Urban Mobility in Istanbul

Final report

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1. INTRODUCTION

This final report is prepared in comply with the Item 5 of the Terms of Reference in the Annex of the Order Letter undersigned by the Consultants and Plan Bleu on September 3, 2007 and presents the Case Study, Urban Mobility in Istanbul: Trends and Prospects.

The present contract aims at supplying Plan Bleu with an expert's report on urban travel trends in **Istanbul**.

The aim of this case study is to present urban mobility trends in Istanbul with respect to the demographic and spatial growth dynamics of the urban area.

The promotion of sustainable urban development is one of the seven priority fields of action of the MSSD, focused on a type of spatial planning that integrates transportation planning and urban land - use planning, an orientation also highlighted by the conclusions of the Plan Bleu 2005 report "*A Sustainable Future for the Mediterranean*".

The main objective of the case studies is to improve information and knowledge about urban mobility trends in connection with the expansion of urban areas, so as to call attention of decision-makers and other stakeholders on impacts in terms of sustainable development. Two additional objectives are also sought:

a) Favour the strengthening of local expertise, in particular through integrated approaches on mobility by transport specialists and urban land planning specialists;

b) Call the attention of decision-makers, professionals and other local actors to the environment and sustainable development challenges in the pair land - use planning - transport Planning.

In the Southern and Eastern Mediterranean (from Morocco through to Turkey), trends have also been marked by continuous mushrooming of city outskirts, but within a context of a fairly high natural demographic growth (3.6%/year). Up to 2025, these countries will be accommodating near 100 million additional city dwellers. Personal motorization is still fairly low[1], though increasing significantly – 4.5% per year during 1984-2000, while

[1] *In 2003: motorization rate of 124 cars per 1000 inhabitants in the Southern and Eastern Mediterranean countries, as against 590 cars per 1000 inhabitants in the Northern Mediterranean countries.*

public transport records a marked decrease in modal split in most cities. Global prospective models on personal travel and modal split up to horizon 2050[2] reveal that the Near East and North African countries are likely to experience mass motorization before 2020.

In view of such changes, urban mobility – passenger travel in expanding urban areas – raises major sustainable development concerns, related not only to the sustainability of our planet, but also to the sustainability of our societies.
On global level, the type of spatial growth to be experienced by cities within the next three decades will determine their energy consumption and greenhouse-gas emissions in the second half of the century. These emissions will vary according as to whether the cities of the South will tend toward the sprawling city model, with long distances, conducive to car dependence (as in the French Riviera) or toward that of the dense city, structured by a land-use planning and a transport supply granting priority to mass transportation (case of Barcelona);

On the economic and social level, urban congestion costs and accessibility to the city represent two key challenges:

a) According to the European Conference of Ministers of Transport, the measures taken in most cities to relieve congestion in town-centres are reporting fairly efficient results, whereas traffic problems in the outskirts are becoming more serious, with strong impacts on economic activity, time management, city attractiveness and human health. For the Mediterranean countries, congestion costs have been roughly estimated by Plan Bleu as about 41 billion dollars for 2000, with significant differences among countries, but an overall strong increasing trend (16 % per year between 1995 and 2000);

b) The often-wild expansion of urban areas acutely raises the issue of access to the city and to services by populations living both inside and outside the agglomeration. Public transport generally operates in city-centres and dense areas, while suburbs and peripheral areas remain poorly serviced, if at all. The issue of more sustainable urban transportation systems is highly dependent on efforts for gaining control over traffic in city periphery areas and sub-urban connections; at the same time, by acting on areas that are currently poorly or non serviced, transport may become a tool to combat the exclusion of certain parts of the city.

This report consists of five sections. Present land-use and spatial components of Istanbul are presented in the second section. Urban and sub-urban travel patterns in relation with the transportation system and land – use characteristics are explained in the third section. Section four presents the institutional framework for the management of urban transportation in Istanbul. Conclusions are summarized in section five.

[2] *A. Schafer, MIT, 2000.*

2. THE CITY and ITS SPATIAL COMPONENTS

This chapter describes the macroform of Istanbul and its components such as land use pattern, population, and employment and how these components have changed between the years 1985 and 2007.

2.1. Present City Macroform and Land Use

Istanbul is the leading city of Turkey which provides more developed financial, commercial, industrial, cultural and educational services than other cities in the country. Between 1990 and 2004, Istanbul produced 21 % to 22.7 % of Turkey's total annual GDP. However, Istanbul's shares in GDP by sector and international trade indicate its greater importance in the national economy, especially financial, professional and international trade, which enjoy shares of more than 40 %, followed by commercial shares of 35.5 % (JICA, IMM, 2007).

The city has the unique urban form with hilly terrain divided by the strait of Bosphorus linking with Marmara Sea, where urbanization has spread into two sides of European and Anatolian combining historical quarters and new urban areas. The macroform of the city is basically shaped by its historical spatial patterns, topography, geographic (physical) thresholds, demographic and socio – economic structure. Istanbul retained its seashore city characteristics until the end of 1960s and has developed as a linear city that lies in the southern skirts along the Marmara Sea for more than 65 km from Silivri to Gebze. Historical Peninsula, which is the old core of the city, has lost its CBD role after 1980s, because of decentralization of both industrial and commercial services. The new settlements were formed on the periphery, expanding the city borders in the direction of west, east and north. A general land use pattern of Istanbul together with the existing main highway network is shown in Figure 2.1.1.

The first land use plan in Istanbul was prepared in 1937 by Henry Prost, a French architect and a planner. He proposed to decentralize the industry from Historic Peninsula to the outside of the old city walls with the new plan. The industry originally located on the seashore of the Golden Horn because of the sea transport possibilities, began to move to their new places around 1950s and 1960s. The industry on its new location found massive labour forces who were the newcomers of the city as a result of the migration that began during the same period. The new immigrants settled between the city walls and the industrial areas where there are no planned urban plots with infrastructure. The first squatter developments called as "gecekondu" observed on these areas such as Zeytinburnu and Taşlıtarla.

The industry continued to expand towards the outskirts of the city until 1970s. The housing development also spread near the areas where the industry took place. The process was fast and Istanbul Metropolitan Municipality (IMM) and the land use plans always stayed behind the developments in producing planned plots with infrastructure.

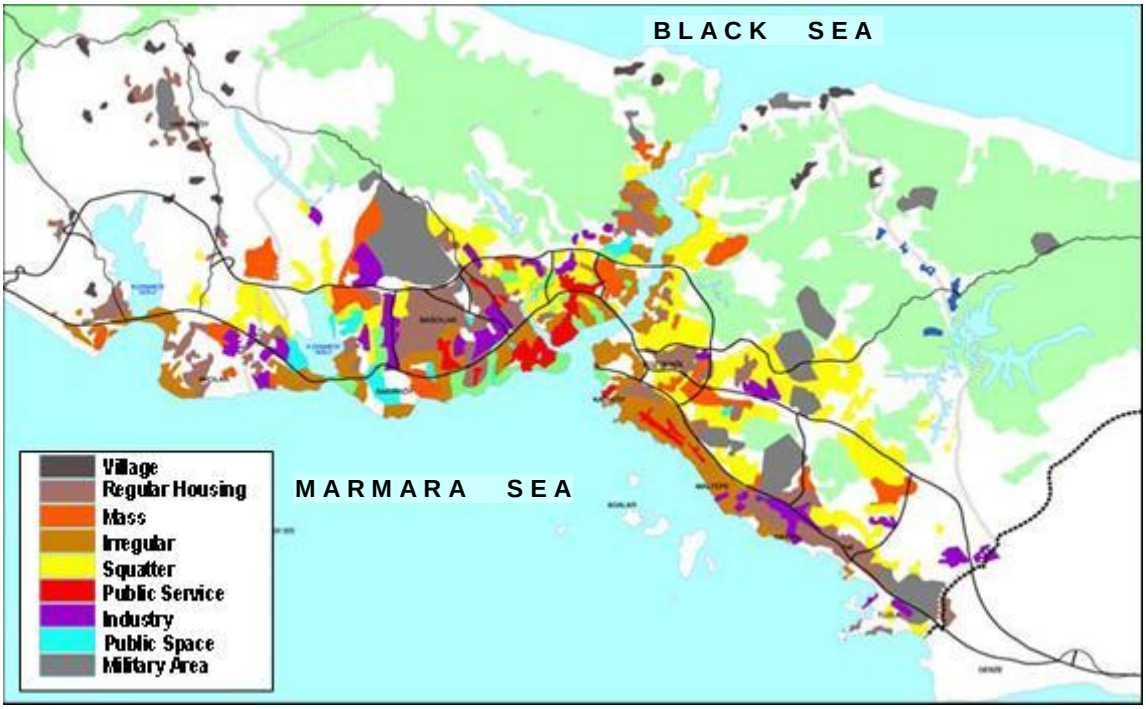


Figure 2.1.1: General Land Use Pattern of Istanbul (*Source: JICA, IMM, 2007)*

In 1970s, although there were many commercial functions along Taksim – Şişli axis, the Historical Peninsula was accommodating the CBD functions such as financial institutions, specific offices and specialized retail etc. The land use pattern in Istanbul began to change dramatically just after the first locally manufactured private car appeared in 1967 and the first Bosphorus Bridge in opened in 1974. The first impact of the Bosphorus Bridge was on the distribution of the population between two sides of the city. Nearly 80 % of the population was living on the European Side of Istanbul in the year 1965. This ratio has decreased down to 76 % in 5 years and to 73 % in 10 years.

The distribution of the population between two sides of Istanbul in the period between 1965 and 2007 are given below and shown in Figure 2.1.2.

Years	1955	1960	1965	1970	1975	1980	1985	1990	2000	2007
European (%)	80	79	79	76	73	70	68	66	65	64
Anatolian (%)	20	21	21	24	27	30	32	34	35	36

The first 1/50.000 scale land use master plan of Istanbul Metropolitan Area was approved in 1980. By the implementation of that plan decentralization has began and mainly the manufacturing industry has moved to outside the residential areas. New industrial areas have developed both on the west and east peripheries of Istanbul such as Ikitelli and Tuzla, even beyond the city borders such as Gebze and Çerkezköy. New settlements have been developed also outside the old residential areas such as Büyükçekmece in the European Side and Kurtköy in the Anatolian Side. The city macroform has become more linear then it was before.

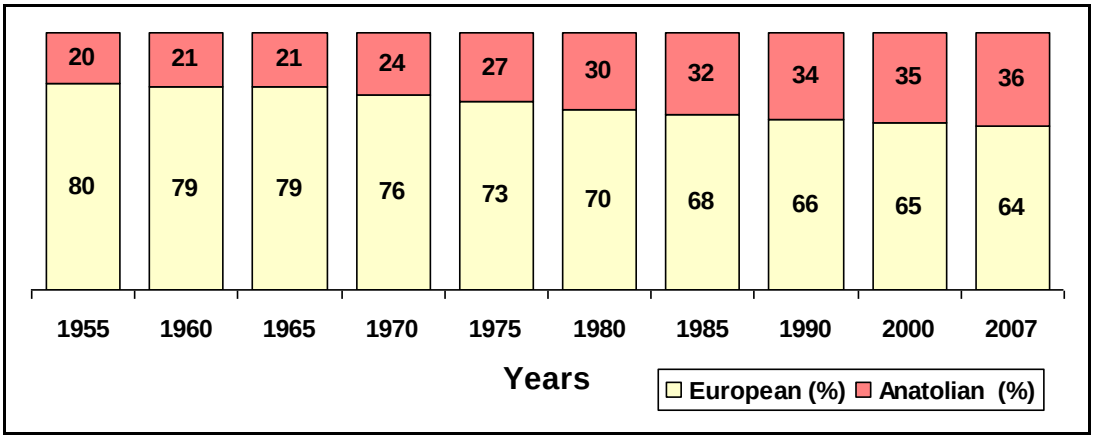


Figure 2.1.2: Distribution of Population between the Sides of Istanbul (%)

Historical Peninsula, which is the old core of the city, has lost its CBD role after 1980s, because of decentralization of both industrial and commercial services. The new settlements were formed on the periphery, expanding the city borders in the direction of west, east and north. The new CBD of the city was shaped along the Zincirlikuyu – Levant axis, because of the new transportation facilities provided by the Bosphorus Bridge. The second Bosphorus Bridge (FSM) which was built in 1988 speeded up the new development trends.

Istanbul Metropolitan Municipality prepared a new 1/50.000 scale zoning master plan in 1995. One of the three main strategies of the "Istanbul Metropolitan Area Sub-Region Master Plan" completed in 1995 was to achieve growth of the urban macro-form in a linear and multi-centred form, but with a degree of hierarchical ranking. The Master Plan set out general principles for planning that are of relevance to employment sub-centres and the achievement of the strategy. The development of sub-centres was encouraged to achieve population decentralization away from the highly populated areas. Specifically, new "wing-attraction centres" were proposed, and their development as primary centres of "first degree rank" was promoted. This is closely related to the principle of a balanced distribution of development and growth over the metropolitan region.

Today, the coastal area both along the Marmara Sea and along the Bosphorus is mainly occupied by residential areas. The Historical Peninsula and the inner areas far from the sea are the places of mixed residential and commercial functions, sometimes sharing the same buildings. The central business district (CBD) of Istanbul which was originally located around Eminönü has shifted to Şişli – Zincirlikuyu – Maslak axis along the Büyükdere Street. The lands left by the manufacturing industry along this arterial street have been occupied by new high-rise shopping and business centres that have generated considerable transportation demand within certain hours of the day. However, there are still many traditional handcraft production, some retail and commercial activities in the old CBD.

As a result of rapid and extensive growth, the macroform of the city has changed from a single centred one to a multi-centred one with a number of sub-centres such as Bakırköy, Bağcılar, Büyükçekmece in the European side and Kadıköy, Üsküdar,

Kozyatağı in the Anatolian Side. The new settlements away from the original city centre have been developed as car - dependent residential areas.

The existing detailed land use pattern of the central Istanbul is given in Figure 2.1.3. Figure 2.1.4 shows the land use pattern of Istanbul Province in the same detail.

As described above, Istanbul has become a “city of industry” in marked contrast with its previous image as a historical, cultural and tourism city. The manufacturing industry has been a leading sector of the economic development of Istanbul. In recent years, industry has been losing its share in Istanbul’s GDP by production, instead commercial financial and service have been increasing, thus changing the urban industrial structure of Istanbul. While the higher cost of land, traffic congestion, and increasing social pressure against industrial pollution (air and water pollution, noise, and others) are driving the factories out of the densely built-up urban areas, the organized industrial zones (OIZ) which have been developed throughout the country, especially in the Marmara region in accordance with the government decentralization policies, have been attracting new investments for manufacturing. In this context, provinces like Kocaeli, Bursa and others in the Marmara region which are adjacent to Istanbul have attracted considerable numbers of factories, and have rapidly increased their industrial production (JICA, IMM, 2007).

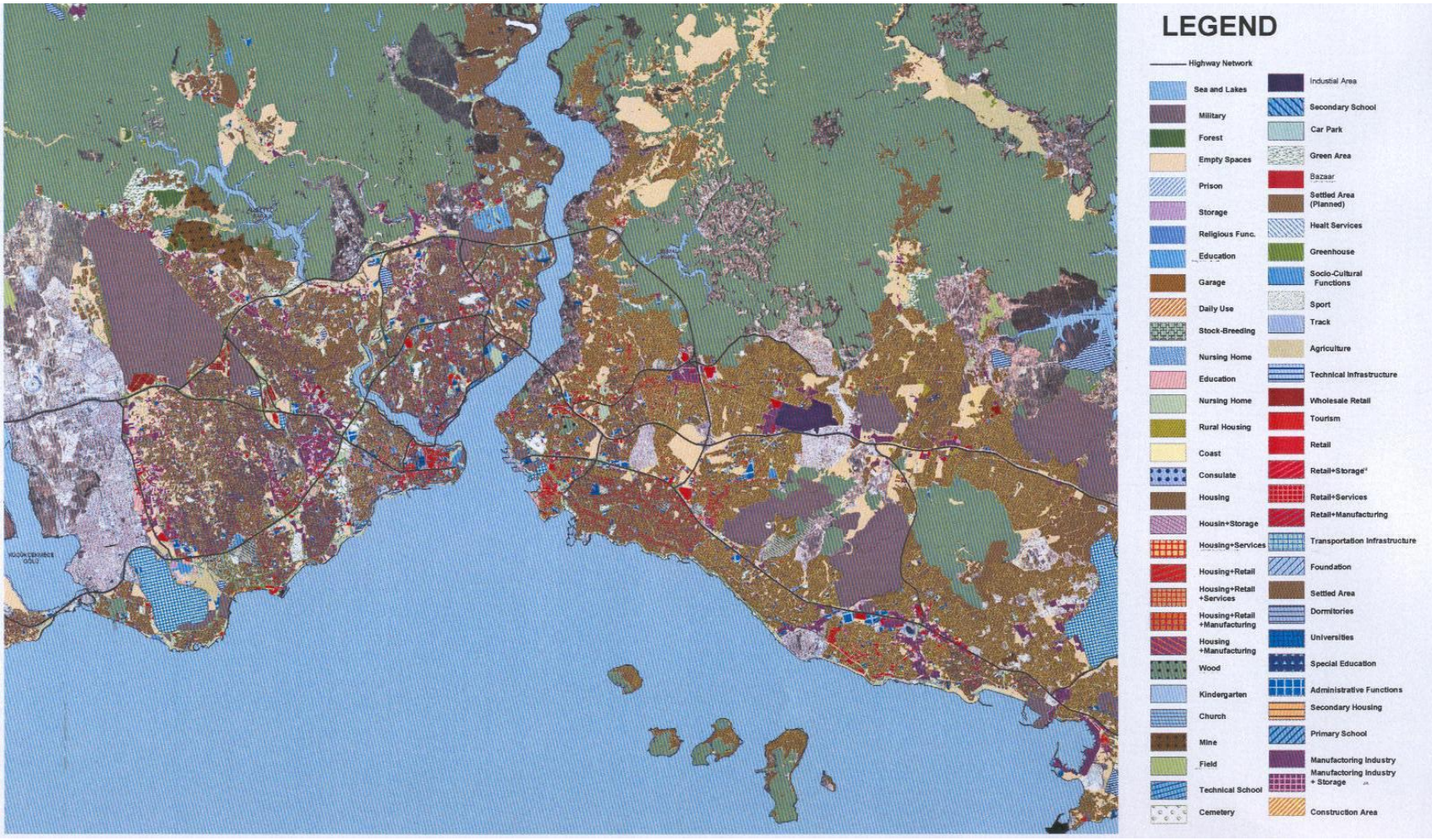


Figure 2.1.3: Detailed Land Use of Central Istanbul (2006) *(Source: Istanbul Metropolitan Planning Center)*

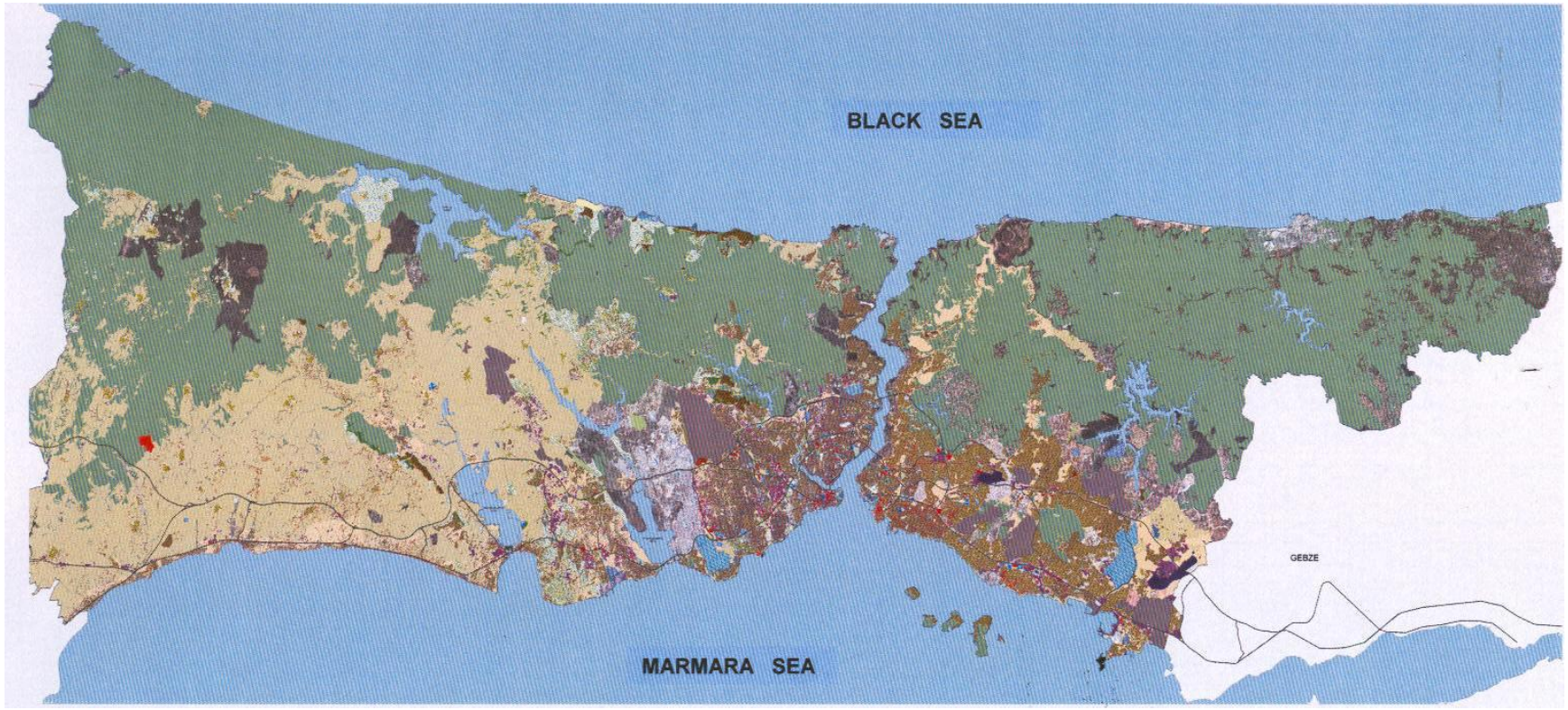


Figure 2.1.4: Detailed Land Use of Istanbul Province (2006) *(Source: Istanbul Metropolitan Planning Center)*

2.2. Administrative Divisions

The province of Istanbul is divided into 32 districts each corresponding to a certain area to comprise the entire province[3]. While some of the districts are totally urbanized, some of the districts distant from the city center comprise both urban and rural settlements (villages). All districts have a district center, a local municipality and an elected mayor. But the local municipalities of the districts not necessarily administer the whole district area. Some of the rural settlements (villages) within the districts should have their own municipalities and mayors when their population reaches to 2,000 inhabitants. The number of rural municipalities has reached to 41 in 2007. Presently, there are 73 local municipalities, including the district and rural ones, and each of them has its own authority and responsibility area. The districts are divided into quarters and villages and every quarter or village has an elected head officer (*muhtar*) but his/her responsibilities are limited with specific administrative procedures such as registration of residents and keeping the records. Istanbul has 805 quarters and 151 villages.

Although the total area covered by the districts remained same between 1950 and 1995, the number of districts in the metropolitan area has changed as follows:

Year	No. of Districts
1950	16
1965	19
1990	25
1992	32
1993	33
1995-2007	32

The present 32 municipal districts in an area of 5,390 km^2 are shown in Figure 2.2.1.

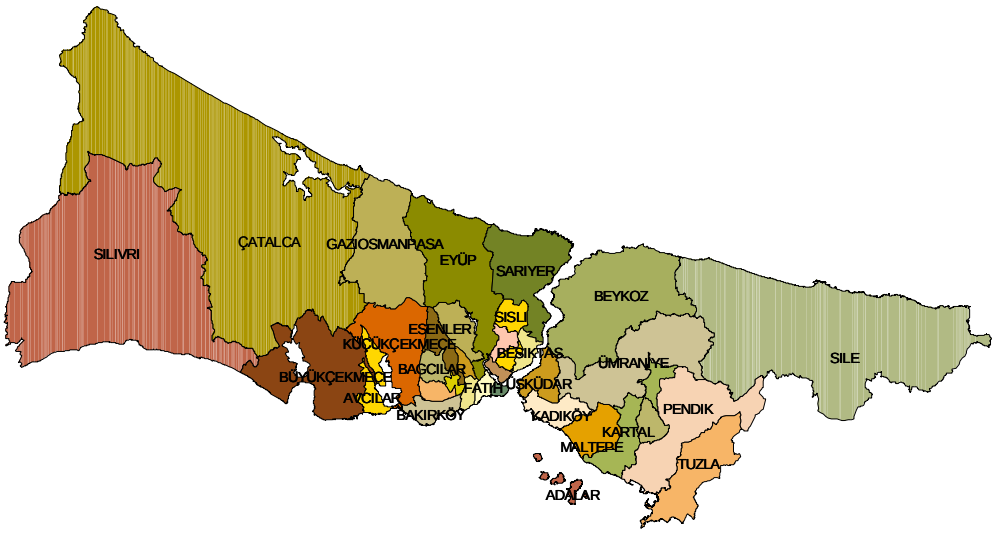


Figure 2.2.1: The Municipal Districts of Istanbul

[3] *In April 2008, the number of municipal districts of Istanbul increased from 32 to 38.*

2.3. Population and Demographic Data

Istanbul is the biggest metropolitan city in Turkey with a population of 12.6 million in 2007. The city's population has grown rapidly since 1950. In addition to the natural population growth, extraordinary migration from rural areas has been the major factor (Figure 2.3.1). Average annual population growth rates in the 1935 -2000 period are as follows:

1935 - 1950	1.87 %
1950 - 1970	4.87 %
1970 - 1990	4.44 %
1990 - 2000	3.37 %
2000 - 2007	3.30 %

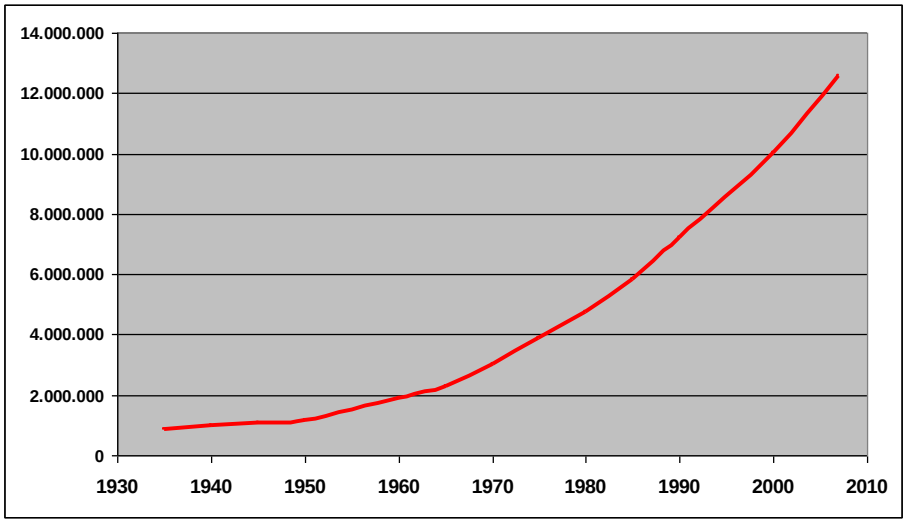


Figure 2.3.1: Population Growth in Istanbul

The data regarding the demographic and spatial growth dynamics of the urban area have been collected from two sources:

- The national population census carried out by Turkish Statistical Institute (TUIK).
- Data collected for the transportation master plans of Istanbul approved in 1987 and 1996, and household travel surveys (HTS) in 2006.

