Wall

Single faced wall is one row wall construct with 18 and 21 cm thickness stones. Cut stone is used as material (Figure 3. 38-3.39). This kind of walls extensively used on upper floor facades, access from vaulted space to rock carved space and inner walls. In upper floor walls iron tie bars are used to keep wall strength. Iron tie bars can be placed in upper part of wall closed to cornice line while in rare samples it is placed lower part of wall one or two stone rows above the projection. They are built on ground floor double sided walls by creating cornice inside result of thickness difference or set on arch of ground level that is used to enlarge the plan.

Figure 3. 34 Double sided walls constructed with cut stones

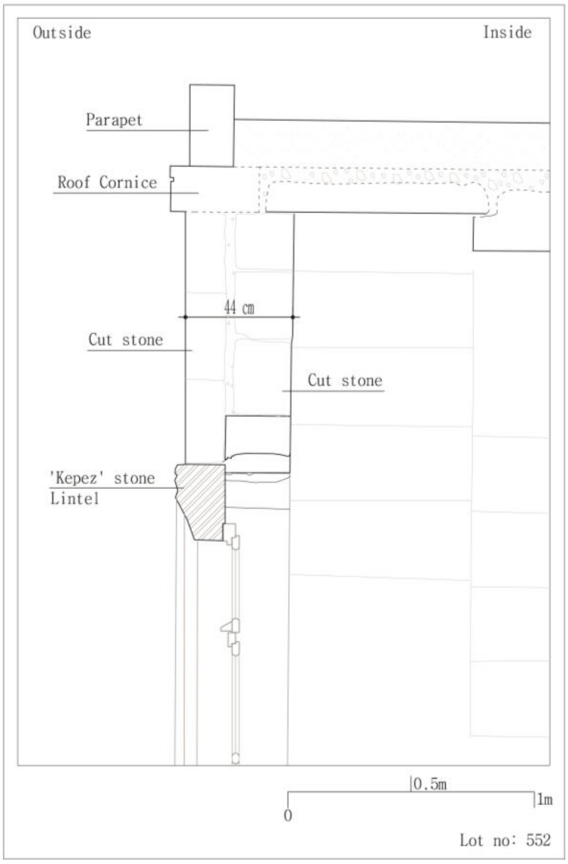


Figure 3. 35 Double sided walls constructed with cut stones

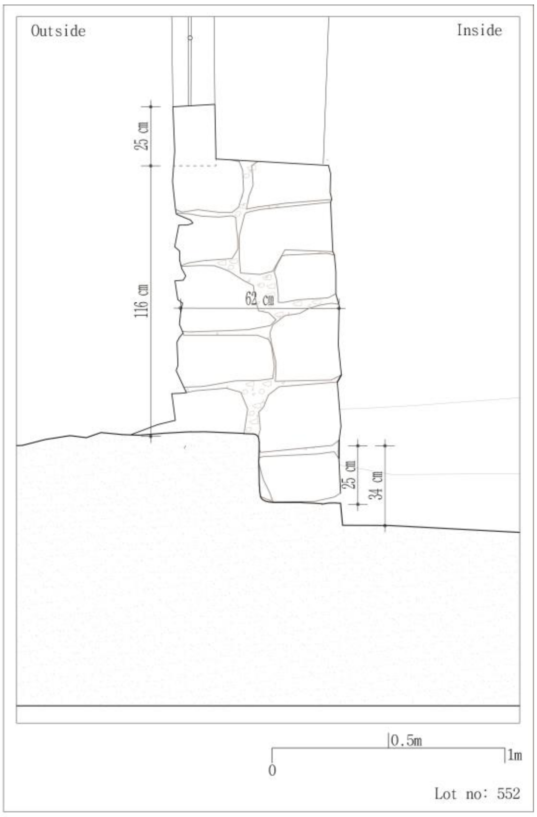
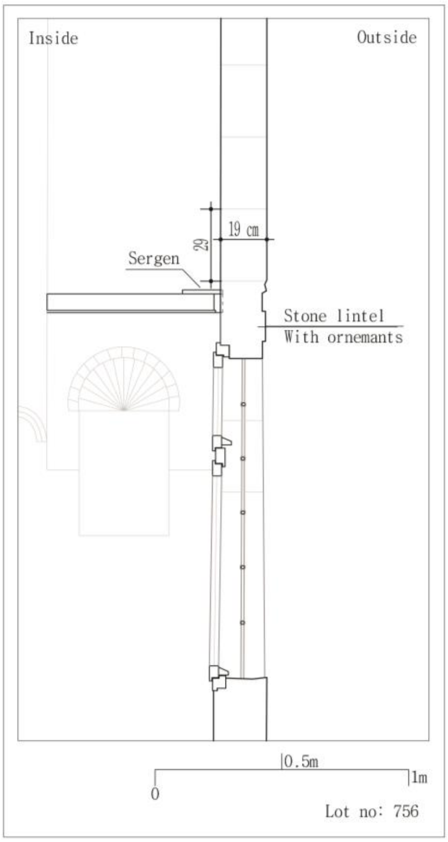


Figure 3. 36 Double sided walls constructed with rough cut stones-ground floor wall

Figure 3. 37 Double sided walls infill with ‘*şillez*’ – Supporter wall of vault



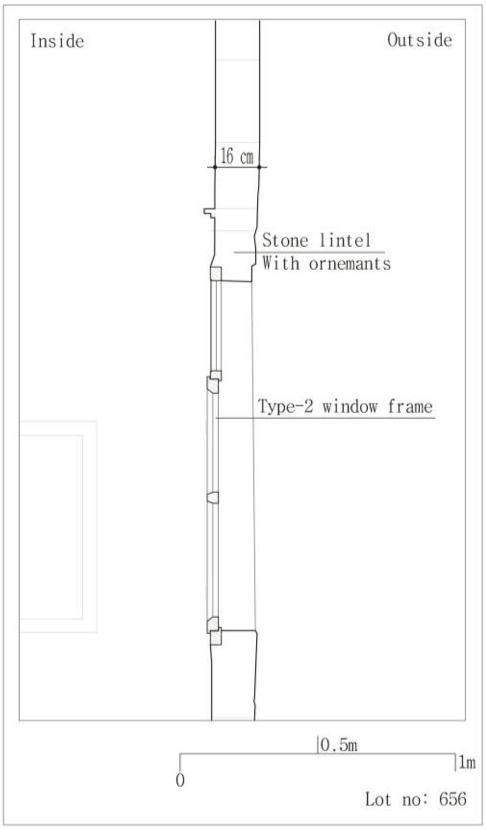
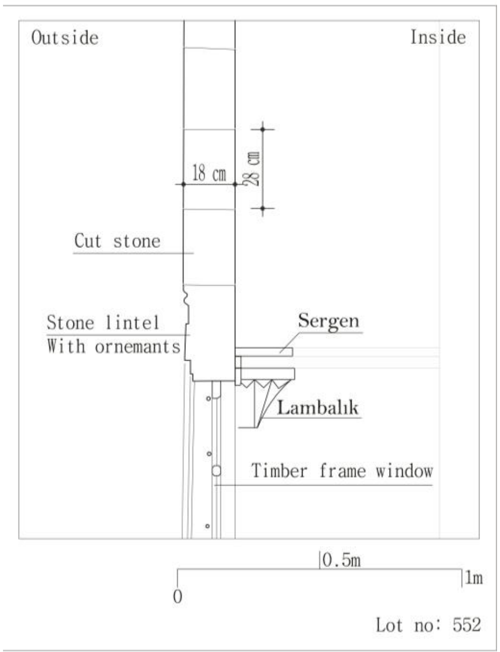


Figure 3. 38 Single sided walls



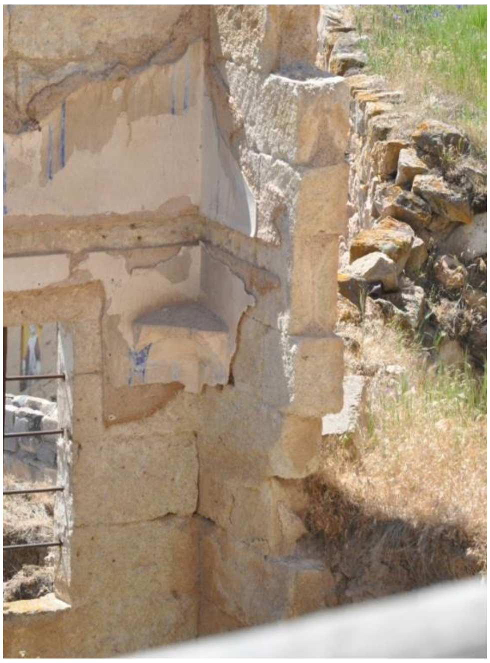


Figure 3. 39 Single sided walls

3.2.2.3 SUPERSTRUCTURE

3.2.2.3.1 CURVILINEAR SUPERSTRUCTURE

Arches

Arches take place with different functions in buildings. Besides being main unit of special vault system of region, produces superstructure in front of the rock-cut spaces in order to enlarge floor plan (Figure 3. 42-3.44). Arches are not just used to create spaces; but also take part as supporting elements (Figure 3. 40-3.50). When upper floor weight comes across void of rock space, rock space is supported with an arch or set of arches. In time, some rock spaces need arch supporters due to safety of places. Arch is bearing stairs to the upper floors. Buildings established on steep sloped ground are bearing to upper level of ground with arches (Figure 3.51). Many types of arch profiles can be seen in buildings; such as pointed arch, circular arch and raised arch.

Vaults

In Uçhisar houses, as well as Cappadocia houses, vaults are the most characteristic structures which are different than common vault system. This system is created by several arches, built 60 and 75 cm far from each other. Spaces that are left between each arches covered with another arch row. They are placing on top of supporting arches. Local masons call this superstructure as *'kaburga tonoz'* (Figure 3. 44).Supporting arches called *'kaburga kemer'* and covering arches called '*kapak kemer'*. Each of the stones that created *'kapak kemer'* is called *'kapak taşı'*. To provide formwork to *'kapak taşı'* and keep it more stable, voussoirs of supported arches are shaped as reverse 'T'. *'Kapak stones'* placed on these parts (Figure 3. 45). Dimensions of supported arches change between 60-80cm x 25-30 cm and *'kapak taşı'* is between 5 and 7 cm width. Between supporting arches normally one row of *'kapak kemer'* is built up, but in three examples *'kapak kemer'* is built as two and three rows. Thus the system becomes appear like a common vault (Figure 3. 46). These vaults are spanned 'hayat' unit and they are the largest opening that covered by vault. Stones that used for supporting arches are hard and more durable stones. Other row arches do not have any structural roles, so the lighter stones are preferred to construct them. However, in some examples, kapak kemer are built up with hard stones. Mason mentioned that houses which is built up with hard stone are belongs economically powerful owners. These superstructures are seen in upper floors and ground floors. Span of places that extended with vault system changes between 370 - 320 cm height and 435-315 cm width (Figure 3. 47)

Figure 3. 40 Supporter arch in rock place

Figure 3. 41 Supporter arch under rock

Figure 3. 42 The arches take place in front of rock mass

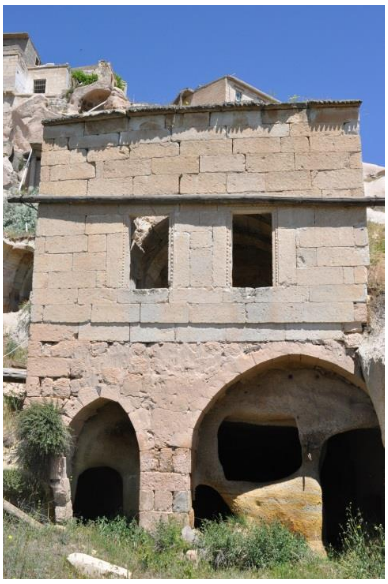


Figure 3. 43 The arches take place in front of rock mass

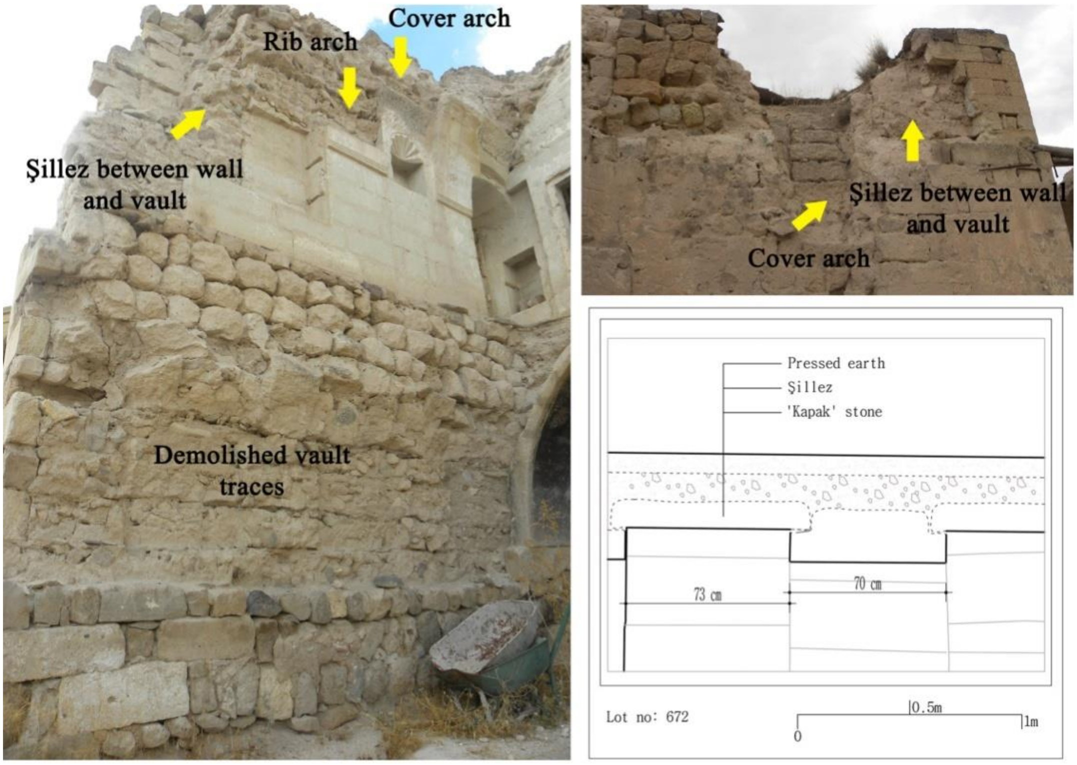


Figure 3. 44 ‘Kaburga kemer’

Figure 3. 45 Various reverse ‘T’ shaped voussiur stone

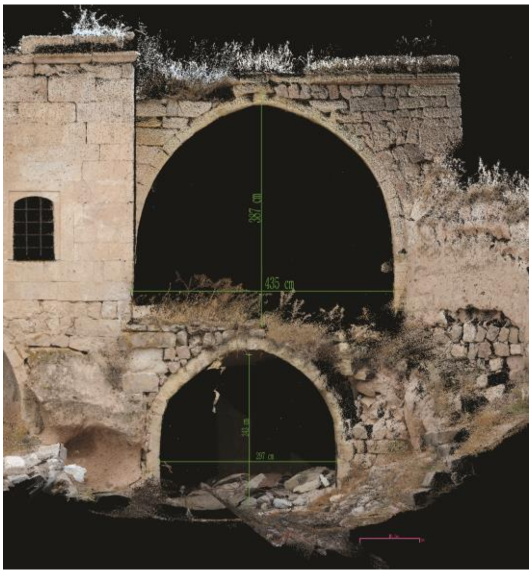


Figure 3. 46 Upper floor widest vault arch with three rows of cover arch

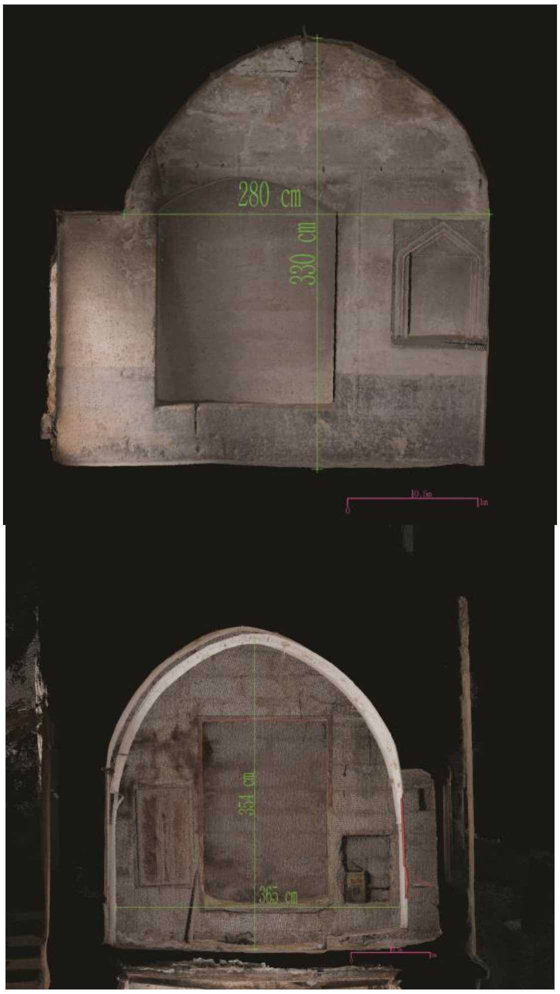


Figure 3. 47 Upper floor vault arch

3.2.2.3.2 FLAT SUPERSTRUCTURE

Timber Beams

Timber beam structures are only flat superstructures that are used in houses. Timber is more flexible and more durable material to tensile strength thrust forces than stone. Thus, timber is preferred to use to cover wider spans beside stone structures. Timber beams are placed on inner cornices. Cornices can be constructed with walls. Sometimes beams are directly set on wall or stuck in wall row. In some examples, timber rows placed just next to each other; while some have 30-50 cm span between each of them. Timber beam system is locally called '*hezen'* (Figure 3. 51).

Generally system is constructed through narrow side of rooms, however some bigger space that are not possible to span at a time, cover with two groups of beams. Beams reach each other in the middle of way on supported beam. Supported beams are more durable than other beams and type of wooden can be different than others. Thickness of timbers differs 12-15 cm; but big supported ones are approximately 15 cm radius. Timbers are shaped roughly or geometrical. Big supported ones are sometimes body of tree directly insert to wall system in its natural shape (Figure 3. 49, 3.55). After timbers are set, big stone pieces are filled on rows and clay soil is laid on them. Then stone tabs are closed on top of all layers.

Another layered system is timber beams covered up with rush mat than again soil mixture applied just before stone covers set on. In timber floor coverings, same layers till the clay soil and timber lata 5x5cm placed 30-50cm far from each other and 5x10cm laths are set on in perpendicular way to it (Figure 3.54-3.55). This structure system can be seen both ground floors and upper floors cover and also helps to transitions from masonry system to rock body (Figure 3. 48). In some examples instead of rush mat 'saylak' stone is used; while in another samples pumice stones take '*saylak*' stone's place (Figure 3. 50, 3.58).

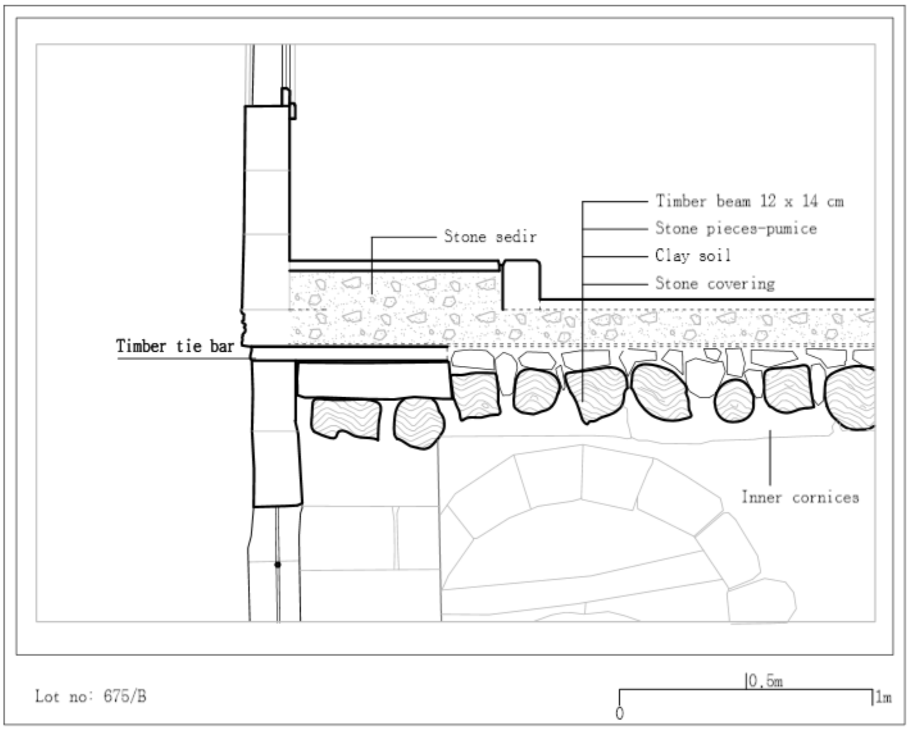


Figure 3. 48 Timber beam superstructure drawing

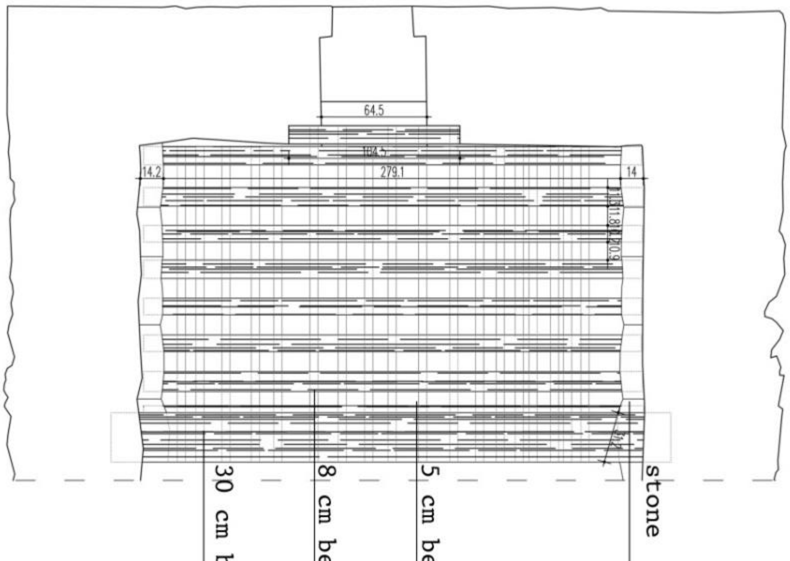


Figure 3. 49 Body of tree directly insert to wall system in its natural shape

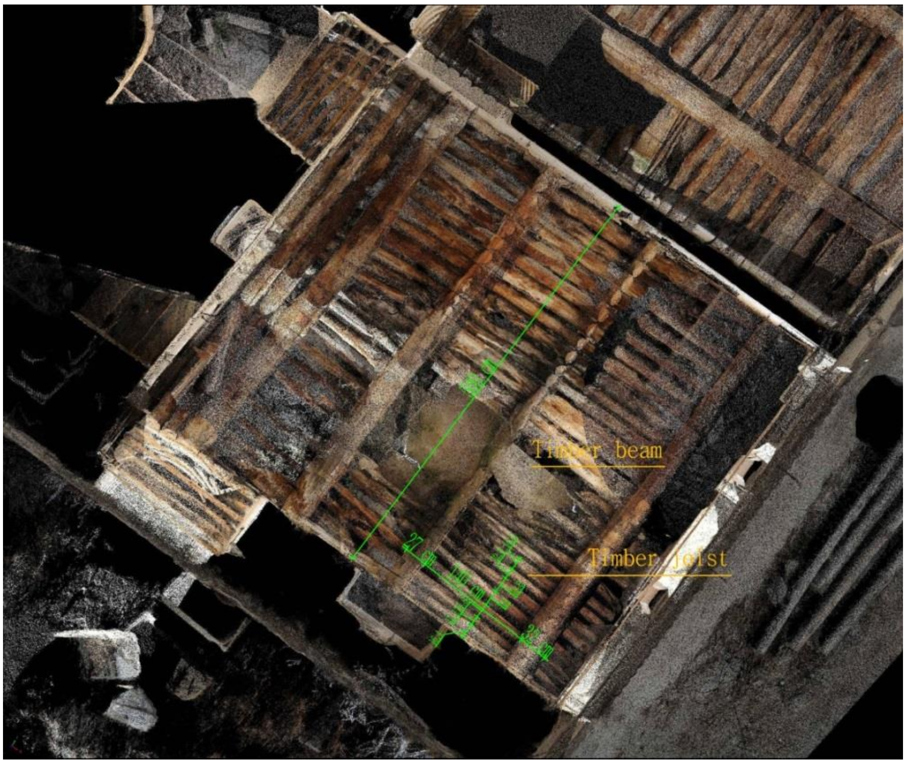


Figure 3. 50 Orthophoto of timber beam structure

Figure 3. 51 ‘*Hezen*’

Figure 3. 52Timber beams with lata

Figure 3. 53Timber beams with lata

Figure 3. 54 Timber beam superstructure

Figure 3. 55 Natural shaped beams

Figure 3. 56 ‘*Saylak*’ stone above the timber and soil layer on top of them

Figure 3. 57 ‘*Saylak*’ stone above the timber beams

3.2.2.4 ROOF AND ITS ELEMENTS

The upper part of the building casing, that is plain or tilted at an angle of less than 60° from horizontal. Roofs are the first damaged part of buildings during time, besides the other elements of buildings. Especially earth roofs need more maintaining. During the site survey, three kinds of roofs are determined considering their construction methods. Classification of roof is defined as follows;

Earth Roof

Earth roof is the most common roof type in Uçhisar. Even though most of them are renewed with concrete, number of examples still existed. Mostly abandoned houses kept earth roof, if the roof is not demolished. On the other hand, due to ease of maintenance compared to earth roof in used houses has been renovated with concrete roof. As a result of topography features, resulting intricate urbanization, a house's roof is becoming the other house's terraces. Therefore, roof does not only serve as structural functioning; but also become a space of daily life in this region. The roof is an area used for drying fruits, vegetables and also fertilizer. According to construction methods and layers of roof, roof types differentiated depending on superstructure of last storey.

- Earth Roof on Curvilinear Superstructure

  After finishing upper floor vault, broken stone pieces filled in *'tonoz koltuğu'* and *şillez* applied on them (Figure 3. 58). And the last layer, clay soil, lay out. After all layers prepared, roof pressed by the heavy tool called '*yuvak*'. Every autumn roof is recompressed, in order to not take water in earth (Interview, 2012). Total thickness of the roof layers can be changed in each house between 15 – 40 cm (Figure 3. 59). In some earth roof examples, top of vault and *'tonoz koltuğu'* filled with slurry earth instead of using stone and rock pieces. The thickness of earth between vault and top of roof is higher than other samples (Figure 3. 60). Clay soil is brought from Avanos. This technic is applied when owner does not have enough stone and rock to fill upper part of superstructure (Interview, 2012).

- Earth Roof on Flat Superstructure

Flat superstructure of roof can be created in two main methods. First method is placing approximately 25-30 cm diameter trees stuck in a wall 100-190cm far from each other. Than smaller sized 6-15 cm diameter timber joist are placed on them so as to seal the space between the main beams (Figure 3. 61 – 3.63). Other method is sequence of equal wooden beams adjacent to each other. Beams are generally sitting on niches that created on the wall (Figure 3. 63-3.65). Diameter of beams are appears smaller than other method. They are changing between 8-15cm. To complete the roof, few layers adding onto superstructure. Primarily, straw mat is laid, then thin and hard stone that extruded into plates called '*Saylak*', is laid on the mat layer. Last layer is completed with 15- 25 cm earth called '*çorak*' (Figure 3.66).

Another roof layer formed by covering the earth directly after the straw mat laid. In this system *saylak* is not come up as another layer. In two examples, on timber beams, really thin wooden plates are placed than *saylak* stone placed between earth and wooden plates.

Rock Roof

As could be expected all the rock carved places have rock roofs. There are no extra layers or structures built up to rock base. Most important thing is from beginning of carving process mason must be sure if the rock is strong enough to be used as roof (Interview, 2012). As mentioned in arches, in case of having safety problem with the rock ceiling, arch built connected to rock ceiling to support ceiling in rock places (Figure 3.67).

Figure 3. 58 Şillez infill

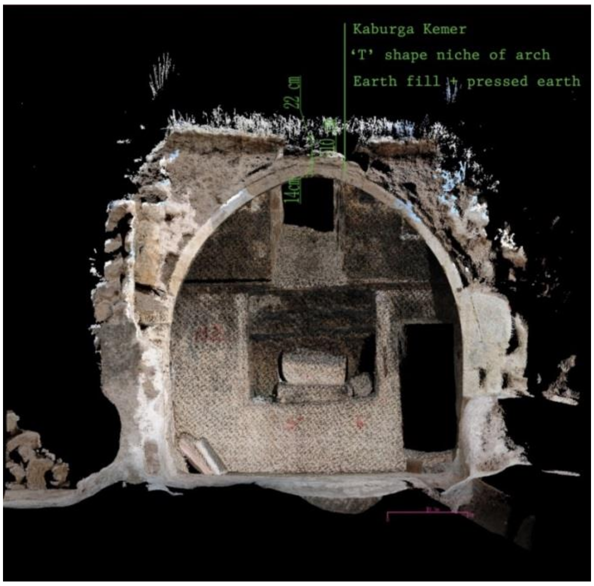


Figure 3. 59 Orthophoto of earth roof filled with 'şillez'

Figure 3. 60 Slurry earth infill

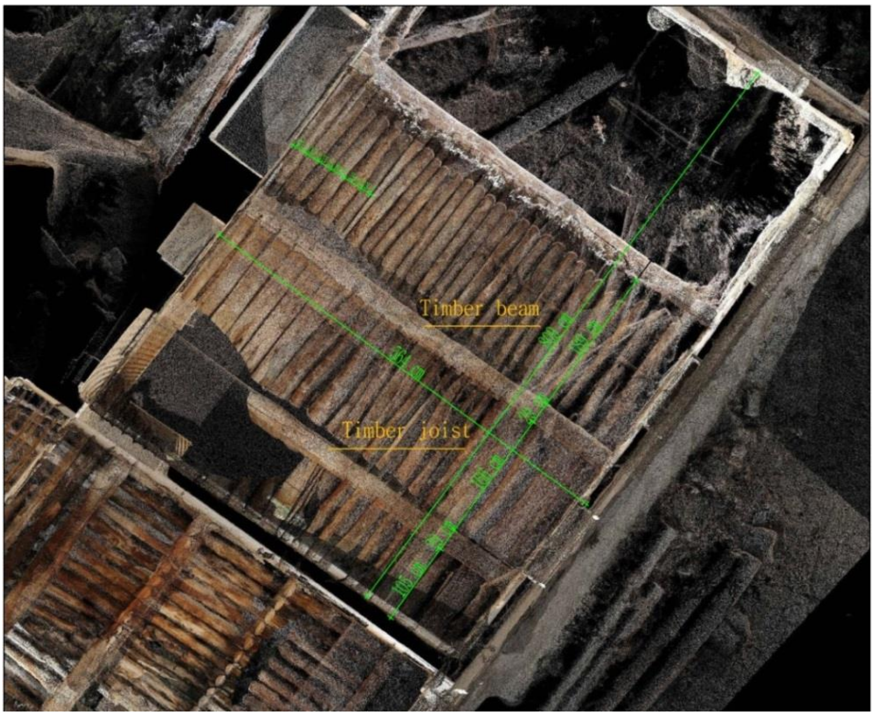


Figure 3. 61 Earth roof on timber beam superstructure (Orthophoto)

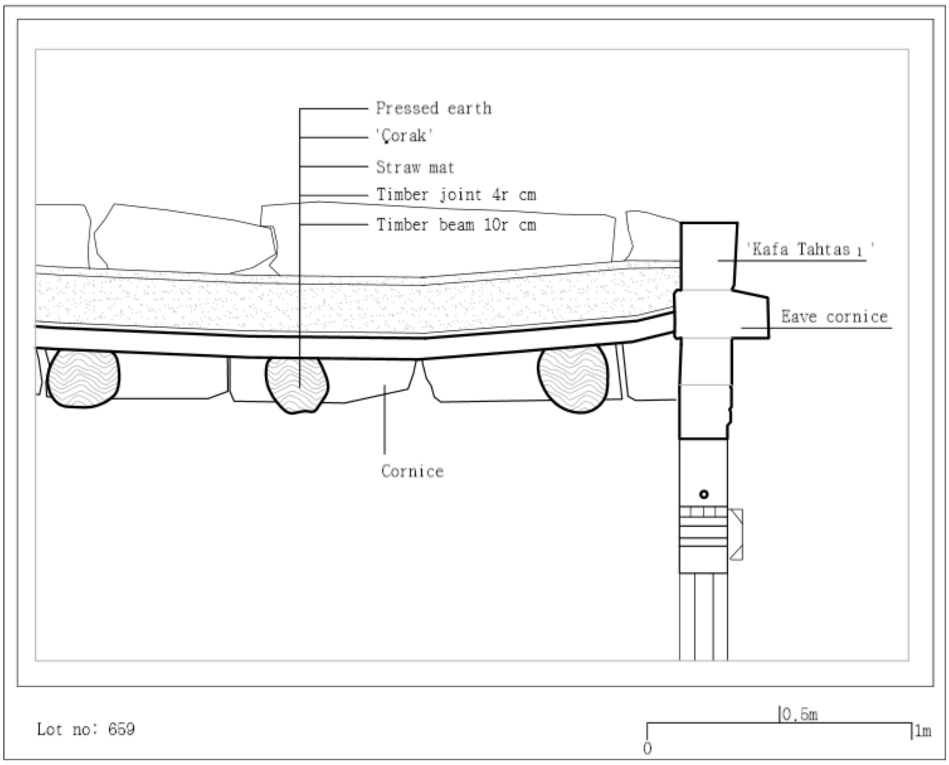


Figure 3. 62 Earth roof on timber beam superstructure

Figure 3. 63 Main beam stuck on wall row

Figure 3. 64 Timber beams sitting on niche

Figure 3. 65 Earth roof on flat superstructure

Figure 3. 66 Rock roof spaces

Roof Elements

Chimney

Chimneys are masonry or metal canals providing air condition or letting smoke out from places. Due to the change of earth roof with concrete, wide range of the original chimneys were destroyed. In Uçhisar houses chimneys divided into two groups according to their duty in building.

- *Type-1:* First type provides air condition to places. This type is commonly seen in *tandır* houses (Figure 3. 67-3.69). In vaulted rooms, one stone of *kapak kemer* left open and chimney is placed in that goes through roof and pass beyond roof level. Traditional hand-made terra cotta bowl is inserted to the opening (Figure 3. 69).

- *Type-2:* This one is used for get rid of smoke in places, where fire place is placed. Chimney is built in double sided walls. Some placed in outside wall of house and some placed between two vaults of adjacent rooms. End of chimney, passed beyond roof level called chimney platform (baca kürsüsü). Chimney platforms are made by terra cotta or stone (Figure 3. 70-3.72).

- *Type-3:* This type of chimney takes place in rock places which has *tandır* in it. Chimney is carved out after carving the rock places (Figure 3. 72). Opening of the chimney in the rock carving sites are very important to maintain the moisture balance in space. The shaft of chimney diameter is changing between 20-30 cm.

Çörten

One of the roof element that throw out huddled rain and snow water from stone gutter that projected from surface of building wall. Generally buildings have one *çörten* while some have more than one. That architectural element is called '*çörtlek*' in Uçhisar. *Çörten* can take place in same row with cornice or in below row of cornice (Figure 3.73). They are projected 20-30 cm out from surface. Width of the *çörten* changes between 18-25 cm, having 5-8 cm hole that collect water and lead out into the middle of stone. In one house *çörten* is placed in '*yunmalık*' which is in second storey, in order to disposal of used water. Material of *çörten* needs to be resistant to water and have high porosity. Thus hard stone, such as *kepez* stone is chosen to use (Figure 3.75).

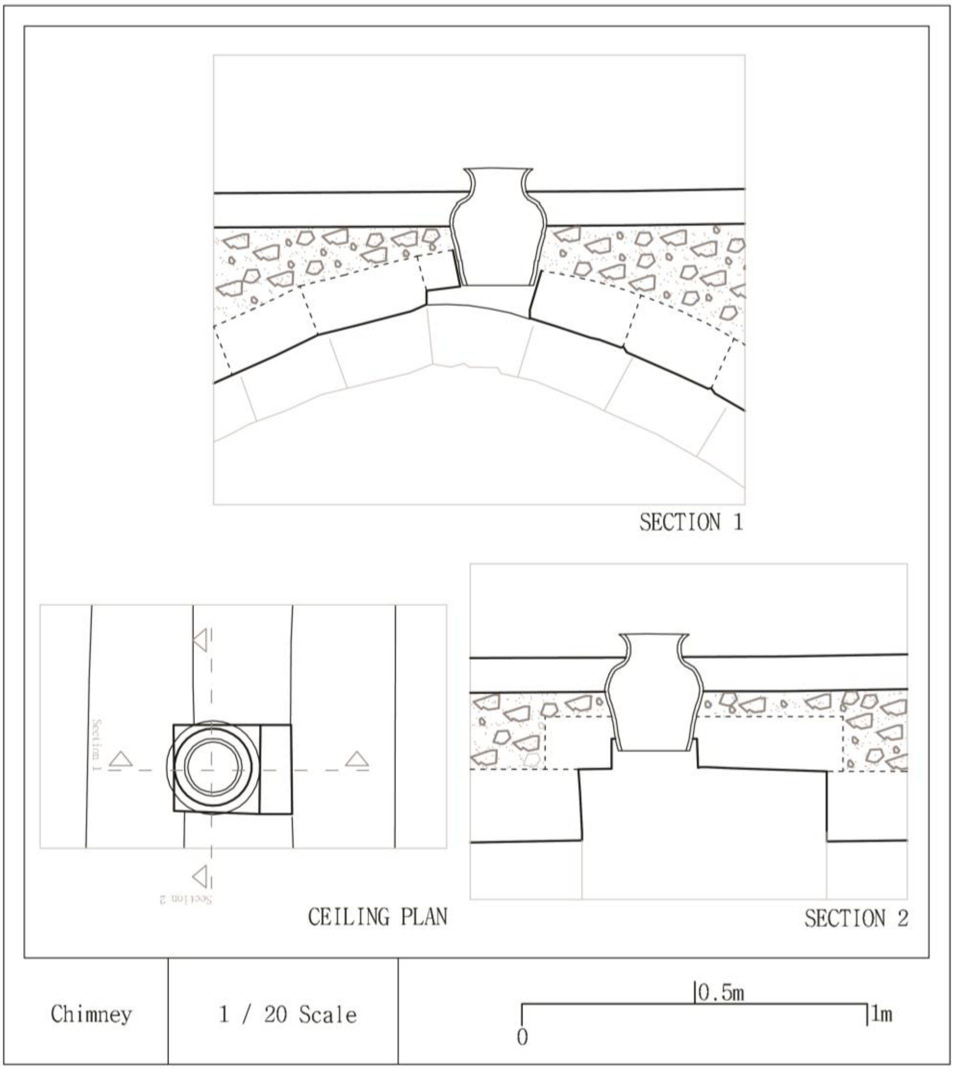


Figure 3. 67 Drawings of Type-1 chimney

Figure 3. 68 Chimney in *Tandır* room

Figure 3. 69 Traditional hand-made terra cotta bowl insert to the opening

Figure 3. 70 Terra cotta chimney platform


Figure 3. 71 Stone chimney platform


Figure 3. 72 Rock-carved chimney

Figure 3. 73 *Çörten* placed two rows under roof cornice

Figure 3. 74 *Çörten* made by *kepez* stone

3.2.3 RELATIONS BETWEEN MASONRY STRUCTURES AND ROCK CARVED SPACES

Serious numbers of Uçhisar houses are built up with mixed technique of rock-carving and masonry houses. Construction processes begin with carving rock places. After carved-out places created, processes followed by construction of masonry part. In the light of interview with masons, we may assume some of rock places carved-out in early ages. Later, masonry part built in front of rock places to enlarge the plan scheme and added new storey under need of more places. However, information of early made carved-out places could not be obtained from the studied buildings.

Since two different methods of producing spaces come together, a transition section developed at the point where they physically met (see app. B). Different transition methods occurred, in due to direction carved-out and masonry structure are joint each other. In this aspect relation between carved-out places and masonry system can be grouped into two.

<u>Transition from Carved-Out and Masonry System in Horizontal Relation</u>

Horizontal relation appears when masonry part of building built up in front of rock carved places. Masonry structure connects to rock mass with timber beams or with rib vault.

- *Vault;* Another transition method is developed with vault structure. This transition is seen in space that covered with vault system, constructed in front of carved –out places and create separate room. Walls are constructed following line of rock shape and vault built-up on walls. When vault construction finished, connection between last arch of vault and rock surface is not appear squarely, because of the rock surface nature. Thus, gaps are filled with pieces of stones and rocks while top of vault filled. In some examples vault structure is used to widen rock place and create a room together with rock carved place. A groove carved on rock-surface and last arch of vault placed on it. This method improves strength of arch and gives clear finishing between rock and arch system (Figure 3. 75-3.77).

- *Timber Beams;* Masonry part built in front of carved out places connected to rock with timber beams. Building facade and side walls are constructed till the same level of top level of rock space, later then timber beams placed between front masonry façade and rock to connect structures. On masonry wall timber beams sit directly to top of wall and second floor wall continuous thinner starting from same row with beams. And on side of rock part, timber placed on a groove that shaped from rock's itself (Figure 3. 77).

Relation Between Carved-Out and Masonry Plan Scheme.

From the studied buildings five of the houses that measured with laser scanner have rock carved places which are placed under masonry structures. All storeys plans, including rock carved places, are drawn from point cloud. Later each plans overlapped to each other in layer order (see app. B). Overlapping plans gives opportunity of compare the plans scheme of carved-out places and masonry building. From the new data coming from superposing plans, can be seen masonry structure placed as much as possible on solid part of rock in order to transmit weight of structure to rock. When rock carved place plan larger then upper structure, a rock wall or rock column shaped just under where the upper storey weight transmit to rock (Figure 3. 78). Rock carving methods developed under influences of long time historical experiences that learning, following and practising rock formation types of region and development of instinct of masons by considering need of rock carved places.

