

**Appreciation of Nature in Architecture:
Interaction between Topography & Design in the
Case of Karmi (Karaman) Village, North Cyprus**

Arezoo Khani

Submitted to the
Institute of Graduate Studies and Research
in partial fulfilment of the requirements for the degree of

Master of Science
in
Architecture

Eastern Mediterranean University
September 2015
Gazimağusa, North Cyprus

Approval of the Institute of Graduate Studies and Research

Prof. Dr. Serhan iftioęlu
Acting Director

I certify that this thesis satisfies the requirements as a thesis for the degree of Master of Science in Architecture.

Prof. Dr. zgür Dinyrek
Chair, Department of Architecture

We certify that we have read this thesis and that in our opinion it is fully adequate in scope and quality as a thesis for the degree of Master of Science in Architecture.

Prof. Dr. Hıfsiye Pulhan
Supervisor

Examining Committee

1. Prof. Dr. Hıfsiye Pulhan

2. Assoc. Prof. Dr. Rafooneh M. Sani

3. Assoc. Prof. Dr. Ege Uluca Tumer

ABSTRACT

One of the main problems of contemporary architecture is the segregation of human life from the natural environment due to rapid change of science and technology. Studies on the essences in the interaction of man and environment could be possible through historical and vernacular settlements, where the dynamics of nature and peculiarities of human beings are exceedingly regarded during the production of the built environment. In this research, Karmi (Karaman) village, a vernacular settlement in North Cyprus, is selected as the case study to analyse and illustrate the relationship between nature and man in general, and the interaction between topography and design in particular. In this study on the building traditions, used in this village, are intended to review of organic concepts in architectural design and provide a reference for contemporary designers and introduce them some of the concerns on organic approaches, make comparison of the architecture design concepts with the information gathered from the village (by personal observations of the researcher and interviews with the occupants of the village) highlighted some practical approaches at different scales of design, ranging from settlement to interior space scales. Although this village is almost a perfect model to be utilized as a source for designers, there are some recently constructed buildings totally conflicting with the traditional fabric of the settlement and boldly indicate harsh interfere of human being to the nature.

Karmi village is considered an important source of knowledge and case illustrating how topography and building can interact and create settlements in harmony with nature. At the same time, it gives opportunities to monitor destructing implications in

nature and to understand the differences between the environment, sensitive approaches and the over ignoring this important notion in contemporary times and designs.

In North Cyprus, there is a serious problem due to the lack of sufficient concern in the use of the natural topography, especially since the "construction boom" in the early 2000s, especially in the region of Kyrenia where Karmi Village is located.

There have been problematic matters in the world in finding the solution to save nature. Therefore, this research in the case of appreciation of nature focuses on the interaction of topography and the built environment. This study aims to clarify how architecture could affect and be affected by the environment, where buildings and nature are interacted as in the case of Karmi village in North Cyprus.

Under aforementioned conditions, the authentic of urban pattern of Karmi Village, where determination has begun should be studied before it's lost and putting toward the values of this pattern has a great importance. Under the guidance of these conditions, it is aimed to discuss and state, how architecture affected the environment and influenced by the environment by considering the case of Karmi Village.

Keywords: Topography, Vernacular Architecture, Natural environment, Built environment, Karmi village, North Cyprus.

ÖZ

Çağdaş mimarinin temel sorunlarından biri, doğal çevre ve insan ilişkisinin, sözkonusu etkileşimin yeterince önemsemeyen bilim ve teknolojiye olan değişiklikler dolayısıyla kopmasıdır. İnsan-çevre etkileşimini esaslarının araştırılmasında, tarihsel ve yöresel yerleşimler – bu olanlar doğadaki dinamizmin ve insan güdülerinin yapılaşmış çevrenin oluşumunda son derece etkili olduğunu gösteren yerlerdir – çok önemli bir yere sahiptir. Bu çalışmada, doğa ile insan ilişkisi ve topoğrafya ile tasarım etkileşimi genel olarak ele alınıp, Karmi (Karaman) köyü özelinde örneklenip açıklanmaktadır. Karmi Köyü, Kıbrıs'ın yöresel mimari dokusuna sahip, Beşparmak Dağları eteklerinde bir yerleşimdir. Yapılan bu araştırma ile hedeflenen, insan-çevre ilişkileri ve topoğrafya-tasarım etkileşimleri üzerinde bir farkındalık yaratıp, Karmi Köyü özelinde deneyimlenen yapı geleneklerinin çağdaş tasarımcılara bir referans oluşturması ve organik yaklaşımlar üzerine yol göstermektir.

Köy sakinleri ile yapılan görüşmeler ve köy mimarisi üzerine yapılan gözlemler doğrultusunda, mimari tasarımda organik kavramların gözden geçirilmesi ve karşılaştırılması yapılmış; yerleşim ölçeğinden iç mekan ölçeğine kadar tasarımın farklı boyutlarında temel yaklaşımlar vurgulanmıştır. Köyde, yapılaşmış çevreye dair kullanılabilen mükemmel yakın bir model varken; yakın zamanda inşa edilen bazı binaların bu yerleşimin, geleneksel dokusunu tahrip ettiğini ve insanoğlunun doğaya nasıl aykırı bir müdahalede bulunduğunu göstermektedir.

Bu noktada, Karmi köyü, topoğrafya ve bina etkileşiminin nasıl olduğunu ve doğa ile nasıl uyumlu bir tasarımın oluşturulabileceğini gösteren önemli bir kaynak olarak kabul edilebilir. Aynı zamanda, Karmi Köyü mevcut geleneksel dokusu ve yeni yapılaşmış çevresi ile, doğal çevreyi yok edici olumsuz etkileri tespit etmeyi, çevreye duyarlı yaklaşımları önemsemeyi ve günümüz mimarisinde bu önemli anlayışı görmezden gelen durumlara karşı bilinç geliştirmeye olanak sağlar. Karmi Köyü'nün uzun yıllar boyunca sahip olduğu geleneksel doku, Kuzey Kıbrıs'ta, özellikle Karmi köyünün de bulunduğu Girne bölgesinde, 2000'li yılların başında ortaya çıkan "inşaat patlaması" ile olumsuz etkilenmiş ve doğal çevresiye çeşitli müdahalelerde bulunulmuştur. Bu sürecin sonucunda da, topoğrafya-bina etkileşiminin çarpıcı örneklerine sahip yerleşimlerden biri olan Karmide bu durumdan ciddi bir şekilde olumsuz etkilenmiştir.

Söz konusu bu şartlar altında, olumsuz etkilenmeye başlamış olan Karmi Köyü'nde özgün dokunun kaybolmadan çalışılması ve bu değerlerin ortaya konması büyük önem taşır. Tüm bunlar ışığında, bu çalışmada Karmi Köyü örneğinde mimarlığın çevreyi nasıl etkilediği ve mimarlığın çevreden nasıl etkilendiği tartışılarak açıklanmaktadır.

Anahtar Kelimeler: Topoğrafya, Geleneksel Mimarlık, Doğal çevre, Yapılaşmış Çevre, Karmi Köyü, Kıbrıs.

DEDICATED TO MY FAMILY

ACKNOWLEDGMENT

Be thankful for what you have; you will end up having more.

Dear LORD, from the bottom of my heart, I want to thank you for being with me in all the way and thank you for all I have. Thank you for giving me hopes for the writing of this thesis and everlasting love.

I am so appreciative to my dear supervisor, Prof. Dr. Hifsiye Pulhan, for endless motivation and support at all steps of my thesis study. She improved my knowledge during my research and she supported as well as participated to my ideas during the writing process of the selected topic. Without her advice this thesis would not have come into being.

My grateful thanks are also extended to Assoc. Prof. Dr. Rafooneh M. Sani and Assoc. Prof. Dr. Ege Uluca Tumer for their support and encouragement.

I would like to show my appreciation to the Dean of the Faculty of Architecture, Prof. Dr. Sebnem Onal Hoskara, and the Vice deans Assoc. Prof. Ozlem Oglac Turker and Assoc. Prof. Mukaddas Fasli for their kindness and support; and here I want to show my gratitude to my colleagues, Assistants of the deanship in the faculty of architecture, for being there for me in happy days and rough moments.

I am so grateful to my family, my father Jafar Khani, my mother Farideh Ashrafpour and my sisters, Masoumeh Khani, Mansoureh Khani, and also my brother Amir Mohammadeh Khani and the very special person Sona Khani (nephew) for their endless love and support during my academic career, as well for their tolerance and support for me during this thesis. Last but not the least; My thanks, from the bottom of my heart to Hatip Menekse (My New World) for his love and his peace. I really believe, he is the greatest thing that ever happens to me.

I would like to thank to my friends who accompanied me during my site observations of the selected case studies in the village and for their support. Thank you for encouraging, listening, and offering me advice through this entire process. Besides, thanks for your support and care that helped me to overcome setbacks through these difficult years. I greatly value your friendship and I deeply appreciate your belief in me. I am very happy since I found another family here in EMU that they have shared their life stories with me and kept their smiles for me with in spite of the difficulties they had in their own personal lives.

Thank you all

TABLE OF CONTENTS

ABSTRACT.....	iii
ÖZ	v
DEDICATED TO MY FAMILY.....	vii
ACKNOWLEDGMENT.....	viii
LIST OF TABLES	xii
LIST OF FIGURES	xv
LIST OF MAPS	xvii
LIST OF CHART.....	xviii
1 INTRODUCTION	1
1.1 Problem Statement	4
1.2 Aims & Objectives	5
1.3 Research Methodology	6
1.4 Structure of the Thesis.....	7
2 THEORTICAL FRAMEWORK OF THE STUDY	8
2.1 Interaction Between Topography and Settlement	8
2.1.1 Form of Settlements.....	9
2.1.2 Direction of Growth.....	16
2.1.3 Orientation of Plots.....	19
2.1.4 Street Pattern & Topography	23
2.2 Topographic concerns on vernacular settlements.....	33
2.3 Sloppy Topography in Architecture	36
2.3.1 Level differences in the buildings.....	36
2.3.2 Building orientation on the site.....	37

2.3.3 Openings and Accessibility	37
2.4 Summary of the Chapter	42
3 ANALYSIS OF THE RELATIONSHIPS BETWEEN TOPOGRAPHY AND ARCHITECTURE IN KARMI VILLAGE	43
3.1 Introduction of Karmi Village: Geographic location and History	43
3.2 Vernacular architecture of Karmi Village: Settlement	45
3.2.1 Form of settlement	47
3.2.2 Direction of growth in Karmi village.....	50
3.2.3 Orientation of buildings in Karmi village	51
3.2.4 Street pattern of Karmi village.....	53
3.3 Effect of the natural topography on buildings of Karmi	57
3.3.2 Building orientation on the sites	90
3.3.3 Accessibility	92
3.3.4 Openings	97
3.4 Summary of the Chapter	101
4 CONCLUSION	104
REFERENCES.....	113

LIST OF TABLES

Table 1: Characteristic topographical urban form,(Morris,2013 develop to by Author)	13
Table 2: Plans of settlement form diagrams and organic growth (Morris, 2013).....	14
Table 3: Slope shapes (LVP, Commission, 2008)	22
Table 4: Usage of different type of slope (LVP, Commission, 2008).	23
Table 5: Various terms of street based on Moudon, 1991 ,developed by Author,(2015)	25
Table 6: Classifications of streets according to Lynch, Eisner and Gallion (Eisner et al., 1993) (Lynch and Hack, 1994) (Edited by Author,2015)	27
Table 7: Slope shape and its impact on slope hydrology (US Forest Service, 1979).	27
Table 8: Interconnected street, (Department of Planning and Community Development, 2001, pp. 61-64) Edited by Author.....	32
Table 9: Step streets of Karmi Village, (Author, 2015).....	55
Table 10: K1, Analysis of building – K1 on Ivy steps, Karmi, Kyrenia, North cyprus (Author, 2015).....	60
Table 11: K2, Analysis of building – K2 on Pool road, Karmi, Kyrenia, North Cyprus (Author, 2015).	62
Table 12: K3, Analysis of building – K3 on Pool road & Mulberry road, Karmi, Kyrenia, North Cyprus (Author, 2015).....	64
Table 13: K4, Analysis of building – K4 on Oleader road, Karmi, Kyrenia, North Cyprus (Author, 2015).	66
Table 14: K5, Analysis of building – K5 on Citrus road, Karmi, Kyrenia, North Cyprus (Author, 2015).	68

Table 15: K6, Analysis of building – K6 on Poppy steps & Citrus road, Karmi, Kyrenia, North Cyprus (Author, 2015).....	70
Table 16: K7, Analysis of building – K7 on Pool road, Karmi, Kyrenia, North Cyprus (Author, 2015).....	72
Table 17: K8, Analysis of building – K8 on Hilarion road, Karmi, Kyrenia, North Cyprus (Author, 2015).....	74
Table 18: K9, Analysis of building – K9 on Pool road, Karmi, Kyrenia, North Cyprus (Author, 2015).....	76
Table 19: K10, Analysis of building – K 10 on Pool road, Karmi, Kyrenia, North Cyprus (Author, 2015).....	78
Table 20: K11, Analysis of building – K11 on Pintree road & Plum walk, Karmi, Kyrenia, North Cyprus (Author, 2015).....	80
Table 21: K12, Analysis of building – K12 on Cypress road, Karmi, Kyrenia, North Cyprus (Author, 2015).....	82
Table 22: K13, Analysis of building – K13 on Pool road, Karmi, Kyrenia, North Cyprus (Author, 2015).....	84
Table 23: K14, Analysis of building – K14 on Pool road, Karmi, Kyrenia, North Cyprus (Author, 2015).....	86
Table 24: K15, Analysis of building – K15 on Almond road, Karmi, Kyrenia, North Cyprus (Author, 2015).....	88
Table 25: Architectural analysis of level differences in Karmi village (Author, 2015)	89
Table 26: Architectural analysis of accessibility in Karmi village (Author, 2015)....	92
Table 27: Architectural analysis of building openings Karmi village (Author, 2015)	97
Table 28: Architectural analysis of topography from selected building in Karmi village (Author, 2015).....	103

Table 29: Architectural analysis of Topography in Karmi village (Author, 2015) .	107
Table 30: interaction between topography and settlement in Karmi Village (Author,2015).....	110
Table 31: Important Architectural design approach in Karmi Village.	111

LIST OF FIGURES

Figure 1: Mediterranean Assis village in Italy,	16
Figure 2: Mediterranean Gubbio village in Italy, Developed by Author base on (House & House, 2004).....	17
Figure 3: Masouleh settlement (Seyhoun 1969).	18
Figure 4: Sun path and building orientation.....	20
Figure 5: Building orientation of Abyaneh settlement(Developed by Author, 2015)	21
Figure 6: A,B and C, Orientation of streets in sloppy land, (Author, 2015).....	28
Figure 7: Roads running parallel to the land (Author, 2015).....	30
Figure 8: Roads running perpendicular to the land (Author, 2015).....	30
Figure 9: Urban fabric of Mardin (Author, 2015).....	35
Figure 10: Characteristic of street in Mardin settlement (Author, 2015).....	35
Figure 11: The location of Cyprus Island on the world map, Base on Google earth, developed by Author 2015).....	44
Figure 12: (Left) Location of Kyrenia in North Cyprus, Base on Google earth, developed by Author 2015), Figure 13: (Right) Location of Karaman in Kyrenia, Base on Google earth, developed by Author 2015)	44
Figure 14: Karmi settlement form (Author,2015).....	47
Figure 15: Height of Krami village from the sea level, (Google Earth), Developed by Author	48
Figure 16: Upper level of Karmi village from sea level, (Google Earth),	49
Figure 17: Lower level of Karmi village from sea level, (Google Earth), Developed by Author	49

Figure 18: Analysis Karmi village from sea level, Based on (Google Earth), Author, 2015)	49
Figure 19: Direction of growth in Karmi village, (Google Earth), edited by Author	50
Figure 20: Orientation of buildings in Karmi settlement (Author, 2015).....	51
Figure 21: (Left) Sloping street in Karmi Village in North Cyprus (Author, 2015),	
Figure 22: (Right)Street in Karmi Village in North Cyprus (Author, 2015)	56
Figure 23: Narrow step street in Karmi village, North Cyprus (Author, 2015).....	56
Figure 24: Entrance of the building directly to the courtyard, Karmi village, North Cyprus (Author, 2015)	93
Figure 25: Main entrance from the upper level of step street to lower level of building (Author, 2015)	94
Figure 26: Secondary entrance from the lower level of step street to the upper level of building (Author, 2015)	94
Figure 27: Two entrances from the street with steps to the different level of building (Author, 2015).....	95
Figure 28: Secondary entrance from the street with few step to the lower level of building (Author, 2015)	95
Figure 29: Entrance to the building with few steps (Author, 2015).....	96
Figure 30: Entrance the building by the means of a bridge (Author, 2015)	96

LIST OF MAPS

Map 1: Figure ground map of Karmi village, (Author, 2015)	46
Map 2: Topography map of Karmi village (Author, 2015)	52
Map 3: Street network of Karmi village (Author, 2015).	54
Map 4: Street network of Karmi village (Author, 2015).	54
Map 5: Karmi(Karaman) village, Analysis map (Author, 2015).....	105

LIST OF CHART

Chart 1: Structure of the Thesis, Source: (Author, 2015)	7
Chart 2: Variety of land form (Based on Watson, Plattus, & Shibley 2003).....	10
Chart 3: Use of the streets (Moudon, 1991), edited by (Author, 2015).	26
Chart 4: Summary of the chapter 2, Source: (Author, 2015).....	42
Chart 5: Summary of the chapter 3, Source: (Author, 2015).....	101

Chapter 1

INTRODUCTION

The existence of human being is always associated with the environment, unavoidably and directly affects and surrounds people's lives. It brings people together identifies individuals and defines their feeling and looking. In particular, natural environment is essentially needed for humans to survive, as much as fresh air and clean water. As a consequence, the natural environment has always played an important role in the development of great civilizations, living patterns and the built environments since the ancient times.

According to Carlson (2000), "the appreciation [of environments] must be fashioned a new, with neither the aid of frames, the guidance of designs, nor the direction of designers." (Carlson, 2000, p. Viii). At the end of the twentieth century a huge reversal attitude occurs in the aesthetic understandings, which are mostly shown through the listing of the aesthetics of the environment. It centres on philosophical issues concerning the judgment of the entire cosmos as that it consists not only of particular objects, but also environments themselves. In this style, environmental aesthetics goes beyond the appreciation of art in aesthetic appreciation of two natural and human environments. Theories of technology, industrial machinery and aesthetics are very substantial, and aesthetics once again come back to the nature and glorifies old view that stresses the importance of nature. Aesthetics of the 21st century, how to treat nature, are closer ancient theory and to those modern, although

conceptually they differ completely in pragmatic level and idealistic. (Jovanovic-Popovic et al., 2012).

Refer to Jovanovic-Popovic (2012) the contemporary interpretation of the aesthetics of the environment should emphasize that it does not consider the natural factors, but factors created as a result of human influences in sociological, cultural and economic. Interaction between man and nature is architecture and it usually works as a mediator between them and enhances human's relation with nature. Since, nature also embraces and contains man and his edifices; the creation of any artefacts in the nature is obliged to appreciate its power and forces.

Natural environment presents a collage of landscapes stretching from the depths of oceans to the peaks of the great mountain ranges. Without a doubt, this wide range of shapes and movements of the earth's surface, which might be called also topography, directly influences the development of settlements and also design of buildings in architecture. Topography is the earth, which rises and falls like the significant three-dimensional segments in the form of cities (Watson, Plattus, Shibley, 2003).

One of the most basic determinants of a settlement and its spatial form is the land that the settlement is built on, and the most important land features is topography. Conditions and form of land, whether it is flat or hilly, gently rolling or mountains, all affect the architecture of the settlements. Lands or sites suggest various types of architecture to fit in. Remarkably, flat lands usually accept vertical or assertive horizontal architecture. Likewise, slight hills may suggest a vertical architecture at the top, followed by cubic forms on the slopes, or may suggest ending the construction just near the hilltop (Leatherbarrow D. , 2002).

Step hillsides or valleys prepare a ground for terracing and facing towards the sun. Moreover, details and characteristics of site are usually taken into account in order to be used as part of architecture and urban embellishment, such as native rocks, colour themes of the land, form of local waterways and trees. Throughout ages, such settlements, which are principally the traditional, ones, have remained as the evolutionary results achieving established relationships between man and environment. As one of the most important features of the natural landscape, topography provides the needed medium for architecture and provocation for creativity. Just like silence that pause that anticipate movement or precedes speaking. Several writers believe that building should be rooted in the land (Leatherbarrow D. , 2002).

Konstantinid (1975) claims that: “Architecture is not an art, in a natural function; it grows from the ground, like animal and plants or trees that unfold and develop (A. Konstantinid, 1975, p 309)”. One of the ways that helps architecture to identify buildings is the use of site compositions in the natural landscape. In most of the times, lines of the roofs are associated with the lines of hills and other topographic features in the natural landscape (Leatherbarrow D. , 2002).

Topography is a crucially important issue in architecture. The rule is to extract and develop all hidden qualities in the sights and surroundings as inseparable components of a larger spatial system, naturally. In the natural landscape, all those shapes and movements of the earth's surface give the topographic features of sites and they affect different aspects of buildings and settlements consequently. Generally, access to natural sources in a settlement depends on the slope and level differences of a site.

Also, availability of sunlight or provision of view for a building depends on the topography of a site. Flat site usually does not affect much the location and layout of the building, but on sloping sites, topographic features might leave tremendous effects on the location, orientation and layouts of spaces. In this regards, many traditional settlements in the Mediterranean region come forward as the striking examples of such developments. Moreover, several traditional and also contemporary buildings are distinguished with their strong interaction with their surroundings by developing special design strategies for the appropriate use of topography. In such designs, considerations on topographic features are visible more in definition of sections rather than plan solution as in the case of an ancient Greek amphitheatre or a Modern house designed by Richard Joseph Neutra. At this point, power of ground once again appears in the design of a building and indicates the inevitable connection between building and environment (Leatherbarrow D. , 2009).

Buildings always have strong connections to the ground by means of their foundations. However, the issue is here beyond the limits of a structural necessity. Buildings are immovable entities and they are growing up from a natural landscape, which influences the architectural genetics, if these forces are considered appropriate (Leatherbarrow D. , 2002).

1.1 Problem Statement

Important issue in the case of appreciation of nature is designing with respect the environment and responding to its features. Topography is one of those features considered in the architecture and development of settlements throughout the ages. It posed sometimes as a tangible reality and sometimes as a stimulating ideal. However, in the recent times, more interest in contemporary building technologies and new design paradigms regarding the concept of placelessness have caused certain

shifts in the practice and theory of architecture. The lack of interest and response towards the environment is much visible in contemporary settlements and architecture. Even the settlements, which were used to be under the impact of the topographic features, are currently growing with the construction of buildings designed carelessly. They are neither responding to the topography nor the spirit of place and environment.

In this respect, Karmi (Karaman) Village in North Cyprus is one of those particular traditional/vernacular settlements having peculiar urban tissue and spatial layouts strictly determined by the topographic features of the natural environment. As in several other Mediterranean traditional settlements, the interaction between nature and architecture has been continuously shaped the built environment and made the Karmi Village distinctive and unique with its unchanging and authentic architecture. Although the traditional tissue and the silhouette of the village has been suffering from and damaged with the newly built buildings following the contemporary design trends and technologies, the village still provides endless opportunities to researchers to learn more about the power of nature and topography on architecture with several cases.

1.2 Aims & Objectives

The aim of this research is to examine the relationship between nature and architecture with a special emphasis onto topography. On the basis of a theoretical research and background, all hidden qualities in the natural environment/landscape of Karmi village in North Cyprus are aimed to be focused for a comprehensive understanding about the appreciation of nature in architecture. Under this scope, the research is based on vernacular Mediterranean architecture and analysis the

relationship between the building form and the natural surroundings with sloping landscapes. At the end of the study, it is aimed to have certain outcomes illustrating (i) how architecture and nature interacted and reshaped the environment accordingly and (ii) how architecture can employ topography as a design tool? (iii) Examine the role of topography as a design tools in Karmi village in North Cyprus.

1.3 Research Methodology

This study includes qualitative and quantitative research methods to read analysis and understand architectural characteristics in a natural environment with sloping landscape. Methods for data collection mainly include literature and field surveys. In the literature survey, certain keywords and conceptions, which are to be extracted mainly from the sources about Contextual Design, Regionalism, Vernacular Architecture and Phenomenology are focused and utilized for the development of the theoretical framework of the study. Findings revealed from literature survey will guide the studies in the field in Karmi Village. The selected cases will be measured, sketched, photographed and documented for further interpretations and evidences of the study. Information about the selected buildings can be obtained and treated using the accompanying techniques: Collections of photos; Plans and measurements of selected buildings. Also data can be prepared in the following three sections:

- (i) Location and Identification;
- (ii) Context: topography, landscape features, type of settlement, pedestrian and vehicular access, distance to populated centres and approach roads, surrounding space
- (iii) Common building features: shape, plan form and configuration, number of floors, internal partitions, openings, roofs and facades characteristics;

1.4 Structure of the Thesis

This thesis includes four chapters. The first chapter involves: introduction, aims and objectives, problem statement, research methodology of this thesis. Second chapter is theoretical framework of the study which gives the information about the interaction between topography and settlement, to deal with street pattern, orientation of plots, direction of growth and form of settlements, which particularly shaped by the vernacular builders in the first part of the theoretical framework and second part, focuses more on sloppy land in architecture and clarifies certain/ particular characteristics of a built form such as the level differences, orientation, openings and accessibility of a built form. Third chapter consists of analysis of the relationships between the topography and architecture in Karmi village. Last but not the least; the final chapter is concluded with the part that clarifies certain outcomes illustrating, how architecture and nature interacted and reshaped the environment accordingly and how architecture can employ topography as a design tool (Chart1).

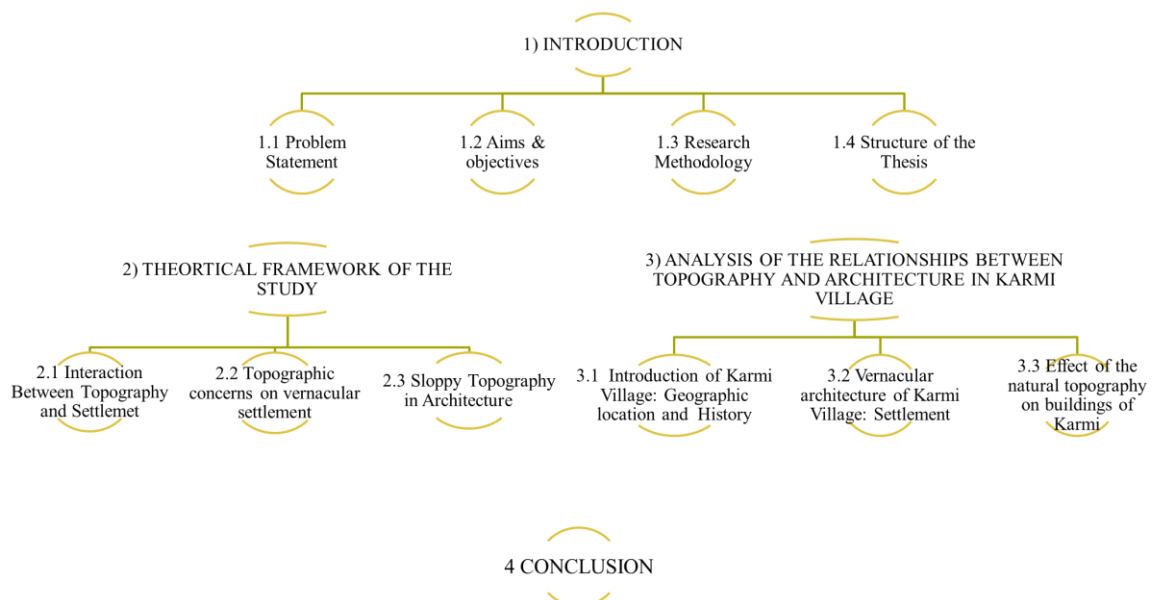


Chart 1: Structure of the Thesis, Source: (Author, 2015)

Chapter 2

THEORETICAL FRAMEWORK OF THE STUDY

2.1 Interaction Between Topography and Settlement

In history, as now, topography played a key role in the creation of the third urban dimension; its visual effects ranging from virtually no regulation in an open meadow, the dramatic skyline of San Francisco; and Athens, Rome and Edinburgh as other European examples pending. Muslim cities, the characters in Muscat, Ghardaia and Sanaa (II) owe much to their topographic parameters (Morris, 2013).

The explanation of topography in architecture is what is truly is. Vertical topography profundity is target in scientific and aesthetic perspectives. The topography is not simply indicated what is found in site, it permits to what is happening eventually prior or what may yet happen. Initial phase in architectural design can be perceiving the site, this is because of structures and buildings will be a monster association with foundation, ground is influencing the outline and tries to balance.

Assisting the topography and comprehension is as an essential component in design, can translation of what can't be seen and what can be seen. Admiration to topography it is clear that, the building is permitted to slip into the skyline and this implies steadiness from the visual viewpoints. Topography is accompanying the history of people and activity of people and it is corresponding execution (Leatherbarrow D. , 2002).

In this chapter with mainly focus on vernacular architecture, gives the information about the interaction between topography and settlement, to deal with street pattern, orientation of plots, direction of growth and form of the Settlements.

2.1.1 Form of Settlements

According to Watson (2003) topography, the rise and fall of the surface of the earth, is another significant part of the three-dimensional shape of the city. Often it is represented, especially in places where it is important, for the rendering of topographical lines inside and outside the city plan. Each city is built on a plot of land (Watson, Plattus, & Shibley, 2003).

