

4. Transport Master Plan: Strategy and Structure

4.1 Toward a More Demotorized Society

All large cities in the world, without exception, have been working hard to cope with the rapid pace of motorization. They constructed ever extensive networks of trunk roads, widened streets and expanded parking spaces, while introducing better signal systems and elaborate traffic controls to improve the efficiency of the available road capacity. In most cities, nonetheless, the transport demand kept growing far more rapidly than the accretions to the transport networks. People are fed up with chronic congestion that besets urban life and the authorities are thinking less positively about investing in new transport infrastructure. The lesson learned painfully from the perseverance of the last five decades is this. The growing urban congestion is not stoppable by the supply of roads.

The growth of cities is shaped by land use and transportation. The former defines the spatial distribution of urban functions and the latter connects them. The municipal government of Istanbul plans to expedite the east – west metropolitan expansion while inhibiting the urban sprawls in the north – south dimension. It aims to establish additional CBDs in the metropolitan area. If the urbanization should extend lineally eastward and westward, the future motorized person trips would have to travel ever longer distance, overloading the already congested roads. The planned addition of CBDs is the most apposite policy option for easing the pressure of congestion.

The keynote of the future transport policy in Istanbul rests on the shift from private automobiles to public transportation and the shift from bus services to railways. Such shifts are indeed the global trend, and probably the only available option for Istanbul, the city about to face a full explosion of motorization.

The strategy of metropolitan Istanbul is aimed at transit oriented development (TOD). It mainly consists of a railway network appropriately laid down to provide stations within 500m to 700m from any place in the CBDs, the park & ride system based on the network, and the more evenly mixed distribution of urban functions suited to the expected multi-polar restructuring of the city.

IMM officially announced the railway extension of well over 500km. If the intention is to transform Istanbul to a more “demotorized” urban society, 500km is not enough. The development of the railway network should be the long-term commitment, in both planning and financing, that goes hand in hand with consistent land use planning.

4.2 Do We Really Need More Roads?

Quite a few people openly profess, “the demand increases precisely because more roads are provided,” or “it is of no use to construct any more roads, because the congestion will never disappear as more and more people will begin to drive their own cars,” or “the road development is the prime culprit of air pollution by exhaust gas.” This is going too far too soon.

The full development of an urban railway system takes ten to twenty years. It would probably take just as long, if not more, to have the planned shift accepted and welcomed by the city population. A demotorized society requires a long gestation period to mature, while during all that time Istanbul and other big cities in the world are burdened by seemingly unstoppable motorization.

The undeniable fact is that the roads have always buttressed and will continue to support the urban economy. Even if the planned TOD be completed, roads would remain the mainstay for urban logistics, taking care of both trunk transportation and door-to-door delivery. The clogging up of roads means the asphyxiation of urban economy and population. It is essential to provide the road capacity that allows some reasonable service level (e.g., the V/C

ratio of less than 0.7 and the average driving speed of 10km or more per hour). Istanbul, like other cities in the world, will continue investing in the road construction and improvement, while gradually shifting the primary emphasis toward railways. Notably, the investment in roads must start nearly from scratch in the city’s newly urbanizing areas.

4.3 Transport Demand Management (TDM)

When the supply of transport services lags far behind the demand growth, the users need be persuaded to forfeit some of their individual freedom of mobility. In order to have them ride some public transport means instead of driving their cars, a certain combination of carrots and sticks, so to speak, is necessary. Taking into consideration many TDM alternatives tried elsewhere in the world, the following four measures are proposed for metropolitan Istanbul.

- Collection of tolls from highway users (as taxation on congestion)
- Prevention of long hour parking in the CBD by charging higher parking fees
- Introduction of the park & ride commuting system
- Introduction of the traffic cell system in the historic conservation area in the CBD

4.4 Development Finance and PPP Schemes

The master plan projects are estimated to require at least US\$40 billion as discussed in the next section. It is extremely difficult to get the necessary finance solely from the national and the municipal government coffers. Judging from the past performance, one third of the total investment must be financed by sources other than the public sector.