Turkish Statistical Institute (TUIK) has been carrying out national population census in Turkey since 1927, at 5-year intervals between 1935 and 1990. The last population census was carried out in 2000, 10 years after the 1990 census. In 2007, a different methodology (address based) was used and the results were announced recently in January 2008. According to the results announced recently, Istanbul's population has reached to 12,573,896 in 2007 while the Turkey's population was found as 70,586,256[4] (17.8 % of Turkey's population).

[4] *Turkish Statistical Institution (TUIK), 2007.*

The results of the population censuses and the address based new system in 2007 are given in Table 2.3.1.

Table 2.3.1: Population Growth in Istanbul

Year	Population
1935	**883.599**
1940	**991.237**
1945	**1.078.399**
1950	**1.166.477**
1960	**1.882.092**
1965	**2.293.823**
1970	**3.019.032**
1975	**3.904.588**
1980	**4.741.890**
1985	**5.842.985**
1990	**7.195.773**
2000	**10.018.735**
2007	**12.573.836**

The age groups by sex are also a good indicator to analyse the demographic characteristics of the population. Age group by sex in 2007 in Istanbul is given in Table 2.3.2. The table shows that 25 % of the population in Istanbul is under the age of 20 and more than 50 % of the population is under the age of 30. Turkish Statistical Institute (TUIK) has also announced that the median age of the population in Turkey is 28.3 (27.7 for males, and 28.8 for females).

Table 2.3.2: Age Groups by Sex (2007)

Age Group	Population			%	Acc. %
	Male	Female	Total		
0-4	497.651	469.715	967.366	7,69	7,69
5-9	537.301	505.608	1.042.909	8,29	15,99
10-14	533.365	501.693	1.035.058	8,23	24,22
15-19	529.061	487.704	1.016.765	8,09	32,31
20-24	521.083	568.511	1.089.594	8,67	40,97
25-29	680.205	671.363	1.351.568	10,75	51,72
30-34	614.363	591.694	1.206.057	9,59	61,31
35-39	524.222	498.862	1.023.084	8,14	69,45
40-44	458.489	444.186	902.675	7,18	76,63
45-49	385.347	371.661	757.008	6,02	82,65
50-54	318.979	318.927	637.906	5,07	87,72
55-59	235.185	240.314	475.499	3,78	91,50
60-64	156.917	171.001	327.918	2,61	94,11
65-69	109.886	135.240	245.126	1,95	96,06
70-74	82.398	107.208	189.606	1,51	97,57
75-79	56.734	92.508	149.242	1,19	98,76
80-84	31.149	61.162	92.311	0,73	99,49
85-89	10.756	24.269	35.025	0,28	99,77
90+	8.672	20.447	29.119	0,23	100,00
Total	**6.291.763**	**6.282.073**	**12.573.836**	**100,00**	

Source: TUIK, 2007.

Population pyramids, sometimes called as age – sex pyramids, display the demographic structure of the population graphically and gives a better understanding. The population pyramids broken down by five - year age intervals and gender in 2007 in Istanbul are shown in the Figure 2.3.2. These pyramids show a triangle-shaped pattern for the ages between 25 and 90+ and reflect a very high growth rate for the period until 1980s.

The age groups between 0 and 25 have smaller population than the age groups between 25 and 35, and indicate a decreasing rate of population growth rate after 1980s.

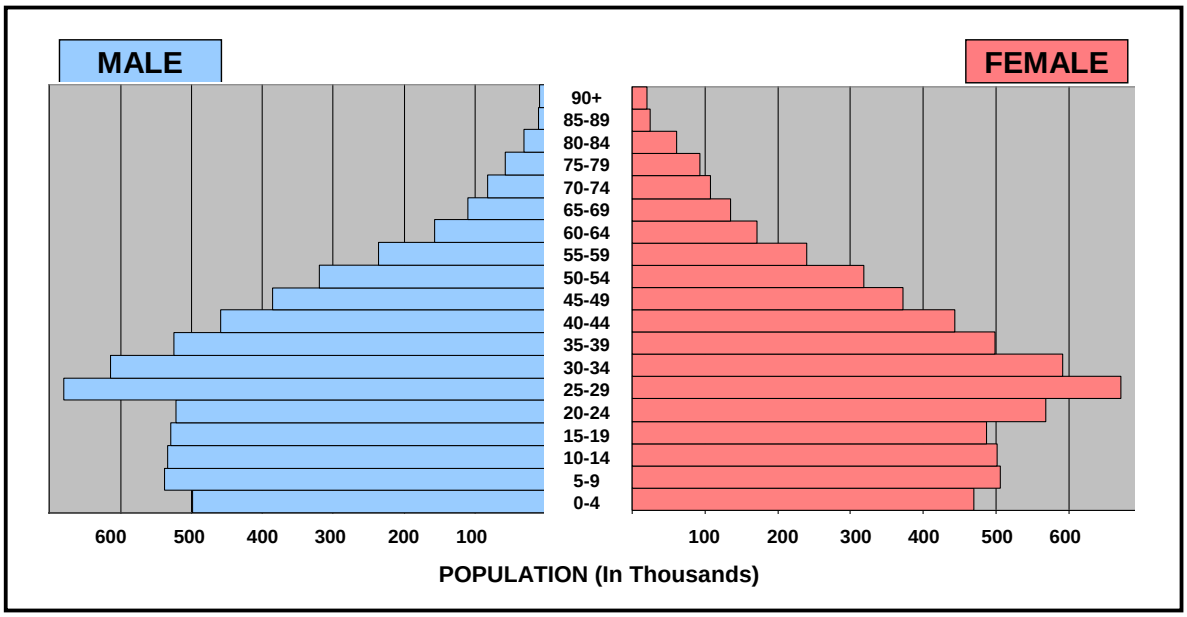


Figure 2.3.2: Population Pyramids of Istanbul (2007)

For the sake of comparability with the city area covered by the statistical sources of demographic and economic data, the results of 1985 and 1990 population census were adjusted according to the administrative divisions in the year 2007. The population of quarters (*mahalle*) which compose the districts were used to estimate the 1985 and 1990 population figures with the existing administrative boundaries.

The population of the municipal districts of Istanbul in 1985, 1990, 2000 and 2007 is shown in Table 2.3.3.

It is important to note that 3 additional districts (Silivri and Çatalca in the European side, and Şile in the Asian side) covered in the 2006 household travel surveys (HTS) are the largest districts of Istanbul (56 % of total area of the province) but only account for 2 % of the total population. The average population density and the density of the area covered in the 1996 HTS are given in Table 2.3.4 and in Figure 2.3.3.

Table 2.3.3: Population of Municipal Districts of Istanbul (1985 – 2007) (*)

District No	District Name	1985 Population	1990 Population	2000 Population	2007 Population
01.	Adalar	14.785	19.413	17.760	10.460
02.	Avcilar	140.888	126.493	233.749	323.596
03.	Bağcilar	168.784	291.457	556.519	719.267
04.	Bahçelievler	129.315	298.211	478.623	571.711
05.	Bakirköy	332.180	301.673	208.398	214.821
06.	Bayrampaşa	188.376	212.570	246.006	272.196
07.	Beşiktaş	204.911	192.210	190.813	191.513
08.	Beykoz	134.787	161.609	210.832	241.833
09.	Beyoğlu	245.999	229.000	231.900	247.256
10.	Eminönü	93.383	83.444	55.635	32.557
11.	Esenler	135.373	223.826	380.709	517.235
12.	Eyüp	199.247	211.986	255.912	325.532
13.	Fatih	497.459	462.464	403.508	422.941
14.	Gaziosmanpaşa	291.715	393.667	752.389	1.013.048
15.	Güngören	123.476	213.109	272.950	318.545
16.	Kadiköy	577.863	648.282	663.299	744.670
17.	Kağithane	120.996	269.042	345.239	418.229
18.	Kartal	173.683	273.572	407.865	541.209
19.	Küçükçekmece	197.890	352.926	594.524	785.392
20.	Maltepe	209.449	254.256	355.384	415.117
21.	Pendik	109.543	200.907	389.657	520.486
22.	Sariyer	147.503	171.872	242.543	276.407
23.	Şişli	405.530	250.478	270.674	314.684
24.	Tuzla	76.139	96.150	123.225	165.239
25.	Ümraniye	143.118	303.434	605.855	897.260
26.	Üsküdar	348.217	395.623	495.118	582.666
27.	Zeytinburnu	147.849	165.679	247.669	288.743
28.	Büyükçekmece	58.365	142.910	384.089	688.774
29.	Çatalca	57.141	64.241	81.589	89.158
30.	Silivri	55.625	77.599	108.155	125.364
31.	Sultanbeyli	3.732	82.298	175.700	272.758
32.	Şile	19.436	25.372	32.447	25.169
Total		**5.752.757**	**7.195.773**	**10.018.735**	**12.573.836**

(*) According to the 2007 district boundaries.

Table 2.3.4: Population Densities (1985 – 2007) (Inhabitants / Km^2)

Years	1996 HTS Area	Additional Districts in the 2006 Study	Average
1985	2,390	44	1,067
1990	2,988	55	1,335
2000	4,165	73	1,859
2007	5,244	79	2,333

Average population density of Istanbul has increased from 1,067 inhabitants per km^2 in 1985 to 2,333 inhabitants per km^2 in 2007. However, zonal densities are as high as 44,205 inhabitants per km^2 in the densely populated areas in the European side of the city (Figure 2.3.3).

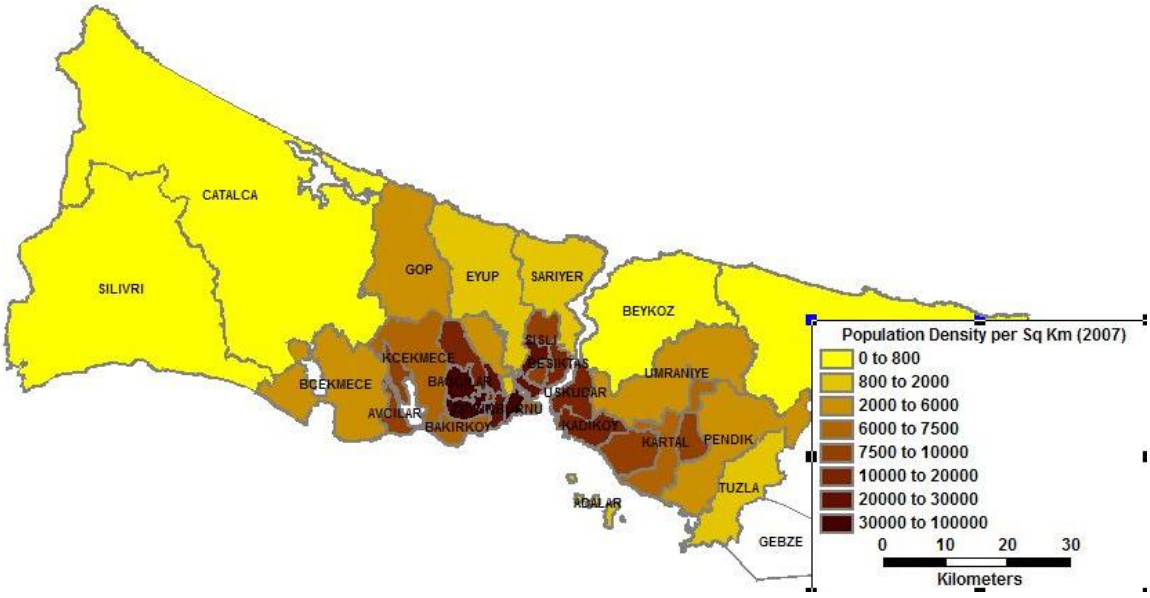


Figure 2.3.3: Population Density in Istanbul (2007)

2.4. Employment

Employment data by districts of the city is the most difficult data to collect in Istanbul. The data about civil servants, industry workers, tradesmen and the other workers within the districts were collected separately by the Governorship of Istanbul, Istanbul Chamber of Industry and Istanbul Chamber of Commerce in the course of the transportation master plans prepared in 1987, 1996 and 2006. However, because of the high portion of informal employment (it is estimated as high as 1/3 of total employment) in some sectors, about one third of the present population is estimated to be employed. Therefore, employment estimates were made by considering the trip ends of the daily work trips and indication on the working sites generating these daily trips.

Total employment was estimated as 3,862,821 in 2006. Average employment density in 2006 was estimated as 717 employees per km^2. However, zonal densities are as high as 33,797 employees per km^2 in the European side of the city (Figure 2.4.1).

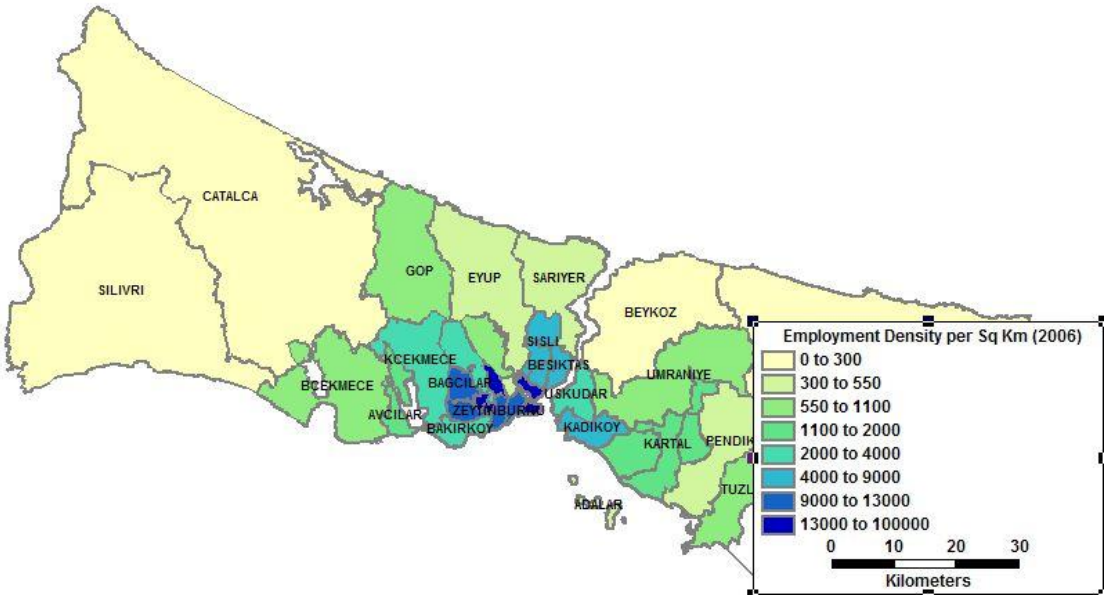


Figure 2.4.1: Employment Densities

2.5. Development Trends and Land Use Pattern Changes by Years

High increase rate of population and the development of the industry and service sectors within the province have changed the land use pattern of Istanbul by years. The agricultural and natural areas have decreased as the lands allocated to housing, industry, commercial functions and transportation infrastructure have increased since 1940s. Table 2.5.1. shows the areas allocated for different functions within the most settled area of the province in the years of 1945, 1968, 1988 and 2000.

The most dramatic lost has been observed in the agricultural areas. The agricultural areas have decreased from about 95,000 hectares in 1945 to 37,000 hectares in 2000. The housing areas have increased 7.4 times whilst the population has increased 9.3 times in the same period. These figures clearly reflect the increase of the densities within the existing and the new housing development areas.

The increases in the surface of the rivers and lakes indicate the new water dams or water reservoirs which have been developed to provide new water supply for rapidly increasing population. This development also indicates the new areas that need to be protected as the water catchment areas of dams for a sustainable development.

Table 2.5.1: Land Use Pattern by Years (Hectares)

Years	Housing	Agricultural Land	Industry Commerce Transportation	Natural Areas	Urban Green Areas	Rivers and Lakes	Total (Excluding Sea)	Sea	General Total (Including Sea)
1945	6.537	94.991	5.534	111.190	723	3.058	222.033	88.721	310.754
1968	14.392	94.133	13.659	95.758	980	3.267	222.189	88.565	310.754
1988	36.886	62.580	31.749	83.012	2.180	6.618	223.025	87.729	310.754
2000	48.506	38.811	36.965	89.727	2.025	7.465	223.499	87.263	310.762

Land use patterns in the years of 1945, 1968, 1988 and 200 are shown in Figures 2.5.1 through 2.5.4. As shown in the land use in 1945, the settlements and other industrial and commercial functions mainly took place in the Historical Peninsula and Pera (Beyoğlu District) with very limited development in the Anatolian Side of the city. There were also some villages along the Bosphorus.

The effects of the plan prepared by Henry Prost can easily be seen from the land use pattern in 1968 given in Figure 2.5.2. The industry originally located on the seashore of the Golden Horn has moved out of the city walls after 1960s. The new housing areas, mostly irregular and informal, have been developed around the industrial areas. Existing housing areas of the city also experienced remarkable changes and the low density single or two storey houses were transformed into 5 – 6 storey apartment blocks.

However, the land use pattern in Istanbul began to change dramatically just after the opening of the first Bosphorus Bridge in 1973. Therefore, dramatic urban sprawl between 1968 and 1988 can be seen in Figure 2.5.2 and Figure 2.5.3.

After the approval of the first 1 / 50,000 scale Land-Use Master Plan of Istanbul, new industrial and housing areas have developed both in the west and the east peripheries of the city and the new settlements spread towards Büyükçekmece in the European Side and Kartal in the Anatolian Side (Figure 2.5.4).

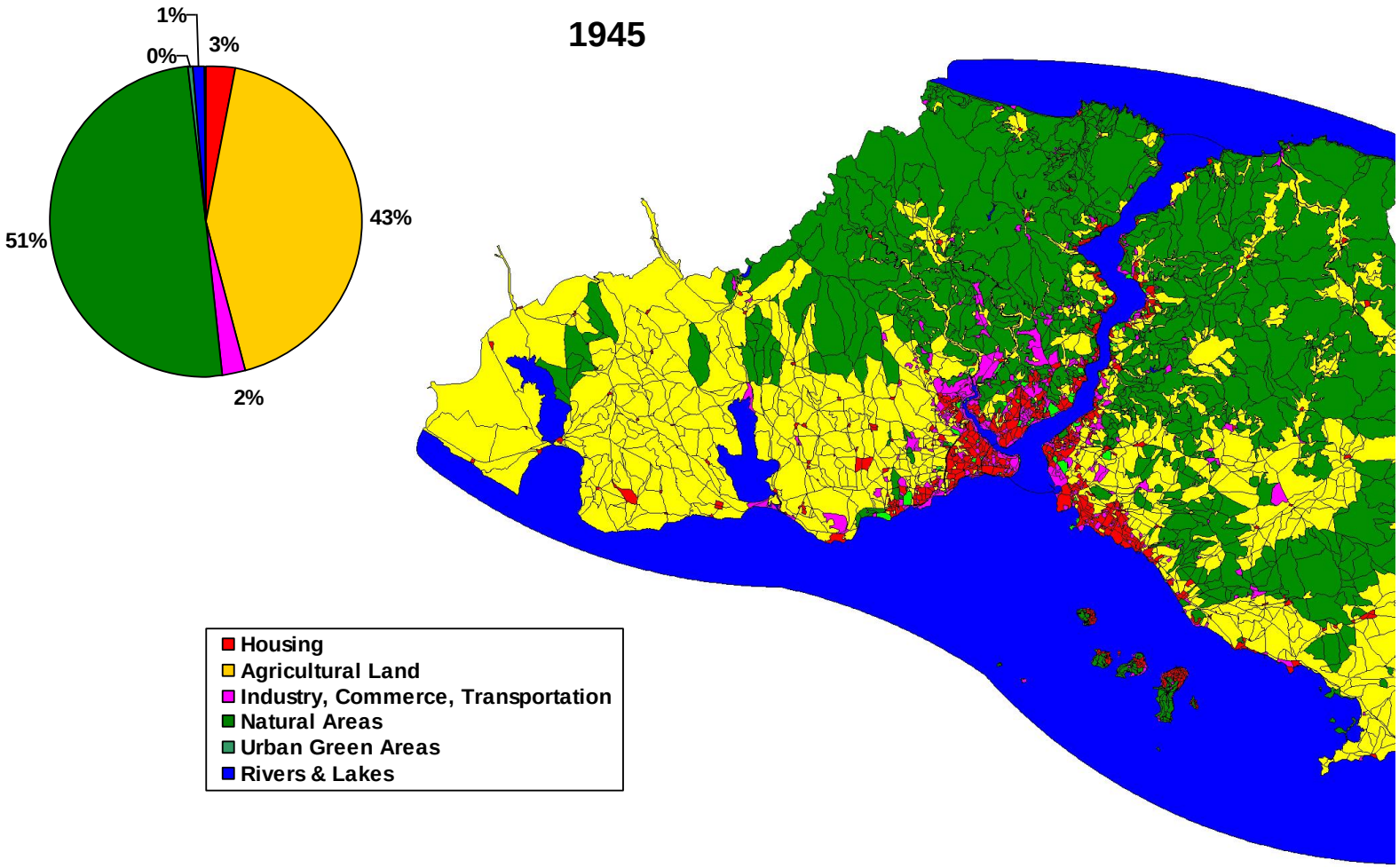


Figure 2.5.1: Land Use Pattern in 1945 *Source: Kemper, G., et al. (2000)*

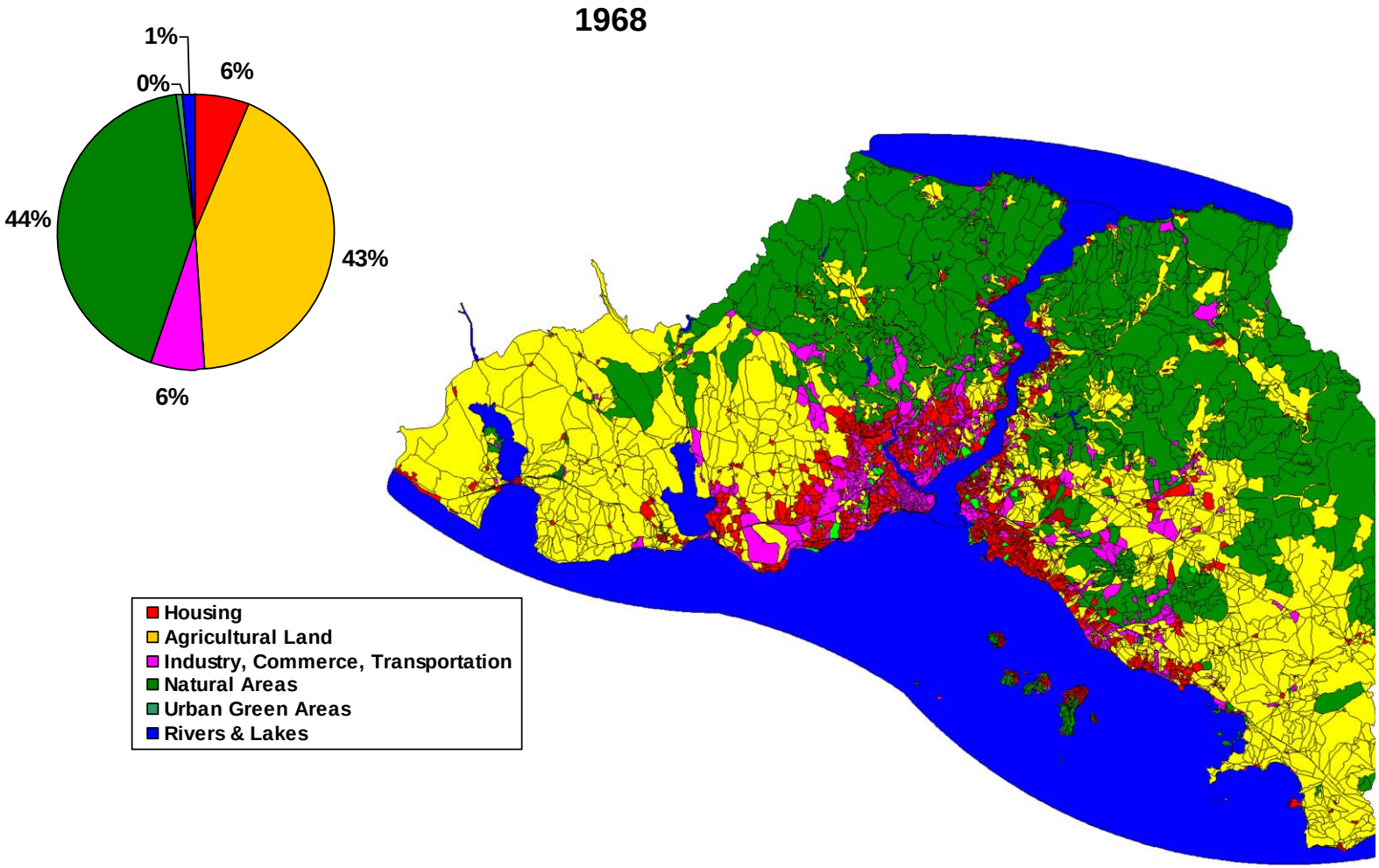


Figure 2.5.2: Land Use Pattern in 1968

Source: Kemper, G., et al. (2000)