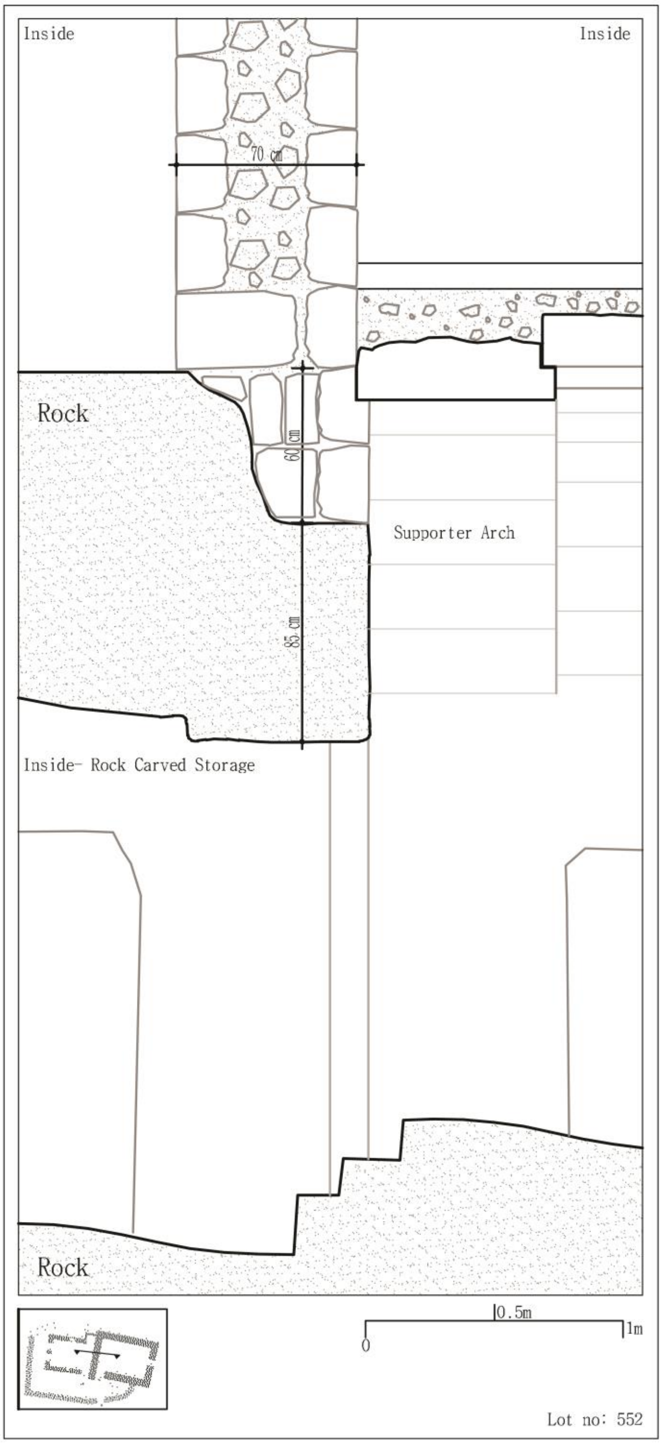


Figure 3. 75 Masonry structure connection with rock carved place

Figure 3. 76 Transition between rock and masonry by vault

Figure 3. 77 Transition between rock and masonry by timber beams

Figure 3. 78 Carved-out coloumns

3.2.4 ARCHITECTURAL ELEMENTS

Staircases

Staircases are the circulation elements which connect ground and upper floors to each other.

In Nevşehir and Uçhisar houses stone is the main material of stairs. As far as, stone of stairs are generally simple rectangular shaped, in some examples, the side of stairs stones are decorated with ornaments. Ornamented steps, has a 2-3 cm indent named “limonluk” on side surface of steps (Solmaz, 2013) (Figure 3. 82). Beside stone stairs, another stair type is the rock stairs that constructed by shaping the rock which has no regular dimensions for steps. Stair types, in Uçhisar houses can be classified in two groups according to where they take place in building;

Inner stairs; built inside of building bearing ground floor to upper floor and/or upper floor to flat roof. *Outer stairs*; placed in courtyards. Stairs rise up to upper storey attached to building wall or courtyard wall. When examples of Uçhisar houses stairs are examined in context of construction method three different groups are found.

- *Type -1;* steps are supported by arch (Figure 3. 79). Arches are composed of stones, where in some examples timber beams are used to help supporting stairs by placing behind stone arch (Figure 3. 80). This method is haphazard and primitive way of supporting stairs by reducing use of more stone.

- *Type-2;* stair is built on masonry walls. Steps sit on masonry wall. Stone steps completely sit on the masonry wall or as well as in some cases, a part length of the steps sit masonry wall while the rest part is projected out of the masonry wall (Figure 3. 81)

- *Type-3*; each steps are hanging on from one side while other side is stuck in wall row. In this wise, steps can remain suspended by the pressure of stones of walls (Figure 3. 85).

Figure 3. 79 Type-1 staircases

Figure 3. 80 Staircase arch supported and timber beams

Figure 3. 81 Type-2 staircase orthophoto elevation

Figure 3. 82 Staircase with *limonluk*

Figure 3. 83 Type-2 staircase

Figure 3. 84 Type-2 staircase, steps are projected

Figure 3. 85 Type-3 staircases

Floor And Ceiling Coverings

Floor Coverings

An architectural element that covered floor of spaces to provide appropriate usage of ground and protect main structure of floor in a way.
In Nevşehir and Uçhisar houses, room's floors are covered with stone and timber coverings.

- *Stone Floor Coverings;* Stone coverings can be found in ground floors and upper floors of houses. First storey stone coverings can be either placed on timber beam superstructure that ground floor covered with timber beam superstructure and even ground floor covered with vault.
  Ground floors are generally covered with stone while some of house's floors are left as rock ground or correcting ground surface with pressed earth. Stone coverings are rectangular shaped stones which has no regular measurements, produced from durable hard type stone to reducing abrasion. Construction process starts with applying clay mud onto finished ground of floor, then 3-5 cm stone covering set on top of applied mortar (Figure 3.87).

- *Timber Floor Coverings;* Timber plank is used in ground floor when it is elevated. When timber planks are used either in ground floor or upper floors, 5x10 cm timber beams are placed on the infill or clay mud with 30cm intervals. Then, 2 cm thick, 30 cm wide timber planks are nailed above these beams. After then timber baseboards changing in height between 10 and 20 cm are placed (Figure 3.88).

Ceiling Coverings

Among the studied houses, demolished example of timber ceilings could not be found, thus the construction techniques of timber coverings could not be examined in details. Nevertheless, on the basis of information received from externally visible part of the construction, timber plates are framed four walls of the room by nailing and middle part of ceiling covered direction of long side of room with timber plates which are nailed to each other with laths. Ceiling coverings are only seen in timber beam structure whereas unique vault system that belongs to region does not require a special ceiling covering.

Cornices And Projections

Cornices

An ornamental or simple moulding on the wall of a room just below the ceiling or below the copestone (called *kafa tahtası* as locally) of room. Three different types of cornices were identified in Uçhisar houses according to where they take place in buildings.

- *Eave Cornices;* these cornices are placed just above the copestone at the end of the last storey (Figure 3.89)**.** In order to dripping snow and rain water, upper surface of eaves cornices are shaped incline. Thus, the water is prevented to come directly to façade of buildings. Eaves cornices are projected 5 cm through inside of the roof layers (Figure 3.90).

- *Inner Cornices;* Inner cornices, as the name suggests, are placed inner side of the buildings. Different than outer cornices, mainly has a role in structural system of houses which has a room covered by timber beam structures (Figure 3. 90). As mentioned before, under title of superstructures of Uçhisar houses, one way of constructing of timber beam structure is placing timber beams on cornices which are projected 15-25 cm from the wall surface towards the room. *Outer Cornices;* outer cornices are generally decorated elements on façade of traditional Uçhisar houses. The cornices between the storeys are constructed 8-10cm projected from façade surface.

- *Storey Cornices;* This type of cornices are placed at the end of the ground floor wall. It is visually separating two storeys from each other and can be examined in two groups generated by its place as inner cornices and outer cornices (Figure 3.92).

Figure 3. 86 Stone floor coverings

- Figure 3. 87 Timber floor coverings

Projections

Projections are basically defined as part of upper storey that extends outwards from lower storey's surface. From the studied site, limitedly information gathered about projections, because damaged houses are not damaged from the projection area that would give opportunities to analyze projection's construction method and its relation with other element of building in more detail. However, general frame of construction projection can be still acquired with that limited information. As the main material of Uçhisar houses, stone, is used in projections. But in one house, timber used with stone by placing on stone consoles. In this method, we may assume that timber behaves like a lintel to weight of masonry wall that sit on consoles.

According to their formation projections can be built as corner bracket projections or as plain projections.

- *Plain Projections;* Most common projection type that has been noted in Uçhisar houses is plain projections (Figure 3. 94). This type preferred to expand the upper floor plan. Generally plain projection built up by cantilevered stones that are placed with 30-60 cm intervals onto top of ground floor finishing level. The upper storey is built on this cantilever which continues along the façade (Figure 3.93-3.94).

- *Corner Bracket Projections;* These type of projections are constructed to provide regular plan scheme to upper floor, whereas the ground floor has to be established in irregular plan scheme, because of the lot borders. Two or three row of stone projected through street (Figure 3. 95).

Figure 3. 88 Eave cornice on façade

Figure 3. 89 Inner view of eave cornice

Figure 3. 90 Inner cornices

Figure 3. 91 Ornamented outer storey cornice

Figure 3. 92 Orthophoto of projection

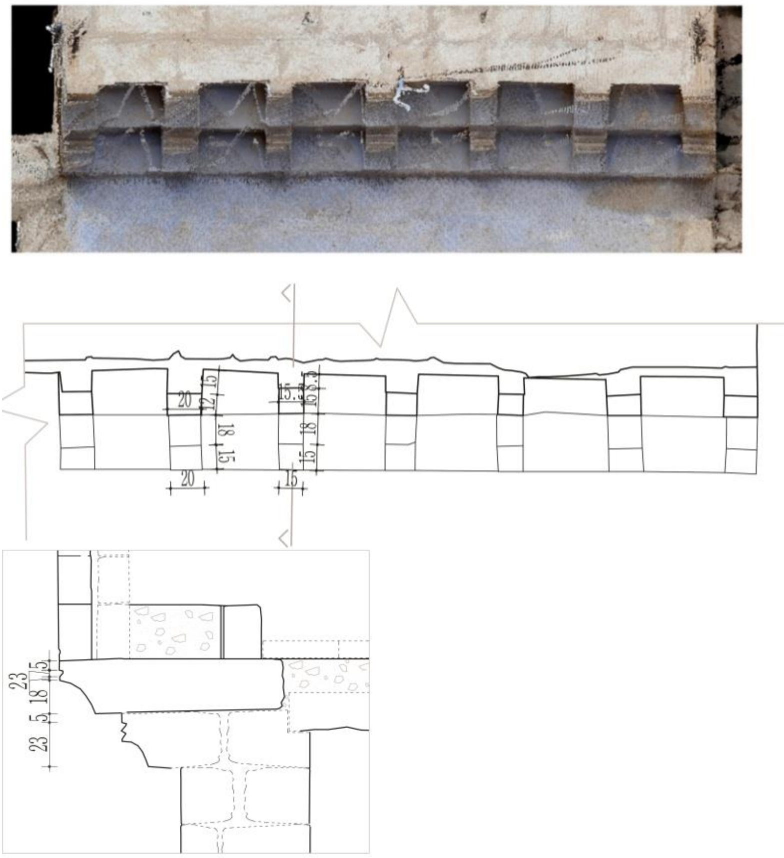


Figure 3. 93 Drawings of plain projection

Figure 3. 94 Plain projections

Figure 3. 95 Corner Bracket Projections

Openings

Doors

From different aspects, door types can be grouped in different classifications. One group can be made according to their place in house unit, other one considering where they placed in room and other one is consist of construction methods.

Their place in house unit; courtyard doors, main door of building outside to interior, interior doors. And stable, storage doors can be added as another subtitle in this phase. Because spaces with different functions have different entrance features that differences are directly reflected in the construction system.

- *Courtyard doors*; opening of doors differs between 140-210 cm and door have generally have double wings made of timber. But in three of the houses, courtyard door openings are 95-110 cm width with one timber wing. Even though the courtyards walls made of rough cut stone, door frames are always built with cut stone that some examples are made by hard stone. Voussoirs of arches can be ornamented and in three examples have stone cornices around door opening. In two examples of studied buildings, 120 cm above the ground, on both sides of courtyard door opening projected stones are placed to use in order to put light on it. To spanning the door openings, semi-circle arches, depressed arches and plain arches are used. Inner part of the door openings are covered with timber lintel which in mean time holding door wings working mechanism. In some rare examples top windows are noted.

- *Outside doors;* these doors are exterior doors that transition between house and courtyard or between house and street. In İbrahimpaşa, Ürgüp and Mustafapaşa outside doors are generally 160 x 220 cm which have two timber wings (Solmaz,2013). Uçhisar exterior doors are one wing timber doors that 80-87 width and 195-210 cm height including 30 cm of doorstep. Opening of the door spanned with an arch. Only in two houses two winged outside doors noted. Very rare timber doors have ornaments. Construction frame of door opening can easily noticeable. 60-120 cm long side stone is placed vertically to both side of opening and another stone bind on long side than arch of opening placed on these stones. The wall that door placed in either built with rough cut stone and cut stone, door opening always created with cut stones. Kepez stone is prevalently used in that framing. Outside doors connecting directly to street have lightening window above the door with 30-40 x 30-60 cm dimensions.

- *Inside doors;* In Uçhisar houses, because of the simplicity of plan schemes, interiors doors that allows passing from room to room, are not common. But still from information gathered via the studied buildings, it is noted that vaulted room interior doors are generally placed on partition walls. Only in one house, passage from ‘taşlık’ to room made by a door placed under covering arch of vault system. Rooms covered with timber beam structures have inside walls on supporting walls. In both cases, inside doors openings are spanned with plain arches in 80-85 cm wide and 200-210 cm high. Ornaments on lintel are detected in one house.

- *Stable and storage doors;* in some examples these doors are placed on single wall doors that separating storages and room where in some other examples, connection between rock cut places storages and masonry constructed places are made from rock surfaces where the storage door is shaped from rock masses. Opening on rock masses can have timber door wing and framed that timber frame fit in hollow that created on rock surface. A piece of cloths are used to cover openings. One example of that type is 35 cm higher than ground with 155 cm height and 75 cm width with its timber door wing which appears like a cub-board. Doors placed in masonry walls generally have one wing timber door with 85x 165 cm dimensions (Figure 3.99-3.100).
- *Their place in room;* In vaulted rooms, inner doors are placed on wall of arches, in rare examples door is placed between two arches of vault system.

According to spanning of door openings, used construction methods are examined under four types.

- *Type 1*: To spanning door opening arc, placing outer part of wall, and timber lintel, built inner side are used. These type are seen either in vault covered rooms and timber beam covered rooms. Arc is constructed outer side of wall, than after timber lintels are placed behind arc, stick into wall. Sectioning of arc thickness is always 20 cm. and total thickness of lintel changes between 45-75 cm. 3-4 timber lintels can be used in a door (Figure 3. 96).
- *Type 3;* these doors are created by carving rock surface. The shape of opening can be in linear form or more like in arc shape (Figure 3.99). Width of doors changes between 70-80 cm and height 155-165 cm. Some examples have simple timber door wing (Figure 3.98)
- *Type 2;* these type of doors are built with two arches placed one after another. Arch that placed inner part is set 35-45 cm higher than outer arc. This type of door seen in outer doors and can be either take place under the arc of vault

cover (Figure 3. 101). Outer arches section is 18 cm and inner arc is found with 35 cm and 74 cm wide. One timber wing door is hanged with a timber lintel which is stuck to gap between two arches (Figure 3.98). Width of door openings are noted between 80-85 cm while height of inner arches key stones from the ground level are 200-230 cm and outer key stones are 165-175 cm (Figure 3. 100).

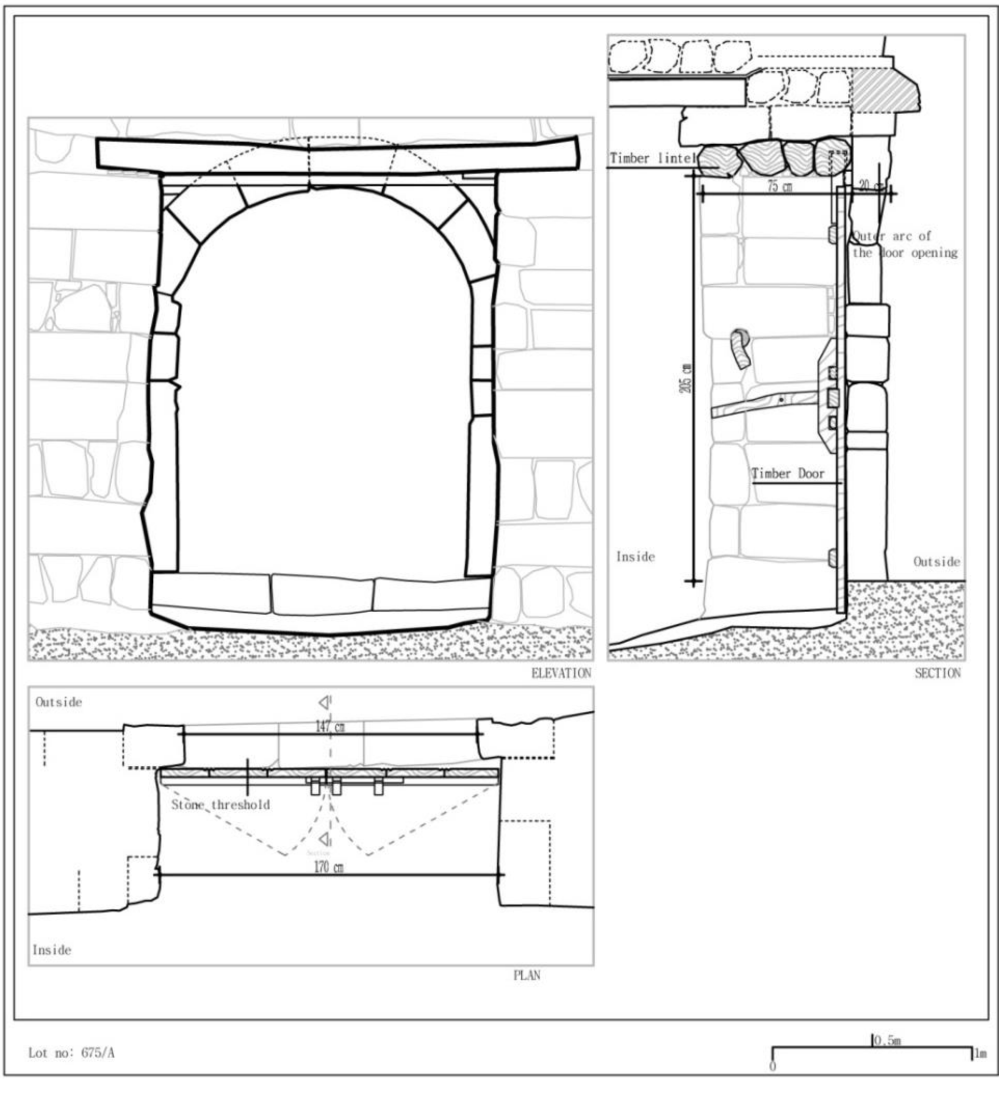
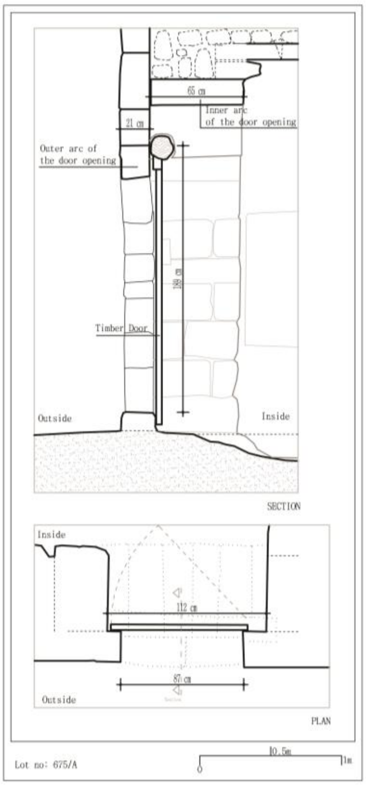


Figure 3. 96 Door Type-1



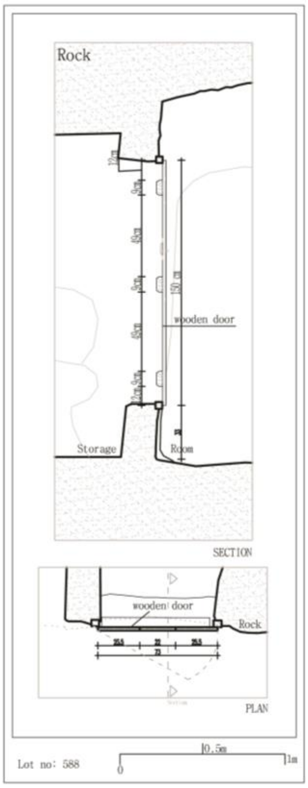


Figure 3. 97 Door Type-2

Figure 3. 98 Door Type-3

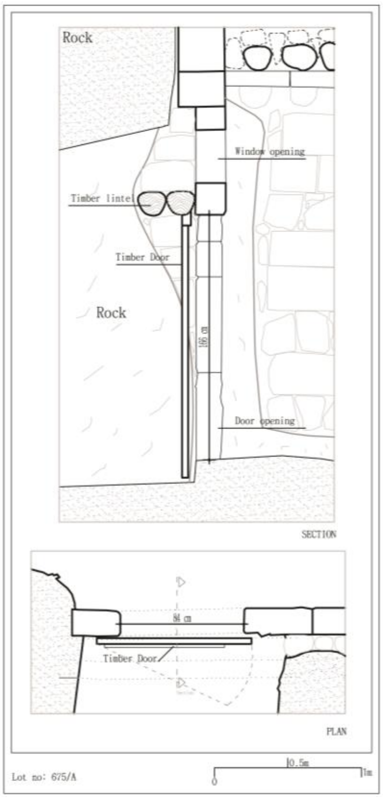


Figure 3. 99 Door Type-3

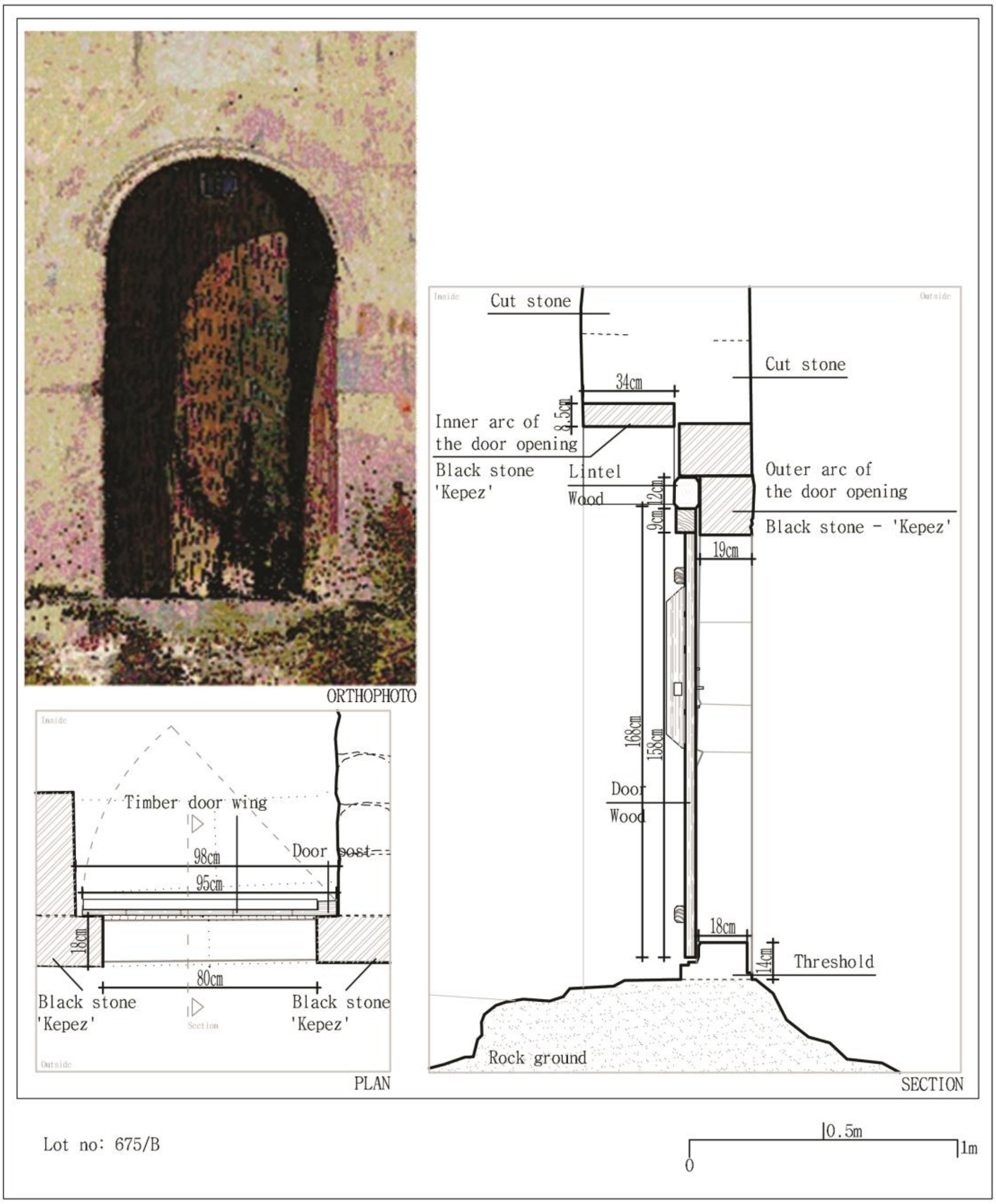


Figure 3. 100 Door Type-2

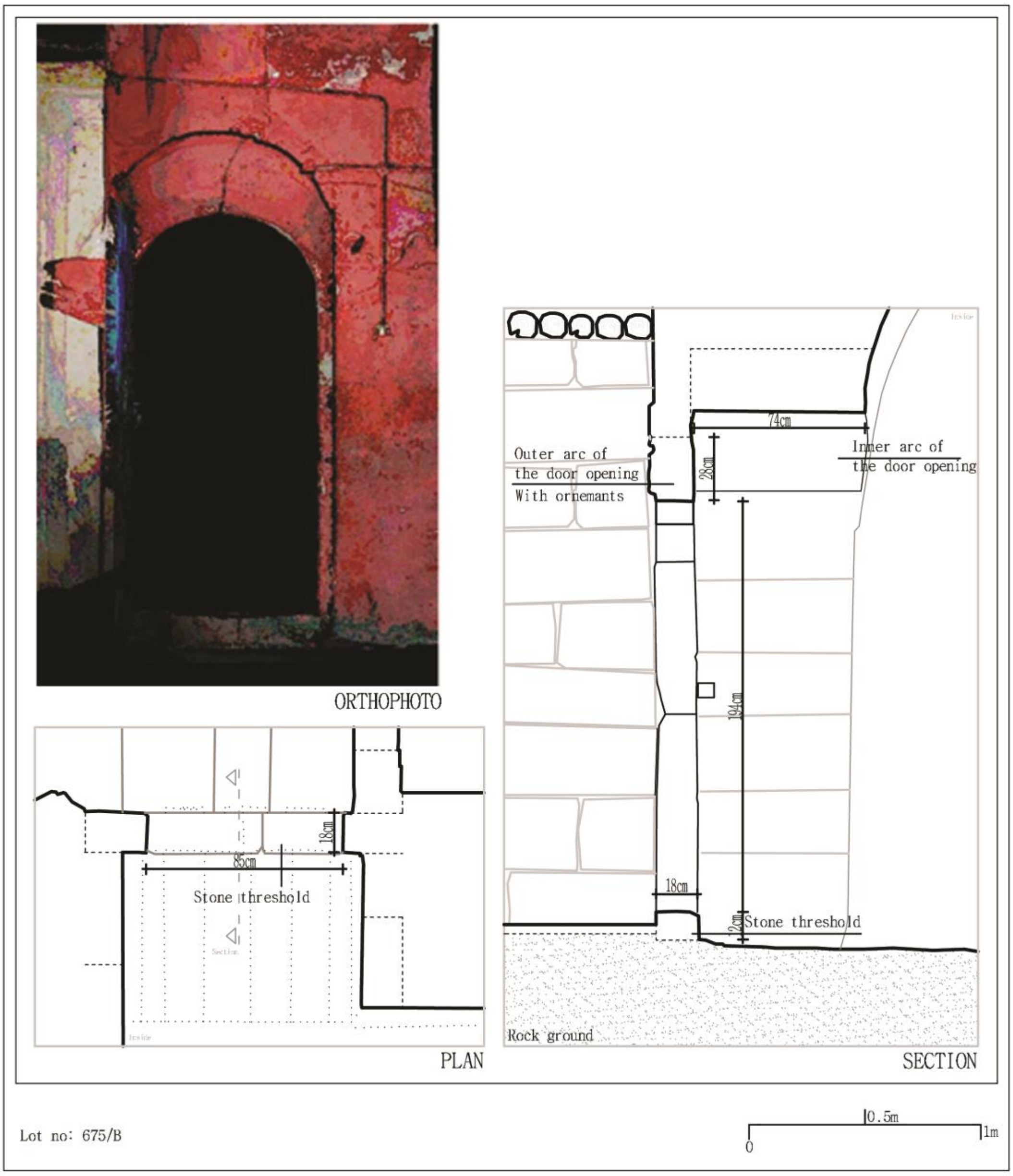


Figure 3. 101 Arch spanned door

Windows

Windows are the elements contact inner side with outside while getting air and light to spaces. First classification of windows is done by comparing with spanning method of window opening considering wall type that window is placed. In double sided walls spanning window openings are made mainly in two ways. First way inside of room window opening appears covering arch and flat lintel from outside (Figure 3.104-3.106) Second way is similar to the first way; but window opening from inside spanned with flat lintel made by timber. Outer part of wall with 19-21 cm width; inner part is spanned with timber beams that total width of timber lintels reaches 60 cm (Figure 3.104-3.105) In some examples, Windows that are placed in double sided walls can be found either in ground floor and upper floors. Ground floor windows dimensions are mainly smaller than upper windows, having 50-60 cm width and 60-80 cm height. The openings of these smaller windows are positioned at high point from eye level of one passerby to provide privacy (Figure 3.108).

The single sided walls are generally used in upper storey of house so the windows on single sided walls mainly are placed on upper storey of main façade. Width of windows 70 cm and height is 130 (Figure 3. 102, 3.109, 3.10). These windows have iron railings and generally the lintel stone is ornamented. Beside construction methods of windows, another criterion by which to evaluate the windows are the window profiles. In Uçhisar houses window frames and wings are made of timber and many examples have iron window railings. Unfortunately, original window frames are generally has been lost; however from the existed examples, four different types of window profiles can be determined.

- *Type-1*: This window is composed of two parts in vertical. The window, known as the guillotine type window is opened by sliding lower part over the upper part (Figure 3. 102).

- *Type-2*: In this type of window profile, profile is consist of two parts in vertically and divided three parts in horizontally. This type of profile appears in bigger sizes than other window profiles (Figure 3. 106).

- *Type-3*: Timber framed window is created two parts in horizontal, one part constitutes 1/3 height of window and it is opened horizontal direction (Figure 3. 108). The left 2/3 height is placed above divided in two wings.

- *Type-4*: This type consists of two horizontal parts in same dimensions with Type-1. While two wings of above part can be both opened, the upper 1/3 part of window could not be opened (Figure 3. 109).

- *Type-5:* Although there are many in the surrounding cities from this window type, in Uçhisar only in one house determined. Window frame is divided into two parts horizontally and three parts vertically consist of upper two parts that can be opened together and lower part is opened separately.

