

# **Relationship between the Urban Form and Socio-Spatial Segregation: The Case of Famagusta**

**Aida Jalalkamali**

Submitted to the  
Institute of Graduate Studies and Research  
in partial fulfillment of the requirements for the Degree of

Master of Science  
in  
Urban Design

Eastern Mediterranean University  
September 2014  
Gazimağusa, North Cyprus

Approval of the Institute of Graduate Studies and Research

---

Prof. Dr. Elvan Yılmaz  
Director

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

---

Prof. Dr. Özgür Dinçyürek  
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 Urban Design.

---

Prof. Dr. Naciye Doratlı  
Supervisor

---

Examining Committee

1. Prof. Dr. Naciye Doratlı

2. Prof. Dr. Şebnem Önal Hoşkara

3. Assoc. Prof. Dr. Türkan Uraz

## **ABSTRACT**

Considering the urban form of cities in North Cyprus, urban segregation can be considered as one of the major problems after 1974. The city of Famagusta which is located on the east of the island, is no exception with regard to this general problem; though in this case the problem of urban segregation have been intensified due to different geographical limitations, effects of division of the city after the war in 1974, and political decisions. Thus, segregated urban form of Famagusta affects the social structure of city in a negative way.

This thesis explore the urban form in relation with socio – spatial segregation, because physical separation of different social groups in the city has a distinct direct relationship to the way cities are shaped and structured. Understanding and investigating this relationship quantitatively is the major focus of this study. This thesis suggest that the more a spatial structure of a city become fragmented, the more it become socially segregated as well. In order to explore the statement, and study this relationship two methodologies of ‘Space Syntax’ and ‘Social Area Analysis’ are utilized in this study. Methodology of space syntax will analysis the urban form of Famagusta neighborhood by neighborhood based on how much they are accessible, integrated, and intelligible, then in the second part, the methodology of social area analysis will explore the social structure of each neighborhood through census data based on socio – economic variables of education, income, and occupation. Then results of physical and social structure of neighborhoods will put together to show how much they are matched and affect each other.

**Keywords:** urban form, urban segregation, space syntax, socio – spatial segregation,  
social area analysis

## ÖZ

Kuzey Kıbrıs'taki kent formları göz önünde bulundurulduğu zaman, 1974 sonrasında kentlerde kentsel ayrışmanın ana problem olduğu görülmektedir. Kıbrıs Adası'nın doğusunda yer alan Gazimağusa kenti de, Ada genelinde yaşanan bu problemle karşı karşıya bulunmaktadır. Gazimağusa'da yaşanan kentsel ayrışmanın coğrafik sınırlamalara, savaş sonrası bölünme ve politik kararlara bağlı olarak ortaya çıkmış olmasının yanı sıra, ayrılmış kentsel formu da Gazimağusa'nın sosyal yapısını olumsuz yönde etkilemektedir.

Bu tezde kentsel form ve sosyo-mekansal ayrışma arasındaki ilişki irdelenmektedir. Çünkü, farklı sosyal grupların fiziksel ve mekansal olarak ayrışmasının, kentin oluşum ve şekillenmesi ile doğrudan ilişkisi vardır. Bu ilişkinin nicel çözümleme yoluyla anlaşılması ve incelenmesi bu tezin temel hedefidir. Sonuç olarak bu tez , bir kentte ne kadar fazla mekansal ayrışma varsa, o kadar sosyal ayrışma yaşandığını önerir.

Bu tezde işlenecek olan konuyu daha detaylı anlamak, açıklamak ve irdelemek için iki farklı method kullanılmıştır. Bunlardan ilki 'Mekan Dizimi' ve ikincisi ise 'Sosyal Alan Analizi' dir. Kullanılan Mekan Dizimi methodu ile, Gazimağusa kentinin kentsel formu mahalle mahalle analiz edilerek, mahallelerin ne kadar ulaşılabilir olduğuna, birbirleri ile ne kadar entegre olduklarına ve her birinin ne kadar anlaşılabilir olduğuna bakılacaktır. İkinci method olan Sosyal Alan Analizi methodu ile de, nüfus sayımı sosyo ekonomik verilerinden elde edilen eğitim, gelir ve meslek değişkenleri analiz edilerek, kentin her mahallesinin sosyal yapısı irdelenecektir. Daha sonra, mahallelerin fiziki ve sosyal yapısına ilişkin olarak ortaya çıkan bulgular biraraya getirilerek, bu

bulguların birbiri ile ne kadar eşleştiiğini ve birbirlerini ne kadar etkilediđi irdelenecektir.

**Anahtar kelimeler:** kent formu, kentsel ayrışma, mekan dizimi, sosyo mekansal ayrışma, sosyal mekan analizi, Gazimağusa.

# **DEDICATION**

I would like to dedicate this study to my Family as an indication of their importance  
in this study as well as my life.

## **ACKNOWLEDGMENT**

I would like to express my appreciation to my supervisor Prof. Dr. Naciye Doratlı for her kind support, patient and invaluable contribution to my work. She made me to try my best, and work hard. Without her generous love and supervision I couldn't finish this study as it is now.

I owe quit a lot to Aminreza Iranmanesh who encourage and supported me all throughout my studies.



# TABLE OF CONTENTS

ABSTRACT .....	iii
ÖZ .....	v
DEDICATION .....	vii
ACKNOWLEDGMENT .....	viii
LIST OF TABLES .....	xii
LIST OF FIGURES .....	xiii
1 INTRODUCTION .....	1
1.1 Research Problem .....	4
1.2 Aim of the study and Research Question .....	5
1.3 Methodology of Research .....	6
2 THEORETICAL FRAMEWORK .....	10
2.1 Urban Form .....	10
2.1.2 Determinants of urban form.....	11
2.1.3 Scales and types of urban form.....	11
2.1.4 The components of urban form.....	14
2.1.4.1 The street pattern.....	15
2.1.5 Reading urban form through space syntax .....	17
2.1.5.1 Accessibility.....	18
2.1.5.1.1 Physical and Visual accessibility .....	18
2.1.5.1.2 The effect of block size on accessibility: .....	20
2.1.5.1.3 Scales of accessibility .....	20
2.1.5.2 Intelligibility.....	21
2.1.5.3 Integration .....	22

2.1.6 Socio – spatial dimensions of urban form .....	24
2.2 Socio – Spatial Segregation.....	26
2.2.1 Effective factors on socio-spatial segregation .....	30
2.2.1.1 Ethnic – Race Based spatial segregation.....	30
2.2.1.2 Socio economic – based spatial segregation .....	31
3 METHODOLOGY.....	34
3.1 Space Syntax .....	34
3.1.1 Measuring Segregation and Integration of spaces in space syntax.....	37
3.1.2 Theory of natural movement.....	40
3.1.2.1 Axial map.....	42
3.1.3 Measuring Accessibility through space syntax.....	46
3.1.4 Measuring integration through space syntax .....	46
3.1.5 Measuring Intelligibility through space syntax .....	48
3.2 Social Area Analysis .....	49
3.2.1 Examine an example of the Application of SAA: İzmir case.....	52
3.2.1.1 Variables .....	52
3.2.1.2 Calculation and Mapping Technique .....	53
4 CASE STUDY: FAMAGUSTA .....	56
4.1 Physical development of city during the history .....	58
4.2 Urban Macro Form of Famagusta .....	65
4.2.1 Macro Form of the City .....	65
4.2.2 Street network pattern.....	66
4.2.3 Physical constraints.....	68
4.3 Quarters and Social Structure of Famagusta .....	69
4.3.1 Social Structure in general.....	71

4.4 Investigation on the Relationship between Urban Form and Socio – Spatial Segregation .....	73
4.4.1 Methodology for the analysis of the urban form through SS .....	73
4.4.2 Methodology for the socio – spatial segregation analysis through SAA... ..	74
4.5 Urban Form Analysis through SS .....	78
4.5.1 Measuring Accessibility through Depth Factor .....	79
4.5.2 Global-Local Integration.....	82
4.6 Socio – Spatial Segregation Analysis through SAA .....	89
4.6.1 Occupation and Income Indicators .....	89
4.6.2 Education .....	91
4.7 Social Rank Analysis.....	92
4.8 Discussion .....	94
5 CONCLUSION .....	100
REFERENCES.....	106

## LIST OF TABLES

Table 1. The main framework of study .....	9
Table 2. Urban form patterns and their main characteristics .....	13
Table 3. Syntax variables and their definitions .....	49
Table 4. Social Rank (Socioeconomic Status) Index .....	52
Table 5. Urbanization Index .....	53
Table 6. Socio Area Analysis of neighborhoods based on study of İzmir in 1972....	53
Table 7. Framework of methodologies that are used in this study .....	55
Table 8. Historical periods of urban developments .....	58
Table 9. Urban Developments of Famagusta during each period .....	59
Table 10. Socio Area Analysis of neighborhoods based on Social Rank Indicators	75
Table 11. Types of occupation .....	76
Table 12. Percentage of each level of education in fifteen neighborhoods .....	77
Table 13. All Space syntax variables for each neighborhood .....	86
Table 14. The Ranking of District in each Variable .....	87
Table 15. Types of occupation .....	90
Table 16. Percentage of each groups occupation in fifteen neighborhoods .....	90
Table 17. Percentage of each level of education in fifteen neighborhoods .....	91
Table 18. Social rank structure of Famagusta neighborhoods .....	92
Table 19. Classification of neighborhood from lowest to the highest Social Rank ..	93

## LIST OF FIGURES

Figure 1. Street pattern organization by shape.....	17
Figure 2. Visual accessibility .....	19
Figure 3. Illustration of accessibility with block size .....	19
Figure 4. Accessibility through block patterns .....	20
Figure 5. The axial line, the convex space, and the isovist.....	37
Figure 6. The spatial layouts are different in each graph, when they are recognized from different spaces.....	38
Figure 7. Deep and shallow spatial organization. (a) Total deep spatial structure. (b) Average deep spatial structure. (c) Shallow spatial structure .....	39
Figure 8. (a) A notional grid with a horizontal main street, vertical cross street, side streets and back streets. (b) Notional grid: pattern of ‘integration’ values – or the closeness of each line to all others – from dark for highest through to light for least. (c) Notional grid: pattern of ‘choice’ value, or the degree to which each line lies on simplest paths from each line to all others, from dark for highest through to light for least .....	41
Figure 9. Axial lines and intersection points in each building, however high visual integration spots have darker tones as well.....	43
Figure 10. The six 1-square mile samples of urban patterns and their primal graphs: 1. Ahmedabad; 2. Barcelona; 3. San Francisco; 4. Venezia; 5. Wien; 6. Walnut Creek. Cities are so diverse that, at a first sight, it seems hard to imagine that they share any common, though hidden, pattern, which is what they actually do.....	45
Figure 11. Axial map of London.....	47
Figure 12. Social Area Analysis .....	51

Figure 13. Location of Cyprus Island in Mediterranean Sea .....	56
Figure 14. The location of Famagusta within the Cyprus .....	57
Figure 15. Famagusta after 1974.....	60
Figure 16. Famagusta – Fortified city in Venetian Period .....	61
Figure 17. Map of Famagusta in 1987 the expansion of city toward the south outside of wall city.....	62
Figure 18. Extension of city toward the south outside the wall city .....	63
Figure 19. Expansion of port (British storage near the port against the wall) .....	63
Figure 20. Maras district before 1974 as the core of the city with most population and density .....	64
Figure 21. Hotels and accommodation in Maras’s sea shore before 1974.....	64
Figure 22. Linear growth of city along the sea shore.....	66
Figure 23. Street pattern of Famagusta .....	67
Figure 24. Physical barriers and their types .....	69
Figure 25. Distinct parts of Famagusta .....	70
Figure 26. Neighborhood districts and their locations .....	71
Figure 27. Process of data analysis. It has been done at city scale and for each individual neighborhood .....	79
Figure 28. Mean depth map of Famagusta, the colours represent a spectrum between dark blue as the lowest and red as the highest depth.....	81
Figure 29. Global integration of Famagusta .....	83
Figure 30: Local integration of Famagusta, the colors represent a spectrum between dark blue as the lowest and red as the highest integration factor.....	84
Figure 31. Segregated properties by considering each variable.....	89
Figure 32. Classification of neighborhoods based on their social rank groups .....	94

Figure 33. Exploring the relation between urban form and socio – spatial segregation

..... 97

# Chapter 1

## INTRODUCTION

Complexity is a fundamental property of cities. City's complexity is caused by diversity of social, spatial, and economic factors that interact to form its structure. Therefore, this structure cannot be inherently homogeneous and integrated. As these factors fluctuate, division and segregation occur at different levels of the urban fabric. The phenomenon of segregation is inherited in social life of mankind caused by ethnic, economic, racial diversity, and cultural preferences. Fundamentally, segregation is caused by dissimilarity in socio-economic structure which simultaneously interacts with spatial dissimilarity of urban form.

White (1983) explains: "In one sense-the sociological-segregation may mean the absence of interaction among social groups. In another sense-the geographic-segregation may mean an unevenness in the distribution of social groups across physical space". This segregation refers to the isolation of social groups even if they live in proximity with each other.

The thesis tries to emphasize the urban form and its components, then comprehend the relation between the built layer and the social layer of cities, as the study of built environment would never be isolated from its social layer. Therefore the foundation of this study is built on the interrelationship between these two layers. One of the main



concerns of this research is to understand the effects of 'urban form' on social segregation of cities.

Usually, the locational choice of people in the city depend on their relationship with the built environment and social groups. Therefore by examining these relations it is possible to recognize the connection between people and the way they interact within the city. This connection is based on goods, services, and activities that city can provide at different levels. Amount of different groups of people have access to the goods, services and activities, is affected by their location in the urban structure (Legeby, 2010). Accordingly, the spatial properties of urban space affects the interaction between people and their activities. Thus, clusters of different types of interaction convey to the socio-spatial segregation in cities. Legeby (2010) argues that the accessibility of people to the city's resources and facilities is influenced by the structure of cities. Therefore it makes the segregation a subject, a fact which is concerned by town planner, urban designer and architectures.

The mutual relationship between human and the built environment has been studied by many pioneer scholars such as Mumford (1961), Rapoport (1977), Alexander (2005)). Lewis Mumford (1961) illustrates the importance of the social content together with urban form, and how these two features interact with each other. Rapoport (1977) emphasizes a certain need for developing new scientific methods in order to explore the built environment by focusing on human culture and the way of interaction with the context. He argues that the spatial organization of space and the interaction between its elements could vary in different context (Rapoport, 1977). Interaction between people and their living environment and their preferences is a dynamic phenomenon that changes through time.

Furthermore, creating an empirical approach to understand the relations between spatial and social structure of cities has been a challenge for many researchers around the globe. In order to understand this relationship more clearly, it is necessary to figure out the social and physical dimensions of the city at the same time. Moreover this relation needs to be studied and connect the social city and physical city as suggested by urban theories and practices as well (Hillier and Hanson (1984); Hillier and Vaughan (2007); Franzén 1992; Olsson 1998).

When considering the concept of social segregation, which is one of the major concerns of this thesis, it is essential to note that “segregation” has important spatial indications and implications. For conceptualizing “segregation”, it is necessary to consider the built environment and physical space. Thus the social segregation can’t be discussed without consideration of spatial dimension.

One of the most important notions of segregation is separation, separation of functions and activities, as well as separation of people in the urban context. The important point here is that without seeing space as structured and shaped as built form, none of these separations can fully be understood. What is social segregation in spatial terms? Legeby suggests: “social categories and social activities are not only social phenomena but also are spatial phenomena” (Legeby, 2010). It means that if people and their activities belong to different types, the role that space plays here is to cause, reproduce, and define the rules for both people and their activities. Therefore it is critical to conduct more systematic research on the relation and interaction of social city and physical city (Hillier and Vaughan (2007), Franzén. (2009)).

In the relevant literature, it has been suggested that the “space syntax method” which is also one of the methods that is utilized in this study, tries to read the interaction of social city and physical city and index this relation. Through this methodology the physical structure of the city is not considered just as a neutral basis for social activities, but as an entity functions as a central core of social outcomes. In this methodology there are variables of accessibility, intelligibility, integration, which are helping to specify also measuring the social segregation of urban districts. Understanding cities in this way is an important fact for this thesis. The actual answer for the notion which is framed here is, in first step to read the urban form through space syntax then to address its relation to socio – spatial segregation.

### **1.1 Research Problem**

Herold, Goldsein and Clarke (2003) argue that in urban studies a gap of knowledge exists in terms of understanding the relationship between the physical & social layers of cities and the structural dynamic of urban life. Recently, many scholars investigate the relation between physical form and social structure of cities. Batty & Longley (1994) argue that cities’ “physical form” are the outcomes of a “multitude of social and economic processes, constrained and shaped by the geometry of the natural and man-made world”.

One of the main phenomena in urban studies is the concept of socio-spatial segregation. Spatial segregation is known as the physical interval of two or more groups into different areas (neighborhoods); or equally as Michael J. White (1983) mentions, “the geographic-segregation may mean an unevenness in the distribution of social groups across physical space”, which shows that socio-spatial segregation is a reciprocal phenomenon. However, by considering the spatial segregation concept

alone, the subject of urban segregation creates numerous negative impacts on the urban population in terms of spatial and residential segregation (Feitosa et al., 2006). Several studies tried to find a way to investigate how urban form of a city causes or influences the socio – spatial segregation process in cities. Also, recent studies in this field show the importance and urgency of this subject in urban studies.

The phenomenon of segregation in physical pattern of a city on its own have the ability to encourage social fragmentation in cities. Based on its urban form, the city of Famagusta in North Cyprus which is the case of this thesis, suffers from diverse factors which lead to fragmentation of the built pattern. These factors include:

- The division of city after war in 1974
- Devoting large amount of land to the army and UN forces
- Occupation of the sea shore by various functions such as military, free port etc. and decreasing accessibility and usage of seafront.

However, in addition to these, the city has an old historic core which is segregated from other parts of the city by a thick wall around it which has minimum accessibility to the outside. Furthermore, there are lots of preserved wet lands in the city. Therefore, based on the previous discussion on the effects of the built form of the city on its social characteristics, it seems that the city's urban form cause or intensify the unevenness and inequality distribution of different social classes in the city, which then definitely lead to socio – spatial segregation in the city.

## **1.2 Aim of the study and Research Question**

Accordingly, by referring to the mentioned problems of the case and necessity of understanding and deal with spatial segregation, the main goal of this research is to investigate the influence of urban form on socio – spatial segregation of Famagusta.

For achieving this goal first it is necessary to understand the concept of urban form, formation, and its components. Reading the urban form through space syntax, in order to be able to assess spatial segregation through urban form elements. At the second step to understand the concept of spatial segregation, its formative systems through socio – spatial segregation; then how it is translated through different contexts. So, this research expects to answer the main research question:

- “What is the relationship between the urban form and the socio-spatial segregation and how it appears in Famagusta?”

This research expect to address the following sub-research questions:

- How to read social city, physical city, and their interactions?
- What is urban form and what are its components?
- How to read urban form and its variables through space syntax?
- What is socio – spatial segregation?
- What are the shaping factors of socio – spatial segregation?
- What is the Social Area Analysis, and how this methodology can measure the socio – spatial segregation?

### **1.3 Methodology of Research**

This study firstly tries to build up a framework by addressing the existing literature in order to explore the concepts, the theories and methodologies for understanding the urban form through qualitative research methods. Additionally this study investigates on the tools and methods which are used in distinguishing the spatial dimension more precisely, also to figure out the formation of socio-spatial segregation. The ‘urban form’, effects urban segregation and consequently the socio-spatial segregation. One of the main objective of this study is to investigating the ‘urban form’ elements and see which can be quantified, like, accessibility, integration, and intelligibility. The

research uses 'space syntax' method to read and quantify the spatial characteristic of urban form, then for socio – spatial segregation this study uses statistical Social Area Analysis to read and quantify the social characteristic of Famagusta. Accordingly, the study mainly uses quantitative data in both social and spatial scope of methodology (space syntax measurements and census data for social area analysis). Qualitative data interpretation has been used in some parts to explore the role of physical barriers, military zones and how they affect the social socio-spatial structure of the city.

Measuring the spatial segregation is the basic point of the methodology. However, based on the literature review of socio – spatial segregation, although the term 'segregation' refers to the physical distribution of social groups in a city, the spatial segregation measurement in these studies is based on the dissimilarity index of social groups in the city; without considering the spatial dimension at all (Massey (1978), Kestenbaum (1980) Taeuber and Taeuber (1976), Lieberman and Carter (1982)).

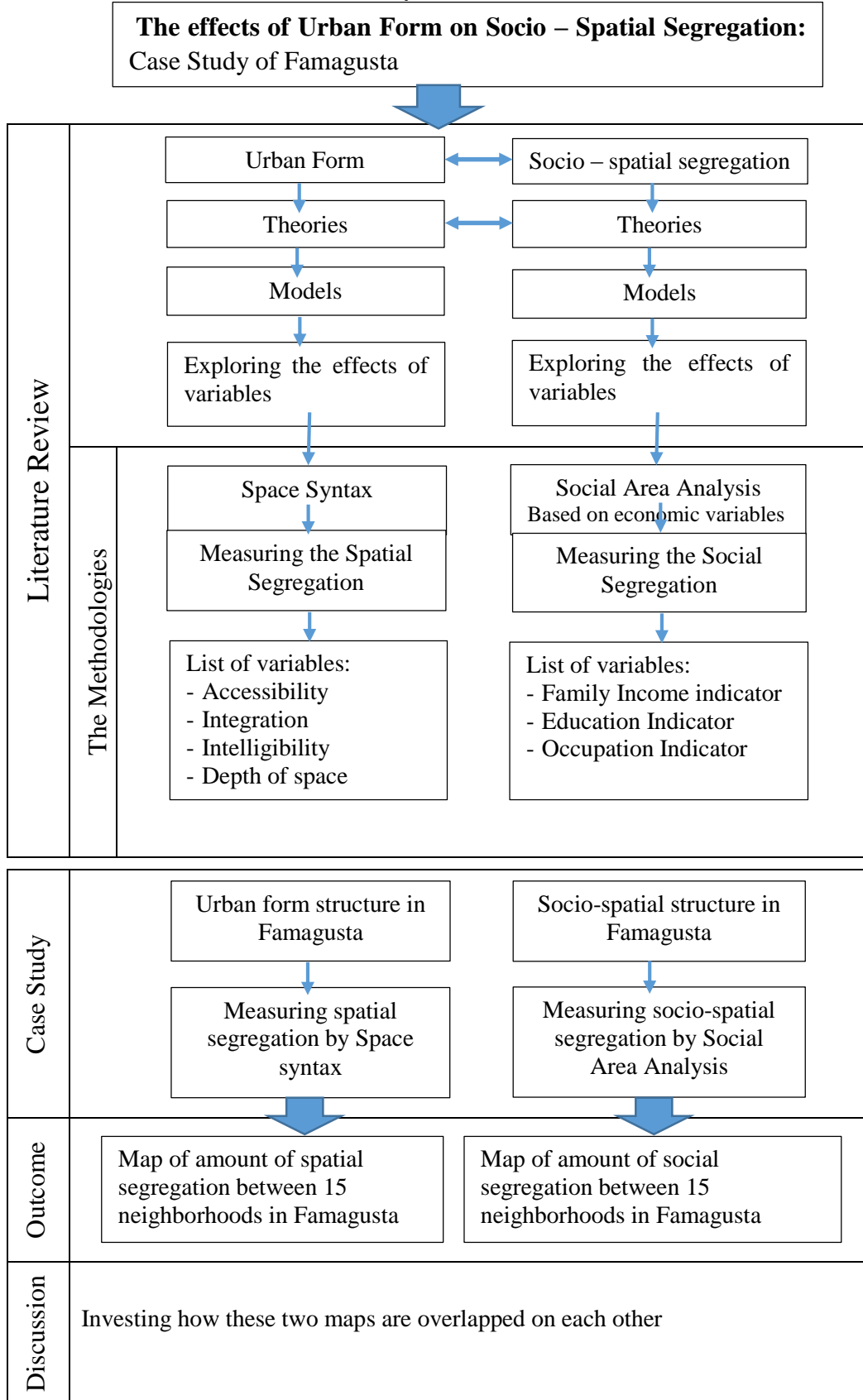
Considering the researches on the relationship between the social and spatial dimensions, Legeby (2010) states that, "although segregation is an inherently spatial concept, the spatial dimension of social segregation is defined and analyzed using quite simple spatial descriptions and weak theories on the relation between spatial and social phenomena". On the bases of his argument there is a lack of research in understanding the mutual relations between spatial and social segregation in cities. Understanding this mutual interaction requires more sophisticated empirical research by using new accurate methods. Among all the existing methodologies this research determines the 'space syntax' as the most appropriate method for exploring the inherent relationship between 'spatial' and 'social' as well as measuring the 'spatial segregation' based on the physical factors of urban form.