Topography can be known as one of the important issues which affect the form of the settlements. In local areas people, mostly didn't change the shape of the land, but they tried to adapt their settlements to the existing topography of the site which formed the building patterns. Therefore, the topographical aspect of the sites mainly defined the form of the buildings and settlement patterns (Memarian 1997).

Latency is considering the natural topography evidence such as urban land and weather. The capacity challenges as an opportunity to invisible physical things in the area. Capacity must be discovered and they are not showing themselves as the opposite side of the material or within the area that shaped (Leatherbarrow D. , 2009, p. 64).

The shape of the earth and its features are the most important determinants of the shape of a city. Speaking of relief, we speak mainly of the topography. Looking at the landscape, we seek his character. As urban designers, there is the shape of the hilly terrain, flat, hilly, mountainous (Chart 2) -in relation to architecture and cities

that are put into it. Flat ground may suggest vertical or horizontal architecture affirmed. A slightly hilly site may require vertical architecture summits with cubes flow on the slopes, or can suggest a cessation of architecture just below the ridges. A hillside or valley may be open to terraces, with an orientation to the sun. In all cases, we must assess the qualities of the land, including the design relationships they express (Watson, Plattus, & Shibley, 2003) .

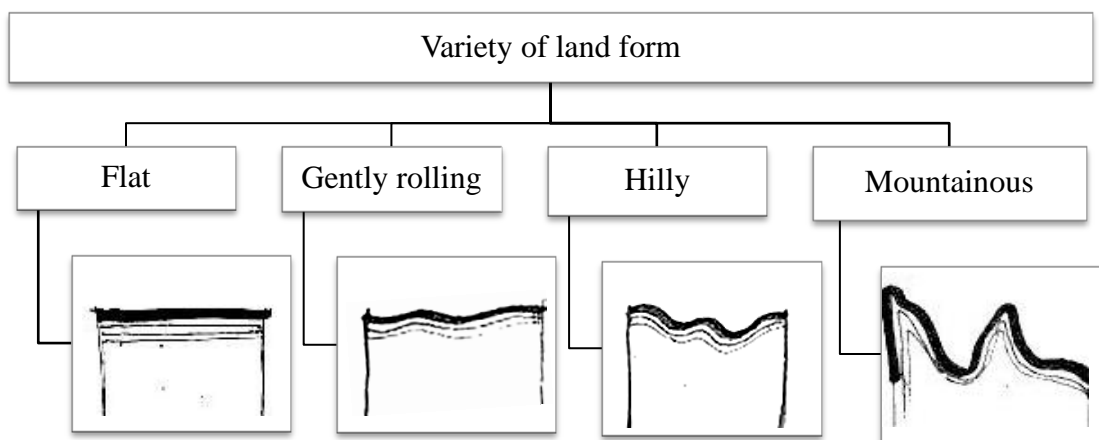


Chart 2: Variety of land form (Based on Watson, Plattus, & Shibley 2003).

The important features of a landscape should be noted carefully cliffs, peaks, range of hills on the horizon, plateaus, rivers or lakes. These are accentuating landscape features that can be used as active or passive as panoramas, supplementing the architectural and urban design sites (Figure 1). They can be used as the main objectives of vista points within the city or special sites for buildings. Some are best left in their natural state (Watson, Plattus, & Shibley, 2003).

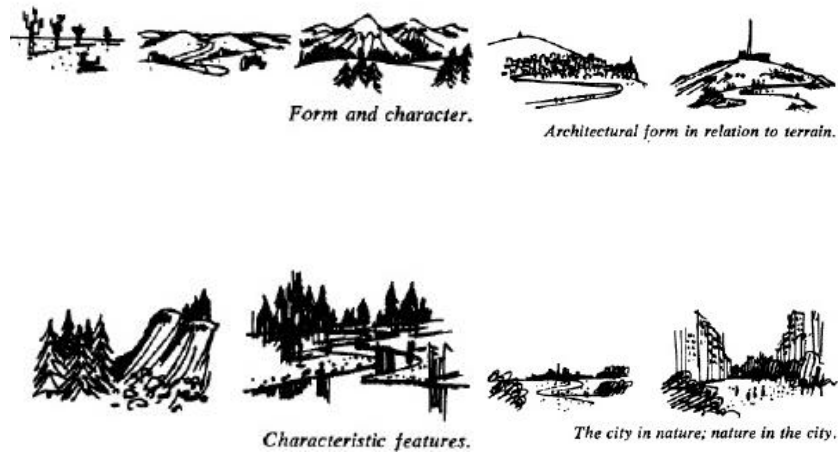


Figure 1: Characteristics of topography on the settlement form (Watson, Plattus, & Shibley, 2003).

One view, expressed by Morris (2013) London and Rome, among many other ancient cities established, is characterized by historic buildings with floors well below the levels of the adjacent street.

The hilly topography of Rome itself, as described by Lanciani was totally changed before the end of the ancient period; Palatine, for example, was covered "with a layer of waste thick'i 6-67 feet" where the occupation was continuing, the streets have increased because the new surfaces have been on the old levels, often requiring incorporation steps. Where cities were deserted for long periods, dust accumulates naturally. As one of several introductory explanations, the term "organic growth" is also used to describe the kind of urban form that evolved without preconceived planned response; likewise, in direct contrast, the planned urban form, which is the result of predetermined intention (Morris, 2013).

The question of the topography is centrally effective not only in the primary meaning hills and valleys to determine the configuration of the colonies, as in the supplementary and meaningful sense for rural preexisting inevitably affects city

shaped development (Watson, Plattus, & Shibley, 2003). In the history of forms settlements in both rural / urban status village / town were determined by factors. These determinants are of two different origins. First, there are three arising from geographical attributes "natural world" of the location of a settlement; especially, its climate, topography and building materials available. Each played a decisive role in the shaping of all historical urban forms, both organic and planned growth. Second, there are many determinants that have their origin in the human intervention in the natural resolution process, which is a determining factor 'artificial'. As will be seen, part of the latter group applies to both organic growth and planned cities (especially enrichment); Whereas there are others (notably the grid system subdivision of land) whose relevance is limited to only cities planned. The characteristic shape of an urban settlement in a given period is the result of a number of locally effective determinants (Table 1,2). In the simple, distant past that some of reigning; compared to the conditions prevailing in the late twentieth - century urban / metropolitan areas, where many determinants can be identified, many (if not most) that are seemingly in conflict with other (Morris, 2013).

Table 1: Characteristic topographical urban form,(Morris,2013 developpt by Author)

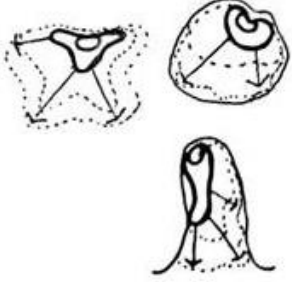

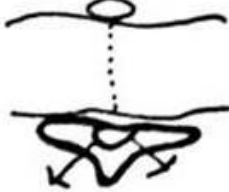
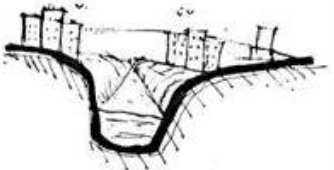
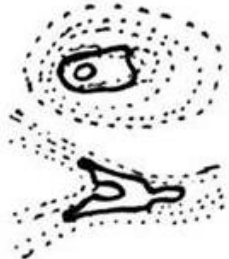

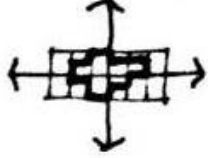
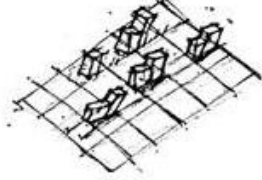
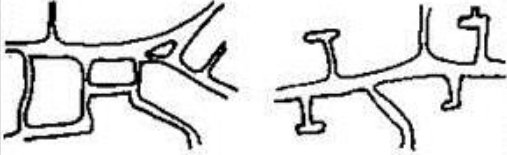
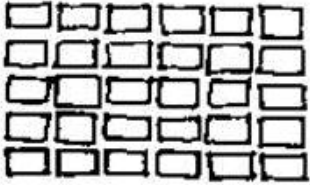
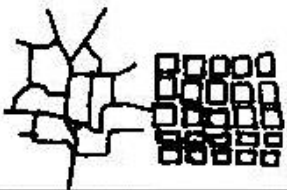
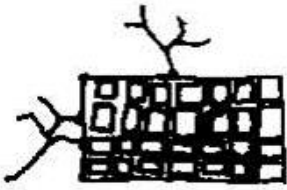

A	<p>seafront, island and peninsular origins – respectively Brighton, Manhattan Island, Miletus.</p>		
B	<p>Riverbank origin, initially with ferry or ford limitation on cross-river settlement and awaiting later (modern) construction technology for significant bridgehead development. Both locations usually resulted in growth directions away from the nucleus - London, Kiev.</p>		
C	<p>Hill and ridge-top origins - Edinburgh - and the valley base converse – Makka.</p>		
D	<p>Flat, open 'prairie' location, with no major topographical growth constraints - Oklahoma City.</p>		

Table 2: Plans of settlement form diagrams and organic growth (Morris, 2013)

A	Two characteristic kinds of Organic Growth: Western European, providing for street frontage plot development, and Mesopotamian/Islamic with housing access culs-de-sac.	
B	The gridiron as the usual basis of Planned Urban Form.	
C	An organic growth nucleus with planned gridiron extension, loosely based on Edinburgh.	
D	A planned gridiron nucleus with organic growth extension, loosely based on Timgad.	
E	E, the special three-dimensional Western European circumstances whereby an early medieval organic growth pattern was superimposed on the abandoned gridiron of a temporarily deserted Roman city based on Cirencester, England.	

Organic settlements on hillsides layouts are then meshed earlier in the flat areas are more recent, be influenced by the planning regulations and the introduction of traffic. Some researchers report some architectural features to ethnic and / or religious identity (Asatekin, 2007).

The main characteristic of each environment which makes it distinctive is based on different ways of its extension. The way that a landscape is extended is totally based

on the form of the land which can be called as topography. “Topography simply means “place-description”, but it is generally used to denote the physical configuration of a place. In our context “topography” primarily means what geographers call the surface relief. On a flat plain, extension is general and infinite, but usually variations in the surface relief creates directions and defined spaces.” (Schulz N. , 1980, p. 32).

In Norway the ground consists of hillocks which is never open and free, but tiny valleys are passing through. It seems to be designed for dwarfs as a micro-landscape. In Northern France the low undulating mounds create a kind of super-human scale while in Denmark a “human hill landscape” is formed which is horizontally extended but emphasizes on vertical dimensions of the relief. These variations appeared through texture, color and vegetation on the ground. “The words texture and color refer to the material substance of the ground, that is, whether it consists of sand, earth, stone, grass or water, whereas vegetation denotes elements which are added to end transform the surface relief” (Schulz N. , 1980). In Siena the town formed to integrate three directions of North (Florence), South (Rome), West (Grosseto, coast). In this village where the scale increased and the hills are converted to the mountains a series of terraces have been formed on the slope of the mountainous area. These terraces were the natural response to the form of the ground and topography. In other words, mountains are places inside of the thorough scene, places which make the structure of Being show. Mountains and hills are spatial supplements to valleys and bowls, and capacity as essential space- characterizing "things" in nature. The general certain properties of mountains and hills mean by words, for example, "crest", "peak", "ridge" and "slope" (Schulz N. , 1980).

2.1.2 Direction of Growth

Topography is the main characteristics of the location of the main parts of the settlement, dividing a quarter of the next. Another model of urban structure that is difficult to classify is based on the notion that the landscape should be the primary consideration. It can be argued that, at some level, the review of the form of the landscape should influence the whole development (Moughtin, C. Shirley, P., 2005).

At the point when the scale increments and the slopes get to be mountains, the settlements are typically situated on the sloppy mountainside, shaping a progression of patios(Figure1,2). Great illustrations are outfitted by Gubbio and Assisi (Schulz N. , 1980).

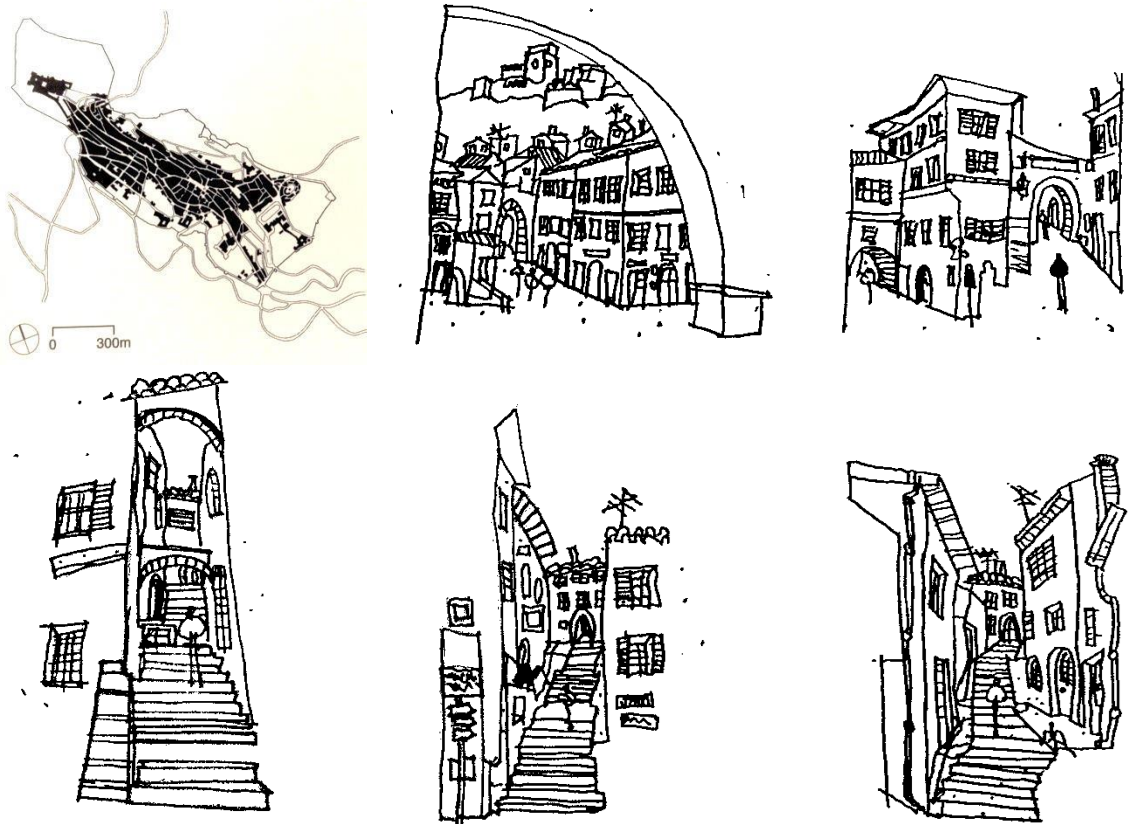


Figure 1: Mediterranean Assisi village in Italy, Redraw by Author base on (House & House, 2004).

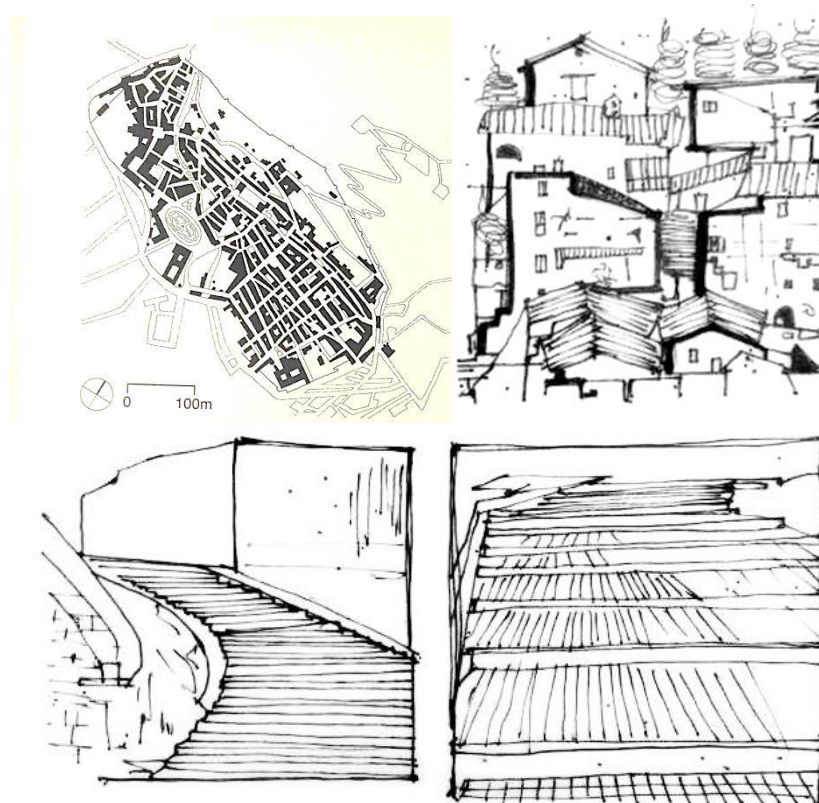


Figure 2: Mediterranean Gubbio village in Italy, Developed by Author base on (House & House, 2004).

Masouleh (Figure 3) is another mountainous city which is located in Iran. This village is located towards the south direction and goes along with the slope of the land on East-West axis. This village also has been totally formed according to the counter line of the land which creates a kind of stair-shape settlement. This type of formation has been resulted in a kind of settlement in which roof of the lower buildings has become a courtyard or a pathway for the upper accommodation units (Ghobadian, 2006).

In Masouleh village, like other villages in the mountainous area, settlement is not located in the lower foothills because during the nighttime the cold weather which is heavy goes to the lower level of hills and also in this part of the hills there is a risk of

flooding. On the other hand the Northern side of the mountain has been always in the shadows and is too cold so its discomfort for residents.

Similarly, the top part of the mountain, due to severe wind, it's not suitable for location of the settlement. In the mountain area the best part for location of settlements and to have a more relation with the natural environment is in the middle of the mountain, on the South part. The Masouleh village shows the effect of environmental conditions on the formation of its built environment because buildings harmonized with the natural slope (Memarian, G.H., 1997).



Figure 3: Masouleh settlement (Seyhoun 1969).

Therefore, it can be seen that topography as one of the essential natural elements has affected the form of the settlements. In other words, instead of ruining the nature for achieving an artificial man-made settlement, it has been tried to adapt the buildings and organize them according to the capability of the natural environment.

2.1.3 Orientation of Plots

Topography can command the location of roads and therefore the location of subcentres and centers. In many areas, flat land is at a premium and should be canceled for agricultural uses.

Slopes should not be a constraint site insurmountable if innovative design solutions and sound construction techniques are applied. Protection of soil and native vegetation are key concerns in areas of steep slope. Reduce the size of the footprint of development, to eliminate the use of automobiles and their requirements for parking, elevation gateways, and the use of insoles points of structures are appropriate design solutions (Watson, Plattus, & Shibley, 2003).

Topography in flat land dosen't have that much affected in layout and location of buildings but in sloppy land the topography has a direct effect on the view or sun. In hot-dray atmosphere, a north slope would be best as it would get minimum direct radiation. It is genuinely just if the slope is enough steep for shading the building, The topography or the form of land of a site and surroundings could either be sloping, undulating or flat. If the land is flat, similar conditions would prevail over the entire site. However, in case of undulating ground in hot-dry climates, the construction of a building in a depression involves a relatively lower air temperature. It is due to the fact that cold air is heavier than warm air tends to settlement in the depressions while warm air rises. Similarly, while building on the slopes, the leeward side is preferable Nevertheless; warm winds would be minimized on either slope (Ahuja & Rao, 2005).

The majority of villages which are located on sloppy topography have narrow valley with more than a fifty percent slope. Besides, in this kind of village, buildings are located on the best directions to reach maximum sunshine. Bottom of the valley is not suitable location of buildings, because they may be exposed to flood of rivers and night winds that blow from the high to the bottom of the valley. The structure situated at the top of the mountain makes access to waterway, water troublesome; also it wouldn't be free from cool winds, particularly in winter. So the best position has been indicated in the blow sketches (Figure 4).

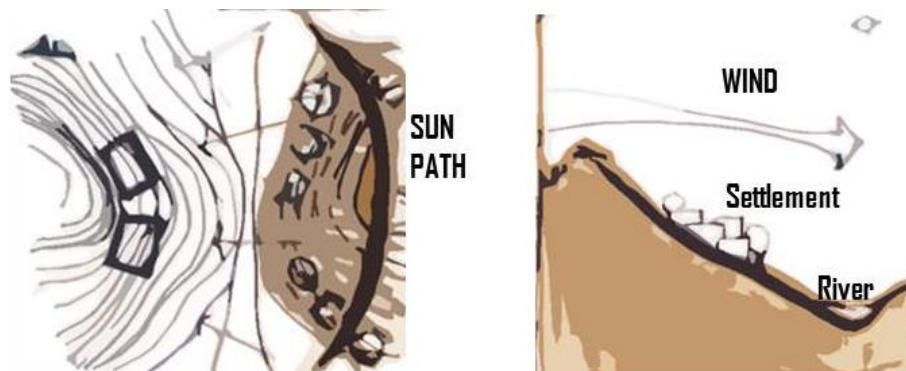


Figure 4: Sun path and building orientation
Resource: (Watson, lab, 2002), Developed by (Author, 2015).

Village texture completely follows the common slope and the roads have emerged on the basis of management and as parallel layers and get to know public networks in texture. Alleys situated on a hillside and generally one primary pathway with most extreme width as the most critical axis unite two sides of the village together. Different alleys ways make optional courses parallel to fundamental way, and all follow the prevalent slope (Rahmatabady & Amjadian, 2012).

Abyaneh (Figure 5) is one of the villages in Iran located in a mountainous area which affects from the slope of the settlement. This village has been mostly oriented

towards the East - West while it couldn't be expanded towards North or south because of the agricultural lands and steep slope of the area (Zargar, 2003). The houses are mostly located on north domain of this land which has a rock foundation. The whole settlement has been formed parallel with the ridge of the mountain base which carries the village (Shaterian, 2008). Buildings are stand out from the skirt of the mountains and seats on the steep topography. Hence, the connection with the earth and buildings is very important in these regions.

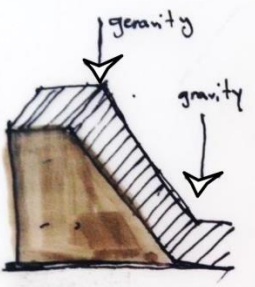
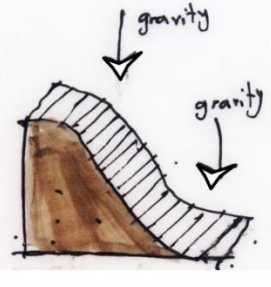
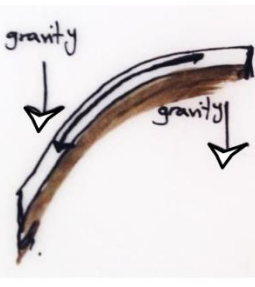
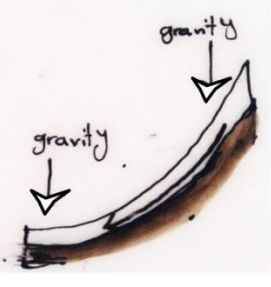


Figure 5: Building orientation of Abyaneh settlement(Developed by Author, 2015)

The form of a slope is a respectable symbol of how stable it is. Straight and S-formed slopes tend to be more stable than convex or concave slopes (Table 3). A concave slope is rounded inward like the inside of a bowl, which goes for less steep steeper. A convex slope is curved or rounded as the outside of a circle, namely from less stiff steeper. The slope, the greater its online hardware (sediment and / or rock) are gravely more will erode the slope or course. Concave and convex slopes are more


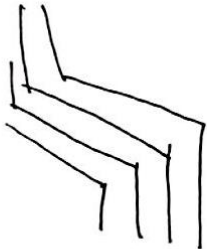
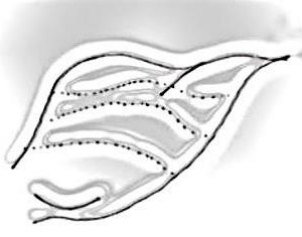
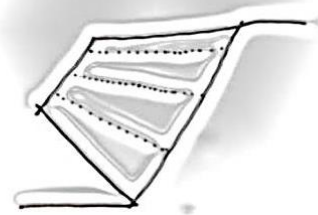


prone to instability because the slope is more in line with the force of gravity (Lehigh Valley Planning Commission, 2008).

Table 3: Slope shapes (LVP, Commission, 2008)

Slope shapes	
Straight (More artificial)	S-shaped (Natural)
	
Convexity (Natural inclined)	Concavity (Natural concave)
	

The wish to handle the steep slopes is usually determined by the building proportion. In some cases, the natural slope of the hillside is steeper than what the ranking on the cut or fill slope should be, making it difficult to cut the slopes to the proper evaluation. Cut and fill slopes that are categorized too steeply, or situated in unstable soils, usually over a period of time will be collapsed. These slopes can suffer from slow, Long-term erosion along their surface or slide down the hillside. Table 3 shows examples of preferred and not preferred grading techniques (Lehigh Valley Planning Commission, 2008).

Table 4: Usage of different type of slope (LVP, Commission, 2008).

Usage of different type of slope	Rounded transition Varied slope	Abrupt transition Uniform slope
Plan	 <ul style="list-style-type: none"> ▪ preferred 	 <ul style="list-style-type: none"> ▪ Not preferred
Elevation	 <ul style="list-style-type: none"> ▪ preferred 	 <ul style="list-style-type: none"> ▪ Not preferred
Section	 <ul style="list-style-type: none"> ▪ Preferred ▪ Respect natural topography 	 <ul style="list-style-type: none"> ▪ Not preferred ▪ Grade larg flat terrace


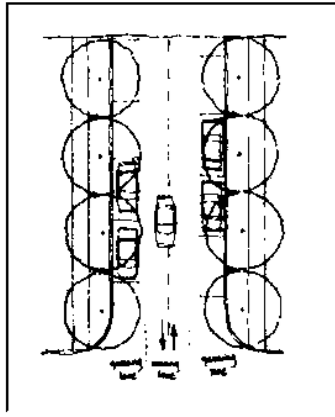

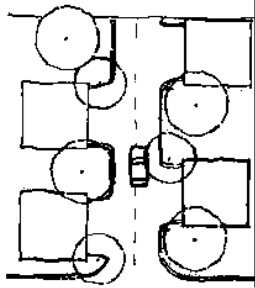

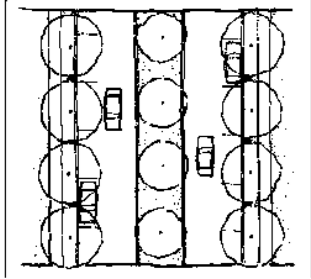

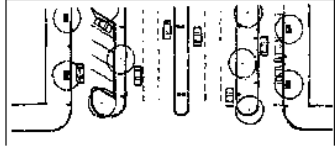
2.1.4 Street Pattern & Topography

In Oxford Dictionary the term street is determined as “a road in a town or village [comparatively wide, as opposed to a lane or alley] running between two lines of houses; usually including the sidewalks as well as carriageway. Also the road together with adjacent houses” (Ellis, 1991; pp: 115). According to Kostof’s words, “street” can be defined as a roadway with a pedestrian and buildings on the sides (Kostof, 1992; pp: 189).

The common point among all these descriptions is that street has been generally introduced as a road which passes through the buildings surrounded. Another important issue in street definition is about its pavement because the word street has driven from the Latin word “sternere” which means “to pave” (Kostof, 1992; pp: 190. Moreover, Rkywert asserted that street is a terminology totally related to all the Latin-derived words which has roots with “str” which have a kind of relevancy with construction and building issues.

We can use various terms such as boulevard, road, avenue, walk, street, etc, which have alike meanings and were used almost interchangeably. But, there is a major distinction between the road and the street. Road suggests movement to a destination and the transport of people and goods on foot, pack-animal or vehicle. Alley, for example, remains a narrow passage; Avenue is a main street with one or more rows of trees; and the term suggests boulevard just again a tree-lined street (Table 5).

Table 5: Various terms of street based on Moudon, 1991 ,developed by Author,2015)

Name	Definition	Graphic explanation	
Road	Movement to a destination and the transportation of people and goods on foot, by pack-animal or vehicle		
Alley	A narrow passage		
Avenue	A wide street with one or more lines of trees		
Boulevard	A tree-lined street		

Although, nowadays, the role of transportation in the street is the largest among the others. Street as a foundation is a similar basic subject of its architectural identity issue. The target of the street can be considered in three broad categories: traffic channels for traffic, the exchange of goods, and exchange and social communication

(Chart 3). All three are inseparably linked to the shape of the street in human life (Moudon, 1991).