The government of Turkey has a tendency to resort to the BOT scheme for financing large-scale projects like tunnels, bridges and railways that charge the users. However, the operation of public transport services is not very profitable by the very nature of being “public”. It takes long time to recover the large initial investment cost and the operation in the meantime must be prepared for many risks. Therefore, the private capital is hardly likely to show interest in public transportation. Moreover, there are not many instances in the world of successful ventures by the private investors.

If the external borrowing and the issuance of bonds are to be excluded, it is a very critical issue how to generate a secure source of self finance. In accordance with the user-pay-principle or the polluter-pay-principle, the tax rates on gasoline and diesel can be raised or new taxes might be introduced by earmarking them for transport investment. However, Turkey is already one of the countries where fuels are most heavily taxed (US\$2.9 per liter of gasoline as of August 2008). It will be very difficult to raise the gasoline tax any higher. The viable alternative worth consideration is to collect tolls from highway users.

Assuming that the private capital be attracted to participate, it is possible to devise the PPP scheme for railway development in which the private and the public sectors duly share the risks involved in the investment and operation. To create a source of fund for the public sector contribution, the master plan proposes the establishment of the Transit Development Acceleration Fund (TDAF) with time-limited legislation.

5. Network Planning

5.1 Definition of Transport Network and Approach to Network planning

There are many transport projects in various stages of development or preparation in metropolitan Istanbul. Some are already under construction, being tendered or readied for tender, while others are being designed or formulated. Thus, the formulation of a master plan is farthest from the freehand drawing on a new canvas.

The present study listed up the committed projects that had been already under construction or officially approved by the municipal assembly. The transport network at the end of 2007 plus these projects were then defined as base network. Almost all committed projects are scheduled to be completed by 2013, and a few during the period of 2014 -2018.

All other projects and proposals, viz., those awaiting official approval or currently under formulation by the national and the municipal government and others proposed by the present study or by the private sector interests, were added to the base network and the result was defined as maximum network.

The maximum network would require an outlay of capital too huge to be realistic, and moreover it might contain overlapping proposals and unfeasible investments. Some projects might be unwelcome from the viewpoint of environment and desirable land use. Therefore, it is necessary to scale down the maximum network after careful project evaluation and prioritization. The downscaling must also examine the financial and administrative capacity of the executing agency or agencies. It is not possible otherwise to prepare a master plan of reasonable feasibility and sound investment efficiency. In addition, the master plan network must possess a clear strategic orientation that would ensure an appropriate spatial balance among regions in the country.

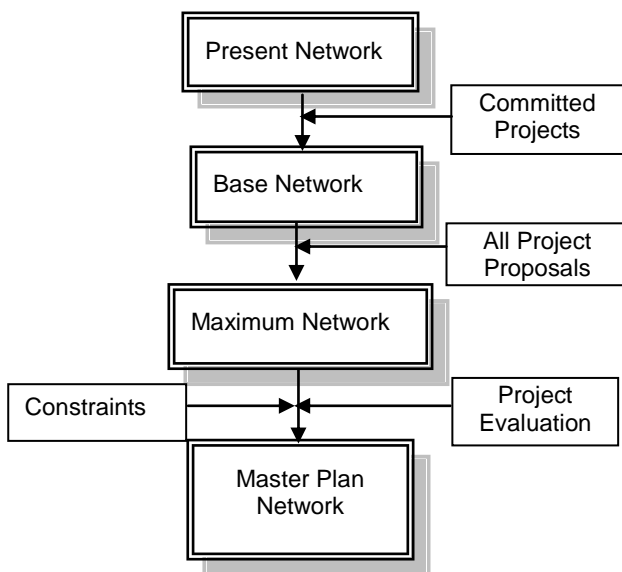


Figure 5.1.1 Definition of Master Plan Network

5.2 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.

