ISTANBUL TECHNICAL UNIVERSITY ★ GRADUATE SCHOOL OF SCIENCE ENGINEERING AND TECHNOLOGY

URBAN TRANSFORMATION IN MEETING PLACES THE CASES OF BURSA AND YAZD

M.Sc. THESIS

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Anabilim Dalı : Herhangi Mühendislik, Bilim
Programı : Herhangi Program

JANUARY 2014

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To my parents,

FOREWORD

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ABBREVIATIONS

Rn **:** Radius n

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URBAN TRANSFORMATION IN MEETING PLACES THE CASES OF BURSA AND YAZD

SUMMARY

In 19th century, due to modernization programs, historical cities faced powerful socio-spatial conversion. A new and different urban pattern system was imposed on the historic fabric of the city, while traditional urban structure was created over centuries through cumulative evolvement. The planned demolition of buildings has deeply wounded the body of historic urban fabrics all over the world. During the modern housing projects of the 1860s and later in many countries, the historic parts of the cities were demolished to make open spaces for new buildings and constructing new roads for commuting by motor vehicles. By the appearance of modern motorized means of transportation in the old fabric of cities, many physical and spatial changes started to take place in the core of the traditional cities.
This fact is also obvious in urban transformation of cities with Islamic culture. Construction of new boulevards and wide streets and highways as well as new urban amenities such as industrial and commercial buildings changed the spatial structure of the cities in a modern way. In some cases this modernization transformation was totally different from the traditional urban pattern of the old city. For example, in city of Yazd (an Islamic Iranian city), grid urban pattern was imposed on the organic structure and not only affected the physical form of historic city but also caused many social and economic changes within the traditional life of people.
This research attempts to find the effect of urban modernization transformations on the fabric of historic cores in cities with Islamic culture; how the modern changes affected the old system specifically the structure of meeting places and why is it necessary to preserve the old structure of historical cores in Islamic cities? Is it possible to preserve this structure after urban modernization process?
The layout of an Islamic city generally includes the following characteristics: a medieval citadel or fort, a nearby central market and one or more public baths clustered around a Friday mosque, a madrasa (Religious school) and caravanserai, a narrow irregular street pattern, ethnic quarters, courtyard houses, medieval walls and gates, some spillover marginal housing outside the walls, and a complete lack of open civic space other than the Friday mosque courtyard (Cantacuzino 1982; Abu-Lughod 1993; Bianca 2000a, 2000b) Streets were not "laid out" as in American and European cities after the mid-19th century, but were composed of leftover space after houses were built. In this study meeting place refers to Bazaar, Mosque, Madrasa (Religious school) and Public bath that are the main urban elements of an Islamic city.
In order to answer the mentioned questions, The thesis investigates the urban configurational features of two Islamic cities (one in Iran and another in Turkey), in before and after urban modernization process. The city of Yazd in Iran is a good example of a city with Islamic urban morphology and city of Bursa is the first capital of Ottoman Empire. There are several reasons which support this selection. Firstly,

they both belong to oriental type of historic cities, which enable the research to have a decent analyze of the field related to our topic. The second reason is that both of these cities experienced a long period of continuous existence in their traditional form before modernization. The third reason is that both of these historical cities transformed to an Islamic city after converting to Islam, so the meeting places of these two cities are the same (Bazaar, Mosque, Madrese, Hammam). Forth, the urban modernization system is not the same for both of these cities so it can be a good selection for our comparative analysis. Fifth, before urban modernization there were a lot of similarities between the urban structures of these two cities, for example both of them are fortified town and had organic urban pattern, but after urban modernization the walled-city of Yazd ruined and grid urban pattern was imposed to the organic urban pattern of the city. Also, both of these cities were famous for silk textile.

To find answer for the questions of this research, a methodology is required which is able to investigate the spatial layout and examine the preferable hypothesis. At first, the major problem of this research for example urban change is firmly linked with the physical manifestation of the city. Therefore, the taken up methodology should be able to deal with morphological and spatial matters. Secondly, since the urban spatial structure is made of a system of interacting elements, the taken up methodology has to be analytical well. Thirdly, the focus of this research is a comparison between old and new, as well as a comparison between two different cities. It needs a methodology capable of comparative research. In order to reach all mentioned aims the adopted methodology should be capable to correlate the spatial and morphological analysis with the activity of the society.

This investigation is made by using Space Syntax methodology to compare spatial structure of these cities before and after urban modernization transformation. Space Syntax theory is able to reveal some hidden properties of the built environment, which are most, involved in human's social life. "The aim behind the technique is to describe different aspects of relationships between the morphological structure of man-made environments and social structures and events" (Kubat, 1999). The application of Space Syntax in this research has helped to understand configurational features of cities developed in different process of urban transformation. Although space syntax is the main methodology of this research, it is not the only method which is used in this thesis. Method of comparison is another technique used in this research. This is a comparative study of syntactic measures of historic cores of two Islamic cities before and after urban modernization transformations.

In addition, technique of 'urban element analysis' is also used to understand the effect of urban modernization on the urban structure of meeting places of these Islamic cities before and after urban modernization. "urban elements" in this research refers to meeting places such as bazaar, mosque, public bath and religious school. Therefore, it is possible to find that which urban modernization system is more successful to preserve traditional urban pattern of historic Islamic cities.

Finally, at the end of this study it is possible to say that the ultimate objective of this research is to suggest how to fill the gap between the past and present, or traditional urban structure and contemporary urban planning. The aim of the present study is also to investigate how to preserve the urban structure of historic cores in Islamic cities, during urban modernization construction. According to the gained results of this study and other performed studies, the only way to do this is by understanding the traditional layout of the old city and considering the tradition urban pattern while constructing new streets and roads. In other words, in order to preserve the old urban structure of traditional-Islamic cities, it is necessary to consider and fallow the traditional –Islamic urban features. In this way; it would be possible to adopt the needs of contemporary Islamic cities while still preserve cultural aspects and Islamic identity of the past.

Toplanma Mekanlarında Kentsel Dönüşüm; Bursa ve Yazd Örnekleri

ÖZET

19. yüzyılda, modernleşme hareketlerine bağlı olarak, tarihi kentler güçlü bir sosyo - mekansal tartışmanın içinde kalmış, yeni ve farklı kent dokusu, yüzyılların kümülatif birikimi ile oluşan geleneksel, tarihi kent dokusunun üzerinde yer almıştır. Bu dönemde başlatılan planlı yıkımlar, dünya genelinde tarihi kent dokusunu, strüktürel bakımdan derinden etkilemiştir. 1860'lar ve sonrasında, birçok ülkede uygulanan modern yapı projeleri süresince, kentlerin tarihi kısımlarında yeni binalara alan açmak ve motorlu araçlara güzergah yaratmak için yıkımlar gerçekleştirilmiştir. Bu süreç aynı zamanda İslam kültürünün hakim olduğu şehirlerdeki kentsel dönüşümlerde de gözlemlenmiştir. Yeni kentsel konfor olarak bulvarlar, geniş caddeler ve demiryollarının yapımı kentlerin mekansal strüktürünü modern bir yöne doğru değiştirmiştir. Bazı durumlarda bahsedilen bu dönüşümler eski şehirlerde geleneksel kent dokusuna oldukça farklı düşmüştür. Örneğin; Yazd (İran) kentinde, grid sistem organik dokuya eklemlenmiştir. Bu durum kentin tarihi dokusunu olumsuz etkilemiş, geleneksel gündelik hayatta da bir çok sosyal ve ekonomik değişime yol açmıştır.

Bu çalışmada Space Syntax yöntemi kullanılarak, modernleşme hareketlerinin İslam şehirleri üzerine etkisi araştırılmıştır. Açılım olarak, modern değişimlerin eski kentsel dokuya ve özellikle toplanma mekanlarına etkisi açıklanmaya çalışılmış, toplanma mekanları olarak bir İslam kentinin temel kentsel ögelerinden olan pazar, cami, medrese(dini okul) ve hamamlar belirlenmiştir. Ek olarak islam şehirlerinde modernleşme sürecinden sonra tarihi merkezin eski strüktürünü korumanın neden önemli olduğuna dair saptamalarda bulunulmuştur.

Bir İslam kenti temel olarak şu karakteristikleri içermektedir: Ortaçağdan kalma bir kale, hemen yakınında merkezde bir pazar ve bir veya fazla cami avlusu ile çevrelenmiş hamam yapıları. (Cantacuzzino 1982; Abulughod 1993; Bianca 2000a, 2000b) Cadde ve sokak yapısı 19.yüzyıl sonrası Amerikan ve Avrupa şehirlerinden tamamen farklıdır fakat, evler inşa edildikten sonra artakalan boş alanların tasarlanmasıyla oluşmuş mekanlardır. Bu çalışmada toplanma mekanları tanım olarak, bir islam kentinin temel kentsel ögeleri olan 'pazar, cami, medrese (dini okul), ve hamam'ları ifade etmektedir.

Bu tez kapsamında iki islam şehrinin kentsel konfigürasyon özellikleri incelenmiştir. İran'dan Yazd ve Türkiye'den Bursa kentleri seçilmiş olup, Space Syntax metodu ile modernleşme öncesi ve sonrası mekansal strüktürleri karşılaştırılmıştır. Temel amaç; kentlerde modernleşme sürecinin, Yazd ve Bursa örnekleri üzerinden toplanma mekanlarının yapısını nasıl etkilediğini açıklamaktır. Çalışma alanı olarak Yazd kentinin seçilmesinde, bir islam kentinin morfolojik dokusu olarak iyi bir örnek teşkil etmemi etkili olmuştur, Bursa'nın seçilme nedeni ise Osmanlı İmparatorluğu'nun ilk başkenti olmasıdır. Buna ek olarak diğer sebepler de söz konusudur: İlk olarak her iki şehir de tipik tarihi doğu şehri strüktüründedir. İkinci

etken olarak iki şehir de, modernleşme hareketlerinden önce uzun süre geleneksel dokularını koruyabilmişlerdir. Üçüncü etken ise iki şehrin de tarihi dokusu İslamiyetten sonra oluşmaya başladığı için, ikisinde de toplanma mekanları aynıdır. (Pazar, medrese, cami, hamam) Dördüncü etken ise ortak noktaların bulunmasına karşın, modernleşmenin etkileri iki kente de farklı yansımıştır ki, bu durum karşılaştırmalı analiz yapabilmek açısından önemlidir. Son olarak, beşinci etken ise; modernleşme öncesi iki şehir de kent strüktürü bakımından birçok ortak özellik barındırırken (surlarla çevrili organik kent dokusu) modernleşmeden sonra Yazd'da grid sistem kentin organik dokusuna dahil edilerek, şehrin dokusu bozulmuştur. Aynı zamanda iki şehir de ipek dokumaları ile ünlüdür.

Bu çalışmada, mekansal örüntüyü ve belirlenen hipotezi daha iyi araştırabilmek için bir yönteme ihtiyaç duyulmuştur. Yöntemi belirlerken birtakım kriterler göz önünde bulundurulmuştur. İlk olarak, araştırmanın temel problemi, kentteki değişimin doğrudan olarak fiziksel göstergelere bağlı olması, kullanılacak metodun morfolojik ve mekansal durumlara uygun olması gerektirmiştir. İkinci olarak kentin mekansal strüktürü, birbirleriyle etkileşim halinde olan birçok elementten oluştuğu için kullanılacak metodun yeterince analitik olması gerekmiştir. Üçüncü olarak, bu araştırmanın odağı iki farklı kentte yeni ile eski arasındaki karşılaştırma olduğundan kullanılacak metodun karşılaştırmalı olması gerekmiştir. Dolayısıyla, kentin hem sosyal hem de fiziksel olarak morfolojik ve mekansal analizlerinin yapılabileceği bir metoda gerek duyulmuştur.

Bu araştırmada belirlenen kentlerin modernleşme öncesi ve sonrası mekansal strüktürlerini karşılaştırabilmek için Space Syntax metodu kullanılmıştır. Space Syntax metodu, yapılı çevrede bulunan, sosyal hayata çok iyi entegre olmuş fakat fiziksel olarak gizli kalmış alanları açıklayabilmek için oldukça geçerli bir yöntemdir. 'Yöntemin asıl amacı, yapısal strüktürün sosyal strüktür ile olan ilişkisini tanımlamaktır.' (Kubat, 1999) Bu çalışmada Space Syntax uygulaması, kentsel dönüşümü değişik süreçlerde yaşayan ve gelişen kentlerin konfigürasyonel özelliklerini anlamaya yardımcı olmuştur. Space Syntax'in ana metod olmasının yanısıra, bu çalışmada başka yöntemler de kullanılmıştır. Karşılaştırma metodu, yine bu çalışmada kullanılan diğer bir yöntemdir. Bu çalışma iki islam kentinin tarihi merkezlerinin modernleşme öncesi ve sonrası syntactic ölçümlerine dair bir çalışmadır.

Ek olarak, 'kent elemanlarının analizi' tekniği aynı zamanda modernleşme hareketlerinin, seçilen islam şehirleri üzerinde öncesi ve sonrası etkilerini anlamak için de kullanılmaktadır. Bu araştırmada 'kent elemanları' pazar, cami, hamamlar, ve dini okulları tanımlamaktadır. Böylelikle islam şehirlerinde tarihi merkezin kentsel dokusunu koruma konusunda hangi modernleşme hareketinin daha başarılı olduğuna dair bilgi sahibi olmak da mümkündür.

Çalışmanın sonunda nihai amaç olarak, öncesi ve sonrası arasındaki boşluğu doldurmak veya geleneksel kent dokusu ve çağdaş kent planlamasının nasıl mümkün olabileceğine dair öneriler söyleyebilmek mümkün olmuştur. Bütün bahsedilen bu kriterlerin yanısıra, bir diğer amaç da moderleşmeye yönelik konstrüksiyon süreci boyunca, islam şehirlerinde tarihi merkezdeki kentsel dokunun nasıl korunabileceğini de araştırmaktır.

Bu araştırmadan ve diğer yapılmış araştırmalardan alınan sonuçlara göre, kentte yeni cadde ve yol inşaat süreci sırasında, kentin geleneksel tasarımını anlamak ve geleneksel kent dokusunu dikkate alarak bir çalışma gerçekleştirmek tarihi merkezlerdeki dokuyu korumak için tek çözüm olarak görünmektedir. Diğer bir deyişle, düz bir bakış açısıyla islam şehirlerinde geleneksel kent dokusunu korumak yerine, geleneksel islami karakteristikleri gözönünde bulundurarak korumaya çalışmak daha anlamlı olacaktır. Böylelikle, çağdaş kentsel gereksinimleri, varolan kültürel dokuya, geçmişten gelen islam kenti kimliğini de koruyarak eklemlemek Mümkün olacaktir.

1. INTRODUCTION; RESEARCH QUESTIONS, PROBLEM DEFINITION AND METHODOLOGICAL CONSIDERATIONS

1.1 The Aim of the Study

The main objective of this research is an investigation of transformation and change in historic cores of traditional Islamic cities: how the modern changes affect the old system specially the structure of meeting places and why is it necessary to preserve the old structure of historical cores in Islamic cities? Is it possible to preserve this structure after urban modernization process? Meeting place in this study refers to bazaar, mosque, madrasa (Religious school) and public bath which are main urban elements of an Islamic city.

The thesis investigates the urban configurational features of two Islamic cities (one in Iran and another in Turkey), before and after urban modernization process. As an Iranian who lives and studies in Turkey, I could gain knowledge about urban morphology and urban patterns of Turkish cities. The city of Yazd in Iran is a good example of a city with Islamic urban morphology and the city of Bursa is the first capital of Ottoman Empire. There are some common characteristics between these two cities which will be explained in part 1.3.

Two different systems were used in remodeling the cities. In the city of Yazd (in Iran) grid urban pattern was imposed to the old organic pattern of the city; however in the city of Bursa historical core of the city was not demolished by grid urban pattern as what was done in Yazd. To answer the mentioned questions of this research, methods of configurational analysis of the urban grid is used. A comparison between an Iranian and a Turkish city is made, in order to trace how the spatial structure of the Islamic-traditional city has responded under the different circumstances, and what the influences of these responses have been on the fabric and the social aspects of the historic centres. So we can come to a brief conclusion that why it is necessary to preserve the old structure of historic cores in Islamic cities.

The first chapter is where the questions of the research are asked and the intentions of the thesis toward answering these questions are expressed. In the first part of this chapter, the aim and main objective and the main research questions of this study is presented. The second part of this chapter attempts to imply the problem definition and significance of this study. In the third section, where the Iranian city of Yazd and the Turkish city of Bursa will be introduced and their similarities and differences, which make them suitable for comparison, will be discussed. Then it will focus on the issue of a research methodology, including the ways and the techniques which can orient the thesis toward finding appropriate answers to its questions. The final part of the chapter is an attempt to introduce the outline of the thesis by reviewing the content of the subsequent chapters.

1.2 Significance of Study and Problem Definition

This thesis attempts to investigate what modernization meant for Islamic cities, by using space syntax as a tool. The focus of this study is to present the effect of urban modernization on the structure of meeting places in Islamic cities through an analytical investigation of the urban structure before urban modernization and at present time. So, although there are other studies that investigated the effect of urban change on historic core through using space syntax tool; this research shows a unique approach to find the effect of urban modernization on the structure of meeting places in two Islamic cities in two different countries.

Urban modernization process varies from country to country and different systems could be used to change the city. It is clear that with the passing time, urban change is inevitable, and urban transformation varies from time to time. So the aim of this study is not to critique the urban transformation phenomenon with the time passing or through modernization process, but to investigate the effect of urban modernization and urban grows on the historic core of the traditional-Islamic city and to answer whether it is possible to preserve the old structure of this core after urban modernization process. All cities face urban transformation from the past to present and until future, we cannot stop the time and we cannot prevent transformation of urban spaces with the time passing. "When the old institutions of the city are competent in dealing with the new demands, the process of change remains incremental, but when the forces behind the change become enormous, a radical change in the constitution of the city is inevitable" (Karimi, 1998, P. 11). In this relation, Turkish and Iranian traditional Islamic cities have been introduced as two examples, which have different systems in urban transformation. Whereas Iranian cities have grid urban pattern for all cities after urban modernization process, Turkish cities have different system for each and it is adapted to the organic urban pattern of the traditional city. Whereas Iranian cities have lost the old city by building new road constructions, in most of the Turkish cities the old city has been preserved and new city is built besides that.

By this introduction about the combination of the old and the new the practical examples of modification, we may now raise the question that will orient the discussion toward a structure of research. The question is: Why is it necessary to preserve the structure of meeting spaces in cities with Islamic culture? Is it possible to preserve this structure after urban modernization process and urban growth? Therefore, the impact of the modern grid on traditional areas, and the structure of the meeting places in historical core of the whole city are all issues that arise from this argument.

The mentioned questions are the framework of the study but it still needs some clarification about the period within which traditional and modern city are discussed. In this study, the old or "traditional" city is the one before any modification due to modern changes. This period was considered to be before the industrialization of the late 18th century, in the case of Turkish city, and before the closing decades of the 19th century, in the case of Iranian city. Cities after receiving their modern changes will be considered as "new" or "modern" ones. In order to cover a larger span of the transformation process, the 'modern' cities will be studied in their most recent form. The focus of this study is the syntactic changes of meeting places in two Islamic cities after urban modernization programs.

1.3 Selection of Case Studies

It has been implied before that one traditional Islamic Iranian city and one traditional Islamic Turkish city will be studied in this thesis. The Iranian city is the city of Yazd and the Turkish one is the city of Bursa. There are several reasons, which support this selection**.** Firstly, they both belong to oriental types of historic cities, which enable the research to have a decent analyze of the field related to our topic. The second reason is that both of these cities experienced a long period of continuous existence in their traditional form before modernization. The third reason is that both of these historical cities transformed to an Islamic city after converting to Islam, so the meeting spaces of these two cities are the same (bazaar, mosque, madrasa, hammam). Forth, the urban modernization system is not the same for both of these cities so it can be a good selection for our comparative analysis. Fifth, before urban modernization there were many similarities between the urban structures of these two cities, for example both of them are fortified town and had organic urban pattern, but after urban modernization, the walled-city of Yazd ruined and grid urban pattern was imposed to the organic urban pattern of the city. In addition, both of these cities were famous for silk textile.

1.4 Research Methodology

In order to find answer for the questions of this research, a methodology is required to investigate the spatial layout and to examine the preferable hypothesis. At first, the major problem of this research for example urban change is firmly linked with the physical manifestation of the city. Therefore, the taken up methodology should be able to deal with the morphological and the spatial matters. Secondly, since the urban spatial structure is made of a system of interacting elements, the taken up methodology has to be analytically surfable. Thirdly, the focus of this research is a comparison between old and new, as well as a comparison between two different cities. It needs a methodology capable of comparative research. In order to reach all mentioned aims the adopted methodology should be capable to correlate the spatial and morphological analysis with the activity of the society. "The aim behind the technique is to describe different aspects of relationships between the morphological structure of man-made environments and social structures and events" (Kubat, 1999).

The fact is that urban studies suffer from a general lack of analytic methods and practical techniques. This insufficiency becomes even more serious when the issues related to spatial structure are important in urban studies program. In this context, space syntax, a theoretic-methodological framework, appears to be a preferable one for this research. Space syntax is a set of theories and techniques that analyses the configuration of living spaces -both cities and buildings- and ties them in the other aspects of society.

Although space syntax is the main methodology of this research, it is not the only method, which is used in this thesis. This research is a comparative study so method of comparison is another methodology, which is used in this study. In order to comprehend all the methodologies used in this study, we need to know how and in what relations these methods should be applied. These matters are the subject of the following chapters. At first, we need to select right case studies for the research. Then a syntactic model of urban grid will be made for both selected cities in two conditions: Before urban modernization and after that. In other words, the urban morphology of city in its traditional form and in the current time will be analyzed.

The configuration features of these cities will be analyzed by using space syntax technique. In addition, technique of 'urban element analysis' will be used in this study too. After having analyzed the urban elements of the cities in two mentioned conditions a comparative technique will be used to compare the urban changes of these two cities after urban modernization.

1.5 The Layout of the Thesis

The problem definitions and research questions mentioned in the second section of this chapter were developed around three major themes: the old city as it was, the old city as it is now, and the consequences of change and growth specially change of meeting places in historical core of the Islamic city. Five chapters will be developed around these three themes to make the skeleton of the thesis. Second chapter is about the general characteristics of an Islamic city. The selected case studies before and after urban modernization and urban modernization systems in these cities will be explained in third chapter.

The research methodology chapter which will explain Space Syntax technique and a number of analytical and technical ideas used in this research will be defined in this chapter, and the data analysis and concluding chapters are the other parts of this thesis.

2. GENERAL CHARACTERISTICS OF AN ISLAMIC CITY

2.1 The Traditional (Pre-Industrial) Islamic City

Urban studies that have sought to explain the cities of the Islamic world have often been discussed within the framework of the "Islamic city" concept (Marcais, G. 1913, 1946;Marcais, W. 1928; Pauty 1951; von Grunebaum 1955; de Planhol 1959). According to this concept, Islam is an essentially "urban religion" conforming to urban life and regulating its societies, and is thus considered to be the prime definer of the city form. To explain urban morphologies and structuring principles, an Islamic city model-where the congregational (Friday) mosque forms the city's central core, with the market, the religious school, and public bathhouse surrounding it-has been widely used (von Grunebaum 1955; de Planhol 1959). The classic model of the traditional Middle Eastern Islamic City, published early in the 1920s by European scholars under the charm of Orientalism (Abu Luhod 1993). Orientalists drew their definition from medieval Muslim writers who considered a city simply as a place with a Friday mosque, a market or bazaar that is a linear market developed through the streets, and a public bath. This definition, however, makes no distinction between city and town, or village for that matter, as each may have all three precondition of features. The model generally includes the following characteristics: a medieval citadel or fort, a nearby central market and one or more public baths clustered around a Friday mosque, a madrasa (Religious school) and caravanserai, a narrow irregular street pattern, ethnic quarters, courtyard houses, medieval walls and gates, some spillover marginal housing outside the walls, and a complete lack of open civic space other than the Friday mosque courtyard (Cantacuzino 1982; Abu-Lughod 1993; Bianca 2000a, 2000b). Streets were not "laid out" as in American and European cities after the mid-19th century, but were composed of leftover space after houses were built. Consequently, wide streets were considered a waste of space. Houses formed clusters around these narrow, leftover, semi-public alleys. Eventually, clusters of clusters formed neighborhoods, clusters of neighborhoods formed quarters, and clusters of quarters formed cities (Figure 2.1).

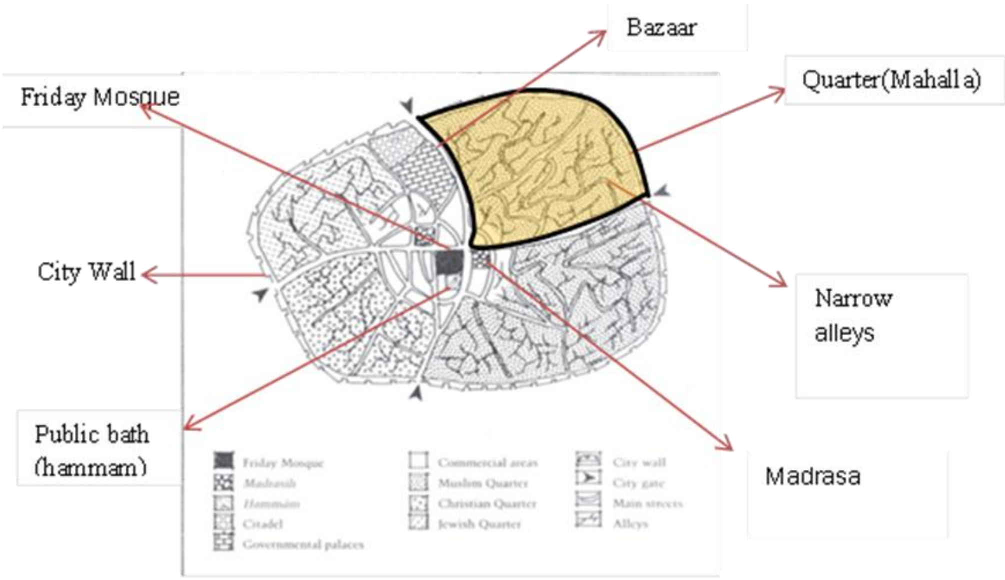

Figure 2.1: Layout of an Islamic City (Habib, Miklos, 1970).

Despite lacking scholarly consensus, the model was widely disseminated through a "conspiracy of copying and glossing" in which a whole generation of scholars uncritically cited or incorporated others work into their own (Abu- Lughod 1993, p.17). The model depended on the idea that Islam was an "urban" religion, which both depended on and required that people live together in communities." (Brown 1973, p.27)

The term Traditional refers to Muslim towns from the Ottoman period, between the 16th and the 19th centuries. During this stage, the Muslim cities manifested an important phase in which they preserved the formerly developed principles of their physical form. The traditional physical pattern reflected the integration of the religious practice in the daily life of the individual and society, the relation, which directly or indirectly - have conditioned the structure of the built environment (Bianca, 2000). The urban pattern of these cities remained largely unchanged until the nineteenth and twentieth centuries. The space, at a functional level, was clearly divided into public and private realms. The public realm contained all the common activities, such as trade and commerce, religion, education, administration and other public facilities. The house where extended families lived constituted the private realm, one of the main dividing lines between the two realms of the town was the distinction between patterns of activities of men and women (Madanipour, 2003: 184), (O'Meara, 2007: 19).

