ROLE OF COMMUTER RAIL IN ISTANBUL'S PUBLIC TRANSPORTATION: A CASE STUDY OF HAYDARPAŞA-GEBZE LINE

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Ayşe IŞIK

Fatih University

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APPROVAL PAGE

I certify that this thesis satisfies all the requirements as a thesis for the degree of Master of Arts.

Assist. Prof. Ali DEMİRCİ
Head of Geography Department

This is to certify that I have read this thesis and that in my opinion it is fully adequate, in scope and quality, as a thesis for the degree of Master of Arts.

Assist. Prof. Michael A. MCADAMS
Supervisor

Examining Committee Members

Assist. Prof. Omar ALAGHA

Assist. Prof. Ali DEMİRCİ

Assist. Prof. Michael A. MCADAMS

It is approved that this thesis has been written in compliance with the formatting rules laid down by the Graduate Institute of Social Sciences.

Assist. Prof. Mehmet ORHAN
Director

ABSTRACT

AYŞE IŞIK **July 2005**

ROLE OF COMMUTER RAIL IN ISTANBUL'S PUBLIC TRANSPORTATION: A CASE STUDY OF HAYDARPASA-GEBZE LINE

Commuter rail is becoming a major part of transportation choice for growing major metropolitan areas. The development of commuter rail services has been paid great attention as a result of the increased public awareness of congestion, dependence on fossil fuels, and other environmental issues, as well as rising automobile costs.

Commuter rails were very widely used as a mode of transportation in Istanbul until 1980. They have played a key role in urban transportation by carrying annually average thirty million passengers. As a result of rising number of automobiles and the establishment of publicly provided highway infrastructure, commuter transit profitability declined. In recent, commuter rail systems in Istanbul, both Haydarpaşa-Gebze and Sirkeci-Halkalı lines, have faced the problem of passenger decrease because of the security and quality problems of the systems.

Personal security and service quality are important factors affecting many people to choose among various public transportation modes. Due to frequent crime incidents resulted in deaths recently, poor quality of service and wrong transportation policies, the number of passengers traveling by commuter rail have been constantly decreasing for the last two decades. As a result of this, today Istanbul's commuter rails are operated with 28.9% of its capacity in urban transportation.

The primary purpose of this study is to clarify the main problems of commuter rails in urban transportation by choosing Haydarpaşa-Gebze commuter rail as a case study. For that reason, a brief but informative survey about the decline in the commuter rail system and the passenger perception about the system were conducted. In addition, crime incidents and the statistics of passenger data were exanimate to clarify the underlying reasons for the current problems of Istanbul's commuter rails.

Key Words: Commuter Rail, Security, Transportation Policy, Rider ship Survey, Metropolitan Area.

KISA ÖZET

AYŞE IŞIK **Temmuz 2005**

İSTANBUL ULAŞIMINDA BANLYÖ TRENLERİNİN ROLÜ: HAYDARPAŞA- GEBZE BANLYÖ HATTI ÇALIŞMASI

Banliyö trenleri, bugün, gelişen metropol alanlar için tercih edilen bir ulaşım sistemi halini almaktadır. Kentsel alanlarda artan trafik yoğunluğu, fosil yakıt rezervlerinin azalması ve dolayısıyla akaryakıt fiyatlarının artması sonucunda otomobil kullanım maliyetlerindeki artış ve çevre kirliliğine artan duyarlık gibi sebeplere bağlı olarak banliyö trenlerinin geliştirilmesine büyük önem verilmektedir.

Banliyö trenleri 1980 yılına kadar İstanbul ulaşımında çok yaygın olarak kullanılan taşıma araçlarıydı. Bugün ise otomobil oranındaki artış ve karayolu altyapısına verilen önemin artması sonucu, banliyöde taşınan yolcu sayısında sürekli bir azalma gözlemlenmiştir. Son yıllarda, İstanbul'daki banliyö sistemlerinden olan Haydarpaşa-Gebze ve Sirkeci Halkalı hatlarında, trenlerdeki güvenlik ve yolculuk konforu sorunlarına bağlı olarak, taşınan yolcu sayısında azalma meydana gelmiştir.

Kişisel güvenlik ve konfor, insanların toplu taşıma aracı seçiminde önemli bir rol oynar. Banliyö hattında uygulanan yanlış ulaşım politikası, trenlerde işlenen suçlar (soygun, darp ve öldürme) ve düşük kalitedeki hizmetten dolayı, son yirmi yıl içinde bu hatlarda taşınan yolcu sayısında sürekli bir azalma meydana gelmiştir. Sonuç olarak, bugün banliyö trenleri ancak toplam kapasitesinin %28.9'u ile çalışmaktadır.

Bu çalışmanın temel amacı, İstanbul'da Haydarpaşa-Gebze banliyö hattını çalışma alanı seçerek, banliyö ulaşımındaki ana problemlerin altında yatan sebeplere açıklık getirmektir. Bu amaca yönelik olarak, kısa fakat İstanbul'daki banliyö hatlarındaki genel problemleri tanımlayan ve bu hattaki yolcuların banliyö taşımacılığıyla ilgili izlenimlerini ortaya çıkaran bir anket çalışması yapılmıştır.

Anahtar Kelimeler: Banliyö treni, Güvenlik, Ulaşım politikası, Yolcu anketi, Metropol alanlar.

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LIST OF ABBREVIATIONS

T.C.D.D	Directorate General of State Railway Administration
IDO	Istanbul Sea Bus Corporation
TDO	Turkish Sea Bus Corporation
I.E.T.T	Istanbul Electricity Tunel and Tramvay
LRT	Light Rail Transportation

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INTRODUCTION

1.1 Background

The inadequacy of transportation infrastructure is one of the most common problems of metropolitan cities in the world due to the rapid increase in automobile ownership in urban populations. The emergence of automobiles during the first half of the 20th century led to road congestion gradually in all major world cities gradually. Public transportation is seemed as the resurgence because of the fact that it decreases congestion, air pollution, energy consumption and the amount of new road construction. Many larger cities presently have networks of commuter rail lines running from outlying towns and suburbs to the city center (e.g. Tokyo, Chicago and Paris).

Istanbul, as the greatest metropolis of Turkey and one of the most rapidly growing cities of the world, experienced a rapid population increase after the WWII due to domestic migration, which can mainly be attributed to social and economic problems in the rural areas, especially in the East and South-East regions of the country. This growth combined with increased automobile ownership resulted in more traffic having been added to the roads of Istanbul. As the use of automobile in the urban area continued to grow, the government constructed more new roads, bridges, viaducts, tunnels, interchanges and intersections. Despite all these efforts, an efficient solution for traffic problem could not be found out yet. This led the city and transportation planners to focus on rail transportation after 1990s to solve

transportation problems in Istanbul .As a result, they constructed new rail lines such as Metro between Taksim and 4th Levent, light rail system along Aksaray and Yeşilköy and Tramvay between Eminönü and Zeytinburnu in which central business districts are located. On the other hand, transportation authorities have not made any development on existing commuter lines that have a huge potential to meet travel demand in Istanbul .So, commuter rails have lost its importance in the transportation system of Istanbul after 1990s.

Before the 1980's, commuter rail, located along the mostly populated suburbs of the city, was the most effective form of public transportation in Istanbul. Istanbul has two commuter rail systems, Haydarpaşa-Gebze and Sirkeci-Halkalı lines, extending along the south side of the city parallel to the Marmara Sea. These lines used to meet the demand for public transportation in the city for many years satisfactorily. Since the 1970's, the transportation policy of Istanbul has focused primarily on highway transportation. Istanbul's commuter rails have not received proper attention by the local government and transportation authorities. Today, traffic congestion, parking problems and inadequate public transportation are the main results of the one-sided and un-balanced transport policies taken by the authorities since 1970's. Intra-city rail systems such as metro and light-rail transit (LRT) are not satisfactory enough to meet the present and future needs of public transportation system. Thus, the inadequacy of the public transit directly reduces the mobility and accessibility in the city of Istanbul. As a result of the

mobility and accessibility problems in the city, many economic and social difficulties are experienced by the citizens, such as social exclusion from basic services like better employed education, health and recreational opportunities.

To increase the mobility and accessibility to basic services in the greater metropolitan city of Istanbul, the local government (municipality), supported by the central government politically and financially, have currently placed great emphasis on the development and expansion of urban rail systems both by constructing new LRT systems and renovating old tram networks. However, the regional rail system of Istanbul which is operated by the Republic of Turkey State Railroad (TCDD) has not rehabilitated its infrastructure and rolled stock or developed new policy and management plans. Most of commuter rails' cars have been used since 1980. They are very old and unfitting for a comfortable travel. As well, some security problems have caused the commuter rails to be used seldom by the passengers. This study was undertaken to explain the factors behind the passenger decline in the commuter rails in Istanbul. It will focus on the Haydarpaşa-Gebze commuter line and its problems.

1.2 Scope Of The Study

Istanbul is the largest metropolitan city in Turkey. It has two commuter rail systems: The Sirkeci- Halkalı line on the European side and the Haydarpaşa-Gebze line on the Anatolian side of the city (see figure 1).

The first railway station on the European shore of Istanbul was located in Yedikule and it started to operate in January 1871 when the line extended to Küçükçekmece along the Marmara Sea shore from Sirkeci railroad station on the entrance of Bosphorus (Bayraktar, 1992). The other commuter rail system, the Anatolian regional rail, services along Haydarpaşa-Gebze line. Kadiköy is the starting point of the Anatolian Railways. It was built in 1872 when the line extended to Gebze. This study will focus on Asian commuter line (Haydarpaşa-Gebze). The commuter rail system provides transportation service from the major central business district (Kadıköy) of the Anatolian part to the Asian suburbs (e.g., Maltepe, Kartal, Pendik, Tuzla and Gebze) (see Figure 1).

