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*Review article*

UDK / UDC:

656.1.025.2(437.3)

656.2.025.2(437.3)

Primljeno / Received:

15. ožujka 2013. / 15<sup>th</sup> March 2013

Odobreno / Accepted:

20. svibnja 2013. / 20<sup>th</sup> May 2013

## THE INTEGRATED PUBLIC TRANSPORT SYSTEM

### *SUSTAV INTEGRIRANOG JAVNOG PRIJEVOZA*

#### SUMMARY

*The paper aims at presenting the approach to the integration and formation of the public transport system as a modern tool of the rising number of passengers, who use public transport for the majority of their mobility cases – mainly for going to school, work, office, for getting medical care and treatment, or when travelling at one's leisure. The three integrated public transport systems, representing the main types of the IPTS, are analyzed in this paper– the first one is the regional system IREDO, the second one is the IDS JMK system around Brno, and last one is the PID system around Prague.*

**Key words:** *Integrated public transport system, railway traffic, road traffic, passenger*

#### SAŽETAK

*U ovome je radu prikazan pokušaj integracije javnog prijevoza te pokušaj formiranja sustava integriranog javnog prijevoza kao suvremenog načina prijevoza sve većeg broja putnika koji usluge javnog prijevoza koriste svakodnevno – pri odlasku na posao, u školu, ured, kod liječniku ili na putovanje za vrijeme odmora. Tri su glavna sustava integriranog javnog prijevoza Češke Republike analizirana u ovome radu – prvi je regionalni sustav IREDO, drugi je sustav IDS JMK oko Brna, dok treći predstavlja sustav PID oko Praga.*

**Ključne riječi:** *sustav integriranog javnog prijevoza, željeznički promet, cestovni promet, putnici*

## 1 INTRODUCTION

Public transport plays a very important role in a modern society. A suitable relationship between carrying people by their own cars and public transport can be a successful one only by the integration of the uniform public transport within some area. This integration makes public transport more accessible and attractive for people, who cannot use their own cars for travelling when at leisure. A functional integrated public transport system can be a quality alternative for people who do not use public transport yet. The integrated system cannot bring new types of transport or new technologies in transport, but can bring a new economic and more organized relationship among all the subjects interested in this mobility (mainly passengers, counties, catchment villages and carriers).

## 2 WHAT DOES THE INTEGRATED PUBLIC TRANSPORT SYSTEM MEAN AND HOW HAS IT TO OPERATE?

The integrated public transport system (IPTS) is a special kind of public transport. The basic of this IPTS is formed by the public mobility in a uniform transport, tariff and information system. Every part of the transport which is integrated into the IPTS has to cooperate with the other parts of. This cooperation is very important, because it is perceived by most passengers and the passengers are on top of the IPTS – they are the beginning and the end of the system. Simplicity and clarity are other basic characteristics. The passenger has to be in every talk about the IPTS. Without them the IPTS loses its meaning. Functionally, the IPTS has three continuities – the temporal, spatial and tariff one

At first, it is necessary have some basic prerequisites:

- transport prerequisites – it is necessary to have some basic characteristics (intensity, quantity, direction) within the area, when the IPTS has to be created,
- information prerequisites – the users have to have a general awareness and information about the functioning, purpose and choice of the IPTS,

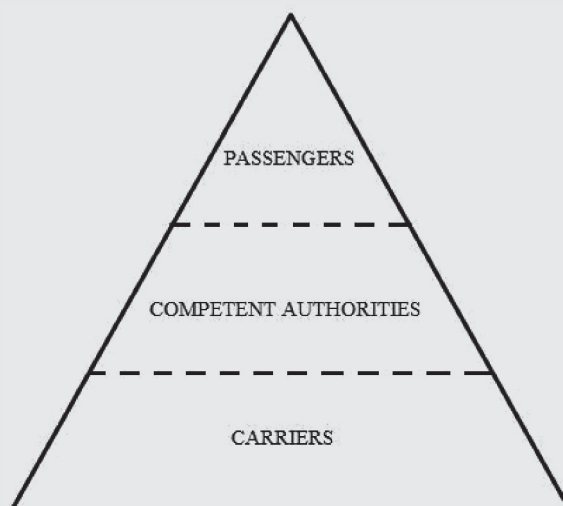
- cooperative prerequisites – the participants must take an active part in the creation of the IPTS and must cooperate with other participants (after the organizer has got their names); the political part is very important too, because this problem must be solved at the level of the governments, which must work together,
- economic, technical and technological prerequisites – it is necessary to have a financial stability, while the forwarders must have technical and technological qualifications.

