INTERACTION OF URBAN FRINGE AND TRANSPORTATION SYSTEM: ISTANBUL CASE

A Thesis Submitted to
The Graduate School of Engineering and Sciences
İzmir Institute of Technology
in Partial Fulfillment of the Requirements for the Degree of

MASTER OF SCIENCE

in City Planning

by
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October 2007
İZMİR

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ABSTRACT

INTERACTION OF URBAN FRINGE AND TRANSPORTATION SYSTEM: ISTANBUL CASE

Nowadays, urban sprawl is common problem of all cities. Decentralization of housing with low density and jobs into urban fringe areas is considerable development. Sprawl is blamed a wide range of problems likewise wasteful use of land, air pollution, dependence on car, increased traffic congestion, lengthened travel distance and time, but it is not clear explaining how urban sprawl affects travel behavior in Turkey?

The aim of the thesis is to identify the influence and importance of urban sprawl on travel behavior in Turkey. Firstly literature survey on urban sprawl and urban fringe was examined. Geographic Information System was used to define and map urban sprawl. Daily trip production in sprawl and urban core was analyzed. In addition daily travel behavior was inquired. For this study, 2007 İstanbul Master Plan Household and O-D survey was also used. It allows comparisons travel behavior between sprawl and urban core area.

The results confirmed that there is no much difference on socio economic situation between people living in urban sprawl area and people living in urban core area. However using of private car is higher rate in sprawl area than urban core. In addition sprawl population drive more time and distance than urban population. The results provide important insights into the importance of sprawl on transportation and suggest that transportation system can be adversely affected to the extent that cities continue to expand to urban sprawl areas as wanton.

As a consequence, sprawl effects İstanbul transportation as negative because sprawl affects travel behavior. This situation creates increased private car ownerships and traffic congestion. To solve this problem and many other problems in transportation related sprawl, studies on transportation and master planning should be considered sprawl fact.

ÖZET

KENT ÇEPERİ VE ULAŞIM SİSTEMİ İLİŞKİSİ: İSTANBUL ÖRNEĞİ

Kentsel saçaklanma günümüzde tüm kentlerde yaşanan bir olgudur. Ofis, konut, ticaret ve rekreasyon alanları olarak metropoliten kentlerin çeperlerinde karşımıza çıkan bu yeni gelişim süreci birçok problemin kaynağı olarak gösterilmektedir. Üzerinde tartışılan problemlerden birisi de saçaklanmanın ulaşım üzerinde yarattığı olumsuz etkilerdir. Özel oto kullanımındaki artış, bunun yarattığı hava kirliliği ve trafik sıkışıklıkları, daha uzun süreli ve mesafeli olarak yapılan yolculuklar ve bu yolculukların insanlar üzerinde yarattığı psikolojik etkiler, araştırılan konu başlıkları arasında yer almaktadır. Fakat tam olarak Türkiye'de saçaklanmanın seyahat davranışları üzerindeki etkilerinin neler olduğu ve bunun trafiği nasıl etkilediğine yönelik tanımlayıcı bir çalışma yapılmamıştır.

Bu nedenle bu çalışmada kent çeperinde yaşanan yeni gelişim sürecinin İstanbul trafiği ve seyahat davranışları üzerindeki etkilerinin araştırılması yapılmıştır. Günlük olarak yaratılan çeper ile merkez kent arası yolculuklar incelenmiş ve bireylerin seyahat eğilimleri araştırılmıştır. Ayrıca kent ve çeper arasındaki farklar karşılaştırmalı olarak incelenmiştir.

Çalışmanın sonucu olarak kent çeperinde yaşayan bireyler ile kent merkezinde yaşayanların sosyo-ekonomik yapıları arasında çok büyük bir farkın olmadığı gözlemlenmiştir. Fakat buna rağmen kent çeperinde özel oto kullanımın kent merkez alanına göre daha yüksek oranda olduğu tespit edilmiştir. Bu da kent çeperinde özel oto bağımlılığının daha yüksek olduğunu göstermektedir ve bu durumun trafik sıkışıklıklarına neden olduğu bilinen bir gerçektir. Ayrıca çalışmada çeperde yaşayan bireylerin kent merkezine oranla daha uzun mesafe ve süreyi kapsayan yolculuklar yaptıkları belirlenmiştir.

Özetle saçaklanmanın zaten sorunlu olan İstanbul trafiğine olumsuz olarak etki ettiği belirlenmiştir. Bu sorunun çözümü için ulaşım ve planlama çalışmalarının saçaklanma olgusunu da göz önünde bulundurarak gerçekleştirilmesi gerekliliği ortaya çıkartılmıştır.

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CHAPTER 1

INTRODUCTION

The effect of industrialization concept which surrounded whole world after 18th century on people and cities is an undeniable fact. From that date on, people started to migrate to cities intensively. The process of urbanization gave rise to rapid enlargement of cities. Especially, along with the progress in the areas of production technology, communication and transportation, vast changes occurred both in economic and spatial structures. With time, population accumulating in cities caused the cities to expand into the surrounding areas. This continual expansion of cities has affected settlements of urban fringe areas. Now a new process of development occurring rapidly and continuously in urban fringe areas has appeared. This condition is usually termed as urban sprawl. Studies on this new process of development have appeared densely after 1940s. The sprawl which has different character as to location and time has been tried to explain with different definitions. At the present day, a common definition still does not exist. The studies on urban sprawl are directed toward the definition of this development, the negative effects it created and the relationship between the city and the fringe.

Of the relations between city and urban fringe, transportation is an important subject which we face, because it directs the sprawl of the city. Progress in the field of transportation has both directed and triggered the development of urban fringe. Because of the rapid development of transportation substructure and the increase in car ownership, people began to move away from the city and even to show a leaping development by having big gaps with the city center.

Firstly, this outward dispersion accelerated with becoming widespread of railroad. Suburban villages sprang up along the rail lines. The suburban expansions of the late 19th century, however, did not totally encircle the city. Being rail-based, the overall pattern was one of a few routes radiating out from the city center (where commerce and industry was still located), with residential development focused within a few blocks of either side of the transit line. This left huge swaths of open space between the rail lines (Planning Commissioners Journal 2006).

"The concentration of population into ever-expanding urban centers was the most important development in population distribution in the first half of the 20th century. While rural people moved into metropolitan areas, the dense populations of central cities emptied out into the surrounding countryside. The automobile helped trigger both a rural-to-urban migration, and a city-to suburb relocation, resulting in settlement patterns today that conform more to commuting, recreation, and retirement than to farming, mining, or logging" (Heimlich and Anderson 2001).

"It is well known that in most cities and towns growth is occurring outside the urban core area, with very low densities of residential and commercial activity in surrounding areas. This condition is often known as urban sprawl and has been subject to a wide range of criticism, including for its negative effects on travel behavior and commuting. Residents of sprawl areas may drive longer distances to more dispersed destinations, be more reliant on automobiles due to a lack of transit service and limited opportunities for biking or walking, and contribute unnecessarily to air pollution and congestion" (Weber and Sultana 2005).

There are researches consider urban fringe area and urban sprawl from various views. Many disciplines like planning, geography care fringe area as a subject. They have explained transformation and expansion process, form, land use, socioeconomic characteristics, cost and effects of fringe areas. Some researches regarding transportation have inquired effects fringe areas especially related with commuting time. In these researches, they are included cost of sprawl, travel behavior, demands of people. In Turkey there are some researches about fringe area today. They inquire different development trends of fringe areas. In addition there are qualitative judgment related to interaction sprawl and travel behavior but there is no quantitative research about it. Therefore, this study has been planned to understand how the development of fringe in İstanbul affects transportation system. It will be tried to explain influence and importance of urban sprawl on urban transportation and travel behavior.

1.1. Aim of the Study

"Urban expansion and urbanization of rural area is a dynamic process because rural people moved off the farms, and residents of the densely populated central cities dispersed to surrounding suburbs. Enabling this dispersion are investments in new

infrastructure such as roads, sewers, and water supplies" (Heimlich and Anderson 2001).

Technological developments in the field of infrastructure and increasing population make the urban sprawl inevitable. Furthermore, increasing car ownership and changing standard of living direct people to urban fringe areas and promote sprawl formation. People who settle in urban fringe never break off connection with the city center. They maintain their daily routines within the city and there exists an everlasting trip between urban core and sprawl. In terms of transportation and travel behavior between sprawl and urban, the primary argument focuses on high levels of dependence on cars for transportation and greater distances between destinations. Impacts of these could include more and longer daily trips and greater traffic congestion, reducing access to services or jobs (Weber and Sultana 2005). Furthermore, driving private car is preferred by people living in sprawl area because it is more comfortable and it gives ease of access to where they want to go. In recent years, improvements in automotive sector have been also effective on the increases in these preferences. Accretion of dependence on private car, preference living in sprawl areas, and insufficiency of transportation system cause traffic congestion.

At the present day many big cities face traffic congestion problem. One of these cities is İstanbul. It has become more bothersome due to especially the increase car ownership after 1970 and rapid expanding of cities in urban fringe after 1980. In the literature, observations about interaction of urban sprawl and transportation have been gone increasing in recent years. Urban sprawl is blamed that it causes many traffic problems. These problems especially about commuting time created by spreading cities (Crane and Chatman 2003, Gordon and Richardson 1997) have been searched. Moreover, researches about influence of urban sprawl on commute distance (Schwanen, et al. 2004), traffic congestion (Johnson 2001), air pollution, transportation cost (Carruther and Ulfarson 2003), and high level of dependence on cars (McCarthy 2004) have been performed. The results of these researches reveal that sprawl causes more driving, more dependence on car, more spent of time in traffic. As a result, these negative effects act whole city and daily life by causing traffic congestion and air pollution.

However, there is no quantitative research about interaction of urban sprawl and transportation in Turkey. On this account the aim of this study is to analyze influence of urban sprawl on transportation system and understand interaction of urban sprawl and

travel behavior in İstanbul. In this context, this thesis examines the influence and importance of urban sprawl on trip travel characteristics within İstanbul and investigates accreting extra imposition of development of sprawl in İstanbul traffic.

1.2. Methodology and Data

Poor infrastructure in transportation system or misallocation of investment, new developments in metropolitan urban fringe cause people to spend more time in traffic. In this research characteristics of trips between the fringe area and the urban core have been analyzed, and travel behavior caused by development of sprawl has been examined. Time and distance of trip, trip modes, origin and destination of trip, purpose of trip and many activity analyses have been investigated, and the reasons effective in these preferences have been analyzed. The differences between the trips made by people living in city center and urban fringe have been observed. In addition, the changes and problems in traffic of city created by sprawl have been examined.

First of all, in this study, review of literature has been done to conceive definition of urban fringe, urban sprawl and development process of these terms. In literature, on account of lacking common definition, firstly urban fringe and sprawl terms have been determined. To understand development and transformations of urban sprawl in İstanbul, previously spatial development, planning process and population growth have been inquired. Then previous studies on İstanbul fringe area have been analyzed. It has been used map drawn up by İstanbul Metropolitan Planning and Urban Design Center (IMP) in 2007. The map shows boundaries of urban core and urban fringe areas. In that study, it has been used population potential map, development process of settlement area and previous definition about sprawl in İstanbul to define boundaries of urban core and urban fringe area. Definition map of urban fringe area by Doğru which is drawn in 2002 has been used as reference. It has been updated by using population potential map and development map of settlement by years. The study carried by Istanbul Metropolitan Planning and Urban Design Center is still in progress therefore the definition of urban core and urban fringe boundries is subject to change.

In addition, transformation of urban fringe which have taken place in the process of development of İstanbul is explicated. This transformation, within the context of plans of environmental regulations made for the overall city, especially after 1980, has

depended on the researches for entire İstanbul. Macro plans have been analyzed and aimed to understand the process of development by comparing with land use characteristics of today. Spatial development of industrial and residential areas direct urban development have been analyzed. Changes and development in residential areas and the decentralization of industrial areas have been analyzed to explicate process of development in İstanbul. Periodic development process and spatial dispersion of these areas have been analyzed by using Geographic Information System (GIS). Besides, population growth rates have also been searched. In this way population mobility in urban fringe was tried to understand. Data of the Turkish Statistical Institute (TURKSTAT) has been used. Population values of the year 2005 which were calculated by the İstanbul Metropolitan Municipality (IMM) in transportation research based on that of the year 2000 have also been used. It is used exponential increase method to calculate 2005 population. However in some districts which are under populated it has been got access to vast accretion of population. Therefore it has been implicated age structure in projection to counteract it.

Furthermore interaction of urban fringe and transportation has been searched. The connection between fringe areas and the main roads (E-5, TEM, Şile Road and orbital roads) of İstanbul have been analyzed. With the new linked transportation connections it is tried to understand how development is directed. GIS also has been used for this study. New roads and spatial development process in İstanbul overlapped in ArcGIS. Connection between fringe area and urban core area has been evaluated and trips between these areas are explained. Distributions of trips between urban core and urban fringe have been obtained by using survey of İstanbul Transportation Master Plan which is executed by IMP. This study includes İstanbul and Gebze. It includes the survey of the Transportation Master Plan which was addressed on overall 90.000 houses. Transportation Master Plan Household and O-D survey performed between dates March 2006-March 2007. It was visited 90.000 household, and it was got 80 % answering ratio and totally interviewed 263.768 persons. Also it was employed self weighted, multistage, stratified cluster sampling. Sampling rate is 2, 2 %.

In the thesis, it has been analyzed first phases (ilk kademe) in urban fringe area. Sampling rates of first phases in case area are more than 1.0 %. First phases which has less sampling rate than 1.0 % were discarded to make a better statistical evaluation. Thence only Göktürk was discarded because sampling rate of Göktürk is 0, 3 %. Consequently, case area includes 17 first phases that are Çavuşbaşı, Bahçeşehir,

Beylikdüzü, Esenyurt, Gürpınar, Kıraç, Yakuplu, Arnavutköy, Boğazköy, Bolluca, Haraççı, Taşoluk, Bahçeköy, Akfırat, Orhanlı, Alemdar, and Ömerli. These areas will be mentioned in chapter 5.

The characteristic of trips in case study are determined according to some variables. Variables include;

- number of auto,
- number of worker,
- number of house owner person,
- average household income.

Besides trip data have been evaluated. Distribution of trip mode and purpose has been investigated. Trip time has been calculated as minute by Microsoft Office Access. Trip distance also has been calculated as meter. Distance between origin and destination points of trips has been calculated using TransCAD shortest path tool.

With this study, the negative or positive effects of unconsciously added load to the city traffic in İstanbul by sprawl will have been determined. It will be implemented travel behavior survey and comment about results Thereby, with decisions made according to the results obtained better quality accessibility will be provided.

1.3. Structure of the Thesis

This thesis includes four chapters except introduction and conclusion parts.

In the second chapter, development process of metropolitan areas and new development process of cities in urban fringe is examined. In addition driving forces for sprawl are determined and alternative strategies against urban sprawl are determined.

In the third chapter, different development process of urban fringes in developing and developed countries are tried to be explained through samples. Then fringe development process in Turkey is explained. In addition interaction between transportation and urban sprawl is criticized.

In the forth chapter, firstly development process of İstanbul is analyzed. Then development and transformation process of urban fringe in İstanbul are determined related to population, industry and residential settlements. Transportation development process in İstanbul and general characteristic of İstanbul transportation are also explained.

In the fifth chapter, urban core and urban fringe areas in İstanbul are defined. Trip characteristics of fringe and urban core area are analyzed. Some variables are examined. Travel behavior in sprawl and urban core areas are compared each other and other research results.

In the last chapter all study is evaluated. General comparative discussion about travel behavior and sprawl is implemented.

CHAPTER 2

NEW DEVELOPMENT AND GROWTH PROCESS IN METROPOLITAN CITIES

The change in cities after industrial revolution, increase in motor vehicles, developments in communication technology and increasing population in 20th century were cause of the city growth in time and change interaction with others. With these changes, cities of industrial revolution getting free of just to mean the city, namely the form of traditional city, it exposed a new form 'metropolitan cities'.

"Motor vehicles which especially became widespread in 20th. century expand daily connection areas and integrated settlements in a very wide area. Increase in population in the face of these, environment getting under control, technological success and developing a complex social organization are the interconnected processes which advanced urbanization. Economical and demographical growth gathered speed and transformation process of cities to metropol started after sovereignty on an environment in which there are other cities" (Özçevik 1999).

Metropolitan area concept first started to use in the United States of America. In 1910s it is brought forward that in Chicago, on a specific communication, transportation, specialization and organization level mutual interaction is changed in several ways, the working place and living place are diverged from each other rapidly, in environment suburbs existed, the metropolitan city which is in center of spreading of relations commands and controls in economic social and management relations and metropolitan area is introduced as a new social and economic module (Özçevik 1999).

The rapid urbanization process which was by the second half of 20th century started to be unfastened as from this date. According to developments, change in the structure of metropolitan cities is occurred. These developments occurred in different form and time in respect of the development level of the city.

Especially after 1950s, development in out of city center increased. The metropolitan city event which is the highest level of development, after reaching to a specific saturation it started to affect environs of the city. Technology, private cars ownership, easiness in communication triggered this development.

"Metropolitan expansion since 1950 has occurred because rural people moved off the farms, and residents of the densely populated central cities dispersed to surrounding suburbs. Growth is spilling out of metropolitan areas, as population disperses to rural parts of metropolitan counties and previously rural nonmetropolitan counties (Heimlich and Anderson 2001). This dispersion are supported by investments in roads, sewers, and water supplies" These investments, economical and technological developments, increase in population and new consumer demands composed a new structuring area out of the city center and gave rise to fringe concept. The studies towards explaining this concept are intensified after 1950s.

2.1. Defining Urban Fringe and Its General Characteristics

The definition of fringe was in different ways. There is no a common fringe definition. Fringe has a heterogeneous structure and differs according to place and time. Therefore it fails to recognize the uniqueness of the urban fringe.

"Many terms are found in the literature, implying different delimitations and levels of analysis. The following list illustrates the diversity in terminology: rurban fringe (Schenk 1997), urban fringe (Kumar 1998, Kabra 1980, Hill 1986), rural hinterland of the city (Kundu 1991), the city's countryside (Bryant, et al. 1982), peri-urban fringe (Swindell 1988), rural fringe of the city (Leeming and Soussan 1979), peri-urban areas (Dupont 1997, McGee 1991), desakota regions (McGee 1991), and metropolitan fringe (Browder, et al. 1995, Rao 1991, Saini 1989)" (Dissertations University Of Groningen 2007).