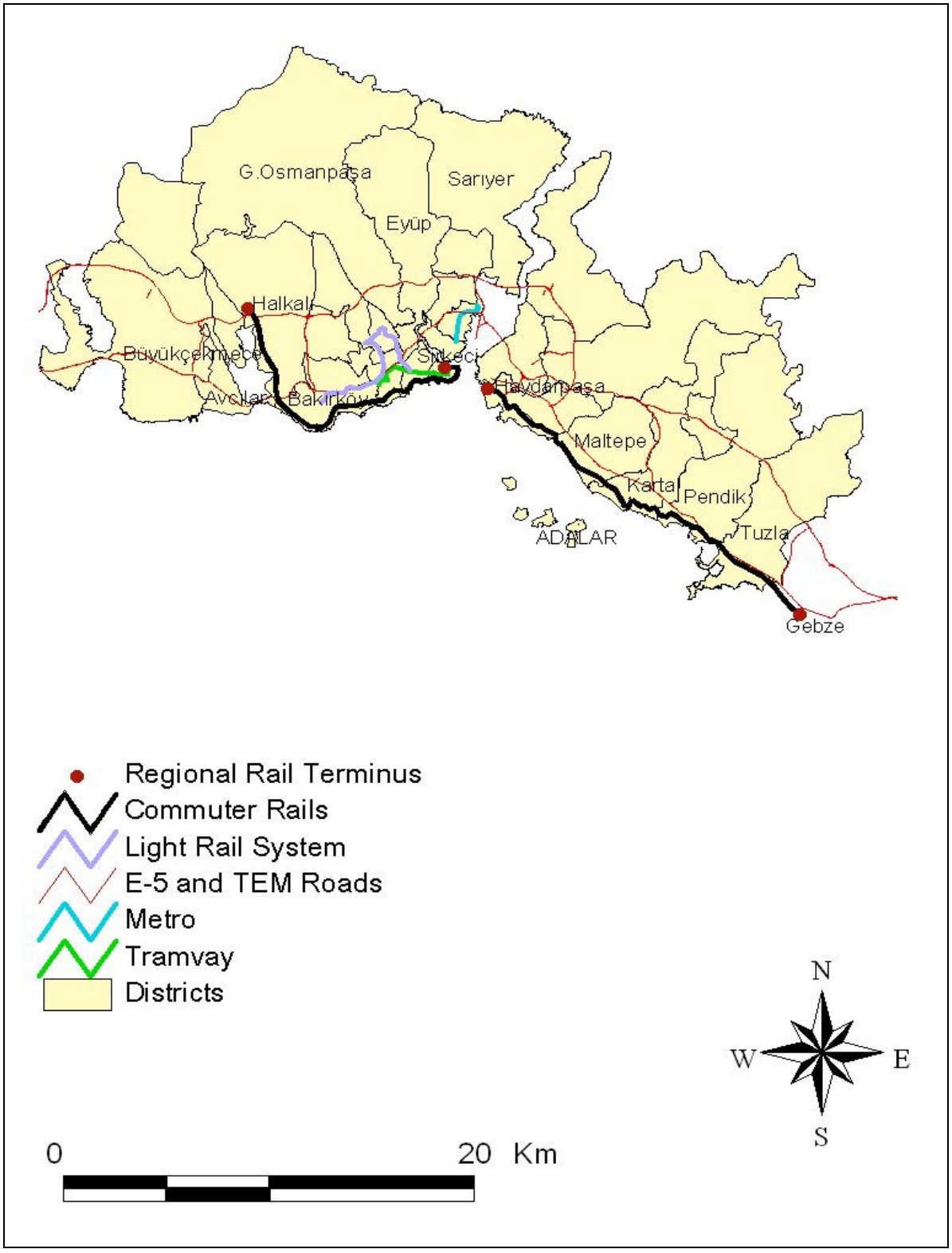

Figure 1 : Transportation Map of İstanbul

The Haydarpaşa-Gebze commuter rail represents less than one percent (0.4%) of public transport travel in Istanbul. The line is 44 kilometers long and served by 27 stations. The Anatolian part of Istanbul has experienced rapid population growth for the last two decades. This part of the city has no rail system to meet the current travel demand in the area other than this commuter rail line. However, passengers traveling on Haydarpaşa–Gebze commuter rail have been decreasing constantly. This result could also be due to the existence of two alternative commuting highway corridors, namely, the D-100 highway and TEM expressway. This study will investigate the underlying reasons for the declining riders on the commuter rail by several means including a passenger survey and some interviews with many commuter rail authorities. The results of the analysis will help to disclose the general reasons for passenger reduction on the other commuter rail in Istanbul.

1.3 Objectives of The Study

Transportation problems or in other words, poor mobility and accessibility are the most serious problems of Istanbul. Due to rapidly increasing population of the city, authorities could not prepare proper plans and make necessary projects to meet the increased travel demand in the city after World War II. Transport demand has already exceeded transport supply in many densely populated areas in the city. Improving urban rail systems is a significant step to increase the transport supply. However, the regional rail

system of Istanbul has been ineffective for a long time in decreasing traffic congestion. The role of commuter rail needs to be understood better and authorities need to develop new strategies to improve its effectiveness in the spectrum of public transportation modes.

The first objective of this study is to determine the underlying reasons of passenger reduction and operational problems of the Istanbul's commuter rail system. The second objective is to demonstrate the importance of this system in Istanbul's public transportation by giving examples of modern commuter rail systems around the world. The main limitation of the study is that only one commuter rail system in Istanbul is studied. This research builds a framework to determine the problems of commuter rails and get a more detailed information about how policy, crime incidents and service quality of transit affects passenger demand. This research will hopefully provide information for urban decision makers and transportation authories about the reasons behind the decline of Istanbul's commuter rail systems.

In this study, the main research question is: What were the factors that caused the ridership decline on the Haydarpaşa-Gebze line? Was it due to security or lack of coordination with other transit modes? The other questions to be answered in the study are: How did transportation policy influence the role of commuter rail in urban transportation? What is the role of commuter rails? What kind of people use commuter rail and why? What can be done to attract riders' attention back to the commuter rail? These

questions will help us understand current roles of the commuter rails in Istanbul's transportation.

1.4 Thesis Organization

This thesis is structured around two objectives, as noted in the previous section. The problems on the commuter rails and their results were elaborated. Research questions, research approach and scope of the study were introduced. In chapter II, in order to understand the role of commuter rails in urban transportation, the background of urban policy and urban development process were analyzed and previous research were reviewed. In chapter III, the current public transportation in Istanbul was elaborated. In chapter IV, the methods of analysis of the study are presented and the passenger survey design is described. In chapter V, the results of the data obtained from the survey and other sources are presented. In chapter VI, conclusion and recommendations for future research are presented.

LITERATURE REVIEW

2.1 Introduction

Commuter-rail systems offer public transportation service between central business district (CBD) and suburban areas. They provide alternative ways of travel besides private transportation and rubber-tire transit modes, and serve in highly concentrated business and residential centers. A commuter rail system has been in operation in Istanbul's transportation since the end of the 19th century. They have played a significant role in the development of Istanbul for many years. In the last two decades, they have lost their riders potential due to the lack of quality in transportation and management policy which cause some security problems and lack of necessary coordination with other public and private transportation modes. Commuter rail systems in Istanbul are not fully integrated with other regional transit services to encourage transfers and increase the efficiency of the transit systems throughout the urban area. There is a possibility that better integration among the modes of transport will improve efficiency and increase the number of passengers of the commuter systems in Istanbul. In addition, poor quality service and fear of crime in rails may have also driven passengers away from commuter rail transportation. Personal security surely affects many people's decision to use public transportation. The problem of personal security observed in the commuter-rail systems is the result of the lack of understanding of public transportation security. To determine the current condition of the commuter rails in urban transportation, several

research studies concerning commuter rail problems in Istanbul have been conducted. The next section will discuss these studies.

2.2 Literature Review Concerning Istanbul Commuter Rail Systems

Commuter services are an important part of the urban transport systems. Commuter rails, in addition to providing an alternative way of transportation, could serve as a significant transport project to reduce congestion and increase personal mobility and accessibility to major attraction centers in metropolitan areas. They can also be easily upgraded to high-capacity metro systems, which can be a very efficient transport mode in highly traveled urban corridors, without requiring a large amount of land for right-of-way. However, they have lost their reputation in urban transportation for the last two decades. There are few studies that present the factors affecting commuter rails in Istanbul in negatively. One of these factors is presented in this study.

BAYRAKTAR, Z., 1992: Bayraktar presented a paper concerning the role of commuter rails in Istanbul's transportation and the problems related to passenger decline in the 2nd Transportation Congress in Istanbul. In this paper, the decline of the riders in commuter rails in Istanbul during the last two decades and its reasons were studied. Besides, general characteristics of commuter rail and the level of the quality of service provided in the system were discussed. She asserted some suggestions for the revival of commuter

rail in urban transportation. According to this study, in order to increase the efficiency of commuter rails in Istanbul, they must be integrated to other

ÖNCÜ, E., 1992: This study claims that commuter rails in Turkey have not been improved adequately to compete with automobiles. The increase of automobile ownership and improved highway network in Istanbul may have had a significant impact on the commuter rail riders. The study identified the general problems of commuter rail systems in Istanbul, Ankara and Izmir. As commuter rails in these major cities is operated by the Republic of Turkey State Railways (TCDD,) , these cities are all facing the same commuter rail problems such as passenger security, lack of proper management and comfortable ridership in trains. The study also presents common barriers in the development of commuter rail in major cities.

Coordination of public transportation modes in urban areas is very significant for creating more livable cities. In major cities, the emphasis on intermodal transport facilities has been increasing constanly. The issue of intermodal integration in urban transportation is rather new in Turkey (Akın et al., 2001).

One of the criteria in the success of potential commuter rail service is how it is integrated with other modes of transportation. However, Haydarpaşa-Gebze commuter is not coordinated efficiently with the buses and ferries along its service corridor. This case blocks the transfers from other transit modes to Haydarpaşa-Gebze commuter rail (Ilker, 1997).

There are two studies about the importance of coordination among the transit modes in Istanbul to create an efficient transportation system. One of them emphasizes the lack of connectivity of commuter rail with the other transit modes in Istanbul.

AKIN, D. et.al, 2001: Akin revealed how important the coordination of mass transportation modes for creating more livable cities is. In order to prove this idea, a passenger survey was conducted on the rail systems of Ankara, Istanbul and Izmir. In this paper, rail transit modes in these cities were examined by making observations on the modes of urban rail transit with respect to availability of coordination with other transit modes especially with rubber tire systems. Also the intermodal integration problems, which these systems were faced, were discussed in the study. The paper includes useful recommendations for transportation planners and authorities about how a successful coordination of rail transit systems with other transit modes can be achieved.

ILKER Ü. et.al, 2001: Ilker et.al presented a paper in the 5th Transportation Congress. In their study, they emphasized the importance of the integration of commuter rail and other transit systems in Istanbul's transportation by drawing on an analysis of the successful experiences of Paris and London rail systems.

Crime committed on or around public transport facilities is increasingly becoming a problem in most countries. As cities become larger and public

transportation systems grow, criminal activities will continue to pose problems for those who manage the systems of transporting people across and between cities (Easteal, 1991).

Railroad security has become the focus of increased attention in Istanbul due to the increasing crime incidents in commuter rails. Security problems have driven passengers away from commuter rail to safer transit modes (Demirbilek, 1997).

ÇİMEN, A., 1987: In this study, he focused on crimes on rail systems and described several preventive methods being used to cope with this problem. Also, He presented general types of crime and factors affecting the crime in trains and at stations. Examples from European countries were given to explain the reasons of crime in rail systems of Istanbul. This study identifies the types of crime committed on railways as pick-pocketing, theft and vandalism. The paper also focused on the spatial and temporal distribution of the crime incidents in world's rail systems. It describes how physical environment of stations affects crimes in rail system.

TCRP SYNTHESIS, 1997: This paper was prepared by Transit Cooperative Research Program in the U.S. to assess the influence of crime incidents on passengers' travel choices. It offers some information on a variety of approaches to improve transit security. In this report, the nature and the extent of transit crime, effective strategies to combat problem

situations and case studies of specific control practices deemed successful by transit agency professionals are discussed.

2.3 Characteristics of Commuter Rails

There are many definitions for commuter rail in the literature. One of them is "*Regional rail systems, or commuter rail systems, usually provide a through a central business district area into suburbs or other locations that draw large numbers of people on a daily basis" (Wikipedia* Encyclopedia). The trains providing such services may be termed as *commuter trains*. Commuter trains are usually optimized for maximum passenger volume, in most cases without sacrificing too much comfort and luggage space, though they seldom have all the amenities of long-distance trains. The general range of commuter trains varies between 15 to 180 km with operating speeds from 55 - 175 km passenger coaches are either single or double level cars, with a capacity of between 80 and 110 passengers for single-level cars and 145 - 170 for double-level cars (Demirbilek, 1997). The general features of commuter rails are identified in the following;

"In general, commuter trains differ from heavy rail and light rail. Commuter trains are larger, have a lower frequency of service, have scheduled service and are serving lower-density areas by connecting suburbs with the city center. Commuter rail cars are usually pulled by diesel multiple units (DMU's) which are self-propelled, bidirectional, articulated passenger rail cars with diesel engines, electric generators and electric motors located

below the passenger compartment. In some areas, electrified rail electric multiple units are used" (Wikipedia Encyclopedia)

2.4 General Features Of Haydarpasa-Gebze Commuter Rail

The Haydarpasa-Gebze line which serves the Asian side of Istanbul was constructed according to international standards, and its all rights were given to TCDD in 1871. It runs in the Anatolian part from the main train station, Haydarpaşa, to Gebze on the border of Kocaeli. The 44 kilometer long line has 27 stations, and a trip takes approximately 65 minutes. Although its maximum daily capacity is of 130,800 passengers, the average number of passengers is 30.000 with 116 journeys taking place from 6 am to midnight every day. It means that it works with only approximately twenty eight percent (28.9%) of its capacity. The commuter rail represents less than one percent (0.4 %) of the rail transportation in Istanbul. Average service frequency is 10-15 minutes in peak hours and 20 and 25 minutes in off-peak hours. Most services terminate at stations on the periphery of downtown. The same rail line also serves for a long distance travel mode as a passenger rail from suburbs to suburbs (TCDD, 2003).

The commuter rail runs through the districts of Kadıköy, Pendik, Kartal, Tuzla and Gebze. Kadıköy, the center of the district, is the hub of traffic for people traveling from the Asian side of the city to the European in the morning and visa versa in the afternoon. Pendik is a suburb of Istanbul between Kartal and Tuzla districts (see Figure 2). It has faced with high

population increase due to the high rate of domestic migration from rural to urban areas during the last twenty years.