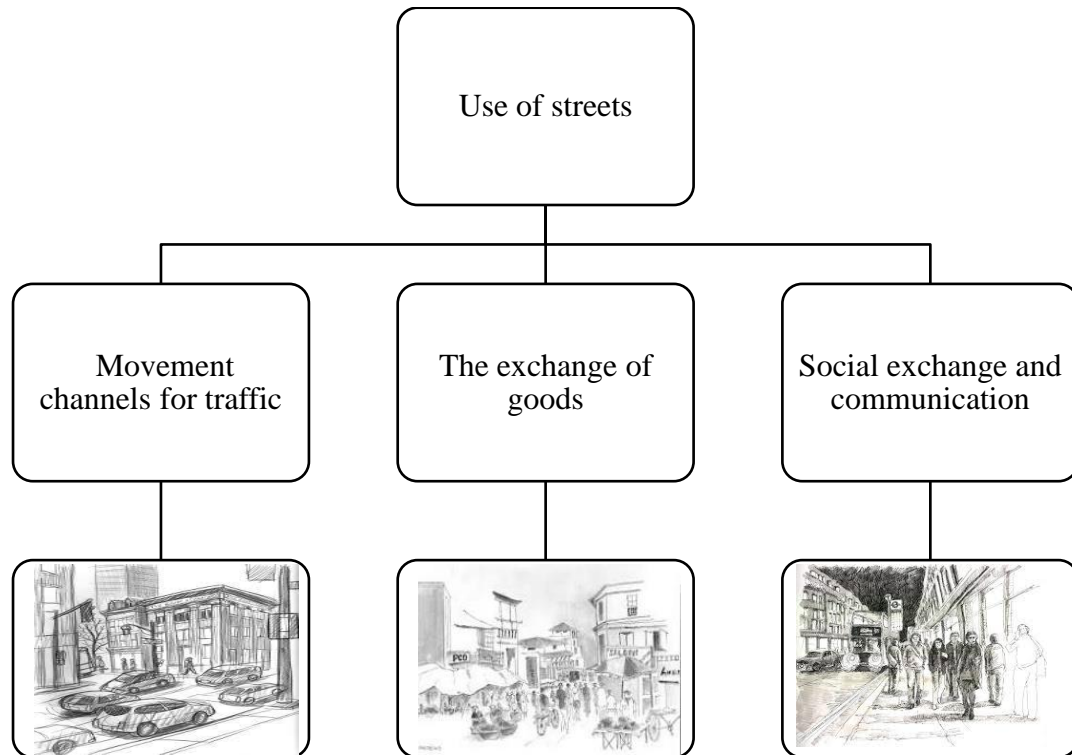


Chart 3: Use of the streets (Moudon, 1991), edited by (Author, 2015).

The use of the street as a channel for traffic causes declines in their social role in human life. In transport planning, road types differ mainly in two parts distributors and access roads. Distributors are continuous over long distances, enabling high speeds and generally to vehicular traffic. The access roads are short, have low speeds and for cars, people and cycles in the same channel.

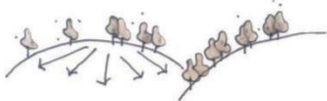


According to Lynch's and Eisner and Gallion's classifications the street can be hierarchically evaluated into four levels, which is shown in the table below with their definitions (Eisner et al., 1993) (Lynch and Hack, 1994).

Table 6: Classifications of streets according to Lynch, Eisner and Gallion (Eisner et al., 1993) (Lynch and Hack, 1994) (Edited by Author,2015)

	Types	Definition
1	Minor streets (loops or cul-de-sacs)	“Take place at the bottom of hierarchy and fronted by low-intensity uses. Minor streets are open at only one end, with provision for a turnaround at the other”.
2	Collector Streets:	“Minor streets connect to the collectors on which occur local centers, small-scale activities and uses of moderate density”.
3	Major Arterials:	“They ensure unity throughout contiguous urban area and usually from boundaries for neighborhoods. Major arterials carry the large volumes of traffic and built with long intervals. Intensive fronting uses and access controlled but not excluded”.
4	Freeway:	“Major arterials connected the freeway which designed only for motor traffic and crossed only by totally grade-separated intersections at wide intervals. Freeway does not allow fronting access”.

Pedestrian street can be added into this category of road. On the other hand other types of roads, pedestrian streets without traffic has the greatest potential to support social interaction and human activities. These categories of the street can also be labeled to their main function as blood residential, commercial collector etc. To be a road hierarchy attention has great importance in the design and analysis street. Hydrology and geomorphology factors of hillslope are important concerns in the design, location and construction of a road. Impacts slope of the morphology of the road drainage and stability ultimately road. Important factors are the form of slope which is flat, convex, concave (Table 7).

Table 7: Slope shape and its impact on slope hydrology (US Forest Service, 1979).

Convex slope	Straight (Parallel) slope	Concave slope
		

Streets are organized in a way which is shaped by the topography and natural features that bring up mystical views and eventually increase the unique character of the built environment. This integration of street with topography and natural features help people to find their location in the area by creating the sense of place.

Street network organization should integrate with the topographic feature on the area. Where land provide a slopes 6 % or more, the arrangement of the main streets should be at the right angle with the contours. (If the slope is less than 6 %, the street arrangement is not controlled by topography.) If the arrangement of street layout brings up street levels to become higher or lower than lot, street layout should be reconsidered. If the slope of the lot is from on sideway to another, precautious design should be taken into consideration by designing split-level house on the sloppy area in order not to use retaining walls on the side boundaries of the lot and help other structural and drainage problems. If the slope of the lot is from on back to front, precautious design should be taken into consideration by designing split-level house on the sloppy area in order to create proper integration to street and not to use retaining walls on the back boundary of the lot and help other structural and drainage problems. Orientation of streets should be straight or have slight curves to obtain edges on junction points with good vistas of street trees and buildings facades (Morrish, 2008).



Figure 6: A,B and C, Orientation of streets in sloppy land, (Author, 2015).

As it is shown in figure 6 sketches (A), this road has a straight arrangement that centers consideration on the slopes behind. The perspective is additionally ended with the house toward the end of the road which is likewise situated midway in the city hub. Together they make an emotional perspective and solid feeling of spot for the road (Figure 6). Sketches B shows the road keeps running down the shapes to give a perspective straight to the water. This methodology additionally empowers houses that keep running over the forms and evades high side and low side parts (Figure 6).As it is shown in figure 5 sketches (C), the accommodation in this street have absorbed the slope by designing houses to have the garage on the lower side of the block with the house above the garage packaging (Ahuja & Rao, 2005).

The amount of radiation received directly into the street (and to some extent the lower floors) is determined by the width of the street. The orientation affects the time of day when the radiation is received. The modulation of the width and the street orientation can very effectively minimize or maximize heat gain. Street width to construct the ratio of height also affects the received light. In hot-dry climates, the first need is to minimize heat gain. This could be achieved by cutting the sun. Small street width to height ratio of the construction ensures narrow streets and thereby shading. In particular, the north-south streets should be narrow. This would enable the mutual shading of morning and evening sun. However, this aspect can be considered advantageously only in the planning and design of new buildings (Ahuja & Rao, 2005). Driveways and roads should be designed to follow the natural topography of the site, with soft horizontal and vertical curves (Lehigh Valley Planning Commission, 2008).

On sloppy land, roads should be as narrow as its functionally acceptable. And also on sloppy land , placing buildings only on the inside of the outermost streets allows the building to front the roads along the edges of Neighborhoods. Perpendicular roads to the contours can minimize the amount of leveling needed, but can cause difficult access problems and view limitation. These roads tend to have significant character as buildings step up the hill (Figure 7). In Figure 8 retaining walls may be required between adjacent buildings, social interaction over the streets and alleys is extensively easier than along streets running parallel to the land. Using these paths requires greater flexibility in the types and locations of the buildings (Department of Planning and Community Development, 2001). Narrow streets were observed to be more common in warm climates vernacular dwellings (Zhai & Previtali, 2010).



Figure 7: Roads running parallel to the land (Author, 2015)

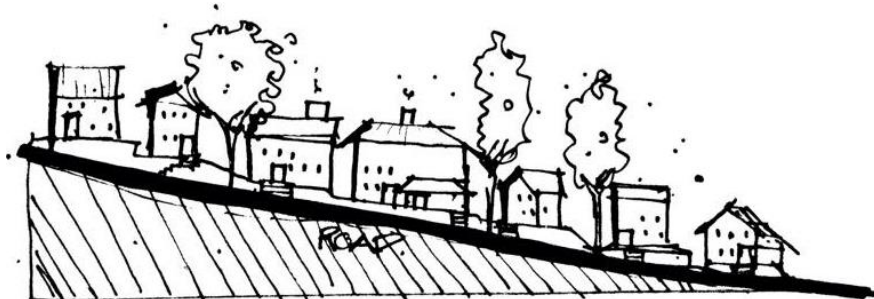
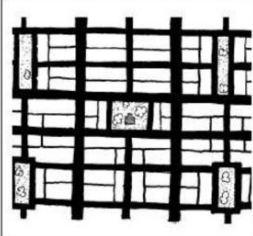



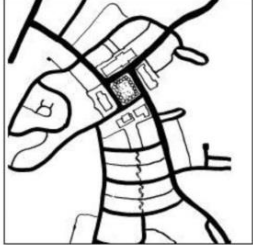

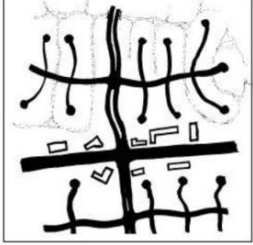


Figure 8: Roads running perpendicular to the land (Author, 2015)

Table 8 shows the interconnected street, with their definition and characteristic. “The form of the street can be analyzed in terms of a number of polar qualities such as straight or curved, long or short, wide and narrow, enclosed or open, formal and informal” (Moughtin, 1992; pp:133).

Table 8: Interconnected street, (Department of Planning and Community Development, 2001, pp. 61-64) Edited by Author.

INTERCONNECTED STREETS	Definition	Characteristics:	Figure
The Rectilinear Grid Pattern	“The rectilinear grid pattern is a street system providing maximum road connections and some road hierarchy. It represents the classic grid street pattern used in many street systems laid out at the turn of the century. This pattern is the preferred pattern in the absence of natural features to prevent its use.”	<ul style="list-style-type: none"> • Provides opportunities for the creation of blocks. • It allows for and promotes a variety of lot types within an easily managed menu of options. • A hierarchy of thoroughfares can provide opportunities for architectural treatment of buildings at corners. • Alleys can be loaded on both sides, providing efficiency in infrastructure. • Some streets may terminate at T-intersections, especially in General Areas and Edges. • It may have park spaces interspersed at regular intervals or more randomly. • Straight thoroughfares can enhance the character of rolling terrain. • The pattern is easily expandable. • Unless it is interrupted periodically, it can be monotonous, such as exists in Manhattan. • It does not work well on steeply sloping terrain in cold climates. • It must be seriously deformed to accommodate environmental features such as ravines.” 	 <p>“Example of a Rectilinear Grid Pattern with residential streets, boulevards, and parks.”</p>
The Diamond Grid Pattern	“The diamond grid pattern is a grid street system characterized by interconnections at angles.”	<ul style="list-style-type: none"> • It can work well with steep grades; at extreme grades, a discontinuous pattern may be justified. • A varieties of lot sizes are possible. • It can produce spectacular and dramatic .hill towns.. • It can result in awkward intersections that are not in conformity with VDOT Standards; intersection safety must be considered. • Alleys may be difficult to accommodate. • Some lots may be awkward in shape and in terrain, making building difficult and expensive. • Siting of buildings relative to streets can be difficult. Effort must be made to avoid the look of houses seeming to sit high above the street or houses falling down a hill.” 	 <p>“Example of Diamond Grid Pattern that provides interconnections and responds to steep terrain.”</p>
The Picturesque Landscape (Olmstedian) Pattern	“Inspired by American landscape architect Frederick Law Olmsted.s plan for Riverside, Illinois, the Picturesque Landscape pattern is a loose and warped grid able to respond easily to terrain and natural conditions.”	<ul style="list-style-type: none"> • It works well with steep grades and is highly responsive to terrain by absorbing environmental features. • The monotony of the grid is broken by deflected vistas. • It provides for even dispersal of traffic throughout the network. • Blocks are not easily created which makes it appropriate only for single-family detached houses. • It can be very disorienting to motorists, making it easy for them to get lost. • There is no hierarchy of streets intrinsic to the concept. • Lot sizes cannot be controlled. • When used too often, this pattern can become monotonous.” 	 <p>Example of picturesque landscape pattern following the terrain and preserving environmentally sensitive areas.</p>
The Rural Village Pattern	“The Rural Village pattern is a loose network of streets that resembles slightly twisted and discontinuous grid street pattern with varying block sizes.”	<ul style="list-style-type: none"> • It provides a series of interconnections that are loosely organized rather than systematic. • T-intersections are commonplace, as are intersections at 85 degree angles. • Sidewalks serve as pedestrian paths. • It follows existing roads on the land which normally result from natural features. • It easily responds to environmental features such as swales, streams and slopes by avoiding them.. • Monotony is eliminated by deflected and terminated vistas. • A street hierarchy provides opportunities for higher design speeds and long routes for through traffic. • The street network provides for even dispersal of traffic. • Building lots sometimes are larger than is appropriate. • It can be used with new and existing development patterns. • Blocks are difficult to design. • It may provide too many intersections or intersections at angles too acute for VDOT standards. • It can be difficult to expand because it can avoid existing development.” 	 <p>Example of a rural Village pattern showing loosely organized interconnections.</p>
The Curvilinear Grid Pattern	“The curvilinear grid pattern is a modified grid that provides fewer connections than the Rectilinear and Diamond Grid and more easily adapts to the terrain.”	<ul style="list-style-type: none"> • It can be used with new and existing development patterns. • Thoroughfares are curved and run parallel to the topography to accommodate moderately sloped terrain. • A variety of lots can be accommodated and designed. • A hierarchy of thoroughfares can provide for architectural treatments on corners for higher design speeds. • Alleys are loaded on both sides, providing efficiency in infrastructure. • Curving streets can provide another way to create visual interest. • Paths (with stairways and ramps) may be included mid-block where grades prevent vehicular access. • The system is easily expandable. • Curvilinear blocks can be challenging to the creation of lots for townhouses and are more difficult to plat. • It may reduce the character of sloping terrain by paralleling it. • It can result in asymmetrical streets with uphill and downhill houses with retaining walls.” 	 <p>Example of the Curvilinear Grid Pattern that runs mostly parallel to topography.</p>
The Spider web or Star Pattern	“The Spider web Pattern is a grid pattern of streets radiating from a center and interconnected mostly at right angles. It is a geometrically pure pattern with a central focus and derives from the Italian Renaissance notion of the Ideal City”.	<ul style="list-style-type: none"> • It creates formalized central space. • Diagonal streets can create hierarchy for through traffic. • Streets may be positioned to respond to ridges and swales of terrain. • Traffic is dispersed evenly through the network. • The monotony of the grid can be interrupted by deflected vistas. • The street system can be disorienting and difficult for drivers to use. • It requires many special buildings, particularly at the center, in order to achieve spatial definition”. 	 <p>Example of Spider web Pattern that radiates from a center or monument.</p>
The Stem Pattern	“The stem pattern is characterized by a series of cul-de-sac streets feeding onto collector streets and arterials. It is the pattern that characterizes much of the conventional development in Albemarle County. This pattern is not recommended for standard application in the Development Areas. It may be appropriate in unique situations”.	<ul style="list-style-type: none"> • It is a completely hierarchical system and conforms to the existing VDOT hierarchy of streets, terminology, and standards. • It can be responsive to steep terrain. • It can provide for a maximum number of lots on discontinuous streets. • Where it was perfected in Radburn, New Jersey, it offered a secondary system of pedestrian paths behind each stem of houses to separate pedestrian from vehicular traffic. • It can contribute to traffic congestion by the absence of an interconnected network. • Longer average vehicles miles traveled result from backtracking. • A complete separation of land uses and housing types is intrinsic to the pattern. • The street hierarchy results in major collector roads lined with rear-facing lots, usually as separate entry drives. • Separate pedestrian paths are rarely provided because of the assumption that residents can walk in the street for recreation. • High design speeds and wide roadways can lead to excessive speed.” 	 <p>Example of the Stem Pattern of cul-de-sacs, collectors, and arterials.</p>

2.2 Topographic concerns on vernacular settlements

In rural settlements different land reliefs infer different physical growth and forms (Schulz N. , 1980). The formation of settings in the sloppy area is generally parallel to the slope contours. On a plain, settlements may take the form of an enclosure or of a dense cluster, although on a hill, settlements often have the form of concentric or longitudinal clusters, creating a series of semi-circular terraces perpendicular to the slope. The Mediterranean vernacular manufactured fabric is characterized by envelopes, continuous buildings arrangements, compactness, high density and Adherence to a specific topographic organization that responds very well, face to the climate. Public open spaces and enclosed private moderate the extreme summer temperatures and provide shelter against intensive sunshine during the summer. The narrow streets and compact organization of buildings are typical in layout of the vernacular settlement in hot, dry climates, as they provide shade in the streets and facades of buildings during the summer period (Decay & Brown, 2001).

Vernacular architectures, built by people whose results design is influenced by traditions in their culture, have been gathered through a long period of trial and error and the ingenuity of local builders who possess specific knowledge about their place on the earth (Zhai and Previtali, 2010). Climate is a key environmental factor that affects the formation of vernacular architecture in the world. Environmental factors such as climate, building materials, topography and socio-cultural differences affect the design of the old villages and traditional houses in the vernacular. Building from the outside is affected from these three components: Season, time and climate. (Leatherbarrow D. , 2009, p. 58). Climate is one of the important factors which are affecting vernacular architecture. An application example of vernacular thoughts in

buildings, cold can be stated to have small windows to prevent cold air infiltration, for thermal insulation and high density of the materials used in construction; lightweight materials and more holes in the flow of air are used in hot weather. Furthermore, vernacular buildings should have a maximum proper slope in a roof against the rain and a minimum area against the wind flow. The shelter is a basic human need, to vary the size and take different forms depending on local climatic conditions. In dry-hot conditions, natural climate immune response takes the form of a parts group on one, sometimes two floors, rarely more, around a courtyard where there is always some shade and therefore a degree of convection air movement (Morris, 2013).

As it is mentioned the socio-cultural differences as one of the environmental factors, affect the design of the old villages and traditional houses in the vernacular architecture. According to the view of Williamson, cultural symbols of vernacular architecture include local forms related to the environment, the use of local building materials and techniques. He also suggests that the nativist approach is based on three factors: the emphasis on public participation and local experts, the study of culture and local buildings (Williamson, 2003).

The objects of vernacular architecture are directly conditioned by the setting in which they arise (both natural and man-made: the cultural, sociological, and so on). In addition to this part, Mardin city which is located in Turkey is respectable illustration. Heavy weather Mardin played a key role in how the architecture was developed. The dry and hot climate ranks at the top of the climatic situations. Therefore, it can perceive the harmony between the pattern of the city and this hot

climate. The narrow streets accord with the climate as they provide the peoples with shade and protect from direct sunlight. While the main streets parallel the steep inclination, both ramped or flat, they become stepped when perpendicular to the slope and then turn into stairs.

Sometimes the streets, which have an organic cause, are roofed. These roofed sections of the streets are called "kabalti" or "Abbara". These spaces function as open to the public shelters that protect people from heat in summer and rain in winter, and at the same time, they create wealth and diversity in the creation of the street in the Mardin settlement. While the houses are facing south, none hampers or closes the view of another (Figure 9, 10). The topographic structure slope of the settlement area is another important factor in the creation of the general characteristics of Mardin regulation. Having the settlement perched on a steep hill so becomes a strong design impact and ensures the use of type terrace house the building structure (Ozorhon & Ozorhon, 2014).

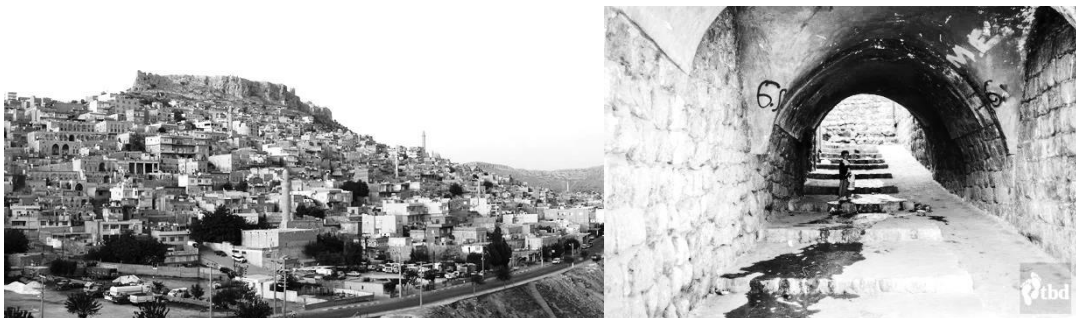


Figure 9: Urban fabric of Mardin (Author, 2015).

Figure 10: Characteristic of street in Mardin settlement (Author, 2015).

2.3 Sloppy Topography in Architecture

In the third part of theoretical framework it is aim to clarifying the role of sloppy topography in architecture. In this case, it is tried to consider the impact of topography on architecture base on level differences in the buildings, building orientation on the site, openings and accessibility.

One view, expressed by Kostof (1995) is that “buildings are often born of images and live on in images”. No building is a lonely object, sufficient unto itself. It belongs in a larger setting, within a neighborhood of other buildings or a bit of nature, or both, and derives much of its character from this natural or manufactured environment that holds it. According to Leatherbarrow (2002) in settlement of buildings, land topography is of awesome significance. The best places allowed by the land are the placement of buildings, the creation of streets on the land. In architecture, it ought to be viewed as that the greater part of the hardware used in the building must be prepared for surrounding condition changes. Architecture and landscape design should develop from topography, local climate, history, and building practice (Watson, Plattus, & Shibley, 2003).

2.3.1 Level differences in the buildings

One of the characteristics of sloppy land is that buildings are built one above another. As an example, in Masouleh Village buildings are built one above another and usually South-facing. Therefore, the top of the lower house is the patio of the upper buildings. The ground floor is typically utilized as a path (Memarian, GH., 1991) and store rooms are also placed at this level. Stairs connect the ground floor to the first floor where the winter and summer rooms are situated (Memarian, GH.; Sadoughi, A., 2011). In any villages which is built on a steep hill, a unique architecture is used

for its construction. The houses form rows of huge steps and each house roof is the yard of the house in the upper row. Courtyards and roofs both serve as pedestrian areas similar to streets. In the other words, when people cross a road, they are actually walking on the rooftops of the other houses (Kakouei et Al., 2012).

2.3.2 Building orientation on the site

The direction of the building depends on its topography, wind, suitable private spaces and sound control. The significance of orientation in a building must be considered at the beginning, when the designer is arranging the area of the expanding on the site, the point being to guarantee the most extreme accessibility of valuable characteristic light and daylight to the inside. The flexibility in architect's design is the key role to give the positive orientation to the building to get the sun path and daylighting, also natural green view from the outside (Phillips, 2004).

Refer to Leatherbarrow (2009) operations in and outside the building is dependent on several possibilities: those interests and customary practices of residents, or climate, seasons and weather. The workings of the construction are also dependent on changes to those parts that have been joined together to form work.

Therefore, it was stated that buildings areas should occupy the best locations within the settlements space, using the topography profit, taking into account the climate, and having the best exposure to the sun with green areas accessible to them (Watson, Plattus, & Shibley, 2003).

2.3.3 Openings and Accessibility

On Sloppy land, topography affects the layouts and location of the building and it can hardly seen the role of topography in sloppy land. On the other hand, in flat land

topography doesn't have that much affected in layout and location of buildings. Topography of the site has a direct effect on the accessibility, view or sun (Leatherbarrow D. , 2009, p. 44). The interaction between opening and accessibility it can divided in two parts Visual and physical accessibility.

2.3.3.1 Visual Accessibility

Orientation of buildings and environments of the building affected the value of the outside view, but it is of significance that, it should be abused where a view is accessible. There will be examples in extensive building organizations where inner perspectives, starting with one a piece on the inside, then onto the next may be hard. From visual accessibility point of view the most significant criteria is the relation between windows and natural lighting. Jean Nouvel claims to put nature to act in his architecture; the beauty and magnificence of the surfaces of the constructions are not the consequence of one technique design or structure, but besides the action of ambient lighting, which saturates variously and wonderfully skins with fluctuating qualities. The environment in this case, natural light must therefore be regarded as intrinsic to the edifice (Leatherbarrow D. , 2009, p. 62).

The architect must take the issue to consider when planning the details and the location of the windows, when planning his building. Among the classical principles of harmony, proportion and symmetry that statement Vitruvius, he stressed that architects should select healthy sites for their buildings, and the careful design of buildings prevented disease. It was clear that the well site was one which was oriented to authorize the introduction of natural light. Vitruvius was the first to study the subjective and quantitative parts of sunlight, proposing explicit rules to assess whether an interior is well day light (Phillips, 2004).

Refer to Nouvel, nature, is not an object to be observed, but a component which can "structure" of the building. He wants the glass panel for more a picture of the landscape. His point is to have the environment and the building work together, and perform their undertaking together. This link metaphor closely to perform; the task of building is to bring architecture to life. Nouvel's technique is to let the characteristics of the surrounding scene immerse the building's surfaces so totally that they turn into the characteristics of the building itself. For this to happen, two sorts of progress must happen: to start with, the building must be dematerialized; and second, light must be seen and regarded as though it were a matter (Leatherbarrow, 2009, p62).

According to Phillips (2004) window has created throughout the hundreds of years, however its obvious characteristic is the sunlight penetration to the indoor spaces and air circulation in the building. Since, the use of the windows was before the glass invention, originally the windows were open to the outdoor spaces without any glass infilled. Day lighting remained the main means of lighting for all types of buildings until the early twentieth century. Buildings must be sized and positioned to capitalize on views without negative impact seen from afar. When the views are down, extreme care must be taken to avoid breaking the crest of the hill with building heights (Department of Planning and Community Development, 2001, p. 109).

Topography is the second native language with which the language of the picturesque attempted to communicate. Appleton (1986) suggests that the topography is particularly important for the picturesque, even to ask a geological theory of determinism (and topographic suite). He suggests that the mountain areas of Britain have a plot more suited to the picturesque (Bowring, J., 1995).

Light in ancient periods was known as both intellectual and artistic, that's why it was the symbol of unity and love. In this way, in ancient arts holy places were shown by light. Light is not only the most general natural phenomenon, but also it is the unstable one. Light is creating dynamic spaces by changing during a day which gives a special character to the fact of space. That's where light is used by man to appreciate nature (Schulz N. , 1980).

Daylight is obviously crucial. Experience the natural colour; for while the physical colour of our experience in the daylight that changes from morning to night, the progressions are a piece of our experience; we remunerate over and over shows up a white divider, in spite of the fact that the night may be hotter or is shaded by daylight, or adjusted by cloud arrangements, it is the shading we see as regular. Human requirement for control of his surroundings is the light on his work, or the air that he inhales is a piece of the experience of the characteristic universe that by opening windows, we must have the capacity to have natural ventilation.

According to (Phillips, 2004) there is a hypothesis that discernment receptive to a level of progress; it is the common request of things that the presence of the inside spaces changes with time; Taking the example of buildings in the northern hemisphere, and using the simple fact that the sun rises in the east and sets in the west, it would be normal to ensure that those parts that could benefit most in the morning light, like a kitchen, morning room or even rooms are located on the east side, while those who are more likely to be used in the afternoon or evening as the living rooms oriented south or west. There will obviously be open discussion about the attraction of selecting a particular introduction for a specific utilization of room,

and there may additionally be clashing with the introduction of a room when connected with the capacity to appreciate a specific perspective (Phillips, 2004).

The outer perspective from the windows makes an important relation between the human and the outside world which helps us to carry out the information caused to get the experience of the daytime, climate and seasons (Phillips, 2004). One view, expressed by Williams (2007) is that use of native vegetation and improving the topography and creates rooms framed views of the village and countryside.

2.3.3.2 Physical Accessibility

Visualize the section rather than the plan is the most direct way to understanding the role of the ground or floor in a building. Regarding topography, the first obligation of the design would be to give access to the building to its recessive or remove foundation, on the grounds that the design works to modulate, while suffering from its effects, which can be improved. Topography is a name for an additional performance network that weave a web in the action of a person and its history, a network involved in a range of sites it shows are really great as another, similar, but not the same (Leatherbarrow D. , 2002, p. 29).

2.4 Summary of the Chapter

As it is shown in following chart the aims of this chapter is to clarify the theoretical framework of the study which is categorise in four part, the first part is more focus on interaction between topography and settlement, the second part is topographic concerns on vernacular settlements, the third part is about the sloppy topography in architecture.