The fringe concept became to be surveyed in literature in 1940s and 50s. The first definition is made by American studies. Later studies which were made in Australian and European metropolis started to take a place in literature. The fringe concept is undertaken in different ways in literature and in definitions content of the study changes according to time and place.

The urban fringe concept was the first used in a study which was done by T.L. Smith in 1937. "According to Smith fringe as the built up area just outside the corporate limits of the city" (Velibeyoğlu 2004). Later some studies were done on this subject and new definitions were put off. Definition of fringe has been changed according to content of studies. Pryor analyzed the fringe in two groups as urban fringe and rural fringe,

realizing the change of land use depending on distance. He described urban fringe as sub zone of the rural urban fringe in contact and contiguous relation with the central city, exhibiting a density of occupied dwelling higher than the median density of the total rural urban fringe, a high proportion of residential, commercial, industrial and vacant as distinct from farmland, and a higher rate of increase in population density land use conversion, and commuting. And he also described rural fringe that sub zone of the rural urban fringe contiguous with the urban fringe, exhibiting a density of occupied dwellings lower than the median density of the total rural urban fringe, a high proportion of farm, as distinct from non- farm and vacant land, and a lower rate of increase in population (Velibeyoğlu 2004).

Thomas L. Daniels describes fringe according distance and population as "the area within 5-50 miles of a city that has scattered, low density development fewer than 500 people per square mile typically on 1-10 acre lots."

Ramachandran described fringe as "the rural-urban fringe is an area of mixed rural and urban populations and land uses, which begins at the point where agricultural land uses appear near the city and extends up to the point where villages have distinct urban land uses or where some persons, at least, from the village community commute to the city daily for work or other purposes" (Dissertations University Of Groningen 2007).

Heimlich and Anderson emphasis fringe as "the urban fringe is that part of metropolitan counties that is not settled densely enough to be called urban. Low-density development (2 or fewer houses per acre) of new houses, roads, and commercial buildings causes urban areas to grow farther out into the countryside, and increases the density of settlement in formerly rural areas."

Gallent, et al. in their study on urban fringe area in England undertake the fringe area in six dimensions.

Location: The urban fringe is a zone of transition where urban areas meet the countryside. The characteristics of fringe areas will also vary according to distance from the urban edge.

Land use: The urban fringe is often the location of particular land uses and functions. These areas are often characterized by a wide variety of suburban related uses, which are in many instances, space-demanding, such as water treatment works and golf courses.

Population density: As in delimitations of rural areas, particular population characteristics are frequently attributed to the fringe, though not in the UK. In the United States and in Canada, precise and rigorous definitions of urban fringe have been employed in population censuses for many years. In Canada, the urban fringe has been a defined geographical unit since 1961: it is said to include all small urban areas (with a population of fewer than 10 000 persons) within a census metropolitan area (CMA) or census agglomeration (CA) which are not contiguous with the urban core of the CMA or CA. Likewise, the US Bureau of the Census has defined geographic entities for the collection of land use and population statistics. It includes the 'urban fringe', and describes it as comprising 'rural areas in metropolitan counties.

Spatial economy: Also in a US context, Hite (1998) sees the urban fringe as possessing certain (spatial) economic characteristics and efficiencies. Hite argues (1998) that '"urban" and "rural" are labels applied to different parts of space based on its [economic] uses. The urban fringe 'is the frontier in space where the returns from traditional and customary urban land uses are roughly equal to the returns from traditional and customary rural land uses'. Spatially, the urban fringe is economically transitional.

Transitional/interfacing zone: Many definitions of the urban fringe emphasize its transitional nature, or its role as an interface between urban and rural areas. A recent European study of three urban centers (Newcastle/Gouda/Leidschendam) by Reurba (2001) described the urban fringe as a 'transitional location where city and countryside overlap and is found at the edges of settlements and developed areas. It will not commonly have any major development or infrastructure, and may have agricultural or recreational activities on a fairly large scale. It can also contain scattered small communities and freestanding residential and commercial developments.'

Landscape: The fringe is often perceived as a focus for un-neighborly land uses, and sometimes as an untidy landscape prone to the abuse of both legal and illegal tipping. But it is also recognized that the urban fringe may contain a diversity of landscapes, host important habitats and boast significant levels of biodiversity (Gallent, et al. 2004).

The urban fringe commonly defined as the transition zone between the city or urban areas and the surrounding countryside (Lamb 1983). Ralph E. Heimlich and William D. Anderson define the urban fringe as low density settlement 0.5 acre lot so larger in metropolitan counties (2001). The importance of the land use dynamics at this

interface is underestimated or at least undervalued, because measurement of land use change is difficult" (Theobald 2001).

Jed Griffiths has described the fringe as the last frontier of planning. According to other researchers if fringe is a last frontier, it means that it is an indescribable last frontier.

"Many commentators, point out social characteristics of fringe. Foot (2000), for instance, suggests that the Italian periferia can be seen as a focus for certain ways of living; more traditional neighborhoods exhibiting positive qualities of community, neighborliness and solidarity; together with other often newer peripheries exhibiting negative features, including crime, unemployment and delocalization" (Gallent, et al. 2004).

"It is not merely an extension of town into country, or a transitional aberration delaying the onset of real countryside: it is that land lying between urban areas and countryside with its own separate and frequently unique characteristics. These are:

1. a multi-functional environment, but often characterized by essential service functions;
2. a dynamic environment, characterized by adaptation and conversion between uses;
3. low-density economic activity including retail, industry, distribution and warehousing;
4. an untidy landscape, potentially rich in wildlife" (Gallent, et al. 2004).

A Cumberland County Council report of 1957 implied urban fringe areas:

a. contain the city to a planned population and to prevent its outward growth;
b. provide a belt of countryside between the city and rural towns of the county;
c. provide an escape from urban living with spiritual, mental and physical relaxation;
d. provide for rural pursuits close to the city;
e. provide for institutions which require a rural site;
f. provide major reserves for Government use;
g. provide for major Open Space Reserves;

h. provide for a united area around the city which can be planned countryside, providing for husbandry of the land, desirable standards of living, working and playing, and maintenance of beauty, character and tradition (Bunker 2002).

2.2. Definition of Sprawl

Sprawl is a worldwide problem. Especially after 1980 sprawl took large part in literature. According to changes in the fringe by location and time gave rise to different definitions of sprawl. In definitions there are common and different parts. But in general common point is being accepted as an unplanned development.

Sprawl can be defined in a variety of ways. According to The Sierra Club, "sprawl is low-density development beyond the edge of service and employment, which separates where people live from where they shop, work, recreate, and educate - thus requiring cars to move between zones" (Sierra Club 2007).

Ewing (1997) defines sprawl as the combination of three characteristics:

1. leapfrog or scattered development;
2. commercial strip development; and
3. large expanses of low-density or single-use developments as well as by such indicators as low accessibility and lack of functional open space (Johnson 2001).

"Nelson and Duncan have synthesized a broad definition of sprawl as unplanned, uncontrolled, and uncoordinated single-use development that does not provide for an attractive and functional mix uses of and/or is not functionally related to surrounding land uses and which variously appears as low density, ribbon or strip, scattered, leapfrog, or isolated development" (Pendall 1999).

The US Department of Housing and Urban Development (USHUD, 1999) defines sprawl as "a particular type of suburban development characterized by very low-density settlements, both residential and non-residential; dominance of movement by use of private automobiles, unlimited outward expansion of new subdivisions and leap-frog development of these subdivisions; and segregation of land uses by activity".

Richmond (1995) adds the following indicators of sprawl: decentralized land ownership and fragmentation of governmental land-use authority, and disparities in the

fiscal capacities of local governments. Downs (1998) adds two more characteristics of sprawl to those presented above: widespread commercial strip development, and no low-income housing outside central cores (Johnson 2001).

"Some researches analyze negative sides of sprawl. The negative impacts of sprawl leapfrog development and low-density and unlimited outward expansion is the same as those that define the positive aspects of sprawl. Definitions of sprawl are difficult to quantify, as metropolitan areas may have some but not all of the characteristics of sprawl and to varying degrees" (Johnson 2001). In addition, Orfield (1997) has drawn attention to the negative political and fiscal impacts of suburban sprawl, not just in the areas that are experiencing sprawl but also in the inner cities and inner-ring suburbs that are losing population to farther-out suburban areas.

The Sierra Club emphasis negative impact of sprawl as follows:

- Traffic congestion.
- Longer commutes that steal time from family and work.
- Worsening air and water pollution.
- Loss of farmland, open fields, forests and wetlands.
- Increased flooding.
- Raised taxes to pay for services police and fire departments and infrastructure new schools, roads, water, and sewer structure (Sierra Club 2007).

There is no widely accepted definition of sprawl. Most definitions have some common elements. To summarize a variety of definitions or characteristics of sprawl, having in common:

a. Segregated land uses: Geographic separation of essential places such as work, homes, schools, and shopping,
b. Causes of an externality: Emphasis on the automobile for transit, loss of productive farmland, air and water pollution et al,
c. Demand of self behavior: A push for growth the further side of metropolitan boundary,

d. Aesthetic judgment: Low-density and mixed development that is dispersed and uses a lot of land; residential and employment densities that are generally lower than those in further-in suburbs or in the central city,
e. Process of population and urban growth: A process of growth occurs over some period of time,
f. The inability of local governments and poor planning: lack of devising common policies to address perceived negative characteristics of the current growth regime.

2.2.1. Driving Forces for Urban Sprawl

Sprawl as a part of development focuses on fundamentally land development and transformation of land uses. Changes in land use are the end result of a variety of forces that drive the millions of separate choices made by individuals and governments. It is possible to mainly summarize driving force of sprawl as below.

1. Urban expansion and population growth

Increase in population is an undeniable fact. The great majority of world population lives in cities. Both immigrations and the natural increase in population speed up the growth of cities. Rapid population growth and immigration also give rise to city widening and sprawling.

2. Social effects

Change in life style, increasing air pollution, noise and crime in center gave rise to move to out of cities. Although it is not explained well changing social trends with effects of other variants, for instance, demand for low density, preference of places in nature direct people out of city.

3. Employment, economic development, and technology

"Developments in information and communication technology have been a major driver in the recent U.S. economic expansion. New technologies have changed the economics of spatial decisions, both for consumers and businesses, and are facilitating the existing trend toward a more dispersed economy. Although the new

technologies will technically enable firms and residents to disperse to rural areas, they are more likely to relocate both to lower cost metropolitan areas and to suburban and exurban locations within metros" (Heimlich and Anderson 2001).

4. Infrastructure and transportation

Metropolitan areas grow organically, like a living thing, with stages of growth that are palpable and predictable. After the new housing developments are built and occupied, the new residents realize they need new schools and improvements in the roads, sewers, and water supplies servicing the new housing; the expanded infrastructure then attracts more housing at higher densities. When a critical mass is reached, shopping centers and businesses follow the population, to serve them and to be closer to the labor force.

Investments in infrastructure, such as roads, sewers, and water supplies, can be one of the most important drivers of urbanization, since infrastructure provides the essential framework for development (Heimlich and Anderson 2001). A study in Maryland showed that highway construction was a key factor in growth, with new roads preceding migration outward from the cities (Heimlich and Anderson 2001).

Population growth and the pressure on the land increase requires closer to the better-serviced and accessible areas along the roadsides. On this reason sprawl firstly occur trough transportation axes in general.

5. Poor planning and management

Local governments generally do not develop adequate capacity to plan for and manage growth until it is too late to effectively channel development. Planning and zoning have generally been upheld by valid regulation. Local governments often fail to appreciate impending growth facing them, and generally lack capacity to develop adequate responses before growth overwhelms them.

"Changes in land use are the end result of many forces that drive millions of separate choices made by homeowners, farmers, businesses, and government. Economic growth increases income and wealth, and preferences for housing and lifestyles, enabled by new transportation and communications technologies, spur new housing development and new land-use patterns" (Heimlich and Anderson 2001). Growth, demands and land use change are anticipated results.

2.2.2. Alternative Development Strategies against Sprawl

Sprawl acknowledged as undesirable form of development. Sprawl also has been seen as cause of diverse problems. Economic, social and environmental disadvantages of sprawl have been inquired in lots of searches. Therefore a number of land-use strategies that include sprawl as well as certain alternatives to sprawl have been generated (Razin 1998), but urban sprawl has complex structure and it differs from country to country. Therefore there are different strategies to fight sprawl. Some prevalent development strategies against sprawl are defined in this context.

1. Transit-oriented development (TOD) aims to design livable communities that are centered on high quality train systems. It is defined as walk, livable, mixed-use communities built around transit stops. Train stations are prominent places of city. It is easy to access stations by walk. It is provide maximize access to public transport and reduce dependence on car.
2. Urban growth boundaries (UGB), one antidote to sprawl, have been defined by Stoel as a line drawn around a city at a distance sufficient to accommodate expected urban growth. Beyond the boundary, urban development is prohibited (Johnson 2001). It is intended to control urbanization by designing higher density area inside the boundary and protect farmlands and natural resources around city.
3. Smart growth based on rehabilitation land-use to make them more sensitive to solve problems of lack of housing diversity, traffic congestion, and environmental confusion. When city is growth, smart growth purposes to provide developed infrastructure, acquiring certain open spaces and increased social equity. 10 guidelines for smart growth are:

- Mix land uses,
- Take advantage of compact building design,
- Create housing opportunities and choices for a range of household types, family size and incomes,
- Create walking neighborhoods,
- Foster distinctive, attractive communities with a strong sense of place,

- Preserve open space, farmland, natural beauty, and critical environmental areas,
- Reinvest in and strengthen existing communities & achieve more balanced regional development. Provide a variety of transportation choices,
- Make development decisions predictable, fair and cost-effective,
- Encourage citizen and stakeholder participation in development decisions of Smart Growth (New Urbanism 2007).

4. "The sustainable development strategy, derived in large part from the World Congress on Sustainable Development held in Rio de Janiero in 1992, is designed to limit growth to the degree that public facilities and services are in place to accommodate this growth" (Johnson 2001).
5. "New urbanization" derived from traditional urbanism and a basis for smart growth. It is trend had its roots in the work of maverick architects and planners in the 1970s and 1980s that coalesced into a unified group in the 1990s. From modest beginnings, the trend is beginning to have a substantial impact. More than 600 new towns, villages, and neighborhoods are planned or under construction in the US, using principles of the New Urbanism (Newurbannews 2007). Principles of new urbanization are walk ability, connectivity, mixed-use and diversity, mixed housing, quality architecture and urban design, traditional neighborhood structure, increased density, smart transportation, sustainability and quality of life.

There are also some other policies to control urban sprawl that frequently based on land use plans at the national, regional and metropolitan levels such as zoning and land use policies, transportation investment decisions, and taxation.

2.3. Summary

There are many researches about urban fringe and sprawl terms which are occurred in accordance with development in 20th century. Each researches investigates these terms from own view point. In addition to this sprawl have different characters to time and place. On this account there is no mutual definition of these terms.

In the literature survey, it is noticed that sprawl has been searched in terms of physical and socio economic characteristics, impacts, negative effects especially in

environment and transportation. Sprawl has been criticized that it causes many negative effects. Criticisms include following items.

- air pollution caused by car using,
- spent of time in traffic,
- environmental and water pollution,
- people live in fringe area driving farther,
- car dependence, wasteful use of land,
- traffic congestion,
- lengthened travel.

Despite these negative effects, people has preferred to live in urban sprawl and they have maintained connection to city center for daily activities either school or work. Offices of people live in fringe area generally are in urban area instead of sprawl or rural areas. And also many activities such as school, shopping and cultural are in the city center. Distance between these two areas and lack of public transportation are considered daily trips can create diverse problems. In spite of these problems people preferred to live in sprawl. Therefore it is important to research interaction sprawl and travel behavior.

In addition to defining of term, impacts of sprawl on transportation system have been analyzed in recent years. Attention focuses on high levels of dependence on cars, trip distances, and increasing trip time. Then sprawl creates more and longer daily trips and traffic congestion. Besides, many other subjects have been studied. They will be mentioned in the next chapter.

In this study, urban fringe treats according to Ramachandran description as “the rural-urban fringe is an area of mixed rural and urban populations and land uses, which begins at the point where agricultural land uses appear near the city and extends up to the point where villages have distinct urban land uses or where some persons, at least, from the village community commute to the city daily for work or other purposes”. In parallel with urban expansion will be analyzed in respect of demographical, physical, land use characteristics and planning process. Planning study and daily transit relation development of transportation system also will be researched. Then urban development and these studies are assessed. In this context, transformation process and characteristics of sprawl in developed and developing countries will be studied in the next section. And it will be surveyed interaction between sprawl and transportation.

CHAPTER 3

URBAN FRINGE AND TRANSPORTATION SYSTEM

With the industrial revolution in 18th century people started to immigrate to big cities- where production facilities are seen. Usage of technology development in agriculture, too and replacing machines instead of man power forced people to immigrate to cities. After the industrial revolution a rapid process of urbanization started. Cities which started to be in a great production process until 19th century, in this process were in a bad situation from the point of life standard. A new urban land is needed for the intensive population in cities. New suburbs which are near cities and transportation facilities started to be built to provide the lack of urban land. The private car ownership in 20th century, developments in highway system gave rise to suburbs diverge from city. Furthermore, in this century the development in production needed bigger places and as a result of this they took place in more widely areas outside the cities. The industry which is outside the city engendered the necessity of house in its close quarter. As a result, an industry and house lands which are dependent on city started to build outside the city. These places glamorized more by making the needed infrastructure for them.

Although this process of development is the same in its general framework, it has some differences in developing and developed countries. Experiencing the same process of development in different time periods causes diversification of development. Discrepancy of population growth rate, technology and utilization resource and so forth are different in both countries. Development which is different in terms of time and process is evaluated in following parts separately as developing and developed countries.

3.1. Development and Transformation Process of Urban Fringe in Developed Countries

In most traditional European cities, suburban areas usually became the choice of the lower-income laboring classes in 17th-century. This outward dispersion accelerated with the widespread arrival of the steam railroad in the 1850s. Suburban villages sprang up along the rail lines. The introduction of the electric trolley car in the 1880s permitted an even larger segment of the population to leave the center city behind, as trolley car lines followed major streets to the edges of the city. The suburban expansions of the late 19th century, however, did not totally encircle the city. Being rail-based, the overall pattern was one of a few routes radiating out from the city center (where commerce and industry was still located), with residential development focused within a few blocks of either side of the transit line. This left huge swaths of open space between the rail lines (Planning Commissioners Journal 2006).