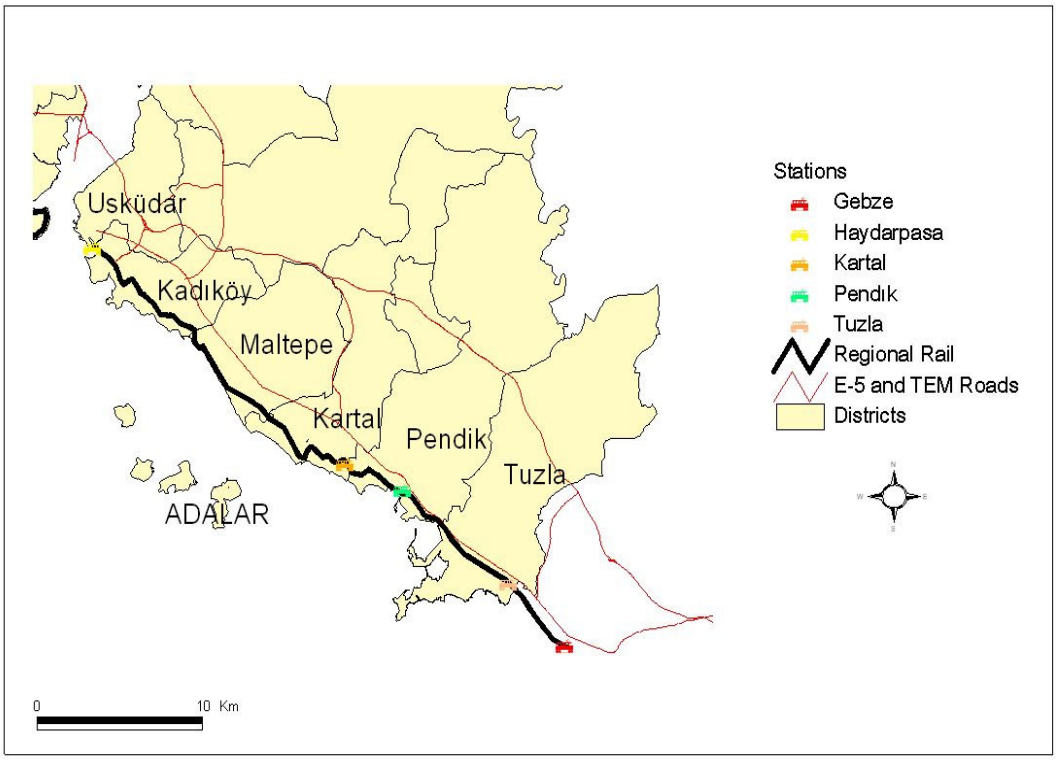

Figure 2: Location map of Haydarpaşa-Gebze Line.

Kartal is a district of Istanbul which is located on the Asian side of the city, by the coast of the Marmara Sea on the southwest part of the Kocaeli Peninsula. It has a total population of 407,865 (Kartal Municipality, 2004). After the construction of Haydarpaşa-Gebze commuter line, Kartal has become one of the most important industrial areas in Istanbul. It has more than 40.000 employees (Wikipedia Encyclopedia). Gebze as the last station of the commuter line in the east end is a district of Kocaeli, which is one of the biggest industrial area between Istanbul and Kocaeli. It has a high

worker population travelling from Istanbul to Gebze each day. In spite of the high work-travel demands in these regions, the ridership of the Haydarpaşa-Gebze regional rail line has been decreasing gradually.

2.5 Assessment Of Ridership Rate In The Regional Rail

The Haydarpaşa-Gebze commuter rail system dates back to the late nineteenth and early twentieth century. The twentieth century witnessed the development of railways in Istanbul as well. Until the last two decades of the century, the rate of passengers travelling by commuter rail was quite high compared to the other transit modes. In Figure 3, the proportion of passengers in regional rail between 1945 and 2004 is indicated. The commuter rail played a significant role between the years of 1940 and 1966. It had an average of seven million riders (1940-1966) in Istanbul with one million people (see Figure 3).

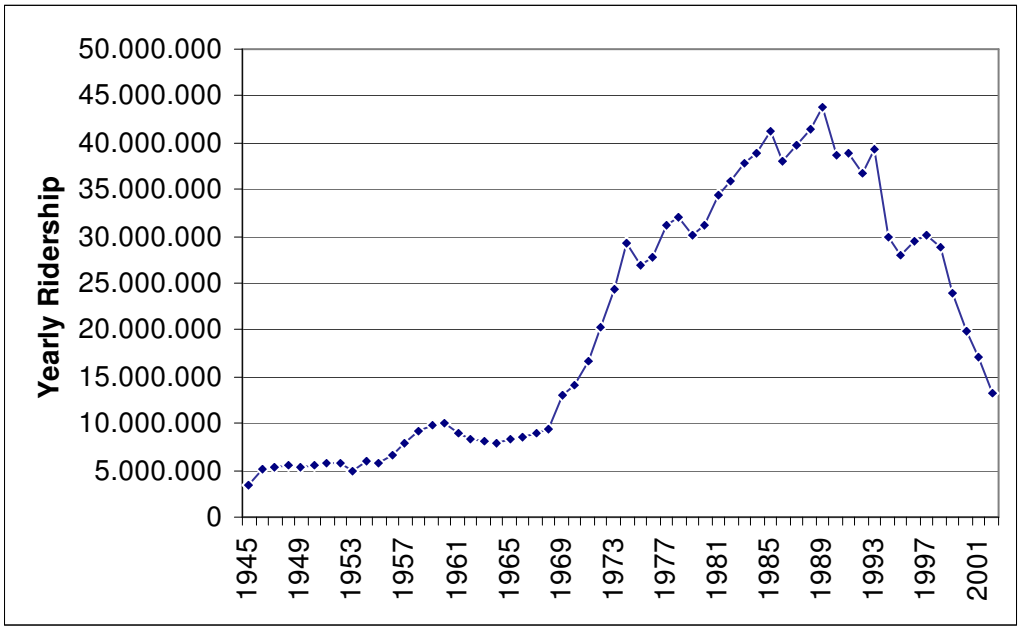

Figure 3: Yearly Ridership of Haydarpaşa-GebzeCommuter Rail Between 1945 and 2004 (TCDD)

The Haydarpaşa-Gebze commuter rail had highest riders number between 1966 and 1989. After the commuter rail system was electrified in 1966, its quality (e.g speed, comfort) noticeably improved. This new commuter system attracted a large number of riders. Another factor behind the increasing commuter rail ridership between 1966 and 1989 was that the highway transportation had not developed satisfactorily yet. During the 1970's, the population of Istanbul began to increase rapidly. In addition, in the Istanbul metropolitan area, there was a considerable migration from the crowded central districts of Istanbul to the Asian side of the Bosphorus between 1980 and 1990 (see Figure 4). Asian side had less than one million population until 1970s, but its population has reached two million from 1970 to 1990's.This case affected rate of commuter rail passengers positively.

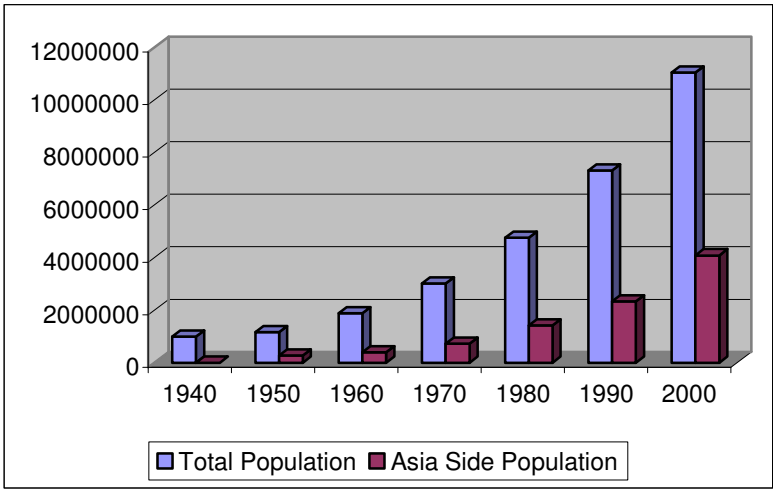

Figure 4: Total Population of Istanbul and Asia Side (1940-2000) Source: (Istanbul I. Kentiçi Şurası)

This sprawl in the population caused a rapid rise in demand for housing development and an increase in the demand for mass transportation. In these years, commuter rail ridership increased due to both population increase and using other transit systems inefficiently. As a result, the number of passengers using commuter rail reached the peak (annual average ridership of over 40 million passengers) between 1985 and 1990.

Although the second half of the 20th century witnessed the development of railways in Istanbul, the commuter rail went into decline after 1990s because of the fact that the transportation policies favored the highway against the rail. After 1990, the automobile began to gain popularity rapidly in Istanbul, and the number of cars and passengers travelling by bus between Asian and European sides increased. It affected the usage of commuter rail as a transit carrying passengers to cross European Side by ships in Kadıköy. The automobile ownership rose rapidly and intra-city bus and minibus services took place in urban transportation, whereas the power of commuter rail decreased (see Figure 5).

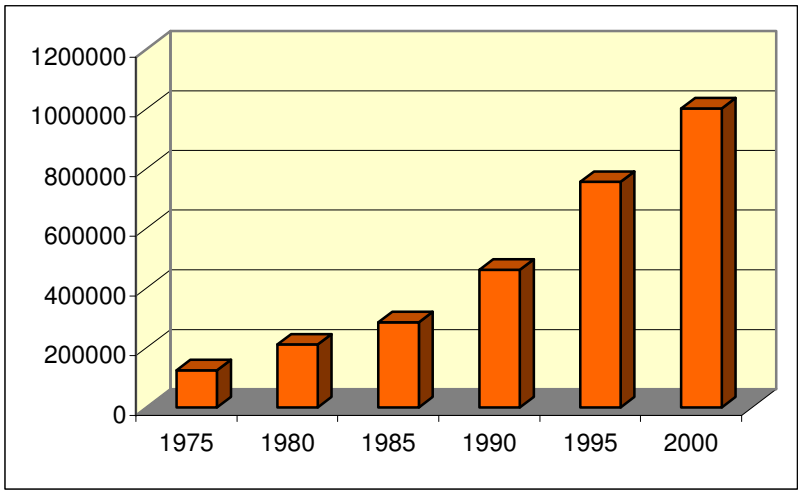

Figure 5: The Number of Cars in Istanbul between 1975 and 2000s
Source: (DIE, 1975-2000)

There is no doubt that rising car ownership in Istanbul is not the only reason for passenger decline on the regional rail. Another reason is that the transport authorities disregarded improving the rail and investing in the Istanbul's regional rail systems. During the 1990's, commuter rail in Istanbul faced with several security problems in trains and at stations. Commuter trains became places of crimes such as theft, pick pocking and vandalism. This may have caused people to choose other public transportation modes such as bus and minibus modes in the same corridor. At the end of 20th century, the average passengers of the Haydarpaşa-Gebze line was almost equal to the ridership in 1970s. When Asian side of the city had a very low population (724.567 people) in the 1970's, the Haydarpaşa-Gebze commuter line had an annual ridership of 15 million. However, today approximately four million people are residing on the Asian side of the city according to the 2000 census; the commuter line carries less than 15 million passengers. The

security problem and low service quality can be considered as the possible main reasons for the passenger decline on this line. Poor coordination with other modes could also be considered a contributing factor.

2.5 The Present Suburban Trains Conditions in The World

In an era of growing highway traffic and associated congestion, citizens, businesses, and their government representatives have looked for reliable alternatives to the private vehicle. As population and employment centers have increased, and highway corridors have become more congested, commuter rail have been an attractive alternative. A number of metropolitan areas across the world have been studying or have implemented commuter rail systems. Commuter rail is the choice of transportation system for many growing major metropolitan areas. The development of the commuter rail services has become popular in many developed cities such as Nagoya, Osaka and London combined with the increased public awareness of congestion, dependence on fossil fuels, and other environmental issues. These cities have been expressing greater interest in commuter rail, day by day, as an alternative mode of transportation between communities. Table 3 gives a summary of commuter rail market in developed cities. Nagoya is the third mostly populated city in Japan with 8 million people. It has a 500 mile suburban network with approximately 800 stations. The annual capacity of the system is 650 million passengers. The commuter rail ridership is 12% of total public transportation in Nagoya (see Table 1).