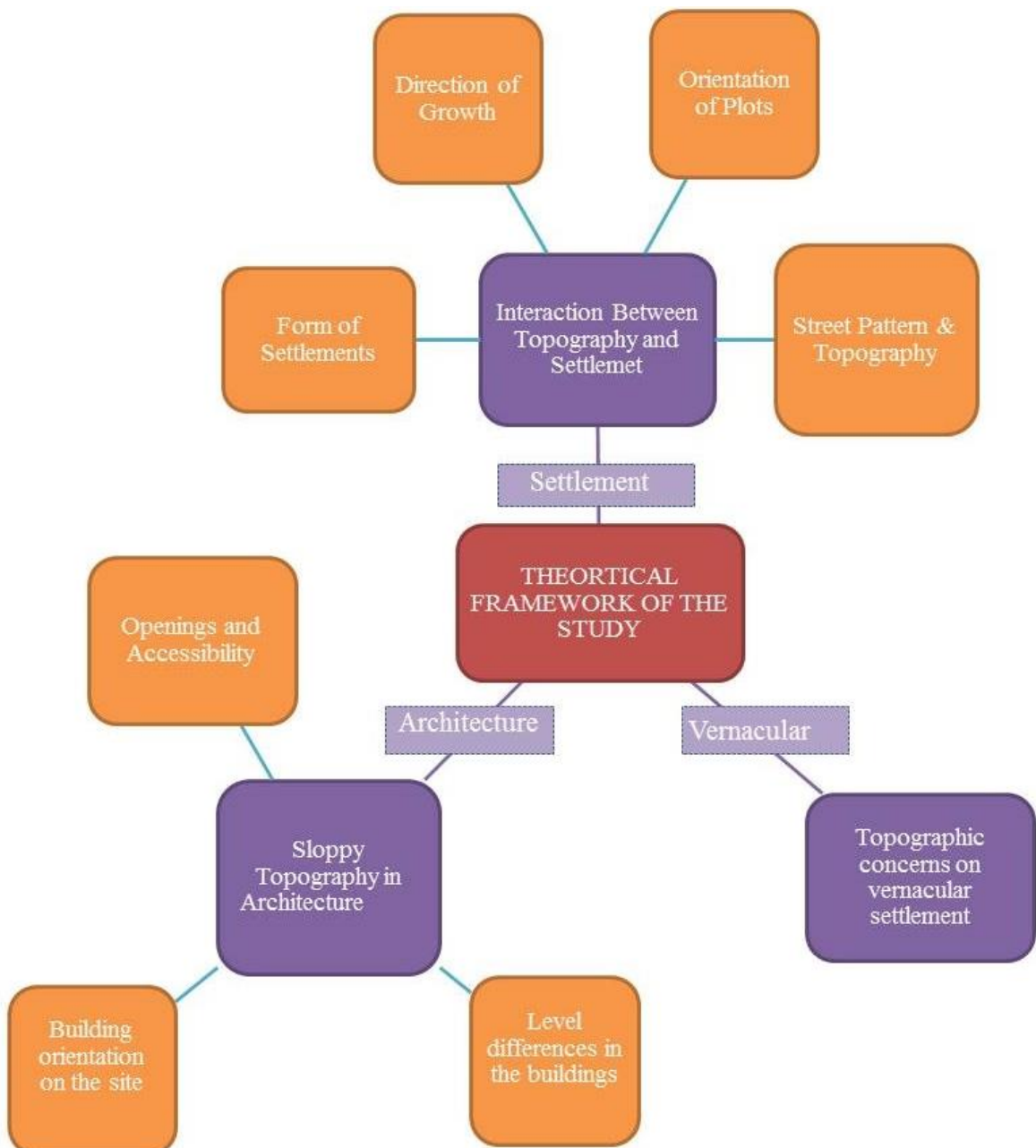


Chart 4: Summary of the chapter 2, Source: (Author, 2015)

Chapter 3

ANALYSIS OF THE RELATIONSHIPS BETWEEN TOPOGRAPHY AND ARCHITECTURE IN KARMI VILLAGE

In this chapter to understand the influence of topography on the formation and development of the urban pattern and architecture, Karmi village have been selected as a case study which is located in North Cyprus. Generally, Cyprus Island based on topography is divided into three physical regions corresponding to the main geological divisions includes the Mesoria Plain, running from the Guzelyurt Bay in the west to Gazimagusa Bay in the east and separating the two highland areas, the Troodos Mountains or the Southern Range, occupying the central part of the island, and the Girne Mountain Range, or Northern Range, along the Northern coast (Gursan, 2002).

3.1 Introduction of Karmi Village: Geographic location and

History

Karmi village is located in north Cyprus in 35° 19' 6.90" (N) latitude and 33° 15' 16.74" (E) longitude (Panoramio, 2010). This Mediterranean village is located in a mountainous area with topographic, gorgeous natural and organic environment, which has been preserved in its original natural character far from the modern technological environment. The word of "Karmi" alludes back to "Karmanite Monks", who were a gathering of monks living in a religious community in the village in the past ages. They used to live and do their activities within the natural environment of the village and charge animals. Perhaps, the selection of this area for

the award of the monastery had been purposely, since the natural environment and gorgeous landscapes are inspiring for people in monasteries and Papal areas. By a brief research on the background of Karmi and its past records, it can be observed that this village location is on the Besparmak mountains (west mountain of Kyrenia) that was abandoned by Greek-Cypriot at the period of the war in 1974 (Figure 11,13) (Hyland, 1999).



Figure 11: The location of Cyprus Island on the world map, Base on Google earth, developed by Author 2015)

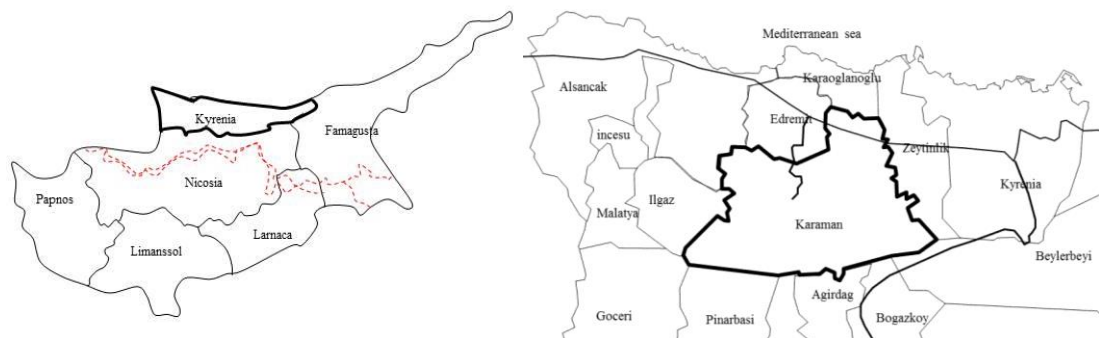
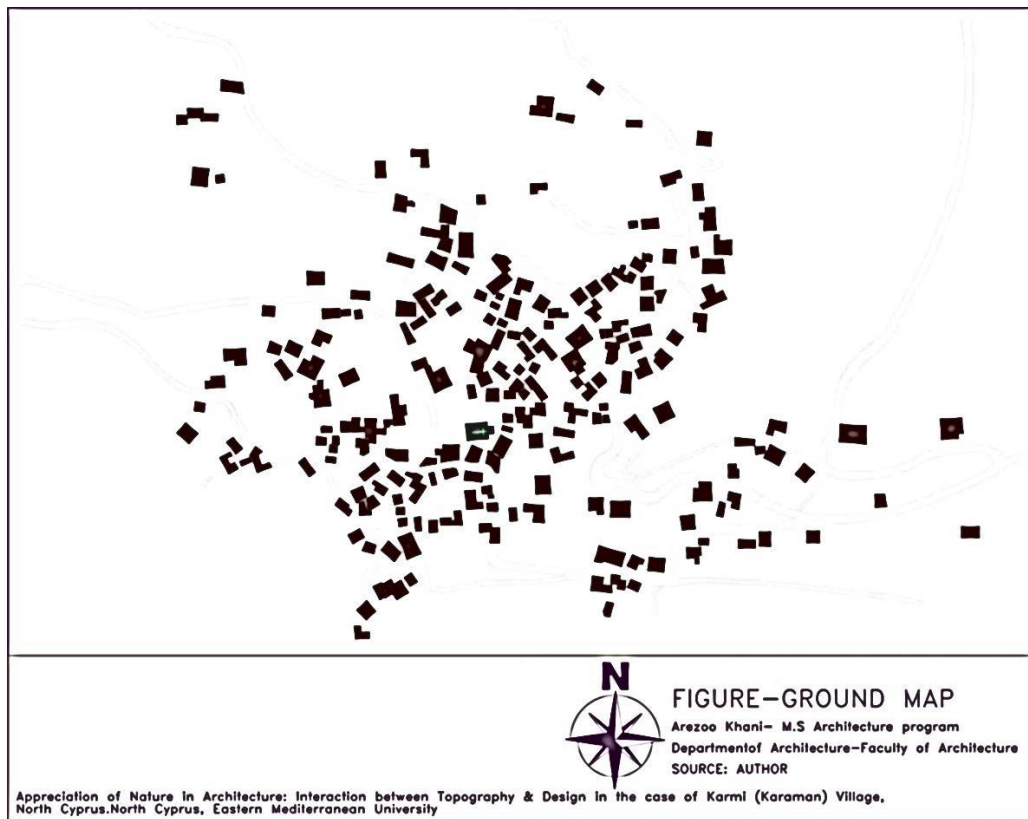


Figure 12: (Left) Location of Kyrenia in North Cyprus, Base on Google earth, developed by Author 2015), Figure 13: (Right) Location of Karaman in Kyrenia, Base on Google earth, developed by Author 2015)

Furthermore, existing houses in this village during the wartime were left empty and created a ghost village. In 1979 the remaining part of village was renovated by the Council of Minster Renovated for touristic aims (Hyland, 1999). Besides, the village was under the Acquisition of Tourism Ministry in 1984. During this period, the ministry started to rebuild the road and pathways, provide many parking and apply infrastructures. In continues, telephone boxes installed, water pipes and street lighting completed. Thus, during seven years 150 houses were renovated and the most parts of village renovated. In this regards, when the need of modern accommodation increased, polices makers decided to keep the character of village safe (Hyland, 1999).

3.2 Vernacular architecture of Karmi Village: Settlement

Topography is the important and the axial environmental factor, which has the crucial role in the creation and formation of this settlement. In this regards, investigation of morphological determinations of the village reveals a fact that the arrangement of the buildings was done organically (Map 1). Hence, topographical and natural lines are creating and organizing the characteristic of the village. Accordingly, the buildings are mainly located parallel to the lines of the topography and they are essentially rectangular sites along the steps of the topography, instead of being perpendicular to the topography lines.



Map 1: Figure ground map of Karmi village, (Author, 2015)

According to above, there is not a specific geometric principle of organization in the village such as grid, radial or modular organization, a kind of order is distinguished through the village. The main roads and main square (public spaces) can be recognized from the density of buildings. In the central parts of the village the density is more intense. The buildings get further from each other when we move away from the central part of the village. From the map most of the road and alleys are readable, even without drawing the roads, routes and connecting points and spaces of the village. Thus, there is a kind of order in disorder in this village that regular organization at the same time happening in an irregular arrangement; the main principle of organic architecture is harmony and unity with the surrounding natural environment. Subsequently, these characters are seen in the two-dimensional vision of the city, some similar characteristics are found in the third dimension of the

village too. Therefore, orders and disorders mentioned above are readable for users and passengers in the village (Map 1).

3.2.1 Form of settlement

Based on chapter two that is mentioned the natural topography of the earth, is part of the three-dimensional shape of the city and due to Table 1, Karmi settlement is located in a mountainous area (category C: hill, and mountain type) (Figure 14).



Figure 14: Karmi settlement form (Author,2015)

In the following, figures number 15 and 16 are showing the slope of the Karmi village which start from the upper level of mountain till the sea level. Direction of the path is from the South to the North. Besides, by focusing on the section of the path, Karmi village is 1339 feet up from the sea. The settlement is located in a mountainous area with a radical slope (Figure 15). Figure 16 shows the highest part of the village is 1175ft from the level up. According to the figure 17 the lower level of the Karmi village is 976ft from the sea level. From the figure 18 it can perceive, church is the focal point of the village that is located 1076ft from the sea level up.



Figure 15: Height of Krami village from the sea level, (Google Earth), Developed by Author

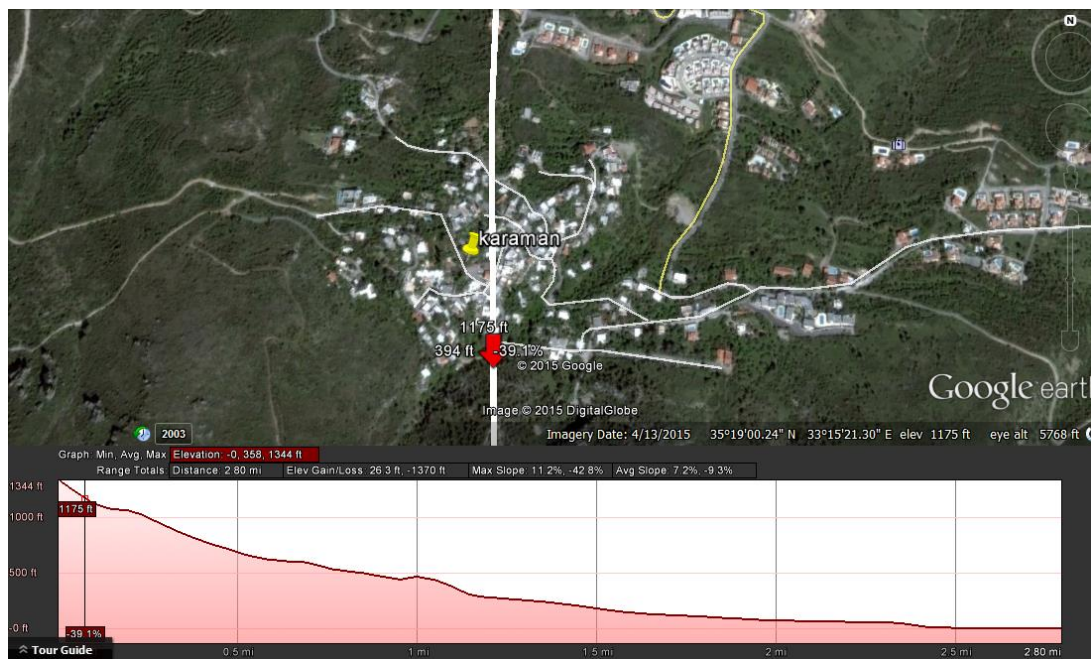


Figure 16: Upper level of Karmi village from sea level, (Google Earth), Developed by Author

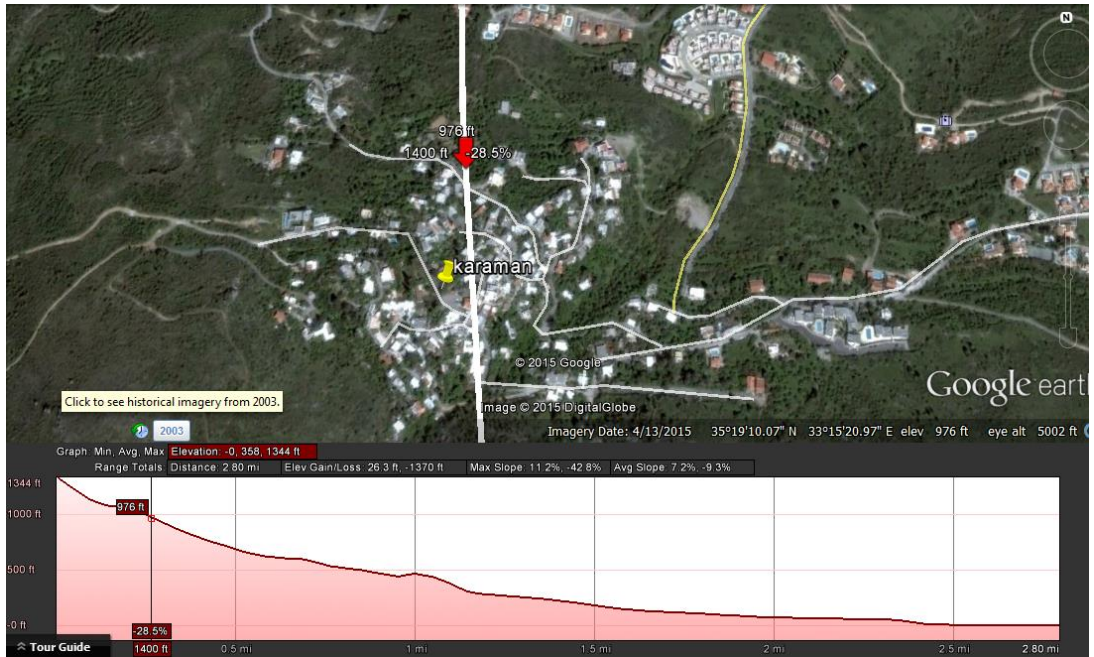


Figure 17: Lower level of Karmi village from sea level, (Google Earth), Developed by Author

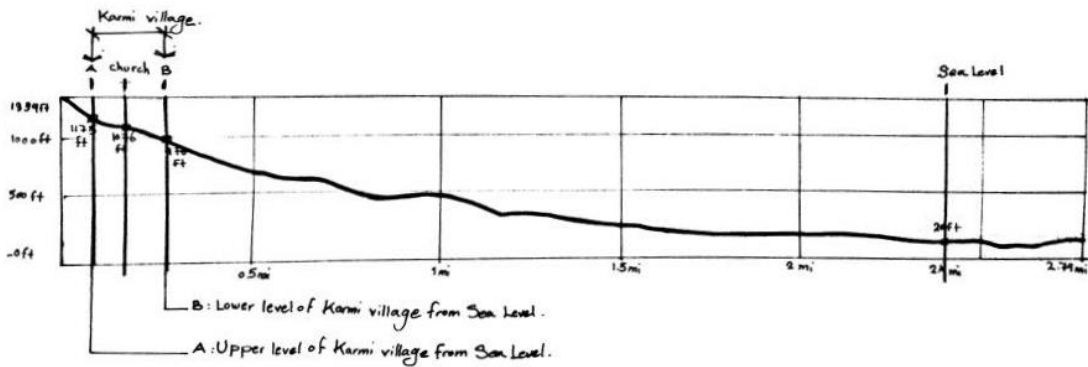


Figure 18: Analysis Karmi village from sea level, Based on (Google Earth), Author, (2015)

3.2.2 Direction of growth in Karmi village

The topography is main significance in this settlement. Location of the buildings and roads are the best places, which permitted by the land. Buildings are situated in the village, independently relying upon the geography of the area and a few houses meet up to frame collections of houses.

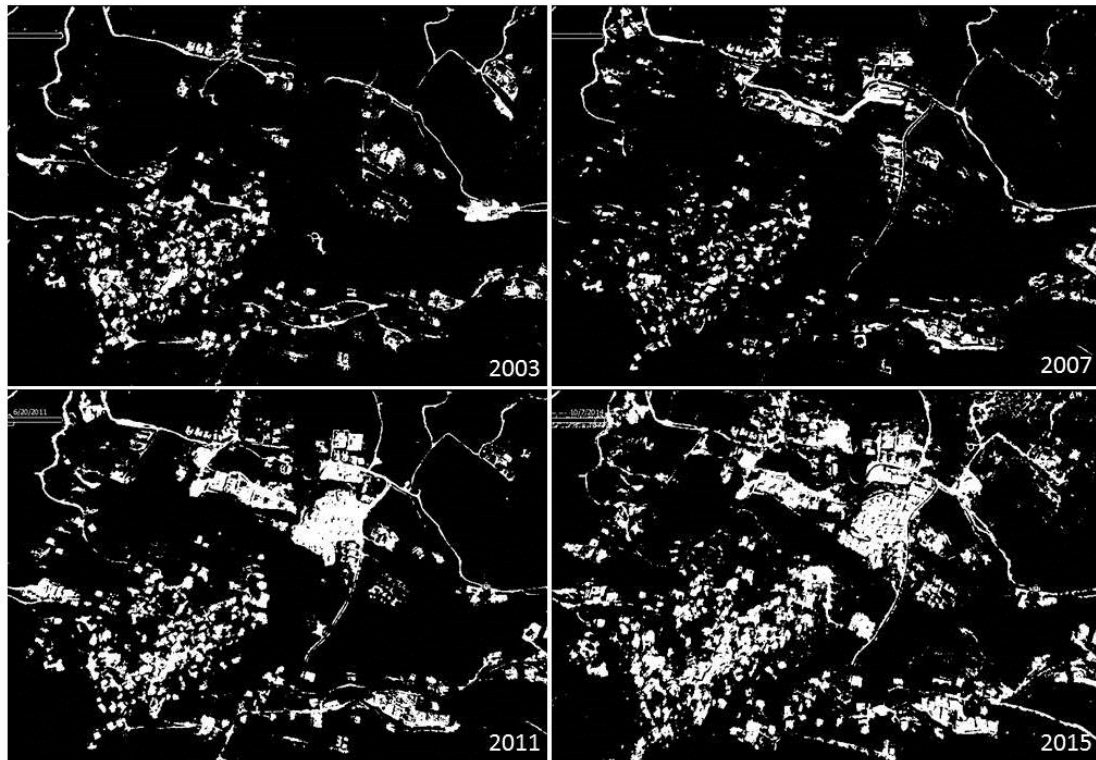


Figure 19: Direction of growth in Karmi village, (Google Earth), edited by Author

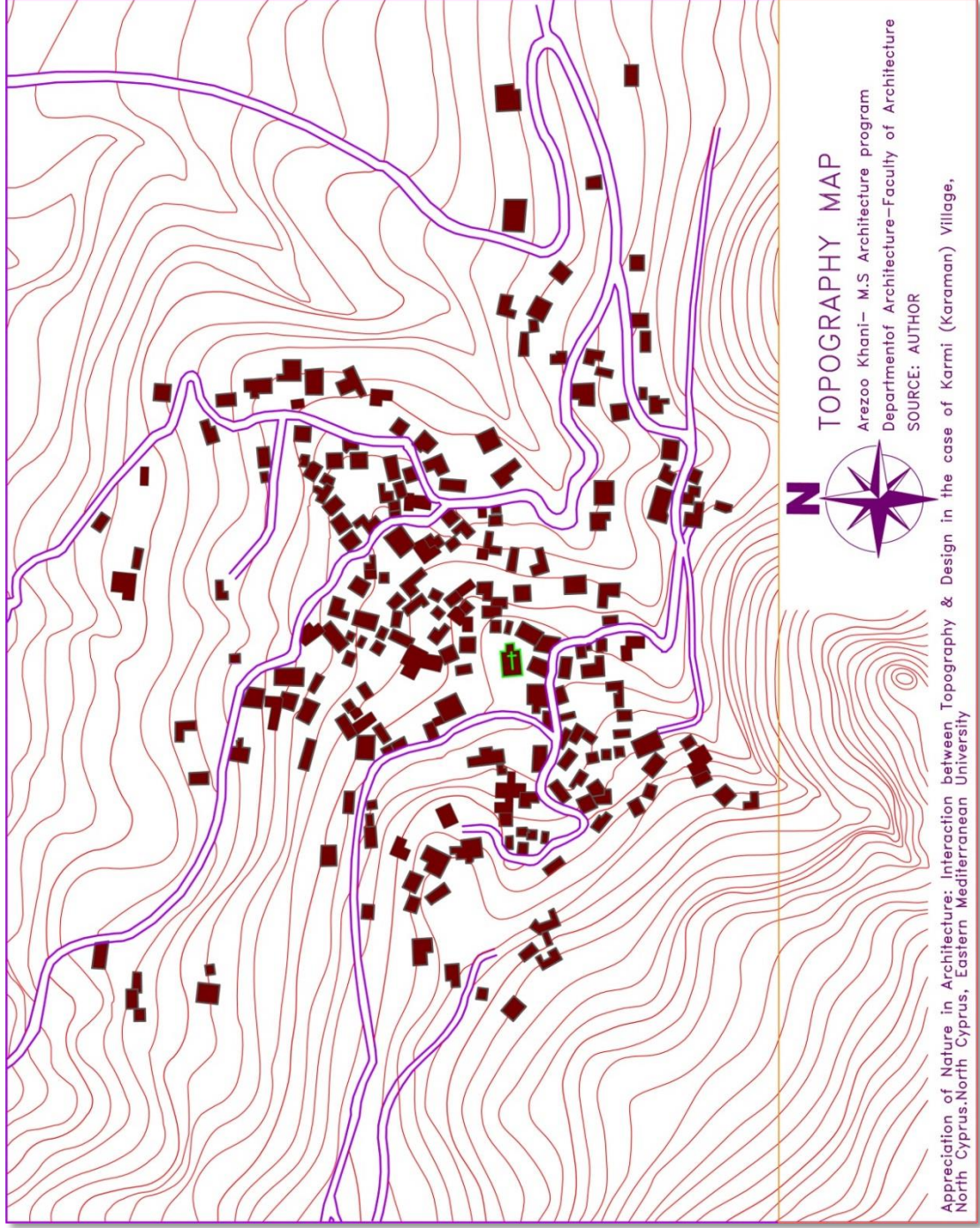
Among 2003 until 2015, Karmi village start to grow in the direction of the North, the growing start from the Southwest direction, then its grow to the Southeast after that its rooted in direction of the North side. It should be noted that the slope of the settlement, it is upward the Southwest direction. According to the above figure, development of village and location of buildings started from the upper level towards the lower part of the mountain (Figure 19).

3.2.3 Orientation of buildings in Karmi village

According to topography map (Map 2), the most significant criteria in Karmi village is the relation between traditional buildings with their surroundings, there are positively highlighted. This regards, the mountain hugs the building. Thus, the face of the buildings is towards the slope of the land (Figure 20).



Figure 20: Orientation of buildings in Karmi settlement (Author, 2015).

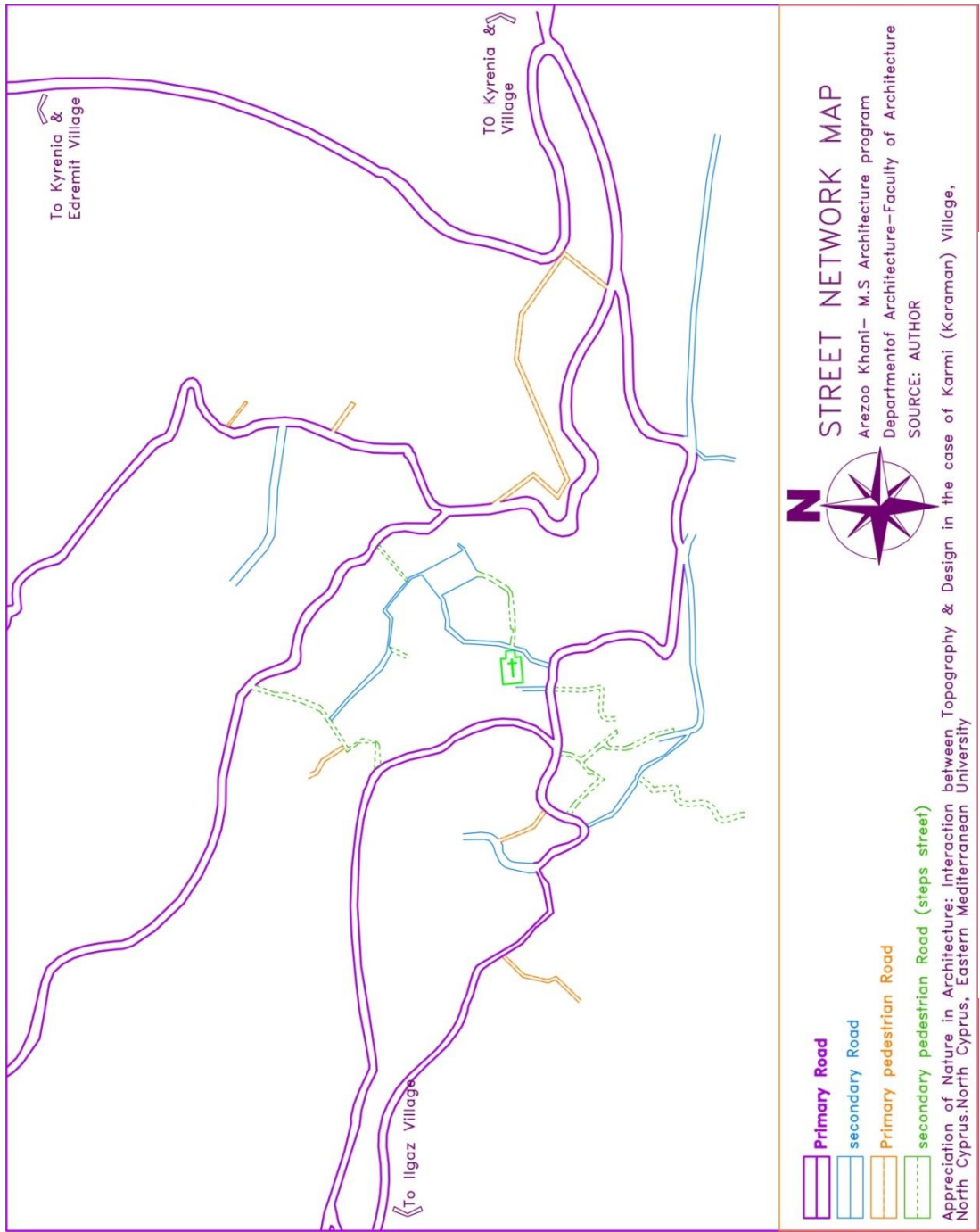


Map 2: Topography map of Karmi village (Author, 2015).

3.2.4 Street pattern of Karmi village

The location of the settlement on the hills and steep land, has created a situation to the districts for contacting and accessing to each others, they must use steep streets with stairs. Hence, access to these districts seems difficult, since they are all connected to each other with routes to the south and access to each street takes a short period of time. These pathways are following the line of the topography. Besides, Roads for crossing through Karmi village are designed with adequate slope and step in two types: The first type is longitudinal parallel roads with a few steps; the second type is transversal routed with a quite number of steps which circulates between the upper and also the lower part of the village. Based on the street network map, the existing streets are an example of tree branches (organic), which are formed freely (Map 3).

Based on the following table number 9, it is clear that the step streets are the main type of streets inside of Karmi village that it is tried to shows the most of them as sketches in table number 9 with their location. Steps street is one of the especial characteristic points of Karmi village, as vertical access between different levels.



Map 3: Street network of Karmi village (Author, 2015).

Table 9: Step streets of Karmi Village, (Author, 2015)



Streets in Karmi village have own characteristics because sloppy land gives special identity to the streets; they are sloppy, narrow and steps (Figure 21-23). In the following figures number 22 and 23, streets ended with the building, this is the usual visual perspective of the streets in the village on sloppy land.

