

Review Article

A review of modal distribution and sea transport in Istanbul for information (accessibility) process

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Abstract

Highways in Turkey have unstable distribution in its distribution and mass transportation cannot get the share that it needs to be, which makes traffic problems getting worse. Local governments are aiming to manage the cities more effectively with the reform process. To minimize traffic congestion and congestion-related problems technical solutions, political decisions, and society's governance of the changing consumer culture habits are required. In this research data on modal distribution of transportation modes in Istanbul are presented and the effect of mass transport in the city of Istanbul especially the seaways on Bosphorus bridges traffic congestions was investigated.

Keywords: Modal distribution, mass transportation, maritime transport, car ownership, highway transport mode

1. Introduction

After 1950's, automobile has started to form the urban especially in North America and Europa. Firstly, the areas between the railway line have expired, then the cities have extended averagely 50 km to periphery. The main characteristics of these urbans are disaggregation of residential areas and business areas, multi centered structure, low density locations and increasing of travel distances because of the other factors. Although the number of automobiles per 1000 person of United States of America is 1.5 times of Europe, usage of automobile of United States of America is 2.5 times of Europe (Ilıcalı et al).

In Turkey, the uneven weight of the highway transport mode has been maintained for many years and in recent years the situation has been improved. In general, the tendency of distribution in the transportation sector has shown that over 90% of the highway has a weight in both passenger and freight transport (Ilıcalı et al). During the last years of the Ottoman Empire and during the first decades of the Republic, railway transportation was mainly invested, followed by investments in the highways with political engagements (Kızıldaş).

The number of metropolitan municipalities in Turkey is more than 30 and the powers and responsibilities of the metropolitan cities cover not only the central provinces but also the whole province boundaries (Román et al). In this sense, both quantitatively increasing as well as qualitatively increasing investment in urban planning and transport are also vital. In recent years car ownership rates have increased exponentially in Istanbul due to the increase of the Gross National Product (GNP) (Kızıldaş).

In this context, the road investments made are not enough alone and in the long run the problem of traffic congestion cannot be prevented effectively due to lack of planning, integration, and unrelated transportation master plan-reconstruction plan originated from them. Furthermore, the rates of car ownerships in Turkey are higher than most European and USA cities (Altan et al).

The main problem in Istanbul is the car has a high rate of time in terms of traffic during the day. This is related to the diversity and productivity of the options provided to the user as well as to the 'consumption culture' in the first place (Altan et al). Promise: the fact that Kadıköy-Kartal Metro Line has been realized is an advantage, and there are things to be done to ensure the workability of this line and to reduce traffic congestion as much as possible (Kızıldaş). Because, here, integration is the forefront. As we have already explained, this includes 'physical, spatial, commercial, operational' integration. In this sense, to make the metro line efficient, it is the first thing that comes to mind such as minibus that feeds this line, good design of bus lines, provision of large parking lots to main stations and ticket integration. This research presents modal distribution of Istanbul transportation system and the effect of mass transport on Bosphorus bridges traffic congestions (Chen).

1.1. Transportation Data

The rate of car ownership in Turkey and the use of highway transport are on extremely high levels. The use of public transportation is not at the desired level yet (SUMP). In this context, the use of public transportation, the increase of transportation infrastructure investments and usage rate of subway and light rail systems are important points that should be enhance together. (Gerçek and Demir). Also, improvement and utilization of conventional railway lines on intercity travels and true investment selections of high-speed railway investments will regularly decrease the dependency level to oil together. It is an action that provides three layers of sustainability which are social, environmental, and economic (Kızıldaş).

The population of Istanbul has been increased geometrically since 1970's that increase amount is about 4-5 times (Kızıldaş). On the same period, the number of private car has been increased more accelerated that increase amount is approximately 30 times on the period of 1970-2000 (Kızıldaş). The increase on car ownership is higher than the increase on the population can be expressed with the increase of Gross National Product GDP, changing of consumption culture on radical levels and the effectiveness of highway transportation mode either transportation system or mass transport (Tzeng and Shiau). The

transportation values in Istanbul reveal the necessity to use public transportation in a higher level than in the existing situation. For this, balanced modal distribution and modal integration are necessary.