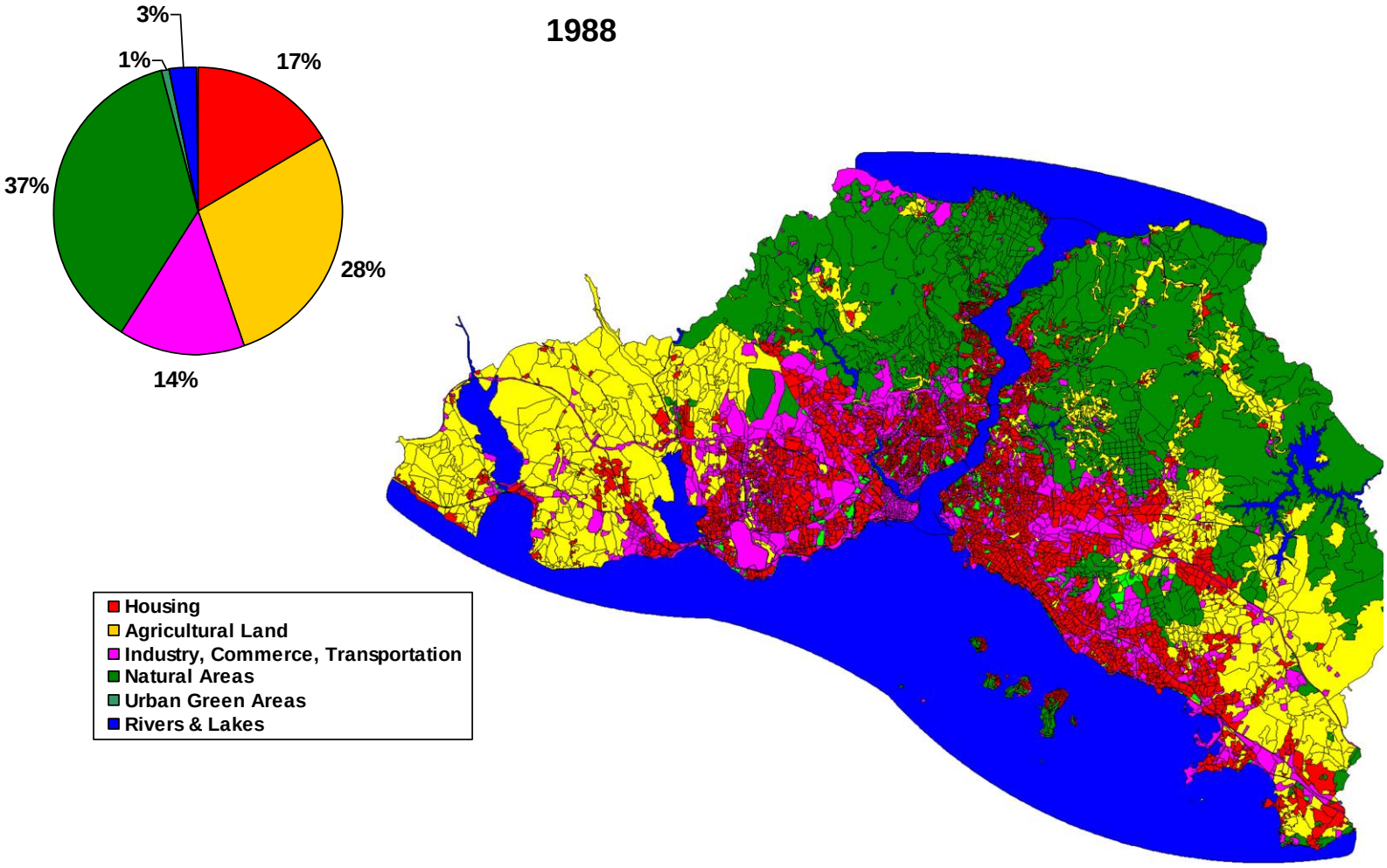


Figure 2.5.3: Land Use Pattern in 1988 *Source: Kemper, G., et al. (2000)*

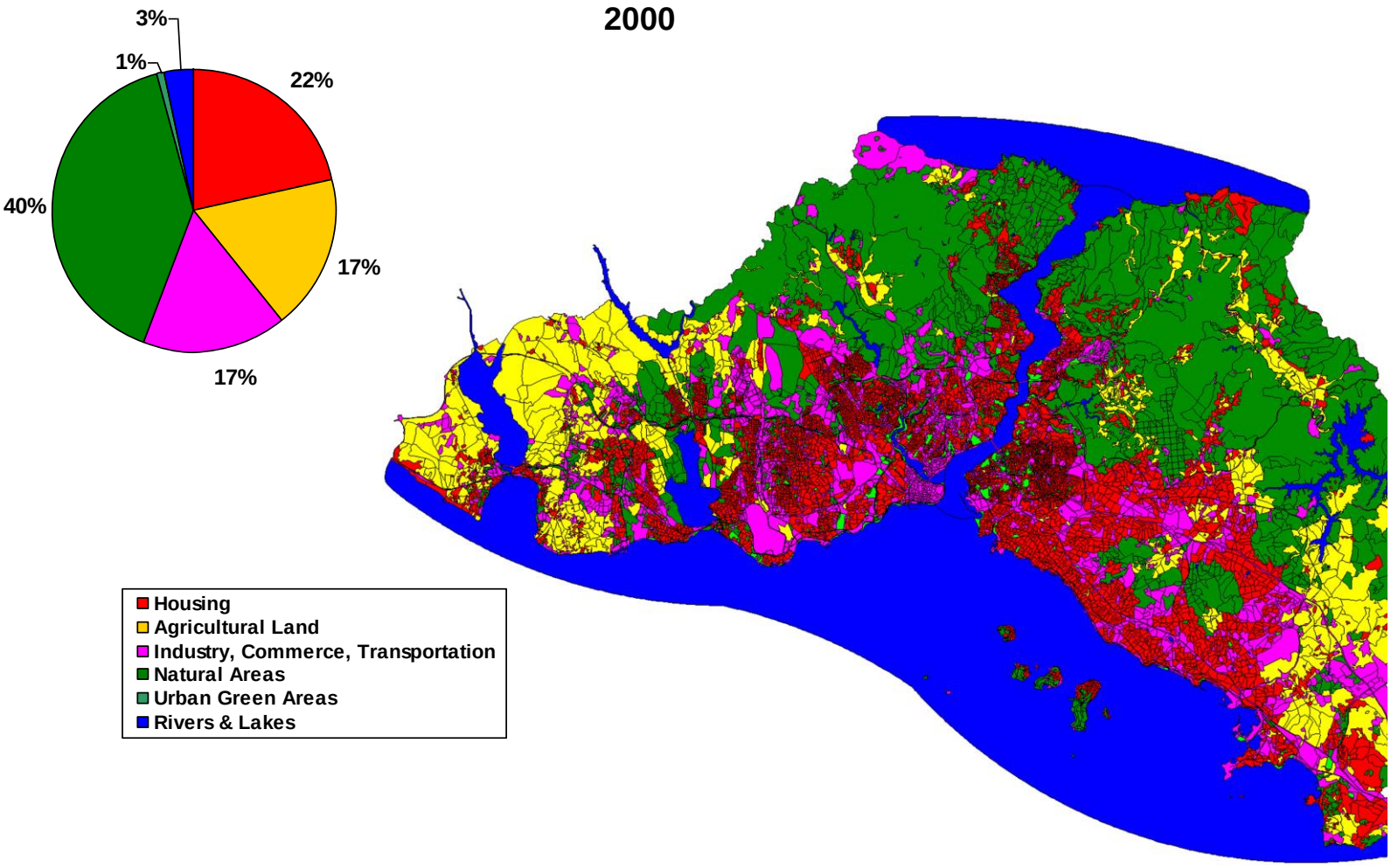


Figure 2.5.4: Land Use Pattern in 2000 *Source: Kemper, G., et al. (2000)*

Figure 2.5.5 shows how different land use functions have been changed between the years 1945 and 2000.

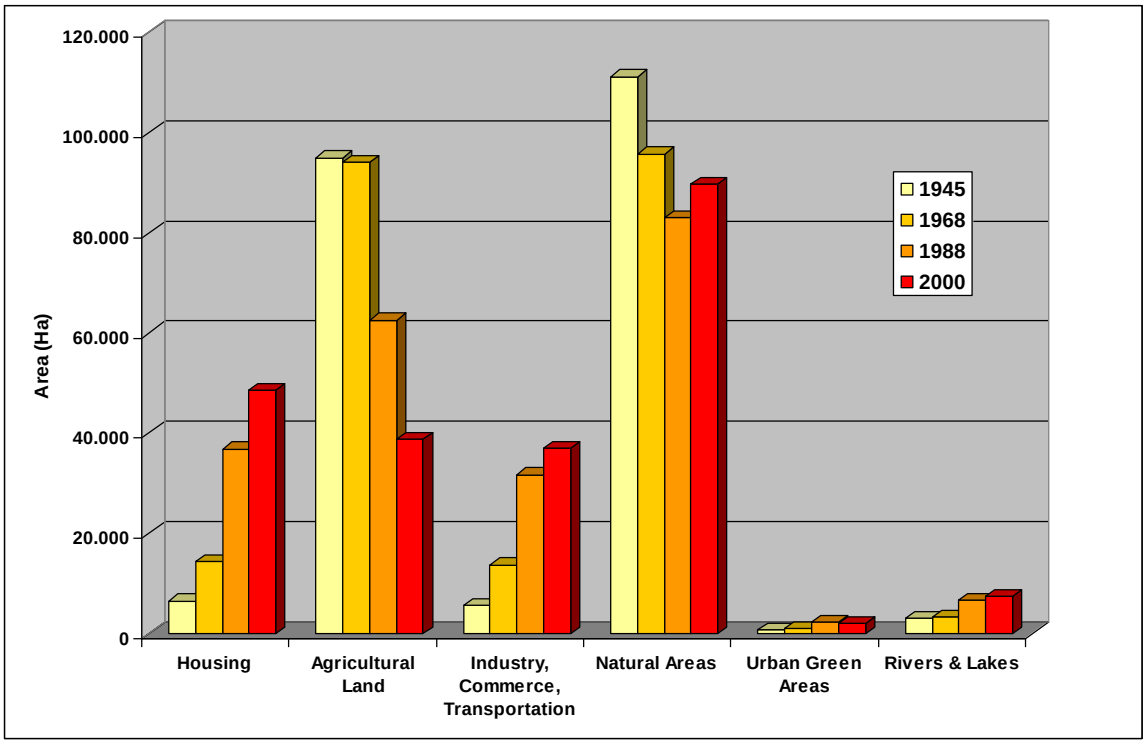


Figure 2.5.5: Change in the Land Use Pattern by Years

In order to emphasize the population distribution changes in different regions between the years 1985 and 2007, Istanbul is analysed in three rings: the core, the first ring and the second ring. As can be seen in Figure 2.5.6, the core consists of a circle with a 3-km radius centring the Historical Peninsula. Fatih, Eminönü and Beyoğlu districts are considered in the core.

The districts of Bakırköy, Bahçelievler, Beşiktaş, Güngören, Bağcılar, Esenler, Gaziosmanpaşa, Eyüp, Bayrampaşa, Kağıthane, Kadıköy, Üsküdar, Şişli and Zeytinburnu compose the first ring with a radius of approximately 15 km.

The second ring has a radius of approximately 30 km. and covers the districts of Büyükçekmece, Sarıyer, Beykoz, Ümraniye, Kartal, Sultanbeyli, Maltepe, Adalar, Avcılar and Küçükçekmece. The areas outside these three rings are considered as rural areas which cover Silivri, Çatalca, Şile, Pendik and Tuzla districts.

The three rings are superposed with the district borders and shown in Figure 2.5.7. Rural areas of Gaziosmanpaşa and Eyüp districts are considered in the second ring. The percentages of the areas covered by the four regions are also given in the same figure.

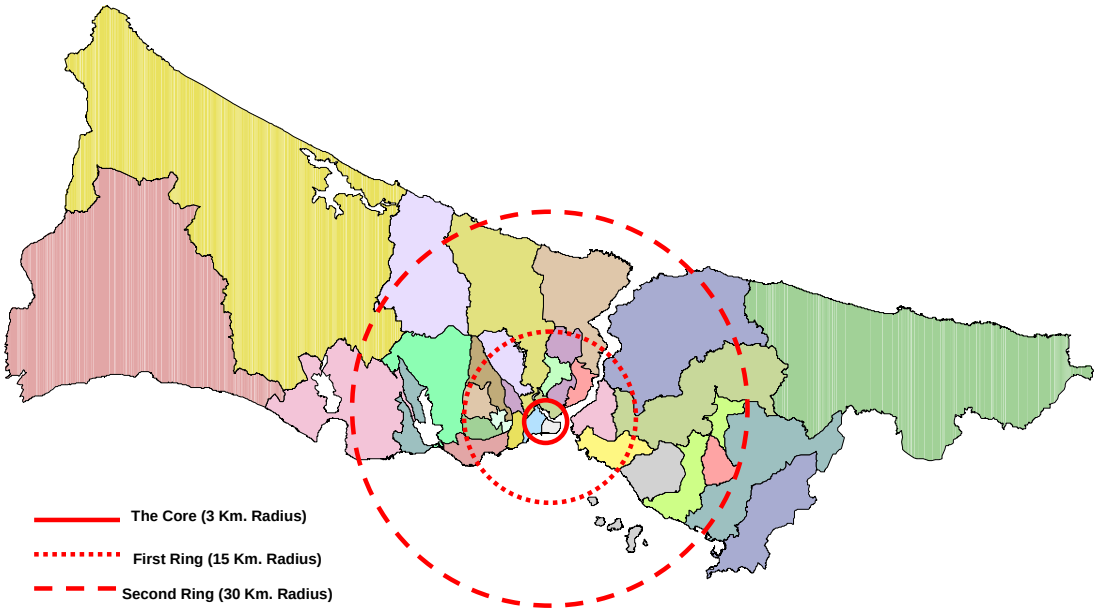


Figure 2.5.6: The Regions within the Rings

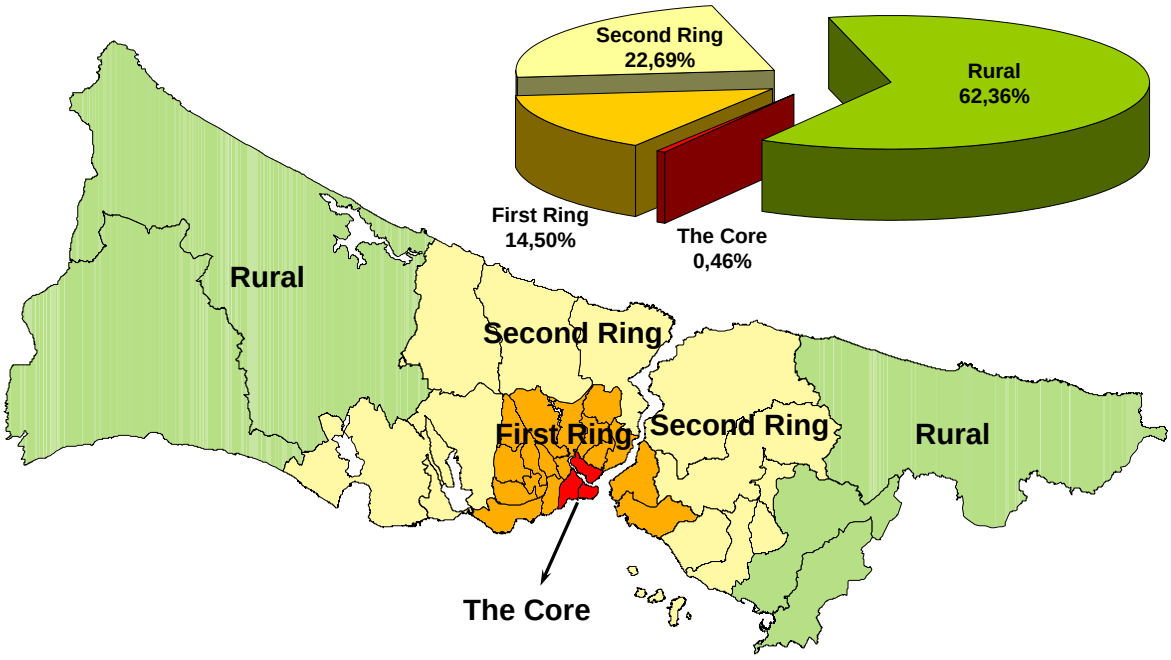


Figure 2.5.7: Superpose of the Rings with the District Borders

The core which has a 0.46 % share of the total area used to accommodate 14.5 % of the total population in 1985. The share of the population in the core area has decreased to 5.6 %

in 2000. The area within the first ring shows the same development trend with the core. The share of the population within the first ring has decreased from 58.6 % in 1985 to 51.6 % in 2007.

The population within the second ring has shown a rapid growth in the same period. The share of the population in the rural areas also had an increasing growth rate but not as much as that within the second ring. As a result, the population of the core and the first ring, that comprise the old settlements of the city, have a lower increase rate than Istanbul in general.

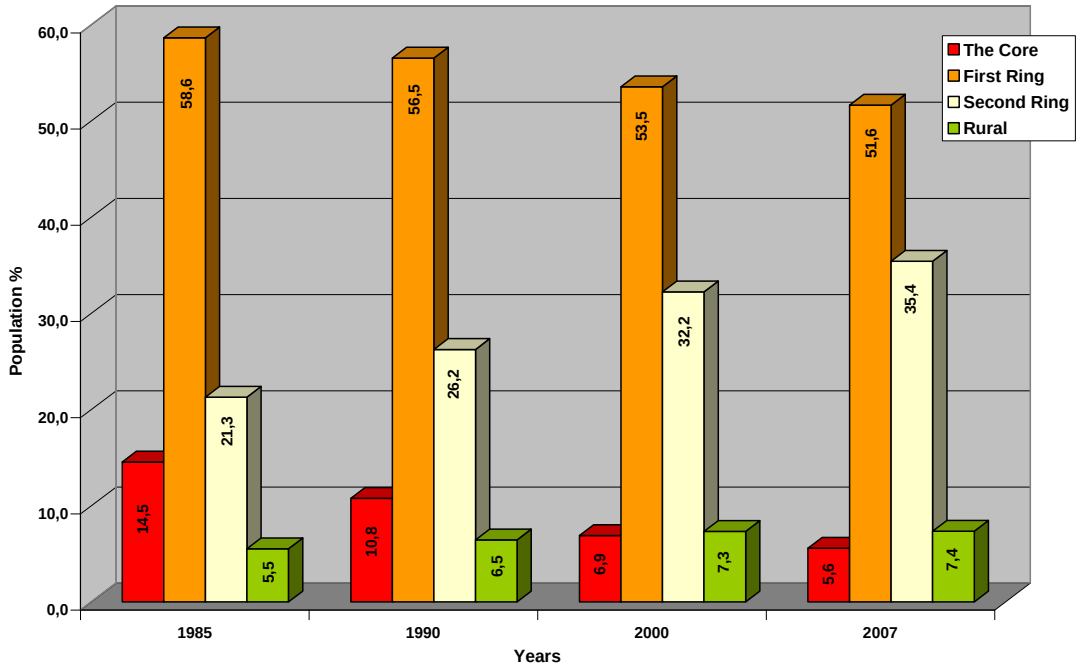


Figure 2.5.8: Population within the Rings

2.6. Threats on the Natural Resources

High level of urbanization in Istanbul has negatively affected the natural resources such as forests, agricultural areas and drinking water supplies. As explained in the previous section, agricultural lands, natural resources and urban green areas, which were originally covering 94 % of the total lands in 1945, have decreased to 58 % in 2000.

Transportation infrastructure is the most important factor that encourages the new settlements and threats the natural resources. Existing agricultural and forest areas inside the buffer of 5 km. of the highway infrastructure is shown in Figure 2.6.1 and Figure 2.6.2.

As can be seen from these figures, 80 % of the agricultural lands in Istanbul take place within the buffer of 5 km. which corresponds to an area of 119,085 ha. The forests within the city are in a better position than the agricultural lands, but still 58 % of the forest areas take place within the buffer of 5 km.

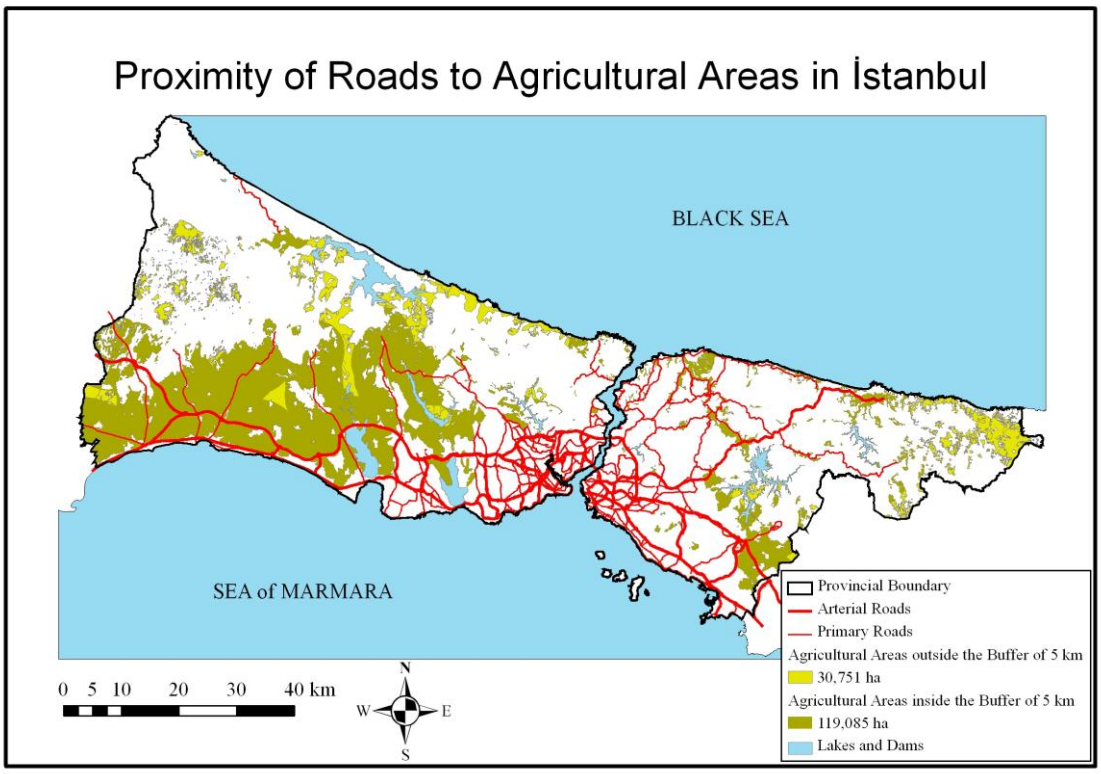


Figure 2.6.1: Agricultural Areas and Roads

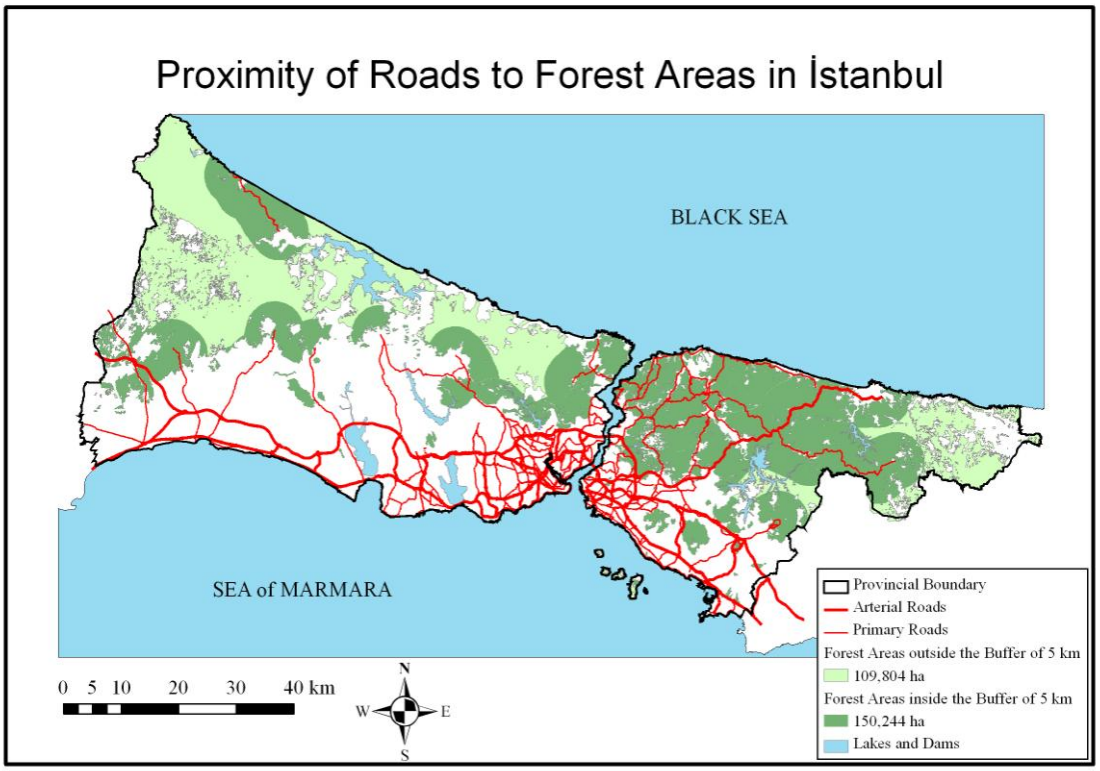


Figure 2.6.2: Forests and Roads

3. URBAN and SUB-URBAN TRAVEL

3.1. Transportation System and Mobility Data Collected

The separated geographical condition of Istanbul together with insufficient road network capacity and narrow access roads have generated constraints of transportation system. Especially insufficient link with two urban areas of European and Anatolian side in the city for passenger and freight services has become a fundamental issue in recent years in conjunction with rapid increase of inter and intra-regional economic activity of the city.

On the other hand, urban road network and village roads in Istanbul are not sufficient, causing traffic problems while highways have been developed like other metropolitan cities by development density. Public transportation development in recent years has been boosted in the railway sector in Istanbul although development density (25 m / km2) is still low in comparison with other metropolitan cities, while bus network has served urban commuters as major transport means of citizen of Istanbul.

Private vehicles have created serious traffic congestion problems and environmental pollution in the urban centres of Istanbul.

Transportation system and mobility data have been collected from the following sources:

- Household travel surveys (HTS) conducted for the transportation master plans prepared in 1987, 1996 and 2006.
- Public transport official data (riderships, modal split, trip length, etc.)
- Transportation infrastructure data of the city for the years given above.

In 2004, the new Metropolitan Municipal Law (No.5216/2004-5) extended the jurisdiction of IMM to the provincial borders, the same as Istanbul Provincial Government jurisdiction; Istanbul Metropolitan Municipality (IMM) presently covers the entire province of Istanbul. Therefore, HTS data for the years 1987 and 1996 covers an area of 2,352 km^2, whilst 2006 data covers a larger area of 5,390 km^2 as shown in Figure 3.1.1.

In this study, the most recent travel data have been obtained from IMM that completed an extensive household travel survey (HTS) covering 72,280 households in 2006 which is equivalent to a sampling rate of 2.2% to the total in Istanbul.