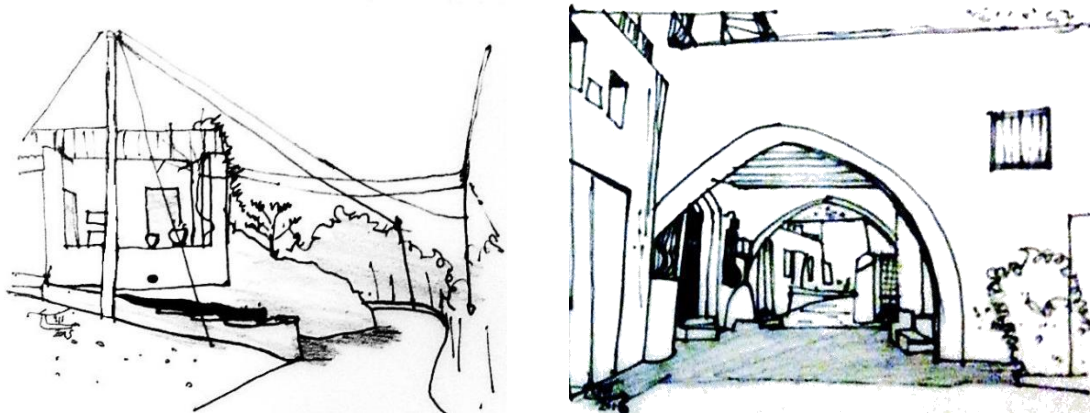


Figure 21: (Left) Sloping street in Karmi Village in North Cyprus (Author, 2015),
Figure 22: (Right) Street in Karmi Village in North Cyprus (Author, 2015)



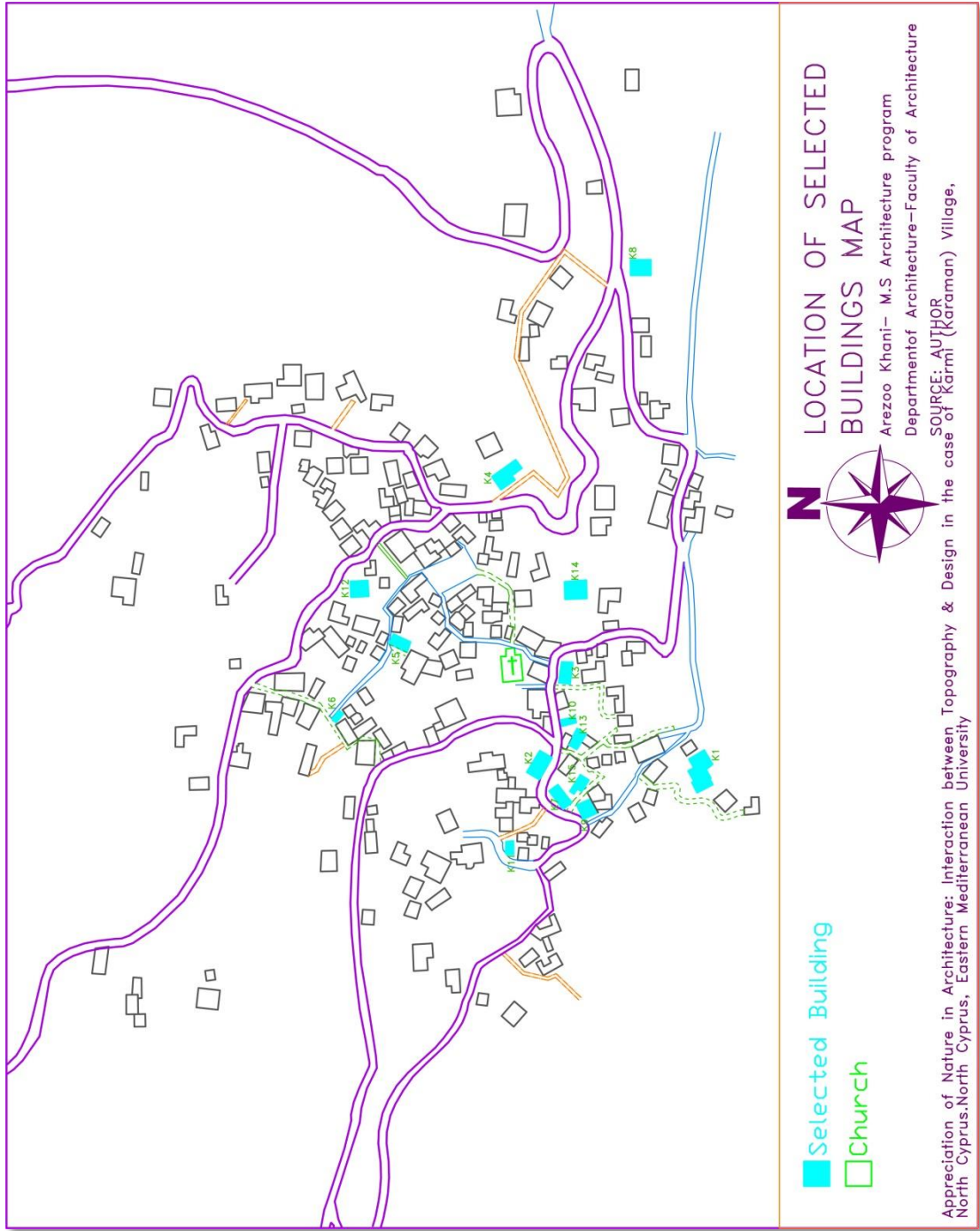
Figure 23: Narrow step street in Karmi village, North Cyprus (Author, 2015)

3.3 Effect of the natural topography on buildings of Karmi village

Architectures shall consider the connection and relationship among surrounding environment and buildings. This consideration can be included sun, wind, soil, rain, the slop of the site and etc, (Shellard & Lamb, 1968, pp. 823-827). In the site with a high level of slope, there is a big opportunity for architect to use of land without damaging the environment (Richards, 1966).

Accordingly, to find the relation among topography and architectural design in Karmi village a set of analyses which are divided into four parts are used. The first part is analysing the level difference in the buildings. The second part is building orientation and third part has focused on accessibility to and inside the buildings. The final one is about the location of the building's openings.

Generally, in Karmi village approximately there are 200 buildings, which in this research fifteen buildings in different locations are selected based on topography lines and accessibility to them. All these buildings considered existing topography in their own architectural design (Map 4).



Map 4: Location of selected buildings map (Author, 2015)

- Building Number One (K1):

Building number one (k1) is located on the upper level of the village (Table10). Due to analysis of level difference on this building, it is clear that topography as a main element has a direct effect in the interior spaces of the building. Besides, in this building we can see one floor, which it has three different levels that each level is related to different function. Furthermore, these three different levels from lower to appear on our main entrance and hall, and in the upper level bedrooms are located. In the second part of the table number 10, the building orientation on the site is analysed. Hence, the building number one (k1) is oriented towards the slope of the land in the upward south direction. Moreover, in part three of the table number 10, the accessibility and circulation inside the building are analysed. The result shown, in this building accessibility and circulation inside of the building is started from the main entrance in down level to the entrance hall, then with some steeps it is going one level up to the hall. After that from the hall the building has another access to the outside, then again with some steep from the hall it can go to bathrooms and bedrooms which are located in the upper level of the building. Last part of analysis has focus on the opining of the building. Opening mostly are located on the north side of the building that biggest one of them are located in north direction and smaller ones are located on west and east sides. The location and direction of openings show the building is located in the north direction to gets the more natural view. As a conclusion, the building number 1 is oriented in the harmony of the site towards the south direction and all organization of the functions and circulation inside building are under effect of natural topography slop direction. Thus, the relationship between building and their context is strong.

Table 10: K1, Analysis of building – K1 on Ivy steps, Karmi, Kyrenia, North cyprus (Author, 2015).

<p>LOCATION OF THE BUILDING</p>	<p>LEVEL DIFFERENCES IN THE BUILDING</p>	<p>ACCESSIBILITY</p>
<p>PLAN OF THE BUILDING</p>	<p>One floor three different levels</p>	<p>Main entrance on lower level from courtyard Secondary entrance on upper level from courtyard</p>
<p>SECTION OF THE BUILDING</p>	<p>BUILDING ORIENTATION ON THE SITE</p>	<p>OPENINGS</p>
<p>K1 AREZOO KHANI, EMU, FACULTY OF ARCHITECTURE, DEPARTMENT OF ARCHITECTURE,</p>	<p>Oriented towards the slope of the land (upward South)</p>	<p>Mostly located on North Larger openings on North Smaller ones on west & East</p>

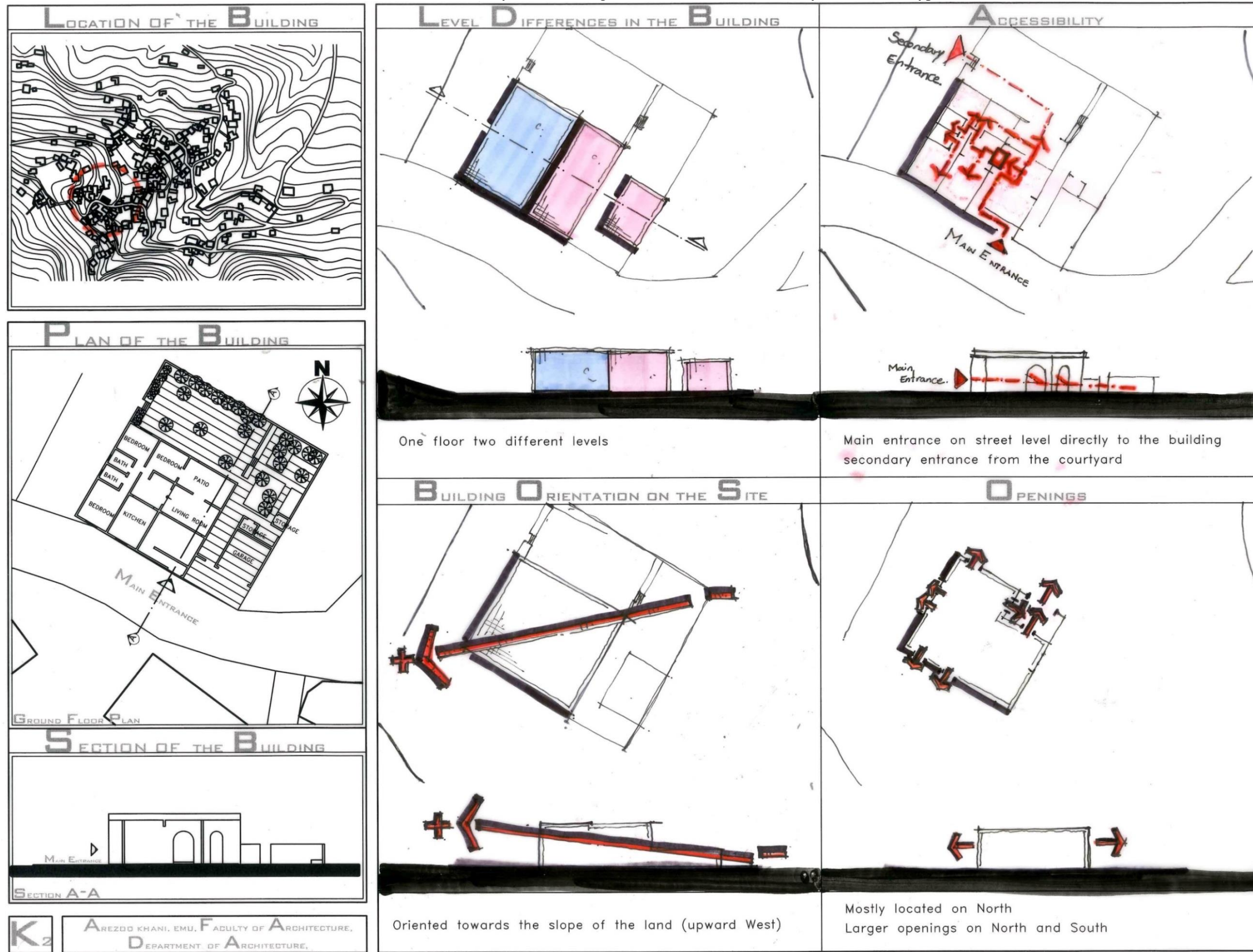
Appreciation of Nature in Architecture: Interaction between Topography & Design in the case of Karmi (Karaman) Village, North Cyprus, North Cyprus, Eastern Mediterranean University

- Building Number 2 (K2):

Table number 11 is shown the location of building number 2 (K2). Level difference analysis on this building is showed; there is one floor with two different levels. The level difference in this building is very poor but has direct effect on the building level that is clear from interior part and also from exterior part of the building, especially from courtyard. Thus, this building is located in the ground with harmony with surrounding natural environment. This Building is oriented toward the slope of the land upward West direction, the land in this area is upward west and the building is located in that direction. The Orientation of the building on the site is too much importance in define characteristic of the building such as accessibility and openings. The third part of analysis which is about the accessibility of the building, it is showing the main entrance of the building is from the street (at the same level to street level) directly to the building the horizontal circulation is continuing to the hall and from the hall has another access to the outside. Then from the hall with vertical circulation there is access towards the bedroom on upper level. This building has the secondary entrances on the Northwest side, from the courtyard.

From the inside of the building, it is too important to have a visual contact to outside because of two reasons: the first is having a natural lighting and the second one is having a good view of the outside. Accordingly, the opening of the building are analysis and they are located in same direction of the slope of the land, hence in this building opening are mostly on the North side and the larger openings are located on North and South sides. According to the following table, it can understand the effect of the sloppy land to the building in the positive way. This building has strong relation with its own context.

Table 11: K2, Analysis of building – K2 on Pool road, Karmi, Kyrenia, North Cyprus (Author, 2015).



Appreciation of Nature in Architecture: Interaction between Topography & Design in the case of Karmi (Karaman) Village, North Cyprus. North Cyprus, Eastern Mediterranean University

- Building Number 3 (K3):

Due to table number 12 the building number 3 is located on the flat land and there is no any level difference inside of the building but from outside there are some steps to go inside of the building. Besides, this building has just one floor (Table12). Furthermore, this building is oriented towards the slope of the land, upward southwest. The main entrance of the building is located on the North side of the Pool road street. Access to the building is possible by four steps from the street to the building. Circulation in the building is continuing horizontally. Moreover, openings of the building mostly are located on the North side. In this case, it should be noted that the building has harmony with the slope of the site in this part of the village the slope of the land is less so the building just have little level differences in the interior parts.

Table 12: K3, Analysis of building – K3 on Pool road & Mulberry road, Karmi, Kyrenia, North Cyprus (Author, 2015).

<p>LOCATION OF THE BUILDING</p> 	<p>LEVEL DIFFERENCES IN THE BUILDING</p>  <p>One floor No different levels</p>	<p>ACCESSIBILITY</p>  <p>Main entrance with four steps from street to the building</p>
<p>PLAN OF THE BUILDING</p>  <p>GROUND FLOOR PLAN</p>	<p>BUILDING ORIENTATION ON THE SITE</p>  <p>Oriented towards the slope of the land (Upward Southwest)</p>	<p>OPENINGS</p>  <p>Mostly located on North</p>
<p>SECTION OF THE BUILDING</p>  <p>SECTION A-A</p>		

K3

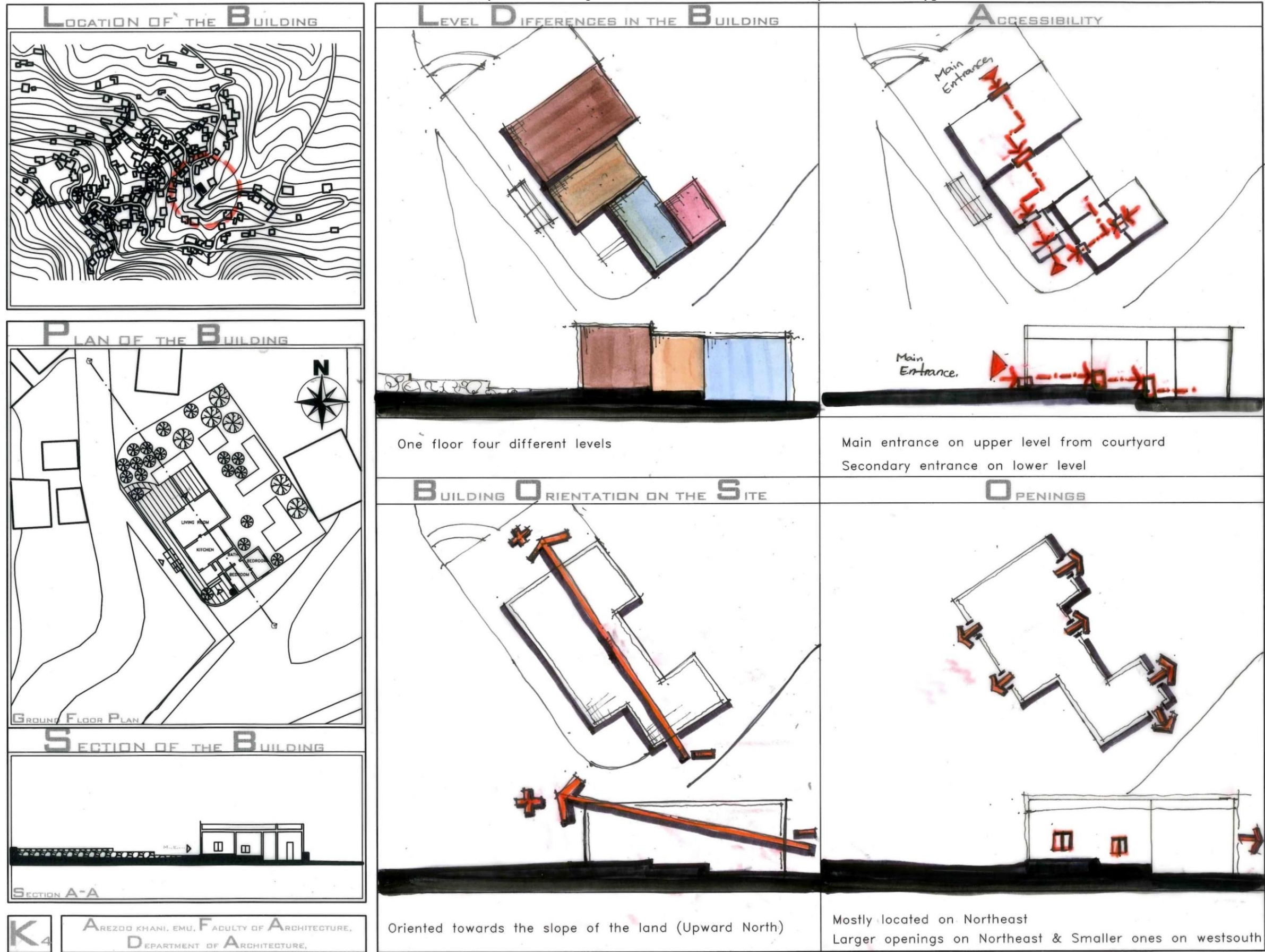
AREZOO KHANI, EMU, FACULTY OF ARCHITECTURE,
DEPARTMENT OF ARCHITECTURE,

Appreciation of Nature in Architecture: Interaction between Topography & Design in the case of Karmi (Karaman) Village, North Cyprus, North Cyprus, Eastern Mediterranean University

- Building Number 4 (K4):

The building number 4 is shown in the table number 13. The level difference analysis is shown that this building has one floor with four different levels. This level difference is in related to the nature of the land. Besides, the orientation of the building is toward the slope of the land in the upward North direction. The access to the building is from the main entrance which is located in North side of the building. The main entrance of the building is located on the upper level of the courtyard, also should pass from the steps (vertical element) to enter into the building. This building has a secondary entrance, which is located on the lower level of the main entrance. Furthermore, the openings of the building are mostly located on Northeast site. Besides, larger openings are located on the Northeast and the smaller ones are located on the West south. The consequence of these analyses, make clear the building has harmony with its own context, which means the building has strong links to the surrounding environment.

Table 13: K4, Analysis of building – K4 on Oleader road, Karmi, Kyrenia, North Cyprus (Author, 2015).

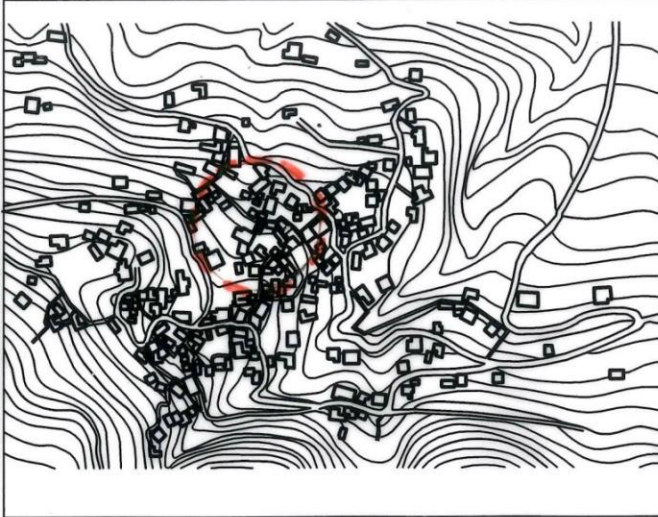
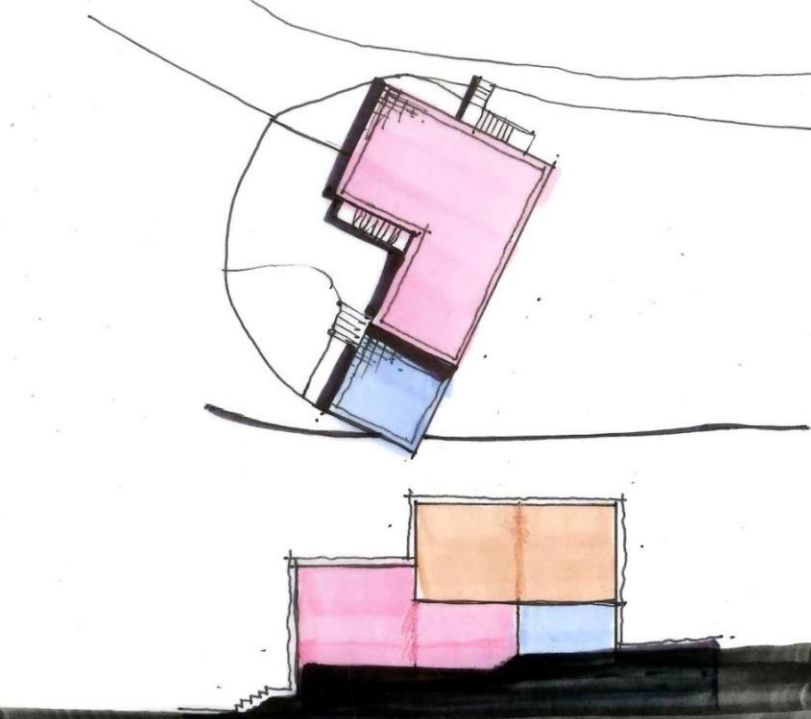
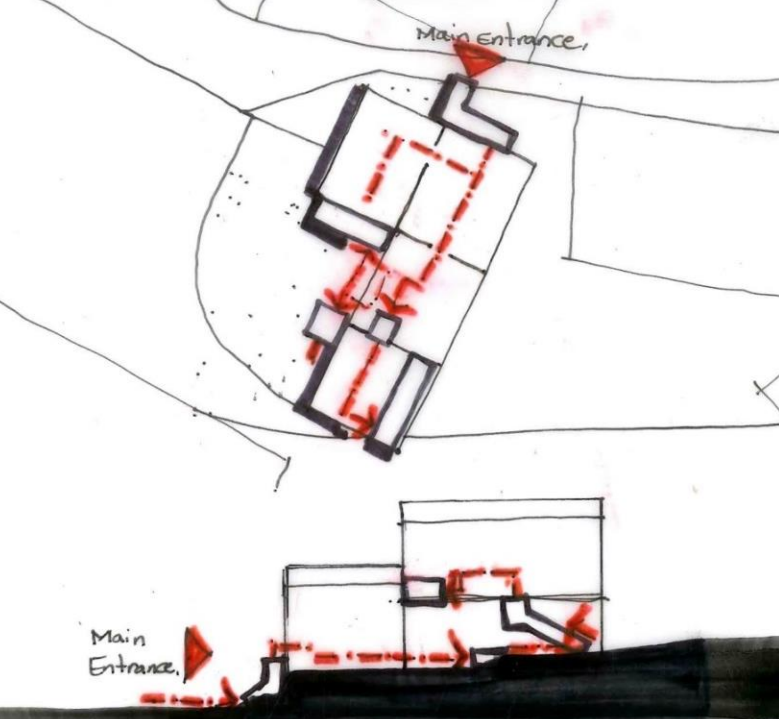
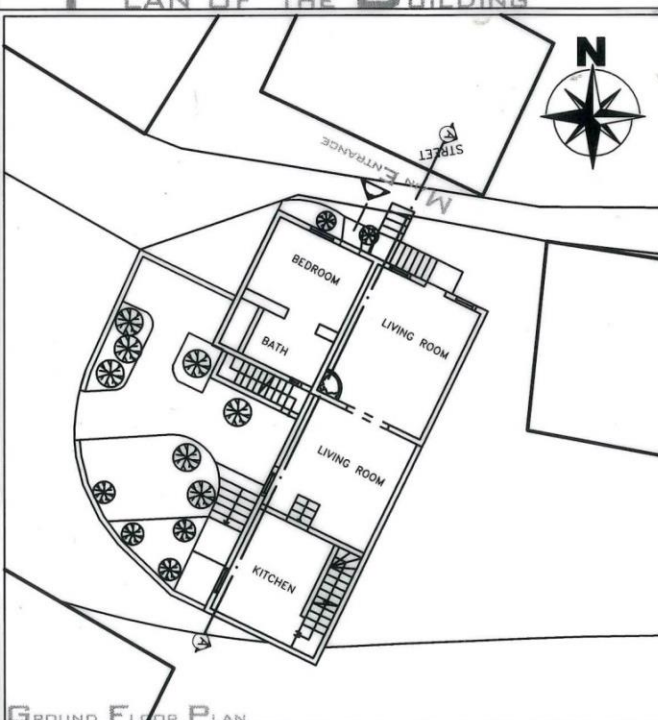
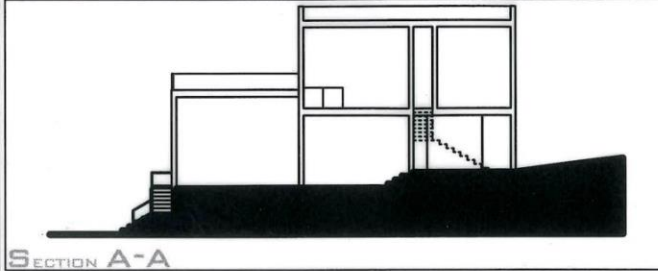
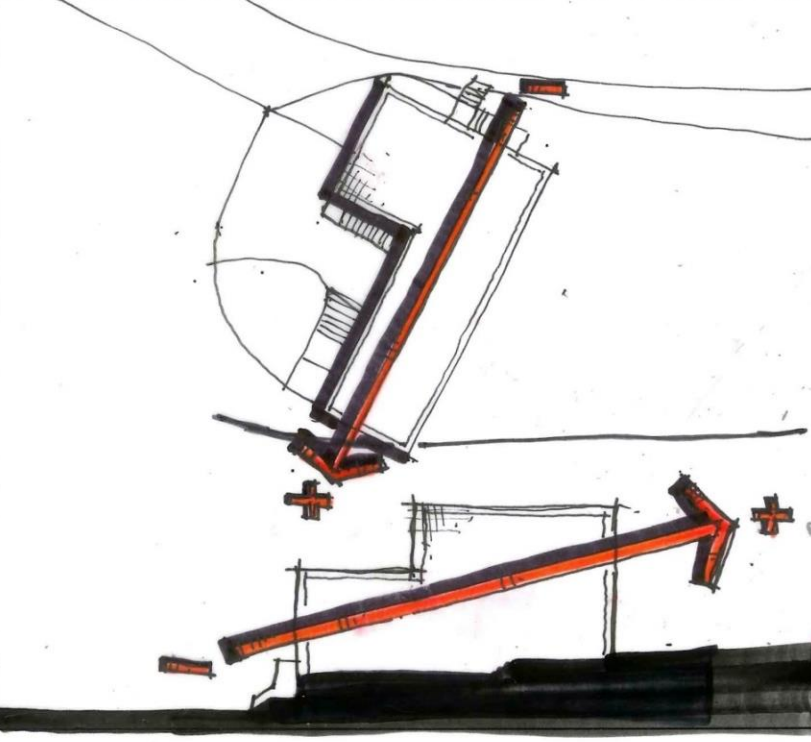
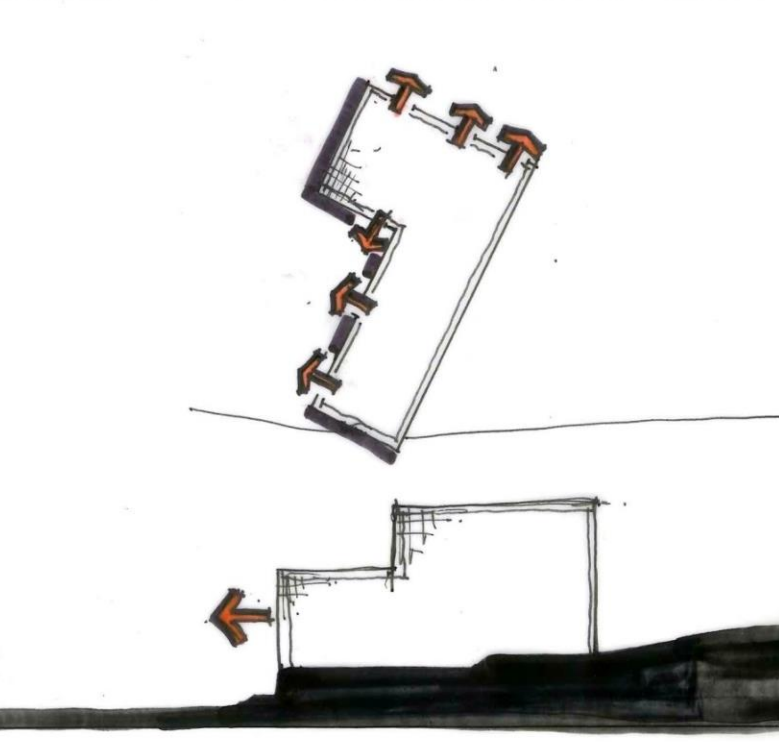


Appreciation of Nature in Architecture: Interaction between Topography & Design in the case of Karmi (Karaman) Villages, North Cyprus, North Cyprus, Eastern Mediterranean University

- Building Number 5 (K5):

Based on table 14, the building number 5 is located in high sloppy part of the village. From the street level building has two floors which are connected via staircases that it is shown in part one of table 14 and ground floor has two different levels. Furthermore, the building is oriented towards the slope of the land which is going upward the Southwest direction, hence with this orientation building get access from the street with some steps to go inside of the building. It can perceive that to go from each function to another one, should pass through the vertical element and the access inside the building continues with staircases to the upper level. Most of the openings of this building are located on the North side, which the largest openings are located on the North and the smaller ones located on the West side.