“Space syntax began from the observation that space is the common ground of the physical and social cities. The physical city is a complex pattern of space, while all social activity and interaction happens in space.” (Hillier & Vaughan, The city as a one thing, 2007) In addition this measure is “essentially formal interpretation of the notion of spatial integration and segregation, and it was the formalisation of these terms which first seemed to identify structures which linked the social and the spatial. Providing a measurable scale from segregation to integration, enabled statistical comparison of different spatial forms across cultures and hence provision of a platform from which social origins and consequences might be investigated.” (Hillier & Vaughan, 2007)

In the second part, in order to specifically verify the socio – spatial segregation structure of Famagusta, the methodology of Social Area Analysis (SAA) is used in this study. This methodology looks into the social inequality of inhabitants and tries to measure it through their distribution in 15 neighborhoods. However since the socio – spatial segregation resulted through the interplay of many different factors, this research limits the analysis of Social Area Analysis into the socio – economic dimensions.

The whole structure of thesis is presented in Table 1:

Table 1. The main framework of study





## Chapter 2

### THEORETICAL FRAMEWORK

#### 2.1 Urban Form

This section follows two main goals. First to explore fundamental components of urban form. Secondly, to read these urban form components through space syntax, as they are essential in measuring the spatial segregation of urban form. In this way, first there is a need to understand what the urban form is; and how it can be defined. There are many different approaches for specifying the concept of urban form. For example according to Tsai (2005): “Urban form can be defined as the spatial pattern of human activities at a certain point in time” (Tsai, 2005) . Furthermore Batty & Longley (1994) state: “In terms of the study of cities, form will represents the spatial pattern of elements composing the city in terms of its networks, buildings, spaces, defined through its geometry mainly, but not exclusively, in two rather than three dimensions. Yet form can never only be conceived in terms of these local properties but has a wider significance or gestalt, a more global significance in the way cities grow and change.”

Definitely the topic of urban form is very essential in urban studies. The term of form indicates shape or more in detail, it would provide a way to understand and observe cities through their spatial patterns. Urban form specify a city’s development and the pattern of its growth. Based on the features like transportation, density, and use of land; the way these features influenced cities, development to be dispersed or adjoining would be comprehended. Thus this concept not only considers the space but also the

procedures and its operation. The form of an urban area, can be determined through a growth process, and this development process can take place both in unplanned or planned ways. Consequently “urban form” is a result of integrating social form and spatial form. It comprehends physical form as well as fundamental social, demographic and economic processes which form it (Chakraborty, 2009)

### **2.1.2 Determinants of urban form**

According to Sun (2013), the process of urban form development is affected by many different factors, such as geographical location, colonial position, history and religion. Usually, spatial analysis involves all these factors. Additionally it also conveys to figure out the historical development of cities as well as to understand the natural and man - made determinants of urban forms.

Natural and man-made factors influence the main characteristics of ‘urban form’. For example, the geographical locations of cities are the basic sources of natural causes. The constitution of geographical locations holds three major factors; these factors are: topology, climate and available construction materials. Thus, the shape of urban forms has been influenced by natural factors both in present and historical settlements.

Meanwhile man-made factors contain the interventions of human in formation of cities. In comparison with the natural factors, these factors are very different and diverse; which include: “economy, politics, defense, religions, the gridiron, aesthetic planning and functional regions.” (Sun, 2013)

### **2.1.3 Scales and types of urban form**

Tsai states that, urban form can be studied in spatial terms. He categorized ‘urban form’ in three categories: ‘spatial-structure patterns’, ‘density’, and ‘diversity’. A


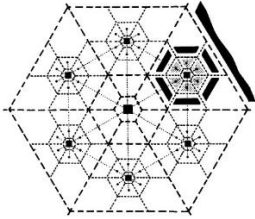
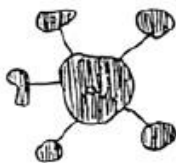

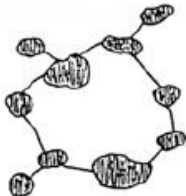
city's spatial structure, is determined by the general shape in different and various patterns, such as polycentric against mono centric forms, decentralized against centralized patterns and incoherent (disconnected) against coherent (connected) developments. Besides to the mentioned characteristic's forms, urban form yet in wider aspect may contain spatial structure of transport systems in cities like miles of freeways. Urban form can be observed based on different geographical scales and these scales are classified into three levels as "metropolitan area, city and neighborhood." Furthermore, in general terms, urban form of cities can be recognized in two level: the "external form" and the "internal form". The external form defines the total shape of the city (radical, linear, sprawl...) and size of it, whereas, the internal form of a city defines the structure of the city, density, compactness, fragmentation of activities, accessibilities, etc. (Chakraborty, 2009).

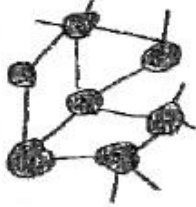

Kostof (1991) tried to categorize the shapes of cities. According to him early cities in general had many shapes such as "Non – geometric" city form. These types of cities usually present very slow, unplanned, and natural developments. In the second type, the whole city environment seem to be ordered and totally designed, including the buildings, streets, housing – units and residential hierarchy, but they are randomly placed in the city. In the third model the orthogonal planning is applied as the urban form pattern; such as the grid – iron patterns of streets, equal size of plots and buildings and logical distribution between main streets and the alleys through the city (Kostof, 1991).

Urban form patterns are categorized differently based on different scholars. However in order to make a summary, three most important types of them by referring to Moughtin (2005) are: "the linear cities, the city set out in the form of a grid, and the

highly centralized or inward looking city". The Centralized form of Moughtin include the two forms: the "Central Redial Form" and the "Star Like Form". Meanwhile based on Visseh (1999) the other patterns of cities would be: "a loop and different cores around it", a "Galaxy form with different number of cores", and "Commodiouness form". (See Table 2)

Table 2. Urban form patterns and their main characteristics (Viseh, 1999 & Moughtin, 2005)

Types of City Form	The shapes of them	Explanation
The Linear Form		Growth near see, river, rail road or any linear source.  Can grow very fast.  Ability of dealing with fast mass of movements.
The Grid Form		This form has the ability to subdivision of lands easily.  Fluent movement and high accessibility.  Increasing the quality of communication.
Central Redial Form		More isolated.  Organic and natural.  Usually extend around the central buildings
Star Like Form		Star shape cities have the ability to be centralized and more complicated.  This form is appropriate for medium to large size of any city
loop and different cores around it		Less accessibility.  There is no central core.  There are separate core of groups which are organized around a loop.

Galaxy form		<p>This form is very similar to the central radial form, which is more characterized.</p> <p>Better accessibility.</p>
Commodiousness form		<p>Different types of grid plan can be applied in this form.</p>

### 2.1.4 The components of urban form

Talen (2012) used urban form as three – dimensional character; he believes that “Form is controlled by building lines, setbacks, and lot coverage, but it can also be a function of street width, building type, and building height.”

Almost all researchers define the key elements of urban form same as of urban morphology. As defined by Carmona, et al (2003) “urban morphology is the study of the form and shape of settlements” (Carmona, Tiesdell, Heath, & Oc, 2003). Moreover, Moudon (1992) states that “the study of urban morphology equals the study of urban form” (Moundon, 1992). Thus, the component of urban form as (Conzen, 1960) mentioned for urban morphology are: land uses, street patterns, plot patterns, and building structures.

However among these four elements, the street network pattern plays the most important role in shaping the macro urban form. At the same time this component is the largest spatial pattern of cities; where all the movement flows are realized through it. So it could be stated that the street pattern based on its structure affects the most

important variables of *integration*, *intelligibility*, and *accessibility*, the factors which make possible to measure the spatial segregation through space syntax. As a matter of fact this research focuses on this component because all the necessary variables which are *accessibility*, *intelligibility*, and *integration* are used in space syntax for reading urban form are extracted and will be based on 'street networks'. Therefore, it is necessary to introduce the 'street network pattern' and see its effective role in the analysis of urban form.

#### **2.1.4.1 The street pattern**

Carmona. et al, (2003) states that: The street pattern can be named as physical arrangement of urban blocks. In another perspective, streets are the public spaces between blocks which are working as movement channels, or "public space network". Street networks include the largest part of public space in each city; as Jane Jacobs states: "Streets and their sidewalks, the main public places of a city, are its most vital organs." (Jacobs, 1965)

Street pattern as an important factor in shaping the urban form of cities is coming from the essential need of trading goods and services and connecting communities to each other. Paths and roads through evolution of cities connects all the districts to each other on every levels and scales. Historically these elements have followed the natural landscape of cities; but in some cases, these roads and routes crossed these patterns for providing new connection such as building new bridges over the rivers. However, today after industrial revolution the rail roads, highways and light rail lines in the cities have been organized as a new structure of cities and direct their developments. Moreover, street network patterns set the lot lines and describe the patterns of buildings

and ownership; which all generate the places we experience in our everyday life (Portland Plan Comprehensive Plan Evaluation, 2008).

To sum up, the forms of cities are identified based on the scale that they are observed. At city scale, just the most noticeable features can be identified; like: rivers, mountains, hills, highways, main roads and overall land uses. At district scale, the most dominant features can be identified such as: block patterns and collector streets. At the scale of neighborhood, lot lines, local street grids and building massing can be identified (Portland Plan Comprehensive Plan Evaluation, 2008). Considering the analysis of urban forms, street network patterns has essential role for investigating the characters of urban structure.

The typology of street network of a city can show the urban form typology of that city (Figure 1). Additionally streets are the dominant elements that shape the framework and the core of cities by shaping the important human activities within them (Jacobs, 1961). Peponis, et al (2007) assess the mutual relation between ‘street connectivity’ and density in urban environment through a spatial perspective. They argue that the degree of street connectivity could fundamentally affect the characteristics of urban environment and facilitate or impede people movement, urban density, and land use. Higher connectivity in street pattern draw more users by offering more accessibility, choices and opportunities for them (Long, Baran, & Moore, 2007). According to Hillier and Ida (2005) “The movement flows are mainly determined by the spatial configuration of urban street networks”. Accordingly, the street network patterns significantly influences the urban form and its life (Hillier & Iida, 2005). In the following section, as they are significant criteria that conveys to the understanding of *segregation* and *integration*, *accessibility*, *intelligibility* and *integration* will further be presented.



Figure 1: a) plan of a small town in the south of French

b) street network of the city (axillar map, which shows the connectivity) (Hillier & Vaughan, 2007, p. 218)

Figure 1. Street pattern organization by shape (Marshall, 2005)

### 2.1.5 Reading urban form through space syntax

In order to understand and read urban form through space syntax it is necessary to find an interface between these two subjects. Literature survey reveals that integration, intelligibility, and accessibility can be considered as the interface of urban form and space syntax. Because they convey to the understanding of segregation and integration in the physical urban form.

In the following, these variables will be presented from an urban form perspective. Whereas their role in terms of measurement, they will be referred to in the on chapter space syntax.



### **2.1.5.1 Accessibility**

“The notion of accessibility has been one of the key concepts in studies of urban growth and urban structure.” (Darroch, 1972) As Muska (2005) states: “Accessibility means the ability to reach desired goods, services, activities and destinations.” Additionally, the following factors affect accessibility:

- “Mobility – the physical movement of the population, which is realized by various transport modes (walking, cycling, public transport, car and other modes of transport).
- Land use – geographic distribution of activities and destinations.
- Road network – layouts of roads and paths and their connections.
- Other factors – information, affordability, comfort, security, etc.” (Muska, 2005)

Between all these effective factors, as far as the focus of this research is based on physical parameter of accessibility; the important factor in physical accessibility is the number of ‘choice’ which a public area offer to its users. Bently et al (2008) state: “Only places which are accessible to people can offer them choice; the extent to which an environment allows people a choice of access through it, from place to place.”

#### **2.1.5.1.1 Physical and Visual accessibility**

In general, accessibility of any public space system based on the number of alternative ways offered from one spot to another one. However the important point here is that these different available choices must be visible for all visitors, otherwise just the local people who are living there and familiar with the district can take advantage of it. Thus, the visual accessibility is also important as well.

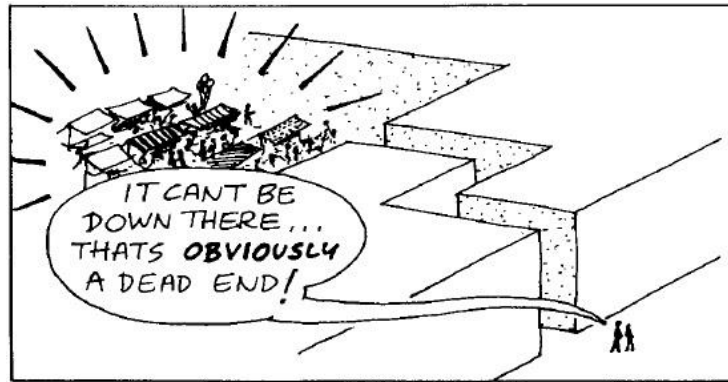


Figure 2. Visual accessibility. Source: (Bently, Alcock, Murrain, McGynn, & Graham, 2008)

Both visual and physical accessibility rely on how the grid of public spaces split the districts into blocks. As it is illustrated below, the pattern, size and shapes of blocks would be different based on the route and public spaces network patterns (Bently, Alcock, Murrain, McGynn, & Graham, 2008).

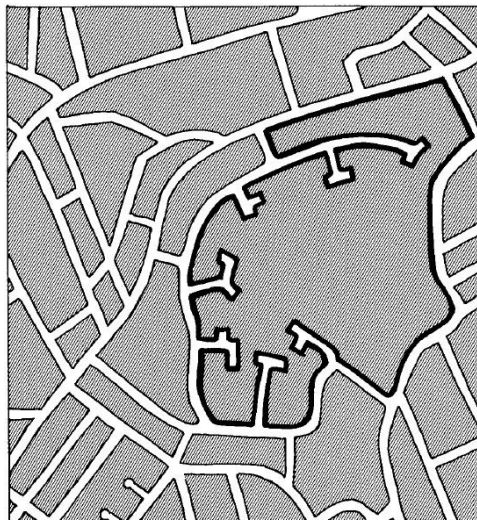


Figure 3. Illustration of accessibility with block size. Source: (Bently, Alcock, Murrain, McGynn, & Graham, 2008)

### 2.1.5.1.2 The effect of block size on accessibility:

To compare two districts, which in one of them is divided by smaller blocks and the other one is split by bigger size of blocks; the first one provides more choices or alternative ways for people to reach their destination. Thus a region with smaller blocks is more accessible. As it is shown in the Figure 4 the district with bigger blocks offer three alternative routes, while the other one with smaller blocks offer nine alternatives from A to B (Bentley, Alcock, Murrain, McGynn, & Graham, 2008).

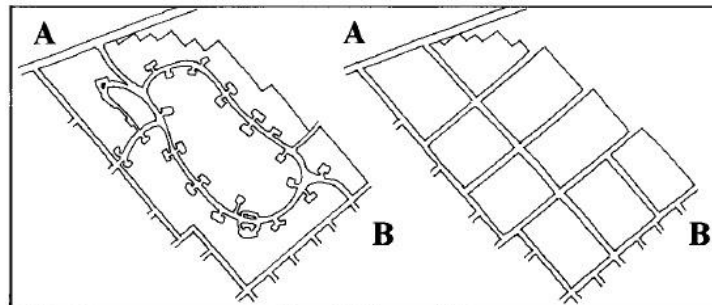


Figure 4. Accessibility through block patterns. Resource: (Bentley, Alcock, Murrain, McGynn, & Graham, 2008)

Therefore, smaller blocks provide more physical accessibility in a given area. Also they increase the visual accessibility, promoting the awareness of choice which is available for people: “the smaller the block, the easier it is to see from one junction to the next in all directions” (Bentley, Alcock, Murrain, McGynn, & Graham, 2008).

### 2.1.5.1.3 Scales of accessibility

The important part in any accessible area is that the area contains a linkage system which can provide access from the surrounding areas and through its site. The first step would be analyzing these links and see how they can be categorized.

Accessibility can be analyzed in two scales:

- Global scale

- Local scale

- **Global scale of accessibility**

To provide high accessibility in the city as a whole, to and through each neighborhood, it should be connected with the maximum number of direct links which are possible from the main streets system: those streets that connect the different parts of the city (Bently, Alcock, Murrain, McGynn, & Graham, 2008). Therefore, the appropriate work to do is to see which nearest main streets are connected to each neighborhood; and which one of them are the longest direct street that has the most linkage through the city.

- **Local scale of accessibility**

Local scale of accessibility means to see every link within the neighborhood that joins the neighborhood to the system of main streets. Next step would be to compare the streets with each other to see which one of them connect the neighborhood most directly to the main streets; This can be done to see how many turns each street have to reach the neighborhood (Bently, Alcock, Murrain, McGynn, & Graham, 2008). After all by considering the district, all streets should be counted to see which one of the streets has the most connection to the other streets, thus the strongest linkage of neighborhood to its immediate surroundings.

#### **2.1.5.2 Intelligibility**

People can take advantage of choice which the quality of accessibility provide in the built environment, if they can figure out the place's layout, and to know what is happening there: "Legibility - the quality which makes a place graspable" (Bently, Alcock, Murrain, McGynn, & Graham, 2008) .

“Legibility refers to the ease with which the spatial structure of a place can be understood and navigated as a whole. The legibility of a place is improved by a street or pedestrian network that provides travelers with a sense of orientation and relative location and by physical elements that serve as reference points.” (Ewing, Handy, Brownson, Clemente, & Winston, 2006) Legibility is named as the transparency or clearness of the cityscape “the ease with which its parts can be recognized and can be organized into a coherent pattern” (Lynch, 1960).

Although Lynch introduced the concepts of “imageability” and “legibility”, for making this quality for being more quantitative or to measure it, Hillier, in the space syntax, introduces the idea of “intelligibility”, which signifies the “quality of an environment as being comprehensible and easy navigable” (Conroy & Bafna, 2003). The “intelligibility” notion is the key concept in space syntax; as Hillier (1996) states: “Intelligibility [...] means the degree to which what we can see from the spaces that make up the system – that is how many other spaces are connected to – is a good guide to what we cannot see, that is the integration of each space into the system as a whole. An intelligible system is one in which well-connected spaces also tend to be well-integrated spaces. An unintelligible system is one where well connected spaces are not well integrated, so that what we can see out of their connections would mislead us about the status of that space in the system as a whole”.

### **2.1.5.3 Integration**

Studying the patterns of spatial integration is very important in urban analysis. Because cities develop to provide opportunities for community life, exchange and interaction, urban fabrics have an important job, to protect the essential connections and to maintain the structure of circulation which is related with these procedures. Peponis et

al (1997) state, the important function of urban structure is “to provide an intelligible framework within which parts are identified and related to the whole”. The existence of cities has different reasons, such as the way cities always bring a sense of awareness, orientation and potential. In addition these senses depend on the areas and range of activities that everyone can experience in any place of city in any time. For making sure that these qualitative requirements are satisfied, the powerful tool is the spatial form of cities. The necessity of continuity of urban access, or the integration of urban districts can provide a defined structure.

Integration, though, is not just a physical thing. It also creates a concept to realize how urban systems work (Hillier, 1996). Studies and research on many European cities proved that there is a very clear and strong relation between the density of pedestrian movements and integration (Hillier et al., 1987, 1993; Peponis et al., 1989). Whereas as Peponis et al (1997) states: “The more a space is integrated, the greater the chances that it will be more densely occupied by moving people.” Different case studies with different urban structures as rectilinear, regular, irregular, and segregated urban grids bring the same result and prove this relationship, even in large metropolitan areas and small towns (Peponis, Ross, & Rashid, 1997). This relationship does not only exist during the store or normal working hours but also during other time periods (Peponis, Hadjinikolaou, Livieratos, & Fatouros, 1989). It seems that the function of spatial configuration effects the pedestrian movements considering the influences and characteristics of land use.

In order to have a better understanding of city space, we have to distinguish between movements within the space and commuting space; in other words movement inside a city space as a destination or movement between two destinations. The first type is

essentially a configurational function of space and second type is a function of network and connectivity among the elements. Urban space is an interface of these two types of movements. Furthermore the two types can be in balance or one can be dominant according to the usage of space, however a well functioning urban space needs the equilibrium of both types (Peponis, Ross, & Rashid, 1997).

#### **2.1.6 Socio – spatial dimensions of urban form**

The mutual relationship between human and the built environment has been studied by many pioneer scholars (Mumford (1961), Rapoport (1977), Alexander (2005)). Lewis Mumford (1961) illustrates the importance of the social content together with urban form, and how these two features interact with each other. Rapoport (1977) emphasizes a certain need for developing new scientific methods for exploring the built environment by focusing on human culture and the way of interaction with the context. He argues that the spatial organization of space and the interaction between its elements could vary in different context (Rapoport, 1977). Interaction between people and their living environment and their preferences is a dynamic phenomenon that changes through time.

In order to understanding the formation of cities by human activities it is necessary to find out what is the relation between social city and physical city and how they act together. Hillier et al (2007) says: The structure of each city is made from two things: “a large collection of buildings linked by space, and a complex system of human activity linked by interaction. We can call these the physical city and the social city.” Furthermore Chakraborty (2009) states: “As urban life has expanded, the form, which the cities have acquired, are not based on its spatial form but also on its social form. These two components together make up the morphology of an urban area.”

Accordingly, urban theories and urban practice should join social city and physical city together (Hillier & Vaughan, 2007). But, the supporting methods and practices which are promoting both, on one side the morphological practices for physical city and on the other side the social analysis for social city, inherently choose unequal view to describe the whole city. If the emphasis of focus is on one city, (physical or social), the other is not much concerned. As a result of this approach, as the 'other' city is relegated to a secondary role, it may be very difficult to consider the comprehensive patterns of forces in the formation of the city as a whole. As a result, it is not surprising to see many incomplete practice and theories about the city, none of which tried to see the city as both of the 'physical' and 'social' cities, at the beginning of 21<sup>st</sup> century.

However it is tried to be asked whether a city in any case should be seen as a one thing or two things? The answer is that, both of the social and physical city act equally to generate significant results. The physical city is the other side of social city: it cause the other one being formed and then perform within the principles of the other's forces. It seems that both of them depends on each other. However, the critical issue here is how to determine the interconnection between them.

Practically, in all theories and practices, any intervention in the city comes from the principles and agreements of a city as one thing. For example: in theories on social city, in the small – scale private looking residential area, they tried to promote the community; without considering the physical effects of that area, or in the physical city, they just consider the effects of built environment.

Evidently, as Hillier et al (2007) state, lack of interaction between social and physical layers of city might lead to phenomenon of socio – spatial segregation. As we have



seen, during the second half of the 20<sup>th</sup> century this challenge was posed, by rapid failure of many ambitious social housing structures, and then a general widespread public belief which believed that the spatial and physical form of these projects were in some way involved in these failures. Today this challenge is posed in a more universal form, such as the problem of social segregation in many cities, its inherent quality, its formation factors and its consequences. A lot of ideas can be formed for segregation, which just focus purely on the social and economic factors or racial, ethnical issues without considering the space (Darden, et al, 2000. Cutler, et al, 2008. Borjas, 1997. Collins, et al 2000. Farley, 1977. Jargowsky, 1996. Massey, 1987. Burgers, 1998. Fischer, 2000). However, the term of segregation is a spatial term, moreover the way that patterns of segregation take place in the cities, bring back the discussion to the question of ‘how urban segregation can contain physical meaning above and over the social meaning? Is it possible for segregation to be a one city phenomenon?’ (Hillier & Vaughan, 2007)

Regarding the discussion, the way in which patterns of spatial integration and segregation influence the location of different classes and social groups in the city, it can be argued that there is an essential relationship between spatial segregation and social segregation. For this reason, spatial form needs to be understood as a contributing factor in forming the patterns of socio- spatial segregation in cities.

## **2.2 Socio – Spatial Segregation**

In order to understand the process of socio – spatial segregation, there is a need to understand specifically the meanings of ‘segregation’ and ‘spatial segregation. The word “segregation” emerges in nineteenth-century genetics and makes reference to the separation of genes which happens through meiosis (Mendell1st law of segregation)

(Maloutas T. , 2012). The Chicago School in the first half of the twentieth century, illustrated an explanation from similarity by the vegetable kingdom and segregation was taken up by human ecology as a symbol or representation to be used for residential segregation of ethno – racial groups. This symbol afterwards became the segregation's dominant connotation (Park, 1957). The Dictionary of Human Geography, in a very brief explanation brings the meaning of segregation as – “The residential segregation of subgroups within a wider population” (Johnston, Gregory, & Smith, 1986).

The nature of spatial segregation however, in urban structure of cities has specific meaning. Brown et al., (2006) state: “Spatial segregation is inherently geographical” (Brown & Chung, 2006). Thus it is related to the physical structures of cities where neighborhoods spatially or physically are segregated from each other; or in other words spatial segregation is known as the physical interval between two or more groups in different areas (neighborhoods). Brun (1994)says: “The concept of segregation refers to its empirical form as, spatial distinctions among the residential zones of population groups living in the same [urban] agglomeration” (Brun, 1994, p. 22). Furthermore, Dupont (2004), mentioned: “Segregation is a form of unequal spatial distribution of population groups in the space” (Dupont, 2004).

