Istanbul Metropolitan Municipality
&
Japan International Cooperation Agency (JICA)

THE STUDY
ON
INTEGRATED URBAN TRANSPORTATION MASTER PLAN
FOR
ISTANBUL METROPOLITAN AREA
IN THE REPUBLIC OF TURKEY

Final Report

January 2009

IMM Directorate of Transportation Planning
&
ALMEC Corporation
Nippon Koei Co., Ltd

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PREFACE

In response to a request from the Government of the Republic of Turkey, the Government of Japan decided to conduct "The Study on Integrated Urban Transport Master Plan for the Istanbul Metropolitan Area" and entrusted to the study to Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Tetsuo Wakui of ALMEC Co., LTD. And consists of ALMEC Co., LTD. And NIPPON KOEI Co., LTD. between June, 2007 and October, 2008.

The team held discussions with the officials concerned of the Government of the Republic of Turkey and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studied and prepared this final report.

I hope that this report will contribute to the promotion of this project and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Turkey for their close cooperation extended to the study.

January, 2009

EIJI HASHIMOTO,
Vice President
Japan International Cooperation Agency

January 2009

HASHIMOTO Eiji
Vice President
Japan International Cooperation Agency
Tokyo

Letter of Transmittal

Dear Sir,

We are pleased to formally submit herewith the final report of the Study on Integrated Urban Transportation Master Plan for Istanbul Metropolitan Area In the Republic of Turkey.

This report compiles the result of the study which was undertaken both in Turkey and Japan from June 2007 to January 2009 by the Team comprising ALMEC Corporation and Nippon Koei Co., Ltd.

We owe a lot to many people for the accomplishment of this study. First we would like to express our sincere appreciation and deep gratitude to all those who extended their extensive assistance and cooperation to the Team, in particular the Steering Committee and composed by Istanbul Metropolitan Municipality.

We also acknowledge the officials of your agency, the JICA Advisory Committee, and the Embassy of Japan in Turkey to their support and valuable advise in the course of the Study.

We hope the report would contribute to the sustainable development of Istanbul.

Very truly yours,

WAKUI Tetsuo
Team Leader
Integrated Urban Transportation Master Plan for Istanbul Metropolitan Area

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ABBREVIATIONS

ABB	before merged Bombardier
ADB	African Development Bank
AGR	Declaration for the Construction of International Arteries
AGT	Automated Guided Transit System
APSA	Agency for the Protection of Special Areas
ATC	Area Traffic Control
AYKOME	Infrastructure Coordination Center
BAGEV	The Foundation for the Economic Development of Western Mediterranean
BD	Business Development
BDOM	Design-Build-Operate-Maintain
BIMTAS A.S	Istanbul Engineering and Consultancy Services Company
BLT	Build-Lease-Transfer
BO	Build-Operate
BoP	Bosporus Crossing
BOT	Build-Operate-Transfer
BOO	Build-Own-Operate
BRT	Bus Rapid Transit
CAF	Cost Assurance and Freight
CBD	Central Business District
CCBD	Central Business District
CCTV	Closed Circuit Television
CEO	Chief Executive Officer
CFO	Chief Financial Officer
CRF	Central Road Fund
DB	Design-Build
DBB	Design-Bid-Build
DBFO	Design-Build-Finance-Operate
DBSA	Development Bank of Southern Africa
DBOM	Design Build Operate Maintain
DD	Deputy directors
DHMI	General Directorate of State Airport Operations
DLH	Directorate of Railway, Airport and Harbor Construction of the Ministry of Transport
EAIF	Emerging Africa Infrastructure Fund
E-5	European Highway System No.5
EEA	European Environment Agency

EEC	European Economic Community
EGEV	Aegean Foundation for Economic Development
EIA	Environmental Impact Assessment
E-IRR	Economic Internal Rate of Return
E&M	Electrical and Mechanical
EMPI	Earthquake Mitigation Plan for Istanbul
EMU	Electrical Multiple Unit
ENC	Environment Council
ERP	Electronic Road Pricing
ETC	Electronic Tool Collection
EU	European Union
FDI	Foreign Direct Investment
F-IRR	Financial Internal Rate of Return
GDP	Gross Domestic Product
GRDP	Gross Regional Domestic Product
GPRS	General Packet Radio Service
GRP	Gross Regional Product
GSM	Global System for Mobile Communications
GTO	Gate Turn Off
HBO	Home Based Other
HBS	Home Based School
HBW	Home Based Work
HCE	Higher Council for the Environment
HCP	Higher Council for Planning
HOV	High Occupancy Vehicle
HRT	Heavy Rail Transit
IBB or IMM	Istanbul Metropolitan Municipality
IDO	Istanbul Sea Buses Company
IETT	Istanbul Electric Tramway and Tunnel Authority
IGBT	Insulated Gate Bipolar Transistor
IMA	Istanbul Metopolitan Area
IMF	International Monetary Fund
IMM	Istanbul Metropolitan Municipality
IMP	Istanbul Metropolitan Planning and Urban Design Center
IPO	Initial Public Offering
ISBAK	Istanbul Transportation Maintenance Company
ISC	infrastructure service charge
ISE	Istanbul Store Exchange
ISKI	Istanbul Water and Sewerage Authority

ITU	Istanbul Technical University
IUAP	Istanbul Transportation Master Plan
JBIC	Japan Bank of International Cooperation
JICA	Japan International Cooperation Agency
JDA	Joint Development Agreement
KGM	Directorate General of Highways of the Ministry of Public Works and Settlement
LEC	Local Environment Committee
LRT	Light Rail Transit
MEKIK	Council of Mersin Development and Co-Operation
M&E	Machine and Equipment
MOC	Ministry of Culture
MOE	Ministry of Environment
MOEF	Ministry of Environment and Forestry
MOI	Ministry of Interior
MOIT	Ministry of Industry & Trade
MOLAND	Monitoring Land Use
MOND	Ministry of National Defense
MPWS	Ministry of Public Works and Settlement
MOT	Ministry of Tourism
MOTC	Ministry of Transport & Communication
MPEG4	Moving Picture Coding Experts Group 4
MPWS	Ministry of Public Works & Settlement
MRT	Mass Rapid Transit
NAF	North Anatolian Fault
NATM	New Austrian Tunneling Method
NDFA	National Development Finance Agency
NGO	Non Governmental Organization
NHB	Non-home based
NPAA	National Programme for Adoption of the Acquis
NTMA	National Treasury Management Agency
NUTS	The Nomenclature of Territorial Units for Statistics
OD	Origin and Destination
OECD	Organization for Economic Co-Operation & Development
OIZ	Organized Industrial Zone
O&M	Operation and Maintenance
PA	Privatization Administration
P-A	Production and Attraction
PCU	Passenger Car Unit
PDA	Personal Digital Assistant

PFI	Private Financing Initiative
PGA	Peak Ground Acceleration
PHC	Privatization High Council
PI	Project Implementation
PP&E	Project Preparation & Evaluation
Pphpd	Passengers per Hour per Direction
PPP	Public Private Partnership
PSP	private sector participation
RFP	Request for Proposal
RoRo	Roll-on & Roll-off
ROW	Right of Way
RTMS	Remote Traffic Microwave Sensor
SABEKAK	Council of Samsun Regional Economic Development
SAIF	Southern Africa Infrastructure Fund
SAEDF	South African Export Development Fund
SAPPID	Sustainable African Public-Private Partnerships for Infrastructure Development
SAPROF	Special Assistance for Project Formation
SEE	State Economic Enterprise
SPA	Special Project Areas
SPC	Supreme Planning Council
SPO	State Planning Organization
SPV	Special Purpose Vehicle
TAU	General Directorate of Technical Research and Application
TAV	Tepe-Afken Joint Venture
TBM	Tunnel Boring Machine
TCDD	General Directorate of Turkish State Railway
TCK	Director General of Highways
TCP/IP	Transmission Control Protocol/Internet Protocol
TDA	Transit Development Acceleration
TDAF	Transit Development Acceleration Fund
TDI	Turkish Maritime Transportation Company
TDM	Traffic Demand Management
TEM	Trans-Europe Motorway
TEU	Twenty Feet Equivalent Unit
TfL	Transport for London
TOD	Transit Oriented Development
TODAIE	Public Administration Institute of Turkey and the Middle East
TOR	Transfer of Operating Right
TTC	Travel Time Cost

UDI	Under secretariat of Defense Industry
UKOME	Transportation Coordination Center
ULASIM A.S	Istanbul Transportation Company
UMA	Under secretariat of Main Affairs
UNDP	United Nations Development Programme
UN/ECE	United Nations Economic Commission for Europe
UTK	Transport and Traffic Commission
VAT	Value Added Tax
VGF	Viability Gap Funding
VICS	Vehicle Information and Communication System
VMS	Variable Message Sign
VOC	Vehicle Operating Cost
WIDEC	West Istanbul Urban Development Corporation
YPK	Secretariat of High Planning Council
YTL	New Turkish Lila (Yeni Yurk Lila)

Executive Summary

1. Introduction

The economy of Turkey has been steadily expanding since the late 20th century. In the process, metropolitan Istanbul witnessed rapid population concentration and motorization. During peak hours, the entire built-up areas are now clogged with heavy traffic. The mitigation of chronic traffic congestion is one of the most pressing issues for the municipal government.

IMM has been allocating the largest part of its development budget to the transport sector, toward the improvement of roads, railways and shipping and parking spaces. The transport infrastructure, notably railway facilities, takes long time to develop, whereas urbanization inexorably evolves ahead rapidly to change the volume and the structure of traffic demand. It was thought necessary to formulate an integrated master plan for the transport sector which incorporates effective policy measures and investment planning consistent with the long-term metropolitan land use plan. IMM commenced in May 2006 the study for the integrated transport master plan, or IUAP as initialized from the Turkish study title, and soon JICA agreed to provide technical cooperation.

2. Environment for Planning

2.1 Land Use Plan

IMM completed in mid 2007 the land use plan for the target year of 2023. A new group of commissioned experts has been reviewing it since April of 2008. The salient features of the plan are outlined below, because it provides the basis for the present transport master plan.

2.2 Population

The rate of population growth has been slowly declining in Istanbul in the long term, but it is yet high at over 3% per annum. The recent annual increase ranged from 0.4 to 0.5 million. Assuming the estimated 12.53 million in 2007 with annual growth of 3%, the population of Istanbul would exceed 20 million in 2023. At a lower growth derived from the past trend, the population will reach 18 million. The planned target of 16 million presupposes substantially lowered growth. It is requisite to implement decisive policy instruments to curve further concentration.

2.3 Motorization

As of 2005, the registered automobiles in the metropolitan region totaled 1.33 million. With the expected economic growth, the number of motorized vehicles will increase rapidly by more than 3.14 times to 4.19 million in 2023.

Registered automobiles per thousand of population were 111 vehicles in 2005 and will increase to 245 by 2023. In 2005, 31% of the metropolitan households owned one passenger car and 4% two or more. The passenger car ownerships are estimated to increase to 67% of the households in 2023.

3. Environment for Planning

Figure 3.1 shows the distribution of OD trips within and without the study area. The percentage distribution of trips between the European and the Asian sides does not change much during 2006 -2023, and Bosporus crossing trips increase 1.5 times, or as much as the growth of the total trips.

Trips between the study area and elsewhere outside and through trips increase 2 to 3 times over the period, totaling 3.3 million. This is equivalent to over 10% of the total trips within the study area in 2023. The trips between Silivri and Tekirdag show notably large increase.

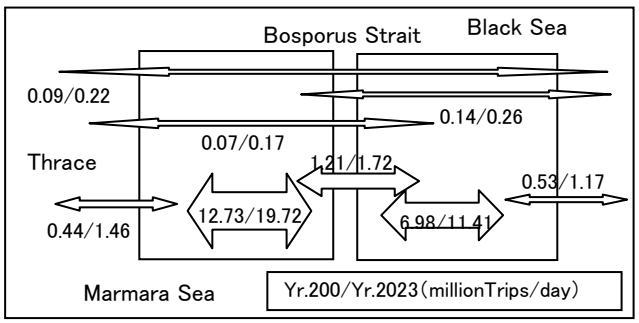


Figure 3.1 OD Trips Within and Without the Study Area

The forecast outcome of the “Do Nothing” case contains crucial implications for transport planning.

- There is no way to cope with the expected tripling of automobile traffic. It is imperative to promote the demand shift to public transport means.
- East-west arterial routes must be strengthened in capacity.
- The congestion will chiefly occur in highways. It is essential to adopt policy instruments for dispersing the future motorized traffic to general roads.
- The transport capacity across Bosporus Strait and across Golden Horn Bay falls seriously short of the demand forecast.
- The transport capacity both across K. Cekmece Lake and B. Cekmece is inadequate.

4. Network Planning

4.1 Master Plan Objectives of Network Development

The master plan network was identified by keeping in view the following objectives.

- The network must be reliable enough to support various economic activities and daily lives of the metropolitan population.
- The network must be securely disaster-prepared.
- The network development must be economically justifiable and financially feasible.
- The network must be environmentally sound.

4.2 Total Investment in Master Plan Projects

The total investment required for the master plan projects amounts to US$24.2 billion (US$ 11 billion for 52 road projects and US$13.2 billion for 16 railway projects). The total cost of 10 projects scheduled for completion after 2023 is US$5.5 billion, of which US$0.8 billion will be spent before 2023 and must be added to the above total.

Figure 4.1 shows the required investment in roads and railways by period of completion. The amount of investment decreases from the short term to the long term, but in reality it will either stay on the same level or increase because new projects are likely to be added on the occasion of the master plan review at every five-year or ten-year interval.

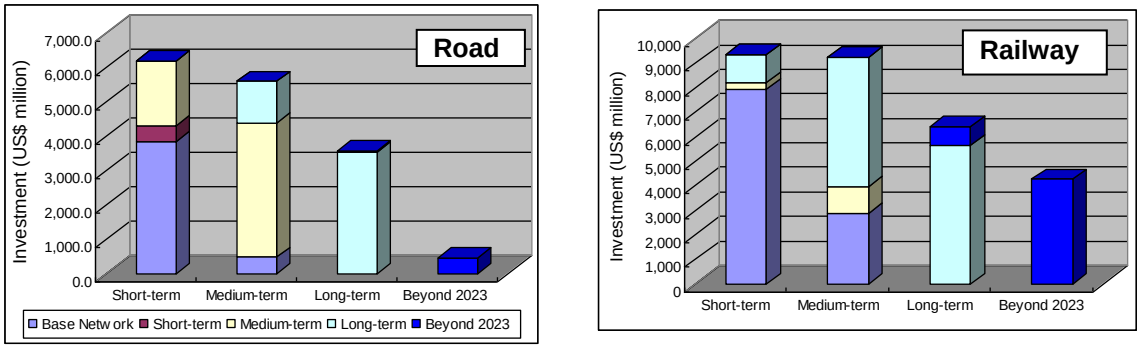


Figure 4.1 Investment in Master Plan Projects by Period of Completion

4.3 Bosporus Crossing

When the Marmaray railway crossing and the road tunnel are completed, the total capacity for Bosporus crossing will substantially increase. The capacity expansion will not, arguably, ease the pressure of demand for very long. The expected traffic on the new railway would probably consist of those passengers who otherwise travel by bus or ferry. The railway crossing would have only limited appeal to those who cross the Strait by car on the existing two bridges. The metro-bus route is now planned on the 1st Bridge, but this will not increase the capacity of the bridge. The daily passenger traffic across the Strait will again increase to 1.2 times the available capacity by 2023.

The present master plan proposes the completion by 2023 of the 3rd bridge as both railway and road links across the Strait. The new bridge is needed simply to meet the expected growth of demand. However, there are many arguments against the new bridge. Main points of contention are the problem of land acquisition and the adverse impact on natural environment and landscape. It is necessary to undertake careful studies over these issues and explain the circumstances of project formulation until a general consensus begins to emerge.

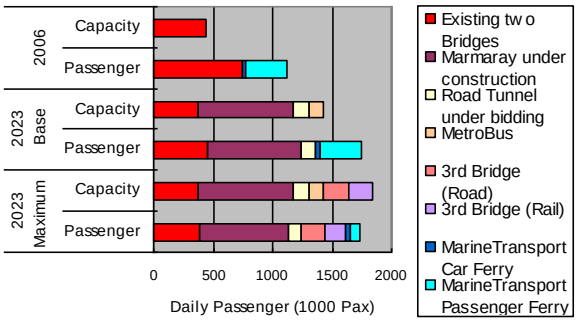


Figure 4.2 Bosporus Crossing Capacity and Passenger Traffic

5. Road Plan

5.1 Transversal Expressways

Metropolitan Istanbul extends lineally eastward and westward. The transversal movement dominates the traffic flows in the city and is destined to do so in the future. The two existing east – west expressways, TEM and D-100, will not be able to service the growing traffic before long. The need of the third transversal thoroughfare has been variously argued with proposals and counterproposals.

Moreover, the present master plan proposes the 3rd Bosporus crossing bridge as both railway and road links, which precludes the possibility of having the new expressway further north from the 2nd Bosporus Bridge. Accordingly, the present study made the transport demand forecast on the route passing in-between the existing two bridges and evaluated the new expressway.

The traffic on the new east - west expressway in 2023 will be in the range of 80,000 – 100,000pcu, very close to the capacity of a 6-lane expressway. The two existing expressways would suffer severe congestion unless the new thoroughfare should be provided.