Railway systems and especially metro investments have a vital role for traffic congestion decrease in Istanbul. Furthermore; the location of Istanbul in the middle of the sea and nested with the sea, modal share of seaways is very low (Kızıldaş). In the Bosphorus, seaway transport parallel to the shore line is tried but the desired efficiency was not obtained. Here; the existing city line ferry fleet between nearby distances is sufficiently large and meets general demand route by route. Because of the frequent stationing of parallel lines on shore, it is necessary to make more frequent trips with smaller ferries and suitable physical ferry design for easier piercing. In Istanbul, the City Lines operate with a capacity of 10% and the use of the capacity even at 40-50% will reduce the traffic congestion levels of Bosphorus bridges accesses on significant levels (Tzeng and Shiau).

1.2. Modal Distribution and Sea Transportation

Istanbul contains a huge volume of population and employment that incorporates continuously positive and negative affects which comes from the position of being regional and international center. All of these effects reflect directly to Istanbulites too. As it is known, Istanbul is a city that continuously get a huge amount of immigrants. Istanbul is the biggest metropolitan and the most industrial city of Turkey.

It has also one of the most significant transportation corridor nowadays as in the historical period too. Sea transportation in Istanbul interacts from traffic safety to inter-modal integration, from collecting public transportation, to increasing quality of service with focus on punctuality-comfort-security. In this context; in Turkey (especially in Istanbul) during both intercity and inner city travels; it seems that seaway and railway will have bigger importance day by day. Variable topography, socio-cultural composition, economic distribution, geographical location and similar characteristics of Turkey and Istanbul, make it possible and necessary to have a multi modal and integrated approach in transportation (TR 10th Development Plan).

Here another important point which is mass transport fleet can realize its potential on the parallel of increase level of the population and car ownership in mentioned years period (Wong et al). From this point, it can be said that the urgent necessity on increasing of effectiveness and efficiency of mass transport is integration, not fleet. On the same period the share of minibuses is 19.00% in 1987 and 16.71% in 2006 (Litman). The partial share decrease in minibus mode is due to the increase of GDP and enhancement of mass transportation operation. But it can be said that there is a considerable increase on minibus lines on the parallel of expansion of urbanization and extension of transportation networks. We must be confronted with the fact that the share of sea transportation which should be distributed in Istanbul is 20%. That share is far behind today's (Kızıldaş).

Mass transport must provide a more integrated, comfortable, punctual and safe service in all means of transport and in this sense visible returns in the short term can be received. At this point railway systems' integration and operability are very important parameters. Here on Figure 1, Istanbul railway system map is seen in detail. It is understood that the main axes of railways in the city have emerged on an integrated way, densely and effectively. Another important transportation mode of Istanbul in mass transport is BRT (bus rapid transit) that is named Metrobüs. Metrobüs is a vital element of city's integrated mass transport system and it takes very high capacities of passenger transport of Istanbul. Metrobüs has 44 stations from Anatolian side to European side of Istanbul that accesses from east point to west point on main south axis of the city. Here on Figure 2, detailed Metrobüs map and stations can be seen.

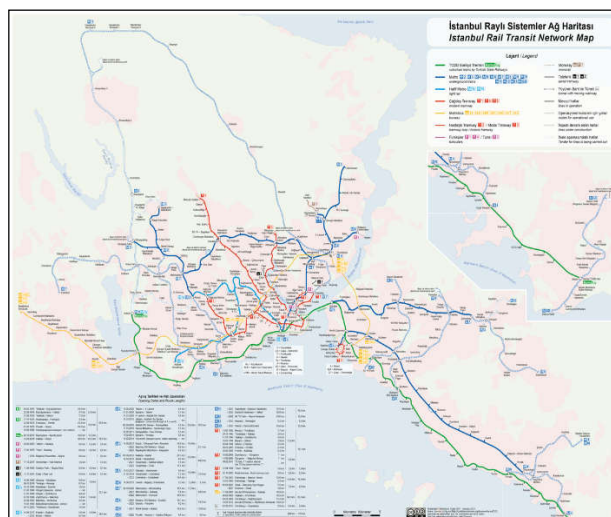


Figure 1. Istanbul Railway Transit Network Map (Kızıldaş)

When we look at the general data of mentioned year; according to the figures of the General Directorate of City Lines, we can see that City of Seaway works only with an occupancy capacity of 10%. This capacity even enhances to 50% levels, an additional roughly 1,000,000 passengers are shifted to the sea. Averagely a car in Istanbul carries 1-2 passengers; this would mean the decrease of 500-600 thousands of cars in main arterials (Kızıldaş).