5.3 Available Financial Envelope

The municipal investment of Istanbul in the transport sector (including maintenance and repair) was 2.28 billion liras (US\$ 1.9 billion) in 2007. The amount is equivalent to 1.8% of GRDP in the study area. In other major cities of the world, the transport investment ranges from 1.0% to 3.0% of GRDP, but during the construction boom the level often rises to 4.0% or even exceeds 5.0%.

Metropolitan Istanbul is currently in the cradle stage of urban railway development and aims at the total extension of 500km. The entire transport sector investment worth 1.8% of GRDP is unlikely to finance this development. By anticipating the full-scale private sector participation and the creation of new financial sources, the investment target is set at 2.7% of GRDP, roughly 1.5 times the amount of 2007. Because the present study assumes the GRDP growth of 5.2% per annum, the available financial envelope would reach YTL 7.21 billion (US\$6.01 billion) in 2023. The cumulative total during 2009 – 2023 would add up to YTL48 billion (US\$40 billion).

The transport sector investment over the past five years allocated 38% to roads and bridges, 30% to railways, 20% to maintenance and improvement and 12% for others. Because the cost of maintenance and improvement is likely to rise in the future, the combined share of railways and roads would be about 60% of the total outlay of US\$40 billion. The share of roads and bridges always exceeded that of railways so far, but their positions would be reversed in the future. The infrastructure development for the master plan network assumes the financial envelope of US\$40 billion shown in Figure 5.3.1 for roads and railways.

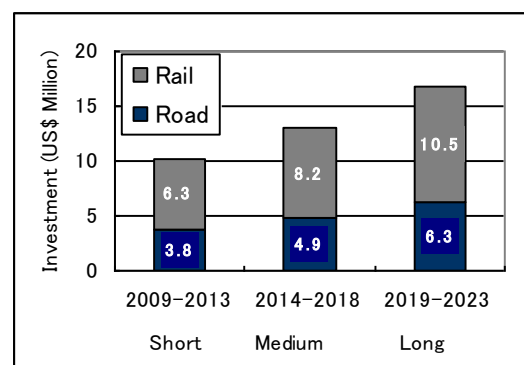


Figure 5.3.1 Financial Envelope Available for Roads and Railways

5.4 Base Network

(1) Committed Projects

Many transport projects are currently in various stages of preparation or implementation, viz., (a) being studied or formulated, (b) under detailed designing, (c) being tendered, or (d) under construction. Those under detailed designing are classified as committed projects along with those in the later stages of implementation, because they were officially approved at the municipal assembly. The committed projects by definition are meant for implementation and constitute part of the base network as given. They were not subject to the evaluation by the present study.

As of March 2008, 93 road projects and 15 railway projects are officially committed. 81 road projects are scheduled to be completed by 2013, and the remainder by the end of the subsequent five years. 7 railway projects are scheduled to be completed by 2013 and the rest during the next five years.

The committed projects are located somewhere in the built-up areas of Istanbul, except a few road projects. They have been proposed and approved basically to catch up with the runaway demand. They are hardly meant for the urbanization envisioned for the future Istanbul.