In England, social and physical changes were formed because of development occurred in 18th. "At the end of the 18th century, scattered middle-class suburban villages surrounded London. By the 19th century the process of building suburban villas by the middle-class was a commonplace practice" (Mubarak 2004).

The increase in communication and car ownership in 20th century started the process of transformation of urban fringe. Until this period, fringe gave shelter to middle income people. After this period, the low income group living in urban fringe started to give its place to middle and high income groups. With developments in transportation new sprawl areas started to depart from cities more. The wide lands are appropriate for new process of development which needs big areas in urban fringe. Therefore, the production units which were moved to urban fringe composed a low intensity and limited structure in this area.

"The nature of American sprawl changed radically with coming of the inexpensive automobile in the 1920s. No longer limited to close proximity to major streets and trolley lines, low density development expanded to previously inaccessible areas, often leapfrogging over undeveloped areas to more distant locations. Independent suburban villages, with their own land subdivision, planning, and zoning authorities, grew rapidly" (Planning Commissioners Journal 2006).

After World War II, a new system of development was implemented nationwide, replacing neighborhoods with a rigorous separation of uses that has become known as conventional suburban development, or sprawl (Newurbannews 2007).

By the end of the 20th century, sprawl had reshaped metropolitan areas across America. While central cities still remained a focal point for government, financial, and large corporation day-time office workers (and night-time theater goers), they had been drained of newer production industries, and of middle- and upper-income residents (Planning Commissioners Journal 2006).

In advanced industrial societies such as Northern America and England things that seen for last 20 years from the city center were some management and administration functions which are dependent inspection and coordination associations in this city, moving to suburbs called with some names such as new cities, satellite city around (Kıray 1998).This case in urban fringe gave rise to area to transform itself to a heterogeneous structure. In social and land use cases it has a heterogeneous structure. There are mixed land use such as house, shopping, industry, big offices and have a lower intensity from the city area. Although sprawl has a disconnected structure from city, difference between sprawl and urban reduced so much. There are not great differences about socio-cultural, economical and technological usage.

But despite these positive developments, with having a low intensity of structure and spreading to wide areas, increase of using of car have come up many problems. First of all there are problems in transportation and air pollution problem is in a scary size. Although the urban fringe performs a life style which is away from noise and chaos of city, these people who are dependent on city in their daily life have some traffic problems between city and urban fringe. “In the outlying suburb of Washington, businesses, shopping centers, and residential developments encroach on land that recently consisted of farms and woods. Mass transit is scarce in these areas, and highways have expanded and re-expanded to meet increased demand. But larger highways have failed to reduce congestion. In 1998, a federally sponsored study found that traffic delays caused the average resident of the Washington area to waste two full work weeks per year while stuck in traffic” (Stoel 1999).

3.2. Development and Transformation Process of Urban Fringe in Developing Countries

In these countries there is trade development before the industrial revolution. In developed countries big coastal towns which were made for distribution of industrial products later had transformation with technological developments. In these countries, development mostly has been affected by crowds who have come to cities with emigration, small or medium scaled industry and location of advanced technology. The differences of sources, the difference in usage in technology, feebler institutional and professional structure and in parallel with these growing speculations differentiate the process of development.

In the developing countries, developing of the fringe has appeared in parallel with transformation process of cities. This development which was realized after 1960 was affected by site selection of advanced technology and medium scaled industry and emigrations. Advanced technology took part far away from city center and medium scaled industry took part in urban fringe. People who migrated in city preferred places close to city because of the high land value in city center. Then, they started to become intense around middle scaled industry. After site selection of production advanced technology outside of city, development toward these areas gave rise to be settled vacant land among this area or agricultural areas to change function. In the main roadside or around the old small settlements new housing areas and working places started to occur.

The urban fringe has the characteristics of a confused, complicated transit area in which both the escapers from the city and people who migrated to city live. It encloses both country side and urban characteristics.

Differently from the developments in fringe of developed countries, in spite of the increase in communication and transportation opportunities in developing countries there is still the difference between these two areas. In the fringe area which has a heterogeneous structure in terms of land use, when moving towards field from city it is intense first, then, a scattered structure which is becoming sparse attracts the attention. Moreover, the agricultural areas in urban fringe are gradually depreciating; on the other hand, an urban income is becoming a current issue. In these areas where the substructure has not been done exactly, doings of urbanization creates an unplanned

development. In other words, a pre-industrial city does not get transformed via the industrial phase into a post-industrial urban structure and pattern according to Western models of the non-planned city.

The most important differences from the Western post-industrial city are the following.

- The size and variety in low-cost housing, which determines to a considerable extent the morphological pattern in the Third World and is not comparable with a pattern in the Western world.
- The relation between urbanization and social change. In the industrialized world the spatial component of urbanization was coupled with a strong social-cultural component that changed the rural behavior pattern. In the developing countries this last component is less evident and the importance of the belonging to an extended family remains. Hence we observe there the phenomenon of urban villages.
- The importance of the informal circuit in the urban economy of the Third World is fundamental. One can not state that this is just an intermediate stage leading to formal employment in industrial and tertiary sectors.
- The strength of the cultural tradition has its impact on the morphological pattern in the sense that traditional elements are sometimes pertinent components of the urban form (Vanneste, et al. 1999).

3.3. Development of Urban Fringe in Turkey

"Turkey, like so many other nations in the twentieth century, has been transformed by rapid urbanization. As is the case everywhere, urbanization, in Turkey is an inherent component of the process of modernization. Migration, the growth of urban economies, and rapid expansion of cities are integral features of the set of structural changes we call modernization. Urbanization, however, is not merely a synonym for modernization or industrialization. Instead urbanization refers to a particular element of the development process- the concentration of population in relatively large settlements. Concentration of people into large settlements is associated with distinctive economic, social, and political changes, such as specialization of the labor force, alteration in

family structure, and changes in the political attitudes of urban dwellers" (Danielson and Keleş 1985).

The primate city fact which occurred in 1950s when the characteristic of settlement is changed and the urbanization started with its wide meaning, at last, after 1960s has gone towards metropolitan area with changes on society's part (Kıray 1998). By this date the city which has developed around the existing settlements has started to expand. After that date, cities in Turkey have been spreaded to urban fringe an increasing rates.

In 1970s, increasing in automotive sector affected urban form. Automotive transportation has had the same effect on the Turkish metropolis as in cities all over the world, permitting more dispersed location of jobs and residences, particularly along the main highways that radiate outward from the urban core. Rising land prices have pushed development outward in search of cheaper sites. Factories no longer cluster around port and rail facilities, and newer industries are highly decentralized in the major Turkish cities. Housing development reaches far beyond the limits of public transportation, in the form of both low-density conventional housing and squatter dwellings (Danielson and Keleş 1985).

In the urban fringe where urban structures have started to raise together with squatter housing which speeded in 1960s, development of mass housing and cooperative housing after 1970 also have taken part. The character of countryside has taken urban characteristics. The huge agricultural areas were divided into small pieces and the land speculation started. Having these developments in the place, the social and economic structures are changing, too. It can be seen that the number of workers in non-agricultural sector has increased due to the increase in non-agricultural activities. Additionally, those who immigrate to cities preferred these areas as they were cheaper lands, and this gave rise to a mixed structure in the fringe.

After 1980s, urban land market entered into a different period, in Turkey. In this period big scales about housing were aimed and laws were adopted directed to this aim. With the problems such as congestion, infrastructure and environment, car ownership became further widespread, and the belt highways, credit facilities, urban land market accelerated. The urban fringes where those who emigrate made room for accommodation in previous periods now came under the areas of cluster housing and the following demands of cooperative of medium scaled group according to working place or job. The high income groups who were stucked in city could not maintain the

non-mandatory assurance, house and environment prestige. Like small groups, the high income groups organized to open lands for housing in metropolitan urban fringe (Doğru 2002). The demand of high income group developed significantly, especially after 1990. The luxury housing areas in urban fringe were affected by the current usage of transportation and land use, and at the same time, they were determinative in building of many new transportation connections (Çekiç and Ferhan 2004).

3.4. Urban Sprawl and Transportation System

From date of first settlements to 19th century, form of urban figure on walking. These cities disappeared by effect of growth population and industry after mid of 19th century. Small cities located environs of train stations which are out of city so that train and tram enabled more fast access. In addition, cities were developed along transportation axles. After starting of using private car in 20th century, people preferred to move to surrounding areas of cities. Private car ownership has provided large freedom in people's travel choices. Development in transportation technology and regarding accretion of accessibility, new roads and infrastructure facility growth also acted people's spatial choices which have been efficient to form cities.

Early cities were compact, to make them easier to defend and to keep home, work and activities within walking distance of each other. Nevertheless most fashionable and respectable addresses tended to be located close to the center of town because of latent transportation vehicles and infrastructure (Frumkin, et al. 2004). But over time, cities sprawled beyond their original boundaries, notably after development in transportation. Many activities and people started to settle in urban fringe because of moving away from complex city life, high land price, air pollution and many other reasons. Besides, life in urban fringe area provides larger land, fresh air, placid space, low land price and so on. In the US, lower cost housing is often unavailable in peripheral areas and, as a result of not living close to their place of employment. In contrast to typical US cities, the most socio-economically disadvantaged areas in Australia are located in outer suburban locations, as opposed to the centre of the city. Higher income groups, on the other hand, will often make a conscious choice to distance themselves from employment zones and their negative externalities (Buchanan, et al. 2006). For that reasons people has expanded urban surrounding area and settled in

low density. “The highway system has been the major force for continued low density settlement and suburbanization. The barriers of distance continue to dissolve; factories and offices continue to move to where employees want to live” (Gordon and Richardson 1997).

New development in urban sprawl has the potential to affect travel demand. Characteristics of the new development such as size, type, shape and land uses have been criticized to affect how daily travel. The studies measure urban form and travel behavior in a variety of ways, use a variety of study designs, and consider a variety of spatial scales, from the neighborhood to the census tract to the entire metropolitan region (Frumkin, et al.2004). One of the important county-level studies was published in the late 1980s by Peter Gordon, Ajay Kumar, and Harry Richardson, which looked at the amount of time involved in commutes. They found that commutes in spatially large cities took more time than in small cities (Crane and Chatman 2003). In addition “travel behavior theory and other behavioral theories point to the importance of relationships between longer-term choices, such as residential location choices, and shorter-term choices, such as daily travel choices. Work by Domencich and McFadden (1975) and others on travel behavior theory recognized that daily choices about travel are related to choices about auto ownership, residential location, and job location (Handy, et al. 2004). One study focused on the impact of residential relocation on travel patterns in the United Kingdom found that there is an association between housing migration and increased commuting distances, with increased travel accompanying moves out of the central city. Research in Sydney found similar increases in travel time after moving out and also found that people had fixed travel mode preferences when traveling to work and that a change in residential location did not lead to a large change in travel mode after relocation. Research in Denmark by Naess (2005) and the US by Krizek (2003) have found similar findings (Buchanan, et al. 2006).

Like these, many researches about effects of sprawl on travel have been studied especially on commuting time, longer trip distances, and greater reliance on the car. Especially dependence on use of car is very important problem. “According to the 2001 National Household Travel Survey (NHTS), households without a vehicle made 34.1% of their trips by auto, 19.1% by transit, and 43.5% by no motorized modes; in contrast, households with one vehicle made 81.9% of their trips by automobile and households with 3 or more vehicles made 90.5% of their trips by automobile” (Handy, et al 2004). Sprawl is blamed causing these results in many researches. On the other hand some

research suggests that many people who live in sprawl would prefer more walking communities. Survey in Boston and Atlanta confirm there is indeed a latent demand for communities that permit less driving and more walking.

Now, accretion of trips both interurban and intraurban has become global phenomenon. People have covered longer distance for work or shopping in the course of time, and have drive more private car regarding economical growth. This situation is related to development of sprawl. In Turkey especially in the metropolitan area, it is similar to the world. New development areas in urban fringe of metropolitan cities have affected travel behavior but there is no research about this subject in Turkey. This study is the first to research influence of urban sprawl on daily travel behavior.

CHAPTER 4

ANALYSIS OF URBAN FRINGE AND TRANSPORTATION SYSTEM IN İSTANBUL METROPOLITAN AREA

4.1. Development and Transformation Process of İstanbul Metropolitan Area

İstanbul is a metropol which has always been at an important situation for Turkey. Besides its economic, social and cultural features, it is an important center with its historical and geographical position as well. İstanbul is the focus of activeness with this feature and it is on a continuous development process as the result of migration and its rapid population growth. Development process of metropolitan area started to show its effects in İstanbul after 1960s. But, the process that was experienced in İstanbul evolved differently from the developed countries. The city which had not completed its industrialization process yet and which experienced rapid population growth had developed unplanned.

The first Bosporus Bridge (Boğaziçi Bridge) which was opened to the traffic in 1973 and the connection roads directed the form of the city and accelerated the spread of the city. Afterwards, the second Bosporus Bridge that was opened in 1988 caused the city to expand towards north. At the same time, the roads which were constructed in order to obtain interior city connections affected the development of the city quite considerably. The increased automobile ownership of the people which was seen at the same term caused people to head out of the city and this situation was effective at the expanding of the town. İstanbul has developed as a one-centered city, however daily trips are expanded to large areas and this situation is being felt as a burden on the traffic.

The planned development of the city was aimed with the planning studies, but these studies were not successful because of some political and economic reasons. The city which had developed uncontrolled got into a rapid sprawl process. Due to the spreading of the town towards fringe, unplanned, and rapid development process in the

city has started to be insufficient for infrastructure. Especially traffic problems have become more evident.

"The development process of İstanbul, starting from its establishment until our day, has increased or decreased according to its population's economic and political situation, however, it is observed that, there has always been an expanding at the spill out of the city" (Sazak 2002). In this section, the evaluation of the expanding process that has seen in İstanbul and the evaluation of the issues which were effective at this process, like population, industry, residence and transportation, will be deliberated. Besides there four main topics, the plans that determine the development direction of the town and which comprise the whole city will be evaluated, as well.

4.1.1. General Growth and Development Process of İstanbul

İstanbul city has stood in the forefront at every term. The city has an important position for the country's economy; within time it has come into a situation of accommodating a very crowded population due to migration and population increase. On the other hand, the rapid increase of the population has brought some problems together with it. The center of the city which had arrived to a saturation point started to develop and expand city through fringe areas after 1950s. The town has continued its rapid development process until our day, and it accommodates various problems which were caused by this rapid growth in its structure.

The planning studies which were being made to the aim of organizing İstanbul's development started at the 19th century. Until 1930s, lots of planning studies were made at the urban scale. 1580 and 1593 numbered laws which were legislated in 1930s stated that, the municipalities which were greater than some certain level had to make planning. In this way, arrangement of city was made with the local implementation plans until 1950. In this term, the planning of İstanbul occurred around the prevailing historical city center and the growth continued according to plans which were being prepared in respect of one-centered growth model that expands through every direction and in the form of destroying historical city pattern and renewing it (İBB 1995).

In 1965, planning offices which were going to make the plans of İstanbul, Ankara and İzmir were formed with the decision of Council of Ministers. These offices were connected to Ministry of Public Works and Settlement. It was decided that, the

plan were going to be financed by Iller Bank. According to this decision, İstanbul Metropolitan Area Planning Office was established in 1966. In the same year, İstanbul Industrial Zones Master Plan was prepared by the bureau.

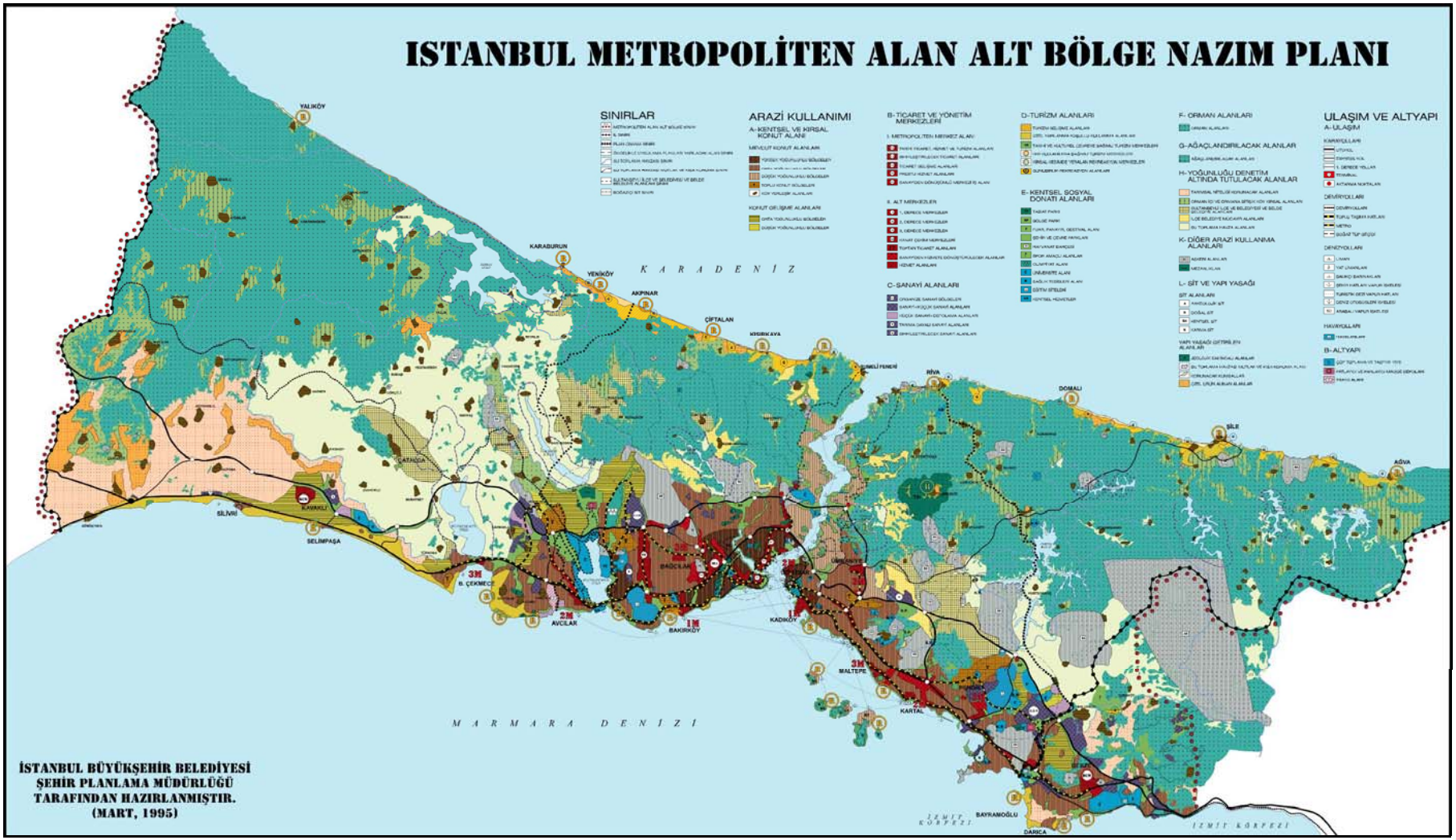
In the Industrial Zones Master Plan that was approved and become valid in 1966 it was emphasized that, growth should be taken into account in a greater frame than the settled area; it should be firstly thought within the limits of East Marmara and Thrace Sub-Region and afterwards within the limits of İstanbul's metropolis. It was anticipated that, at the regional level, the industry-service development of the cities like İzmit and Bursa should be supported and at the metropolitan level, the development of the industry, the observed growth tendency at the east edge should be supported through establishing Industrial Estate. It was suggested that, there was the necessity of organizing various industry regions also at the west edge and infrastructural investments should be used as a tool in designating the limits of development. In the plan, it was anticipated that, faster development of the east edge in contrast to the west could occur, and by forming a second axle in the west-east direction with urban fringe roads, decentralization would be easier (Yüzer and Giritlioğlu 2003).

