

# Existing Case of Transportation System in Turkey and Transportation Trends in Istanbul

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**Abstract:** Transportation sector is one of the most important elements of a country's economy with its highway, railway, airway and seaway modes, besides the information and communication infrastructure. Transportation sector has a pattern that affects the society continuously with its economic and social inputs that has a significant role in economies of countries in terms of being an important part of manufacturing process and effects of sizable investments on economy. Demands of more comfortable, more reliable, more safe and more punctual transport in developing economy is an arising trend worldwide and this shows an increase the importance of the transportation sector. Establishment of an efficient and functional transportation system is closely related with traffic safety, intermodal integration and balanced modal distribution. In Turkey, an important improvement has been achieved in these issues, but also some basic constitutive problems are still continuing. These constitutional problems can be summarized as providing traffic safety, integration of innovative implementations to transportation system, enhancing of infrastructure and an effective usage of existing infrastructure.

**Key words:** Traffic safety, modal share, railways, transportation system, transportation policies.

## 1. Introduction

Some solutions to the transportation system problems particularly traffic safety, necessitate a range of analysis that consists of benefiting technological improvements (ITSs: intelligent transportation systems), providing intermodal integration and balanced modal distribution, directing consumption culture, giving priority to environmental friendly and sustainable approaches [1].

ITSs have rapidly developed within the sustainability framework worldwide, which are considered on service and security control, as priority especially in the USA, Germany, UK, Australia, France, South Korea, Sweden, Japan, Netherlands, Canada, and Singapore. ITS experiences and activities in these countries are developed according to different needs that has a history of 30-40 years. In Turkey EDS (electronic detection system) has been applied in Istanbul as a first sample of ITS. Also, some significant improvements

and spreads have been seen in some countries, such as, Brazil, China, Thailand and Taiwan. Table 1 shows the passenger traffic by modes in different countries.

ITS is very significant for obtaining the road and rail traffic safety. Nowadays railway traffic safety is mentioned with HSR (high speed railways) more, but it contains urban railways too. Another function of ITS is running the system suitable to the mentality of the intermodal integration and balanced modal distribution.

ITS is directly related with urban mobility and enhances its existing functions. For existing effects of Bosphorus Bridges, Marmaray, developing urban railways and existing case of marine ways in Istanbul are investigated and evaluated in detail in this paper. Existing case and future perspective of marine ways in Istanbul have to be investigated, examined and analyzed in detail.

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**Table 1 Passenger traffic by transportation modes [2].**

	EU – 27	USA	Japan	China	Turkey
Billion passenger/km	2010	2009	2010 (1)	2010	2010
Highway	5,248.1	6,318.5	853.7	1,491.4	226.9
Marine way	38.1	0.6	4.3	7.2	0.5
Railway	493.9	58	393	876.2	5.5
Airway	524.2	887.9	73.8	403.2	18

It is clear that to meet the economic development targets of Turkey, there is a need for transportation system that works efficiently and reduces the problems at minimum levels. However, economic development, as either the result or the reason of the social development and cultural development necessitates an integrative approach [1].

Although economic development is directly related to presence of modern transportation systems, because of urbanization and related issues, the necessity of qualitative development that supports the quantitative improvement and advances an integrated approach to economical-social-cultural and political phases in transportation and urbanization planning is clear.

## 2. Modal Share and Existing Case in Turkey

Especially in Istanbul and generally in Turkey and in our region, the land structure is very suitable for cableway systems, maritime lines, railways and inner waterways are suitable for investments. As a result, multimodal transportation has the way of land characteristics, geography, location, population characteristics, economy, culture and similar features. Ensuring balanced modal split and intermodal integration has a significant point by the reasons of energy saving, sustainable transportation, enhancing of service parameters, reducing of traffic congestion sourced problems and providing highway traffic safety.

As is known, highway transportation mode has 90% modal share at modal distribution in Turkey. In last years, significant development has recorded about balanced modal distribution, but it is not in suitable case yet. Not providing a balanced modal distribution and intermodal integration in a transportation system

has negative effects on highway traffic safety too. In Istanbul, metro and light railway system investigations have been realized for balanced modal distribution and intermodal integration. And 148-km urban railway lines have been done in total in Istanbul and Marmaray has been in service in 2014, so a high amount of passenger transport have been realized in Istanbul [2]. It is necessary to increase mass transport values that is an important part of traffic safety and an effective transportation system, an important advance is recorded in Istanbul about this issue. But beside of this, traffic accidents that occurred in Ramadan Feast have increased in last years, which presented the necessity of more detailed studies by different aspects. In this notice, important information is given about Interactive Signaling System that is developed by last innovations, presented to Security General Directorate and approved by Highway Traffic Safety Strategy Coordination Council. In conclusion, urgent presentative proposals for providing traffic safety of rubber tired mass transport by the parallel of smart technologies are given.