(2) Total Investment in Base Network

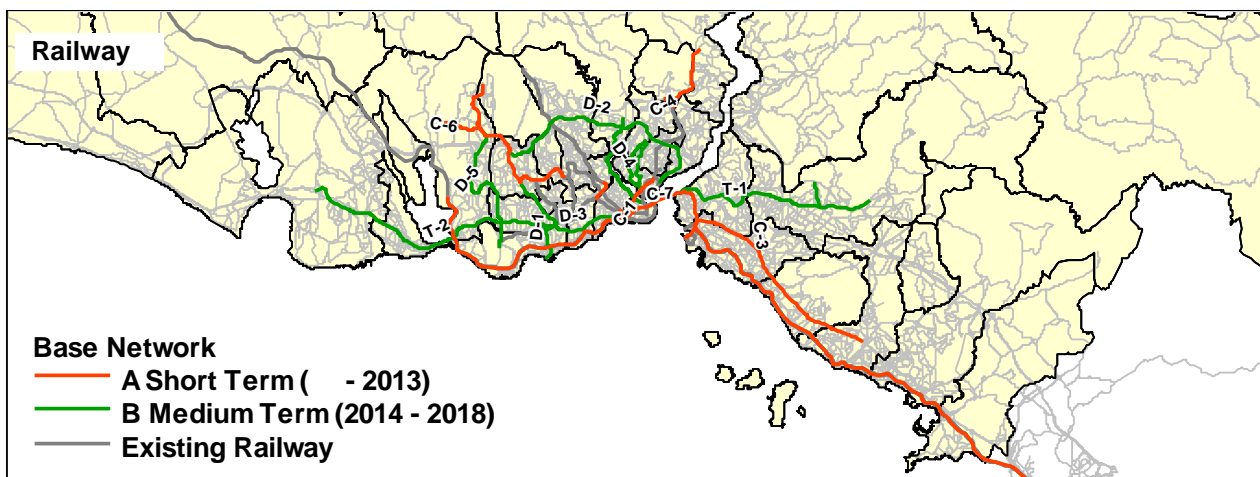
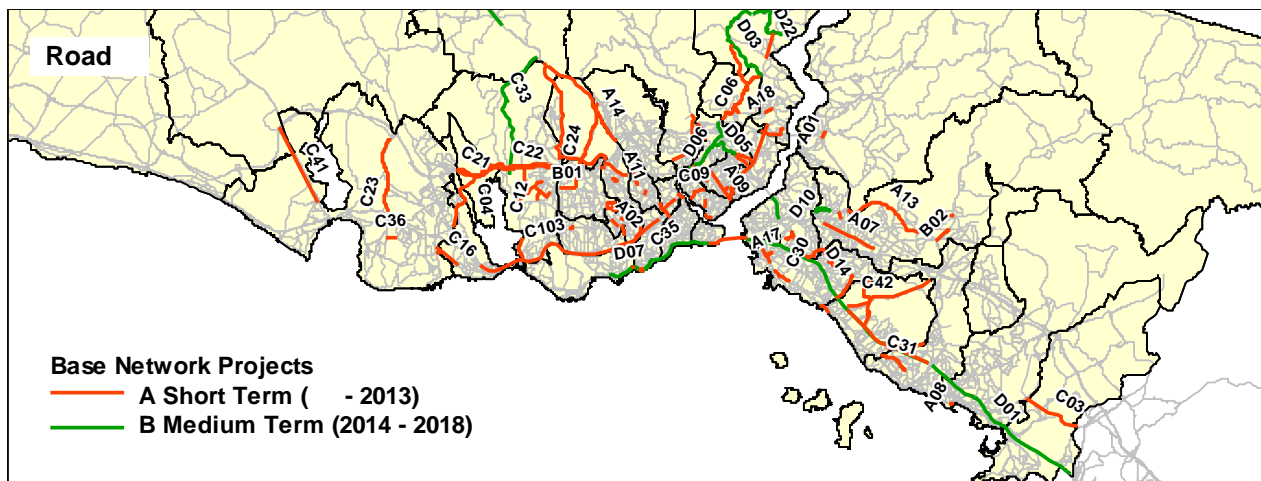
The total cost of the base network projects was estimated by utilizing the most recent information available on the committed projects and their schedules of implementation. The details of the estimate are shown in Appendix 3. The total investment amounts to YTL19.2 billion (US\$16 billion), with 27% allocated for roads and 72% for railways.

As mentioned in 5.3, the estimated financial envelope available for transport development is US\$40 billion over the period of 2009 – 2023. The share of roads and railways in the envelope amounts to US\$24 billion, of which US\$10 billion is for the period of 2009 - 2013. The short-term investment cost of the base network projects, as shown in Table 5.4.1, exceeds the available finance. The front-loaded budget spending will be necessary to implement additionally the projects proposed by the master plan for the same period.