Table 14: K5, Analysis of building – K5 on Citrus road, Karmi, Kyrenia, North Cyprus (Author, 2015).

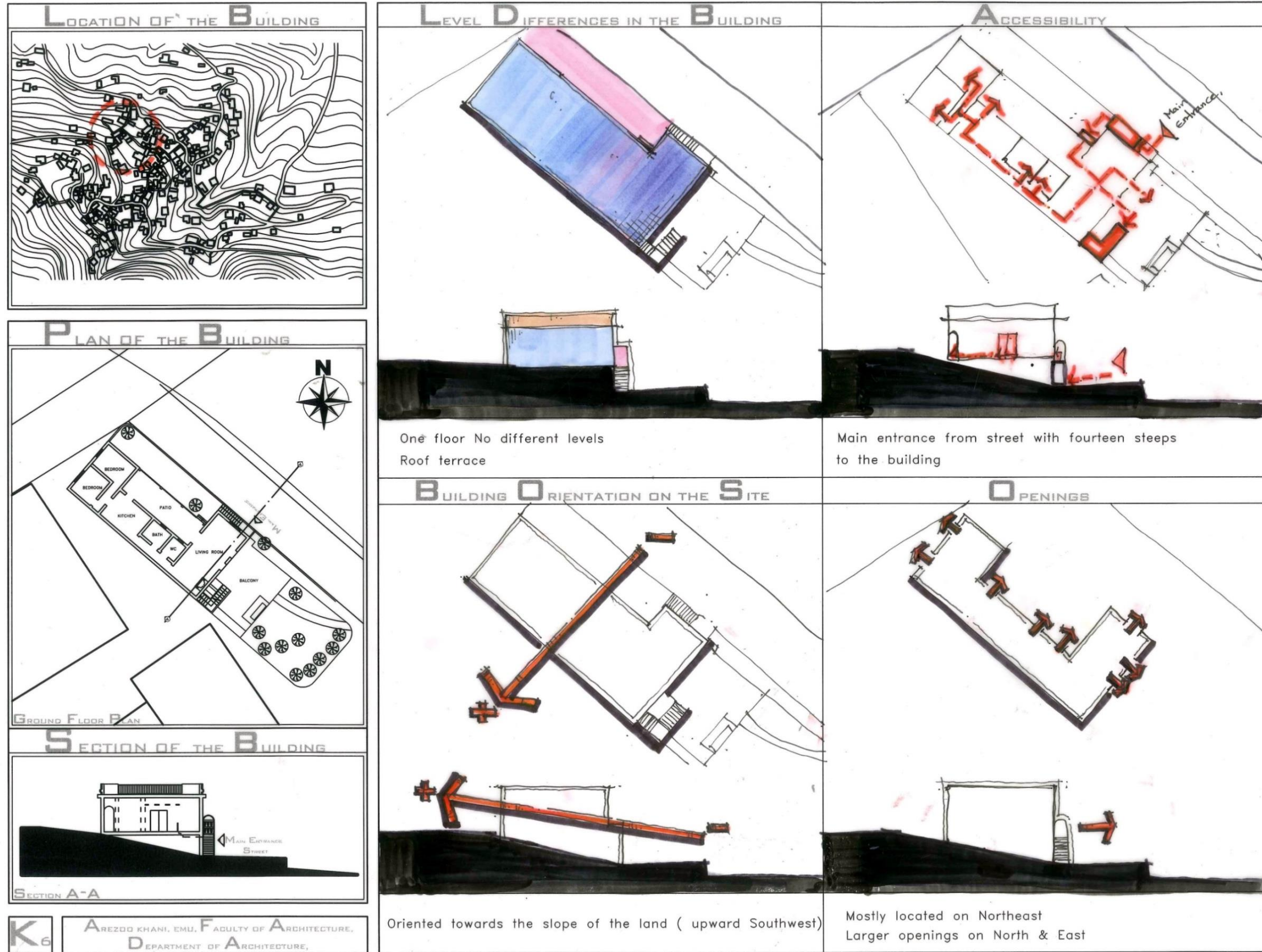
<p>LOCATION OF THE BUILDING</p> 	<p>LEVEL DIFFERENCES IN THE BUILDING</p> 	<p>ACCESSIBILITY</p> 
<p>PLAN OF THE BUILDING</p>  <p>GROUND FLOOR PLAN</p>	<p>Two floors connected via staircases Ground floor with 2 different levels</p>	<p>Main entrance on lower level from courtyard Secondary entrance on upper level from courtyard</p>
<p>SECTION OF THE BUILDING</p>  <p>SECTION A-A</p>	<p>BUILDING ORIENTATION ON THE SITE</p> 	<p>OPENINGS</p> 
<p>K5 AREZDO KHANI, EMU, FACULTY OF ARCHITECTURE, DEPARTMENT OF ARCHITECTURE.</p>	<p>Oriented towards the slope of the land (Upward Southwest)</p>	<p>Mostly located on North Larger openings on North & Smaller ones on west</p>

Appreciation of Nature in Architecture: Interaction between Topography & Design in the case of Karmi (Karaman) Village, North Cyprus, North Cyprus, Eastern Mediterranean University

- Building Number 6 (K6):

The building number 6 is located next to the road (Table 15). The first part of table 15 is shown that the building is located on a higher level than street level, but inside of the building there is no any level difference. This building has one floor that there is no level difference. Most of the buildings in Karmi village have a roof terrace that this building is one of them. Moreover, based on the building orientation analysis, this building is oriented towards the slope of the land upward to the Southwest. The analysis of the access and opening of the building is shown for access to building number 6, it should pass the vertical circulation; it means that the building has the steps at the main entrance. The number of steps in the main entrance is fourteen, which shows the level difference between the street level and building level. For access from street to building there are fourteen steps which goes direct to the patio and from patio again with three steps can enter into the building after that inside the building circulation is continued horizontally. Besides, the openings of this building are located on the Northeast and also the largest openings are located on the North and East side. As a conclusion for table 15, the building is located in harmony with the slope of the site, and it has direct effect on all characteristics of the building in a positive way.

Table 15: K6, Analysis of building – K6 on Poppy steps & Citrus road, Karmi, Kyrenia, North Cyprus (Author, 2015).



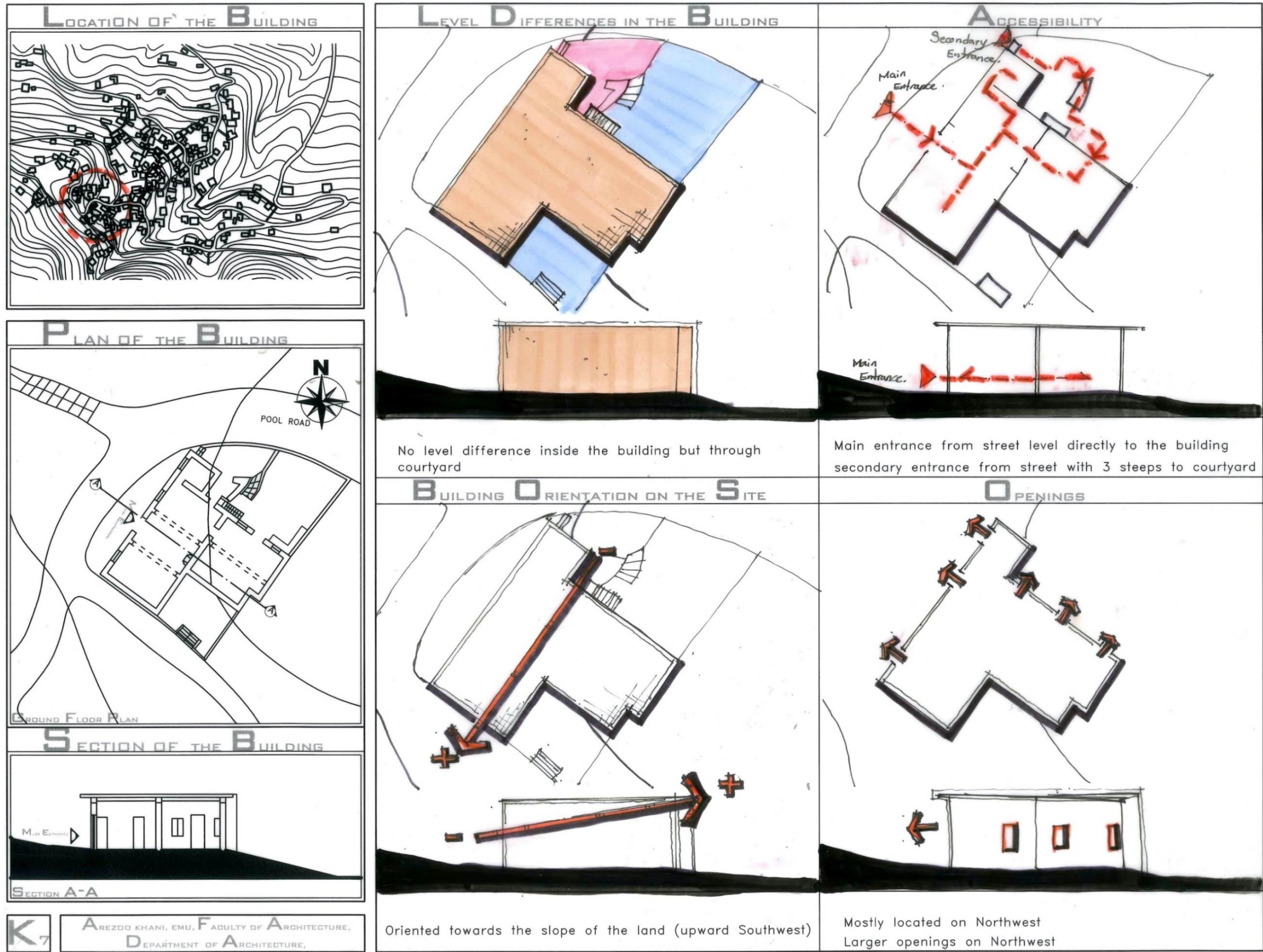
Appreciation of Nature in Architecture: Interaction between Topography & Design in the case of Karmi (Karaman) Village, North Cyprus, North Cyprus, Eastern Mediterranean University

- Building Number 7 (K7):

Building number 7 is located on Pool road. In this building, there is no any level difference, but throughout the courtyard there is a level difference (Table16). Furthermore, this building is oriented towards the slope of the land upward southwest. Main entrance of this building, as it is shown in the third part of the table 16, is from the street directly to the building, also this building have a secondary entrance from street with three steps to the courtyard. Inside the building, all access are horizontal. In the last part of table 16, it can see the openings of the building mostly located on the Northwest and also the largest opening is located on the Northwest for the sake of the view.

The results of this building analysis are shown, the topography of the land affected the building design and also the orientation of the building with the harmony of the sloppy land gives more opportunity to the building, such as diverse access to the building from different level, have views of the nature and have comfortable natural lighting inside the building.

Table 16: K7, Analysis of building – K7 on Pool road, Karmi, Kyrenia, North Cyprus (Author, 2015).



- Building Number 8 (K8):

Case 8 (K8) as it is shown in table 17 is located in the main entrance of the Karmi village in between of two topography line next to the primary road. According to the first part of the table, this building is on two floors which are connected via staircases, and also it is clear that the level difference in the sloppy land affected the courtyard too. According to the second part of the analysis, this building is oriented towards the slope of the land upward south direction. It should note, the settlement slope is upward south and upward southwest. According to this section, building's main access is from the street to the courtyard with twenty two steps. This is another characteristic of most Karmi houses, building's levels are upper than street levels and this is because of sloppy topography. Access is started vertically and again from the courtyard to the building. Furthermore, accessibility in this building has continued horizontally (Table17).

Openings in this building are mostly located on the West direction. However, larger openings are located on the West and smaller ones located on the South direction. The opening of this building is different with other buildings in this settlement and the reason is the mountain gives the shadow to the house so natural lighting doesn't give bad effect to the interior part of the building.

Table 17: K8, Analysis of building – K8 on Hilarion road, Karmi, Kyrenia, North Cyprus (Author, 2015)

<p>LOCATION OF THE BUILDING</p>	<p>LEVEL DIFFERENCES IN THE BUILDING</p>	<p>ACCESSIBILITY</p>
<p>PLAN OF THE BUILDING</p> <p>FIRST FLOOR PLAN</p>	<p>Two floors connected via staircases level difference through courtyard</p>	<p>Main entrance with 22 steps from street to the building</p>
<p>SECTION OF THE BUILDING</p> <p>SECTION A-A</p>	<p>BUILDING ORIENTATION ON THE SITE</p>	<p>OPENINGS</p>
<p>K8 AREZOO KHANI, EMU, FACULTY OF ARCHITECTURE, DEPARTMENT OF ARCHITECTURE.</p>	<p>Oriented towards the slope of the land (upward South)</p>	<p>Mostly located on West Larger openings on West Smaller opening on South</p>

- Building Number 9 (K9):

Table 18 shows the location of building number 9. This building is located between a primary and secondary roads. This building has one floor with four different levels. It is clear the exterior level difference had a direct effect on interior spaces. Besides, the slope of land in this part of the village affected the courtyard level. Since, there are three different levels in the courtyard. Existing level difference in this building, divided and defined the functions Clear, which this is an opportunity the sloppy lands give to the buildings. Furthermore, this building is oriented towards the slope of the land upward the Southwest direction. Besides, all parts of this building are in related to each other like as a tree with its roots and its branch. If the trunk of the tree was not stable in the ground the branches in downwind can be bent and crack. So it is important to have a good root in the ground and have a strong trunk for perseverance.

The main access of this building is form courtyard directly to the building without any vertical elements. Access to the building is possible from one pedestrian road (Step Street) from the Northeast side and secondary access from the Northeast side, which is access for entering to the bedroom. To enter into the building, first there is a small garden that invited us with one level difference, and then with one step it is possible to go inside the building. About openings of this building, mostly they are located on the North and the largest one is located on the East. Openings are looking towards open areas instead of other buildings and roof traces are looking towards Mountain.

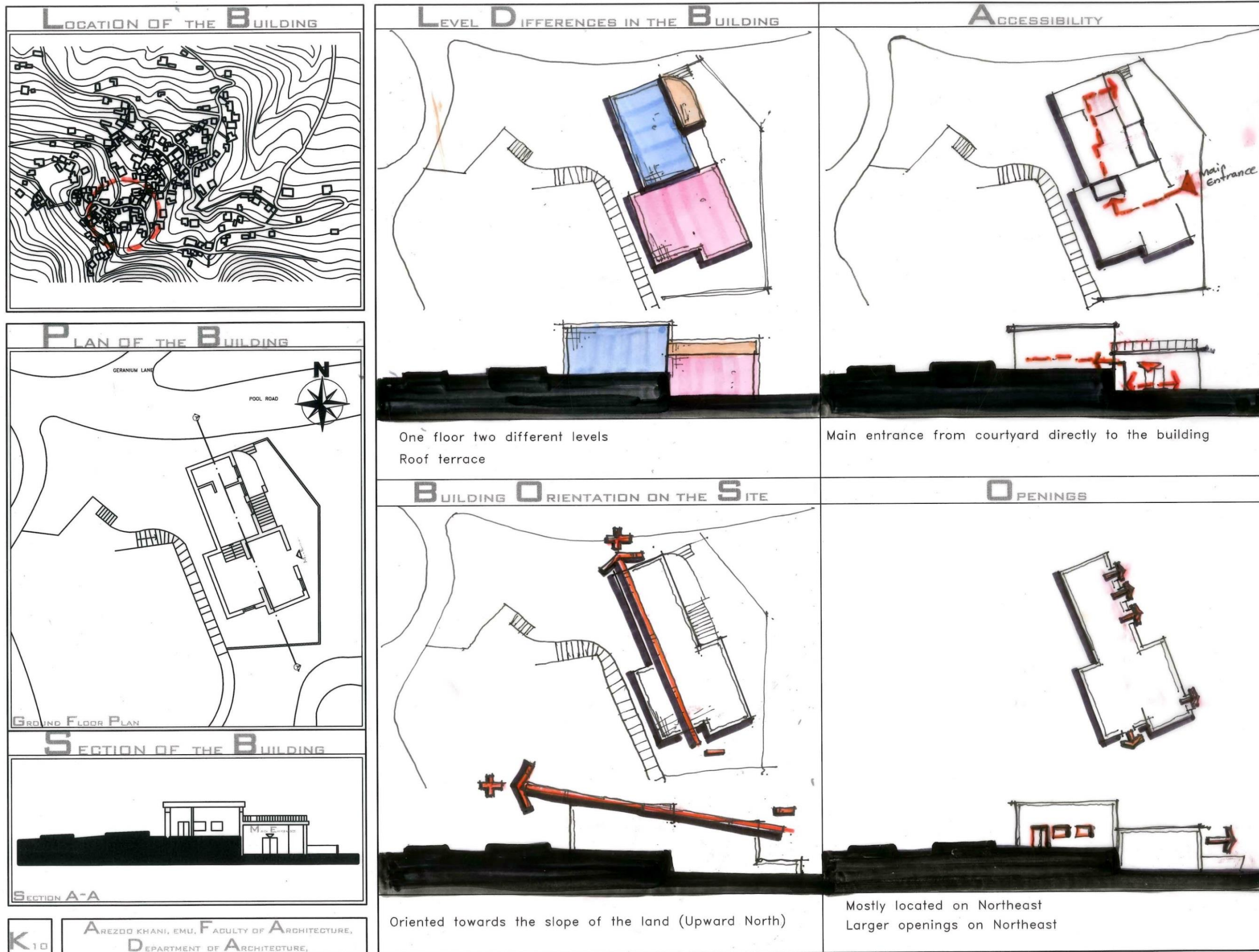
Table 18: K9, Analysis of building – K9 on Pool road, Karmi, Kyrenia, North Cyprus (Author, 2015).



- Building Number 10 (K10):

Table number 19 has a focus on building number 10. This building is located next to Pool road and this building has one floor with two different levels. There is one roof terrace in this building. Generally, this building is located on a level upper than street level (Table19). In continues, the orientation of the building is towards the slope of the land in the upward North direction. The main entrance is from courtyard directly to the building. Although, it is important to mention that to access from the main street to the courtyard there is a vertical element of access (Table19). About the openings of this building, most of them are located on the Northeast and the largest opening is located on the Northeast. Building's openings are looking towards open areas instead of other buildings.

Table 19: K10, Analysis of building – K 10 on Pool road, Karmi, Kyrenia, North Cyprus (Author, 2015).



Appreciation of Nature in Architecture: Interaction between Topography & Design in the case of Karmi (Karaman) Village, North Cyprus. North Cyprus, Eastern Mediterranean University

- Building Number 11 (K11):

The building number 11 is located between a steps street and a primary road (Pine tree road) (Table20). This building due to analysis has two floors, which are connected by staircases. The building's orientation is toward the slope of the land, upward the Northwest. Thus, the building is in harmony with its own context. In addition to the above analysis, by focusing on accessibility to the building the main access to the building is located on the street level directly to the building. There is a secondary entrance from the courtyard with a vertical element (staircases). The accessibility inside the building is horizontally. The main entrance is located on the upper level and from first floor there is an access to the roof with staircases. Furthermore, openings of this building are mostly located on the Southeast side. It is clear that the location of the building, its direction, and location and size of openings are important in the sloppy lands as well as how much sloppy land gives opportunity to design of the buildings to have high quality of the buildings.

Table 20: K11, Analysis of building – K11 on Pintree road & Plum walk, Karmi, Kyrenia, North Cyprus (Author, 2015).

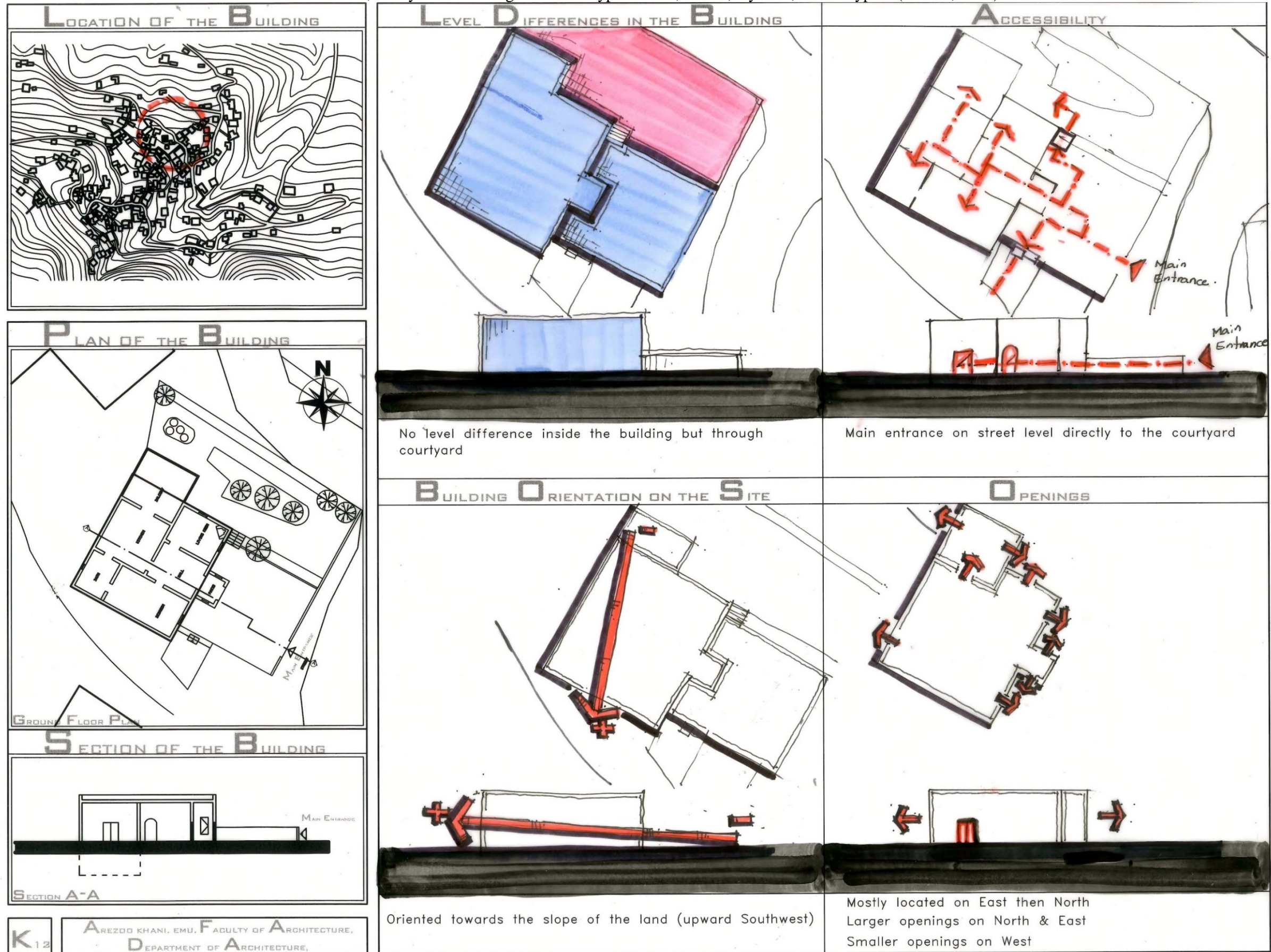
<p>LOCATION OF THE BUILDING</p>	<p>LEVEL DIFFERENCES IN THE BUILDING</p>	<p>ACCESSIBILITY</p>
<p>PLAN OF THE BUILDING</p> <p>GROUND FLOOR PLAN</p>	<p>Two floors connected via staircases</p>	<p>Main entrance on street level directly to the building Secondary entrance from courtyard via staircases</p>
<p>SECTION OF THE BUILDING</p> <p>SECTION A-A</p>	<p>BUILDING ORIENTATION ON THE SITE</p>	<p>OPENINGS</p>
<p>K11 AREZDO KHANI, EMU, FACULTY OF ARCHITECTURE, DEPARTMENT OF ARCHITECTURE,</p>	<p>Oriented towards the slope of the land (Upward Northwest)</p>	<p>Mostly located on Southeast</p>

Appreciation of Nature in Architecture: Interaction between Topography & Design in the case of Karmi (Karaman) Village, North Cyprus. North Cyprus, Eastern Mediterranean University

- Building Number 12 (K12):

According to table number 21, the building number 12 is located next to the primary road. This building is oriented towards the slope of the land, upward the Southwest direction. Hence, this building is in harmony with its own context. The building accessibility is from the primary road and the main entrance is on the street level, which directly connects to the courtyard. Besides, accessibility inside the building is horizontally. The building's openings are mostly located on the East and North sides. The largest openings are located on the North and East as well as the smallest ones are located on the West side. In this building, openings due to their size and orientation are looking towards the open areas instead of other buildings.