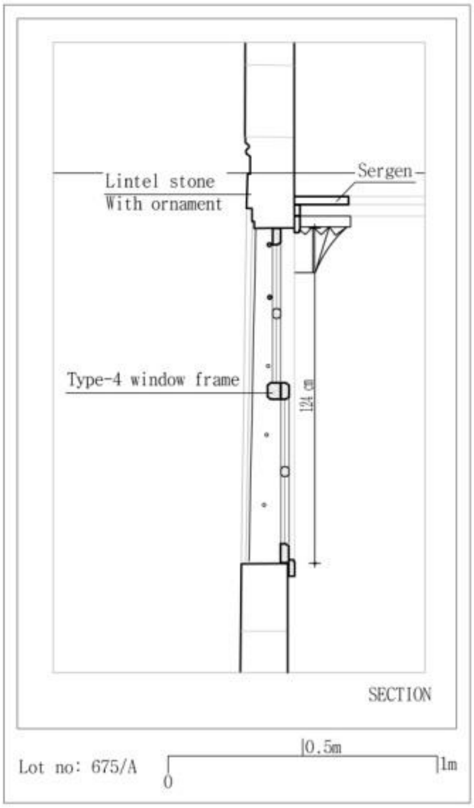


Figure 3. 102 Window Type-1

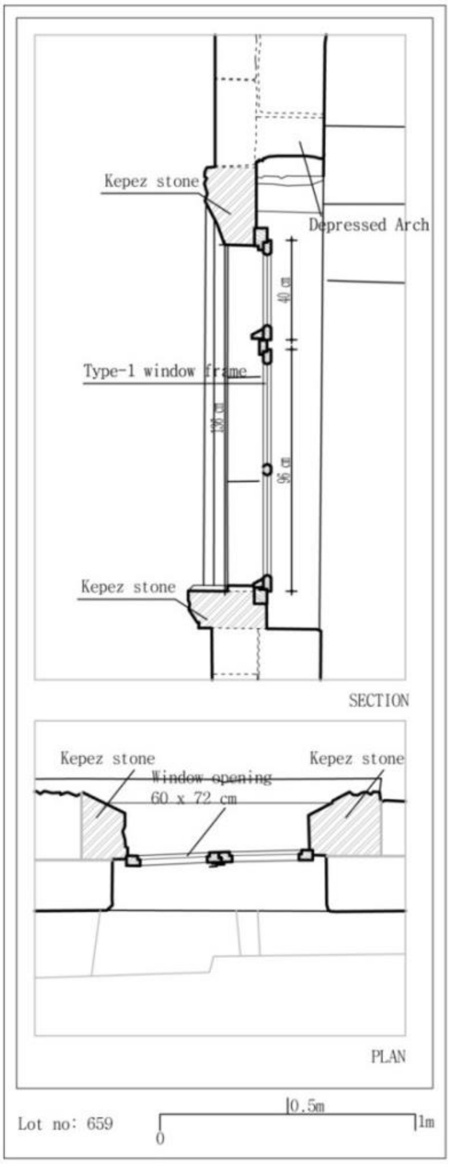


Figure 3. 103 Stone Arch Lintel window

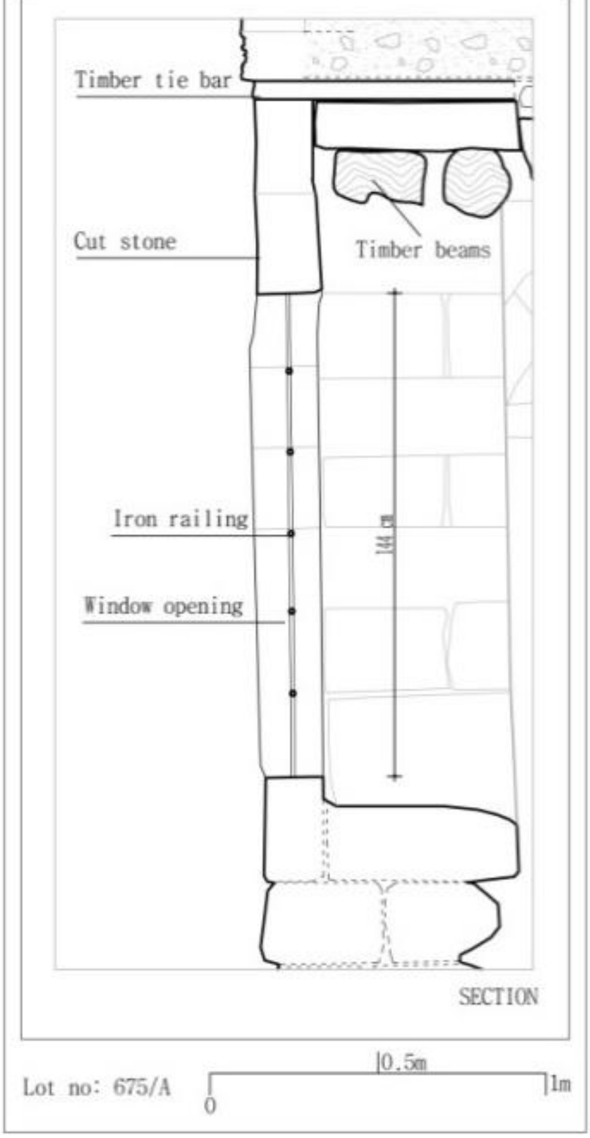


Figure 3. 104 Timber Lintel window

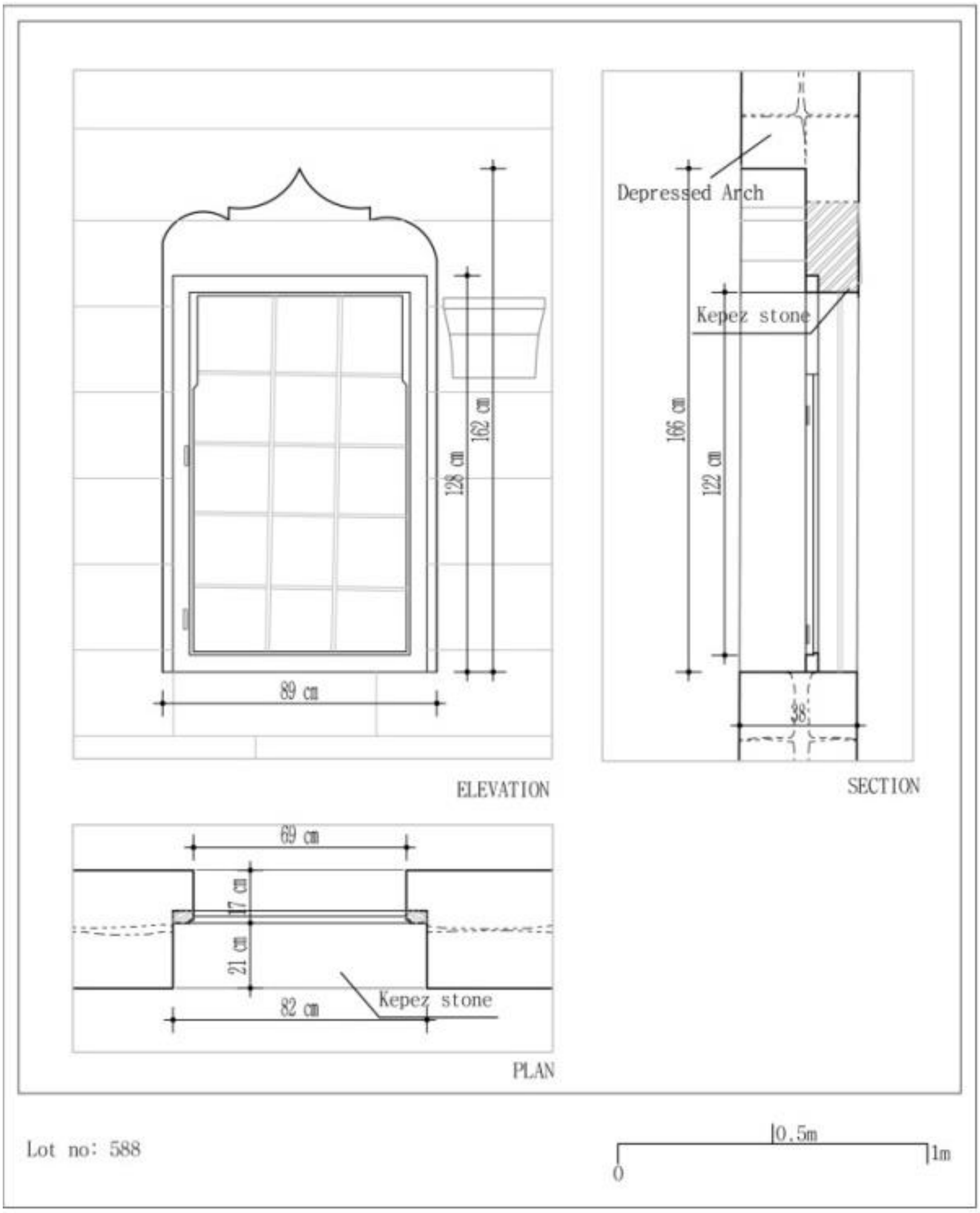


Figure 3. 105 Arch lintel window

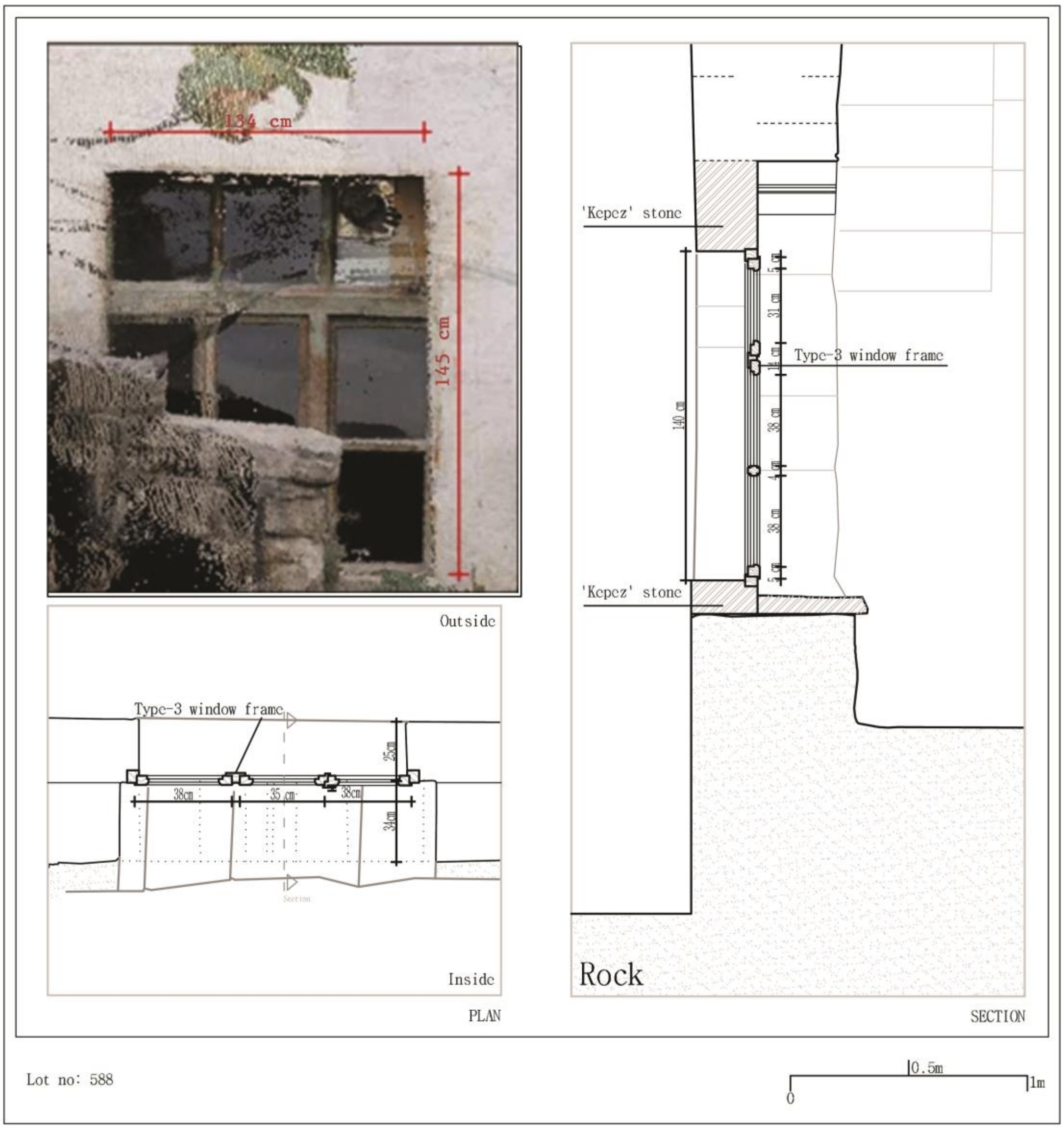


Figure 3. 106 Window Type-2

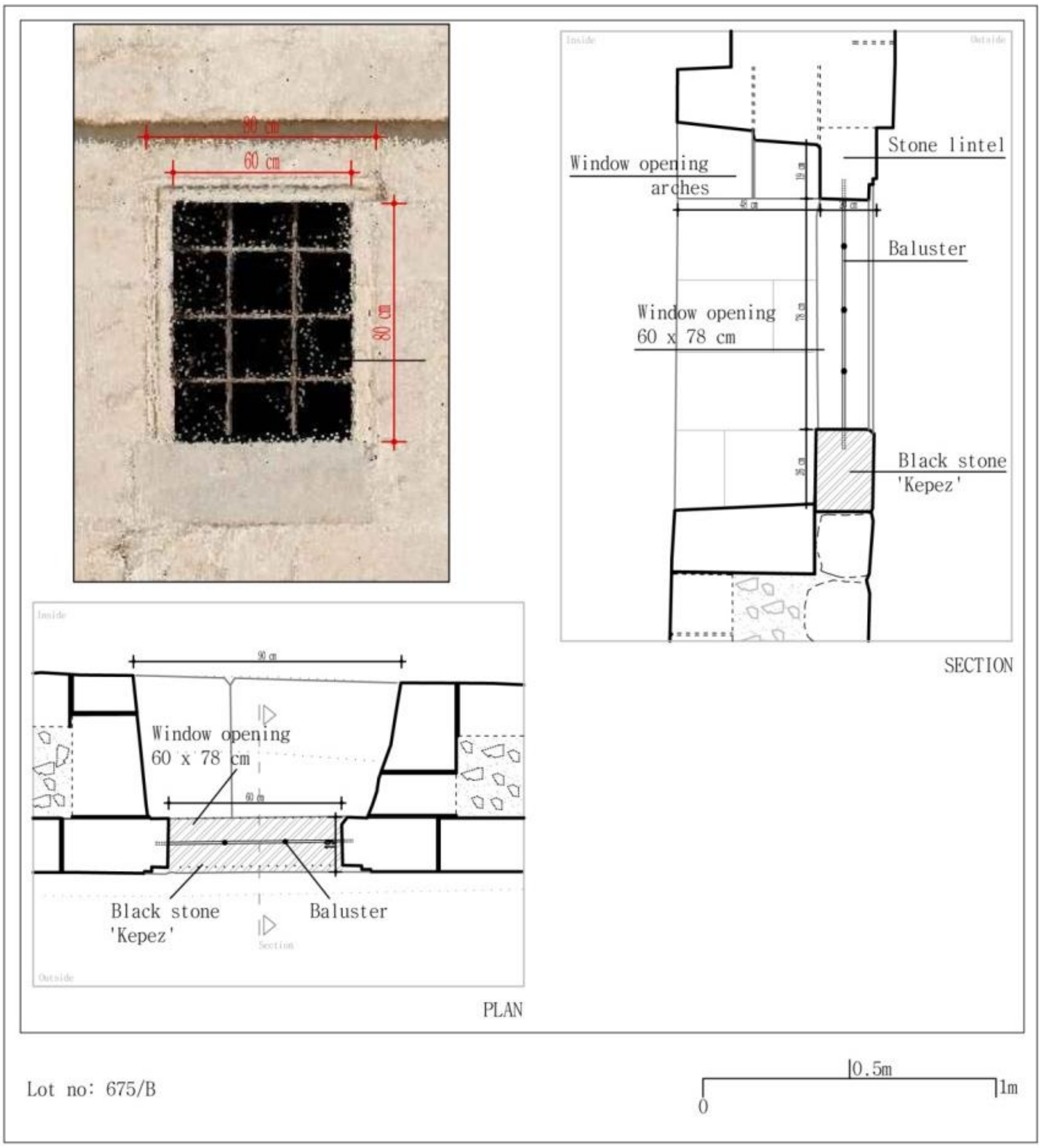


Figure 3. 107 Ground floor window

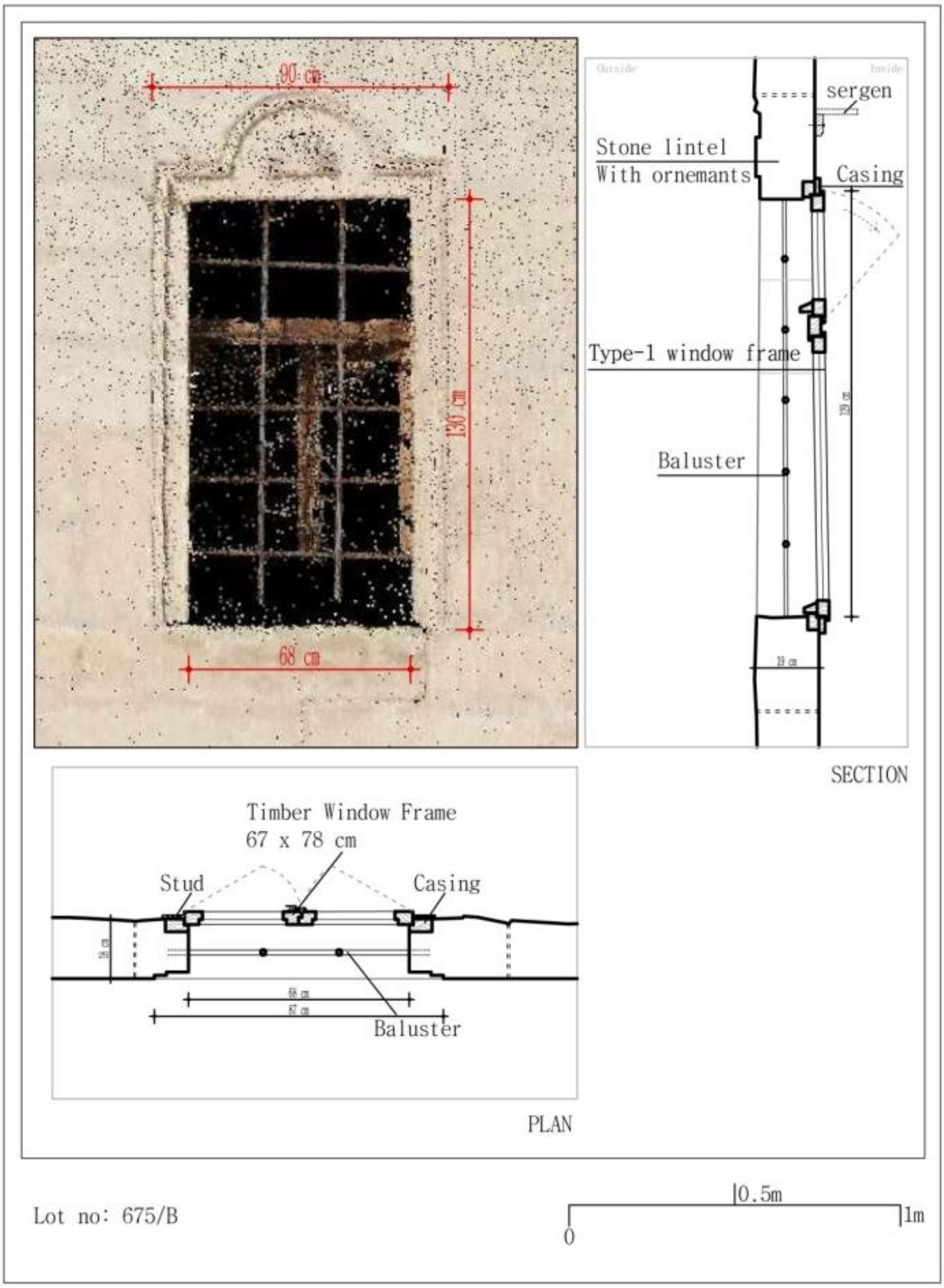


Figure 3. 108 Upper floor window –Window Type-3

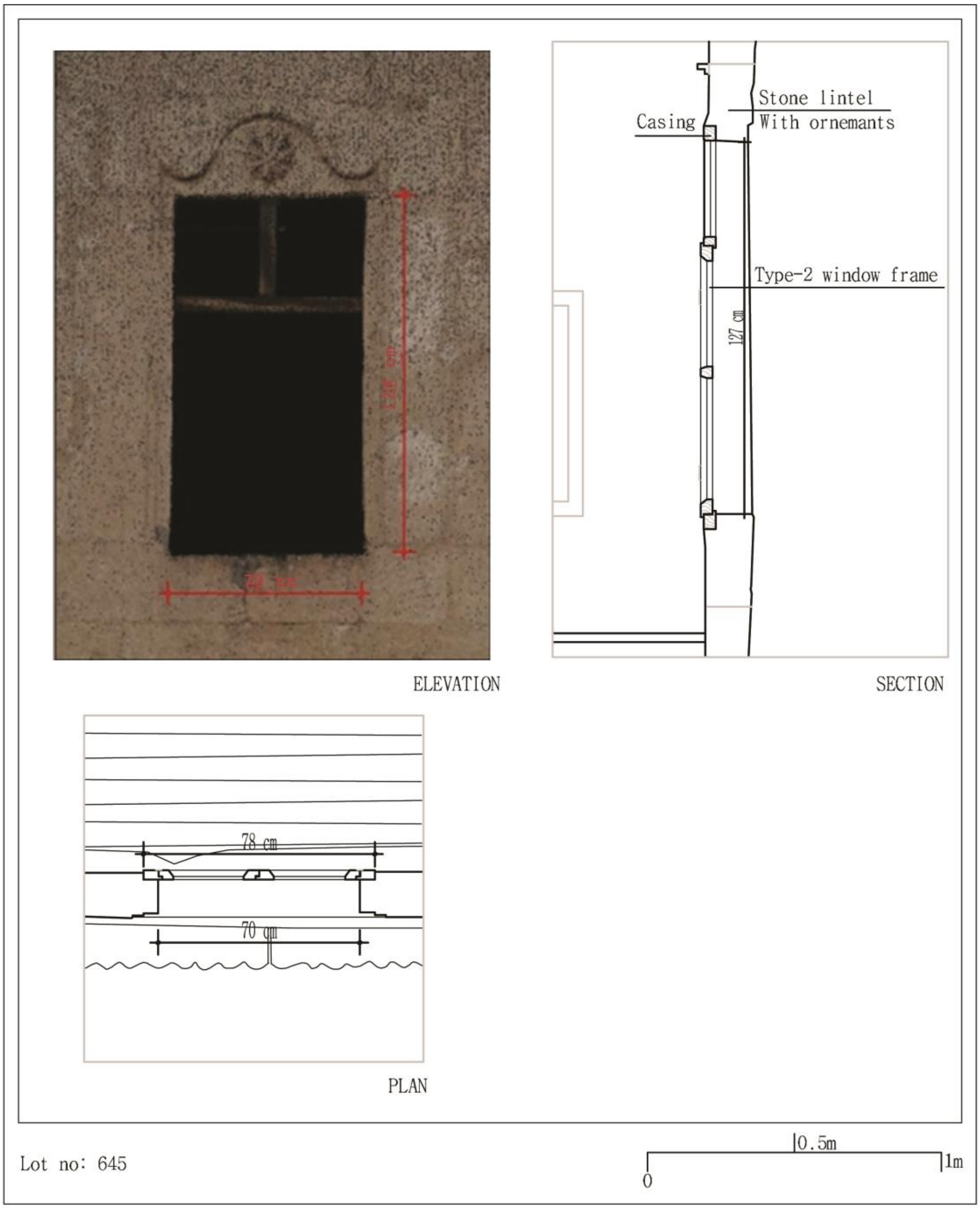


Figure 3. 109 Window Type-4

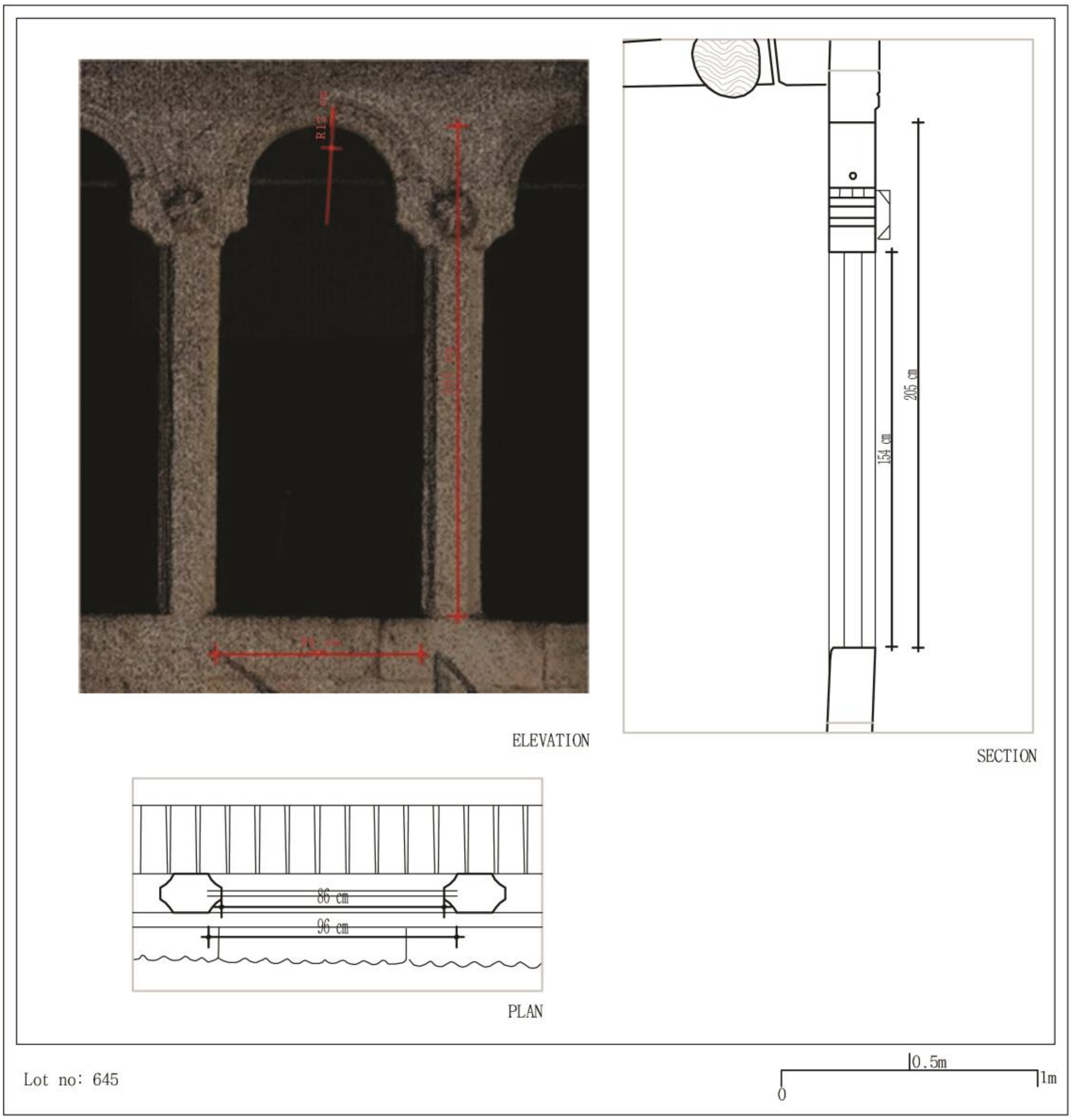


Figure 3. 110 Aiwan arch spanned openning

3.2.5 OTHER ARCHITECTURAL ELEMENTS

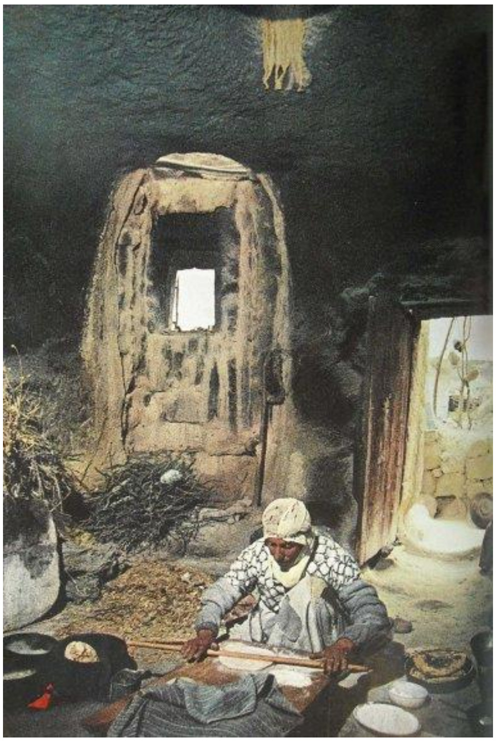
Heating And Cooking Elements

Tandır

Tandır is one of the architectural elements that is used for cooking and heating of places. Women were used to spent day time in *tandır* room, especially during summer times (Figure 3. 111). Beside the cooking bread and food purposes, it serves as a heating element in a room. This element is built in ground floors by digging rock ground that found either in a room, kitchen or in a *tandır* room. More than one *tandır*s can be found in a place (Figure 3. 111).

Tandır is made by composed of rock and terra cotta materials. Rock ground is digged 50-65 cm down with 50-80 cm diameter (Figure 3. 116). After carving rock ground in cylindrical shape, an air tunnel which ensures oxygen for the fire to burn and for air circulation carved till outside of the place and terra cotta pipe is fit in, then covered with earth that comes from digging and bring it same level with room. One side of canal opens to inner side of *tandır* and other one reaches to outside (Figure 3. 114). Into cylindrical carved space a terra cotta placed in middle which is 15-20 cm smaller than cylindrical space. 15-20 cm gap that occurred in between filled with earth, salt, clay and pieces of glass in order to keep heat inside. Than filled part is covered in 15-20 cm thick, 20 cm dimensions rounded stones or 3-5 cm thick and 25-30 cm wide flat stones, preferably made of hard stones cover. And 3-5 cm thickness of hard stone is used as a cover of whole *tandır* (Figure 3. 115).

Tandırs can be found in kitchen for cooking purposes and in the rooms cooking and heating purposes. Some houses have *tandır* houses which are especially built up for *tandır* (Figure 3. 113). This place is used as kitchen. In rock-cut places, some examples there have more than one *tandır* in *tandır* room.



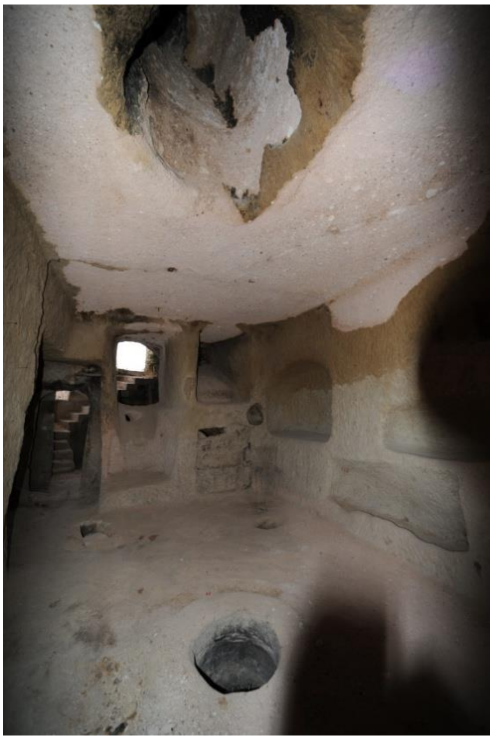


Figure 3. 111 Old photo of daily routine in carved out *tandır* room

Figure 3. 112 Two *tandırs* in carved out place with chimney above

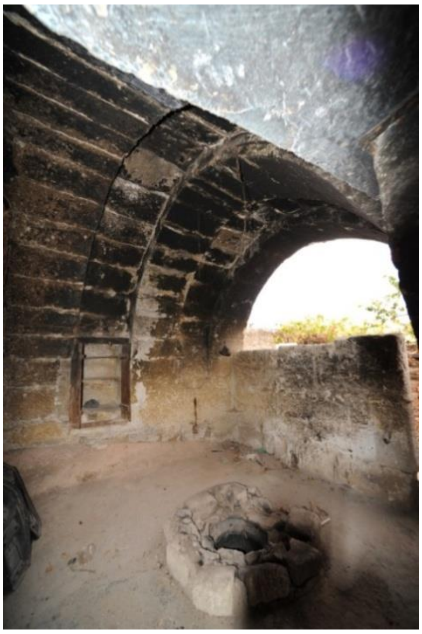


Figure 3. 113 Tandır in *tandır* house

Figure 3. 114 (left) Air tunnel coming out of space, (right) Air tunnel on ground

Figure 3. 115 (left) *Tandır* - (right), *Tandır* and *tandır* cover

Figure 3. 116 Opened *tandır* hole

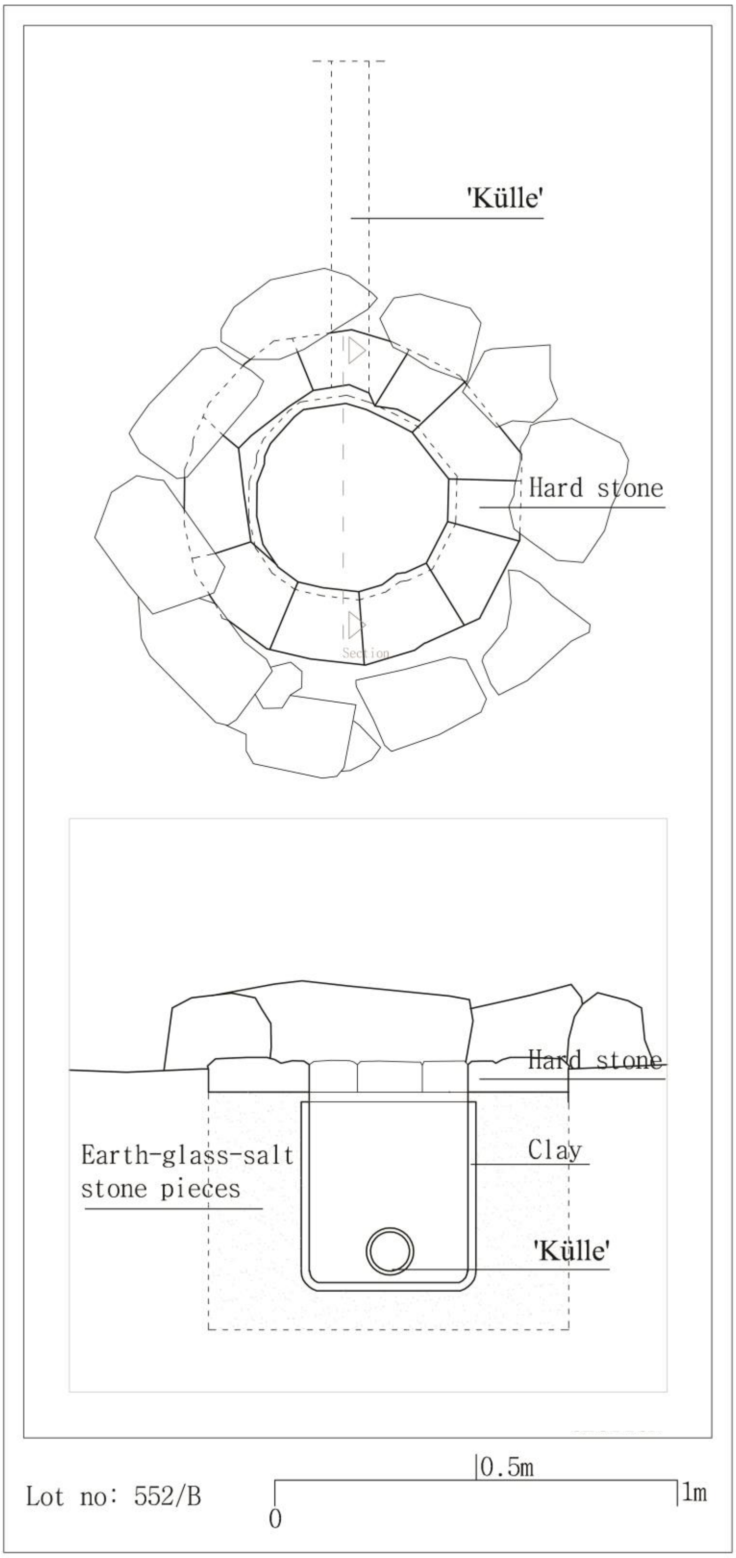


Figure 3. 117 Tandır drawing

Fireplace

Fireplace is an architectural element that is used for heating places and for cooking. According to using purpose of fireplace, places that fireplace built in differentiate. For heating purposes fireplace can be take place in rooms and fireplaces used for cooking built in kitchen (Figure 3. 120). The fireplaces are appears in different shapes and made of two different materials. One type is constructed with stone, while the other one shaped from rock in carved places.

- *Rock Fireplace;* Rock fireplaces have different types in shapes and dimensions. Rock fireplaces can be totally made by carving rock massing (Figure 3. 118-3.120). In some examples it is seen that shaft of the fireplace is carved from rock, but the face of the fireplace which is ornamented constructed with stones fitting in carved space (Figure 3. 121). Shaft of chimney was not reachable, therefore any dimensions are determined.

- *Stone Fireplaces;* Most of the stone fireplaces are found in vaulted covered rooms. But it has also found instances in timber beam rooms. In vaulted rooms fireplaces are generally placed supporting wall of vaults placed under cover arch (Figure 3.123). Despite this, two of the houses have fireplaces on short wall of room, one is placed between two windows on main façade of building and the other one is placed on back wall which withstand to rock.
  The wall of room that fireplace is going take place is construct keeping the hole of fireplace which is generally 2/3 of the wall (Figure 3. 123). The same method is done for chimney shaft during construction of upper part of wall. To reaching the shaft of chimney was not accessible in many houses, but two measured shafts have 20 x 20 cm sizes.

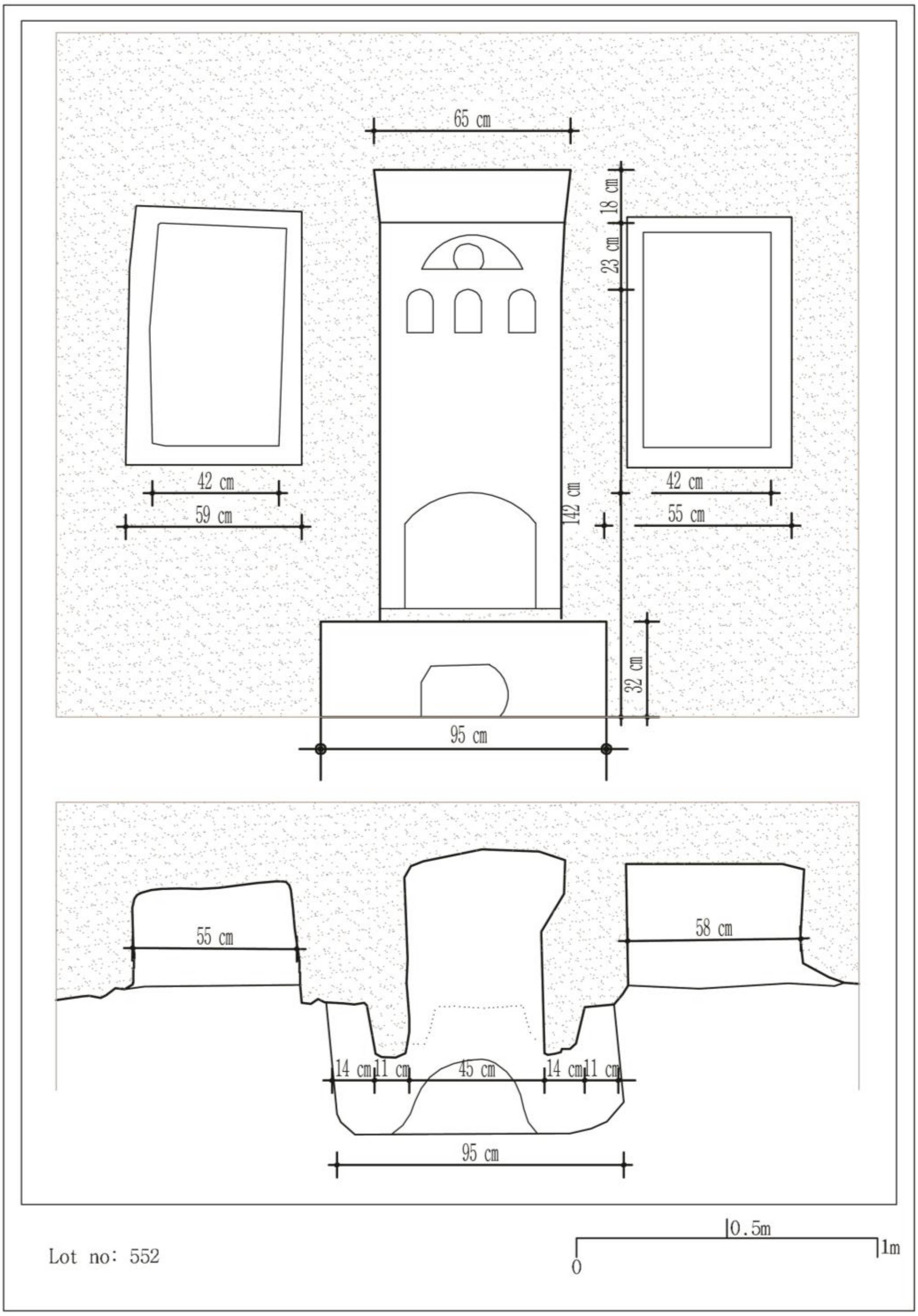


Figure 3. 118 Drawing of rock fireplace

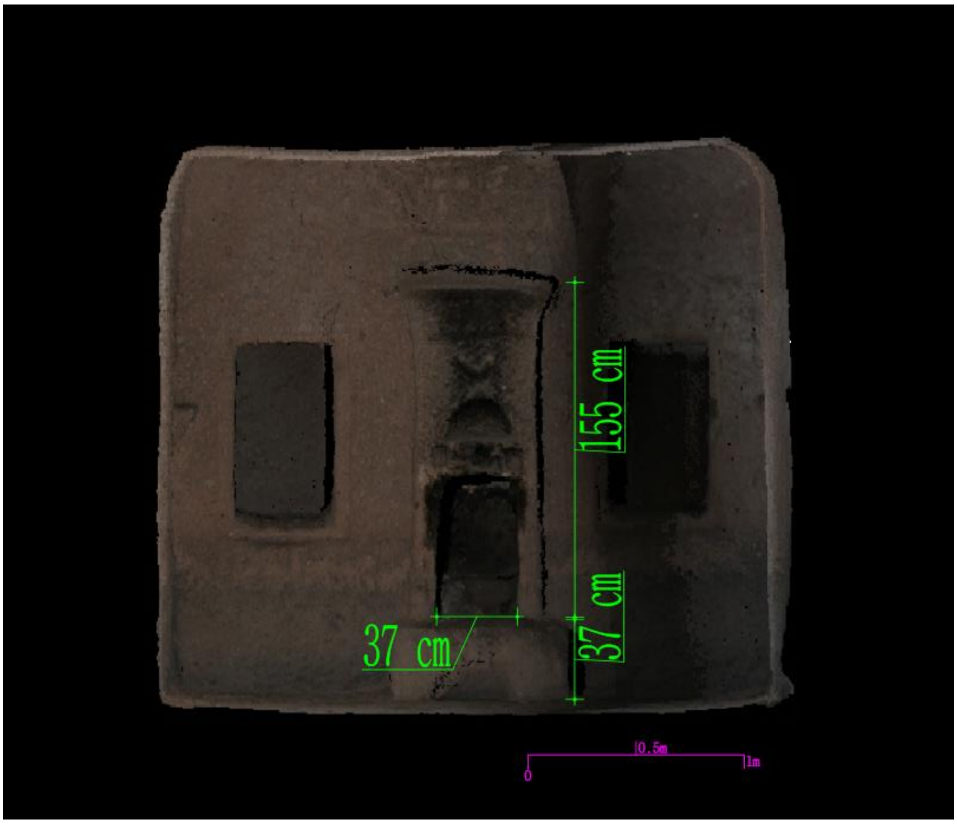


Figure 3. 119 Orthophoto of rock fireplace


Figure 3. 120 Old view of rock carved places having fireplace
http://www.eskiturkiyefotograflari.com/nevsehir01

Figure 3. 121 Rock fireplace

Figure 3. 122 Fireplace on cover arch

Figure 3. 123 Place of fireplace in wall

Sedir

Sedir is an architectural element raised from the ground and used by purpose of sleeping and sitting. They are extensively placed in front of the windows that kept short direction of main façade wall. But in few examples *sedir* continues along one side wall and appears as "L" shaped.

- *Timber Sedir;* In the fieldwork, timber *sedir* were generally found on the upper floors. However, it was detected two samples that placed in ground floor. Some of the studied samples of *sedirs* were still standing; but in some of the houses, already demolished timber *sedir* traces could be noticed. Traces provided efficient information about the process of making *sedir*.
  Timber *sedir* are used in the room where the timber *seki* take place. These two architectural elements are built together. Ground elevation of *sedir* changes from 25 to 30 cm and distance between the window opening and top of *sedir* is noted 45-50 cm. In the construction process, at 25 cm from the floor hollows opens to the built wall. Hollow's measure is occurred as average 10x5 cm rectangular. Offered in these holes wooden beams that are 8 x 4 cm dimensions placed. The other end of the exposed wooden beams are placed on the wooden plates on the opposite side that is extends along the short side of room. The wooden plate is composed 3x3x25-40 cm plates that are nailed to each other (Figure 3. 124). In one houses instead of opening whole in order to hold timber beams, one row of façade stone is projected inside of room and 3 x 5 cm beams are placed on these stones (Figure 3. 126). After finishing structure of *sedir,* timber plates that are 2 cm thick covered. From the traces of *sedir* that can be easily seen that timber *seki* placed 1 cm into wall in some of the examples.

- Stone *Sedir*s; In Nevşehir region stone *sedir* can be used on ground floors and upper floors. But in Uçhisar houses stone *sedir* only experienced in upper storeys (Figure 3. 125). A stone line wide created 70-80 cm far from room's wall that creates a space between wall and stone border (Figure 3. 129). Each stone of line is 18cm wide. The space is filled with soil containing rock pieces adding. Top of filled space is finished with a pressed earth or covered with stones (Figure 3. 128). From the level of ground, height of *seki* changes between 20-35 cm and 50-60 cm above the bottom of window level.

- *Rock-Cut Sedirs;* This type is found in one example of studied buildings. Rock-cut *sedir*s is shaped by carving rock ground in rock cut place. Dimension of the *sedir* is measured as 50 cm high and 90 cm.

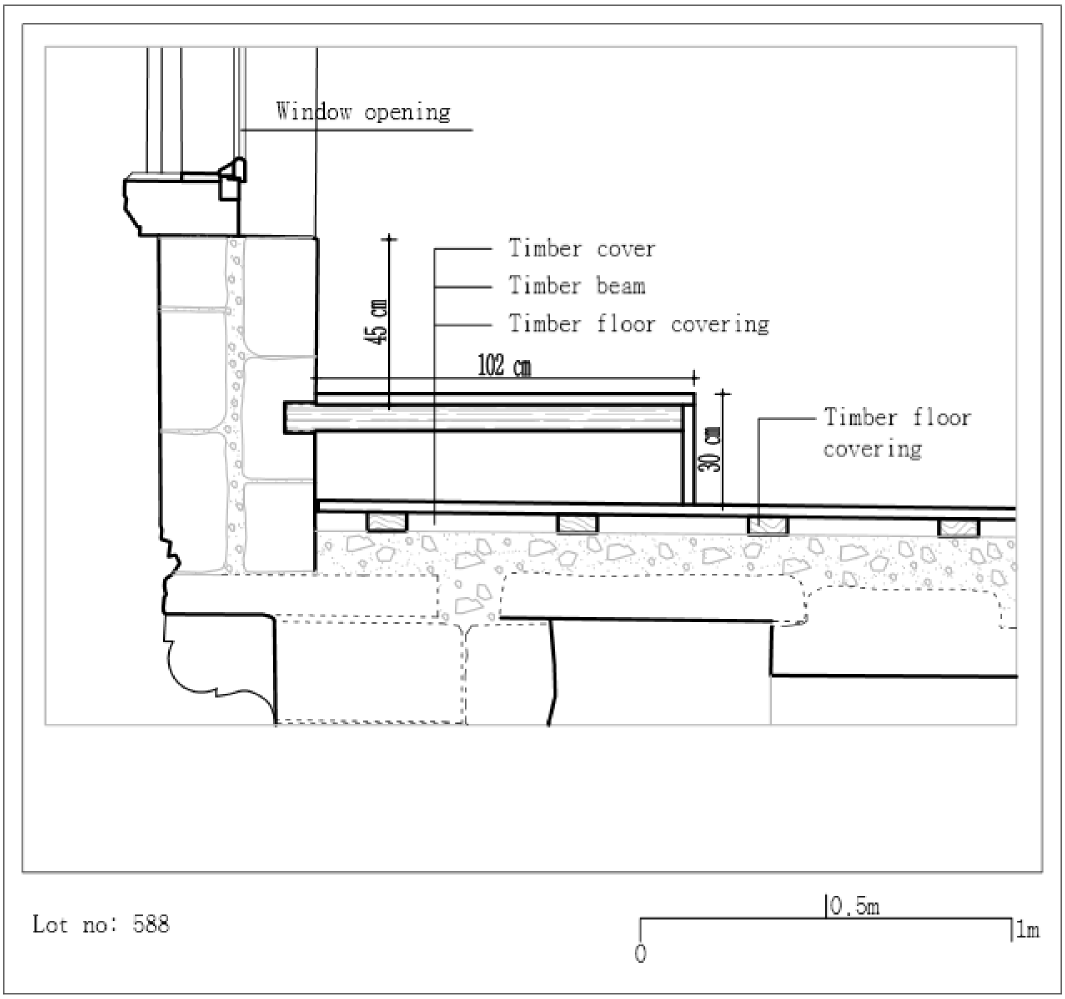


Figure 3. 124 Timber *seki* drawing

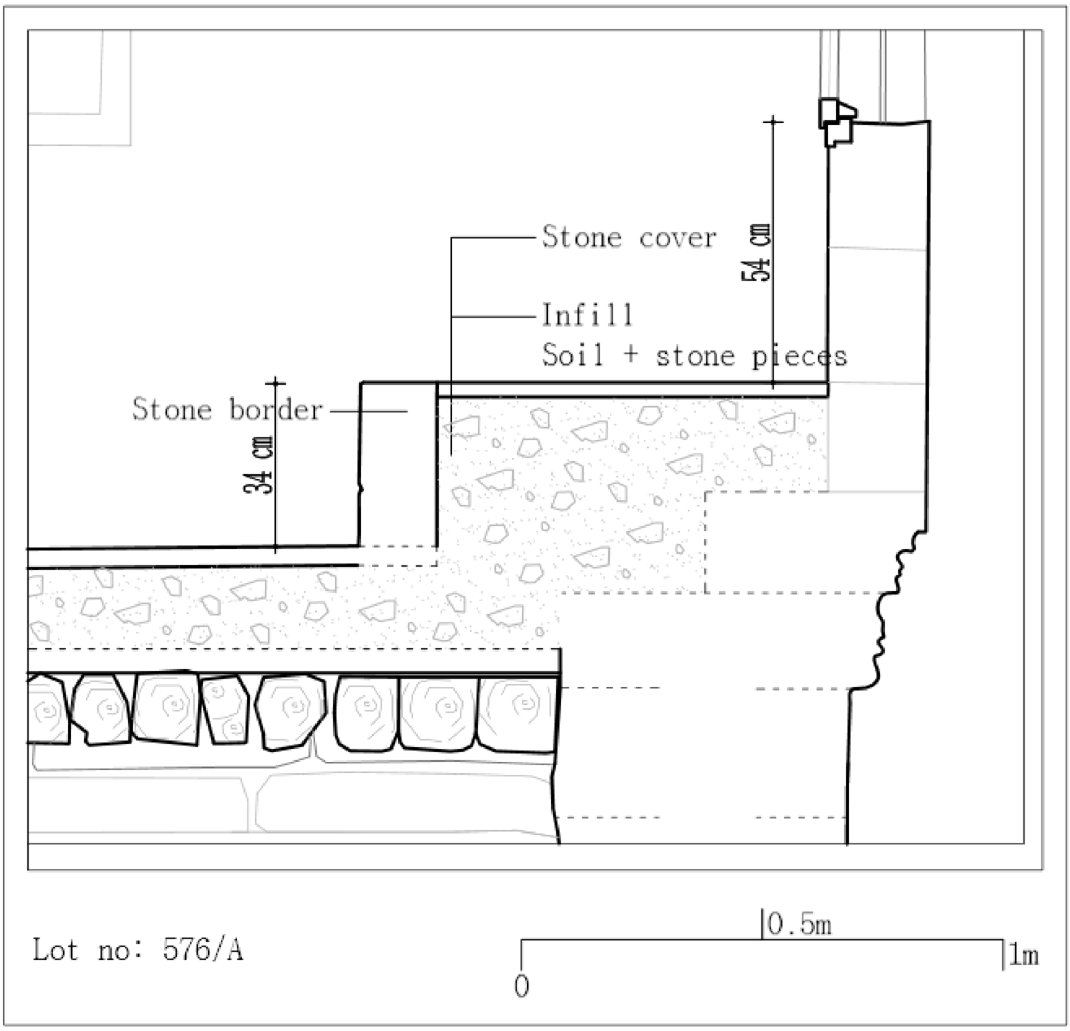


Figure 3. 125 Stone *sedir* drawing

Figure 3. 126 Timber *seki*

Figure 3. 127 Projected stone usage Instead of opening hollow for *sedir*

Figure 3. 128 Soil and stone pieces infill of *sedir*

Figure 3. 129 (left) ‘L’ shaped stone *sedir* (right) Stone *sedir*

Seki, Pabuçluk, Musandra:

Seki

Seki is an architectural element that built elevated from floor of room. This elevated platform covers floor of room; beside entrance part of room floor which is called '*pabuçluk'*. Rock, stone and timber are used materials for *seki* that changes the construction methods.

- *Timber Seki:* Intact examples of timber *sekis* are found, both in ground storey and upper storey of masonry buildings. However traces of timber *sekis* and hollows are clearly readable from the side surfaces of rock carved rooms (Figure 3. 130). In some of rooms with *seki*, on the side walls where timber *seki* ends, timber plates are nailed to wall which is lost in many instances the traces of the plate and nails are still stuck in surface can be seen. If timber *sedir* exist with *seki*, this plate is continuing on the wall that *sedir* is lean on (Figure 3. 132).

  The information gathered from *seki* examples of Uçhisar houses show that during construction of *seki*, firstly clay mud is plastered on infill, then timber beams are placed on plastered ground with 30 cm distance from each other. After placing timber beams which are 2-3 cm thick and 8-10 cm wide, timber coverings set on top of these beams. Timber covering dimensions are 1-1.5 thick and 20-25 cm wide. Generally each timber coverings have same width; but in some examples they have variable dimensions

- *Stone Seki;* In upper storey of one house stone *seki* is noted. Seki is elevated 10 cm from floor. Covered stones sizes have not regular dimensions. Stone 'L' shaped *sedir* covered two sides of room, sitting on stone *seki*. Traces of 40 cm height *musandra* can be seen on two sides of *seki*.

  In other settlements of Nevşehir, as another type of seki, rock-cut *seki* are also created by carving rock ground. But in Uçhisar, rock studied carved out places do not have any rock *seki* examples (Figure 3. 133).

Pabuçluk

In traditional houses, a place where people take off their shoes in entrance of the room is called *pabuçluk (*Figure 3. 134*)*
Pabuçluk is 8-10cm lower than *seki* and in some examples lower level goes all along on short side of room (Figure 3. 134-b). Generally located on the opposite side of where the *sedir* take places in the room, but in one example *pabuçluk* takes small place just near the *sedir* (Figure 3. 135).