If the area has the above-mentioned basic prerequisites, the IPTS can be a benefit:

- to passengers:
  - systemic transport coherence and attraction of THE public transport
  - uniform tariff system,
  - uniform information system,
  - uniform system of quality in service,
  - uniform selling and check-in system,
- to the organizer:
  - public transport is a long-term economical transport
  - systemic transport results in a long-term view,
  - basis for homogeneous surroundings of various partners. [1]

The pyramid of transportation on figure 1 shows the succession of segments of the IPTS. Passengers have to be at the top, because they use this system and the system is in fact created for them. They evaluate it if usefulness, flexibility, quality, clearness and awareness are well-balanced. Competent authorities are in the middle, because they create and apply items and principle of management and control of the IPTS. They evaluate efficiency and optimization of the transport capacity volume and structure. These competent authorities conclude an agreement with the carriers. The carriers are on the base of this pyramid, because they carry out the transport.

If the basic factors are satisfied (mainly demographic characteristics, structure of the city and relationship between the city and other communities around, transport in this area and usual way of spending free time), the organizers can start with planning the IPTS. [2]



**Figure 1** Pyramid of transportation  
*Slika 1. Piramida transporta*

Source: author on the basis of [1] / Izvor: autor na temelju [1]

At first, it is necessary to prepare the backbone lines which are mostly made up of the railway, if it exists in the area. After that, supplementary road transport lines, which at the contact points with the railway or between themselves form a transport (transit) junction. The network of the integrated traffic lines contains only regional lines. Long-distance lines are not integrated in the system. For a good planning, it is necessary to prepare the so called OD-matrix, with starting (Original) and terminal (Destination) data included. The entering data are formed by the volume of passengers between two positions, which is possible to get, for example, from the gravity model. [3]

Thereby, the basic lines network is created and is accessible for creating timetables. Timetables have to be compiled descending from the backbone network to the supplementary parts and it is desirable to create timetables in a tactful way what is more significant for the passengers.