The urban form of a traditional city grew as an aggregation of enclosed cellular units, taking the shape of private houses, mosques and markets, all collected within a coherent urban fabric. Close linkages with other buildings secured the integration of small and sing units into larger clusters, forming a cohesive urban form. Each enclosed area is focused on the centre of its courtyard, and elevations of the building are turned inward, facing each other instead of looking onto the street. Buildings exude a definite sense of place and identity, and provide users with a feeling of security, peace and equilibrium. The mosque complex became the reference point in the urban fabric. Meandering streets all seem to radiate and merge from one mosque to the next. The division of land was not based on a uniform method and was seldom done with geometric discipline, therefore, hardly ever-followed straight lines with no end. The size and the alignment of lots were due to the continuous subdividing of the land and the result of uncontrolled urban homesteading. The walls on these meandering roads were often delicate plans of small and large homes, each responding to the local climate and to Islamic life with its accent on privacy (Khan, 1978). Islamic cities were divided into quarters, each with its own distinct character. The quarter was named after a central street, or sometimes after the ethnic group that occupied it or the particular trade that was practiced there. Within the district, there were several narrow streets, with dead-end alleyways called Zuqaq (neighborhood) (Antoniou, 1998). The quarter represented clusters of households of particular quality of life, based on closeness, which is manifested in personal relations, common interests and moral unity. The pattern was dense, and each quarter had its own mosque, shops, and other necessary objects. They even had their own gate, which was usually closed at night. The quarters were also ethnically organized (Saud, 2002). This ethnically based distribution of quarters first took place in Madina, as mentioned earlier, by the Prophet, where the tribe was accustomed to maintaining strong ties between its members, preferring to live close to each other. Almost the same process continued in the planning of traditional cities.

In addition to the social solidarity between people, the process of clustering, as suggested by Rapoport (1977), provided a way in which the physical environment was organized to help reflect the cultural identity, "…the result is group identity reinforced by clustering, manifested by environmental symbols and contained by boundaries. The process of clustering helps cultures survive, provides the appropriate settings for behavior with cues which can be understood, appropriate organizations of meaning and communication, and sharing of symbols and unwritten rules, and congruent activity systems and temporal organizations”. This, in fact, suggests that the meaning of the environment depends on the understanding of people and that the success of the environment organization is a result of the congruence between the physical settings, such as clues and symbols, knowledge, worldviews, and images that are embodied in people’s mind. This is how the Muslims were able to reflect that sense of intimate environment through adapting whatever planning system and architectural concept or element that fits their cultural identity and values.

As the major focus of this study is on the structure of meeting places in Islamic city the major urban element of an Islamic city will be explained in fallowing parts.

2.2 The Main Urban Elements of an Islamic City

2.2.1 Mosque

The very first piece of Muslim Architecture was the mosque that the Prophet himself built at Medina. The same process then continued with every Islamic town. It occupied the heart of the town and was usually surrounded by the Bazar (market). This was where weekly Friday prayers were held. Attached to it, there was the Madrassa-school providing the religious and scientific teachings (Saud, 2002). Every medieval urban agglomeration had its own main congregational mosque, and there were other mosques within the city districts as well (Behrens-Abouseif, 1989). The "mosque seldom took monumental forms (as European cathedrals did), except in cases where the prestige of royal sponsors was involved". "Most of the institutional functions were fulfilled by the Friday Mosque, the prime public building, which, in line with the Islamic philosophy of life, had not only religious but all sorts of political and social functions" (Bianca, 2000). Hence, in addition to its main function as a place for prayer, the mosque has provided space for social functions such as education, community gatherings, and shelter for travelers and food distribution to the poor. In later periods of Islamic history, there developed specific building forms for these various functions (Kuban, 1974).

2.2.2 Bazaar

"Located outside the main mosque provided the economic activity in the town". "The central area was also the gathering of other public activities such as social services, trade, art and crafts and baths" (Saud, 2002). Its location was usually influenced by the position of the mosque. This parallel existence of religious and commercial needs is reminiscent of medieval towns in Europe, where market square and cathedral square are closely related (Antoniou, 1998). The development of the bazaar inside the city has been mainly from city gates toward the city centre. Sometimes one branch of the bazaar extended from one gate to the others. The bazaar in traditional Islamic cities functioned as the main service and communication space. It developed simultaneously with the physical growth of the city.

Its traditional urban structure and development continued up to the beginning of 20th century. But the development of new streets, to give best access to automobiles, reallocated the commercial centers along the main streets and gradually weakened the role of the bazaar in the life of the cities. The bazaar has historically been one of the main factors in social life and development of the traditional Muslim cities. This element has been able to create spatial link between religious, economic and political centers: The bazaar as commercial, the Maidan (public open space) as administrative and political, mosque and madrassa as religious, and the neighborhood centre as the distribution system of city services and facilities (Ferdowsian, 2002).

In addition, bazaar included a building which was a roadside inn where travelers could rest and recover from the day's journey. Caravanserais supported the flow of commerce, information, and people across the network of trade routes covering Asia, North Africa, and southeastern Europe, especially along the Silk Road.

2.2.3 Public Bath (Hammam)

Hammam consists of four major spaces, entrance, Rakht-kan (reception and changing hall), Sarbineh and water stores. The way Hammam is connected to the access network is very important. Several short, narrow and meandering footpaths join the entrance of the Hammam to the network. This ensures gradual adjustment of the body temperature when emerging from the Hammam. The changing hall consists of several locker rooms, which were allocated based on the social classes. The Sarbineh consists of several washing and massage areas.

Beside Friday mosque, bazaar, madrasa, and public bath streets and courtyards played an important role in spatial organization of the traditional city, and most importantly, in the distinction between the private and public spaces. A network of narrow and winding streets consisting of public, private, semi-private streets, and cul-de-sacs connected between quarters and the central place. Alongside the streets system, a complementary system of courtyards and open spaces with different privacy levels existed as well. The streets of the public area- where the main mosque, main Madrassa (school) and the main market are located- are wider and more systematic. In the private area-consists of the residential areas- the streets are narrower, only a few wide thoroughfares existed. The rest were narrow winding lanes that protected the privacy and security of the inhabitants. The small lanes had doors that were closed at night (Behrens-Abouseif, 1989).

2.2.4 Religious School (Madrasa)

Madrasa or religious school is another element of Islamic city in which students learn about religion of Islam, and some religious events could be held in Madrasah too. In contrast to the residential houses in Islamic cities, religious buildings are frequently provided with external projections in the shape of entrance doorways, outside ornament and, possibly with high and fancy minarets. Their appearance is the same as the mosque.

2.3 Residential Quarters in Islamic Cities

Islamic cities were divided into quarters, each with its own distinct character. The quarter was named after a central street, or sometimes after the ethnic group that occupied it or the particular trade that was practiced there. Within the district, there were several narrow streets, with dead-end alleyways called Zuqaq (neighborhood) (Antoniou, 1998). The quarter represented clusters of households of particular quality of life, based on closeness which is manifested in personal relations, common interests and moral unity. The pattern was dense, and each quarter had its own mosque, shops, and other necessary objects. They even had their own gate which was usually closed at night. The quarters were also ethnically organized (Saud, 2002). This ethnically based distribution of quarters first took place in Madina, as mentioned earlier, by the Prophet, where the tribe was accustomed to maintaining strong ties between its members, preferring to live close to each other. Almost the same process continued in the planning of traditional cities.

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Houses are consistently built around multi-use courtyards with entrances secluded from main streets and squares. Streets, limited to pedestrian traffic, never became formal or monumental (Fez, 1980). The house opened onto a secondary (dead end) street or cul-de-sac, and was included a close reception room, a corridor gave access to an interior courtyard (Raymond, 1980). The courtyard, as a focal point, determined the shape and the size of sites, which was integrated with groups of houses that formed neighborhoods. Some forty percent of a city may be taken up by private courtyards (Antoniou, 1998).

Figure 2.2 illustrates how the courtyard (which is always considered to be the prototype of the traditional Muslim urban fabric) was originated by ancient civilizations. It has been suggested that the courtyard was originally developed by the Greeks and Romans, and later adopted by Muslims. Mike Danby (1083, cited in Mortada, 2003), points out in his discussion of Islamic architecture that “the concept of the courtyard house was accepted because it did not conflict with the principles of Islam. In fact, it was a plan which could easily be adapted to achieve a high degree of privacy as required by the Islamic way of life” (P. 137).

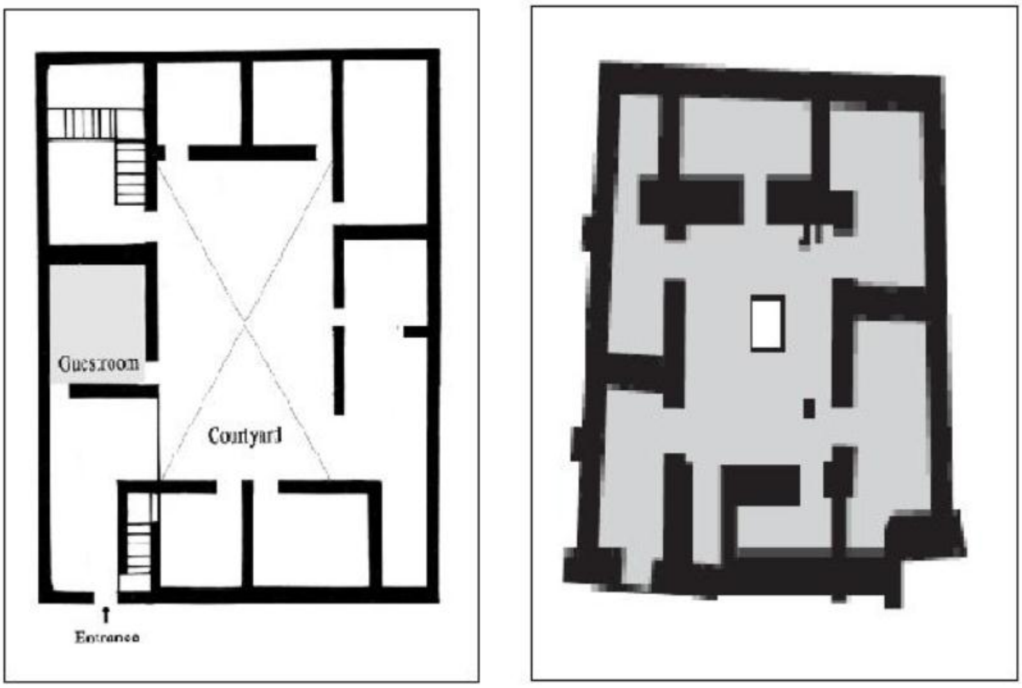

Figure 2.2: (Left) plan of a traditional house from Saudi Arabia. The location of the guest room (colored light gray) was close to the entrance and separated from the family domain to maintain the privacy of women in the rest of the house. (Right) architectural elements originally developed by ancient civilizations and later adopted by Muslims, courtyard of a house from the period (1800 B) in city of Ur. After (Mortada, 2003).

2.4 Urban Modernization in Islamic Cities

From the past to the present, the cities in the world have faced different changes and transformations. Due to urban modernization program, many cities in the world faced many changes in historical cores; many historical buildings were demolished to make open spaces for new constructions. However, these kinds of urban transformations are not the same in different cities in the world. Some cities changed suddenly without any consideration to their traditional urban structure; but, there are some other cities that changed gradually by considering their previous urban structure.

In the Middle East, urban modernization began in the final decades of 19^{th} century, also in Islamic cities. Historical cores of many cities in Iran, Turkey, Lebanon, and Egypt and so on were demolished during urban modernization process. This process happened after urban modernization in Europe so it happened rapidly and in a short time. Rapid urban modernization resulted in huge physically changes in the Middle Eastern cities and led to some changes in social life and identical characteristics of the city.

In Iran, urban modernization process began in the last decades of 19th century. Before that, some other urban transformation constructions had been done by the order of Iranian kings. However, those urban changes were in a good harmony with the old structure of the city and did not impose a new and completely different system to the old one. Previous study on city of Isfahan done by Kayvan Karimi shows that how urban transformation of Isfahan till 19th century was done according to the old structure of the city without disturbing the urban morphology and identity of the city; but urban modernization program which began in 1930 changed the urban morphology of the old city drastically without any harmony between old and new. Generally, during the urban modernization of Iranian cities, a kind of grid urban pattern with long, wide, and straight roads was imposed to the old structure of the city. It was easy and simple pattern so was repeated in all Iranian cities. In 19th century the grid urban pattern was imposed to organic urban structure of city of Isfahan, without any consideration to the old structure of the city (Figure 2.3-Left). However, in 16th century when Isfahan was the capital of Iran, Safavid Empire made some urban transformations to show its power. So a new and big square was made in another part of the city but well- connected to the old square and the new urban system was in a good harmony with the old one (Figure 2.3-Right).

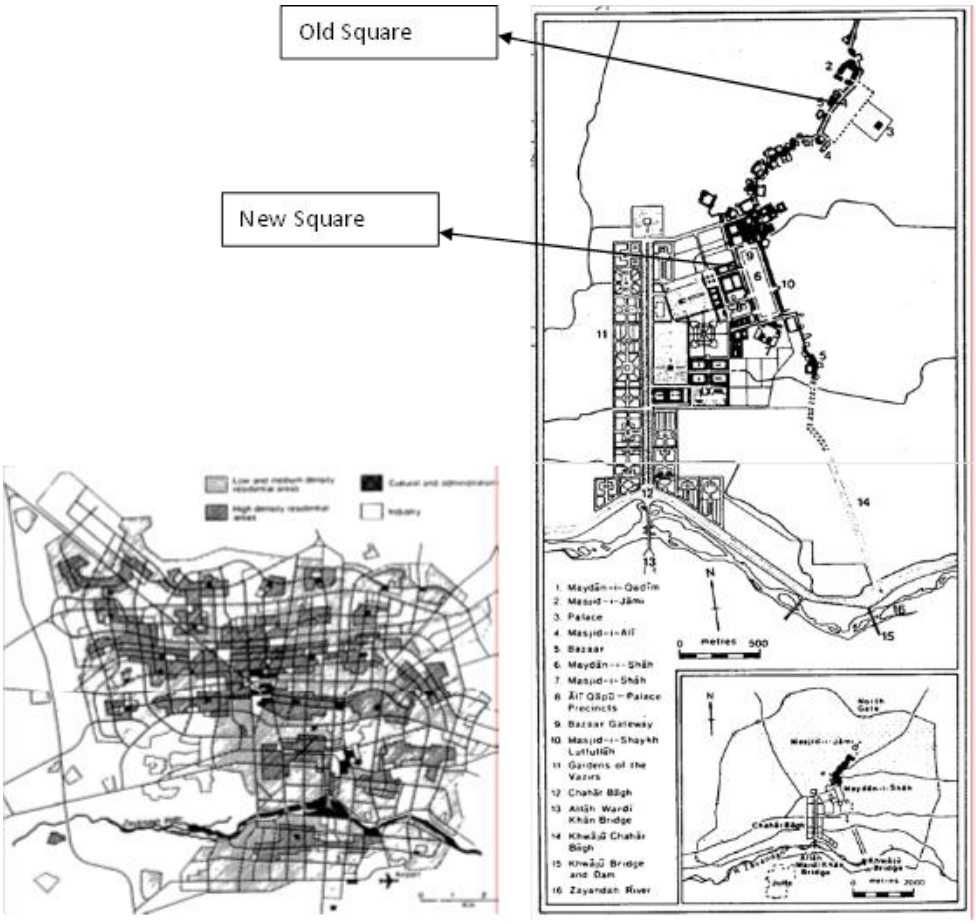

Figure 2.3: Modern master plan of city proposed in 1960s, grid urban pattern (Left) (Lawless, 1980).Map of Isfahan in 17th century which shows a well connection between the old and new squares of city (Right) (Ardalan and Bakhtiar 1975).

As it said before, urban modernization in Iranian cities led to severe damages in historical cores of the cities; because the grid urban pattern that was imposed on the historic structure of the city was not in the harmony with the traditional urban structure of the city. Besides that, many historical architectural buildings were demolished physically due to new urban construction; also, in some cases because of the wrong urban road system some important elements of the city like bazaar or Friday mosque got isolated and were segregated from other parts of the city, while Friday Mosque must be located in the heart of the Islamic city.

In Turkey, relationships between Ottoman Empire and European states started a rapid period of change in Ottoman social fabric. So a kind of urban modernization under the influence of western culture took place. During the 19th century the Ottoman Empire made some reformations (called Tenzimat) in classical Ottoman system and replaced it by new ones. These reformations were done under the inspirations of European thought and society, adapted to Ottoman culture and demands. Therefore, Ottoman Empire could impose a new, modern, westernized controlling management replaced the old one. By this way, Ottoman Empire attempted to protract its power over the empire and made a new system of government, which was not match to the traditional system.

"Urban life changed markedly during Abdulhamit II's reign. In Istanbul, Izmir, Edirne, Salonica, and the other main cities, streets and site walks were now paved and lit with gas lamps and kept clean and safe. Horse-drawn public street cars were operated, usually by foreign concessionaries." (J.Shaw & E. Shaw, 1977, P 241)

Urbanization in this period is one of the most decent indicators of social transformation. The population of western parts increased a lot. Therefore, cities needed to grow and new urban structure was proposed. Urban modernization process in Turkish cities during Ottoman Empire did not take place in every corner of this empire at the same time and in a same way. On the contrary, to urban modernization system in Iranian cities, which proposed grid urban pattern for most of the traditional cities; urban modernization system of Turkish cities was not the same for different cities. In other words, different urban patterns were proposed for different cities. For example in city of the cities of Bursa and Antakya, walled city is kept and new city was built beside that without disturbing the previous city; during the urban modernization process in mentioned cities, organic urban pattern was used for historical parts according to its traditional urban morphology, and new parts of the city is a combination of grid and organic urban pattern. On the other hand, the city of Istanbul developed by another system and whole of the city was affected by urban modernization.

3. HISTORICAL AND URBAN TRANSFORMATION DIMENSIONS OF THE CITIES OF YAZD AND BURSA

3.1 Historical and Urban Transformation Dimensions of the City of Yazd

The city of Yazd is located in central Iran and the capital of the Yazd province. It is near to a desert at the center of Iran. It is located 677 K. far from Tehran, the capital of Iran. Yazd province is surrounded by province of Isfahan in the North and the West, by Khorasan in the East, by Fars in the South-West and by Kerman in the South-East, as shown in Figure 3.1.

Figure 3.1: Location of Yazd Province in Iran (http://en.wikipedia.org/wiki/Yazd_Province, 20.09.2013).

According to the history of Yazd, since the Sasanian Empire (224-651) the city has been famous for beautiful silk textiles. The region is still an important center for silk waving.

"After Qom and Tehran, Yazd, as a province, has become one of the most highly urbanized states in Iran. As of 1996, over 75% of the population in the province lived in cities. The city of Yazd itself has grown from a small dusty town of 63,000 residents in 1956 to 330,000 people in 1996" (A. Modarres, 2006).

3.1.1 City of Yazd in past and present

The city of Yazd is located in central part of Yazd province. The city dates from the fifth century and Marco Polo described it as "Nobel city". The area is mostly desert and sand-ridden plain area. Historically, Yazd has been the link between the province of Fars and Khorasan and between the West of Iran and Kerman, and it was located in the junction of the trade routes from central Asia and India. Because of having a lot of religious buildings it was called "Darol-ebade" (Home of Piety). Some of the inhabitants of the city are Zoroastrians whose ancestors who had immigrated to Yazd and Kerman when Muslims Arabs conquered Iran. Yazd still is an important city for Zoroastrian Iranians.

The city of Yazd could preserve its Iranian-Islamic characteristics for many years, and it is still one of the most interesting and charming Islamic cities of Iran. It is especially famous for its humanistic scale (Pirnia, 1992), organic urban pattern and the traditional courtyard houses of extended families. In 1970 city of Yazd was selected as one of 27 Iranian cities which were successful in preserving the historical part of the city. The idea behind this goes back to the concept of locating cultural heritages such as traditional buildings and monuments under protection program for restoration and preservation. In order to preserve the old parts of the city a master plan for the old parts was prepared, not only for the enjoyment of tourists, but also for the protection of the historical features of historical parts of Yazd to be able to continue its normal life within the city as a whole.

Many of the dwellers of the historical and old parts of the city and some other people from outside of the area prefer to live in the old part of the city, however preserving and maintaining the old houses of that part is money-time consuming and some residents are not in a position to pay for that.

So, unfortunately many of the beautiful old houses have been neglected to the extent of getting damaged. However, these quarters are settlements for many families.

On the other hand, the city expanded very fast during the last century and today it is a combination of old fabric and new urban fabrics. These newly urban environments caused some basic spatial problems such as lack of functional and spatial system

(Mohammadi, 1999). Today, the city of Yazd is generally divided into two parts new city and old city. Old city is located in the centre of walled city of Yazd, which covers an area of about 98.5 ha. The old city is around 550 ha. The city itself is divided into 8 regions.

The urban morphology and the architecture of the city are related to its location in the country. It is located at the edge of a large desert area about 1320 meters above the sea level. So its climate like all deserts is arid and hot. The weather during the summer is hot and dry, and during the winter it is cold and dry. In the summer the maximum temperature is 42 centigrade degree and in the winter it could be -8 centigrade degree. The temperature of this region changes a lot from day to night, and summer to winter, while the average humidity is about 10%. The amount of rainfall is averagely 50 mm on the plains and 122-240 mm on the mountains. Then the most important climate characteristic of this region is heat which is a harsh and tough situation for inhabitants to live in. Therefore, people had to find some solutions to overcome their environmental problems. Because of such dry and hot climate an especial style of urban pattern and architecture raised by people of the region. The architecture of the historical parts of Yazd is perhaps the most traditionally kind of Iranian architecture that could be found, preserved by the hot and dry climate and spared the demolition of Mongols (1220) and other invaders (Afshar, 1995). The layout of old Yazd was strongly adapted to climate conditions (Gideon, 1983). Like other Iranian and Middle Eastern cities, the architecture and the urban pattern of the city of Yazd is because of the climate conditions. It means, using two features: narrow twisting alleys (Figure 3.2), and large open courtyards and internal gardens as shown in Figure 3.3. The narrow alleys functioned as reservoirs of cool fresh air. The courtyards with their close layouts were able to retain any cool air which was deposited during the night (Fathy, 1986). The walled city of Yazd was built as compacted as possible in order to reduce the surfaces which are connected to the sunshine directly, and to increase the shaded surfaces.

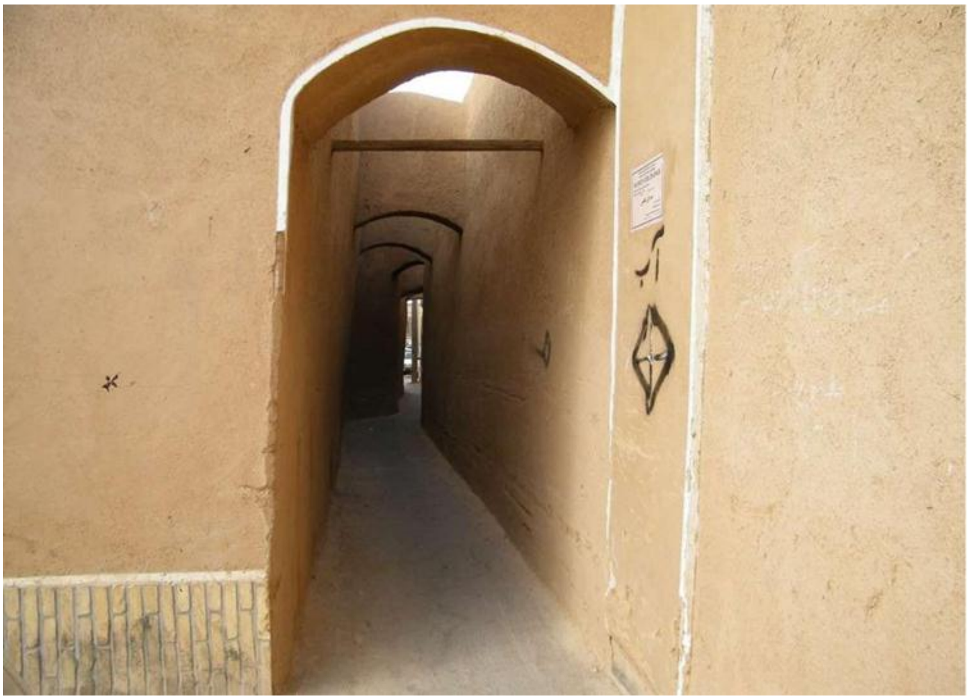

Figure 3.2: Top-An example of a narrow alley. Bottom-A general view of the compact fabric of the city of Yazd (http://www.iranreview.org, 20.09.2013).

Wind towers (Badgir) are a typical architectural feature of city of Yazd. Wind towers are seen from Kashan, a city located in North of Yazd, to the Persian Gulf but mostly developed and famous in city of Yazd.

Figure 3.3: An example of the court yard of a dwelling unit in the walled city (Boot, 2011).

Yazd is also famous for its skyline, traditional houses which are made by sand and brick and has a color of sand, domed roofs, wind towers which are wholly combined with each other, shown in Figure 3.4.

In contrast with the old city of Yazd, the new urban pattern which was proposed for the city of Yazd was wide streets and absence of courtyards in most houses. New urban morphology of open spaces of city had no attention to climate situation and this ignorance can be seen in the selection of building materials too.

Figure 3.4: A general view of the old city, the wind-towers (Badgir), is one of the main elements of city skyline (http://www.panoramio.com/photo/92875016, 13.10.2013).

3.1.2 Urban transformation of the city of Yazd

This part of the research concentrates on an investigation of the basic physical and spatial aspects of the main elements of the city of Yazd, from the point of view of their development process during the history. The main focus of this part is on the basic layout of the city and its main elements. Further emphasis will be placed on the process of formation and transformation of the city as a whole.

By taking a look to the historical urbanization of Iranian cities, it can be concluded that the development of most traditional Iranian cities has generally occurred in three periods (Habibi, 1996). Regarding to this point, development of Yazd maybe divided into three main historical periods as bellow:

1. The development of the city in walled city until 14th century (Historical city)
2. The development of the city which is beyond the walled city in the 1920s which is the beginning of the modern street system (Old city)
3. The development of the city in the last 90 years (New city)

In the following sections urban transformation of Yazd regarding to each historical period (mentioned above) will be discussed.

3.1.2.1 Urban morphology of the city of Yazd up to the late 14th century (walled city)

The walled city of Yazd developed in different steps and periods up to the late 14th century this process is shown in Figure 2.5. According to the history, before Islam and in Achaemenian period (550BC-330 BC) a city called "Isatis" was located in the current location of Yazd, although there is no evidence of that city now (Afshar, 1966). According to another historical story, the foundation of city of Yazd, dates back to the era of Alexander the Great, who established a prison for prisoners of war in that location (Afshar 1966, P 26-27). There is another story by Iraj Afshar (1995) which says that one of the Sananian shah's sons named Yazdgerd, developed the city so the name of the city became Yazd.

In the eight century the city was occupied by Muslims during the third Muslim Khalifa (Afshar, 1966, P 30-39). The city developed around the walled city and to the North-West of the Friday Mosque. Later a bazaar and other buildings and residential quarters were added.