The economic evaluation suggested high economic returns: namely, the IRR of 45% for the European side of the new expressway, 19% for the bridge crossing, 39% for the Asian side, and 38% for the entire distance from Silivri through Gebze. This evaluation assumed that the construction of the bridge would be equally allocated to the road and the railway link. If the entire cost of the bridge be part of the road construction, the IRR would be down to 15%, less feasible yet feasible enough.

5.2 Tunnel Roads in Builtup Areas

The construction of underground roads is one of the few alternatives available for the densely packed urban areas. The extreme difficulty of land acquisition in the builtup areas precludes any new road extension on the land. The construction of elevated roads is also becoming increasingly difficult to find enough space. Going underground is practically the only possibility left.

The master plan proposes 13 tunnel roads to be completed by 2023. The longest tunnel road proposed for the distance of Kuyumcu Kent – Otogar – Eyup (RD018) is estimated to cost as much as US$330 million and thus scheduled to be completed after 2023. Long distance tunnel roads in the urbanized areas require especially careful safety and security measures. Ventilators and shelter caves must be provided for emergencies like traffic accidents and fires inside, while the tunnel structures must be sufficiently earthquake resistant.

5.3 Road Network Development in Newly Urbanizing Areas

The Marmara coastal area from Buyukcekmece to further west is at present sparsely populated with density ranging from 1 to 30 persons per km2, and serviced by a paltry extension of arterial roads. This western area is expected to absorb a large population increase of 2.5 million by 2023. The density will then increase to 60 persons per km2 on the average, and reach 100 to 120 persons per km2 in its urban subcenters. The area's requirement of arterial roads, at the density of 1.0km to 2km per km2, would be simply enormous.

IMM itself does not have the mandate to take direct advantage of the situation. Instead, the present study proposes the establishment of a non-profit third sector body that will undertake the land development and the construction of multi-story residential and office buildings to sell at market price. The proposed body, tentatively called "West Istanbul Urban Development Corporation (WIDEC)", will internalize the profits from real estate dealings to invest in local economic and social infrastructure. The proposed institutional development will partly solve the financial constraint on the master plan implementation. If the proposed organization needs the business acumen for real estate development and marketing, it is as well to head hunt appropriate persons from the private sector or to invite the participation of private capital.

6. Railway Plan

6.1 Railway Projects of Base Network

There and 16 committed railway projects, including those under construction, and all of them will be in operation around 2015. The urban railways of Istanbul will soon outgrow the cradle stage and begin to mature. Figure 6.1 shows the base network of railways lines. The red lines will be completed by 2013 and blue ones by 2018.

The Marmaray suburban line (C-7) is the biggest committed project. It runs on the rail extension of the Turkish National Railways (TCDD), but shortcuts the Yenicapi – Sirkechi section by using the new underground rail leading to the Bosporus crossing immersed tunnel and reaches the underground terminal at Uskdar on the Asian side. It is the first railway line that connects the European and the Asian side. The line is scheduled to be in operation in 2013.

Figure 6.1 Base Network of Railway Projects

6.2 Master Plan Railway Projects

The master plan examined and proposed 21 projects to be added to the base network. The aggregated extension is a little over 300km, a total increase of 551km combined with the committed projects.

Twelve projects are proposed for metro railways, with aggregated extension of 178km costing US$12.5 billion. These metro projects require large investment, accounting for two thirds of the total projects both in number and cost. Two light metro projects will extend the existing airport line. Three suburban railway projects are extensions of the Marmaray line, including its branch line. Three monorail projects will service the localized short-distance demand.

Three metro lines of RL-005, RL-017 and RL-018 will constitute the second railway line to connect the European and the Asian side. The start of their operation is scheduled in 2021 and 2022. The preparation must start in 2011 to begin the construction works in 2013.

6.3 Passenger Demand for Railway Services

Passengers increase in acceleration as railways extend their lines. The railways now account for a mere 5% of the total daily demand of 270 million passenger km in metropolitan Istanbul. By 2023, 110 million passenger km will be serviced by the railways, an increase of 11 times (Figure 6.2). The share will expand to 28%. However, most of this increase will come from the shift of passengers from public bus services. Passengers on private bus services provided by schools and companies will also shift to the railways. The shift from private automobile users will not amount to much, a mere few percent of the railway passengers. In other words, the expansion of the railway network does not by itself induce an appreciable decrease of the automobile traffic. Such a shift requires a number of specific policy measures.

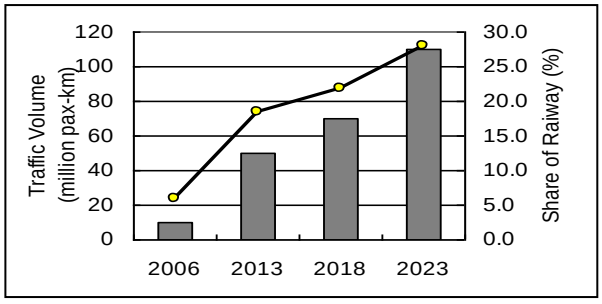


Figure 6.2 Growth of Demand for Railways

6.4 Bosporus Crossing (Railway)

The Bosporus crossing will be provided soon by the Marmaray railway line and the undersea tunnel road in addition to the existing two bridges. Even then, however, the demand will exceed the available capacity in 2023. Many passengers, many more than at the present moment, would be forced to cross the Strait by ferries. The present study accordingly examined the possibility of the 2nd railway crossing. The location was sought between the existing two bridges, with two alternatives of a bridge and an undersea tunnel. On the European side of the Strait, the metro line of Seyrantepe – Kazilcesme (P2-1) is available, while two metro lines, Umraniye – Bostanci (P1-3) and Sogutlucesme – Bahcelievler (PP-2), are in accessible distance on the Asian side. Consequently, the alternatives were increased to four by adding the choice over the Asian-side lines (Figure 6.3). Alternatives 1 and 2 involve a new bridge, while Alternative 3 and 4 a new undersea tunnel. Alternatives 1 and 3 rely on P1-3, while the other two on PP-2.

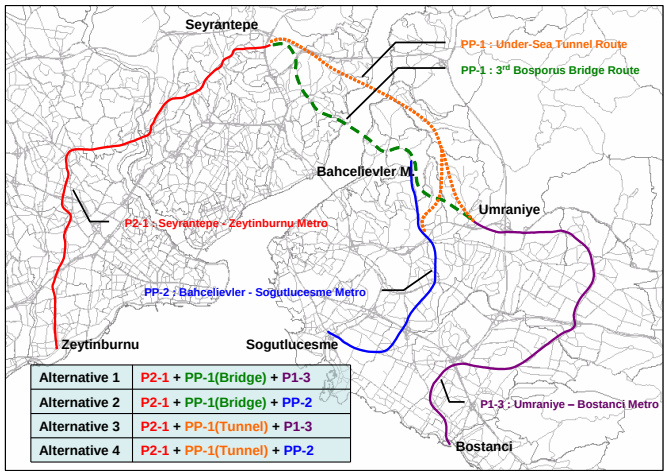


Figure 6.3 Four Alternatives for New Bosporus Crossing

Table 6.1 Evaluation of Four Alternatives

Alternative	Cost (US$ million)	Demand in 2023	Internal Rate of Return (%)	
			Economic	Financial
Alt-1	3.44	13,580	16.3	11.9
Alt-2	2.78	10,849	24.7	12.7
Alt-3	3.30	11,135	12.0	11.3
Alt-4	2.69	8,896	19.7	11.6

The results of comparative analysis are summarized in Table 6.1 The costing was only on the crossing section. The bridge is assumed to serve both railway and road, and the estimated cost is thus halved in the two bridge alternatives. Even halved, the cost of the bridge is on a par with the tunnel. The estimated demand on the bridge would be larger by 20% than the tunnel, because it is possible to provide stations close to the abutment.

On the Asian side, Alternative 1 using P1-3 would have the transport demand 25% larger than Alternative 2 on PP-2, but the investment cost for the former is also higher by 23% than the latter. The same applies between Alternatives 3 and 4. The PP-2 line operates in the already builtup areas, whereas the P1-3 line runs through the areas yet to grow in population. Therefore, the economic benefit and the revenue immediately expected after the start of operation would be higher in Alternatives 2 and 4 on PP-2, as duly reflected in the higher IRRs. Alternative 2 is higher in both economic and financial feasibility than the others, its E-IRR being especially remarkable. The master plan thus proposes Alternative 2 (the bridge and PP-2) for Bosporus crossing.

7. Road-based Public Transport Plan

7.1 Reorganization of Bus Services

Bus services in metropolitan Istanbul are provided along some 1,000 regular bus routes and 500 mini bus routes. One can, in principle, go from any one place to his or her destination by making one or two transfers (using two to three different bus routes). However, the waiting time involved in such trips is tediously long, while it is hard to get a clear picture of how all these bus routes are laid down.

Regular bus services have two options for the future: namely, (1) to give up long distance travels and specialize in short distance feeder services for transit stations, and (2) to diversify into specialized niches, such as premium all-seated bus rides and late night services. Most of the existing bus services will eventually follow the first option.

7.2 Expansion of Metro Bus Network

IETT began in Sept. 2007 the operation of its first metro bus route of 19.5km from Avcilar to Topukapi (the section numbered 1 on Figure 7.1). The route of 10.5km from Topukapi to Zincirlikuyu (the section numbered 2) was added in Sept. 2008. IETT is now developing the third route going further east, across the 1st Bosporus bridge to Sogutlucesme near Kadikoy.

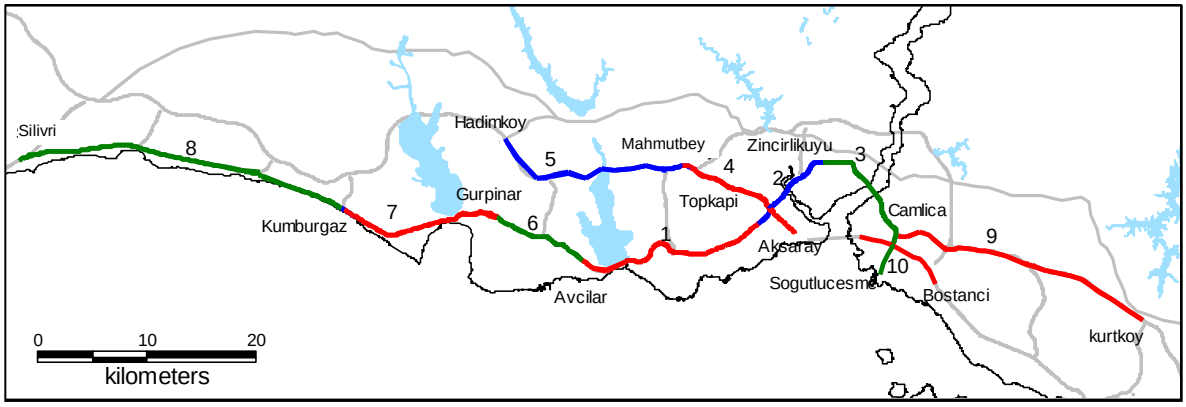


Figure 7.1 Expansion of Metro Bus Network

7.3 Feasibility of Metro Bus Extension

The well-developed transit network is the goal for public transportation in Istanbul, but it takes long time to achieve this goal. The metro bus service can be viewed as a most suitable transitional provider of public transportation. It will take, for example, more than 10 years from now to complete the extension of the suburban railway to Silivri. In the meantime, the metro bus transports the passenger traffic between the western area and CBD. When the rapid transit comes in to replace the metro bus, two exclusive bus lanes will be released for the automobile traffic. This improves the economic and financial viability of the transit operation as well as alleviates the congestion on the expressway.

The total number of daily passengers on the metro bus network is estimated to reach 2.22 million in 2023. The internal rate of return and the net present value were calculated on the seven proposed routes. The social benefit is the savings realized by the reduced cost of vehicle operation and the reduced travel time, while the economic cost is the entire expenditure on goods and labor for the project implementation.

The financial analysis was done over the cost of construction and O&M and the total fare revenue. Except for the route 4 (Aksaray – Mamutbey), the collective and individual financial IRRs are over 12%, indicating reasonable feasibility.

8. Traffic Management

8.1 The Worst 30 Traffic Jam Prone Areas

The worst 30 traffic jam prone areas have been identified based on the information from the Traffic Control Center of the City and selected taxi companies. Out of these 30, 13 are specific sites while the remaining 17 are sections of expressways or trunk roads. The traffic jam frequently seen at these areas can be attributed to either of the three (3) reasons; traffic merging, poor-standard structure and roadside activity.

12 sites out of the 30 have been judged to improve if the countermeasures listed in Table 8.1 are implemented. Early planning and implementation are recommended.

At present, reversible lane is applied on the two (2) bridges across the Bosporus. Since traffic jam occurs at the end of these reversible lanes where traffic is merged into the original lane, extension of these reversible lanes beyond the off-ramp is effective to alleviate the traffic congestion at these points.

Table 8.1 Counter-measures against Existing Traffic Bottlenecks

No.	Name	Possible Solution
1	Kadikoy - Hasanpasa	• Limit on-street parking along Sogutlu Cesme Cad. to delivery service with time limit of 15 – 30 minutes. • Strict enforcement of the above. • Widening and improvement of sidewalk. • Provision of shuttle bus service connecting parking site and the harbor.
2	Uskudar - Altunizade	• Extension of reversible lane to the nearest interchanges from the bridge on both sides (see the figure below).
3	Uskudar – Bulgurlu	• Additional traffic sign to implement priority rule at roundabout.
6	Beykoz – Kavacik Koprusu	• Extension of reversible lane to the nearest interchanges from the bridge on both sides
7	Besiktas – Levent Koprusu	• Extension of reversible lane to the nearest interchanges from the bridge on both sides.
8	Beyoglu – Taksim Meydani	• Enforcement of illegal parking • Provision of taxi stand. • Strict enforcement of no parking / standing. • Construction of pedestrian barrier to prevent jaywalking.
14	Maltepe Minibus Caddesi	• Construction of median barrier. • Prohibition and/or management of on-street parking.
15	D100 Basibuyuk Koprusu Maltepe Koprusu Arasi	• Partial widening of D100 at uphill section.
16	D100 Bostanci Koprusu Yenisahra Arasi	• Extension of merging lane. • Prohibition of bus stop use except buses.
17	D100 Goztepe Koprusu Mevki	• Extension of merging lane.
26	Hsim Iscan Gecidi Yusufpasa Arasi	• Prohibition of on-street parking. • Management of pedestrian movements. • Improvement of signal control
27	Balat Yolu Eyup Sapagi Eminonu Arasi	• Demand responsive signal at intersection connecting to O-1.

8.2 Transport Demand Management (TDM)

"*Road development never catches up the increase of traffic demand of motor vehicles*" – This is a bitter lesson learned not only by Istanbul but by most large cities in the world. Although one of the major targets of this master plan is the modal shift from private to public, it is never realized merely by developing railway network.

Thus a demand-side approach that leads the traffic demand to the intended direction of infrastructure development becomes necessary. By reviewing the TDM measures implemented at present in the world, applicable policies should be introduced to Istanbul. In this master plan, congestion charging, park & ride, parking control and traffic cell for improved environment of historic areas have been dealt with.

9. Implementation Plan

9.1 Investment Plan

The total investment required for the master plan including other subsectors is shown in Table 9.1. The total investment accounts for USD68.6billion. This is comparable to the estimated amount of possible investment at USD68billion. Investment schedule of each project in the road and railway sectors is shown in Table 9.2.

Table 9.1 Transportation Sector Investment Plan in 2009-202

(US$ billion)

Sub-Sector	Short	Medium	Long	Total
Road & Bridge	6.2	5.6	3.6	15.4
Railway	10.2	9.3	6.5	26.0
Maintenance & Improvement	4.3	5.5	7.1	17.0
Other Subsectors	2.6	3.3	4.3	10.2
Total	23.4	23.8	21.5	68.6

There are four (4) possible new sources, viz: a) Congestion charging, b) Transit Development Acceleration Fund, c) West Istanbul Urban Development Corporation (WIDEC) and d) Private sector participation. The former three (3) are supposed to be earmarked exclusively for transport development.

9.2 Possibility of PFI

The PFI (Private Financing Initiative), particularly the BOT scheme with 100% private funding, is difficult for the railway projects, because capital recovery period is long despite the large investment amount, railway fare tends to be controlled low and, above all, the risk is high. There is almost no example successfully implemented.

The sector that needs the largest investment is railway in the master plan. Without a mechanism to involve the private sector in the railway development, the master plan is hardly implemented. Individual negotiation with the private proponent project by project is time and cost consuming given the long list of proposed projects. A new and comprehensive mechanism is thus required.

9.3 Establishment of TDAF

Establishment of a strong organization is proposed. This organization, controls all the railway PPP projects with its fund TDAF. Transit Development Authority (TDA) should be established under IMM. TDA plans, invites tender and grants permission with a selected private entity. For non-profitable lines, it provides VGF (Viability Gap Funding) from TDAF. The concessionaire secures fund, constructs and leases facilities to TDA for the concession period. In one word, the BLT scheme is applied.

9.4 West Istanbul Urban Development Corporation (WIDEC)

Suburban housing development may be possible by constructing roads and railways under the initiatives of the private sector. However, the creation of urban cores requires government intervention. The JICA Study Team proposes to establish a public organization that promotes urban development (hereafter West Istanbul Urban Development Corporation: WIDEC). Profit-oriented mind and know-how of the private sector should be incorporated into this organization together with its financial capability.