Musandra

Musandra is wooden balustrade which is placed on *seki* that facing with *pabuçluk.* It is used for taking support by holding it during people taking off their shoes (Figure 3. 137). This element is found only two of the houses and traces of *musandra* on side of walls of room are noted in some houses that provide information of height of *musandra* (Figure 3.136-3.137).

Figure 3. 130 Timber *seki* hollows on rock surface

Figure 3. 131 Timber seki

Figure 3. 132 Timber *seki* and timber plate traces on wall

Figure 3. 133 Stone *seki*

Figure 3. 134 (left) Pabuçluk (right) Pabuçluk go along short side of room

Figure 3. 135 Pabuçluk near *sedir*

Figure 3. 136 Musandra traces

Figure 3. 137 Musandra

Storing Elements

Niche

An architectural element, locally called '*taka*', is constructed into stone walls during processes of construction of wall or carved into rock surfaces. Dimension of niches are differentiated, either the space they are found. It is possible to find niches in all plan units, such as kitchen, room, aiwan and storage. Number of niche can be more than one in a room.

- *Rock- Cut Niches;* these niches are shaped by carving rock surfaces. There are many different shaped and size of rock cut niches. In storage so many number of niches can be found in many different sizes (Figure 3.142). Sizes are probably changing by purpose of using. Some of them are shaped more rectangular, while some are more rounded. Even there is not an obvious measuring, the average size changes between 30-50cm x 50-70cm and the depth of rock niches is averagely 30-20 cm (Figure 3.144).

- *Stone Niches;* Stone niches are built into the stone walls. In the vaulted rooms, they are built into side walls that under the post line of cover arches (Figure 3. 144). But in some examples it can be placed on front façade of room (Figure 3.143).

  In case of stone wall of room bonded in front of rock, the background of that stone niche can leave as rock in order to unnecessary use of stone. The common used sizes are 30-40 x 40-50 cm. and the depth is between 25cm and 30cm. This can be added that some of the niches have ornaments on top stone of niches, while some types are simple niches without any decorated stones (Figure 3. 138, 3.145).

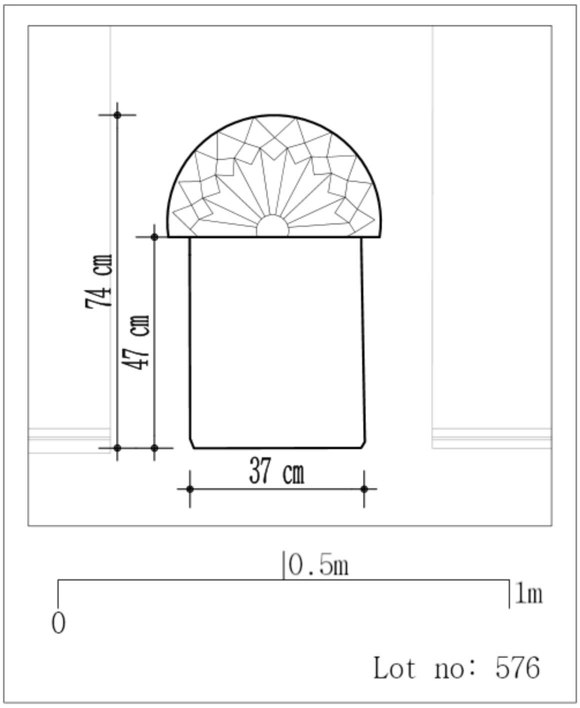


Figure 3. 138 Stone niches drawing

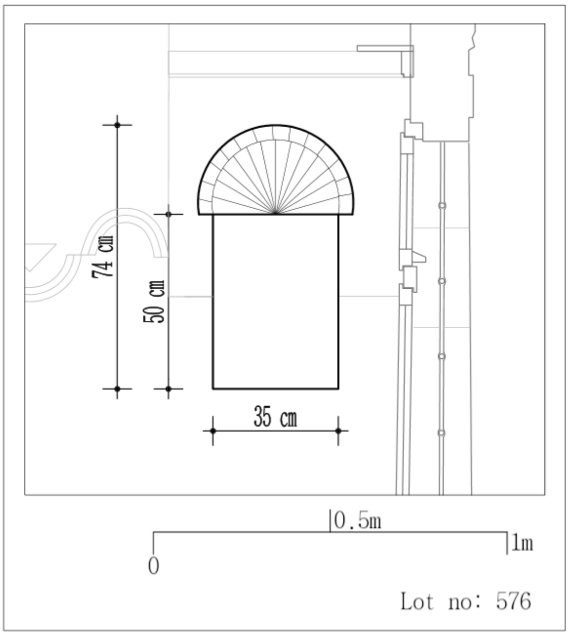


Figure 3. 139 Stone niches drawing

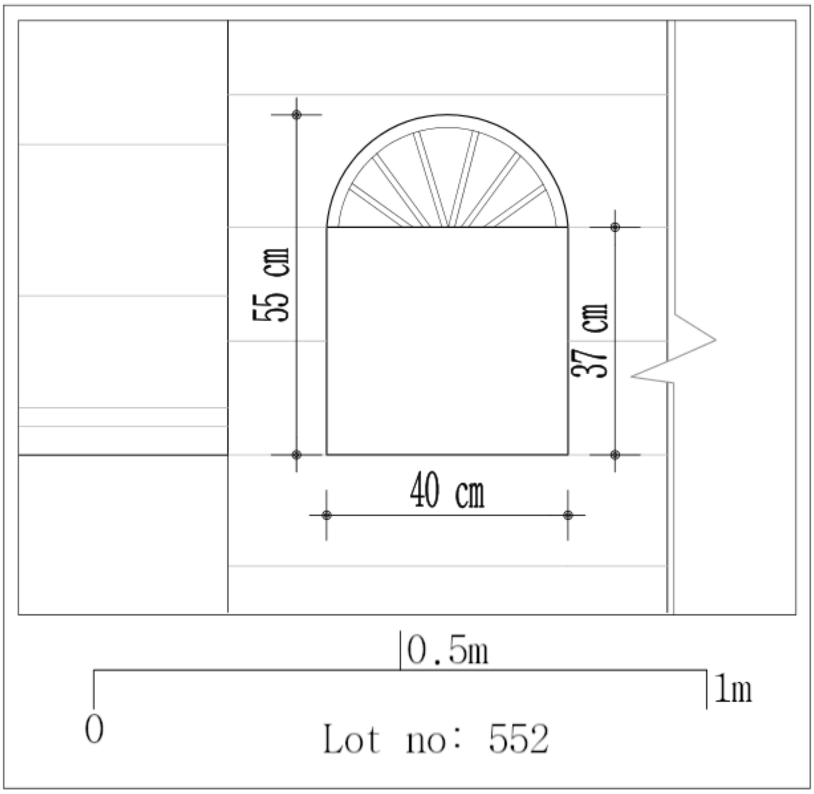


Figure 3. 140 Stone niches drawing

.


Figure 3. 141 Different size of rock niches


Figure 3. 142 Niches between windows



Figure 3. 143 Rock carved niches



Figure 3. 144 Stone niches on vault arch

Built-in Cupboard

Built-in cupboards are kind of niches which have timber frame, wings and shelf in it. They are generally sized 60-70 x 90-130 cm and 30-45 cm deep (Figure 3. 145). The main construction materials of built-in cupboards are stone and wood.

In some examples, it is noted that stone and rock mixed used to create cupboard. Half of the cupboard opening cut off from rock wall and other half of the opening completed with stone masonry (Figure 3. 148).

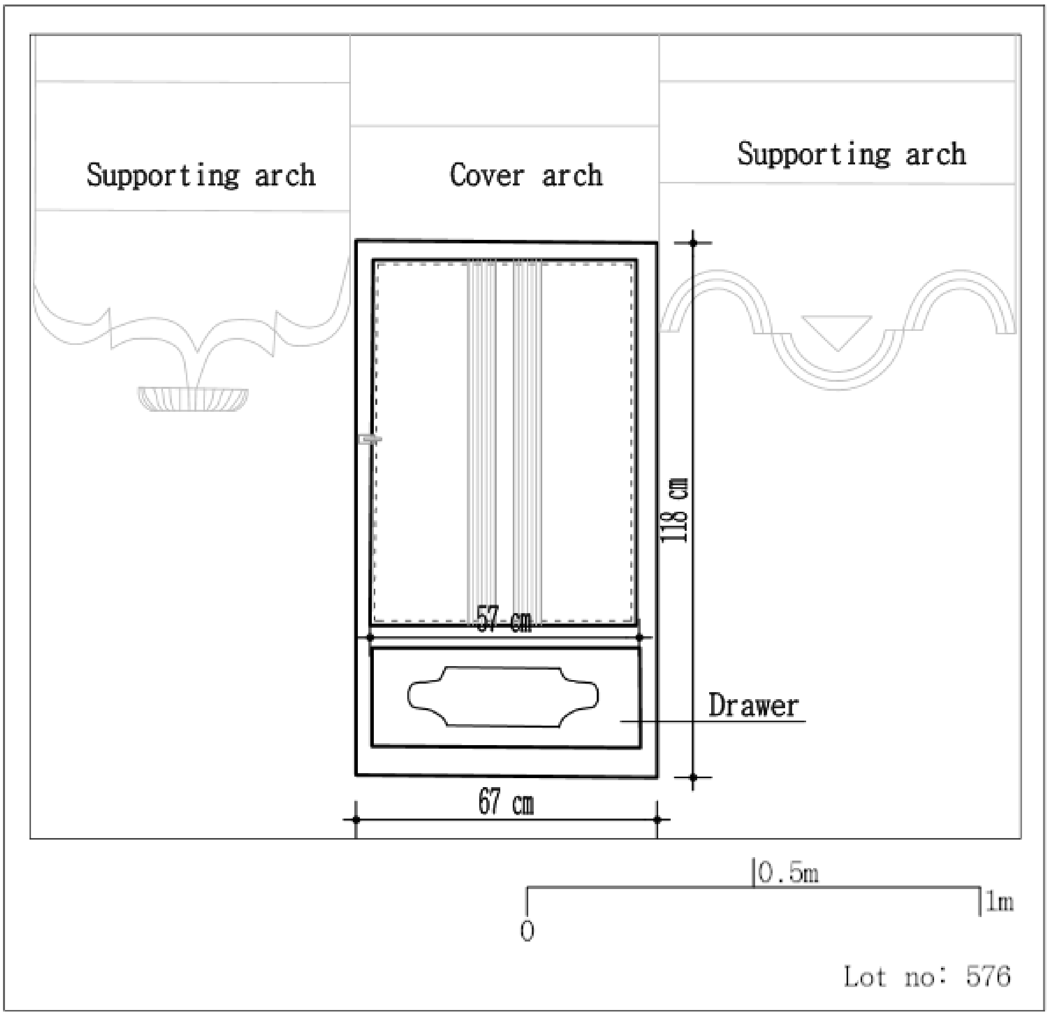


Figure 3. 145 Cub-board with drawer

Most of the cup-boards have traces of wooden frame around opening, while some of them still keeping it. They generally have one single wing door, but some of them are divided in two as a door and drawer. Drawer has 1/3 of height of total opening and used in bottom rest part is divided by shelves and closed by single door wing. In some examples shelve is divided into two parts and some of them are into three parts (Figure 3. 147).

Most of the cup boards are built in masonry structure that between two arches of vaulted rooms or placed to back wall of building near to *yüklük*. In different size of cup-boards that differentiated by using purposes built just near each other (Figure 3.149). If the building is leaning against the rock, back part of cupboard opening is left as rock surface to decrease the stone usage. Timber lintel is seen in few examples on cup boards. Rock cut cup boards divided to parts with a wooden shelves another observed types of cup-boards.

<u>Yüklük</u>

Yüklüks are other kind of niches which have bigger measurements for storing. In traditional houses people generally used to sleep on wool mattress that spread over *sedir*. During day, wool mattress, pillows and quilts used to be stored in *yüklük*. A piece of cloth cover was nailed to in front of *yüklük* to use as cabinet door. In one example of houses yüklük has wooden frame around opening that might use to have a door wings. Yüklüks are placed between cupboards or niches in a room into middle of wall or sometimes placed to wall that have a door to connect another room. Sometimes built into the side of the wall and have *lambalık* or cup boards nearby.

According to their construction way while considering the used materials, yüklüks can be made of stone masonry by rock carving.

- *Type-1*; Within the masonry structures, the openings of *yüklük* is spanned by depressed arch or with a semi-circle arch (Figure 3.150-151).
  Figure 3. 149Timber lintels are other used materials to cover openings. *Yüklük* openings heights are changes between 200 and 170 cm, while width is differentiated 140 to 160 cm (Figure 3.146).

- *Type-2;* Beside masonry constructing method, *yüklük* can be built in rock surfaces by carving. These types of carved *yüklüks* are 40-60 cm high from ground and have 120-150 x 150-200 cm dimensions (Figure 3.151). In one example of *yüklük* is composed of rock and stone material spanning opening with timber lintels. The Sergen, is nailed in front of timber lintel of *yüklük* an opening, kind of mixed of skylight and chimney , constructed just above the *yüklük* for air condition (Figure 3.152). This example has 140 x 155 cm dimension and placed 82 cm distance from floor of room which is higher than usual *yüklüks.*

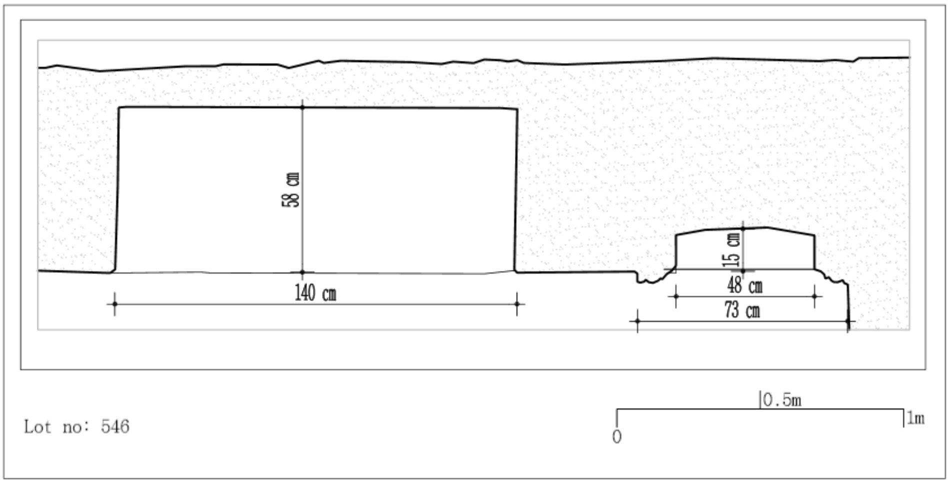


Figure 3. 146 Orthophoto elevation and plan of *yüklük* and *lambalık*

Figure 3. 147 Built-in cub-board with drawer

Figure 3. 148 Cubboard mixed built with stone and rock

Figure 3. 149 *Yüklük* spanned with timber lintel

Figure 3. 150 Type-1 *yüklük* spanned with an arch - Type-2 *yüklük*

Figure 3. 151 Orthophoto elevation of yüklük

Lambalık

Before electrical network is attained to city, candles and oil lamps were used to use for lighting. To hold lighting elements, an architectural element is constructed into walls as a niche or projected from wall surface as a console which is called *lambalık.*

- *Type-1;* This type is made of stone that projected from the wall. *Lambalık* can be hung on the wall in shape of cone with very simple ornaments that placed upside down or Cone shaped *lambalık*'s mainly take places in between two windows of main façade, corners of the room and between two arches on the side walls of vaulted rooms (Figure 3. 154). The total height of upside down cone is between 12 and 18 cm, the diameter is 20 cm on top. They are placed 140-150 cm above from the room floor. Simple 3-4 cm flat stone which can be fit in corner of the walls, between two windows or projected from arch of vault through room (Figure 3. 153-3.155). Edges of flat stone formed rounded. A room can have more than one *lambalık..*

- *Type-2; Lambalık* is constructed into walls as a niche. Dimensions of openings are vary between 60-75 x 75 -110 cm and they commonly placed 70-80 cm high from the ground
- Figure 3. 152). In some example of niche *lambalık,* the lower part of niche projected 10-15 cm with decorating stones. In one example, a mini shelf made by stone is placed in *lambalık* which is projected half way of lambalık's depth. This part used to put religion book 'Quran' (Figure 3.159)

Sergen

Sergen is a wooden shelf which is created for putting stuff and keeping dried foods. These shelves are built on room walls closer to ceiling and approximately 200 cm high from the room floor. In vaulted rooms, shelves are nailed on main façade of space. They surround all the way above the window and turn to side walls. They are end up at the end of the first arc of vault. In two examples, shelf placed on back wall of room surrounding above the cupboard and 'yüklük' (Figure 3. 156) In the process of producing *sergen*, timber laths are nailed to wall and timber bracket nailed to these laths to support shelf. Latter timber plates that are 2-3 thickness and 20 cm wide laid on top of bracket and nailed to other elements (Figure 3.158-3.159).

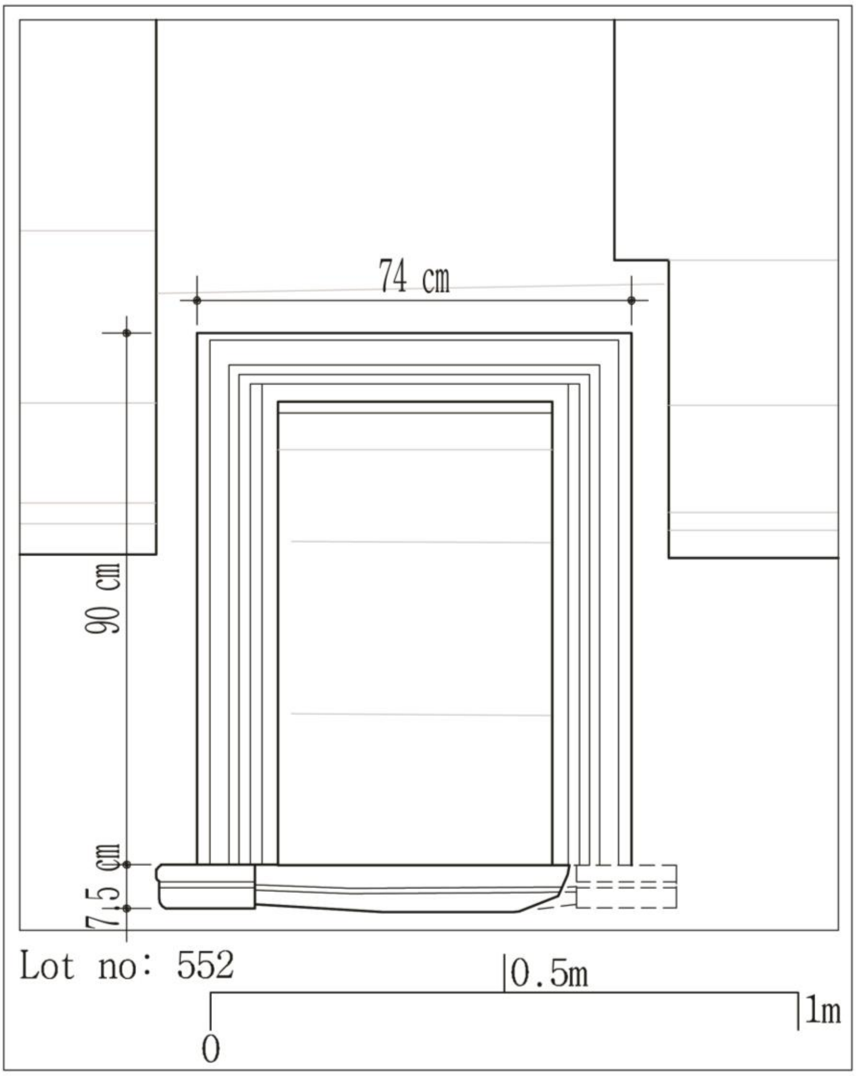


Figure 3. 152 Type-2 *Lambalık*

Figure 3. 153 Projected flat *lambalık* between two windows

Figure 3. 154 *Lambalık* types

Figure 3. 155 *Lambalık* with small shelf

Figure 3. 156 *Sergen* surrounding above the cupboard and above the window

Figure 3. 157 *Sergen* detail

Figure 3. 158 Timber laths of *sergen*

Manufacturing Element

Şıralık

Grape agriculture was one of the important economic input of region. Grape juice, molasses and wine manufacturing are common products of grapes. Local people grow their own grapes in the region's field and by these grapes manufacture molasses and grapes juice in their own dwellings. *Şıralık* is an architectural element that is used purpose of producing grape juice. This element is found mostly in storage rooms and in kitchens. Grapes are put in a cell, and grapes are squeezed to produce grape juice in this cell. This cell is a kind of big sink made of rock and has a small hole in close part to the ground. After squeezing it, the grape juice is flow from that small hole to other smaller bowl which is locally called *'bolu'*. Nearby the *şıralık*, there might be small circle holes on ground to put grape juice pots for storing. Holes keep the pots in balance and they locally called '*küplük*' (Figure 3. 160).

In studied buildings of Uçhisar, all of the *şıralıks* are made by carving from rock in rock carved places. However, due to their construction methods, two types of *şıralıks* are determined.

- *Type-1;* this is constructed into rock wall by carving. Rock wall is started to carve as niche 50-60 cm above the floor. Then *şıralık* is created, shaping the rock, in 150-160 cm wide and 180 cm height and keeping 120-170 cm long way inside. Ground of *şıralık* that grapes are filled in to squeeze has 20-25 cm depth (Figure 3.160-3.162).

- *Type-2;* Second type *şıralık* is created directly on rock floor. Rock floor is carved 10-20 cm deep in floor level and 20 cm lower than bottom of *şıralık 'bolu'* is carved to gather squeezed grapes. In some examples, it is seen that side of bowls are rendered (Figure 3. 162-3.164).

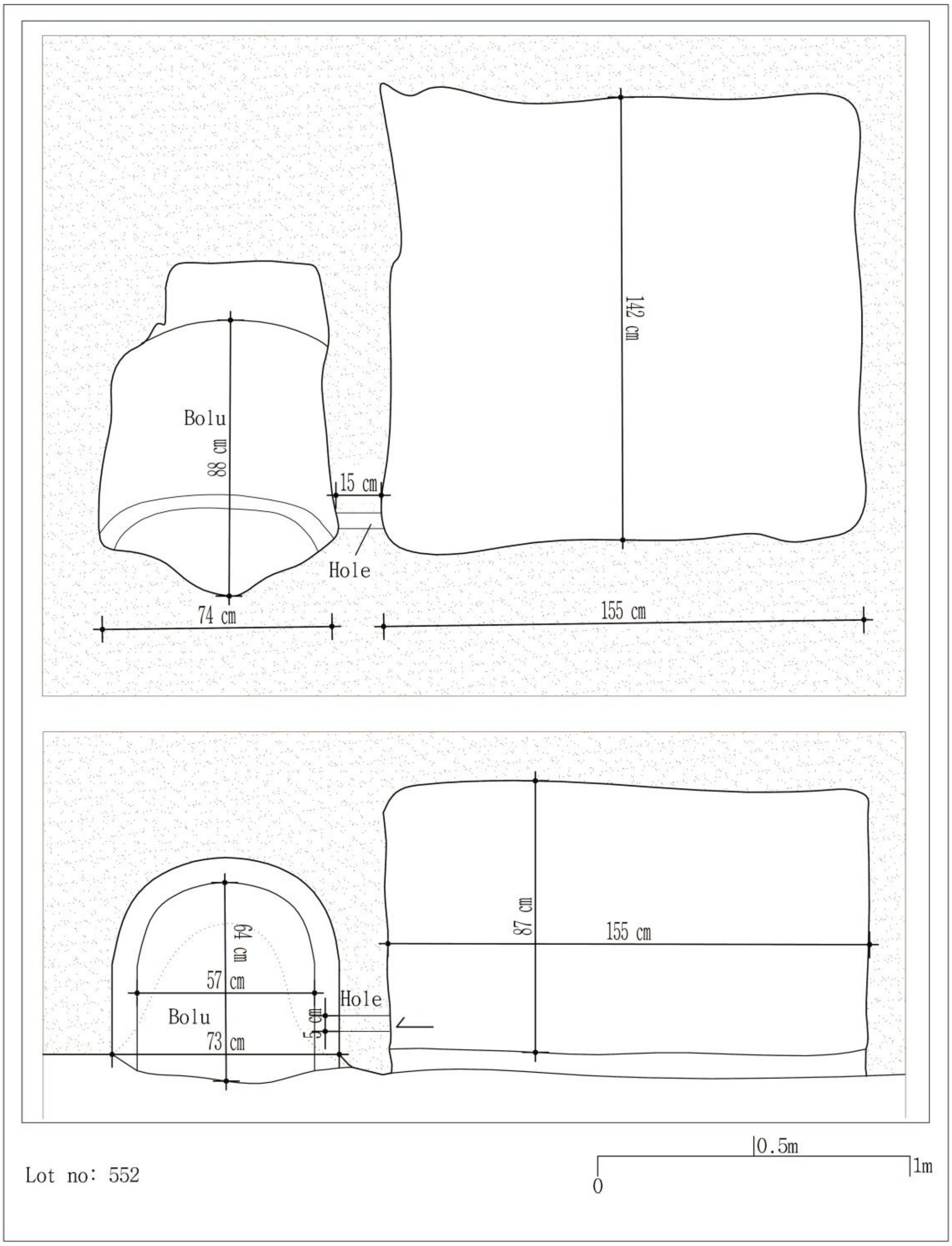


Figure 3. 159 Şıralık Type-1

Figure 3. 160 '*Küplük*', '*Bolu*'

Figure 3. 161 Rock cut *şıralık* with '*bolu*'

Figure 3. 162 Rock cut '*şıralık*'

Figure 3. 163 Type-2 *Şıralık*

Yunmalık

Yunmalık is stone niche built for ablution that is really small spaces. According to studies done in Uçhisar, *yunmalık* is constructed in 115 x 100 cm dimensions on the upper floor of houses. To provide privacy, a timber wing within a timber frame is used which looks may like cub board when it is closed. Commonly, it is embedded in the behind wall of the room and covered with wooden beams.(Figure 3.165-3.166). However, in three examples of *yunmalık* are placed on vault's supporting walls that is projected through outside of building, appeared as projection on façade. Figure 3. 164. These types are covered with small vaults. In one of the *yunmalık*, a çörten was noted in order to provide water disposal.

Figure 3. 164Gusülhane projected on façade

Figure 3. 165 Gusülhane placed into behind wall

Nails

During site survey, on the façade of buildings and surface of rock carved spaces large iron nails have been discovered (Figure 3. 166). These nails that are also located in courtyard walls are not as a contribution to building structural sense; but serve to everyday life in the houses. Nails that are placed in outside walls used to hung meats to dry them. Dry meats were used to stocked in storages in order to use during winter time. Because of the humidity and temprature conditions people mostly stored in the carved out places fruits (Figure 3.168-3.169) Thus juicy fruits are long lasting in rock carved places. To store some of the fruits or other kind of stuff people used to use iron nails to hang them (Figure 3.170).

Figure 3. 166 Iron nails

Figure 3. 167 Meats hung on nailshttp://www.eskiturkiyefotograflari.com/nevsehir01)

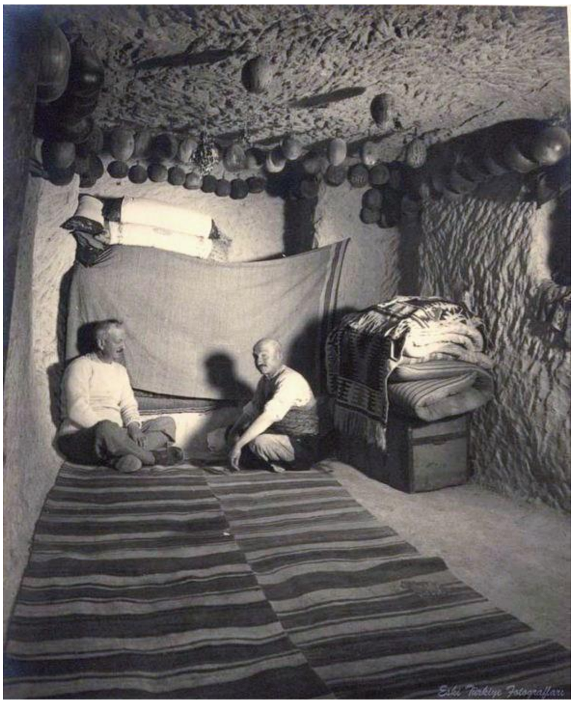


Figure 3. 168 Meats hung on wall   Figure 3. 169 Watermelon hung on ceiling
http://www.eskiturkiyefotograflari.com/nevsehir01)

CHAPTER 4

A BASIC SCENARIO OF CONSTRUCTION PROCESS WITH AN EVALUATION OF STUDY

The general conclusive remarks made on construction system of Uçhisar houses and the settlement that are obtained from the studies can be summarized as follows:

- The most important transport axis of the settlement, formerly named Divanhane, currently with a new name Goreme Street is main axle. On this axle there are three unused historical fountains. The castle is placed in a small square and the square around the roads connecting vertical to Goreme Street. The surrounding of the castle, surrounded by dwellings that consist mostly with dead ends. The housing, in the old fabric of the settlement, established on flat lands near castle and on slope lands.
- In addition to the requirements of the traditional daily life, traditional Uçhisar houses are basically formed by taking advantages of the topographic features of the site, using easily accessed and processed materials within extent of physical properties of them are used. An unavoidable reality that the characteristic feature of the topography, *tufas*, used very purposive way by the mean of usage of spaces.
- In region, people tried to take advantage of the rock formations. Creating the rock spaces, stone producing from rock, in foundations, walls and other architectural elements all have attempted to use as much rock as possible. This case, as well as ensuring the continuity of the structure due to the sliding resistance for a long time, provided that an economical contribution to minimize use of other materials.

Thus rock carving methods developed under influences of long time historical experiences that learning, following and practising rock formation types and development of mason’s instinct by considering need of rock carved places.

- Cappadocia houses are superset of the Uçhisar houses. When Uçhisar houses analyzed within general characteristics of this superset, Uçhisar used to be economically smaller city than the neighbour cities, comparing with the study of İbrahimpaşa, Mustafapaşa and Ürgüp. This is one of the reasons why Uçhisar houses were appeared smaller and modesty decorated than other cities around.
- Being subset of Cappadocia region, depending variation of materials and layout patterns, sample of three main categories of the traditional houses structures are observed in investigated settlement.

    - ***Rock-carved houses***; places are generated by carving out , vertically or horizontally as far as rock formation allows, valley slopes or fairy chimneys in which are the earliest samples of housing.
    - ***Masonry houses***; masonry buildings, two or three storied which are not directly in relation with carve-out places.
    - ***Mixed technique of rock-carving and masonry houses***; places are created by built-up masonry structures addition to the main rock-cut space.

- A common situation that intricate structures of rock urbanization caused a problem while the ownership of a masonry building on the lot belongs to an owner, the ownership of the rock-cut space spanned under that masonry building in neighbour lot that belongs to other person is also case of Uçhisar houses.
- Houses are generally two storeyed or three storeyed by adding underground carved spaces. They can be built as facing with street or drawn back from the lot. And courtyard commonly part of the daily life especially in summer times.
- As result of topography of settlement, intricate and complexity of rock carved places typical plan organisation did not occur when rock carved places and masonry structure plans take consideration together. However, regarding through only masonry structures, mainly three types of plan schemes are stand out.

- First is simplest plan scheme that is comprised of one unit of ground floor and one unit of upper storey.
- Second plan scheme has two units on upper storey. Units can be either covered with vault system and timber beam system.
- Third type plan scheme are sketched in bigger houses, having sofa in middle of plan and have another unit on both sides.

- Commonly used materials are stone and rock, while the others are timber and iron. In Uçhisar houses stone is most extensively used material that is shaped in cut-stone and rough cut stone. Soft and easily shaped stones called locally Çavuşin stone. These types of stones are getting more hard and durable in time. That type stone is used in Nevşehir houses known with different names taken their names from where they quarried, such as Nevşehir stone and Espelli stone in Ürgüp. In Uçhisar it is called Çavuşin stone because of the stone is quarried from Çavuşin district. More durable stones such as 'Kepez stone' are preferred to be used in structurally important parts that need to protect long-term durability. During construction process pickaxe, bellow and anvil, wedge and sledge are used tools.

Under the context of Chapter-3, all structural elements of Uçhisar houses being a part of entire architectural structure are individually defined and categorized considering their functions, construction method and used material types with gathered information from the Uçhisar houses and with the help of other reliable sources. Architectural structure is formed by various structural elements coming together. Elements that are structure per se, positioned considering the function within the whole system and create architectural structure. To understand entire architectural construction of Uçhisar houses holistically, 3D model of four studied buildings are created (see app. B). 3D model helped to understand structures with all the elements of a whole and their relationship with each other, starting from the base of a structure up to the roof. After finishing 3D modeling of four houses, other houses were analyzed in this point of view and at the end observed that the construction processes of a building could be summarized and explained under the main common stages in each houses. Each stage could vary within itself by using different structural elements that were defined in Chapter-3, but main frame of construction stages were kept. Thus, by the aim of explaining construction process, a basic construction scenario of a house within a general evaluation of previous surveys, analysis and interview is prepared (Figure 4. 1).

Construction processes scenario of a house could be briefly explained in five stages;

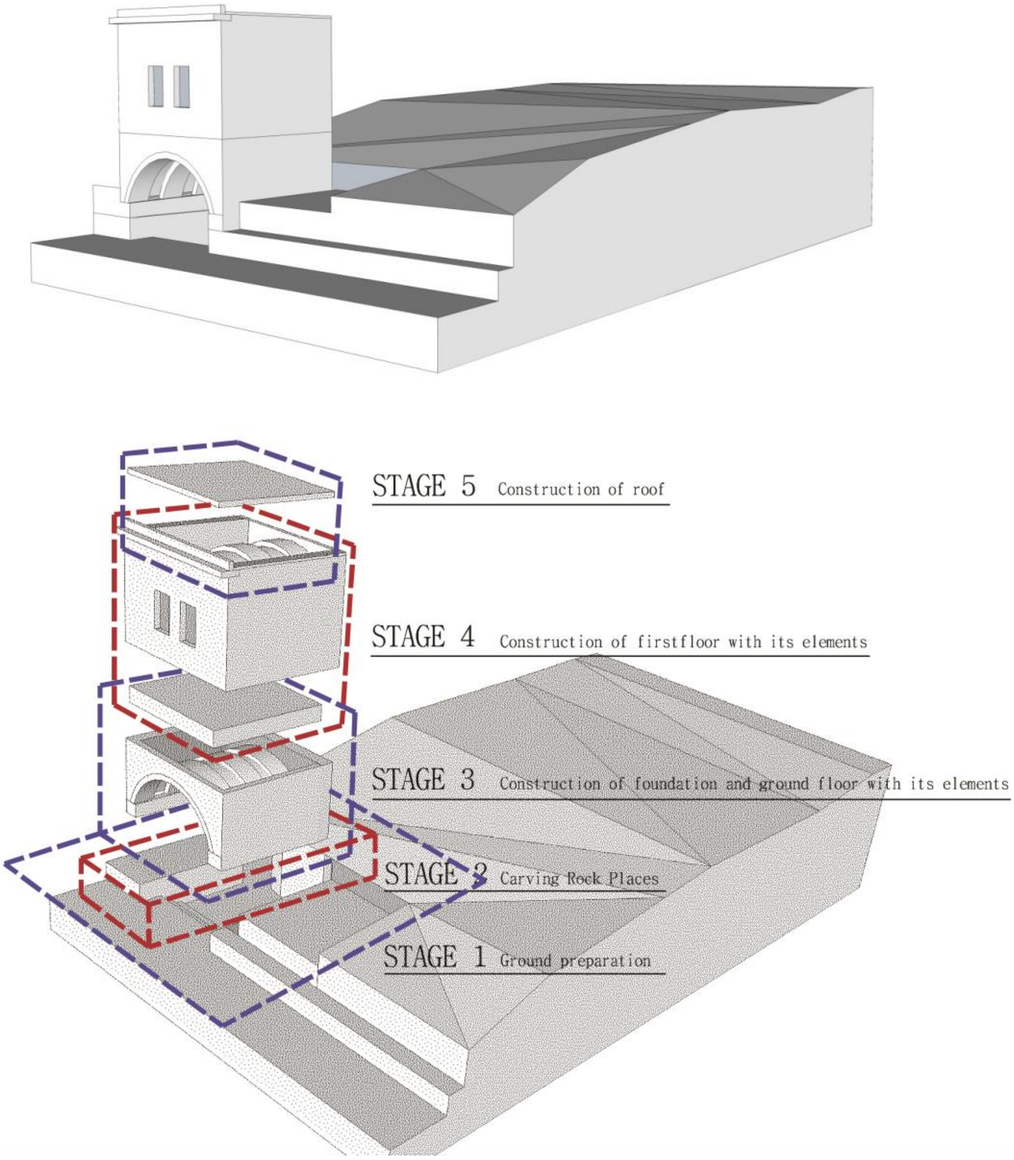


Figure 4. 1 Construction stages of scenario

STAGE-1:

Mason determined rock type through local definitions that described under the light of experiences gained by masons at region. Crack and layers of rock are checked. Cracks that may intersect each other result by separating big part from the rock mass that is accepted as a serious security issue by rock masons.

- Surface of the site that building would be constructed , brought to the same level by scraping high parts of rock ground and/or filling hollow parts with earth.
- If the rock would be used as foundation wall, rock ground was dig until reaching proper high for being foundation wall. The rock foundation walls could be leveled as rising to upper level.
- In slope lands, the area that building is going to set up is prepared by carving as a cell in two or more levels. Each cell is called '*lamba*' and this step of construction process is called '*lamba açma*' in the region (Figure 4. 2).

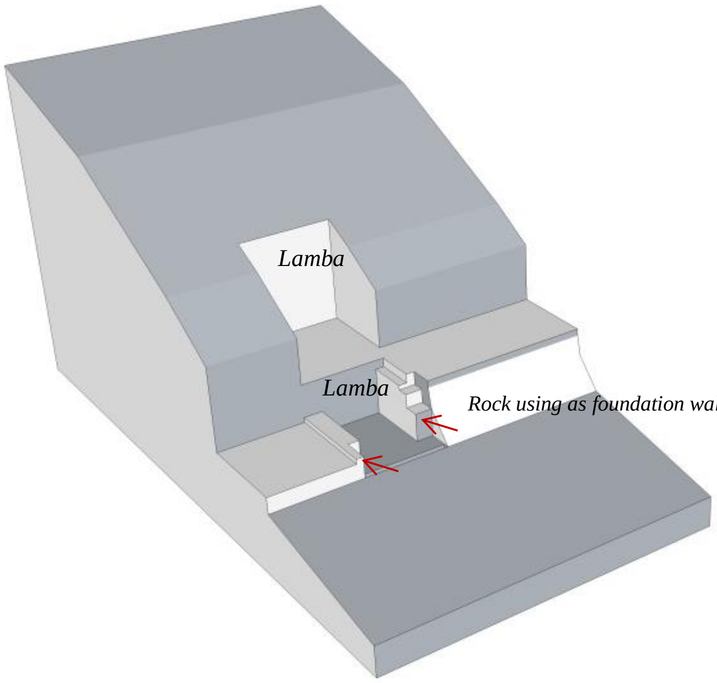


Figure 4. 2 'Lamba' and rock using as foundation wall

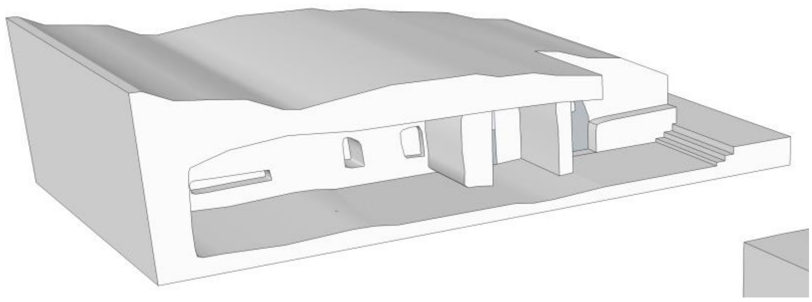


Figure 4. 3 Carved-out places, carving starts from stairs

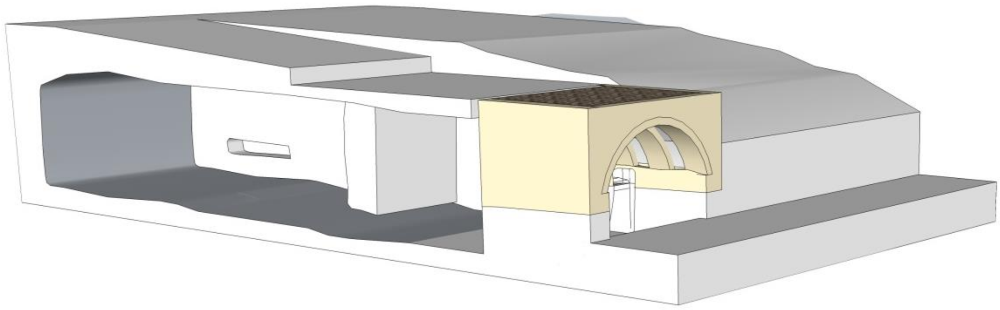


Figure 4. 4 Rock-cut places continuation of *Tandır* room

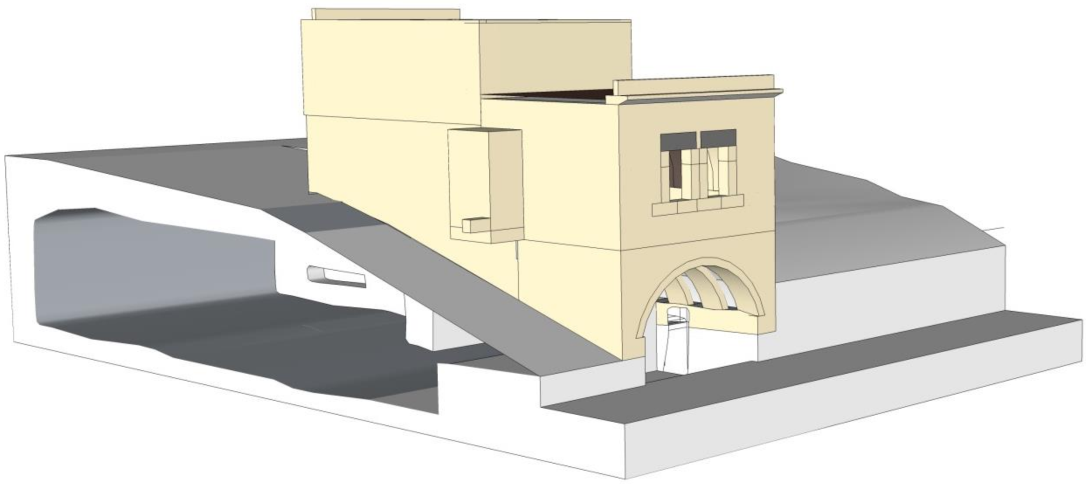


Figure 4. 5 Rock-cut places underneath of masonry structure

- To create rock carved spaces, two different methods were obtained. The carved-out spaces take place underneath of masonry structure and located in the continuation of masonry structures (Figure 4. 4Figure 4. 5). Some of the houses contain these two examples together (see app. B).
- If carved-out spaces take place underneath of masonry structure, carving primarily begin from stairs (Figure 4. 3). Then continue to create rooms, as many number of rooms as owner need, by following steps of rock carving explained in detail under 'rock carving' part of 3th chapter.
- If carved-out spaces located continuation of masonry structures, initially rock carving spaces are carved, than masonry structure built in front of rock-cut houses (Figure 4. 4). This type of relation between masonry structure and rock-cut places are mostly seen in deep slope sides.