TABLE 1: COMMUTER RAIL MARKET IN DEVELOPED CITIES

Demographic	Tokyo	Osaka	Nagoya	Paris	London	Sydney	Istanbul
Population (000)	31,200	15,250	8,050	9,650	12,230	3,539	10,070
Urban Area (Square Miles)	2,030	1,050	1,090	1,060	1,600	811	2, 756
Gross Product/Capital 1999	$28,32	$25,376	$28,535	$32,343	$27,365	$25,643	Non Available
Core Population	26%	17%	27%	22%	59%	15%	32%
Suburban Population	74%	83%	73%	78%	41%	85%	68%
Public Transport Market Share	56.7%	59.5%	24.6%	24.1%	17.1%	13.6%	63.3%
Commuter Rail Market Share	**39.5 %**	**36.4%**	**12.0%**	**7.2%**	**3.7%**	**5.6%**	**1.2%**

Source: (Urban Transport Book, 2003)

Paris is one of the biggest cities in Europe with 9.7 million populations and has an extensive commuter rail network. The Paris suburban rail system carries 37 million passengers annually, and this mode includes only one-fourth of all transportation of the city (Urban Transport Book, 2003). These cities, Tokyo, Nagoya, Osaka, Paris, Sydney and London have experienced a successful commuter rail management for the last three decades. There are two important conclusions that can be drawn from the experiences of commuter rail systems of Japan, England, Australia and France. First, independent private companies or municipalities operate these systems.

Second, commuter rail lines coordinated with other transit modes are very efficient for serving trips from suburban areas. These commuter trains are clean and fast. Passengers are given a reliable and anxiety-free ride. The systems help ease highway congestion, protect mobility, and improve the quality of life. Although there is high automobile ownership per capita in such cities as Paris, London and Tokyo, , the ratio of passengers choosing commuter rails is significant. The main reason for this success is that private companies operate the systems and there is systematic integration between commuter rail and the other transportation modes. Nagoya and Osaka commuter rails are working with high quality of service. The location of commuter rails and stations in these regions are another factors attracting many passengers to commuter rail.

Rail commuter service provides, in many respects, the best quality service for the users, because modern equipment has been obtained. In contrast to major world commuter rails, Istanbul experienced a decline in commuter rail passengers. Commuter rails in Istanbul do not conform to international standards for the system management and operations. Also, unlike commuter rail in major cities (Paris, London et.al), Istanbul's commuter rail lines are away from densely populated areas.

GENERAL CHARACTERISTICS OF THE PUBLIC TRANSPORTATION IN ISTANBUL

3.1 Introduction

Transport is a vital component of city planning and management. A functional urban transport system is usually a good indicator of the health of a city. Many cities in the developed world have made effective urban transportation systems their priority in terms of pricing, efficiency and investment. Istanbul has approximately ten million people which have been facing transportation problems for two decades. The lack of coordination among the different transit modes, growth of private car ownership causing more traffic congestion are the main problems in Istanbul transportation.

During the 1970s, the population of Istanbul began to increase seriously due to the migration from the other regions. Rapid growth of population caused rapid increase in the vehicle and transportation demand in Istanbul. This increase ended in insufficient mass transportation created growth of private car ownership in Istanbul transportation. Rail and sea based transportation have not played an active role in city transportation for a long period.

The other important aspect of commuter rail decline in İstanbul is the authority and governance operating it. Public transportation in İstanbul is managed by five different authorities (IETT, TCDD,IDO, TDİ ULAŞIM A.S).

The TCDD authority that operates commuter rail in İstanbul has

different management system from central transportation authories. It created some difficulties in development of commuter rails in the city. The transportation authorities did not provide a strategy to incorporate commuter rail as part of transportation system, which will provide alternative choice to the automobile for commuters in Istanbul. In addition, state policy did not support the use of commuter .After Second World War, with American aid through the Marshal plan, Turkey shifted its priorities from rail to road transportation. Over the years, bus and truck have become the transportation of choice on the newly build roads. Authorities in Turkey have systematically concentrated on building roads while neglecting the railways. The rail network expansion came slowly to a halt. Istanbul's public transportation policies have always been in favor of highway transportation, and seaway and railways projects have not gotten proper attention from the central government and city officials for 50 years. Government has recently offered a solution for rail transportation in Istanbul by connecting management of commuter rail to Istanbul MunicipalityTransportation Departments.

3.2 Highway Transportation

The most common transportation in Istanbul consists of the surface transportation. Istanbul has more than one-half million (1.688.049) vehicles including private cars, taxis, buses and minibuses, which constitute 91.8% of the public transport system. Rail-based transportation accounts for 5.7% of

the passenger trips. It contains six types of trains: commuter rail, metro, light rail, tramway, nostalgic train (street car) and tunnel. Sea-based transportation including ships, sea motor and sea buses account for 2.5 % of total transportation in İstanbul (Istanbul I. Kent Şurası) 2003).

3.2.1 Private Car

Private car ownership in Istanbul has been increasing for the last two decades, which is the cause of more traffic congestion. The number of private cars was approximately four hundred and sixty thousands (462.056) in 1990; whereas there are more than one million automobiles in Istanbul transportation according to the 2000 Census (DIE, 2002). With the influence of population growth in the 1980s, the number of private cars has been growing in city transportation. Private cars in Istanbul are carrying daily three million passengers (3.100.000) in average (see table 2).

3.2.2 Taxi

The taxis, named yellow taxis, are other transits that serviced in Istanbul transportation. Their fare is depending on travel distance. Therefore, they do not have integration with the other mass transportation and they do not have important role to meet public transportation demands. However, there are 17,000 taxis carrying around 750,000 passengers per day in Istanbul.

3.2.3 Bus and Minibus

Buses in city transportation servicing as private busses and IETT buses are the most important mass transit system in Istanbul; there are 3816 buses in the city. The buses carry 2.3 million passengers per day. There are two types of IETT buses. They are standard and articulated buses. The standard buses are old model cars that are 15 or 20 years old. They have an unattractive appearance. There are also some standard buses which have as modern and comfortable appearance as the articulated buses have. (Ist. I.Kent Şurası, 2003). Generally, buses are servicing along main roads. For two years, the Greater Metropolitan Istanbul Government (IBB) provided coordination of buses with other modes in European side to improve use of mass transportations. Although the integration of fare system between buses metro and light rail system is achieved, there is no integration of buses with either commuter rail in Asian side or in European side. Since commuter lines are extending far away from main roads, the coordination of commuter rail and buses can not be accomplished. In addition, that buses and commuter rail are operated by different managements is another problem.

TABLE 2: SHARE OF THE PUBLIC TRANSPORTATION MODES IN ISTANBUL

ISTANBUL Transportation	**Vehicle Type**	**Vehicle Rate**	**Daily Average Passenger Transportation**	**Total Trip (%)**
HIGHWAY TRANSPORTATION % 91.8	IETT	2.587	1.500.000	14,8
	Public Transit	1.229	800 000	7.9
	Minibus	5.860	2.000.000	19.8
	Dolmuş	590	70.000	0.7
	Taxi	17.416	750.000	7.4
	Service buses	32.000	1.050.000	10.5
	Car	1.628.367	3.100.000	30.7
	Total	***1.688.049***	***22.770.000***	***91.8***
RAIL TRANSPORTATION % 5.7	**Commuter Rail**	**101**	**124.104**	**1.2**
	Metro	32	130.000	1.2
	Light Rail	60	158.000	1.7
	Tramway	45	144.000	1.5
	Nostalgic Tramway	3	5.000	0.0
	Tunnel	2	13.000	0.1
	Total	***243***	***574.000***	***5.7***
SEA TRANSPORTATION % 2.5	TDI	59	160.000	1.7
	İDO	25	19.000	0.1
	Sea Motor	319	72.000	0.7
	Total	475	251.000	2.5
		1.688.767	***10.095.000***	***100***

Source: (Istanbul I. Kentiçi Ulaşım Şurası, 2003)

3.3 Railway Transportation

The first line of rail-based transportation in Istanbul started in 1871. First carriages were horse drawn and they serviced until 1911 along Galata, Aksaray, Yedikule, then the tram network was electrified by overhead contact wire in 1914. This system was in use until the 1961's. Then, rail

based projects and improvement have been suspended by government authorities. During this period, the main development on rail systems was that commuter rails in both sides of Istanbul were electrified. Major concerns about rail-based transit systems emerged during the 1980's and during the 1990's. New projects were concluded. The actual system consists of six types: commuter rail, metro, light-rail, street tram and tunnel system. All systems are managed by the municipality but the commuter rail that is owned and operated by a central government agency (TCDD).

3.3.1 Commuter Rail Systems

Istanbul has two commuter rail systems: Sirkeci on the European side and Haydarpaşa on the Asian side. Both of systems extend along the coastline, westward from Sirkesi to Halkali and eastward from Haydarpaşa to Gebze. There is no connection of these two systems, because they locate on different sides of Istanbul. The commuter rail systems run between central business districts and suburbs in Istanbul. Although Sirkeci –Halkalı and Haydarpaşa-Gebze lines' direction are parallel to the sea transportation, authorities have not succeeded any integration of fare and schedule of commuter rails with ships. In a day, 28,755 passengers travel by ships from Eminönü to Kadıköy, but how many of them use Haydarpaşa-Gebze commuter rail as second transit is unknown (Istanbul I. Kentiçi Şurası, 2003).

3.3.2 Metro

The Metro system in Istanbul began to served in 2000. This line is 7.6 km long with six stations, from Taksim to 4th Levent. The journey between the two ends takes 10 minutes from Taksim to 4th Levent.

It runs along commercial and entertainment districts (e.g. Mecidiyeköy, Taksim, Levent). Although the stations have a capacity of eight cars, trains run with four cars. Metro is a quite new and modern system which has an attractive appearance. Unfortunately the metro system is used less than its capacity. The ratio of Current ridership capacity is over 0.43 (Akin, et al., 2004). Metro system carries approximately 130 thousand passengers per day. The fact that this line is short and does not have connections to other rail based transportation systems could be a reason for the lack of passengers. In recent, to coordination of metro and bus has been provided by Istanbul Municipality increase movement of passengers from one transit to metro. Authorities aimed at solving Istanbul's transportation problems by constructing new rail line, but they were not able to succeed entirely on their aims. Lack of connectivity among transits is main obstacle for solving transportation problem (Akın, et.al, 2001).

3.3.3 Light Rail System

The Light-Rail System extends along major districts (Aksaray, Otogar, Esenler, Yenibosna and International Atatürk airport of Istanbul) in Istanbul. This line is about 18km long with 16 stations. The journey takes about 28 minutes from Aksaray to the airport with trains. This system works

approximately 66% of its capacity. Its one-way maximum capacity is 24.000 passengers/hour, but it works with the capacity of 16,000/hour actually. The daily average number of passengers is 144,000 from 6am to midnight (Gümüşoğlu, 1992).

The stations had both central platform and side platform configuration; there are stations (Bakırköy and Bahçelievler) in tunnels and outside.

3.3.4 Tramway

The tramway system is extending from Eminönü, Beyazıt Topkapı to Zeytinburnu. This line is 11.2 km long with 21 stations. The journey takes about 40 minutes from Zeytinburnu to Eminönü. While Sırkeci-Halkalı commuter rail services along Shore of Marmara Sea, tramway runs on central business districts with high potential passenger capacity. For that reasons, the number of passengers in tramvay is more than commuter rails' passengers. Eminönü is the last station of these two systems. It runs along central business districts. The system has a one-way capacity of twelve-thousand (12.000) passengers/hour but carries 140,000 passengers daily. Trains run on the surface of the roadway usually in the middle of the street with protection barriers separating from the vehicular traffic. Although, this system shares the same corridor with Sirkeci-Halkalı commuter rail in some places, the coordination of tramvay of commuter rail is so hard because of distance between these systems (Ilker, Ü. et.al, 2001)

3.4 Sea Transportation

Istanbul is located along the north shore of the Marmara Sea, and the Bosporus strait has an immense potential of sea transportation. However, the effect of sea transportation in Istanbul is lower when compared to other transits. Sea transportation in Istanbul consists of the 2.5% of total transportation. The sea transportation includes movement of passengers between two continents (Europe and Asia sides). This transportation system includes three types; transits are operated by Turkish Sea Management (TDI), ships and sea motors. Since commuter rails service along the shore of Marmara Sea (sea transportation), the coordination of commuter rails with this system is easier than with the other transportation systems (Istanbul I. Kentiçi Şurası, 2003).