Most of the time spatial segregation is known as residential segregation, because most studies are about people and the place they live in and how far they live from each other. Thus, many definitions related to the residential dispersal, as Maloutas, et al (2012) suggest: “Segregation indicates the spatial segregation of two (or more) population groups; here this separation is understood as residential, but it may also refer to separation in schools, in the workplace, in transportation or in leisure activities as well”. Furthermore, segregation can be different from complete separation to totally

equal scattering of inhabitant groups in the spatial region of any city; where the distribution of inhabitant groups sometimes is mostly unequal, which leads to the development of highly separated regions.

Whereas, according to Legeby (2010), no matter whether segregation happens to particular social groups in neighborhoods or exist in the labor market, the fact is that segregation is a spatial concept. Segregation as a concept, as suggested by Legeby, considers the existence of a definite social hierarchy between different parts of population. Segregation determines the borders between groups, and specifying the place of each group in the hierarchy of interaction, influencing relationship, and power. Segregation in social structure of a city is effectively associated with social polarization and resist to changes; which smoothly provides a base for political dispute. The concept of segregation means a standardized form of social polarization which shows itself in physical separation as well. Still, although segregation means separation between groups and individuals, it does not stand as the opposite of social integration. Legeby (2010) underlines that segregation implies for a separation of the parts from the total. The concept of segregation is about spatial differentiation, where for a lot of segregated areas the important element is housing.

Today the importance of spatial segregation as well as social exclusion and social polarization has been increased; and they are among the main debates of today's urban studies as a phenomenon of globalization all around the world. As Marcuse, et al (2002) state, the threat of globalization scared cities around the world, the fear of taking the unsought United States social composition and pattern of urban spatial form. This pattern encompasses the growth of segregation, downturns the city centers, reduces public amenities, which leads to the commercialization of civil life, and social

polarization. These are definitely the result of the big gap, between the high classes of rich people who are well-educated and professional; and poor social classes of the city who are mostly immigrants with low proficiency, left out minorities of racial or ethnic as ghetto clusters and people from middle class with unstable working – class. They call this model the “partitioned city” (Marcuse, P. Kempen, R. 2002).

A negative results of segregation, which has been internationally emphasized, is exclusion. Additionally, segregation can threat democracy along with economic growth. The socioeconomic and ethnic housing segregation make it very hard for entire society to be integrated. For instance, a city which is faced with housing segregation, doesn't have equal life chances for its people so they will be prevented from integration in society (Legeby, 2010). Eva Öresjö stresses exclusion as a subject and its intricate nature, such as: “The problem in Sweden is not merely segregation in housing but the strong social and ethnic exclusion mechanisms that are growing. It is reflected in discrimination at work, segregation in secluded housing, political marginalization, etc. Today, being an immigrant no longer means a limited phase in the life of an individual. It has become a state which can extend over several generations, irrespective of actual citizenship or place of birth and upbringing. Many immigrants remain in permanent state of cultural subordination and social exclusion” (Öresjö, 1997).

It should be noted that “Segregation is not the same thing as diversity. The presumed negative effects of diversity occur when people of different backgrounds live among each other. Segregation is all about isolation of people of diverse ethnicities and races from each other” (Uslaner, 2012).

### **2.2.1 Effective factors on socio-spatial segregation**

As it has been highlighted above segregation, social division and social elimination are the main issues in today's urban discussions. The subjects of diversity of race and cultural groups, immigrant population and refugee groups in the city are all important factors for creating inequality in social structures of cities. Not just America and western European countries but also the developing countries are now faced with these social and cultural inequalities and it is reflected in many ways in the spatial structures of their cities (Musterd & Ostendorf, 2013).

Spatial development of the city in line with the socio – economic changes, which would end up with socio – spatial segregation can be studied based on two important concepts: Ethnicity – Race and Socio – Economic characteristics. Accordingly, “Ethnic – Race Based spatial segregation” happens in specific time, when a group of people with a specific culture, ethnicity or values, want to be segregated even spatially from others in the cities. Whereas “Socio - economic based spatial segregation” refers to an exclusion of a neighborhood. Therefore the neighborhood reinforces social exclusion and undermines social cohesion at the higher level in the whole structure of the city.

#### **2.2.1.1 Ethnic – Race Based spatial segregation**

Racial preference, ethnic diversity between inhabitants of a city and especially in case of immigrants; cause significant inequality in spatial distribution of people in that city. Two theories of spatial assimilation and place stratification focus on all the effective factors and the relationship between them, such as the relation of ethnic and race groups with each other, also with socioeconomic factors and discrimination (Musterd & Ostendorf, 2013). The Black ghettos in the America and South Africa are without

any doubt are the greatest expression of racial, ethnic or immigrant segregation. Less extreme of spatial concentrations of immigrants, but still noticeable come across in Europe and also America. There seems to be a tight relationship among the racial and immigrant separation on one side and the socio-economic separation on the other. In general, for example Blacks and immigrants, frequently have a comparatively weaker employment situation compared to other inhabitant groups. However, Denton and Massey (1988) have concluded that the inequality in income class in some cases isn't much effective when compared to the ethnicity of the group. However, minor integration took place when Asian and Hispanic people are earning a higher income (Musterd & Ostendorf, 2013).

It should be considered that, the situation of immigrant people coming from developing countries is also related to the situation of the native inhabitants, therefore this may even intensify the spatial segregation patterns. The levels of inequality and spatial segregation which are varying in each country and each city, depend on the specific context. For example these levels appear to be much lower in European countries, than those in the North American States (Musterd & Ostendorf, 2013).

### **2.2.1.2 Socio economic – based spatial segregation**

Over the past decade, the process of globalization has led the developed western countries towards a process of economic restructuring. Additionally, technological improvements has conveyed to a developing interconnectedness and international system of money, goods and flows of people throughout the world. In this era one of the feature of changes has been the increasing demand for services, which called for a more efficiently trained labor force. However, this economic restructuring process normally also generated demand for low skilled or unskilled jobs and calls for

unemployment. The final result of this process of economic restructuring is an increase in social segmentation, a growth on both poles of the socio- economic spectrum. For instance an upsurge in the number of households with low skill and income (mainly immigrants) meanwhile has been accompanied by the upsurge in the proportion of people with high level of education, skill and incomes.

But as long as economic factors cause differentiation in social classes, just like high classes employees, middle class workers and unemployed people, it calls for divided neighborhoods where families belonging to the same class are concentrated in one area. Some researchers tried to analyze the disadvantage of economical segregation. As Robert, et al. (2009) mentioned, economic segregation in residential neighborhoods cause definite social inequality; so “social dimensions of segregation, particularly in terms of the degree of residential stability and social cohesion, affect outcomes such as health, crime, and education”.

As Mustard, et al. (2013) state, “Increased social inequality and social division results in the social inclusion of one part of society and the social exclusion of another part”. As a consequence, the excluded social class will be restricted from reaching the opportunities and the chance to participate in the main society; they also will experience poverty, therefore weaker schools, housing market, and limited socio-cultural integration. The most important reflection of this situation is segregation and division in spatial patterns. On the other hand the residential concentrations of poorer households will result in socio – economic segregation.

Literature survey reveals that there has been an extensive effort devoted to examine the spatial segregation based on socio – economic characteristics of inhabitants. To

this end there has been methods that are suggested to determine the spatial segregation of different social classes. Among these, Social Area Analysis, which has been utilized as one of the methodologies in this research and will be presented in the next chapter, can be considered as the forerunner of similar methods that were later suggested. (Lughod, 1969) (Anderson & Egeland, 1961) (Spielman & Thill, 2008) (Johnston R. J., 1971) (Brown & Horton, 1970)).



## Chapter 3

### METHODOLOGY

Exploring the relation of urban form and socio – spatial segregation is the aim of this thesis. However based on the previous studies, Lima (2001) tries to investigate the effects of socio – spatial segregation on the urban form of the city. He used space syntax for analyzing the spatial structure of city specifically in three regions; then he verified the socio – spatial segregation of those regions based on socio – economic variables and land advantage – and disadvantage. After that Vaughan in (2007) did a very useful study by collecting 4 studies in one article in order to investigate the urban segregation through different dimensions and its focus is based on space syntax.

This chapter will introduce two methodologies, as the major one is the ‘space syntax’ which is somehow formed the basic concept of this research as investigating the social logic of space, and how it makes possible to measuring the spatial segregation. The second part will briefly introduce the methodology of ‘Social Area Analysis’. This methodology verify the social hierarchy or social segregation of 15 neighborhoods of Famagusta based on an application of this methodology in İzmir.

#### **3.1 Space Syntax**

Hillier, Hanson and their Colleague (1996) developed the idea of “social logic of space” in order to find an appropriate pattern to explore the relation between social components and spatial features of the city. They tried to suggest a method which could be used for understanding socio – spatial structure of city and problem solving.

Space syntax is one of the rare methodologies which tries to measure the relationship between social life and built environment. Space syntax from the urban morphological tradition perspective emerged in the 1970s. Hillier & Vaughan argue that the space as the container of human activities is the foundation of physical and social structure of cities. Human interaction within the space is the social space and complex network of spaces and connection is the physical space, and these two are affecting each other spontaneously.

Space in syntax perspective plays an important role in human societies, as it is a source that makes inhabitants to organize themselves. Therefore as Bafna (2003) states: “the space of inhabitation is configured—a term that space syntax recognizes as an act of turning the continuous space into a connected set of discrete units.” However it is useful to transforming the space to the “discrete configuration form”. Accordingly, it becomes possible to use different labels to its individual parts; then these parts can be referred or named as different people, groups, or activities; which are also can carry behavioral patterns and reflect specific culture on them (Bafna, 2003).

In space syntax, the spatial configuration lets the social structure to be mapped on itself. However space syntax theory “denies this simple space-as-form and society-as-content distinction” (Hillier & Hanson, 1984, p. 9). Instead, in space syntax program it is the ground and basis “that social structure is inherently spatial and inversely that the configuration of inhabited space has a fundamentally social logic” (Bafna, 2003).

Hillier and Vaughan (2007) claim that the space syntax methodology can help the understanding of social and spatial patterns simultaneously. Accordingly, for analyzing urban segregation issues, the method can add new perspectives to socio-

spatial studies. The method can be recognized in two ways. First of all, the concept of space is independent and active factor in the social patterns analysis. By separating the social form at the first step from spatial form, it would reveal and show the influence of spatial form on social outcomes, and in turn the influence of social dimension over the spatial form. Secondly, the analysis of space syntax functions across scales. Besides most importantly it is originally built on street-scale data, and the important thing about it is that on this level, “people experience the city, and where they meet, interact and carry out economic and social transactions.” (Hillier, Vaughan, 2007)

Idea of segregation and integration can be formalized, based on a methodology in urban studies which can simultaneously quantify the social and cultural influences and meanings over the spatial structure of cities. Space syntax’s main goal is to suggest a new approach to analyze and describe different types of urban layouts, and identify probable impact on the social results and on the social life. Legeby (2010) explains further that: “Space syntax is a set of tools that are linked to a set of theories that can be used to explain, describe, analyze, and understand spatial systems from a point of departure of how people perceive and are able to use space. Through comprehensive analyses of space in combination with observations of human activity, it has become evident that space and social activity are related.” Thus, space syntax methodology proved that the spatial layout can show and represent the social patterns, also space can influence the social patterns by influencing the movement patterns which is called “natural co-presence in space” or “natural movement” (Hillier and Vaughan 2007).

Space syntax at the same time shows both our instinctive engagement with space and the objectivity of space. Space includes the background of human activities. From a

spatial perspective whatever a human can do have this possibility to be translated to simple geometrical forms.

Based on space syntax, there are three types of space concepts: the axial line (as movement is basically linear – boulevards, avenues, streets, alleys, they are all linear concepts); the convex spaces (essential for interaction such as public open spaces, and squares); and the isovist (“the variably visual field that anybody can see from any point in space”) (Legeby, 2010). These three geometrical elements show how to categorize the building and urban spaces, also to analyze using the space and human experience.

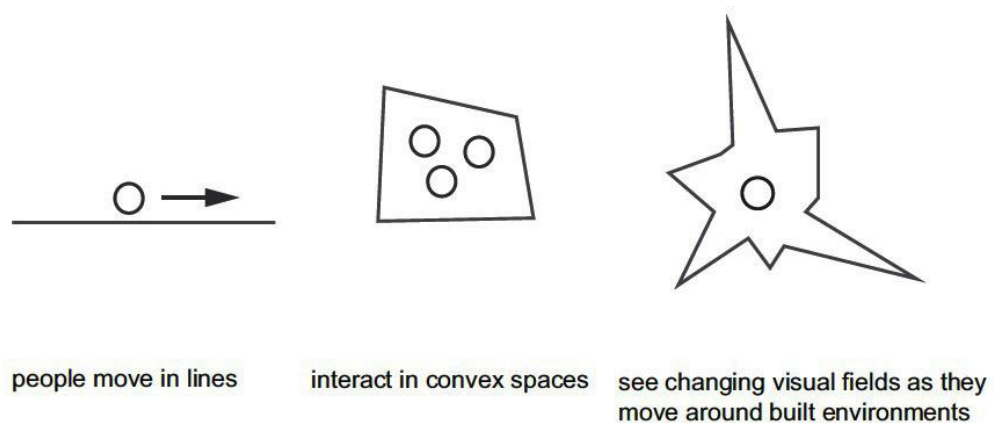


Figure 5. The axial line, the convex space, and the isovist. Resource: (Hillier 1996).

### 3.1.1 Measuring Segregation and Integration of spaces in space syntax

The concepts of segregation and integration, which are essential for understanding of socio-spatial segregation, can be systematically approached through spatial configuration. Simply because, spatial configuration is about the relations between spaces, which explains the existing relations between spaces that create the whole system. Furthermore, the spatial relations have the potential to exemplify or hold social ideas. The social ideas at first need to be specified in theory after that converted into

measuring methodologies which are directly related to the geometric representations of spaces as a system (Hiller and Hanson 1984).

Hillier & Vaughan (2007) indicate the importance of the configuration of space as it carries the possibilities of social meaning and has social consequences: “a spatial configuration not only looks but is different when seen from different points of view in the layout.” it is shown visually in the Figure 6 and the justified graph below.

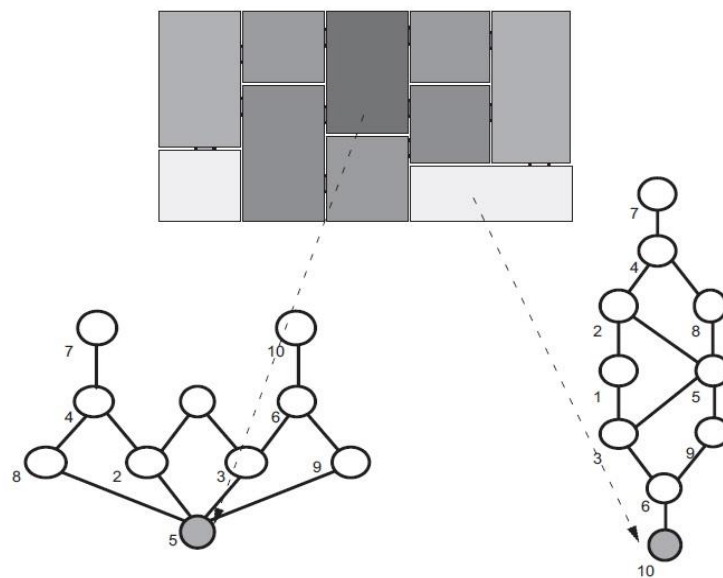


Figure 6. The spatial layouts are different in each graph, when they are recognized from different spaces. Resource: (Hillier & Vaughan, 2007)

These two graphs are presenting different spatial layouts by different space in the same organization. Each graph show a real feature of that layout. In the left graph space (5) is shallow compared to the other spaces, and in the right graph space (10) is deep in terms of its relationship with the whole structure.

These types of graphs are called “justified graph” or “j-graph”. These graphs then have the ability to measure the integration and segregation of spaces in relation to each

other. Furthermore, based on the specific shape of each graph, Figure 7 it shows the degree that a person should pass in order to go from a specific “space” to all others. The degree can be low or high; it depends that the graph is deep as on the left, or it is shallow like the one on the right. Accordingly, if it is shallow, it is integrated, and if the degree is deep, it is segregated. Therefore, as Hillier et al (2007) state, it is possible to “index each space in the layout in terms of the degree to which it integrates the complex, and the average for the whole will be the degree of integration or segregation of the whole complex.”

If all these spaces with their relation to each other presenting the same relation for different urban districts to each other, it is possible to draw the same type of graphs to observe how deep or shallow, when they are compared to the whole structure of the city; and consequently how much they are integrated or segregated based on spatial organization of the city.

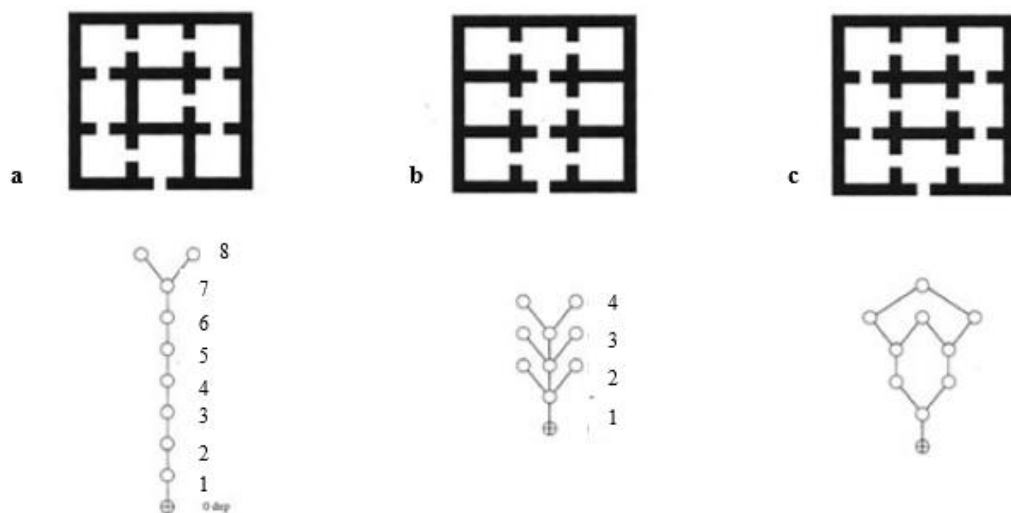


Figure 7. Deep and shallow spatial organization. (a) Total deep spatial structure. (b) Average deep spatial structure. (c) Shallow spatial structure. Resource: (Hillier B. , 1996).

Application of the configurational measures is the real function of space syntax to the different types of geometric features, which are created by buildings and cities. No matter if the lines, convex spaces or isovists are selected for analysis, the point is that, all of them are based on ‘spatial aspects of human behavior’. As a result, as also Legeby (2010) confirms: “the line of reasoning of hierarchical or shallow spatial systems might be possible to relate to the reasoning of hierarchical or shallow social systems as well.” It means that when spatial segregation happens, in consequence the social segregation will be happened as well (Hillier & Vaughan, 2007).

### **3.1.2 Theory of natural movement**

One of the main concepts related to the urban form in space syntax is the theory of *natural movement*, which introduces the idea of way finding based on urban form. Hillier & Vaughan (2007) state: “the configuration of the urban street network, which is the largest spatial pattern in the city, is in and of itself a key determinant of movement flows and hence co-presence in space.” So as it is shown, it has a very important effect on the functions of cities and forms of cities; therefore Hillier et al (1993) refer to this as the theory of natural movement. On the other hand the theory of natural movement is the key notion of understanding how the social city is based on physical city; how a specific structure of buildings and spaces can result in developing a city and bring live to it or let it fail– as living cities. Moreover it can help to realize how each space is generated based on segregation – or integration. Hillier & Vaughan (2007) said: Theory of natural movement is a key to “understanding cities as socially meaningful patterns of relative integration and segregation”.

As an example for the function of this theory, the abstract grid in Figure 8, contains main street, cross street, back street and side street; also the people who are moving

between these blocks on those most direct streets. It is very obvious that the main street would be more used by people compared to the side street or back street. Also central section of main street is more populated or people pass more than the peripheral ones. The main street is more accessible which means that this street is easier to get rather than other streets. Even though the cross street is used and is accessible, through the theory of natural movement in space syntax, this street is estimated to be less populated or passing people through it is less when compared with the main street. It is estimated that in the overall grid the position of each street affects the movement flows to – and through the streets. As Hillier and Vaughan (2007) clarify, theory of natural movement or the way people behave and choose their path is related to “the way the grids are put together, and it is not a matter of psychology”.

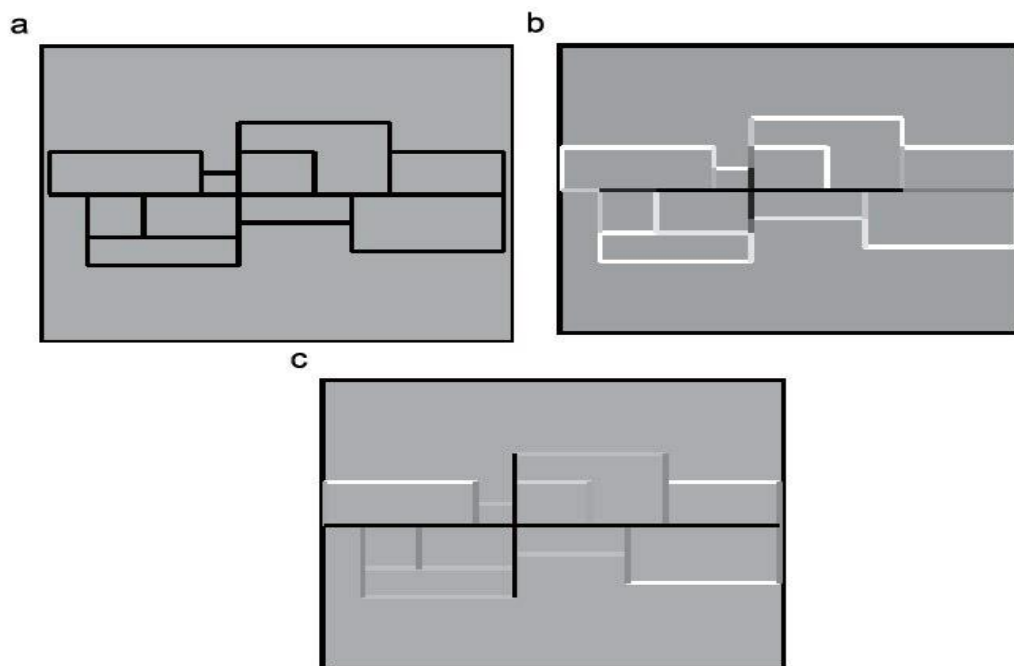


Figure 8. (a) A notional grid with a horizontal main street, vertical cross street, side streets and back streets. (b) Notional grid: pattern of ‘integration’ values – or the closeness of each line to all others – from dark for highest through to light for least. (c) Notional grid: pattern of ‘choice’ value, or the degree to which each line lies on simplest paths from each line to all others, from dark for highest through to light for least. (Hillier & Vaughan, 2007)



The concept of 'nearer' is very important in this argument and it shows how actually cities are working and causing segregation or integration first physically then socially. In fact all people prefer to go to the destination which are more near than far distance, so if some locations are in some sense 'nearer' to all locations within a certain radius than others, as in Fig. 8a, this will give these locations greater potential as destinations than others, simply by virtue of having easier accessibility.

Movement through a space define the accessibility of that space and accessibility of movement would measure the integration. Figs. 8b and c show the integration measures applied to the axial map, and colored up in shades of grey, from dark for integrated to light for segregated (Hillier and Hanson, 1984).

### **3.1.2.1 Axial map**

Axial map is the most important part of syntax analysis of this research. Axial map is based on 'Axial line', which is one of the component concepts of space syntax. Axial map is developed from street network, which is one of the dominant features of the city. Axial map analysis is determined as a proper tool for the research, as it shows the basic structure of built environment through its space formation. The space is described with straight line, which is named as "Axial Line". In short term, in order to analyze the space, it is modeled by "fewest and longest straight lines covering all convex spaces". (Hillier & Hanson, 1984) For a better understanding, the concept of 'axial map' in Figure 9 simply show how we draw the most possible short and straight lines in space (convex spaces).