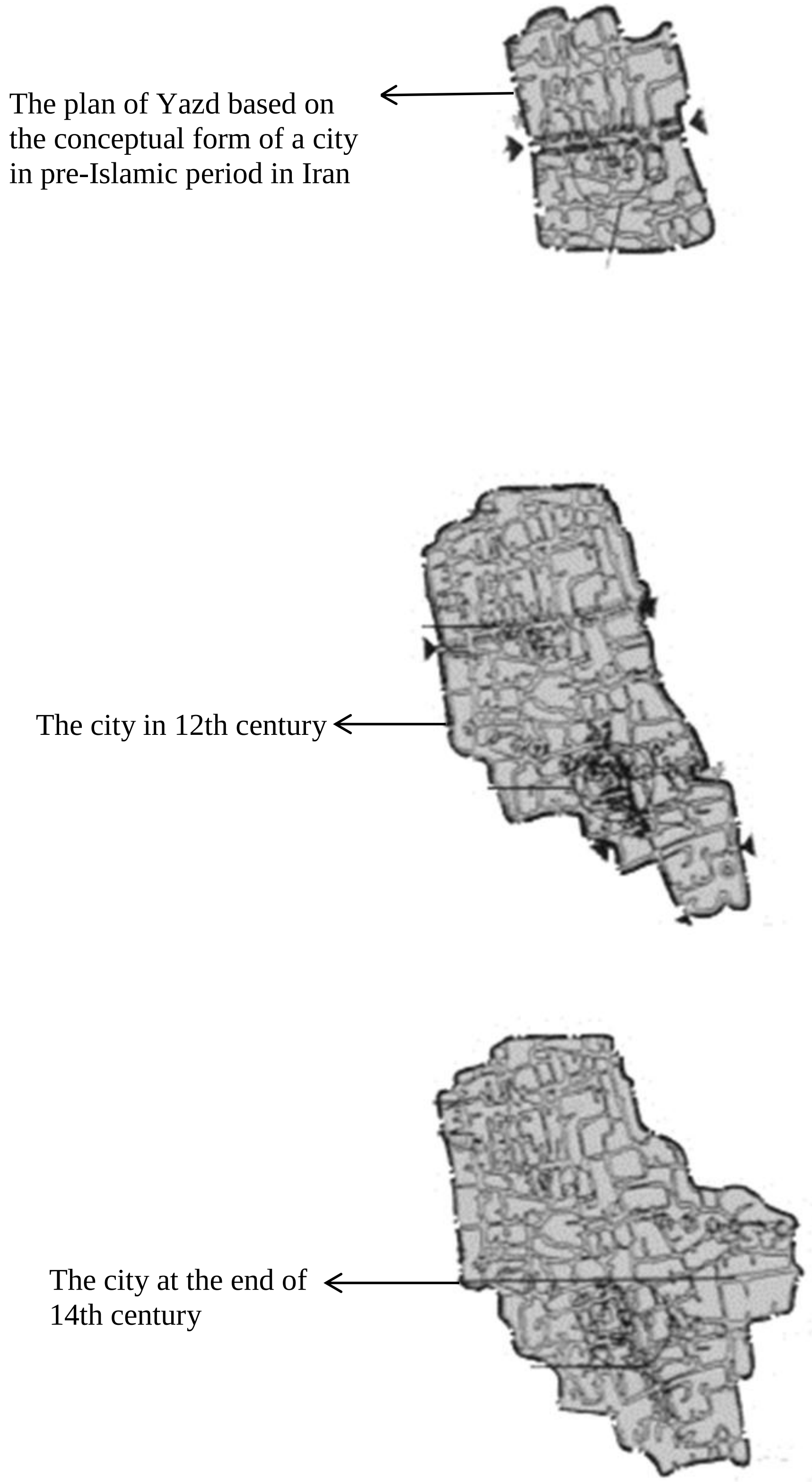

Figure 3.5: The physical growth of Yazd from pre-Islamic era up to the 14th century (Mohammadi, 2001).

In 11th and 12th century, the city center was moved to a new location around Friday Mosque, where a new commercial center called Chahae souq–i-Shahi, was built, like other Islamic cities this centre included Religious school and water reservoir. Perhaps the first major growth of the city was in this period.

In the 14^{th} century number of new buildings were constructed and the development of the city was toward South and the South-West. A new wall also was built with 7 gates (Afshar, 1966, P 83-84).

To sum up, the development of city of Yazd before 15^{th} century could be divided into three distinctive stages:

1. City development before Islam and the early Islamic period,
2. City development until 12^{th} century,
3. City development until the late 14^{th} century.

Before Islam, the urban pattern of the city of Yazd was regular like other Iranian cities in that era. It included three main parts, the citadel, the walled city and the immediate development outside that. Then after Islam, the urban pattern of the city transformed to organic one with main Islamic urban elements such as Bazaar, Friday Mosque and several neighborhoods. In the walled city of Yazd religious buildings and open spaces played important role in the city. The skyline of the city is decorated with tall minarets and wind towers that Yazd is famous for these cooling towers.

3.1.2.2 Urban transformation of the city of Yazd from the late 14^{th} century to the early 20^{th} century (old city)

In the beginning of the 15^{th} century, an urban complex consisted of bazaar, Friday mosque and a water reservoir was built around the square of the city which was located at the extreme South-East of the city (Afshar, 1995). This complex called Amirchaqmaq square still could be seen in the center of the city of Yazd and. The old city centre which was around the old Friday mosque (Masjid-i-Jame) was gradually transformed to this square. The process of transforming the old city centre to the new place was almost in contrast with the development of the other Islamic cities of Iran such as Isfahan in which the old Friday mosque didn't change and the city centre remained around that. The bazaar also extended from the old Friday mosque to Amirchaqmaq square as a good link between the old city centre and the new one. The bazaar grew very well and became an important commercial centre in the region. This urban growth process is shown in Figure 3.6.

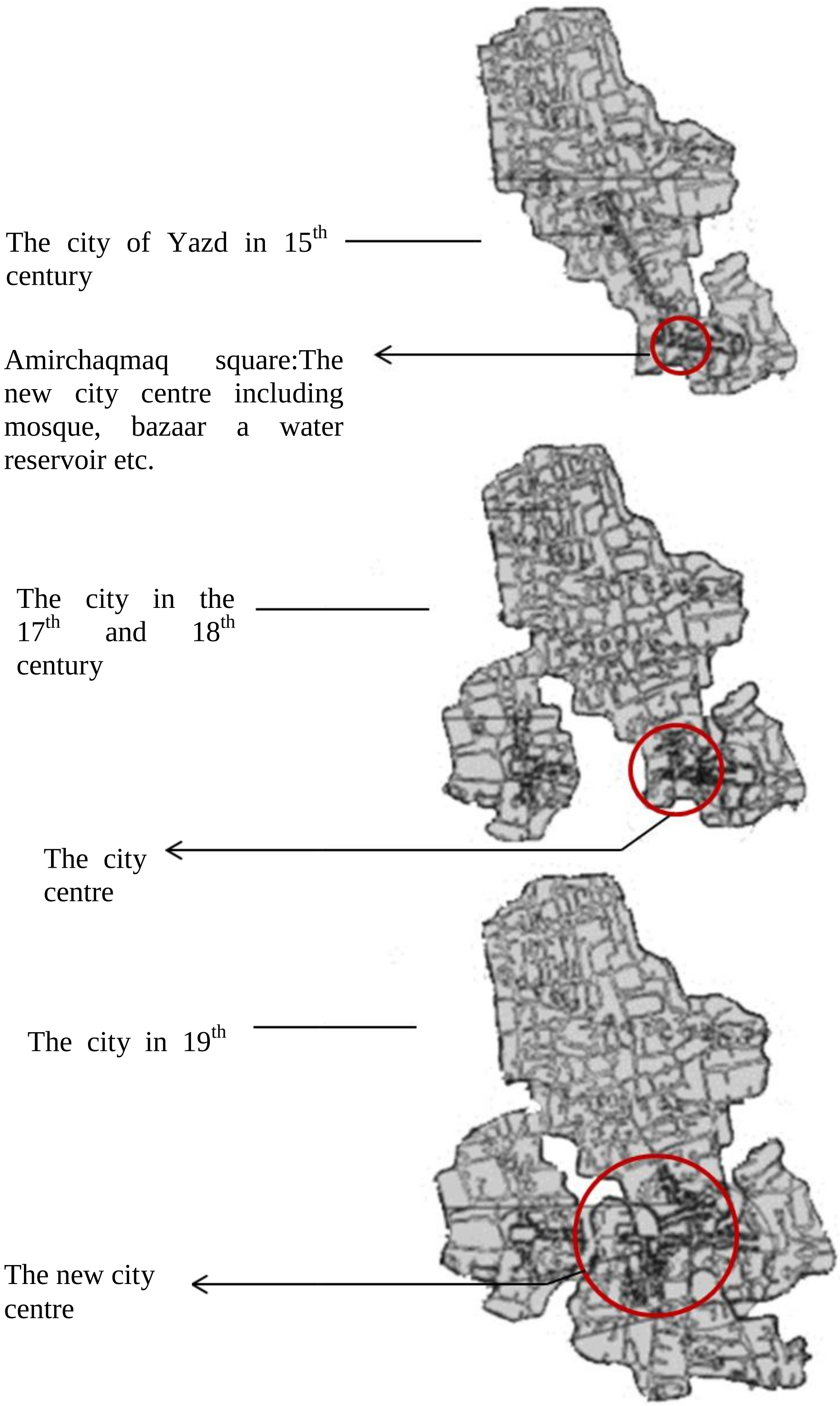

Figure 3.6: The physical growth of the city from 14th century to 19th century (Mohammadi, 2001).

During the Safavid density (1501-1773), the city of Yazd did not develop so much in comparison to other Islamic-Iranian cities like Isfahan, Tabriz, Kerman, Shiraz etc.

Even the number of buildings, which were built during this era, was not a lot (Tavassoli, 1982).

In 1790s, another complex opposite the Amirchaqmaq square in the South-West of the walled city was built and called "Shahtahmasb" square. These two squares were well connected to each other by an axial road full of commercial functions. The city centre remained in mentioned squares but the city started to grow toward the West and South-West, were several new neighborhoods were added, see Figure 3.7.

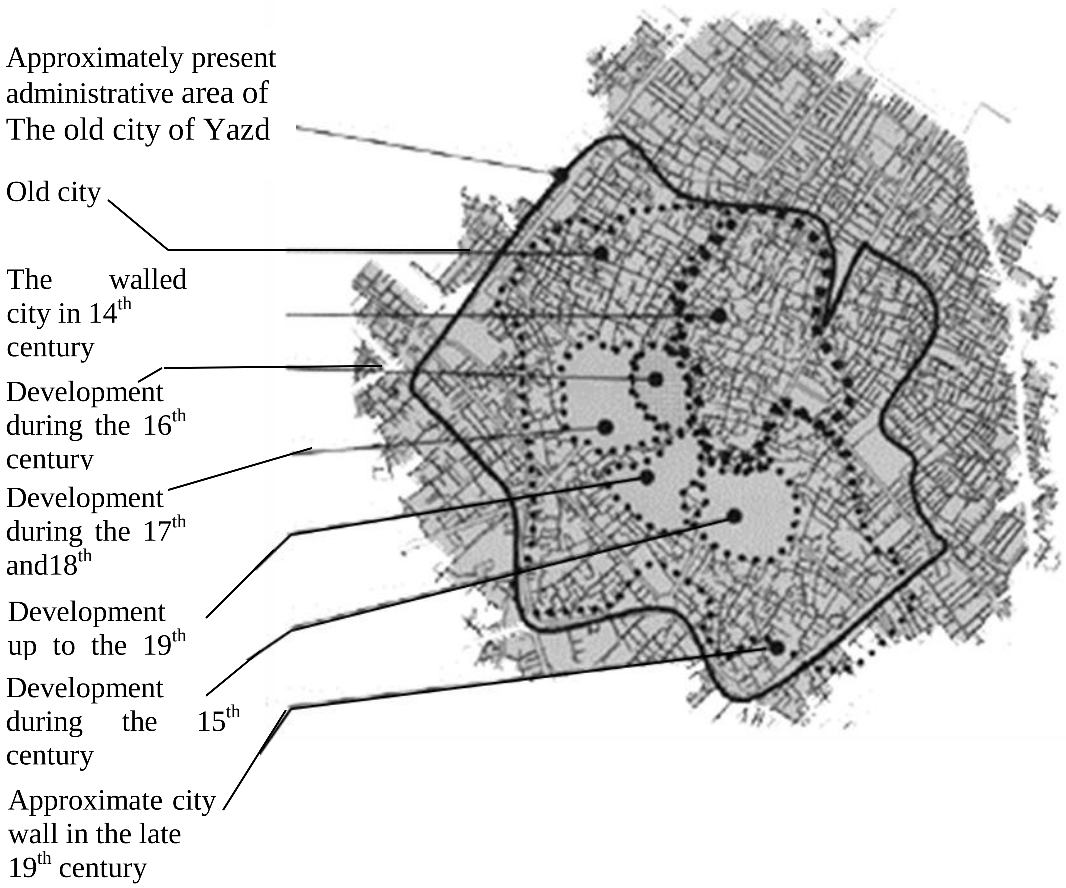

Figure 3.7: The process of immediately development outside the walled city (Mohammadi, 2001).

During the Qajar Period (1796-1925) the city was divided into two parts: the walled city which was in the Northern part called the Old and now it is called the historical city, and the new to the Southern part is called old city at the present time. In half of the 19th century, the city developed toward the South and South-East of the city and several residential quarters were added. A new square consisting of school, mosque, public bath, water reservoirs was built in the middle of commercial rout between Amirchaqmaq and Shahtahmasb squares and was named "Khan" square. By development of the city beyond the city wall, those main urban elements, which were located inside the walled city, were gradually declined. The religious and commercial centers moved to the new locations. So the Khan square became the most important city centre for commercial activities, because it was located in the middle of commercial rout between Amirchaqmaq and Shahtahmasb squares.

All the elements such as citadel, bazaar, Friday mosque and the main squares in the core of the city were located among the residential quarters. Agricultural lands and gardens surrounded the old city. Some villages were also located around the old city (Figure 3.8).

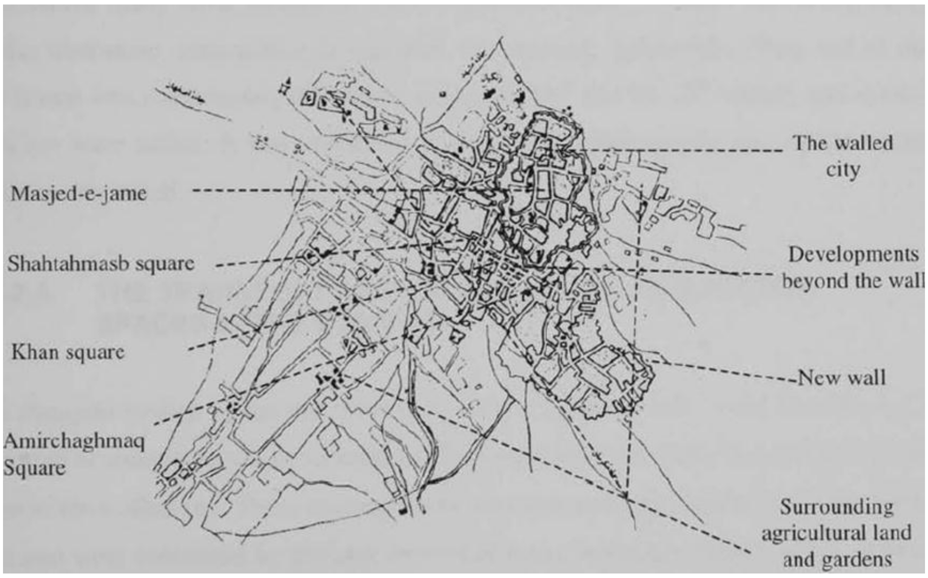

Figure 3.8: The city of Yazd in 1859 (Afshar, 1995).

3.1.2.3 Urban transformation of the city of Yazd from 1920s up to present time

The first and the most significant urban modernization activity was done by the order and decision of Reza Shah (1925-1941) to drive a major network of long, wide and strait streets as could be seen in most other Iranian cities (Wilber, 1981). This urban modernization was even took place it the heart of the old city of Yazd. This was the most simple pattern that engineer could propose for the city without any attention to the traditional organic pattern of the old city of Yazd and caused a lot of disruptions. The construction of Ghiam and Imam (Shah and Pahlavi) streets was the first sign of urban modernization and significant change in the old city of Yazd. Their construction cut the old fabric of the city which was planned well integrated and congested area (Figure 3.9). Bazaar was divided into two parts by Ghiam Street. The urban transformation which occurred in old city of Yazd introduced some new urban elements and segregated some parts of the old morphology.

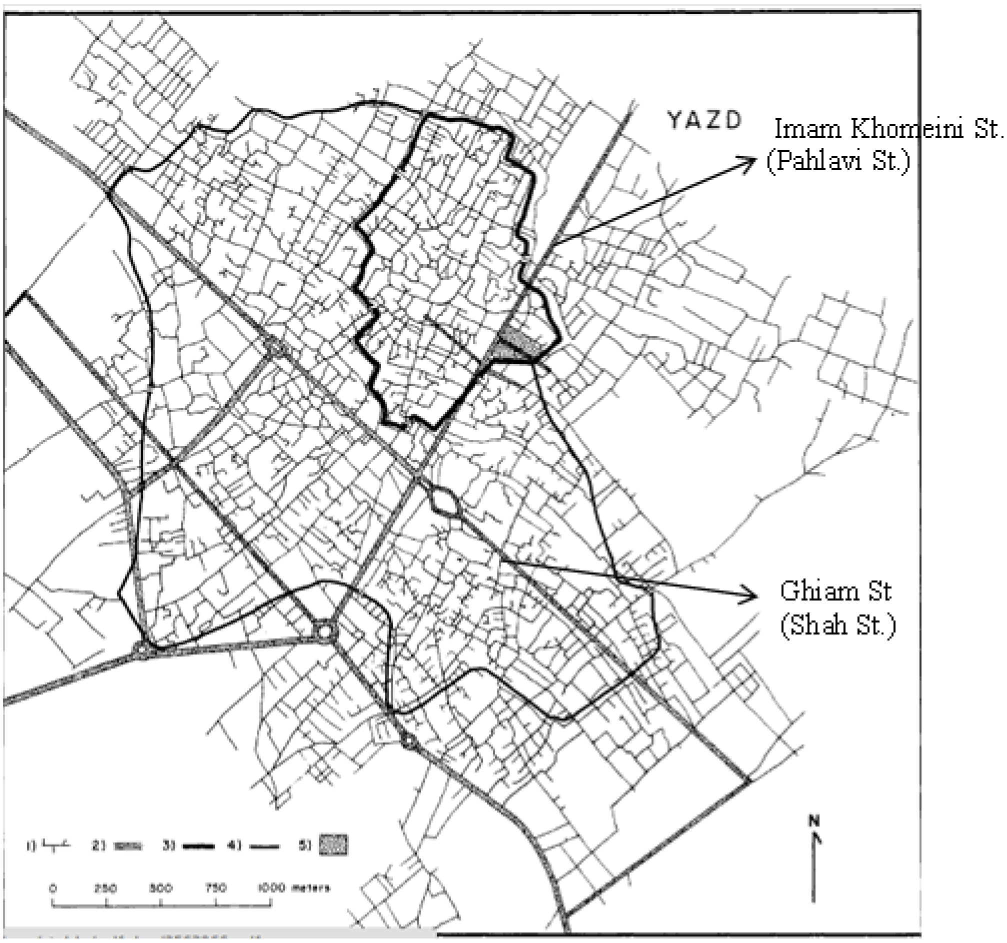

Figure 3.9: The first sign of urban modernization by construction of Pahlavi and Shah Streets (Afshar, 1995).

These streets became the most important transportation channels, with some other new cross-cutting streets, this shape of grid urban pattern was imposed over the whole city. Two old public open spaces of the city, Amirchaqmaq and Shahtahmasb squares changed to traffic circles and other traffic circles (Squares) were added to the city (Figure 3.10). So the historical function of Amirchaqmaq and Shahtahmasb as a place for pedestrian movements changed to a place for car movements. The general width of main streets changed to around 24 meters, this urban patterns system formed the basis for modernizing the city.

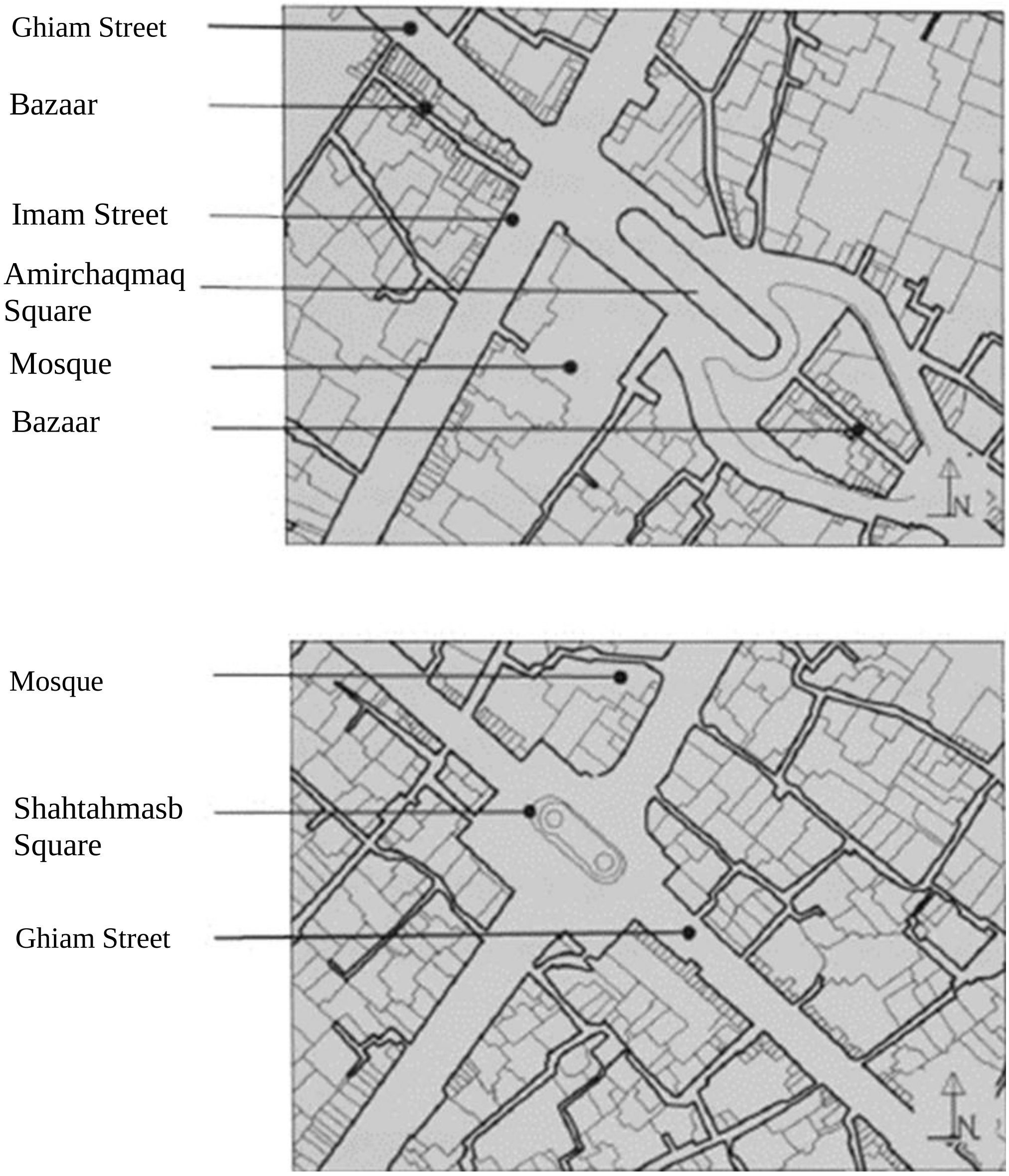

Figure 3.10: The Present Situation of Amirchaqmaq and Shahtahmasb Squares (Mohammadi, 2001).

Although the bazaar of the city of Yazd still plays an important role in the city, new commercial activities were located in new streets and roads without any good connection and link to the old bazaar during the urban modernization process.

In the 20th century, the city grew toward the South and South-West. By developing some parts of the old town, residential areas were created. In the second half of the nineteen century the process of sub-urbanization got started in the city of Yazd and other Iranian cities.

According to the first official census (1956) the population of Yazd was 63,502, during the 1960s and early 1970s. Hence, at the time of the second official census

(1975), the population of the city reached 135,925 people. The Islamic revolution of 1979 followed by the Iran–Iraq war one year later increased further rural migration to cities. Between 1975 and 1987, the annual rate of population growth in Yazd was 5.3%. In 2000, the population reached 326,776 people with an annual growth rate of 3.4%. In the most recent official report (2009), the population of Yazd attained 464.991 persons (Yazd Municipality, 2009).

Due to urban population growth, the city of Yazd faced a rapid process of urban growth. Since the mid-1970s the physical size of the city has doubled every ten years or so, and between 2000 and 2009, the size of urban growth of city of Yazd was as large as all the urban area developed in more than 2000 years of history. Growth rates of this nature are rare in Iran.

As in many cities of the developing countries, urban development in Yazd appears as an unplanned and disordered pattern which has emerged after the location of existing highways, villages and towns and has been created by the realities of differential land rents, industrial location, and communication networks. Also, such rapid and unplanned growth has created important problems such as lack of enough services and facilities for the residents, insecurity, increase of commuting length, and of energy consumption, and local climate change, among other matters. Figure 3.11 shows the urban growth of Yazd from 1975 to 2009.

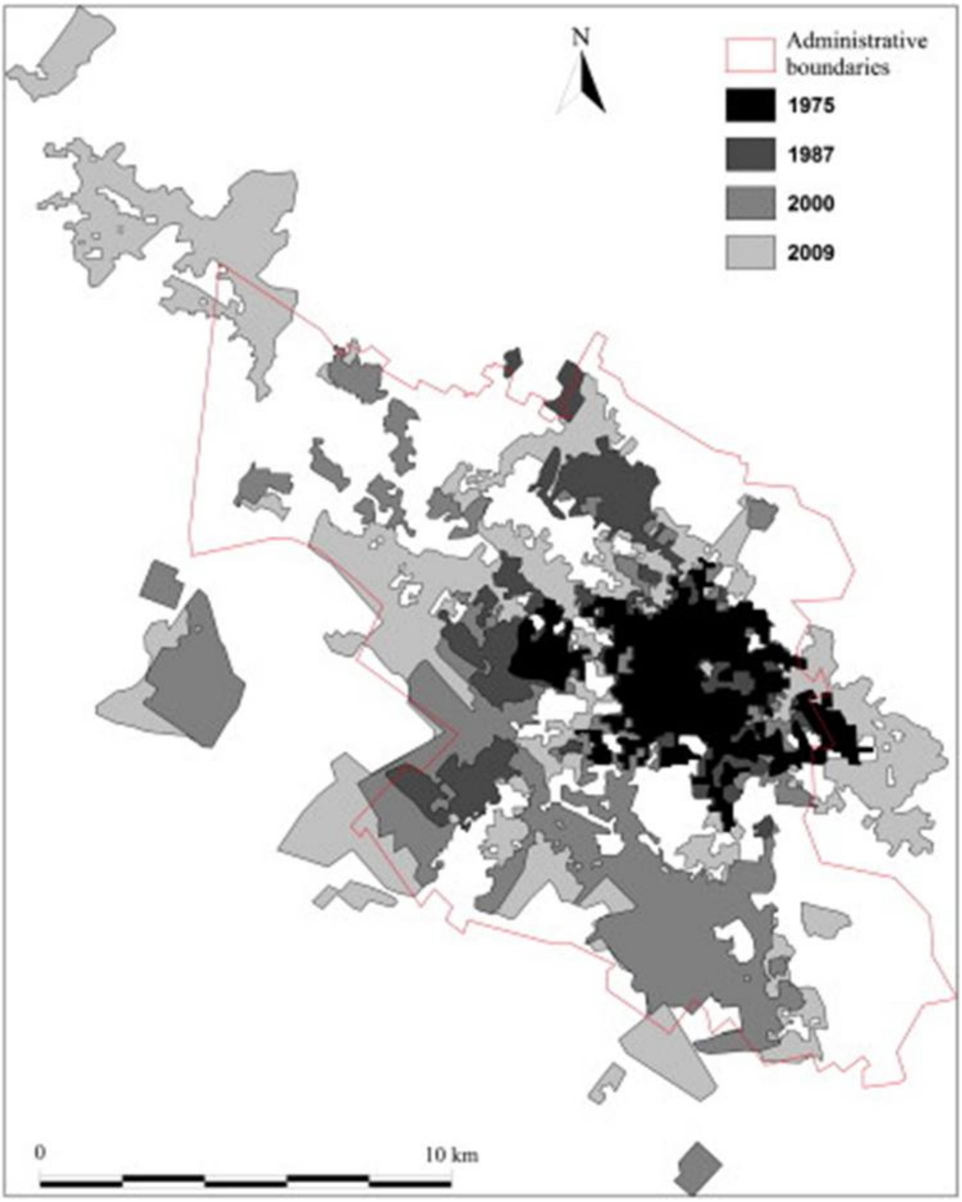

Figure 3.11: Urban Growth in Yazd from 1975 to 2009 (Yazd Municipality).

3.1.3 Effect of urban modernization on a typical urban block in the city of Yazd

This part is going to present the transformation of a typical urban block after urban modernization changes in the city of Yazd. By introducing new streets within the traditional urban quarters in this city the general form and shape of the blocks located around them has been changed and some blocks divided into two or more parts. These subdivisions occur in several urban quarters in the city of Yazd. Figure 3.12 shows introducing new streets within the historic urban core in the city of Yazd. A typical urban block is selected to present the effect of urban modernization programs on the shape of urban blocks in city quarters.