Development fund should basically be produced by the “capital gain” of urban development projects. The organization of WIDEC should be so designed that it can do both the profit-generating projects and public services projects. The profit-generating functions such as land transaction, housing and business/commercial development, and the public service functions such as development of transport infrastructure, parks and other public facilities should be balanced according to the pre-determined criteria.

10. Urgent Actions Program

The followings were recommended as action programs to be urgently implemented.

1) Countermeasures for Traffic Jam Prone Areas
2) Authorization as Official Master Plan
3) Surveys and Researches
   a. Freight Movement Survey and Logistics Plan
   b. Preparation and Update of Transport Network Inventory
   c. Surveys and Plans for Traffic Safety
   d. Policy Study on Land Use Guidance
   e. Research on BOT/PPP
4) New Organizations and Institutions
   a. Establishment of TDAF
   b. Establishment of WIDEC

Table 9.2 Implementation Schedule of Projects

(1) Road Project in Base Network

Project		Length	Cost	Short-Term					Medium Term				
Code	Name	km	US$ mill.	09	10	11	12	13	14	15	16	17	18
A01	Kavacık Square - Mihrabat St. TEM Linkage Road Intersection construction	0.7	8.3										
A02	Güngören Abdi İpekçi st.road and common infrastructure addition construction	1.0	11.5										
A03	(Kartal Çınar St.) Kadıköy between Kızıltoprak-Göztepe Park Bağdat Street Infrastrcuture and Road Organization Construction	1.9	7.7										
A04	Başıbüyük B.Bakkalköy Road and Common Infrastructure Construction	5.0	12.6										
A05	Başıbüyük Süreyyapaşa Road and Common Infrastructure Construction	2.0	8.9										
A06	Balta Limanı - TEM B.Dere Linkage Road Construction	2.8	0.9										
A07	Ümraniye Hatboyu st.Road and Common Infrastructure Construction	5.2	7.3										
A08	Pendik İDO Dock completion of missings, linkage roads and underground autopark construction	0.5	23.4										
A09	Kagithane - Piyalepasa - Dolmabance (Inonu Stadium) Tunnel	1.4	372.8										
A10	Edirnekapi D-100 Road Widening Project	1.3	6.8										
A11	Istek - Giykop To Esenler Karaosmanoğlu Ave. Road Widening And Rehabilitation Project	2.6	18.5										
A12	Küçükçekmece Halkali Residence Area Connection Road	5.3	18.1										
A13	Şile Highway Ümraniye Junction Connection Road Rehabilitation Project	11.5	38.9										
A14	Gaziosmanpaşa County Boğazköy Town road and related infrastructure project	9.8	7.0										
A15	İstinye acclivity-TEM side road- in between Baltalimanı road project	3.8	12.9										
A16	Vatan street improvement (TEM linking road) (Anıt Cemetery – Sağmalcılar subway station) project	1.7	4.5										
A17	Kadıköy Kurbalıdere street altitude reducing project	0.7	1.9										
A18	Istinye Park Front Intersection and Road project	3.8	12.9										
A19	Kağithane - Piyalepasa Tunnel Project	2.5	102.5										
B01	Bağcılar CBD Region, Halkali Street Road	1.5	15.0										
B02	Widwning project of Sümer ve Uysal Streets Road in Sarıgazi Demokrasi	3.8	6.5										
B03	Çavuşbaşı M.Akif Ersoy St.and Linkage Road Construction	0.9	7.5										
B04	Dolmabance - Fulya Tunnel	1.1	53.9										
B05	Fulya - Levazim Sitesi Tunnel	2.4	117.6										
B06	Levazim Sitesi - Akatlar Tunnel	1.6	78.4										
B07	Sanyer Merkez -Cayirbasi Tunnel	2.0	125.1										
B08	Zinciridere - Levazim Tunnel	0.7	36.1										
B09	Bosphorus Road Tunnel Crossing	5.5	453.8										
C01	Kartal, A2 Çanakkale intersection- in between Tugay road linking road	0.4	3.1										
C02	Eyüp –Fevzi Çakmak street - TEM linking road project	1.3	8.3										
C03	Tuzla, Şifa street - Aydıntepe road -in between Sabiha Gökçen airport road	5.7	36.8										
C04	Avcılar - Firüzköy Tahtakale Road project	6.0	90.0										
C05	Eyüp, Ayvansaray street – D100 linking roads, junction project	0.8	15.2										
C06	Cendere-Ayazağa-Büyükdere street project	12.6	140.2										
C07	Esenler, Atışalanı street-in between TEM North side road (842.Street-769.Street-Köyiçi street) road , intersection project	1.2	17.6										
C08	Esenler,Kurudere street- in between Barboros street(559.Street) Road, intersection project	0.4	2.3										
C09	Beyoğlu, Piyalepaşa Boulevard - in between Hasköy street road, intersection implementation project	1.7	14.6										
C10	Kağıthane, Sultan Selim street - İnönü street - Talatpaşa street - Dere street linking road implementation project	1.6	14.7										
C11	Junction project in Bahçelievler, Yıldırım Beyazıt street- Atatürk street- Değirmenbahçe street intersection	0.5	6.9										
C12	Road project in Küçükçekmece, between Sakarya street- Halkalı Center (İkitelli street)	0.9	4.4										
C13	Road project in Bayrampaşa, between Tuna street-Yahya Kemal street	0.5	6.0										
C14	Zeytinburnu, coast road curve arrangement	0.6	5.7										
C15	Road improvement project between Karamançiftlik street and 3004 street in Kadıköy,	2.3	23.3										
C16	Road project in Avcılar, between Petrol Office street. - Kumcular Haramidere road	3.4	31.2										
C17	New road project in Başakşehir, 4.Etape (Old Edirne road - TEM highway)	7.6	99.6										
C18	Road prject inŞişli, Zincirlidere street- Büyükdere street linking Project	0.3	2.6										
C19	Road project in Kadıköy, (Bostancı Tunnel street - Kayışdağı street) linking	1.4	11.3										
C20	Road project (İstek-Giykoop. - Başakşehir 4.Etape)	7.1	120.3										
C21	Altinşehir To Bahçeşehir Widening And Rehab. Project	7.6	103.9										
C22	Mahmutbey Altinşehir Servis Road Widening And Rehab. Project	8.6	85.8										
C23	Büyükçekmece - Tem Highway To D-100 Connection Road Widening And Rehab. Project.	7.7	92.9										
C24	Sultançiftliği To Mahmutbey Bridge Connection Road Rehabilitation Project	6.5	34.7										
C27	Widening of D-100 Highway Between Küçükyalı - Kartal	8.9	74.1										
C28	Eyup(Silahtaraga) - GOP cd. Tunnel,	0.1	22.2										
C29	Üsküdar, between Çamlıca Underpass- D-100 Land route (Hospital road) road, junction implementation project	1.8	39.8										
C30	Üsküdar, between 3004 St.- D-100 branch road, junction project	2.1	10.6										
C31	Kartal, Saraylar st.- Köroğlu st. - Teçerdağ st. - Kortej st. Road rehabilitation project	2.8	13.2										
C32	Widening project between Büyükdere st.- Belediye st. (Dereboyu st.) in Kağıthane	1.2	10.9										
C33	Road construction Project between İstasyon street - Kayabaşı in Küçükçekmece	12.8	207.1										
C34	Bağcılar Esenler street - Güngören street - 6. street road rehabilitation project	3.3	27.9										
C35	Fatih Eminönü Kenndy street (between Aksakal street - 10.Yıl street) road rehabilitation project	5.9	165.0										
C36	Beylikdüzü Gürpınar road linkage road junction project	1.0	7.0										
C37	Dr. Fazıl Küçük street and Alemdağ street linkage road project in Ümraniye	0.9	7.9										
C38	Güngören, Ali Rıza Gürcan Street Road Rehabilitation Project	1.1	8.2										
C39	Beyoğlu, Bülent Demir Street Road Rehabilitation Project	0.9	5.3										
C40	Şişli, Dereboyu st.- Zincirlidere Road road, junction project	0.9	18.2										
C41	Catarca-Mimar Sinan TEM Linkage Project	9.4	51.4										
C42	Maltepe Buyukbakkalkoy-Yakacik Linkage Project	4.4	47.9										
D01	Widening of D -100 between Kartal - Çayırova and surrounding road project	16.1	116.3										
D02	Kağıthane Sultan Selim st.- Barboros st linkage road project	0.3	8.3										
D03	Bahçeköy-Kilyos Road project in Sariyer	16.3	226.4										
D04	Gaziosmanpaşa, between Arnavutköy - Karaburun road, junction project	21.9	145.7										
D05	Kağıthane, between Belediye st.- Cendere st. (Galata Deresi st.- Mithatpaşa st.) road, junction project	2.7	23.9										
D06	Kağıthane, Silahtarağa st.- TEM Sadabat Viaduct (Cendere road) road, junction project	5.8	74.4										
D07	Zeytinburnu Bakırköy Kenndy street (between 10. Yıl street - Fildamı road) road rehabilitation project	4.8	39.1										
D08	Küçükçekmece between Aşık Veysel street - D-100 Highway road project	1.0	9.6										
D09	Beşiktaş, between Kadırgalar street-Askeroçağı street (Taşkışla st.) road junction project	0.8	8.7										
D10	Ümraniye between Küçüksu Tantavi Tunnel TEM linkage road branch roads, road junction implementation project	3.2	55.6										
D11	Road project between Bosporus Bridge - Altunizade junction E-5 Highway	2.1	31.5										
D12	Bayrampaşa, 12.Street Altitude Reducing Project	1.1	7.7										
D13	Kağıthane, between Hasdal TEM flyover bridge - Kemerburgaz st. (Kemerburgaz road) road, junction project	1.3	12.6										
D14	Between Harem - Kartal Junction D -100 North - South Branch roads and surroundings road, junction implementation project	20.8	167.0										
D15	Kadıköy, in front of Fenerbahçe Stadium Taşköprü street - O1 road intersection road, junction implementation project	1.5	13.8										
D16	Kadıköy, Coastal Road Bostancı junction and surrounding road, junction implementation project	1.2	10.6										
D17	Kağithane - Hasdal Connection Road Rehabilitation Project	1.7	18.7										
D18	Çırpıcı Creek's linkage to Ayvalıdere and construction of completion of missings and Istasyon street and railway bridge transition construction(Zeytinburnu autopark construction)	0.3	1.7										
D19	Bağcılar, GÜNEŞLİ – TEM Linkage Road Project	1.8	9.6										
D20	Linkage road project among Çamaşırcı Deresi İnönü District, Fındıklı District and İçerenköy District	1.5	7.1										
D21	Junction project in Güngören , Atatürk street - Kıvırcık Street - Çınçın street intersection	0.5	6.0										
D22	Road project between Sarıiyer – Bahçeköy – Mine linking road	4.0	31.7										
D23	Beyoglu - Tersane St Road Costruction Project	0.8	12.5										
	Total	338.6	4,297.5	3,837					487				

(2) Road Project in Master Plan Network

Project		Length	Cost	Short-Term					Medium-Term					Long-Term					Beyond 2023	
Code	Name	(km)	mill.US$	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	
RD001	Tophane - Iplikci Tunnel	1.67	62.8																	
RD002	Widening of Hatboyu street (Coastal road Linkage) in Ü mraniye	8.07	195.2																	
RD003	Bakırköy between D-100 Land Route (İncirli Junction) - Coastal Road (Ataköy Junction) underpass - flyover project	9.45	118.3																	
RD004	Widening project between Kıraç and Esenyurt construction road	2.83	9.4																	
RD005	Between Hadımköy bridge- Yassıören road, road, junction project	9.23	28.6																	
RD006	Beykoz, Miharabat Street-TEM Highway Linkage project	1.44	12.3																	
RD007	Ümraniye, between Küçüksu junction- İsfalt association (Küç üksu street) road rehabilitation project	12.85	50.6																	
RD008	Beylerbeyi - Harem Tunnel	4.15	210.0																	
RD009	Beylerbeyi - Hekimbasi Tnnel	3.09	175.8																	
RD010	Kadikoy - Moda Tunnel	1.03	48.4																	
RD011	Tophane - Haskoy Tunnel	1.19	24.9																	
RD012	Road Construction For W. Trade Center by Private Sector	9.24	40.3																	
RD013	Küçükçekmece D-100 Highway Çobançeşme Junction - Olympics Road Linkage Road and Junction Project	26.54	291.8																	
RD014	Yakuplu Kumcular Servis Road Project	7.29	24.5																	
RD015	Derbent Haciosman Tunnel Project	2.87	61.9																	2027
RD016	Armutlualti - Poligon Mah. Tunnel Project	2.68	68.1																	
RD017	Armutlualti - Ayazağa Tunnel Project	2.55	73.5																	
RD018	Kuyumcu Kent - Otogar - Eyüp Tunnel Project	13.83	332.8																	2030
RD019	Road rehabilitation project between Bağcılar, Malazgirt underpass-Mehmet Akif avenue (8.St-1/3St-1/13 St-2/13 St)	3.10	8.8																	
RD020	Tuzla Formula-1 Road Network 6 numbered road project	5.70	25.0																	
RD021	Link Road between Malazgirt Rd and Mahmat Akif Bulbari	0.90	4.3																	
RD022	Road project in Bakırköy,(D-100 Highway Sefaköy junction - airport A-14 Apron linkage road)	0.52	9.7																	
RD023	Sultanbeyli Necip Fazıl street - Kartal TEM linkage road project	0.33	4.1																	
RD024	Between Ümraniye Mandıra st - Bağ st road project	0.60	4.5																	
RD025	New linkage road project between Ümraniye Karadeniz street - Mandıra street (continuous section of Hatboyu street)	0.21	4.5																	
RD026	Kartal Şehit Ahmet Yalçın St - Arkoz St - Çavuşoğlu St, Adnan Kahveci Viaduct Linkage road junction project	2.02	12.7																	
RD027	Ümraniye, between Şile Road Yenidoğan junction - Paşaköy junction road, junction implementation project	4.24	19.3																	
RD028	Re-organizing The existing road in Ümraniye Çekmeköy Çavu şbaşı street according to the construction plan as 20m	2.49	7.5																	
RD029	Kartal between Tekel street - D-100 road, junction implementation project	2.48	25.0																	
RD030	Üsküdar between Zübeyde Hanım Street - Hekimbaşı Çiftlik street construction roads implementation projects	1.34	13.8																	
RD031	Beykoz , between Kavacık junction – Çekmeköy junction (Ç avuşbaşı road) road, junction implementation project	11.10	31.6																	
RD032	West Buyukcekmece Road Network Package	40.46	495.6																	
RD033	East Silivri Road network Package	66.30	842.0																	
RD034	Silivri Center Road network Package	74.57	827.2																	
RD035	West Silivri (Port Area and University Area) Road Network Package	91.85	844.6																	
RD037	Tuzla Center Road Network Package	58.51	477.7																	
RD038	New Motorway west section Package	102.43	965.4																	
RD039	New Motorway Kucucekmece section Package	40.49	547.7																	
RD040	New Motorway Kagithane section Package	17.30	520.5																	
RD041	New Bosphorus Crossing	7.77	843.0																	
RD042	New Motorway Kadikoy Branch Package	10.97	332.5																	
RD043	New Motorway Uskdar-Umraniye Package	20.75	360.0																	
RD044	New Motorway Umraniye-Tuzla Package	55.98	683.5																	
RD045	Widening of TEM Highway (Umranye-Tuzla) Package	69.48	490.4																	
RD046	Widening of Connection road (TEM-D100) in Kartal	15.23	112.0																	2026
RD047	Kucucekmece Road Network Package	17.50	135.8																	
RD048	Bahcesehir Road Network Package in Avcilar	10.68	202.7																	
RD049	New Truck Route for Ambarli Port - Logistic Center(tunnel for about half length)	11.89	358.9																	
RD050	E-W Missing Linkage in Gungoren (tunnel)	1.10	57.4																	
RD051	N-S Missing Link inBahcelievler (tunnel)	2.40	121.4																	
RD052	Connection Tunnel between Bosna Bulvari and Hatboyu St (tunnel)	1.13	52.4																	
RD053	Re-Construction of Ankara Road between Pendik and Baglanti Road (incl. 2km new road)	15.43	63.0																	
RD054	Connection Road between New Motorway and Uskudar Tunnel (50% tunnel)	4.06	123.9																	
RD055	Widening of Kennedy Street between Road Tunnel and Mustafa Kemal St. in Eminonu	1.93	38.2																	
		893.25	11495.6	2,359					5,107					3,573					457	

: Detail Design and Land Acquisition

: Construction Period

(3) Railway Project in Base Network

Project		Length	Cost	Short-Term					Middle-Term					Long-Term				
Code	Name	(km)	US$ mill.	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
C-1	Taksim - Yenikapi Metro (Extension of E-1)	5.2	468															
C-2	Edirnekapi - Sultanciftligi Tramway (Extension to Topkapi and Habipler)	3.0	62															
C-3	Kadikoy - Kartal Metro	21.7	1,547															
C-4	4. Levent - Ayazoga - Darussafaka (Extension of E-1)	8.0	480															
C-5	Otogar - Bafcilar (Kilazli) Light Metro	5.6	358															
C-6	Bagcilar - Ikitelli - Olimpiyat Koyu Metro	15.9	1,069															
C-7	Marmaray Project	76.5	3,000															
C-8	Aksaray - Yenikapi (Extension of E-2)	0.7	42															
T-1	Uskdar - Cekmekoy Light Metro	19.0	1,314															
T-2	Bakirkoy - Beylikduzu Light Metro	25.0	1,464															
D-1	Bakirkoy - Bahcelievler Bagacilar Metro (Extension of C-6)	9.0	710															
D-2	Kabatas - Besiktas - Sisli - Giyimkent - Bagcilar Metro	25.0	1,912															
D-3	Yenikapi - Bakirkoy Metro (Extension of E-1)	7.0	481															
D-4	Halic - Cevresi Tramway	9.6	243															
D-5	Yesilkoy - Ataturk Airport - Ikitelli Metro	14.3	1,130															
D-6	Sishane - Kulakasiz - Cemal kamaci Guzergahi Monorail	5.8	289															
	Total	251.3	14,569	10960					3609									