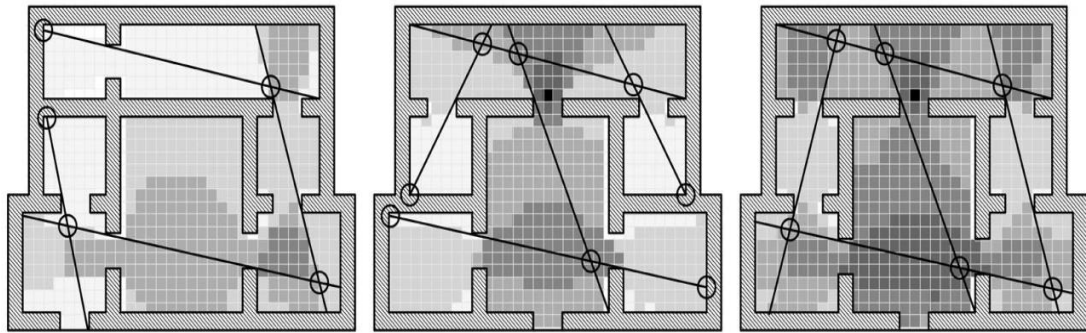


Figure 9. Axial lines and intersection points in each building, however high visual integration spots have darker tones as well. Source: (Dawes & Ostwald, 2013)

Peponis et al., (1997) state that: “The axial map comprises the fewest and longest lines that are necessary in order to cover all parts of the urban fabric. The number and length of axial lines is a function of the degree to which other parts of the system are directly accessible and visible from each point. The intersections between axial lines are then treated as the elementary relations between spaces.”

Space syntax tries to capture the main linear nature of urban space. Rendering the street network pattern through “fewest and longest lines”; it is possible to draw about the system (Hillier & Hanson, 1984). In order to take the important topology of street network geometry, it should be considered as a graph. So the lines can be treated as the elements of a graph and intersections as links. For example Porta, et al., (2006) analyze the street networks of six different case studies, by means of syntax (Figure 10), simplifying them to see just their connections graphs (Axial map).

At the same time, the axial map as a graph has a specific quality, which has a fractal nature (Carvallo & Penn, 2004). This quality shows itself in all urban streets; no matter on which scale, they are all consist of great number of small lines and few number of long lines (Hillier & Vaughan, 2007, p. 215).

Axial line analysis is the best analysis for long narrow paths. Therefore it is usually used to perceive street configurations in urban areas (Dawes & Ostwald, 2013). The axial map is representative of movement potential in an environment including the accessibility, and intelligibility of urban spaces. Meanwhile, description of the system of spaces based on axial maps will help to measure the spatial integration as well.

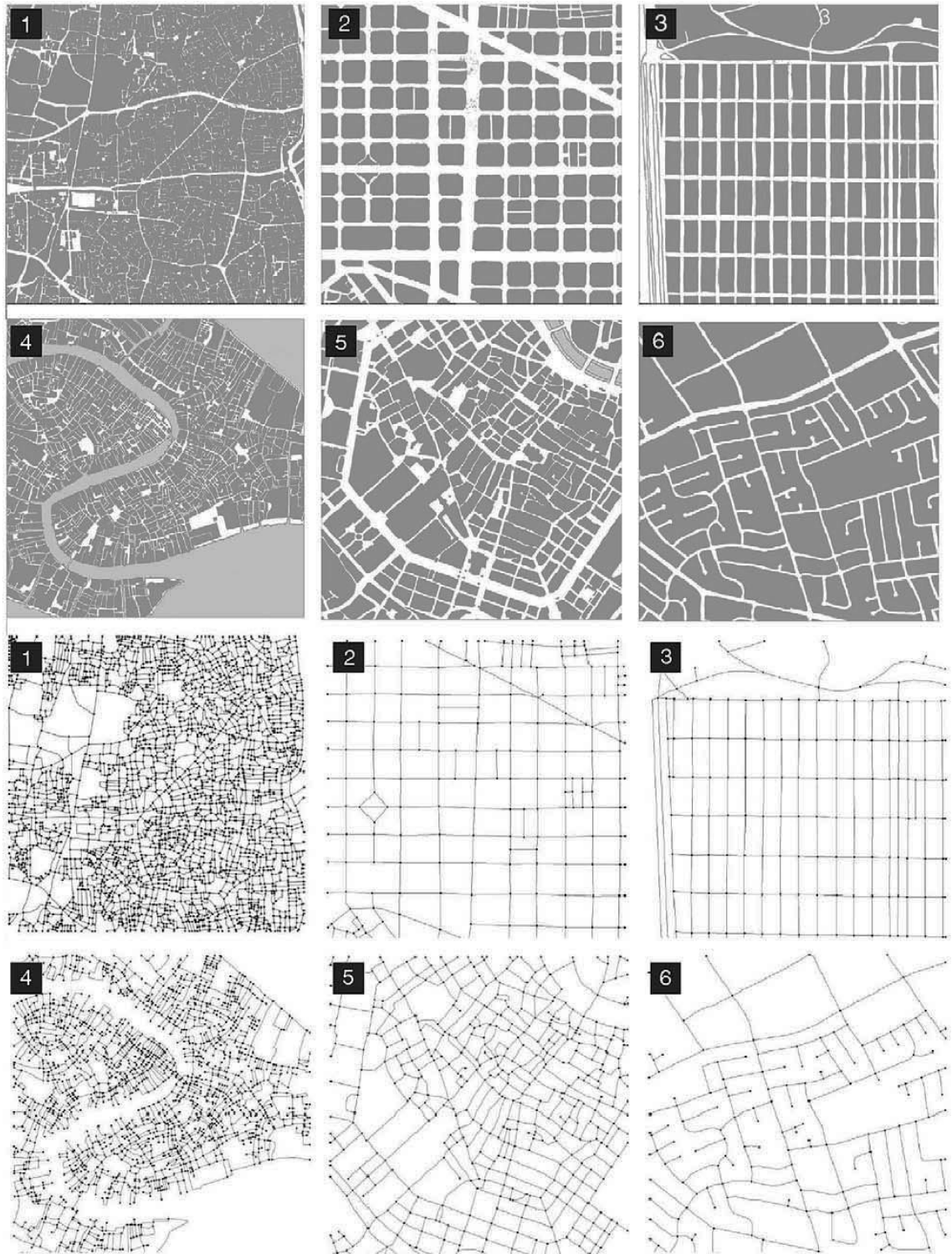


Figure 10. The six 1-square mile samples of urban patterns (above) and their primal graphs (below): 1. Ahmedabad; 2. Barcelona; 3. San Francisco; 4. Venezia; 5. Wien; 6. Walnut Creek. Cities are so diverse that, at a first sight, it seems hard to imagine that they share any common, though hidden, pattern, which is what they actually do (Porta, Crucitti, & Latora, 2006).

### **3.1.3 Measuring Accessibility through space syntax**

In space syntax analysis, accessibility can be measured mainly by depth and through the connectivity, integration and intelligibility of urban layout represented by axial lines. To measure the degree of accessibility, space syntax techniques are used to determine whether, or to what extent, the geometry of the urban structure facilitates accessibility to and from various areas of the city, rather than from one specific location to another. The measures produced by space syntax analysis give an account to the differences in accessibility and location in the urban form. They “analyze the patterns of connection, differentiation and centrality that characterize urban systems and the relationships of parts to whole that they engender” (Peponis et al., 1997, p.342).

### **3.1.4 Measuring integration through space syntax**

Integration is an important feature of axial map. As Peponis et al (1997) state: “Integration measures the relationship of each line to the network as a whole. The integration value of a line is a function of the minimum number of other lines that must be used in order to reach all other parts of the system.” Integration is different in any case’s axial map. For instance, take the axial map of London, in England (Figure 11). The axial map can be presented in a graph, where the lines are “vertices” and intersections are “connections”.



Figure 11. Axial map of London. Source: (Hillier & Vaughan, 2007)

“Connectivity of an axial line measures the number of lines that directly intersect that given axial line. Thus connectivity of a space represented as an axial space, denotes the number of immediate neighborhoods of a space. Integration of a space is by definition expressed by a value that indicates the degree to which that space is integrated or segregated from a system as a whole (global integration), or from a partial system consisting of spaces a few steps away (local integration)” (Choudhary, 2012).

The local integration means a space can be accessible from another space in the system if they have just three changes of direction between themselves. In between the “local accessibility” refers to most locally integrated lines, which is also calls “the pedestrian level of accessibility” as well. Meanwhile “global accessibility takes into account how far the whole system is accessible from outside itself” (Lima, 2001).

Integration is not only a formal feature, but also it can help to figure out how urban systems work (Hillier, 1996). Through the studies which have been undertaken mostly for the European cities, it is shown that there is an important and strong relationship between integration and amount of pedestrian passing through specific spaces (Hillier et al., (1987); Peponis et al., (1989)). “The more a space is integrated, the greater the chances that it will be more densely occupied by moving people” (Peponis, Wineman, Rashid, Kim, & Bafna, 1997). This result has been tested and approved in case studies, which spatially are totally different from each other; for example: rectangular, irregular, regular, or segregated urban grids, residential districts and business centers. Even this result is the same during different time period in a day and in a whole week (Peponis, Hadjinikolaou, Livieratos, & Fatouros, 1989).

Looking at the concept of integration as a measurement presenting the “depth” or “shallowness”, which has been discussed before, it can be stated that, integration is an in-between value that measures the depth of space from any point –inside or outside- in the spatial system to the rest of the system by using axial line.

### **3.1.5 Measuring Intelligibility through space syntax**

“The correlation between connectivity and global integration is an important indicator of how clear an urban system is for its users; and this is referred to as Intelligibility” (Choudhary, 2012). Or as Lima (2001) differently states in another way: “Intelligibility of a system indicates the relationship of local and visible spaces located one step away (correlation of global integration with connectivity) or three steps away (correlation of global integration with local integration) from each space, and globally merely inferable spaces”. Table 3 summarizes all the related variables which are used to measure the spatial structure of the case study of this thesis.

Table 3. Syntax variables and their definitions

<b>variables</b>		<b>Definition</b>
Accessibility		Accessibility can be measured through the connectivity, integration and intelligibility of urban lay out represented by axial lines.
INTEGRATION	Integration	Integration is an in-between value that measures the depth of space from any point –inside or outside- in the spatial system to the rest of the system by using axial line.
	Global Integration	The degree to which that space is integrated or segregated from a system as a whole.
	Local Integration	The degree to which that space is integrated or segregated from a partial system consisting of spaces.
intelligibility		The correlation between connectivity and global integration.

### 3.2 Social Area Analysis

In urban studies since 1955 scholars such as E. Shevky and W. Bell, developed the methodology of “Social Area Analysis” tried to consider all the social inequalities of residents such as income, ethnicity, education, occupation, etc. in order to qualify the social characteristics of residents based on their neighborhoods.

It should be noted that, the foundation of Social Area Analysis, goes back to the Chicago School in 1920. “The Chicago School approach of the 1920s was perhaps the earlier attempt at defining social processes of organization and change” (Hale & Austin, 1997). Referring to this approach, as long as industrialization brings inequality forces into the communities, these communities can’t act any longer effectively as agents of social control. The Chicago School approach’s perspective of social disorganization provides the basic foundation of the comprehensive series of theories, which are all referred to as “social ecology” theories (Hale & Austin, 1997).



Hale & Austin (1997) said: “Social ecology theory promotes the idea that the social structure of any given areas influences the behavior of the social group in that area”. One of the main theories which was founded under the ecological paradigm was Social Area Analysis. This methodology was a response to the problems that rose in industrial revolution of modern cities. As the Oxford Dictionary of Geography explains, social area analysis is: “The analysis of a city to define social areas—urban areas which contain people of similar living standards, ethnic background, and life-style.” (Oxford Dictionary of Geography, 2009) This methodology provide three categories of variables which can indicate the community organization of any given area. As Shevky and Bell defined, these indicators were “social rank, economic status, and neighborhood segregation.” (Anderson & Bean, the shevky- bell social areas: confirmation of results and a reinterpretation, 1961). However, it is good to mention that the factor of “economic status” is referred to as “urbanization” or “family status” as well in different sources.

Social rank refers to the skills distribution patterns of inhabitants, which is the main cause of individual segregation and through time social segregation. Shevky and Bell stated that unequal scattering of these skills cause social stratification. The variables that were selected by Shevky and Bell, for defining social rank were: education, occupation, and income.

The second factor “economic status” was hypothesized to show the changes in the relationship between populations and the economy. Definition of the level of urbanization or development of a society, can be measured based on the amount of changes in the economic status. However, certain variables applied for measuring the “economic status” were: “the housing type, fertility, and percentage of women in the

labor force.” (Hale & Austin, 1997) Meanwhile based on these criteria Shevky and Bell (based on the 1955 standards) anticipated a modern economy or modern society, if, the percentage of women in labor force increased, the fertility decreased, and the multifamily housing number increased based on increasing density of housing.

Lastly, neighborhood segregation referred to the changes which happened in the arrangements of the inhabitants, based on changes in gender and age configuration which is shown through relocation of the inhabitants in space, and even segregation of certain groups. Based on this factor, counting the numbers of new immigrants as well as examination of the tendency of these new immigrants to live in separated neighborhoods of foreign – born citizen, were the attitude of Shevky and Bell to indicate this variable. In conclusion through all these three factors it was tried to define the "social area typology" (Hale & Austin, 1997). The concept of “Social Area Analysis”, its indicators and its implied areas are shown in figure 12.

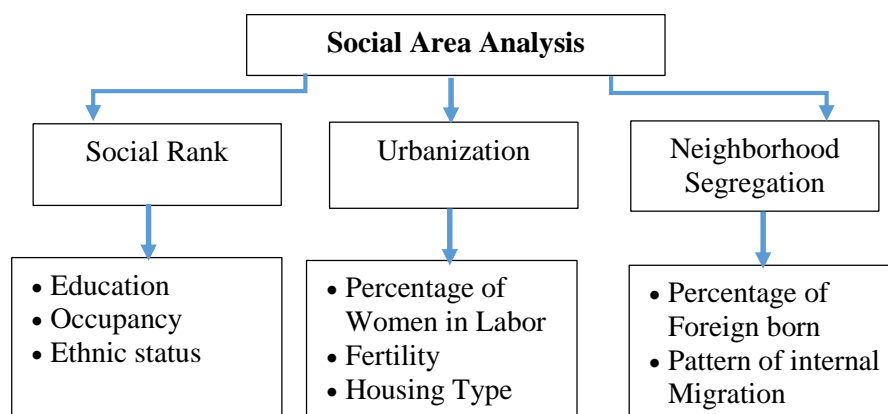


Figure 12. Social Area Analysis. Resource: (Maloney & Auffrey, 2013)

The relevant data for SAA is mostly derived from the census, which is essential to determine the values for family, ethnic and economic characteristics of each neighborhood.

In the following, an example of the application of SAA on İzmir will be summarized. Because, the application of İzmir has been taken as a basis for the development of the methodology, which is applied to the case (the city of Famagusta) of this research.

### 3.2.1 Examine an example of the Application of SAA: İzmir case

As it has been mentioned before, SAA in its original format or with some modifications has been applied for many different cases. With some changes and adaptation this method has also been applied to İzmir (Turkey)<sup>1</sup>. Since in this research, the method for İzmir has been utilized with some limitations, which will later be highlighted, before going further, variables and calculation and mapping techniques of İzmir case will be summarized below.

#### 3.2.1.1 Variables

According to Keleş (1972), in some similar studies, some scholars preferred to use a single variable for social rank, whereas in practice it can be recognized that more than one has been utilized. For İzmir, occupation, income, education and housing condition were determined as variables for determining social rank (socioeconomic status).

Table 4. Social Rank (Socioeconomic Status) Index.

Occupation	Unskilled, semiskilled, skilled workers %
	Workers in private services %
	Artisans, craftsmen and peddlers %
Income	Household with monthly income less than 500 TL %
Education	Uneducated Inhabitants %
Housing	Squatter houses %

<sup>1</sup> Instead of Census tract data random sample questionnaire survey has been utilized.

Two variables, which are household size, (crowdedness), and the percentage of women in the economically active population, have been determined for the urbanization index.

Table 5. Urbanization Index

Crowdedness	Households with seven or more people %
Economically active Women	Women with income %

In this study, ethnic diversification has not been included. Also According to the İzmir study, the Social Area Types of neighborhoods is defined based on the table that is translated and stated below.

Table 6. Socio Area Analysis of neighborhoods based on study of İzmir in 1972

Number	Districts	Social Rank						Urbanization				Social Area Type	
		Occupation	Income	Education	Household	Mean Value	Standard Value	Family Structure	Women In Labor	Mean Value	Standard Value		

### 3.2.1.2 Calculation and Mapping Technique

First of all, percentages for each variable are calculated, which has been transferred into a Typification Matrix for districts of İzmir. For each district a simple arithmetical mean (an average) has been calculated, which presents the position of each district in terms of social rank and urbanization. Afterwards a standard score has been calculated according to the formula below:

$$\text{Standard score} = 100 - x (r - o)$$

$x = 100 / (\text{highest average score} - \text{lowest average score})$

r= Average score of the district

o= Lowest average score

Accordingly, all standard scores range between 0-100, which would ease grouping as well as comparison on two axes (social rank and urbanization).

Each district has two standard scores; one for social rank and one for urbanization.

When combining these two scores, it was possible to locate each district in a social area on a social space diagram.

In the study, social rank standard scores are grouped and ranked as follows (Keleş, 1972, pp. 34-35):

Group I: 0-24 – Lowest social rank

Group II: 25-49

Group III: 50-74

Group IV: 75-100 – Highest social rank

In this end it is possible to draw the main framework of methodologies for this study.

(Table 7)

Table 7. Framework of methodologies that are used in this study

Main sub heading	Method	Variables Categories	Variables to Measure	Aim of methodologies
Urban Form	Space syntax	Spatial Variables	<ol style="list-style-type: none"> <li>1. Depth</li> <li>2. Integration</li> <li>3. Global Integration</li> <li>4. Local Integration</li> <li>5. Accessibility</li> <li>6. Intelligibility</li> </ol>	Exploring spatial segregation in Famagusta's urban form. Based on neighborhood scale.
Socio – spatial Segregation	Social Area Analysis	Socio – economic variables	<ol style="list-style-type: none"> <li>1. Education</li> <li>2. Occupation</li> <li>3. Income</li> </ol>	Investigating the socio – spatial segregation of urban neighborhoods in Famagusta.

## Chapter 4

### CASE STUDY: FAMAGUSTA

Famagusta (Turkish: Mağusa or Gazimağusa) is known as a coastal city which is located on east Cyprus in the Mediterranean Sea. The geographical location of the Island is very strategic, and it is the third biggest island in the Mediterranean Sea. (Fig 13)



Figure 13. Location of Cyprus Island in Mediterranean Sea (source: Google Earth)

Famagusta is the third largest with around 50,500 inhabitants (SPO, 2011) and one of the most important cities of Cyprus during history because of having longest sea shore and its critical location on the island (Fig 14).



Figure 14. The location of Famagusta within the Cyprus (source: [http://en.wikipedia.org/wiki/File:Cyprus\\_location\\_map.svg](http://en.wikipedia.org/wiki/File:Cyprus_location_map.svg))

In history, the city of Famagusta, was influenced physically, socially and culturally by different conquerors. Although the city survived since its foundation and became so successful over 60 decades, it is faced with division in 1974, when one of the most important districts of the city in the south-east, Maras (Varosha), is extracted from the city and became closed to the inhabitant since then till now. After 1974 the physical structure of the city was totally changed and caused a lot of consequence on social structure of the city as well. In order to understand the socio – spatial structure of Famagusta, which is the aim of study, it is firstly, necessary to understand the physical structure of the city and the process of its developments through the history.



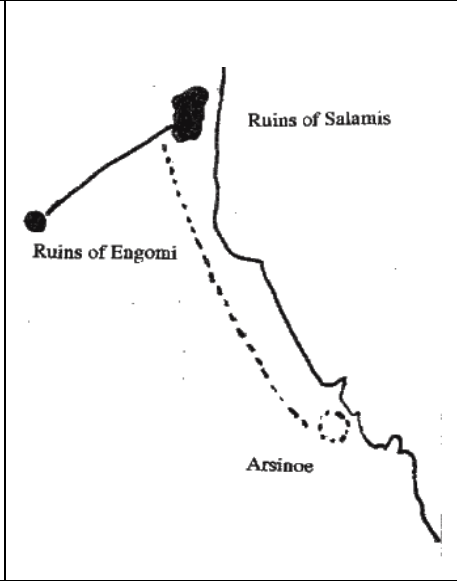
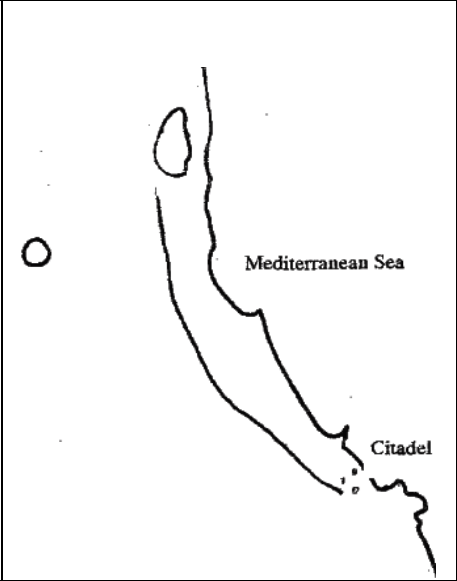
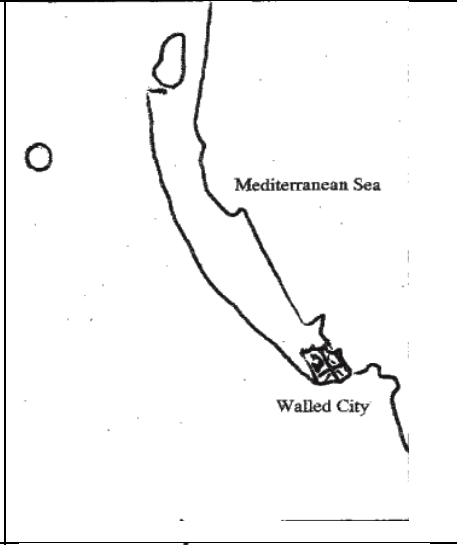
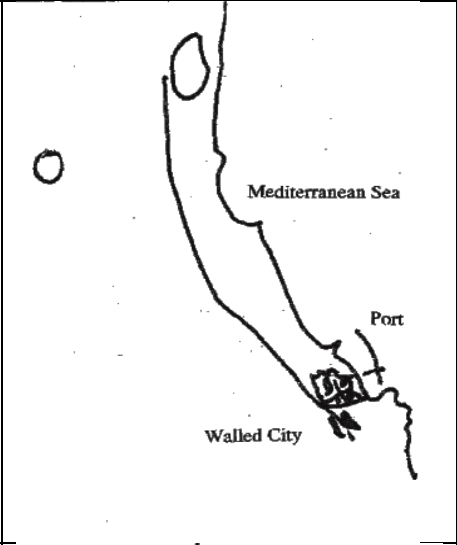
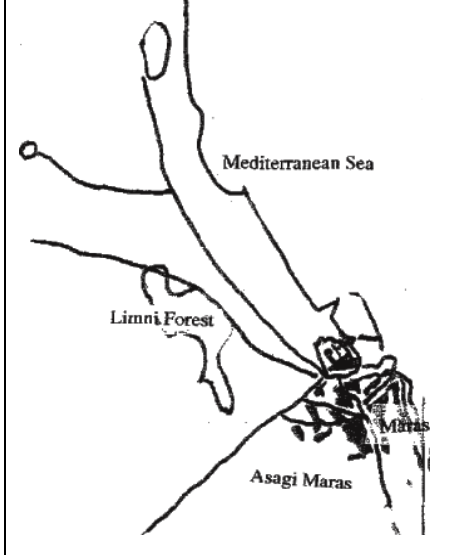
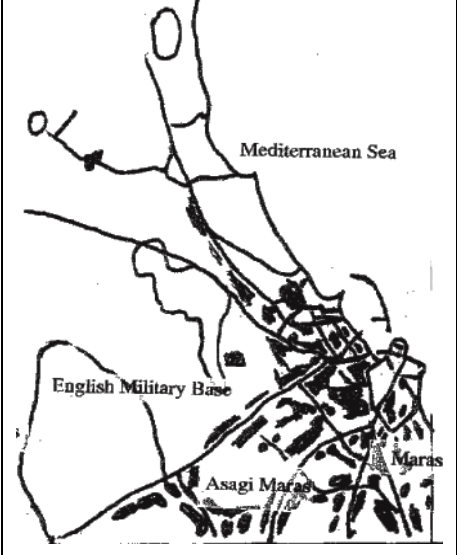
## 4.1 Physical development of city during the history

Considering the physical development of Famagusta through history, it shows that the urban development of the city is happened during seven historical periods. Which is briefly presented in the following tables:

Table 8. Historical periods of urban developments

Date	Name of Period	Explanation
648–1192 AD	The early period	The foundation of city up to the ruined of Arsinoe city (as an little fishing coastal town)
1192–1489	The Lusignan	The commercial trading costal town
1489–1571	The Venetian	The fortified city used for military purposes
1571–1878	The Ottoman	<ul style="list-style-type: none"> <li>- Conquer of city by Ottoman,</li> <li>- Arrival of Turkish people to the city</li> <li>- Development of the city outside of the walls through the south by Greek refugees</li> </ul>
1878–1960	The British	<ul style="list-style-type: none"> <li>- Expansion of the city approaching to the south</li> <li>- Expansion of Famagusta port</li> <li>- First urban legislation which is enacted in 1946 by name of “Streets and Building Regulations-Cap 96”</li> </ul>
1960–1974	Cyprus Republic	<ul style="list-style-type: none"> <li>- the British left the island in 1960</li> <li>- Establishment of Republic of Cyprus</li> <li>- Turkish Cypriots were mainly in the Walled City, Greek Cypriots outside the walls (mainly toward the south)</li> </ul> <p>Growing population and size of city especially in south-east of the city toward the Maras and Asagi Maras as Tourism center</p>
After 1974	Divided Cyprus  (the period after the war)	<p>Division of island into two parts, the south part for Greeks Cypriots and the North for Turkish Cypriots</p> <p>The development of the city extended towards the North, because of:</p> <ul style="list-style-type: none"> <li>- the Maras district was abandoned the city couldn't grow to the south</li> <li>- the establishment of the EMU university</li> </ul>

Table 9. Urban Developments of Famagusta during each period (source: (Önal, Dağlı, & Doratlı, 1999))

<p>EARLY PERIOD 648–1192 AD</p>			<p>LUSIGNAN PERIOD 1192–1489</p>
<p>VENETIAN PERIOD 1489–1571</p>			<p>OTTOMAN PERIOD 1571–1878</p>
<p>BRITISH PERIOD 1878–1960</p>			<p>REPUBLIC OF CYPRUS 1960–1974</p>

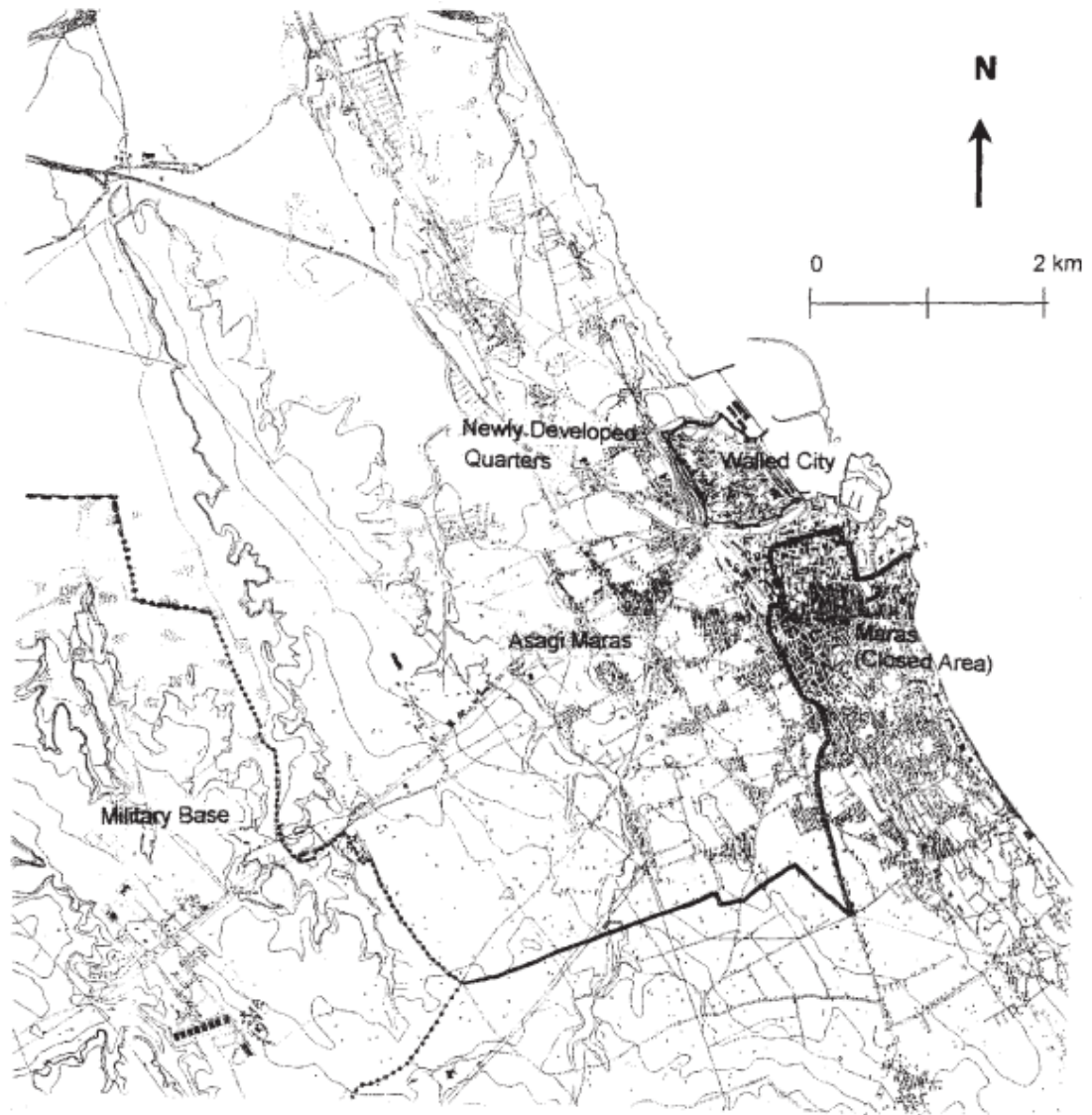


Figure 15. Famagusta after 1974. Resource: (Önal, Dağlı, & Doratlı, 1999)

The foundation of Famagusta dates back to the 300 BC when Ptolemy II found this city on the ruins of Asinoe settlements. This city for a long time stay as a little fishing costal town. But after destruction of Salamis/ Constantia with Arabs in 648 AD the refugees of the city moved to the Famagusta (current situation of the city). Later the city was developed as a commercial costal town.

Famagusta became one of the important commercial centers between west and east and it was developed and expanded during the Lusignan period in 13th century. Due

to its new situation on that time they built a citadel and a fort to protect the city. Also the physical development of city improved, since in this period they constructed 300 constructed churches with the Lusignan kings palace.

After Lusignan period, Famagusta became a fortified city during the Venetian period as a military base. Under the rule of Venetians the city became one of the most noticeable fortified medieval city in 15<sup>th</sup> century. They built the wall around the town, the citadel, bastions, moat, land gate and the sea gate. (Fig 16) During this period urban development expand mainly through the south-east/north-west and south/north directions, also the center of city remain in front of Venetian Palace square with the St Nicholas church on the other side of it (Önal, Dağlı, & Doratlı, 1999) .

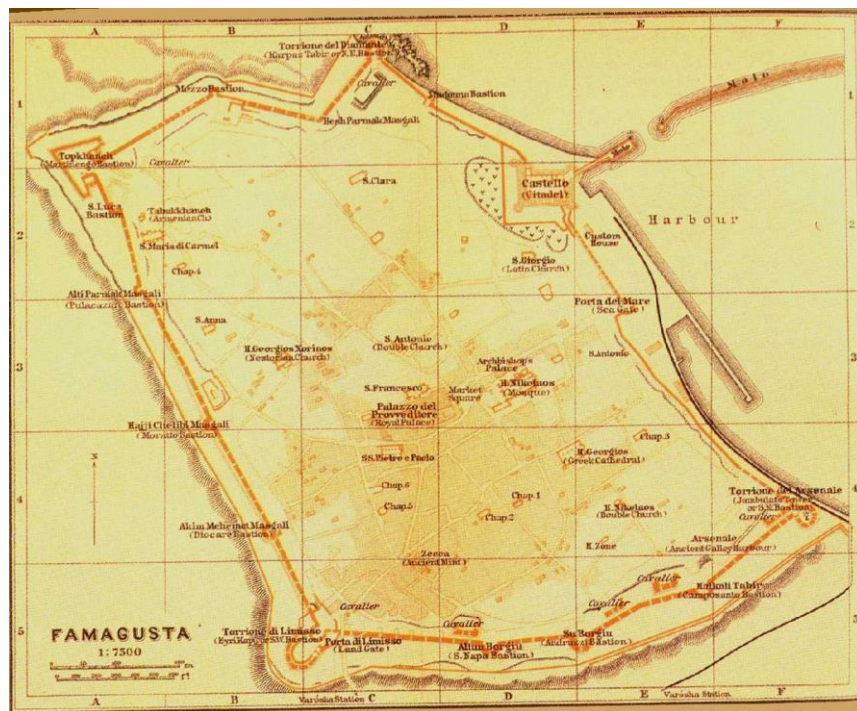


Figure 16. Famagusta – Fortified city in Venetian Period (1489–1571) Resource: <http://www.cypnet.co.uk/ncyprus/city/famagusta/maps/>

The Ottomans period start in 1571 after they conquered the city. During this period the city faced a lot of social and physical changes. At the time a lot of Muslim Turkish

people came from Anatolia to the city and they forced non-Muslim people to move out of the city. In consequence of deriving out of Greek people outside the wall, the city start its development in south direction of the city along the seashore. Therefore two urban districts of Maras and Asagi Maras developed on that time, which were during the time became more populated and dens compare to the wall city (Önal, Dağlı, & Doratlı, 1999).

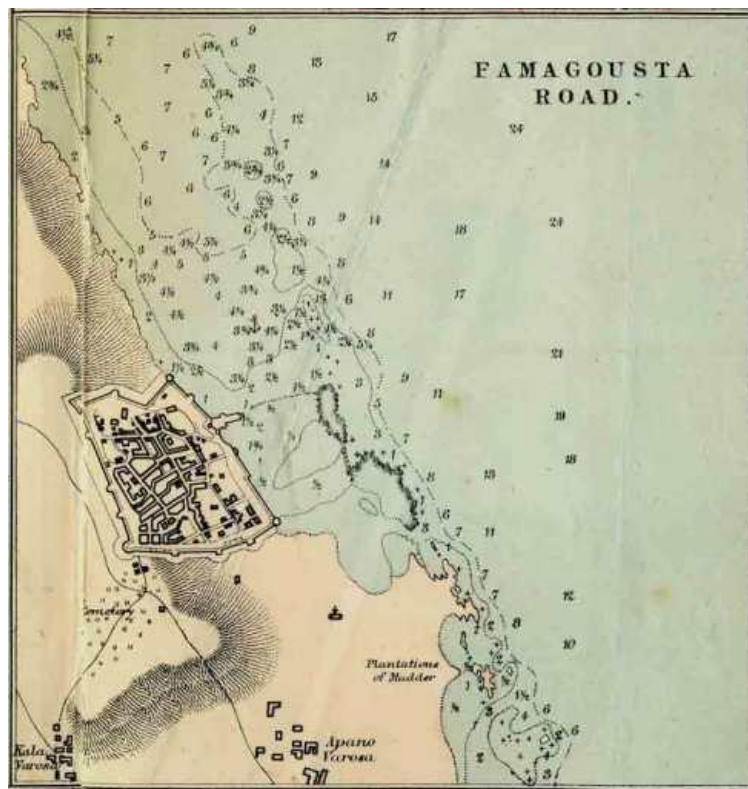


Figure 17. Map of Famagusta in 1987 the expansion of city toward the south outside of wall city. Resource: [allikypros.files.wordpress.com/2010/01/](http://allikypros.files.wordpress.com/2010/01/)

The Ottomans in 1878 hire the Cyprus Island to the British colony. During this period the port became very important and it was expanded. Also development of the city was accelerated toward the south which was already started in Ottoman period. Since the major economic activities existed in the Maras and Asagi Maras therefore these two parts became more dominant and developed faster in compare to the wall city .On that

time mainly the Turks were dominant inside the Walled City and the Greeks outside the wall (Önal, Dağlı, & Doratlı, 1999). However in this time first urban legislation enacted in 1946 named as “Streets and Building Regulations- Cap 96”. (Doratli, N., Hoskara, S., Zafer., N., Ozgurun, A., 2003)

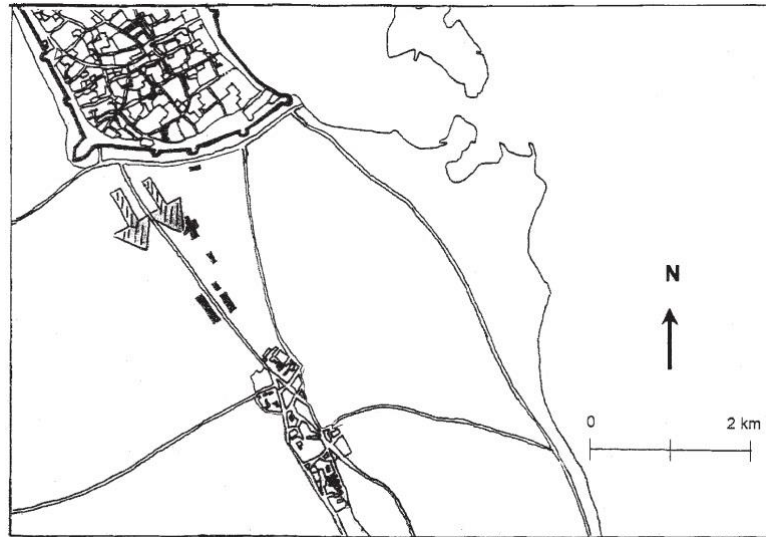


Figure 18. Extension of city toward the south outside the wall city. Resource: (Önal, Dağlı, & Doratlı, 1999)



Figure 19. Expansion of port (British storage near the port against the wall)  
Resource: [allikypros.files.wordpress.com/2010/01/](http://allikypros.files.wordpress.com/2010/01/)

British left the island in 1960, and the Republic of Cyprus was established. It was based on partnership between two majorities of Turkish and Greek Cypriots. However as it mentioned before, the whole city core, economic activities (base on tourism), density and population were located on the south east of the city, and most of urbanization happened on those districts. Since the south and south-east of city were ruled by Greeks, the Turkish became separated and neglected as they were living in the Walled City and north-west of the city. (Fig 20, 21)



Figure 20. Maras district before 1974 as the core of the city with most population and density. Resource: <http://www.google.com/imgres>



Figure 21. Hotels and accommodation in Maras's sea shore before 1974. Resource: <http://www.google.com/imgres>

After the war in 1974, the island was divided into two parts, the Turkish Cypriots in the North and the Greek Cypriots in the South. This war and division had a huge effect on Famagusta as well, since Maras district was closed to habitation and the city lost its most urbanized and developed part.

This district was the core of city and other neighborhoods were shaped around it. As a matter of fact, extraction of this part of the city severely affected the other neighborhoods, and future development of the city. Urban development of the city after 1974 and exclusion of Maras left no chance except growing towards the north-west direction almost in a linear shape along the sea shore. (Fig 22)

It should be mentioned that, the city has expanded towards the North – west direction in almost uncontrolled and very fast due to several reasons. Firstly, there is no master plan of Famagusta. Secondly, the establishment of EMU has increased the attractiveness of the undeveloped areas in the North and North – West of the city. As a result, also supported by other factors, which will further be explained in the following section, the city presents a fragmented structure, with low connections between its neighborhoods.

## **4.2 Urban Macro Form of Famagusta**

In this part the urban macro form of the city, street network, and the main physical constraints that affect the growth and integration of urban layout will be presented.

### **4.2.1 Macro Form of the City**

This city like most cities, which are developed along the sea shore, has a linear pattern, in order to have most accessibility to the water and the sea breeze (Figure 22). However, typology of Famagusta's urban form, referring to discussions on chapter



two, is also decentralized, and incoherent. It means, physical layers of city are not overlapped on each other to become denser. Also these layers frequently are cut and fragmented, mostly because of two reason, firstly man – made and natural – made constraints prevent a coherent growth which will discussed later. Secondly, the lack of master plan for physical development of the city which results in a haphazard growth, and sprawling along the sea.

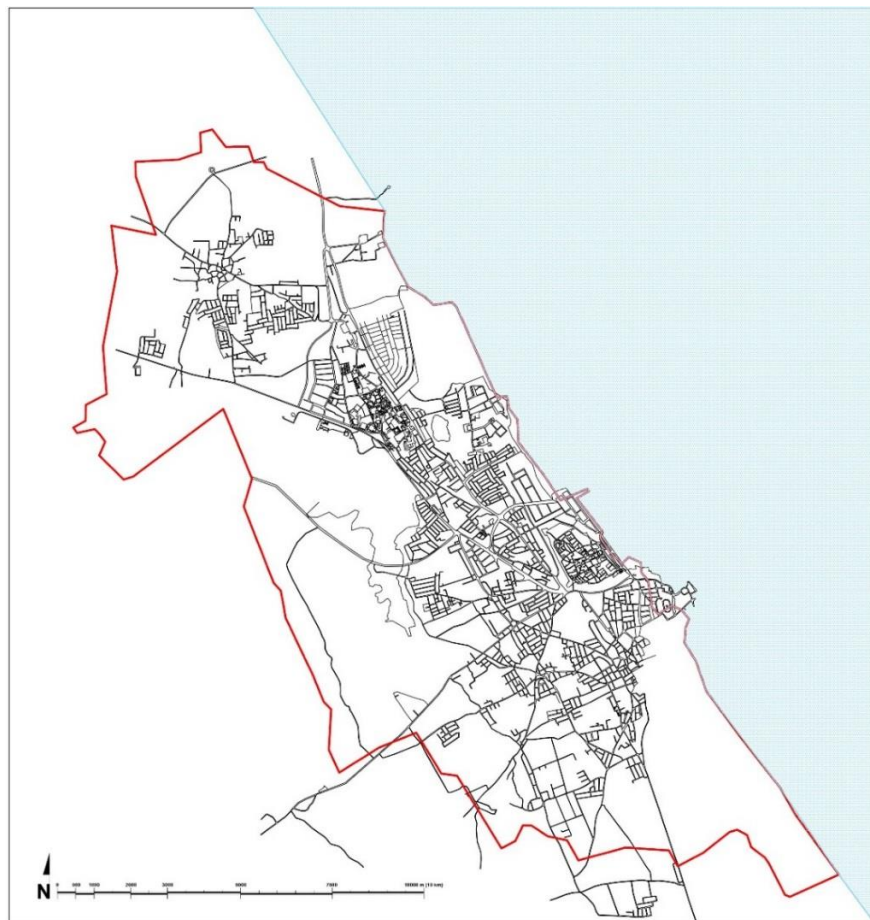


Figure 22. Linear growth of city along the sea shore. By author

#### **4.2.2 Street network pattern**

Typology of street networks as it was discussed in chapter two, shows the urban macro form of city. Thus, the linear form of Famagusta can be more clearly and abstractly determined when just the network of streets are drawn. Furthermore, the way they are

connected to each other or where they are disconnected show the spatial potential and limitation of city's urban layouts. Meanwhile, street network patterns are used in this study as the basic ground of spatial integration and segregation in the space syntax analysis. In Figure 23 below the urban macro form of Famagusta is shown based on its street network pattern.



Figure 23. Street pattern of Famagusta. By author

### **4.2.3 Physical constraints**

Physical constraints in cities refers to the all natural and man – made thresholds which limits the growth and development of the city. Famagusta presents both of them, which severely affect the development patterns of the city. Also they intensify the spatial segregation between city's neighborhoods. (Fig 24)

#### **Natural constraints**

Cities can be observed as awesome manmade settlements based on their geographical characters. In this way cities have to respect these natural characters and use them efficiently. During the growth of cities sometimes these natural properties are transformed into natural constraints for spatial growth and cause discontinuity in the spatial patterns of cities (Dupont, 2004). Since Famagusta is geographically located near the sea, it has a lot of wet lands which is in need to be preserved because they are valuable for the ecology of local animals or other living species. Meanwhile, the Limni forest and wet lands on the west also cause natural thresholds for the city.

#### **Man – made constraints**

In general war and division of island in 1974 caused a lot of physical barriers. Especially for Famagusta this has been very serious, which has restricted spatial development as well. Closed Maras, military areas, and UN camp take a lot of land from the city and more importantly they cut off a lot of spatial connections between districts of the city and reduce accessibility. Consequently, they increase the spatial segregation in the physical layout. It is also necessary to mention that the physical connection of the Walled City to the districts outside is also very limited because of the thick wall around it, which has just three gates for access to outer parts.

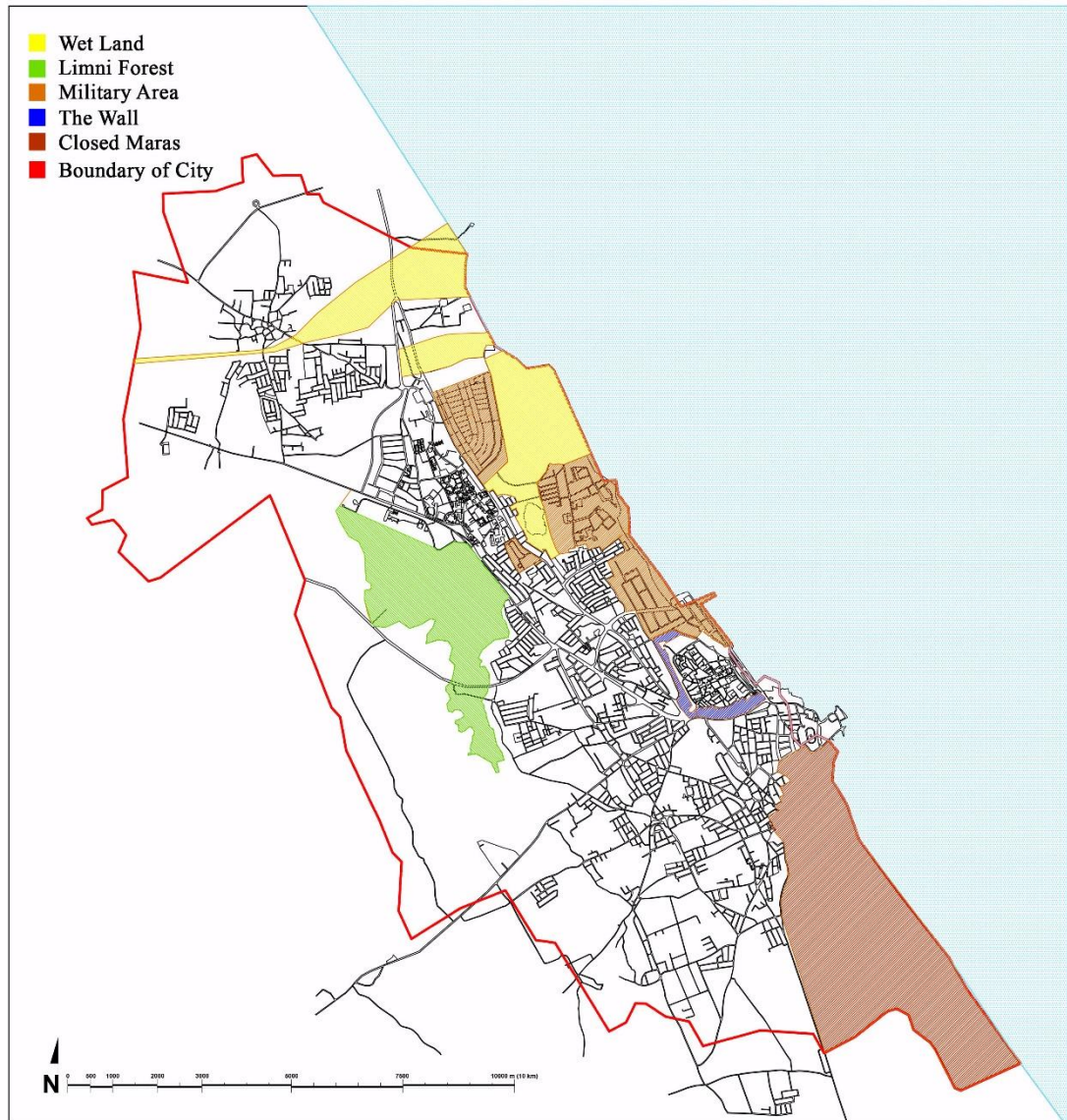


Figure 24. Physical barriers and their types. By author

### 4.3 Quarters and Social Structure of Famagusta

Analysis of the spatial structure of Famagusta shows that based on the linear structure, the city can't grow in all directions. Therefore quarters are more or less organized in a sequential pattern, along a linear axis, which are Salamis Road and Gazi Mustafa Kemal Boulevard. Besides, the physical barriers also, reduce the connectivity between quarters, which also decrease the accessibility between them. According to Önal et al. (1999) Famagusta is composed of four main parts:

1. The Walled City
2. Asagi Maras
3. Closed Maras
4. Newly developed Quarters

However, considering the recent development, trends, Tuzla (residential suburb around Tuzla village) can be considered as a new added main part to the city. (Figure. 25)