Table 5.4.1 Cost of Base Network Projects

(US\$ million: 2008 price)

Subsector	2009 - 13	2014 - 18	Total
Roads	3,837	487	4,324
Railways	8,778	2,891	11,669
Total	12,615	3,378	15,993



(3) Demand and Congestion in Base Network

Figure 5.4.2 shows the OD traffic forecast for 2023 as assigned onto the base network. Although not as severe as the “Do Nothing” case shown elsewhere, the congestion level of over 1.5 is found on many links in the network.

The average congestion ratio (or the average V/C ratio of all the network links, weighted by the link distances) is 0.47 for the present metropolitan network as a whole and 0.75 for the CBD. The same ratio estimated for 2023 is 0.79 for the entire base network and 0.81 for the CBD. The average congestion level of the entire base network will be just as high as that of the present CBD.

The traffic volume (in person kilometers) on the links with congestion of 1.5 or more makes up 20% of the total on the present network. The same share forecast for the base network in 2023 is nearly 40%. This clearly shows that the base network will not be able to cope with the expected growth of demand. The network is in need of investment larger than the committed projects.

Table 5.4.2 Average Congestion Ratio

Year	Network	Metrop. Area	CBD*
2006	Present	0.47	0.75
2023	Present	0.93	1.00
	Base	0.79	0.81

*The area surrounded by TEM, Basin Expressway and Kozuyayag Anadolu Expressway.

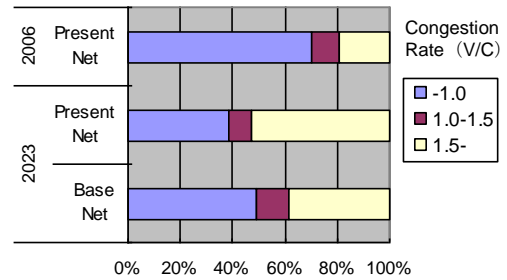


Figure 5.4.3 Percentage Composition of Traffic Volume by Level of Link Congestion

