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## Comparison of light rail systems in Turkey with the method of comparative standard determination

Yasar Vitosoglu<sup>a\*</sup>, Rukiye Ozden<sup>b</sup>, Polat Yaliniz<sup>a</sup> and Safak Bilgic<sup>c</sup>

<sup>a</sup>*Dumlupinar University, Faculty of Engineering, Department of Civil Engineering, Kutahya, Turkey*

<sup>b</sup>*Kutahya Governor's Office of Urban Development and Environment Directorate, Kutahya, Turkey*

<sup>c</sup>*Eskisehir Osmangazi University, Faculty of Engineering and Architecture, Department of Civil Engineering, Eskisehir, Turkey*

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### Abstract

In today's urban structure, the selection of public transport systems that can respond to the demands for people to travel more comfortable and faster is essential. Considering the comfort and speed at issue, the demand for rail systems in urban public transport is increasing day by day. Due to their characteristics such as high capacity, speed, safety and comfort, rail systems play an important role in meeting the transport demands of large cities. All of these features give the rail systems ample opportunities.

In this study, the five large cities in Turkey (Ankara, Bursa, Adana, Kayseri and Samsun) have been considered, and by using the Method of Comparative Benchmarking, it has been determined how efficiently the light rail transit systems actively operated in these cities were used. It has been also discussed how the systems which were below the average could increase their performances by following the operation policies of other systems that work efficiently. The systems to be analyzed with the method of comparative standard determination are evaluated by taking into account a process that consists of four stages. These four stages are Self-Assessment, Selection of Similar Systems, Determination of Indicators, and Comparison and Determination of the Threshold Values for Efficiency, respectively.

As a result of the study carried out, it has been concluded that the Bursa Light Rail System is the most efficient system. The Bursa Light Rail System having the longest line among the five systems has proven to be made with a proper planning study, remaining above the average in terms many indicators. The most surprising result of the study has been the Adana Light Rail System. It has been seen that the Adana Light Rail System planned to be converted into the rail rapid transit system in the future is the most inefficient system.

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\* Corresponding author. Tel.: +90-274-2652031; fax: +90-274-2652066.

E-mail address: [yvitosoglu@hotmail.com](mailto:yvitosoglu@hotmail.com)

## 1. Introduction

Currently, one of the most reliable transport modes in the world is rail systems. As a result of emerging technologies, the urban rail systems have become indispensable for large cities.

Rail systems play a vital role in meeting the transportation demands in large cities due to their superior characteristics such as high carrying capacity, speed, safety and comfort. The backbone of the public transport systems in large cities are formed by suburban railway, subway and light rail lines. The lower-capacity public transport modes such as bus, trolleybus and minibus serve to feed these main lines.

### Nomenclature

C	line capacity
$C_v$	vehicle capacity
n	number of vehicles in train
$f_{maks}$	maximum frequency
$P_c$	productive capacity
$V_o$	commercial speed
$w_o$	offered work
L	total length of line

## 2. Productivity in the transportation system

Productivity or efficiency can be defined scientifically as to ensure maximum benefit at minimum cost. Productivity is also very important in urban public transport. In urban public transport, if the service provided is not consumed on time, it cannot be stored for the next time.

Transportation is an expensive service; resources are limited. Therefore, authorities should focus on the opportunities for providing services with minimal resource consumption. Especially, the investment and operating costs of rail public transportation systems are high; so, it is inevitable that they are used efficiently.

During the planning of the rail systems, the assumptions regarding that the competing modes will disappear, the feeding systems will be created and the integration of business and pricing will be provided are made, and the riding levels that make the project efficient are put forward. However, even after rail system lines are opened, the expected levels of ridership cannot be reached because these necessary regulations have not been fully realized and the following stages of the line have not been put into practice. Therefore, at the rail systems in Turkey, which were built to have the capacities at the level of 30-70 thousand passengers per hour, the passenger demands still remain at the levels of 10-12 thousand per hour although several years have passed (Oncu, 2009).

At the Report prepared by European Transport Commission in 2001, productivity was evaluated from three different perspectives (Selvi, 2002). Operators aim at increasing performance with minimal resource usage. They are interested in reducing costs and increasing productivity. Users want to be able to cover their costs. In addition, they are interested in quality of service such as accessibility, comfort, reliability, and security. City requires the formation of minimal damage for sustainability.

The efficiency of a public transportation system is provided by compromising the benefits to be derived from these three perspectives. Productivity in transport includes resource utilization and costs on the one hand and productivity on the other hand (Transport RTD Program, 2001). In order to ensure efficiency in urban public transport, it is important to select the right public transportation system.

## 3. Efficiency analysis with the method of comparative benchmarking

The method of comparative benchmarking is a method that has developed during the last twenty years, and is used in many different sectors. In rail public transportation, it has been implemented since 1995. In this method in which similar systems are compared to each other, it is essential that the successful systems in the same category are examined for closing the performance gap of a system.

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