STAGE-2:

In this stage foundation of building is set up on prepared ground. Foundation is created on rock with varies transition methods from rock to stone. The most efficient reason to vary foundations is formation of topography. Especially in deep sloped lands rock is shaped as foundations wall. Stone foundations are constructed in two rows of stones leaving gaps in between. This gap is filled with broken stone and rock pieces dimensions and total width reaches 45-85 cm. In local discourses this infill material is called '*şillez'* (Figure 4. 6).

STAGE-3:

After foundation is built-up, ground floor walls are started to bond. Ground floor walls are made of double sided walls which can be made of cut stone and rough cut stone. In the buildings that have rough-cut walls on ground levels the smaller rough stones are used in the middle of the wall and cut stones are used closer to the corner. Corner stones of the building are locally called '*ürkün taşı*' and smaller rough cut stones are called '*kafa taşı*'.

Main façade wall and side walls are constructed jointly, till reaching up level of window, while living door opening from the beginning of wall construction. In outer doors of houses it is clearly noticeable that 60-120 cm stone placed as formwork of door openings (Figure 4. 7). Vertically to both side of opening and another stone bind on long side than arch of opening placed on these stones (Figure 4. 9). The wall that door placed in either built with rough cut stone and cut stone, but door formwork always created with cut stones. *Kepez* stone is prevalently used in that framing. Similar method is used in windows when the wall height reaches window opening level (Figure 4. 8). Kitchen, *tandır* house and storages are placed in ground level. *Şıralık* and *tandır* are only taking place on ground level (Figure 4. 10).

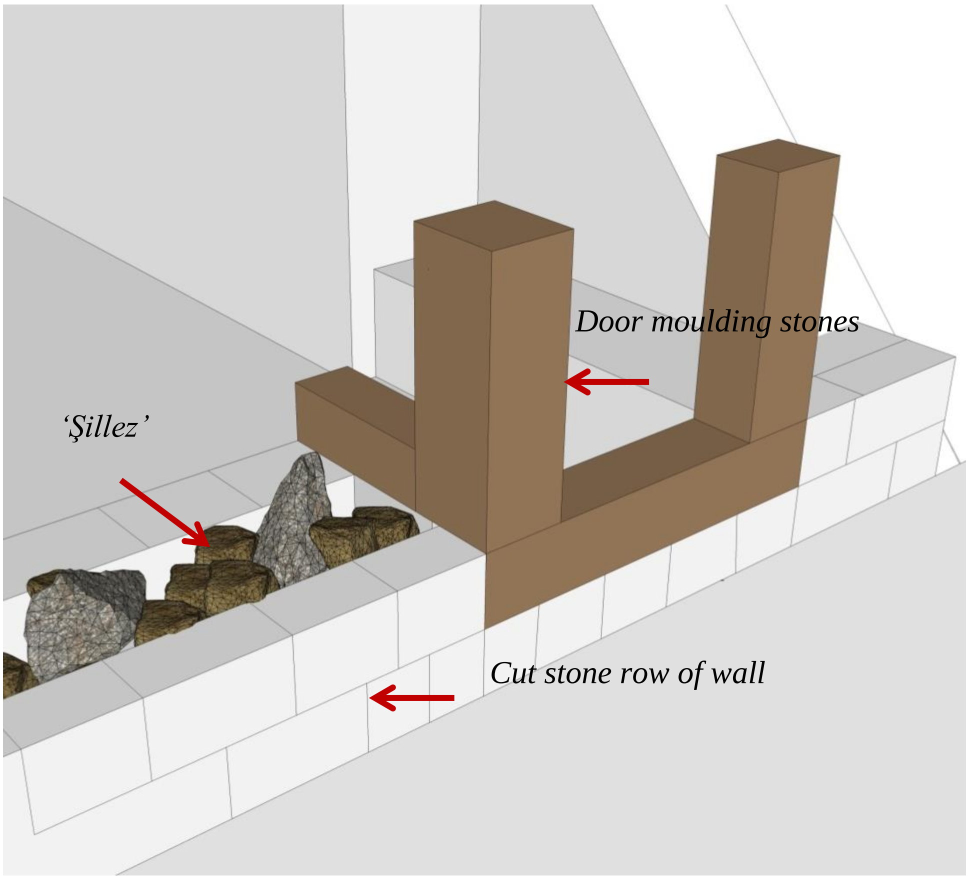


Figure 4. 6 Wall section of double sided wall filled *with şillez* and door formwork

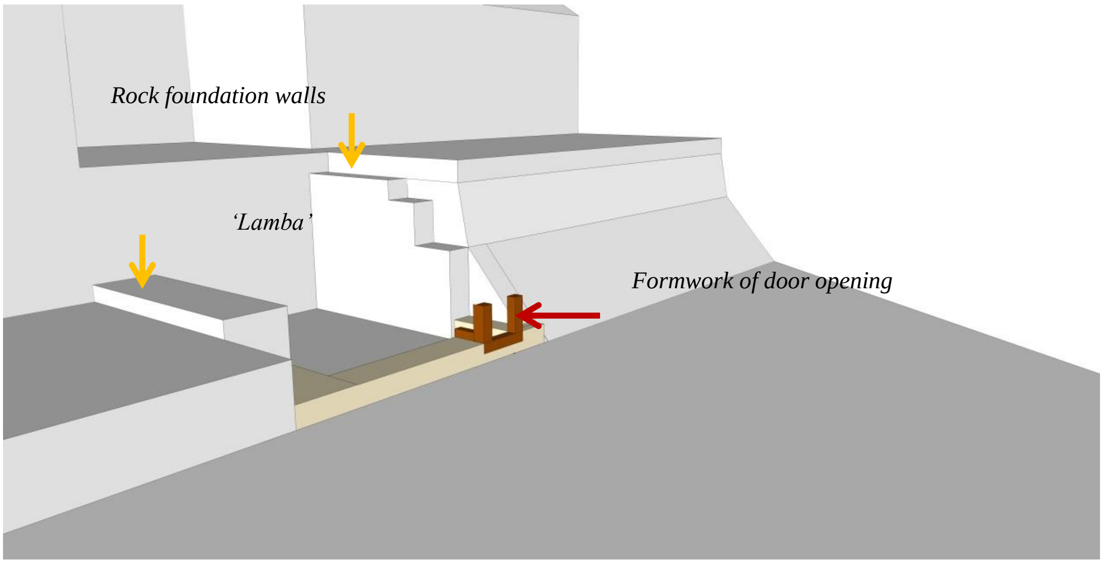


Figure 4. 7 Door formwork with side stones

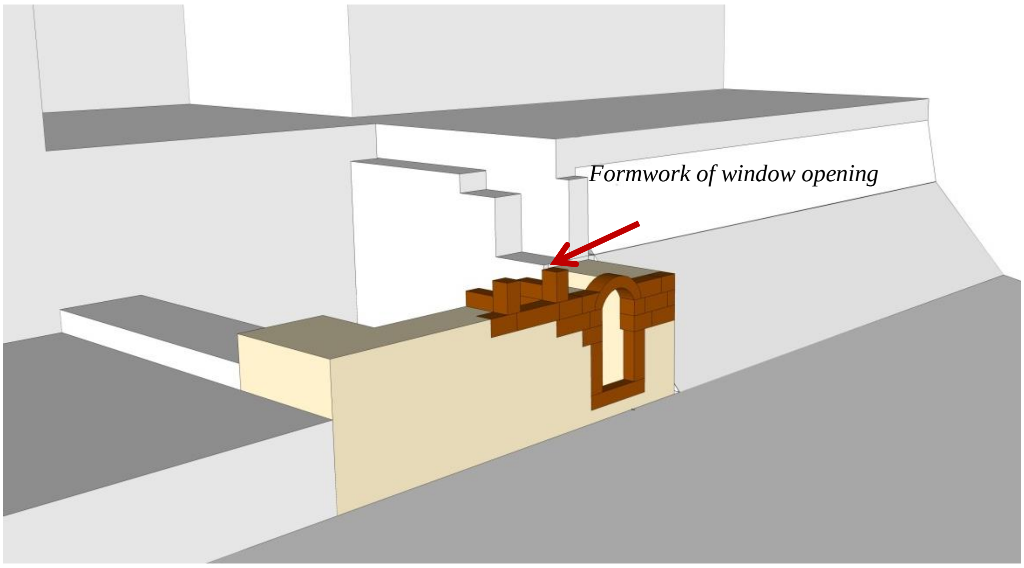


Figure 4. 8 Window formwork in ground floor

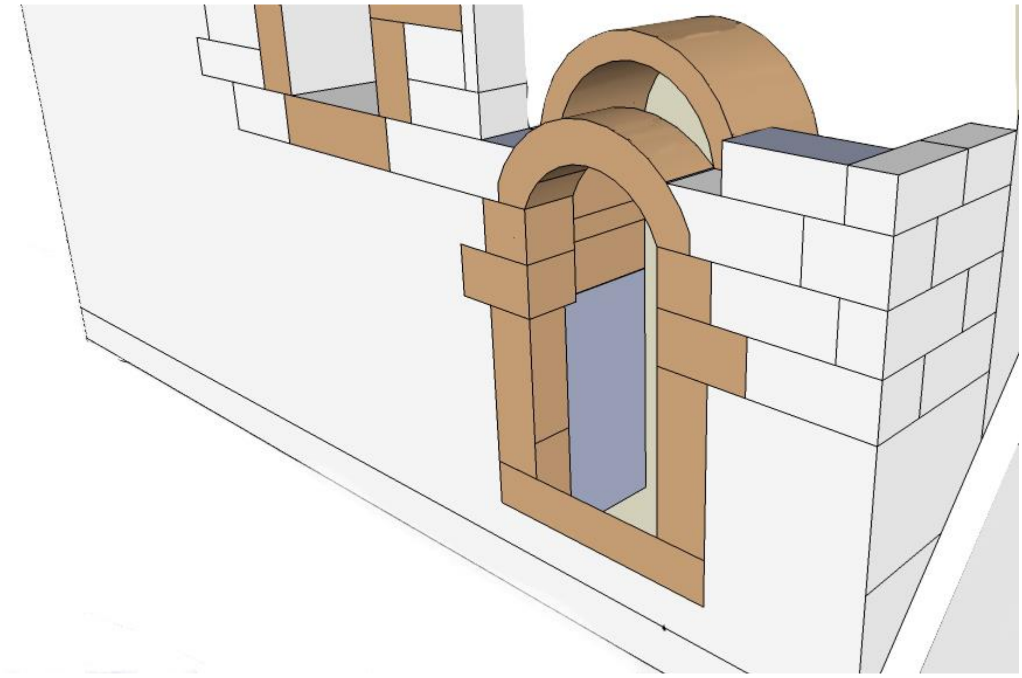


Figure 4. 9 Double arched door during construction process

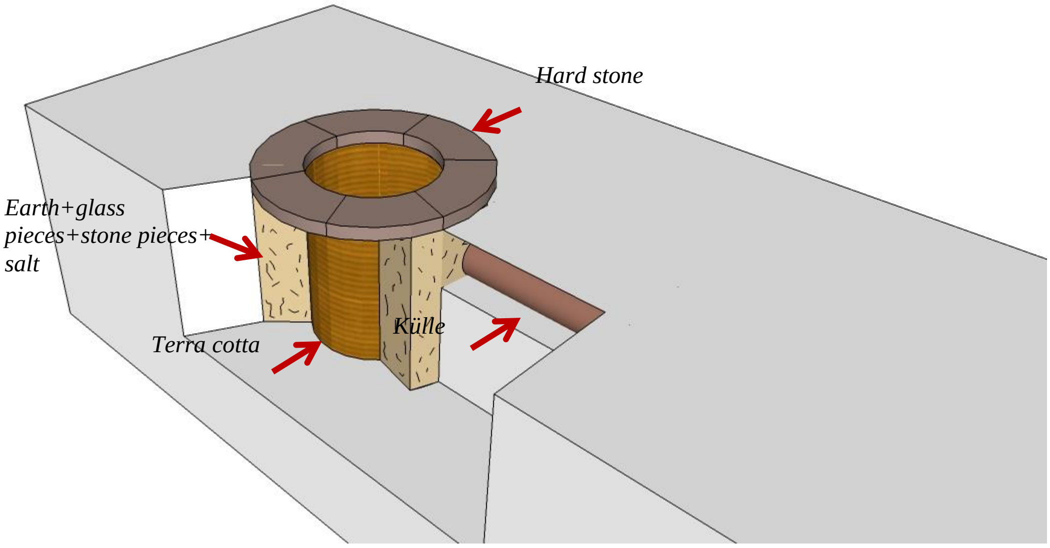


Figure 4. 10 Tandır detail

In ground floor spaces, to spanning the room either vault system and timber beam system can be built.

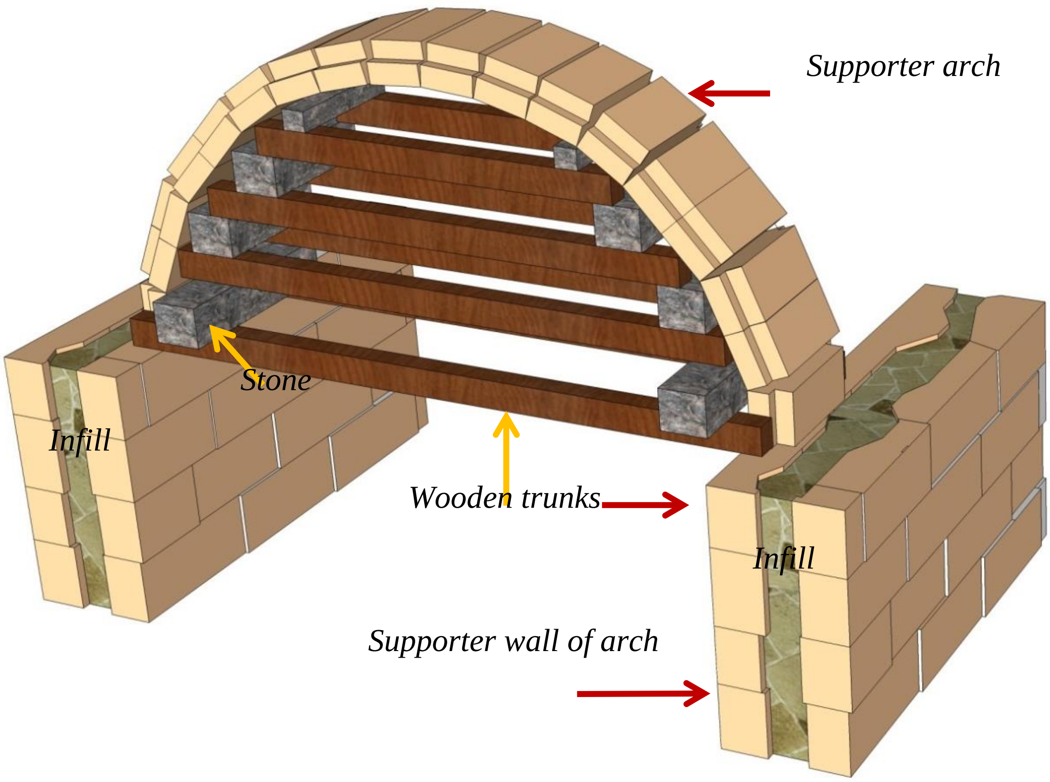
- Vault system

Firstly, the side walls of rooms are constructed to height of impost line of arches that are going to create vault. Than by establishing wooden formwork, supporter arches of vault system is started to built-up. Formwork system consists of a double row of wood planks rising by sitting on top large stones pieces (Figure 4. 11Figure 4. 12Figure 4. 13). To meet lateral load weight coming from arches, from the impost line of arch around two or three rows of stone walls is built and the gap between arch and stone rows filled with large pieces of stone. During placing voussoirs which are shaped in reverse 'T' shape, in order tuck stones their face are fixed to each other with small plain hard stone pieces. This stone is called '*Saylak*' stone (Figure 4.14, 4.17). In some examples instead of stone wooden pieces are used. After supporter arches are completed, between each arches are covered with '*kapak kemer*' (Figure 4.15,4.17)

Only the supporter arches of vaults need to establish of formwork, because the cover arch is placed directly on supporter arches.

- Timber beam system

Timber beam structure system which is locally called *hezen* composed of timber beams adjacent to each other or set up with intervals between. Timber beams that are 8-15 cm diameter are placed on inner cornices projected 5-15 cm from the wall surface or they are directly set on at the end of wall row. In some examples, bigger size beams that are generally made of trunks that stuck in row of walls and having smaller sized joints placed on top of these trunks. On top of the timber beams one after the other rush mats, stone pieces and clay mud infill is laid (Figure 4.18)



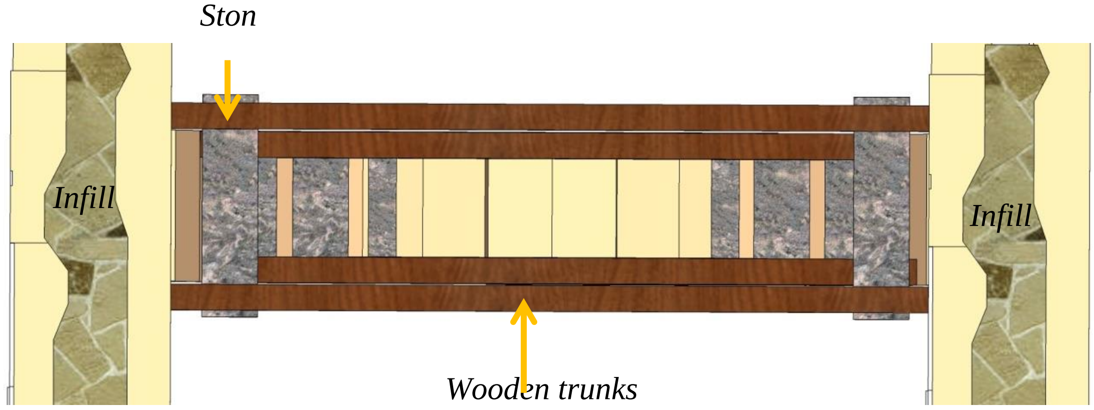


Figure 4. 11 Formwork of vault

Figure 4. 12 Formwork of vault[8]

Figure 4. 13 Voussoirs are placing with formwork[9]

Figure 4. 14 Formwork Voussoirs[10]

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[8] Snapshot is taken from documentary of Eczacibaşi Kültür Filmleri Göreme – Kapadokya/1962
[9] Ibit.
[10] Ibit.

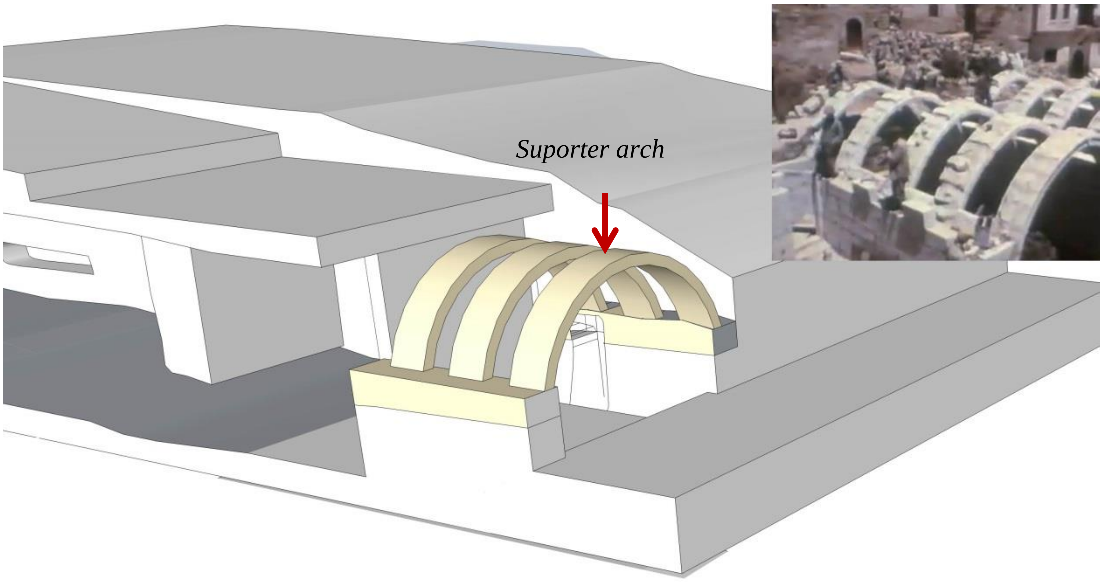


Figure 4. 15 Supporter arches of vault

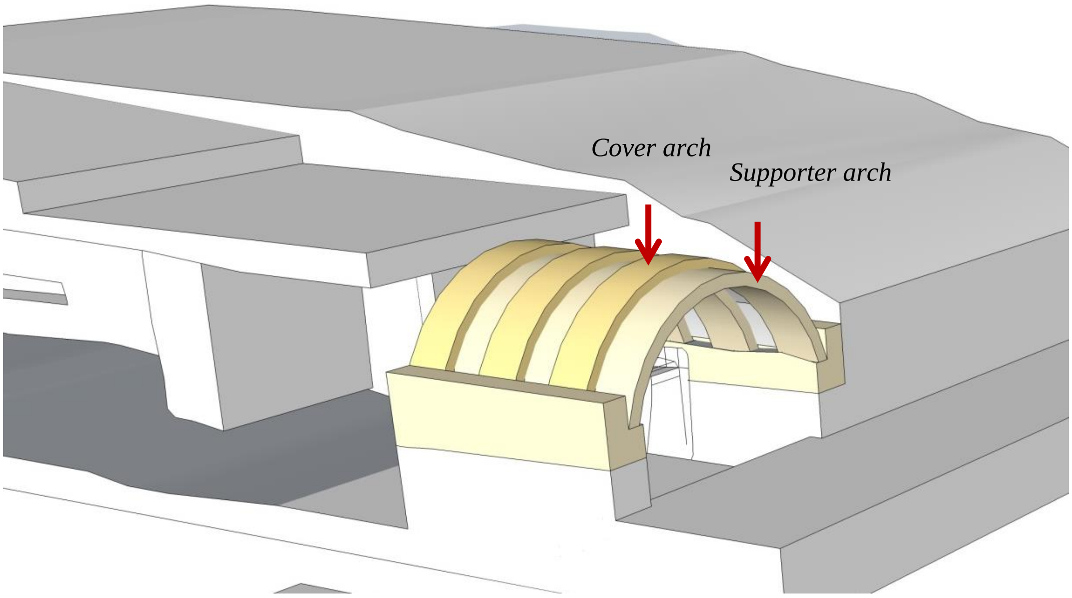


Figure 4. 16 Cover arch added to supporter arches

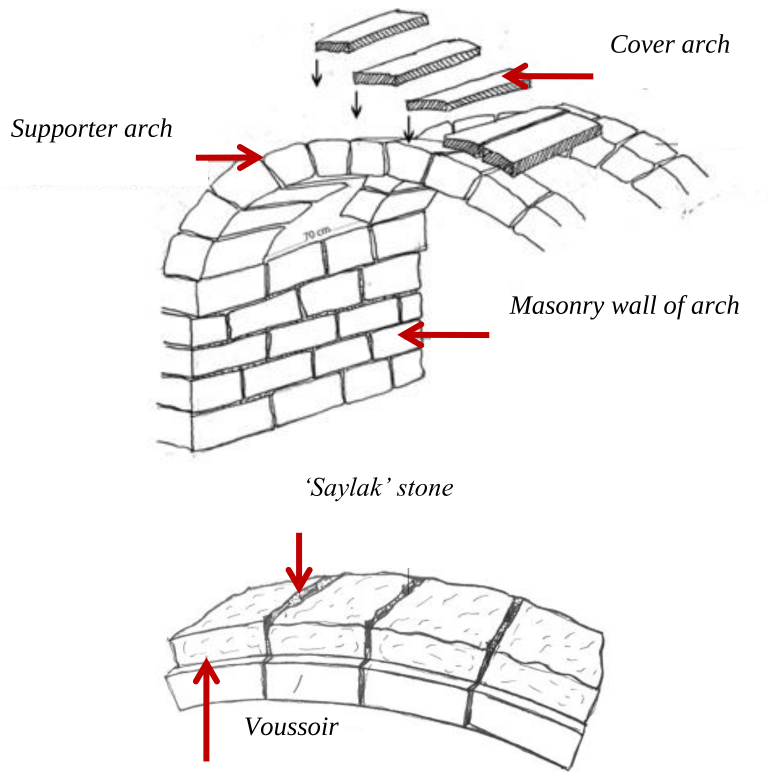


Figure 4. 17 Cover arch added to supporter arches (Contunie)

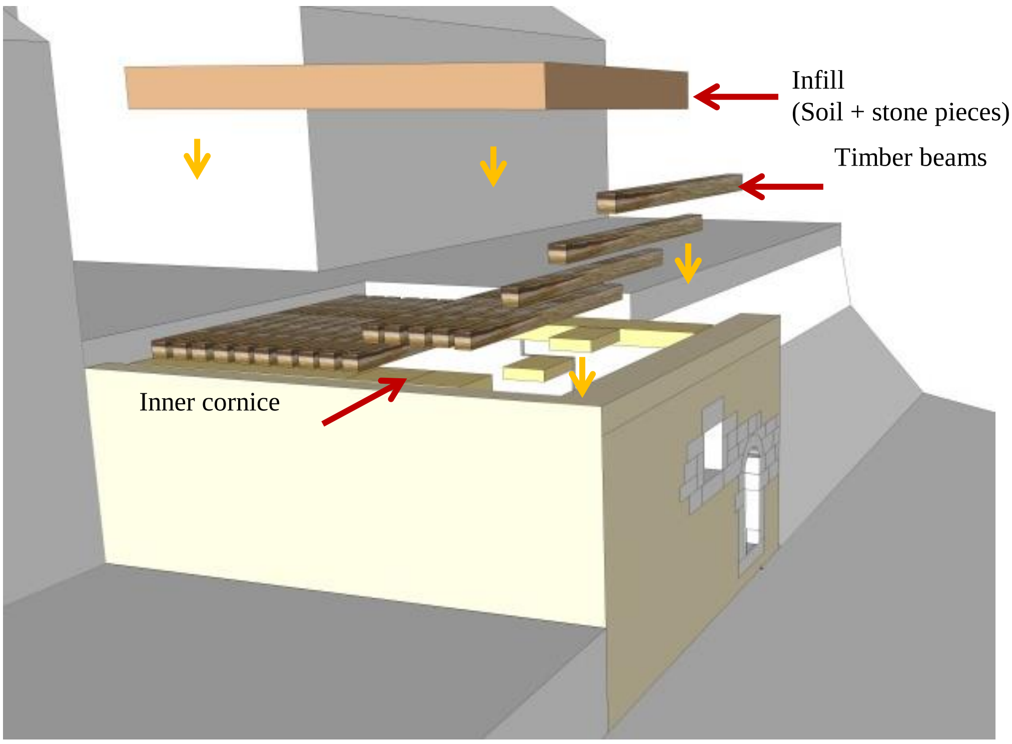


Figure 4. 18 Timber superstructure process

STAGE-4:

The upper storey's plan is always larger than the ground storey, as a result of setting back the wall of upper storey on rock base (Figure 4. 19). Sometimes the opened '*lamba*' of ground storey is appears lower than a height of room, so the distance between rock and superstructure of room is filled with stone walls. Upper floors can be covered with vaulted ceiling or timber beams system. Side walls of the upper storey always double sided walls infill with *şillez*, the outer row of wall can be made of rough cut stone or cut stone, whereas the inner wall is always made of cut stone. The thickness is changes in between 60-85cm. Main façade walls are made of two ways; one is single faced wall construct with cut stone which has 18-21cm thickness. Second way is double sided walls with 40- 60 cm thickness. If the room is covered with vault system, connection between main façade wall and vault is depending on which type of wall is used for the façade. When the main wall façade is made of single faced wall, the last arch and wall are built adjacent to each other.

If the wall is double sided wall, one side of the last cover arch is placed on supporter arch and other side is placed on inner side of wall row, using it as formwork (Figure 4. 20). So the inner row of wall ends just under the cover arch, while the outer side wall row is visualised main façade (Figure 4. 21). Even though the window measurements are bigger than ground floor's window sizes that are mainly in 70 – 130 cm dimensions, window and door opening are made of same formwork method as mentioned at ground floor. Exterior door and interior door are seen in upper floors. Interior doors dimensions around of 80-90 x 200-210 cm. In ground floor timber *seki* and *sedir*; stone *seki* and *sedir* are both determined. Stone sedirs which are around 80-100 cm in width and 20-30 cm in height, constructed with stone borders. Timber *sedir*s are built in 70 x 25-50cm. They are usually placed 40-50cm below the window level. They are constructed by 8x8cm timber beams that are placed into the hollows of wall which are spaced 40-45 cm between each other. Compared to the ground floors, upper storey is richer about architectural elements. There are more niche, built-in cupboards and *yüklük* on the upper floors. These elements can be made of in two ways.

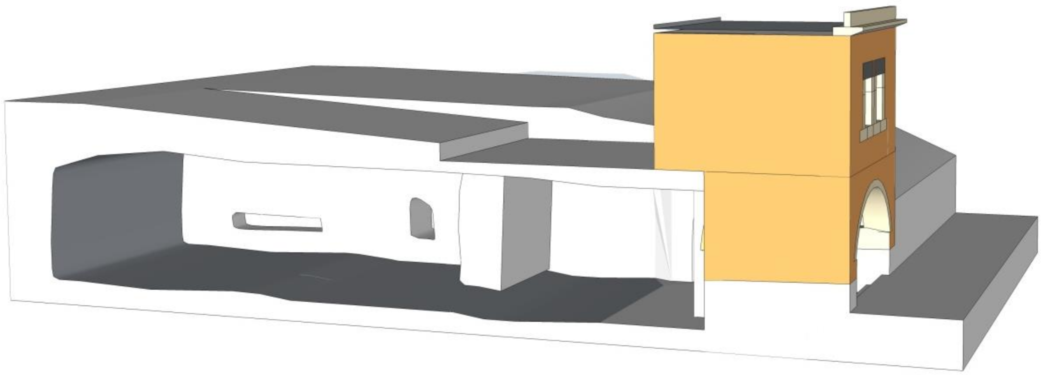


Figure 4. 19 Upper storey back wall extending back through on rock base

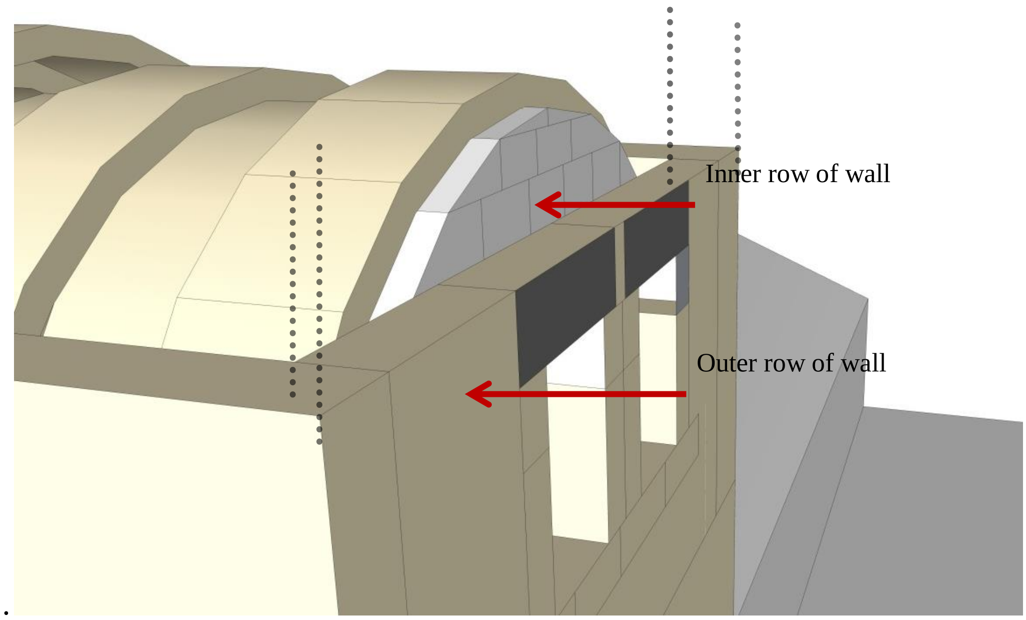


Figure 4. 20 Cover vault is placed on inner row of double sided wall of front façade

One is stone and other is rock-cut. Niches sometimes have got timber frame around, shelf and even a drawer covering with timber wing which became a cup-board in this way. Niches have various sizes; but the cup boards are generally 60-70 x 90-130 cm. All these elements are constructed during wall construction. Fireplaces are other architectural elements that changes section of walls during construction process. Their places are left while bonding the walls. In upper storey only stone fireplaces are used which is 60-70 cm x 90-120 cm. Another architectural element is *'lambalık'*. It is made as console *lambalıks* with stone, projected through the wall or built as a niche on the wall. In one room more than one *lambalıks* can be found. Superstructure of room can be built as vault system or as timber beam structure.

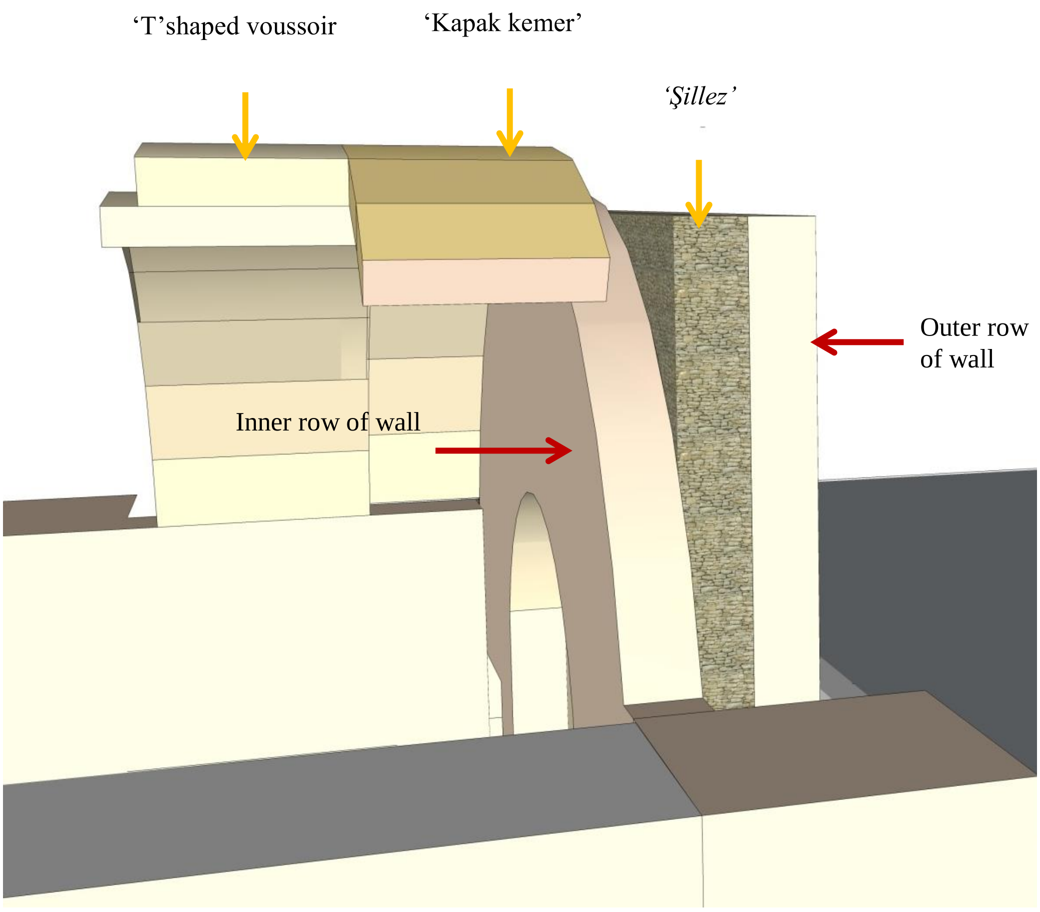


Figure 4. 21 Arch sitting on double sided wall's inner row

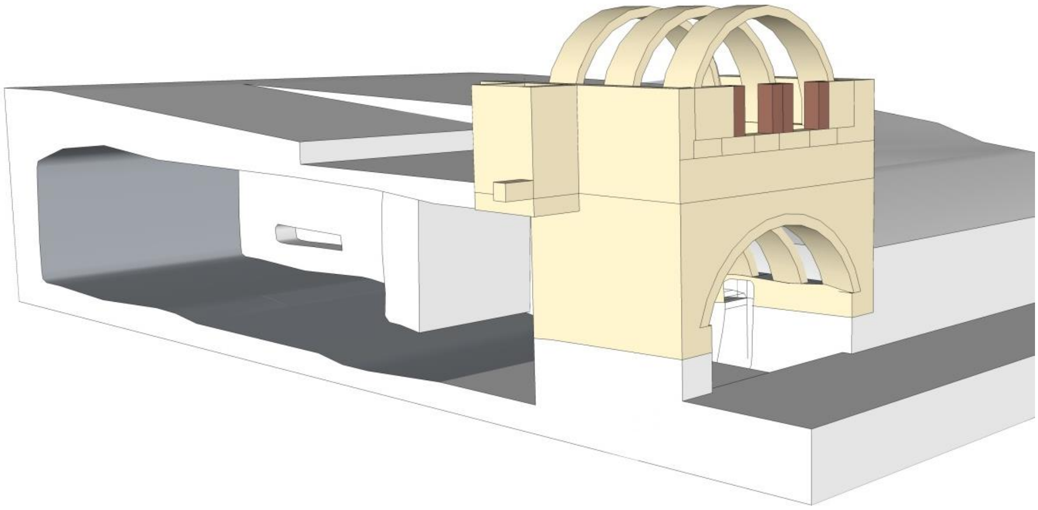


Figure 4. 22 Upper floor window formwork and supporter arches

STAGE-5:

For roof structure to finishing the process, piece of stones and earth mixture laid on vault system or timber beam superstructure (Figure 4. 23). Last layer of roof is finished with pressed earth in average %3 roof pitch due to provide drainage. Rain and snow water are lead to towards a certain direction with roof pitch and collected than removed from the building with the help of the *çörten*. *Çörtens* are made of hard stones and placed under one or two stone rows of *kafa tahtası*, or on the same level with eave cornice. The last layer, earth layer is laid on the roof, is compressed by the *‘’Yuvak’’*. ‘*’Yuvak*’’, middle of the two ends of the cylindrical stone or wood, is used to compress the earth of roof (Figure 4. 24). Finally, salt is sprinkled over the entire surface. Pouring salt is a primitive method of insulating use to prevent moisture transition. Instead of salt gypsum powder poured on roof in some parts of the region which are also known. Compaction of *‘yuvak’* refreshed every fall again to lasting of roof condition.

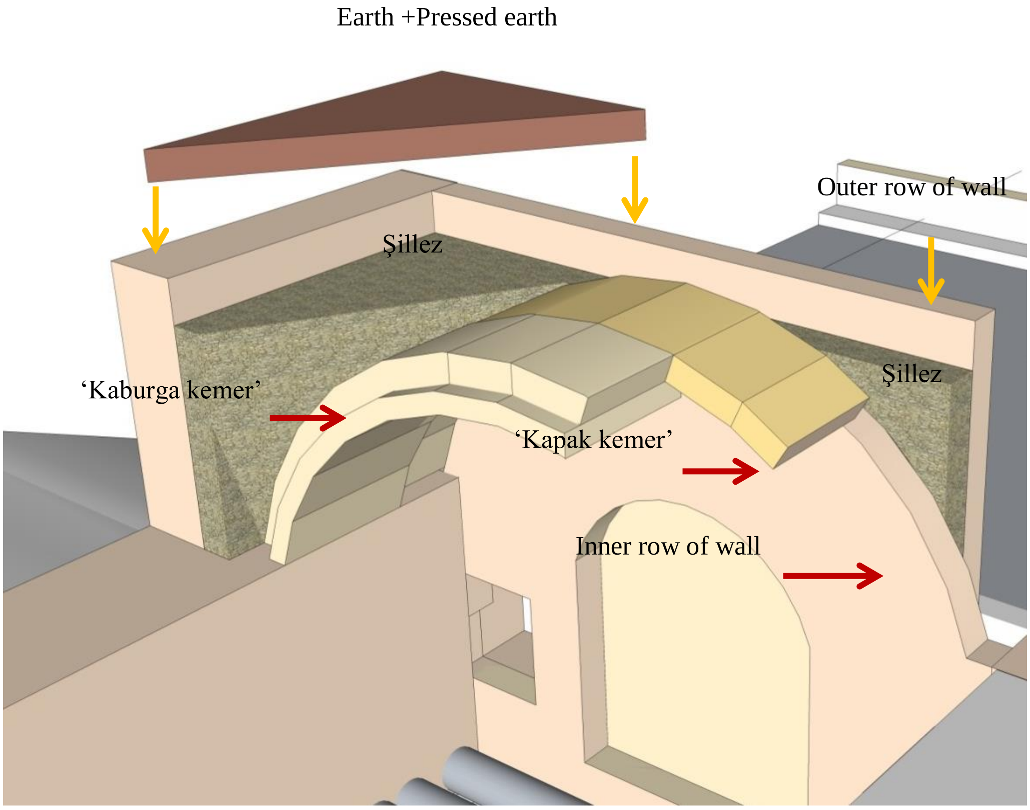


Figure 4. 23 Roof structure on vault system

Figure 4. 24 '*Yuvak*'
(http://www.yalihuyuklulerdernegi.com/default.asp)

CHAPTER-5

CONCLUSION

- The thesis can be summarized as; in order to fill lack of information about construction techniques of region, understanding the traditional techniques of houses and document all authentic details according to data collected during site survey about the Uçhisar houses. It was intended to access traditional features of region to the next generations not just as written and printed documentations. It may also be considered as being a layout for the future works on the new restoration projects.

- Rapid change in social and, economic structure and technology has already begun to affect human's physical environment. In this globalised world conditions, conservation and promotion of values of traditional buildings with their setting environment should be a significant part of our cultural heritage policies. Therefore, any preservation and conservation studies for traditional settlement with their architectural features should focus on continuance of its local distinctive elements and meet the needs of contemporary uses required.

- In this regard, the traditional construction techniques with its unique elements in terms of material, style, function and form cannot be preserved, if the building units and elements are not identified in a detail and proper manner. Depending on this aim, primarily information about construction methods, construction materials and architectural plans of historical and traditional buildings should be understood by analyzing and documenting of the construction techniques of them in a proper way.

- In this respect, Cappadocia is one of the most special environments that have to be preserved in Anatolia because of its unique geographical features and architectural character. Uçhisar, the case study of this thesis, is a city in Cappadocia region represents local architectural examples within typical Cappadocia unique geographical features. However, the rapid tourism development in the region has quickly brought the physical changes in the historic environment. Increased number of tourists with their need of accommodation and other service facilities leads to implementation of restoration projects of traditional buildings.

  Unfortunately, some restoration projects are not effective to protect and promote the traditional features of buildings. This may be related with economic insufficiencies and tight deadlines; but mostly the lack of research that exists on the local construction techniques. The most striking example of this rapid development could be assessed with the experience of the restoration project of some of traditional houses that are investigated for this thesis (Figure 5.1).