3.4.1 Ship

Sea transportation is mostly made by the inter-city ships operated by the Istanbul Sea Buses Corp. (IDO). This company began to be controlled by the Municipality of Greater Istanbul to find a solution for Istanbul's sea transportation. IDO has twenty-five vehicles carrying nearly nineteen thousands (19 000) passengers per day. Although the geographical location of Istanbul is suitable for improving sea transportation, the rate of sea transportation is too low (Ilker Ü, et.al, 2001).

3.5 Outlook Future Of Commuter Rail

The central government of Turkey has designed a project named ***Marmaray*** to find a solution for traffic congestion due to the high commuting rate between the two continents of Istanbul. ***Marmaray*** is the name for a project to link the European and Anatolian halves of Istanbul by an undersea rail tunnel across the Bosphorus strait. The construction of the project started in May 2004. It includes a 13.3 km Istanbul Strait crossing, and 63 km of suburban train lines has been upgraded to create a 76.3 km high capacity line between Gebze (east end) and Halkalı (west end). The upgrade of the suburban lines requires the laying of a third track along most of the way to increase the line capacity up to 75.000 passengers per hour in each direction. Marmaray project is expected to be finished in 2008. After its completion, the share of the rail transport is projected to rise from 3.6% up to 27.7%, which will place Istanbul to 3rd rank in the world after Tokyo and New York City (Marmara Project, 2003). This project may change the role of the commuter rail by both renewing old trains and lines and connecting the commuter rail with other transport modes in Istanbul (Evren et.al, 1992)

METHODS of ANALYSIS

4.1 Introduction

There have been no previous ridership studies on the Haydarpaşa-Gebze rail commuter line. Therefore, a methodology was developed in order to obtain perceptions of commuter rail passengers in this line. In this study, there are three methods employed to assemble information for understanding the mission of commuter rail in urban transportation. These methods are survey questionnaire, observations (site visits), and interviews with the managers and security officers of the commuter line. Observation includes both physical environment of stations, commuter rail line and commuter rail passengers. How physical factors affects passenger decline in commuter rail and what the environmental obstacles for coordination of commuter rail are and other modes (e.g private and I.E.T.T buses) was examined by this method. Also, observation was about origin - destination of passenger and socio-economic structure of riders.

4.2 Data Collection

The data analyzed in this study are divided into three groups. First, crime data obtained from the Haydarapaşa-Gebze Security Department. The data set includes information on crime types, crime rate and stations at which crimes are committed. During the interviews with the rail authorities of the commuter rail, questions are asked to clarify security problems of this

system and security strategies to prevent and control crimes. The questionnaire focused on;

1. Nature and extend of crimes
2. Transit characteristics causing crimes.
3. Consequences of crimes
4. Crime prevention and control strategies
5. Results of strategies

All of these questions disclosed very important information about user perceptions and the nature of the security problems in the commuter trains. In addition, to demonstrate the physical conditions of the commuter trains and stations, several photographs were taken to help us understand whether the physical characteristics of the system encourage crime incidents or not. Also, some questions were asked the manager of commuter rail in Haydarpaşa Gebze line. These questions are about why the number of riders decline in commuter rails, what they plan to prevent this decline in commuter rails, or they think that Marmaray Project may solve problems of commuter rail exactly or not.

According to the manager of Haydarpaşa-Gebze commuter rail, there are several factors behind the decline in commuter rails; problems combined with transportation policy of state, problems related to Istanbul transportation system (lack of systematical transportation management), troubles with local law (especially about crimes). For them, Marmaray

project will solve general problems about commuter rail by connecting commuter rails each other and other transits. Due to marmaray project, they have not invested on the development of commuter rail nowadays.

Secondly, riders data obtained from TCDD consists of the number of yearly passengers from 1940 to 2004 and the number of daily passengers for the last fifteen years. Thirdly, data collected by using the passenger survey, observations and site visits, and interviews with the managers and security officers of the commuter line revealed precious information. This required directly administered surveys in order to obtain credible information.

4.3 Passenger Opinion Survey Method and Design

A travel survey is one of the most important ways of obtaining critical information needed for transportation planning and decision making. This survey was used to gather current information about the demographic, socioeconomic, and trip-making characteristics of individuals. In addition, it was used to understand of travel choice, location, and scheduling of daily activities.

The survey provides detailed information about different trip purposes, origins and destinations of people, trip distance, mode of travel and the demographics of the people who travel. Survey focused mainly on user perceptions of the commuter rail service. For this study, several commuter rails were analyzed before choosing survey questions. This study will provide a context for the results of more local studies.

The survey data reported in this thesis are based on an interview with a sample of 204 Haydarpaşa-Gebze commuter line passengers in April 2005. All interviews were conducted during weekdays as well as weekends. The survey was conducted during off-peak hours, because peak hours were not convenient for collecting reliable data about user's perceptions of system's performance.

The biggest problem while conducting high-quality travel surveys was women' being unwilling to participate. The total number of responses was 204, and the passengers were asked 12 questions. Some of the questions are about problems related to the reduction on train recently. The survey includes the following questions:

1. Trip purpose, travel mode to access the rail station,
2. Demographic questions (age group, educational level, etc.)
3. Household income, place where they live and work,
4. Opinions on travel quality and the level of service provided.
5. Commuters were asked to choose out of the two of the most important problems that disturb them.
6. Commuters were also given an opportunity to express their comments and recommendations to improve the system in terms of riding quality, connectivity with other transit modes and not tolerating the crime in trains.

The results of the survey were analyzed by SPSS 10.0 (statistical package for social sciences). The reason for choosing this program is that it analyzed the variables more elaborately than some other programs such as Excel Program. All variables were analyzed within this program. The collation of raw survey data and the summary statistics, and cross-tabulations of several variables were organized in a best way by this program. In the data disaggregated using cross-tabulations, male and female passengers' answers were compared to see whether the answers are significantly different or not. In addition, frequency charts for the variables of genders, mode to transit, and purpose of travel were drawn.

ANALYSIS AND DISCUSSION

5.1 Introduction

Commuter rail problems are actually a complex bundle of interrelated problems. They can be grouped in three major categories: security, riding quality and integration of transits. There is a close relationship between the decline in commuter rail ridership and these problems. The primary focus of this part is to provide a brief, but informative survey of commuter rail transit operations in Istanbul, concentrating on the ridership decline in the commuter rail system and passenger perceptions towards the rail system. In addition, by analyzing crime incidents on this line, an important problem in commuter rails, level of personal security, will be understood. The aim is to meet passengers' security concerns, identify which station is under high crime incidents and why crime incidents usually occur at those stations. There is no doubt that crime problems are one of the most serious reasons causing passengers not to use rail systems.

5.2 Security Problems In Commuter Rail

Personal security is an important factor in the decision making of many people whether to use public transportation or not. Passenger security has become the focus of increased attention in the last decade, especially after increasing crime incidents in commuter rail lines. Crimes on the Haydarpaşa-Gebze commuter rail are divided into two groups: 1) Crime against passengers including robbery, pickpocketing, physical and sexual

assaults; and 2) Crime against system properties including fare, theft, and vandalism incidents. Peddlers are another problem in transit, which irritates passengers. Suburban trains have recently turned out to be the center of theft and snatch. Transit crime is extensive in Istanbul's commuter rail, and its magnitude is far more than the published statistics.

There are 117 officers totally patrolling the trains, lines and stations. Of these, 93 control ticket boxes at stations located along the double lines of the commuter rail, and 24 provide security within the train. However, 116 trains with six cars travel along the line during an average day (TCDD, 2003), which means that the number of security officers is very insufficient compared to the number of trains and stations. So, security officers are not able to prevent the crime and protect the passengers the trains.

The crime rate in the commuter rail transit is high, but the crime statistics are not reliable because the security department of the rail service can not posses the data accurately due to the lack of security officers. The graph in Figure 6 is an evidence of the lack of security in the commuter rail. Another reason for the statistics' being low is that many victims can not report the offenders to security officers, since people use transit regularly, and they fear to be offended badly next time.

These organized crime groups force teenagers for crime, because they do not get serious punishments for their offences when they arrested by the police. These teenagers use knives and throw people out of the moving trains whenever they meet any resistance from passengers. Therefore,

people choose safer modes in the same corridor. In addition, since the security officers in the trains do not have as enforcement power as a police officer's to control and prevent the crimes, they can not truly prevent crime committed in the commuter rail.

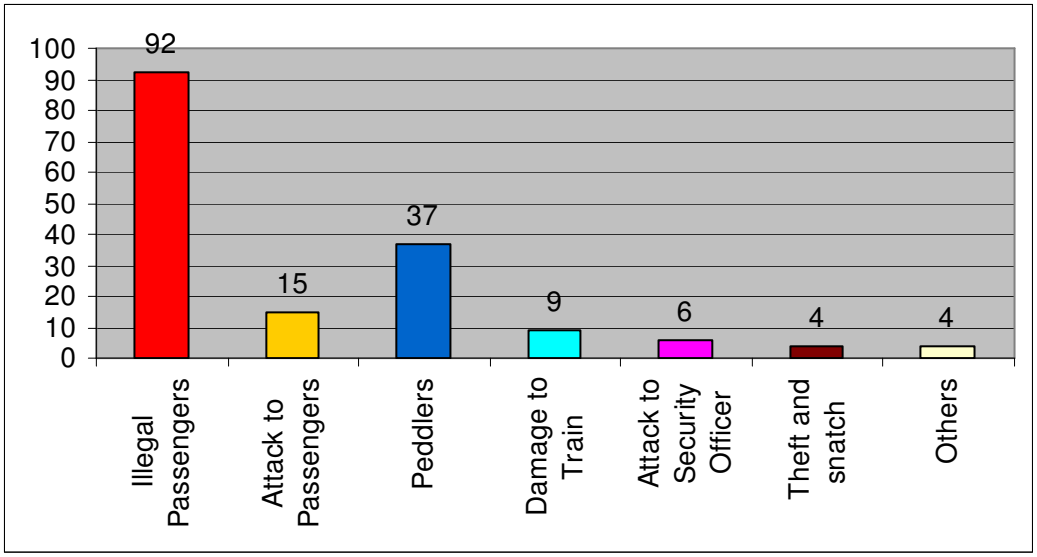

Figure 6: Types of Crime in the Haydarpaşa-Gebze Commuter Line (TCDD, 2003)

The committed crimes in the suburban trains vary according to the time of day and circumstances related to the incident, e.g., vandalism happens during the times when the trains are not crowded. Vandals are usually school-aged children, and the crime is viewed as an aspect of juvenile delinquency. The types of transit property destruction include breaking windows, ripping seats, graffiti, and stoning moving trains (TCRP, 1997). The other crimes are robbery and pick pocketing that occur especially during peak hours. Another disruption to the passengers is the peddlers.

After having using the Akbil (electronic) ticket system in all transit modes and controlled ticket boxes at the gates of commuter rail stations, the problem of peddlers and illegal passengers has been dramatically reduced. However, illegal passengers have still been posing high cost for the system, as they can get in the train by jumping from walls and fences.

5.2.1 Distribution of Crimes at Stations

As shown in Figure 7, Pendik is the station where the crimes have the highest rate of all stations. Approximately seventy-eight (78%) of the crimes occur in and around this station since the crime groups are organized in this neighborhood, and the layout of the station gives them an easy escape after committing a crime.

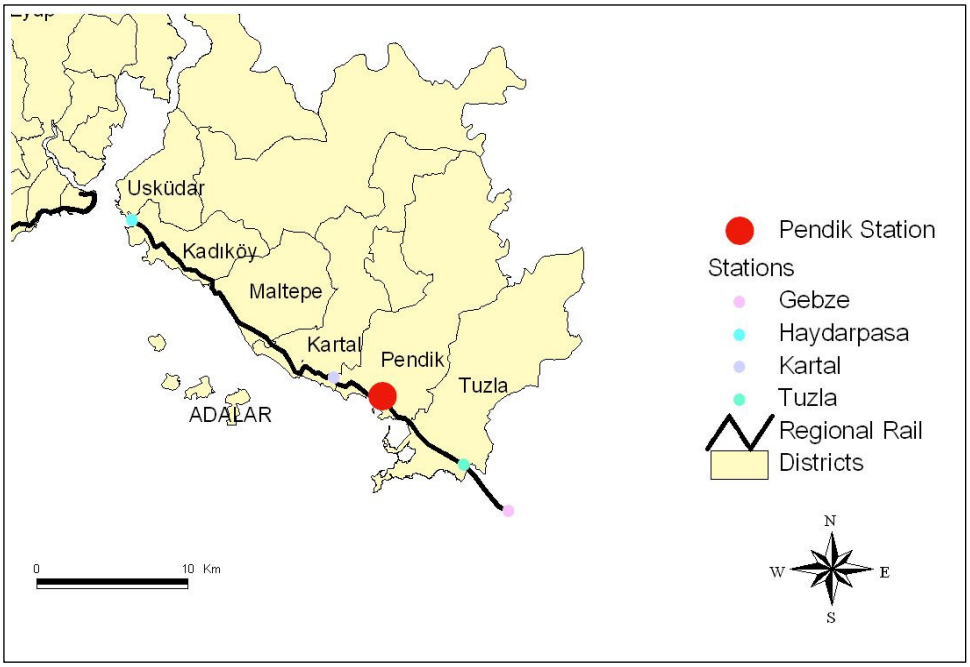

Figure 7: Distribution of crimes along the stations.