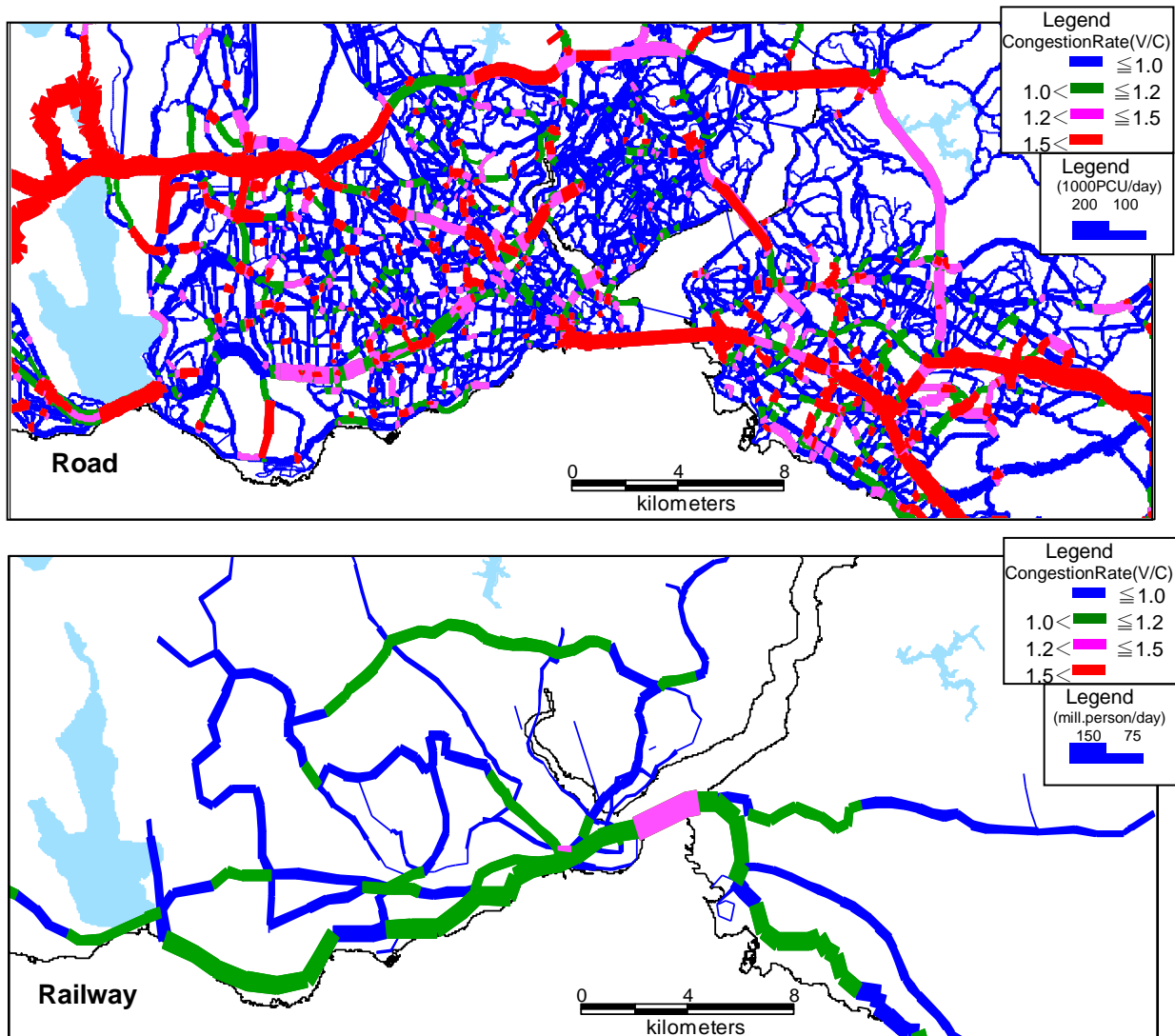


Figure 5.4.2 Traffic Assignment on Base Network for 2023

5.5 Master Plan Network

(1) Master Plan Projects

The projects selectively added to the base network were those currently under study and project ideas of reasonable relevancy. Moreover, a considerable number of projects were conceived and proposed out of the discussions and analyses undertaken in the course of the present study. All these projects or project ideas were added to the base network to obtain the maximum network. The addition in the maximum network totals of 55 road projects (proposals for the built-up areas are bundled into project packages) and 23 railway projects. Their total cost amounts to US\$31.9 billion (US\$12.3 billion for roads and US\$19.6 billion for railways). The amount exceeds by 33% the balance left after subtracting the total cost of the base network projects (US\$16 billion) from the financial envelope of US\$40 billion.

78 additional projects in the maximum network were evaluated by their economic, financial and environmental justifiability as well as by their relative significance for the future transport development. The results of evaluation were then comprehensively examined to select 68 projects for the master plan period (2009 - 2023), the remainder being left for completion later than 2023. In the order of priority, the projects were assigned to the short term (2009 - 2013), the medium term (2014 - 2018), the long term (2019 - 2023 and thereafter).

The summary of the evaluated projects is shown, with suggested implementation schedules, in Annex C. The short-term projects are defined as those that would be completed by the end of the said five years, and likewise for the medium- and long-term projects. If a given medium-term project takes long time to complete, its implementation must be started that much earlier to be completed by the end of the assigned five-year period.

Figure 5.5.1 shows the distribution of master plan projects per period of implementation. The largest road project concerns the east-west transversal road including the 3rd Bosphorus Bridge. The road sections on the European and the Asian side will be completed before 2019 with the bridge construction completed during 2019 - 2023.

The short-term road projects mainly consist of packages of small projects with high expected economic impact in the built-up areas and similar packages for road network development in the western part of Bahcesehir District with rapid population growth. The Asian-side section of TEM will be completed during 2014 - 2018. The road network development package along B. Cekmece - Silivri - Gumusyaka is scheduled for the medium- and the long-term implementation.

None of the railway projects is for the short term, because their development takes long time to complete. Although most of the proposed projects must be started during 2009 - 2013, their completion is scheduled for the medium or the long term. The 3rd Bosphorus Bridge will serve as both road and railway links. The completion of the railway across the bridge is scheduled for the same period (2019 - 2023) as the road link.