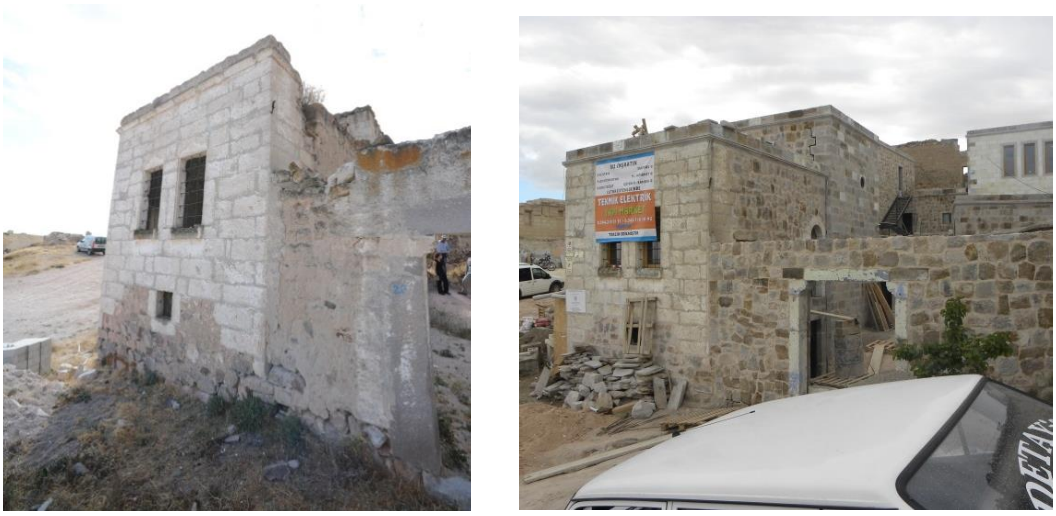


Figure 5.1 Lot no: 545- An investigated house that is rapidly restored

- During study, local names of architectural elements were obtained from the interviews. Tradition of passing father to son, local mason number is very few that worked with traditional methods. Fortunately, during this study, it was a chance to interview with masons that have worked in Uçhisar. This interview provided the documentation of each stage of construction process for a traditional house in Uçhisar. Further study can be focused on documentation of the construction process examined in practice. Due to the lack of knowledge of traditional materials, the use of a combination of traditional materials and modern construction materials can be another important issue to discuss.

- Chosen Uçhisar houses were analyzed with their construction methods and each architectural element was grouped by their construction techniques and materials. During investigating it is noted that each element in the structures can be composed of different variations. Even though similarities and differences observed in the houses, a continuity of traditional structure is determined and at the end of study a basic scenario of a house could be described. But yet, that is difficult to say that studied buildings represent entire houses in Uçhisar. Therefore, in further study, analyzing more number of buildings based on this study would be appropriate to create a larger database about traditional Uçhisar houses.

- This study was prepared by an architect's point of view. However understanding the traditional houses holistically an inter-disciplinary study with ones specializing in their field such as materials scientists, geological scientist or construction engineer will contribute the studies.

REFERENCES

Binan, D. (1998). Güzelyurt örneğinde Kapadokya Bölgesi Yığma Taş Konut Mimarisinin Korunması İçin Bir Yöntem Araştırması . İstanbul: Yıldız Teknin Üniversitesi, Mimarlık Ana Bilim Dalı, Doktora Tezi.

Choisy, A. (1873). L'art De Batir chez les Romains.

Cimşit, F. (2007). Tepe Kent Yerleşmelerinde Psiko-Sosyal Alan Olgusunun Konut Örüntüleri İle İlişkisi; Uçhisar Örneği. İstanbul. İstanbul Teknik Üniversitesi,Fen Bilimleri Enstitüsü, Doktora tezi

Coşkun, M. (2009). Kapadokya'nın jeolojik oluşumu, korunması ve geleneksel dokunun turizm katkısı. Mustafapaşa , Nevşehir

Erençin, A. (1979). Kapadokya Yerel Konutlarında Turizme Yönelik Yenileme Çalışmalarına Bir Yaklaşım: Örnek Avcılar Köyü, unpublished phd thesis, İstanbul Teknik Üniversitesi, Fen Bilimleri Enstitüsü, İstanbul.

Geray, C., Keleş R., Yavuz, F., & Hamamcı, C. (1983). Şehircilik, Cumhuriyet Dönemi Türkiye Ansiklopedisi, C.9.

Giovanni, L. (1971). Arts de Cappadoce, Les Editions Nagel. Geneve.

Kaphib, T. (2010). Ministry of Culture and Tourism - General directorate of information-Destination Cappadocia.

Nevsehir - Uçhisar Belediyesi Koruma Planlamasi Çalismalari . (2006).

Güney, E. , Güney, H., Güney S. (1974) Nevşehir İli Yakın Çevre İncelemeri, İstanbul

Öztürk, F. G. (2009). Kapadokya'da Dünden Bugüne Kaya Oymacılıgı-Rock Carving In Cappadocia From Past To Present / Arkeoloji Ve Sanat Yayınları.

Sevin, V. (1998) Tarihsel Coğrafya, In M. Sözen (Edt.), Kapadokya), İstanbul

Solmaz, F. (2013). Construction techniques of traditional houses in Nevşehir; Case Study on Ürgüp , Mustafapaşa and İbrahimpaşa. Middle East Technical University A Thesis Submitted To The Graduate School Of Natural And Applied Sciences. Ankara.

Stea, D., & Turan M. (1993). Placemaking, Ipswich Book Co. Ltd., Ipswich, Suffolk.

Tuncel, M. (1998). Oluşum Çağları, In M. Sözen (Edt.), Kapadokya İstanbul: Ayhan Şahenk Vakfı Yayınları.

Umar, B. (2011). Kappadokia, Inkılap Yayınevi.

Uzunçarşılı, İ. (1974). Abideler ve Kitabelerle Aksaray Tarihi.

Eczacibaşi (1962) Kültür Filmleri Göreme – Kapadokya , Documentary

http://tuikapp.tuik.gov.tr/adnksdagitapp/adnks.zul > (viewed on 17.08.2013).

http://whc.unesco.org/en/list/357/ > (viewed on 09.09.2014).

http://www.eskiturkiyefotograflari.com/ > (viewed on 12.11.2014).

http://www.nevsehir.bel.tr. / > (viewed on 13.01.2015)

APPENDIX A

GLOSSARY

Table A.1 Glossary

TURKISH / ENGLISH	TURKISH DEFINITION	ENGLISH DEFINITION
Bolu / -	Üzüm suyunun toplandığı yer	A bowl that collects grape juice
Çorak / -	Toprak çatılarda kullanılan toprağın yöresel söylemi	Local name of earth used in earth roof
Çörtlek / Waterspout	Yağmur ve kar sularını yapıdan uzaklaştıran çatı elemanı	Roof element that throw out rain and snow water
Hezen / -	Geleneksel konutlarda ahşap kirişli üst örtü	Local name of timber beam in traditional houses
Kaburga Kemer / -	Kemer odalarda bulunan ana taşıyıcı kemerlerin her biri	The main supporter arch of arched rooms
Kaburga Tonoz / -	Tonoz sisteminde ana taşıyıcı kemer	Main supporter arches in vault system
Kafa Tahtası / -	Çatı üzerinde silmeden sonra gelen 30-50 cm duvar	30-50 cm wall which placed on roof
Kafa Taşı / -	Cephelerde kullanılan küçük kaba yonu taşlar	Small rough stone pieces used in facade walls
Kapak Kemer / -	Kaburga tonozlu mekanlarda kaburga kemerin aralarını kapatan kemer	The arch which covers the intervals of kaburga kemer in vaulted rooms
Kapak Taşı / -	Kapak kemeri oluşturan her bir taş	Each stone of kapak kemer
Kayır / Purmice	Ponza taşının yöresel söylemi	Local name of purmice
Kemer koltuğu / Arch seat	Kemerin arkası ile duvar arasında kalan bölge	The area left between the extrados of the arch and wall
Kepez / -	Yöresel volkanik bir taş	Volcanic type of local stone
Külle / -	Tandırın içinde hava akımını sağlayan kanal	A pipe provides air flowing to tandır
Külünk / -	Kaya oyma ve taş şekillendirmede kullanılan yöresel sivri kazma	Pickaxe using for carving rock and breaking apart to stones

TURKISH / ENGLISH	TURKISH DEFINITION	ENGLISH DEFINITION
Küplük / -	Pişmiş topraktan yapılan küpleri koymak için kaya zemine oyulan alan	Rock carved spots for the terra cotta wares to fit in
Lambalık / -	Aydınlatma elemanın konulduğu mimari eleman	An element for putting enlightening equipment on
Musandra / -	Pabuçluk ve seki arasında bulunan ahşap korkuluk	Wooden balustrade between pabuçluk and seki
Saylak / -	Bir tür yassı taş	A type of flat stone
Sedir / -	Oturmaya veya yatmaya yarayan eleman	Sitting and/or sleeping space
Sergen / -	Ahşap raf	Wooden shelve
Şıralık / -	Üzümden şarap ve pekmez üretmek için üzümün koyulup ezildiği mimari eleman	An architectural element to squeeze grapes to produce vine and pekmez
Şillez / -	Killi toprak, taş parçaları,saman ve su ile yapılan yöresel bir karışım	Special local mixture of clay soil, stone pieces, straw and water
Taka / Niche	Nişe yöresel olarak verilen isim	The local name of niche
Tandır / -	Yere çukur kazılarak yapılan bir fırın türü[11]	An architectural element which is used for cooking and heating purposes
Tandır Evi / Tandır house	İçerisinde tandır bulunan özellikle yaz aylarında kullanılan tonozlu oda	Vaulted room which has tandır and especially used during summer
Ürkün taşı / -	Yapının köşelerini oluşturan taşlar	Stones take place corner of the buildings
Yunmalık / -	Yıkanmanın gerçekleştiği küçük niş	A narrow place built as stone niche built for ablution
Yuvak / -	Toprak damlı evlerin üstündeki toprağı sert bir katman haline getirmek için dam üzerinde yuvarlanan silindir biçimindeki ağır taş. [12]	The cylindrical tool which is used for pressing clay soil of earth roofs
Yüklük / -	Evlerde yatak, yorgan gibi eşyaları koymaya yarayan yer veya büyük dolap, yük, yük odası[13]	Deep and big niches in traditional houses to put and store the staffs like quilts and pillows

[11] http://www.tdk.gov.tr/ , Türk Dil Kurumu
[12] Ibit
[13] http://www.tdk.gov.tr/ , Türk Dil Kurumu

APPENDIX B

OVERLAPPING OF ROCK CARVED PLACES AND MASONRY STRUCTURE PLANS

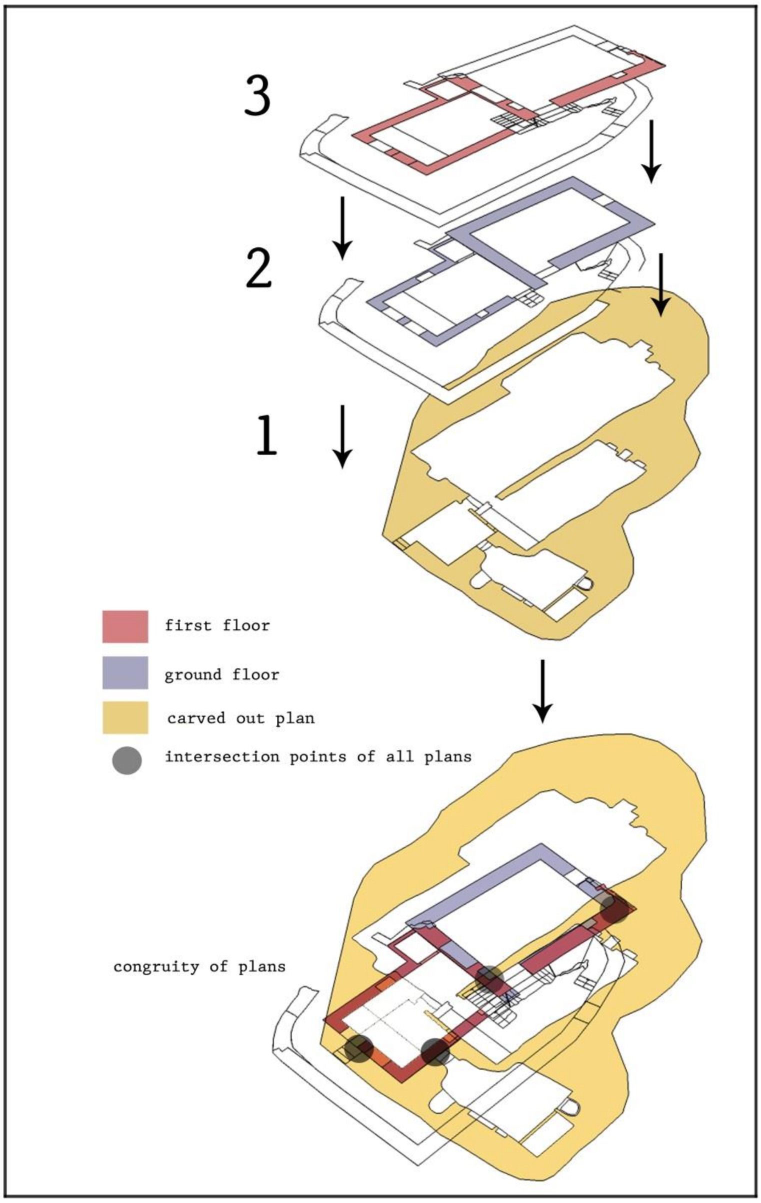
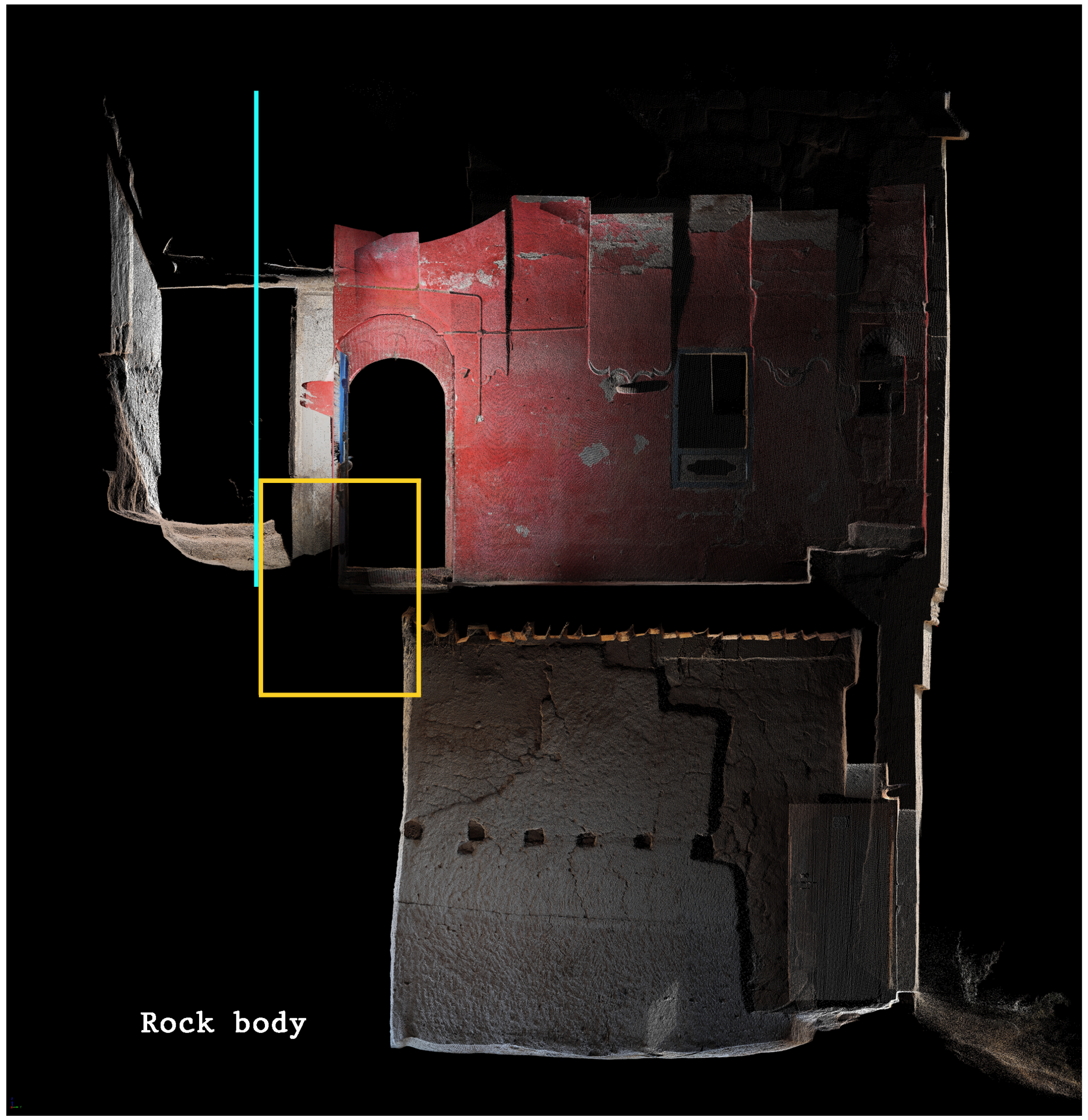


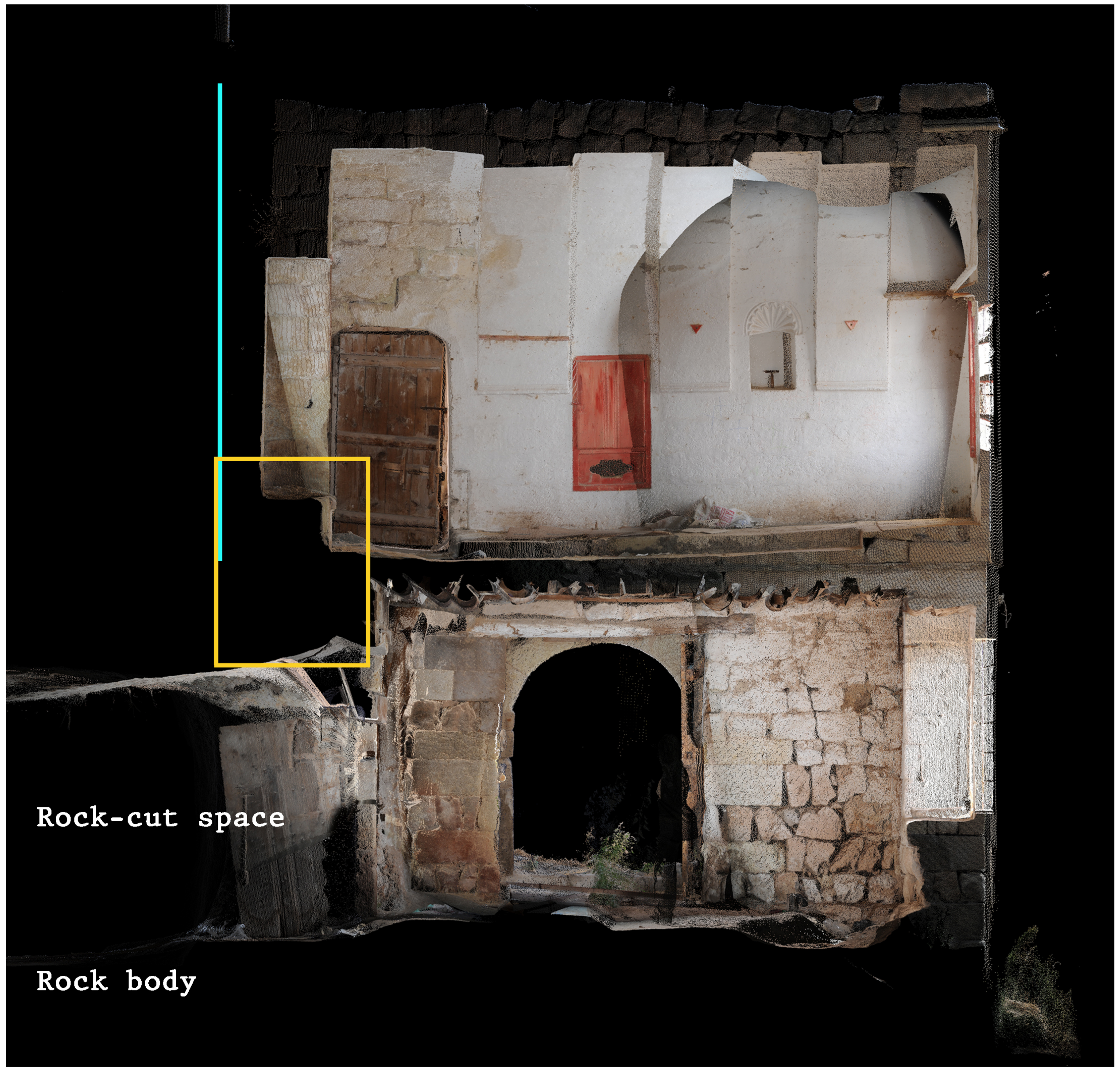
Figure A. 1Overlapping method of floor plans-552

Figure A.2 Overlapped plan scheme of houses

Upper storey back wall draw back from the line of ground storey and set up on rock base



lot no: 576/A



lot no: 576/B

Figure A.3Upper floor back wall relation with rock mass (Orthophoto)

APPENDIX C

3D MODEL OF STUDIED BUILDINGS

Appendix C is given in following pages

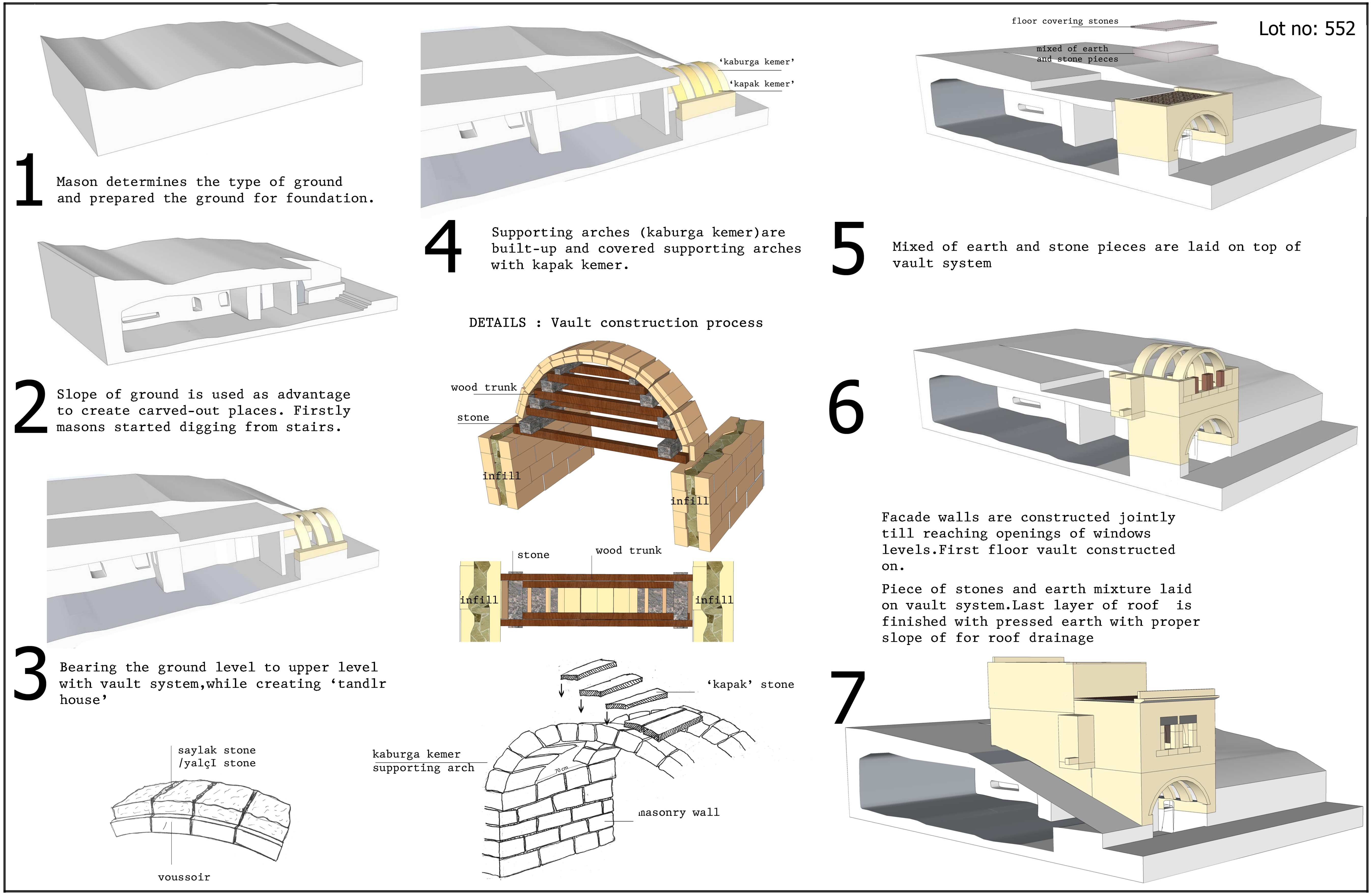
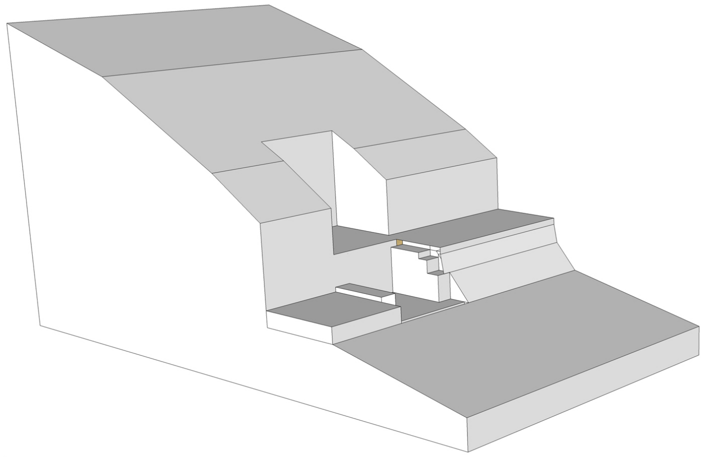


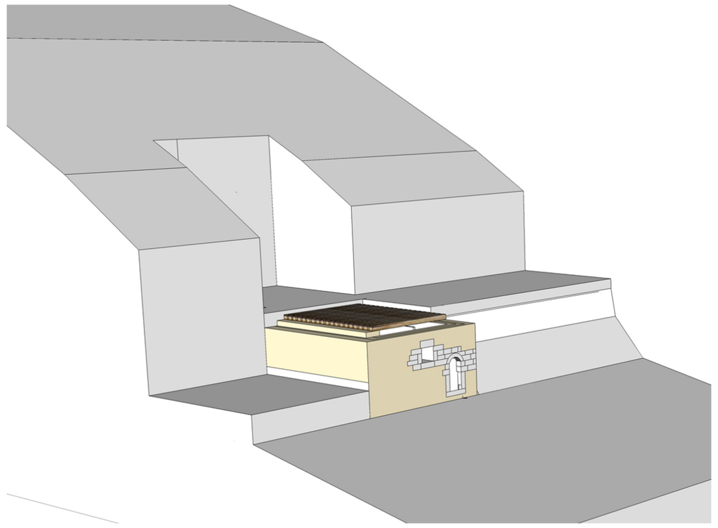
Figure A.4 3D Model of studied building - 552

Lot no: 675/A



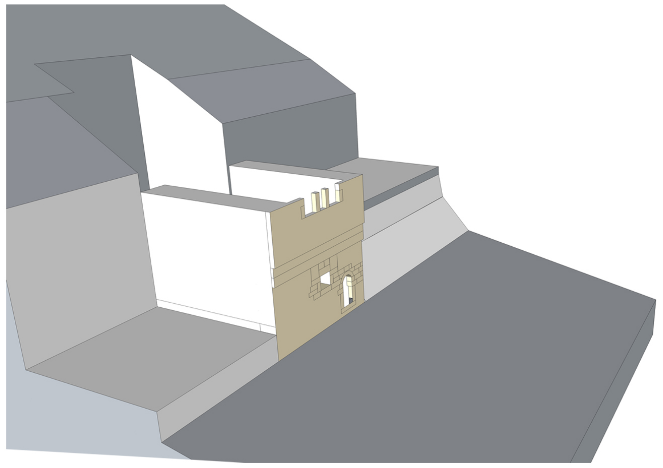
1 The rock ground is carved-out by openning lamba
Using rock as foundation wall on two sides
The rock behind, becomes 4th wall of the groundfloor.

2



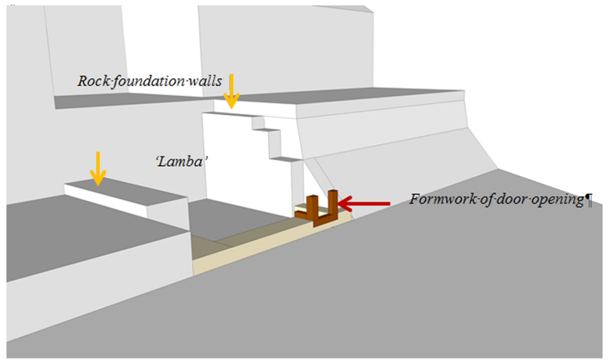
Three sides walls are constructed jointly till reachng opening(door,window) levels.The door opening width is determined by putting stone on short surface which is about the half way of door opening height.Same method is repeated for window opening.

Walls of ground floor reach proper high, as same level with rock walls left.
Mean avarage 10x20cm flat stones put on, projected 8 cm ahead, top of the walls.
Timber beams 10 x 15 cm are rank in line, adjoining eachother, on the projected stones, along between walls of short dimension of room.
Timber beam rows are covered with 'sal' stones.Then earth mix spread on stones.

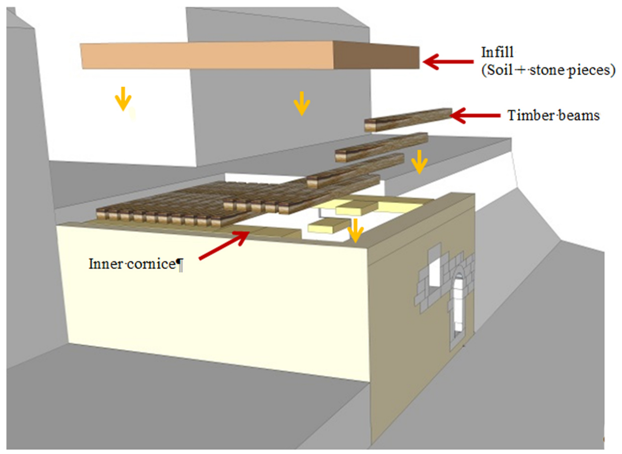


3 Second floor walls are strarted to built, 20 cm ahead from the ground floor walls, by the two rows of small projections.
Walls are constructed till the level of window opening on front facade. End point of moulding of windows are at the same level with impost line of the supporter arches.

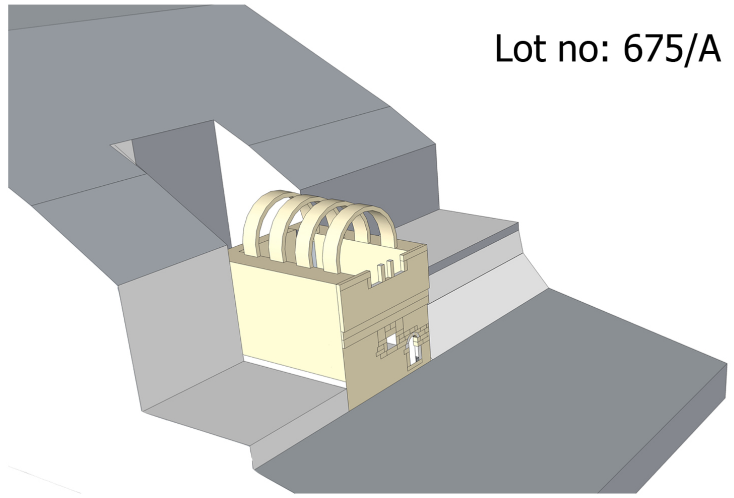
DETAIL: Moulding method of openings

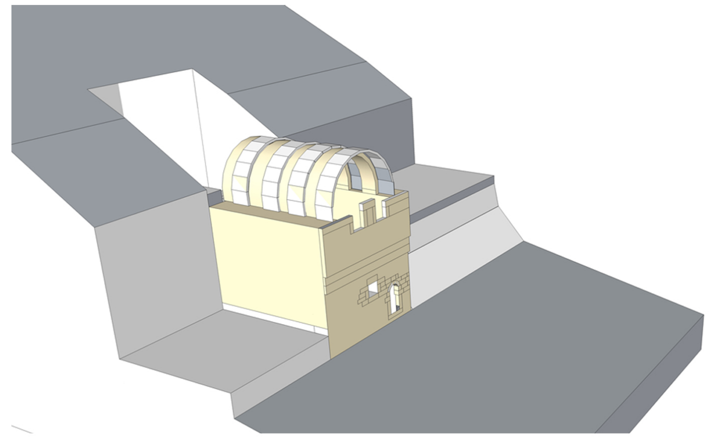


DETAIL: Timber ceiling construction



4





From the level half way of window openings, supported arches are built-up on top of the side walls, 70cm left each between.
First voussoirs of each arches are ornamented.Gaps are covered by 'kapak' stones. Side walls are constructed while filling in between arches and wall row with sillez.Roof is finished with pressed earth with proper slope of for roof drainage.

5

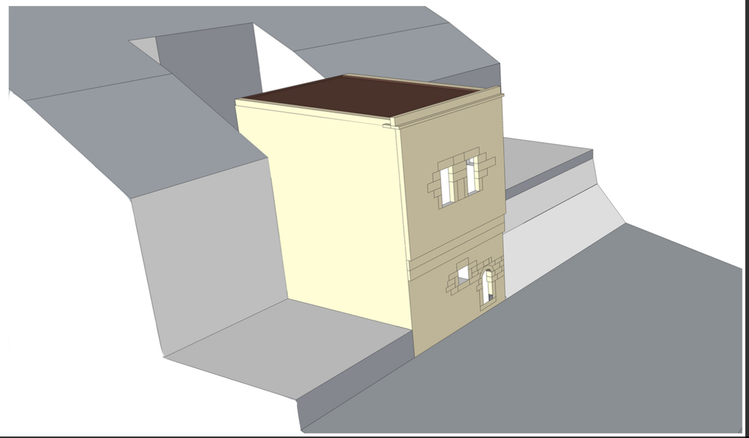


Figure A.5 3D Model of studied building - 675/A

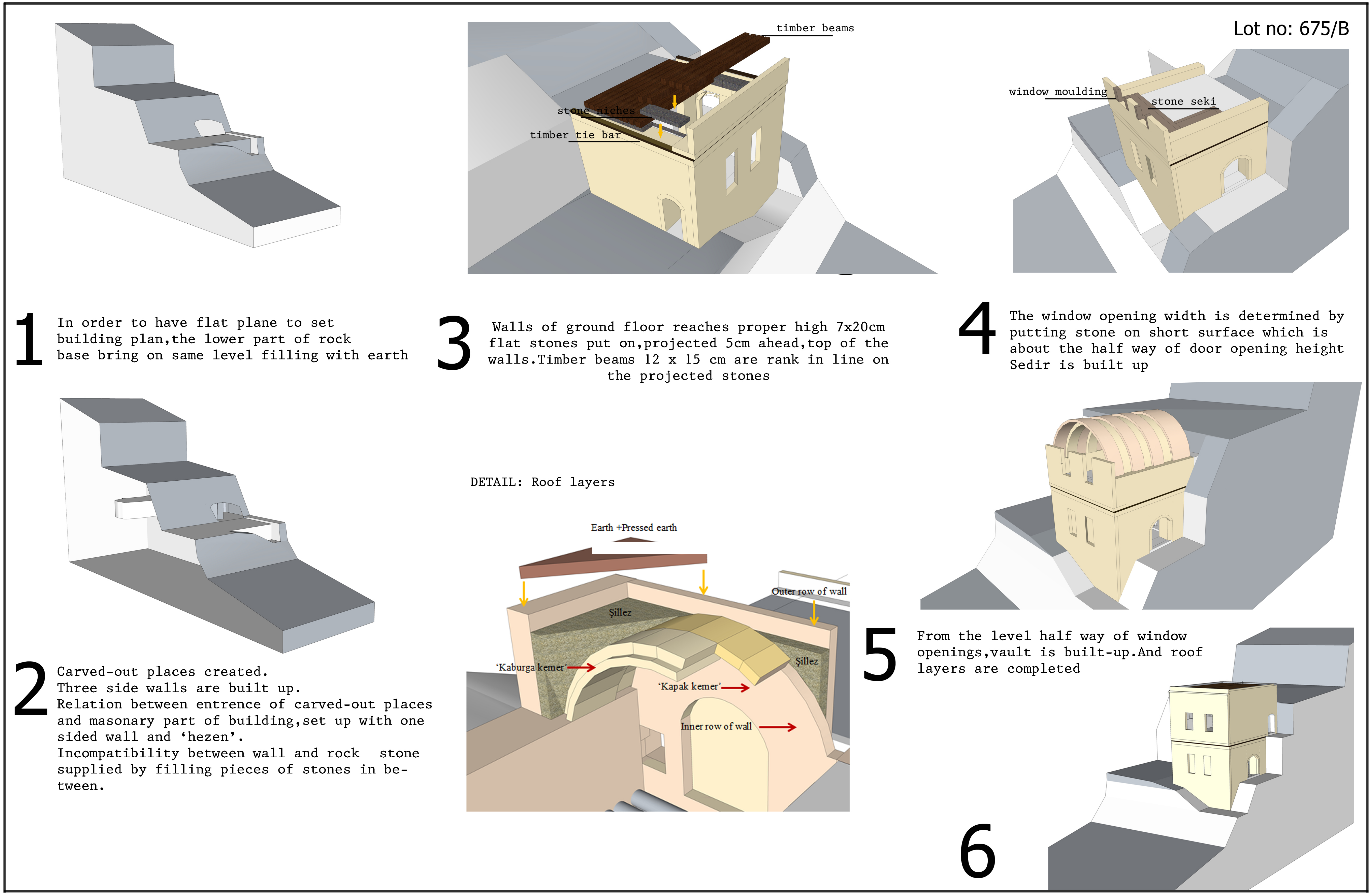


Figure A.6 3D Model of studied building - 675/B

APPENDIX D

DRAWING OF BUILDINGS

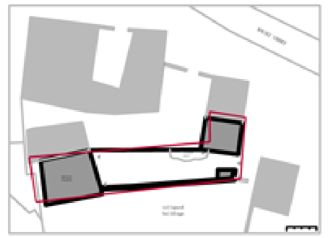
Appendix D is given in following pages

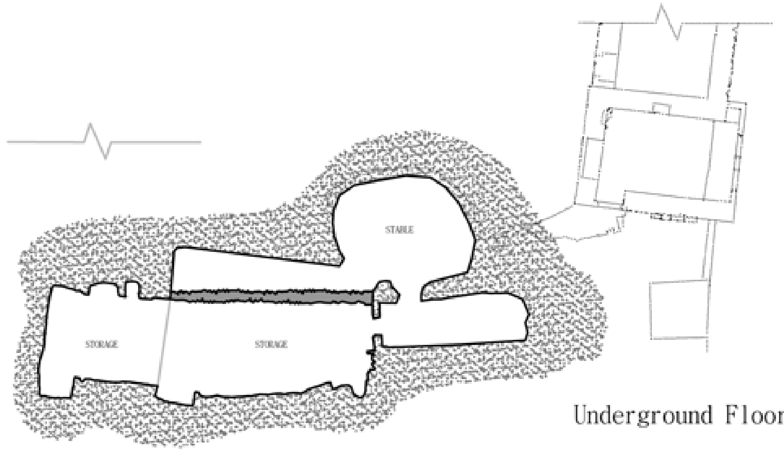
Lot no
546

MIDDLE EAST TECHNICAL UNIVERSITY
GRADUATE PROGRAM IN RESTORATION
'CONSTRUCTION TECNIQUES OF TRADINITIONAL UCHİSAR HOUSES'
Prepared by: Pınar Başak Tongal
Supervisor: Dr.Fuat Gökçe

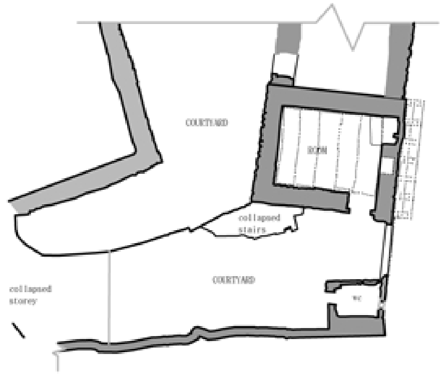
Measuring method: Laser scanner - Hand measurements