Especially after 1970s, the development of globalization which was the dominant economic system at that term showed its effects more clearly in big cities. As a prolongation of this change, new structural changes occurred. Starting from the 1970s, mass housing implementations has increased and after the construction of the orbital roads, it fastened the process. However, these new settlements were swallowed by the city that had been expanding rapidly and uncontrolled, and they combined with the city. This process continues by repeating itself in the similar way. All of the vacant lands around the intensive urban core and villages turned to suburban areas. The city continued to grow without control by adding these suburban areas to its borders from every direction. It was observed that 1/25.000 scaled İstanbul Master Plan (1973) is insufficient on the basis of city growth.

In 1980, a metropolitan scaled plan firstly was done by Ministry of Public Works and Settlement. It was approved in 29.07.1980. The plan which was targeting the year 1995 was a 1/50.000 scaled Master Plan. The planning studies that were done after 1980 included planning decisions which supported the expanding policies of the town. Discharging operations of the production areas that are in the city center and planning orbital roads are decisions that support the expanding process of the metropolis. In the plan prepared in 1980 term, the location decisions of mass housing and great industry

areas targeted especially the fringe areas of the city like Büyükçekmece, Küçükçekmece, Pendik and Tuzla. These kinds of decisions triggered the city's shift to these directions.

Planning authorization of İstanbul Metropolis was given to the Metropolitan Municipality and Ministry of Public Works and Settlement with the 3030 numbered law which was legislated in 1984. Metropolitan Area Planning Office was connected to İstanbul Metropolitan Municipality in 1985. Afterwards a restructuring was done in 1989 and in March 1994, 1/50.000 scaled İstanbul Metropolitan Area Master Plan was approved by the Metropolitan Municipality. After the local elections in 1994, reexamination studies of this 1/50.000 scaled master plan started, and in 15.11.1995, 1/50.000 scaled İstanbul Metropolitan Area Master Plan was approved by the Metropolitan Municipality. After the approval of Metropolitan Area Master Plan, Metropolitan Area Master Plan which was approved in 1980 continued to be implemented in İstanbul. All of the plans that were made after that day until today were prepared according to this upper-scaled plan (İBB 2006a).



Map 1. İstanbul Metropolitan Area Development Plan (1995)

In 1995 plan, decentralization of industrial zones was suggested and these zones were located at the areas which are close to water reservoirs in İstanbul urban fringe. This decision was taken in order to diminish the pressure on Central Business District (C.B.D); however the development in the urban fringe was not taken into consideration with this decision and as a result of this, new and big settlement, mass housing and cooperative apartment housing areas started to develop around these new industry zones.

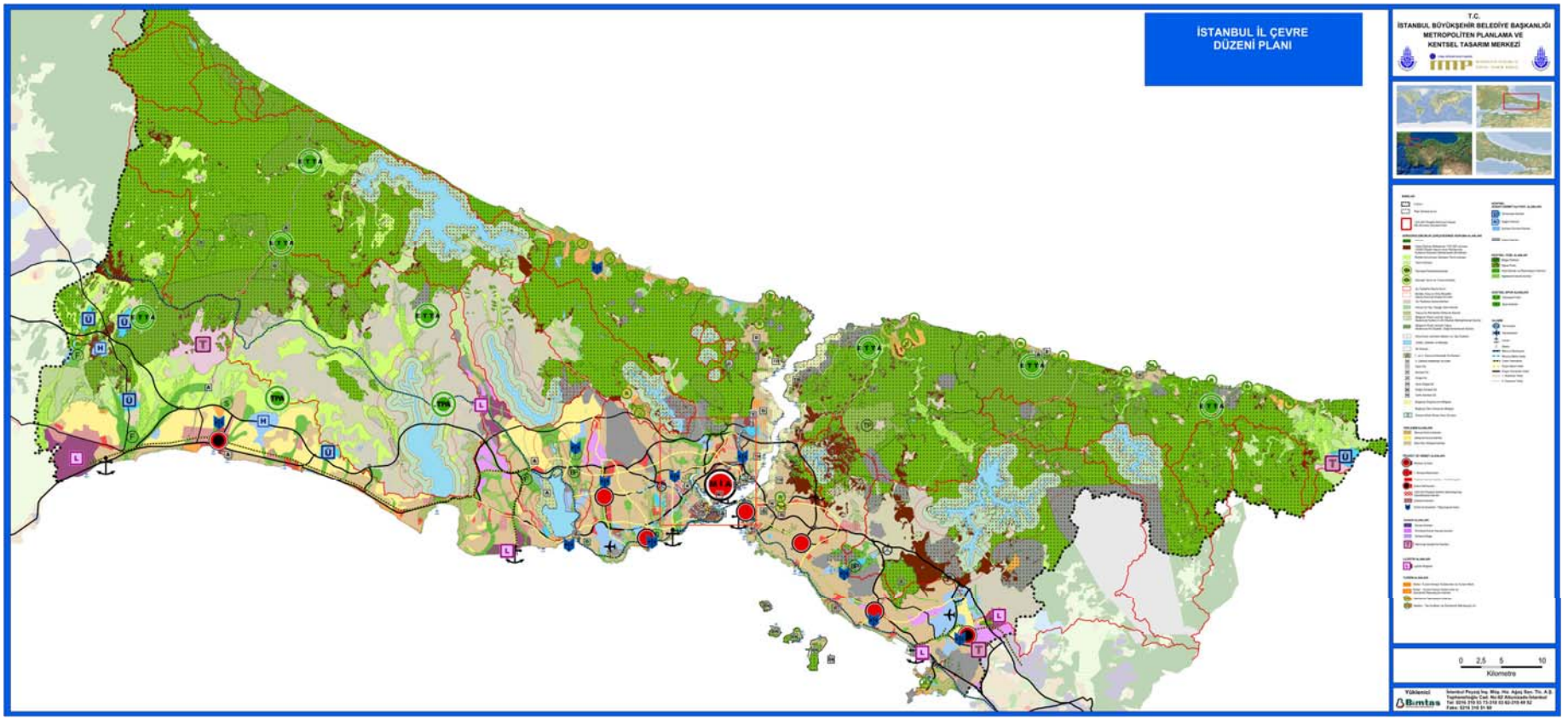
The town developed according to the local roads of First and Second Bosporus bridges. This situation fastened the development of Sultanbeyli and Samandıra regions in Asian Side, and Arnavutköy and Gürpınar regions in the European Side. Industrial development has occurred partially according to the plan; however, it developed at a bounced form beyond the borders of the Municipality. This development, through migration, enabled the constitution of shanty towns.

When we evaluate the planning studies related to İstanbul Metropolitan; we can see that, the area that İstanbul Metropolitan has expanded and the growth at the urban fringe is quite different from the targeted level of 1973 and 1980 plans. In 1995 Plan, though, lots of decisions were taken related to metropolitan fringe. Decentralization of the industry and services, and taking these to the wings (edges) of the city are the most important decisions which was taken for the metropolitan fringe.

New developments are observed about planning at the present day. According to the 5216 numbered Metropolitan Municipality Law that was approved in 10.07.2004, environment arrangement planning authorization is transferred to the Metropolitan Municipality. Planning endeavors have started within the Metropolitan Municipality in accordance with this plan. A 20 year development process was planned with the 1/100.000 scaled İstanbul Province Development Plan which was completed in 2006. A sustainable urban development through evaluating global and regional dynamics and increasing the quality of life were the targets of this plan. Multi-centered structuring was described. Thus, a symmetric distribution of development was targeted. In this way, the integration of urban fringe with the urban is going to be achieved; development will be extended to the whole region through centers and focuses (İBB 2006a).

Decentralization of industrial areas out of İstanbul and controlling the population increase in İstanbul are within the targets of the plan. Besides, it is considered that, new attraction centers that will be created in Silivri and Kartal boroughs will ease urban core-urban fringe transportation problems. “New attraction centers will

be able to control the settlement of population at these areas with their transportation systems which are based on rapid and high-capacity rail systems and which have public transportation priority. According to the multi-centered urban development target that determines the macro form, the direction of CBD to the west and creating sub-level centers within the city and attraction centers that are integrated to the rail systems in two wings are supplemental politics. These policies offer solutions to the various problems like symmetric distribution of income, sustainability and decentralization of the industry. Multi-centered structures make contributions to equal access to services both socially and spatially and creates healthy living environment by diminishing residence-business transportation to minimum levels" (İBB 2006a).



Map 2. İstanbul Metropolitan Area Development Plan (2006)

4.1.2. The Urban Fringe as Part of İstanbul Metropolitan Area

Process of sprawl in İstanbul city which is one of the metropolitan cities of Turkey and is affected from globalization truth shows a similar character with the process seen in the entire country. After 1950s, demand that caused the density of the center started to loose its strength. Developments that occurred after that date fastened the expanding through the urban fringe.

Sprawl process started in 1950 when industry choose place around main transportation axles. It continued its development in 1960s around industry zones like grease spots. Until the ends of the 1960s, İstanbul had developed by protecting its natural features with a partial protectionist approach. However, due to rapid and unplanned urbanization which occurred after 1970s, it entered to a term in which natural and geographical features were not seen important.

After 1975, city sprawled towards urban fringe and created a very fast transformation in this area. Changes at urban fringes in metropolitan area started at this term and new industry and residence areas were placed into the urban fringe which had rural characteristics. As a result of the growth of the industry within city, the process of moving industry zones to urban fringe and illegal and uncontrolled development at this area has started. When industry zones were expanded to longer-distances through urban fringe from city center, firstly, residence sub-cities, then, industry sub-cities and also satellite cities settled in the fringe of metropolis. The rapid and uncontrolled development that occurred at İstanbul Metropolitan fringe turned the urban fringe into areas where great urban development problems are seen (Doğru 2002).

This process developed quickly in 1970s, and during the 1980 term, it continued quite rapidly as planned and unplanned. The planning studies that were done after 1980 term, the expanding policies of the metropolitan city were supported. Before 1980, urban fringe were opened to residence generally with migration; but after 1980, these regions turned to be targets of the cooperative housing demands of the middle-bracket income.

1990 period is a term in which sprawl is partially continued under control. Decentralization of the factors like especially industry that create problems at the city center to the urban fringe was deeply taken into consideration and was partially applied. On the other hand, this development caused new industry and residence areas to develop

in regions which were beyond the municipality border. In the period; while settlement areas in the center grew slowly, unplanned and infrastructural insufficient residence areas at the urban fringe grew quite rapidly. Unlike this trend, at that term, high-income people started to choose a new lifestyle by leaving the city center and settling around urban fringe. The increase in car possession played an important role in these decisions. Far from the city center and isolated from the other parts of the city, a villa style settling and living was preferred. This movement started in 1980 but it fastened and expanded after 1990. The residences of these new cities promise an isolated from problems and isolated from the whole city and a secure life; they prepare base for being isolated from public life. These places are reflection of changing-new life style. "When we look at the distribution of luxurious-residences which developed at the urban fringe after 1980, we see that they generally settle around forest areas which prevail at the northern sides of both edges of the city, at the Ömerli Barrage basin, around Terkos Lake, in Büyükçekmece and Çekmeköy" (Çekiç and Ferhan 2004).

Residence place area choosing process takes shape according to the development and alteration in the transportation, and also depending on private-car possession of income-groups. Similarly, area choosing of industry zones takes place according to the development at transportation, and depending on various economic criteria. Besides, the selection of industrial zones location affects the settlement choosing criteria of the population particularly caused by migration.

4.1.3. Population Development

İstanbul is the city that has the greater and faster population growth rate than Turkey. According to 2000 population census results, population of İstanbul was 10.018.735 and this amount corresponds approximately to 14 % of Turkey's total population. İstanbul's population grew at a close ratio until 1950s; however, it got into a quite rapid population growth process after that term. The city developed under the control of agricultural sector until 1950s, but after those years rapid industrialization is one of the major factors that caused rapid population growth. The concept of migration from country to town fastened at that term, and this caused great amount of migration demand to İstanbul Metropolitan Area. Table 1 shows the changes that have occurred in İstanbul's and Turkey's population is seen.

Table 1. Population Growth of Turkey and İstanbul

(Source: Turkish Statistical Web Site, 2007)

Year	Population of Turkey	Population of İstanbul	İstanbul/Turkey Rate (%)	Growth Rate of Population in Turkey (%)	Growth Rate of Population in İstanbul (%)
1927	13.648.270	806.863	5,91		
1935	16.158.018	883.599	5,47	18	10
1940	17.820.950	991.237	5,56	10	12
1945	18.790.174	1.078.399	5,74	5	9
1950	20.947.188	1.166.477	5,57	11	8
1955	24.064.763	1.533.822	6,37	15	31
1960	27.754.820	1.882.092	6,78	15	23
1965	31.391.421	2.293.823	7,31	13	22
1970	35.605.176	3.019.032	8,48	13	32
1975	40.347.719	3.904.588	9,68	13	29
1980	44.736.957	4.741.890	10,6	11	21
1985	50.664.458	5.842.985	11,53	13	23
1990	56.473.035	7.309.190	12,94	11	25
2000	67.803.927	10.018.735	14,78	20	37

The population growth rate of İstanbul and the general population growth rate of the country develop at the same parallel; however, especially after 1950, the increase rate in population growth of İstanbul became much more rapid. When we look at an annual basis, we see that the population growth rate in İstanbul is quite faster than the general population growth rate of Turkey.

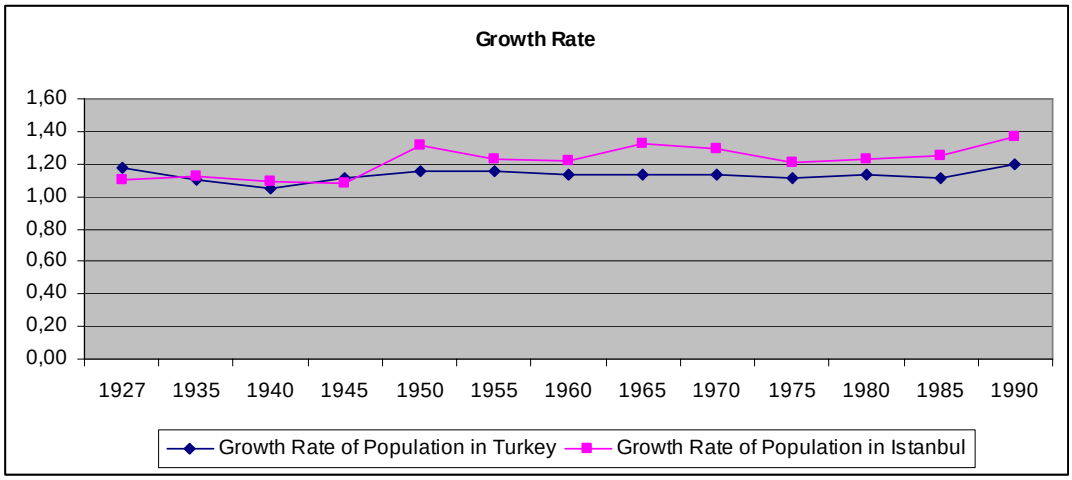


Figure 1. Comparison of Growth Rate in Turkey and İstanbul

It is observed that, the population living in İstanbul had increased more and more from 1950 to our day. It is adopted definition of TURKSTAT used after 1950 to confirm development of population in space. Population was analysed in two groups as city center and urban fringe that city center is county defined as central zone and urban fringe is county out of central zone. City center includes Bakırköy, Beyoğlu, Beşiktaş, Eminönü, Eyüp, Sarıyer, Şişli, Fatih, Bayrampaşa, Zeytinburnu, Kağıthane, Adalar, Beykoz, Kadıköy and Üsküdar. Urban fringe also includes Küçükçekmece, Büyükçekmece, Çatalca, Silivri, Kartal, Ümraniye and Şile. However, they do not contain villages and subdistrict in their boundaries. In parallel with definition, 82 % of the population was living in central parts of the city and 2 % of the population was living in urban fringe parts in 1955. However, in 1965, 75 % of the population was living in central parts and 8 % was living in urban fringe.

When we look at the situation in 1980, we observe that 59, 2 % of the population was living in central municipality, 40.9 % of the population was living in other municipalities. After 1980, population and accordingly settling incentives have moved out of the central municipality and new-municipality content became valid (Aysu 1990). As a result, we can say that, after 1950s, İstanbul's population started to depart from the city center and expand to urban fringe of the center. It is observed that, with the politics that were applied especially after 1980, this incentive became clearer.