Table 21: K12, Analysis of building – K12 on Cypress road, Karmi, Kyrenia, North Cyprus (Author, 2015)

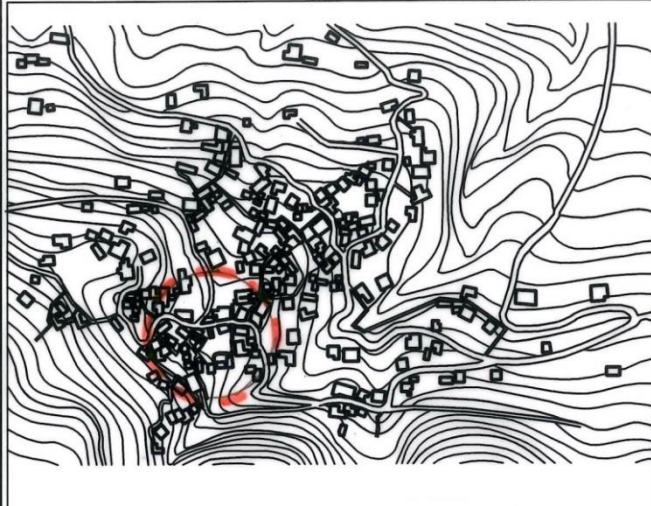
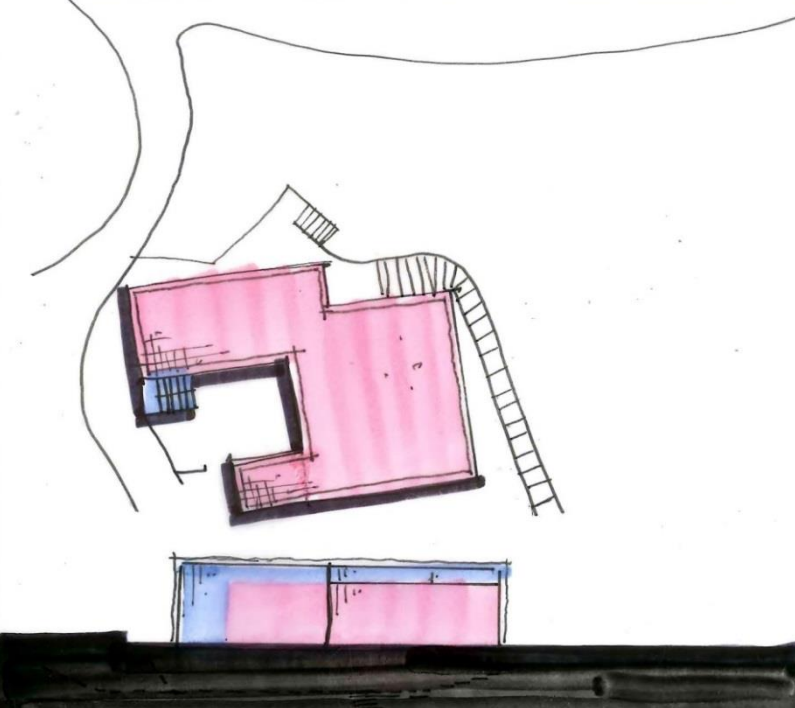
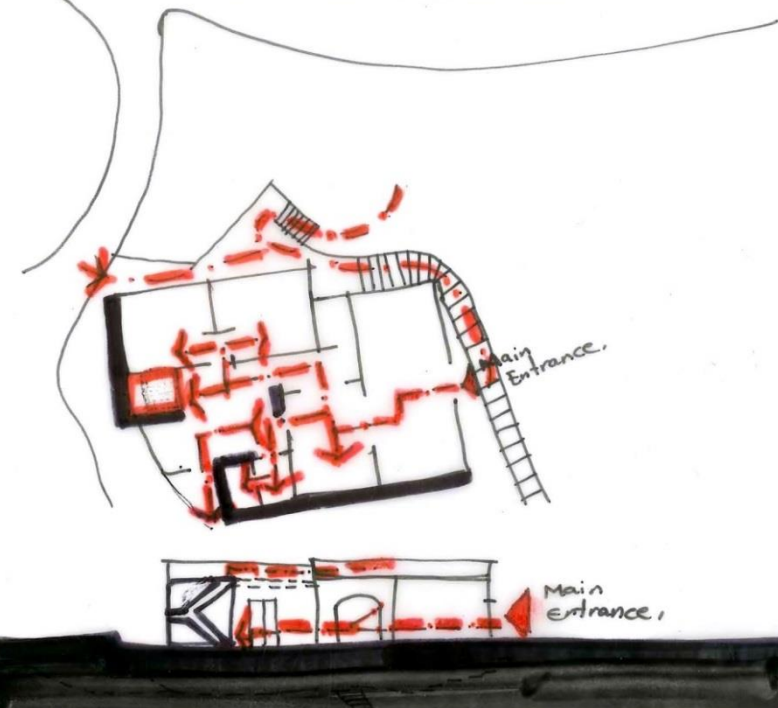
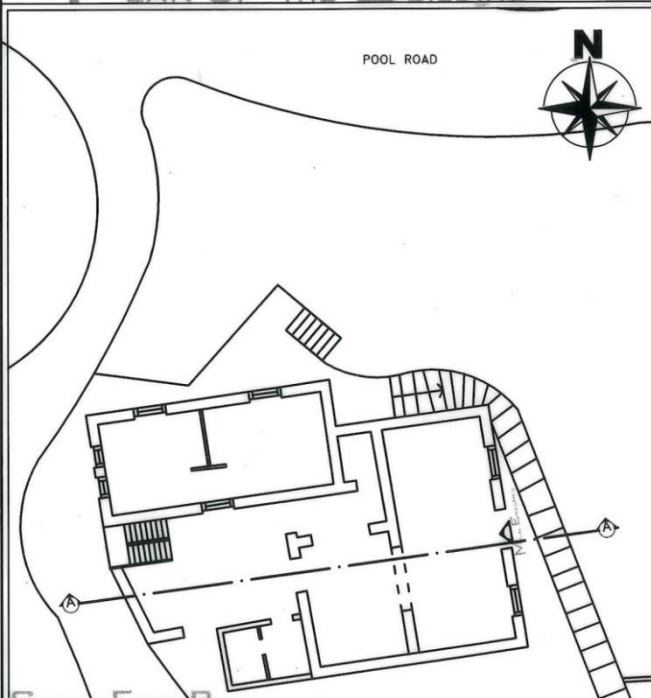
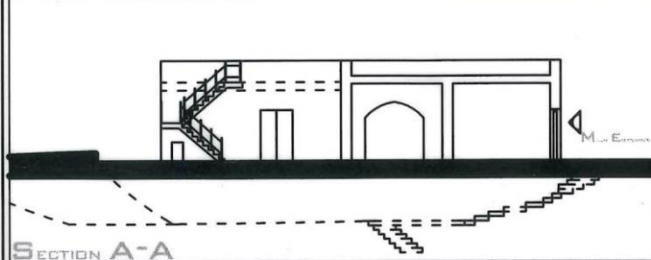
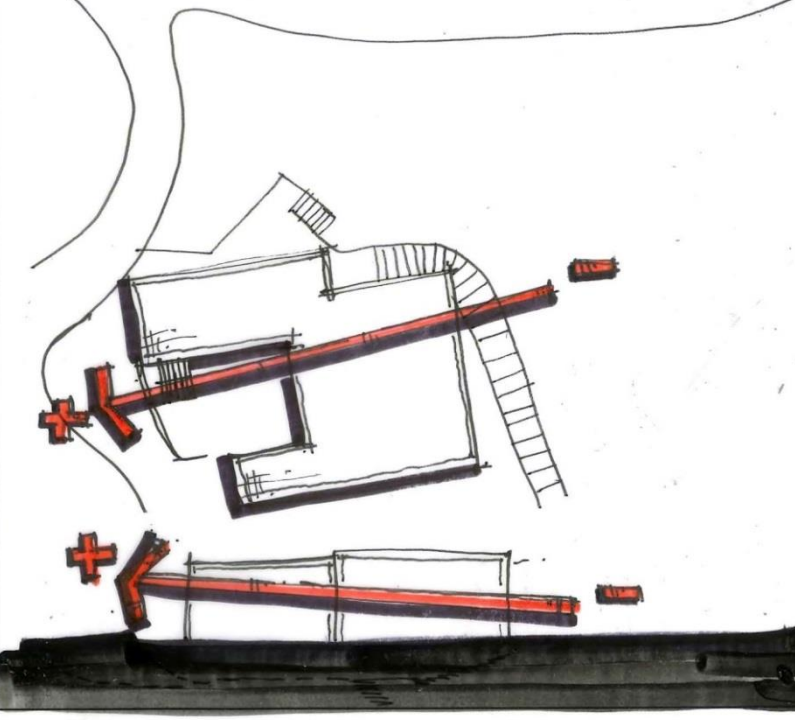
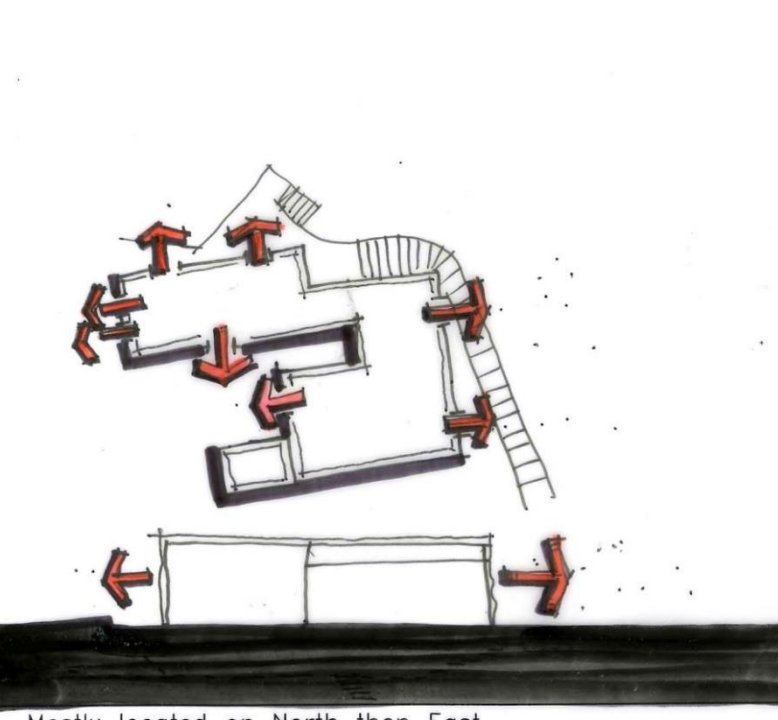


Appreciation of Nature in Architecture: Interaction between Topography & Design in the case of Karmi (Karaman) Village, North Cyprus, North Cyprus, Eastern Mediterranean University

- Building Number 13 (K13):

According to table number 22, the building number 13 is located next to the primary road (Pool road). This building does not have any level difference and it has a roof terrace. The orientation of the building is towards the land slope. In this part of the village the slope of the land is very little and it is close to be flat. Hence, this building has harmony with its context. Furthermore, to access the building from the street there are steps since the building is in the lower level of the primary road. Besides, the main entrance of the building is from the step street and in interior spaces accessibility is horizontally. However, for access to roof terraces is essential pass through the staircases. The openings of this building mostly are located on the North and East sides. The largest of them is located on the East side and the smaller one is located on the West side (Table22).

Table 22: K13, Analysis of building – K13 on Pool road, Karmi, Kyrenia, North Cyprus (Author, 2015)

<p>LOCATION OF THE BUILDING</p> 	<p>LEVEL DIFFERENCES IN THE BUILDING</p> 	<p>ACCESSIBILITY</p> 
<p>PLAN OF THE BUILDING</p>  <p>POOL ROAD</p> <p>GROUND FLOOR PLAN</p>	<p>No level difference inside the building Roof terraces</p>	<p>Main entrance from steep street directly to the building</p>
<p>SECTION OF THE BUILDING</p>  <p>SECTION A-A</p>	<p>BUILDING ORIENTATION ON THE SITE</p> 	<p>OPENINGS</p> 
<p>K13 AREZOO KHANI, EMU, FACULTY OF ARCHITECTURE, DEPARTMENT OF ARCHITECTURE,</p>	<p>Oriented towards the land (Flat)</p>	<p>Mostly located on North then East Larger openings on East Smaller openings on West</p>

- Building Number 14 (K14):

Based on the table 23, the building number 14 is located a bit far away from the road. This building has two floors which they are connected by staircases. Slope of the land in this part of the village is affected the courtyard of this building and it is clear there is level difference through the courtyard. This building has a roof terraces, which is clear in the sketches of building in table number 23. Besides, this building is located in the lower level of the street. The building orientation is towards the slope of the land, upward the West direction. The main entrance of the building from the outside is accessible by nine steps down to the building. Besides, through the inside of the building accessibility goes horizontally. Hence, from the entrance hall there is a staircases to go down level and from the living room there is another staircase for access to upper level which is roof of the building. Furthermore, there is an access into the building from the courtyard on the North part.

Due to table 23, the building's openings, are mostly located on the North and East sides. The largest openings are located on the East direction and the smaller ones are located on the West direction. Finally, this building has the comfort sun light during the day time in the interior parts.

Table 23: K14, Analysis of building – K14 on Pool road, Karmi, Kyrenia, North Cyprus (Author, 2015).

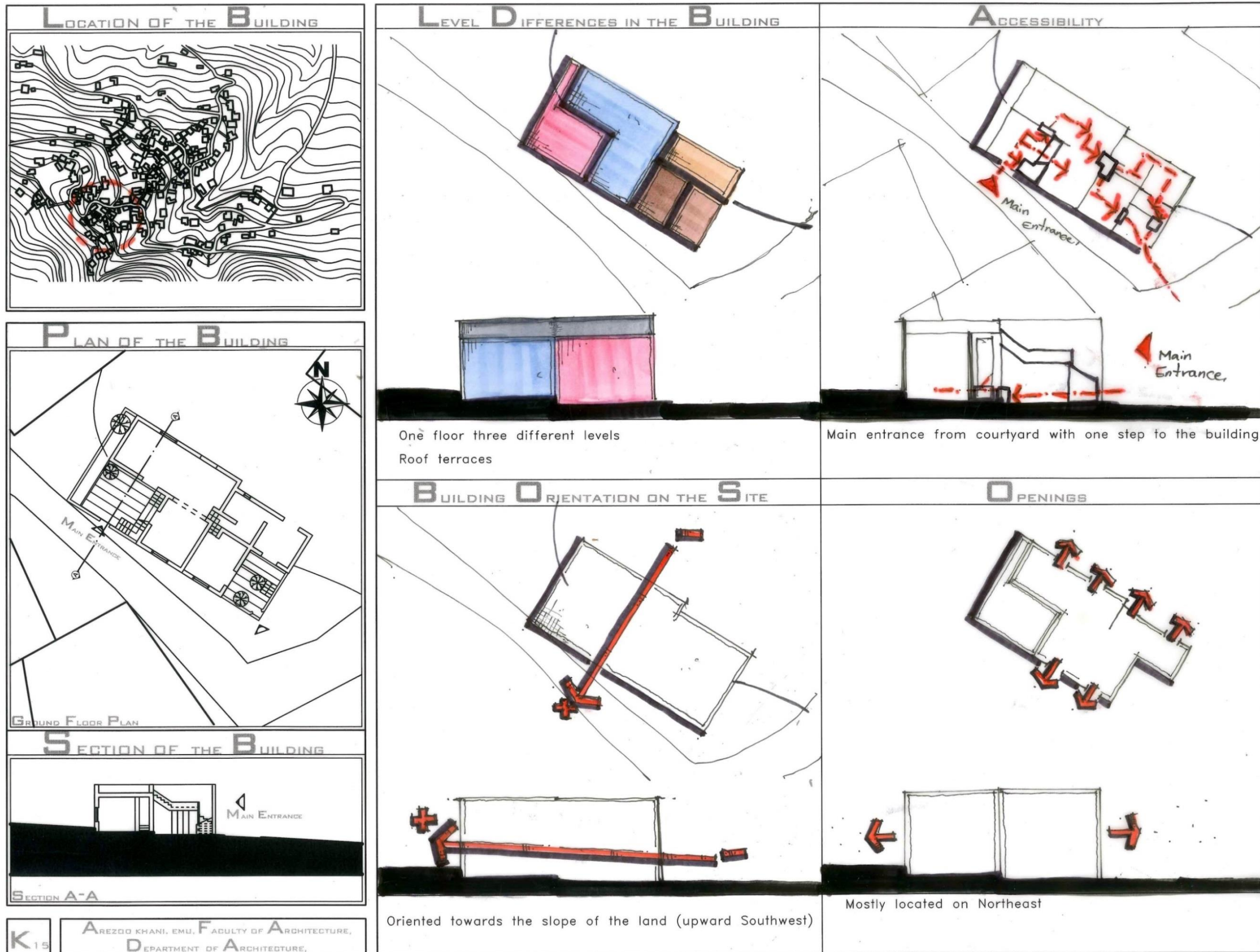


Appreciation of Nature in Architecture: Interaction between Topography & Design in the case of Karmi (Karaman) Village, North Cyprus, North Cyprus, Eastern Mediterranean University

- Building Number 15 (K15):

Due to table number 24, the building number 15 is located next to the secondary pedestrian road. The building has one floor with three different levels in exterior part. Besides, this building has roof terraces. The building's orientation is towards the slope of the land, upward in Southwest direction and it has the harmony with the environment. In sloppy land, building has a chance to have different access form different levels. The main entrance is from the courtyard with one step for access to the building. Besides, in this building existing level difference divided functions very clearly and each function is on different level. Hence, for access to each function passing from the vertical elements is essential. These vertical elements give opportunity of dance to the interior spaces. Besides, there is another access to the bedroom from the South part. In this building, openings are mostly located on the Northeast. The direction of opening gives opportunity to user of building to have a view of the open areas instead the other buildings.

Table 24: K15, Analysis of building – K15 on Almond road, Karmi, Kyrenia, North Cyprus (Author, 2015).



Appreciation of Nature in Architecture: Interaction between Topography & Design in the case of Karmi (Karaman) Village, North Cyprus, North Cyprus, Eastern Mediterranean University

4.3.1 Level differences in the selected buildings

This part has an aim to show and summarize the story's types and analyze the level difference in the selected buildings. In this regard, the level difference in the buildings and also the level difference in the courtyards are considered.

Table 25: Architectural analysis of level differences in Karimi village (Author, 2015)

Architectural analysis of Topography		Level differences in the building in terms of topography				
		One floor different levels	One floor no different levels	Different floors	Roof terrace	Level difference through courtyard
Houses	K1	✓				
	K2	✓				
	K3		✓			
	K4	✓				
	K5			✓		
	K6		✓		✓	✓
	K7		✓			✓
	K8			✓		✓
	K9	✓				✓
	K10	✓			✓	
	K11			✓		
	K12		✓			✓
	K13		✓		✓	
	K14			✓	✓	✓
	K15	✓			✓	

According to the table 25, it can be reached that 40% of selected buildings are in one floor with different levels and 33% of them just have a floor without different levels. Besides, 26% of them have different floors, which are connected via staircases, some of them from the courtyard and some of them from inside of the buildings. Moreover, 33% of them have roof terraces and 40% of selected buildings have level differences through their own courtyards. Thus, this part includes some buildings

which have level differences through inside of the buildings and some buildings which don't have level differences through inside, but they have level differences through the courtyards. It is worth noting here that based on the analysis, topography affect all buildings' levels in both internal and external spaces. In addition, users of these building have a chance to enjoy a variety of nature experiences from the roof terraces in different directions.

3.3.2 Building orientation on the sites

In the sloping land, building's orientation on the site it is too much important and all affection of the sloppy topography in the buildings it is coming from the orientation of the buildings.

Table 26: Architectural analysis of building orientation in Karmi village (Author, 2015)

Architectural analysis of Topography		Building orientation on the site in terms of topography					
		Oriented towards the slope of the land (upward South)	Oriented towards the slope of the land (upward West)	Oriented towards the slope of the land (Upward Southwest)	Oriented towards the slope of the land (Upward North)	Oriented towards the slope of the land (Upward Northwest)	Oriented towards the land (Flat)
Houses	K1	✓					
	K2		✓				
	K3			✓			
	K4				✓		
	K5			✓			
	K6			✓			
	K7	✓		✓			
	K8	✓					
	K9			✓			
	K10				✓		
	K11					✓	
	K12			✓			
	K13						✓
	K14		✓				
	K15			✓			

As mentioned in the chapter two, orientations of the buildings on the site, it is link to the land form and also the climatic issues. In general, all these issues and aspects should consider during the design of buildings. According to table 26, all buildings are oriented toward the slope of the land on their own location, which are in different direction includes 20% of them are oriented towards the slope of the land in the upward South direction, 13% of them are oriented towards the slope of the land in the upward West direction, and 47% of them are oriented towards the slope of the land in the upward Southwest direction. Besides, 13% of the buildings are oriented towards the slope of the land in the upward North direction, 6.6% of them are oriented towards the slope of the land in the upward Northwest direction and 6.6% of the selected buildings are oriented towards the flat land. Thus, it is clear that selected buildings are nicely located in harmony with the slope and topography of land.

3.3.3 Accessibility

It is mentioned that sloppy land provides another meaning to the accessibility of the buildings with various languages. Accordingly, in the following table the existing types of accessibility in selected building are explained.

Table 26: Architectural analysis of accessibility in Karmi village (Author, 2015)

Architectural analysis of Topography		Accessibility in terms of Topography							
		Main Entrance					Secondary Entrance		
		on lower level from courtyard	from courtyard directly to the building	on street level directly to the building	With steps from street to the building	from courtyard with one step to the building	on upper level from courtyard	from the courtyard in same level with main entrance	on lower level of main entrance
Houses	K1	✓					✓		
	K2			✓				✓	
	K3				✓				
	K4	✓						✓	✓
	K5	✓					✓		
	K6				✓				
	K7			✓	✓				✓
	K8				✓				
	K9		✓						
	K10		✓						
	K11								✓
	K12			✓	*1				
	K13			✓	*2				
	K14				✓	*3			
	K15					✓			

The above table is related to the architectural analysis of accessibility in terms of topography. In this table buildings are categorized in different types according to the level of their main entrances and also levels of their secondary entrances. Furthermore, main entrance of 20% of selected buildings are in the lower level of the courtyard. 13.3% of their main entrances are from courtyard directly to the buildings. Main entrance of 33.3% of that buildings are on street level directly to the buildings and in 33.3% of them to access main entrances there are steps from street to the buildings. Besides, 60% of selected buildings do not have second entrance,

they have just some openings to the courtyard. It is essential to note here that, 13.3% of secondary entrances are from courtyard with some steps of the buildings and in 6.6% of them secondary entrances are on the same level with main entrances, but in 6.6% of the buildings, secondary entrances are in the lower level in comparison with level of the main entrances. Finally, can mention it the access to 20% of secondary entrances are from street with steps to the courtyards.

In the following sketches, different types of access into the existing buildings in Karmi village are showing. In the figure 24, it is clear that the access of building is from the street to the courtyard with some steps. Besides, it is clear the directions of street and building are towards the slope of the land.

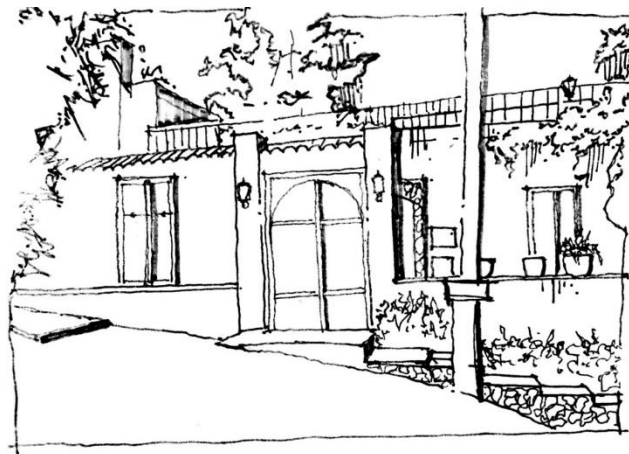


Figure 24: Entrance of the building directly to the courtyard, Karmi village, North Cyprus (Author, 2015)

In the following sketches, the existing slope of the village is clearly perceivable. Besides, due to notes mentioned above, the main characteristic of Karmi village is steps streets. In the following sketches, it is clear that the buildings are in harmony with its own context and the building's orientations are towards the slope of the site.

According to figures number 25 and 26, there are two entrances to the buildings. The main entrance is from the street and second one is from the street to the terrace. Thus, the good relationship between the building and its context give this chance to the building to have two different access from different levels directly to different floors of the buildings. Hence, in some buildings there are two access, which one of them is from the lower level to the ground floor and the second one is from the first floor. Consequently, the slope of the land affects the form of the buildings in this village (Figure 27, 28).



Figure 25: Main entrance from the upper level of step street to lower level of building (Author, 2015)



Figure 26: Secondary entrance from the lower level of step street to the upper level of building (Author, 2015)

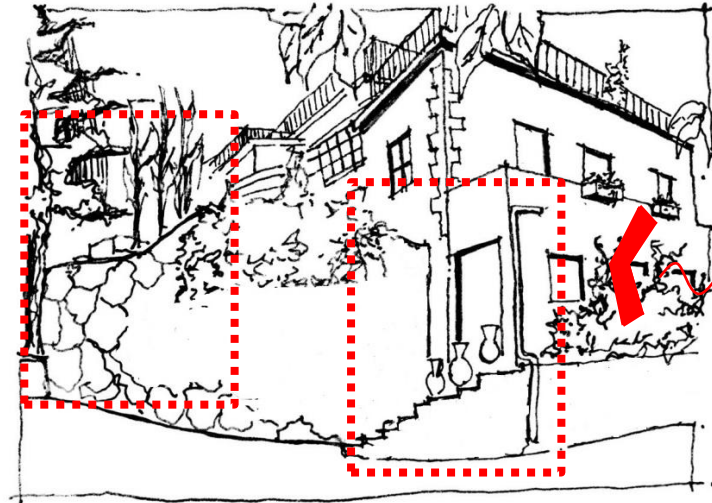


Figure 27: Two entrances from the street with steps to the different level of building (Author, 2015)

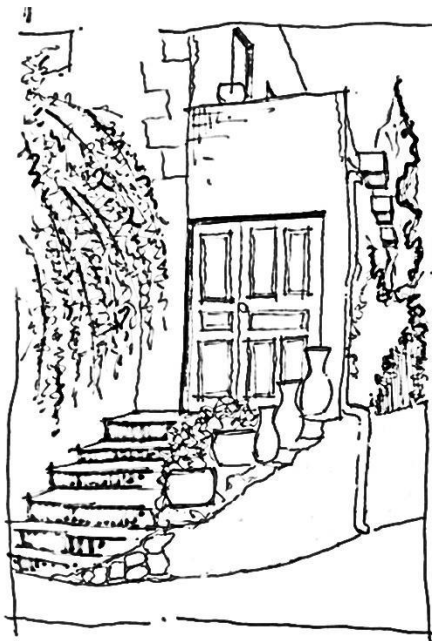


Figure 28: Secondary entrance from the street with few step to the lower level of building (Author, 2015)

Besides, in some buildings the main access to the building is from the street to the building with few steps (Figure 29). However, in the figure 30, another type of the entrance is shown, from the street there is one bridge can provides an access to the upper level of the building.



Figure 29: Entrance to the building with few steps (Author, 2015)



Figure 30: Entrance the building by the means of a bridge (Author, 2015)

3.3.4 Openings

The buildings' openings are playing a crucial role in the building's aesthetic. Hence, the direction and size of them are very important. However, openings have a direct effect on characteristic of the buildings.

Table 27: Architectural analysis of building an openings Karmi village (Author, 2015)

Architectural analysis of Topography		Building openings in terms of Topography															
		Direction of location						Direction of opening according to size									
		Mostly located on North	Mostly located on West	Mostly located on East	Mostly located on Southeast	Mostly located on Northeast	Mostly located on Northwest	Larger opening						Smaller opening			
								on North	on South	on East	On West	on Northeast	on Northwest	on West	on East	on South	westsouth
Houses	K1	✓					✓							✓	✓		
	K2	✓					✓	✓									
	K3	✓															
	K4					✓					✓						✓
	K5	✓					✓							✓			
	K6					✓	✓		✓								
	K7						✓						✓				
	K8		✓							✓							✓
	K9	✓								✓							
	K10					✓					✓						
	K11				✓												
	K12	✓			✓			✓		✓				✓			
	K13	✓			✓					✓				✓			
	K14	✓			✓					✓				✓			
	K15					✓											

Accordingly, in this part openings are analysed by focusing on two aspects, the first aspect is about which side of the buildings has more opening and second aspect is about the size of openings and the location of the largest and the smaller openings is in which direction. According to result of analysis, 53.3 % of buildings have openings on the North direction, 6.6% of them have openings on the West direction, 20% of the buildings have openings on the East direction, 6.6% of buildings have openings on the Southeast direction, 26.6% of buildings have openings in the

Northeast direction and 6.6% of the buildings have openings in the Northwest direction. As the result shows the most of the buildings have openings on the North direction. It is essential to mention that the direction of the mountain is upward to the South direction that means buildings are located in this direction to have the best view. Openings are looking towards open areas instead of other buildings and this positive aspect it is because of harmony between building's orientations with the natural topography.

Furthermore, 33.3% of the largest openings are located on the North, 6.6% of them are located on the South, 33.3% of the largest openings are located on the East, 6.6% of them are located on the West, 13.3% of the largest openings are located on the Northeast, and 6.6% of the largest openings are located on the Northwest. Besides, 33.3% of the smaller openings are located on the West, 6.6% of them are located on the East direction, 6.6% of them are located on the South direction, and 6.6% of the smaller openings are located on the West south direction (Table 28).

Generally, all old style buildings in Karmi village are appreciated to nature and they tried to use the highest level of natural light and views (Figure24-29). Obviously, the character of Karmin village is from the individual buildings that matched themselves with the existing situation of nature. Thus, the proportion of the buildings, their size, dimensions of the openings, covering materials, semi-open and open spaces around the buildings as well as landscaping elements belonging to the buildings are important items.

On the facades of the buildings on Karmi village natural and organic materials are used. Hence, some parts of the facades are covered with white gypsum or similar

materials in light colors to provide the feeling of softness and freshness on the facades. Besides, there is another special things in Karmi village that some parts of the building's façades are left without covering. Hence, organic architecture use material for beauty and decoration but in some buildings in Karmi village they leaving some facade without cover to expose the beauty and the natural characteristics of buildings. Besides, executives and opening shutters are made of materials such as stone and wood. In Karmi village the heights of the buildings are not too high, maximum buildings are in three floors and opening sizes are relatively small compared to whole areas of the facade. Due to the structural stability, load bearing walls and traditional building materials dictate these types of properties of the buildings, which are common for vernacular buildings and associate the meaning of organic and suburban areas for viewers. Thus, the facades carry hidden messages from organic ideas. Use of semi-open spaces is one of the special properties which exist in Mediterranean architecture. Incorporation of the interior spaces with open outdoor spaces through these semi-open spaces of transition are very effective in hot, humid regions. This can be seen largely through some vaulted spaces and balconies or verandas in Cyprus. Finally, these types of spaces are seen in Karmi too. Semi-open spaces and additionally giving cool and ventilated spaces are to backing the thought of "mix of the fabricated environment and nature" upheld in natural architecture; so yet this is another message from the spaces for the viewers. In organic architecture landscaping and gardening elements are another important component to which should be considered. Usage of plants, tree, pergolas, and vegetation are extensively seen in Karmi village.

Accordingly, it is essential to mention here, all buildings in Karimi village have level difference, but some of them have in interior spaces and some of them have in exterior spaces of the buildings. Besides, many of these buildings have level difference in both spaces. Furthermore, building's openings are looking towards open areas instead of other buildings.

3.4 Summary of the Chapter

As it is shown in following chart the aims of this chapter is to consists of analysis of the relationships between the topography and architecture in Karmi village, which is categorise in four part, the first part is introduction of Karmi Village (Geographic location and history), the second part is vernacular architecture of Karmi Village settlement, the third part is about the effect of the natural topography on buildings of Karmi. And the last one is summary of the chapter (Chart 5).