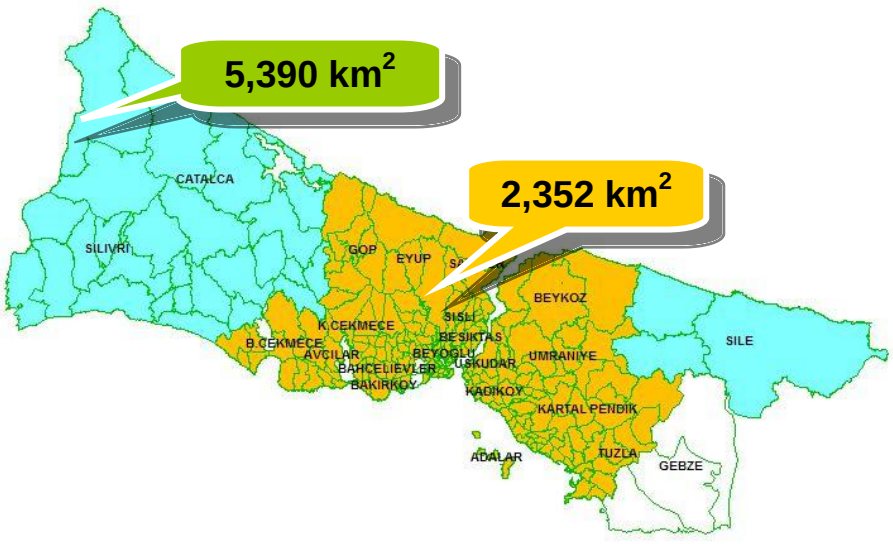


Figure 3.1.1: Development of Metropolitan Area of Istanbul

3.2. Road Network

Urban transportation has long been formed by a road-based policy focusing on providing more road capacity to accommodate the rapidly increasing number of motor vehicles in Istanbul. As a result, multi-lane roadways, over and underpasses, complex intersections etc. have been built to solve the ever increasing congestion problem. However, additional capacity provided by these road investments facilitated a rapid growth in car use and created "induced traffic" as a result of the changes in the land-use and activity patterns.

Almost 90 % of the private + public passenger trips are made by road vehicles in Istanbul and requires an extensive road network. For 2.3 million motor vehicles circulating on city roads, there are two transit highway routes (TEM-Trans European Motorway and Bosphorus Bridges Roads). Both of these roads are congested nearly every hour between 07:00h and 21:00h.

Two highway bridges connect the European and Asian sides over the Bosphorus Strait. The first Bosphorus crossing was constructed in 1973, together with the necessary beltway as an outer motorway. The second bridge commenced operations in 1988 on the north side of the first bridge, connecting to the Trans European Motorway (TEM). Although the TEM serves as intercity transportation, it is being used for daily intra city trips crossing the Bosphorus, especially in the rush hours.

The historical background of the city affected and shaped the roads in Istanbul. The roads in the historic peninsula are generally narrow and have low capacities to serve the car traffic created by dense population. The road-based public transportation system is largely consisted of municipality buses, private buses and the minibuses.

Existing road network and highway densities by municipal districts are shown in Figure 3.2.1 and Figure 3.2.2, respectively.

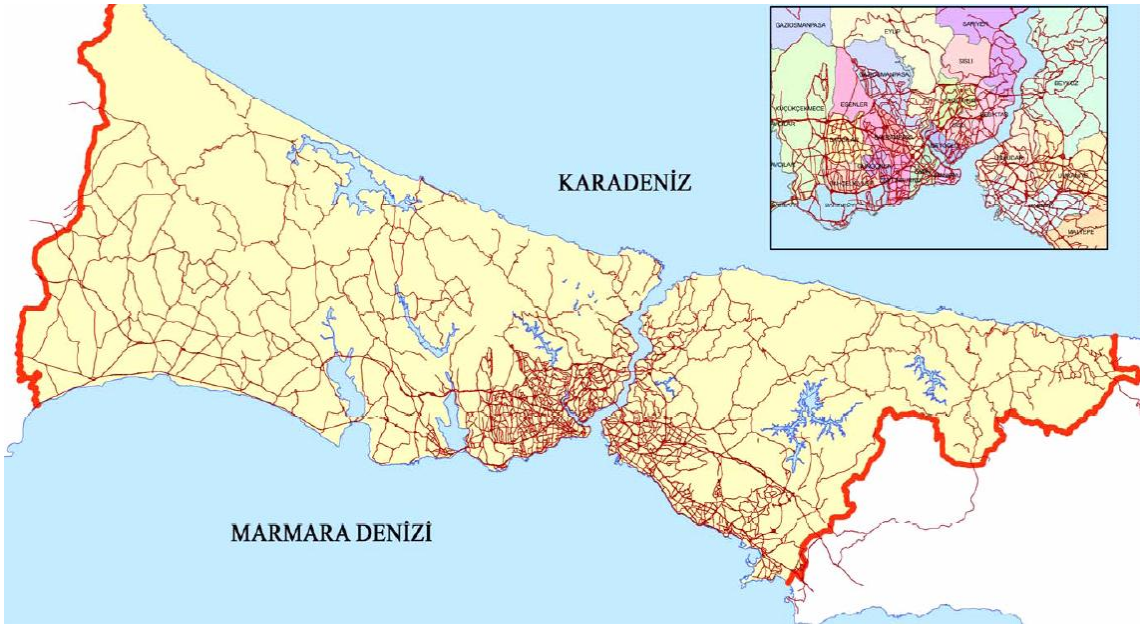
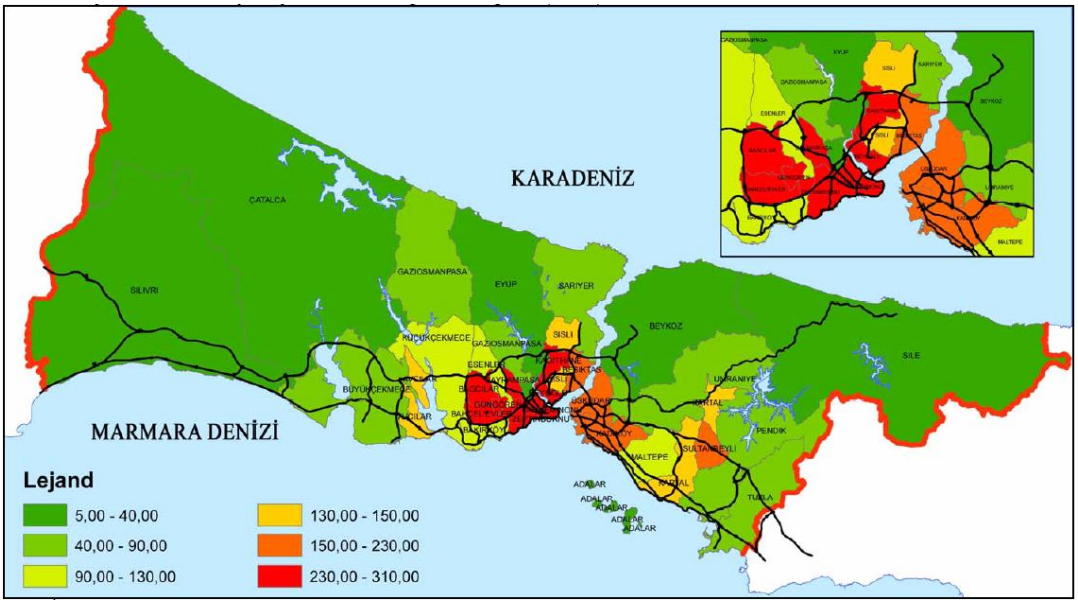


Figure 3.2.1: Arterial Roads in Istanbul *Source: IMM*

According to the Municipality of Istanbul, the total length of the road network, as of 2007, is 26,853 km, of which 63 % or 16,800 km is developed in the European side as shown in Table 3.2.1.

The roads in Istanbul are classified into 3 categories: freeways, arterial roads and other roads. In this classification, freeways are limited only to TEM of about 150 km in total length and it is under the responsibility of the General Directorate of Highways (KGM). Other roads are under the responsibility of IMM and they are classified into two categories; arterial roads and other roads (Table 3.2.1).



Source: IMP

Figure 3.2.2: Highway Densities by Districts (m/ha)

Table 3.2.1: Classification of Roads in Istanbul (km)

		2001	2004	2005	2007
European Side	Freeways (TEM)				151.1
	Arterial Roads	872.8	959.8	1,673.7	2,349.3
	(E-5)				(incl. 200.9)
	Other Roads				15,557.8
	Total				18,058.2
Asian Side	Freeways (TEM)				101.4
	Arterial Roads	680.4	771.9	1,282.8	1,757.3
	(E-5)				(incl. 100.0)
	Other Roads				8,899.7
	Total				10,758.4
Total	Freeways (TEM)				252.5
	Arterial Roads	1,553.2	1,731.7	2,956.5	4,106.6
	(E-5)				(incl. 300.9)
	Other Roads				24,457.5
	Total				28,816.6

Source: IMM Transportation Department

The E-5 seems to be a freeway like the TEM in terms of road structure such as wide carriageway, access control etc. However, it can also be grouped with other arterial roads in this classification. The arterial roads are illustrated in Figure 3.2.1.

The Municipality of Istanbul is now under the process of re-classification of its road network due to the following reasons: (a) the recent urban expansion of new residential areas requires the review of its road network; (b) the improvement work of the roads also requires a review of the functions of each road. Therefore, the new classification will clarify road functions by introducing more detailed category such as arterial, semi-arterial, collector etc.

3.3. Public Transportation System

The public transportation system in Istanbul has been unable to keep pace with the rapid growth and changing urban structure. Local authorities have been struggling under the pressure of urbanization without sufficient funds to accommodate growth. Turkey has in recent years been increasingly interested in improving its cities' public transportation systems. One of the most important examples of this is the revitalization of urban rail transit systems. Even though this is a local initiative, the national government has also adopted a policy to improve the conditions of transport systems in all medium-size and large cities in Turkey. Istanbul is served by a relatively good public transport system, which is generally well managed and continuously being improved. The Municipality of Istanbul has successfully introduced an electronic ticketing system (Akbil) that allows for discounted transfers within the public transport network (buses, ferries and rail transit system) and better integration of the system, but additional actions are needed to further improve the efficiency and attractiveness of the public transport system, and stop or at least slow the shift to private vehicles.

3.3.1. Buses and Minibuses

Buses and minibuses (including "dolmuş" that operate on certain routes) together form the main body of the public transport network (Figure 3.3.1 through 3.3.3). Today, 591 bus routes and 123 minibus routes provide service for over 4.5 million passengers on a network of 6,100 kilometres. The existing public transportation infrastructure in the city is mainly operated by the Municipality of Istanbul and largely based on road systems. The extensive public bus system includes nearly 4.222 buses, of which 2.858 operated by IETT and 1.347 operated by the private operators under the license of the Municipality and handle the 25 % of the total daily road-based trips[1].

[1] *IETT, 2006.*

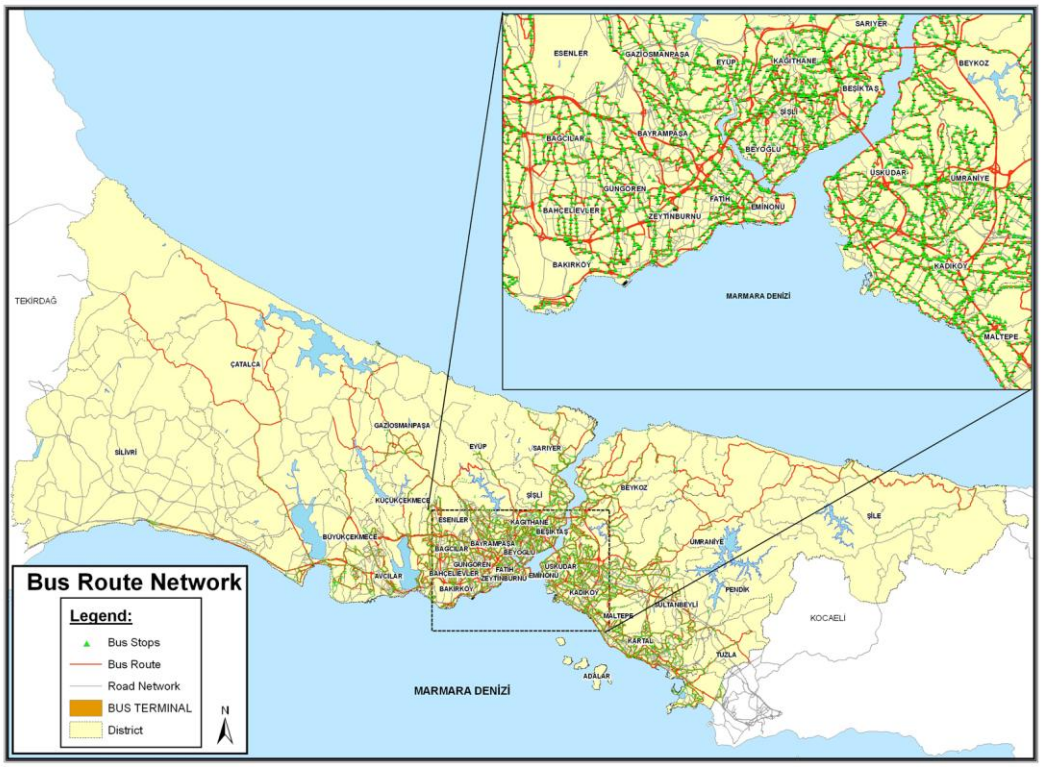


Figure 3.3.1: Service Coverage of Bus *Source: JICA (2007)*

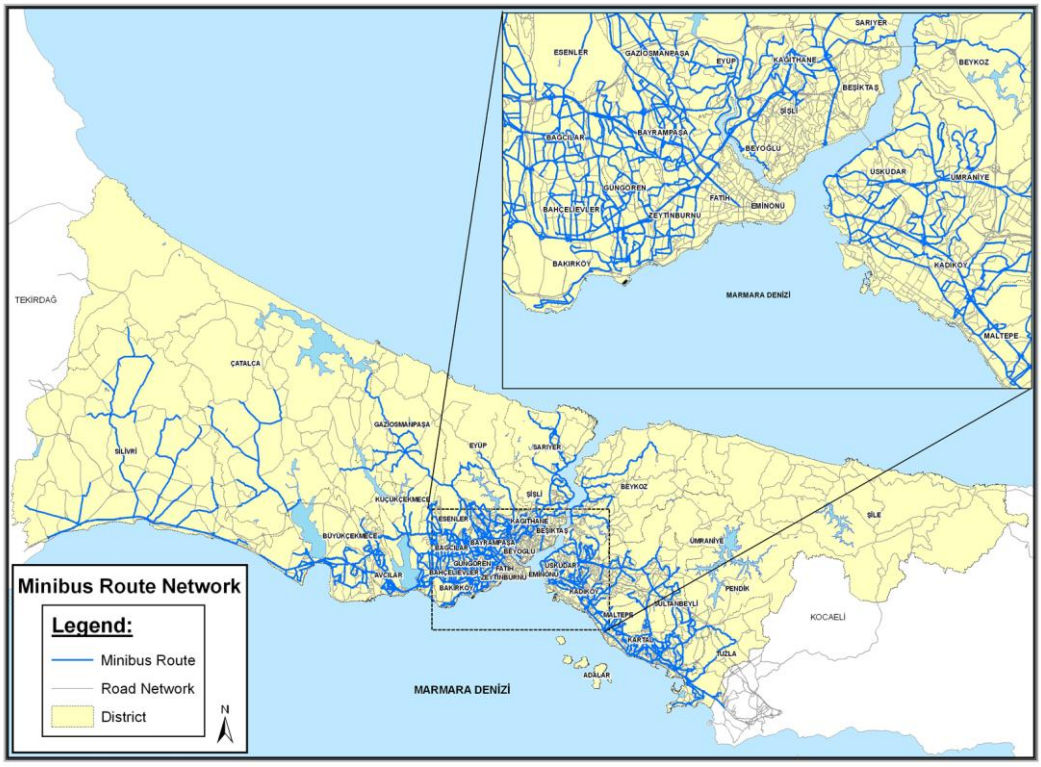


Figure 3.3.2: Service Coverage of Minibus *Source: JICA (2007)*

Figure 3.3.3: Service Coverage of Dolmuş *Source: JICA (2007)*

3.3.2. Rail Transport

The rail system is not extensive with a total length of 137 km of which most provides a low level of service (Figure 3.3.4). The Istanbul Metropolitan Municipality has recognized the need for improving the public transport system and has started some rail transit projects.

Istanbul has a metro (8.5 km), a light metro (19.3 km), three tramways (32 km), two funiculars (1.2 km), two nostalgic tramways (4.2 km), suburban railways (72 km), and two cablecars (0.9 km) with a total length of 138 km. The standard gauge of 1435 mm is applied for all lines of the metro, the light metro, and the tramways. Table 3.3.1 shows the daily riderships of the existing railways operated by IMM.

Since Istanbul is a hilly city, there are natural constraints on the construction of railways, because they require a gentle gradient of less than 5 % and a radius curve larger than 300 m. Istanbul has very limited flat areas which are mostly found along its coastline. Therefore, many kinds of railway systems, such as subway, cablecar and funicular, are constructed and operated. However, cablecar and funicular are not suitable for mass transit.

The existing metro line between Taksim and 4 Levent was opened in September 2000 and carries about 160,000 passengers daily among 6 stations. The southern extension of this line will connect the metro to the Marmaray Project at Yenikapı Station, the Bosphorus railway tunnel crossing project that will connect the existing railway commuter lines on the two sides of the city. Yenikapı is planned to be a multimodal transfer station for metro, commuter railway, sea-bus and the northern extension of the existing metro line operating between Taksim and 4. Levent is also under construction and planned to be opened in 2009.

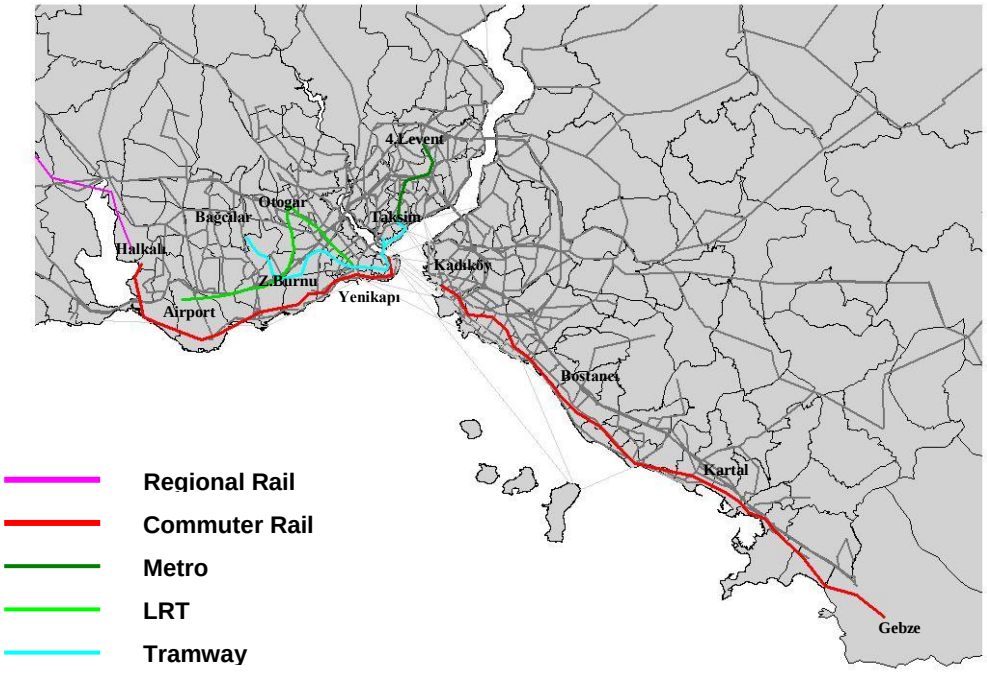


Figure 3.3.4: Present Rail Transit Network

The first section of the existing LRT line was opened between Aksaray and Yenibosna in 1989. With the extension to the Atatürk Airport recently completed, the line presently connects Aksaray to the Atatürk Airport with a double-track system of 20 km- long and serves 18 stations. Depending on the location, the station is elevated, at-grade or underground. Stations have both central and side platforms and can accommodate 4-car trains. The LRT carries about 224,000 passengers daily.

There are also two other tramways that operate in the European side of Istanbul from Zeytinburnu to Kabataş and from Zeytinburnu to Bağcılar. These tramways carry about 245,000 passengers daily.

Turkish State Railways (TCDD) operates commuter trains from Gebze to Haydarpasa in the Asian side and from Sirkeci to Halkalı in the European side. Commuter railways carry about 110,000 passengers daily.

Table 3.3.1: Daily Ridership of the Rail Transport System Operated by IMM

Route	Type	2003	2004	2005	2006	2007
Taksim - 4.Levent	Metro	106,402	118,880	128,182	146,786	157,476
Aksaray - Havaalanı	LRT	154,400	175,115	191,047	212,664	223,963
Zeytinburnu - Kabataş	Tramway	119,949	134,389	157,707	184,312	212,210
Zeytinburnu - Bağcılar	Tramway	-	-	-	30,225	35,008
Taksim - Kabataş	Funicular	-	-	-	17,080	20,933
Tünel	Funicular	8,968	9,878	9,979	10,782	-
Kadıköy - Moda	Tramway	1,014	1,419	1,547	1,568	1,716
İstiklal Caddesi	Tramway	1,757	1,605	1,416	530	-
Cable Car	Cable Car	739	679	656	2,490	3,886
Total		**393,229**	**441,965**	**490,534**	**606,437**	**655,192**

Source: IMM

Presently, construction work for new lines and extension of the existing lines are underway. The total length of the projects under construction is 149.6 km. The Marmaray Project is expected to be completed by 2012, while the other rail transit projects are scheduled to be completed in 2008 or 2009. The rail transport projects that are under construction are listed in Table 3.3.2 and shown in Figure 3.3.5.

Table 3.3.2: Rail Transport Projects under Construction

Project / Route Name	Type	Length (km)	Operation Date	Cost (M $)
Taksim - Yenikapı	Metro	5.9	March 2009	420
Kadıköy - Kartal	Metro	21.7	December 2009	1,100
4.Levent - Darüşşafaka	Metro	8.0	March 2009	450
Otogar - Bağcılar	LRT	5.4	December 2008	1,250
Bağcılar - İkitelli - Olimpiyat Köyü	Metro	15.9	December 2009	800
Marmaray	Metro	76.5	March 2012	3,000
Aksaray - Yenikapı	LRT	0.7	March 2009	50
Topkapı - Edirrnekapı -Sulatançiftliği	Tramway	15.5	June 2008	140
Total		**149.6**		**7,210**

Source: IMM

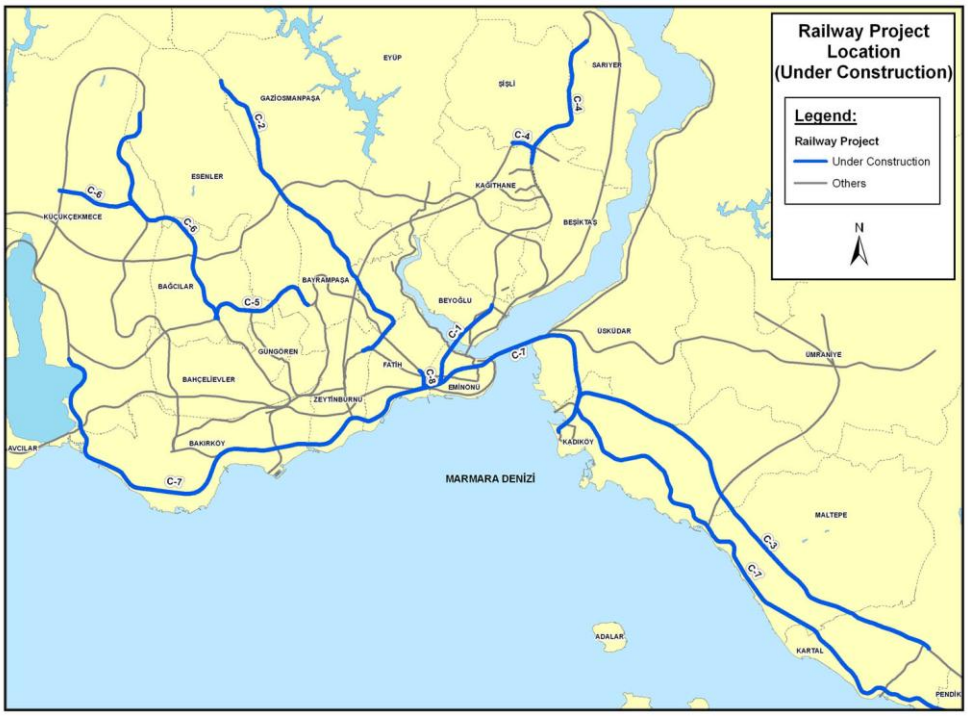


Figure 3.3.5: Rail Transport Projects under Construction (*Source: IMM)*

3.3.3. Sea Transport

Sea public transport of Istanbul is operated by both private and public sector. Turyol and Dentur, two private companies, are specialized in passenger transport with small-to-medium-sized boats.

Although sea passenger transport is limited in the share of all passenger volumes of Istanbul, ferries between European and Anatolian sides have played an important role in carrying sea commuting passengers. IDO A.S. (Istanbul Seabuses Corporation) is the major company of

ferry services under IMM operating 20 sea buses and six ferries for vehicles. It has the following services:

- Fast ferry
- Seabus
- Intercity passenger ferry
- Intercity vehicle ferry
- Mavi Marmara passenger ferry

“Fast ferry” carries both passengers and cars at relatively high speed, while “Seabus”, “Intercity passenger ferry” and “Mavi Marmara passenger ferry” carry only passengers, and “Intercity vehicle ferry” is specialized to carry vehicles. In 2006, IDO carried 243,000 passengers daily while privately operated ferries carried 84,000 passengers a day. Figure 3.3.6 shows the service coverage of sea transport lines.

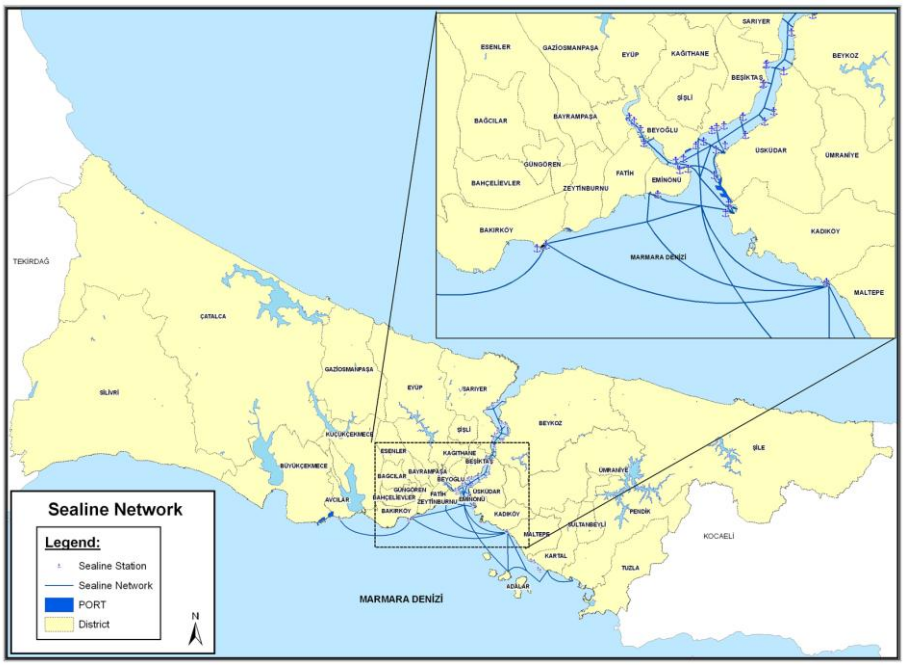


Figure 3.3.6: Service Coverage of Sea Transport *Source: JICA, IMM (2007)*

3.4. Car Ownership

Istanbul Metropolitan Municipality (IMM) has faced a large rapid increase of car ownership in recent years in conjunction with current population increase and economic growth. The total number of vehicles registered in the province of Istanbul is 2.6 million in 2007 (20 % of Turkey’s total motor vehicles). The number of automobiles registered in Istanbul has increased dramatically from 200,000 in 1980 to 1.7 million in 2007 (Figure 3.4.1). In 2007, 26.4 % of Turkey’s total automobiles are registered in Istanbul. According to the 2006 HTS, the car ownership rate was estimated as 114 cars per 1000 inhabitants. As compared to the metropolitan cities of developed countries, car ownership is still low in Istanbul. Table 3.4.1 shows the car ownership of the households in 2006. 65 % of the total households in Istanbul have no car. JICA, IMM (2007) study estimates that the percentage of car owning households will increase from 35 % in 2006 to 60.6 % in 2023.