Pendik station is located in a low-income area and composed of people migrated from east- and south-east Anatolia regions. The intensity of the crimes in this line is related to the level of crimes in Pendik.

5.3 Factors Encouraging Crimes ond Development Of Strategies

Problems related to transportation security in the commuter rail system are classified as architectural and technological problems.

5.3.1 Architectural Problems

In the past, commuter transit was highly popular since it was the most common form of urban public transportation in Istanbul. Because TCDD had often financial problems in recent years, the investments for the development of commuter rail have been suspended for a long time. Most of commuter rail cars have not been replaced for thirty years. Therefore, the physical appearance of the trains and stations are not attractive at all. The doors of train cars are not automatic so that criminals can open and run away after incident, or victims can be thrown out of the trains by offenders while the train is moving (see Figure 8).

Figure 8: A view from the inside of the train cars in the Haydarpaşa-Gebze Commuter Rail Line

To escape easily from the crime place, offenders generally choose the first or the last car of the train, which is close to exits. They can open doors of the train and run away. Architectural design is the most popular strategy for crime prevention and security provision. Crime prevention and control, especially in the transit environment, begins with the facility and the vehicle design. The environment of rail lines can not always be secured by high fence and walls; therefore, criminals are able to access easily to stations from different points (see Figure 9).

Figure 9: A view from Atalar Station (TCDD)

In addition, crime control and prevention is rather difficult in the commuter lines of Istanbul due to longer stations. High quality fencing must be used to restrict the unwanted access to trains and stations and to minimize the exposure of passengers to crime incidents. Systematic analysis of the data, both qualitative and quantitative, has identified common design features that are repeatedly associated with fear of crime in addition to highlighting significant differences between different groups of respondents.

5.3.2 Technological Problems

There is currently no camera system installed on the trains and around the stations, which prevents recording incidents. TV and video monitoring and recording is a common way for security control in all trains and rail stations. The commuter rail also does not have emergency communication panels that are accessible to all passengers. Communication panels help passengers feel safe since they enable passengers to speak

directly to either police or train operators. Another factor leading crimes in transit is poor lighting systems at stations and along the lines. Therefore, crimes like robbery, theft, pick pocketing usually occur during peak hours and after 9 pm on summer days and 6 pm on winter days. Lighting is a popular and proven crime prevention technique applicable in both transit and non-transit settings (TCRR Synthesis, 1997). Lighting and other safety features must be incorporated into the commuter rail platform design

5.3.3 Additional Information Gaps

To target preventing crime and control resources in a cost effective way, the TCDD security department must lay out detailed victimization data in terms of nature of crime, time of day and other related incident characteristics. This data would profile offenses committed against passengers. Effective analysis that helps decision making is only possible when detailed and timely incident data are available, which help trace the consequences of violence, crime and fear. However, such kinds of data provide very little information. Many transit agencies, even those which cooperate with police divisions, do not seem to have the capacity to produce reliable crime statistics. Reliable longitudinal crime incidence data are not generally available. Therefore, such data set does not produce reliable results for the crime incidents in the Haydarpaşa-Gebze commuter rail.

5.4 Analysis of Passenger Survey Data

Specific qualitative comments and recommendations made by the survey respondents are presented throughout the text to illustrate their particular concerns as well as graphs and tables providing a summary of their responses. For comparative purposes the responses are expressed in percentages rather than frequencies.

5.4.1 Gender

This study includes slightly more males than females since many females refused to answer the survey. Out of 204 respondents, 77.5 % are males, and 22.5 % are females in survey (see Figure 10). So, the survey does not reflect the women's point of views equally towards the commuter rail. However, for this kind of study, the answers of women and teenagers are very important especially for rating the level of security in the rail transit.

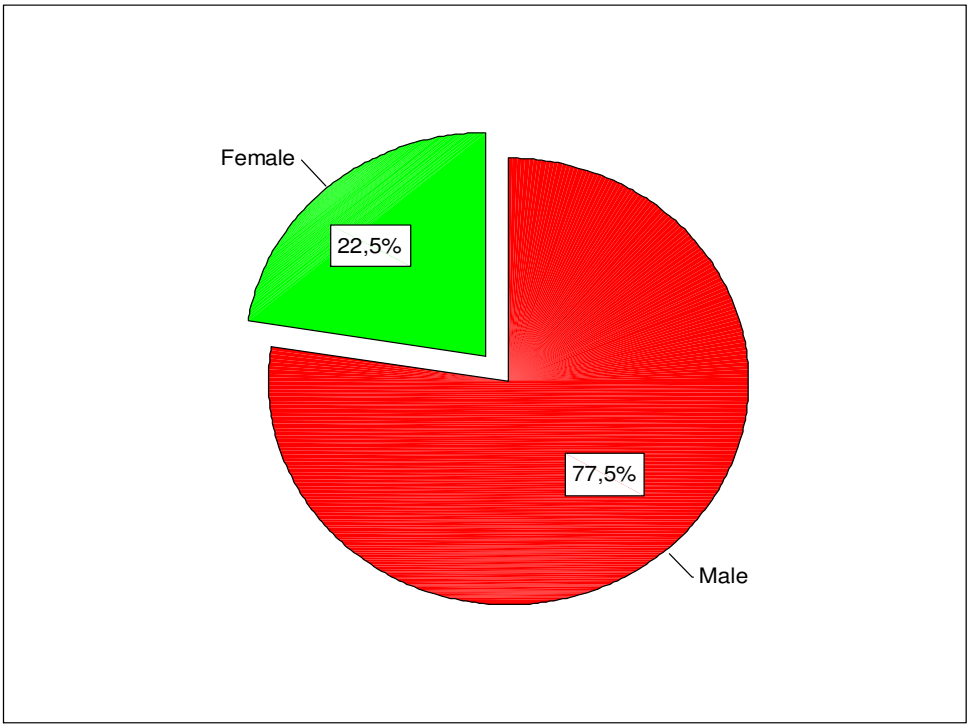

Figure 10: Gender Distribution of the Survey Respondents

5.4.2 Age Groups

Most survey respondents are between the age of 25 and 34 (38%). Passengers 65 and over are only 2.5 % of the respondents, while 2.9 % are between the age of 55 and 64. These age groups of respondents make up only small percentage (see Table 3). The main reason for this situation is that the bus transit (I.E.T.T) offer discount tickets or free travel for senior citizens (65 and over). The management of the commuter rail line does not offer such discounts.

Table 3: AGE DISTRIBUTION OF THE SURVEY RESPONDENTS

		Frequency	**Percent**	Valid Percent	Cumulative Percent
Valid	Less than 18	13	6,4	6,4	6,4
	18 - 24	56	27,5	27,6	34,0
	25 - 34	**75**	**36,8**	**36,9**	**70,9**
	35 - 44	29	14,2	14,3	85,2
	45 - 54	19	9,3	9,4	94,6
	55 - 64	**6**	**2,9**	**3,0**	**97,5**
	65 and over	**5**	**2,5**	**2,5**	**100,0**
	Total	203	99,5	100,0	
Missing	System	1	,5		
Total		204	100,0		

Another observation is that the commuter rail is not preferred by those who are less than 18. This age group is obviously high school students who do not find the system secure to ride with. Like in the case of senior citizens, discounted tickets are not offered by the commuter rail management to students. It is probable that students choose other modes offering discounted ticket. Moreover, the commuter rail line is located at a distance far away from schools, shopping mails etc. This may be the other reason for that the students do not use the commuter rail. However, young people are the major users of public transport. So, they should be provided some advantages by commuter rail management in order them to use commuter rail.

5.4.3 Employment Statue

Nearly forty-eight (48%) of the respondents were workers, self employers or government employers. Students make up 22% of the respondents (See Figure 11). University students use the commuter rail to access the boats in Kadıköy traveling to European side. Low and constant fare regardless of the distance is the primary reason for the use of the commuter rail by workers with low income.

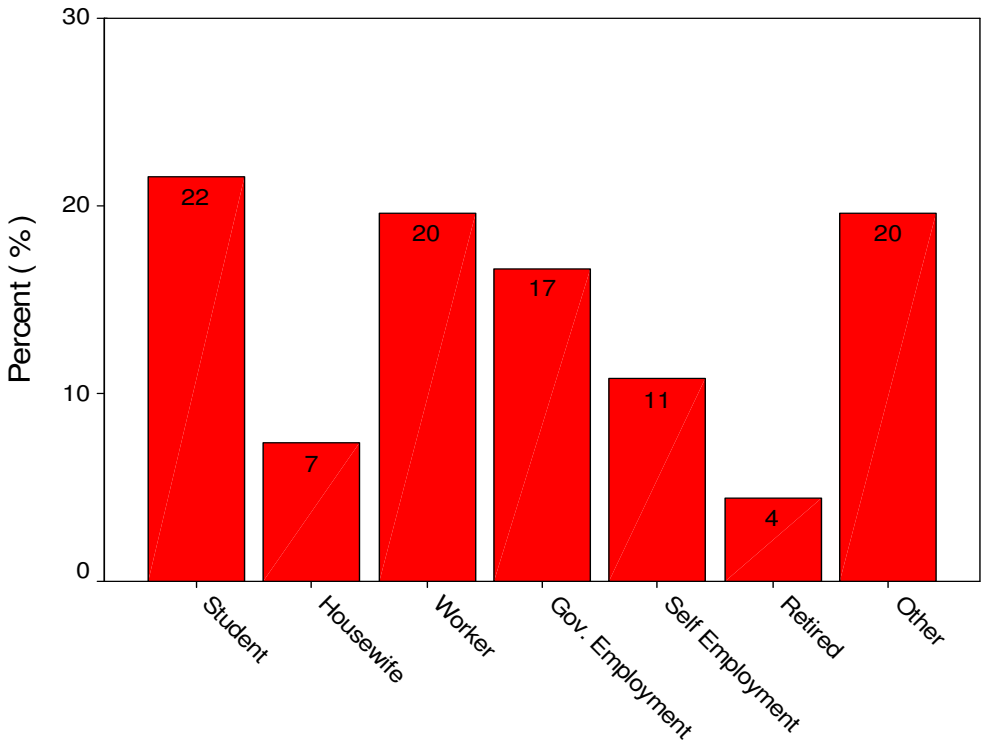

Figure 11: Percentage of Rider Occupation

5.4.4 Trip Purpose

As expected, the overwhelming response to this question is "work travel" (34%) followed by the "recreation travel" (29%). The reason why

work trip is the most frequent answer is that the majority of passengers are workers, self employers and government employees. Although the rate of students traveling by the commuter rail is high, trip purpose for education is only 9% of all travel purposes (See Figure12).