Highway transportation mode saves its rate in modal distribution in Istanbul transportation system. The rate of highway transportation mode has been increased in Istanbul for last 30 years because of the construction of Bosphorus Bridges. The construction of the bridges accelerated the developing of two sides of the city towards either in Bosphorus axis or in Marmara Sea axis and inner parts, and strengthened the multi-centered characteristic of Istanbul. This result has supported the enhancement of car ownership and change of population-employment distribution to Asian side's advantage directly or indirectly. When examining modal distribution in Istanbul, it is predicted

that railway modal share will enhance 30% with metro line investments in intra urban modal distribution and planned 11 million passengers/day will be transported by railway systems in 2023. In modal distribution of Istanbul, it is a necessity that the seaways have to take 20% modal share and today this share is very low from this target [2].

Increasing of modal shares of railway (Marmaray) and seaway will reduce the highway traffic between two sides of the city. Plans of Istanbul transportation system have to be provided to realize by getting related precautions and if necessary by directive regulations. In this notice, effect of Bosphorus side passes to city transportation related to 40 years' Bosphorus construction period with side passes transportation data, under the new condition of Marmaray and metro investigations and a prediction are going to be presented about existing and planning transportation investments.

### 3. Implementation of ITSs and Safety Studies

In parallel to the infrastructure and environmental necessities in the context of railway investments in Turkey, a detailed evaluation is presented surrounding wall that is one of the significant railway safety elements. As is known, another important aspect of railway safety is a railway corridor neighboring a residential area case. Though surrounding wall is a solution for preventing the entrance of people and animal to the railway corridor, its different implementation related to material selection and technical combination, concrete wall implementations, station platform neighboring safety precautions, education precautions, public informative campaigns, landscaping solutions is going to be evaluated in comparison with different country implementations [2].

In this context, surveying and evaluation results of the Ankara-Eskisehir HSR (high speed railway) section of the Ankara-Istanbul High Speed Railway line are discussed. Therefore, solutions and studies in different countries experiences are evaluated with

different researches in projection period. In the recent years, by developing a projection on high speed railway, and light railway system investments, it is a necessity to evaluate the Ankara-Eskisehir HSR line, the Ankara-Konya HSR line, the Eskisehir-Konya HSR line and lastly the Ankara-Istanbul HSR line in terms of railway safety with developing technology. So in this regard, the necessity that occurs from existing surrounding wall implementations and railway investments is evaluated in detail with regard to innovation [3].

ITS in our country has been planned to be structured in a systematic strategy document that has been prepared for public dissemination. Intelligent Transport Systems Strategy Document has been prepared to increase the usage of ITS in roadway by the Turkish Transport, Maritime Affairs and Communications Ministry. ITS applications have always headed the pool of the legislation and its policy. First, technology has been improved, then in the applications, which used this technology, has been invented, but only after that applications have become as widespread usage by local, application policies and then legislations have been introduced [4].

High balanced modal distribution and inter-modal integration are indispensable requirements of transportation systems' reliability functionality. In terms of Turkey's transportation, there is a high ratio of highway transportation on modal distribution and the insufficient ratio of "Mass Transport" on "Highways" and any other modes continue to be a problem, despite existence the recent efforts for reducing this imbalance among the transportation modes. Car ownership ratios are very high in Turkey as a natural outcome of recent consumption culture practices. It can be seen that there are a number of ways to prevent high ratios of highway transportation in modal contribution with the human focused approach and using ITS for true location and time decisions. Fig. 1 shows an ITS related instrument usage in different countries worldwide.



Fig. 1 Automatic subway line cities by year 2013 [5].

#### 4. Transportation System Developments in Istanbul

In this context, the use of multimodal transportation systems for Istanbul was reviewed. It was seen that there is a high imbalance towards the use of highway transportation. Especially, the marine and the railroad lines are underutilized and have not developed properly over the years. Due to extensive use of highway transportation, inter- and intra-city traffic experiences extensive congestions, delays, time and monetary losses. One of the bottlenecks of this congestion is at the Bosphorus Strait where there are two long span bridges.

Recently, one of the bridges on the strait, FSM (Faith Sultan Mehmet) Bridge, has undergone rehabilitation, thus offering reduced traffic capacity. This reduced capacity is taken partially by the other long span bridge (Bogazici Bridge) and partially by the marine transportation lines. In this paper, the traffic flow data before and after the FSM Bridge maintenance are

presented along with the marine line data, especially for the redistribution of the traffic during the rehabilitation work at the FSM Bridge. It was concluded that with a well-developed and designed strategy, the marine lines can provide a more balanced modal distribution and more efficient transportation for the city of Istanbul. Table 2 shows population improvement and Table 3 shows residential and economical values in Asian-European sides in terms of years.

