The Determination of the Entrance Fee to the Bus Terminal

Martina Lánská

Abstract: This paper deals with the determination of the mathematical tool for the price calculation of the entrance fee to the bus terminal (BT).

Key words: the bus terminal, the bus terminal operator, the entrance fee

1. Creation of a mathematic tool for determination of the entrance fee to the bus terminal (BT)

This formula should be universal and suitable for determining the entrance fee per any BT under the pre-determined conditions that are as follows: economic information of the BT, operational information of the BT and information of the interest of carriers in using the services of the BT.

The following procedure was chosen for creation of the mathematic tool:

1. Creation of a demand function for entrance to the BT.
2. Creation of a cost function of BT operator.
3. Creation of a profit function of the BT operator.
4. Creation of the mathematic tool for determining the entrance fee to the BT for the price for which the operator’s profit is maximum and the price when the capacity of the bus terminal will be maximally used.

1.1. Creation of the demand function – demanding the entrance to the BT

The demand function of the entrance to the BT is created by means of a regressive analysis of the first degree based on the data as acquired from the records of connections using the BT.

A database of connections presenting a weekly demonstration of traffic on the BT was generated from all above-mentioned connections. This database of connections was further supplemented by the following information: From the list of concrete days when the connection was dispatched one may determine the number of days when the connection was operating; the connections are divided into three categories, i.e. international, long-distance and suburban (this classification is further used for correction of certain features of the connection); capacity of the connection according to the category (initial condition), occupancy coefficient according to category (initial condition), lowest required profit of the

---

1 Ing. Martina Lánská, CTU in Prague, Faculty of Transportation Sciences, Department of Logistic and Transportation Processes, Horská 3, 128 03 Praha 2, phone: + 420 224 359 160, e-mail: xlanska@fd.cvut.cz
bus carrier for the given connection according to the category (initial condition), length of the route, average costs per one kilometre (initial condition), other costs associated with the operation of the given connection (entrance fees to other BT, road tolls etc.), price of a basic bus ticket from the point of departure to the point of destination, price scale of entrance fees to analyzed BT.

Average costs and profits may be calculated from such completed database as well as the profit per every connection may be calculated from their difference. For such determined profit a decisive rule is applied that should state whether the bus carrier who runs the given connection is or is not interested in entrance to the BT.

Bus carrier’s interest in the entrance of the connection to the BT is determined by the following conditions: The profit is positive and the bus carrier is interested in the entrance of the given connection to the BT or the profit is zero or negative and the bus carrier is not interested in the entrance of the given connection to the BT. Based on this decisive condition we may state the number of connections and subsequently the number of buses that are interested in the entrance to the BT for the given entrance fee. By means of a regressive analysis and from the collected data we may get the demand function describing the demand of bus carriers for the entrance to the BT.

1.2. Creation of the cost function – Cost of the BT operator

Costs associated with the existence and operation of a company are its basic economic indicator and their cut-down is the main tool for profit creation at present. Therefore it is extremely easy for the BT operator to create the demand function from his own inter-company economic information.

This function consists of two components: Fixed component – costs independent on production (depreciations, rent etc.) and must be thus covered even though the company does not produce, in case of the BT this is the status when no bus enters the BT; and the variable component – costs dependent on the volume of production (for instance material costs) mostly related to a production unit, in case of the BT there are the costs related to a single entrance of a single bus to the BT.

The decision of what costs belong to what group is not currently arranged by any regulation and it is purely the subject of economic arrangement of every company.

1.3. Creation of the profit function – profit of the BT operator

For creation of the profit function of the BT operator it is necessary to define the function describing the dependency of receipts on the number of entrances of buses to the BT. The amount of the entrance fee at which the profit is maximum, may be calculated from the first derivation of the profit function. This shall be laid equal to the zero and then we can calculate the corresponding fee for maximal profit. This value may be added to the demand function, cost function, receipts function and profit function and thus we can determine the demand, costs and receipts at maximum profit of the BT operator.

For determining the amount of the entrance fee with maximally used capacity of the BT it is necessary to determine first the price from the demand function at which the BT is maximally used. Subsequently we may determine the costs, receipts and profit for the maximally used BT.

Literature