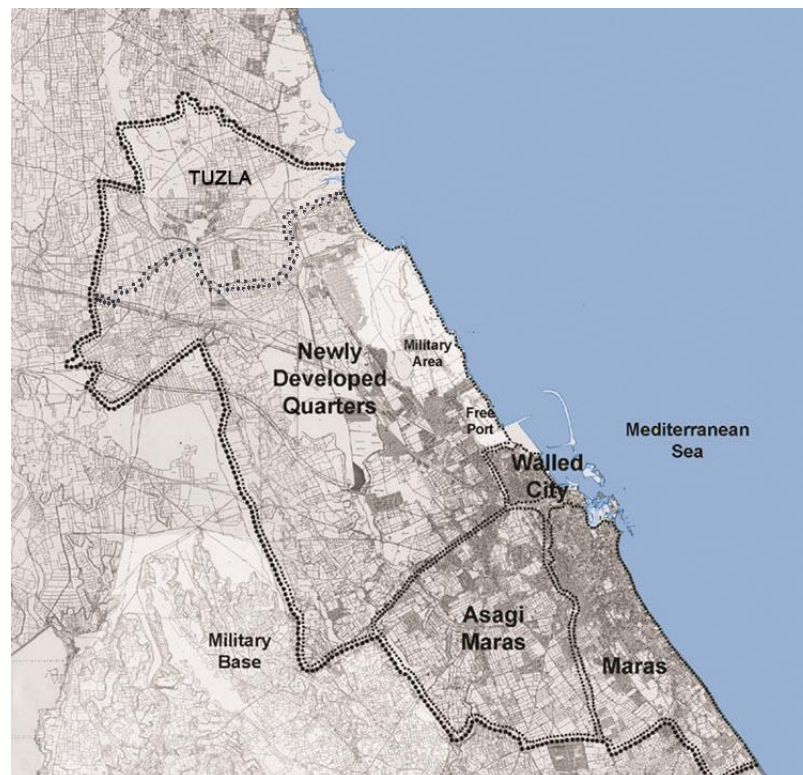


Figure 25. Distinct parts of Famagusta. Resource: State Planning of Famagusta

Newly developed quarters, refer to the quarters of the city, which started to rapidly develop after Maras was closed to inhabitants in 1974. These five neighborhoods are: Baykal, Dumlupinar, Canakkale, Karakol and Sakarya. Asagi Maras is also consist of eight neighborhoods: Harika, Anadolu, LalaMustafa Pasa, Zafar, Pertev Pasa,

Canbulat, Piyale Pasa, and NamikKemal. Walled City is also one neighborhood, which is called Surici in Turkish. The last neighborhood is Tuzla on the North West of the city. (Figure 26)

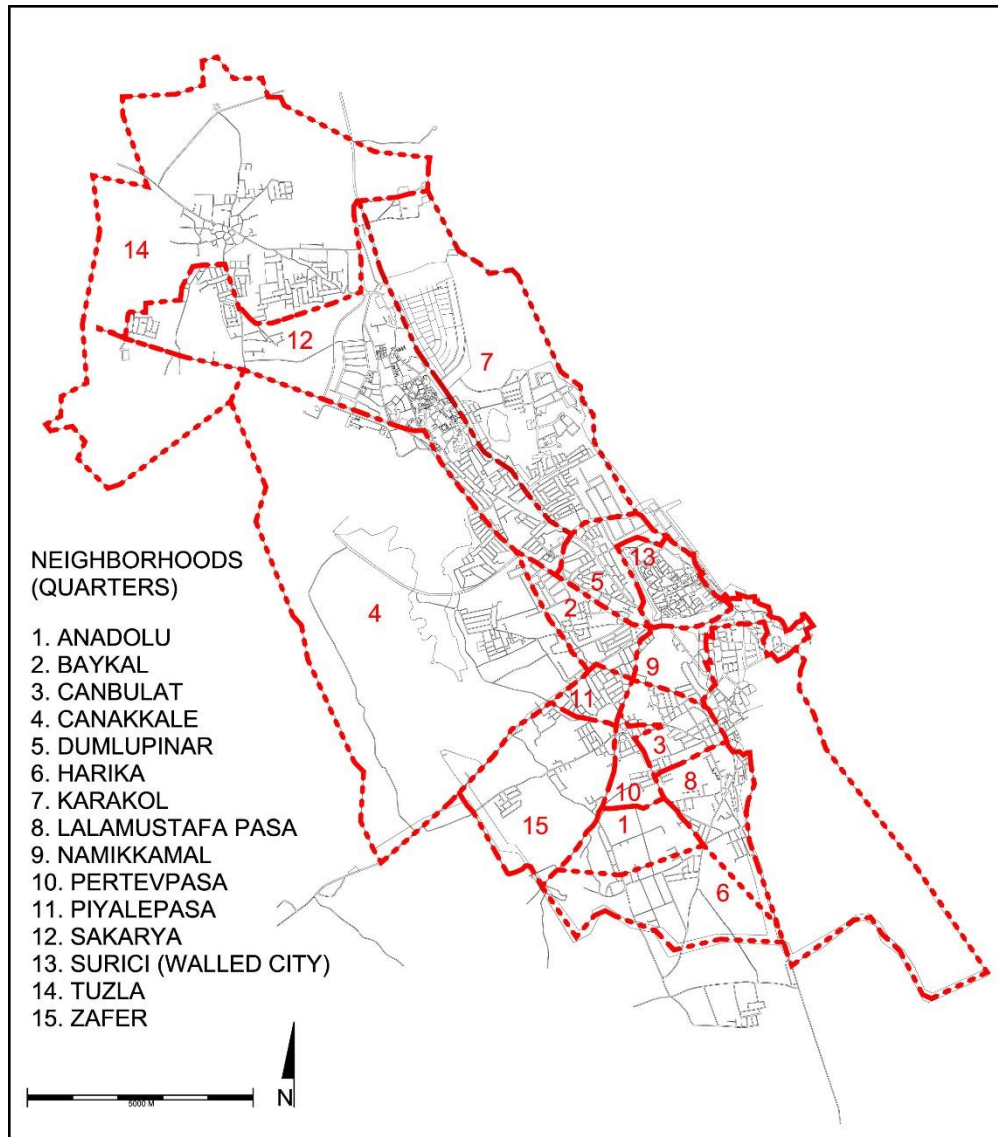


Figure 26. Neighborhood districts and their locations. By author

#### 4.3.1 Social Structure in general

The social structure of Famagusta like its physical structure changed a lot since 1974. As Doratli (2000) mentioned: “The city can be considered as a mosaic of different cultures, not only due to students and academic staff from many countries, but also the

new comers after 1974, from the south of the island, and from different parts of the mainland, Turkey.” In addition to the multicultural structure of the city, the settlements of inhabitants with similar racial and cultural background in specific quarters, affects and support the socio – spatial segregation.

District of Asagi Maras after 1974 lost a lot of its connections to the city center which was Maras, and after new development of the city towards the North, it became a more or less neglected area, which has after the Walled City the lowest connection and accessibility to other districts. (Table 14)

The new developed quarters were almost agricultural lands before 1974, beside the wet lands. However after war, the city had no chance except to grow towards the North, and use these lands. Through time they became most populated and urbanized districts of the city. On the other side these districts has the highest connections to the other quarters and most importantly to the university. Also the Ismet Inonu Boulevard, which is the main street between Sakarya, and Karakol contains most of the commercial and leisure activities in the city.

Most of the inhabitants in two districts of Sakarya and Kaliland (a part of Canakale quarter), are the international students, university staff and other Turkish Cypriots. Two neighborhoods of Baykal and Dumlupinar are mostly occupied by Turkish Cypriots and less students.

District of Tuzla as it mentioned before, was a little village before 1974. But it grew very fast; because of its closeness to the university, and governmental hospital. Its

population are mainly Turkish Cypriots. Conversely, the accessibility of this district is low; to the rest of the city.

Due to the current physical and social situation of Famagusta, it is evident that physical and social structure of city are related to each other. Also it can be estimated how much the social structure of the districts is the consequence of the physical structure of those districts. In order to investigate this relation, and how much they will match together, in the following section it is attempted to explore the relationship between the urban form and socio – spatial segregation of Famagusta; as it is already discussed in the literature review and defined by the aim of this study.

#### **4.4 Investigation on the Relationship between Urban Form and Socio – Spatial Segregation**

The methods which are employed for this study, are seeking to assess the impact of urban form on socio – spatial segregation. To achieve this goal, the research would first, explore the urban form by space syntax methodology, and social segregation by using SAA. Before presenting the analysis, in the following the methodologies will be presented.

##### **4.4.1 Methodology for the analysis of the urban form through SS**

Examination of city's neighborhoods in terms of the degree of accessibility from other neighborhoods, is also considered in socio – spatial segregation studies (Talen & Anselim, 1998). Referring to these studies, determination of accessibility is very essential in realizing the degree of segregation of inhabitants.

For this study, accessibility is determined as a measurement for the amount of access through space inside different quarters of the city. Additionally, it reveals the size of



physical mobility and amount of accessibility which is possible for individuals inside the layout of city. The estimation of accessibility in urban form, also involves estimation of the total access from any place in the city to any other place in the same city. Accordingly, accessibility should be analyzed at both local and global scale in city.

The space syntax techniques “analyze the patterns of connection, differentiation and centrality that characterized urban systems and the relationships of parts to whole that they engender” (Peponis et al., 1997). In order to investigate the degree of accessibility, this study uses space syntax techniques, to see how much the geometry of urban form can facilitate the accessibility inside the layouts of the city, to and from any location within the city. The measure that space syntax brings out from urban form, shows the differences in accessibility and location.

It should be mentioned that the factor of accessibility in space syntax is a dependent variable, which means that, through space syntax this factor will be analyzed based on the other variables of depth, connectivity, integration, and intelligibility; and they are calculated by the urban layouts which are represented by axial lines (Table 13).

#### **4.4.2 Methodology for the socio – spatial segregation analysis through SAA**

In order to determine the socio – spatial segregation in Famagusta, as it has previously be mentioned İzmir SAA method has been utilized with some limitations. Firstly, the existing census data<sup>2</sup> on Famagusta is too general, which is prepared for the city as a whole, and therefore it is not possible to have neighborhood based values for all

---

<sup>2</sup> Census data has been taken from TRNC State Planning Organization (SPO)

indicators. Secondly, there are no any information on indicators such as ‘Family Structure’, and ‘Women in Labor’ in the census data.

Considering also the suggestion of Keleş, which indicates that some studies on SAA is limited to a single variable, in this research the analysis will be limited to “social rank”, based on the socio – economic status of the inhabitantants. Although housing is a variable, which was part of the analysis for determination of social rank in İzmir, it has been excluded in this study. Because the necessary data for Famagusta is not available in the census data. Socioeconomic status includes variables, education, income, and occupation. Evaluation of these variables will convey to the determination of social areas with high socioeconomic status (high levels of education, high incomes and professional occupations); social areas with low socioeconomic status (low levels of education, low incomes and workers.

Consequently, the Social Rank as it is presented in Table 10, will be measured through three indicators of Occupation, Education, and Income.

Table 10. Socio Area Analysis of neighborhoods based on Social Rank Indicators

Number	Districts	Social Rank			Values		Social Area Type
		Occupation	Income	Education	Mean Value	Standard Value	

- **Occupation and Income**

Occupation categories in the census data provided by SPO, has been grouped into five groups. This grouping is based on the classification of Doratli (2000). She explains

that this classification was done with experts from SPO, which would also convey to the understanding of the level of income. The table below shows this categorization.

Table 11. Types of occupation Resource: (Doratli, 2010)

Groups	Types of Occupation
Group I	Professionals
	- Legislators - senior officials - managers
	- Technicians and associate professionals
Group II	- Clerks
	- Armed forces and related occupations
	- Service workers
Group III	- shop and market sales workers
	- Skilled agricultural and fishery workers
	- Craft and related trades workers
Group IV	- Plant and machine operators and assemblers
	- Elementary occupations
Group V	

Considering the overall objective of SAA, and its application in İzmir, where only ratio of lower ranking occupations (such as unskilled, skilled labors and artisans etc.), have been investigated for Famagusta the lowest occupation classes (Croup IV and Croup V) will be utilized in the analysis.

Since there is no any data on income level, it is assumed that lowest occupation classes have lowest income.

- **Education**

Meanwhile the indicator of education is also classifying the neighborhoods, in seven levels, from primary school to the master / PhD, based on Social Area Analysis, if a

neighborhood has higher education level, it has higher social rank as well. Following the logic of SAA, for this factor just the percentage of primary school will be taken for neighborhoods in Social Rank analysis.

Table 12. Percentage of each level of education in fifteen neighborhoods

Education	Primary School	Secondary School	General High School	Vacational or Technical High School	2 or 3 years Vocational Collage (University)	Faculty or Collage	Master or Doctorate
-----------	----------------	------------------	---------------------	-------------------------------------	--	--------------------	---------------------

### Calculation and Mapping Technique

In line with the application of SAA in İzmir, in this study the same procedure is followed for calculating the standard scores. Finally, the social rank standard scores are grouped and ranked as follows as it has been suggested and utilized in Izmir case (Keleş, 1972, pp 34-35):

- Group I: 0-24 – Lowest ranking neighborhoods
- Group II: 25-49
- Group III: 50-74
- Group IV: 75-100 – Highest ranking neighborhoods.

In consequence the neighborhoods will be classified on five social group from lowest to highest class.

In the following part the physical and social structure of Famagusta based on its 15 neighborhoods will be analyzed. First through space syntax the amount of spatial segregation will be measured; second across the Social Area Analysis the socio – spatial segregation of Famagusta’s neighborhoods will be defined.

## **4.5 Urban Form Analysis through SS**

The space syntax method has been utilized conducted to analyze factors of: Global and Local Integration, Depth, Connectivity, and Intelligibility as the correlation between the sets of variable. Possibility of movement, accessibility through the spatial structure of city at different scales was analyzed using space syntax methodology. The data analysis conducted through UCL DepthmapX Software, version 0.3. The program is an open source and free platform for architects and urban researchers. The analysis have been done in global scale by considering all lines and possible connection and local neighborhood scale. Firstly, the axial map was created which represent the collection of longest possible paths in space. This map is then transferred to the raw axial map which represent the number of local intersection of each path with others. Axial map consists of 1950 lines. In the next step a series of analyses have been done to measure local and global integration and depth (Figure 27). Secondly, the outcome of DepthmapX has been statistically analyzed in SPSS software. Statistical analysis has been used to calculate the correlation between different variables, which is missing in most Space syntax base data analysis. All the analyses have been done for the city as a whole and each individual 15 neighborhoods. Figure 27 shows the graphical representation of data analysis process that is applied in this study.

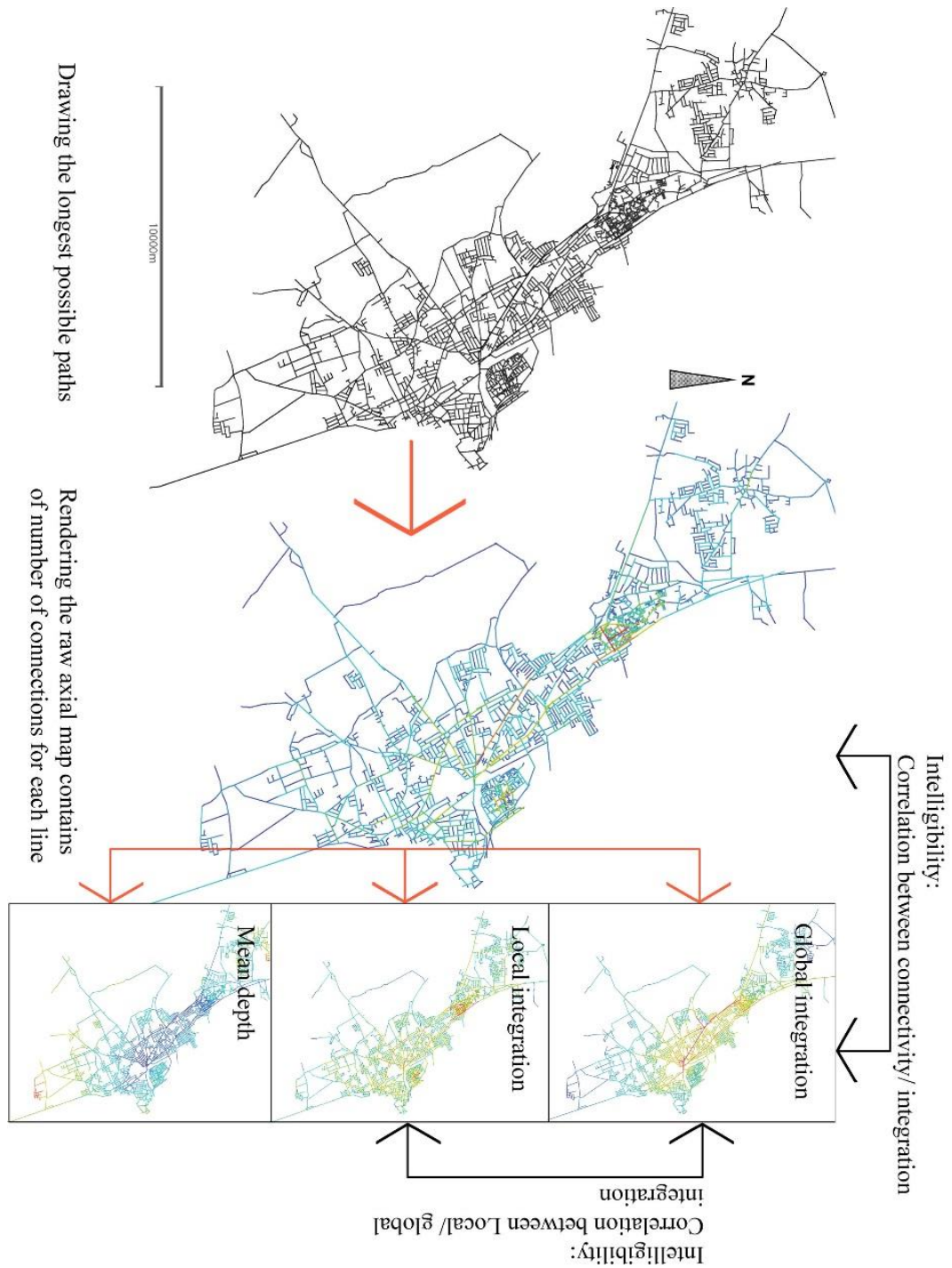


Figure 27. Process of data analysis. It has been done at city scale and for each individual neighborhood. By author

#### 4.5.1 Measuring Accessibility through Depth Factor

First important analytical factor and perhaps the most intuitive one is the depth. Depth distance mainly represent the concept of accessibility as it was mentioned in the previous discussions. It signifies the linear distance from the center of each space (in

this case paths and streets) to any other lines in the networks. Accordingly the space with lower depth are more likely to be more active. The spectrum is dark blue to red which represent minimum to maximum depth. Figure 28 shows the mean depth map of Famagusta. The critical concept to grasp is the fact that in each depth map all elements are being analyzed in comparison with each other. Furthermore if there are few areas with high depth the spectrum in the more closely related areas would become similar, and this is the reality of this map. Accordingly the light blue lines in the city represent areas with significant contrast in depth. The Salamis street (İsmet İnönü Blv in official city map) with average  $D=9.6$  and its parallel line Gazi Mustafa Kemal Blv with  $N=8.5$  have the lowest depth in the city. The linear form of the city and obstacles in west-east direction could explained why two parallel paths with no strong connections in between are the most accessible lines of the network. On the other side of the spectrum Asagi Marash with  $D=21.1$  and Tuzla with  $D=17.3$  are the least accessible parts of city.



Figure 28. Mean depth map of Famagusta, the colours represent a spectrum between dark blue as the lowest and red as the highest depth, By Author.



#### **4.5.2 Global-Local Integration**

Global Integration shows the most efficient paths of the network by considering every other paths in the system. Accordingly, if the line is more integrated, it will be more accessible at the city scale. The outcome of this analysis renders an image with the spectrum from maximum to minimum integration, red to blue which red represents the most integrated paths and dark blue represents the most isolated paths. It is necessary to mention that each color represents a specific numeric value which can be used in statistical analysis. Figure 29 illustrates the global integration of Famagusta. The city poses a red area in the middle similar to the expected pattern. The core of global integration is in the intersection between Salamis Avenue and Gazi Mustafa Kemal Blv (Anit Square). Surprisingly, the Salamis Avenue is not the most integrated path in city scale because of the lack of connections created by UN camp, and other military bases (Figure 29). The overall look at the integration map shows that, the preserved military areas are affecting the urban network integration of Famagusta.

Beside global integration, local integration is extremely vital for interpreting the interaction of different parts of city with the whole. Unlike the global integration, local measurement is not considering the effectiveness among all paths at once. It illustrates the effectiveness by considering a lower scale or in other words a walkable distance. Accordingly, local integration could explain the internal effectiveness of lines in neighborhood scale. Figure 30 shows the local integration map of Famagusta.



Figure 29. Global integration of Famagusta. By author.



Figure 30. Local integration of Famagusta, the colors represent a spectrum between dark blue as the lowest and red as the highest integration factor, By Author.

Local integration map reveals a very interesting fact, as it shows that the Walled City has a very high level of local integration in contrast with its low global integration.

This explains how a very well integrated network can be a segregated cluster in a bigger network. Anit Square shows the opposite in a lower contrast, it is highly integrated globally but does not represent a high local integration. This is the characteristic of a vehicular traffic roundabout. Although it is easily accessible by cars it is not accessible for pedestrian. It could be argued that in a car dependent society global integration would be more significant, but in a non-vehicular design like Walled City of Famagusta local integration is more meaningful. EMU Campus represent a highly local integration which is not unexpected due to its nature of design. There are other types like Tuzla that do not have neither local nor global integration.

In order to understand the degree of spatial quality by considering their location in the network, Hillier (1996) suggested two types of Intelligibility Analysis, which consists of firstly, correlation between local and global integration. Secondly, correlation between connectivity and global integration. These analysis have been done in SPSS software. The three mentioned properties for each individual line were exported in 15 different neighborhood groups, and the Pearson correlation was conducted separately for each neighborhood. Table 14 as one of the most important outcomes of the study shows all analyzed values and variables together. The average values was considered for depth, local and global integration. The data is statistically significant and render interesting results.

Table 13. All Space syntax variables for each neighborhood

	Connectivity	Integration [Global]	Integration [Local] R3	Mean Depth	Intelligibility	
					Global integration/Local integration	Global integration/Connectivity
<b>City Average</b>	3.63	0.67	1.68	14.26	0.592781**	0.362705**
<b>Districts</b>						
<b>1. ANADOLU (N=40)</b>	3.03	0.54	1.44	17.04	0.59255**	0.379627*
<b>2. BAYKAL (N=79)</b>	4.32	0.89	1.99	10.67	0.816748**	0.542087**
<b>3. CANBULAT (N=59)</b>	3.71	0.69	1.74	13.46	0.464272**	0.332565*
<b>4. CANAKKALE (N=210)</b>	2.82	0.67	1.37	14.17	0.626404**	0.393623**
<b>5. DUMLUPINAR (N=65)</b>	3.88	0.85	1.95	11.06	0.820772**	0.425321**
<b>6. HARIKA (N=96)</b>	2.84	0.43	1.32	21.13	0.446749**	0.347706**
<b>7. KARAKOL (N=111)</b>	3.42	0.73	1.67	12.77	0.829385**	0.506182**
<b>8. LALAMUSTAFA PASA (N=81)</b>	3.53	0.57	1.64	16.10	0.591715**	0.383289**
<b>9. NAMIKKAMAL (N=72)</b>	4.06	0.71	1.86	13.49	0.417205**	0.21
<b>10. PERTEVPASA (N=39)</b>	3.85	0.70	1.80	13.35	0.554925**	0.371814*
<b>11. PIYALEPASA (N=50)</b>	3.86	0.77	1.82	12.22	0.527729**	0.22
<b>12. SAKARYA (+EMU) (N=511)</b>	4.27	0.77	1.90	12.26	0.589327**	0.435208**
<b>13. SURICI (WALLED CITY) (N=190)</b>	4.38	0.68	1.92	13.61	0.278742**	0.149620**
<b>14. TUZLA (N=286)</b>	2.98	0.51	1.40	17.92	0.491095**	0.311293**
<b>15. ZAFER (N=88)</b>	3.18	0.60	1.46	15.56	0.594411**	0.471322**
Correlation is significant at the 0.01 level (2-tailed).						
Correlation is significant at the 0.05 level (2-tailed).						
N is the number of lines in axial map						

To put the outcome of Table 14 into perspective Table 15 shows the rank of each neighborhood in categories. All areas out of Standard deviation in the lower end of the spectrum considered as statistically meaningful and segregated at some levels. These district marked grey in this table.