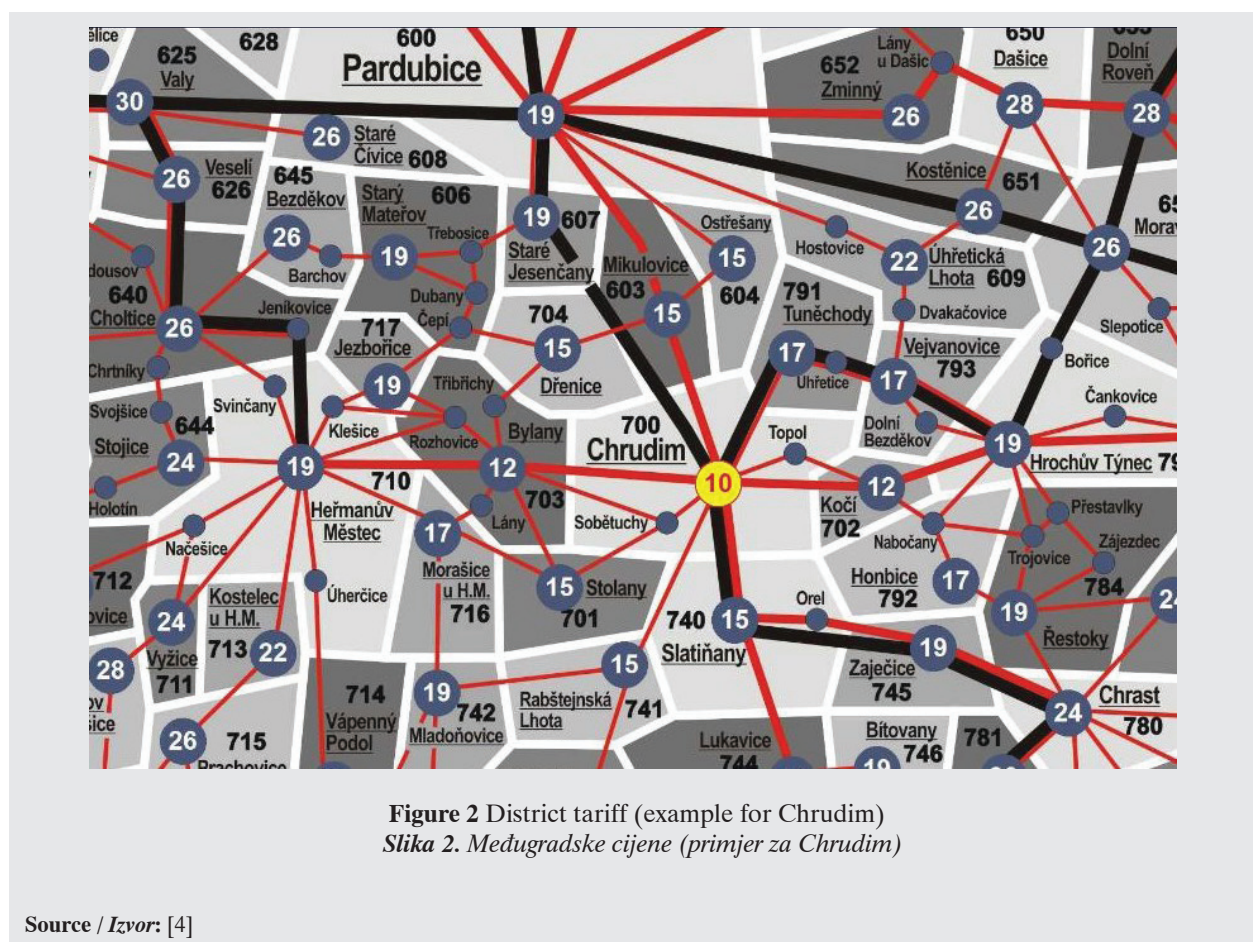
At the end of the preparations made for the IPTS, potential users (passengers) have to be informed of this system. For this reason, it is necessary to organize some promotions in which to present the system – all parts that the users need (network, shipping documents and tariff etc.) and that the system is not functioning without, although it is possible to do so with no promotions.

### 3 TYPES OF THE IPTS IN THE CZECH REPUBLIC

There are three basic types of the IPTS in the Czech Republic. The difference between them is in the structure of the area. The first one is appropriate for areas, where smaller cities are located and not only one city. This type is typical for a polycentric area. The regional IREDO (Integrovaná REGIONÁLNÍ DOprava = Integrated Regional Public Transport) system is in use, namely, in the north-east of the Czech Republic. The second type of the IPTS is appropriate for areas with large cities (or large centres) and at the border of this area is the polycentric area. This IDS JMK system (Integrovaný Dopravní Systém JihoMoravského Kraje = Integrated Public Transport System of the South-Moravia County) is in use around Brno. The last type of the IPTS is typical for a monocentric area with only one large city (or center). This type is in use within the Czech Republic only around Prague and is called the PID (Pražská Integrovaná Doprava = Integrated Public Transport of Prague).

#### 3.1 The IPTS for a Polycentric Area – IREDO

This regional system IREDO is based on the cooperation between the two counties in the Czech Republic and it is in use in the area where there are no large cities as is Prague or Brno. The largest cities there have 100,000 in-



habitants at the outside (Pardubice, Hradec Králové).

The backbone network is created by the railway tracks, which are presented by black lines on figure 2 and the supplementary network is created by road transport (red lines on figure 2). In this IPTS a zone tariff is used. The area is apportioned to fixed parts, the so called zones. In those zones a uniform price of transportation is used. The price of all types of shipping documents is deduced from the basic module – it is the price of a journey in one zone. The price for a longer journey is raised in proportion to the number of zones used – it is the product of a number of zones and of the price for one zone. In this system, it is not possible to change the end of the journey, although this tariff makes it possible for those charges. In the IREDO, for an alternative direction of the journey, passengers have to pay a top price on their journey – for example when a passenger travels from Chrudim to Pardubice: he has to pay CZK19, but he cannot travel via Heřmanův Městec and Valy or via Hrochův Týnec and Kostěnice, because in this direction of the journey the prices are higher (CZK 30 via Valy and

CZK 26 via Kostěnice). The map like the one on figure 2 is posted at all bus and train stations (with a difference of the initial city – in the yellow circle).