Figure 3.12: Introducing new streets within the historic urban core in the city of Yazd, an urban block is marked by red line.

Figure 3.13 shows an urban block in historic core of the city of Yazd in before and after urban modernization construction. It is found from the figure 3.12 that this block is divided into two parts due to urban modernization constructions.

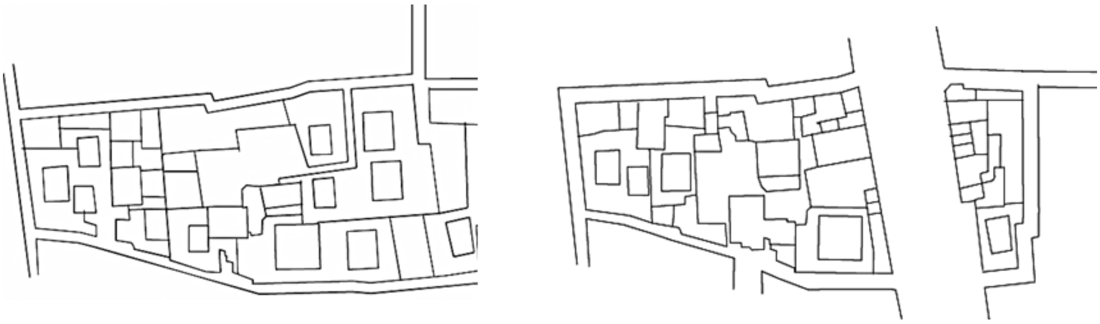

Figure 3.13: A typical urban block in historic core of the city of Yazd in before urban modernization (Left) and after urban modernization constructions (Right).

Figure 3.13 presents how new construction of new streets in 19th century divided one urban block into two parts. The shape of this block in before urban modernization constructions shows the urban features of an urban block in an Islamic city. In other words wide streets were considered a waste of space. Houses formed clusters around these narrow, leftover, semi-public alleys. However, this traditional urban structure was ruined due to new wide street construction without any consideration to traditional organic urban pattern of the city.

3.2 Historical and Urban Transformation Dimensions of the City of Bursa

The city of Bursa is located in the Northern western region of Anatolia in Turkey (Figure 3.14). Uludag Mountain is located in South of Bursa and is famous for mountain sports such as skiing. It is believed that Bursa was found by Prusias in about 150 B.C (I.Orbay, 1983). Bursa was under the control of Roman rules for more than four centuries. When the Roman Empire was divided in 395, the city of Bursa became a part of East Roman Empire. During his reign (525-565) the Emperor Justinianos founded a small thermal city in Pythia (Çekirge) by building a palace. During this era, Bursa stood up both with its baths and its silk production. Bursa passed to the hands of Byzantines. In those days city included just one settlement within a fortress and another at the hot spring area, was called Pythia (present day Çekrige).

In 1326, Bursa was taken from Byzantines, and became part of the Ottoman Empire. The Greek and Jewish residences of fortress, subsequently known as Hisar, were moved to another district below it. After being captured by Ottoman Empire, city faced an urban transformation intended to "Islamize" the environment. A palace was built and the Byzantine church was changed to a mosque (Figure 3.15).

After a period of strengthening, the city of Bursa started to grow out of the fortress. The Orhan Gazi Mosque, a public bath (hammam), and a commercial complex (bazaar and han), were built to the east of the fortress (T.J. Heng, 1985). This group of public buildings and meeting places became as a core for urban development.

"The area subsequently developed into the traditional commercial center, characterized by a bazaar spine, while new residential districts emerged around it. The traditional commercial area remains, to the present day, the most important commercial area of Bursa." (T.J. Heng, 1985)

Ottoman Sultans decided to locate the Kulliyes (complex of public spaces including mosque, commercial center, public bath, madrase) at the high mounts of the city; Orhan, Hudavendigar, Yıldırım, Yesil and Muradiye Kulliyes were constructed on these mounts, see Figure 3.16. The area between these kulliyes consisted of the monumental structures and places constructed by statesmen through waqfs. With the conquest of Istanbul in 1453 the capital of government was moved to Istanbul. Consequently, scholars and senior soldiers close to the Sultan departed from Bursa as well. Until the mid-16th century, the city of Bursa was an international trade centre where silky, spicy and soft goods were sold through the western agents (M. Baghbanci, O.Baghbanci, 2010). City had a relatively quiet period of development from the 17^{th} century to the mid-19^{th} century. In the 19^{th} century Westernization movements started in Ottoman Empire. Urban modernization program started from 1839, included social, political, economic and cultural reforms called Tanzimat.

Bursa was one of the first cities of modernization activities applied in the 19th century because of its very important trade roads and silk production. The outbreak of the World War I in 1914, besides changing the international balances also unsettled the current structure of Bursa. With the outbreak of the war, groups building up the minority of the population, specially the Greeks (Rums) and the Armenians left the city (M. Baghbanci, O.Baghbanci, 2010).

Figure 3.14: Map of Bursa and the region (Heng 1985).

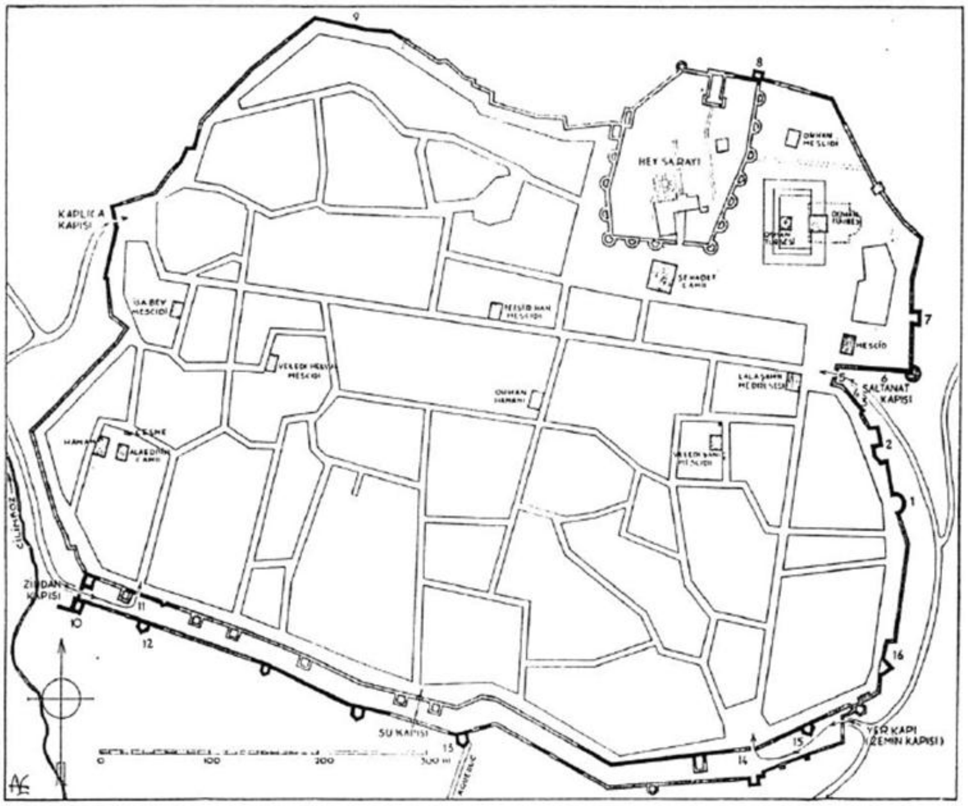

Figure 3.15: Plan of Hisar (Heng 1985).

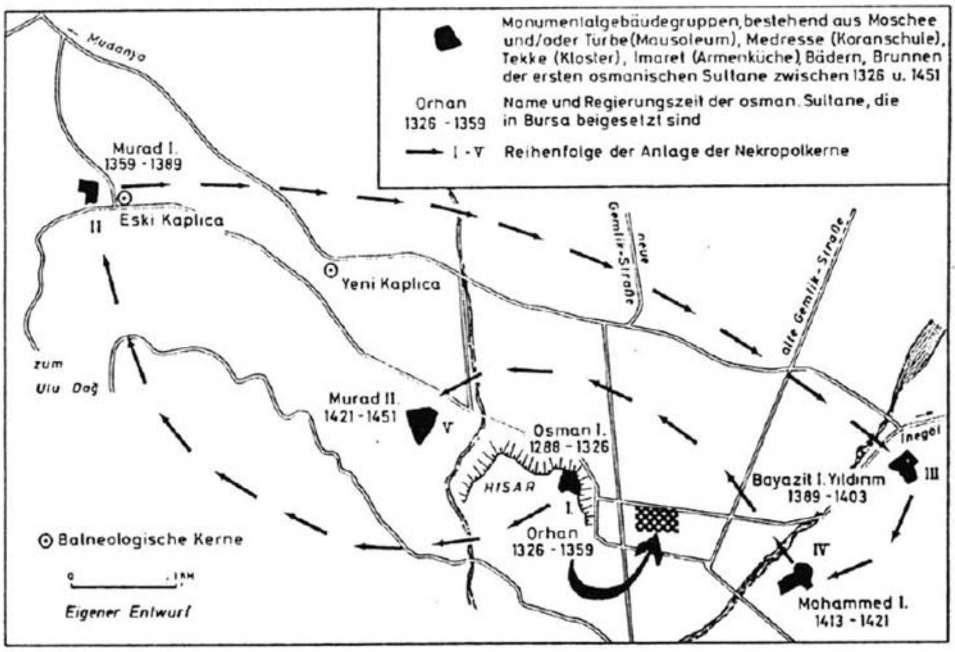

Figure 3.16: The location of first kulliye in the city in the central commercial area (Heng 1985).

In Republic Period because of foreign influences, Bursa faced a lot of social, economic and physical changes. Also because of locating at the important transition conjunctions and close location to Istanbul, Bursa could save its importance in the region.

"The Population Exchange Convention signed in 1923, has influenced Greek and Turkish socities by social, economic, political, cultural and demographic means. Bursa today, after 1960s, has become a very important center of industry leading in textile and automotive and is the fourth largest city in Turkey." (M. Baghbanci, O.Baghbanci, 2010)

3.2.1 Urban transformation of the city of Bursa

3.2.1.1 Urban transformation of the city of Bursa until 13th century

As it mentioned before, the city of Bursa after being captured by Ottoman Empire became the first capital of Ottoman Empire and transformed to an Islamic city. Orhan Gazi, started to develop the city out of the Hisar by establishing mosque, commercial centre, madrase, public bath, thus he founded important Waqfs. The commercial complex had no wall around it and it was unusual at a time that walls played an important role in protecting the city in front of the invasion of enemy. Orhan Gazi continued developing the city of Bursa by constructing a new Kulliye (Public Complex) in a new location away from commercial center, see Figure 3.17. They were considered to make service for residential quarters, like, Yıldırım, Yesil, Emir Sultan and Cekrige. These buildings that the most important of which were mosque was located at top of the hills or mounts. Within each residential quarter were typical cul-de-sac street patterns and traditional Turkish houses which respected topography and skyline of the city. The city growth continued and the Ulu Cami (Grate Mosque) was built in 1399 under the reign of Bayazid I. see Figure 3.18. Ottoman Empire tried to urbanize in order to consolidate its power. The kulliye and other public services were established to improve this urban settlement. Moreover, mosque which was the most important element of each kulliye was an ingenious way to Islamize the land was captured from Christians. Bursa achieved its importance from Historical rather than logistic reasons. According to the geographic location of Bursa, it is situated near traditional trade routes, but it is not the cause of its importance.

Figure 3.17: Kulliye Yildirim in city of Bursa
(http://www.bursaserviscilerodasi.org.tr/yildirim-kulliyesi, 13.10.2013).

Figure 3.18: View of Ulu Cami; a unique hypostyle mosque
(http://forum.donanimhaber.com/m_68057746/tm.htm, 13.10.2013).

The city of Iznik, which was captured in 1329, and situated near the strategic meeting point between the northern trans-Anatolia route and the diagonal route through Anatolia, could have been a more suitable location for a trade centre. On the other hand Bursa's location on top of the hills provided a good security for it. Bursa became an important international trade center for silk and spices.

3.2.1.2 Urban development of the city of Bursa between 13th and 17th century

As it mentioned before, the city of Bursa after being captured by Ottoman Empire became the first capital of Ottoman Empire and transformed to an Islamic city. Orhan Gazi, started to develop the city out of the Hisar by establishing mosque, commercial centre, madrase, public bath, thus he founded important Waqfs. In the year 1402, Bayazid I was defeated by Tamerlane, the mogul emperor, so Bursa was destroyed in some parts. For this reason untill 1453, Bursa was replaced by Edirne as the capital of Ottoman Empire, but Bursa remained the city where sultans ascended to the throne or were buried after death. During the reign of Murad II (1421-1451), Bursa made a quick recovery and greatly expanded. The Kulliye Muradiye was built by Murad II in 1424. Therefore, it became an important royal burial ground (Figure 3.19).

The city continued to develop topographically in the east -west direction by building some commercial activities such as bedesten, arasta bridge, bazaars, open market places and stores on an area outside the citadel.

Separate unit was made around the bedesten by different groups of business centers. Streets in Bursa market square located and developed around the bedesten and were directed to the doors of the bedesten. All of the commercial functions and service activities appeared around the bedesten. Besides centres related to trade other Islamic public spaces such as mosques, public baths and madrasahs were located in this region.

The khans started to be built up in order to provide a better way to collect and deliver trade goods and a good shopping environment could be created and the necessity for exchanging important products and for trading in covered places could be fulfilled. As the number of khans increased, new bazaars appeared especially in those roads connected the khans. Bazaar of Bursa like bazaar in other Islamic cities was shaped in form of guilds, whose production and selling functions differentiated and specialized in particular products with the philosophy of ahilik so the people producing and marketing the same goods gathered in order of guild in particular places and streets (M. Baghbanci, O.Baghbanci, 2010). It is clear that each tradesman was in different street according to his merchandise. The bazaars of Bursa also could be shaped in the style of the shops surrounding a street or built as a distinct place (Figure 3.20).

Agricultural lands were located around the city and the food of the city dwellers were delivered from these lands to the bazaar. Some weekly open bazaars set up on certain days of the week near mosque to provide daily food of the residences. In those regions that Khans were located in, shops were the largest in number and the simplest in style. Shops could be located in roofless streets, inside the covered bazaar, or in a bedesten.

According to Evliya Çelebi, there were 9000 shops in Uzun Carsi (Uzun Bazaar). After the second half of the 16th century, due to the socio-economic and political system, there were no additional changes in the urban structure of the city of Bursa. It can be found that important changes in the physical and social structure did not take place in Bursa and that the city kept its stable structure in the 17th century. Although Ottoman Empire had felt no necessity for wall or hisar at first, due to the necessity of defense against Celali Revolts (in 16th and 17th century), a protection wall was built transportation in the city and construction process happened inside these borders.

In the city of Bursa, the commercial square was the focal point of the city and residential quarters were located around it. Some urban roads networks were constructed to connect the residential quarters to the commercial square. In Islamic city of Bursa, commercial square was not only a place for shopping and trade but also it was the heart of the city where people prayed, met each other, and all social and cultural activities were performed with its mosque. Khans were used by travellers, its bedesten was for shopping and the public path was where the water and the green came together. Because of having large number of khans and attractive urban facilities, commercial activities got stronger in city of Bursa. As it mentioned before Bursa was an important city for silk production. The silk industry in Bursa dated back to Byzantines era, even when Istanbul was captured by Ottomans in 1453, Bursa remained an important city for its silk industry and as a religious city. Bursa also was well known for its therapeutic mineral water.

Figure 3.19: View of Kulliye Muradiye
(http://www.bursa.bel.tr/hizmetler/sayfa/750, 15.10.2013).

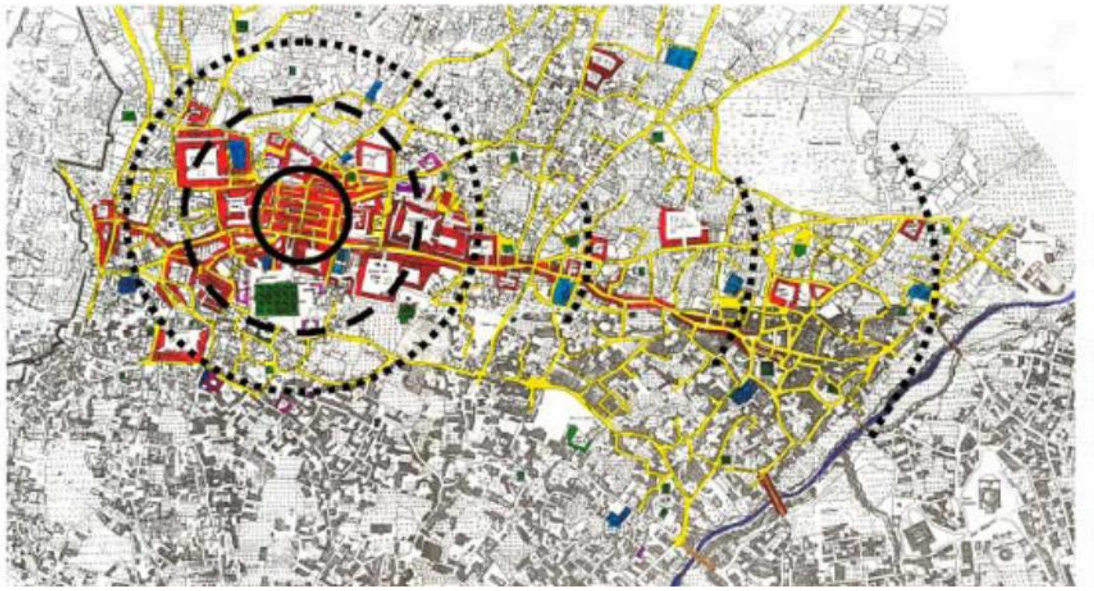

Figure 3.20: The historical evolution of commercial buildings (Red colors) in the Khans Region at the end of the 16th century (Baghbanci, 2010).

3.2.1.3 Urban development of the city of Bursa in 19th and 20th century

The industrial revolution in Europe had a critical impact on Bursa. In order to adjust to West, Westernization movements started in Ottoman Empire. Bursa was the first Ottoman city that became industrialized. This activity coincided with the deterioration of the Ottoman Empire. There were some reasons that led to attempts to modernize the Turkish army according to the Western armies, like the war with Russia and numerous army defeats.

In order to reform Ottoman Empire, Taznzimat charter was implanted in 1839. The reform agenda of Tanzimat charter included the following:

> "1.Modern European society was considered superior to the Ottoman society, and the solution to the problems of the empire was sought in the importation of Western institutions and methods;
>
> 2. Traditional institutions which were impediments to progress had to be eliminated so that new ones could be established (Z.Çelik, 1986, P.32)."

It caused a drastic break from the past and resulted in radical social and political changes which also led to urban landscape changes. Almost all the buildings built in the city of Bursa during Tanzimat period, was totally collapsed after 1855 earthquake. The first map of Bursa after earthquake was provided by a surveyors led by Subhi Bey in 1861 (Figure 3.21). The main urban intervention took place during the period of Sultan Abdolaziz in 1861, by assigning Ahmet Vefik Pasa, who was the ambassador of Turkey in Paris, and had a chance to observe urban modernization projects in Paris which was done by Baron Haussmann; thus making a "new and modern" Ottoman city was started from Bursa.

Ahmet Vefik Pasa, inspected the construction of new road network, canals, a drainage system, schools and hospitals as well as the restoration of historic monuments. As it said before, in 1855 city was ruined in most part so it was almost empty of residence; it was an opportunity for constructing new urban network for urban transportation according to Haussmann's boulevards (Figure 3.22). This bold intervention paved the way for urban modernization of Bursa. Even today, the positive effects of this intervention could be seen in traffic movement through the heart of the city. By a comparison among Bursa and other traditional cities, Ahmet Vefik Pasa's prudence and wisdom gets obvious. The registered map in 1862 shows that urban network was designed according to the hilly topography of Bursa. Urban pattern of Bursa in 1862 was designed for two types of movement: movement along and against the counter of the landscape (Figure 3.23). Such urban pattern shows the integration between traditional movement patterns with the landscape.

Figure 3.21: Map of Bursa drawn in 1861 (Abaci, 2005).

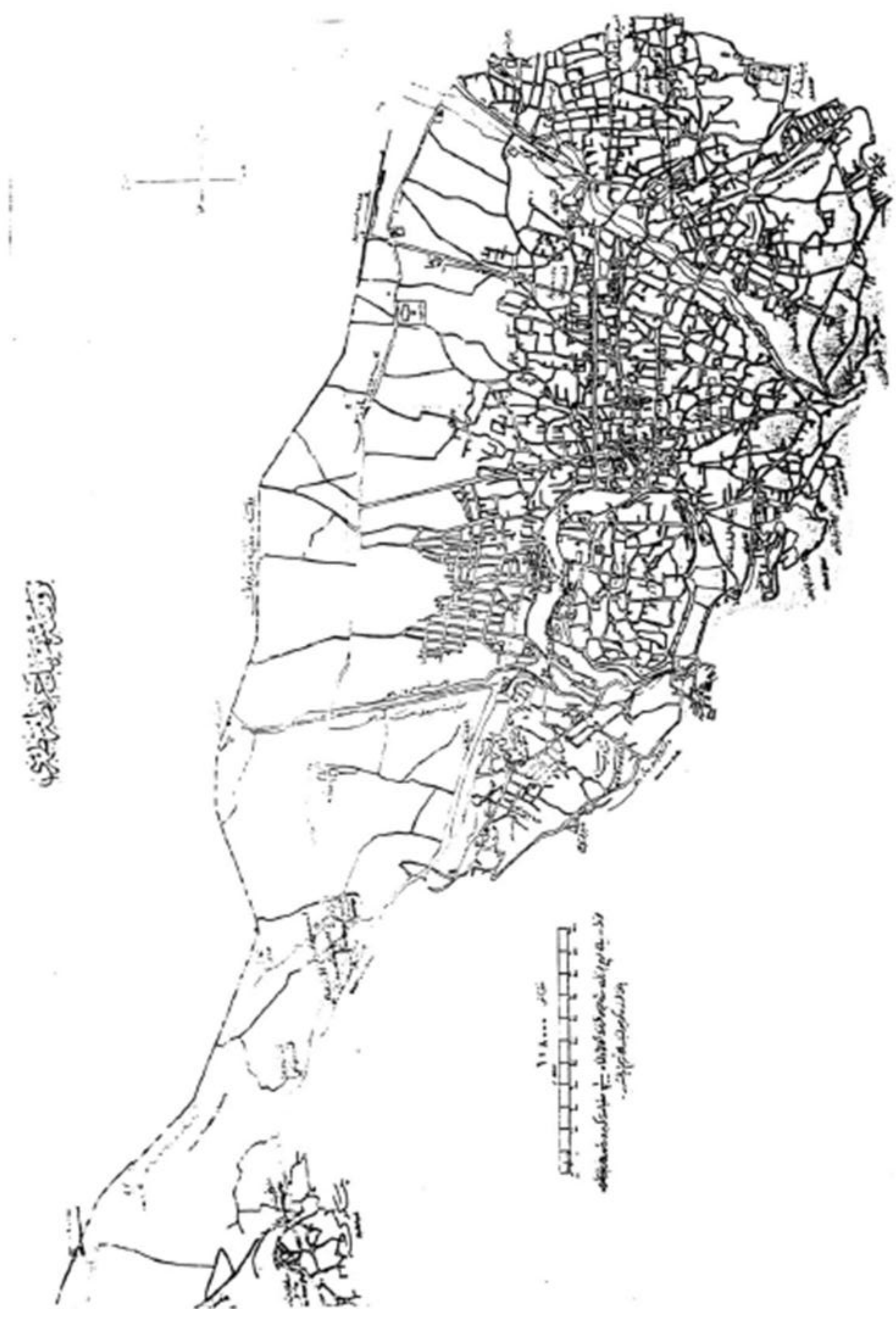

Figure 3.22: Map of Bursa showing intervention by Ahmet Vefik Pasa (Heng, 1985).

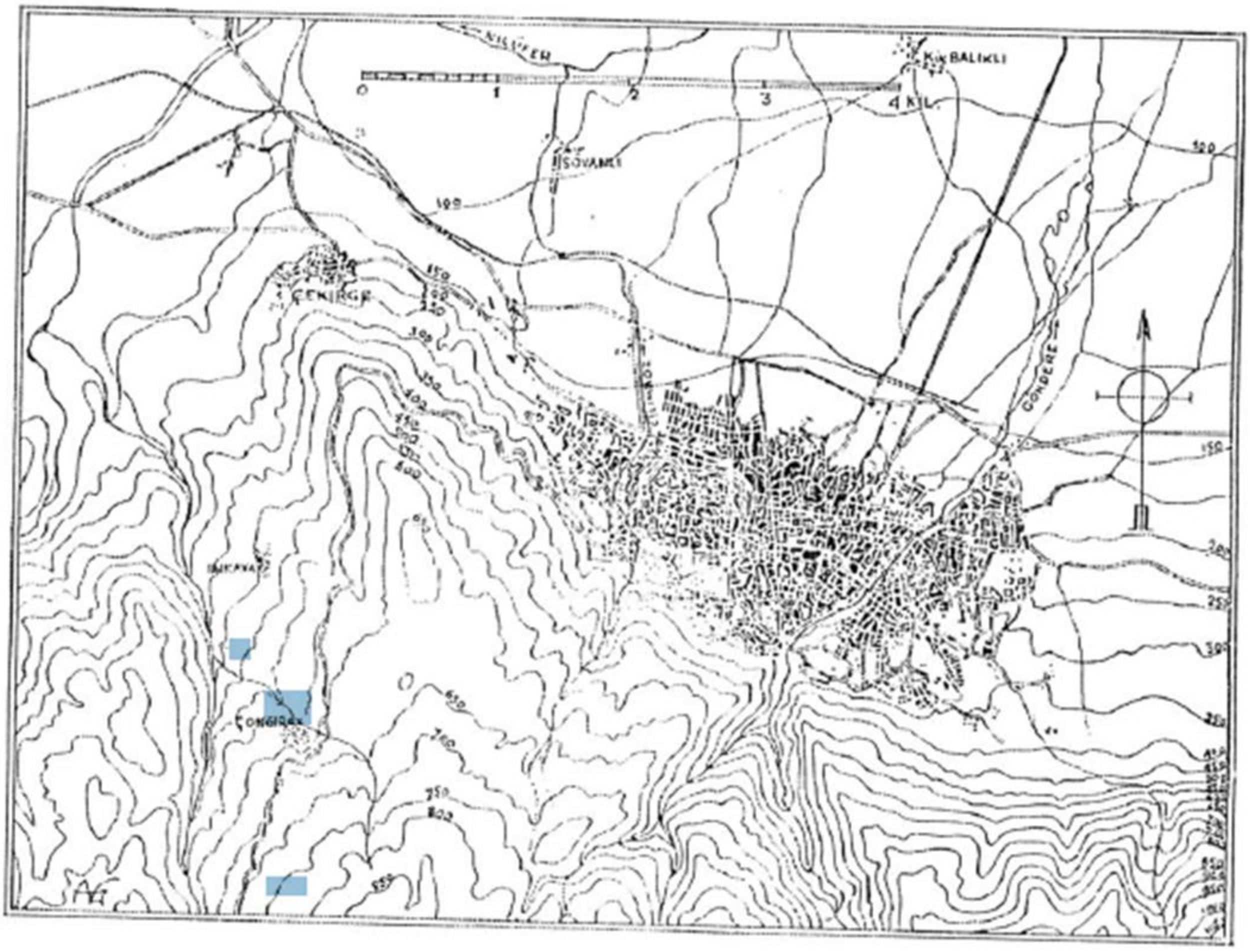

Figure 3.23: Integration of urban development of Bursa with topographic character (Heng 1985).

In the 19th century the city of Bursa had a religious-economic city centre with residential areas, streets and suburbs were located around it; other buildings such as banks, administration buildings, offices and silk fabrics were located together aound a center formed by khans and bazaar.