Table 14. The Ranking of District in each Variable

Integration [Global]	Integration [Local] R3	Mean Depth	Intelligibility	
			Global integration/Local integration	Global integration/Connectivity
2. BAYKAL	2. BAYKAL	6. HARIKA	7. KARAKOL	2. BAYKAL
5. DUMLUPINAR	5. DUMLUPINAR	14. TUZLA	5. DUMLUPINAR	7. KARAKOL
12. SAKARYA (+EMU)	13. SURICI (WALLED CITY)	1. ANADOLU	2. BAYKAL	15. ZAFER
11. PIYALEPASA	12. SAKARYA (+EMU)	8. LALAMUSTAFAPA	4. CANAKKALE	12. SAKARYA (+EMU)
7. KARAKOL	9. NAMIKKAMAL	15. ZAFER	15. ZAFER	5. DUMLUPINAR
9. NAMIKKAMAL	11. PIYALEPASA	City Average 14.26	City Average 0.592781	4. CANAKKALE
10. PERTEVPASA	10. PERTEVPASA	4. CANAKKALE	1. ANADOLU	8. LALAMUSTAFAPA
3. CANBULAT	3. CANBULAT	13. SURICI (WALLED CITY)	8. LALAMUSTAFAPA	1. ANADOLU
13. SURICI (WALLED CITY)	City Average 1.68	9. NAMIKKAMAL	12. SAKARYA (+EMU)	10. PERTEVPASA
City Average 0.67	7. KARAKOL	3. CANBULAT	10. PERTEVPASA	City Average 0.362705
4. CANAKKALE	8. LALAMUSTAFAPA	10. PERTEVPASA	11. PIYALEPASA	6. HARIKA
15. ZAFER	15. ZAFER	7. KARAKOL	14. TUZLA	3. CANBULAT
8. LALAMUSTAFAPA	1. ANADOLU	12. SAKARYA (+EMU)	3. CANBULAT	14. TUZLA
1. ANADOLU	14. TUZLA	11. PIYALEPASA	6. HARIKA	11. PIYALEPASA
14. TUZLA	4. CANAKKALE	5. DUMLUPINAR	9. NAMIKKAMAL	9. NAMIKKAMAL
6. HARIKA (N=96)	6. HARIKA (N=96)	2. BAYKAL	13. SURICI (WALLED CITY)	13. SURICI (WALLED CITY)

Marked neighborhoods in Table 15 present different levels of spatial segregation. Intelligibility as one of the key factors in spatial segregation suggests that if the Correlation between local and global integration of axes is high, the area would be considered segregated from the city network. This is the case for Surici (Walled City), Namik kemal, Piyalepasa, Harika, Canbulat, and Tuzla. This shows itself in contrast for Walled city, which makes it the least intelligible part of the network. Namik kemal neighborhood, due to its proximity to Maras, does not have sufficient connection with city structure. Accordingly it is one of the most spatially segregated parts of the city. Similar properties accrue in Harika neighborhood.

On the other side of the city, Tuzla district is an isolated area. Tuzla analysis shows high depth, low global integration and low intelligibility and it appears in all categories. It seems that EMU campus and wet lands are the causes of this separation.

Figure 31 represents the neighborhoods based on having lowest, integration, accessibility, and intelligibility, for each of these variables the map specifies a Hatch. For example neighborhood of Tuzla has all low accessibility, low integration, and low intelligibility, therefore it contains all the Hatches.

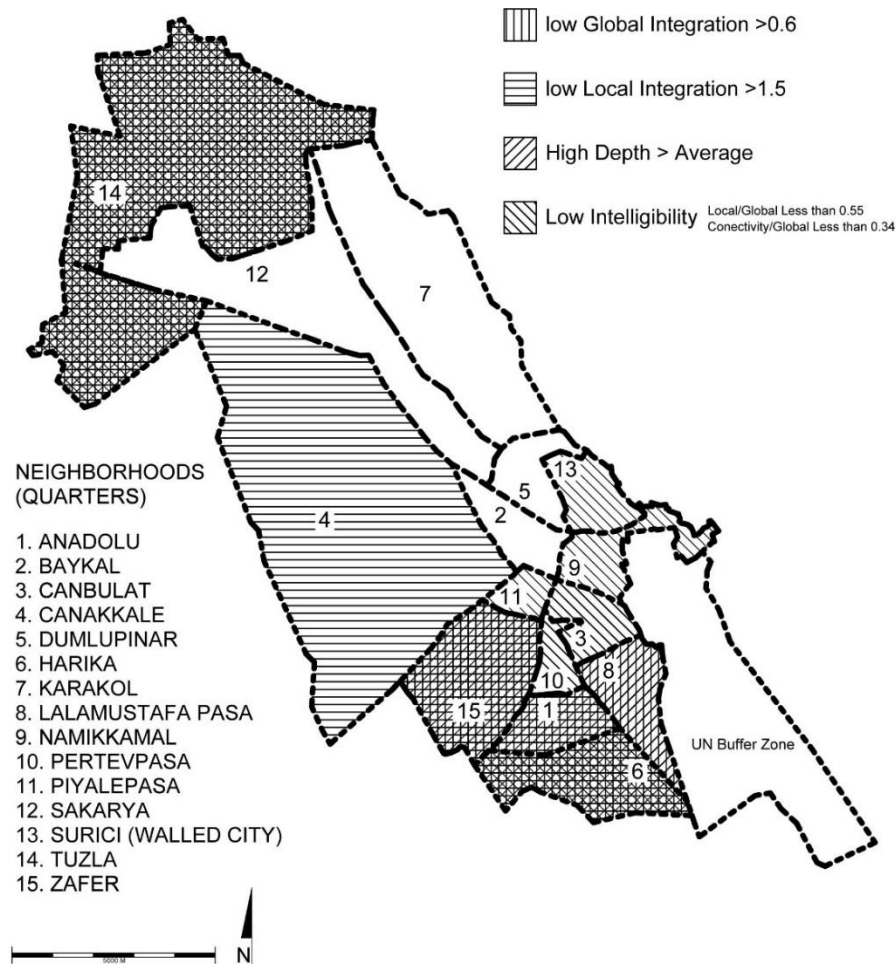


Figure 31. Segregated properties by considering each variable. By author

## 4.6 Socio – Spatial Segregation Analysis through SAA

Referring to the presentation of the methodology, the census data in 2006 has been utilized for identification of the values of the variables, which will be used to determine the social areas of Famagusta.

The variables that will be used as mentioned before are Occupation, Income, and Education. Each of them is specified here based on neighborhoods.

### 4.6.1 Occupation and Income Indicators

Classification of neighborhoods based on occupation is done on five groups, these groups are presenting the level of occupation each neighborhood possess. The first



table as it was presented below shows these classification on five groups, and the second table shows the classification of neighborhoods based on these five groups.

Table 15. Types of occupation Resource: (Doratli, 2010)

Groups	Types of Occupation
Group I	Professionals
	- Legislators - senior officials - managers
	- Technicians and associate professionals
Group II	- Clerks
	- Armed forces and related occupations
	- Service workers
Group III	- shop and market sales workers
	- Skilled agricultural and fishery workers
	- Craft and related trades workers
Group IV	- Plant and machine operators and assemblers
	- Elementary occupations
Group V	

Table 16. Percentage of each groups occupation in fifteen neighborhoods

Occupation	Group I	Group II	Group III	Group IV	Group V
ANADOLU	12.28	17.04	21.8	29.32	12.78
BAYKAL	21.9	33.16	11.77	23.81	4.94
CANBOLAT	15.87	33.87	11.2	26.93	8.8
ÇANAKKALE	11.89	34.19	18.11	25	6.62
DUMLUPINAR	18.34	38.56	22.21	13.52	4.35
HARİKA	11.97	22.22	13.68	29.06	14.53
KARAKOL	28.62	35.79	12.47	14.92	4.01
LALA MUSTAFA PAŞA	11.71	29.71	11.96	28.62	11.96

NAMIK KEMAL	24.51	31.7	15.2	14.87	6.86
PERTEV PAŞA	10.64	28.51	14.47	28.94	13.19
PİYALE PAŞA	14.67	21.42	19.39	23.95	13.49
SAKARYA	17.4	35.42	11.99	24.92	6.03
SURİÇİ	8.59	30.86	16.02	33.07	8.46
TUZLA	26.8	36.83	9.28	17.07	4.64
ZAFER	10.27	20.84	23.15	29.81	11

#### 4.6.2 Education

The Education indicator as it was discussed before is very important to ranking the social structure of city's neighborhoods. Also based on census data in 2006 this factor is categorized in seven educational levels, from primary school to the master / PhD (Table, 15). However in this study based on SAA method, just the lowest educational condition (which is here the primary school) will be taken for Social Rank analysis.

Table 17. Percentage of each level of education in fifteen neighborhoods

Education	Primary School	Secondary School	General High School	Vacational or Technical High School	2 or 3 years Vocational Collage	Faculty or Collage	Master or Doctorate
Anadolu	62.69 %	23.73	21.28	4.90	2.45	6.78	0.38
Baykal	27.74 %	14.56	32.22	5.02	2.26	14.18	4.02
Canbolat	38.99 %	16.70	24.24	3.72	1.72	12.75	1.89
Çanakkale	31.35 %	13.59	37.83	3.85	1.42	10.75	1.21
Dumlupınar	22.56 %	11.85	40.31	4.86	1.80	15.53	3.10
Harika	63.81 %	16.34	10.89	2.33	2.33	4.28	0.00

Karakol	15.22 %	7.79	52.55	4.33	1.77	14.27	4.07
Lala Mustafa Paşa	42.41 %	16.65	22.23	5.48	1.26	10.54	1.42
Namik Kemal	29.25 %	12.83	22.64	10.47	4.15	17.36	3.30
Pertev Paşa	49.01	18.58	17.59	4.55	1.38	8.30	0.59
Piyale Paşa	45.35	17.72	22.60	4.25	1.26	8.03	0.79
Sakarya	15.34	7.21	61.96	3.44	1.34	8.81	1.89
Suriçi	43.09	14.67	25.70	3.76	1.62	8.83	2.34
Tuzla	25.99	13.93	29.59	4.09	2.56	19.13	4.71
Zafer	52.41	17.28	17.47	5.02	1.83	5.35	0.65

#### 4.7 Social Rank Analysis

Social Rank of fifteen neighborhoods of Famagusta are classified through the adopted methodology.

Table 18. Social rank structure of Famagusta neighborhoods

SOCIAL RANKS						Social Area Type
Districts	Occupation Gro IV+V	Education Primery school	Lowest income 2000TL	Mean Value	standard value	
Anadolu	42.11	62.69	42.11	48.97	4.30	Group I
Baykal	28.74	27.74	28.74	28.41	67.20	Group III
Canbolat	35.73	38.99	35.73	36.82	41.47	Group II
Çanakkale	31.62	31.35	31.62	31.53	57.65	Group III
Dumlupinar	17.86	22.56	17.86	19.43	94.68	Group IV
Harika	43.59	63.81	43.59	50.33	0.12	Group I
Karakol	18.93	15.22	18.93	17.69	100.00	Group IV

Lala Mustafa Paşa	40.58	42.41	40.58	41.19	28.09	Group II
Namik Kemal	21.73	29.25	21.73	24.24	79.97	Group IV
Pertev Paşa	42.13	49.01	42.13	44.42	18.20	Group I
Piyale Paşa	37.44	45.35	37.44	40.08	31.51	Group II
Sakarya	30.96	15.34	30.96	25.75	75.34	Group IV
Suriçi	41.54	43.09	41.54	42.05	25.45	Group II
Tuzla	21.71	25.99	21.71	23.13	83.35	Group IV
Zafer	40.81	52.41	40.81	44.68	17.42	Group I

However in order to make the results more clear, in final step in sequence, the neighborhoods are presented in four classification from lowest to highest.

Table 19. Classification of neighborhood from lowest to the highest Social Rank

Group I	Harika
	Anadolu
	Pertev Paşa
	Zafer
Group II	Suriçi
	Piyale Paşa
	Lala Mustafa Paşa
	Canbolat
Group III	Baykal
	Çanakkale
Group IV	Tuzla
	Sakarya
	Namik Kemal
	Karakol

Considering the results which are stated in the table, it is possible to clarify the social structure of neighborhoods in Famagusta. The neighborhoods are hatched, based on their Social Rank on the map below:

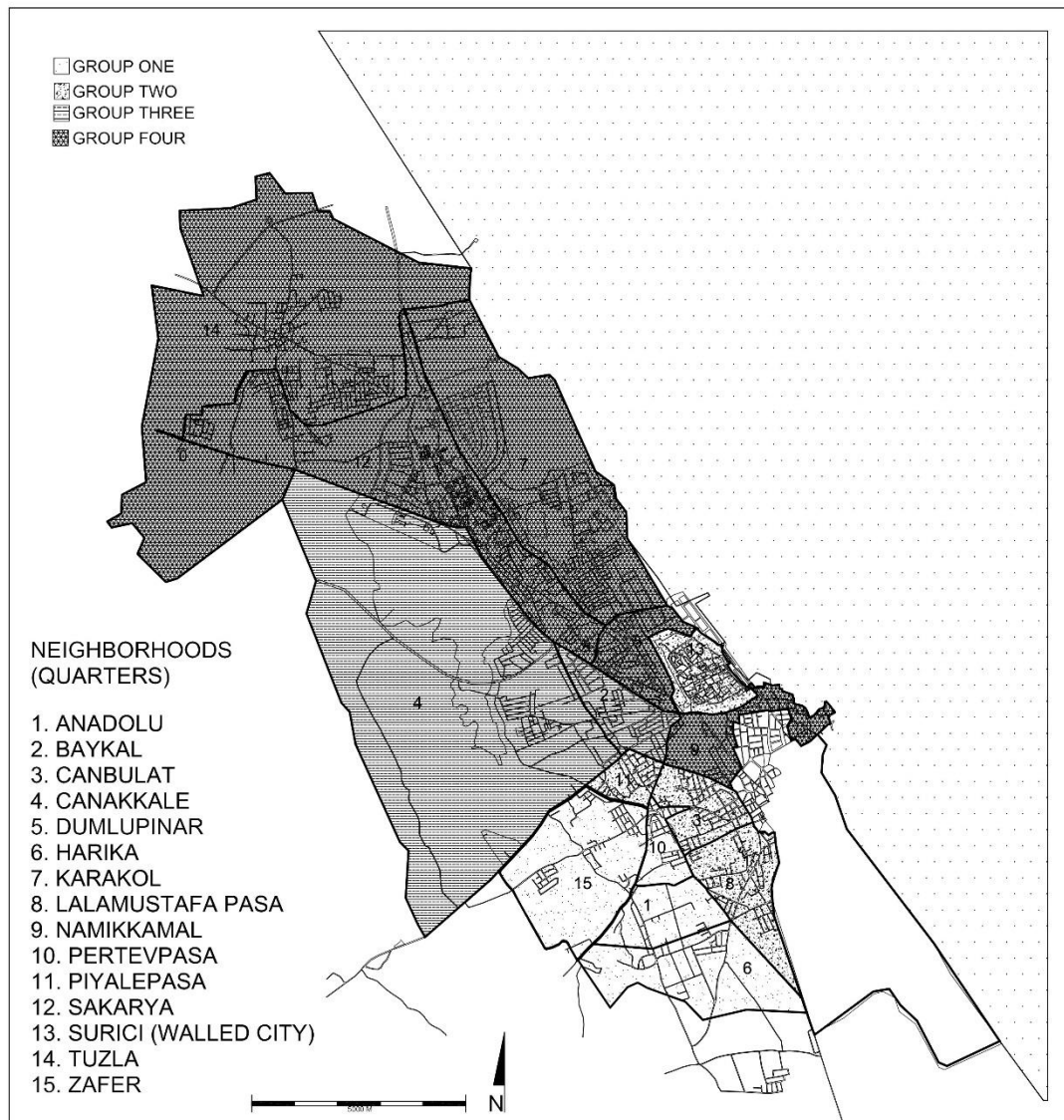


Figure 32. Classification of neighborhoods based on their social rank groups

## 4.8 Discussion

Through attempt for matching the results of space Syntax analysis and the Social Area Analysis, it is possible to see the relationship between the urban macro form and socio – spatial segregation. Matching the results and putting the layers together shows that there are six different categories, which represent different social ranking coupled with similar syntactic measurements.

This section of study tries to put these layers together and explore the effects of urban spatial form on socio-spatial structure of city. Accordingly, after putting all the layers of study together (Figure 33) 6 different categories was determined. These categories represent different social ranking coupled with similar characteristics in space syntax analysis. Physical barriers was considered as one of the features of urban form (figure 33).

Category I: First category is Tuzla district. This district shows interesting opposite results in two categories. Although, it shows high spatial segregation from the rest of the city; it scores high in social ranking. It could be argued that it is a higher class suburb area of Famagusta, in which people are depending on vehicular transportation. The area is being isolated by the wetlands, from one side and governmental hospital and university from the other side. The area does not possess neither high local nor global integration. Naturally, it could be argued that it is a segregated area which is occupied by higher socio-economical rank. Low intelligibility of the area shows the fact that it is not clearly readable for users of city, and it is not easy to find it and access it by walk.

Category II: The newly developed area of the city, which covers four districts, Sakarya, Karakol, Baykal, and Dumlupinar shows high range of integration, intelligibility and accessibility (Table 14). On the other hand, these districts has high level of social rank, mostly because inhabitants have higher education and occupation (Table 16 & 17). These four neighborhoods are actually the core of city, which has higher spatial integration, intelligibility, and mostly local accessibility for pedestrians. These neighborhoods are readable and easy to find. Therefore, they house most of the street shops, restaurants, cafes, bars, leisure activities on two most active streets of

Famagusta which are Salamis Road and Gazi Mustafa Kemal Boulevard, two economically active, well-integrated streets. These two street as it shows in maps of mean depth and local integration (Figure 28, 30) has highest accessibility and highest local integration. Meanwhile both of them has direct accessibility to the university as well. It is so evident and obvious that consequently based on physical characteristics they will be occupied by higher social rank of people as well.

Category III: The neighborhoods, which are spatially semi – segregated, and has medium low social rank, are the Walled City (Surici), Canbulat, and Piyale Pasa. These neighborhoods have specific quality, they spatially has high local integration and medium global integration. But the correlation of their local integration with integration of city structure is very low. Therefore they has low intelligibility, it means none of their main streets are highlighted in global integration, for example neighborhood of the Walled City is very integrated in itself, but in the main structure of city, the usage of its street is very low, therefore it is not easy to read and find. Social rank of these neighborhoods also follows the same pattern as they are in Group II (Table 18), which means that they have not high rank in terms of occupation, education and income.

Discussions	Social Rank Characteristics	Spatial Characteristics
Category Discussion 1	RANK I High social rank	Low Accessibility, (high depth) Low local and global integration Low Intelligibility
Category Discussion 2	RANK I High social rank	High Accessibility, (low depth) High local and global integration High Intelligibility
Category Discussion 3	RANK III Low- Medium social rank	Lowest intelligibility High local integration
Category Discussion 4	RANK IV Low social rank	Low intelligibility Low accessibility, (high depth) Low local and global integration
Category Discussion 5	RANK I High social rank	Extreme Low intelligibility Medium accessibility Medium high integration
Category Discussion 6	Medium social rank	Medium accessibility (Medium depth) Low Local integration Medium global integration

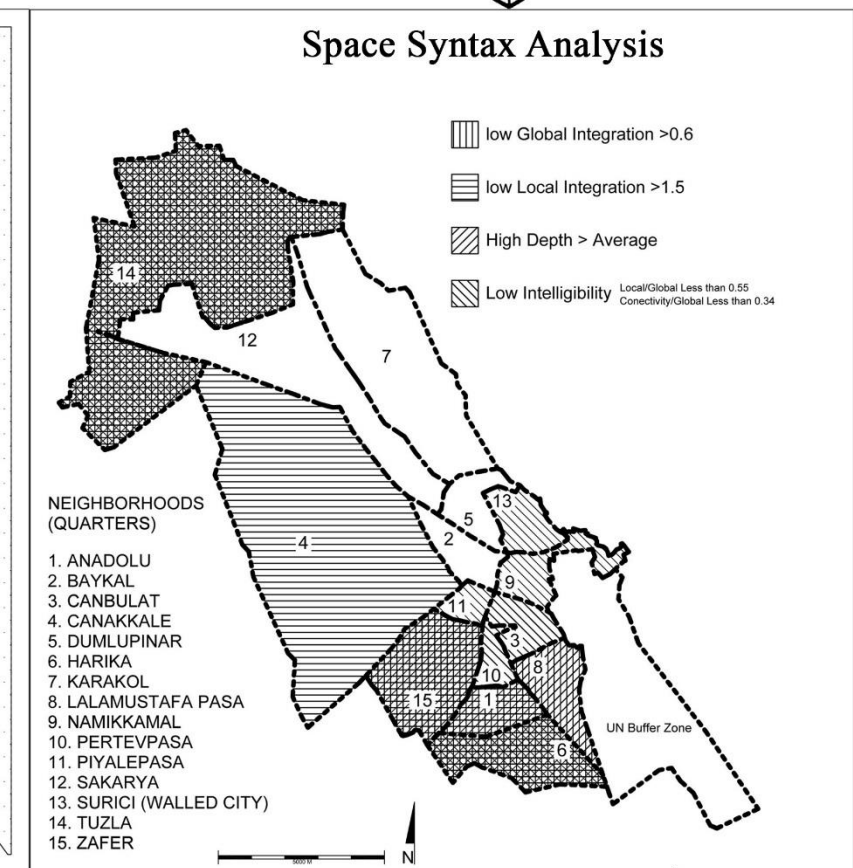
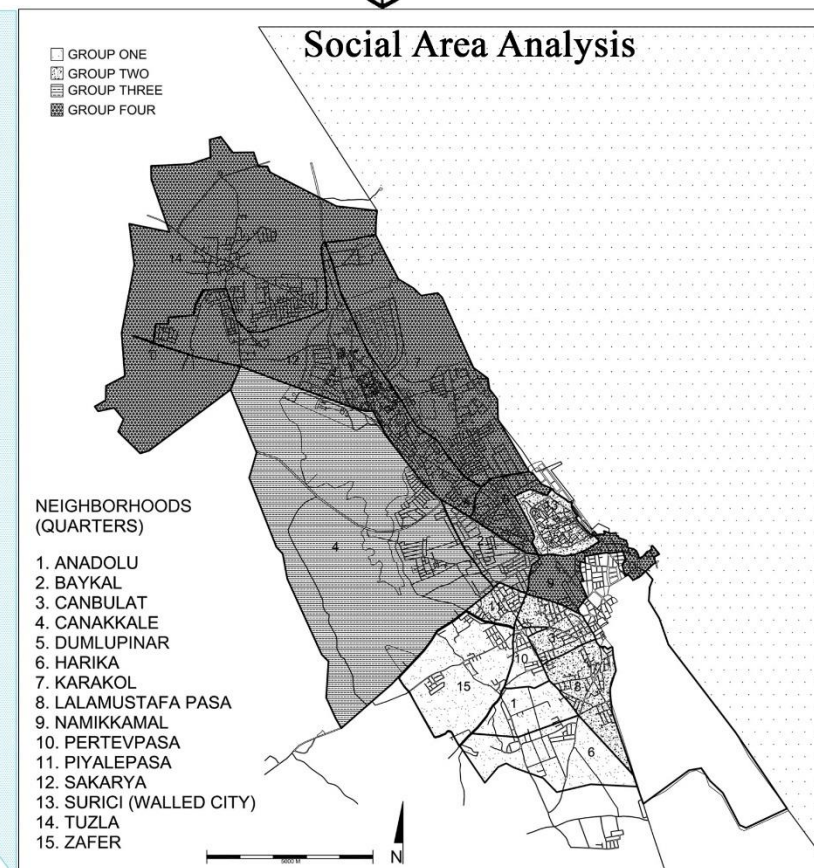
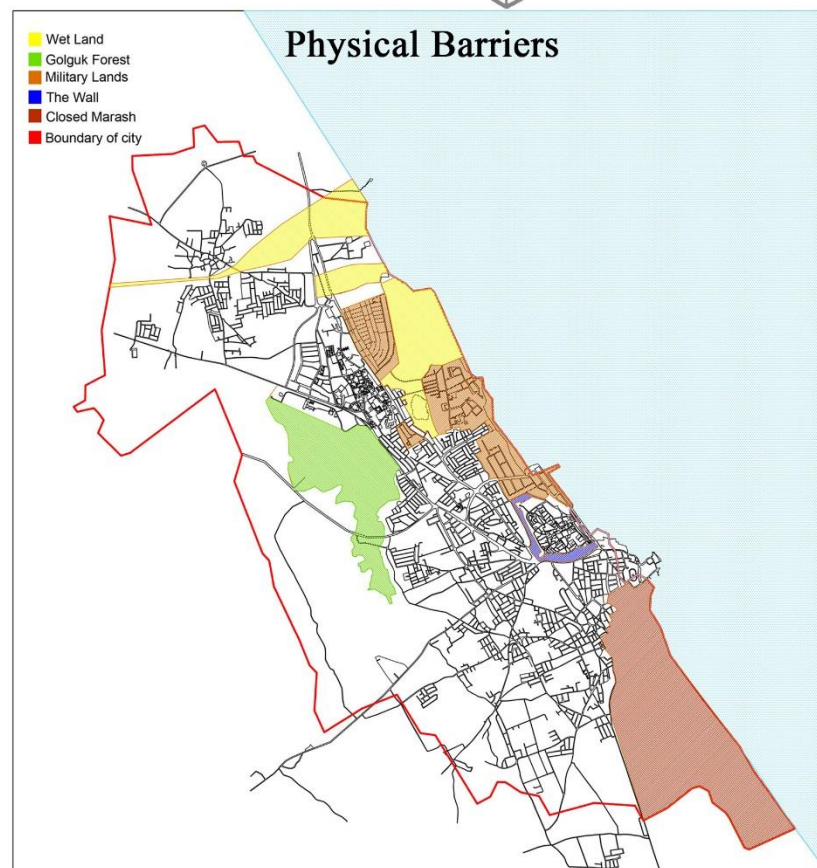
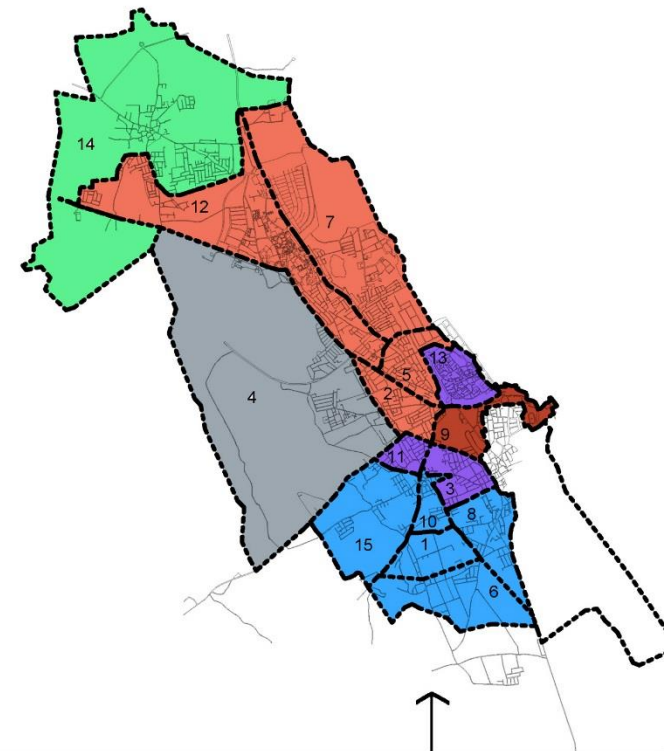


Figure 33. Exploring the relation between urban form and socio – spatial segregation. By author



Category IV: Neighborhoods this category, which are Zafar, Lala Mostafa Pasa, Harika, Pertev Pasa, and Anadolo, show a direct relationship between physical and social structure, as they are spatially segregated and have lower level of social rank. Based on Table 14, these districts severely suffer from low accessibility (high depth), low integration, and low local and global intelligibility. Therefore they are not spatially accessible for the rest of city. Additionally, their isolation even becomes worse than category III, as public transportation to these areas is inefficient, and car ownership may be limited.