When Channel Istanbul project is completed, international marine freight transport will shift from Bosphorus to the channel substantially. So Bosphorus intercity marine passenger transport can use all Bosphorus area for larger hours and periods on more routes. Because of this, passenger marine ways will reach much more transport capacities. Here on Figure 3, Channel Istanbul project details can be seen.

Because of all of these Channel Istanbul project has a significant role on Istanbul's mass transport, intermodal integration, balanced modal distribution, traffic congestion reduces and traffic safety enhances too on a different way with various evaluations. On Figure 4, Channel Istanbul's various transportation connections can be seen.

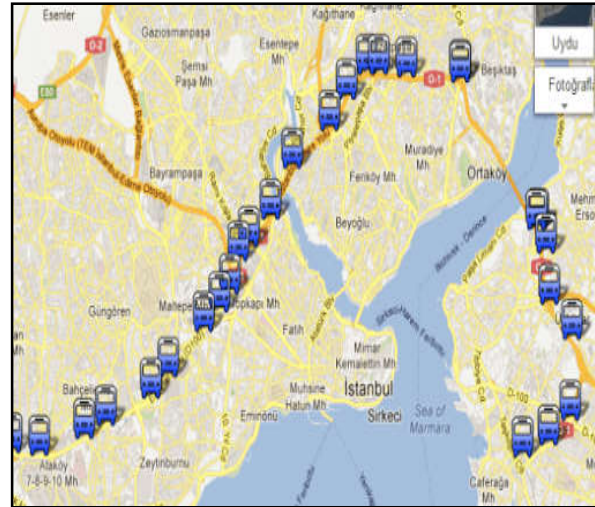


Figure 2. Istanbul Metrobüs Stations Map (Kızıltaş)

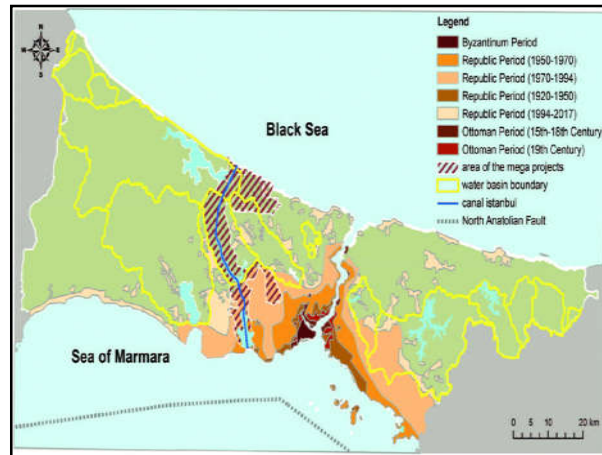


Figure 3. Channel Istanbul Project (Kızıltaş)



Figure 4. Channel Istanbul Transportation Connections (Kızıltaş)

Figure 5 illustrated the proportional distribution of mass transport modes in Istanbul in 2004-2015 years period. It has seen that 10% decrease has been recorded in urban highway transportation mode and this rate has transferred to railway systems by the figure (Kızıltaş). Bosphorus bridge is busy especially at peak hours on the highway lines which are not wide enough at many points. As it can be seen from the figures ; in the first stage of the bridge renovations, reductions up to 30% in car traffic were recorded as a result of consolidation work carried out at Fatih Sultan Mehmet Bridge (2nd Bosphorus bridge). In the same period, an increase of 10% was recorded in Bosphorus Bridge. According to the results from serious reductions in the traffic of Fatih Sultan Mehmet Bridge; sea transportation and the Bosphorus Bridge have recorded demand increases.

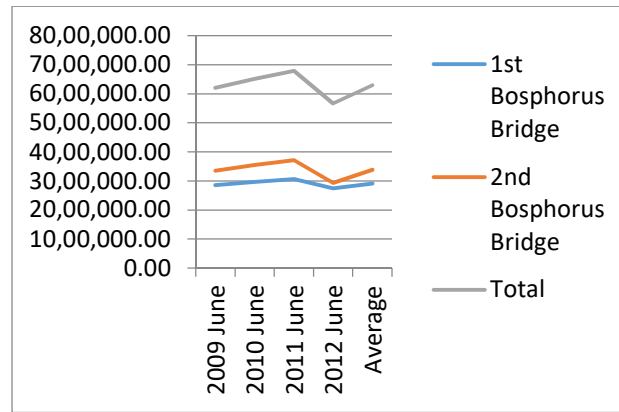


Figure 5. One Direction Monthly Based Total Accessed Vehicle Numbers (Kızıltaş)

As seen in Figure 8, Üsküdar-Eyüp ferry line values have recorded an increase that was 11.12% in a short period during Fatih Sultan Mehmet Bridge maintenance period (Kızıltaş). These values are; for the Kadıköy-Kabataş line is 22.03%. The increase in Üsküdar-Beşiktaş Line reached its peak that was 19.22%. Besiktas-Kadikoy Line in the previous week according to an increase of 19.79%. In Eminönü-Üsküdar, which is another of the dense lines, these value is 8.77%. We have also shown that the case of using sea transportation is accelerating in one year as a whole.