Table 3.4.1: Car Ownership of Households in Istanbul

No. of Cars	No. of Households	(%)
0 Car Own	2,138,702	65
1 Car Own	1,024,220	31
2 Cars Own	120,106	4
3+ Cars Own	17,438	1
Total	3,300,466	100

Source: JICA, IMM (2007)

Figure 3.4.2 shows the car ownership rates (cars per 1000 inhabitants) estimated from the 2006 household surveys for each of the municipal districts of Istanbul. Bakırköy (244 cars) and Beşiktaş (240 cars) in the European side and Kadıköy (216 cars) in the Asian side have the highest car ownership rates. Eminönü (53 cars), Bağcılar (66 cars) and Esenler (68 cars) in the European side and Sultanbeyli (60 cars) in the Asian side have the lowest car ownership rates.

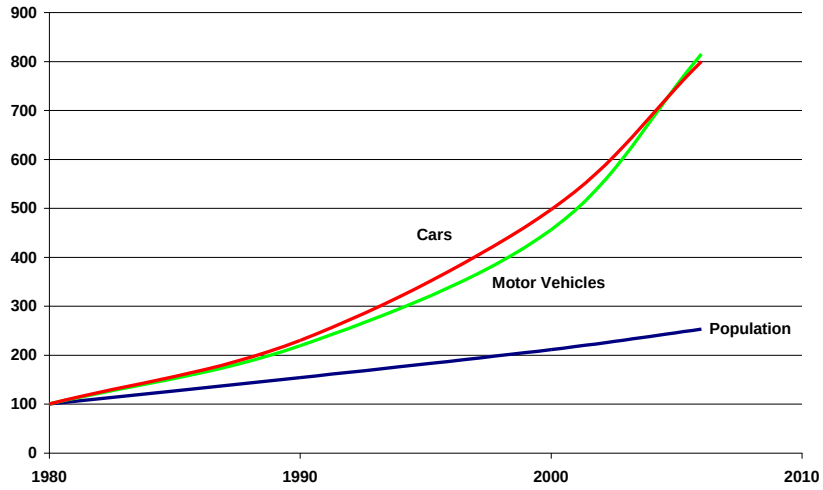


Figure 3.4.1: Growth of Population and Motor Vehicles (1980=100)

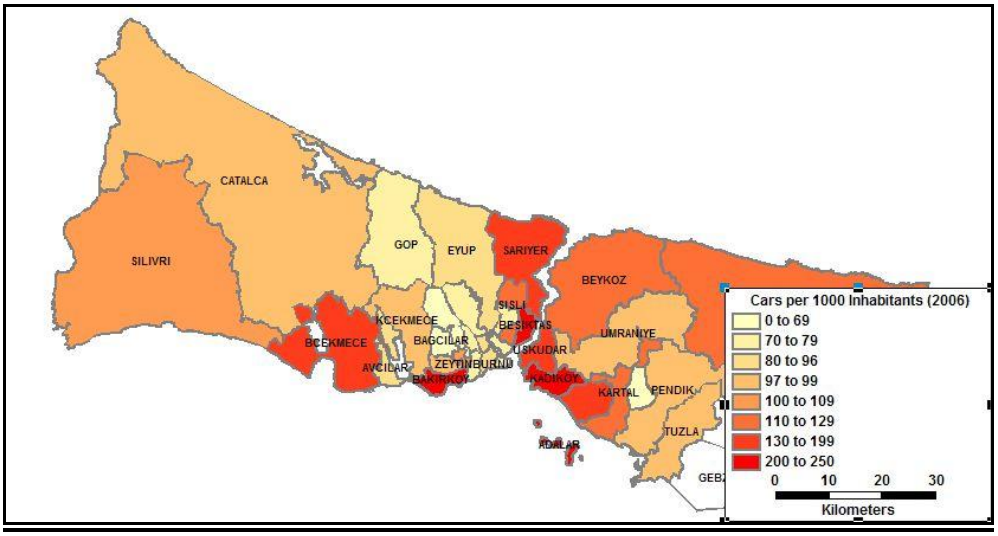


Figure 3.4.2: Car Ownership in Municipal Districts

3.5. Travel Demand and Mobility Trends

3. 5.1. Trip Production Rates

Trip production rate, or simply trip rate (number of daily trips per capita), is one of the most important indicators of urban mobility. Table 3.5.1 and Figure 3.5.1 show how trip rates have changed in the last two decades in Istanbul. As pointed out earlier, the 2006 household surveys covered a larger area than that used in the 1987 and 1996 studies. For the sake of comparability, the figures for the old perimeter in Table 3.5.1 were derived from the household surveys on the same area of 2,352 km^2 considered in the previous studies (Figure 3.1.1). However, it is important to note that additional areas covered in the 2006 survey, account for only 5 % of total daily trips produced, 2.7 % of the daily motorised trips produced, and 2 % of total population. As shown in Table 3.5.1 and Figure 3.5.1, total trip rate has increased from 1.44 trips per day per capita in 1987 to 1.79 trips per day per capita whereas the trip rate of motorised trips has declined from 1.00 trip per day per capita in 1996 to 0.88 trip per day per capita in 2006, because of that the share of walk trips has increased considerably from 35 % to 50.8 % in the same period. This could be explained by the suppressed urban travel demand by motor vehicles due to increasing traffic congestion and travel time on the urban road network. However, further analyses considering the factors such as changes in travel distance and travel time, travel-money budgets of households, land-use pattern etc., are required to better understand the changes in the urban mobility pattern.

Table 3.5.1: Trip Rates and Percentage of Walk Trips in Istanbul

			2006	
	1987	1996	Old Perimeter	New Perimeter
Total trip rate	1.44	1.54	1.79	1.74
Motorised trip rate	0.87	1.00	0.88	0.87
Walk trips (%)	39.5	35.0	50.8	49.3

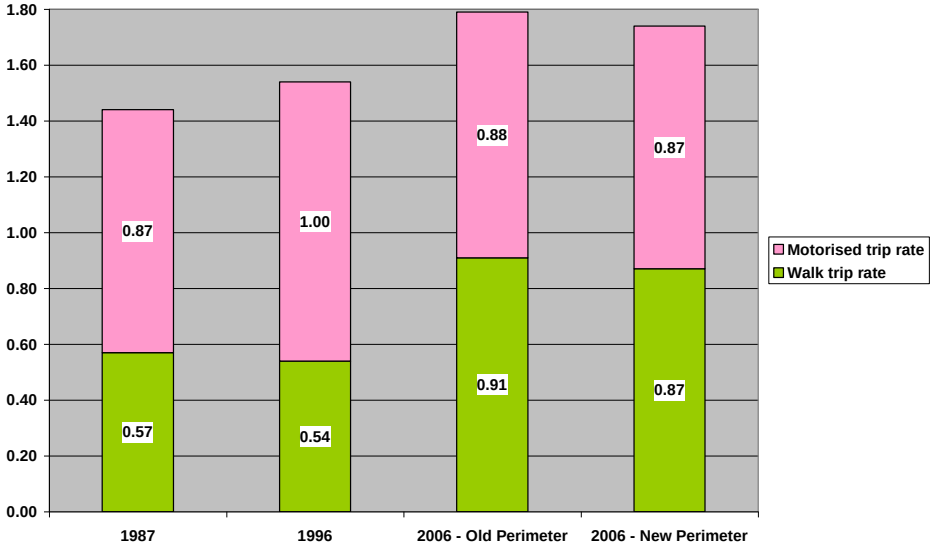


Figure 3.5.1: Trip Rates in the 1987 – 2006 Period

3.5.2. Trip Composition by Purpose

Table 3.5.2 shows the distribution of trips by purposes in the period between 1987 and 2006. It should be noted that HBW, HBS and HBO trips include “return to home” trips in the western sense. As compared to the trip distribution ratios obtained from the household travel surveys carried out in 1996, HBO trips has the largest share of total trips in 2006 whilst the ratios of HBW and HBS trips have considerably decreased. As pointed out earlier, additional areas covered in the 2006 HTS, account for only 2.7 % of the daily motorised trips produced, and 2 % of total population. Therefore, the effects of the motorised mobility in the additional areas on the total figures are negligible.

Table 3.5.2: Trips by Purpose (*)

	Motorised			Walk		Total	
Trip Purpose	1987	1996	2006	1996	2006	1996	2006
Home-based-work (HBW)	42.0	55.0	43.5	36.5	21.1	48.6	32.3
Home-based-school (HBS)	28.0	14.5	15.0	53.5	27.7	28.1	21.4
Home-based-other (HBO)	21.0	18.3	29.5	8.4	45.1	14.8	37.3
Non-home-based (NHB)	9.0	12.1	11.9	1.6	6.2	8.5	9.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Sources: ITU, IMM (1997), IMM Model Calibration Report (2007).
(*) No data is available for walk trips in 1987.

3.5.3. Trip Distribution and Desire Lines

Distribution of motorised trips in 2006 is shown by a desire line chart in Figure 3.5.2. In this figure, the two-directional movements between each pair of the 32 municipal districts of Istanbul are drawn by a straight line whose width is proportional to the number of trips between the districts. Travel volumes less than 20,000 trips per day per direction are not shown for the sake of simplicity. Large trip volumes shown in four areas (one in the Asian side and three in the European side) indicate closer and stronger social and economic relations between the pair of OD districts. These movements are restricted by the Bosphorus crossing. In the European side, there are large movements between the central commercial / business areas in Esenler, Bağcılar, Güngören, Bakırköy and B.Çekmece (west of historical peninsula) and the surrounding residential areas in GOP, Eyüp, Avcılar, K.Çekmece. New commercial / business areas that have been rapidly developing in the north of Golden Horn have resulted in heavy traffic volumes along the south-north axis. In the Asian side, the desire line shows that there are heavy traffic volumes between the business / commercial areas in Kadıköy, Üsküdar and Ümraniye and their surrounding areas.

This travel pattern may stem from the fact that Istanbul’s urban areas have been historically and locally developed in the three areas separated by the Bosphorus Strait and the Golden Horn. Although bridges connect the three traffic areas at present, local activities would not drastically changed since land uses have been formed throughout the city’s long history.

As a result of the polycentric development of the city and increased travel times due to the high congestion on the road network, old urban cores like Eminönü, Beyoğlu, Şişli, and Besiktas attract less traffic volumes from the zones in the outskirts of Istanbul. This has resulted in that average travel distance has dropped whilst the average motorised travel time has increased by 20 % in the last decade.

3.5.4. Modal Split of Urban Travels

The 2006 Household Travel Survey carried out by the Istanbul Metropolitan Planning and Urban Design Center (IMP) in Istanbul has shown that about 21 million trips are made daily in the metropolitan area of which 49.3 % are walk trips. The share of bicycle is negligible (0.1 %). Table 3.5.2 and Figure 3.5.3 show the change in modal split of motorised trips in the 1987 to 2006 period. It should be noted that, as explained in the comparisons of trip rates, the 2006 data were estimated in a larger area as compared to 1987 and 1996 data. However, since the population and mobility densities in the additional districts are extremely low, modal split values estimated in 2006 can be comparable with those estimated in the previous studies in 1987 and 1996.

Modal split of the motorised trips in 2006 is shown in Figure 3.5.4. Bus and minibus transport in Istanbul plays a key role in serving citizens for commutes at present as indicated by the highest share (40.8 %) of all daily passengers in transport sector as shown in Table 3.5.2. Company and school buses are essential complementary modes to public transport system in Istanbul and their total share has doubled in the last decade whilst the share of public transport has decreased from 60 % in 1996 to 47 % in 2006. However, together with company and school buses, share of total trips made by public transport has remained at the same level of 70 % in the last two decades.

Private car, with a share of 26.3 % of total daily trips, is another major element in Istanbul due to the rapid increase of car ownership in recent years. Private vehicles have created serious problems of traffic congestion and environmental pollution in the urban centre. Share of private cars has increased from 19.3 % to 26.3 % in the last decade whilst share of taxi and dolmuş (shared taxi) has declined from 9.4 % to 4.8 % in the same period.

One of the main characteristics of public transport system of Istanbul is the low share of rail transit and sea borne transport which has remained at a stable level of about 6 % in the last two decades. As compared to metropolitan cities such as London (72 %), Paris (87 %), Moscow (77 %), New York (77 %) and Tokyo (96 %)[2], the insufficient rail transit system serves only 10 % of total public transport trips in Istanbul.

[2] *UITP, Millennium Cities Data Base for Sustainable Mobility, 2000.*

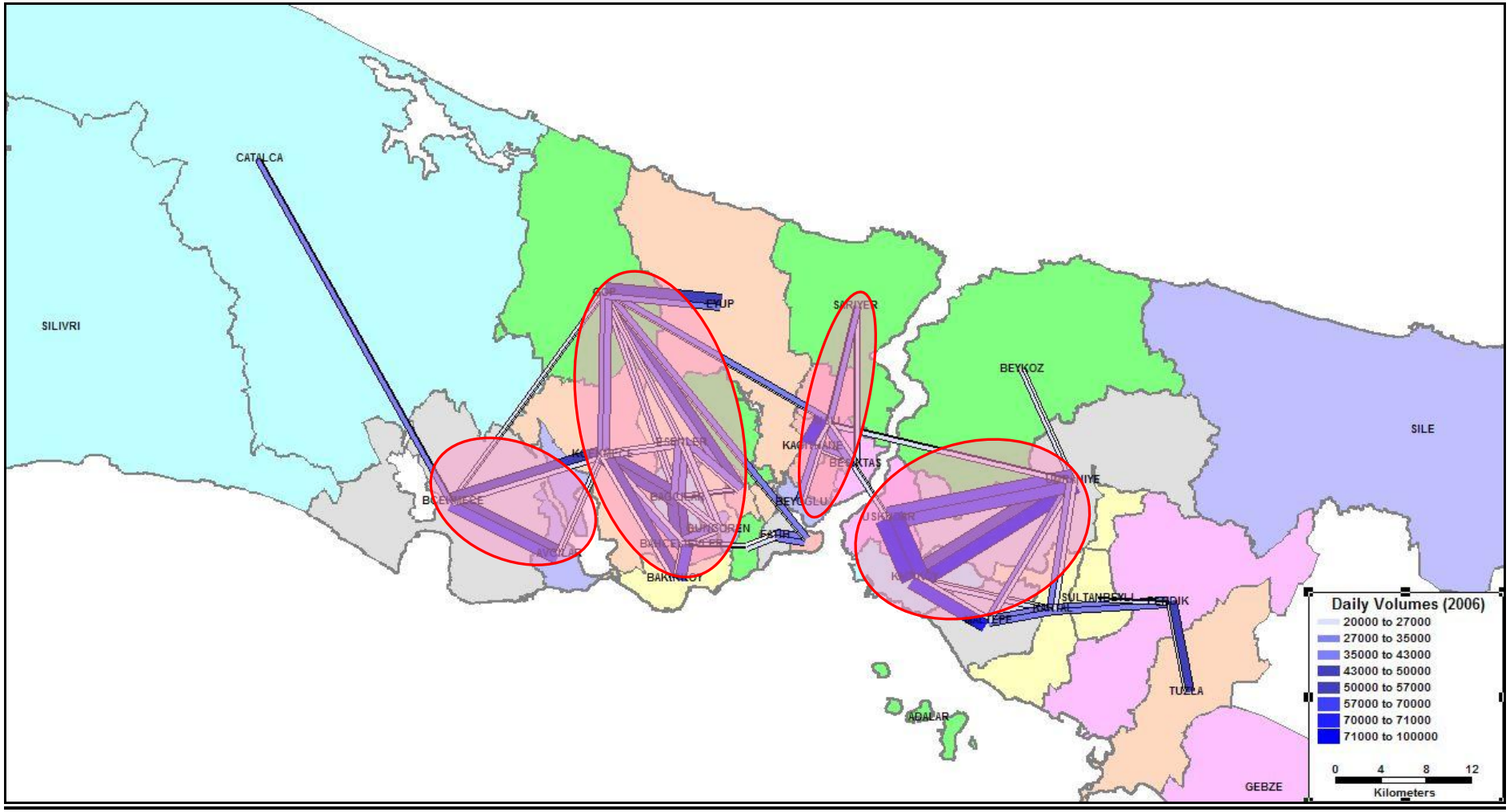


Figure 3.5.2: Distribution of Motorised Trips in 2006

Table 3.5.2: Modal Split of Urban Motorised Travels (%) (*)

Mode	1987	1996	2006
Car	19,3	19,3	26,3
Taxi+Dolmuş	10,2	9,4	4,8
Company/School Buses	10,4	11,4	21,5
Bus	35,2	34,1	24,1
Minibus	19	19,6	16,7
Rail	3,8	3,6	4,6
Sea	2,1	2,6	2,0
Total	100,0	100,0	100,0

(*) 2006 figures estimated from the travel surveys carried out in a larger area shown in Figure 7.

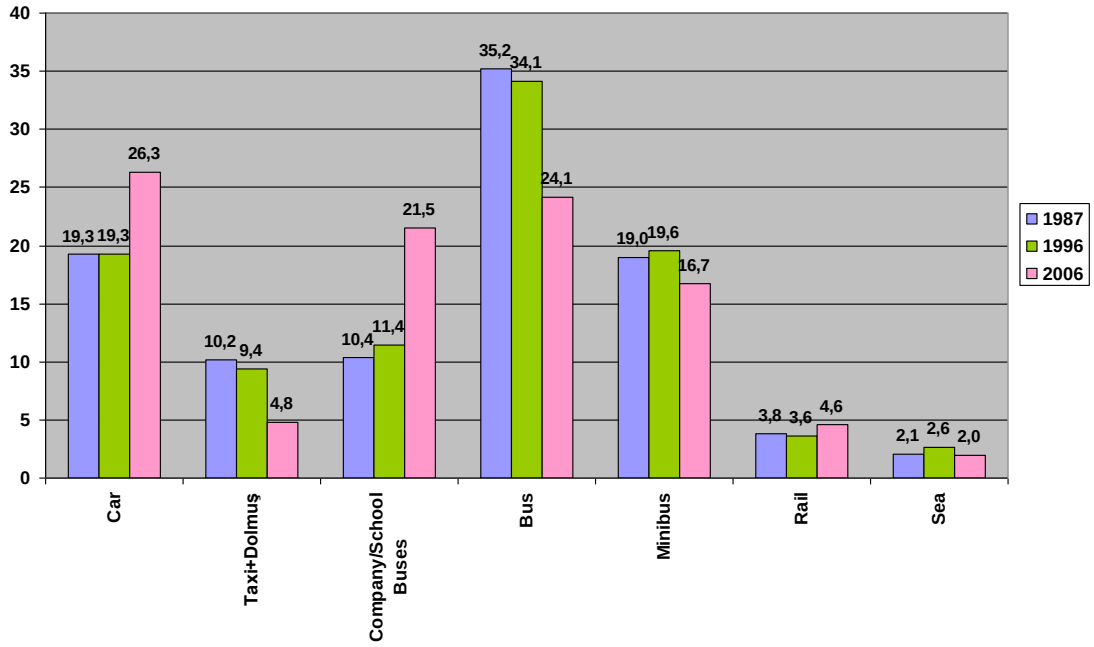


Figure 3.5.3: Modal Split of Urban Motorised Travels in the 1987 – 2006 Period

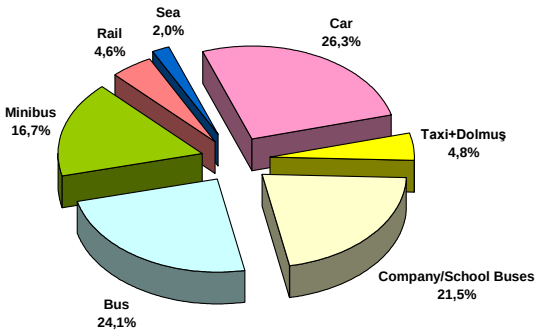


Figure 3.5.4: Modal Split of Urban Motorised Travels in 2006

3.5.5. Travel Time

As shown in Figure 3.5.5, the average travel time per trip has steadily decreased in Istanbul in the last 20 years, from 38 minutes in 1987 to 32.2 minutes in 2006. However, as a result of rapid increase of motor vehicle traffic on inadequate road network, average travel time for motorised trips has increased considerably from 41 minutes in 1996 to 49 minutes in 2006. Istanbul, like many other metropolitan cities of emerging economies, has been suffering from high traffic congestion at low level of car ownership. Road traffic volume in the morning peak hour is shown Figure 3.5.6.

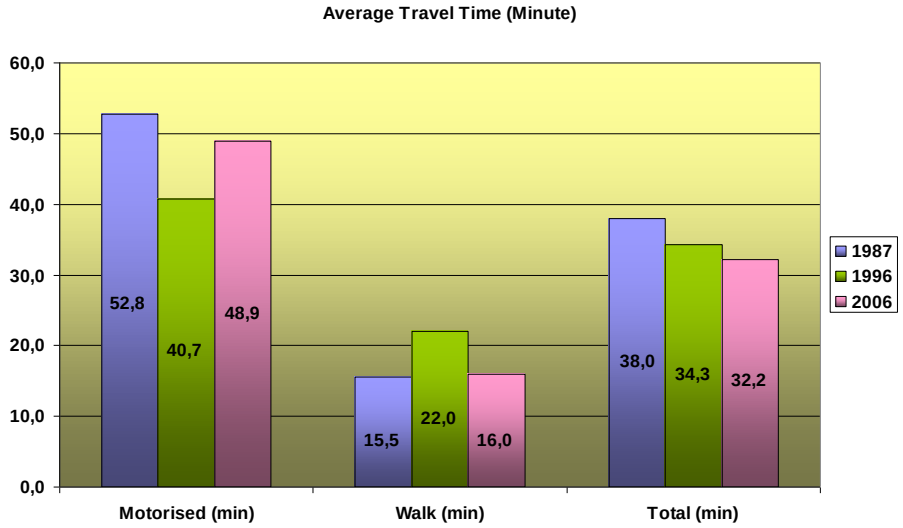


Figure 3.5.5: Average Travel Times in the 1987 – 2006 Period

According to the 2006 HTS, approximately 70 % of the total HBW trips have a travel time of less than 60 minutes and the ratio of travel time exceeding 90 minutes is approximately 6 % of the total. Approximately 15 % of the total trips departed from home concentrations during the morning peak hour between 7:00h and 8:00h.

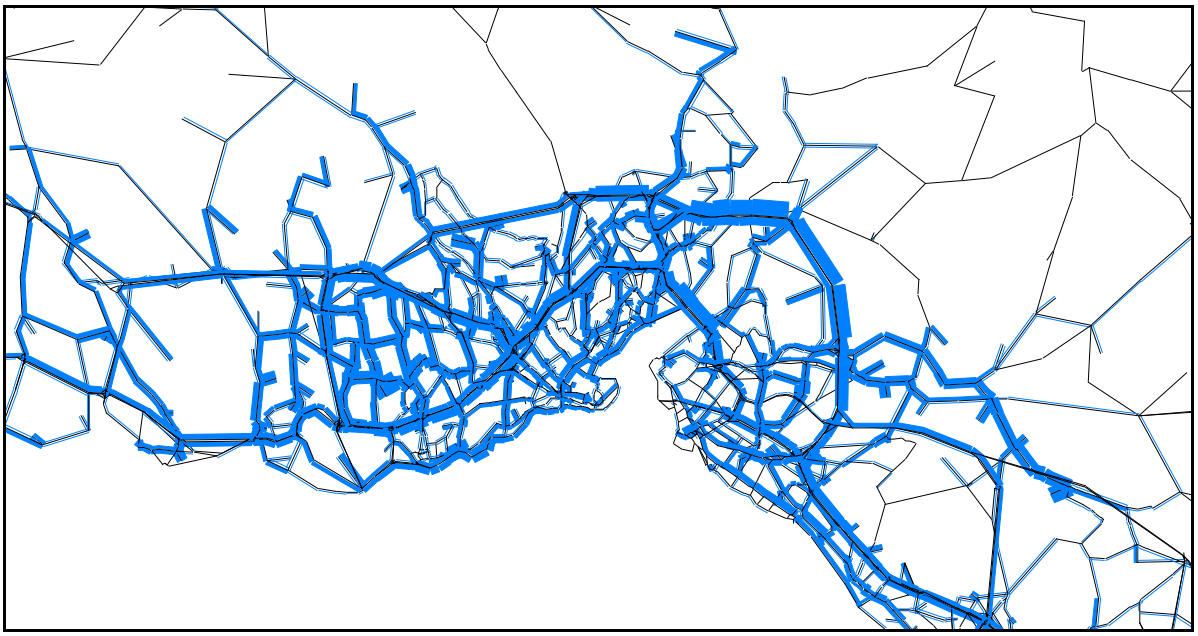


Figure 3.5.6: Morning Peak Hour Traffic Volumes

3.5.6. Travel Distance

In 2006, the average travel distance for all purposes and all modes in Istanbul was estimated as 7.2 km. Average distance of motorized (vehicle) and walk trips was estimated as 11.2 km and 3.6 km, respectively. Distribution of motorised trips by purpose is shown in Figure 3.5.7 through 3.5.11. Average motorised trip length by trip purpose in 1996 and 2006 is shown in Figure 3.5.12.