In the center of the city Bursa, in order to store and dry cocoon, as trade and industry buildings Nuri Pasha Cocoon Warehouse, Şark Dühan (tobacco) Warehouse and on the Northeast of Sarrafiye Madrasah Resulzade Dye-house, are built on Hamidiye (Cumhuriyet) Street, and on the other hand as a reflection of new economic relationships on physical structure, Osmanlı Bank on the southeast of Orhan Mosque, which is located in the direct domain, is built. Single story buildings on Uzun Bazaar, at the end of 19th century and towards the beginning of the 20th century, have been changed to single or group shops of stone buildings which get sun light from one direction and are not higher than five or six meters (M. Baghbanci, O.Baghbanci, 2010). Such changes also happened to administrative buildings. Those administrative buildings which were located inside the fort became a symbol of old administration system and Government Hall representing the new administration system is nowadays built in the area where Atatürk Statue is. The City Hall was the symbol of local administration was built on the east of Orhan Mosque. The City Hall, the symbol of local administration, is located near the main road between the Government Hall, representing provincial management, and Ulucami (The Great Mosque), representing the former dignity of the capital. The post office was rebuilt near Hacılat and Kara Seyh Mosques and a police station was built on the West part of Hamidiye Street. In 1879 the second settled theater (after Istanbul) was established by Ahmet Vefik Pasa, in Bursa.

It is hard to mention a comprehensive planning system for city of Bursa in 19th century. However, governors of the city tried to find solutions for urban changing problems of the day. At the end of 19thcentury and the beginning of 20th century some new urbanism projects were started by Governor Ahmet Vefik Pasa (1865) and continued by Ahmet Munir Pasa (1891-1897) and Mumtaz Reshid Pasha (1903-1906). During these new urbanism projects commercial area which of the city got limited with Atatürk Street (Palace and Government) on the South, İnönü Street on the East, and Cumhuriyet Street (Hamidiye) on the North (Figure 3.24). So, after new urban constructions the commercial area which was a quite large area of the city in

16th century, got limited with mentioned streets. New wide roads were made to provide suitable traffic, but had caused demolishment of many historical monuments. With the modernization in 19th century new urban roads, trade centers, and administrative buildings were built and it led to new socio-cultural life.

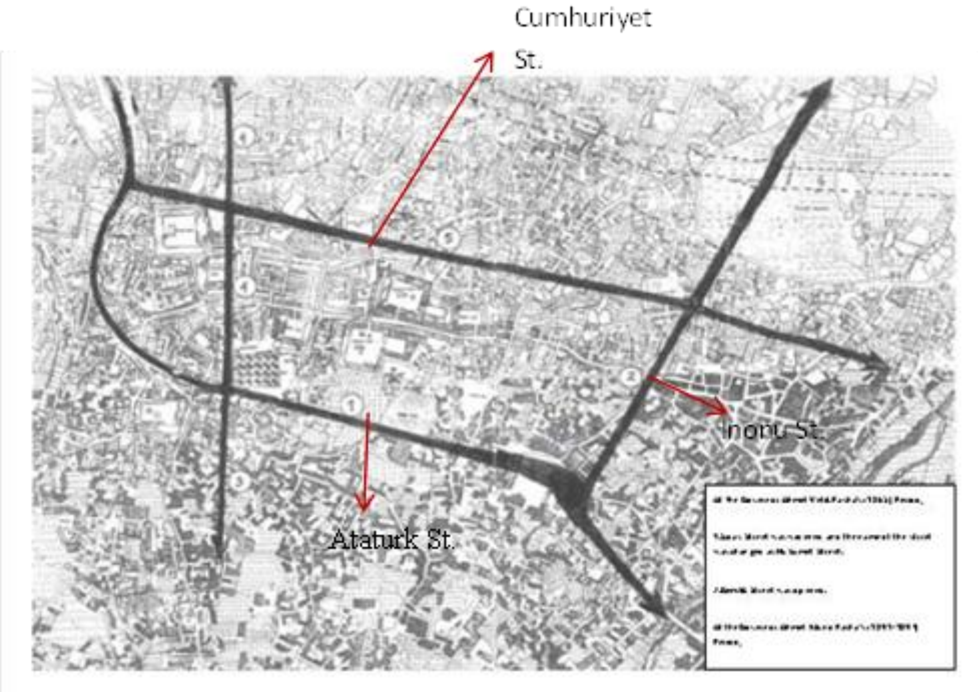

Figure 3.24: The roads at the end of the 19th century and at the beginning of the 20th century (Baghbanci, 2010).

In the First World War, the city of Bursa was occupied by Greek army till September 1922. Subsequently, the capital of Turkey changed to Ankara in 1923. Because of wars and economic crises, Ottoman Empire got instable and it let do formation of Turkish Republic in 1923. This marked another urban transformation in Bursa.

In 1956, many parts of central commercial area of Bursa were burned dawn. Luigi Picinato, the Italian urban planner in Bursa, proposed a new master plan for Bursa which was the first master plan of the city. He proposed to preserve and divert the development far away from the historical parts of the city and prevent invasion on the agricultural lands (Figure 3.25). Because of weakness in leadership this master plan could never get fully implemented. In 1983 another master plan was provided to direct the urban growth of city of Bursa (Figure 3.26). The proposed master plan in 1983 tried to prevent the expansion of the city into the valley. A highway linking Izmir to Ankara was planned to redirect the growth of Bursa into a linear city.

Figure 3.25: First master plan of Bursa by Picinato (Heng, 1985).

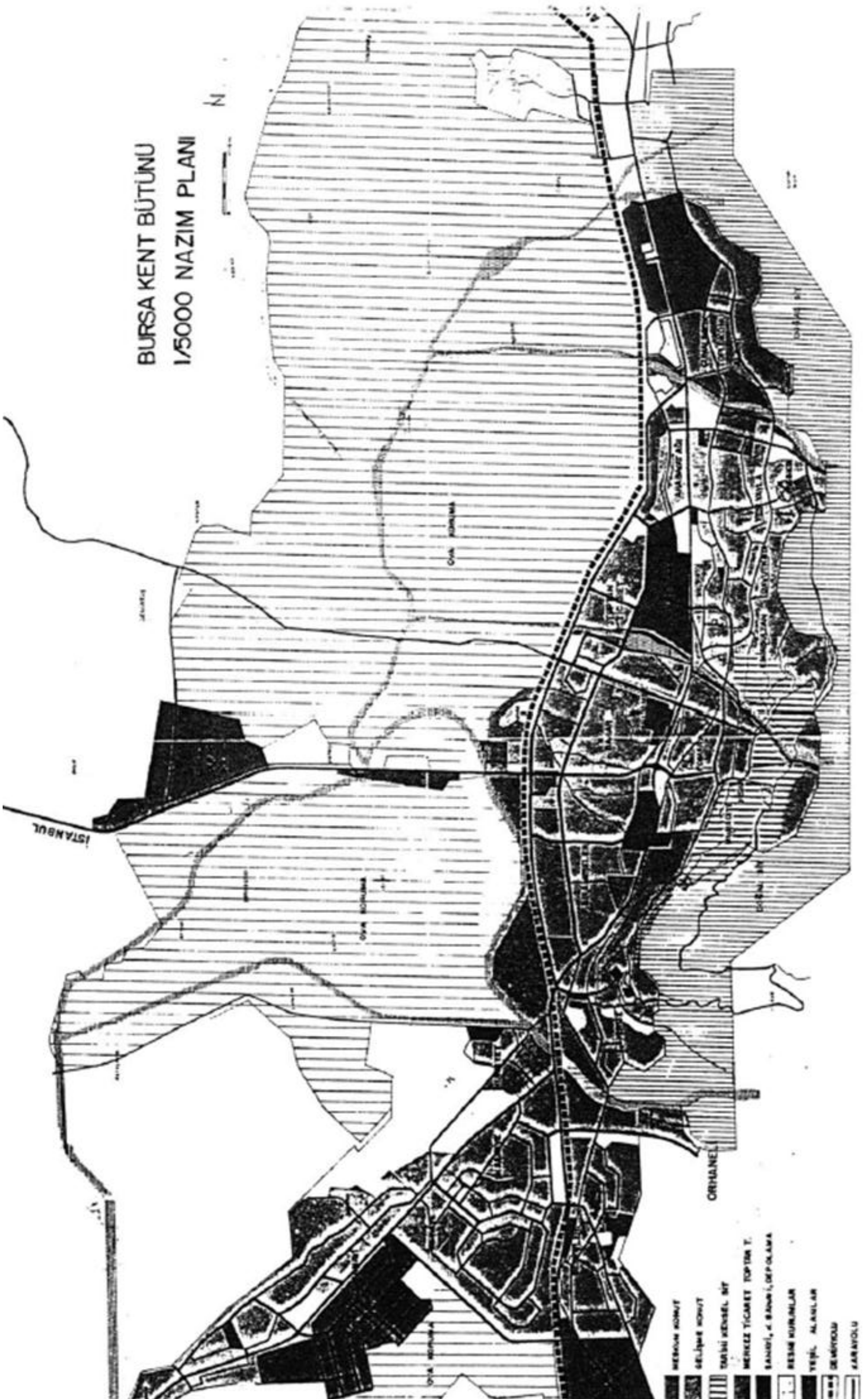

Figure 3.26: Master plan of Bursa in 1983 (Heng,1985).

The 1983 master plan of Bursa indicates that the area of the city as almost double that of 1965. The city development to the North invaded the agricultural land, and the hilly areas in the East. Figure 3.27 shows the spatial development of Bursa in different period from 1958 until 1995.

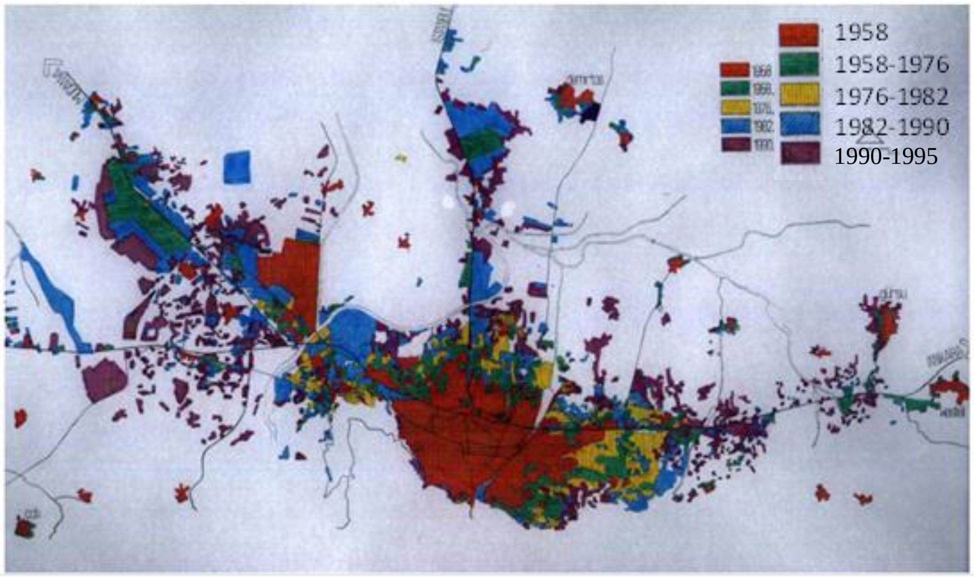

Figure 3.27: Spatial expansion of Bursa by certain periods of time (Bursa metropolitan municipality archives).

3.2.2 Effect of urban modernization on a typical urban block in the city of Bursa

This part is going to present the transformation of a typical urban block after urban modernization changes in city of Bursa. Figure 3.28 shows map of historic core of Bursa in 1862 before urban modernization transformation, a typical urban block is marked by red line. Figure 3.29 presents the map of historic core of the city at present time and the selected urban block is marked by red line.

Comparing the selected area in before and after urban modernization process, shows that the general shape of the block is preserved after urban modernization process; however, remarkable morphological transformation occurred in the content of this plan unit. In most cases the entire lot is built up leaving behind no garden space. This, coupled with the massive scale of the buildings and the change in the spatial quality of the spaces between plan-units, causes the block to lose its previous human scale and identical quality.

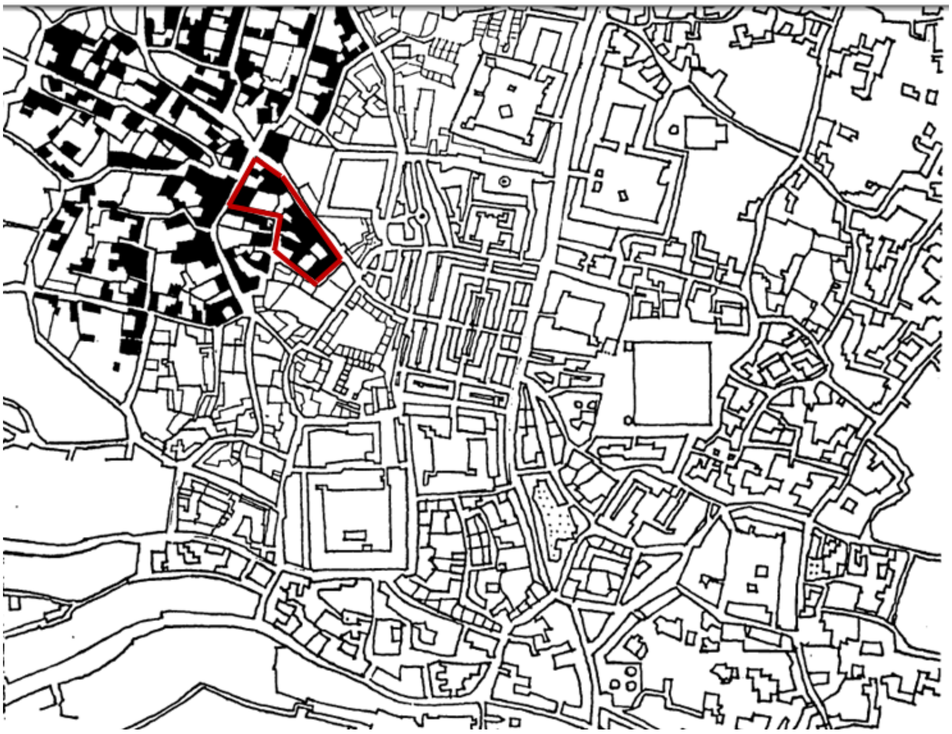

Figure 3.28: Historic core of Bursa in 1862. An urban block is selected and marked by red line.

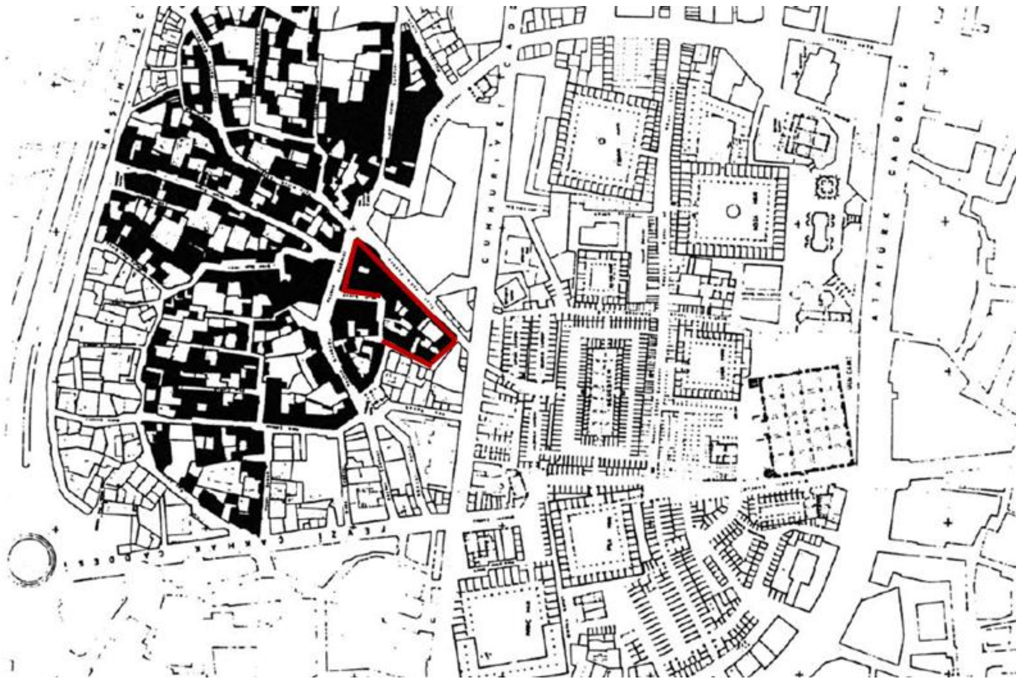

Figure 3.29: Historic core of Bursa at present time. An urban block is selected and marked by red line.

4. SYNTAX THEORY AND METHODOLOGY

4.1 Introduction

In order to do morphological analysis of the case studies, a mathematical model, called space syntax technique, was applied. Space syntax was developed by Hillier and Hanson at the Department of Architectural Studies, University College of London (Hanson 1989; Hillier 1989, Hillier & Hanson 1984; Hillier et al 1983; 1992; 1993). It is a technique that is used in morphological analyses of buildings, architectural plans, urban areas, and urban plans. Space syntax is also one of the few theories which allow us to understand how culture and society are embedded in the specific relational patterns constituting architecture and urban design. The aim of the technique is to describe different aspects of relationships between the morphological structure of human-made environments and social structures and events; so by using space syntax technique it is possible to give quantitative descriptions of built spaces (Kubat, 1997).

Space syntax theory is based on the belief that special layout or structure of the city has a great impact on the human social activities. The structural system of the city has an impact on everyday experiences of people. There is a strong relationship between the urban space and the society (Bafna, 2003). Space syntax technics investigates the relationship between the urban space and buildings. The term urban space is that part of the built volume of a town that is defined by the buildings but not contained by them. These urban spaces are defined as voids (like streets, squares, fields, rooms) between walls, fences and other obstacles that restrain visual field. "Most movements passes through it, most public activities takes place in it, and much of our senses of being in an urban area drives from it" (Hillier and Hanson and Peponis, 1987).

Regarding urban areas, Space Syntax is based on the fact that the urban environment is an interconnected space where spaces link to other spaces. The Space Syntax approach provides an urban morphological representation by looking at only public spaces (open spaces), see Figure 4.1. These public spaces look like a beaded ring system in which space widens to form irregular beads, and narrows to form strings. At the same time the beads join so that there are always choices of routes from any one space to any other space (Hillier and Hanson, 1984, p. 90).

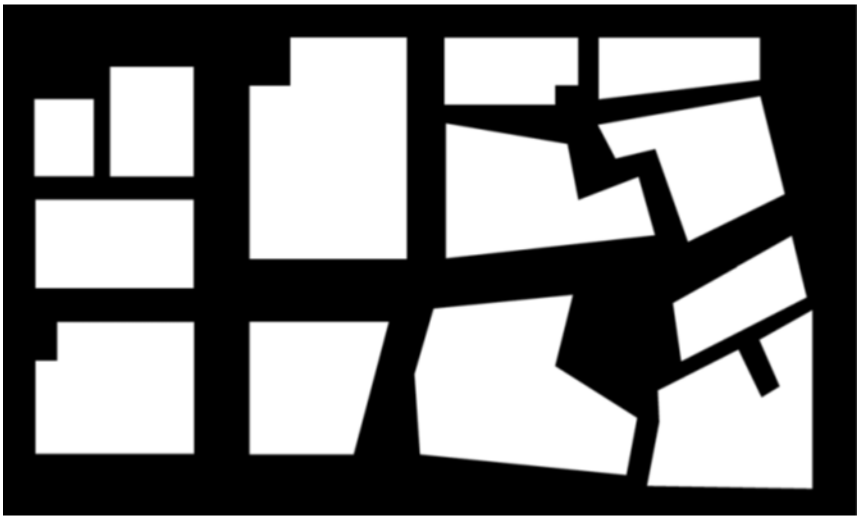

Figure 4.1: The Relationships between public open spaces (black) and buildings (white) in an urban environment (Jiang, 1998).

Based on the concept of the beaded ring system, there are two ways to represent urban environments by only considering the public spaces: convex polygon and axial lines.

Convex spaces can be identified geometrically by areas inside of which no line drawn between any two points goes outside the area. This geometrically quality means that all points within a convex space can be seen from all other points , thus, for example, all buildings entrances on a convex space will be visible from all other entrances on that space (Figure 4.2).

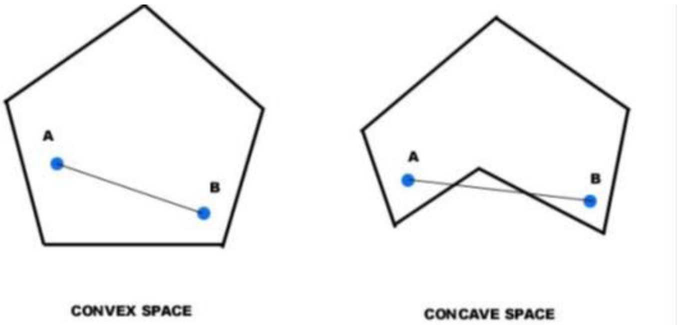

Figure 4.2: Convex Space: All points are visible from all other points in each space (Hillier and Hanson, 1984).

Axial lines deal with linear extension and are represented by an axial map (Figure 4.3). The maximum straight line that can be drawn through an open space before it strikes a building, wall, or some other material object can represent an axial space geometrically. Axial lines represent the longest views across spaces that capture the sense of what a person sees while moving in urban areas. On the other hand, it also represents a person's movement behavior since people always walk in a straight line to minimize the distance, not a curved line.

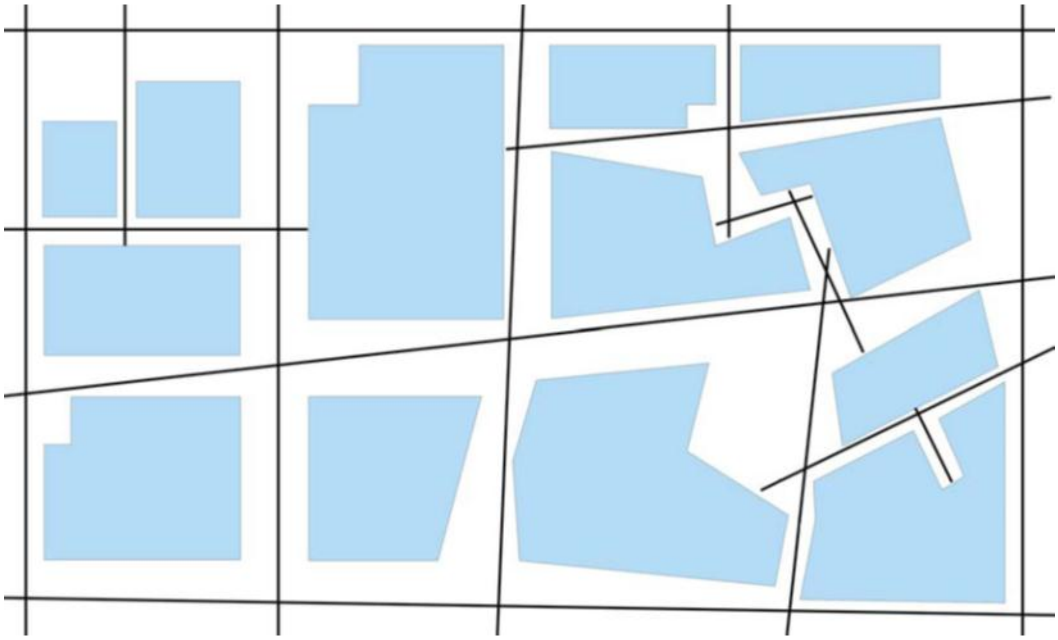

Figure 4.3: Axial map of an urban area (Jiang, 1998).

In the Space Syntax approach, an axial map could be shown by graphs by replacing each axial line with a node, to represent open spaces, and by replacing the intersections between lines with lines. Thus, the graph of each line will be drawn in terms of its relations with the other lines, which is also called a justified permeability graph. Then, by using the graphs, we are able to calculate how each space is related to the other spaces. The primary value that describes how one space is related to all the other spaces (topological relations) is total depth (TD). TD represents the number of turns (steps) that one needs to take to move from one space/line to another space/line. Figure 4.4 shows how topological graphs can be converted to numerical values to measure spatial configuration.

For each space/line, total depth could be calculated by averaging the depth in relation to each space/line in the urban space, which represents a global property. Besides the total depth, just several depths or steps could be calculated for each line, for example, 3 or 4 depths or steps. These relations between spaces are called a local property.

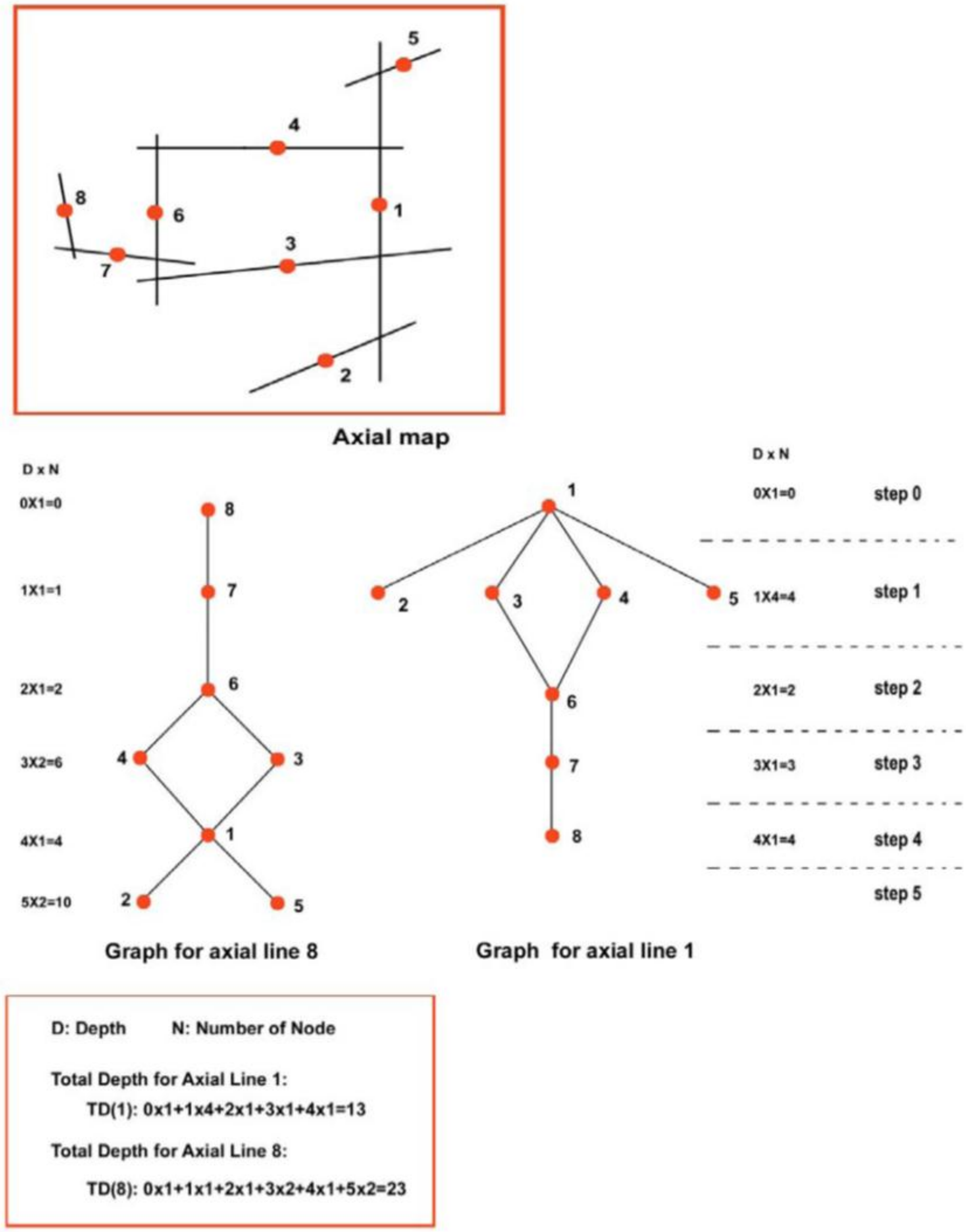

Figure 4.4: Transformation from axial map to justified permeability graphs (Hillier and Hanson, 1984).