(2) Total Investment in Master Plan Projects

As indicated in Annex C, 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.

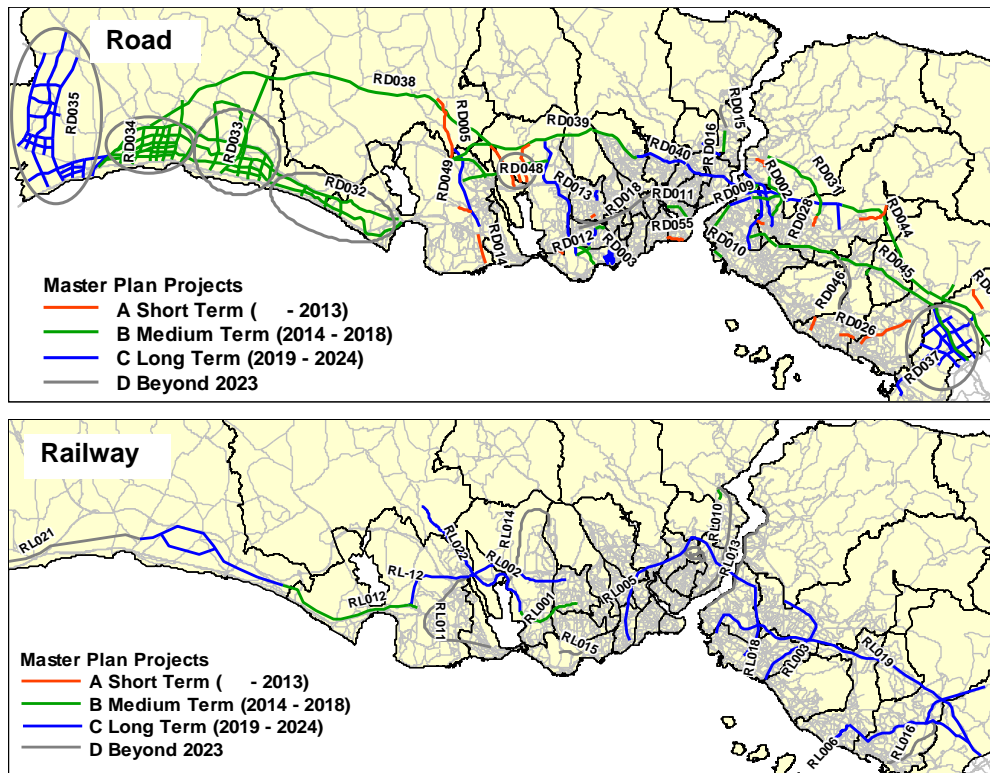


Figure 5.5.1 Master Plan Projects

Figure 5.5.2 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.

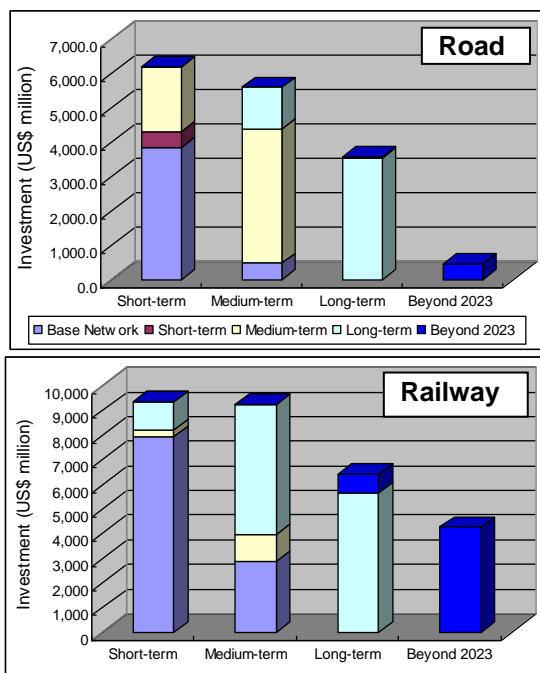


Figure 5.5.2 Investment in Master Plan Projects by Period of Completion

(3) Impact of Master Plan Projects on Congestion Level

As mentioned earlier, the estimated average congestion ratio in metropolitan Istanbul is around 0.47 in 2006 (Table 5.4.2). In the “Do Nothing” case, the ratio would rise to 0.76 by 2023, which is a little worse than the present ratio of 0.75 within the CBD.