"Besides its historical and cultural features, İstanbul is the biggest business and commerce center; as a result of these features, it has always been an attraction point for the population of the county and this attraction continues in our day" (İBB 2005). It is observed that, having a great amount of migration which occurred as the result of the global development pressures that were seen at the country level were also quite effective for İstanbul to be an attraction center. "In İstanbul Metropolitan Area, generally between 1935 and 1980, and especially after 1950, population growth increased swiftly, population moved out of central business areas towards new developing areas, and these new-developing areas started to become urbanized rapidly and afterwards, in these new areas, sub-urbanization was seen commonly" (Aysu 1990). The developments that were experienced in transportation after 1970 moved people away from the struggle of being close to the center and these developments supported the moving towards the urban fringe. After 1980 to our day, investments to highways are being made, automobile possession continues to increase and as a result of these factors, people started to choose to live in the areas that are close to new roads. As the

result of both migrations due to industrial development and due to the rapid population growth that occurred during the globalization process in İstanbul, great amount of population occurred in İstanbul. Infrastructure became insufficient for increasing population and for new settlement areas. People moved out of the center because of their increased standards of life. This factor, together with insufficient infrastructure caused people to be dependent on automobiles. On the other hand, the increase in the use of automobile has negative effects on the traffic of the city.

4.1.4. Effects of Industrial Zones' Development on Urban Fringe

Industrial developments that were experienced after 18th century caused quite important and big differences on the structure of the city. The macro form of the city changed according to the settlement of the industry within the city. Worldwide economic systems were known with the technology that developed especially after 20th century. This caused the settlement of the 'globalization' concept and speeded the market movements. All of these developments caused new developments to occur in industry sector. According to the developments on transportation and communication areas, the growing industry zones within the city were moved out of the city, to the urban fringe areas. Cheap building plot prices have an important role on the decision of moving industry zone out of the city. Moving industry zones to urban fringe brings cheap labor force. As a result, it caused people who had little income and people that came with migration to settle this area. And consequently squatter housing areas occurred at the urban fringe.

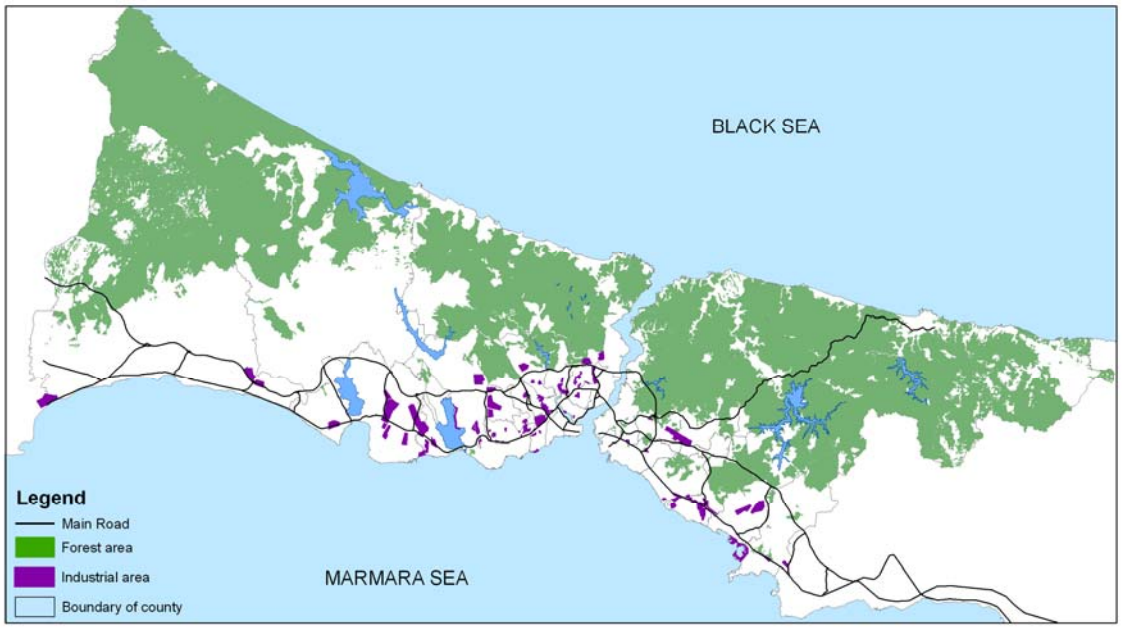
Industrial organizations country-wide choose İstanbul for a settlement place both for production and management, thus, İstanbul has an important place for industry. "In İstanbul, city growth and industry relationship developed as two factors that affect each other. Until 1960s, there was a certain stagnation period. In 1963, planned development period started. Accordingly, industrialization policies were developed and industry sector had a rapid increase. Its ratio in the economy increased and its annual increasing ratio in Gross National Product closed to 7 %. This amount was anticipated in the plan. An increasing of 36.82 % was occurred between 1960 and 1965" (Aysan, et al. 1997). In this term, industry continued its development and it also directed to the growth of the city as a result of this, a development in the form of grease spot started. In 1966,

İstanbul Industrial Plan was prepared and approved. In this 1966 plan, new-suggested industrial zones were insufficient, consequently their development split to the areas out of the plan (Yüzer 2002).

In 1960, for the general development of the areas at the urban fringe, it is observed that, residence areas occurred around the industrial zones in the form of grease spots. "In spite of the developments at the urban fringe, it is seen that, through the urban fringe lines, population growth decreases and residence-settlement areas increase" (Aysu 1990).

"After 1970s, urban rent and costs increased. These kinds of inducements caused industry to develop through Kartal, Maltepe areas and Tuzla, Yakacık, Çayırova, Gebze regions which are around the central settlement" (İBB 2006b). In the plan that was prepared by İstanbul Metropolitan Area Planning Office in 1980, it was determined that, industry zones were going to develop between Büyükçekmece and Küçükçekmece lakes, partially in Kemerburgaz, Ümraniye, Kurtköy, Dolayoba, Gebze, Şekerpınar and Dilovası; and the development of totally 7100 hectares industrial-area was anticipated.

In the Development Plan that was approved in 1980, encouraging advance-technology and artifice-dense industries to settle in İstanbul, and transferring standard technology, unskilled worker-dense industries and much industrial water and energy consuming industries out of İstanbul Metropolitan area were determined. According to these decisions, İkitelli Industrial Estate was established; by this, transferring businesses within the city out of the city was aimed (İBB 2006b).



Map 3. 1980 İstanbul Development Plan Industry Zones

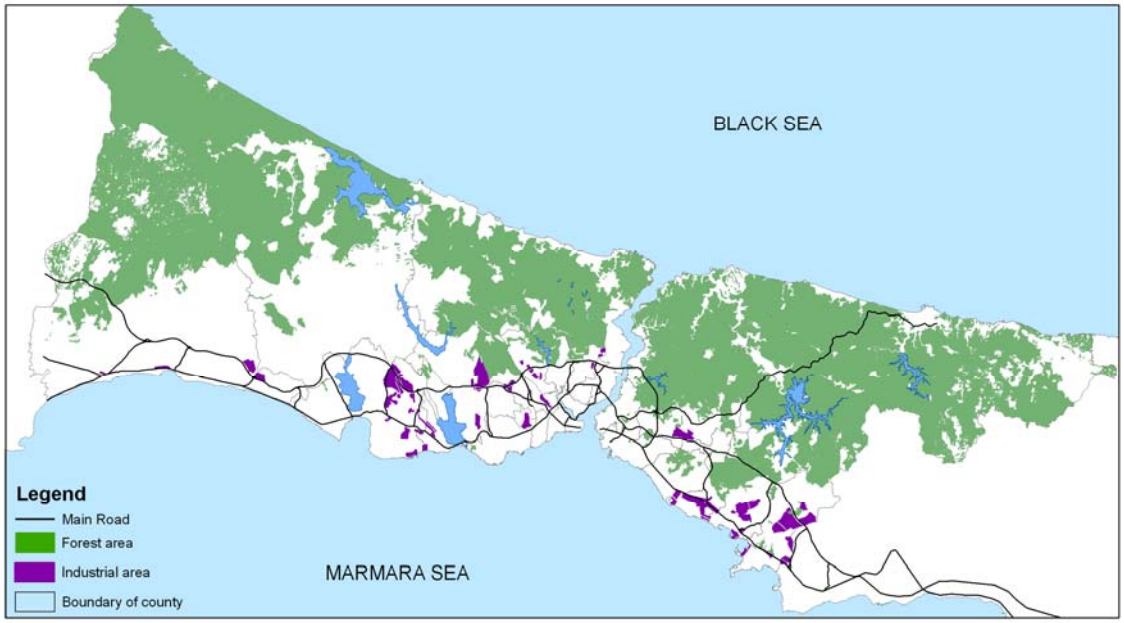
Industry areas which were suggested in the plan and their growth are shown in the Table 2.

Table 2. Industrial Zones in 1980 İstanbul Master Plan (ha)

Industrial Zones	**Area**
Dudullu	265
Kurtköy (Kartal)	400
Gebze	325
İkitelli (Bakırköy)	425
Firüzköy (Bakırköy)	750
Çakmaklı (Çatalca)	625
Peteköy (Silivri)	200

"After 1980's, the industrial zones like Hoşdere, Firüzköy, Kurtköy, Tuzla, Tepeören which were located in urban fringe developed" (Ocakçı 1989).

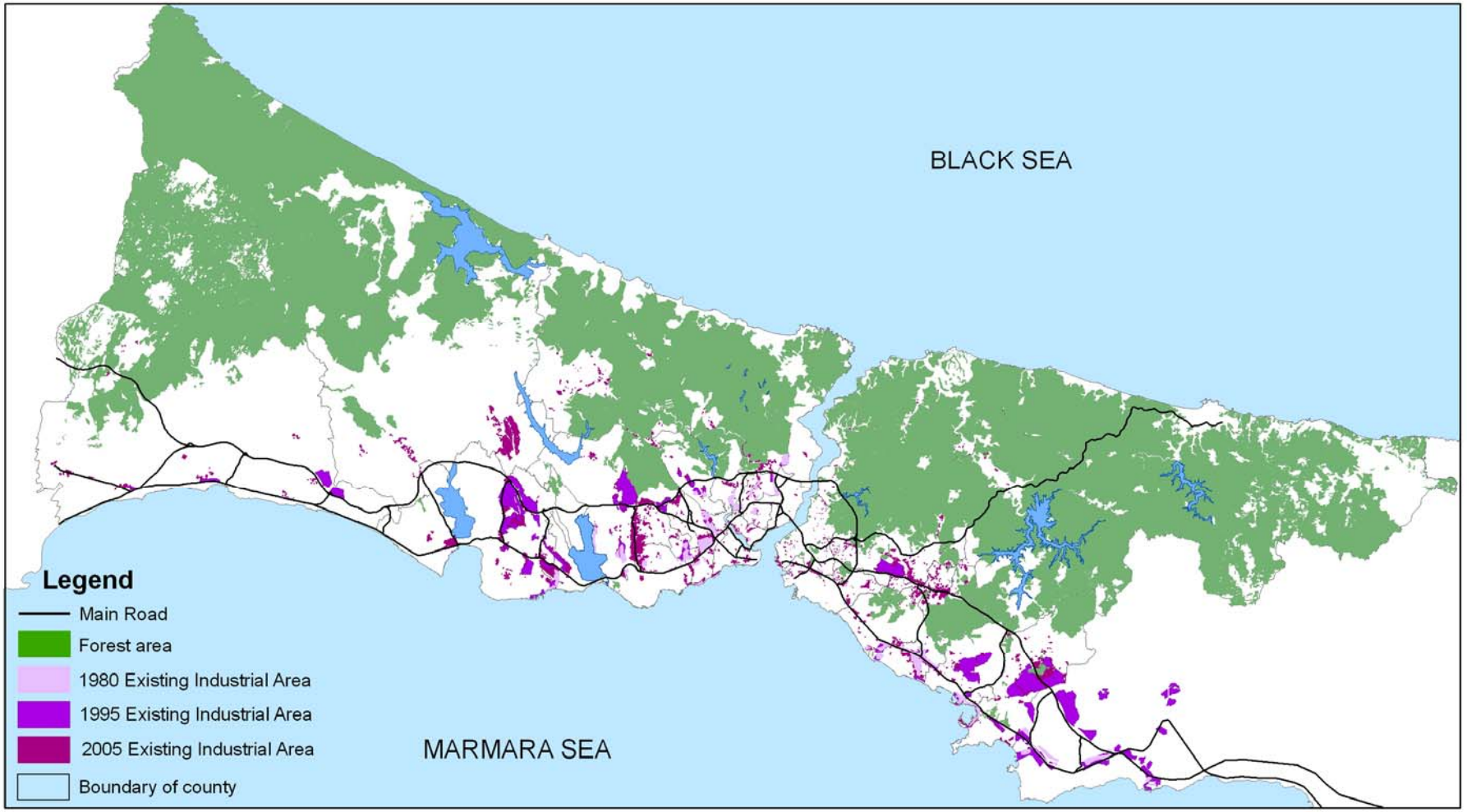
İstanbul Metropolitan Area Master Plan which was approved in 1995 aims to find solution to the small-scale and middle-scale industries at the stated planned areas according to their sectors, prevent the areas from being wreckages which became empty after transferring prevailing industry, moving the industries out of the city which pollute İstanbul, have little value-added to İstanbul, consume too much electricity and water and that create big problems within the city. The plan aims to turn İstanbul to a history, science, culture, commerce, service and art city. In the 1/50.000 scaled İstanbul Metropolitan Master Plan which was approved in 1994, and in the İstanbul Metropolitan Area Master Plan that was approved in 1995, removing production industry out of Haliç, Kurtköy, Bakırköy, Zeytinburnu and Eminönü was targeted; and the industrial zones in Topkapı, Maltepe, Yenibosna, Kartal, Maltepe and Kurtköy were stated as the areas which will turn to service (Ocakçı 1989).



Map 4. 1995 İstanbul Development Plan Industry Zones

With the 2006 Development Plan, shifting to services sector from industry sector which was more effective until the present day was aimed. Locating industry at the potential areas around İstanbul and the rehabilitation of the prevailing industry zones were planned. "Gebze at the east side and Çerkezköy at the west side are evaluated as close regions to İstanbul. It is anticipated that, these regions will be buffer areas for industry investments and labor force" (İBB 2006a). Connecting prevailing industry areas with the İkitelli, Hadımköy and Tuzla industrial zones was suggested.

"In 1966 İstanbul Industrial Plan, industrial area per person was determined as 5.4 m², and total industrial areas were determined as 1140.5 hectares. In 1980 Master Plan of İstanbul, total extend of the industrial areas as of 1995 were anticipated as 7100 hectares and industrial area per person was determined as 10 m². In the present day industrial zones have reached to 11.000 hectares and industrial area per person is almost 10m²" (İBB 2006a).



Map 5. Comparison of Industrial Areas in 1980, 1995 and 2006 İstanbul Development Plans

The process of the development of industrial areas affected the movements of people and their residence-settlement characteristics. During the developments that were experienced until our day, the effects of industrial areas on the structure of the city are seen clearly. In İstanbul, generally, together with the industrial areas that had decentralization, residence areas had also fringed. The fringing of residence areas around industrial zones is seen more clearly in Anatolian Side. Firstly, great industrial zones in Maltepe, Kartal, Pendik, Ümraniye and Tuzla were settled around the mail transportation axles and within time, people moved and settled to the areas around these industrial zones. The interaction between transportation industrial zones and industrial zones residence areas is continuous circle.

4.1.5. Development of Residence Areas

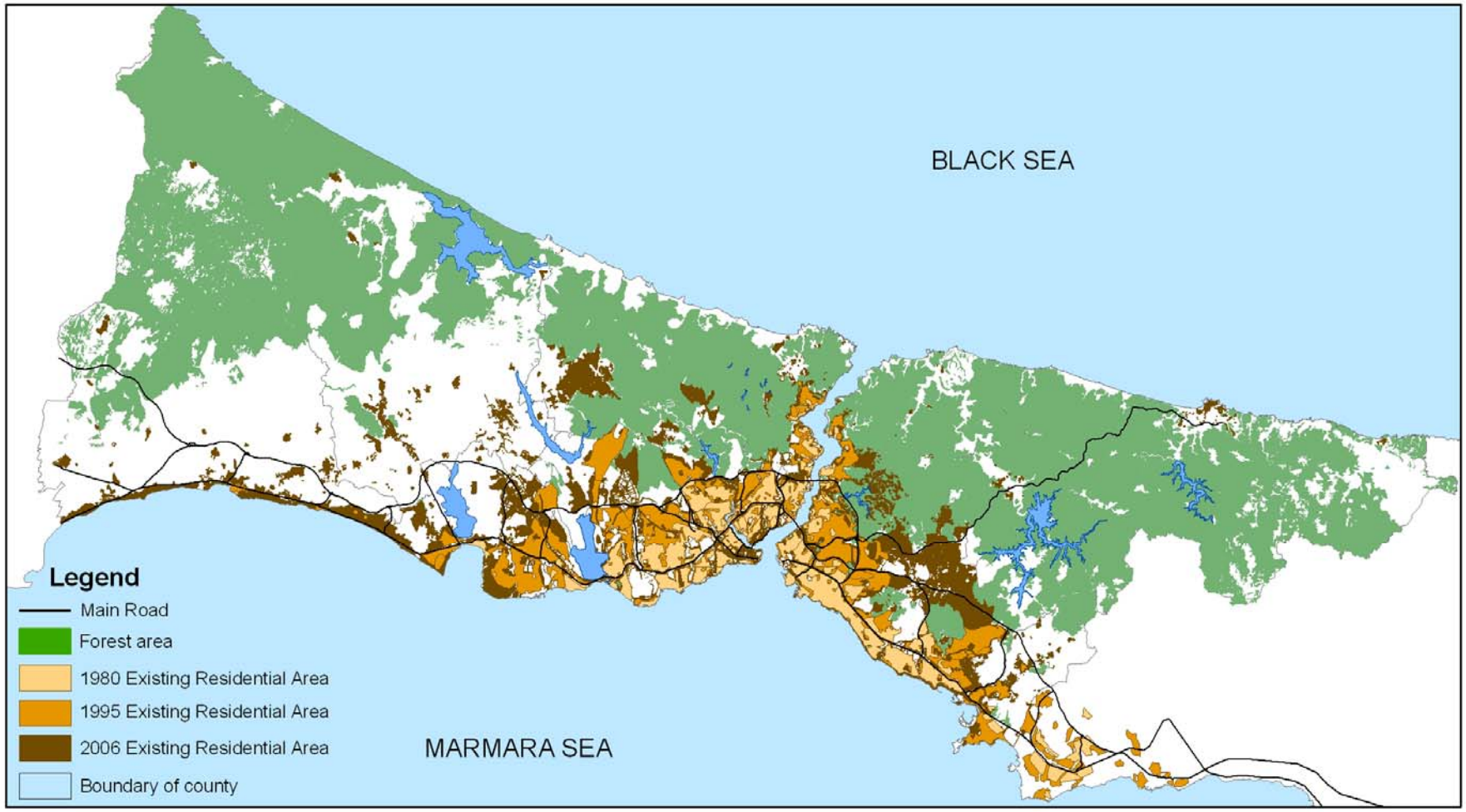
Urban population increases rapidly and this increase is more effective in big cities like İstanbul. This situation created a great demand for residence. In city centers land prices are quite high, there are investments that are made with speculative purposes and some empty areas are not used, however land prices are relatively cheaper at the urban fringe. Consequently settlement residence demands at the urban fringe are increasing.