(4) Railway Project in Master Plan Network

Project		Length	Cost	Short-Term					Middle-Term					Long-Term					Beyond 2023
Code	Name	(km)	US$ mill.	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
RL001	Bagcilar - Halkali Light Metro (Extension of C-5 line)	7.5	494																
RL002	Tekstilkent - Istoc - Olimpiyat Koyo - Bahcesehir (Ispartakule) Metro (Extension of D-2 line)	12.0	1,197																
RL003	Umraniye - Bostanci Metro	14.0	1,225																
RL004	Kartal - Pendik (S. Gokcen Airport) - Tuzla Metro (Extension of C-3)	18.1	1,261																
RL005	Seyrantepe - Alibeykoy - Gop - Kazlicesme Metro	19.5	1,187																
RL006	Kartal D-100 - Kartal IDO Monorail	3.0	94																
RL007	S. Gokcen Airport - Formula 1 Monorail	7.7	242																
RL008	Darssafaka - Cayirbasi Metro (Extension of C-4 line)	2.7	193																
RL009	4. Levent - Gultepe Mah. - Sanayi Mah. - Celiktepe Mah. Monorail	8.6	248																2030
RL010	Besiktas - Sariyer Metro	14.1	787																2030
RL011	Ispartakule -Ambarli - Yakuplu Metro	10.5	1,197																2030
RL012-1	Ispartakule - Kirac - Buyukcekmece - Silivri Suburban Railway (Phase 1)	15.8	651																
RL012-2	Ispartakule - Kirac - Buyukcekmece - Silivri Suburban Railway (Phase 2)	10.0	668																
RL013	Uskdar - Beykoz Metro	15.0	881																2030
RL014	Ikitelli Olimpiyat Koyu - Altinsehir Metro (Extension of C-6 line)	13.0	932																2030
RL015	Ataturk Airport Access Rail (Extension of Marmaray railway)	2.5	160																2028
RL017	Seyrantepe - Bosphorus Crossing - Bahcelievler.M metro	9.8	816																
RL018	Sogutlucesme - Bahcelievler N. Metro	8.6	776																
RL019	Kadikoy - Ibrahimaga - Esensehir - Sabiha Gokcen Airport Metro	36.8	2,365																
RL022	Halkali - Hadimkoy Suburban Railway (Extension of Marmaray Project)	20.4	536																
RL020	Bakirkoy - Beylukzudu Extension	1.0	66																
RL021-1	Silivri - Gumusyaka Extension (Phase 1)	18.9	990																
RL021-2	Silivri - Gumusyaka Extension (Phase 2)	30.0	1,210																2029
	Total	299.5	18,176	1,408					6,275					6,324					4,169

Introduction

1. Background

Istanbul's population and metropolitan sphere is rapidly expanding in pace with its economic development. Its population of 6.15 million in 1980 doubled over 12 million after a quarter of a century. The city's registered automobiles increased 7.5 times over the same period and now are approaching two million vehicles. The rapid pace of urbanization and motorization has far outpaced the development of transport infrastructures, and the ill effects of motorization such as traffic congestion, accidents and the problem of exhaust emissions are worsening.

Istanbul has a plethora of transport modes from the fairly modern to the old ranging from railways, subways, buses, tramways and strait-crossing ferries. However, their services are not effectively put to use because their intersections are underdeveloped that they fail to function as an integrated network. In order to rectify this problem, the Government of Turkey has implemented various policy instruments to strengthen public transport and to encourage the shift in traffic demands but the share of public transportation has continued its long-term decline. Although existing railway systems have the capacity to carry more traffic loads, their share of the traffic demand ironically remains a little less than four percent.

Considering these pressing circumstances, the Government of Turkey requested the cooperation of the Government of Japan in the formulation of a comprehensive urban transportation master plan that will improve the urban traffic problems in Istanbul. The Government of Japan sent a preliminary study mission in November of 2005 to discuss and to consult with representatives of the Government of Turkey over the scope and to form the basic policy of the proposed master plan formulation. The present study was agreed upon ensuring bilateral deliberations.

The Japan International Cooperation Agency (JICA) dispatched a Study Team to Turkey in July 2007 and the Master Plan study started as a joint work of JICA Study Team and Turkish Counterpart Team from the Istanbul Metropolitan Municipality (IMM). The study, which will take 17 months, is scheduled to be completed by October 2008. The study is referred as "**IUAP**" (Istanbul Transport Master Plan).

Prior to the study's commencement, the Turkish counterpart conducted a vast home interview survey on passenger trips, developed the transport database of Istanbul and analyzed the transport demand structure, as well as developed a set of transport demand forecast models. Thereby, it started the joint effort on demand forecast and planning.

This Progress Report includes the main results of the Phase 1 work from June to October 2007, covering areas such as the present conditions of transport facilities, services, demand, and administrations, review of urban development and land use plans, analysis and modifications of transport demand models, and the initial stages of the demand forecasts. The report also includes lists of existing projects and classifies them into two categories: (a) On-going and committed projects, and (b) Projects being planned or under study. The former will form the basis of the Master Plan and will be treated as "given" conditions.

2. Objectives of the Study and the Study Area

The objective of the present study is to formulate an urban transportation master plan for the City of Istanbul that will consist a long-term perspective plan (the target year of 2023), a medium-term plan, a short-term plan (the target year of 2012), and an implementation plan for these three plans. The goals of the proposed master plan may be defined by two levels, the general goal and three specific goals, as shown below.

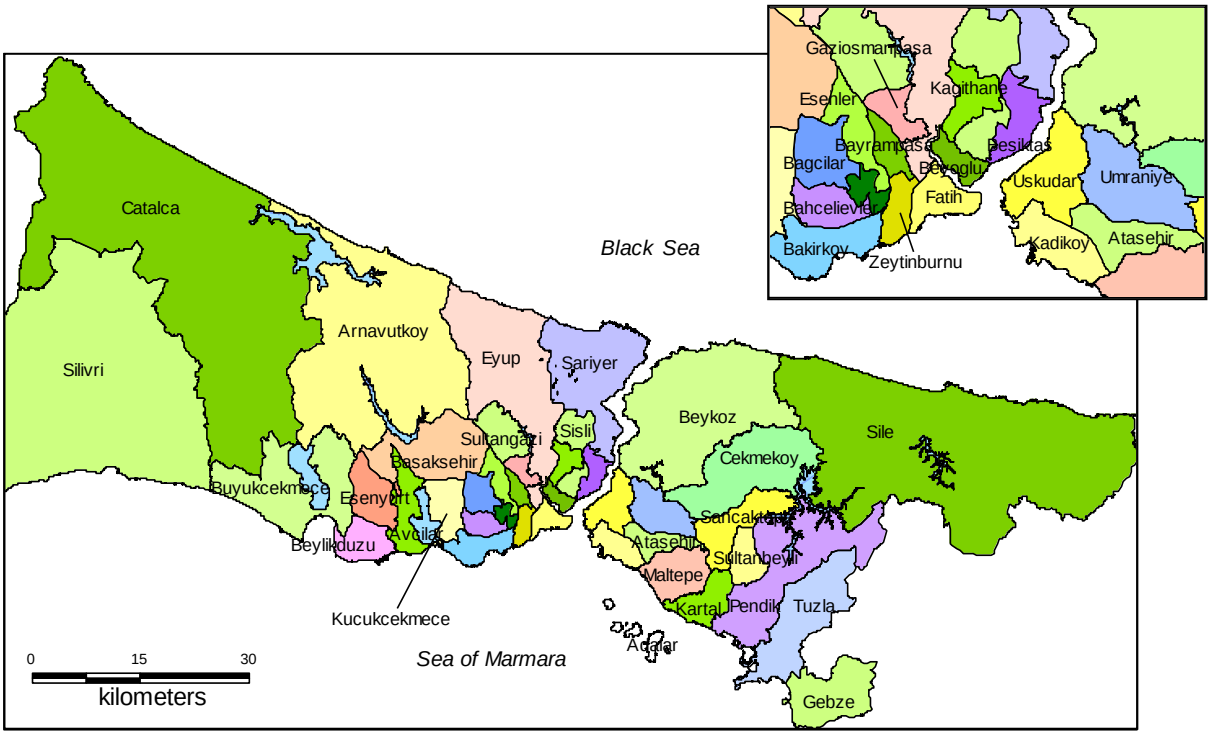
General Goal

General goal is 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 contribution to the upgrading of mobility and accessibility within the city and the regeneration of a more livable urban environment (e.g. better traffic safety, prevention of air pollution, etc.)

Specific Goals

1. To improve and expand public transportation services and thereby reducing the dependency on private passenger cars
2. To improve and develop the road networks to cope with the growing vehicular traffic in the short term, and to shape and induce appropriate future spatial expansions of the city in the long term.
3. To put existing roads to efficient use by strengthening traffic regulations and traffic demand management.

The study area encompasses entire Istanbul Metropolitan Area (same geographic area as Istanbul City) and the adjacent city of Gebze which is closely linked to IMM.

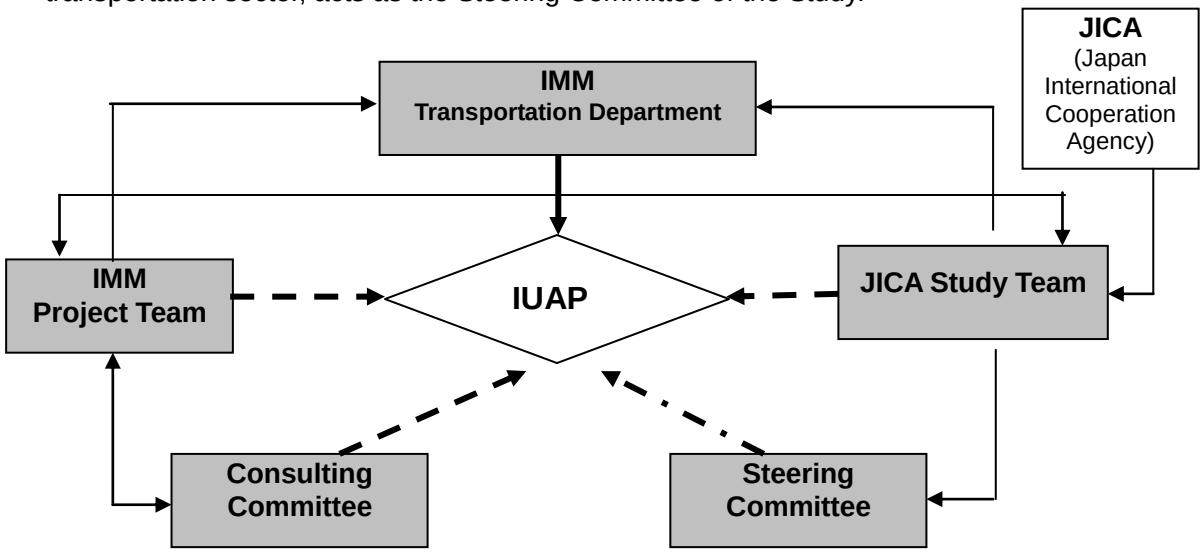


Source: IMM
Note: As of December 2007

Figure I-1 Study Area

3. Study Organization

The study is basically conducted by a joint-study team composed of IMM Team and JICA Study Team, as shown in the figure below. The Transportation Department of IMM is the core counterpart to JICA Study Team. The Consulting Committee composed of three professionals from the universities and acts as a supervisory group for the Project Team. The Transportation Coordinating Committee, consisting of decision makers from each transportation sector, acts as the Steering Committee of the Study.



Source: http://www.bimtas.com.tr/imp/taraflar.html with modification by JICA Study Team

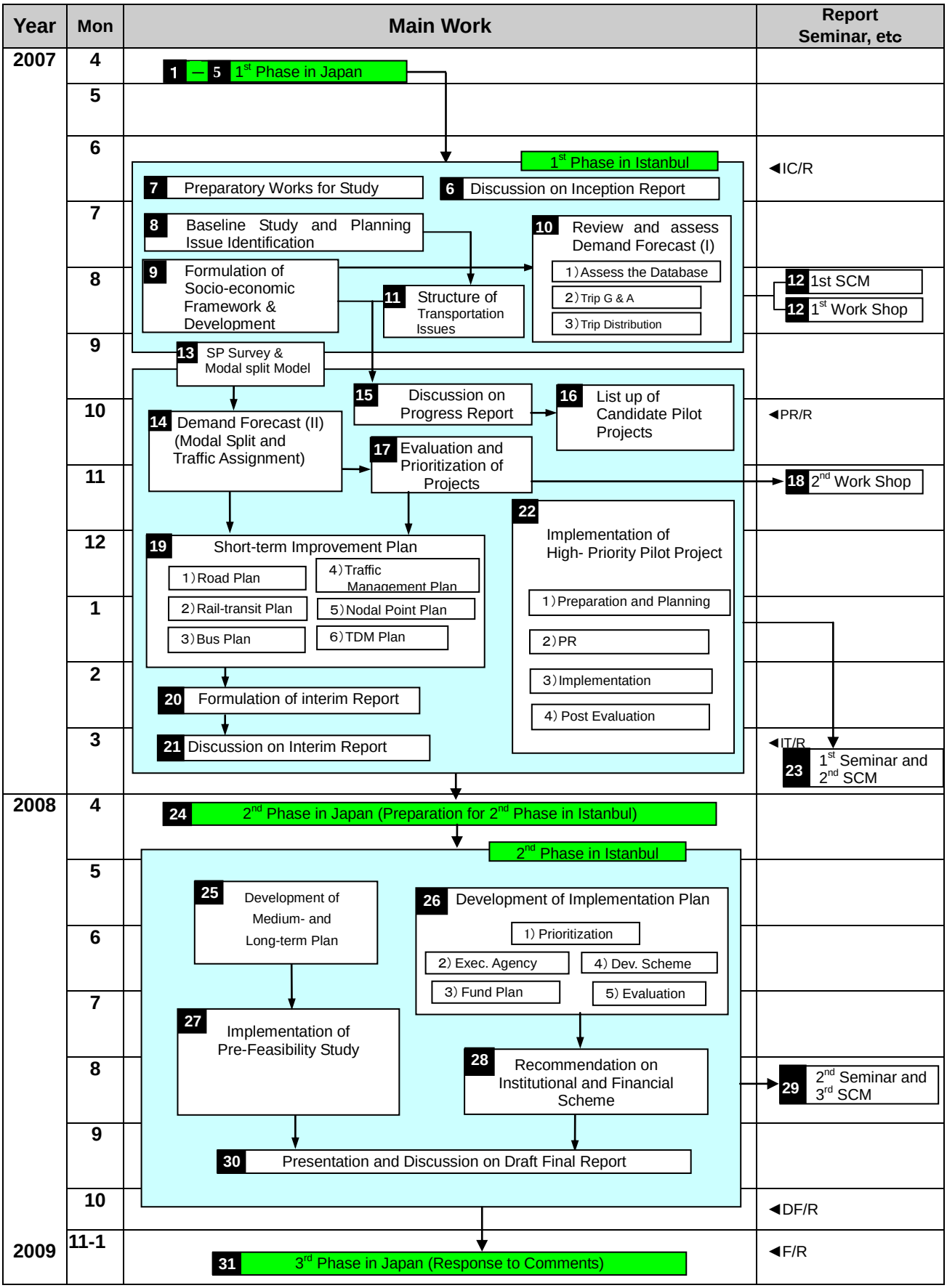
Figure I-2 Study Organization

4. Work Schedule and Chronology of the Study

The Study was started by the IMM Study Team at the middle of 2006 by conducting home interview survey, land use survey and other related traffic surveys. After one year, when the trip database and thereby, trip demand models had been developed, the JICA Study Team joined in the Study.