4.2 Syntactic Concepts

For urban environments, an axial map gives the opportunity to objectively measure spatial configuration of the urban environment. There are three important syntactic measures of spatial configuration of an axial map: connectivity, integration (global and local), and intelligibility. Regarding convex space, another syntactic property - visibility of a convex space --- is more appropriately used to study an urban environment (Hillier and Hanson, 1984, Hillier, 1996).

Connectivity: "Measure the number of the immediate neighbors that are directly connected to the spaces. In axial map connectivity of an axial line is measured by the number of lines that are directly intersecting that line" (D.Dhima, 2006). For example, the connectivity for axial line 1 in Figure 5 is four, since there are four axial lines (2, 3, 4, 5) directly intersecting it. In the meantime, it is indicated that the length of an axial line has some correlation to connectivity indexes, that is, there are more possibilities for lengthy lines to be intersected by others (Jiang, 1998). A modification of connectivity is a control value, which measures how each axial line controls access to immediate neighbors (i.e., those lines intersected by the current one). Both connectivity and control value are local measures since they only take into account relationships between a space and its immediate neighbors (Jiang, 1998).

Integration: Integration measures how many turns one has to make from a street segment to reach all other street segments in the network, using shortest paths. If the amount of turns required for reaching all segments in the graph is analyzed, then the analysis is said to measure integration at radius 'n'. The first intersecting segment requires only one turn, the second two turns and so on. The street segments that require the least amount of turns to reach all other streets are called 'most integrate' and are usually represented with hotter colors, such as red or orange. Integration can also be analyzed in local scale, instead of the scale of the whole network. In case of radius 4, for instance, only four turns are counted departing from each street segment. As Figure 4.4 shows, axial line 1 is shallower than axial line 8, since it has a relatively lower value of mean depth than that of the axial line 8. In this way, integration of a line is by definition a value that indicates the degree to which a line is more integrated, or segregated, from a system as a whole. The higher the integration value of a line, the less its depth, which means the line has high syntactic accessibility in the system or is more reachable. Integration is a global measure (Rn), and we know that the calculation of integration is based on the total depth. However, if a number of depths, instead of all depth, are considered, then the integration is called local integration, which measures the accessibility three or more steps away based on research purpose (Peponis and Wineman, 2002; Jiang, 1998).

In this way, integration of a line is by definition a value that indicates the degree to which a line is more integrated, or segregated, from a system as a whole. The higher the integration value of a line, the less its depth, which means the line has high syntactic accessibility in the system in other words it is easier to reach high integrated line than low integrated one.(Peponis and Wineman, 2002; Jiang, 1998).

If an axial map is displayed by using graduated color symbology based on the integration values, the spatial configuration of the whole system will be visualized and easily compared between different urban environments. Generally, an accepted rule to represent integration is using warm colors, such as red or orange, to represent high global or local integration (high integration values) and cold colors, such as blue or green, to display high global or local segregation (low integration values), as Figure 4.5 shows. The integrated core represents the 10% highest integration values (Hillier, 1986, 1996).

Intelligibility: Hillier (1988, 1996) defined intelligibility as “the degree to which what can be seen and experienced locally in the system allows the large-scale system to be learnt without conscious effort” (Hillier, 1996, p. 215). He argued that a strong association between local information and global information let people easily form the overall spatial configuration in their minds. Possibly, this means that in a layout of high intelligibility, high local connectivity allows a person to understand the overall structure of the system easier. In practice, the intelligibility value is calculated by the degree of linear correlation between connectivity and the global integration value (Hillier and Hanson, 1984). The stronger a correlation, the more global configuration of a space may be inferred from its directly observable local connections. Intelligibility values can be used to quickly compare spatial configuration of different urban environments. In addition, Hillier et al. (1992) observed that intelligibility appears higher in a well-defined “named neighborhood” perceived by residents in London.

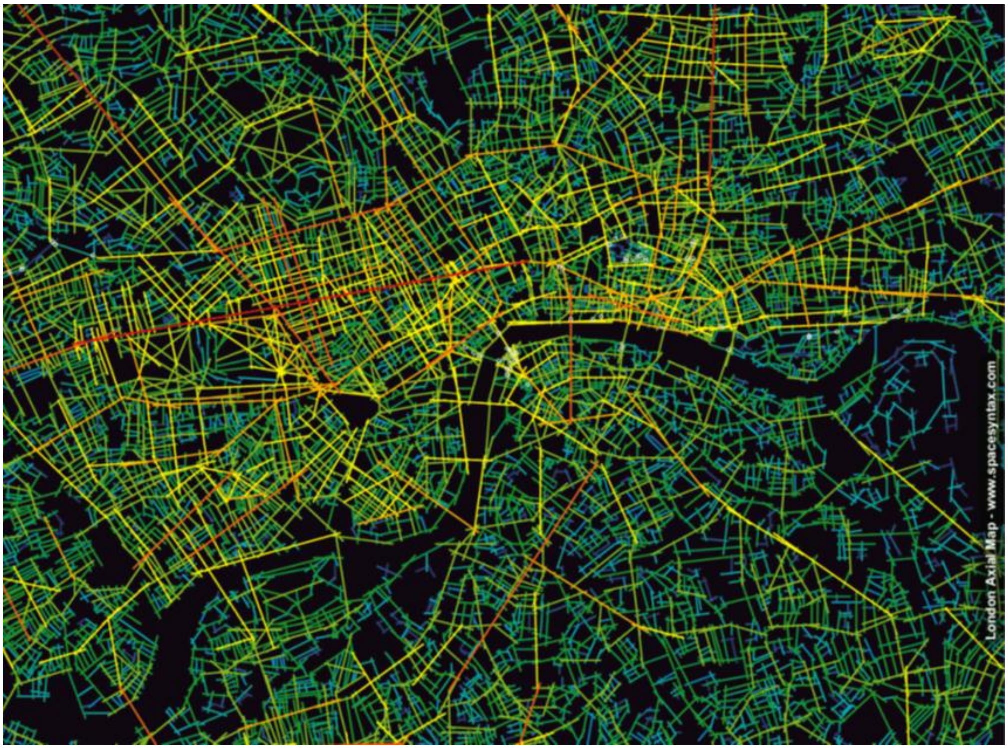

Figure 4.5: Axial map of the city of London (global integration) (Space syntax limited).

4.3. Why Space Syntax?

In this section, I will try to show how space syntax responds to the major problems that other approaches fail to answer. Some of the problems of other technics are as follow: The first difficulty is the lack of a morphological and spatial technic for the study of cities. The second problem is that many of these theories and studies are not able to provide a concept for urban system which is able to show the city as a continuous whole, and not as fragmented parts. The third problem is that other theories are not able to make a relationship between the physical structures of the city and the social activities happened in urban system. The fourth problem is related to the modeling and representation. "How to reduce the continuous space of the public realm to some set of non-arbitrary elements" (Hanson 1989b, 82). The problem is that the structure of the city is usually shown by elements, which are created by some methods of data calculation and have no clear meaning in an urban context. The last important problem is related to the analytical methods for urban models. In most cases, the analysis of urban models relies on the measurements of the elements of the system without taking the relationship between these elements into account. Even in methods that utilize topographical relationships, such as graph theory, some aspects of urban plurality, and the relationship between parts and wholes, do not find a sensible place in the analysis (Karimi, 1998).

Therefore, space syntax technique is a practical way to analyze the configurational features of an urban system to analyze a city as a whole and to make an analytical relationship between physical structure of the city and social urban life.

A distinct characteristic of space syntax analysis is that it has been used in a broad range of academic researches and practical architectural and urban design projects and a large number of urban studies is done by space syntax technic. According to these studies, space syntax is a valuable technic for cross-cultural and non-western urban studies. "syntax theory relies on the most fundamental characteristics of urban systems, its techniques can be applied to different types of settlements and architecture regardless of their origin and background" (Karimi, 1998). The number of studies, which attempt to apply space syntax to, for instance, oriental urbanism and domestic spaces, is growing. The Ph.D. theses of Salah-Salah (Salah-Salah 1987) and Loumi (Loumi 1988) on North African towns, Farida Nilufar's thesis on local structures of the city of Dakar (Nilufar 1997), and Kubat's article on Turkish fortified towns (Kubat 1997) are some of these studies.

These studies show that space syntax is the most proper technic to investigate the fundamental characteristics of different type of urbanism. Therefore, space syntax has no difficulties to investigate the effects of urban westernization on a non-western urban. Not all the positive reasons that the space syntax theory has been trusted for, in this section mean that it is free from difficulties and negative points. The most important negative point related to space syntax is that it is an on-going framework of research, which makes continuous change and development of the ideas inevitable. For instance, originally integration and choice values were both introduced as global measures; however, the subsequent research has shown that integration exhibits a better correlation with movement, making it more applicable to the prediction of movement in cities (Hillier and al. 1986). The second important point about space syntax is that some of its theoretical and analytical hypothesis is based on experimental assumptions; for example the comparison between the values of RA to diamond-shaped pattern in order to revitalize it (Karimi, 1998).

4.4 Sample of Previous Studies

4.4.1 “Urban Conservation and Spatial Transformations Preserving the Fragments or Maintaining the Spatial Spirit” By: Kayvan Karimi

This paper is a comparison of 6 Iranian and 6 English cities to investigate how the spatial structure of the traditional city has responded under different circumstances, and what the influences of these responses have been on the fabric and the social aspects of the historic centres. So historic cores of Iranian and English cities were analyzed by space syntax techniques. For example, he compared the Integration (Rn) in old cities of Iran and England, or the main elements of the traditional cities of Iran and England, in global integration map were compared. Then he made some comparison between old city and its new master plan after urban modernization. Finally, he came to this conclusion that:

The structure of English historic cores, which have not been subjects of extreme urban transformation, appeared to be more adaptable with the old and new mechanisms of life; whereas Iranian cities, which have been modified by radical engineering solutions, seemed to be deprived and disabled in response to the both modern and traditional patterns of urban interaction (Karimi, 1998).

4.4.2 “The Morphological Characteristics of Anatolian Fortified Towns” By: Ayse Sema Kubat

In this paper a study is presented of the morphological characteristics of 9 Anatolian fortified town, Antalya, Ankara, Bursa, Erzurum, Diyarbakır, Iznik, Nigde, Trabzon, and Urfa. The aim of the study is to analyze the comparative morphology of these towns in the light of “space syntax” which is a method used to give quantitative descriptions of built space.

In this study number of factors such as: Syntactic Properties, Measures of convexity, Measures of axiality, Numerical properties, and Syntactic measures of each of those nine cities compared together. At the end, it resulted that as in most type of traditional Anatolian fortified towns, the most integrated parts are located in the center.

In Islamic- Turkish settlement, the residential areas are deep and segregated from the rest of the town. Anatolian fortified towns express deep and segregated urban layouts in comparison to Western cities such as London and Gassin,…and Anatolian fortified towns have low intelligibility value, after urban modernization this urban pattern tries to be in an intelligible order but they maybe not so intelligible when one moves in them, especially if the parts are identical (Kubat,1997).

4.5 Contribution of This Research to the Previous Studies

Besides the mentioned previous studies that investigated the effect of urban change on historic core through using space syntax tool; this research shows a unique approach to find the effect of urban modernization on the structure of historic cores in two Islamic cities. In addition, finding the effect of urban modernization transformation on the structure of meeting places in the core of the traditional Islamic cities is another unique approach of this research.

5. DATA ANALYSIS

As it mentioned in the first chapter the main objective of this research is an investigation of transformation and change in historic cores of traditional Islamic cities: how the modern changes affect the historical structure of city cores and is it possible to preserve the old structure of meeting spaces in Islamic cities after urban modernization? Why is it necessary to preserve this structure?

The purpose of this chapter is to review the methods used to collect data from both study areas, city of Bursa in Turkey and city of Yazd in Iran. The configurational measurements (syntactic description of space) were the source of data for this research. Besides it, method of comparison was used to compare the spatial configuration of these two historical Islamic cities to trace how the spatial structure of the traditional city has responded under the different circumstances, and what the influences of these responses have been on the fabric and the social aspects of the historic centres. As it mentioned before the focus of this research is on the influences of urban transformation (due to urban modernization program) on the structure of meeting spaces in city core of the Islamic cities. So we can come to a brief conclusion that why it is necessary to preserve the traditional structure of meeting spaces in historic cores of Islamic cities. In this way, I compared the spatial characteristics of city of Yazd in before and after urban modernization process, and another comparison between city of Bursa in before and after urban modernization program. Then we can understand which country was successful in preserving the old structure of historical core of the city.

The process of analysis started by drawing the axial line maps of two cities in two periods of time; in before urban modernization and at present time. Then these maps were imported to Depth Map software to find values of Connectivity and Integration Rn. So I could find the configurational characteristic changes of two cities after urban modernization. In the next step, I needed to find the influence of urban modernization on meeting spaces in these two Islamic cities, which are bazaar, mosque, public bath and madrasa. So, the integration value of each of these buildings was found in before and after urban modernization in two Islamic cities. By a comparison between these values, I could come to a brief conclusion about the influence of urban modernization on syntactic features of meeting spaces in city core of these two historical cities. This comparison provided a clear reason for the necessity of preserving the traditional structure of meeting spaces in historical center of Islamic cities.

5.1 Configurational (Syntactic) Measurements

Space Syntax analysis was used to model the historical cities of Bursa and Yazd. The spatial analysis was done by creating an axial map of the fewest, longest lines of visibility and importing that axial map to Depth Map software to get patterns of "Integration" and "Connectivity". This software essentially, converts the urban system characteristics into mathematical based assessment, and this mathematical based analysis could be compared to other aspects of built environment.

It is necessary to draw axial or isovist map first to start the syntactic analysis of the spatial configuration. We then import this axial map (in DXF format) into Depth Map software to produce a visibility graph; this graph shows the value of Integration by ranging from red (or black) for the most integrated line and blue (or light gray) for the most segregated one. By using this produced map, we are able to find the value of global integration and connectivity with the lines up to all steps away or local integration. Besides that, we can analyze certain aspects of spatial configuration of the area. For example, local integration by reduce 3 considers the connectivity with the lines up to 3 steps away.

Integration value indicates that how deep each location is in relationship to all other locations. So well integrated areas are shallow, it means you do not need to turn often to reach from the point to all other points, and when one location is segregated or poorly integrated it is deep so you need to turn a lot in order to reach from the point to other points in the urban system.

As it mentioned in the first chapter, historical Islamic cities have deep structure because of privacy. So we expect low integration value for an Islamic city in comparison to a non-Islamic or western one. So we can expect that the value of Integration of a historical Islamic city increases after urban modernization process.

In the next parts of this chapter syntactic analysis of two Islamic cities of Yazd and Bursa will be shown in two periods of time; first in before urban modernization or 18^{th} century and then at the present time. After finding the effect of urban modernization on city core of these two cities the effect of urban modernization on structure of meeting spaces of the city will be shown, and by a comparison between gathered results of two Islamic cities we can find which one could preserve the structure of its old city core better.

5.2 Syntactic Configurational Measurements of the City of Yazd

To start the syntactic analysis of the old city of Yazd I draw the axial map of the city by using the map of the city in 1928, in that time city of Yazd had faced the urban modernization program only in one part that I tried to reconstruct that part by using the map of the city in 1859 and reconstruction map of rout of bazaar between Amirchaqmaq and Shahtahmasb Squares which was drawn by Mahmoud Tavassoli in 1992, (Figures 5.1, 5.2, 5.3).

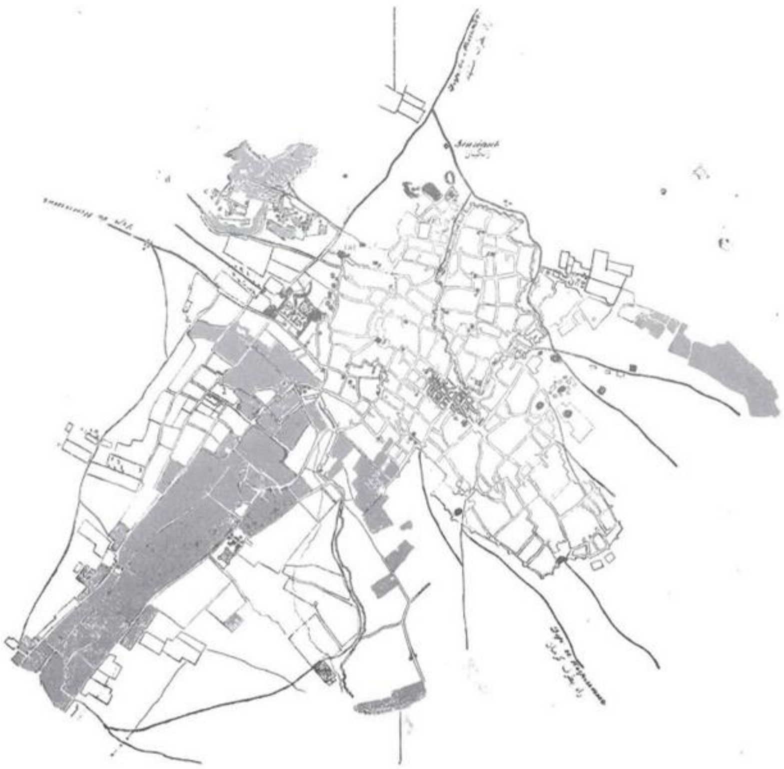

Figure 5.1: Map of the city of Yazd in 1859 (Tavassoli, 1992).

Figure 5.2: Reconstruction of city core of the old city of Yazd before the modern transformation (Tavassoli, 1992).

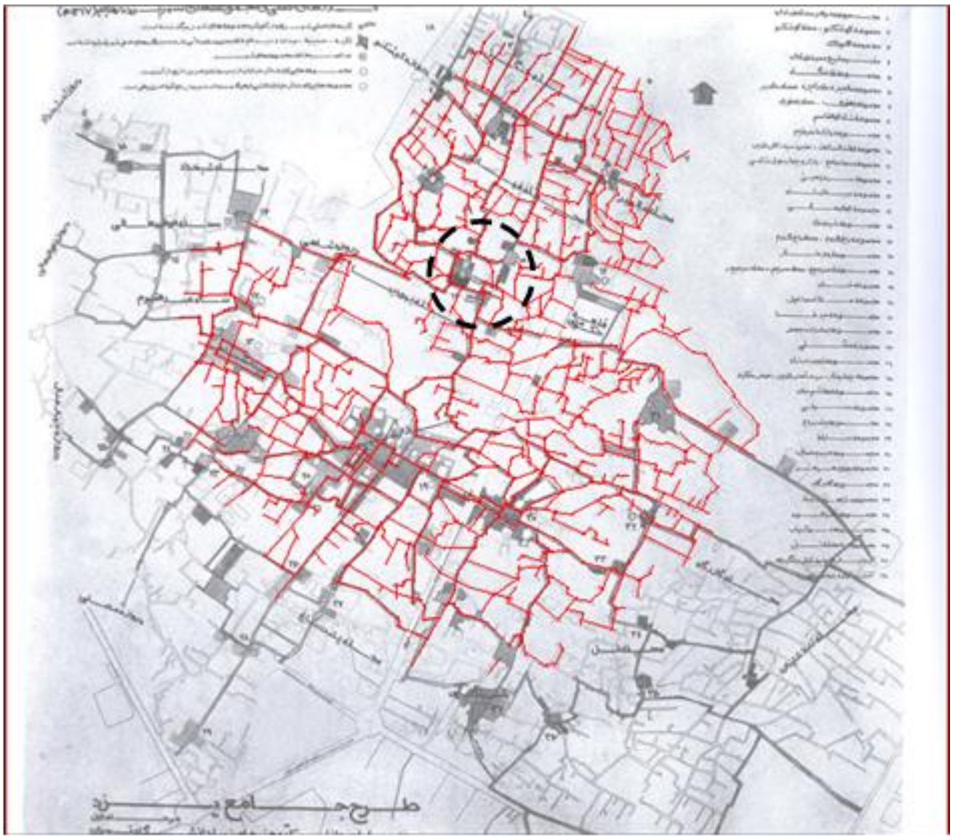

Figure 5.3: Map of axial line in the old city of Yazd in 1928.

As it mentioned in chapter 2 old city of Yazd had two historical cores the first one was around Friday mosque (in the North part) of the city and the second one was the area around Amirchaqmaq and Shahtahmasb squares (in central part) and route of bazaar had connected these cores together and provided a very well-integrated urban system.

In the next step in order to find the effect of urban modernization and urban growth on the city core of the historical city of Yazd, it was necessary to draw the axial line map of the city in present time. In this research, the whole of the city is not considered and large circle around the historical core of the city has been considered to draw axial line map, Figure 5.4 shows the drawn axial line for city of Yazd in the present time.

As it is clear, there is huge expansion in the size of the city and there are some wide streets in a grid shape which are imposed to the historical urban pattern of the historical city of Yazd. Due to these new urban constructions, many parts of historical buildings such as bazaar were destroyed. Ghiam Street divided bazaar into two parts and two city cores of the city of Yazd got segregated from each other.

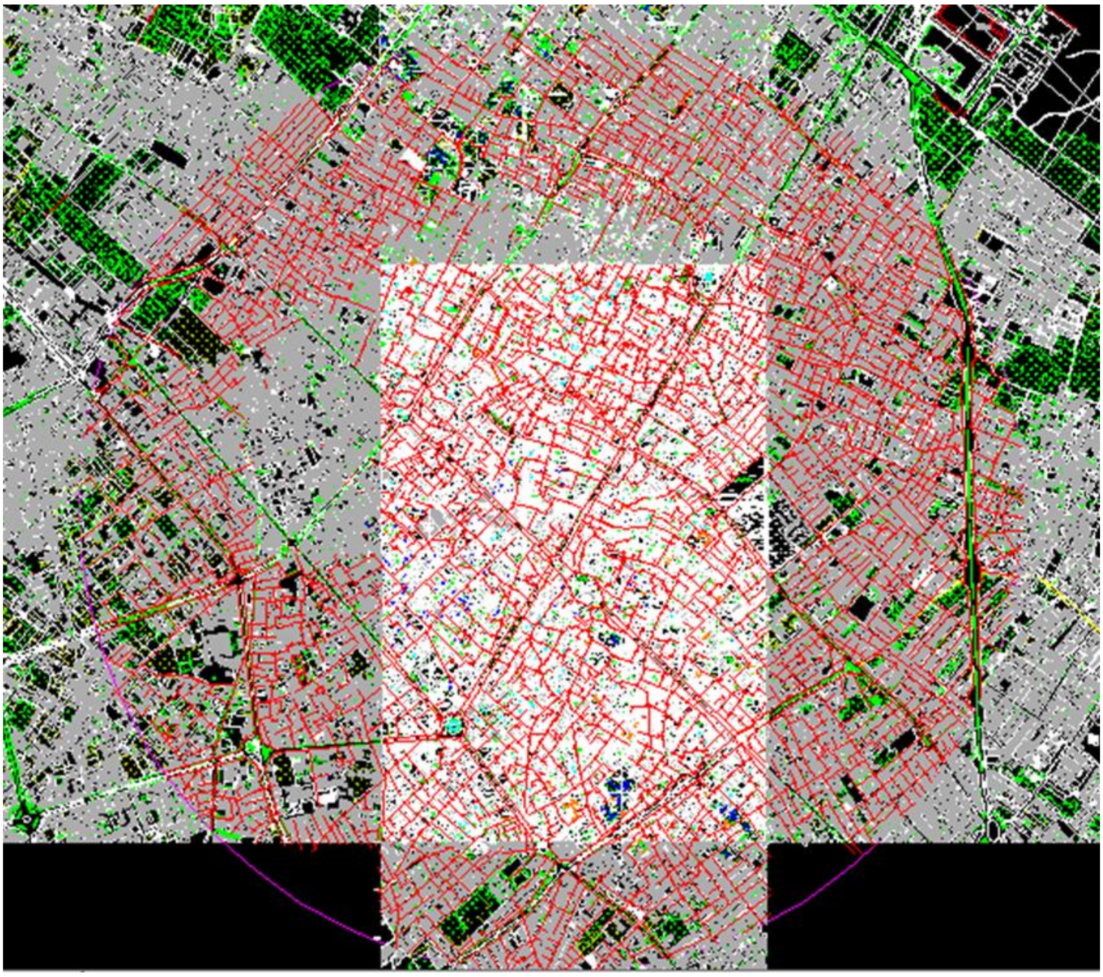

Figure 5.4: Axial line map of historical city of Yazd at present time.

5.2.1 The connectivity measurements

The next step in the analysis of the area is to obtain the visibility graph analysis (VGA), based on how the connectivity relationship between all points within the system is. Figure 4.5 shows the axial line map of old city of Yazd in connectivity measurment, red color lines indicates to the highest value of connectivity and the blue to the least. The line with the highest connectivity value is marked by h-Max on the Figure 5.5.

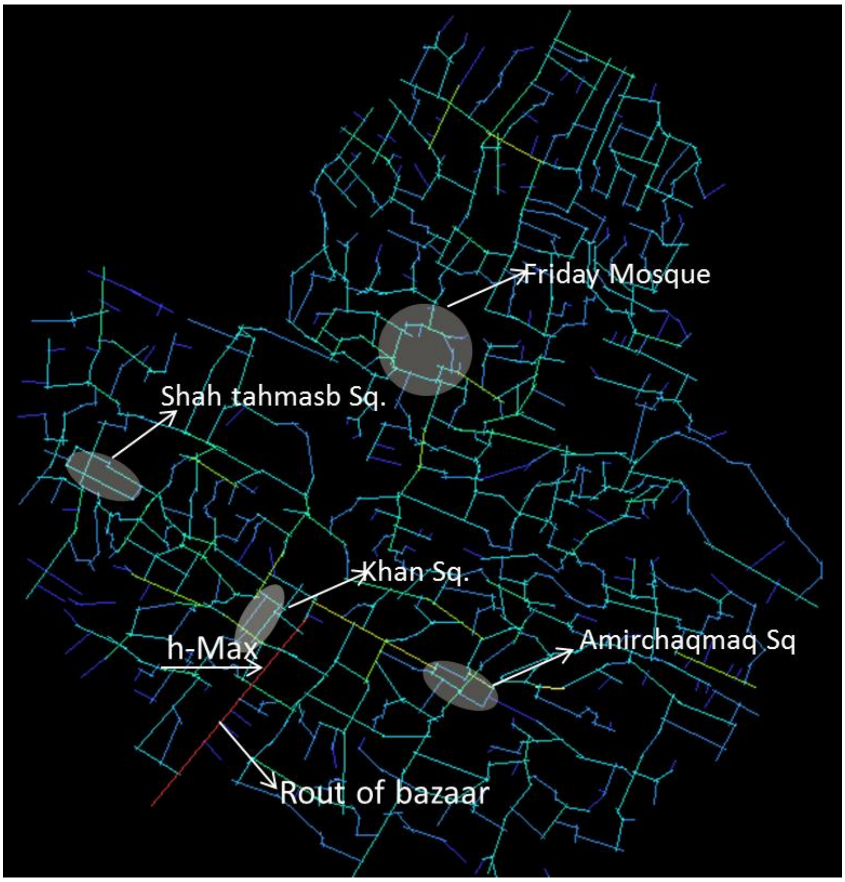

Figure 5.5: The connectivity map of the city of Yazd in 1928, lines marked with the red colors refers to the most connectivity values and the blue to the least**.**

Table 5.1 shows the key connectivity values of the study area in old city of Bursa. As it is clear from the table, the highest connectivity value for city of Yazd in 1928 is 10 and the least one is 1.

Table 5.1: The key connectivity values in the old city of Yazd in 1928.

Connectivity-City of Yazd in 1928	Value
Average	2.62
Minimum	1
Maximum	10
Count of points	943

In next step the connectivity map of Yazd at present time by considering a large span around the historical core of the city is prepared (Figure 5.6). The line with the highest integration value is marked by i-Max.