In 1950, first movements through the fringe area occurred with illegal settlements around industrial zones. In 1950 migration increased rapidly, consequently uncontrolled and unplanned structuring started firstly around industrial zones. Until the middle of 1960s, there have been clemencies from time to time; these clemencies legalized the shanty structures which caused shanty structuring at the urban fringe and around industrial zones to continue increasingly at the next term.

After 1975, increases in the construction of mass housing affected the development of the town and it was effective at the expanding of urban fringe. With the growth of the city, CBD's tend to expand to new areas. The changes in CBD areas and in the transportation system created new prestige areas. The changes in the town's business centers and industrial areas and changes in the city distribution, together with the increase in the scale of the city and arrangements of the city transportation created important differences in residence-domicile areas and residential areas developed according to these changes.

After 1980, urban land market got into different term. This term turned to be a term in which large scales were targeted related to residence issues and laws were legislated accordingly. Crowd of the city center, infrastructural and environmental problems, increased automobile ownership, orbital roads and Bosporus Bridge passes and new credit possibilities caused new movements at the urban land market. Amnesty laws which were legislated in 1983 and afterwards caused shanty building process to increase. These squatter houses generally targeted the areas close to transportation axles and the urban fringe.

In the previous periods, urban fringe were opened to residence by immigrants' constraints. Later on these areas became the targets of the cooperative housing demands of the middle-income bracket that were organized according to mass housing areas and business places or career scales. High-income people who were stacked within the city and whose necessity-over security, residence and environment prestige were not enabled organized as well, and moved towards to big lands at the metropolitan city center in small groups.



Map 6. Development Process of Residential Areas in İstanbul

4.2. General Characteristic of Transportation in İstanbul Metropolitan Area

The construction of transportation network between urban core area of metropolitan and the urban fringe is necessary during the location choosing process of both residence and industrial areas. Residences and industrial zones firstly settle to the areas where transportation network is constructed. The plan decisions made related to transportation are the most important and prior plan decisions for İstanbul that were effective at the direction of the development and sprawl. Starting from 1950, the policies that give importance to highway transportation at the city and country level have been effective in the structuring of the metropolis. In our day, it is observed that highway transportation has a big portion of the city passenger transportation. This distribution negatively affects daily traffic flow.

In 2007, road transportation has a portion of 92, 30 % within the whole passenger transportation of the city, which is quite a big ratio. Besides this, when we look within the city Road transportation system, automobile transportation has the biggest ratio with 44 % which is the highest amount. Second comes public transportation with 28 % and the third one is minibus transportation with 22 %.

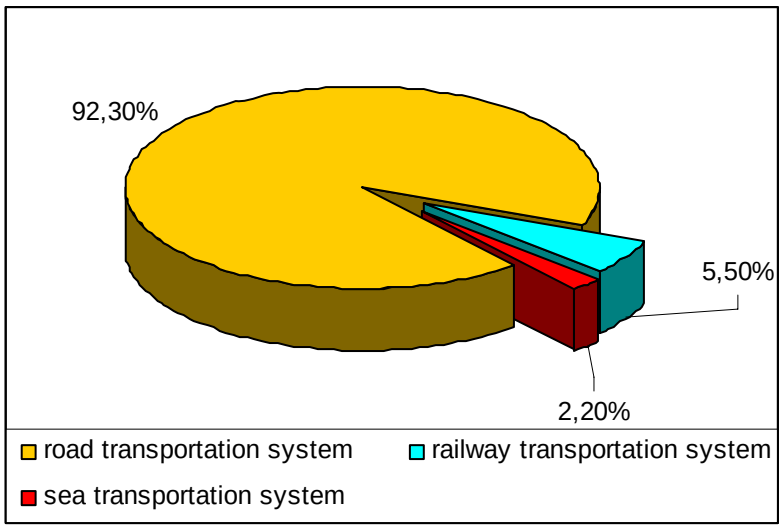


Figure 2. Distribution of Trip Mode in Transportation System

(Source: IETT web site)

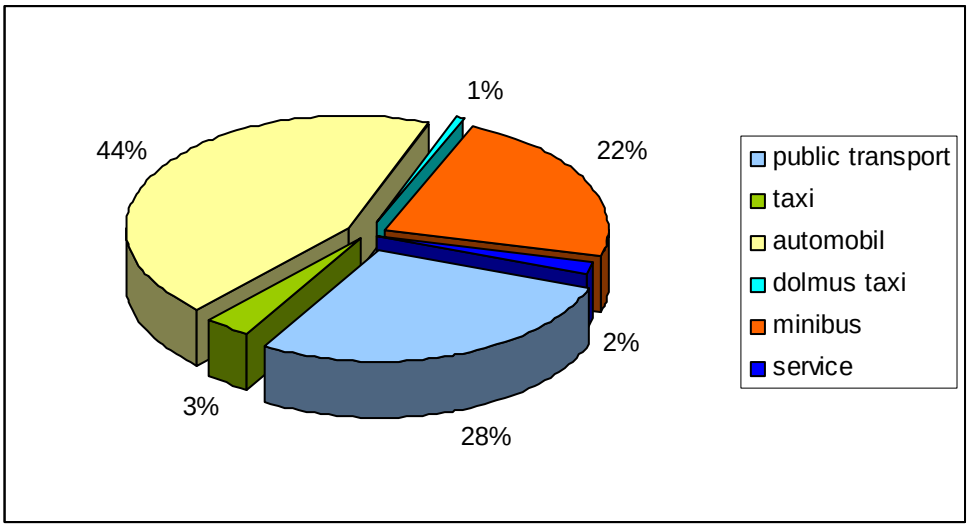


Figure 3. Distribution of Mode in Road Transportation
(Source: IETT web site)

The day by day increase in private-car ownership causes transportation problem to increase as well. Besides this, increase in private-car possession brings parking garage problem. For 2035 when we calculate vehicle-ownership, there will be 447 vehicle/1000 people and 67 vehicles in 150 people/hectare area. Every single vehicle needs a 25 meter square parking garage area. As a result 1675 meter square area will be used for parking garage in every 1 hectare. Consequently, an important parking garage problem will arise in central places (İBB 2006a).

Until 1965, planning and transportation studies that do not involve the town completely, but those concern particular parts were done. Planning studies that enclose the city completely started with the Planning Office which was established in those years. In those years, the foundation of Boğaziçi Bridge which was going to connect two sides of the city was laid and it was opened in 1973. Central functions and CBD started to choose place at two ends of the bridge after First Bosporus Bridge was opened for traffic. This fastened the linear development at the east-west axle and caused the city to develop through north. At the same time, E-5 highway was constructed which caused unplanned industrial and residence areas to develop around it.

Another important concept of the 1970s is the development of the automotive sector and the great increase in private-automobiles. Automobile-ownership has increased day by day, and this has caused the movement area of people in İstanbul to extend and motivated people to move long distances. Consequently, new settlement

areas far-to urban core have been settled. After the bridge connected the two sides of İstanbul, increasing of population increase in the Asian side observes. The people who work at the European side started to live in the Asian Side, as well. This development extended Asian Side to Maltepe and Kartal. At the same time, European Side spreaded until Silivri along E-5 Highway. Behavior of people to this direction made burden on both bridge and urban traffic.

Due to the increasing population and automobile-ownership after 1970, urban transportation problems reached to great levels. The suggested 1971 Plan was not approved. After this, with the contribution of World Bank and cooperation of Metropolitan Area Planning Bureau, English consulting firm Jamieson & Mackay Cons. developed Urban Land use Transportation Model. This study can be accepted as the most comprehensive study that evaluated all of the studies which were previously done about the physical development of the city and also the transportation-land use interaction according to 1995.

After the end of the 1970, over-demand caused traffic congestion at the 1. Bosporus Bridge and its orbital roads. This situation brought in the idea of constructing second Bosporus Bridge which would connect two sides of the city. At the end of the studies, second Bosporus Bridge which was located at the north side of the first one was opened to traffic in 1988. This development fastened İstanbul's movement through north. Besides, it caused sprawl along TEM Highway. Due to the problems that were being experienced related to transportation and urban growth out of the core area made starting transportation-related studies necessary. In 1987, for the first time, Transportation Master Plan studies started and this plan was completed in 1988. Modeling of the traffic demand was done. In 1994, studies on İstanbul Master Plan were started. In this frame, 1987 transportation plan data and collection data in 1994 were calibrated and a new transportation modeling was prepared. The second transportation master plan was completed in 1997 and this plan's target is 2010. In this plan, it is observed that public transportation has importance. And a tube-tunnel project for the Bosporus passing was suggested. The importance of a public transportation system that is complementary, but not competing was emphasized.

Map 7. 1. and 2. Bridge and Main Roads

After 1990, the prevailing transportation network was effective in the direction of the residential areas through east-west and north direction. Also other land uses sprawled immense area. In parallel with mobility accrued in the city. In view of this accretion IETT and the other municipalities were insufficient for public transportation, and therefore minibus transportation gained importance. This situation prepared base for informal buildings and illegal apportioned settlements. Consequently, old İstanbul center started to grow slower than the areas at the urban fringe which were unplanned and did not have infrastructural functions. The investment decisions also affected the growth direction, speed and population allocation of the city. Important developments are seen in İstanbul in this period; tram, metro and LRT were opened for service. Tube-tunnel studies have also started (İBB 2006a). However, İstanbul does not have a sufficient transportation infrastructure yet. As well as this, sprawl of the city is a burden on the traffic.

Road network that is equivalent to European country as length is available in İstanbul. However, disgusting situation on physical structure of network and non-integration characteristic with other transportation system cause problems in traffic. Road public transportation system is supreme portion according to passenger transportation in İstanbul. Two kind of road public transportation have been used. These are İETT and Private Public Bus. Route lengths are seen in Figure 4.

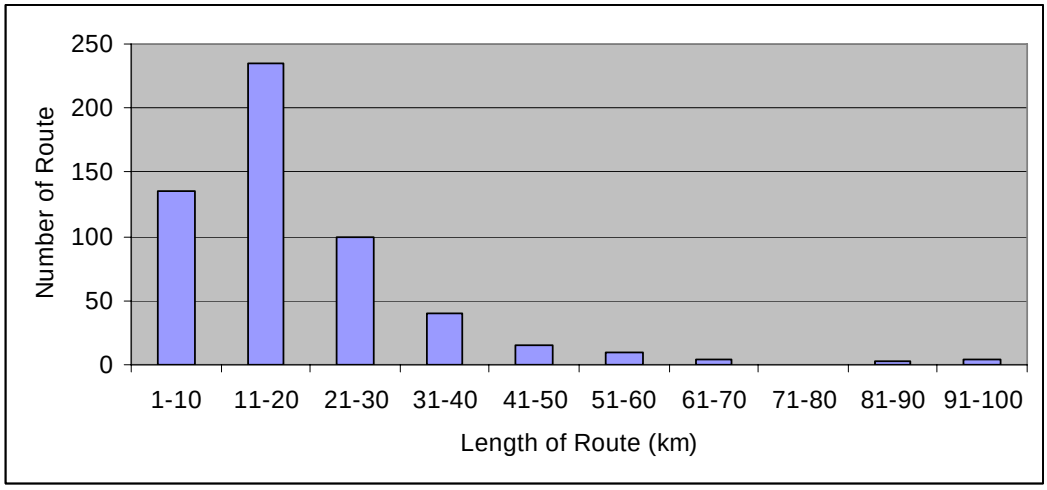
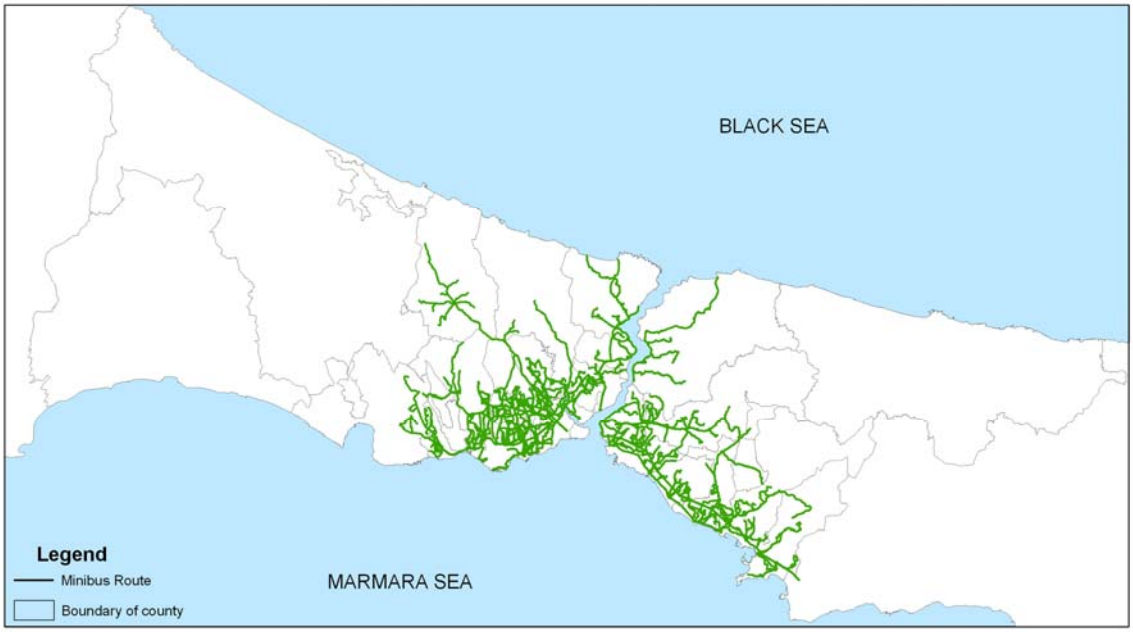


Figure 4. İETT Route Length

(Source: İBB 2006c)

Although daily capacity of İETT is 3.491.779 persons, number of daily passenger 1.312.515. It has 38 % efficiency.

Minibus and dolmuş supply the negation in area where public transportation system is not available. In İstanbul there are 136 minibus and 248 dolmuş routes. Existing route lines are shown in Map 8.



Map 8. Existing Minibus Routes

(Source: IMM, Department of Transportation, 2007)

Railway transportation system is less developed. There are existing 125, 9 km railway. Distribution of length is seen in the following Table 3 and Figure 5.

Table 3. Distribution of Length

(Source: Transportation Insurance Company Web Site, 2007)

Mode	**Length (km)**
Suburban Railway	72,3
LRT	20
Tram	19
Metro	8
Nostalgic Tram	4,4
Tunel	1,2
Teleferic	0,3
Total	**125,2**

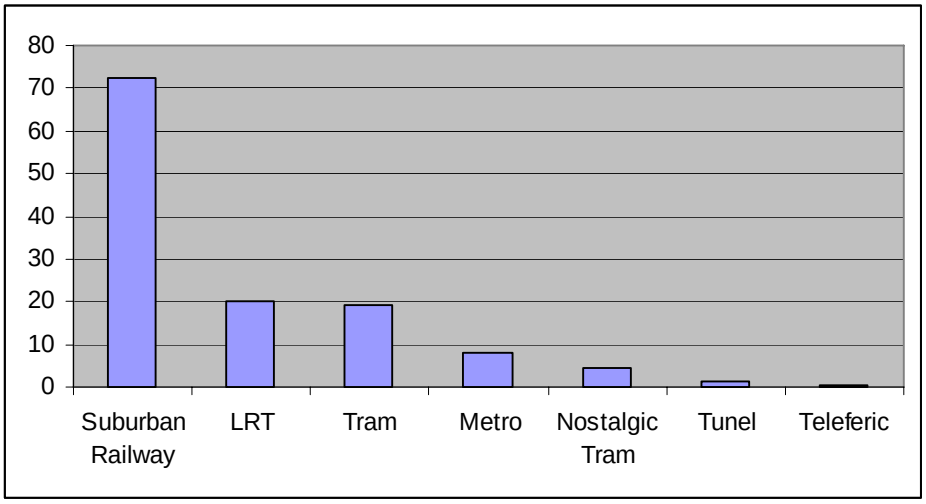
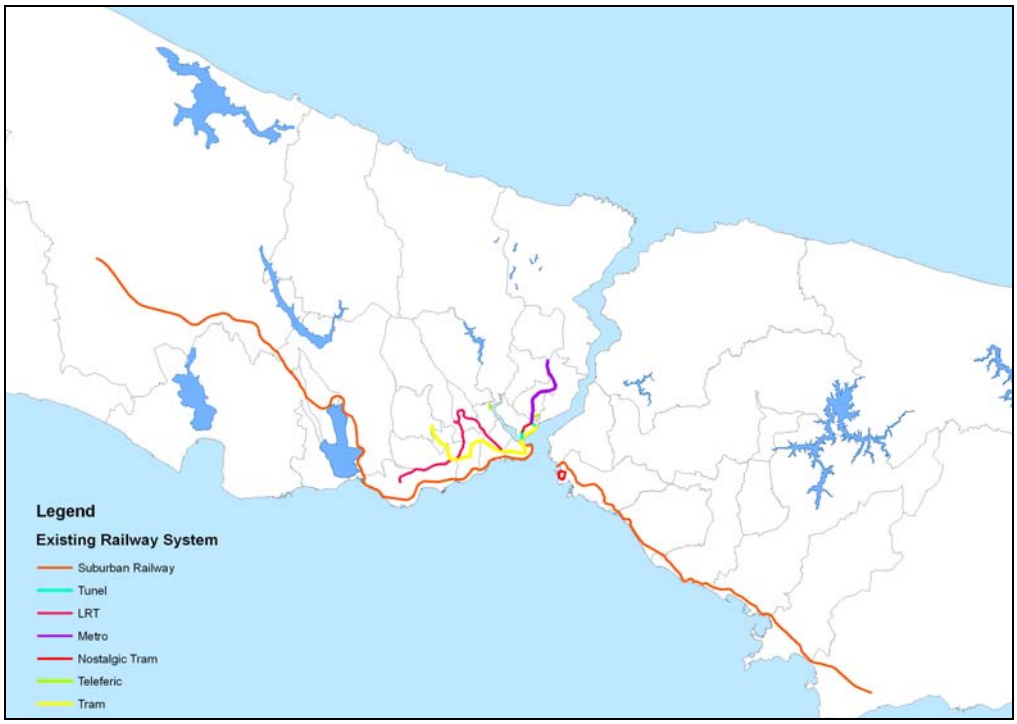


Figure 5. Distribution of Length

Railway system services small area in current but it is tried to develop. Distribution of existing railway system in space is in Map 9.