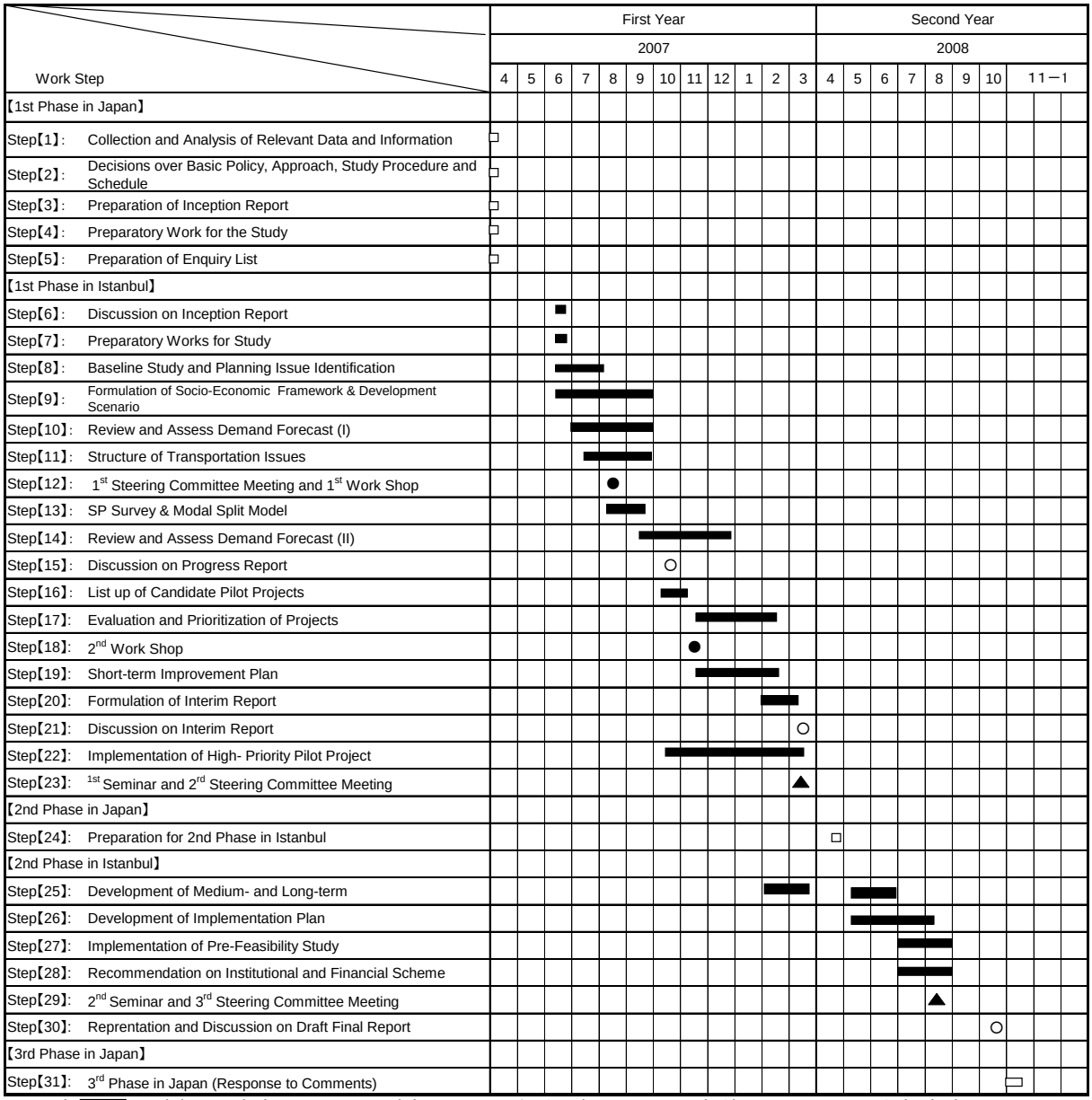
Figure 1-3 and Figure 1-4 show the work schedule originally planned for the joint work by the IMM and the JICA Study Teams. The Study was conducted mostly as scheduled except 1.5 month delay of submission of Draft Final Report due to needs of further discussions on the Master Plan with related agencies. The important turns in the process of study implementation after the participation of the JICA team were as follows.

- June 2007 Presentation of the inception report
- Aug. 2007 1st Steering Committee meeting and 1st Workshop
- Oct. 2007 Presentation of the progress report
- Nov. 2007 2nd Workshop
- Mar. 2008 Presentation of the interim report
- Mar. 2008 2nd Steering Committee meeting and 1st Seminar
- Aug. 2008 3rd Steering Committee meeting and 2nd Seminar
- Oct. 2008 Presentation of the draft final report
- Jan. 2009 Comments from IMM
- Jan. 2009 Submission of the final report



Source: JICA Study Team

Figure I-3 Progress of the Study



Legend: Work in Istanbul Work in Japan ▲ Seminar ● Work Shop ○ Report Submission
Source: JICA Study Team

Figure I-4 Work Schedule

5. Participants

Table 1-1 lists the members of the Study Teams of IMM and JICA, together with the Coordinating Committee, the Advisory Groups, the Japan International Cooperation Agency (JICA) and Cooperators. The Table also lists the names who contributed to the Study by attending to the weekly routine meetings.

Table I-1 Participants

Turkey Side

IMM Transportation Department	
Muzaffer Hacımustafaoğlu	Deputy Secretary General and Director of Transportation Department

IMM Project Team	
Atilla Alkan	Team Leader & Manager of Transportation Planning
İhsan Hadi Karadeniz	Deputy Team Leader & Deputy Manager of Transportation Planning
Neriman Şahin	Msc.Civil Engineer
Mehmet Çakır	Urban Planner
Serap Çetinkaya	Msc.Urban Planner
Serkan Şimşek	Geophysics Engineer
Dilek ÇOL	Msc.Urban Planner
Emel Günay	Msc.Urban Planner
Orhan Aktaş	Msc. Statistician
Nilüfer Dünya	Urban Planner
Aysun Sarı	Urban Planner
Çare Olgun Çalışkan	Msc.Urban Planner
Gizem Erdoğan	Msc.Urban Planner
Berna Çalışkan	Msc.Civil Engineer
Eray Sezer	Msc.Urban Planner
Evren Posacı	Urban Planner

Advisors	
Prof.Dr.Gökmen Ergün	Transportation Planner
Prof.Dr.Aykut Toros	Demographer
Doç Dr. Murat Çelik	Transportation Planner
Yrd.Doç.Dr.Darçın Akın	Transportation Planner

Steering Commitee	
Mesut Pektas	Istanbul Metropolitan Municipality General Secretary
Muzaffer Hacımustafaoglu	Deputy Secretary General and Director of Transportation Department
Metin Akbaş	Turkish State Railways (TCDD)
Kemal Tuncer	Turkish State Railways (TCDD)
İsmail Özdemir	Turkish State Railways (TCDD)
C.Yaşar Tangül	Turkish State Railways (TCDD)
A. Ufuk Kınık	Turkish State Railways (TCDD)
M.Rahmi Gül	Turkish State Railways (TCDD)
Hikmet Erkut	TCK 17. Regional Directorate
Mehmet Küçükoğlu	TCK 17. Regional Directorate
Asım Öztürk	TCK 17. Regional Directorate
Celal Mahmut Solak	City Gendarme Commandership
M.Ziya Erdem	DLH Marmaray Regional Management
D.Sema Yılmazkardeşler	DLH Marmaray Regional Management
Erhan Kura	DLH Marmaray Regional Management
Mehmet Arslan	DLH Marmaray Regional Management
Erdal Şahin	Istanbul Regional Directorate in Ministry of Transportation
Emre Sinan Purtul	Istanbul Regional Directorate in Ministry of Transportation
Yb. Yavuz Geçim	Istanbul Regional Directorate of Marine Undersecretariat
Erkan Tuncer	Istanbul Regional Directorate of Marine Undersecretariat
Kazım Alpay	Istanbul Regional Directorate of Marine Undersecretariat
Şükrü Uçar	DHMI Atatürk Airport Adiminstation General Directorate
Fevzi Sünbül	National Defence Ministry 1st Army Commandership Logistics Department
Ali Özsoylar	Istanbul Security Directorate
Gürzel Fırat	Istanbul Security Directorate
Turan Odabaş	Istanbul Security Directorate
Abdullah Çınar	Istanbul Chamber of Trades
Ömer Kuray	Istanbul Chamber of Trades
Meltem Duran	Istanbul Chamber of Trades

Japan Side

JICA Study Team	
Tetsuo WAKUI	Team Leader / Transport Planning
Kenji TANAKA	Urban Planning
Noboru IKENISHI	GIS / Disaster Protection Planning
Yuko SAKAI	GIS
Kenichi SEKINE	Transportation Demand Analysis
Tesuo HORIE	Transportation Demand Analysis
Toshisada KATSURADA	Road Transportation Planning
Seiya MATSUOKA	Traffic Management
Kentaro OKUNO	Road Planning and Designing
Hiroshi IZAWA	Rail Transit Planning
Teruki MISHIMA	Rail Transit Designing
Shogo UCHIDA	Rail Tranasit Operation and Management
Takashi SHOYAMA	Bus Operation and Management
Akitoshi IIO	Environment Management
Dr.Katsuhiko TAKAHASHI	Finacial and Institutional Planning
Ken KUMAZAWA	Economic / Financial Analysis
Tamaoki WATANABE	Pilot Project Planning and Implementation
Yasuko YAMADA	Coordinator

Japan International Cooperation Agency	
Prof.Dr.Tetsuro HYODO	Advisor / Tokyo University of Marine Science and Technology
Kazumasa SANUI	Project Coordinator JICA Head Quarter
Satoshi UMENAGA	Deputy Resident Representative JICA Turkey Office
Ali BEKIN	Program Manager / JICA Turkey Office

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Selim Çevik	Urban Planning and Transport Expert
Selen Zora	Secretary
Ece Işın Doğan	Secretary
Kosuke NASU	Transport Researcher

Mustafa Silah Yürekli	Istanbul Chamber of Trades
Suat Yalkın	Istanbul Chamber of Trades
Özkan Eker	Directorate of Transport Coordination
Boğaçhan Akalın	Directorate of Transport Coordination
Yavuz Delice	Directorate of Transport Coordination
Namık Kaya	Public Transportation Service Directorate
Can Onur Gotuk	Public Transportation Service Directorate
Abdurrahman Uçak	Science Affairs Directorate
Nihat Cırıt	Istanbul Sea Buses General Directorate (IDO)
Ali Osman Tekkenat	Istanbul Sea Buses General Directorate (IDO)
Fatih Karahacıoğlu	Istanbul Sea Buses General Directorate (IDO)
Hayrettin Oğuz	Istanbul Sea Buses General Directorate (IDO)
Yusuf Boztepe	Istanbul Sea Buses General Directorate (IDO)
Ömer Yıldız	Transportation Corporation (Istanbul Ulasim A.Ş.)
Ali Metin Yazar	Transportation Corporation (Istanbul Ulasim A.Ş.)
Kaan Yıldızgöz	Transportation Corporation (Istanbul Ulasim A.Ş.)
Faruk Karaosman	IETT General Directorate
Mustafa Hatipoğlu	IETT General Directorate
Şükrü Var	IETT General Directorate
Köksal Altınkaynak	İETT General Directorate

Participants Attendance in Weekly Routine Meetings		**Times of Attendance***
Gülşen Teslime Aydın	BIMTAS	30
M.Metin Yazar	Transportation Corporation (Istanbul Ulasim A.S.)	12
Metin Küçükoğlu	TCK 17. Regional Directorate	11
Hikmet Erkut	TCK 17. Regional Directorate	10
Evren Posacı	IMM City Planning Department	10
A.Ufuk Kınık	Turkish State Railways (TCDD)	8
Oğuzhan İmamoğlu	IMM City Planning Department	6
Hayrettin Oğuz	Istanbul Sea Buses General Directorate (IDO)	6
İsa Cerrah	IMM City Planning Department	5
Ömer Yıldız	Transportation Corporation (Istanbul Ulasim A.S.)	5
Abdullah Kazdal	IETT General Directorate	4
Mustafa Murteza	IMM Transportation Planning Department	4
Hasan Üstündağ	Istanbul Sea Buses General Directorate (IDO)	4
Yusuf Boztepe	Istanbul Sea Buses General Directorate (IDO)	4
Mustafa D.Güler	Transportation Corporation (Istanbul Ulasim A.S.)	4
D.Sema Yılmazkardeşler	DLH Marmaray Regional Management	3
Erhan Kura	DLH Marmaray Regional Management	3
Murat Dil	IMM City Planning Department	3
M.Tarık Dündar	Transportation Corporation (Istanbul Ulasim A.S.)	3
M.Rahmi Gül	Turkish State Railways (TCDD)	3
Mevlüt Mert	DLH Marmaray Regional Management	2
Ertan Şimşek	IMM Transportation Planning Department	2
Eser Dağ	IMM Transportation Planning Department	2
Murat Arısal	Transportation Corporation (Istanbul Ulasim A.S.)	2
Kamil Demircan	Transportation Corporation (Istanbul Ulasim A.S.)	2
İbrahim Eren	Turkish State Railways (TCDD)	2
Gülay Çevik	BIMTAS	1
Murat Diren	BIMTAS	1
Mehmet Tekgül	DLH Marmaray Regional Management	1
Gülbin Saldır	DLH Marmaray Regional Management	1
Faruk Karaosman	IETT General Directorate	1
Kadri Yapıcıoğlu	IETT General Directorate	1
Yavuz Fırıncı	IETT General Directorate	1
İhsan Yılmaz	IMM City Planning Department	1
Engin Yetkin	IMM Planning Department	1
Tülay Mesutol	IMM Transportation Planning Department	1
Hale Erez Külekçi	IMM Transportation Planning Department	1
Melda Haznedaroğlu	IMM Transportation Planning Department	1
Lokman Yengin	Istanbul Sea Buses General Directorate (IDO)	1
Fahrettin Ulku	Istanbul Sea Buses General Directorate (IDO)	1
Şefika Demirci	Istanbul Sea Buses General Directorate (IDO)	1
Güngör Evren	Istanbul Technical University	1
Mümin Kahveci	Transportation Corporation (Istanbul Ulasim A.S.)	1
Soner Kazaca	Turkish State Railways (TCDD)	1
Metin Akbaş	Turkish State Railways (TCDD)	1

* Weekly routine meetings were held 50 times in total.

Part I. Present Conditions

Chapter 1 Istanbul Metropolitan Urban Structure

1.1 Location

Istanbul is a cultural and economic crossroad between the Black Sea and the Mediterranean Sea as well as between Europe and Asia, acting as a bridge between the Orient and the trading centers of Europe and the Middle East. However, ever since the height of Turkey's past prominence Istanbul has been in a relative decline as global economic and political changes have not been conducive to cosmopolitan centers like Istanbul. The shift occurred when technological and political changes were brought to the traditional trade and travel sea routes radiating from Istanbul, because Soviet bloc countries, like the Balkans and Central Asia, were blocked from the free trade of Istanbul during the Cold War Era. In the onset of globalization, new transnational processes started in the cities that can exploit opportunities beyond their own state's boundaries. It was advocated that the time was ripe to reassess Istanbul as a bridge between East and West. It should also be noted that Istanbul is unique in its own way because no other world city is effectively identified as one of the Balkans states, as well as the eastern Mediterranean, the Middle East, and Central Asia. In this context the Master Plan proposes to make Istanbul a world city based on its advantages and strategic location.

Figure 1.1.1 Global Context
Source: JICA Study Team

1.2 Urban Growth

1.2.1 Mega City

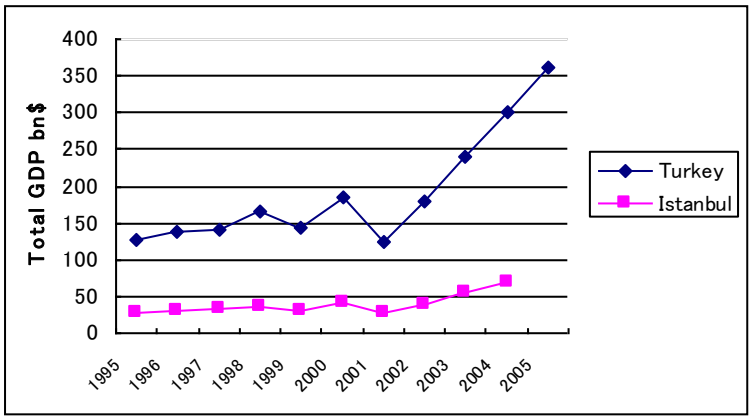
Istanbul's urban growth has been accelerated in relation with the changes in national industrial policies from "import substitute" to "export-oriented" and the corresponding liberalization policies and the measures put into practice in the 1970's, which triggered the industrialization of Istanbul. From then on industry-lead urbanization continuously stimulated the in-migration of population into Istanbul and expanded its urban areas outward. In this process, Istanbul grew from a city of 3.0 million to a mega city of 10 million people (a 30-year population growth from 1970 to 2000). However, it must be noted that the city's population trend has been in a steadily declining annual growth, and the growth peak was as early as 1970's as shown in Table 1.2.1 On the other hand, Istanbul has been increasing its population and its share in Turkey from 8.5 % in 1970 to 15.9 % in 2005.

Table 1.2.1 Population Growth of Istanbul

	1970	1980	1990	2000	2005
Population	3,019,032	4,741,890	7,195,773	10,018,735	11,606,341
Share to Turkey (%)	8.5	10.6	13.0	14.8	15.9
Annual population growth rate (%)		70-80 4.6	80-90 4.3	90-00 3.4	00-05 3.0

Source: National Census, DIE

After overcoming its 2001 financial crisis, the commitment of the Turkish government to pursue sound economic policies, especially deregulation and currency stabilizing measures in response to globalization and towards market economy, has boosted the country's economy as reflected by its GDP from 2002 to 2005 as shown in Table 1.2.2. This development has placed the Turkish economy in a good position to embark on "a sustained path of faster growth".