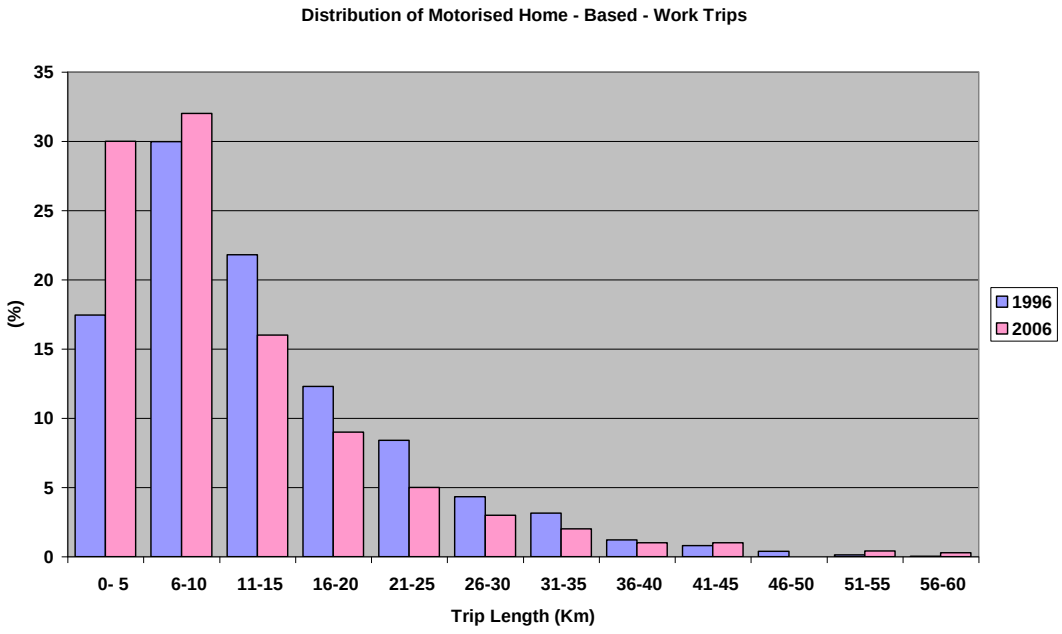


Figure 3.5.7: Travel Distance Distribution of Motorised HBW Trips

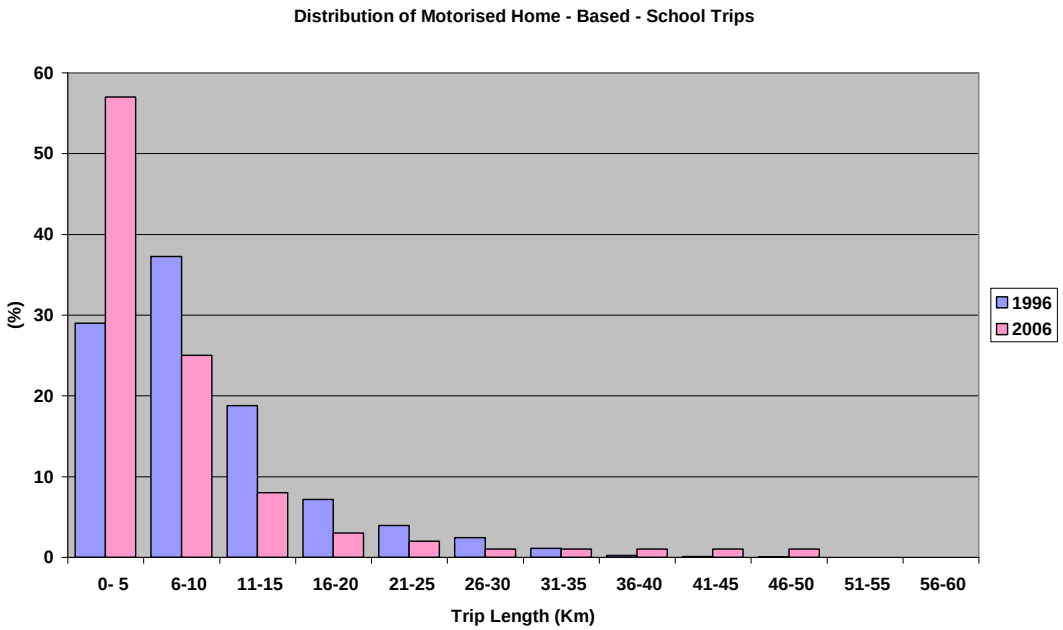


Figure 3.5.8: Travel Distance Distribution of Motorised HBS Trips

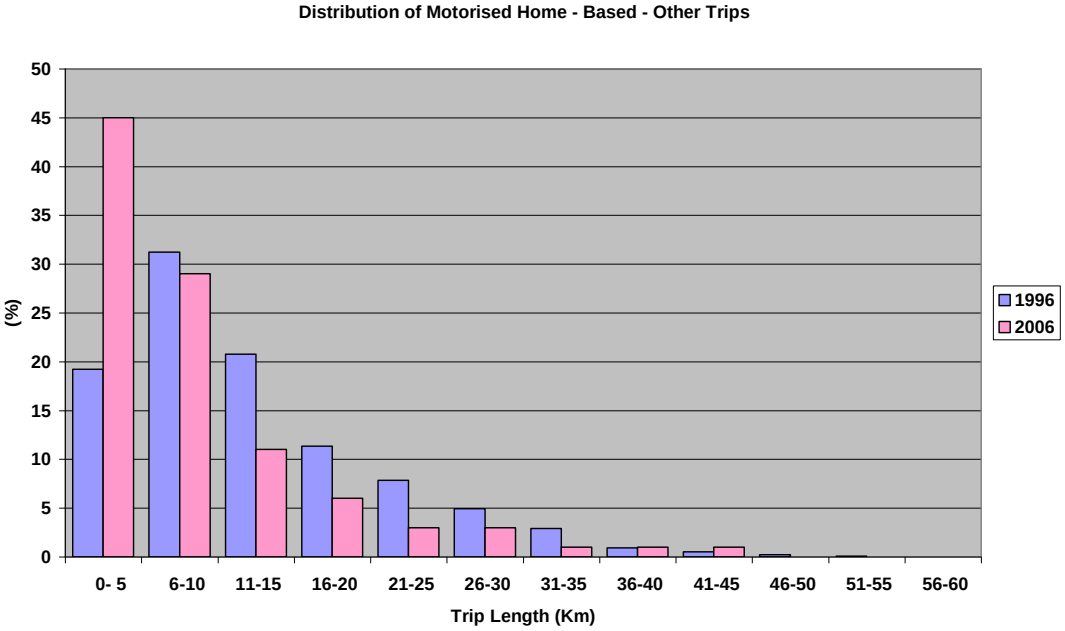


Figure 3.5.9: Travel Distance Distribution of Motorised HBO Trips

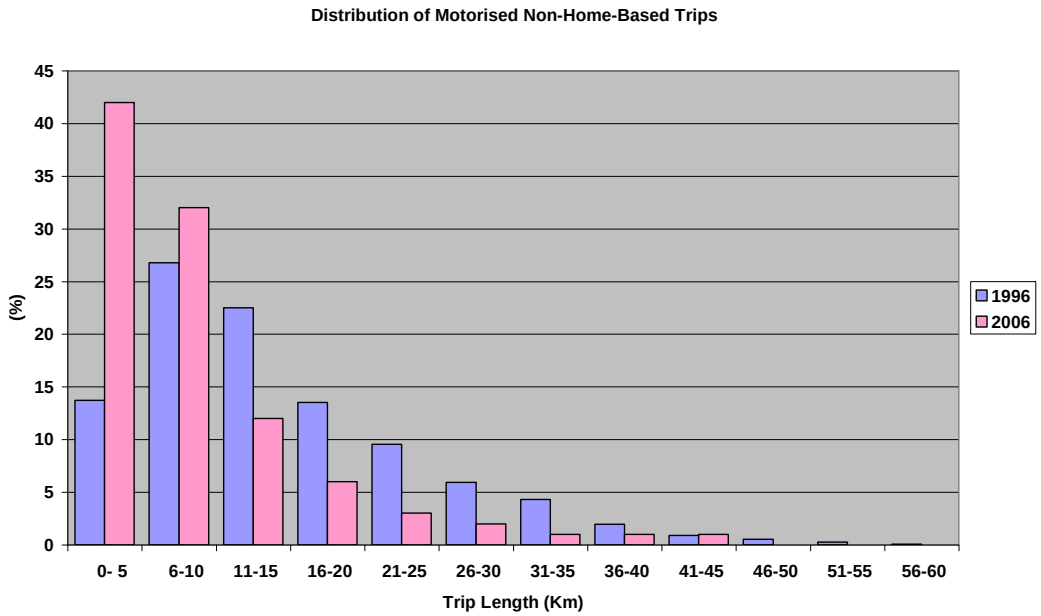


Figure 3.5.10: Travel Distance Distribution of Motorised NHB Trips

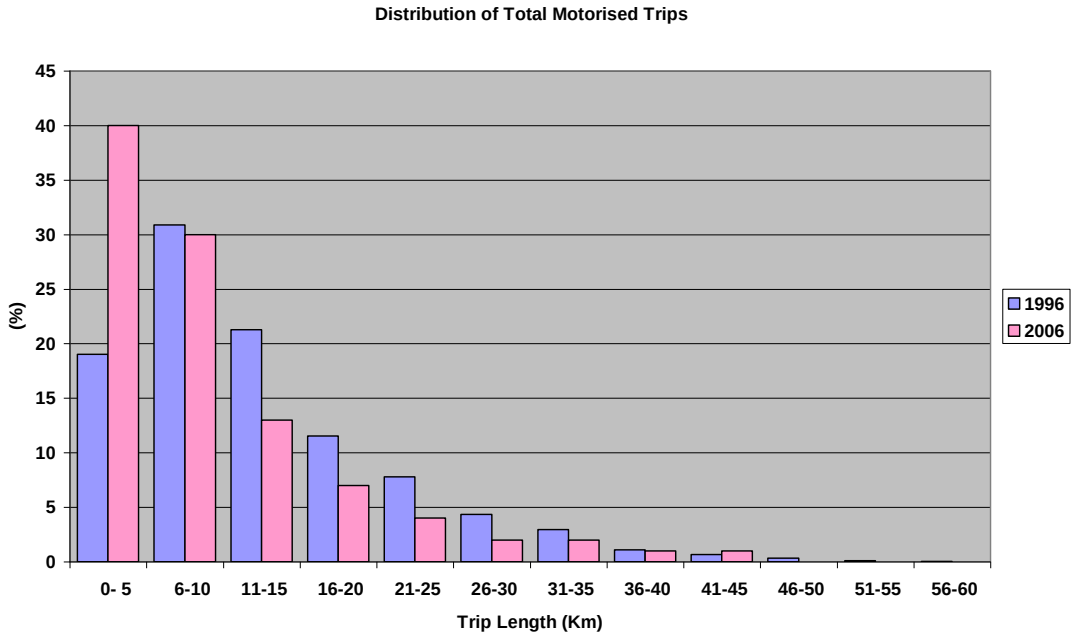
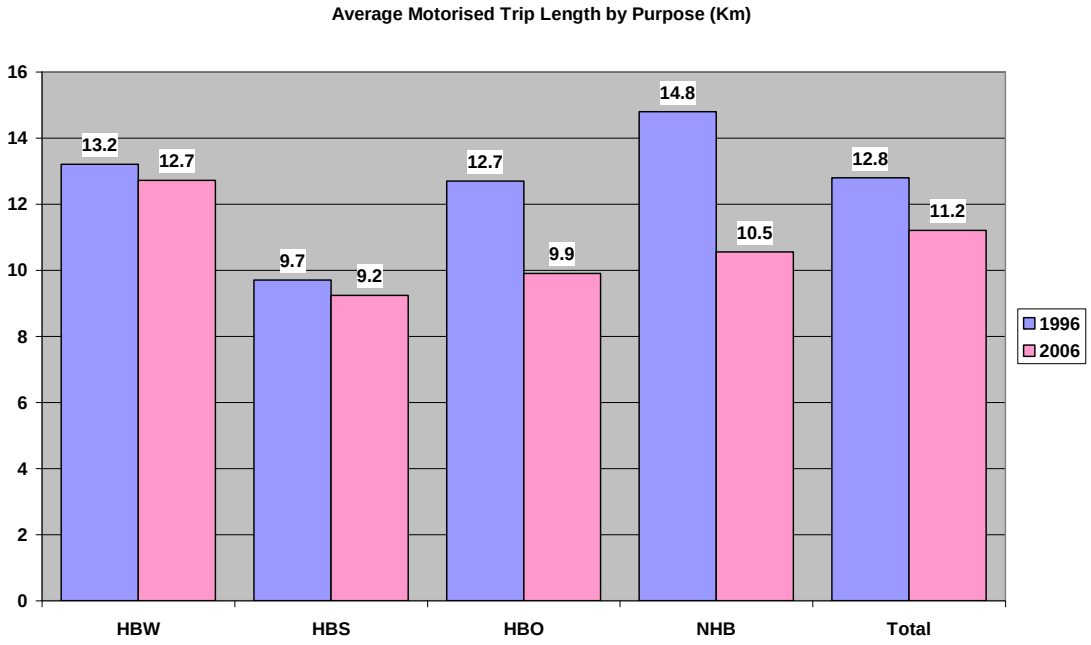


Figure 3.5.11: Travel Distance Distribution of Total Motorised Trips

For all trip purposes, the average travel distance of motorised trips has decreased in the last ten years, mainly for two reasons: a) the polycentric development of the city, and b) particularly for HBO and NHB trips, trip makers tend to prefer making shorter trips by choosing closer locations for their activities because of the increased congestion and travel time.



Source: Istanbul Transportation Master Plan (1997), JICA (2007)

Figure 3.5.12: Average Motorised Trip Length by Purpose

3.6. Transportation Expenditure of Households

According to the Household Consumption Expenditure Survey carried out by Turkish Statistical Institute (TUIK) in 2004, transportation expenditures by five income groups in Istanbul is shown in Table 3.6.1 for the year 2003 – 2004. The share of household transportation expenditures in Istanbul has remained almost constant between 1994 (10.2 %) and 2003-2004 (% 10.4). It can be seen from the table that the HH with highest income spend ten times more in transportation than the HH with lowest income. As monthly income of the HH increases share of transportation expenditures also increases.

Table 3.6.1: Household Transportation Expenditures by Income Groups (2003-2004)

	Lowest				Highest	
	1. 20 %	2. 20 %	3. 20 %	4. 20 %	5. 20 %	Average
Consumption Expenditure (YTL per Month)	543	770	980	1,253	2,678	1,245
Transportation Expenditure (YTL per Month)	35	52	83	128	350	130
Transportation Expenditure (%)	6.5	6.8	8.5	10.2	13.1	10.4

Source: TUIK (Turkish Statistical Institute), (As of 2004, 1 $ = 1.33 YTL)

3.7. Road Safety

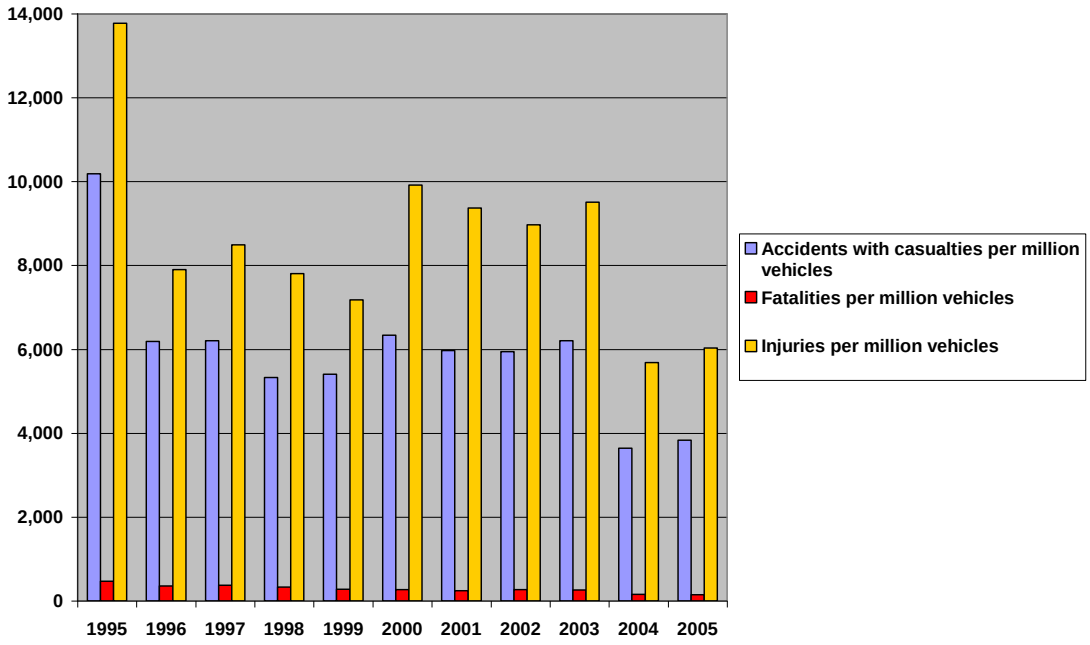
Road accidents represent high social costs. These costs relate to material damage and to injuries or deaths; they include medical costs, “value of life”, etc. The number of people killed or injured allows a partial but readable expression of this cost. As most casualties occur in conjunction with road transport, the indicator is confined to this transport mode.

Road safety is determined by numerous factors, such as the volume of traffic, the state of vehicles, the state and capacity of infrastructure, behaviour of drivers, etc. Although road

safety is not considered a traditional environmental goal per se, it often converges with environmental goals and has important social and health implications.

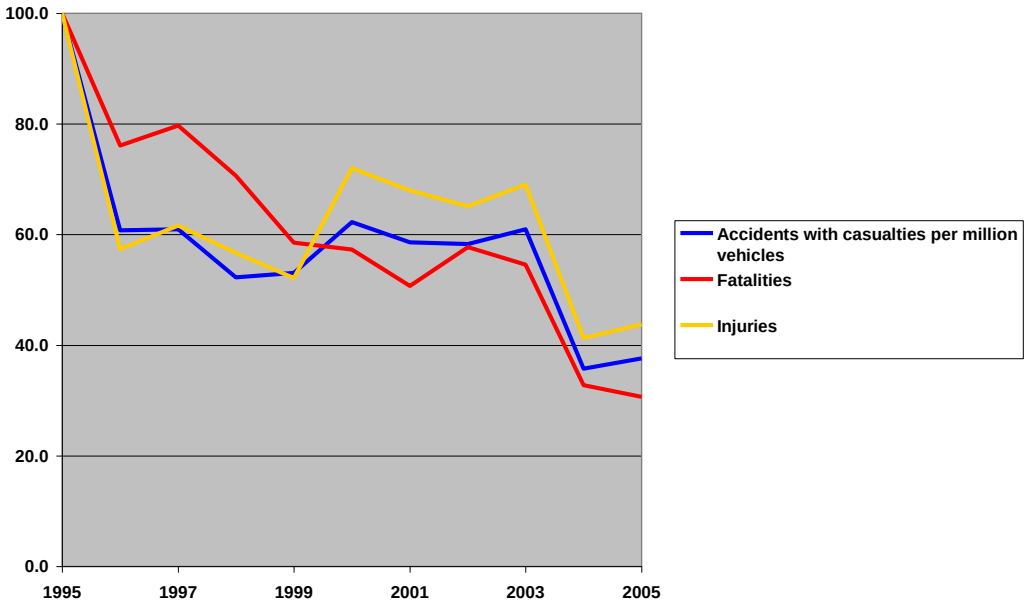
The indicators presented here relate to:
- The number of road casualties (i.e. people killed or injured) and related changes.
- The number of victims per motor vehicle and related changes.
These indicators should be read in connection with indicators on traffic and transport volumes and on road infrastructure (OECD, 1998).

Figure 3.7.1 and 3.7.2 show the statistics for road accidents with casualties in Istanbul between 1995 and 2005. It should be noted that road accidents with no casualties are not included in the data. It can be seen that the number of road accidents and casualties has decreased by about 40 % in 2005 as compared to 1995.



Source: Turkish Statistics Institute (TUIK)

Figure 3.7.1: Road Safety Statistics in Istanbul



Source: Turkish Statistics Institute (TUIK)

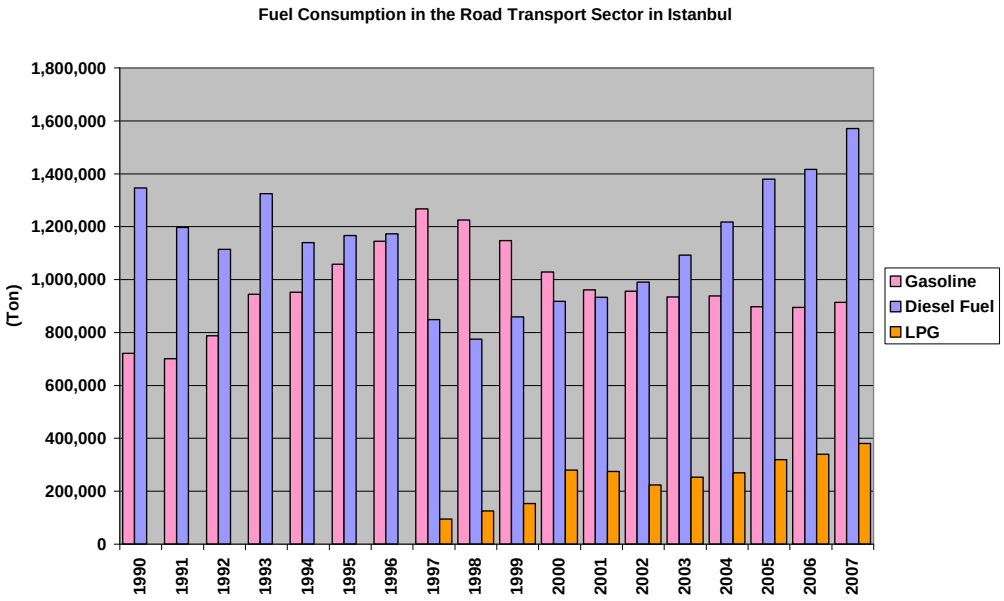
Figure 3.7.2: Road Safety Indicators in Istanbul

3.8. Fuel Consumption in Road Transport

Table 3.8.1 and Figure 3.8.1 show the energy consumption in the road transport sector in Istanbul between 1990 and 2007. Following the economic crises in 2001 in Turkey, more motor vehicles with diesel engine have been used in Turkey and this is reflected in that diesel fuel consumption has increased steadily as opposed to the decrease in the gasoline use. Table 3.8.2 shows the fuel prices for motor vehicles in Istanbul between 2005 and 2007.

Table 3.8.1: Fuel Consumption in the Road Transport Sector in Istanbul

	Gasoline	Diesel Fuel	LPG
1990	721,139	1,346,256	0
1991	699,752	1,196,138	0
1992	787,109	1,113,225	0
1993	944,529	1,323,664	0
1994	951,283	1,138,997	0
1995	1,057,570	1,165,911	0
1996	1,144,307	1,172,191	0
1997	1,266,686	848,703	94,026
1998	1,225,283	774,129	124,895
1999	1,146,266	858,232	153,038
2000	1,028,220	916,695	279,017
2001	960,266	933,109	273,776
2002	955,777	990,180	223,143
2003	933,637	1,091,364	252,890
2004	937,190	1,217,408	268,690
2005	896,449	1,378,995	318,639
2006	894,420	1,416,312	339,966
2007	913,376	1,570,232	380,138



Source: PETDER (Turkish Oil Industry Association)

Figure 3.8.1: Fuel Consumption in the Road Transport Sector in Istanbul

Table 3.8.2: Fuel Prices for Motor Vehicles in Istanbul ($ / litre) (*)

	Unleaded Gasoline 95 Octane			Diesel Fuel		
Year	Before Tax	After Tax	Tax (%)	Before Tax	After Tax	Tax (%)
2005	0.47	1.72	72.8	0.52	1.29	59.5
2006	0.60	1.84	67.5	0.63	1.44	56.4
2007	0.85	2.39	64.4	0.88	1.90	53.6

Source: Turkish Energy Market Regulatory Authority.
(*) Prices at the beginning of the year.

As for January 1, 2008, fuel prices for road vehicles in Istanbul were 2.62 $ / lt for unleaded gasoline (95 octane) and 2.22 $ /lt for diesel fuel. It can be seen in the table that fuel for motor vehicles is heavily taxed in Turkey. Depending upon the oil prices in the global market, gasoline price has increased by 52 % and diesel fuel price 72 % since 2005 in Istanbul.

3.9. Air Pollution

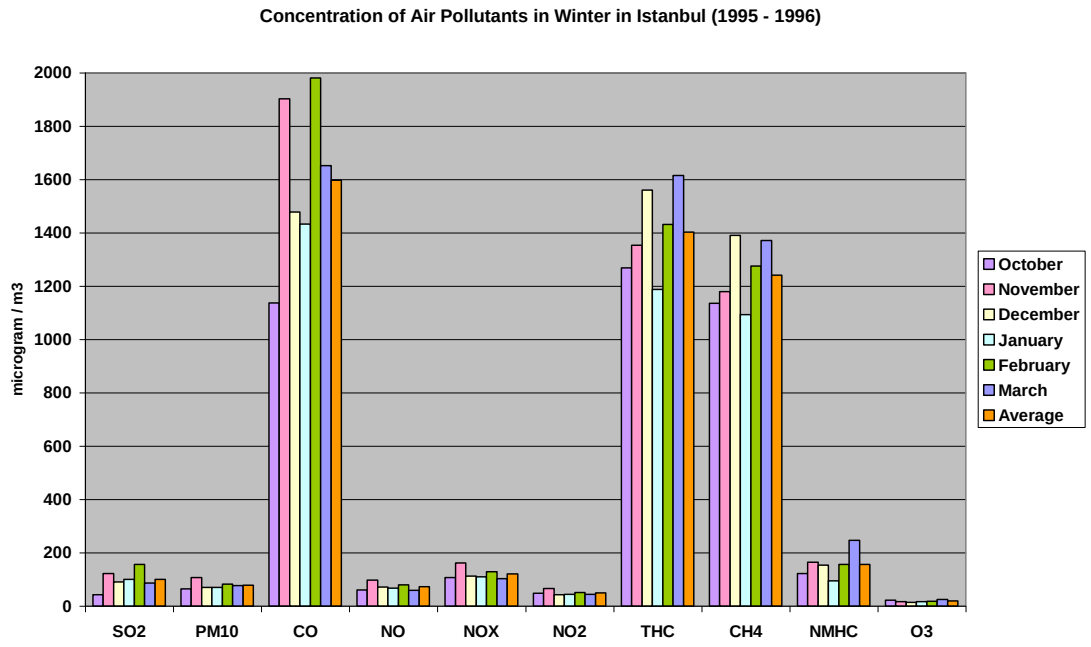
Transport contributes to atmospheric pollution at local, regional and global level. Emissions from the transport sector represent a high proportion of overall man-made emissions in industrialised countries. Most of these emissions are directly related to the consumption of energy by transport activities: world-wide, the transport sector consumes more than 60 per cent of oil products, which constitute about 98 per cent of transport energy use. They are further influenced by a number of factors, including type and size of engine, type and quality of fuel used, average fuel efficiency, age of vehicle, etc.

Carbon monoxide (CO), carbon dioxide (CO_2), nitrogen oxides (NOx), particulate matter (PM) and volatile organic compounds (VOC) are the main pollutants emitted directly by motor fuel

combustion (primary pollutants). Through reactions in the atmosphere these contribute to the formation of secondary pollutants (photochemical oxidants, primarily ozone, smog, atmospheric acids, etc.). Other pollutants include for example lead and SOx.