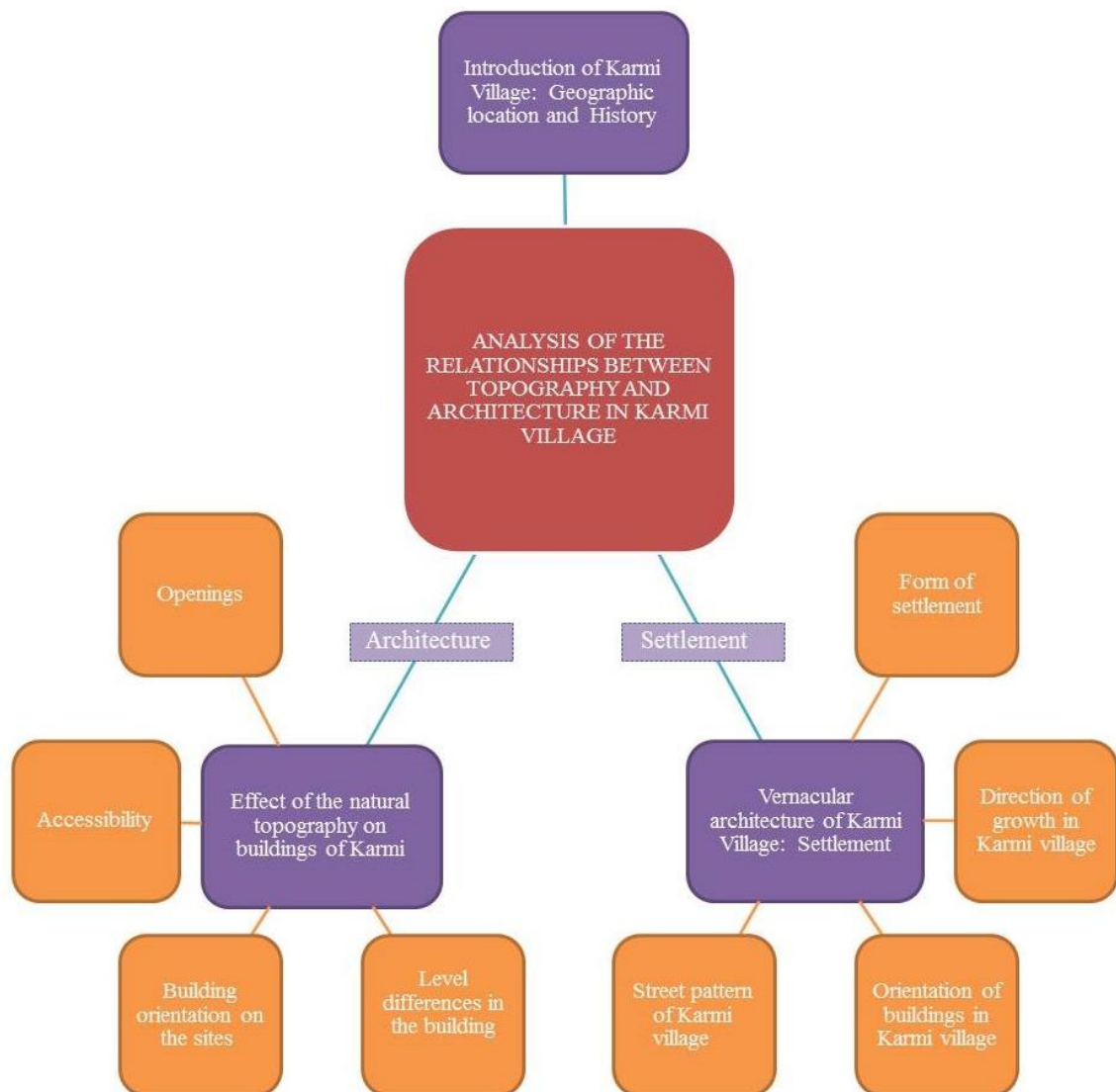
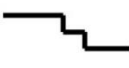







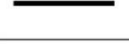



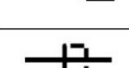
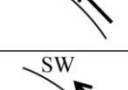


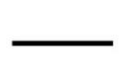




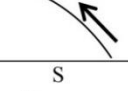








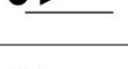









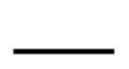
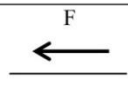


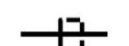
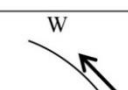







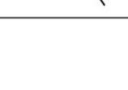








Chart 5: Summary of the chapter 3, Source: (Author, 2015)

In the following table a brief explanation on the architectural analyses of selected buildings in Karmi village based on topography is mentioned. This table consists of four parts, which the first part has focused on level difference in the buildings. In this part the role of topography in the level difference of internal and external spaces of the buildings are analyzed. Second part is about the orientation of buildings on the site, which is related to the position of the buildings on the site to understand the buildings are in the harmony with the site or not. The third part of this table has focused on the accessibility to the buildings, the circulation inside of the selected buildings, main entrance levels, and if any building has a secondary entrance, it should be clear the level of that entrance is lower or upper than the main entrance. Thus, this analysis will make clear how selected buildings can have a nice harmony with the sloppy land. Furthermore, in this case, it will be clear how much different accesses and better access to whole building have many benefits. However, the most important ones are the different level and numbers of the floors in selected buildings will give different identity to the spaces which is based on existing natural level difference. Besides, the sloppy land gives a chance to the buildings to arrange the function organization and circulation inside the buildings, which is a special positive identity for these buildings. The last part of the analysis, it is about the building's openings. In this analysis location and size of windows and doors as well as their direction and direction of views from inside to outside are analyzed. In this part of analysis the main aim is to understanding level of respect in the aesthetic part of architecture to portray the beauty of nature from the inside of the selected buildings (Table29).

Table 28: Architectural analysis of topography from selected building in Karmi village (Author, 2015).

#	Level differences in the building		Building orientation on the site		Accessibility		Openings	
Houses	K1	One floor three different levels 	Oriented towards the slope of the land (upward South)		Main entrance on lower level from courtyard Secondary entrance on upper level from courtyard		Mostly located on North Larger openings on North Smaller ones on west & East	
	zK2	One floor two different levels 	Oriented towards the slope of the land (upward West)		Main entrance on street level directly to the building secondary entrance from the courtyard		Mostly located on North Larger openings on North and South	
	K3	One floor No different levels 	Oriented towards the slope of the land (Upward Southwest)		Main entrance with four steps from street to the building		Mostly located on North	
	K4	One floor four different levels 	Oriented towards the slope of the land (Upward North)		Main entrance on upper level from courtyard Secondary entrance on lower level		Mostly located on Northeast Larger openings on Northeast & Smaller ones on westsouth	
	K5	Two floors connected via staircases Ground floor with 2 different levels 	Oriented towards the slope of the land (Upward Southwest)		Main entrance on lower level from courtyard Secondary entrance on upper level from courtyard		Mostly located on North Larger openings on North & Smaller ones on west	
	K6	One floor No different levels Roof terrace 	Oriented towards the slope of the land (upward Southwest)		Main entrance from street with fourteen steps to the building		Mostly located on Northeast Larger openings on North & East	
	K7	No level difference inside the building but through courtyard 	Oriented towards the slope of the land (upward Southwest)		Main entrance from street level directly to the building secondary entrance from street with 3 steps to courtyard		Mostly located on Northwest Larger openings on Northwest	
	K8	Two floors connected via staircases level difference through courtyard 	Oriented towards the slope of the land (upward South)		Main entrance with 22 steps from street to the building		Mostly located on West Larger openings on West Smaller opening on South	
	K9	One floor four different levels Three different levels in courtyard 	Oriented towards the slope of the land (upward Southwest)		Main entrance from courtyard directly to the building		Mostly located on North Larger openings on East	
	K10	One floor two different levels Roof terrace 	Oriented towards the slope of the land (Upward North)		Main entrance from courtyard directly to the building		Mostly located on Northeast Larger openings on Northeast	
	K11	Two floors connected via staircases 	Oriented towards the slope of the land (Upward Northwest)		Main entrance on street level directly to the building Secondary entrance from courtyard via staircases		Mostly located on Southeast	
	K12	No level difference inside the building but through courtyard 	Oriented towards the slope of the land (upward Southwest)		Main entrance on street level directly to the courtyard		Mostly located on East then North Larger openings on North & East Smaller openings on West	
	K13	No level difference inside the building Roof terraces 	Oriented towards the land (Flat)		Main entrance from steep street directly to the building		Mostly located on North then East Larger openings on East Smaller openings on West	
	K14	Level differences through courtyard Two floors connected via staircases Roof terraces 	Oriented towards the slope of the land (upward West)		Main entrance with nine steps down to the building		Mostly located on North then East Larger openings on East Smaller openings on West	
	K15	One floor three different levels Roof terraces 	Oriented towards the slope of the land (upward Southwest)		Main entrance from courtyard with one step to the building		Mostly located on Northeast	

Chapter 4

CONCLUSION

Since, this thesis focused on impacts of topography on the built environment, in first chapters there has been made a survey on this issue in the existing literature. In Chapter 2 impacts of topography on the formation and urban characteristics of a city have been discussed while in addition effects of topography on individual buildings in architectural scale has been explained. Chapter 3 is an attempt for examining these impacts of topography on built environments in a selected case study.

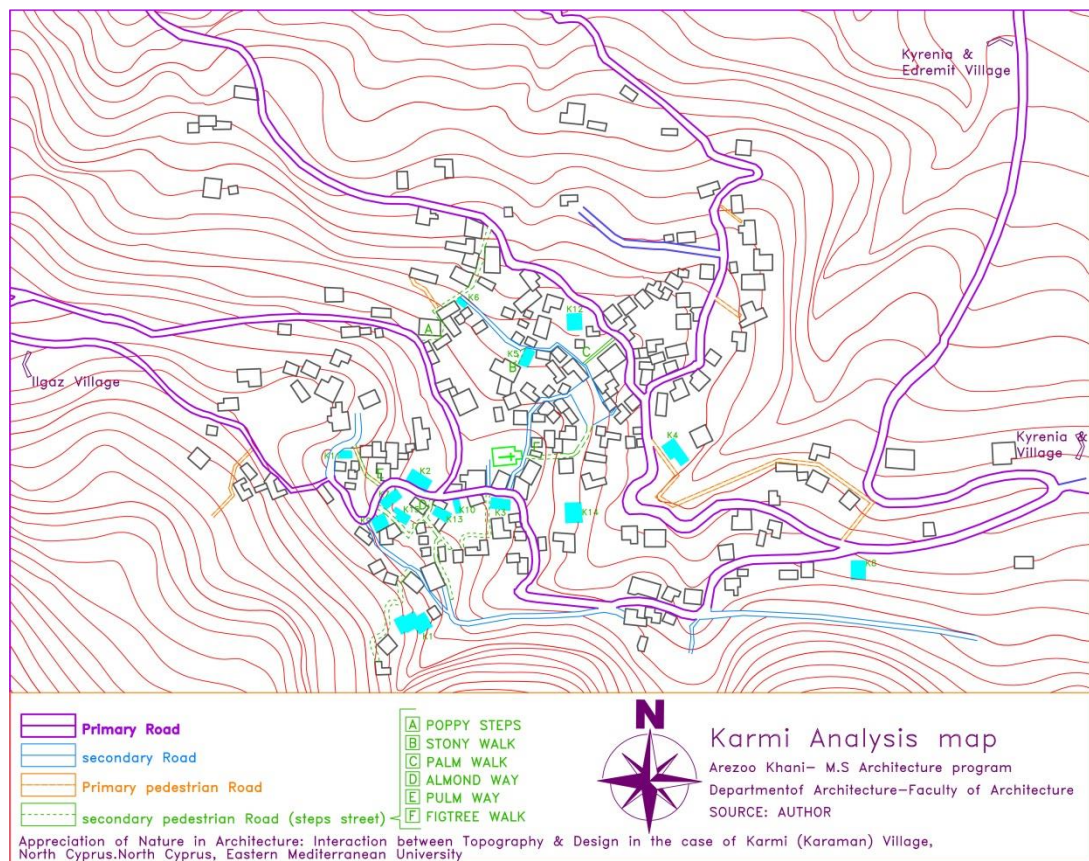
Vernacular architecture of Karmi Village: Settlement

Accordingly, Karmi as a kind of the mountainous village in North Cyprus has been selected in order to be examined as the case study for this research. It has been tried to analyze this village based on the literature survey. The analysis has lead the study toward the following results:

Firstly the morphological characteristics of the village were analysed: settlement pattern of the whole village seems to be shaped organically without any common planning process and arranged according to the slope of the land. The buildings are aligned into the topographical lines, which create a kind of level difference between interior space organizations. The whole village has been formed towards the North-East direction along with the slope of the mountains.

The buildings are located individually in certain distance with the others, while they are connected with stairs in between. Most of the buildings have entrances from

different levels. Therefore, it can be asserted that level differences in the natural environment which were handled by public stairs in urban scale has affected interior spaces as well. Also, a building which seems to be one floor from one side, can be design as, two or three story building from the other side due to the topographical characteristic (Map 5).



Map 5: Karmi(Karaman) village, Analysis map (Author, 2015)

The effect of the natural topography on buildings of Karmi

Secondly, role of topography on architectural characteristics in this village has been analyzed. Based on four main architectural aspects which have been under influence of topography, it has been tried to analyze 15 houses of this village. Although, in the first look these buildings might not seem to have common characteristics, after analyzing the “level differences in the building”, “building’s orientation on the site”,

“accessibility” and “openings”. A kind of common architectural language among these buildings, affected by the topography of the site has been inspected.

Obviously, in all of these houses, slope of the land has affected the interior space organization as well. It has not been tried to flattening the land and locate the building on it, but the whole building has been formed on according to the slope of its headstock. Different interior spaces have been defined at different levels according to the topography. In some of the buildings there are slight level differences with 2-3 steps while in some of the others level differences can be seen as high as a floor of a building connected mostly by one-way straight staircases.

All of the buildings are oriented towards North which goes along with the slope of the land. Therefore, they are not, neither blocking the others view or light nor obstructing the accessibility of the other houses. This is where being oriented towards the topography has come to help architecture to use natural light and view besides providing the best possible access to the buildings.

In almost all of these houses there are more than one access to the building which are defined at different levels for an easier approach to interior spaces. Since, the radical slope of the mountain results in creating step streets through exterior spaces generating different entrances in various levels seems to be unavoidable. Moreover, since the buildings are oriented towards North in harmony with natural slope the openings are also located on the North side while they get even larger in that façade which is also related to the interior spaces placed in that part (Table 30).

Regional architecture is the architecture of the natural environment and developed certain region / climate, while the house itself can be characterized as a necessary piece of the earth, or as an expansion of the eco-framework (Jovanovic-Popovic et al., 2012).

Traditional buildings are placed in the village independently relying upon the land topography, and a few houses meet up to shape gatherings of houses. The houses distributed to that of the earth by one, sometimes in their own groups and not to interrupt the view to one another because of the slope presents a view of harmony with nature. Each house in this Regulation may use natural sources like wind and sun without blocking. As emphasized in whole thesis the main of this analysis are to know more about the architectural framework in sloppy land.

This research attempts to reveal the secrets applied in such sustainable buildings, consistent, elegant, reliable and eco-efficient in Karmi. This kind of approach can be seen in Karmi Village but in most of the vernacular settlement in which buildings seem to be an inseparable part of the land. In such villages, both architecture and nature are responding to each other. These kinds of buildings are not showing themselves off with strange appearances to boast their existence, but they are living there in harmony with the natural environment surrounded. It seems that nature has embraced those architectural entities and gives identity to them. Although the traditional tissue and the silhouette of the village has been affected by the new built environment and following the contemporary design trends and technologies, but, the village still provides endless opportunities for researchers to learn more about the power of nature and topography on architecture with several cases.

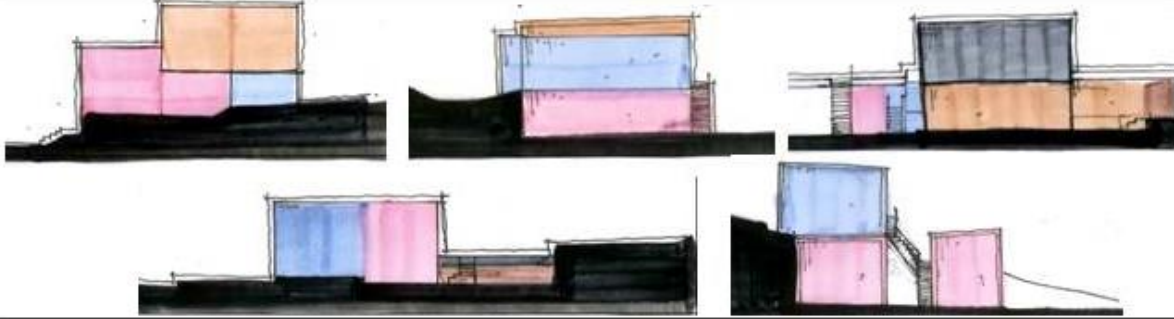
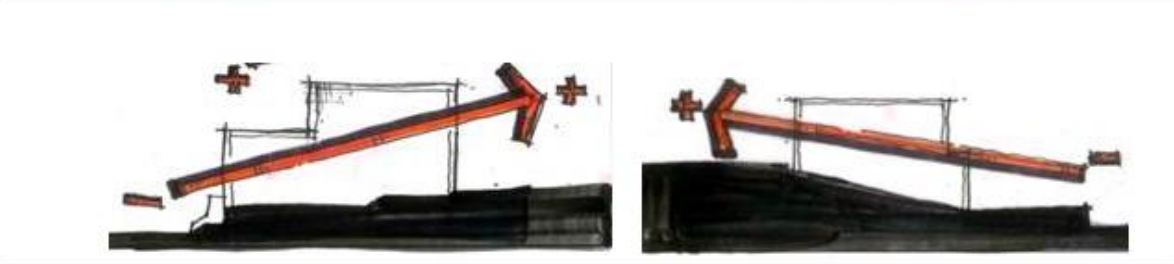

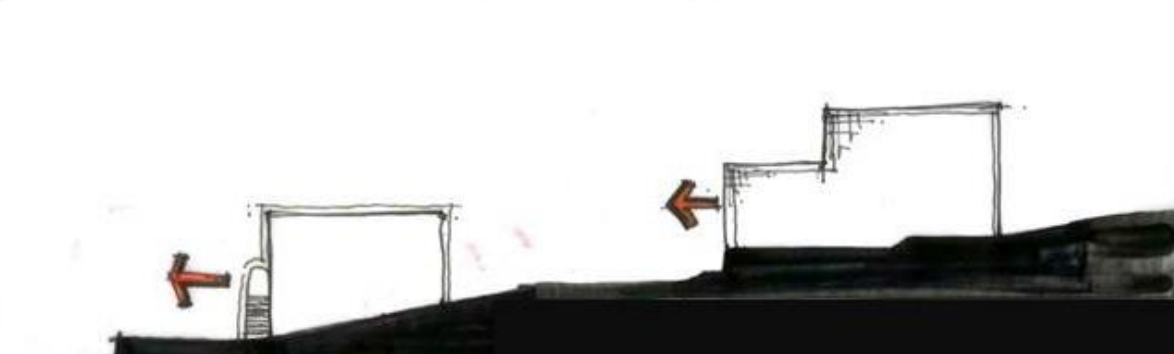
Although, current developments in building techniques make every kind of construction possible they are not mostly used parallel with nature. These days, we are excavating the ground or filling it up and forgetting about the potentials and the characteristics of the site in order to build up our edifices. But it shouldn't be forgotten that architecture exists to appreciate the nature which gives the headstock, materials and ideas to it. That is why characteristics of the context have to be reflected in architectural works. Topography as one of the important features of a site can affect the built environment from the settlement scale up to interior spaces.

Since, the positive aspects of topography usage have been discussed and examined in the case of Karmi village in previous chapters, it is mandatory for contemporary architects to be aware about the potentials of the topography of settlements in the process of designing and implementing. In Karmi as explained in details in chapter two and three, topography has various effects on “form of settlement”, “direction of the growth”, “orientation of plot” and “street patterns” in the layout pattern of Karmi. From the perspective of architecture, topography has an influence on “level differences in building”, “building orientation on the site” and “visual, physical accessibility”. In order to achieve well-integrated architecture in Karmi village and other steepy lands, architects should pay attention to topographical aspects to adopt them in their design processes. Following such an approach will lead contemporary architecture to have a stronger relation with its own base and context. As shown in both table 30 and 31, the design approaches examined in Karmi village can be accepted as guidelines for architects, whom aims for proper designs in appreciation of nature in this village.

Table 30: interaction between topography and settlement in Karmi Village (Author,2015).

Interaction Between Topography and Settlement in Karmi Village	Form of Settlements	<ul style="list-style-type: none"> ➤ Mountains (steep land) 	
	Direction of Growth	<ul style="list-style-type: none"> ➤ Goes along with the slope of the land ➤ In the mountainous area, settlement is located on the upper foothills due to the cooler weather on the lower level of hills and also in this part of the hills, during night time and risk of floods. ➤ Top part of the mountain, due to severe wind, is not suitable for location of the settlement. ➤ In the Karmi village the best part for location of settlements because of aforementioned reasons and interaction with nature is the middle of the mountain. 	
	Orientation of Plots	<ul style="list-style-type: none"> ➤ Buildings are located on the North -East directions part to reach maximum sunshine. ➤ Buildings are aligned to the slope of the land. 	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <ul style="list-style-type: none"> ▪ Preferred ▪ Respect natural topography </div> <div style="text-align: center;"> <ul style="list-style-type: none"> ▪ Not preferred ▪ Grade larg flat terrace </div> </div>
	Street Pattern	<ul style="list-style-type: none"> ➤ On sloppy land, roads are at minimum widths that can be functionally acceptable. ➤ On sloppy lands , placing buildings on the streets that are parallel with contour lines help accessibility and better view for the building. ➤ Perpendicular roads to the contours can minimize the amount of levelling needed, but can cause access and insufficient view problems limitation (A). ➤ In Figure (B) retaining walls are required between adjacent buildings. Social interaction the roads running perpendicular to the land is easier than along the streets running parallel to the land. ➤ Step streets are main type of streets running perpend to the land. ➤ Steps streets provides vertical circulation between upper level of the settlement and lower level of the settlement. 	<div style="text-align: center;"> <p>A) Roads running perpendicular to the land</p> <p>B) Roads running parallel to the land</p> </div>

Table 31: Important Architectural design approach on Karmi Village (Author, 2015).

Important Architectural design approach in Karmi Village	Level differences in the buildings	<ul style="list-style-type: none"> ➤ Different levels on a single floor. ➤ Roof terraces. ➤ Leveling on courtyards. ➤ Entrances on different levels. 	
	Building orientation on the site	<ul style="list-style-type: none"> ➤ Orientations of the buildings is linked to the land form and the climatic issues. ➤ Buildings are oriented towards the slope of the land. 	
	Accessibility	<ul style="list-style-type: none"> ➤ Steep land provides various typologies for entrances. ➤ Two entrances from different levels. ➤ Main entrances with steps. 	
	Openings	<ul style="list-style-type: none"> ➤ The buildings' openings are playing an crucial role in the buildings' aesthetic. Hence, the direction and size of them are very important. ➤ Openings have direct effects on façade and climatic characteristics of the buildings. ➤ Openings looking towards open areas on the North side. ➤ Openings on the North side are larger than the South side of the buildings and provides better view towards the Sea and nature. 	

However, it is important to respect the land which is hosting our buildings with its own special characteristics. A modest building which goes along with its headstock has more words to say than the one which is raised by ignoring its base. A building has to flow on the site gently in harmony with its surroundings in order to strengthen its capacities.

“No house should ever be on a hill or on anything. It should be of the hill. Belonging to it. Hill and house should live together each the happier for the other.”
(Wright, 2005, p. 168)

REFERENCES

- Ahuja, R., & Rao, V. (2005). Natural Cooling Of Residential Buildings Hot-Dry Climated. *Asian Journal Of Civil Engineering (Building And Housing)*, 101,111.Vol. 6,.
- AKIN , E. (2012). Vernacular and Contemporary Together: Ortamahalle, Akçaabat. *6th International Seminar on Vernacular Settlements – 2012, ‘Contemporary Vernaculars: Places, Processes and Manifestations’* (s. 176-186). Famaguta, North Cyprus: Eastern Mediterranean University, Faculty of Architecture .
- Anna-Maria, V. (2009). Evaluation of a sustainable Greek vernacular settlement and its landscape:Architectural typology and building physics. *Building and Environment*, 1095–1106.
- Asatekin, G. (2007). Understanding traditional residential. *The Journal of Architecture*, 389-414.
- Bowring, J. (1995). Pidgin Picturesque. *Landscape Review*, 56-64.
- Carlson, A. (2000). *Aesthetics and the Environment, The Appreciation of the Nature, Art and Architecture*. New York: Routledge imprint of the Taylor & Francis Group.
- Davies, S; Higgins, K.M.; Hopkins, R.; Stecker, R.; Cooper, D.E.;. (2009). *A Companion to Aesthetics*. UK: Blackwell publishing Ltd.

Department of Planning and Community Development. (2001). *The Neighborhood Model: Building Block For The Development Areas*. Albemarle: Albemarle County Board of Supervisors.

Frampton, K. (1995). *Studies in Tectonic Culture, the poetic of Construction in Nineteenth and Twentieth Century Architecture*. London, England: Massachusetts Institute of Technology press.

Fuentes, J. (2010). Methodological bases for documenting and reusing vernacular farm architecture. *Journal of Cultural Heritage*, 11(2), 119-129.

Ghobadian, V. (2009). *sustainable traditional building of Iran*. Tehran: Dubai university.

Gursan, E. (2002). *A study on the Formation of Exterior Spaces in Relation to Topography: Case studies of Karmi and Korkuteli Villages in North Cyprus*. Famagusta: Eastern Mediterranean University.

Hobbs, J. (1980). *Apology—A Study of Atmospheric Resources*. London: Butterworths.

House, S., & House, C. (2004). *Mediterranean Villages an architectural journey*. Australia: National Library of Australia.

Hyland, A. (1999). Ethnic Dimensions to World Heritage: Conservation of the Architectural Heritage of the Turkish Republic of Northern Cyprus. *Journal of Architectural*, 5:1, 59-74.

Jovanovic-Popovic, M., Sunjkic, V., & Tomovska, R. (2012). Aesthetics of Vernacular Architecture. *Opportunities, Limits & Needs Towards an environmentally responsible architecture Lima*. Perú.

Kakouei, M.; Kakouei, M.; Suberania, K.; Musa Kahn, S.; Jahangirzadeh, A.; Akib, SH.; (2012). Masouleh: A City; a History. *World Academy of Science, Engineering and Technology*, 1333-1338.

Konstantinidis, A. (1975). *Elements for self-knowledge - towards a true architecture*. Athens.

Kostof, S. (1995). *A history of architecture: settings and rituals*. New York: Oxford University Press.

Leatherbarrow, D. (2002). *Uncommon Ground Architecture, Technology, and topography*. US: Massachusetts Institute of Technology Press.

Leatherbarrow, D. (2004). *Topographical Stories*. US: University of Pennsylvania Press.

Leatherbarrow, D. (2009). *Architecture Oriented Otherwise*. NY: Princeton Architectural Press.

- Lehigh Valley Planning Commission. (2008). *Steep Slopes, Guide Model Regulations*. D&L NHC, Inc.
- Memarian, G.H. (1997). *Memari Maskoony Irani, Borungara*. Elmo Sanat University.
- Memarian, GH. (1991). *An introduction to house typology in Iran: Houses without courtyards*. Tehran: Iran University of Science and Technology.
- Memarian, GH.; Sadoughi, A. (2011). Application of access graphs and home culture: Examining factors relative to climate and privacy in Iranian houses. *Scientific Research and Essays*, Vol. 6(30), pp. 6350-6363.
- Morris, A. J. (2013). *History of urban form before the industrial revolution*. New York,: Routledge press.
- Morrish, G. (2008). *Street Design Guidelines for Landcom projects*. Parramatta: Cox Richardson.
- Moughtin, C. Shirley, P. (2005). *Urban Design: Green Dimensions*. UK: Architectural Press, An imprint of Elsevier.
- Neutra, R. (1954). *Survival Through Design*. NY: Oxford University Press.
- Neutra, R. (1971). *Building With Nature*. NY: Universe Books.

- Ozdeniz, M. (2009). *Environmental Issues in Architecture*. Norht Cyprus : Unpublish.
- Ozorhon, G., & Ozorhon, I. (2014). Learning from Mardin and Cumalıkızık: Turkish Vernacular. *arts*, 175-189.
- Phillips, D. (2004). *Daylighting: natural light in architecture*. Burlington: Architectural press.
- Rahmatabady, S., & Amjadian, K. (2012). The impact of mountainous geography of west of Iran on architecture and form of Hawraman dwelling. *International Scientific Journal*.
- Richards, J. (1966). High Density Hillside Housing. *The Architectural Review*, Volum:139 (832). pp. 414_415.
- Schulz, N. (1971). *Existence, Space and Architecture*. London: Praeger Publishers.
- Schulz, N. (1980). *Genius Loci, Towards a Phenomenology of Architecture*. NY: Rizzoli press.
- Shellard, H., & Lamb, H. (1968). Design guide climate: climate and topography. *The Architect*, Volume148 (41). pp .823-827.
- Watson, D., Plattus, A., & Shibley, R. (2003). *Time-Saver Standards for Urban Design*. New York: McGraw-Hill Professional.

Williams, D. E. (2007). *Sustainable Design - Ecology, Architecture And Planning*.

Canada: John Wiley & Sons, Inc.

Williamson, T. et al. (2003). *Understanding Sustainable Architecture*. London : Spon
press.

Zargar, A. (2003). *vernacular architecture of iran*. Tehran: Shahid Beheshti
university.

Zhai, Z., & Previtali, J. (2010). Ancient vernacular architecture: characteristics
categorization and energy performance evaluation. *Energy and Buildings*,
42(3), 357-365.