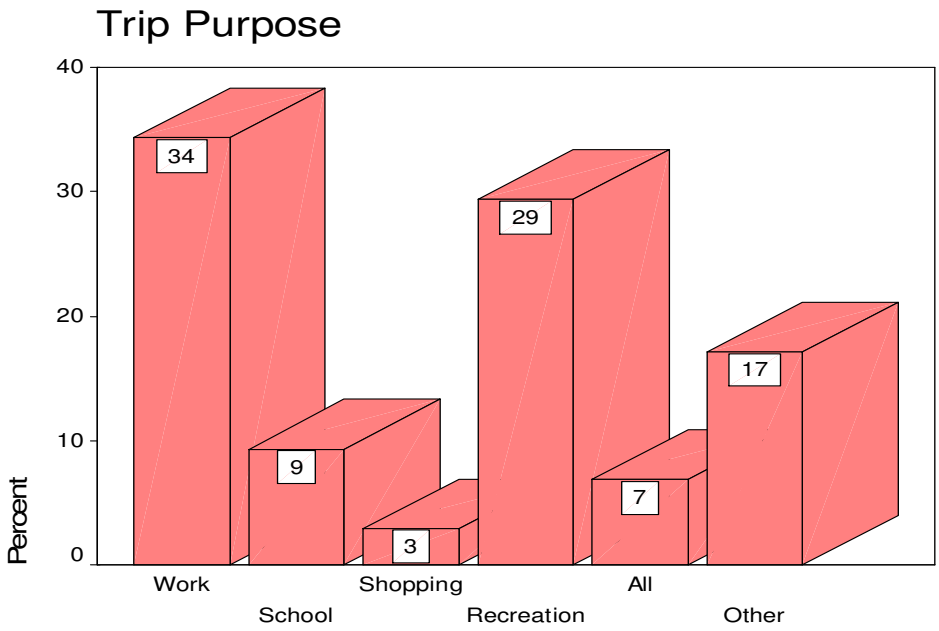

Figure 12: The Ratio of Trip Purpose for Commuter Rail

The reason of this situation can be explained by the analysis of the age groups of the respondents. Generally, school buses are used for school trips in urban transportation. Shopping is only three percent of commuter rail travel purpose since almost all large shopping centers, such as Carrefour, are located along E-5 (D-100) highway which is parallel to the Haydarpaşa-Gebze Commuter Rail line. Rail stations are not located close to dense

concentrations of activities such as large shopping centers; thus, people prefer other transit modes in the same corridor to reach shopping centers.

5.4.5 Reasons for Using the Commuter Rail

Passengers were asked why they choose the commuter rail. The answers are summarized in Table 4. According to the analyses of the survey data, 29% of the respondents believe that the commuter rail is inexpensive. The twenty-two percent (22%) of the respondents choose it because it is the best alternative for them, and nineteen percent (19%) of the respondents prefer the commuter rail because the travel time is shorter than the other modes (bus, minibus)

Table 4: CROSS-TABULATION OF REASONS FOR USING TRAIN AND GENDER

Cause of Using Train * Gender Crosstabulation

			Gender		
			Male	Female	Total
	Inexpensive	Count	48	12	60
		% within Gender	30,6%	26,1%	29,6%
	Short Travel time	Count	30	9	39
		% within Gender	19,1%	19,6%	19,2%
	Providing easy arrival to work or home	Count	24	12	36
		% within Gender	15,3%	26,1%	17,7%
	comfortable	Count	4	5	9
		% within Gender	2,5%	10,9%	4,4%
	It is best alternative	Count	38	7	45
		% within Gender	24,2%	15,2%	22,2%
	Other	Count	13	1	14
		% within Gender	8,3%	2,2%	6,9%
Total		Count	157	46	203
		% within Gender	100,0%	100,0%	100,0%

Actually, the commuter rail is a very convenient mode for passengers traveling a long distance because it is faster than minibus and IETT/Public buses especially during winter months and rush hours. Although commuter rail is cheaper than other modes in long distance travel, only twenty-nine percent of the riders (29%) find it an inexpensive transport mode. Its reason may be the fact that most of the ridership is composed of low-income individuals such as workers, housewives and students.

5.4.6 Mode Usage Before and After the Commuter Rail

The most common mode used before and after commuter rail trip is the mode of minibus, (38%) of all trips (see Figure 11). Modal choice provides some clues about the socio-economic profile of the rail riders. There is a strong relationship between one's socio-economic statue and the transport mode chosen. Passengers of the commuter rail live mostly in poor quality areas. In poor districts, the availability of minibus service is more favorable than public bus. Minibus is more economic than that IETT Bus for short-distance travels, since the fare of the minibus is distance based while I.E.T.T. fare is a flat rate regardless of the distance traveled. Although the commuter rail in Asia side services from Gebze to Kadiköy and Haydarpaşa where ships and sea cars service to the European side of the city, the number of people who are transferred from the commuter rail to the sea transit is low (5%). The factor causing this situation is the lack of fare and schedule coordination between the commuter rail and sea transits. As a

result, there is no passenger transfer between two modes of the transit at a successful level.

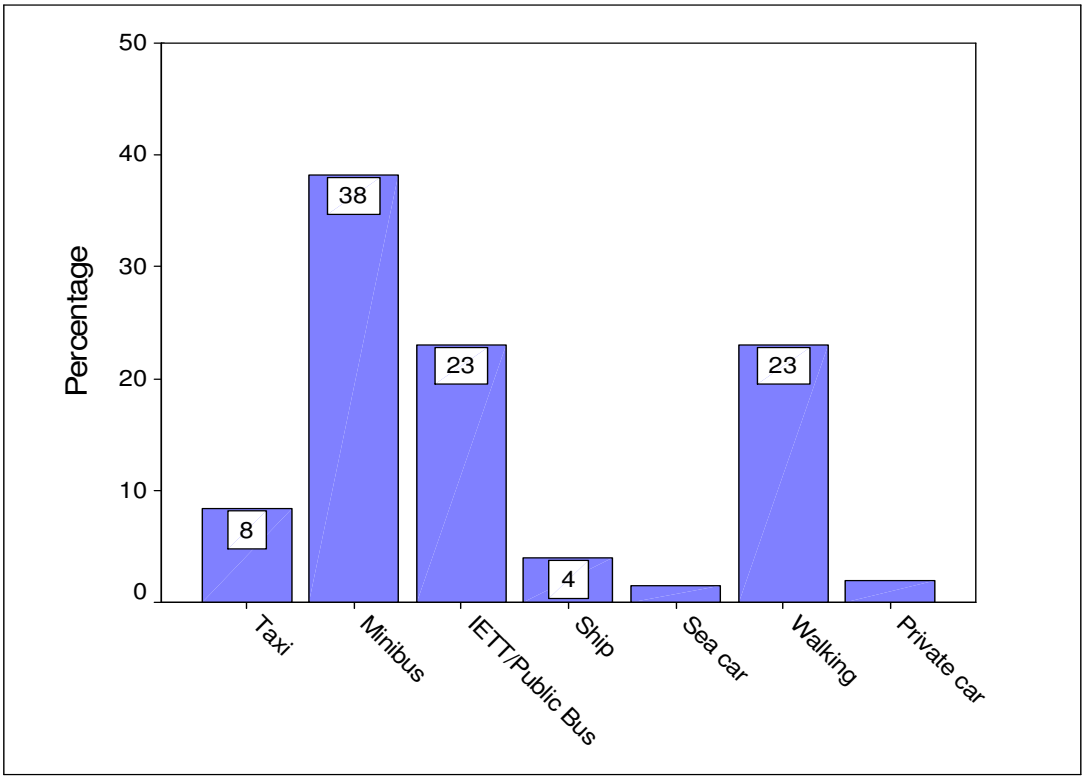

Figure 13: Preferred Modes of Transit Used By Rail Commuter Passengers

Coordinated pricing is an effective approach to generate new revenues for the commuter rail, increase ridership, and help to achieve regional transportation goals. One's decision to use transit is based on a number of factors, including out-of-pocket cost and in- and out of-vehicle travel time, parking costs, riding quality and seamless transfer.

5.4.7 Analysis of Problems Disturbing the Commuter Rail Passengers

When passengers are asked to identify two factors that disturb them, the noise and the lack of security were the most indicated factors (15%) (See Appendix B). The noise and crowd were the second most disturbing factors (12%). Commuter rail has more noise compare to other rail systems in Istanbul. It does make travel by commuter rail very unattractive.

5.4.8 Rating the Security in the Commuter Rail

When rating the quality of security in the commuter rail, approximately 37% of the male respondents and 33% of the female respondents reported it to be poor, 39% of the females and 30% of the males reported it to be fair (see Figure 14).This means that most of the total respondents (70%) think that the commuter rail is not a safe transit for passengers. According to passengers, in the past, offenders generally chose male passengers as victims, but now women are faced with the physical assault and the threat of robbery as well.

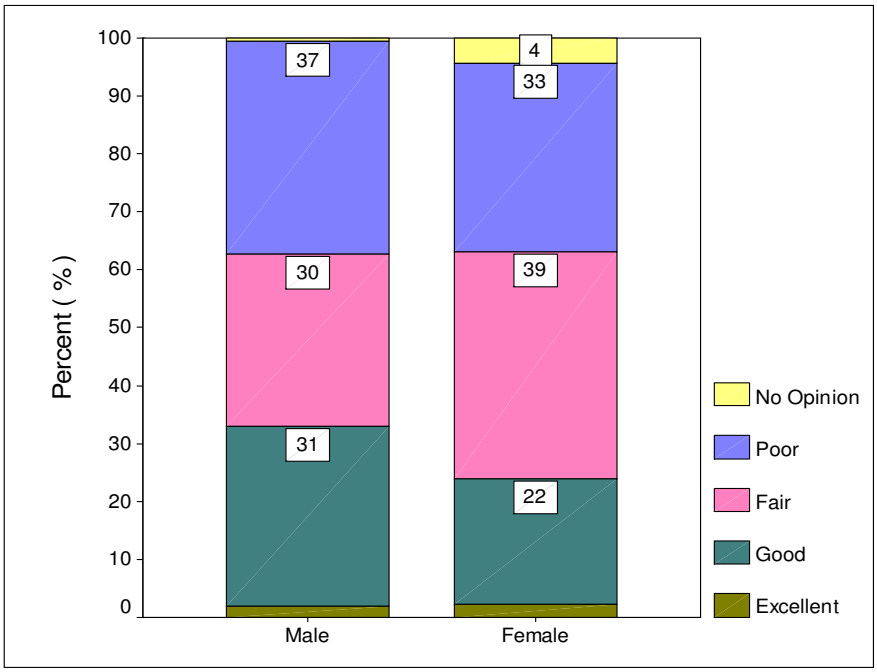

Figure 14: Evaluation of Passenger Security in the Commuter Rail

5.4.9 Evaluation of Price, Travel Speed, Comfort and Cleanness

A higher proportion of respondents in commuter rail (47%) reported that price of commuter rail is comparable to other transit (see Table 5). Commuter rail is cheaper than other modes for many people especially for long distance travellers.

However, it is an expensive transit for specific groups like students and the elderly who are provided discount tickets by other public transit systems. Slightly more than half of respondents viewed travel speed as fair. Actually the train is very convenient transit in rush hours and bad weather because it is not affected by any climatic changes. Travel time end to end is estimated about 65 min with a frequency of 15 minutes during the day. It is

faster than other transits in the same corridor but sometimes it can not reach its destination on time because of sharing the same line with other regional rails. This is thought as a problem by some passengers. Most of the respondents rated the riding comfort as fair (50%). The main factor ruining the comfort is the high level of noise and vibrations in trains. This disturbs passenger very much especially during rush hours.

TABLE 5: THE EVALUATION OF PRICE, TRAVEL SPEED, COMFORT AND CLEANNESS

Gender	Excellent	Good	Fair	Poor	No Opinion
Evaluation Of Price					
Male	5.1%	**47.5**%	32.3%	15.2%	0%
Female	2.1%	**47.8**%	41.3%	8.7%	0%
Evaluation Of Travel Speed					
Male	1.9%	31.0%	**52.5**%	14.6%	0%
Female	2.2%	28.3%	**50.0**%	19.6%	0%
Evaluation Of Comfort					
Male	0.6%	25.9%	**41.1%**	32.3%	0%
Female	2.2%	10.9%	**54.3%**	30.4%	0.2%
Evaluation Of Cleanliness					
Male	0.6%	26.6%	**43.3%**	26.6%	1.9%
Female	0%	19.6%	**41.3%**	37.0%	2.2%

To sum up, the people are reporting commuter rail's price to be good. The other options are reported to be fair. The male and female passengers evaluate the options almost on the same rate. However, the number of male passengers is more than the female reporting the price and the comfort to be poor. For travel speed, cleanliness options, the number of female passengers is more than the male reporting them to be poor.

CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

6.1 Conclusions

Commuter rail is a choice of the transportation system for an expanding number of metropolitan areas. Governmental bodies in these regions have been expanding and improving commuter railroads as a solution to ever more congestion. Commuter rail provides high mobility and variety of travel choices. In contrast, Turkey has focused on the development of highway transportation instead of improving commuter rail in order to solve traffic congestion and its associated problems (i.e., air pollution, energy consumption etc). As a result, the development of commuter rails has been ignored for a long period. The major conclusion that can be drawn from examining commuter rail system worldwide is that independent private companies seem to be more effective in administrating these types of system. However, the commuter rails in Istanbul are operated by a governmental agency (TCDD) independent from the management of other rail systems in urban transportation. While the commuter rails are operated by TCDD, the management of other rail systems is under the control of Istanbul Rail Transportation Agency (Istanbul Ulaşım A.Ş.). This creates problems in the integration and coordination of the transit systems between TCDD and the city authorities on the decision making about the improvement of the rail system. Also, this is one of the reasons why the development of

commuter rail system has been disregarded. In order to take effective decisions on the management of rail systems, the management of the commuter rail should belong to Istanbul Rail Transportation Agency.

As in other metropolises, Istanbul demands a coordinated and integrated commuter rail system with a high level of service as in other transit modes. Authorities must develop a strategy to make the commuter rail a part of the city's integrated transportation systems that will provide an alternative mode of travel for commuters traveling by automobile in Istanbul.

The commuter transit capacity in Istanbul is insufficient. Depending on Istanbul's growing population and economic growth, there has been a huge increase in the car ownership during the past years. This increase combined with its inadequate transportation infrastructure creates severe congestion in commuting. Although the development of the existing rail system is accepted by transportation planners as the best solution for the congestion problems in Istanbul's urban transportation, rail investment projects have been delayed for the last two decades.

TCDD have long disregarded to improve the existing rail system and upgrade the lines and trains in Istanbul. In time, many problems have occurred in the commuter trains as a result of the fact that the existing problems related to level of service and riding comfort have been ignored. Passengers have been decreasing constantly due to the fear of crime, poor quality of service, and the disintegration with other transit modes. To

improve the security and to make the commuter rails as attractive as in the old days, the following strategies should be followed:

1. Safety cameras and alarm systems should be installed in stations and trains for emergency situations.
2. Security officers and undercover police officers should be deployed in stations and trains.
3. Security officers should be increased and given more authority.
4. Type, time and place of crime should be well–documented for taking effective security steps for high-crime rated stations.
5. Crime map should be created along the line and around the stations.
6. According to this map, more security actions should be taken where it is more necessary. Doors of the trains should be automatically controlled to prevent the escape of offenders.
7. Trains should be upgraded.. Fare structure should be reorganized to make the commuter rail more coordinative with other transit modes.
8. Trends in crime incidents at stations that affect passenger security should be identified.

Transit crime is extensive in the commuter rails, and its magnitude is far greater than the published statistics. The commuter rail transit agency (TCDD) must improve the quality of service in the system by reducing crime incidents.

Authorities should encourage development at the train and stations. The design of the stations doesn't conform to standards which help reduce

crime. Trains should also be in good outlook. Inside and outside of the trains must be physically attractive to travelers. Commuter trains should be effectively planned in order to ease traffic congestion in highway corridors of the urban transportation network. In the past, the commuter rail transit was very popular since it was the most common form of urban public transportation in Istanbul.

Mostly people with low income use the commuter rail service in Istanbul's urban transportation. Thus, the service quality must be improved to attract middle- and upper-middle income riders with clean trains in good physical appearance and free of graffiti. A high level of security in both trains and stations must be assured. Commuter rail must be a good transportation alternative for upper-middle income riders.

It is probably impossible to convince all people to give up using their cars for commuting. It would be of great help to improve the commuter rail system in a way that facilitates connections and conveniences for the general public to use it through promotional campaigns. This effort should be treated as a social service campaign and be undertaken by the governmental and non-governmental agencies. It is important to consider the integration between the commuter rail and other transit systems and the appropriate expansion to provide an efficient as well as sustainable transportation service for the citizens of Istanbul. An effectively developed rail network has great potential to meet future travel demand, too.

In conclusion, the authorities must encourage the further development of the commuter rail transit and increase its efficiency. The commuter rail can have a more promising future if successful integration plan with other transit is developed and applied, personal security problems in trains and stations are solved, and riding quality and good level of service are assured., the commuter rail lines (to be realized as the Marmaray Project) in Istanbul may become an efficient means of transportation to increase mobility in urban transportation and to prevent congestion without major highway investments such as the third bridge crossing the Bosphorus.

6.2 Recommendations For Future Research

This exploratory study focused on the analysis of the service quality of the Haydarpaşa-Gebze commuter rail in terms of the management, design, maintenance of railway stations and their immediate access routes. To make effective responses to crime prevention and control and to form more and effective strategies, new researches including a comprehensive passenger survey and crime analysis must be developed. Also some researches should be carried out to see how Marmaray project will be effective in development of commuter rail and solving commuter rail problems explained in this study

APPENDIX A

HAYDARPAŞA-GEBZE COMMUTER RAIL

TRAVEL SURVEY (2005)

Survey Number: …… **Date:** …… **Time:** …… **Station:** ……

The purpose of this survey is to analyze commuter rail passengers' social structure, travel aim and study their impression about commuter rail.The information obtained will be used in the thesis named ' 'The role of commuter rail in İstanbul public transportation: A case study of Haydarpaşa- Gebze line"

A) PERSONAL QUESTIONS:

1. Where do you live ? ……

2. Where do you work? ……

3. What is your gender? …… Male …… Female

4. What is your age?

…… Less than 18 …… 18 – 24 …… 25 – 34 …… 35 – 44

…… 45 - 54 …… 55 – 64 …… 65 and over

5. What is your occupation?

…… Student …… Housewife …… Blue-Collar worker

…… Goverment Employee …… Retired

6. What is your monthly income ?

…… Less 450 YTL …… 450 - 600 YTL …… 600 – 850 YTL

…… 850 – 1.000 YTL …… 1 – 1.250 YTL …… 1.250 and over

B) TRANSPORTATION QUESTION:

7. What is the main origin and destination of your trip?

..... Origin ..... Destination

8. What is the purpose of your trip ?

..... Work ..... School ..... Shopping

..... Recreation ..... All

9. Why do you chose commuter rail ?

.....Inexpensive ..... Short Travel Time ..... Comfortable

..... Providing easy arrival to work/ home ..... It is only alternative ..... Other

10. What is the fruquency of the use of commuter rail in your daily trip?

..... Everyday ..... Once or Twice a week

..... Several times a month ..... Several times a year

11. What are the two main factors disturb you in train ?

..... Noise ..... Too Many Pople ..... Peddlers

..... Lack of Travel Frequency ..... Lack of Security ..... Travel speed

..... Other

12. Please rate commuter train feature regarding following:

Train Feature	Excellent	Good	Fair	Poor	No Opinion
Price					
Security					
Speed					
Comfort					
Cleanliness					

Thank you for your participation in this effort!

APPENDIX B

CROSS-TABULATION OF SURVEY VARİABLES

Appendix B shows the cross tabulatıon of diffferent variables of travel survey. It includes table of reasons of using train and gender, evaluation of securiy and gender, also, evaluation of price and gender.

Cause of Using Train * Gender Crosstabulation

			Gender		
			Male	Female	Total
	Inexpensive	Count	48	12	60
		% within Gender	30,6%	26,1%	29,6%
	Short Travel time	Count	30	9	39
		% within Gender	19,1%	19,6%	19,2%
	Providing easy arriva to work or home	Count	24	12	36
		% within Gender	15,3%	26,1%	17,7%
	comfortable	Count	4	5	9
		% within Gender	2,5%	10,9%	4,4%
	It is best alternative	Count	38	7	45
		% within Gender	24,2%	15,2%	22,2%
	Other	Count	13	1	14
		% within Gender	8,3%	2,2%	6,9%
Total		Count	157	46	203
		% within Gender	100,0%	100,0%	100,0%

Table 1: Cross- Tabulation of Reason of Using Train and Gender

Evaluation of Price * Gender Crosstabulation

			Gender		
			Male	Female	Total
Evaluation of Price	Excellent	Count	8	1	9
		% within Gender	5,1%	2,2%	4,4%
	Good	Count	75	22	97
		% within Gender	47,5%	47,8%	47,5%
	Fair	Count	51	19	70
		% within Gender	32,3%	41,3%	34,3%
	Poor	Count	24	4	28
		% within Gender	15,2%	8,7%	13,7%
Total		Count	158	46	204
		% within Gender	100,0%	100,0%	100,0%

Table 2: Cross-Tabulation of Price and Gender

Evaluation of Security * Gender Crosstabulation

			Gender		
			Male	Female	Total
	Excellent	Count	3	1	4
		% within Gender	1,9%	2,2%	2,0%
	Good	Count	49	10	59
		% within Gender	31,0%	21,7%	28,9%
	Fair	Count	47	18	65
		% within Gender	29,7%	39,1%	31,9%
	Poor	Count	58	15	73
		% within Gender	36,7%	32,6%	35,8%
	No Opinion	Count	1	2	3
		% within Gender	,6%	4,3%	1,5%
Total		Count	158	46	204
		% within Gender	100,0%	100,0%	100,0%

Table 3: The Cross-Tabulation of Evaluation of Security and Gender

Income

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No Income	44	21,6	22,4	22,4
	Less 450 YTL	23	11,3	11,7	34,2
	450-600 YTL	43	21,1	21,9	56,1
	600-850 YTL	35	17,2	17,9	74,0
	850-1.000 YTL	26	12,7	13,3	87,2
	1.000-1.250 YTL	13	6,4	6,6	93,9
	1.250 YTL and over	12	5,9	6,1	100,0
	Total	196	96,1	100,0	
Missing	System	8	3,9		
Total		204	100,0		

Table 4: Income of Survey Respondents in Commuter Rail

		Frequency	**Percent**	Valid Percent	Cumulative Percent
Valid	Less than 18	13	6,4	6,4	6,4
	18 - 24	56	27,5	27,6	34,0
	25 - 34	**75**	**36,8**	**36,9**	**70,9**
	35 - 44	29	14,2	14,3	85,2
	45 - 54	19	9,3	9,4	94,6
	55 - 64	**6**	**2,9**	**3,0**	**97,5**
	65 and over	**5**	**2,5**	**2,5**	**100,0**
	Total	203	99,5	100,0	
Missing	System	1	,5		
Total		204	100,0		

Table 5: Age of Respondents of Commuter Rail

Problems inside train (2 choices)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Noise - Too many people	20	9.8	9.8	9.8
	Noise - Peddlers	25	12.3	12.3	22.1
	Noise - Lack of Travel Frequency	4	2.0	2.0	24.0
	Noise - Lack of Security	31	15.2	15.2	39.2
	Noise - Travel Speed	8	3.9	3.9	43.1
	Noise - Other	10	4.9	4.9	48.0
	Too many people- Peddlers	13	6.4	6.4	54.4
	Too many people - Lack of travel frequency	9	4.4	4.4	58.8
	Too many people - Lack of Security	20	9.8	9.8	68.6
	Too many people - Travel speed	5	2.5	2.5	71.1
	Too many people - Other	2	1.0	1.0	72.1
	Peddlers - Lack of Travel Frequency	3	1.5	1.5	73.5
	Peddlers - Lack of Security	15	7.4	7.4	80.9
	Peddlers - Travel Speed	4	2.0	2.0	82.8
	Peddlers - Other	3	1.5	1.5	84.3
	Lack of Travel Freguency - Lack of Security	6	2.9	2.9	87.3
	Lack of Travel Frequency - Travel Speed	1	.5	.5	87.7
	Lack of Travel Fequency - Other	2	1.0	1.0	88.7
	Lack of Security - Travel Speed	2	1.0	1.0	89.7
	Lack of Security - Other	7	3.4	3.4	93.1
	Travel Speed - Other	1	.5	.5	93.6
	none	13	6.4	6.4	100.0
	Total	204	100.0	100.0	

Table Caption

Table 6 : The Problems inside train

APPENDIX C

DISTRIBUTION OF CRIME INCIDENTS ALONG THE STATIONS

Stations	Illegal Passengers	Attack/ Passengers	Peddlers	Damage Train	Attack Security	Theft/ Snatch	Others	Percent
Pendik	81	10	26	5	4	3	1	77.8%
Fatih	5	1						3.5%
Haydarpasa	1					1		0.5%
Gebze	1	1	2	1			1	4.1
Kartal	2		3					2.9
Yunus		2	2	1				2.9
Bostancı	2				1			0.5
Osmangazi		1	3	1				4.1
Maltepe			1				1	1.1
Tuzla				1	1		1	1.7
Total	92	15	37	9	6	4	4	100%

Table 7: The crime Incidents Along Stations (Haydarpaşa-Gebze Commuter Rail 2003)

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