Map 9. Existing Railway System

(Source: IMM, Department of Transportation, 2007)

Sea transportation system includes three modes. These are:

- City lines ships
- Sea bus
- Sea boat

Number of daily average passenger and number of vehicle are in Table 4.

Table 4. Number of Vehicle and Daily Passenger in Sea Transportation System

(Source: İBB 2006c)

Mode	Number of vehicle	Number of daily passenger
City lines ships	47	161.558
Sea bus	104	34.201
Sea boat	29	49.524
Total	**180**	**245.283**

In the present day, most important problem of İstanbul is transportation. As a result of unplanned developments and wrong investments, the city has a great transportation problem today. This problem reflects the whole city because all of the activities performed in the city have a direct or indirect connection with transportation. In other words positive or negative effects of whole activity generated in the city on transportation are asset, and transportation problems are sum of them (İBB 2006a). Unplanned structuring and population growth and consequently the shift of the city to fringe increase transportation problems.

Transportation problem became important in İstanbul in 1970s. Although it has been trying to solve during the last 20 years, it has been not get to grips with this problem. The main sources of this are the increase in the car ownership and insufficient infrastructure. The investments about transportation are related to highways and these do not support public transportation. This situation props up use of automobile. Although private- automobile transportation is expensive people prefer it because of its facilities that it is comfortable, it is more practical for time, it has point to point transport specialty and people reach destination. Public transportation system is not sufficient to answer the needs of people; comfortable transportation vehicles like metro are less in number and they cannot serve to large areas; these issues support people's incentives to use private car in order to reach to urban fringe and consequently, the automobile number that is added to İstanbul traffic increases day by day, which in turn causes greater traffic problems.

CHAPTER 5

FINDINGS AND ANALYSIS

As in several cities, an expansion is occurred in İstanbul from urban core area to the outside. These improvements which show themselves as residence, industry, and trade land uses are mostly seen in fringe areas of the city and in the form of low-density constructions. This development caused by fast increase of city population and migration causes a number of negative impacts in surrounding areas of İstanbul. Especially trip values daily created by people living in the urban fringe and their impact on urban transport and environment are not ignorable. Residents of sprawl areas may drive longer distances to more dispersed destinations, be more reliant on automobiles due to a lack of transit service and limited opportunities for biking or walking, and contribute unnecessarily to air pollution and congestion.

In this section, time spent by people in traffic to perform their daily activities and change of the distance depending on the location of people and some other variables will be examined in the case of İstanbul and search will be made on the extra load imposed by these daily trips on İstanbul traffic.

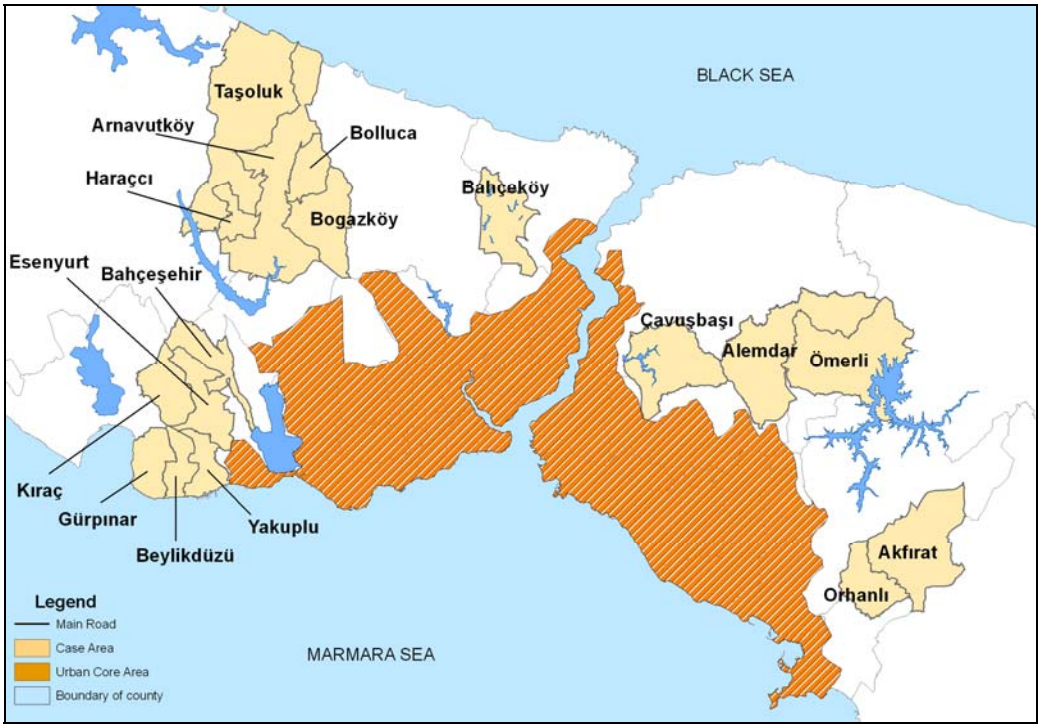
As mentioned before, urban fringe and urban core areas were defined in İstanbul. It has been used map by IMP in 2007 to determine boundaries of urban core and urban fringe areas. These areas are shown in Map 10.

Map 10. Boundaries of Urban Core and Urban Fringe Areas

Urban fringe area includes 18 first phases. First phases with 1, 0 % or higher sample rate in the urban fringe of İstanbul have been selected among determined urban fringe area so as to obtain more accurate results for travel behavior. After this selection, Göktürk is out of the case areas. It has sampling rate of 0,3 %. Case area includes 17 first phases which is shown in the following Map.

Map 11. Urban Core and Urban Fringe Areas in İstanbul

Distribution of case area in fringe and their connection with the core area are shown in Map 12.



Map 12. Case Area

Findings of the survey conducted for entire İstanbul in 2006-2007 periods are used to analyse urban fringe. This research consists of household surveys conducted with 90.000 households within the framework of İstanbul Transportation Master Plan Calibration work. With these surveys, demographic, social-economic data of people are obtained. Also daily trip data of each person are collected. Survey studies cover workdays and academic year. The research aims to identify daily transportation demands of people and connecting these demands with social-economic and demographic structure.

In case area, many variables are used for understanding trip characteristics in urban fringe. Distributions of population and age pattern are evaluated. Economic variables such as income, automobile ownership and home ownership are analyzed. These social and economic surveys are related to trip travel of people. They affect trip demand and mode choices of people.

A lot of trip values are calculated. They are examined in urban fringe. In fringe and urban areas, the values of several trip variables also compared between them. The

average length of commute trips in meters, duration in minutes, driving time for those commuting by car, bus travel time, and bicycle and walking times etc were examined, with significant differences between sprawl and urban areas tested using.

5.1. Evaluation of Survey Results

A total of 12.896 people were interviewed in the urban fringe areas. Total population of these areas as of 2005 is 637.503. Number of survey person, 2005 population and sampling rate are shown in the table. Bahçeşehir was chosen as the lowest sampling rate with 1, 1 and number of persons interviewed in Bahçeşehir is 345. Esenyurt has the highest figure of interviews with 4397 persons.

Table 5. Sampling Rate of Fringe Areas

County	Fringe District	Number of Survey Persons	2005 Population	Sampling Rate (%)
Beykoz	Cavusbasi	494	17285	2,8
Buyukcekmece	Bahcesehir	345	29304	1,1
Buyukcekmece	Beylikduzu	999	61758	1,6
Buyukcekmece	Esenyurt	4397	221972	1,9
Buyukcekmece	Gurpınar	533	31632	1,6
Buyukcekmece	Kırac	833	44897	1,8
Buyukcekmece	Yakuplu	629	39013	1,6
Gaziosmanpasa	Arnavutkoy	1513	61416	2,4
Gaziosmanpasa	Bogazkoy	555	20991	2,6
Gaziosmanpasa	Bolluca	209	9662	2,1
Gaziosmanpasa	Haracci	240	12832	1,8
Gaziosmanpasa	Tasoluk	506	20143	2,5
Sariyer	Bahcekoy	143	6931	2
Tuzla	Akfirat	486	12002	2,9

Table 5. Sampling Rate of Fringe Areas (cont.)

County	Fringe District	Number of Survey Persons	2005 Population	Sampling Rate (%)
Tuzla	Orhanli	339	12002	2,8
Umraniye	Alemdar	561	30452	1,8
Umraniye	Omerli	114	5211	2,1

Age distribution of interviewes is shown in the Figure 6. Accordingly, 20-30 age intervals are the most populated in urban core and urban fringe. But in the urban fringe, people under the age 20 display the highest figures, which is evidence that residents in fringe are younger than the people living in urban core.

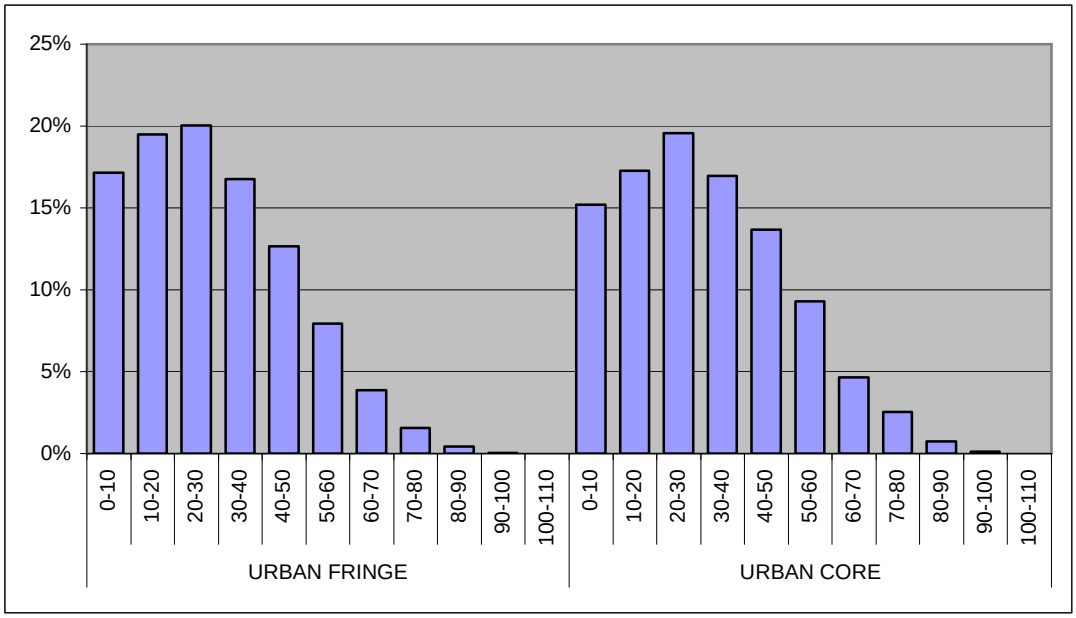


Figure 6. Age Pattern of Urban Fringe and Urban Core Areas

Monthly net income of the household was determined so that the correlation between social-economic structures of people and traveling habits could be comprehended. In the meantime, revenue obtained from real estates and other supplementary sources were also learned beside the monthly income of every household and an aggregate value was obtained. Below is the Table 6 showing monthly average net income of the household.

Table 6. Average Income of Fringe per Household
(Source: İstanbul Transportation Master Plan Calibration Work)

County	**Fringe district**	**Income**
Beykoz	Cavusbasi	998
Buyukcekmece	Bahcesehir	3819
Buyukcekmece	Beylikduzu	1656
Buyukcekmece	Esenyurt	839
Buyukcekmece	Gurpinar	1446
Buyukcekmece	Kirac	913
Buyukcekmece	Yakuplu	1410
Gaziosmanpasa	Arnavutkoy	771
Gaziosmanpasa	Bogazkoy	682
Gaziosmanpasa	Bolluca	852
Gaziosmanpasa	Haracci	773
Gaziosmanpasa	Tasoluk	747
Sariyer	Bahcekoy	1895
Tuzla	Akfirat	741
Tuzla	Orhanli	759
Umraniye	Alemdar	981
Umraniye	Omerli	1010

Number of cars per person in the entire urban fringe is 0, 11. When distribution between areas is considered, it can be seen that rate of car ownership varies between 0, 04 and 0, 38. Bahçeşehir has the highest rate of car ownership, which is attributable to the level of income.

Table 7. Car Ownership in Fringe Area

(Source: İstanbul Transportation Master Plan Calibration Work)

County	Fringe district	Total Number of Auto	Total Number of Person	Car Ownership per Person
Beykoz	Cavusbasi	66	494	0,13
Buyukcekmece	Bahcesehir	130	345	0,38
Buyukcekmece	Beylikduzu	216	999	0,22
Buyukcekmece	Esenyurt	319	4397	0,07
Buyukcekmece	Gurpinar	94	533	0,18
Buyukcekmece	Kirac	57	833	0,07
Buyukcekmece	Yakuplu	101	629	0,16
Gaziosmanpasa	Arnavutkoy	125	1513	0,08
Gaziosmanpasa	Bogazkoy	22	555	0,04
Gaziosmanpasa	Bolluca	16	209	0,08
Gaziosmanpasa	Haracci	29	240	0,12
Gaziosmanpasa	Tasoluk	38	506	0,08
Sariyer	Bahcekoy	32	143	0,22
Tuzla	Akfirat	21	486	0,04
Tuzla	Orhanli	43	339	0,13
Umraniye	Alemdar	58	561	0,10
Umraniye	Omerli	15	114	0,13

House ownership data are examined in 5 groups.

- House owner
- Renter
- No house owner and no renter
- Lojman
- other

According to distribution of ownership in the urban fringe, house owners account for 60 % of the total ownership. Renters are 33%.

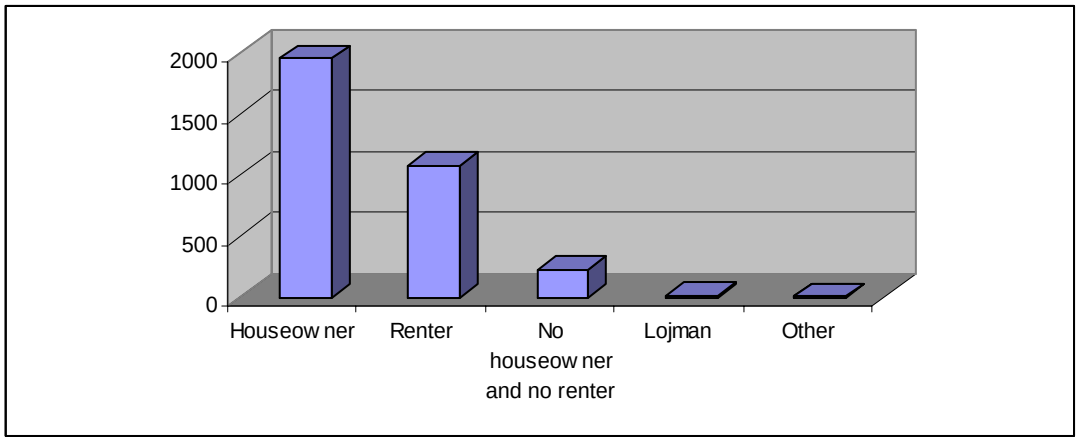


Figure 7. Distribution of House Ownership in Fringe Area
(Source: İstanbul Transportation Master Plan Calibration Work)

According to 2006 household surveys, number of worker in urban core is 198248. Number of workers in the urban fringe is 4120. In fringe, 32 percent of total population works and in urban core 33 percent of total population works. Percentage distribution of workers in the urban fringe to total number of workers is shown in the Table 8. According to this distribution, Yakuplu (40 %) has the highest figures of employment. Gürpınar has the second rank with 39 %. Akfırat shows the lowest employment rate with approximately 7 %.

Table 8. Number of Worker in Fringe Area
(Source: İstanbul Transportation Master Plan Calibration Work)

County	Fringe district	Number of workers	Number of Persons	%
Beykoz	Cavusbasi	135	494	27%
Buyukcekmece	Bahcesehir	127	345	37%
Buyukcekmece	Beylikduzu	370	999	37%
Buyukcekmece	Esenyurt	1430	4397	33%
Buyukcekmece	Gurpınar	208	533	39%
Buyukcekmece	Kırac	307	833	37%
Buyukcekmece	Yakuplu	251	629	40%
Gaziosmanpasa	Arnavutkoy	466	1513	31%
Gaziosmanpasa	Bogazkoy	139	555	25%
Gaziosmanpasa	Bolluca	57	209	27%
Gaziosmanpasa	Haracci	81	240	34%
Gaziosmanpasa	Tasoluk	149	506	29%
Sariyer	Bahcekoy	54	143	38%

Table 8. Number of Worker in Fringe Area (cont.)

County	Fringe district	Number of workers	Number of Persons	%
Tuzla	Akfirat	36	486	7%
Tuzla	Orhanli	100	339	29%
Umraniye	Alemdar	172	561	31%
Umraniye	Omerli	38	114	33%

5.2. Trip Distribution

In 2006 household surveys, trip that people used the day before was taken. All trip information during the day was obtained so that mobility figures in the entire İstanbul were calculated. Trips were evaluated on the basis of differentiation between urban core and urban fringe. Therefore, trips from/to urban core and urban fringe were become assessable.

Total number of trips generated in the urban fringe is 14.809, 73 % of which is in the urban fringe and 27 % between urban fringe and the urban core. Total number of trips generated in urban core and urban fringe is 267.909. Distribution of this trips between urban and fringe shows in Table 9.

Table 9. Number of Trip Distribution for Urban Core and Urban Fringe
(Source: İstanbul Transportation Master Plan Calibration Work)

District	Number of Trip
Urban Fringe - Urban Fringe	10325
Urban Fringe - Urban Core	3764
Urban Core- Urban Fringe	3750
Urban Core- Urban Core	250070

Each trip generates as adapted for a purpose. Trip distribution regarding to purpose includes 4 main groups.