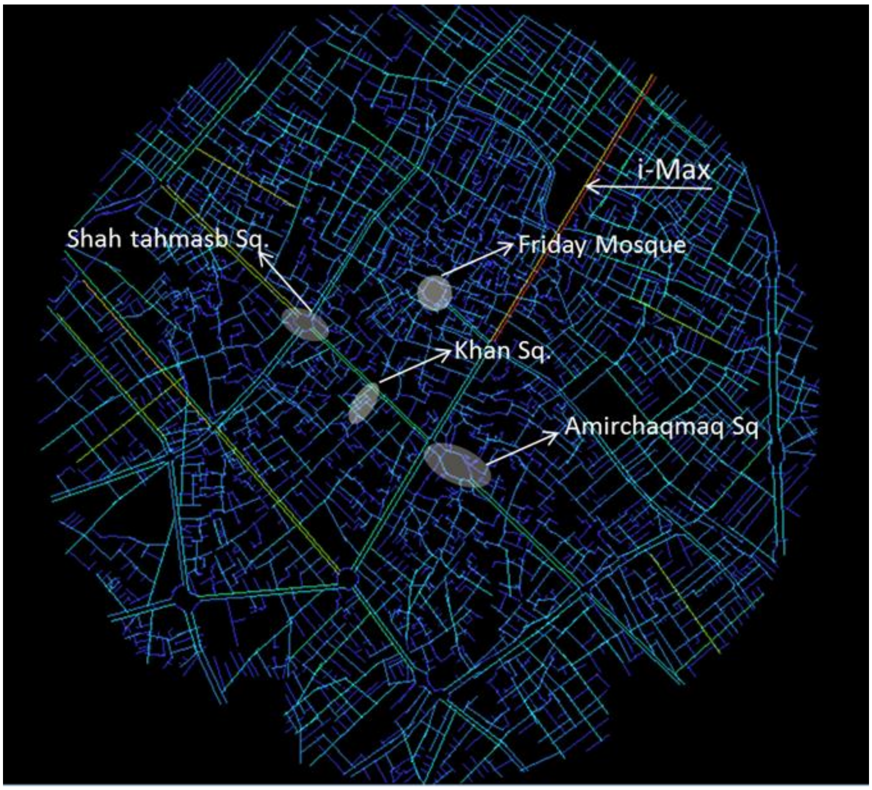

Figure 5.6: The connectivity map of the city of Yazd at present time. Lines marked with the red colors refers to the most connectivity values and the blue to the least.

Table 5.2 shows the key connectivity values in city of Yazd at present time. According to the table the highest connectivity value is 29 and the least one is 1.

Table 5.2: The key connectivity values in city of Yazd in present time.

Connectivity-City of Yazd at present time	Value
Average	2.69
Minimum	1
Maximum	29
Count of points	4698

5.2.2 The integration measurements

In the next step I imported the DXF format of axial map into Depth Map software to get the visibility graph of the selected area, Figure 5.7 shows the axial line map (Integration Rn) for city core of old city of Yazd in before urban modernization process. This graph analysis counts the number of steps that one need to take from a certain point to reach all other points in the urban system. Here, “step” means the longest line of sight between two points. In other words, “integration value”, measures the relationship between different locations or points in an urban system. As it mentioned before integration value shows how deep one point is in relationship to all other points; the more the integration value, the less depth value we have for that point. As it mentioned before warm colors indicate to high integration value and cold colors indicate to low integration value. So, according to the graph analysis shown in Figure 5.7the most integrated part is seen in the central part of the urban system with red color and less integrated parts are in the borders and far and poorly connected to the center. Central part which is shown by red color is the rout of bazaar that makes a well connection between to cores of the city (Friday Mosque and city squares). Depth Map software is able to assign numerical values for each point to measure the integration value of that point. The higher amount of integration for one point is, the more it is integrated.

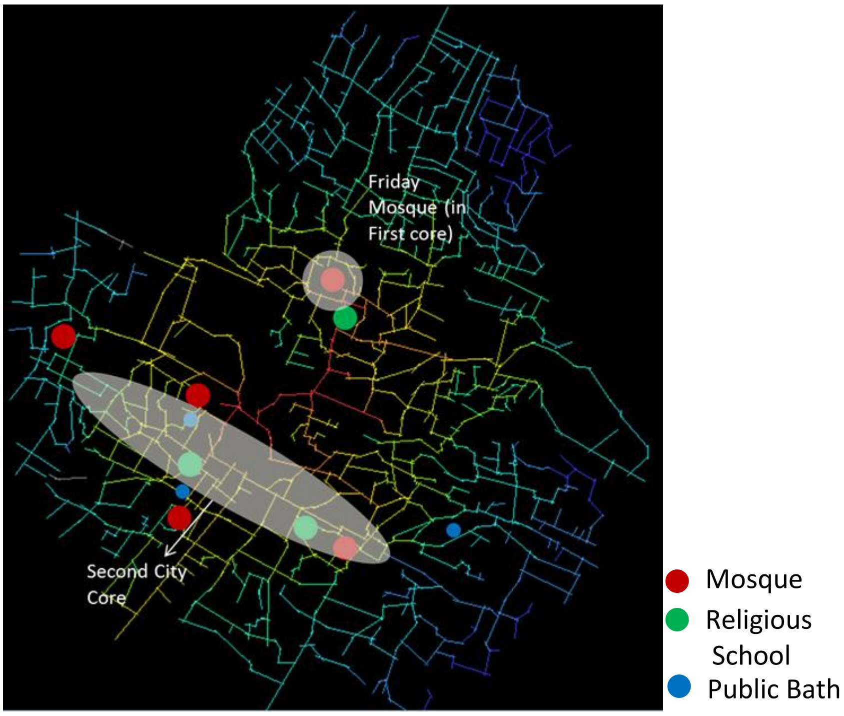

Figure 5.7: Axial line map (Integration Rn) for old city of Yazd before urban modernization warm colors indicate to high integration value and cold colors indicate to low integration values.

Table 5.3: The key integration values of old city of Yazd in 1920.

Integration (Rn)-Old city of Yazd (1920)	Value
Average	0.367
Minimum	0.235
Maximum	0.532
Count of points	943

As it can be seen in Figure 5.7, the highest integration value marked as a1-Max with a value 0.532 is located in the route of bazaar that is in a very central point of the system. There are other high integrated points like point a2-Max and a3-Max which have 0.531 and 0.530 integration values which are in the centre of the city core. The lowest integrated part is shown by a-Min which is located far from the city core and on the border.

In the next step in order to find the answer for the major question of this research I found the integration value of meeting spaces of Islamic city of Yazd in 18th century. As it mentioned before the meeting spaces of an Islamic city are: bazaar, mosque, public bath and madrasa.

To find the integration value of bazaar, mosque and other meeting space buildings in the urban system, The value of integration (Rn) for each entrance of that building was found and the average of those values were calculated. For example if there are 3 entrances for Friday Mosque I counted the average of these 3 integration values to find the global integration value of Friday Mosque in the urban system. If there are more than one building for a kind of meeting space I counted the average of all buildings in that type; for example if there are 5 public bath I got the average of global integration of these 5 public bathes to find the global integration value of public bath in the urban system. By this explanation, the global integration value of each type of meeting space in old city of Yazd is shown in Table 5.4:

Table 5.4: Integration value (Rn) for meeting spaces of city of Yazd in before urban modernization (in the hierarchy order).

Meeting Space	Integration Value (Rn)
Bazaar	0.47
Madrasa	0.45
Mosque	0.43
Public bath	0.39

According to Table 5.4 the most integrated meeting space in the urban system was bazaar of the city and the less integrated one was public bath. Generally, most integrated points were located on the all the way along the ax which connects two city centers together.

In order to analyze syntactical changes of city of Yazd after urban modernization the 2D map of axial line maps in DXF format was imported into Depth Map software, so the visibility graph of the selected area was found, Figure 5.8 shows the axial line map (Integration Rn) for the city of Yazd in present time. In Figure 5.8 the highest integration value is marked by b1-Max with a value of 0.774 and there are other high integrated points like b2-Max and b3-Max which have 0.771 and 0.767 integration values and the lowest one is marked by b- Min with a value of 0.282, as you seen in the Figure 5.8 it is not on the border and it is near Friday Mosque (shown by gray circle) in the historical core of the city.

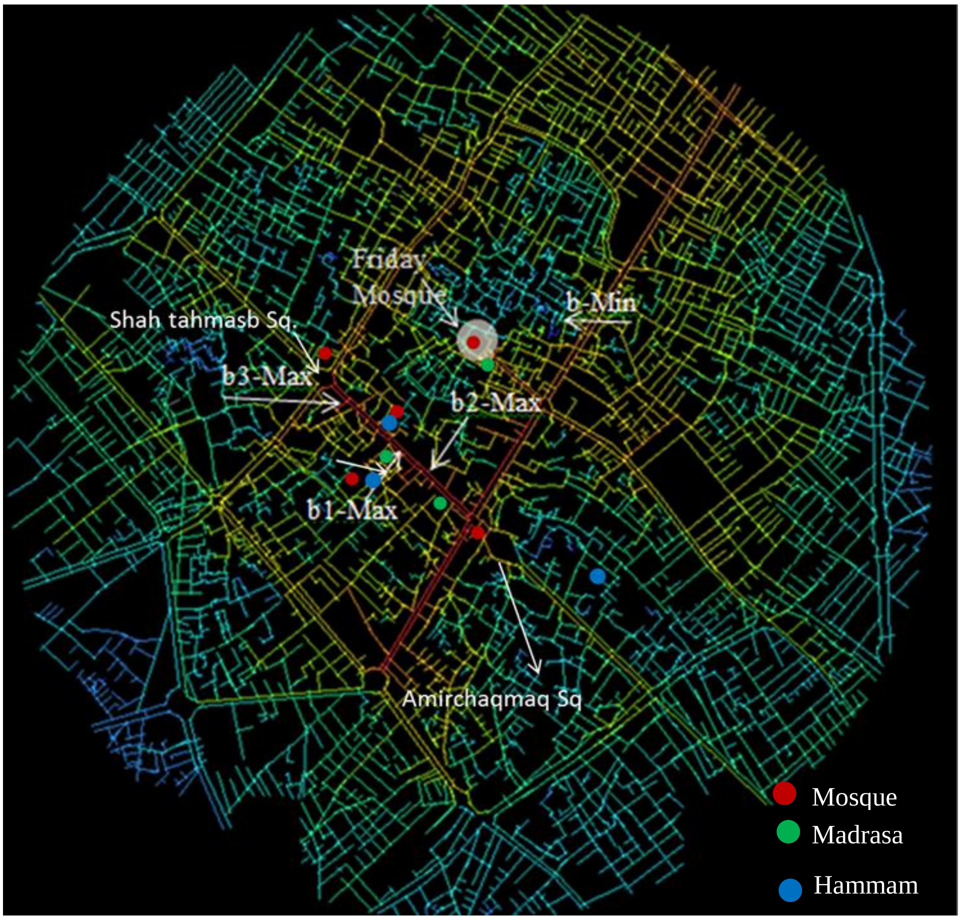

Figure 5.8: Axial line map (Integration Rn) for the city of Yazd at present time; warm colors indicate to high integration value and cold colors indicate to low integration value.

According to Figure 5.8, the most integrated points are located in all the way along two axes, Ghiam and Imam Khomeini Streets. Ghiam Street is a linkage ax between Amirchaqmaq and Shahtahmasb squares. However before any urban modernization programs these two squares were connected by a covered bazaar which was a grate route for pedestrian movements; while, at present time this ax is changed to a car movement channel. The other most integrated part is the ax of Imam Khomeini Street, which is again another car movement channel and many parts of historical bazaar were destroyed due to construction of this street. Besides that, the decent connection between two historical cores of the city is vanished and consequently the Friday Mosque of the Islamic city of Yazd got segregated from other parts of the city. In other words, the integrated core of the old city of Yazd is lost after urban modernization program and we cannot see any central core for the city at present time. Table 5.5 shows the integration values in the City of Yazd at present time.

Table 5.5: The key integration values in the study area at present time.

Integration (Rn)- city of Yazd at present time	Value
Average	0.502
Minimum	0.283
Maximum	0.774
Count of points	4698

By a simple comparison between axial line (Integration Rn) of city of Yazd in before urban modernization time and at present time, as you see in Figure 5.9 it Is clear that the most integrated part of the new Yazd is not the previous core and the integrated part doesn't form a city core anymore, it is just two street lines which play the role of car movement channels. The integration between two historical city cores is disappeared in new Yazd and Friday Mosque of the Islamic city of Yazd got segregated from other parts of the city.

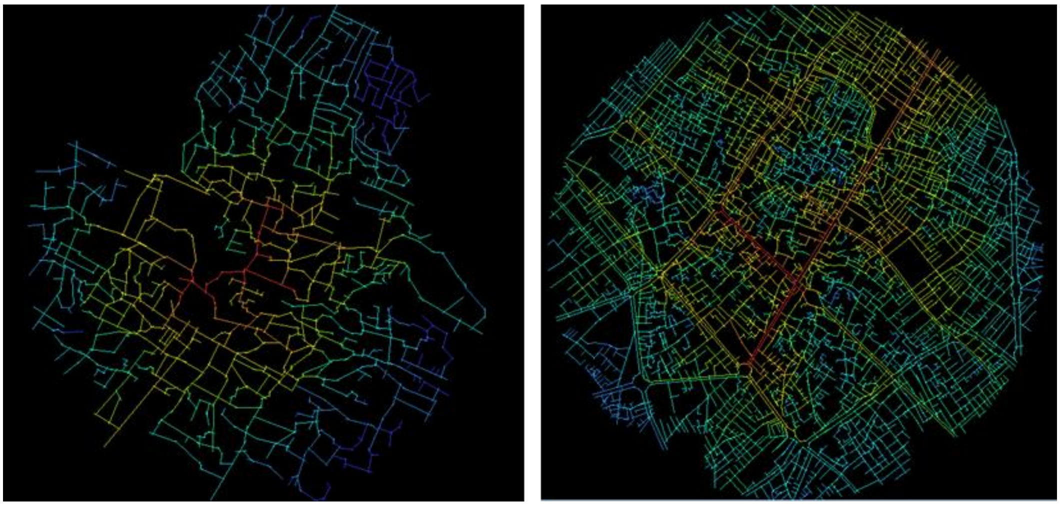

Figure 5.9: Comparison between axial line map (integration Rn) of Historical city of Yazd in 1928 (Left) and at present time (Right).According to above figures the well-integrated city core of old Yazd is disappeared in new Yazd and there is no integrated part in the shape of a city core.

In the next step in order to find the effect of urban modernization and urban growth on the structure of meeting spaces of Islamic city of Yazd, the value of integration Rn for each building is found.

Table 5.6: Integration value (Rn) for meeting spaces of city of Yazd at present time (in the hierarchy order).

Meeting Space	Integration Value (Rn)
Madrasa	0.68
Bazaar	0.66
Public bath	0.56
Mosque	0.54

According to the above table, Madrasa is the most integrated meeting space in the urban system and after that bazaar has the highest integration value; but the integration value of mosque has changed to the lowest one and according to the axial line map Friday Mosque is completely segregated from other meeting spaces of the city. Table 5.6 shows the effect of urban modernization on hierarchy of integration values of meeting spaces in urban system, and how new urban constructions disturbed the old structure of city core of Islamic city of Yazd. As it is shown in the Table 5.4 the most integrated urban element in old city of Yazd was bazaar however at present time Madrasa has the highest integrated value among other meeting spaces of the city and bazaar comes in the second level after madrasa. On the other hand, mosque is the most isolated meeting space in Islamic city of Yazd at present time. Consequently the old structure of city core of Islamic city of Yazd is not preserved after urban modernization programs and it is clear that this kind of destruction subsequently disturbs the Islamic Identity and culture of the city.

Table 5.7: Comparison between the hierarchy of integration value of meeting space in city of Yazd in 1928century and at present time; the maximum value is shown by red color and the minimum one by blue color.

Meeting space	Value of Integration Rn	
	Old Yazd	New Yazd
Bazaar	0.47	0.66
Madrasa	0.45	0.68
Mosque	0.43	0.54
Public bath	0.39	0.56

5.2.3 The intelligibility measurements

As it mentioned in chapter 4 Hillier (1988, 1996) defined intelligibility as "the degree to which what can be seen and experienced locally in the system allows the large-scale system to be learnt without conscious effort" (Hillier, 1996, p. 215). He argued that a strong association between local information and global information makes people easily form the overall spatial configuration in their minds. Intuitively, this means that in a layout of high intelligibility, information about local connectivity allows a person moving through the system tounderstand the overall structure of the configuration. In practice, the intelligibility value is calculated by the degree of linear correlation between connectivity and the global integration value (Hillier and Hanson, 1984). So in order to find the value of intelligibility for city of Yazd in 1928, I got the value of correlation between Integration Rn and connectivity. Figure 5.10 shows the scattogram of glaboal integration Rn againt connectivity. The result is shown by R2 which is 0.098.

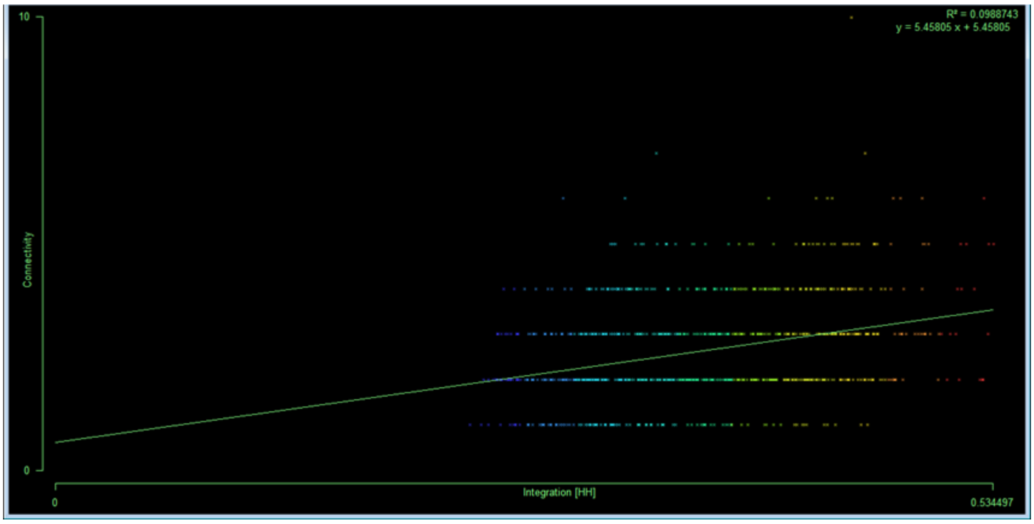

Figure 5.10: The scattergram of global integration Rn against connectivity for city of Yazd in 1928.

In the next step the value of intelligibility for city of Yazd at present time is was found. Figure 5.11 shows the scattegram of Global integration Rn against Connectivity for city of Yazd at present time. The result of this calculation is shown by R2 that is 0.073.

It is clear that the value of intelligibility is reduced from 0.098 to 0.073 after urban modernization and urban grows. As the intelligibility value helps to capture the way people can learn about large patterns from their experience of small parts, or fail to do so (Kubat, 1997), the reduction of intelligibility value means that the legibility or sense of way finding in the historic core of this city after urban modernization process has been reduced.

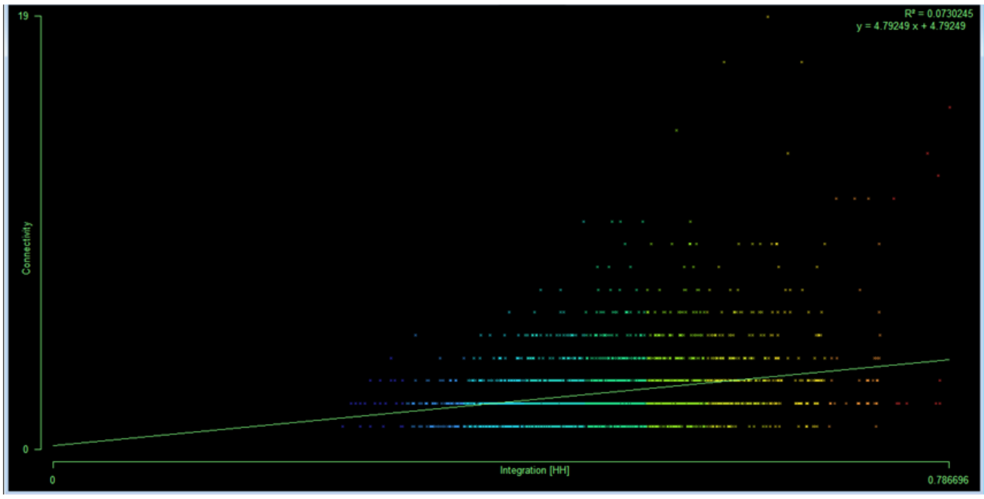

Figure 5.11: The Scattergram of global integration Rn against connectivity for city of Yazd at present time.

5.3 Syntactic Configurational Measurements of the City of Bursa

To start the syntactic analysis of the old city of Bursa I draw the axial map of the city core by using the map of the city in 1860 (Figure 5.12). All the meeting spaces of the Islamic city of Bursa, like route of bazaar, Friday mosque, public bath and madrasa, are located in the core of the city. In the next step I draw the axial lines of map of Bursa at present time. In order to find the effect of city growth on the historical core of the city, I considered a wider span around the historical city core to draw the axial lines of map of the city at present time (Figure 5.13).

Figure 5.12: Axial line map of the historical city of Bursa in 1860.

Figure 5.13: Map of city of Bursa at present time by showing the axial lines of a large span around the historical core of the city.

5.3.1 The connectivity measurements

The next step in the analysis of the area is to obtain the visibility graph analysis (VGA), based on how the connectivity relationship between all points within the system is. Figure 5.14 shows the connectivity map of old city of Bursa, red color lines indicates to the highest value of connectivity and the blue to the least. As it is clear from the map, the most connected line in the map is the rout of bazaar which is called "Uzun Charshi" Street at present time. The axial line of this street is shown by o-Max on the map and its connectivity value is 9.

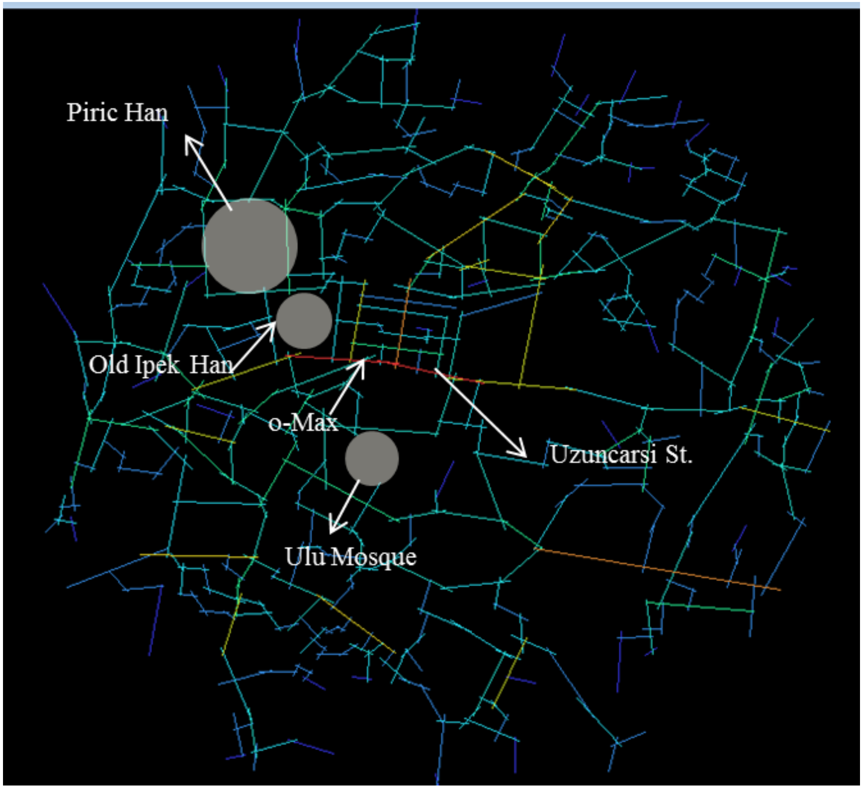

Figure 5.14: The connectivity map of the city core of Bursa in 1860, lines marked with the warm colors refers to the most connectivity values and the cold to the least.

Table 5.8 shows the key connectivity values of the study area in old city of Bursa. It is obvious that the points with high value of connectivity are located in the centre of the area and lines with low value of connectivity are located on the borders of study area.

Table 5.8: The key connectivity values of the study area in the old city of Bursa.

Connectivity-City of Bursa in 1860	Value
Average	2.98
Minimum	1
Maximum	9
Count of points	461

In next step, the connectivity map of Bursa at present time is prepared by considering a large span around the historical core of the city (Figure 5.15).

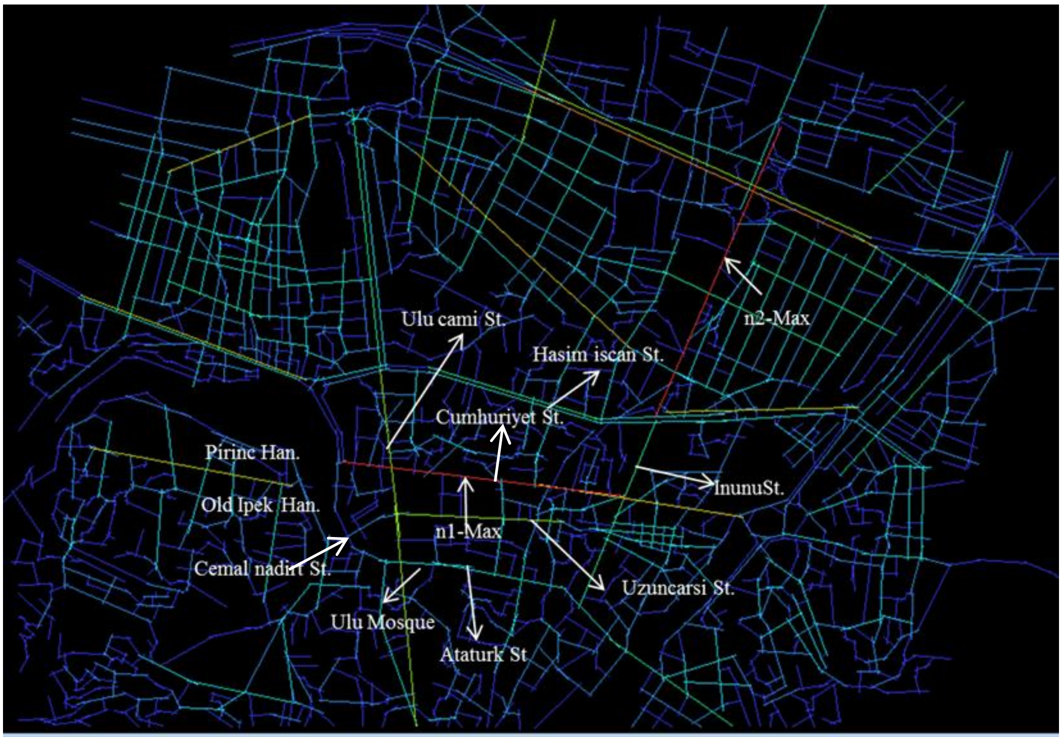

Figure 5.15: The connectivity map of the city of Bursa at present time. Lines marked with the warm colors refer to the most connectivity values and the cold to the least**.**

In this map the maximum connectivity value is 24 at the point marked by n1-Max, this point is located on "Cumhuriyet" Street which is one of the most important streets that surrounds the historic core. The other high value is at the point n2-Max with the value of 23. Table 5.9 shows the key connectivity values of the study area in city of Bursa at present time.

Table 5.9: The key connectivity values of the city of Bursa in present time.

Connectivity-City of Bursa in Present Time	Value
Average	3.45
Minimum	1
Maximum	24
Count of points	1731

5.3.2 The integration measurements

In order to find the global integration value of old city of Bursa I provided the visibility graph analysis based on how the integration relationship between all points within the system is. Figure 5.16 shows the global integration map of old city of Bursa, red color lines indicates to the highest value of integration (Rn) and the blue to the least. As it mentioned before warm colors indicate to high integration value and cold colors to low. It is clear from the Figure 5.16 that the rout of bazaar has the most integration value and points, which are located on the borders, have the lowest one. The highest integration value marked as i1-Max with a value 0.952 is located in the route of bazaar, which is in a very central point of the system. There are other high-integrated points like point i2-Max and i3-Max which have 0.944 and 0.940 integration values which are in the centre of the city core. The lowest integrated part is shown by i-Min, which has 0.350 integration value and is located far from the city core on the border.