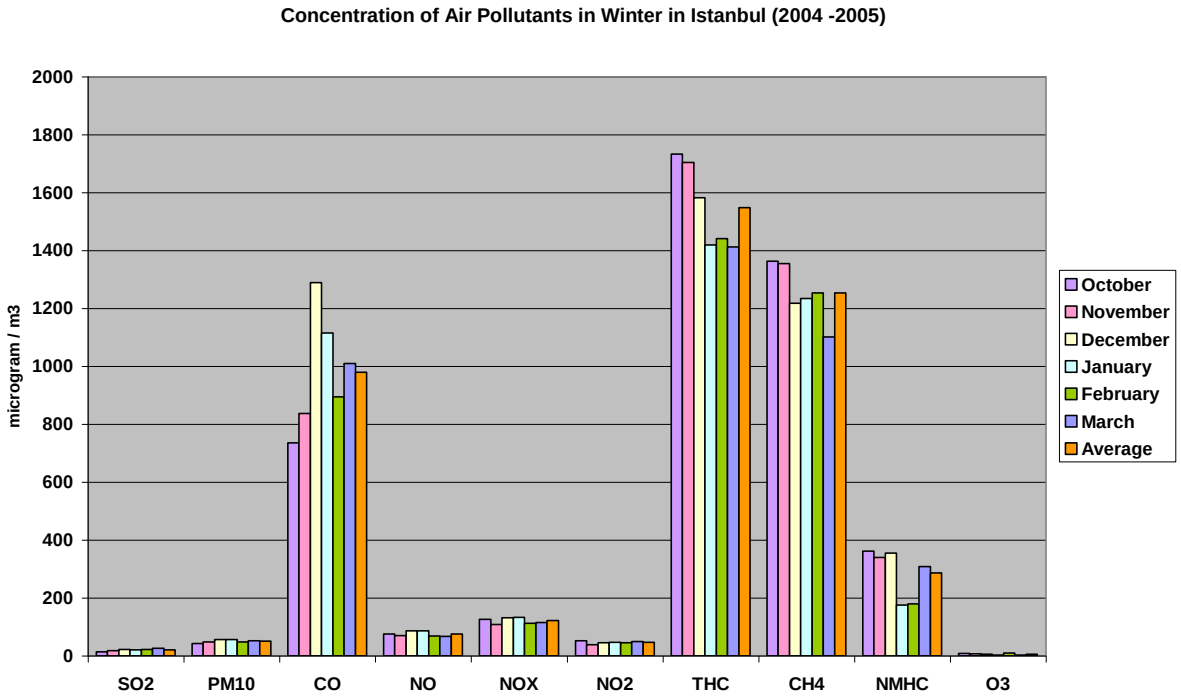
At local level, transport is a main contributor to air pollution in urban areas where road traffic and congestion concentrate. Concerns relate mainly to its effects on human health, but also to its effects on buildings and monuments. Motor vehicles are also a large source of toxic air pollutants including VOC species (e.g. benzene, 1,3-butadiene, formaldehyde, acetaldehyde and polynuclear aromatic hydrocarbons), lead, fine particulate matter, etc. (OECD, 1998).

Figure 3.9.1 and 3.9.2 show the concentration of air pollutants in Istanbul for the 1995-1996 winter and 2004-2005 winter, respectively. Figure 3.9.3 shows the average values of the air pollutants in the 1995 – 2005 period.



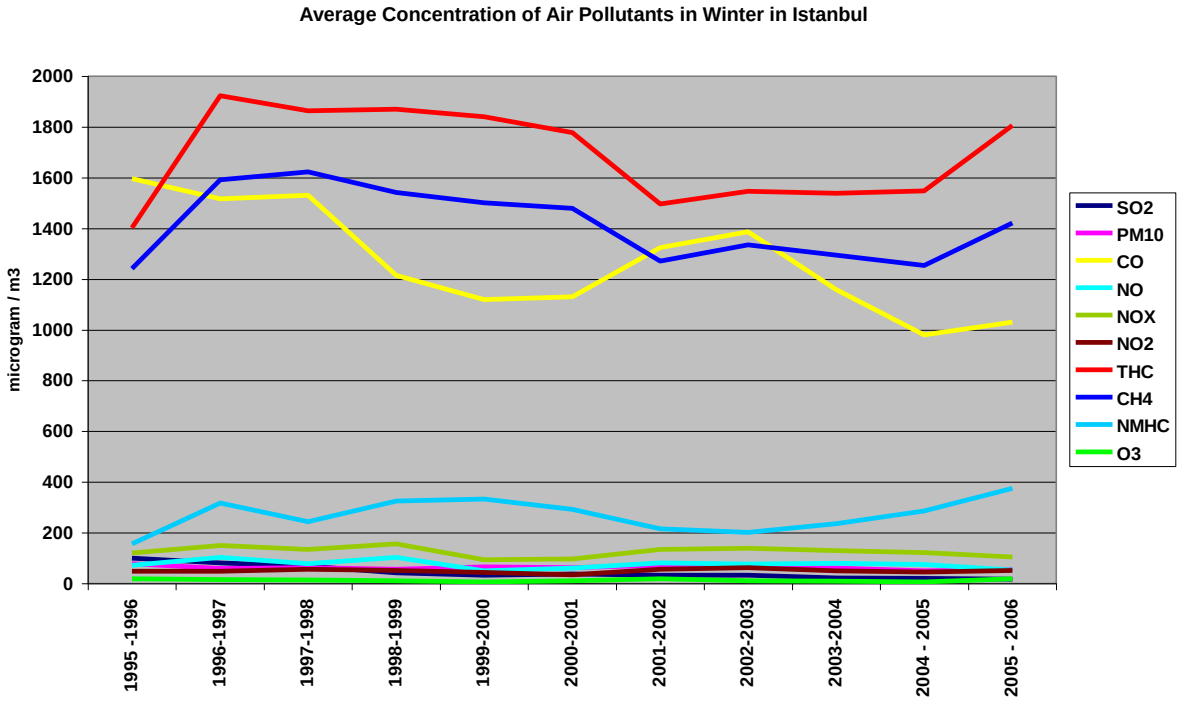
Source: Forest and Environment Directorate of Istanbul Province

Figure 3.9.1: Concentration of Air Pollutants in Istanbul (1995 – 1996)



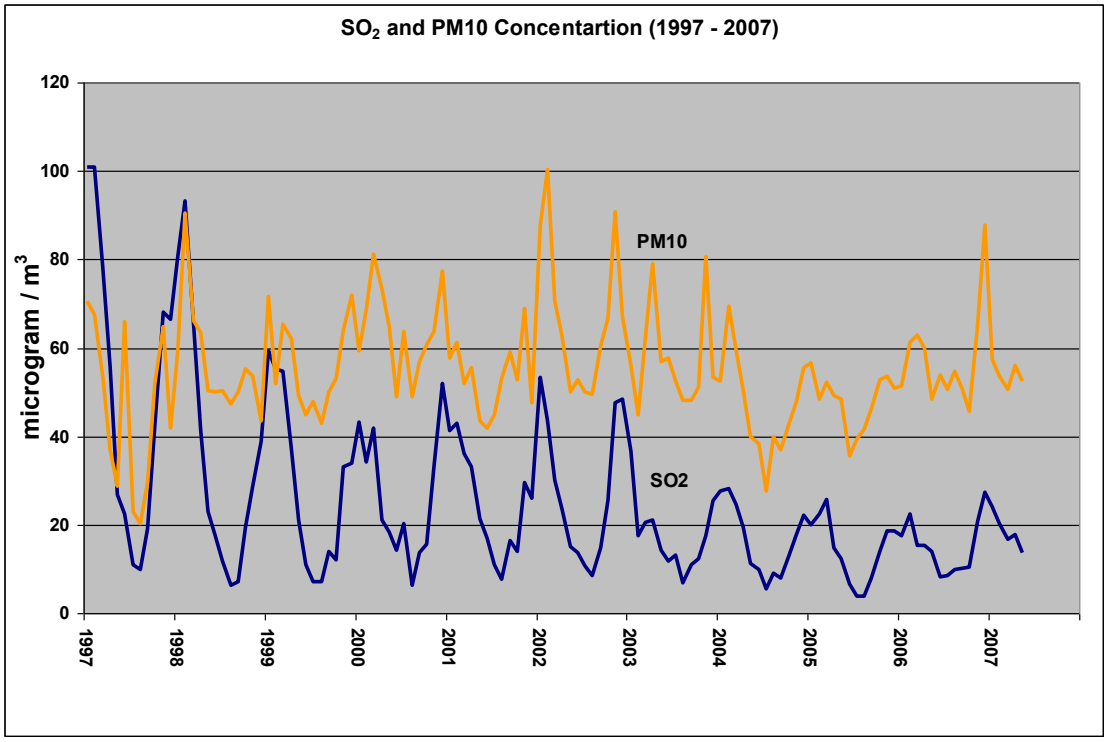
Source: Forest and Environment Directorate of Istanbul Province

Figure 3.9.2: Concentration of Air Pollutants in Istanbul (2004 – 2005)



Source: Forest and Environment Directorate of Istanbul Province

Figure 3.9.3: Average Concentration of Air Pollutants in winter in Istanbul



Source: Forest and Environment Directorate of Istanbul Province

Figure 3.9.4: SO2 and PM10 Concentration in Istanbul (1997 – 2007)

In the last decade, measures that have been taken in order to decrease the pollution caused by industry and heating have performed well especially in large conurbations of Turkey. The widespread use of natural gas has significantly contributed to the reduction of air pollution generated by residential heating and contributed to raising public awareness on the issue of clean air. For instance, SO_2 has dropped from 100 ug / m^3 in 1995 to 18 ug / m^3 in 2006 (Figure 3.8.4).

Likewise, there are positive developments in reducing emissions caused by transportation. To a large extent, the motor vehicle industry in Turkey has adapted the Motor Vehicle Technical Regulations of the EU. Turkey should design a comprehensive policy framework to replicate the successes achieved by the EU. The EU legislation aims at improving the functioning of the international market by promoting efficient environment and user friendly transport services.

During the last decade, the expanding of urban rail transit network; increases in the number of vehicles using unleaded gasoline equipped with catalytic converters and taxicabs using LPG (liquid petroleum gas) have decreased the emissions caused by road traffic. However, the rapid increase in car ownership and the longer travel lengths have limited the positive impacts of these improvements. Motor vehicle traffic is now considered as the major factor causing air pollution.

The relatively high levels of emissions and concentrations of airborne pollutants affect health and quality of life. PM10, NO_2, ozone and CO are the pollutants of most concern in Turkey's largest cities, as their concentrations still exceed the air quality standards at certain locations and during certain periods. Besides their direct effect on health and material damage, PM10, NO_x and SO_x are major precursors for the formation of PM2.5, which inflicts serious health impacts, including increased morbidity and mortality. Moreover, NO_x and VOCs are also

precursors for ozone formation, which has itself serious local social costs and damage, while contributing to global warming.

It should be noted that older vehicles or those with antiquated or malfunctioning pollution controls are a major source of emissions in Turkey for a variety of reasons: a) climates that allow vehicle chassis to last for many years without rusting, and b) economic conditions that increases the value of substandard vehicles sufficiently that they remain on the road well beyond the time they would in wealthier countries.

Turkey has a large population of older uncontrolled vehicles that make a disproportionate contribution to their air pollution problems.

New regulations regarding the quality of fuels used for heating and transportation have been introduced during the past decade. The sulphur content of diesel oil in use is planned to be reduced from 0.7% in 1997 to 0.05% by 2004. In the case of unleaded gasoline, all of the refineries will have completed their isomerisation and reformer units and will be able to meet the entire domestic demand for unleaded gasoline by 2003.

3.10. CO_2 Emission

Data for the emissions from motor vehicles are very limited and not available in Turkey. Therefore, in this study, as explained in Soruşbay and Ergeneman (2006), a fuel based approach was used to estimate the GHG emissions from the road vehicles in Istanbul. The emission factors used in Intergovernmental Panel on Climate Change (IPCC) Tier 1 approach are based on the heat content of the fuel used, the fraction of the carbon in the fuel that is oxidized during the combustion process and the carbon content coefficients. Combustion efficiency is assumed to be 99 % in most cases, depending on the fuel used. Carbon dioxide emissions are estimated using the yearly consumption of gasoline, diesel and LPG fuels and the calculations are based on the carbon content of each fuel.

As shown in Figure 3.10.1, the amount of the CO_2 emissions from road transport in Istanbul is estimated to increase by 37 % between 1990 and 2007, from 6.5 million ton to 8.9 million ton.

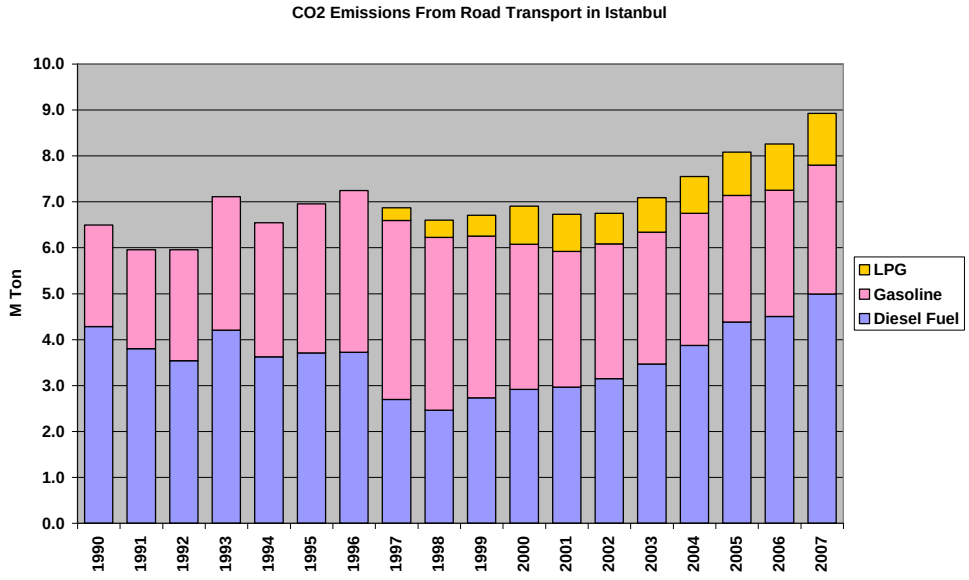


Figure 3.10.1: CO_2 Emissions from Road Transport in Istanbul

4. INSTITUTIONAL FRAMEWORK FOR URBAN TRANSPORTATION AND LAND-USE PLANNING IN ISTANBUL

The large scale land-use planning procedure and responsibilities is complicated and there is no single authority to prepare the large scale plans such as 1/100.000 and 1/50.000. Different laws and the regulations indicate different entities for the responsibilities to prepare and approve these plans. Although there are many conflicts between different laws and the regulations, the responsible authorities can be summarized as follows:

1/100.000 scale Zoning Plans: Ministry of Environment
1/ 50.000 scale Zoning Plans: Ministry of Public Works
1/ 25.000 scale Zoning Plans: Metropolitan Municipalities (*)

(*) Only in the cities which has a Metropolitan Municipality.

Ministry of Environment transferred its responsibility to prepare the 1/100.000 scale plans to the Istanbul Metropolitan Municipality (IMM) with a protocol and the 1/100.000 scale land-use master plan was prepared and approved by the IMM in 2006.

The IMM prepares and approves 1/ 25.000 zoning plans and all land-use development plans including 1/5.000 and 1/1.000 ones, construct and operate the main transportation infrastructure/systems in addition to their responsibilities about all kind of infrastructural and social services, whereas the mayors of the local municipalities are responsible for local needs of their areas such as final approval of the small scale (1/1.000 scale) land-use development plans, to give the construction permits, road cleaning, garbage collection, management of local parking areas and local recreational places etc. The mayor of the IMM is also responsible to coordinate and control the activities of the local municipalities.

The Ministry of Transportation (MoT) is responsible for key administrative duties in transportation and telecommunication sectors in terms of policy formulation, planning strategy and budgeting for the sectors, regulatory activities by law and national orders, regulation, and standards at national level. MoT has made great efforts on the EU accession agenda from physical integration to the harmonization of infrastructure, vehicles, environmental and other standards, the development of logistic networks, the improvement of border crossings and trade facilitation policies (modernization of customs, etc.).

4.1. Legislative Reform in the Istanbul Metropolitan Municipality (IMM)

The administrative reform program, including decentralization and privatization, has also been applied to the IMM through establishment of the new Metropolitan Municipal Law (No.5216/2004-5) in association with related laws for local administration. These laws define that the jurisdiction of the IMM extends to the provincial borders, the same as Istanbul Provincial Government jurisdiction.

Transportation sector also will exercise jurisdiction over a wider entity to be improved by an effective transportation system. There are still difficulties to manage the entity in an integrated manner due to duplication of roles and responsibilities among related stakeholders such as Istanbul provincial government as a local unit of the State Government and the IMM (PCI, JARTS, 2007).

4.2. Institutional Coordination and New Proposed Law

Integrated transportation administration in Istanbul also has considerable issues to be addressed owing to large extent of the IMM jurisdiction with large population requiring several levels of governmental interventions. Whereas the 8th Five-Year Development Plan of Turkey has pointed out issues of weak and unclear roles and responsibilities in larger cities among related stakeholders including the state government, provincial government and local government, IMM has also made efforts to resolve problems of coordination mechanism through establishing the coordination authority of the Transportation Coordination Center (UKOME) for transportation development and management and the Infrastructure Coordination Center (AYKOME) for infrastructure plans and programs within the power of the IMM jurisdiction.

In order to manage transportation administration in a more integrated manner, IMM has presented a bill of "Istanbul Transportation Administration Board (ITAB) Law" before the Parliament (TBMM). Since this bill proposes that ITAB has entire and large power to control, manage and operate almost all transport services, it is still being debated in the Parliament of Turkey whether it should have such large power or not[3].

4.3. Transportation Management and Administration in the IMM

IMM has a number of organizations that are responsible for transportation sector of planning, land use and integration with other sectors, traffic regulation and transportation in different modalities. The institutional structure for transportation and traffic regulation at the metropolitan has a large number of employees (more than 50,000).

Owing to its geographical setting, IMM also provides transportation services in almost all modalities except for air transportation and pipeline networks. For example, it conducts rail transit system (metro, LRT, trams, funicular), cable lift, bus and maritime transportation, and audits transportation carried out by the private sector. Management methods are flexible. For example, it owns a utility that has been established by a special law, IETT (Municipal Bus Operator). In addition, there are economic enterprises owned by the IMM such as Ulaşım A.Ş. and IDO A.Ş. which carry out rail and sea transportation, respectively.

(1) Transportation Coordination Center (UKOME)

UKOME which was established and regulated under the IMM administrative body in 2004 is the new authority aiming at coordinating transportation sector within IMM administrative entity with all relating authorities and agencies in transportation sector. UKOME has responsibilities to coordinate with issues of infrastructure plans, programs and projects mainly on utilities such as water supply, sewerage system and electricity and telecommunication.

(2) Infrastructure Coordination Center (AYKOME)

AYKOME was established in 2004 and is responsible to coordinate with light rail transit, subway projects and underground road projects. Some responsibilities similar to those of UKOME need to be adjusted for better coordination of transportation projects.

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[3] *The Municipality Law (No.5393/2005), The Provincial Local Government Law (No.5302/2005), The Law on Associations of Local Authorities (No.5355/2005).*

(3) Department of Transportation (DoT)

Department of Transportation is the official unit of the IMM that is in charge of transportation at the metropolitan scale. Its duties include decision-making on strategic issues concerning transportation, development of plans and projects, integration of projects and programs that are implemented by units or companies associated with the municipality.

Transportation related issues are the duties of the Department of Transportation, which is headed by the Deputy Secretary General responsible for transportation. Under the Department of Transportation, there are six directorates: Transportation Planning, Transportation Coordination, Public Transportation Services, Rail Systems, Traffic, Road Maintenance and Repair.

(4) Istanbul Transport Corporation (Ulasim A.Ş.)

Ulaşım A.Ş. was established under the IMM in 1988 for operating the rail transit system, where operation and management rights have been switched from the infrastructure owner of IMM to Ulaşım A.Ş. The rail transit system consists of four lines (metro, LRT, tramway and funicular system) totalling 53 km. The share of Ulaşım A.Ş. in the rail system within the metropolitan area is 78.4%. The rest (i.e. 21.6%) is carried by commuter railways operated by the Turkish State Railways (TCDD).

(5) General Directorate of Istanbul Electricity, Tramway and Tunnel (IETT)

General Directorate of Istanbul Electricity, Tramway and Tunnel (IETT), is one of the oldest enterprises of IMM concerning transportation. Its duties have changed during the years that have passed in line with related changes. Currently, it carries out transportation primarily by rubber-wheeled vehicles, providing service with a fleet consisting of 2,500 buses. Number of passengers carried in 2005 was approximately 476 million. The share of IETT within overall transportation in Istanbul is 5%. The figure for its share in public transport in Istanbul is approximately 65%.

(6) Istanbul Seabuses Corporation (IDO A.Ş.)

Istanbul Seabuses Corporation (IDO A.Ş.) was founded in 1987 by the Istanbul Metropolitan Municipality (IMM). IDO A.Ş. aims at serving sea transportation in the Marmara region and in the metropolitan area of Istanbul by ferry and seabus services to reduce the congestion over the two Bosphorus bridges where vehicle traffic is extremely high.

(7) Istanbul Metropolitan Planning and Urban Design Center (IMP)

Istanbul Metropolitan Planning and Urban Design Center (IMP) was established in 2005 to support the IMM's decision-making and strategy development as a task force organization to broad tasks for planning and research work and includes transportation unit, logistics unit and other key sectors for city planning. IMP consists of over 400 urban planning professionals and academics who work on 10 key areas of urban development; among them is integrated land use and transportation planning.

4.4. Decision - Making for Urban Transportation

There are three types of approaches to decision-making[4]:

- Vision led: Involves an individual (typically the mayor or committee leader) having a clear view of the future form of city they want, and the policy instruments needed to achieve that vision.
- Plan led: Specifying objectives and problems, and adopting an ordered procedure identifying possible solutions to those problems, and selecting those which perform best.
- Consensus led: Involves discussions between the stakeholders to try to reach agreement on each of the stages in the plan-led approach.

In Turkey, transportation decisions are generally made by the visions of decision-makers, i.e., policy makers in the local and/or central government (Figure 4.4.1).

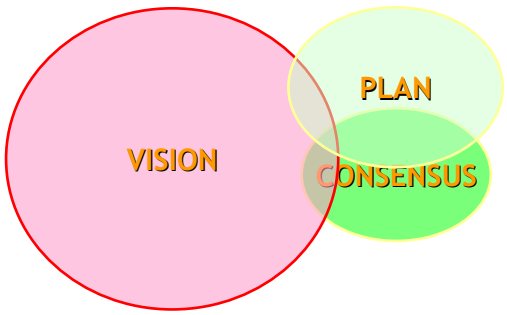

Figure 4.4.1: Transportation Decision-Making Approach in Turkey

Lack of coordination among several state and municipal agencies and their strategies is one of the main reasons for inefficient transport system in Istanbul. The Metropolitan Municipality of Istanbul (IMM) covers 32 local municipalities in an area of 5,390 km^2. The mayors of the local municipalities are responsible for local needs of their areas such as small scale planning, giving construction permits, road cleaning, garbage collection, management of parking areas and recreational places etc., whereas the IMM approves the large scale master plans, build and operate the main transportation infrastructure.

The Ministry of Transport (MoT) plays a key role in the road transport sector. However, responsibilities in relation to the implementation of road transport and traffic legislation are scattered over more than 10 other Ministries and authorities. In the study carried out by the First Council of Urban Transport in 2002, 17 local and national authorities were identified to be partially responsible for the planning, investment, operation and management of transportation in Istanbul. This makes proper planning and coordination of activities extremely difficult. Mechanisms for establishing more effective coordination among the Ministries and streamlined decision making should be developed. As mentioned earlier in this report, in order to address regulatory problems in transportation, a new legislative proposal has been prepared to set up one local authority in Istanbul for the coordination of transport.

[4] *May, A., et al. (2005) "Decision-Makers' Guidebook", European Commission 5th Framework Project, Final Report.*

There are several organizations and directories conducting planning, managing, and controlling public and private passenger and freight transportation by road, rail and sea in the metropolitan area of Istanbul. These could be grouped into four (Table 4.4.1):

- National Government
- Metropolitan Municipality
- Private Groups
- Coordination Centers

Table 4.4.1: Organizations Involved in Urban Transport

National Government
Turkish State Railways (TCDD)
Turkish Maritime Organization
General Directorate of Highways
Directorate of Security and Traffic
Metropolitan Municipality (IMM)
Department of transportation
Directorate of transport coordination
Directorate of traffic
Directorate of transport planning
General Directorate of IETT (Istanbul Municipality Bus Operator)
Istanbul Seabuses Corporation (Istanbul Municipality Ferry and Seabus Operator)
Istanbul Transport Corporation (Istanbul Municipality Rail Transit Operator)
Supervisory Board Department
Private Groups
Chambers of taxi operators
Chambers of dolmus operators
Chambers of minibus operators
Chambers of privately owned bus and service bus operators
Chambers of sea motors operators
Coordination Centers
Transportation coordination center (UKOME)
Transportation coordination technical board
Infrastructure coordination center (AYKOME)
City and county traffic commissions

Source: The First Council for Urban Transport in Istanbul, Final Report, 2002.

Within the acts and laws, the right to manage transportation is given to:

- General Directorate of IETT,
- Metropolitan Transportation Coordination Center,
- Municipalities,
- City and County Traffic Commissions,
- General Directorate of Highways.

For all planning and implementation actions related to traffic and passenger transportation, there is a distribution of responsibilities and functions among these groups. Some of the responsibilities belong to more than one organization, thus the risk of conflicts arises (Table 4.4.2).

Table 4.4.2: Governmental Agency Involvement by Transport Modes

Mode	Type of Vehicle	Infrastructure	Operator	Controller
Highways	Private Cars	A-B	F	A-D
	Taxi cabs	A-B	F	A-D
	Dolmus (Shared taxis)	A-B	F	A-D
	Minibuses	A-B	F	A-D
	Company and School Buses	A-B	F	A-D
	Privately owned buses	A-B	F	A-D-E
	IETT Buses	A-B	F	A-D-E
Maritime	Passenger Ferries	H	H	I
	Seabuses	A	H	A
	Vehicle Ferries	A	G	I
	Sea Dolmus Motors	A	F	A
Railways	Metro/Light Rail Transit/Tramway	A	L	A
	Suburban Rail	K	K	K

Source: The First Council for Urban Transport in Istanbul, Final Report, 2002.