When Istanbul is considered, we can assume a level of 20% for marine transportation to be suitable for Istanbul's inter-modal distribution based on the presence of natural inner water lines. However, because of the high personal car ownership, lack of effective transportation demand-supply management, smart line decisions, effective investment strategies, existing contribution of marine transportation to overall transportation can be seen to be far from this "ideal figure" for Istanbul. Table 4 shows the modal distribution in Istanbul in terms of years. Table 5 shows the modal distribution at the Access of Bosphorus Bridge.

Table 2 Asian-European sides population distribution in Istanbul by years [5].

Istanbul	1970	1980	1990	2000
European side	76%	69%	66%	64%
Asian side	24%	31%	34%	36%

**Table 3 European-Asian sides residential, population and car ownership values in Istanbul by years [5].**

Istanbul	1970	1980	2000
Population	3,500,000	4,800,000	12,900,000
Number of private cars	60,000	200,000	1,800,000
Private car per person	0.017	0.042	0.140
Residential ratio of European side	80%	77%	71%
Residential ratio of Asian side	20%	23%	29%

**Table 4 Modal distribution in Istanbul by years [6].**

Transportation mode	1987 (%)	1996 (%)	2006 (%)
Private car	19.30	19.20	26.34
Taxi+Dolmush	10.20	9.40	4.75
Service vehicles	10.40	11.50	21.48
Buses (İETT+public private buses)	35.20	34.10	24.12
Minibuses	19.00	19.60	16.71
Railway system	3.80	3.60	4.60
Marineways	2.10	2.60	2.00

**Table 5 Modal distribution in Bosphorus bridges accesses [6].**

Transportation mode	Percentage (%)	
Private car	23.80	
Taxi	2.00	
Service vehicles	13.30	
Dolmush	2.70	81%
İETT	33.10	
Private public buses	5.70	
Motorbikes	0.40	
City line ferries	14.80	
Fast ferries	1.50	19%
Motor boats	2.40	

Marine transportation ratio in modal distribution has to be 20% in Istanbul, but this ratio is much lower today. In Istanbul's modal distribution, highways have extremely high ratio and also car ownership is also high. According to the statistics, only 10% of total capacity of city ferry lines is utilized. If 50% of this capacity were utilized, it would remove 500,000-600,000 cars from the traffic. The maintenance on the bridges in Istanbul is a big opportunity for utilizing and demonstrating the importance of marine transportation. In the following sections, the redistribution of the public transportation necessity is presented and the current multimodal transportation condition is discussed [6].

Key issues in Transportation System of Istanbul are modal integration and intermodal distribution. While discussing these problems, it is also important to

consider the political, technological, economic, social and cultural issues for a very old and historic metropolitan city such as Istanbul. The transportation system problems are originated from the consumption culture, demand-supply management, lack of effective and efficient decision process and human focused approaches. In Istanbul, unbalanced high ratio of highway transportation in intermodal distribution and not having sufficient mass transport ratio within all transportation modes are issues to be addressed. Railway systems and marine transportation have not developed and been utilized in intermodal distribution. We anticipate that both rail and marine transportation can provide 20% each in total modal distribution for either intercity or intra-city. Currently, the traffic congestion, cost and time loss on highways, especially

on two main long span bridges are bottlenecks of Istanbul's transportation [7].

## 5. Conclusions

It is an open issue that the economic progress goals of Turkey can be ensured with existence of functional transportation systems. However, economic progress as reason and result of social and cultural progress necessitate an integrated approach. Transportation and urbanization are either reason or result of economic, social, technic, cultural and political developments and phases.

Accordingly the problems of transportation system particularly traffic safety necessitate a range of solutions that contain technological advancements (smart transportation systems), the providing of intermodal integration and balanced modal split, management of consumption culture, featuring of environmentalist and sustainable approaches. Sustainable approach is not only a better choice, but also obligation for awareness of the people about consumption culture.

The basic focus of transportation is people. The parameters of the service for people are safety, comfort, punctuality, accessibility and cost. These parameters provide a cross-check possibility of the people oriented level of a given system [8]. The preciseness and convenience of data that are sourced by level of service parameters performance can be tested by level of perception mentality of the society in terms of consumption culture. All of these express a steady bond and continuous-correlative relationship between not only urbanization-transportation-planning but also technical-economic-sociologic-politic-cultural point of

views [9]. Achieving the targets and gaining these perspectives can be realized with plan integration, multi-disciplinary integration, long-term vision and interdisciplinary base.

In this context, beside the improvement that is sourced by high scaled investments, because of basic planning problems and lack of multi-disciplinary approaches, the level of this improvement can be reduced [10].

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