Source: Statistical Dep. Turkish Statistical Institute

Figure 1.2.1 GDP Growth of Turkey and Istanbul

Table 1.2.2 GDP Growth of Turkey and Istanbul

Year	Turkey		Istanbul		Istanbul's share to Turkey (%)
	GDP	Growth rate (%)	GDP	Growth rate (%)	
1995	127.2	-	26.9	-	21.1
1996	137.4	8.0	29.2	8.6	21.3
1997	140.6	2.3	32.1	9.9	22.8
1998	166.5	18.4	36.1	12.5	21.7
1999	143.4	-13.9	31.4	-13.0	21.9
2000	185.5	29.4	41.0	30.6	22.1
2001	123.4	-33.5	26.3	-35.9	21.3
2002	179.9	45.8	39.2	49.0	21.8
2003	239.2	33.0	53.8	37.2	22.5
2004	300.6	25.7	68.3	27.0	22.7
2005	361.5	20.3	-	-	-

GDP $ billions at current prices
Source: IMM 2007-2011 Strategic Plan

1.2.2 Istanbul in Turkey

Judging from the statistics on Istanbul's share in Turkish GDP (constantly 21 to 23 % as shown in Table 1.2.3), the city does not seem to play an outstanding role in the national economic development although it has been growing at the same pace in whole Turkey. However, Istanbul's share in GDP by sector and international trade, as shown in Table 1.2.3, indicate its greater importance in the national economy, especially financial, professional and international trade. International trade shares more than 40%, followed by commercial at 35.5 % as of 2004.

Table 1.2.3 Istanbul's Share in Turkish GDP by Sector and International Trade

	1995	2001	2004
GDP ($ base)	(%)	(%)	(%)
Agriculture	1.8	1.2	1.0
Industry	26.2	24.0	25.0
Construction	16.3	17.1	18.0
Commercial	28.7	34.1	35.5
Transport / Communication	22.0	21.1	21.0
Financial	40.4	46.0	45.0
Professional occupation	39.3	41.0	41.0
International trade ($ base)			
Export	47.6	47.1	45.7
Import	38.5	40.7	41.3

Source: IMM 2007-2011 Strategic Plan

1.2.3 From "City of Industry" to "City of Commerce & Services"

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, Instead, commerce, finance and services have been increasing the share as shown in Table 1.2.4, changing the urban industrial structure

of Istanbul. While higher cost of land, traffic congestion, and increasing social pressure against industrial pollution (air and water pollution, noise, and others) are driving factories out of densely built-up urban areas to the organized industrial zones (OIZ), these have been developed throughout the country, especially in the Marmara region in accordance with the government decentralization policies. In this context, provinces like Kocaeli, Bursa and others in the Marmara region which are adjacent to Istanbul have attracted considerable number of factories, and have rapidly increased their industrial production.

Table 1.2.4 GDP by Production

	1995	2001	2004
GDP	(%)	(%)	(%)
Agriculture	1.4	0.6	0.5
Industry	30.1	23.8	26.3
Construction	4.1	3.4	2.8
Commercial	25.7	27.8	30.9
Transport / Communication	12.7	13.1	12.8
Financial	7.5	6.9	9.6
Professional occupation	6.5	5.9	6.0
Bank service	7.5	12.6	5.3
Others	4.5	5.9	5.8
	100.0	100.0	100.0

Source: IMM 2007-2011 Strategic Plan

The shift of urban industrial structure to service industry is a common and universal trend that is pursued by world urban centers in the spirit of globalization (liberalization of foreign trade of goods & services and capital investment) and has been triggered by the development of the information and communication technology since late 1970s. Istanbul's geo-political position as a bridge connecting Europe and Asia, the Middle East and others, not to mention its historical heritage as a world city in addition, have expedited the industrial shift of Istanbul, coupled with its government reform projects.

1.2.4 Progress of Transformation

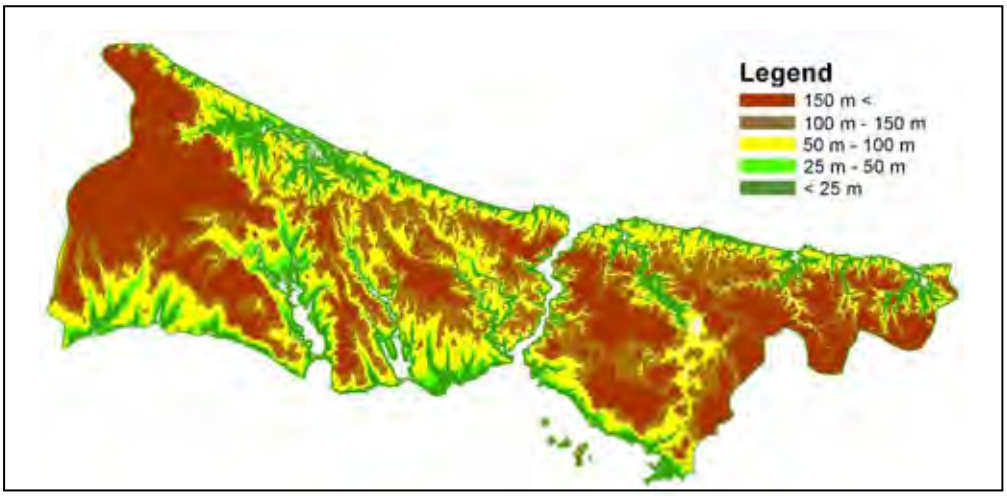
"Transformation" is one of the important policies of Turkish government set forth in its "Long Term Development plan (2001-2023)" in 2001. This makes the country prepared both for accelerating globalization / economic liberalization and accessing to the EU. This is a policy persistently pursued to date. Istanbul is the urban center that pioneers the implementation of the transformation policy of the government. The economic and industrial development situations, as outlined above, are viewed as the progress of this transformation policy, from an industrial city to a city of service in the globalizing world.

1.3 Urban Structure

1.3.1 Natural and Geographic Structure

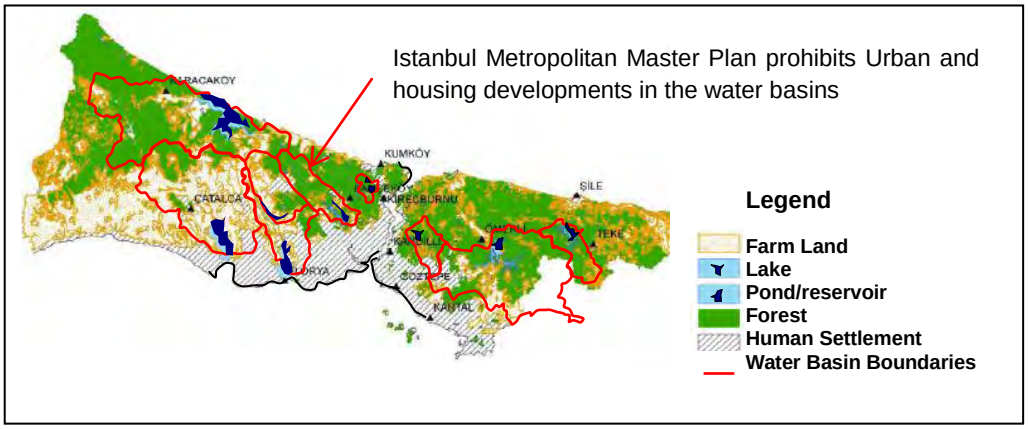
1) Geography

As understood from its name as the “city of 7 hills”, the urban areas of Istanbul have developed from hill to hill. This geographical feature of Istanbul created its quite unique urban landscape which is now world famous. This, at the same time influenced and determined the existing urbanization & land use patterns, transport systems, and eventually its urban structure. It is quite different from other mega cities developed in large alluvial plains.



Source: Land Use Research Unit of IMP

Figure 1.3.1 Elevation Contour Map



Source: *ibid.* as Figure 1.3.1

Figure 1.3.2 Natural Land use & Water Basin Map

It may be generally stated “the higher elevation, the steeper the gradient”. Due to this factor, most of human settlements and urban areas have been developed on lands below 100m, with some exceptions of housing developments situated on steeper hills, especially the squatter area along the industrial valleys. The areas with an altitude of more than 100m or 150m are generally classified as forest areas. The forest area and water basin area are deemed vital for the ecological environment for Istanbul. There is no doubt that even in the built-up areas, there are housing areas on steep land along valleys. In contrast

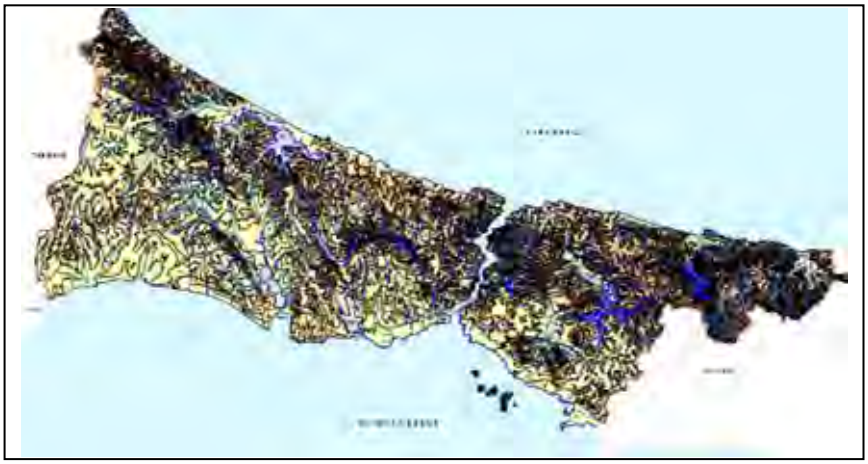
with the land use (Figure 1.3.2), the contour map indicates that the eastern side is relatively hillier than the western side where farming land is predominant.

The other prominent physical feature of Istanbul is its surface water that runs through hills, ranging from the Bosporus Strait and the Golden Horn to various smaller rivers. The city's uneven ground and hilly land created various lakes and ponds as shown in the figures, which are the sources of its rivers. The prevention of water contamination of these water basins and ponds has become one of the most serious development issues of Istanbul.

Table 1.3.1 Istanbul's Slope Analysis

Slope (%)	Area (km^2)	Area (%)
0-10	2,710	50.18
11-20	1,761	32.61
21-30	618	11.44
31-40	226	4.18
41-65	85	1.57
Total area	5,400	100.00

Source: IMM Analytical Report



Source: *ibid.* as Figure 1.3.1

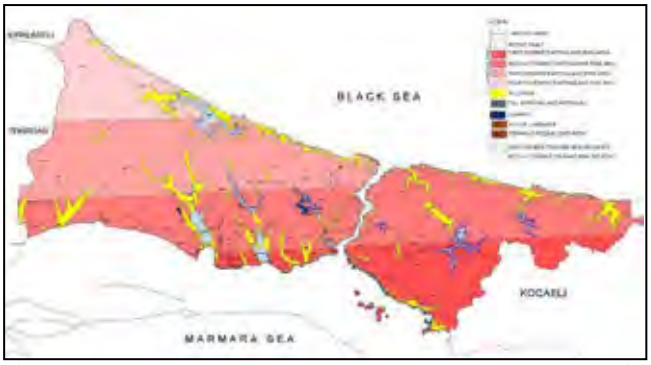
Figure 1.3.3 Slope Distribution in the Study Area

2) Geology

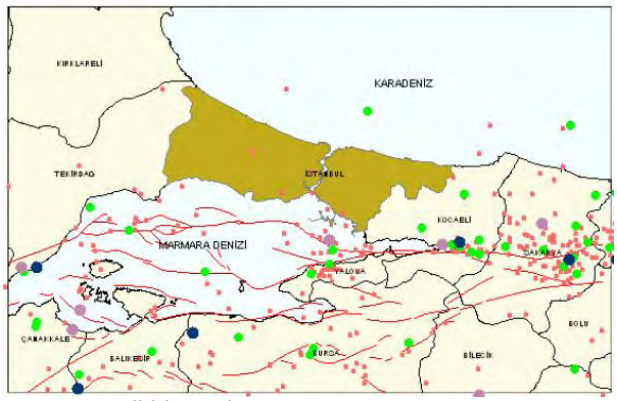
The Geological structure in Istanbul was composed in the long time from the Paleozoic until present and then contains a variety of structure. The structures in Europe and in Asia are different although both of them are complex. The former is called " Istranca Birligi" which contains schist, quartz and magmatite, found in the northern part of Catalca peninsula, especially in Tekirdag and Edirne. "Istanbul Birligi" contains geological structure from the Paleozoic to Mesozoic, found in the both sides of the Bosporus Strait and Widely in Kocaeli Peninsula.

3) Risk of Earthquake

In the south-side of Istanbul of the Marmara Sea, an active fault which is a branch of the North Anatolia Faults runs in east-west direction. The Ministry of Public Works developed a risk map based on data of the past one century, which shows a 50 years probability of earthquake. Because of the active fault, higher risks are shown in the southern area.



(1) Risk



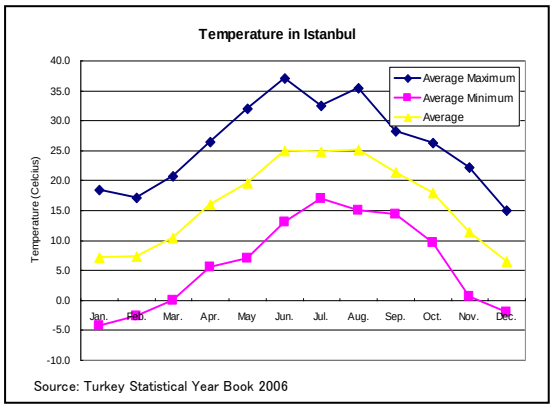
Source: *ibid.* as Figure 1.3.1

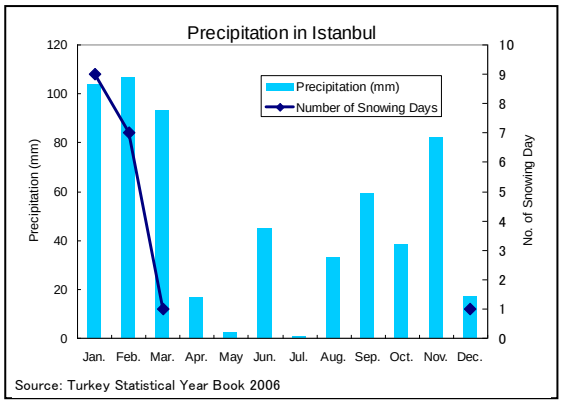
(2) Faults Map

Figure 1.3.4 Risk Map and Active Faults

4) Climate

The Study Area belongs to the Mediterranean Climate, where it is dry and hot (over 30 centigrade) in summer season of June to September and rainy and cold (minus one centigrade in average during January) in winter of November to March. Annual rainfall is 700 – 800 mm, 60 % of which is concentrate in autumn and winter. Sometimes it snows in December to March.





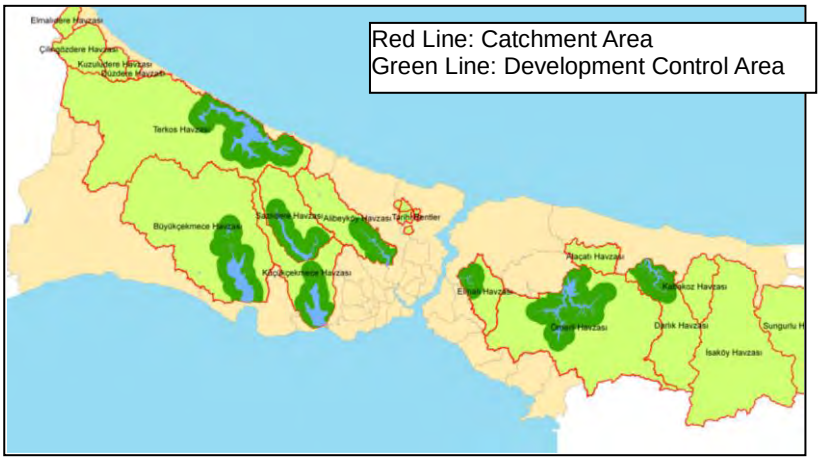
Source: Statistics Istanbul, Statistic Bureau, IMM

Figure 1.3.5 Temperature and Rainfall in Istanbul

5) Water Basin and Resources

The watersheds have been historically protected by forest in the northern area in Istanbul. In the past 20 years, Istanbul has been suffering from shortage of water due to rapid

population increase. Water demand is 1,035 million cubic meter, while supply from the reservoirs inside the city area is about 790 million cubic meter and 245 million cubic meter is transported from adjacent Tekirdag Province. As water supply in Istanbul depends mostly on surface water, IMM protects forest in the watersheds and water reservoir areas by law (Drinking Water Basin Regulation on Law No.2560).