Category V: Namik Kemal neighborhood which is the only one in this category, has the lowest rank of local and global intelligibility. (Table 13 & 14) It means although it can be integrated at local scale, at city scale it is not readable and easy to access by walk. However, based on the social rank analysis, it has the highest social rank like category 1 + 2. The good reason, is that the most occupation of this area are related to mostly the military and other occupation such as tourism and leisure activities (Table 15 & 16).

Category VI: From the social point of view the neighborhood of Canakale in this category, is in the second level of social rank, which is higher than medium. Whereas, based on syntactic measurements, it has good accessibility, and high intelligibility, mostly because it is located near the most integrated street of city Gazi Mustafa Kemal Boulevard. On the other hand, the local and global integration of this area is very low, because this district is not densely populated and developed when compared to the other newly developed parts of city. This district has the accessibility to the highest integrated street of the city, which acts as the main road between Famagusta and Nicosia, Larnaca and Karpaz. Additionally, it has connection to the university and has

accessibility to public transportation as well. Therefore this neighborhood has potential to be more developed, and has spatial qualities to be socially more integrated.

It seems that in case of Famagusta the intelligibility factor has the most affective relation with the distribution of social structure, but it is not always the case. Segregated areas are not necessarily correlated with low income or education, but the opposite might accrue when wealthier people seek bigger houses or tranquility of suburban areas. High intelligibility shows the areas with higher global integration that have internal integration at the same time are the heart of city. Accordingly, in a long run, economic activities and services would become denser in these areas, and change the social fabric slowly.

Famagusta's urban macro form has been affected by many barriers, and they have huge impact on its shape. Military zones, and UN camp, firstly, cause the higher depth of urban neighborhoods by disconnecting their physical connections, and not permitting the city to be integrated and take more shallow structure near the sea. Secondly, they decrease the global integration in general. The local integration in a lot of neighborhoods are higher than average but in global scale in consequence of these impenetrable barriers, the global integration will be decreased. These barriers hindered appropriate growth of the street network in Famagusta and resulted in the decline of accessibility in an unnatural way. Lack of Literal accessibility directed the new development toward outside. It is ironic to see the effects of military borders shaping in two different timelines, walls of old city decreasing its intelligibility in city scale, and harsh borders of preserved military areas decreasing it today.

## **Chapter 5**

### **CONCLUSION**

Urban segregation has social, spatial, and economical dimensions. As cities grow, these factors and forces affect and being affected by each other. Considering the main goal of this research, which was ‘to investigate the relationship between urban form and socio-spatial segregation’, a meaningful relationship between urban and social stratification. This relation has been explored; through examination of the spatial and social dimensions of the city of Famagusta. Based on the social logic of space it has been attempted to show that, in hierarchy of social pattern, urban form of a city also has a direct influence on the process of socio – spatial segregation in the city.

In order to quantify and measure this relationship, two methodologies were applied in this study. At first the methodology of space syntax is selected, and based on its theoretical concepts, through spatial analysis, how much is a space accessible, integrated, and intelligible from any other location in the city has been measured. Through this methodology, the spatial map of city, which shows the segregated districts in the urban structure has been prepared.

These spatial maps suggest that the degree of spatial segregation in the neighborhoods increases the social segregation as well. They also imply that segregated districts would provide limited accessibility to urban facilities, economical activities, etc. Consequently, it could negatively affect social structure of those districts. In order to

examine this argument the methodology of Social Area Analysis is applied to the case of Famagusta to determine the social structure of neighborhoods and classify them according to social rank.

Before investigating this relation, the study widely explained the physical and social concepts of the city in introduction, and how a city fundamentally comprises social layers over the physical layers. It discussed about the importance of considering cities with both of them and investigating the effects of them on each other. The notion of segregation in urban form and how it would be related with social segregation were discussed.

In chapter two, in first section the concept of urban form introduced, and how natural and man – made determinants affect the formation process is explained. Afterwards, the components of urban form and as it is the basic component of syntax analysis the street network pattern has been introduced as the most important component of urban form. In second section, the concept of socio – spatial segregation and its most important types were introduced and discussed, which are: ethnic – race based spatial segregation, socio – economic based spatial segregation. Afterward, Social Area Analysis was introduced as it has been selected as the effective methodology to analyze the socio – spatial segregation of Famagusta.

Later, in chapter three the utilized methodologies are introduced. In first section it is tried to see how urban form can be read through space syntax. Also the most important concepts of syntax, introduced which are: the configuration of space, axial map, depth, and shallowness and the concept of segregation in space syntax. Moreover the syntax variables are defined as they are: connectivity, depth, integration, accessibility, and

intelligibility. In the second section Social Area Analysis is specified as the best methodology in order to measure the social inequality of different neighborhoods based on socio – economic variables of occupation, Income and education.

In chapter four, after theoretical literature review, Famagusta, which was the case study of this research, is presented with the aim to answer to the main research question of this study: “What is the relationship between the urban form and the socio – spatial segregation?” In this chapter after portraying the geography, history, the process of urban formation of Famagusta, and the social structure of city in general based on its main districts was investigated. Afterwards, firstly, the urban macro form of city was examined through space syntax for its fifteen neighborhoods; secondly, social structure of neighborhoods was also examined based on Social Area Analysis. In final section of this chapter the spatial and social analysis were put together.

Application of two different methodologies of “Space Syntax” and “Social Area Analysis” for the first time in this research shows that both of them can provide reliable results in order to specify the spatial structure and social segregation of urban quarters.

In the case of studying the socio – spatial segregation, the methodology of ‘Space Syntax’ is strongly appropriate to investigate the spatial structure of urban districts because fundamentally this methodology tries to investigate the ‘social logic of space’; and clarify the segregation patterns of the city based on this logic. On the other hand in comparison with similar methodologies that work on socio – spatial segregation of different social classes in the city, the methodology of “Social Area Analysis” is specifically applied for urban studies and investigate the social inequality of urban quarters based on “social rank”, ‘urbanization’, and ‘neighborhood structure’. At the

end utilization of these methodologies for this study shows that they are very suitable for neighborhood based studies on social and spatial inequality.

In the analysis sections the results shows statistically significant relationship between spatial structure and social structure of neighborhoods. Referring to spatial segregation of the city on one hand and social rank in the city on the other, it can be concluded, that more integrated and readable (intelligible) neighborhoods of the city have higher social rank as well. It has been determined that newly developed quarters of Famagusta (Baykal, Dumlupinar, Canakkale, Karakol and Sakarya) are most well integrated, accessible, and intelligible neighborhoods of the city and they have higher social rank. Whereas, the most segregated quarters of city, which are near the close Maras (Zafar, Anadolu, Pertev Pasa, and Harika), have lowest integration, accessibility, and intelligibility; meanwhile their social ranks are also the lowest as well. However these results didn't match for every neighborhood of city as it was expected. Famagusta has a neighborhood, Tuzla, which is highly segregated and is not easily accessible, but it accommodates higher social ranking inhabitants. It is categorized on peripheral areas, which is preferred for more tranquility and space. However, as they are more affluent, the inhabitants can cover the distance and cost of transportation to the city for using the facilities of city.

The other important, conclusion which can be drawn up from spatial and social analysis, is that the neighborhoods which are well integrated locally, do not necessarily have high intelligibility. Therefore, they could have negatively impact on their social structure, which make them to become below the average in social rank analysis (the Walled City, Piyale Pasa, Canbulat).

This study shows that, concept of intelligibility at urban scale plays very important role in social quality / rank of neighborhoods. It means, more readable neighborhood would bring more people to pass through it, use it, and as a consequence these neighborhoods become more populated, economically more active quarters, therefore over time their social structure would improve.

Finally it should be stressed that, studying urban form in relation of socio – spatial segregation, would be incomplete without considering political circumstance; especially if the city/country is touched by war. Because as a result of war, gradual process of urban changes, both in spatial and social terms, would be interrupted. This has been the case also for Famagusta, which had also severely been affected by political issues (war) in terms of socio – spatial segregation right after 1974. In the following years after 1974, in line with the governmental policies, Turkish Cypriot refugees from the south of the island and immigrants from Turkey were settled in Asagi Maras, which were left by the Greek Cypriots. As the main purpose was to provide labor force for the already existing agricultural lands, especially the Turkish immigrants were mostly peasants from low ranking social classes. Thus it would be argued that neighborhoods with low accessibility were already low social ranking areas. However, since then till now, as it has previously been put forward, also other factors affected the process of socio – spatial segregation to become more harsh in the city. Considering current physical structure of city, limited opportunity from the south to grow, and several physical barriers in west and east side of city, leads to a leapfrog and sprawling development with low density toward the north side of the city; which cause it to be more segregated, and fragmented. It should finally be suggested that preparation and implementation of a master plan by the relevant authorities, which

would improve accessibility, intelligibility and integration of fragmented quarters,  
would lessen the social segregation in the city.



## REFERENCES

- Johnston, R. J. (1971). Some Limitations of Factorial Ecologies and Social Area Analysis. *Economic Geography*, 314-323.
- Mumford, L. (1961). *The City in History: Its Origins, Its Transformations, and Its Prospects*. MJF Books.
- Alba, R. D., & Logan, J. R. (1993). Minority proximity to whites in suburbs: an individual level analysis of segregation. *American Journal of Sociology*, 1388-1427.
- Anderson, T. R., & Bean, L. L. (1961). the shevky- bell social areas: confirmation of results and a reinterpretation. *social forces*, 40(2), 119 - 124.
- Anderson, T. R., & Egeland, J. A. (1961). Spatial Aspects of Social Area Analysis. *American Sociological Review*, 392-398.
- Bafna, S. (2003). Space Syntax: A Brief Introduction to Its Logic and Analytical Techniques. *Environmental and Behavior*.
- Batty, M., & Longley, P. (1994). *Fractal Cities*. London: ACADEMIC PRESS.
- Batty, M., & Longley, P. (1994). *fractal cities: a geometry of form and function*. Great Britain: Academic Press Limited.

- Bently, I., Alcock, A., Murrain, P., McGynn, S., & Graham, S. (2008). *Responsive environment*. Amsterdam: Architectural Press.
- Bolt, G., & Kempen, V. R. (2010). Ethnic segregation and residential mobility: relocations of minorityethnic groups in Netherlands. *Journal of Ethnic and Migration Studies*, 36, 333-354.
- Brown, L. A., & Chung, S. T. (2006). Spatial segregation, Segregation Indices and the Geographical Perspective. *Population, Speace and Place*, 125 - 143.
- Brown, L. A., & Horton, F. E. (1970). Social Area Change: an Empirical Analysis. *Urban Studies*, 271-288.
- Brun, J. (1994). Essai critique sur la notion de s egr egation et sur son usage en g eographie urbaine. In J. Brun, & C. Rhein, *La s egr egation dans la ville. L 'Harmattan* (pp. 21 - 58). Paris.
- Burgess, E. W. (1967). The Growth of the City. In E. W. Burgess, & R. E. Park, *In The City*. Chicago: University of Chicago Press.
- Carmona, M., Tiesdell, S., Heath, T., & Oc, T. (2003). *Public places-urban spaces : the dimensions of urban design*. Oxford Amsterdam: Elsevier.
- Carvallo, R., & Penn, A. (2004). Scaling and universality in the microstructure of urban space. *Physica A: Statistical Mechanics and its Applications*, 539-547.

- Chakraborty, M. (2009). An approach towards urban form analysis and land use classification: A case of Ahmadabad, India. *the International Institute for Geo-information Science and Earth Observation*, published Master thesis published.
- Charles, C. Z. (2003). The dynamics of racial residential segregation. *Annual Review of Sociology* 29, 167 - 207.
- Christopher, A. (2005). *The Nature of Order ( the Phenomenon of Life)*. Berkeley: Center for Environmental Structure.
- Conroy, D. R., & Bafna, S. (2003). The syntactical image of the city: a reciprocal definition of spatial syntaxes., (p. 4th International Space Syntax Symposium). London.
- Conzen, M. P. (1960). Conzen, M.R.G. 1960: Alnwick, Northumberland: a study in town-plan analysis. *Human Geography*, 1 - 6.
- Cutler, D. M., Glaeser, E. L., & Vigdor, J. L. (1997). The Rise and Decline of the American Ghetto.
- Darden, J. T., & Kamel, S. M. (2000). Black residential segregation in the city and suburbs of Detroit: Does socioeconomic status matter? *Journal of urban affairs*, 22(1), 1-13.

- Darroch, A. G. (1972). Urban accessibility and residential densities: the impact of relative centrality and the journey to work. *Center for demography and ecology*.
- Dawes, M., & Ostwald, M. J. (2013). Precise Locations in Space: An Alternative Approach to Space Syntax Analysis Using Intersection Points. *Architecture Research*, 1-11.
- Denton, N. A., & Massey, D. S. (1988). Residential segregation of Blacks, Hispanics, and Asians by socioeconomic status and generation.
- Denton, N. A., Gretchen, C. A., & Massey, D. S. (1987). The Effect of Residential Segregation on Black Social and Economic Well-Being. *Social Forces*, 66(1), 29-56.
- Doratlı, N. (2000). A model for conservation of historic urban quarters in northern Cyprus . *Publishe PHD thesis* .
- Douglas, M. S., & Denoton, N. A. (1985). Spatial assimilation as a socioeconomic outcome. *American Sociological Review*, 50, 94-106.
- Dupont, V. (2004). socio - spatial differentiation and residential segregation in Delhi: a question of Scale? *Geoforum*(35), 157 - 175.

- Ewing, R., Handy, S., Brownson, R. C., Clemente, O., & Winston, E. (2006). Identifying and Measuring Urban Design Qualities Related to Walkability. *Journal of Physical Activity and Health*, 223-240.
- Franzén, M. (2009). Matters of urban segregation. *Proceedings to the 7th International Spece Syntax Symposium*.
- Galster, G. C., & Keeney, W. M. (1988). race residence, discrimination, and economic opportunity: Modeling the nexus of urban racial phenomena. *Urban Affairs Quarterly* 24 (1), 87 - 117.
- Gini, C. (1997). Concentration and dependency ratios. *Rivista di Politica Economica*, 87, 769-789.
- Group, U. F. (2008). *Portland Plan Comprehensive Plan Evaluation*. URBAN FORM Technical Working Group.
- Hale, R., & Austin, D. M. (1997). an exploratory factor model of social area analysis. *Sociological Spectrum*, Vol. 17, Issue 1.
- Hammarstedt, M., & Ahmed, A. M. (2008). Discrimination in the rental housing market: A field experiment on the Internet. *Journal of urban Economics*, 64(2), 362-372.
- Hamnet, C. (1996). Social polarization, economic restructuring and welfare state regimes. *urban studies*, 33(8), 1407-30.

- Herold, M., Goldstein, C. N., & Clark, C. K. (2003). The spatiotemporal form of urban form growth: measurement, analysis and modeling. *Remote Sensing of Environment*, 286-302.
- Hillier, B., & Vaughan, L. (2007). The city as one thing. In L. Vaughan, *The spatial syntax of urban segregation* (pp. 205 - 230). Progress in Planning: Elsevier.
- Hillier, B., & Hanson, J. (1984). *The Social Logic of space*. Cambridge, UK: Cambridge University Press.
- Hillier, B., Penn, A., Hanson, J., Grajewski, T., & Xu, J. (1993). Natural movement: or configuration and attraction in urban pedestrian movement. *Environment and Planning B: Planning and Design* 20, 29-66.
- Hillier, B. (1996). *Space is the Machine*. Cambridge: Cambridge University Press.
- Hillier, B., & Hanson, J. (1984). *The Social Logic of space*. Cambridge, UK: Cambridge University Press.
- Hillier, B., & Iida, S. (2005). Network and psychological effects in urban movement. *Spatial Information Theory*, 475-490.
- Hillier, B., & Vaughan, L. (2007). The city as a one thing. In L. Vaughan, *The spatial syntax of urban segregation* (p. Chapter 1). Progress in Planning 67.

- Hillier, B., Burdett, R., Peponis, J., & Penn, A. (1987). Creating Life: Or, Does Architecture Determine Anything? *Architecture and Behavior*, 233-250.
- Iceland, J., & Guo, S. P. (2008). Immigrant residential segregation in U.S. metropolitan areas, 1990-2000. *Demography* 45 (1), 79-94.
- Jacobs, J. (1961). *The Death and Life of Great American cities*. New York: Vintage.
- Jacobs, J. (1965). *The Death and Life of Great American Cities*. New York: Penguin Books.
- Johnston, R. J., Gregory, D., & Smith, D. M. (1986). *The Dictionary of human Geography*. Oxford: Blackwell.
- Johnston, R., Poulsen, M., & Forrest, J. (2002). From Modern to Post-modern? Contemporary ethnic residential segregation in four US metropolitan areas. *Pergamon*, 19(3), 161-172.
- Keleş, R. (1972). *İzmir Mahalleleri (Bir Tipleştirme Örneği)*. sosyal bilimler derneği yayımları: A-4.
- Kestenbaum, B. (1980). Notes on the Index of Dissimilarity. *Social Forces*, 275-80.
- Legeby, A. (2010). URBAN SEGREGATION AND URBAN FORM. *published Master dissertation*, KTH Royal Institute of Technology.

- Liebersohn, S. (1980). *A Piece of the Pie: Blacks and White Immigrants Since 1880*. Berkeley: University of California Press.
- Liebersohn, S., & Carter, D. (1982). Temporal Changes and Urban Differences in Residential Segregation: A Reconsideration. *American Journal of Sociology*, 296-310.
- Lima, J. J. (2001). scio-spatial segregation and urban form: Belem at the end of the 1990s. *Geoforum*, 493-507.
- Long, Y., Baran, P. K., & Moore, R. (2007). The role of space syntax in spatial cognition: evidence from urban China. *Processing of 6th International Space Syntax Symposium*. Istanbul.
- Luhod, J. A. (1969). Testing the Theory of Social Area Analysis: The Ecology of Cairo, Egypt. *American Sociological Review*, 198-212.
- Lynch, K. (1960). *The Image of the City*. Cambridge: MIT Press.
- Magnusson, L., & Özüekren, A. S. (2002). The housing careers of Turkish households in middle-sized Swedish municipalities. *Housing studies*, 17, 465-486.
- Maloney, M., & Auffrey, C. (2013). *The Social Areas of Cincinnati*. Cincinnati: University of Cincinnati.



- Maloutas, T. (2012). Introduction: Residential Segregation in Context. In T. Maloutas, & F. Kuniko, *Residential segregation in comparative perspective* (pp. 1 - 36). England: Ashgate Publishing Limited.
- Marcuse, P., & Kempen, R. (2002). *Of States and Cities: The Partitioning of Urban Space*. New York: Oxford university press.
- Marshall, S. (2005). *Streets and patterns*. London & New York: Spon Press.
- Massey, D. (1978). On the Measurement of Segregation as a Random Variable. *American Sociological Review*, 587-90.
- Mayhew, S. (2009). *Oxford Dictionary of Geography*. Oxford University Press.
- Moundon, A. V. (1992). The evaluation of twentieth-century residential forms: an American case study. In J. W. Whitehead, & P. J. Larkham, *urban landscapes: international perspective* (pp. 170 - 206). London: Routledge.
- Muska, J. (2005). Area accessibility and its effect on the provision of parking in urban areas. *SLOVAK Journal of civil engineering*, 19-28.
- Musterd, S., & Ostendorf, W. (2013). Urban segregation and the welfare state. *Routledge*.
- Önal, Ş., Dağlı, U., & Doratlı, N. (1999). The urban problems of Gazimagusa (Famagusta) and proposals for the future. *Pergamon*, 333-351.

- Öresjö, E. (1997). Neighbourhood Integration and Mobilization. In C. G. Guinchard, *Swedish Planning Towards Sustainable Development* (pp. 42-46). Gävle: Swedish Society for Town and Country Planning.
- Park, R. E. (1957). Human ecology. In R. E. Park, *Human Communities the city and human ecology* (pp. 145 - 158). Glencoe: IL: The Free Press.
- Peponis, J., Allen, D., French, S., Scoppa, M., & Brown, J. (2007). Street connectivity and urban density: spatial measures and their correlation. *Proceeding of 6th International Space Syntax Symposium*. Istanbul.
- Peponis, J., Hadjinikolaou, E., Livieratos, C., & Fatouros, D. A. (1989). The spatial core of urban culture. *Ekistics*, 93-108.
- Peponis, J., Ross, C., & Rashid, M. (1997). The Structure of Urban Space, Movement and Co-presence: The Case of Atlanta. *Elsevier Science Ltd*, 341-358.
- Peponis, J., Wineman, J., Rashid, M., Kim, S. H., & Bafna, S. (1997). On the description of shape and spatial configuration inside buildings: convex partitions and their local properties. *Environment and Plannig B*.
- Porta, S., Crucitti, P., & Latora, V. (2006). The network analysis of urban streets: A dual approach. *Elsevier*, 853-866.
- Rapoport, A. (1977). *The Human Aspects of Urban Form*. England: Pergamon Press.

- Robert, B. R., & Wilson, R. H. (2009). *Urban segregation and governance in the Americas*. New York: Palgrave Macmillan.
- Schaake, K., Burgers, J., & Mulder, C. H. (2010). Ethnicity at the individual and neighborhood level as an explanation for moving out of the neighborhood. *Population Research and Policy Review*, 29, 593-608.
- South, S. J., & Crowder, K. D. (1998). Leaving the 'hood', residential mobility between black, white, and integrated neighborhoods. *American Sociological Review*, 63, 17-26.
- Spielman, E. S., & Thill, J. C. (2008). Social area analysis, data mining, and GIS. *Computers, Environment and Urban Systems*, 440-122.
- Sun, X. (2013). Comparative Analysis of Urban Morphology: Evaluating Space Syntax and Traditional Morphological Methods. *Published Master thesis*.
- Taeuber, K. E., & Taeuber, A. F. (1976). A Practitioner's Perspective on the Index of Dissimilarity. *American Social Review*, 884-89.
- Talen, & Anselm. (1998). Assessing spatial equality: and evaluation of measures of accessibility to public playgrounds. *Environmental and Planning A*, 595-613.
- Talen, E. (2012). *City rules : how regulations affect urban form*. United States: ISLAND PRESS.

Tsai, Y. -H. (2005). quantifying urban form: compactness versus 'sprawl'. *urban studies* Vol. 42 , 141 - 161.

Uslaner, E. (2012). *Segregation and Mistrust: Diversity, Isolation, and Social cohesion*. Cambridge University Press.

White, M. J. (1983). The Measurement of Spatial Segregation. *American journal of Sociology*, 88(5), 1008-1018.