A: Metropolitan Municipality
B: General Directorate of Highways
C: City Traffic Commission
D: Department of Security and Traffic
E: General Directorate of IETT
F: Private person or institution
G: Maritime Organization
H: Istanbul Seabuses Corporation
I: Undersecretariat for Maritime Organization, Directorate of Transportation and Ports, Department of Security
K: Turkish State Railways (TCDD)
L: Istanbul Transport Corporation

Key roles and responsibilities of the state for rail and transportation sector consist of: a) policy formulation, b) regulatory role, c) budgeting and financing, d) program implementation, and e) investment of infrastructure projects at all national level of importance. All important issues and subjects which State Planning Organization (SPO), in cooperation with the Ministry of Transportation (MoT), formulates at national level are determined by the Parliament (Turkish Grand National Assembly, TBMM) through assessment and coordination by Councils and Committees in the State.

Public investment (budgeting) process is applied for all projects independent of sectoral variations (including transportation sector) through national development plans (seven years), medium-term plans (three years: multi-year budgeting system) and annual programming (PCI, JARTS, 2007).

4.5. Projects and Policy Tools in Urban Transportation

Rapid and extensive growth of Istanbul, which used to have a single centre, has forced the city structure to become a multi-cantered city with a number of sub-centres. Urban development policies in the Istanbul Provincial Spatial Development Plan (2006) which describes the five strategic priorities to formulate “Global Urban Centre of Turkey” have encouraged the development of employment sub-centres and home-work linkages.

Although transportation sector has supported the expansion of urban area by increasing the capacity of roads and expanding the road network, IMM is still struggling with the pressure of rapid urbanization and with rapid increase in the number of vehicles. In order to cope with these problems and to support adequate urban spatial structure, IMM has given greater importance to public transportation investment in recent years as an effective and environmental friendly tool. On the other hand, Istanbul, as the biggest national and international economic centre of the country, has generated enormous business activities associated with increasing traffic volumes of inter-regional and intra-regional demands. In this context, transportation sector policies in the plan have emphasized detailed actions to "develop variety of transportation modes" and "establish strong international transportation connections" (PCI, JARTS, 2007).

Spatial planning and development of the Istanbul Metropolitan Area are controlled by a mosaic of decision-making bodies at super national, national, regional and local levels. Meanwhile, IMM has faced with the realities and factors such as overcrowding, immigration, insufficient policy programs, illegitimacy, lack of execution of legislative power, etc. within inefficient control system in the spatial development. With all these factors, disorganization and insufficiency of planning and implementation systems appeared to have failed planning efforts.

IMM has carried out comprehensive planning as an approach since mid-1990. Some of the planning studies were directed toward the spatial development for the expanded boundaries of the IMM. In 1995, Istanbul Metropolitan Planning Office has completed the Istanbul Provincial Spatial Development Plan. The new legislations which enable the IMM to cover the whole province for the first time in spatial planning work were enacted in 1995. However, it was reported that the plan was challenged in court by local professional organizations questioning the legitimacy of the IMM's authority on planning over expanded areas. Subsequently, the plan was cancelled.

Istanbul Metropolitan Planning and Urban Design Center (IMP) was established in September 2005 by the Mayor. IMP conducted a household travel survey among 72,280 households in 2006. On the basis of the data collected by the IMP, JICA (Japan International Cooperation Agency) is presently working on Istanbul Transportation Master Plan (ITMP) for 2023. Although the ITMP has not been completed, the Mayor and the Government have announced a set of "mega projects". Among them are (i) urban road tunnels, (ii) the 3rd Bosphorus Bridge and its beltways, and (iii) Bosphorus road tunnel crossing. These mega projects have been criticized by some transport experts, professional organizations and NGOs, and have been challenged in the court, not only on the ground of the legitimacy of the IMP's authority but also on the ground of the negative environmental and land development impacts of the projects.

Table 4.5.1 shows major transportation projects policy tools that have recently launched in Istanbul with the objectives considered by the national and local decision-makers. The policy tools / projects can be grouped into three main categories: a) Infrastructure provision, b) Transportation demand management, and c) Information technology for operators and users.

While there are arguments to support all of the objectives given in the Table 4.6.1, it is important to note that there can be tensions between them. As a result, maintaining a balance among objectives and in the packages of policies emerging from these objectives is not always easy and tradeoffs are sometimes necessary. It is important, therefore, for each city to understand the priority which it places on each of these objectives, and to pursue policies which support the higher priority objectives while still facilitating achievement of the others (May, A. and Crass, M., 2007).

Table 4.5.1: Projects / Policy Tools and Objectives

Policy Tools	Major Projects	Objectives
INFRASTRUCTURE	3rd Bosporus Bridge	Reducing congestion ?
	Bosporus Road Tunnel	
	Urban Road Tunnels	Improving access ?
	Flyovers	
	Marmaray	Reducing congestion Improving access Improving transport safety Reducing GHG emissions Improving air quality
	Rail Transit Projects	
	Park & Ride Facilities	
	BRT (Bus rapid transit)	
	Ferries & Seabuses	
	Bikeways	Not considered.
	Pedestrian pathways	
TDM	Alternate work & school schedule	Reducing congestion
	Parking charges	
	Company & school buses	
IT	Akbil (Smart ticket)	Improving access Reducing congestion
	IT for users & operators	

TDM: Transport demand management, IT: Information Technology

One of the greatest challenges in pursuing sustainability is the need to give sufficient emphasis to longer term impacts. The objectives such as reducing greenhouse gases and improving air quality are likely to be of greater concern to future generations. All of the others affect today's citizens to differing degrees and lead to pressure for immediate action. Given the typical four or five year life of a government, it is all too easy for policy makers to focus on current needs and overlook longer term problems (May, A. and Crass, M., 2007).

Governments are much more likely to seek solutions through the policy tools which represent the supply side of transport policy, than on the demand-side measures of regulation, information and pricing. It is well known that the demand management measures are likely to be more cost-effective in reducing congestion than infrastructure provision, but are more difficult to implement. It is also known from the experiences in Istanbul that such major road projects as given in the Table 4.6.1 will eventually create their "induced traffic".

Non-motorised transport facilities (bikeways and pedestrian pathways) have been ignored by the policy makers in Istanbul. It is now widely accepted that no one type of policy will solve transport problems; we cannot, for example, build sufficient new infrastructure to overcome congestion. In a similar way, none of the approaches in the Table 4.6.1 will be sufficient on its own to address sustainability objectives. There is need for a package of solutions that together will achieve more than any on its own: for example public transport improvements and controls on parking will be better able together to influence demand for car use. Likewise, one policy instrument can be used to overcome the barriers to introducing another: as London found, improving bus services made congestion charging more palatable, while congestion charging provided the finance for the improved services. For packages to work well in this way, governments need to be able to plan individual measures in a coordinated way (May, A. and Crass, M., 2007).

The national and local decision-makers do not seem to have a financial strategy associated with a specific transport strategy. Major transport projects are being developed on an ad hoc basis and are also being funded on an ad hoc basis. For example, the controversial "Tunnels for 7 Hills" project is a major project of urban road tunnels consisting of 35 tunnels with a total length of 156 km and is estimated to cost $2 billion. The Bosphorus road tunnel project is estimated to cost $1.6 billion. 3rd Bosphorus Bridge and its beltways are estimated to cost $4.5 billion.

This trend of trying to accommodate the increasing number of automobiles on the road network while extending insufficient rail transit network, is straining the financial resources of the city. IMM has set aside 1.5 billion YTL ($ 1.00 = YTL 1.29) for road-based transport infrastructure development and 3.5 billion YTL for rail-based mass transit.[5] In 2007, Istanbul Metropolitan Municipality allocated 4.26 billion YTL (53.5 % of its total annual budget) on transportation projects. According to the 2008 Annual Budget, IMM will spend 2.72 billion YTL for transportation projects (52.6 % of its total annual budget) in 2008, of which 774 million YTL (28.4 %) will be spent for rail transit development. In the next 5-year between 2007 and 2011, IMM is planning to allocate 8.4 billion YTL to spend on transportation infrastructure[6].

There are concerns that transport policy responses in Istanbul have been driven by the sectoral interests and not the wider interests of society. There is an urgent need for more openness in transportation policy development and more transparent decision-making process. Promotion of public awareness and fostering a sense of individual and collective responsibility through education and campaigns, and thereby encouraging changes in behavior are of vital importance in promoting a better understanding of sustainable transportation; and in creating a stakeholder base that will work with the city to bring about a public transport system that is sustainable.

On the other hand, increasing public awareness on safety and on environmental impacts of transportation together with the enforcement of the EU legislation have put pressure on the decision-makers to recognize the rights and obligations of transport users in Turkey[7].

Prevailing system for decision-making in Turkey tends to separate economic, social and environmental factors at the policy, planning and management levels. This influences the actions of all groups in society, including the Government, industry and individuals, and has important implications for the efficiency and sustainability of development. An adjustment or even a fundamental reshaping of decision-making, in the light of country-specific conditions, may be necessary if transportation, environment and development are to be put at the centre of economic and political decision-making, in effect achieving a full integration of these factors.

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[5] *"Zeytinburnu-Bagcilar Tramvay Hattı Hayırlı Olsun." Istanbul Bulletin, IBB,September. 2006.*

[6] *IBB Annual Budget 2007, November 2006.*

[7] *Gerçek H., Bulay S., Transportation Planning and Decision-Making in Istanbul: A Case Study in Sustainable Urban Transport Policy Development, Paper presented to the 11th WCTR Conference, Berkeley, 2007.*

5. CONCLUSIONS

5.1. Urban Structure Envisaged by the Istanbul Master Plan

Despite the targets set by the comprehensive city development plans to control the growth, the metropolitan city of Istanbul has been growing rapidly. In the Istanbul Metropolitan Area Master Plan (1/100,000) that has been officially approved by the IMM, the most important planning issue is the sustainable growth into the future. In the plan, industrial restructuring is aimed to develop Istanbul into a global city in response to worldwide globalization (further accelerated market economy, free trade and capital investment associated with information technology development) and integration / accession to the EU (now in the negotiation process). This industrial restructuring also necessitates change in the old and traditional existing urban structures of the city, which can no longer accommodate its growing population and the industrial innovation required for a global city. In addition, in order for Istanbul to be a global city, it must grow from an “industrial city” to a “city of service” in line with the national target of transformation into an information society. This includes the further development of international and national financial, technological, information, and service industries.

It is a common knowledge that the urban structure of a city must be changed or be transformed when that city reaches a certain level or stage of urban growth, especially where the old urban structure can no longer accommodate the increasing urban population and activities in terms of quantity and quality. It is recognized that Istanbul has reached this turning point in which it has to change its urban structure into a mega city of more than 10 million people. However, as compared to other mega cities in the world that have grown from vast alluvial plains, Istanbul has some specific natural barriers for urban expansion and restructuring such as its natural restriction on space for development, the narrow strip of land limited by sea and strait, its hilly and steep land areas, its serious environmental vulnerability, and other factors. In this respect it may be appropriate for the master planning to first prioritize environmental sustainability within which urban restructuring concepts and plans can be devised (JICA, IMM, 2007).

It is certain that the Master Plan was prepared in a period of radical economic and social changes in the world, and wherein Istanbul, correspondingly is planned to transform herself into a global city integrated with the changing social and economic global networks. For this end the plan employed a basic principle of sustainability based on which the urban transformation policies were established for socio-economic growth and urban growth for the city.

It is apparent that the scale and magnitude of the future urban growth of Istanbul will definitively affect its urban structure. However, the Istanbul Master Plan is silent about the socio-economic growth size (GDP, employment, and population) in the target year of 2023 or 2025 except on its population size (JICA, IMM, 2007).

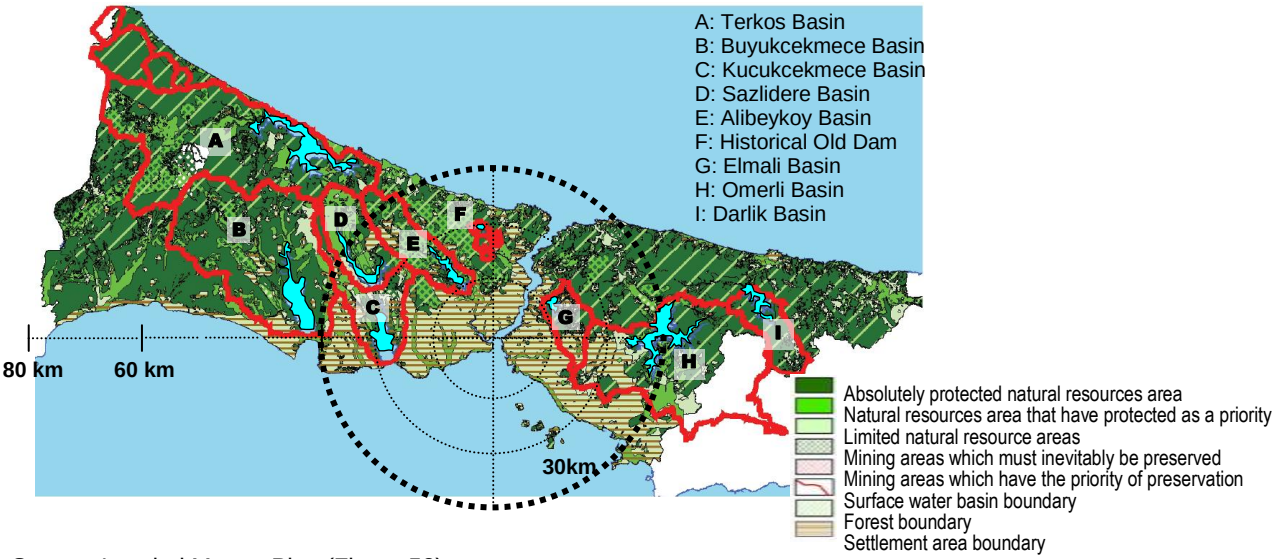
The Master Plan shows that if necessary measures are not taken, it is estimated that at the current un-checked population growth rate (3.2 % annually), the population of Istanbul will increase to 22,037,990 in 2025, and it will be 17,396,595 in 2025 on the assumption that the population growth rate will decline and reach zero growth by 2045. In addition to these population projections in the two cases, the IMP calculated the environmental capacity of Istanbul and pegged the figure at 16,000,000 which is deemed to be a limitation on urban

growth for maintaining environmental sustainability. Based on these discussions, the IMP decided on a population target for Istanbul of 16 to 17 millions in 2023 (JICA, IMM, 2007).

It is needless to say that necessary measures and strong commitments for both central and local governments on population control are indispensable for controlling and attaining the population target of 16 millions in Istanbul. Environmental capacity is set at 16 million to maintain Istanbul's environmental sustainability. The strict enforcement of regulations for containing the urban and housing development (either legal or illegal) in limited areas and controlling land - use intensity, especially population density are needed to keep population volume under the environmental capacities. The Master Plan is also silent on these measures (JICA, IMM, 2007).

According to the Turkey' Statistical Yearbook 2006, Istanbul's employment rate is 42.6 % and this is quite low as compared with the European averages and the OECD countries. This is attributable to its lower share of women in employment in Istanbul and Turkey. To estimate the employment size of Istanbul in 2025 a target was set at 54.6 % of employment rate. This target translates to a ratio of employment per population of 39.5 %, at which the total number of employment of Istanbul is estimated at 6,400,000 in 2025.

Directing and designating the future urban area expansions of Istanbul is the first important task of the master planning since it is likely to determine the future environmental / ecological system of the region as well as the spatial system of social and economic lives and activities in the city's urban areas. Natural threshold synthesis, which was elaborated in the IMP Master Planning, through the risk and potential analysis on natural resources including earth science, agricultural land and soil, forest area and ecology, was mapped out as shown in Figure 5.1.1 so as to work as an urban development framework directing future urban area expansions, land - use plans, and most importantly, the urban structure of Istanbul.



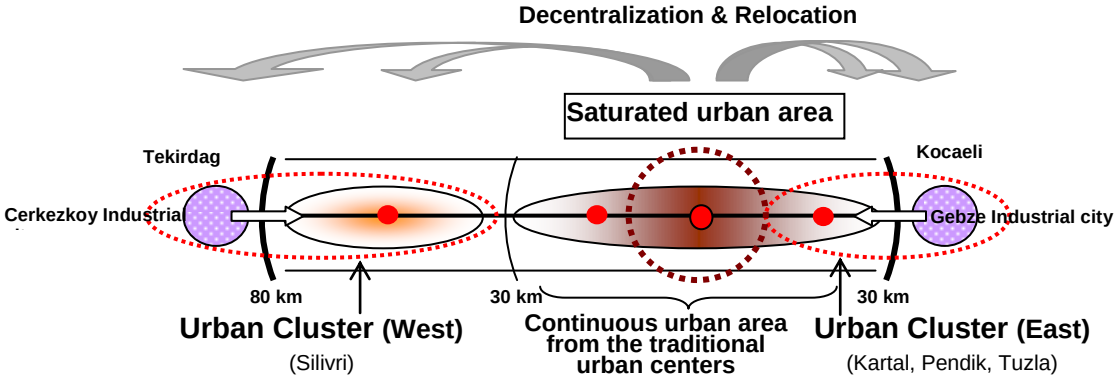
Source: Istanbul Master Plan (Figure 52)

Figure 5.1.1: Natural Threshold Synthesis

This synthesis map presented protected and limited natural areas and water basin areas which are deemed important for maintaining ecological balance and hence the environmental sustainability of Istanbul.

The IMP's environmental policy imposes on future urbanization in Master Plan resulting in the narrow lengthening of future urban areas (10 km x 110 km) along the coastline. The Master Plan tells that the narrow and lengthy urban areas should be structured into "linear development model extending on an east-west oriented axis" or "linear axis with multi-cantered structure or hierarchical urban centre system".
The urban structure transformation of Istanbul assumed in the 2023 Master Plan can be roughly put in shape as shown in Figure 5.1.2. A consistent concept to the IMP Master Plan is represented by the key word "decentralization," meaning that the saturated urban and industrial accumulation in the built-up areas will be decentralized or relocated into suburban areas toward east and west along the "linear development model" so as to regenerate or relieve the saturated or congested urban areas on one hand, and on the other hand, develop new urban settlements in the suburban areas to accommodate the relocated industries from the saturated / congested urban areas and promote new industries and eventually become less dependent on the existing built-up areas, especially the congested central areas. It is expected that less dependency of the new urban settlements (self-reliant town) on the existing urban centres will lessen the pressure or burden on the congested urban centres.

As shown in Figure 5.1.2, development areas are classified with the corresponding administrative districts so as to make clear the geographical development concepts. Among others, the most important six districts in spatial development are specified as Kartal, Pendik, Tuzla Kucukcekmece, Buyukcekmece and Silivri which altogether will accommodate as much as 98.7 % of population increase and 85.2 % of employment increase during the plan period between 2005 and 2023.



Source: JICA, IMM (2007)

Figure 5.1.1: Transformation of Urban Structure in the Istanbul Master Plan

5.2. Future Transport Demand

The relatively low mobility rates in Istanbul reflect the fact that urban travel demand by motor vehicles is suppressed due to severe traffic congestion and long travel times on the urban road network. It can be easily argued that as the quality of transportation services improves in the future, citizens of Istanbul are likely to make more trips and this will result in high travel demand on the transportation network. It is also expected that car ownership will increase and at the same time the share of cars in all modes will grow. According to the demand forecasts carried out by the JICA under a "no road and no transport project" scheme (do-nothing), the share of cars will rise 3 times in 2023 as compared to 2005 (JICA, IMM, 2007).

As a result, traffic volumes on roads will increase and traffic congestion on transport facilities will worsen.

The Istanbul Transportation Master Plan study being carried out by JICA aims at to reduce motorized traffic by investing in the improvement of public transport services thereby promoting a shift in traffic demand from private passenger cars to public transportation, and ultimately contributing to the upgrading of mobility and accessibility within the city and the regeneration of a more liveable urban environment.

In 2023, since the increasing road capacity is difficult in accordance with the increment of car modal shares, it is indispensable to improve and expand public transport services as well as to put the existing roads to efficient use by strengthening traffic regulations, and thereby reducing dependence on private passenger cars. It is indispensable to employ a public transport priority policy as well as traffic demand management in the urban transport master plan (JICA, IMM, 2007).

The main conclusions of this study can be highlighted as follows:

- Urban transportation has long been formed by a road-based policy focusing on providing more road capacity to accommodate the rapidly increasing number of motor vehicles in Istanbul. As a result, multi-lane roadways, over and underpasses, complex intersections etc. have been built to solve the ever increasing congestion problem. However, additional capacity provided by these road investments facilitated a rapid growth in car use and created “induced traffic” as a result of the changes in the land-use and activity patterns.

- The public transportation system in Istanbul has been unable to keep pace with the rapid growth and changing urban structure. Local authorities have been struggling under the pressure of urbanization without sufficient funds to accommodate growth. The rail system is not extensive of which most provides a low level of service. This results in the low share of rail transit and sea borne transport which has remained at a stable level of about 6 % in the last two decades. As compared to metropolitan cities such as London (72 %), Paris (87 %), Moscow (77 %), New York (77 %) and Tokyo (96 %)[8], the insufficient rail transit system serves only 10 % of total public transport trips in Istanbul.

- Istanbul has faced a large rapid increase of car ownership in recent years in conjunction with current population increase and economic growth. The number of automobiles has increased dramatically from 200,000 in 1980 to 1.7 million in 2007. However, as compared to the metropolitan cities of developed countries, car ownership is still low in Istanbul. Private cars have a share of 26.3 % of total daily trips and created serious problems of traffic congestion and environmental pollution in the urban centre. Share of private cars has increased from 19.3 % to 26.3 % in the last decade whilst share of taxi and dolmuş (shared taxi) has declined from 9.4 % to 4.8 % in the same period.

- For all trip purposes, the average travel distance of motorised trips has decreased in the last ten years, mainly for two reasons: a) the polycentric development of the city, and b) particularly for home-based-other and non-home-based trips, trip makers tend to prefer making shorter trips by choosing closer locations for their activities due to the severe congestion and travel time.

- In the last decade, measures that have been taken in order to decrease the pollution caused by industry and heating have performed well especially in large conurbations of Turkey. The widespread use of natural gas has significantly contributed to the reduction

[8] *UITP, Millennium Cities Data Base for Sustainable Mobility, 2000.*

of air pollution generated by residential heating and contributed to raising public awareness on the issue of clean air. For instance, SO_2 has dropped from 100 ug / m^3 in 1995 to 18 ug / m^3 in 2006 in Istanbul.

- Likewise, there are positive developments in reducing emissions caused by transportation. To a large extent, the motor vehicle industry in Turkey has adapted the Motor Vehicle Technical Regulations of the EU. During the last decade, the expanding of urban rail transit network; increases in the number of vehicles using unleaded gasoline equipped with catalytic converters and taxicabs using LPG (liquid petroleum gas) have decreased the emissions caused by road traffic. However, the rapid increase in car ownership and the longer travel lengths have limited the positive impacts of these improvements. Motor vehicle traffic is now considered as the major factor causing air pollution. The amount of the CO_2 emissions from road transport in Istanbul is estimated to increase by 37 % between 1990 and 2007, from 6.5 million ton to 8.9 million ton annually.

- Lack of coordination among several state and municipal agencies and their strategies is one of the main reasons for inefficient transport system in Istanbul. The Ministry of Transport (MoT) plays a key role in the road transport sector. However, responsibilities in relation to the implementation of road transport and traffic legislation are scattered over more than 10 other Ministries and authorities. In the study carried out by the First Council of Urban Transport in 2002, 17 local and national authorities were identified to be partially responsible for the planning, investment, operation and management of transportation in Istanbul. This makes proper planning and coordination of activities extremely difficult. Mechanisms for establishing more effective coordination among the Ministries and streamlined decision making should be developed. In order to address regulatory problems in transportation, a new legislative proposal has been prepared to set up one local authority in Istanbul for the coordination of transport.

- Spatial planning and development of the Istanbul Metropolitan Area are controlled by a mosaic of decision-making bodies at super national, national, regional and local levels. Meanwhile, IMM has faced with the realities and factors such as overcrowding, immigration, insufficient policy programs, illegitimacy, lack of execution of legislative power, etc. within inefficient control system in the spatial development. With all these factors, disorganization and insufficiency of planning and implementation systems appeared to have failed planning efforts.

- Non-motorised transport facilities (bikeways and pedestrian pathways) have been ignored by the policy makers in Istanbul. It is now widely accepted that no one type of policy will solve transport problems; we cannot, for example, build sufficient new infrastructure to overcome congestion. There is need for a package of solutions that together will achieve more than any on its own. For packages to work well, central and local governments need to be able to plan individual measures in a coordinated way.

- The national and local decision-makers do not seem to have a financial strategy associated with a specific transport strategy. Major transport projects are being developed on an ad hoc basis and are also being funded on an ad hoc basis. For example, the controversial “Tunnels for 7 Hills” project is a major project of urban road tunnels consisting of 35 tunnels with a total length of 156 km and is estimated to cost $2 billion. The Bosphorus road tunnel project is estimated to cost $1.6 billion. 3rd Bosphorus Bridge and its beltways are estimated to cost $4.5 billion. This trend of trying to accommodate the increasing number of automobiles on the road network while extending insufficient rail transit network is straining the financial resources of the city. IMM has set aside 1.5 billion YTL ($ 1.00 = YTL 1.29) for road-based transport

infrastructure development and 3.5 billion YTL for rail-based mass transit.[9] In 2007, Istanbul Metropolitan Municipality allocated 4.26 billion YTL (53.5 % of its total annual budget) on transportation projects. According to the 2008 Annual Budget, IMM will spend 2.72 billion YTL for transportation projects (52.6 % of its total annual budget) in 2008, of which 774 million YTL (28.4 %) will be spent for rail transit development. In the next 5-year between 2007 and 2011, IMM is planning to allocate 8.4 billion YTL to spend on transportation infrastructure.

- There are concerns that transport policy responses in Istanbul have been driven by the sectoral interests and not the wider interests of society. There is an urgent need for more openness in transportation policy development and more transparent decision-making process. Promotion of public awareness and fostering a sense of individual and collective responsibility through education and campaigns, and thereby encouraging changes in behavior are of vital importance in promoting a better understanding of sustainable transportation; and in creating a stakeholder base that will work with the city to bring about a public transport system that is sustainable.

- On the other hand, increasing public awareness on safety and on environmental impacts of transportation together with the enforcement of the EU legislation have put pressure on the decision-makers to recognize the rights and obligations of transport users in Turkey. Prevailing system for decision-making in Turkey tends to separate economic, social and environmental factors at the policy, planning and management levels. This influences the actions of all groups in society, including the Government, industry and individuals, and has important implications for the efficiency and sustainability of development. An adjustment or even a fundamental reshaping of decision-making, in the light of country-specific conditions, may be necessary if transportation, environment and development are to be put at the centre of economic and political decision-making, in effect achieving a full integration of these factors.

[9] *"Zeytinburnu-Bagcilar Tramvay Hattı Hayırlı Olsun." Istanbul Bulletin, IBB,September. 2006.*

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