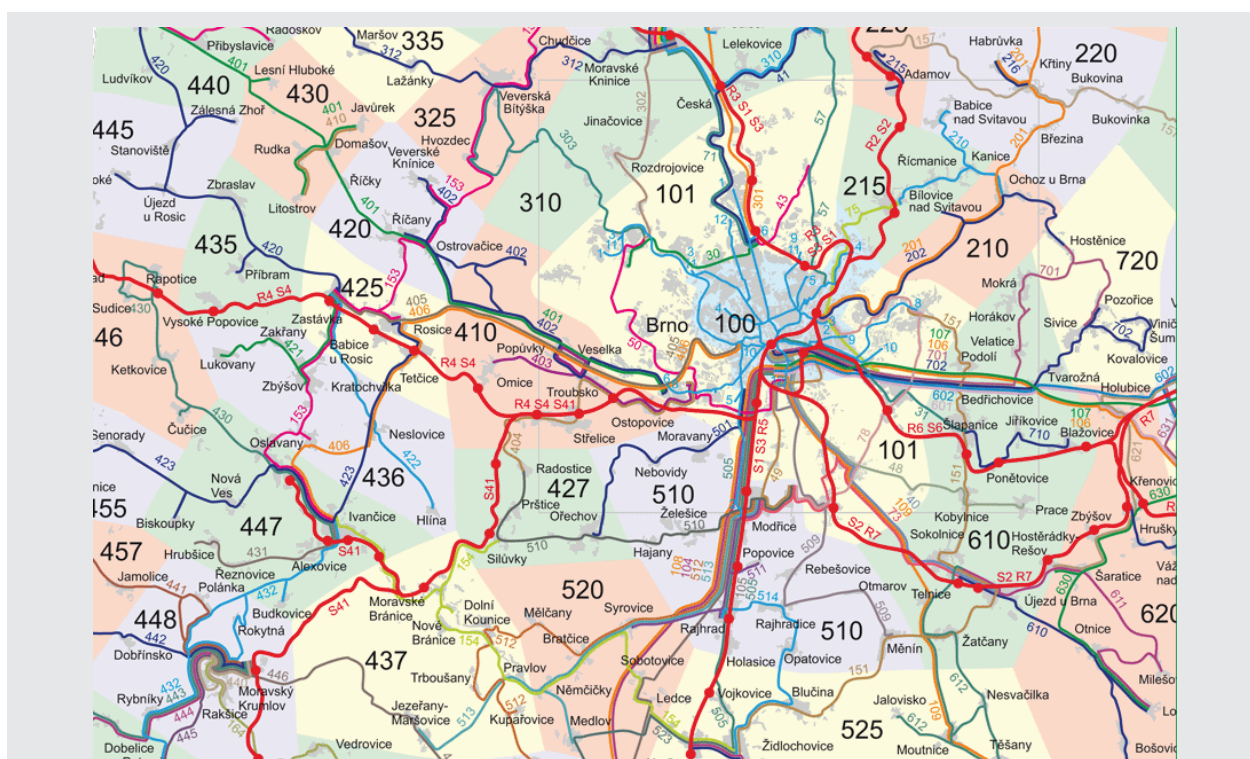
In table 1 a ticket price, whether the passengers use the IPTS tariff or not is compared. The direction between Chrudim and Pardubice is chosen as an example. For the conversion from the CZK to the EUR the following exchange rate is used: CZK 25 = EUR 1. It is possible, in this system, to use the tariff system of the IREDO or tariffs of different carriers.

The organizer of this system (OREDO – Organizátor REgionální DOpravy – Organizer of Regional Public Transport) is gathering information on the exigency of the public transport in all parts of area and is preparing new plans for the improvement of the quality of traffic and finance. This organizer has to cooperate with carriers, counties and catchments villages. Counties and catchments villages order public transport in their parts and pay it – this is confirmed by agreements. Carriers realize this public transport based on the agreement between the OREDO and themselves. [4]

**Table 1** Comparing the ticket price between Chrudim and Pardubice  
**Tabela 1.** Usporedba cijene karte na relaciji između Chrudima i Pardubice

Relation between Chrudim – Pardubice			
Mode of transport		price (CZK)	Price (EUR)
Without IPTS (train)	public transport in city A	10	0.4
	Train	26	1.04
	public transport in city B	14	0.56
Total:		<b>50</b>	<b>2</b>
without IPTS (bus)	public transport in city A	10	0.4
	Bus	19	0.76
	public transport in city B	14	0.56
Total:		<b>43</b>	<b>1.72</b>
with IPTS		<b>19 + 14<sup>1</sup></b>	<b>0.76 + 0.56</b>

Source / Izvor: Author / Autor



**Figure 3** Zone tariff  
**Slika 3.** Cijena po zonama

Source / Izvor: [5]

### 3.2 IPTS for the Monocentric Area in Great Part of the Area and for the Polycentric One at the Border of this Area – IDS JMK.