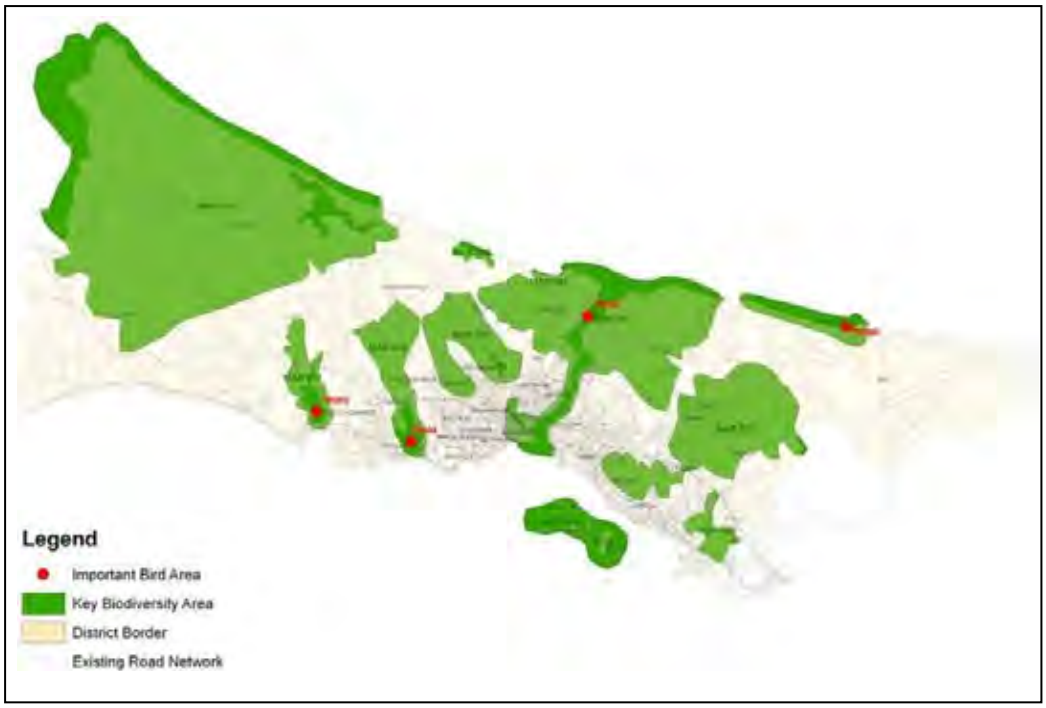
Source: *ibid.* as Figure 1.3.1

Figure 1.3.6 Water Catchment Area and Protected Area

6) Flora and Fauna

Flora and fauna in Istanbul is comparatively abundant and diversified due to the Black Sea in the north, the Marmara Sea in the south and Catarca Pen. and Kocaeli Pen. mostly covered by forest. The Turkish Society of Nature designated 11 key biodiversity areas which covers 44% of the city area, five of which were designated by the Cultural and Natural Protection Lay (No. 2863). In addition, four important bird areas such as the Buyukcekmece Lake, the Kucukcekmece Lake, the Bosporus area, and Sile islands are listed in connection with the RAMSAR Treaty but not appointed yet.

According to the Global Red List, there is no kind in Istanbul classified as CR (critically endangered) but one kind (mole rat (*Nannospalax leucodon*)) in the Kuchkcekmece Lake is designated as EN (Endangered), 9 kinds as VU (Vulnerable), 10 kinds of NT (Near Threatened), 50 kinds as LC (Least Concern) and 33 kinds as DD (data Deficient).



Source: Environmental Research Unit of IMP

Figure 1.3.7 Important Bird Area and Key Biodiversity Area

7) Air

Since 1995, IMM has been periodically monitoring six pollutants in the air of SO_2, NO_x, CO, O_3, HC and PM. Initially, the monitoring focused on air pollution by SO_2 due to heating with coal in winter season. As coal has been replaced by natural gas, SO_2 has been decreasing and since 2023, the density has been lower than the standard of 20μg/m^3 set by EU and WHO. On the other hand, PM10 were almost constant in the past ten years, which is lower than the Turkish standard at 150μg/m^3 but higher than the EU and WHO standard at 20μg/m^3.

1.3.2 Urban Expansion

Spatial urbanization pattern is a summation of results of decisions made by individual persons and enterprises in market economy in relation to the location of houses and enterprises. These urbanization patterns come to light through examination of the expansion of built-up areas as a whole, as well as the distribution of population / employment and their periodical changes.

1) Expansion of Built-up Areas

In 1950, Istanbul's urban area was limited to the coastal areas along Marmara Sea and the Bosporus Strait with small sea-port towns including the historical peninsula, Zeytinburnu, Bakirkoy, Uskudar, Kadikoy, and other areas from where Istanbul towns and urban areas developed and expanded. These expanded built-up areas were merged into large urban areas on the European and Asian sides respectively.

Figure 1.3.4 shows this expansion process:

1965: 3 million population at the start of urbanization

1985: 5 million in the middle of massive urbanization

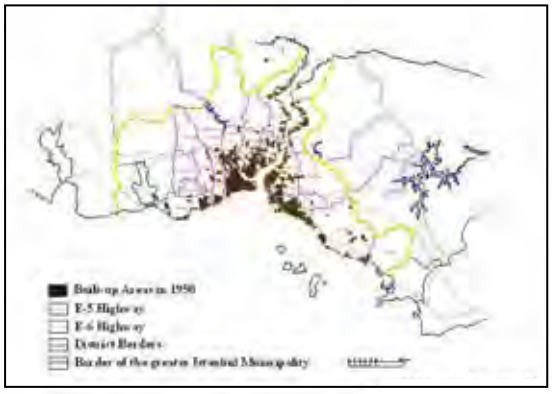
2002: 10 million at the stage of Mega-city

Istanbul Mega City was developed through the expansion of urban areas based on its urban structure that was formed prior to 1965. In this respect, Istanbul now needs to change its urban structure, according to the new image as a mega city in terms of quality and quantity (urban re-structuring as envisioned in Istanbul Master Plan).

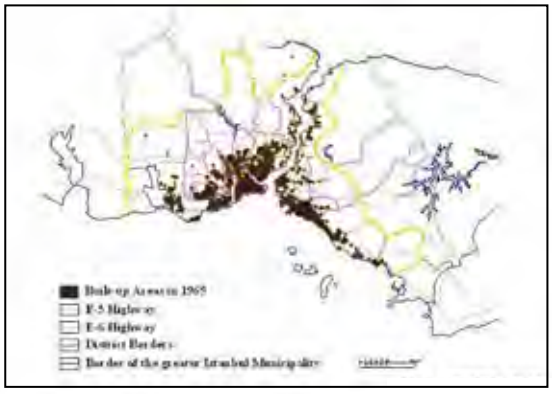
The expansion of built-up areas presented in Figure 1.3.8 roughly suggests 3 major directions of urbanization:

1. Towards the west from the old urban center in Eminonu (Historical peninsula) on the European side.
2. Towards the east from Uskudar & Kadikoy area on the Asian side.
3. Towards the north from the old urban center Beyoglu.

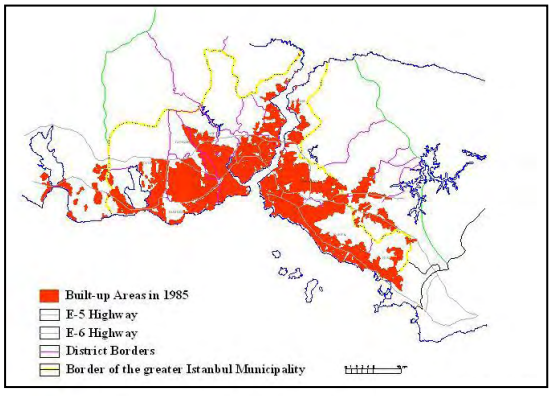
The scale and magnitude of population and employment growth in 3 directions are examined in the following sections.



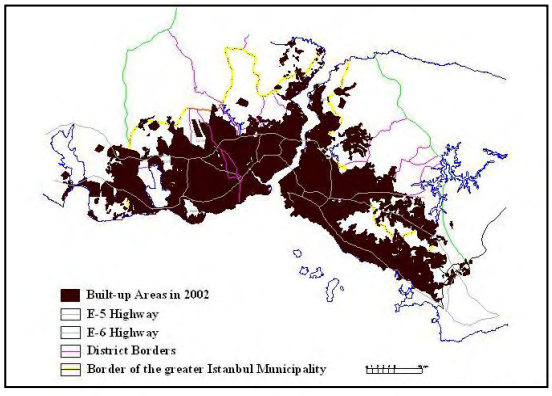
Built-up Area in 1950



Built-up Area in 1965



Built-up Area in 1985



Built-up Area in 2002

Source: Azim *e.* TEZER (2002)

Figure 1.3.8 Expansion of Urbanized Area

2) Population Distribution and Its Changes

Population growth by district shown in Table 1.3.3 indicates the changing situation of urbanization in Istanbul, and Table 1.3.2 summarizes the population growth.

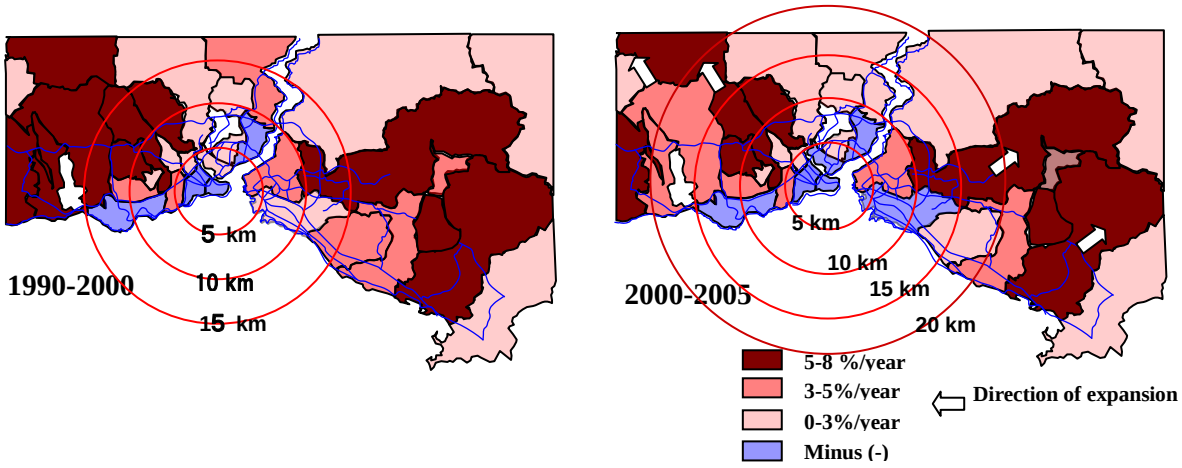
Table 1.3.2 Population Growth by Sector

Section	Population (1000)					Annual growth rate (%)				Share by section (%)				
	1970	1980	1990	2000	2005	70-80	80-90	90-00	00-05	1970	1980	1990	2000	2005
East Section	677.5	1,383.5	2,440.5	3,449.4	4,005.2	7.4	5.8	3.5	3.0	22.4	29.2	33.9	34.4	34.5
North Section	795.5	996.8	1,112.6	1,280.6	1,333.5	2.3	1.1	1.4	0.8	26.3	21.0	15.5	12.8	11.5
West Section	1,485.5	2,264.4	3,622.3	5,230.4	6,251.1	4.3	4.8	3.7	3.6	49.2	47.8	50.3	52.2	53.9
Total Istanbul	3,019.0	4,741.9	7,195.8	10,018.7	11,606.3	4.6	4.3	3.4	3.0	100	100	100	100	100
Old Istanbul	2,849.5	4,500.4	6,884.7	9,371.9	10,789.9	4.7	4.3	3.1	1.4	94.4	94.9	95.7	93.5	93.0

Note: Total includes island population. Sea Table 1.3.3 in detail
Source: Statistical Dept., IMM

While the annual growth rate of population of Istanbul has been constantly decreasing (4.7 % 1970-1980 down to 3.0 % 2000-2005), the east and the west sections have been increasing their shares relative to the north section, which have lowered the share (Table 1.3.2). It is clear from the physical condition (steeper land), that the north section has no more capacity to absorb further increases of population.

Table 1.3.3 shows that almost all the districts hit their highest growth rates in early 70's and 80's, and then they have constantly decreased annual growth rates up to the present. In this declining trend, the districts around the built-up areas in 1985, as depicted in Figure 1.3.9, still maintain 5-8% of growth rate, while the districts within the built-up areas in 1985 decreased their growth rate to 0-3 % or negative.



Source: JICA Study Team Based on Data from Statistical Dept., IMM

Figure 1.3.9 Growth Rate of Population by District

The high population growth rate lasting through decades may be attributed to the district boundaries, which cover old built-up area, urbanizing area and still vacant land. The continuous high growth rate in the districts, covering the northern hilly natural land, implies a high urbanization pressure on the north forest areas. Without the irregularity of district's shapes, districts within around 15 km radius from the center of Istanbul remain stagnant, with low annual growth rates because they belong to the built-up area that has no more

space for further housing. The districts with negative growth rate spread during the period from 1990-2000 to 2000-2005. The most possible reason for population decreases in these old central districts, among others, may be due to land use conversion from residential to commercial use like shopping malls, super markets, office buildings, and hotels through urban redevelopment projects.

Table 1.3.3 Population Growth by District

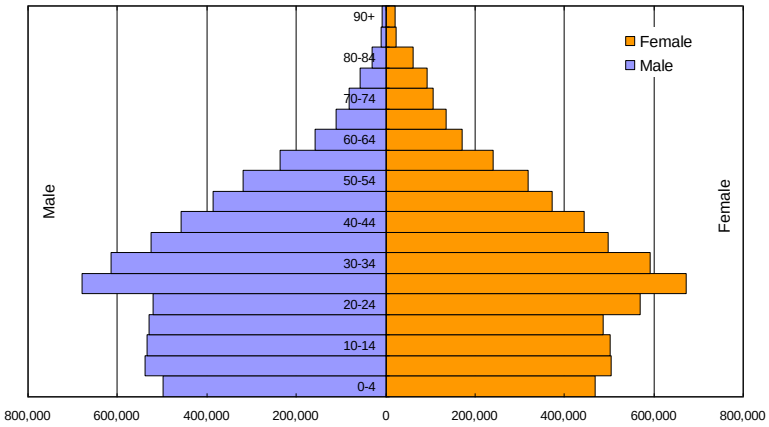
	District	Population (1000)					Annual growth rate (%)				Share by district (%)				
		1970	1980	1990	2000	2005	70-80	80-90	90-00	00-05	1970	1980	1990	2000	2005
1	Adalar	17.6	18.2	19.4	17.8	16.6	0.4	0.6	-0.9	-1.4	0.6	0.4	0.3	0.2	0.1
	Islands	17.6	18.2	19.4	17.8	16.6	0.4	0.6	-0.9	-1.4	0.6	0.4	0.3	0.2	0.1
3	Kadikoy	241.6	468.2	648.3	653.3	597.9	6.8	3.3	0.1	-1.8	8.0	9.9	9.0	6.5	5.2
11	Uskudar	143.5	261.1	395.6	495.1	585.1	6.2	4.2	2.3	3.4	4.8	5.5	5.5	4.9	5.0
5	Maltepe	48.4	142.4	254.3	355.4	400.9	11.4	6.0	3.4	2.4	1.6	3.0	3.5	3.5	3.5
10	Umraniye	27.7	105.0	303.4	605.9	800.7	14.2	11.2	7.2	5.7	0.9	2.2	4.2	6.0	6.9
2	Beykoz	76.4	114.8	161.6	210.8	230.6	4.2	3.5	2.7	1.8	2.5	2.4	2.2	2.1	2.0
4	Kartal	64.0	144.2	273.6	407.9	473.4	8.5	6.6	4.1	3.0	2.1	3.0	3.8	4.1	4.1
7	Sultanbeyli	Na	Na	82.3	175.7	239.2	Na	Na	7.9	6.4	Na	Na	1.1	1.8	2.1
6	Pendik	44.5	100.6	200.9	389.7	508.4	8.5	7.2	6.8	5.5	1.5	2.1	2.8	3.9	4.4
9	Tuzla	11.9	26.7	95.2	123.2	133.7	8.4	13.6	2.6	1.7	0.4	0.6	1.3	1.2	1.2
8	Sile	19.4	20.4	25.4	32.4	35.2	0.5	2.2	2.5	1.6	0.6	0.4	0.4	0.3	0.3
	East Section	677.5	1,383.5	2,440.5	3,449.4	4,005.2	7.4	5.8	3.5	3.0	22.4	29.2	33.9	34.4	34.5
18	Beyoglu	225.9	223.4	229.0	231.9	226.7	-0.1	0.2	0.1	-0.5	7.5	4.7	3.2	2.3	2.0
31	Sisli	220.2	244.7	250.5	270.1	277.9	1.1	0.2	0.8	0.6	7.3	5.2	3.5	2.7	2.4
17	Besiktas	136.1	188.1	192.2	190.8	179.3	3.3	0.2	-0.1	-1.2	4.5	4.0	2.7	1.9	1.5
27	Kagithane	145.4	223.0	269.0	345.2	374.9	4.4	1.9	2.5	1.7	4.8	4.7	3.7	3.4	3.2
29	Sariyer	67.9	117.7	171.9	242.5	274.7	5.7	3.9	3.5	2.5	2.2	2.5	2.4	2.4	2.4
	North Section	795.5	996.8	1,112.6	1,280.6	1,333.5	2.3	1.1	1.4	0.8	26.3	21.0	15.5	12.8	11.5
21	Eminonu	137.0	93.3	83.4	55.6	45.2	-3.8	-1.1	-4.0	-4.1	4.5	2.0	1.2	0.6	0.4
24	Fatih	417.7	474.6	462.5	403.	369.1	1.3	-0.3	-1.4	-1.8	13.8	10.0	6.4	4.0	3.2
23	Eyup	114.7	162.2	212.0	255.9	261.2	3.5	2.7	1.9	0.4	3.8	3.4	2.9	2.6	2.3
32	Zeytinburnu	117.9	124.5	165.7	247.7	287.8	0.5	2.9	4.1	3.1	3.9	2.6	2.3	2.5	2.5
16	Bayrampasa	124.1	168.8	212.6	246.0	255.2	3.1	2.3	1.5	0.7	4.1	3.6	3.0	2.5	2.2
25	Gaziosmanpasa	125.7	219.0	393.7	752.4	997.4	5.7	6.0	6.7	5.8	4.2	4.6	5.5	7.5	8.6
22	Esenler	33.0	113.7	223.8	350.7	462.3	13.2	7.0	4.6	5.7	1.1	2.4	3.1	3.5	4.0
26	Gungoren	40.2	108.4	213.1	273.0	296.1	10.4	7.0	2.5	1.6	1.3	2.3	3.0	2.7	2.6
13	Bagcilar	9.7	95.2	291.5	556.5	721.1	25.7	11.8	6.7	5.3	0.3	2.0	4.1	5.6	6.2
14	Bahcelievler	57.2	171.0	298.2	478.6	574.1	11.6	5.7	4.8	3.7	1.9	3.6	4.1	4.8	4.9
15	Bakirkoy	112.3	165.3	301.7	208.4	174.7	3.9	6.2	-3.6	-3.5	3.7	3.5	4.2	2.1	1.5
28	Kucukcekmece	77.8	192.6	352.9	594.5	742.6	9.5	6.2	5.4	4.5	2.6	4.1	4.9	5.9	6.4
12	Avcilar	11.2	33.5	126.5	233.7	283.1	11.6	14.2	6.3	3.9	0.4	0.7	1.8	2.3	2.4
19	Buyukcekmece	14.9	35.9	142.9	384.1	576.0	9.2	14.8	10.4	8.4	0.5	0.8	2.0	3.8	5.0
20	Catalca	54.9	53.2	64.2	81.6	82.0	-0.3	1.9	2.4	0.1	1.8	1.1	0.9	0.8	0.7
30	Silivri	37.4	53.0	77.6	108.2	123.2	3.5	3.9	3.4	2.6	1.2	1.1	1.1	1.1	1.1
	West Section	1,485.5	2,264.4	3,622.	5,230.4	6,251.1	4.3	4.8	3.7	3.6	49.2	47.8	50.3	52.2	53.9
	Total Istanbul	3,019.0	4,741.9	7,195.8	10,018.7	11,606.3	4.6	4.3	3.4	3.0	100	100	100	100	100
	Old Istanbul	2,849.5	4,500.4	6,884.7	9,371.9	10,789.9	4.7	4.3	3.1	1.4	94.4	94.9	95.7	93.5	93.0

Source: Turkish Statistical Institute and IMP

3) Population in 2007

IMM made a population review in 2007 based on the registration of current dwelling address. According to the results, total population of Istanbul was estimated at 12.5 million.