When all master plan projects are completed as scheduled, the ratio of the entire network would be 0.56 in 2023, a clear improvement over the “Do Nothing” case. The estimated ratio is worse than the present level, but the CBD shows a great improvement with its ratio down to 0.59 by 2023.

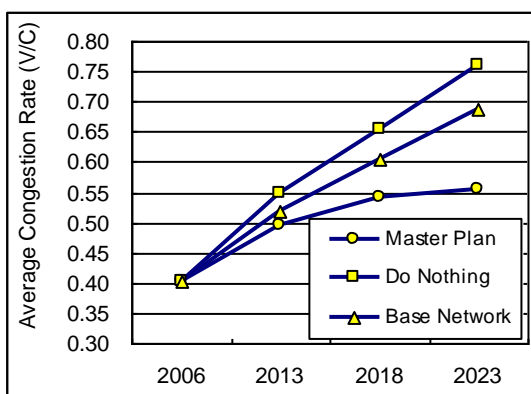


Figure 5.5.3 Average Congestion Ratios by Scenario of Network Development

To look more closely, the links with traffic volume exceeding link capacity within the present CBD add up to some 230km, or 10% of the total CBD network length. The aggregated traffic volume (in person kilometers) on these links accounts for 25% of the CBD network total. With the completion of the master plan projects, the two rates will be down to 8% and 17% respectively in 2023.

(4) Bosphorus Crossing

The Bosphorus crossing has always been the biggest issue for the transport planning in Istanbul. The daily passenger trips across the Strait are currently 1.12 million, and expected to increase to 1.76 million in 2023. Figure 5.5.4 compares the present situation (2006) of capacity and passenger traffic with two cases of network development in 2023 (ferries are not included in the capacity figures).

Assuming the present modal split as given, the aggregated capacity of two existing bridges is, in theory, 440,000 passengers per day. The daily traffic continued to grow at an accelerating pace toward the end of the 20th century and thereafter, now 1.7 times the available capacity. The rapid increase of ferry passengers during the past decade was caused by this widened gap between the capacity and the demand.

When the Marmaray railway crossing and the road tunnel are completed, the total capacity for Bosphorus 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.

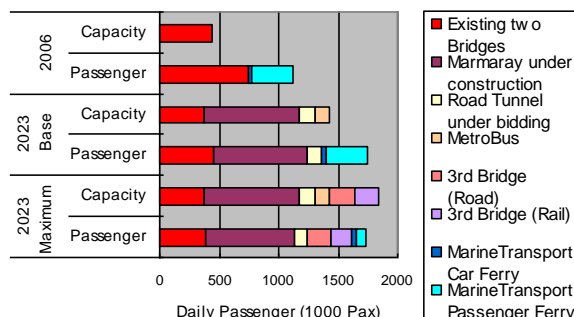


Figure 5.5.4 Bosphorus Crossing Capacity and Passenger Traffic

(5) Transport Infrastructure for Western Urban Development

The afore-mentioned land use plan estimates that the western area from B. Cekmece to Silivri would absorb a population increase of 2.5 million by 2023 and concludes that the area needs the development of the urban core with appropriate urban services. To attract and absorb the population of this size, it is requisite to invest heavily, and as early as possible, in the basic economic and social infrastructure like transport, energy, water supply and sewerage.

In the transport sector, it is necessary to start the network development of trunk and access roads and the extension of railways into the area prior to other investments. At the very least, the land acquisition necessary for such transport facilities must be completed before the urbanization begins to pick up. The master plan proposes a number of project packages for road network development to be implemented over 15 years in the newly urbanizing areas.