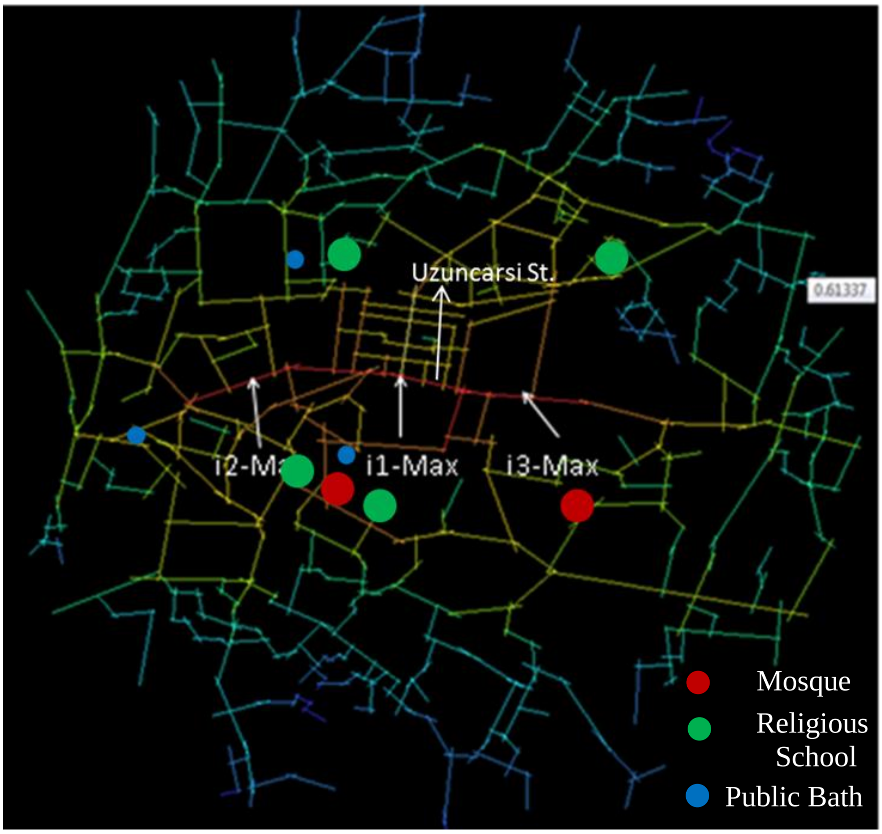

Figure 5.16: Axial line map (Integration Rn) for old city of Bursa (1860); warm colors indicate to high integration value and cold colors indicate to low integration value.

Table 5.7 shows the key integration (Rn) values in the city core of old city of bursa in 1860. In the next step the value of global integration of meeting places located in the city core of old city of Bursa is found (Table 5.10).

Table 5.10: The key integration (Rn) values in the old city of Bursa in 1860.

Integration (Rn)- city of Bursa in 1860	Value
Average	0.614
Minimum	0.350
Maximum	0.952
Count of points	461

Table 5.11: Integration value (Rn) for meeting spaces of old city of Bursa in 1860 (sorted from largest to smallest).

Meeting Space	Integration Value (Rn)
Bazaar	0.87
Mosque	0.85
Madrasa	0.77
Public Bath	0.76

According to the table 5.11, the most integrated meeting space element in old city of Bursa was bazaar and the segregated one was madrasa.

In the next step in order to find, the effect of urban modernization and urban growth on the city core of the historical city of Bursa I needed to provide the visibility graph analysis based on the Integration Rn for city of Bursa at present time (Figure 5.17). The highest integration value marked as d1-Max with a value of 1.13 is located in "Ulu Cami" street, which passes through the historic core of the city. There are other high integrated points like point d2-Max and d3-Max which have 1.12 and 1.11 integration values which are located in the core of the city and around the historic core. The lowest integrated part is shown by d-Min, which has 0.29 integration value and is located far from the city core on the border. So even after urban modernization process the most integrated part of the city is the centre and around the historic core of the city. Table 5.9 shows the key integration (Rn) values in selected area of city of Bursa at present time. By a simple comparison between axial line (Integration Rn) of city of Bursa in before urban modernization time and at present time, as you see in Figure 5.18 it is clear that the integrated core of the city is kept after urban modernization process at present time.

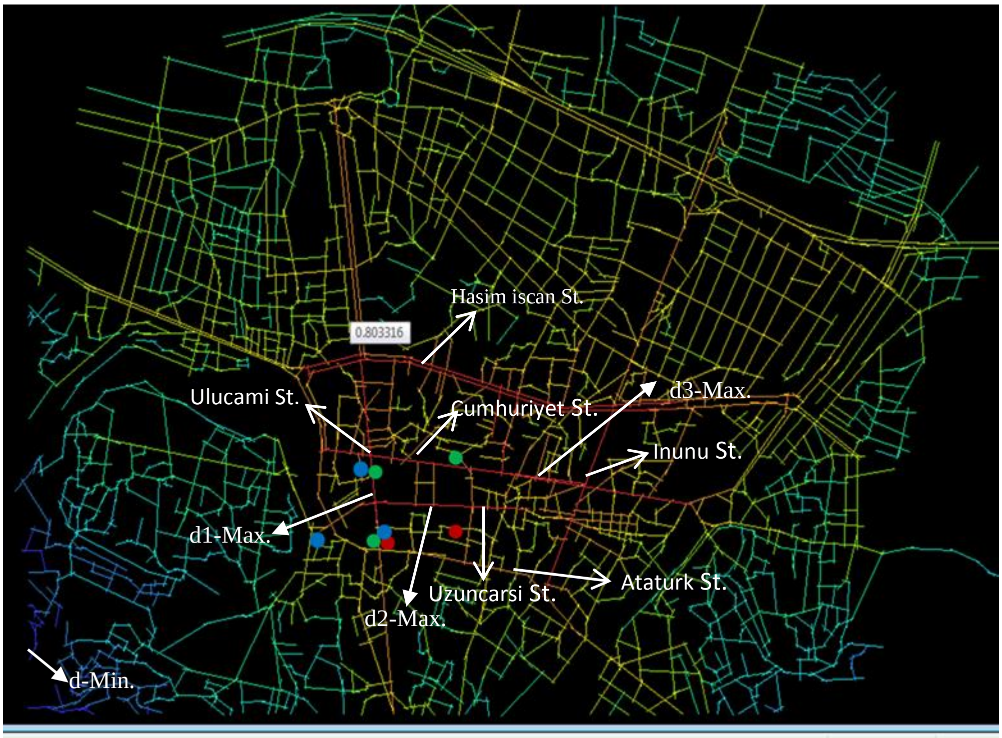

Figure 5.17: Axial line map (Integration Rn) for city of Bursa at present time; warm colors indicate to high integration value and cold colors indicate to low integration value.

In the next step, the key integration (Rn) values in core of the city of Bursa at present time are found (Table 5.12).

Table 5.12: The key integration (Rn) values in core of the city of Bursa at present time**.**

Integration (Rn)- city of Bursa in Present Time	Value
Average	0.73
Minimum	0.29
Maximum	1.13
Count of points	1731

Fıgure 5.18 shows a comparison between axial line map (integration Rn) of old city of Bursa in 1860 (Right) and at present time (Left).According to this figures the well-integrated city core of old Bursa is preserved after urban modernization and still the most integrated part of the city is the city core.

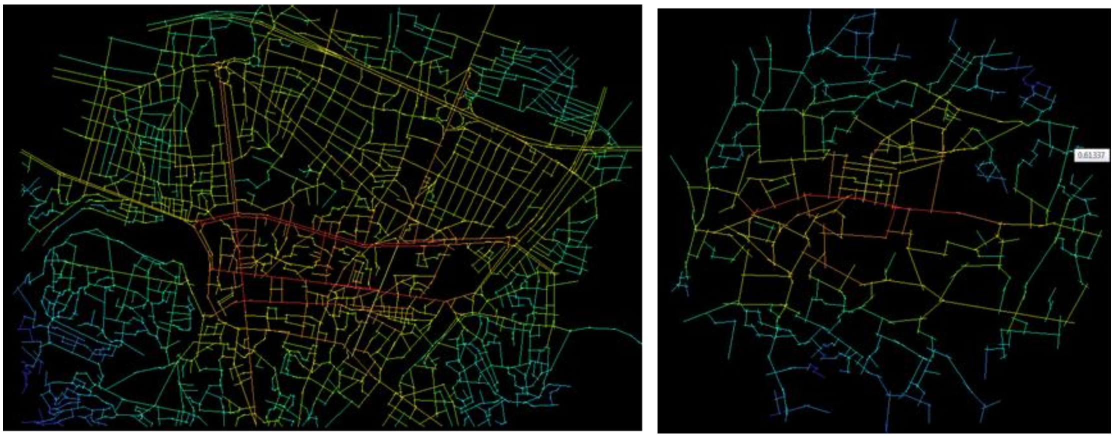

Figure 5.18: Comparison between axial line map (integration Rn) of Historical city of Bursa in 1860 (Right) and at present time (Left).

In order to find the effect of urban modernization and urban growth on the structure of meeting spaces in historic core of the city I found the average of integration values of each type of meeting space in city of Bursa at present time (Table 5.13). According to the table 5.13 bazaar still is the most integrated urban element and Madrsa has the lowest global integration value among other historic meeting spaces.

Table 5.13: Integration value (Rn) for meeting spaces of city of Bursa at present time (sorted from largest to smallest)

Meeting Space	Integration Value (Rn)
Bazaar	0.99
Mosque	0.95
Public bath	0.94
Madrasa	0.92

The next step is to compare the effect of urban modernization on the urban structure of historic meeting spaces in city of Bursa; Table5.14 shows a comparison between the averages of global integration value of each type of meeting space in two-mentioned era.

It is obvious from the table 5.14 that the hierarchy orders of mean value of global integration of historic meeting spaces in city of Bursa is not disrupted after urban growth and urban modernization. The reasonable order of meeting spaces is preserved even after urban transformation processes.

Table 5.14: Comparison between the hierarchy of integration value of meeting space in city of Bursa in 1860 and at present time; the maximum value is shown with red color and the minimum one by blue color.

Meeting space	Value of Integration Rn	
	Old Bursa	New Bursa
Bazaar	0.87	0.99
Mosque	0.85	0.95
Public bath	0.77	0.94
Madrasa	0.76	0.92

5.3.3 The intelligibility measurements

In order to find the value of intelligibility of city of Bursa in 1860, I found the measure of correlation between Integration Rn and Connectivity values. This value, which is shown by R2, is about 0.29224 (Figure 5.19).

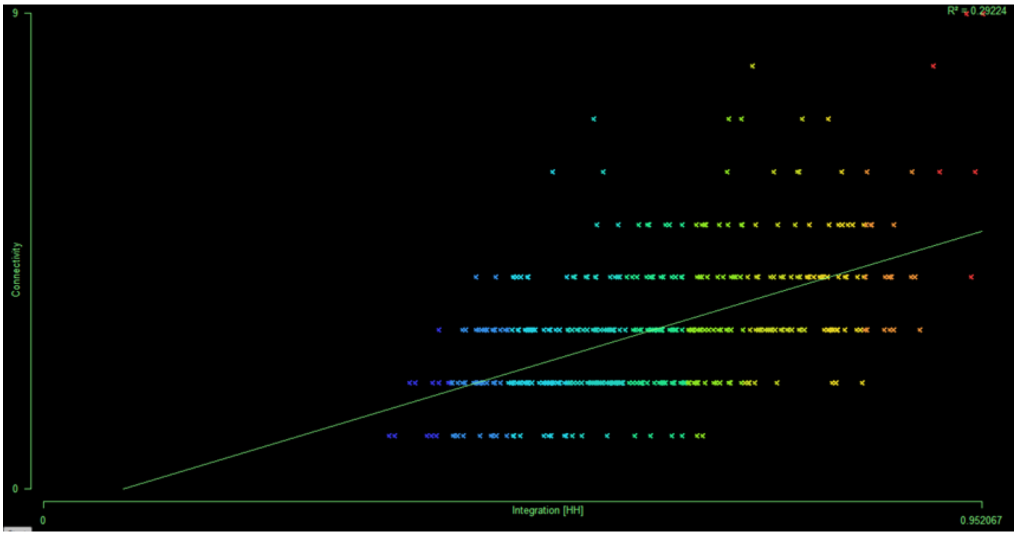

Figure 5.19: The scatter plot of correlation between integration Rn and connectivity values for the city of Bursa in 1860.

Figure 5.20 shows the scattergram of global integration (RN) against local-integration for city of Bursa at present time. And the value of R2 for city of Bursa at present time is 0.10. It is clear that the value of integration has been decreased from 0.29 to 0.10 after urban modernization and urban growth. This reduction explains that the sense of legibility and way finding is reduced after urban modernization in city core in Bursa.

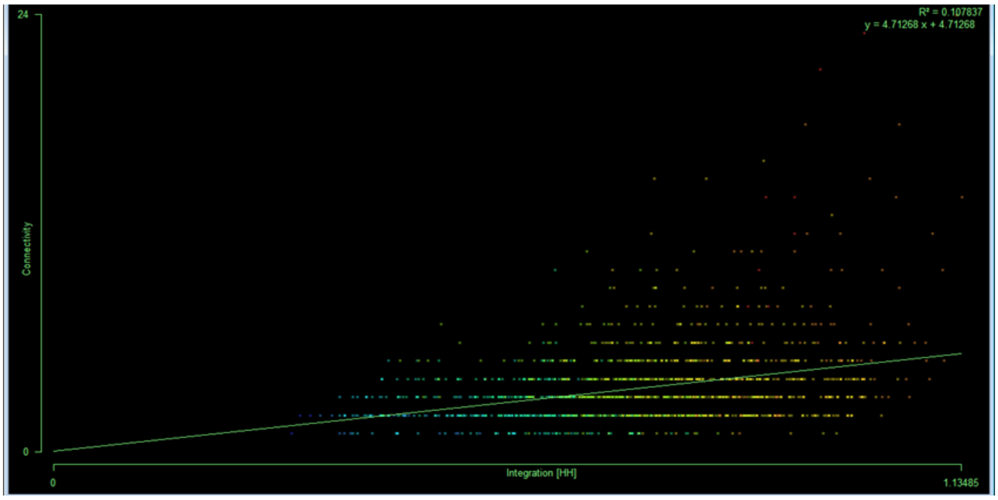

Figure 5.20: The scattergram of global integration (RN) against connectivity for city of the Bursa at present time.

5.4 Comparative Study of Syntactic Measures

As it mentioned before the aim of this study is to find how urban modernization affected the historic core of Islamic cities and the structure of meeting places in the city core. The second question of this research is that whether it is possible to preserve this structure after urban modernization.

To answer the first question I used space syntax methodology to find the syntactic features of selected cities in before urban modernization and in present time especially from the point of view of structure of meeting places in the city core. To answer the second question I used the method of comparison to find which system of modernization worked better and in which of these cities the structure of historic city core could be kept after urban modernization process.

At first the analyzed maps (Integration radius n) of old cities of Yazd and Bursa before urban modernization transformation are compared, shown in Figure 5.21.

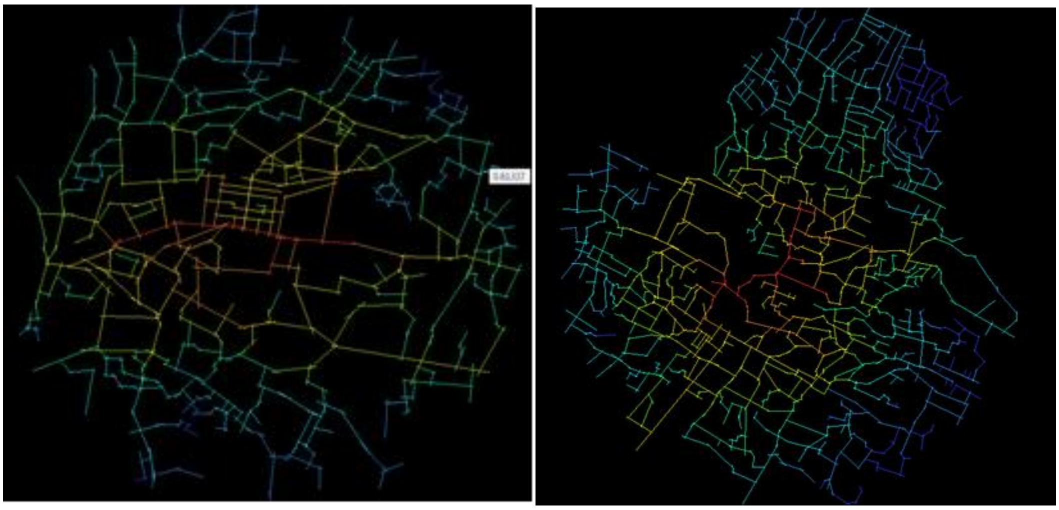

Figure 5.21: Analyzed maps (Integration Rn) of old cities of Yazd (Right) and Bursa before urban modernization transformation (Left); warm color indicates to high integration value and cold color indicates to low integration value.

According to Figure 5.21 in both cases the maps of global integration (radius n) create a clear structure based on a powerful and compact integration core in the centre of the organic grid. The most integrated part of the city is the city core that most used places such as bazaar, mosque, madrasa and public bath are located in this part of the city.

Then the analyzed maps (Integration radius n) of cities of Yazd and Bursa in present time are compared, shown in Figure 5.22.

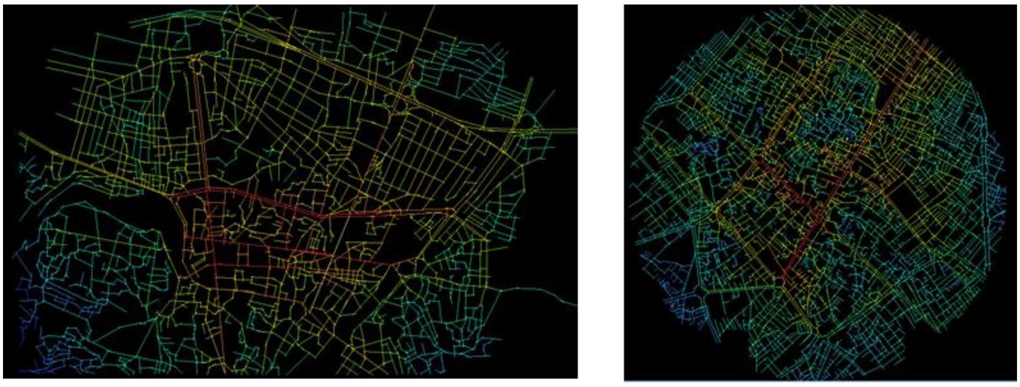

Figure 5.22: Analyzed maps (Integration Rn) of cities of Yazd (Right) and Bursa (Left) in present time. Warm color indicates to high integration value and cold color indicates to low integration value.

By this comparison, we can conclude that only in city of Bursa the historic core of the city still is the integrated core of the urban structure, and integrated core of Yazd is lost after urban modernization transformation. In addition, the less integrated points of the city core of Bursa still are located on the borders however; in modern city of Yazd, the most segregated point is located in the core of the city. Therefore, the integrated core of the city is lost after urban modernization.

In the last part of this chapter, Table 5.15 presents a general summary of characteristics measures for comparison of the morphological transformation of the cities of Bursa and Yazd in before and after urban modernization transformation.

Table 5.15: Comparative analysis of the cities of Bursa and Yazd, before and after urban modernization transformations.

			Bursa	Yazd	Result
Integration Rn		Old	0.61	0.36	The urban structure of city of Bursa is more integrated than city of Yazd in both old and new conditions.
		New	0.73	0.50	
Connectivity		Old	2.98	2.62	Increase in value of mean connectivity in city of Bursa is remarkably more than city of Yazd so road constructions in city of Bursa were more than city of Yazd.
		New	3.45	2.69	
Intelligibility		Old	0.29	0.09	Value of intelligibility decreased after urban modernization in both of these cities; it means legibility of the city cores has been decreased after urban modernization process.
		New	0.10	0.07	
Global Position of Meeting Places in City Core	Bazaar	Old	0.87	0.47	The hierarchy orders of mean value of global integration of historic meeting places in city of Bursa are not disrupted after urban growth and urban modernization. However this structure is completely disturbed by urban modernization process in city of Yazd.
		New	0.99	0.66	
	Mosque	Old	0.85	0.43	
		New	0.95	0.54	
	Hammam	Old	0.77	0.39	
		New	0.94	0.56	
	Madrasa	Old	0.76	0.45	
		New	0.92	0.68	

According to the above, table the value of global integration if city of Bursa is more than city of Yazd in both old and new conditions. On the other hand, the value of global integration of both of these cities has been increased after urban modernization process. Due to construction wide streets, highways, and demolition of traditional narrow streets and cul-de sucs, the urban structure of both these Islamic cities has been increased after urban modernization constructions.

Value of mean connectivity in city of Bursa is more than city of Yazd in any conditions. On the other hand, the Increase in value of mean connectivity in city of Bursa is remarkably more than city of Yazd so new road constructions in city of Bursa was more than city of Yazd.

Value of intelligibility decreased after urban modernization in both of these cities; it means legibility of the city cores has been decreased after urban modernization process.

The hierarchy orders of mean value of global integration of historic meeting places in city of Bursa are not disrupted after urban growth and urban modernization. However, this structure is completely disturbed by urban modernization process in the city of Yazd.

In the fallowing chapter, general results found by this analytical comparison study will be explained in more details.

6. CONCLUSION

In this study, the urban pattern of two different Islamic cities in two different countries is examined comparatively from the point of view of identity, including their mathematical analysis. The main objective of this comparative study is to find the effect of urban modernization transformation on old structure of historic cores of these traditional Islamic cities. Such study is helpful in contemporary urban studies, especially for the renovation of the historical and cultural regions of the cities changed and damaged by the effects of rapid urban modernization and urban growth programs. If the old structure of a traditional city changes dramatically, it is impossible to preserve and maintain its traditional character. The plan analysis and syntactic measures made some contributions to this thought, but it is believed at this stage that the comparative study of historic cores in the past and present can offer more.

In order to conduct this comparison the axial line maps of historic cores of the city of Yazd in Iran and city of Bursa in Turkey are presented in before and after urban modernization process. The map of axial lines shows that different urban pattern systems were used through urban modernization process of these two cities. Both of these cities had organic urban pattern before urban modernization transformation; however in city of Yazd grid urban pattern was imposed to the old organic pattern of the city thus urban structure of the city changed dramatically. In addition, some parts of bazaar of the city were demolished due to such urban modernization system. But in city of Bursa, a new ring road was constructed around the historic core of the city without any dramatically change and demolition in historic urban elements of the city.

The maps of global integration (Rn) for the core of Iranian city demonstrate a total destruction of the old global configuration. The modern streets (Qiam and Imam Streets) are the most integrated lines of the systems. Since these lines have not been drawn in any sympathy with the older lines, the new integration core totally ignores the older centre of integration. Actually, the historic integrated core of the old city is lost after urban modernization transformation and changed to integrated streets. On the other hand, some lines, which used to be segregated become integrated and vice versa. It seems that the new structure pushes the segregated areas into the centre of the city.

The story in the historic core of Turkish city is completely different. First of all, the historic core in the context of the whole city has not been lost through urban modernization. The pattern of global integration in core of modern city of Bursa fallows the pattern of integration in the traditional city of Bursa. In other words, still the most integrated streets are around the historic core of the city and the new integration core seems to be more expanded. The effects of the inner ring road in Bursa can be easily traced on the integration map, which demonstrates how this new trend (ring roads) affects the historic core of the city. Another remarkable notion can be obtained from the analysis of the city of Bursa is that the segregated lines still are located in the borders and far from the city core.

Value of intelligibility (correlation between connectivity and global integration) helps to capture the way people can learn about large patterns from their experience of small parts. People will fail to do so if the value of the correlation is weak.

The intelligibility of city core in city of Yazd is poor in any condition and its value decreased after urban modernization. The intelligibility of city core in city of Bursa is also reduced after urban modernization process, however; the correlation between global integration and connectivity in city of Bursa is higher than intelligibility value in city of Yazd in any condition.

The major objective of this study is to examine the effect of urban modernization on urban structure of meeting places in Islamic cities of Yazd and Bursa. Meeting place in this study refers to urban elements such as bazaar, mosque, public bath and religious school, which are the most important urban elements of an Islamic city. These are places which are created in response to the economic, functional and cultural needs of the people who live in the urban environment, and therefore, their constitution in the organization of the city carries important implications. It is important at this stage of our discussion to know how the constitution of meeting places in the city changes when its spatial structure transforms. As discussed in the previous sections, the pattern of global integration in historic core of city of Bursa has not changed dramatically, thus the urban structure of meeting places in core of this city is not disturbed. In other words, the hierarchy orders of mean value of global integration of meeting places in city core of traditional city of Bursa before urban modernization is similar to modern city. It means the most integrated meeting places in before urban modernization process were bazaar and mosque, and the segregated one were public bath and religious school. This order is preserved after urban modernization process. The story is different in city of Yazd. The global position of meeting places in city core of old city of Yazd disturbed dramatically by urban modernization process. In other words, the most integrated meeting places in old city of Yazd were bazaar and mosque and the less integrated one were religious school and public bath. However, after urban modernization process the global position of meeting places changed dramatically. It means the most integrated meeting places after urban modernization process are religious school and bazar and the less integrated one are public bath and mosque. According to the above findings and also other results in the previous sections, it is apparent that in city of Yazd a larger entity, i.e. the configurational organization has been lost. Consequently, the Islamic identity of the city deteriorated drastically.

In contrast, old city of Bursa seems to have retained its traditional urban morphology features especially in the point of view of Islamic urban elements so the Islamic identity of the city is preserved in an acceptable way.

Now it is possible to compare the findings of this study to previous studies mentioned in chapter 4. As it mentioned before, in a study was done by Kubat, the morphological characteristics of 9 Anatolian fortified towns by using space syntax methodology were compared. Her study resulted that the most integrated parts in all of the Anatolian towns in her research are located in the center. It is the same as in the traditional cities of Bursa and Yazd in which the integrated core was found in the center of the city. The common characteristics among all of these cities is their organic urban pattern before urban modernization changes, so it might be concluded that the integrated core of traditional cities with organic urban pattern is found in the center of these cities.

In addition, in another study was done by Karimi 6 Iranian and 6 English cities were compared (by using space syntax tool) to investigate how the spatial structure of the traditional city has responded under the different circumstances, and what the influences of these responses have been on the fabric and the social aspects of the historic centers. Then, he found that the structure of English historic cores, which have not been subjects of extreme urban transformation, appeared to be more adaptable with the old and new mechanisms of life; the same as city of Bursa in which the historic core of the city has not changed dramatically and the pattern of global integration in core of modern city of Bursa fallows the pattern of integration in the traditional city of Bursa.

On the other hand, Karimi's study shows that Iranian cities, which have been modified by radical engineering solutions, seemed to be deprived and disabled in response to the both modern and traditional patterns of urban interaction, thus the result of present study about transformation of urban pattern in city of Yazd is another evidence to this result that urban pattern in modern Iranian cities changed dramatically without any consideration to their traditional structure.

Finally, it is possible to find that the ultimate objective of mentioned studies is to suggest how to fill the gap between the past and present, or traditional urban structure and contemporary urban planning. The aim of the present study is also to investigate how to preserve the urban structure of historic cores in Islamic cities, during urban modernization construction. According to the gained results of this study and previous mentioned studies, the only way to do this is by understanding the traditional layout of the old city and considering the tradition urban pattern while constructing new streets and roads. In other words, in order to preserve the old urban structure of traditional-Islamic cities, it is necessary to consider and fallow the traditional –Islamic urban features. In this way; it would be possible to adopt the needs of contemporary Islamic cities while still preserve cultural aspects and Islamic identity of the past.

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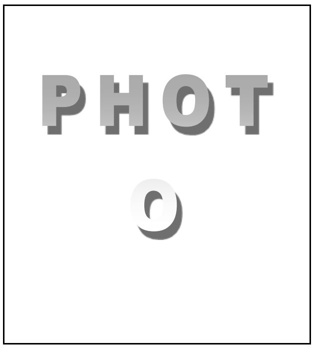

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