- Home based work (HBW)
- Home based school (HBS)
- Home based other (HBO)
- Non home based (NHB)

Travels of urban fringe residents are grouped as HBW (38 %), HBS (29 %), HBO (28 %) and NHB (5 %) according to their purposes. HBW trips have higher value. Distribution of trips for purpose is shown in Figure 8.

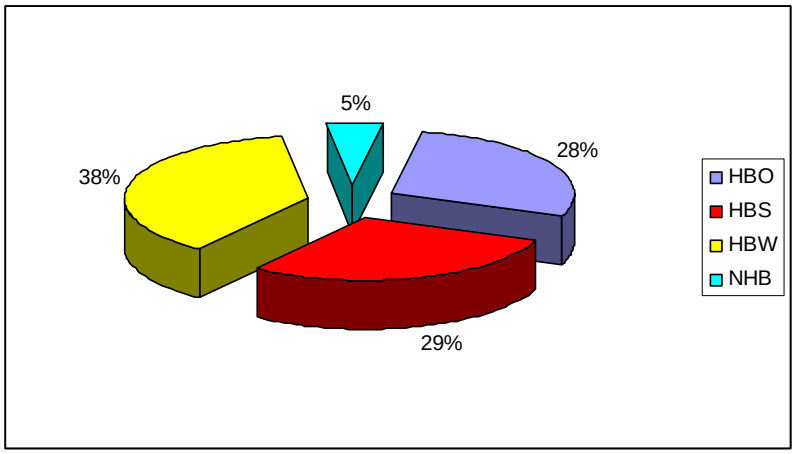


Figure 8. Trip Distribution per Purpose

When we look at the distribution of travels from urban fringe to the urban core according to their purposes, we can notice that number of HBW travels has increased. Sixty percent of total travel from urban fringe to the urban core is HBW travels. Remaining 40 % consists of HBO travel (23 %), school (11 %) and NHB (6 %) travels.

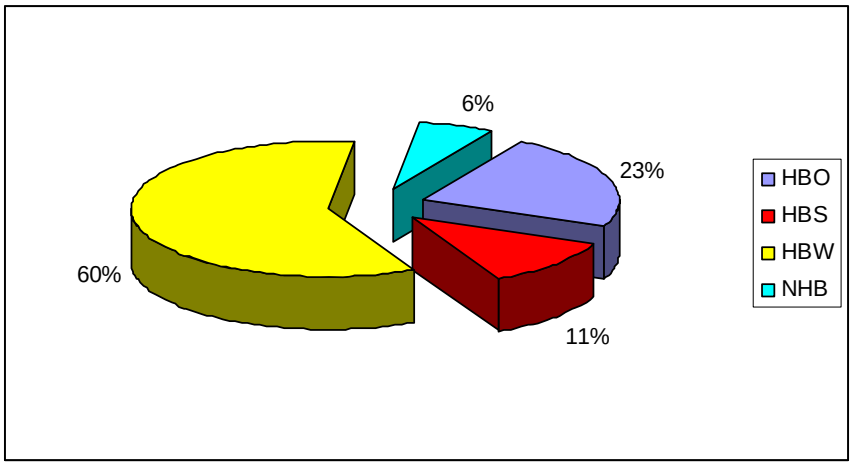


Figure 9. Trip Distribution from Fringe to Urban Per Trip Purpose

Categorization of total trips generated in the urban fringe and urban core for purpose is given in Table 10. A can be seen from the Figure, number of trips from urban core to the urban fringe and vice versa are very close to each other. Accordingly trips between urban core and urban fringe are return travels and HBW trip has the highest ratio.

Table 10. Purpose of Trip between Fringe and Urban
(Source: İstanbul Transportation Master Plan Calibration Work)

District/Purpose		HBO	HBS	HBW	NHB	TOTAL
Urban Fringe	**Urban Fringe**	3201	3895	2836	353	10285
Urban Fringe	**Urban Core**	846	417	2191	223	3677
Urban Core	**Urban Fringe**	824	417	2205	230	3676
Urban Core	**Urban Core**	85205	66458	87623	15566	254852

When distribution of travels according to type of vehicles is viewed, it can be seen that travel by walk has the highest figure. Use of private cars in urban core and urban fringe has the same figure with approximately 14 %. Use of service car is wider in urban fringe, and public transport is more widely used in the urban core. This situation emanates from lack of public transport substructure.

Table 11. Trip Distribution per Mode
(Source: İstanbul Transportation Master Plan Calibration Work)

A kind of Vehicle	Fringe-Fringe	%	Fringe-Urban	%	Urban-Fringe	%	Urban-Urban	%
Other	41	0,4	1047	14,5	1018	14,2	1174	0,4
Walk	7101	71,8	3614	50	3597	50	133453	53,3
Bike	10	0,1	36	0,5	41	0,6	108	0,04
Private car	827	8,4	1044	14,4	1035	14,4	36964	14,7
Service	1150	11,6	1287	17,8	1315	18,3	21487	8,5
Public Transport	757	7,7	200	2,8	188	2,6	56884	22,7
Total	9886	100	7228	100	7194	100	250070	100

Private cars have the highest ratio in HBW trips when distributed according to purpose and type of vehicles of travel generated in the urban fringe. Trip distribution according to purpose and mode is shown in Table 12.

Table 12. Trip Distribution According to Purpose and Mode
(Source: İstanbul Transportation Master Plan Calibration Work)

Mode/Purpose	HBO	HBS	HBW	NHB	Total
Other	20	5	48	31	104
Walk	2632	3309	1515	265	7721
Bike	2		5	1	8
Private car	788	214	1333	289	2624
Service	137	736	1786	59	2718
Public transport	962	507	1471	159	3099

Trip distance is shown in Table 13. When distance of trip is calculated, origin and destination points are employed. Distance between each pair of origin and destination zones are calculated by using shortest path tool of TransCAD. Then these data is matched fringe and urban trips. Trips between urban fringe and urban core have longer distance than other trips. It is changed between 23 and 25 km.

Table 13. Trip Distance per Mode (meter)
(Source: İstanbul Transportation Master Plan Calibration Work)

Areas		Other	Private car	Service	Public transport
Fringe	**Fringe**	10249,26	7795,12	7054,86	7812,43
Fringe	**Urban**	24494,54	25231,14	23209,37	24014,15
Urban	**Fringe**	27272,22	24858,6	23102,54	24332,22
Urban	**Urban**	9399,88	8376,36	8356,19	8719,55

Distribution of trip time according to mode is given in Table 14. Average period of total trips is 65 minutes. Public transportation has longest time. Generally for entire modes trip time is long.

Table 14. Average Trip Time per Mode
(Source: İstanbul Transportation Master Plan Calibration Work)

Mode	Average Trip Time (minute)
Other	62,88
Private car	58,44
Service vehicle	61,11
Public transport	81,13
Walk	27,89

5.3. Comparison of Travel Behavior in Urban Fringe and Urban Core

Expansion of urban areas naturally affects transportation in metropolitan area. In this section, trips accomplished in urban core and urban fringe areas compared between each other to calculate this effects. It is searched that how travel behavior vary between fringe and urban areas, and how it contributes to overall metropolitan traffic patterns.

Therefore, figures of daily trip generated in the metropolitan area, which is grouped as urban core and urban fringe, will be assessed on a number of variables. Variables used only for the urban fringe in the previous section will be used for comparison of figures obtained for urban core and the difference between them will be found, through which the change in traffic witnessed with expansion of the city will be identified. For this purpose, trips generated in the urban core and urban fringe is calculated. These results generated in urban fringe compared with urban core and other research results. Change of trips within the differentiation between urban core and fringe is shown in Table 15. Average figures of all areas in urban core and urban fringe are considered when calculating these figures.

Table 15. Comparison of Urban Core and Urban Fringe Areas
(Source: İstanbul Transportation Master Plan Calibration Work)

Variable	Urban Core	Urban Fringe
Number of person	198248	12896
Number of auto per person	0,11	0,11
Number of worker/Total number of person (%)	0,33	0,32
Homeowner/Number of household	0,57	0,60
Average Household Income (YTL)	1153	1086
Average trip time (minute)	30,54	65,62
Average Other trip time	44,34	62,88
Average Private Car trip time	35,23	58,45
Average Service trip time	43,59	61,11
Average public transport trip time	55,71	81,13
Average walk trip time	16,32	27,90
Percent trip for other	3 %	2 %
Percent trip for Private car	14 %	29 %
Percent trip for service	8 %	28 %
Percent trip for public transport	22 %	36 %
Percent trip for walk	53 %	5 %
Average trip distance (meter)	7119	24230
Average Other trip distance	9399	24494
Average Private Car trip distance	8376	25231
Average Service trip distance	8356	23209
Average Public transport trip distance	8719	24014

Number of people interviewed in the urban fringe is equal to approximately 6 % of the people interviewed in the urban core. As can be seen in the table, difference in home-ownership, number of workers, average monthly income and car-ownership per capita is negligible between urban core and urban fringe. Results of two areas are similar. However, despite the fact that difference between these values which determine social-economic levels of persons, thus, affect their trip travels, is low, there are major changes between travel behaviors.

When we take a look at distribution of mode, we can see that travel by walk has a considerably high rate with 53 % in urban cores. Public transport has displays high

figures in both areas. However, use of private cars in the urban fringe is higher compared to the urban core. Constant spreading of city as unplanned and uncontrolled and long trip time encouraged people to use of private car in urban fringe area because investment and planning are insufficient on public transport systems. In fact, duration of trips in urban core is 30 minutes, whereas average duration of trips in the urban fringe is more than its double. It lasts 65 minutes. Duration of trips is rather long for all vehicles in urban fringe when categorized according to vehicle modes. Travel time in especially public transport is quite high, which is 81 minutes. In California, Los Angeles, San Francisco, and Riverside commute time do not exceed 30 minutes (Crane and Chatman 2003). In Los Angeles, average trip time is 26, 5 minutes. Existing literature suggests that average commuting time ranges from 23 to 27 minutes (Handy, et al. 2004). In addition, "information released by the Census Bureau shows that commuting times are increasing across the country as more people are spending more time alone in their car. Average commute times to work in the U.S. increased an average of 3.1 minutes, from 22.4 to 25.5 minutes, from 1990-2000 according to Census numbers" (Sierra Club 2007). Trip time in İstanbul is much than other cities. Such high time values that trip can reach is an unfavorable condition in terms of accessibility. A long time trips are unwanted due to both psychological negative results created on people and environmental pollution.

Another reason of a long time trips by public transport in the urban fringe is that heavily relies on road public transport. It is a result of lack of rail system investment in the urban fringe. Due to such lack of investment, people are inclined to ride their private cars. People prefer driving their cars in such long distances for reasons of comfort and accessibility.

When distance of travel is calculated, origin and destination points are employed, which was mentioned above. This is due to the fact that surveys do not include transport distances. But it was possible to measure the distance between each pair of origin and destination zones within TransCAD. First, origins and destinations of travels were detected. Areas of these points were grouped as urban core and urban fringe. Then shortest paths were computed between origin and destination with TransCAD and average distance for each area was calculated. Average trip distances are for urban core and urban fringe 7.1 kilometers and 24, 2 kilometers respectively. Not surprisingly, for other transportation mode the average distance in urban fringe are significantly longer than urban core. This corresponds to expectations. There is a huge

difference between the two areas. According to Buchanan et al study in New Zealand the average work-trip distance was 9, 3 km in 2001 and work trip distance by car was 11, 1 km in sprawl. When this value is compared with İstanbul, it is small but in their study it is high value. That is way, trip distance in İstanbul is higher and it is not desirable situation. "Internationally, average trip lengths have increased dramatically in the last 20 years and this increase has been linked to the growing use of the car, allowing greater distances to be traveled" (Buchanan, et al. 2006). This situation is similar to İstanbul, and it causes serious problems on traffic and people. Negative impacts such a long distance, especially in care of traffic congestion, is an important issue which deserves attention.

Each average trip values compared between urban fringe and urban core like trip time, percent of trip and trip distance are higher in fringe than in urban. It is not surprisingly but it is not desired situation. Also different between each part is in a big way. Expanding of sprawl has increased transportation area and this unplanned and uncontrolled development has affected city negatively. Then increasing sprawl could potentially result in raise of travel time within metropolitan area. It is unclaimed position for transportation. That is way development of sprawl as uncontrolled and leap frog is not demanded.

CHAPTER 6

CONCLUSION

Cities are not a stationary state and they are developed consistently. Especially metropolitan cities have been developed after 20th century in term of development of technology and socio-economic structure. Then cities were spreaded out of from their boundaries and encroached on to the surrounding rural areas. Transformation of metropolitan cities gave rise to new development in urban fringe areas. In the literature it is defined by the term 'urban sprawl'.

Sprawl has become a phenomenon which all large cities of the world are faced with. One of these cities is İstanbul. İstanbul has acceded rapid urbanization process after 1950s, and sprawl has occurred because of rapid urbanization. In 1970s development of automotive industry result in accretion of private car use and decentralization of industry areas contribute development of sprawl. In this term, city grew irregularly. Development of sprawl has also caused this irregular development because of planning studies in local scale, land speculation, high emigration, and political problems. Areas in fringe have developed rapidly without infrastructure and plan while urban core of İstanbul growth rather slowly.

Existing roads have conducted to outspread city and sprawl has placed around these roads. New settlements in urban fringe have generated additional travel demand. Travel demand has persistently increased over the past three decades in all metropolitan areas. The growing travel demand and associated side effects congestion and pollution are imposing tremendous pressures on the built and natural environment (Li 2006). In addition, development of sprawl in cities acts daily trip. In terms of transportation and travel behavior, the primary argument focuses on high levels of dependence on cars for transportation and greater distances between destinations. Impacts of these could include more and longer daily trips and greater traffic congestion, reducing access to services or jobs (Johnson 2001).

The major purpose of this thesis is to show how travel behaviors vary between sprawl and urban areas, and how it contributes to overall metropolitan transportation patterns. In this context, urban development process and patterns of İstanbul have been

examined. Spatial development of city in different periods has been evaluated. Additionally the major object of this thesis transportation and travel behavior of İstanbul revealed. The influence and importance of development in urban fringe on urban transportation and travel behavior within İstanbul have been examined. Common assumptions about sprawl and its effects on transportation have been supported by empirical study. In this thesis, it has been shown that how is travel behavior in fringe and how does it vary between urban core and urban fringe areas. In addition, contributions of sprawl to overall metropolitan transportation and trip distribution have been discussed. As a result of this study, similar results with other researches have attained in İstanbul.

Development of sprawl in İstanbul causes more and longer daily trips as in the world. This process imposes transportation adversely in İstanbul. Especially accretion of using private car increases traffic congestion. The automobile has meant greater personal freedom and more options of where to live in relation to work and shopping. Accordingly development of sprawl and at the same time incompetent infrastructure in transportation contributes to use private car. Automobile ownership changed structure of urban form because of greater mobility they provided; cars became the preferred mode of transportation. It has been attained that using of private car has increased in California (Crane and Chatman 2003). It has been determined similarly that using of private car in sprawl areas of İstanbul is higher than in urban core. Contrary to expectations using of public transport rate has higher value than using of private car rate in sprawl. Owing to abstinence of periodic data, it is not to be proved true to comment this result.

Moreover, daily trip time and distance become more length. People who travel from urban sprawl to urban core have the longest commutes, while those who commute within urban core commute fewer minutes. Negative impacts of urban sprawl occurred lots of problems. In addition unplanned development of sprawl is comminatory factors for urban form. Trips from urban fringe to urban core for job are % 60 of total fringe to urban travel. Although İstanbul has grown in space, people have been depending on central area because of mono-centric form of İstanbul. Then it has created density in transportation lines between fringe and urban core. These results suggest that commuting patterns may be altered by decentralization of jobs. Because workers have been yet continued to work in central area and moved to sprawl to live and then

commuting time has been increased. However, if İstanbul is decentralized, commuting time can be decreased.

In addition to commuting time, in terms of transportation system a range of negative effects of sprawl has been identified in literature. They includes the greater cost of building roads and other infrastructure in sprawling areas (Carruthers and Ulfarsoon 2003), greater personal isolation for people who spend all their time in cars or inside their home (Freeman 2001), and various health problems (Weber and Sultana 2005). In order to manage transportation in accordance with sprawl development some policies should be recommend. First investments should be directed to public transport system but not only to routes. Root of the transportation problems in cities in Turkey is to keep route investment in the foreground. Public transport gets behind in view of the private car, because of route investment and poorly public transport studies. Besides discomfort and deficient public transport vehicles direct people to use private car whereas new transportation alternatives should be presented to people. It is necessary to enhance railway system. Especially this system should be designed around density lines and beforehand for new settlement areas.

Now, people prefer to live out of city center and to move away from its chaos and stress. This demand increase sprawl, but sprawl in İstanbul has not been developed under control. There are not organized infrastructure and roads. People lives in dependence on city center for some activities. Dependence on urban core and unorganized and uncontrolled development trends cause negative results. Therefore it should be built more affordable housing near transit and job centers. As mentioned previously, İstanbul is a mono-centric city, but if it is polycentric city, trips which are from fringe to urban and generally include work travel can be decreased. Then traffic congestion can be diminished. It should be also used resources to maintain existing roads before building new ones. Besides building more affordable housing and job centers, it should be promoted and supported regional and statewide planning that combines transportation, land use and environmental planning. In planning progress, it is necessary to determine how will be provided travel demand and additional traffic load created by new life areas in urban. Transport constitutes spine in planning studies. New transport system provides to connect settlement regions each others, but it also increases demand for these areas and affects land use in these areas. That is way, transportation and urban development process should be treated as a whole.

In spite of all problems in cities, people need some criteria to get cities livable. Criteria include clean air, security and quietness, flow of traffic. İstanbul does not provide these situations, and even transportation problems are the first to occur to one. Transportation problems in İstanbul should not be assessed separately. All of the activities in the city are aligned with transportation. All new developments and activities affect transportation negatively or positively. And transportation problems are the result of these effects. Besides sprawling of city regarding to uncontrolled building, increasing of population has aggravated transportation problems.

Consequently, sprawl is inevitable development process in many cities. So, the sprawl phenomenon should not be ignored in both transportation and other planning activities. It is possible to predict and then to direct travel demand and behavior by understanding better relation between urban development trends and transportation and by planning development of city correctly. Transportation planning is serious component of urban planning studies and should be developed with urban plans. Thus urban development trends and development of transportation regarding these are planned alternately and traffic problems can be reduced. In addition development of sprawl and travel behavior are predictable then provide to manage.

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