Plan & Orthophoto

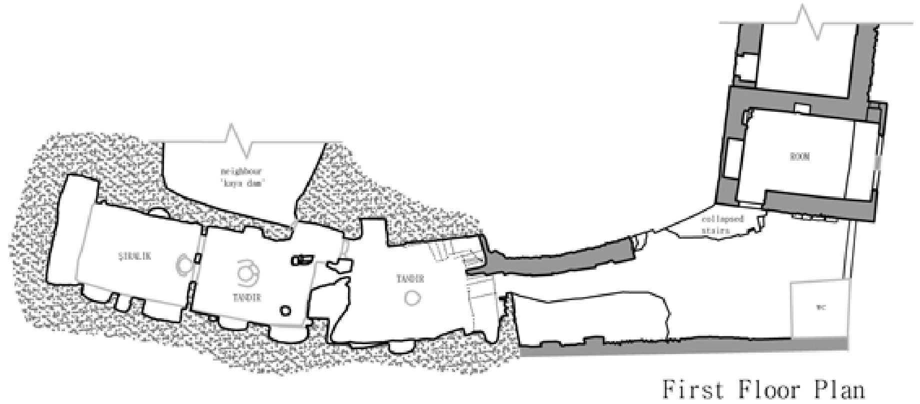

Lay out plan



Underground Floor Plan



Ground Floor Plan



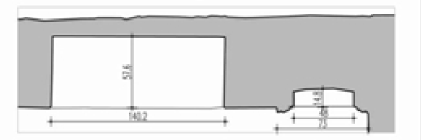
First Floor Plan

0 0.5m 1m 3m

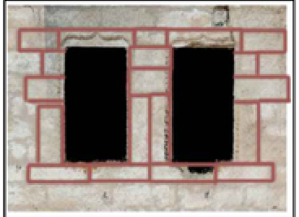
nourth facade

west facade

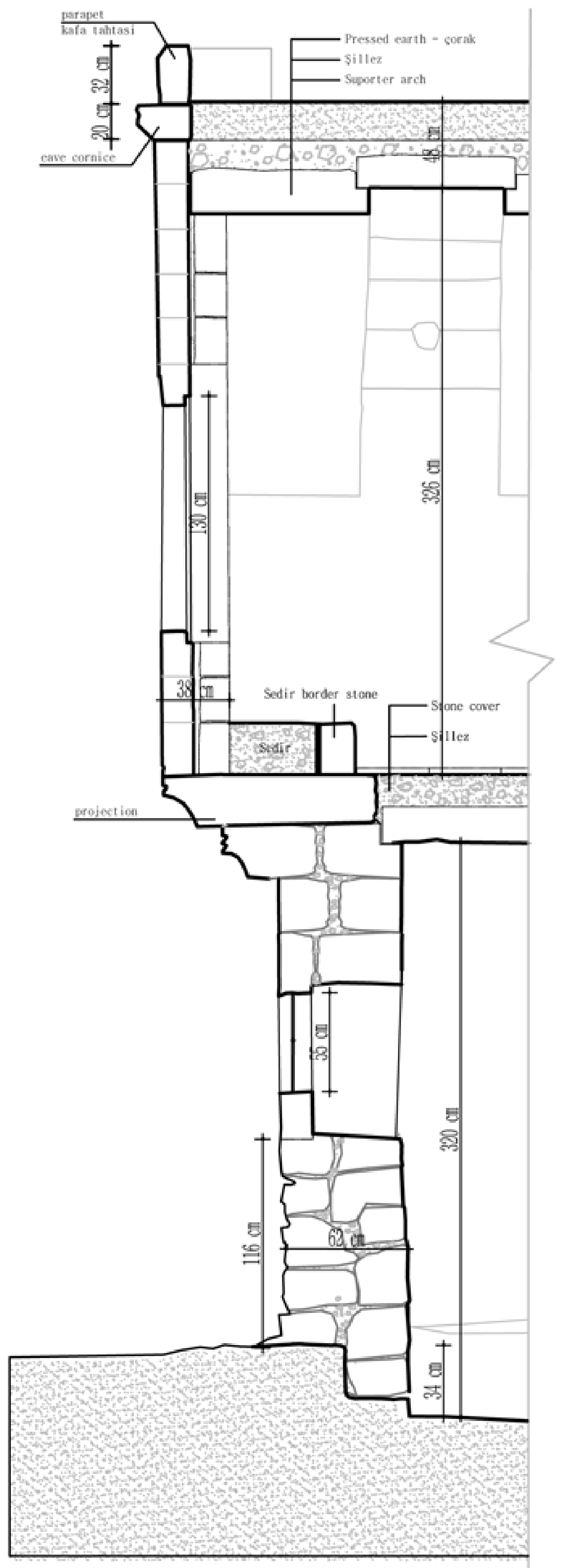
F1 room west part


plan

east facade


east facade window

System Section Detail



Photograph

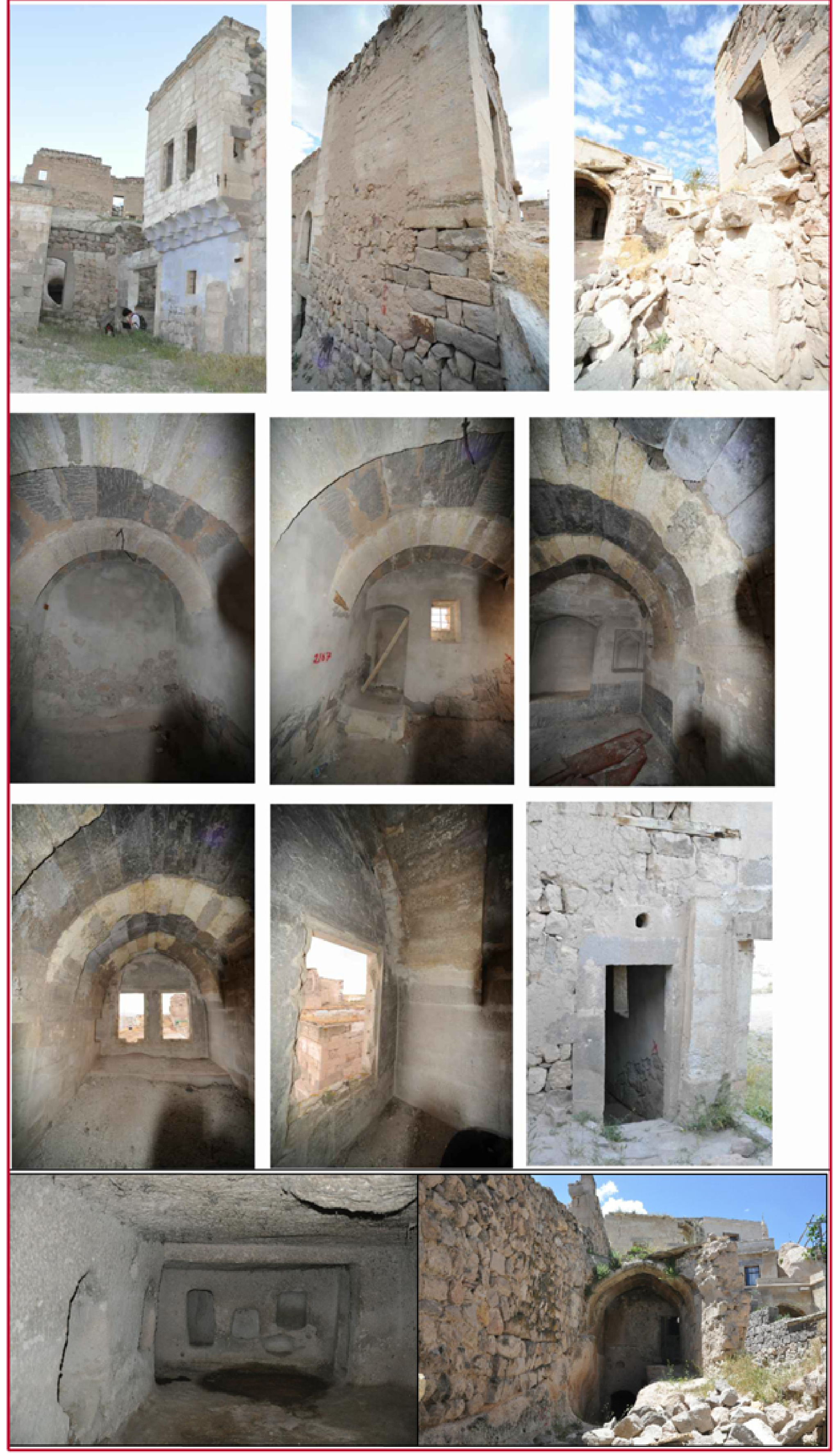


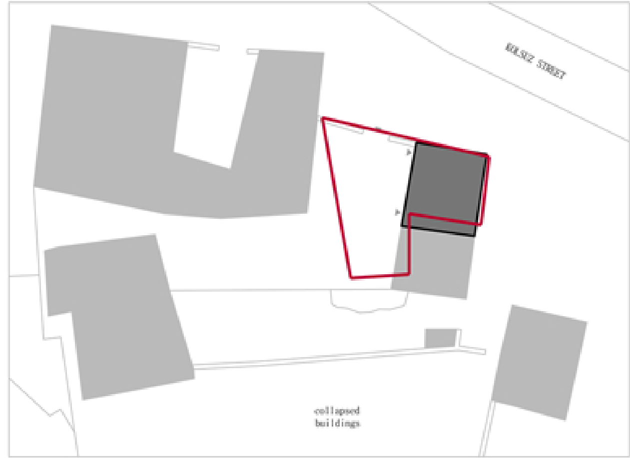
Figure A.8 Drawing of building - 546

MIDDLE EAST TECHNICAL UNIVERSITY
GRADUATE PROGRAM IN RESTORATION
'CONSTRUCTION TECNIQUES OF TRADINITIONAL UCHİSAR HOUSES'
Prepared by: Pınar Başak Tongal   Supervisor: Dr.Fuat Gökçe

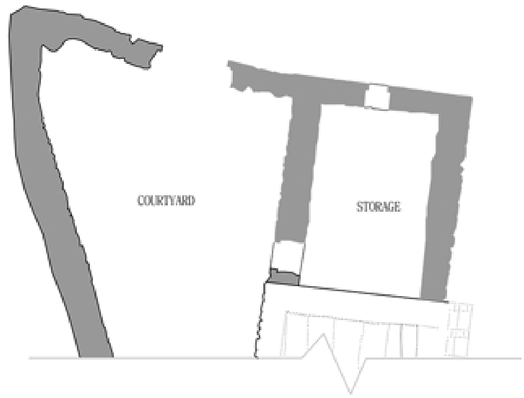
Lot no
545

Plan

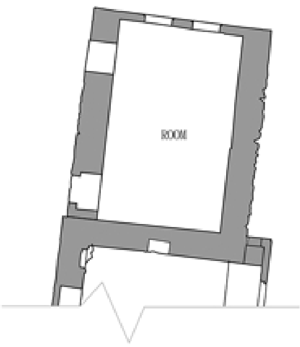
Measuring method: Laser scanner - Hand measurements



Lay out plan



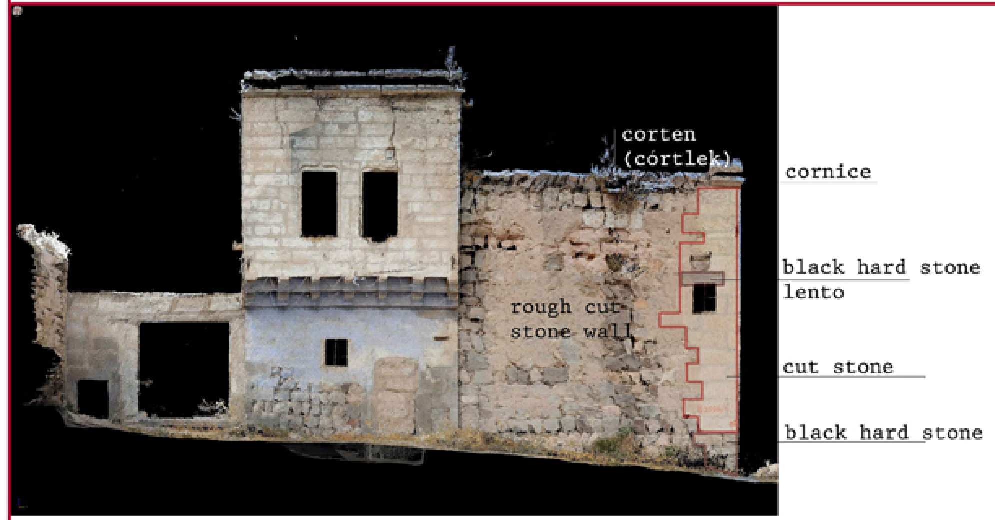
Ground Floor Plan



First Floor Plan

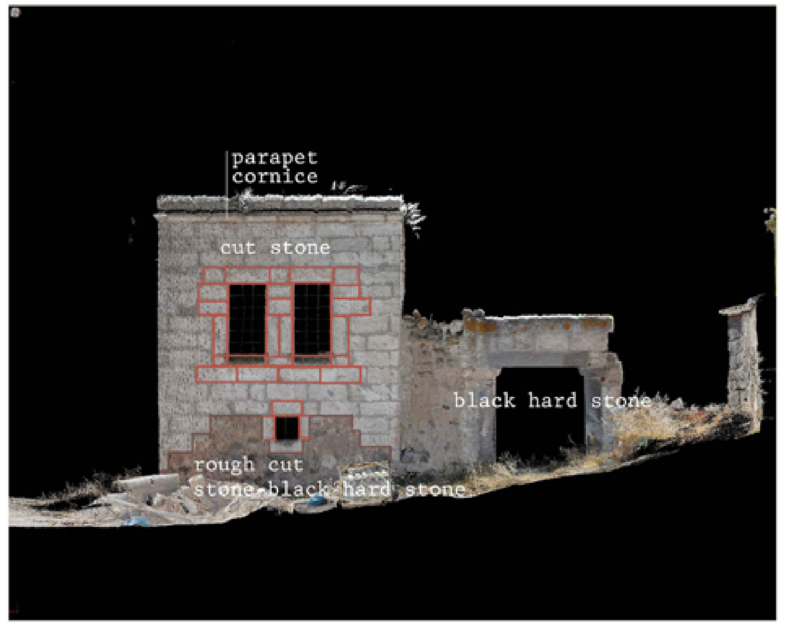
0 0.5m 1m 3m

Orthophoto



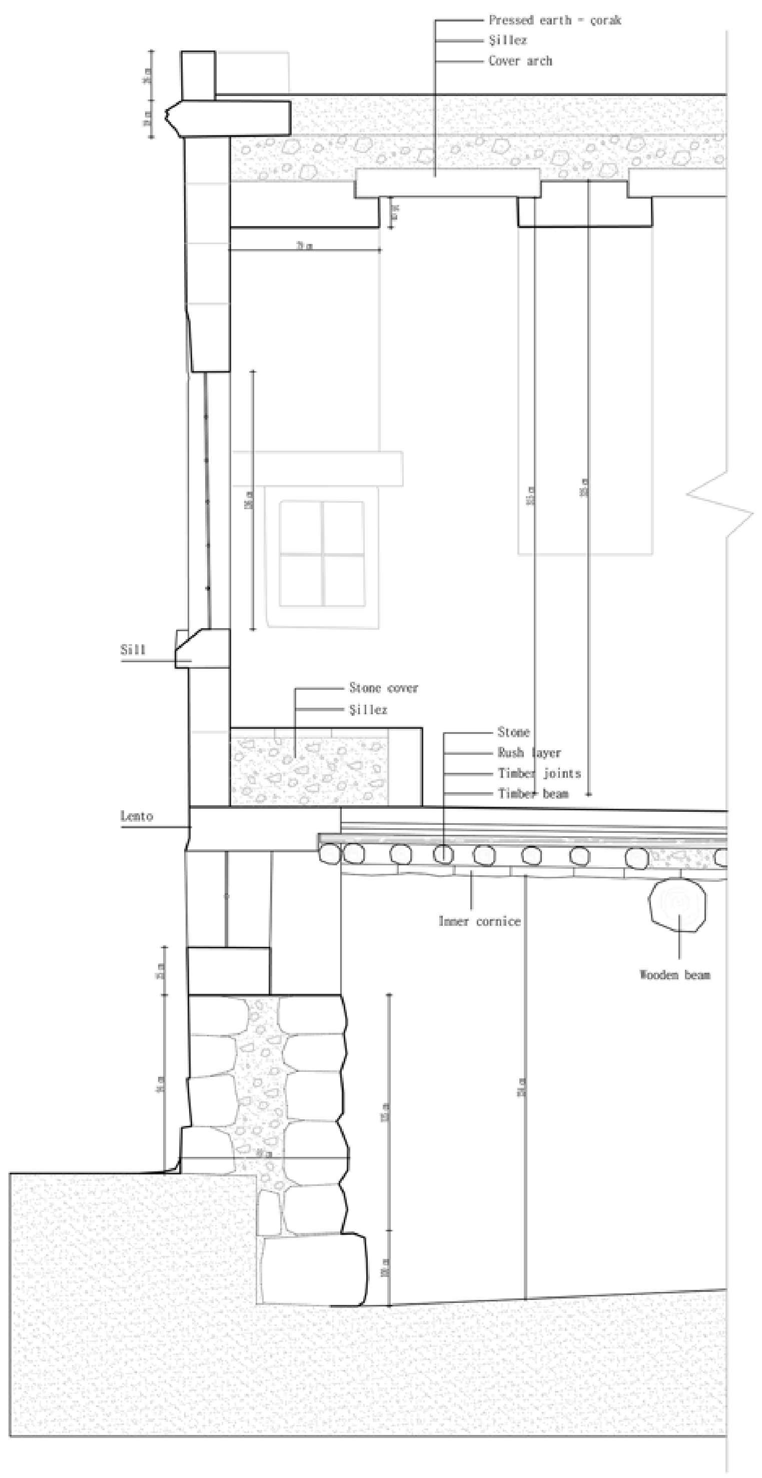
east facade

west facade



north facade

System Section Detail



Photograph

Figure A.7 Drawing of building - 545

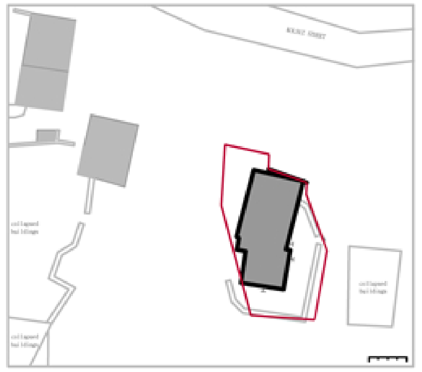
Lot no
552

'CONSTRUCTION TECNIQUES OF TRADINITIONAL UCHİSAR HOUSES'

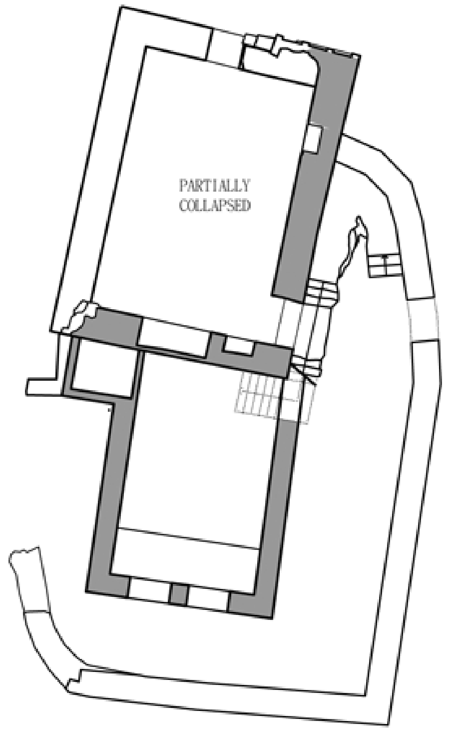
MIDDLE EAST TECHNICAL UNIVERSITY
GRADUATE PROGRAM IN RESTORATION
Prepared by: Pınar Başak Tongal
Supervisor: Dr.Fuat Gökçe

Measuring method: Laser scanner - Hand measurements

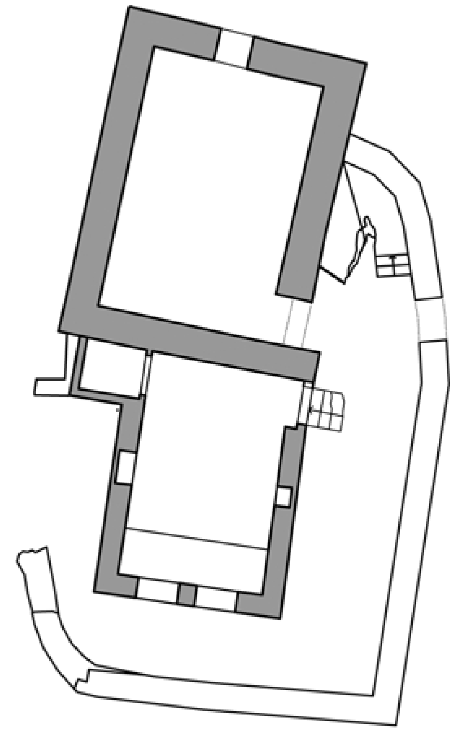
Plan & Orthophoto



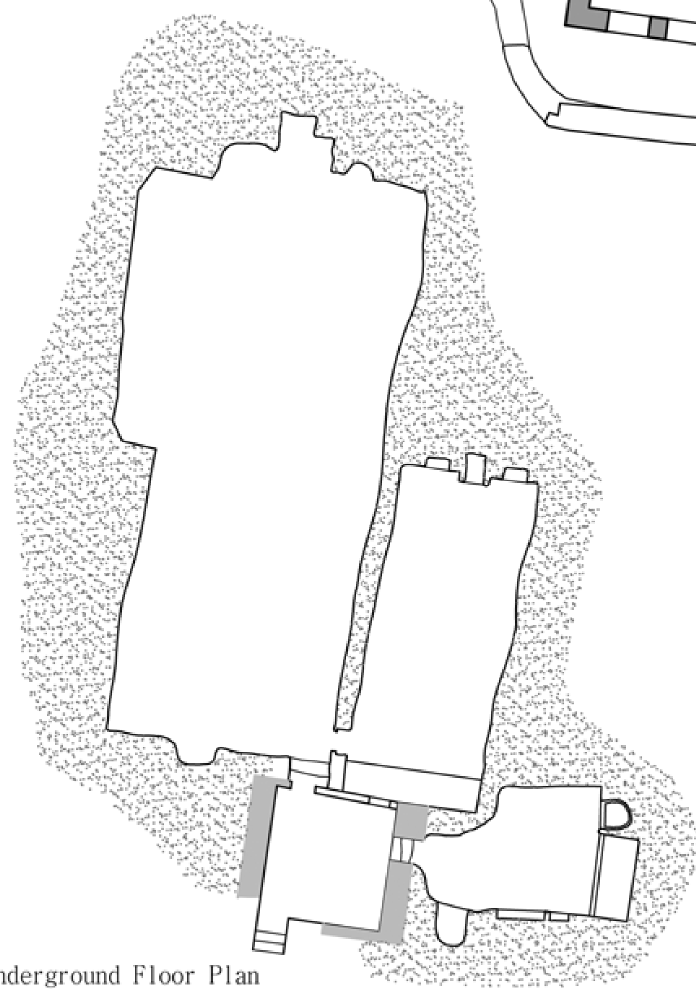
Lay out plan



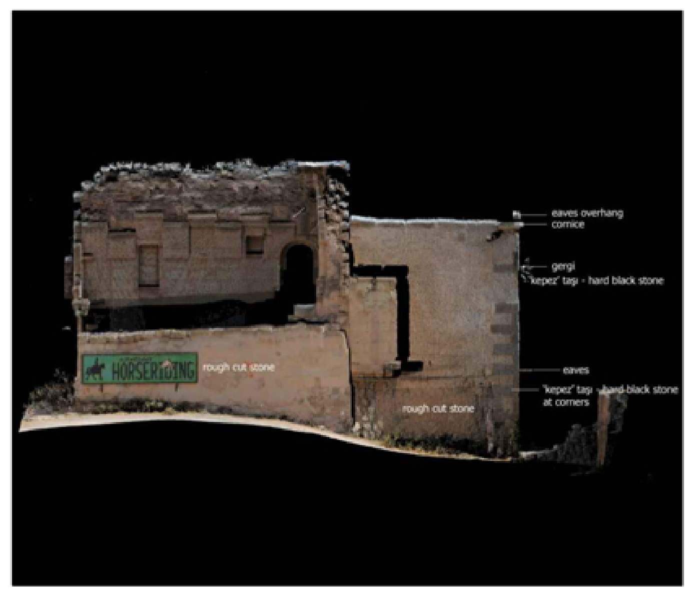
Ground Floor Plan



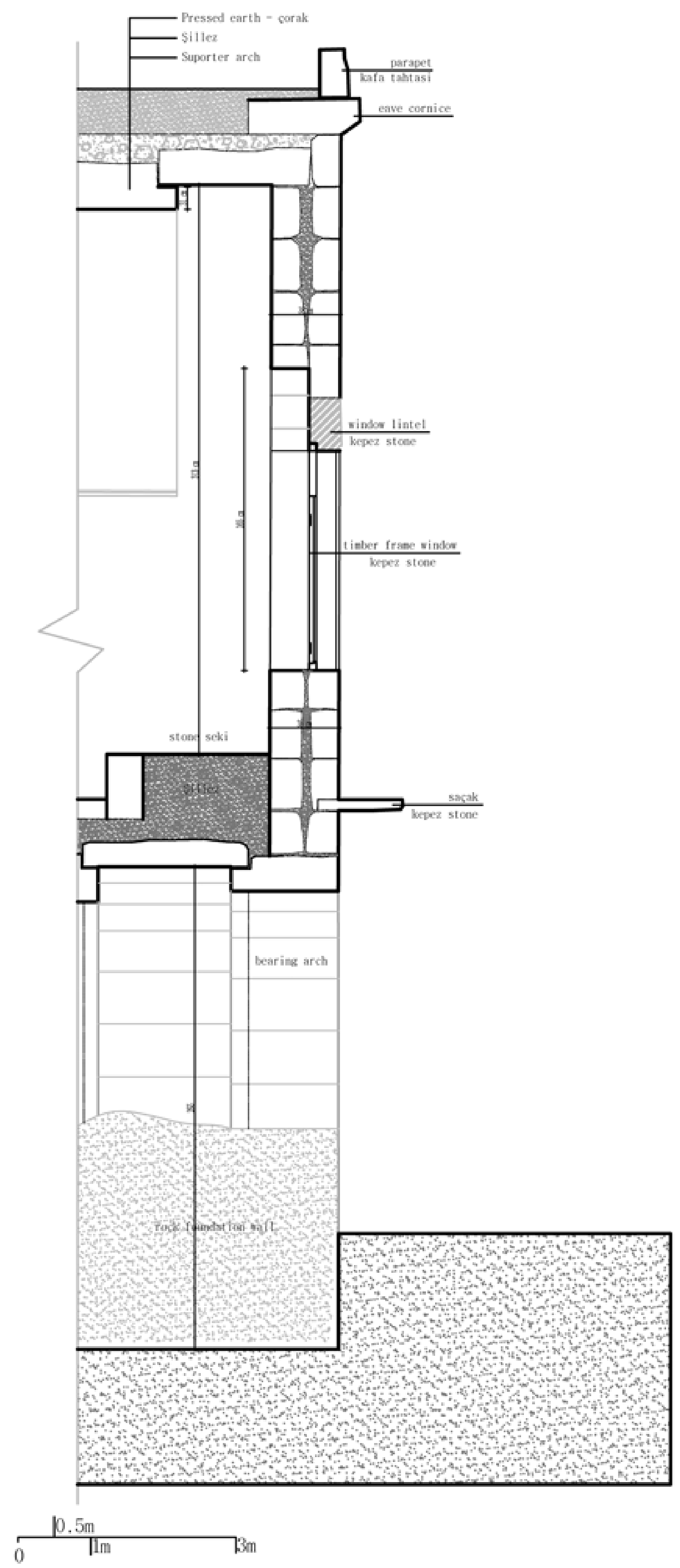
First Floor Plan



Underground Floor Plan



System Section Detail



Photograph

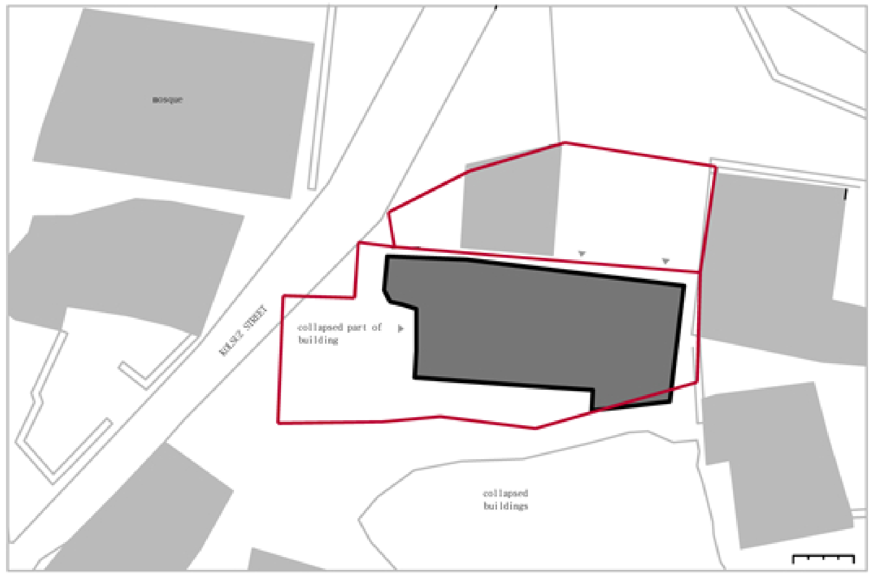
Figure A.9 Drawing of building - 552

Lot no
560

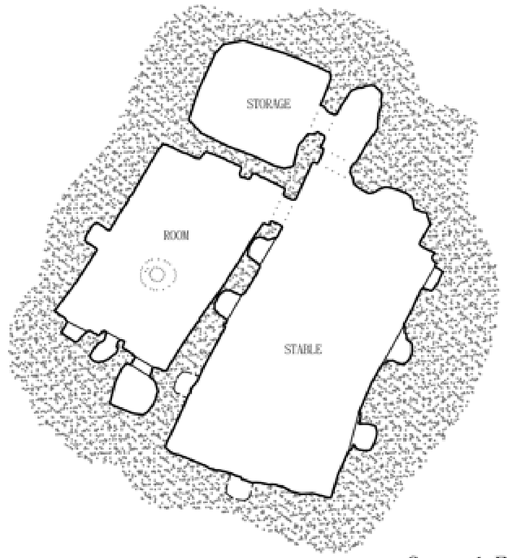
MIDDLE EAST TECHNICAL UNIVERSITY
GRADUATE PROGRAM IN RESTORATION
'CONSTRUCTION TECNIQUES OF TRADINITIONAL UCHİSAR HOUSES'
Prepared by: Pınar Başak Tongal
Supervisor: Dr.Fuat Gökçe

Measuring method: Laser scanner - Hand measurements

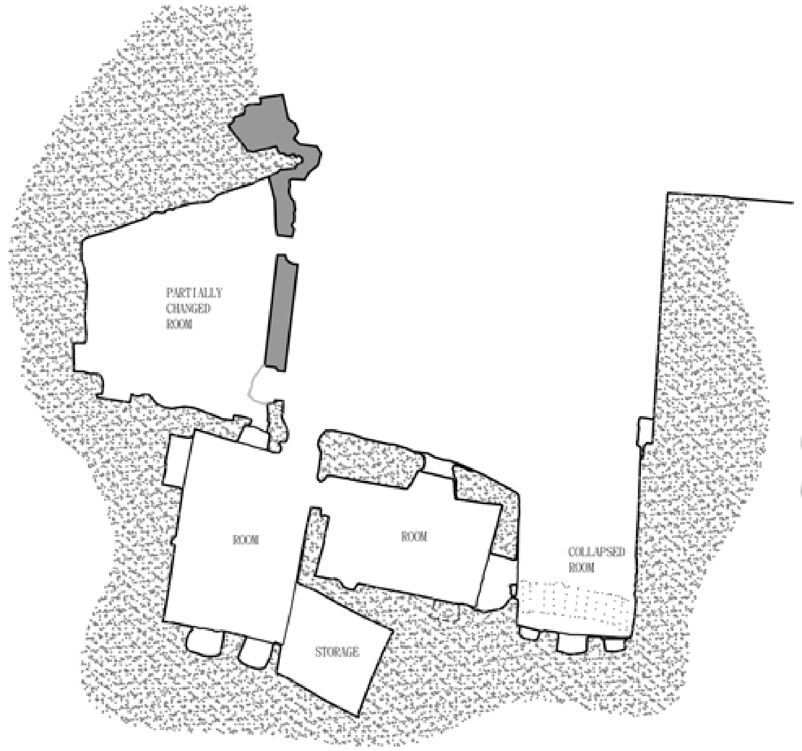
Plan &Orthophoto



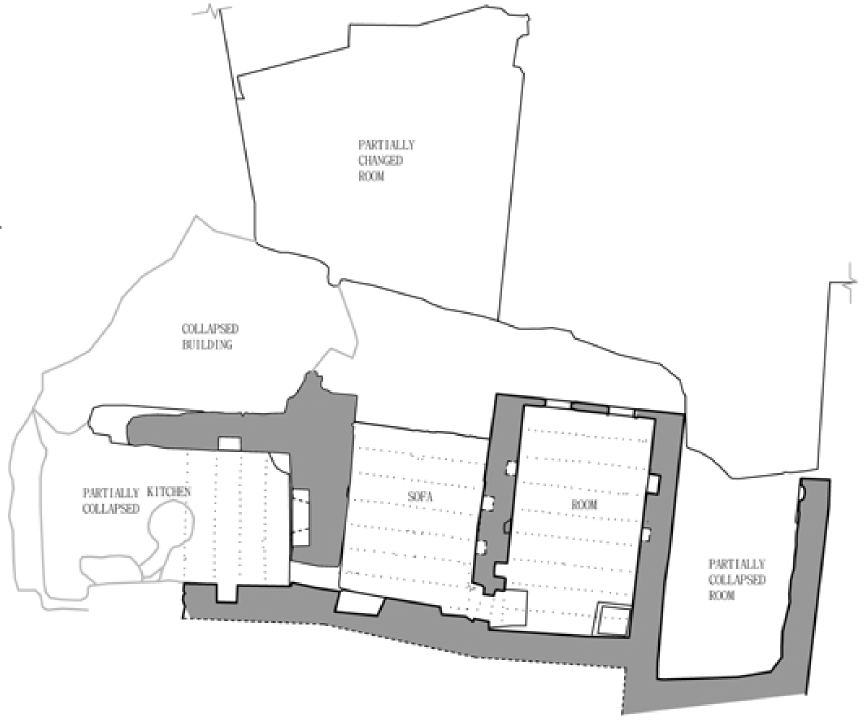
Lay out plan



Ground Floor

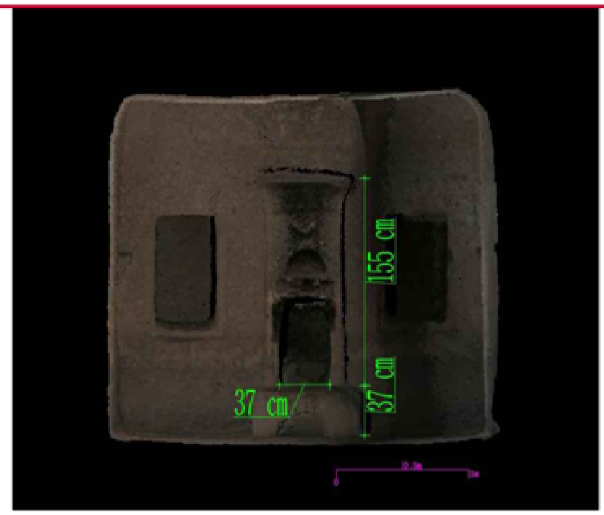


Mezzazine Floor plan



First Floor Plan

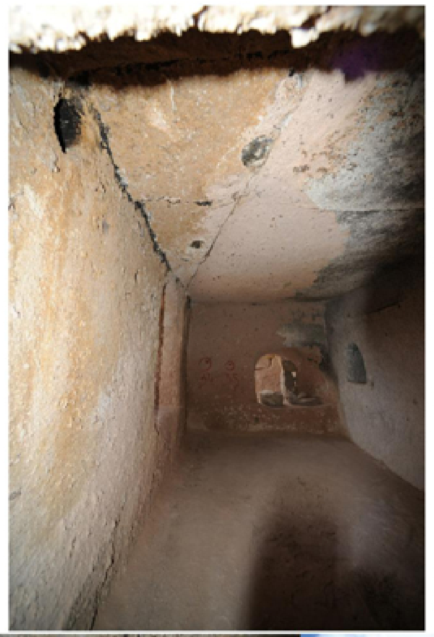
System Section Detail



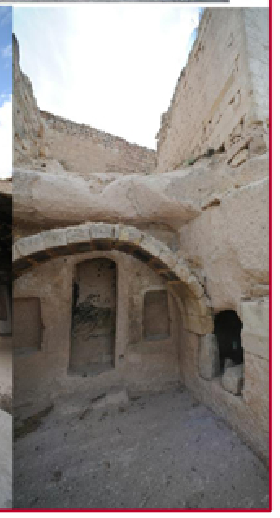
Facade

Photograph









MIDDLE EAST TECHNICAL UNIVERSITY
GRADUATE PROGRAM IN RESTORATION

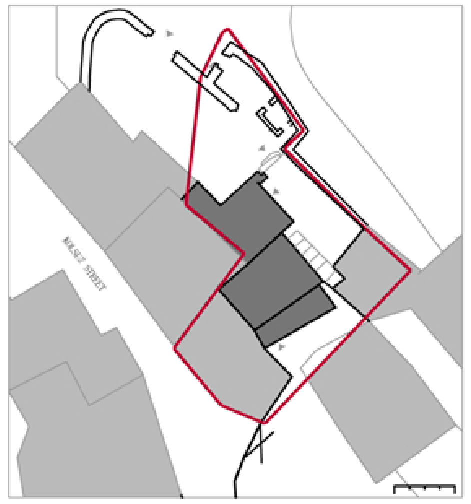
'CONSTRUCTION TECNIQUES OF TRADINITIONAL UCHİSAR HOUSES'

Prepared by: Pınar Başak Tongal   Supervisor: Dr.Fuat Gökçe

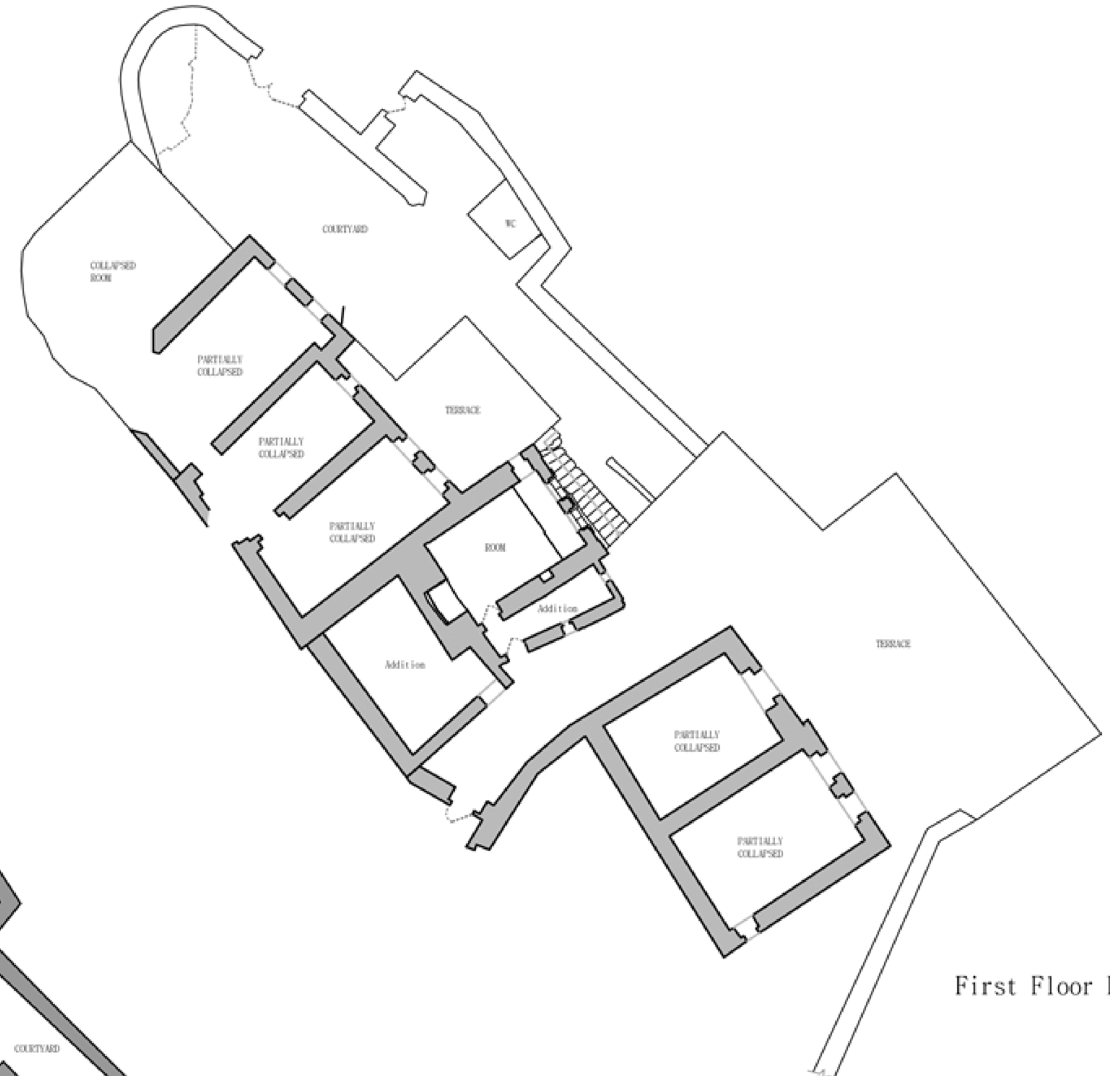
Lot no
588

Measuring method: Laser scanner - Hand measurements

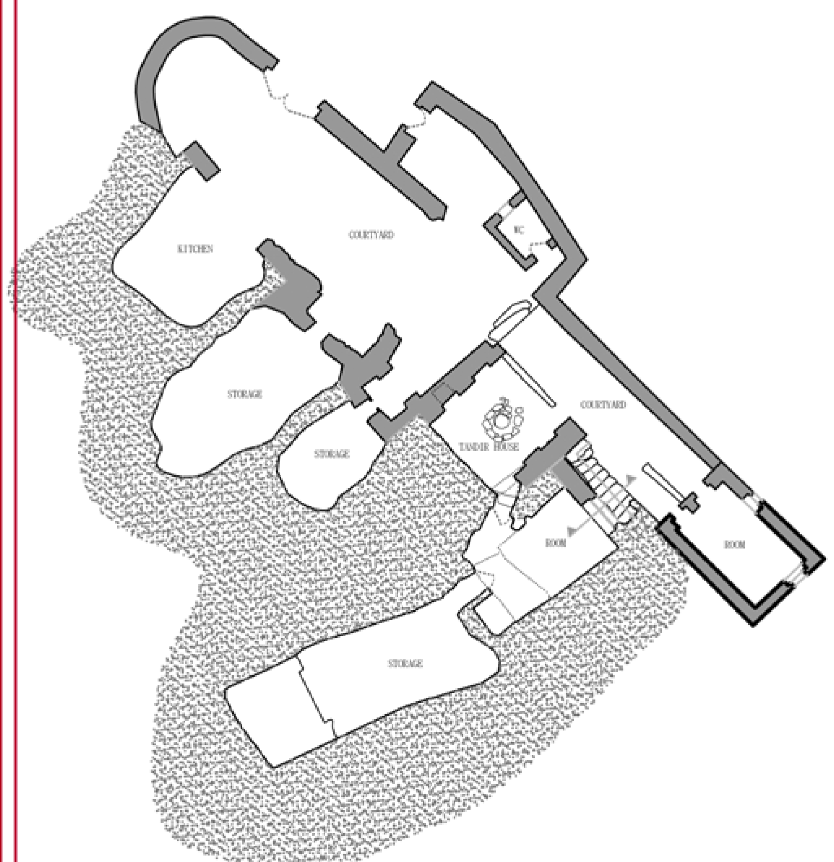
Plan & Orthophoto



Lay out plan



First Floor Plan

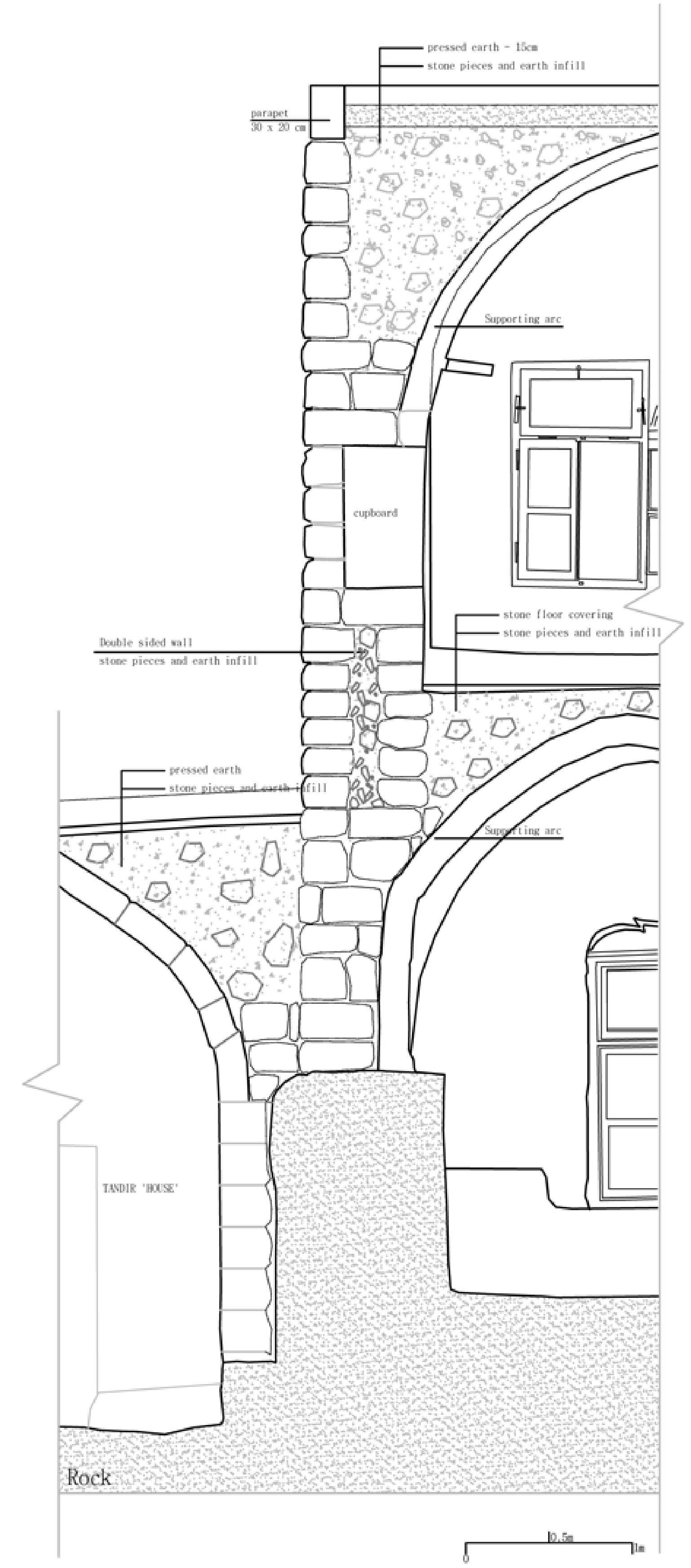


Ground Floor Plan

0.5m 1m 3m 0

Facade of buildign group

System Section Detail



Photograph

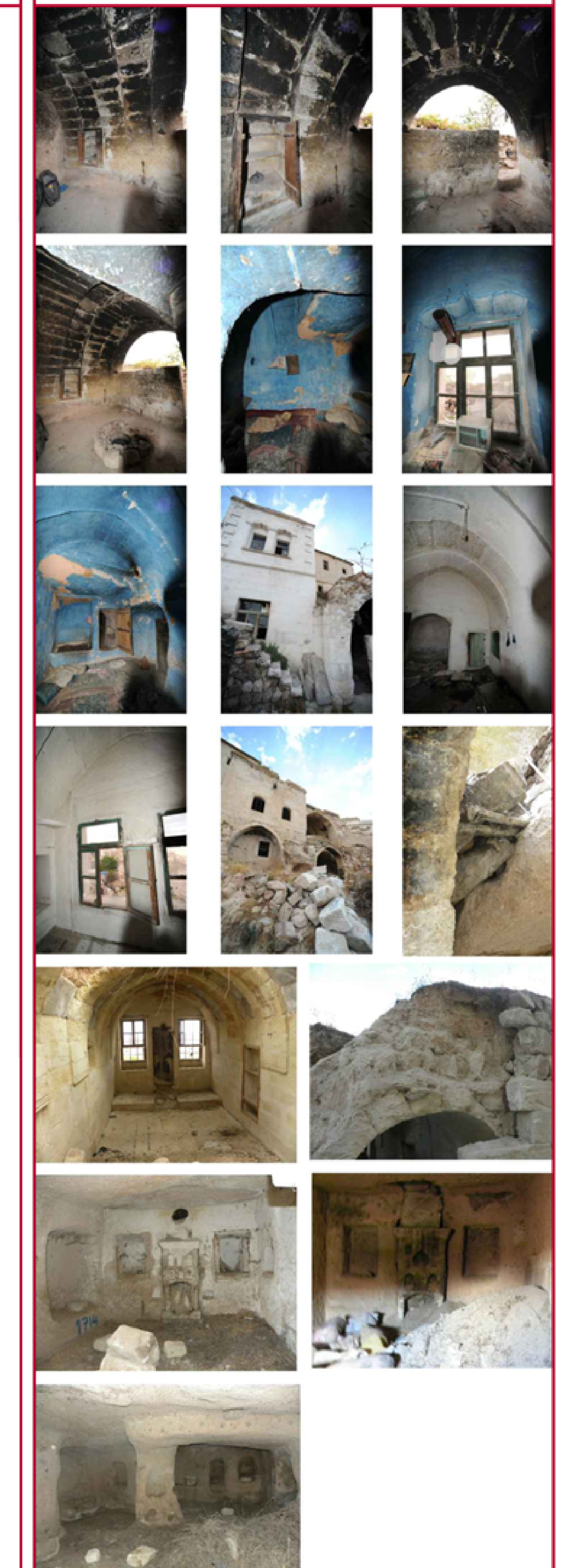


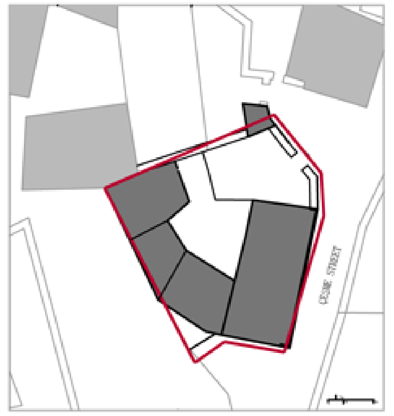
Figure A.11 Drawing of building - 588

MIDDLE EAST TECHNICAL UNIVERSITY
GRADUATE PROGRAM IN RESTORATION
'CONSTRUCTION TECNIQUES OF TRADINITIONAL UCHİSAR HOUSES'
Prepared by: Pınar Başak Tongal Supervisor: Dr.Fuat Gökçe