If we look at the reflections of the amendments to the total change of the City Lines flights; the number of weekly passengers increased by 125,825 in a week. This corresponds to an increase of 11.76%, an increase of 188.858 passengers (Kızıltaş).

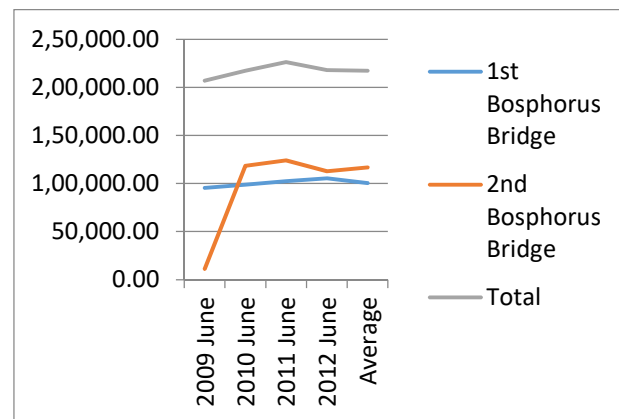


Figure 6. One Direction Monthly Based Daily Average Accessed Vehicle Numbers (Kızıltaş)

In the same way; a significant number of passengers are transported by Bostanci-Bakırköy, Maltepe-Bakırköy, Bostanci-Kabataş. On these lines; it is possible to achieve an optimum level of service on the basis of scales such as cost-time-supply/demand-comfort relation.

Another issue in increasing the share of sea transportation mode has a relation with shifting service vehicles to Bosphorus bridge accesses. Research conducted in this context includes values that can provide the appropriate background for the necessary studies.

2. Results

One of the important problems that we have not yet been able to fully address in Turkey, in intra urban and inter urban routes is about combined flow of private cars and heavy vehicles in mixed traffic can turn into a complete complex (Combes et al).

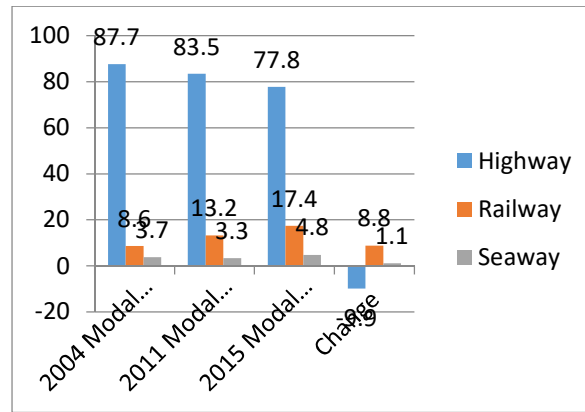


Figure 7. Modal Share of Mass Transport (Kızılteş)

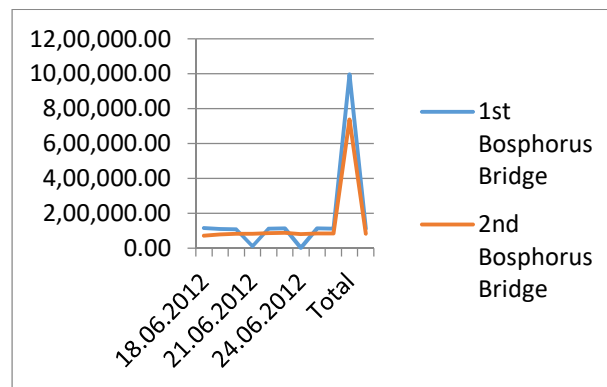


Figure 8. Changes On Number of Accessed Vehicles In Maintenance Days (Kızılteş)

For this; it is proposed to apply 'special lane' on the basis of 'lane for special car' and 'lane for public transportation vehicles'. In this context; the systematic and convenient orientation of the sea transport service in a collective way will provide us significant benefits (Rawat et al).