The population pyramid of Istanbul shown in Figure 1.3.10 shows a clear impact of domestic immigration as people in the young generation, especially in the cohorts of 20 – 35 years show remarkable shares.



Source: JICA Study Team prepared based on Census 2007, Turkish Statistical Institute Information

Figure 1.3.10 Population Pyramid of Istanbul, 2007

4) Distribution of Employment and Its Changes

During 1996 - 2005, employment growth rate/year was 5.6% in the east section, followed by the west section at 5.4%, and the lowest North section at 2.2% (Table 1.3.4). This implies that employment generation has accelerated more in the east and west.

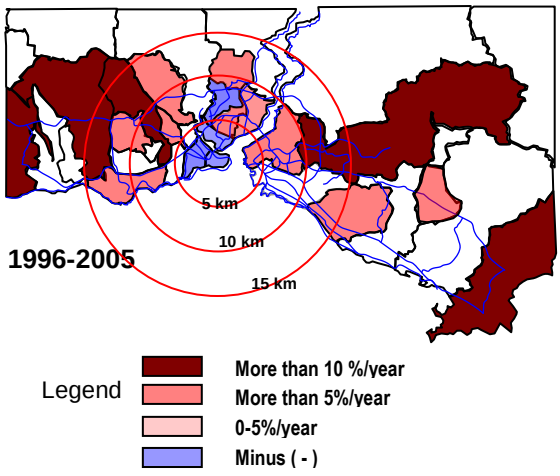
Table 1.3.4 Employment Growth by Section

Section	Employment at work place							Employment at home	
	Number			Share (%)		Ratio of Employment./Pop.		Number	Work place/Home
	1996	2005	Growth (%)	1996	2005	1996	2005	2005	2005
East Section	661,533	1,081,535	5.6	26.2	28.9	0.20	0.27	1,328,140	0.81
North Section	538,206	657,527	2.2	21.4	17.6	0.45	0.49	459,806	1.43
West Section	1,317,267	2,119,925	5.4	52.3	56.7	0.27	0.34	2,038,314	1.04
1996 Study Area	2,520,311	3,736,355	4.5	100.0	100.0	0.27	0.33	3,759,826	0.99
2005 Study Area	-	3,862,821	-	-	-	-	0.33	3,831,347	1.01
Old Istanbul	2,505,372	3,547,627	3.9	99.4	94.9	0.28	0.33	3,559,899	1.00

Source: 1996 and 2005 Transport Master Plan Study

However, as compared with the average rate of 0.33 employment per population of Istanbul, the east section shows a lower rate at 0.27 (2005), which implies a lack of employment in the east section and a number of commuting residents from the east section to either the north or the west section by crossing the Bosporus for work.

Figure 1.3.11 indicates the annual growth rate of employment by district from 1996 to 2005, which suggests the increasing dispersal of employment over the metropolitan area. Istanbul's suburbanization (housing) is coupled with employment generation, or vice versa, and it brings about



Source: Elaborated by JICA Study Team based on Census Data

Figure 1.3.11 Growth Rate of Employment by District

the mixed land use patterns. The highest growth rate of 10% or over per year is found in such districts as Tuzla, Umraniye (East side), Esenler, Kucukcekmece and Buyukcekmece (West side).

As employment includes all industrial categories in calculation, the high growth rate of employment does not show the industrial sector of growth, either commercial/service centers or industrial centers, or combinations of these activities. Referring to the existing land use map, districts with high growth rates can be easily classified as urban centers or industrial centers. Districts located far from the old city with growth rates of more than 10% are identified as emerging industrial centers. The locations of the Organized Industrial Zones (OIZ) correspond to these industrial centers. Districts with more than 5% growth rates are mostly sub-centers which have experienced recent growths. Finally, it noted that the districts with negative growth rates in employment are identified the old commercial centers of Eminönü, Fatih (Historical peninsula), Beyoglu, and the old industrial center of Kagıthane, which is designated as a transformation area toward a new urban center in the Metropolitan Master Plan, as outlined in the following chapter.

Istanbul, which started and concentrated its urban activities in the old core city, has been dispersing employment throughout the metropolitan areas.

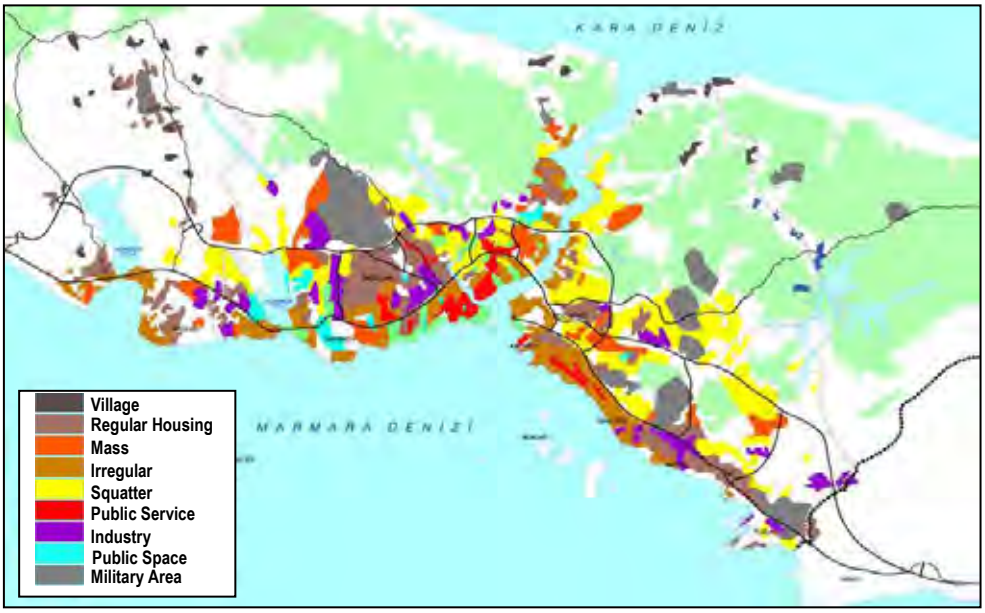
Table 1.3.5 Employment Growth by District

	District (ilce)	Employment at work place							Employment at home	
		Number			Share (%)		Ratio of Employment./Pop.		Number	Work place/Home
		1996	2005	Growth (%)	1996	2005	1996	2005	2005	2005
1	Adalar	3,305	3,834	1.7	0.1	0.1	0.25	0.23	5,087	0.75
	Islands	3,305	3,834	1.7	0.1	0.1	0.25	0.23	5,087	0.75
3	Kadıkoy	176,747	225,179	2.7	7.0	6.0	0.23	0.38	213,435	1.06
11	Uskudar	90,195	146,124	5.5	3.6	3.9	0.19	0.25	204,316	0.72
5	Maltepe	33,026	70,474	8.8	1.3	1.9	0.10	0.18	132,450	0.53
10	Umraniye	89,050	227,433	11.0	3.5	6.1	0.17	0.28	271,381	0.84
2	Beykoz	35,402	51,062	4.2	1.4	1.4	0.18	0.22	70,220	0.73
4	Kartal	102,833	118,918	1.6	4.1	3.2	0.31	0.25	159,186	0.75
7	Sultanbeyli	18,103	37,186	8.3	0.7	1.0	0.08	0.16	66,958	0.56
6	Pendik	100,998	104,680	0.4	4.0	2.8	0.32	0.21	160,705	0.65
9	Tuzla	15,179	78,752	20.1	0.6	2.1	0.15	0.59	41,227	1.91
8	Sile	-	21,727	-	-	0.6	-	0.62	8,262	2.63
	East Section	661,533	1,081,535	5.6	26.2	28.9	0.20	0.27	1,328,140	0.81
18	Beyoglu	182,038	122,877	-4.3	7.2	3.3	0.73	0.54	69,636	1.76
31	Sisli	117,377	246,054	8.6	4.7	6.6	0.49	0.89	100,909	2.44
17	Besiktas	67,850	128,170	7.3	2.7	3.4	0.36	0.71	64,515	1.99
27	Kagithane	130,843	108,146	-2.1	5.2	2.9	0.42	0.29	129,579	0.83
29	Sariyer	40,098	52,280	3.0	1.6	1.4	0.20	0.19	95,167	0.55
	North Section	538,206	657,527	2.2	21.4	17.6	0.45	0.49	459,806	1.43
21	Eminonu	303,976	171,198	-6.2	12.1	4.6	3.34	3.79	15,424	11.10
24	Fatih	141,909	115,997	-2.2	5.6	3.1	0.29	0.31	113,310	1.02
23	Eyup	52,388	77,047	4.4	2.1	2.1	0.19	0.29	82,963	0.93
32	Zeytinburnu	103,409	145,881	3.9	4.1	3.9	0.50	0.51	94,696	1.54
16	Bayrampasa	72,492	130,970	6.8	2.9	3.5	0.26	0.51	81,867	1.60
25	Gaziosmanpasa	101,028	197,673	7.7	4.0	5.3	0.15	0.20	309,232	0.64
22	Esenler	30,122	91,228	13.1	1.2	2.4	0.10	0.20	147,532	0.62
26	Gungoren	87,687	127,928	4.3	3.5	3.4	0.28	0.43	103,707	1.23
13	Bagcilar	95,436	210,332	9.2	3.8	5.6	0.21	0.29	231,148	0.91
14	Bahcelievler	112,627	152,149	3.4	4.5	4.1	0.22	0.27	194,063	0.78
15	Bakirkoy	68,096	107,660	5.2	2.7	2.9	0.29	0.62	64,292	1.67
28	Kucukcekmece	82,636	238,753	12.5	3.3	6.4	0.16	0.32	235,370	1.01
12	Avcilar	50,522	59,642	1.9	2.0	1.6	0.23	0.21	101,524	0.59
19	Buyukcekmece	14,939	188,728	32.6	0.6	5.1	0.05	0.33	199,927	0.94
20	Catalca	-	62,078	-	-	1.7	-	0.76	24,841	2.50
30	Silivri	-	42,661	-	-	1.1	-	0.35	38,418	1.11
	West Section	1,317,267	2,119,925	5.4	52.3	56.7	0.27	0.34	2,038,314	1.04
	1996 Study Area	2,520,311	3,736,355	4.5	100.0	100.0	0.27	0.33	3,759,826	0.99
	2005 Study Area	-	3,862,821	-	-	-	-	0.33	3,831,347	1.01
	Old Istanbul	2,505,372	3,547,627	3.9	99.4	94.9	0.28	0.33	3,559,899	1.00

Source:1996 and 2005 Transport Master Plan Study

1.3.3 Land Use Pattern and Structure

The existing land use shown in Figure 1.3.12 has been shaped as an accumulation of urban and industrial developments carried out in the long history of Istanbul.



Source: IMM/IMP

Figure 1.3.12 Existing Land Use of Istanbul, 2007

1) Mixed land use and small-sized land use groups (small-sized development)

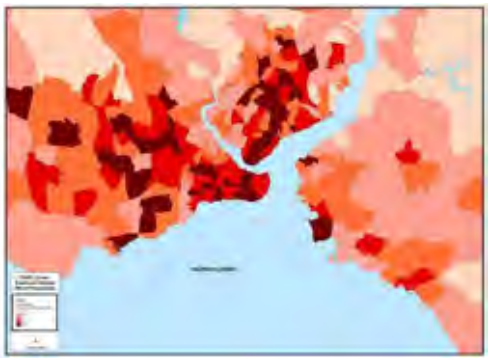
The land use of Istanbul is often characterized as “mixed land use” containing different land uses like residential, commercial, office, and others, in one street or even in a building. Related to this characteristic it is said that Istanbul’s urban area is a large accumulation of small scale developments. This may be attributed to the conditions of land for development, often available only either on hill tops or at slope of valleys. They are usually comparatively smaller than capital capacities of investors and developers.

2) Concentration and spreading

Istanbul is often described as a “compact city” with very high population density and employment. It has received kudos for effective natural preservation, energy conservation and other virtues. The accumulation of population and employment densities shown in Figure 1.3.13 and the existing land use shown in Figure 1.3.12 is remarkable in the central parts of Istanbul: West of Historical peninsula, North of Golden Horn, and East of the Bosporus Strait. However the congested areas have already reached saturation levels and are plagued with environmental deterioration and traffic congestion which started hindering the healthy and functional urban living and activities of Istanbul. In contrast to the concentration trend in the central parts, prominent situation in the peripheral areas of Istanbul is the outspreading/sprawls of housing and urban areas represented by squatters (overnight settlements) as shown in Figure 1.3.12. In this context, the great task of Istanbul is to tackle these urban problems. The IMM Master Plan attempts to provide solutions to these two major problems simultaneously through the combination of regenerating the central built-up areas and the development of new

urban cluster in the city's peripheries.

Population Density



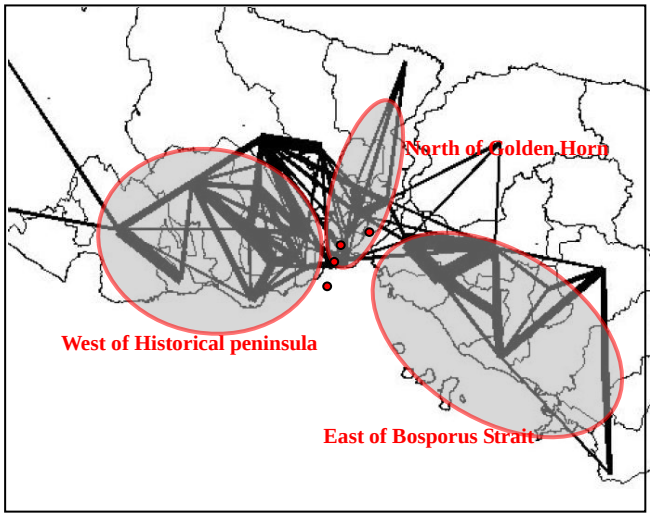
Employment Density

Source: *ibid.*

Figure 1.3.13 Population and Employment Density by Zone, 2005

3) Spatial division affecting land use

In the congested urban areas densely populated zones are located closely in or around dense employment zones over the central parts of Istanbul. Due to such proximity of housing areas with working areas, commuting travel is quite short in Istanbul compared to other mega cities in the world. Actually most traffic are contained in three limited areas as shown in Figure 1.3.14.



Source: Joint Study Team

Figure 1.3.14 Three Traffic Areas in Istanbul, 2005

Figure 1.3.14 illustrates the traffic links and volumes between zones where width of link shows the traffic volume. The larger the traffic volume is the closer and stronger are the social and economic relations between the zones, such as commuting and shopping activities. Based on the traffic volume, closely related zones are grouped into 3 traffic areas - West of Historical peninsula, North of Golden Horn, and East of Bosporus Strait. This implies that most of the daily traffic activities are enclosed in each of these three traffic areas, which means that relatively few trips go to the other traffic areas. Istanbul's urban areas have been historically a developed in the three areas separated by the Bosporus

Strait and the Golden Horn. Although bridges connect the three traffic areas at present, local activities have not drastically changed since its land use was formed through the city's long history. More specifically, it may be interesting to know that urban cores like Eminonu, Beyoglu, Sisli, and Besiktas attract less traffic volume from the zones belonging to other traffic areas.