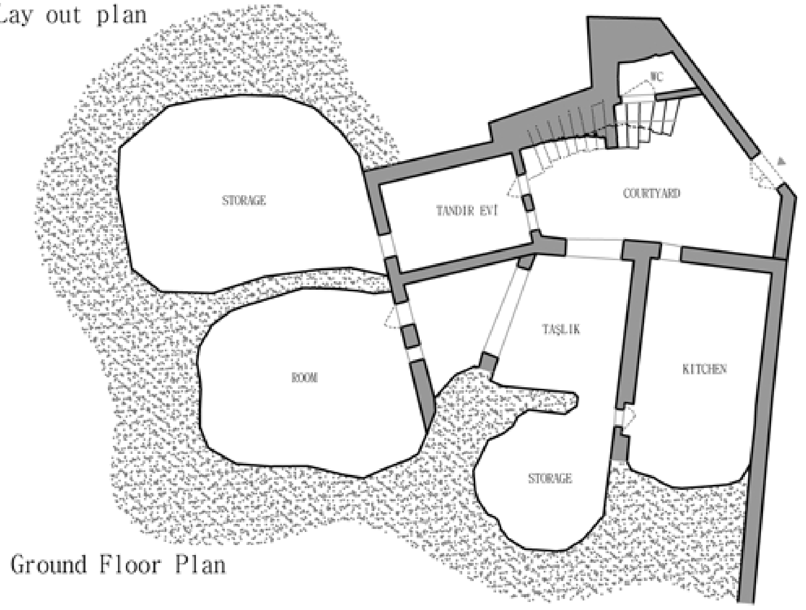
Lot no
645

Measuring method: Laser scanner - Hand measurements

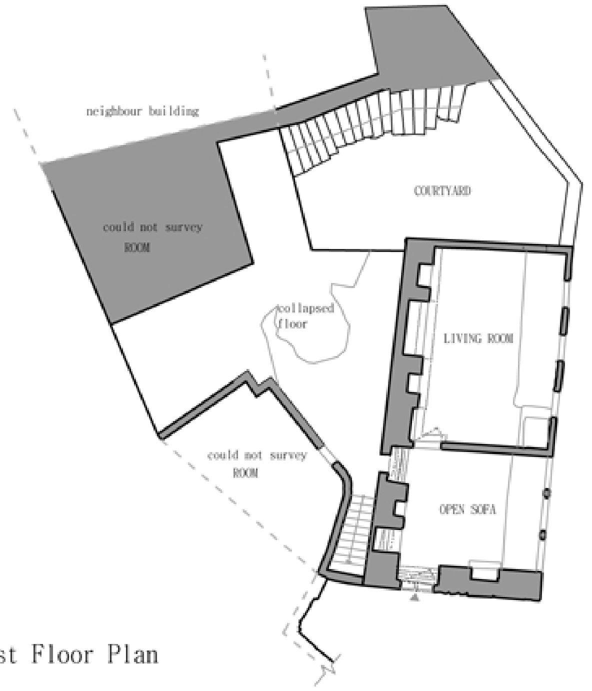
Plan



Lay out plan



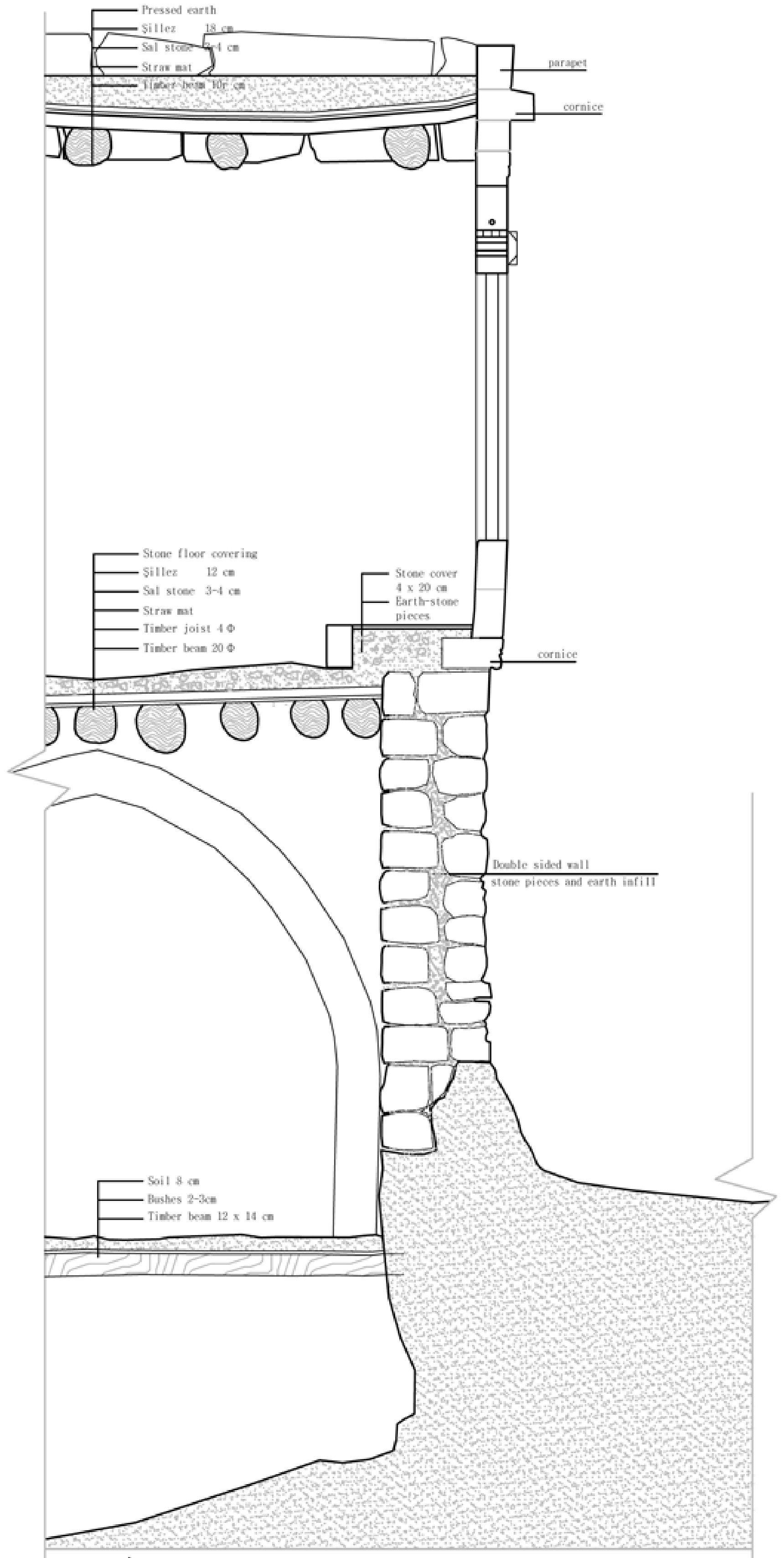
Ground Floor Plan



First Floor Plan

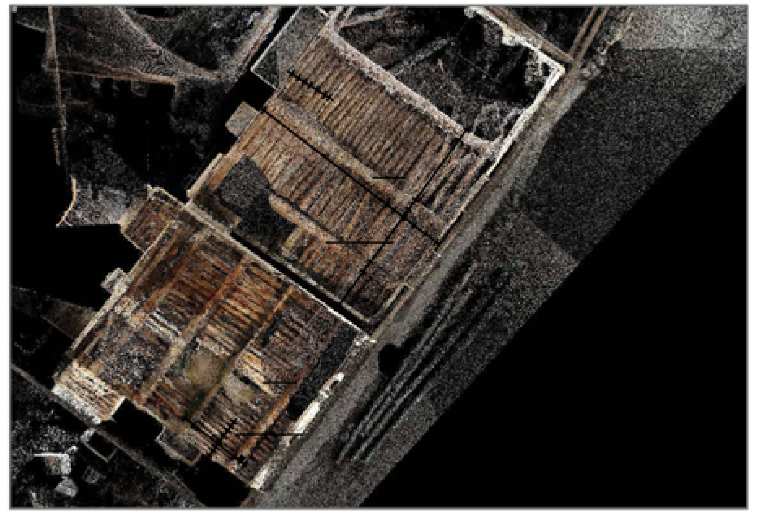
0 0.5m 1m 3m

System Section Detail



Orthophoto

West Facade



Ceiling Plan

South Facade

Photograph

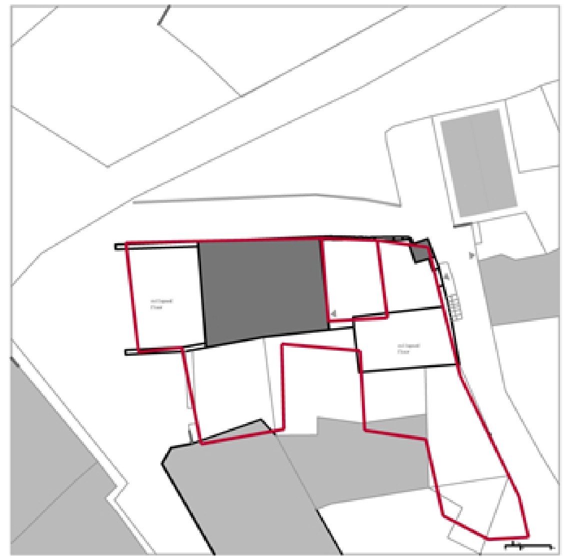
Figure A.12 Drawing of building - 645

Lot no
659

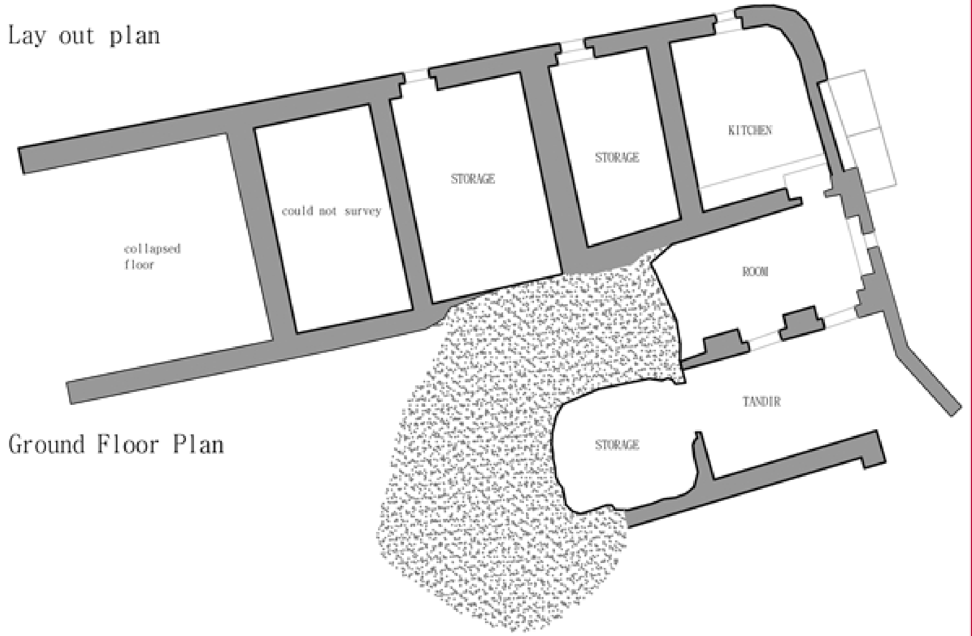
MIDDLE EAST TECHNICAL UNIVERSITY
GRADUATE PROGRAM IN RESTORATION
'CONSTRUCTION TECNIQUES OF TRADINITIONAL UCHİSAR HOUSES'
Prepared by: Pınar Başak Tongal
Supervisor: Dr.Fuat Gökçe

Measuring method: Laser scanner - Hand measurements

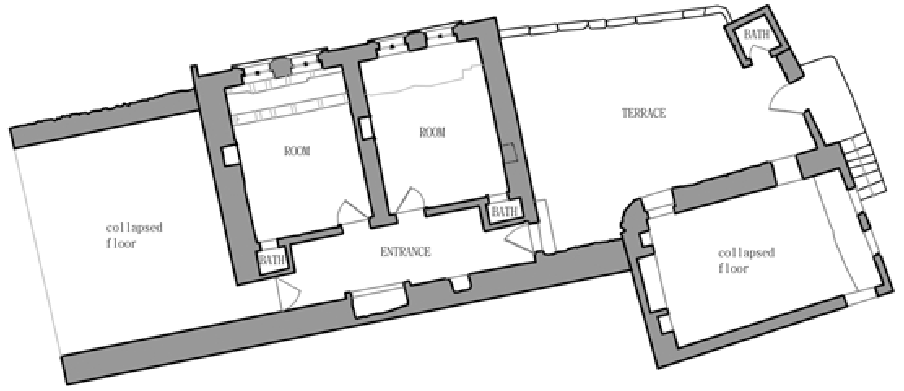
Plan



Lay out plan



Ground Floor Plan



First Floor Plan

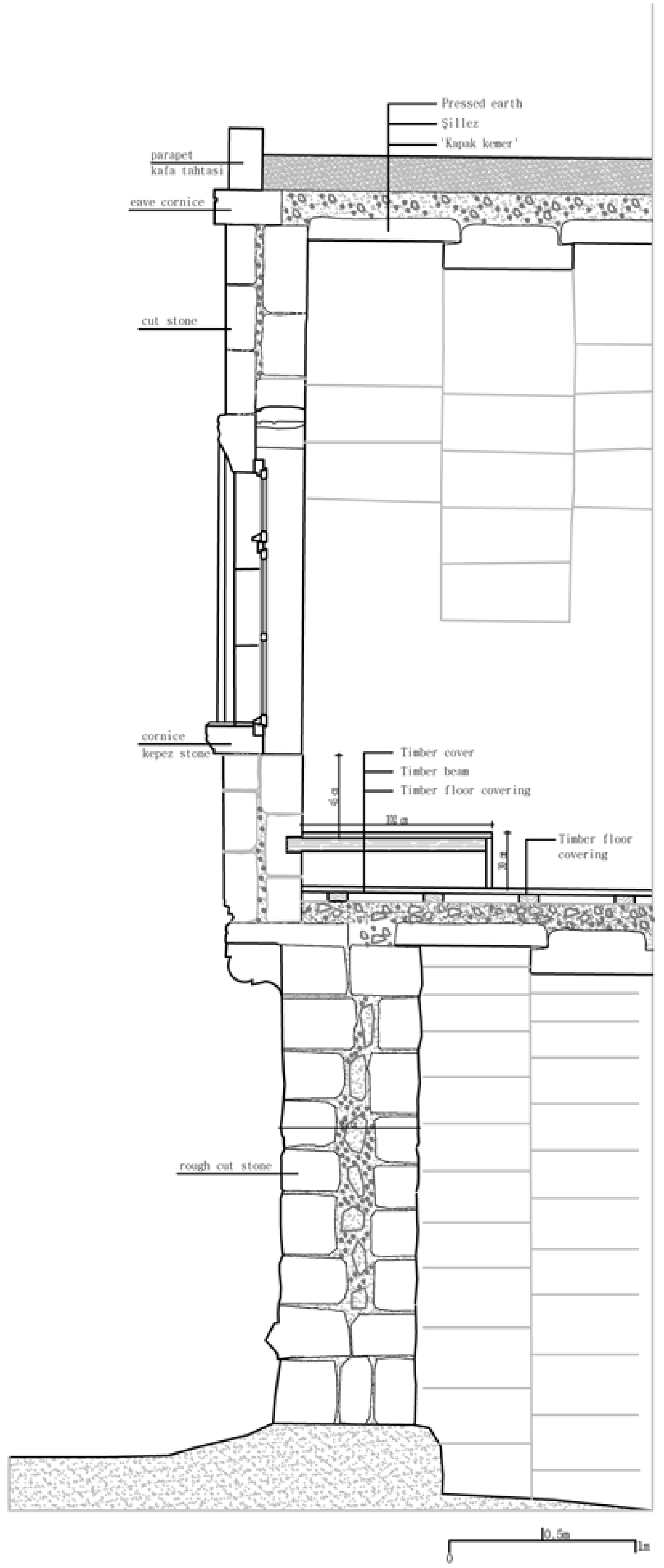
Orthophoto

Yüklük

Vaulted room

Facade

System Section Detail



Photograph

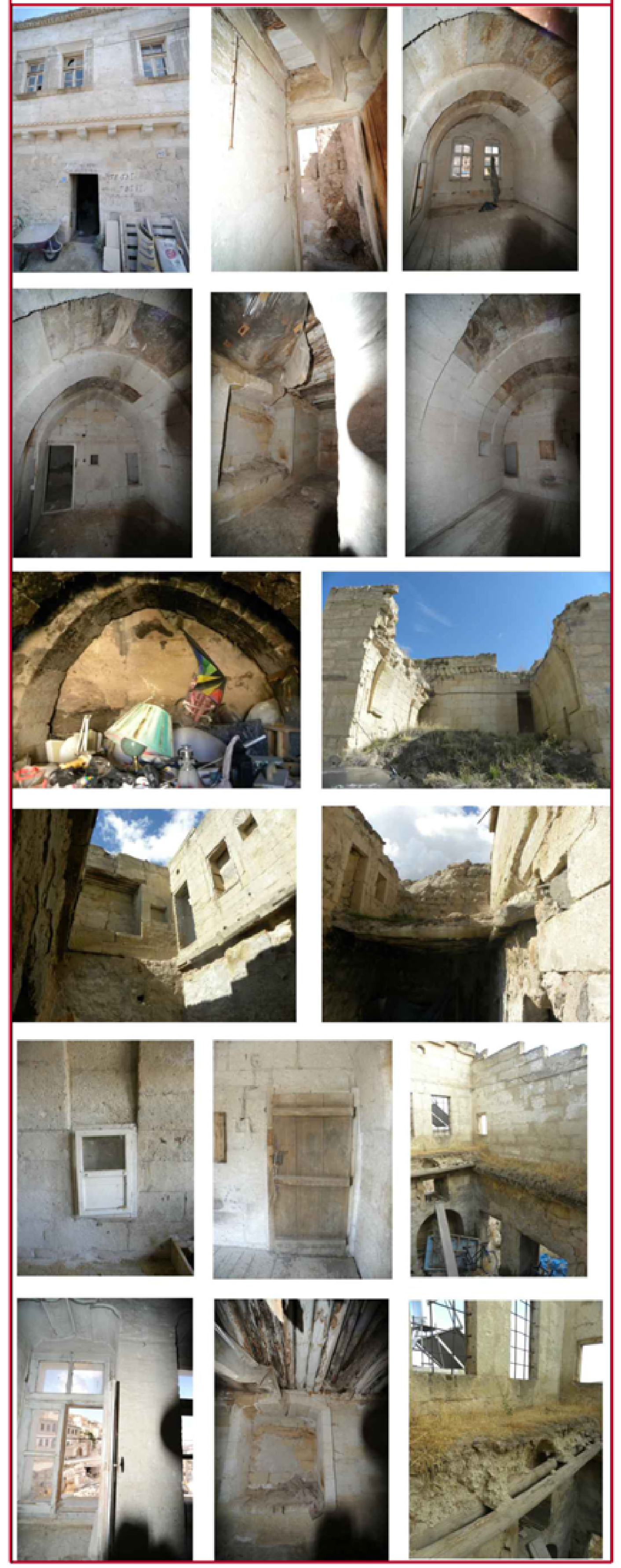


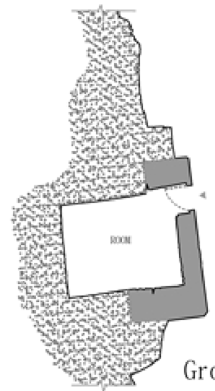
Figure A.13 Drawing of building - 659

Lot no
675/A

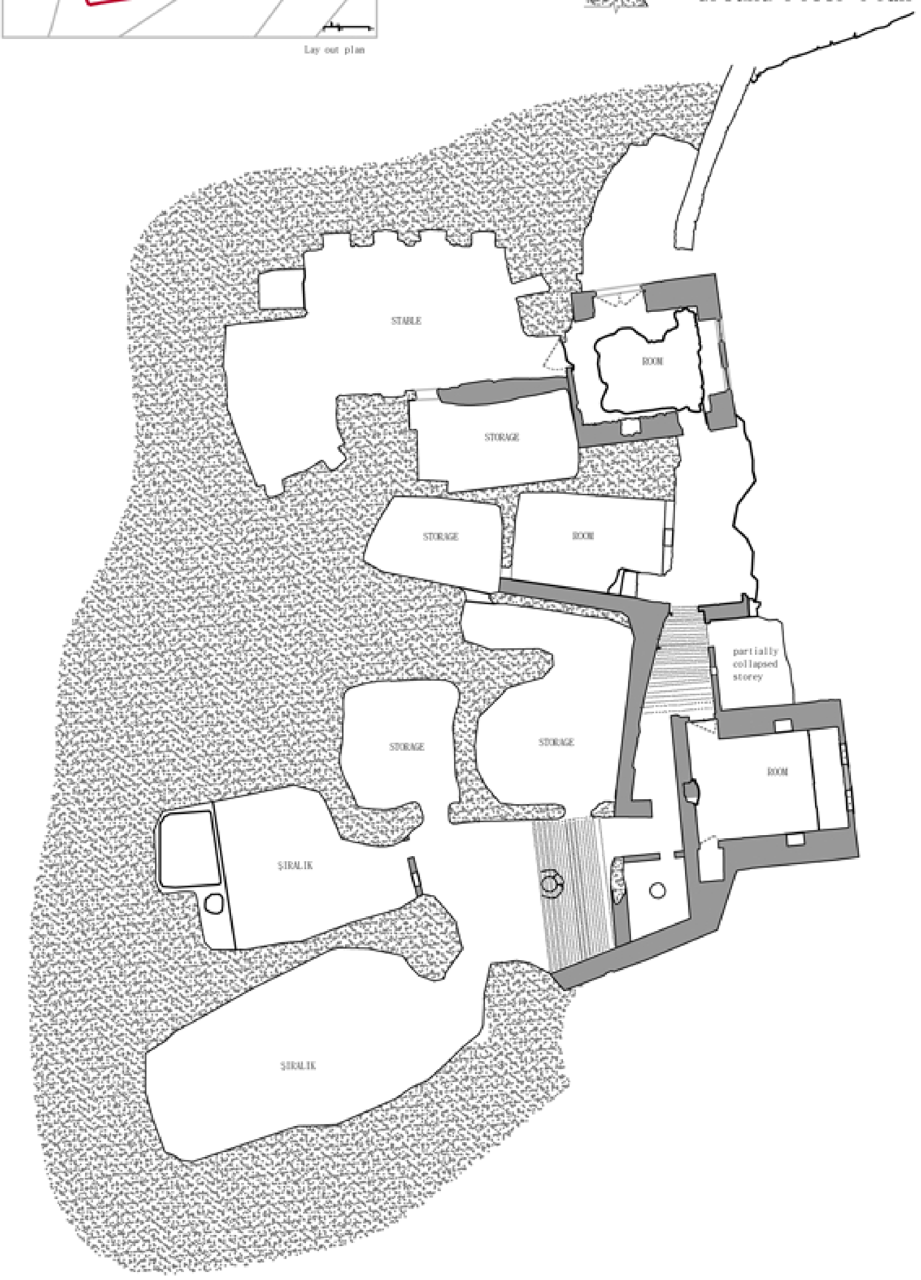
MIDDLE EAST TECHNICAL UNIVERSITY
GRADUATE PROGRAM IN RESTORATION
'CONSTRUCTION TECNIQUES OF TRADINITIONAL UCHİSAR HOUSES'
Prepared by: Pınar Başak Tongal Supervisor: Dr.Fuat Gökçe

Measuring method: Laser scanner - Hand measurements

Plan

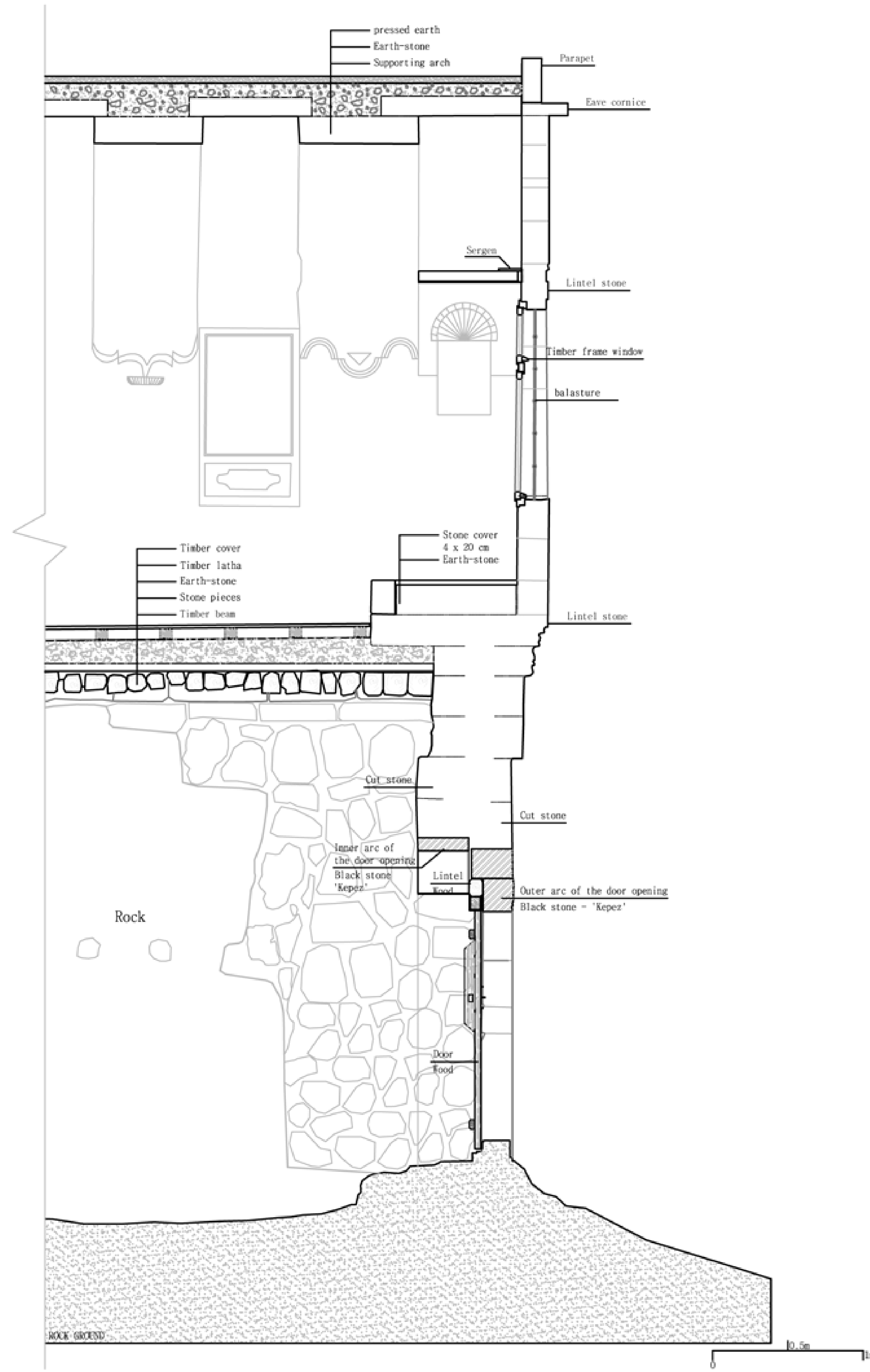


Ground Floor Plan



First Floor Plan

System Section Detail



Photograph

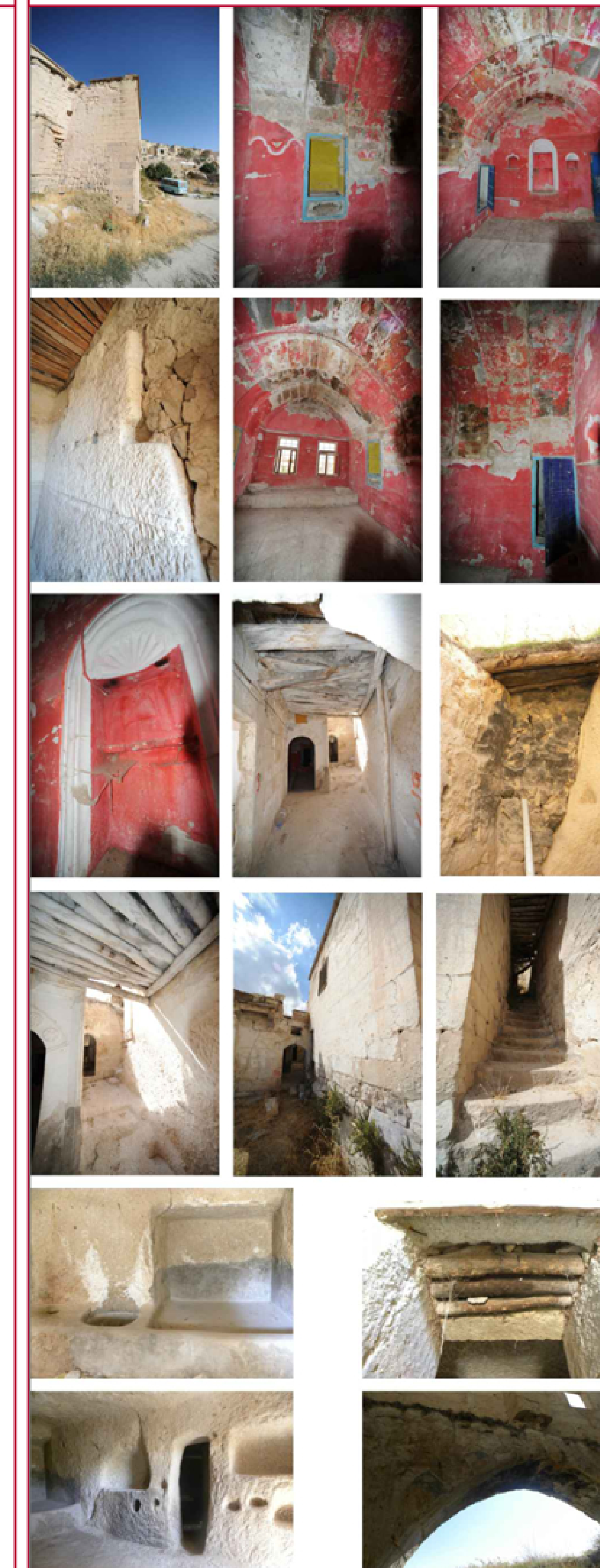


Figure A.14 Drawing of building - 676/A

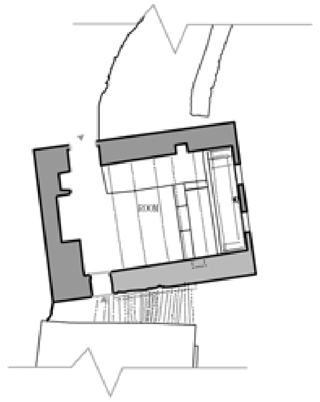
MIDDLE EAST TECHNICAL UNIVERSITY
GRADUATE PROGRAM IN RESTORATION
'CONSTRUCTION TECNIQUES OF TRADINITIONAL UCHİSAR HOUSES'
Prepared by: Pınar Başak Tongal Supervisor: Dr.Fuat Gökçe

Lot no
676/B

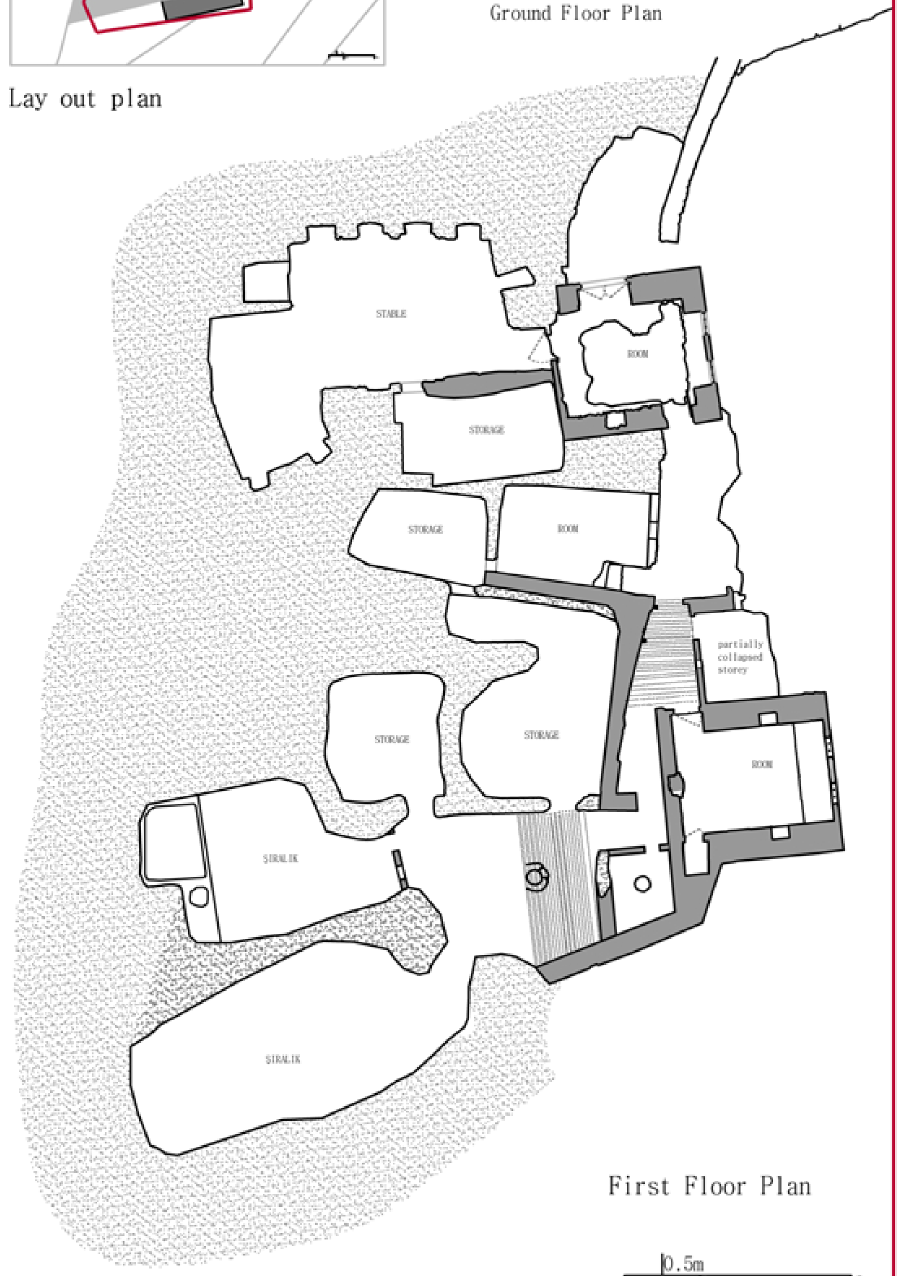
Measuring method: Laser scanner - Hand measurements

Plan

Lay out plan



Ground Floor Plan



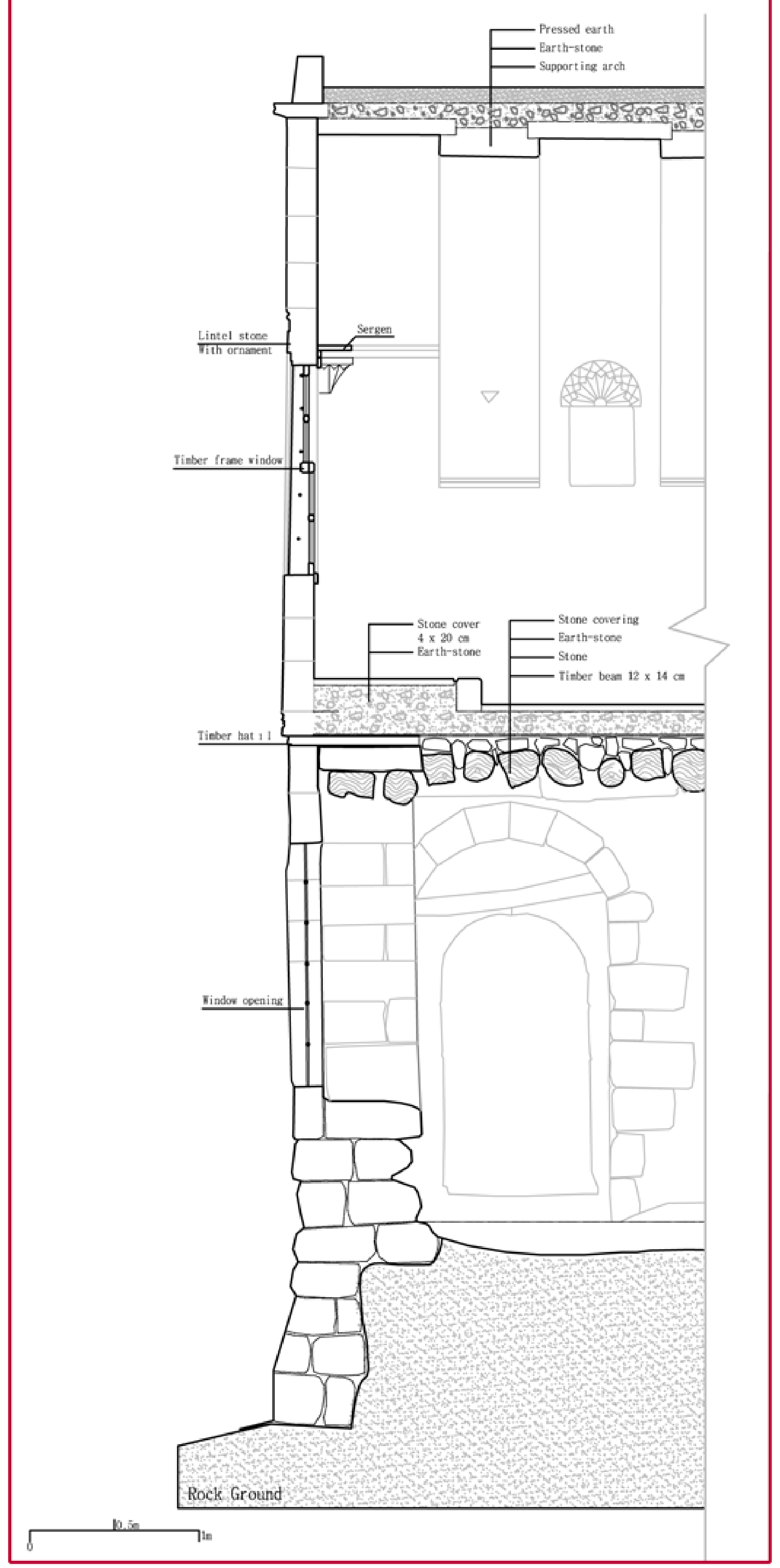
First Floor Plan

Orthophoto

Front Facade

Facade of buildign group

System Section Detail



Photograph

Figure A.15 Drawing of building - 676/B