According to the censuses that were made between 07: 00-09: 30 hours on 29.06.2012, service trips that were made on Bosphorus bridges have been revealed on Figure.3 and Figure.4. As it can be seen on figures; both bridges are in the form of an intensive crossing from Asia to Europe in the morning peak hours. Outcome which can be extracted from here is; Asia-Europe is the predominant direction of the Bosphorus accesses in morning peak hours, it indicates that these vehicles transport passengers to the European side for work-school and similar purposes. And similar density is also on the direction of Europe to Asia during the evening peak hours (Marsh and Shilling).

The total number of service vehicles passing through both bridges in both directions at morning peak hours is 7.160. 4.813 of these are transporting to Europe at the same time period in the morning peak hours. Another consequence of this data is heavy traffic on the Bosphorus bridges for both directions (Bureau of TSRITA).

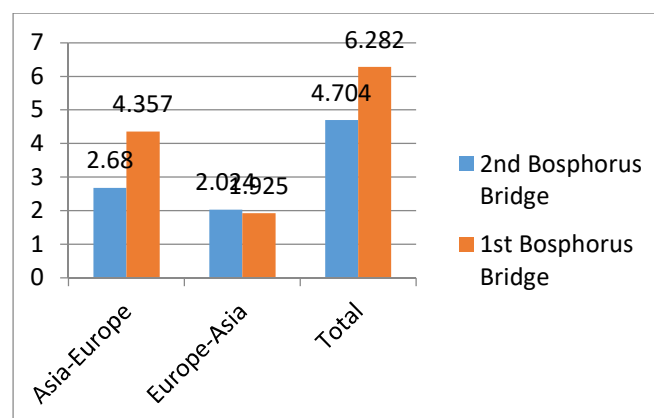


Figure 9. Number of Total Accessed Service Vehicles On Both Direction by The Bosphorus Bridges (29.06.2012) (Kızılteş)

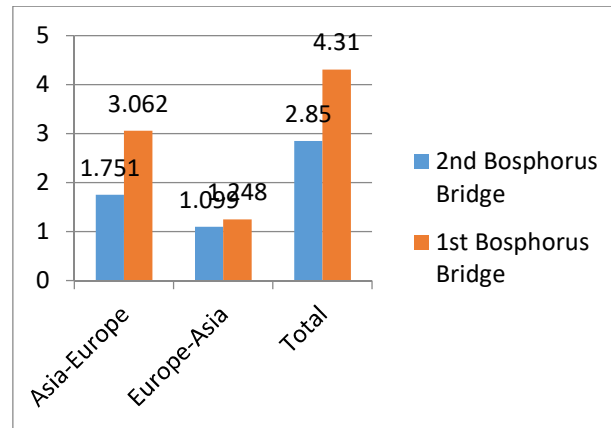


Figure 10. Number of Full Capacity Accessed Service Vehicles On Both Direction by The Bosphorus Bridges (29.06.2012) (Kızıldaş)

3. Conclusions

In recent years car ownership rates have increased exponentially in Istanbul due to the increase of the Gross National Product (GNP). The main problem in Istanbul is the car has a high rate of time in terms of traffic during the day. And this shows necessity to use public transportation in a higher level than in the existing situation (Perugia et al).

Railway systems and especially metro investments have a vital role for traffic congestion decrease in Istanbul. Furthermore; the location of Istanbul in the middle of the sea and nested with the sea, modal share of seaways is very low. In Istanbul, the City Lines operate with a capacity of 10% (Kızıldaş).

This capacity even enhances to 50% levels, an additional roughly 1,000,000 passengers are shifted to the sea. Averagely a car in Istanbul carries 1-2 passengers; this would mean the decrease of 500-600 thousand of cars in main arterials (Altan and Kızıldaş). And this will reduce the traffic congestion levels of Bosphorus bridges accesses on significant levels. 10% decrease has been recorded in urban highway transportation mode in the period between 2004-2015 (Altan and Kızıldaş).

This rate has transferred to railway systems. Also the study shows that a significant number of passengers are transported by Bostancı-Bakırköy, Maltepe-Bakırköy, Bostancı-Kabataş. On these lines; it is possible to achieve an optimum level of service on the basis of scales such as cost-time-supply/demand-comfort relation (Kızıldaş and Altan).

Conflict of interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Data Availability Statement

All graphs and data obtained or generated during the investigation appear in the published article.

Author's Contributions

Ethics

There are no ethical issues with the publication of this manuscript.

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