IDS JMK is a system with a large city and on borders of a smaller area, but with important cities. Brno, the largest city of the area, and the area around, was at the first lap of the IPTS in

the South-Moravia County in 2004. The reason for creating some IPTS was the increasing number of carriers and an unintelligible public transport which was the reason for an increasing number of people using their own cars for transport.

The backbone network is created by railway tracks and the supplementary network by road transport like in the previous system. The tariff is a little bit different from the tariff system

<sup>1</sup> In the IREDO it is not possible to buy a ticket for public transport in city with the ticket for the IPTS.

in the IREDO. They have a zone tariff too, but there is a possibility here of changing the end of the journey, because in the IDS JMK they use tickets, in which the number of the using zones can be noted. This type of the tariff is shown on figure 3, where different colours and block-sized numbers represent different zones.

The advantages of this tariff is the projection of the demanding transport and for this reason it is, therefore, more easily to put the costs of the carriers and the prices of the tickets at parity. Zone tariff can be used in huge areas and currently can be creating a tariff, in which a price for a short journey is lower. The disadvantages are a more complicated distribution of the tickets and tickets automats, because it is necessary to put down more information on the ticket. Automats in buses have to change a number of zones in every crossing border of the zone.

In table 2 the ticket price is compared, whether the passengers use the tariff of the IPTS or not. As an example the relation between Vyškov and Brno is chosen. For the conversion from CZK to EUR, the following exchange rate is used: CZK 25 = EUR 1.

The organizer of the IDS JMK (KORDIS JMK – Koordinátor integrovaného dopravního systému Jihomoravského kraje – Coordinator of the Integrated Public Transport System of the South-Moravia County) is interested in the same parts as the OREDO, but only for themselves. They are responsible for the organization of transport within the area of the South-Moravia County (agreements between carriers and themselves and between counties

or catchments villages), they plan and guarantee the development of the IPTS, control finance in this system and permanently organize active campaigns to bring information to potential passengers. They also cooperate with carriers on the renewal of the rolling stocks, equipments for stations and transfer terminals. [5]

### 3.3 IPTS for a Monocentric area – PID

PID is the only one monocentric IPTS in the Czech Republic. It is given to the property of the main city. A great number of passengers are traveling to Prague for work, study or in free time. The integration of this area started in the 90's of the 20<sup>th</sup> century.

The backbone network of the PID is the railway tracks and the supplementary network is formed by road transport like in the previous systems. But in this system, a river ferry is integrated. A different tariff system, called district tariff, is used in this IPTS. In the district tariff, the price is fixed by the head of the districts, which are included in the journey. This tariff apportions the transport network component parts of lines or tracks to the partial districts. The size of the district can be different, but it respects the network structure and the distance between beginning and ending of a journey. It is not necessary buy tickets at every transport post, since only one ticket is needed for the whole journey. The advantage of this tariff system is the possibility of being used in huge areas, but problems in the application of the said networks and the alternative direction of the journey in this area, are great disadvantages of the district tariff.

**Table 2** Comparing of ticket price in relation Vyškov – Brno

*Tabela 2. Usporedba cijene karte na relaciji između Vyškova i Brna*

Relation between Vyškov – Brno			
mode of transport		price (CZK)	price (EUR)
Without IPTS (train)	public transport in city A	16	0.64
	Train	67	2.68
	public transport in city B	25	1
Total:		<b>108</b>	<b>4.32</b>
without IPTS (bus)	public transport in city A	16	0.64
	Bus	46	1.84
	public transport in city B	25	1
Total:		<b>87</b>	<b>3.48</b>
with IPTS		<b>49</b>	<b>1.96</b>

Source / Izvor: Author / Autor

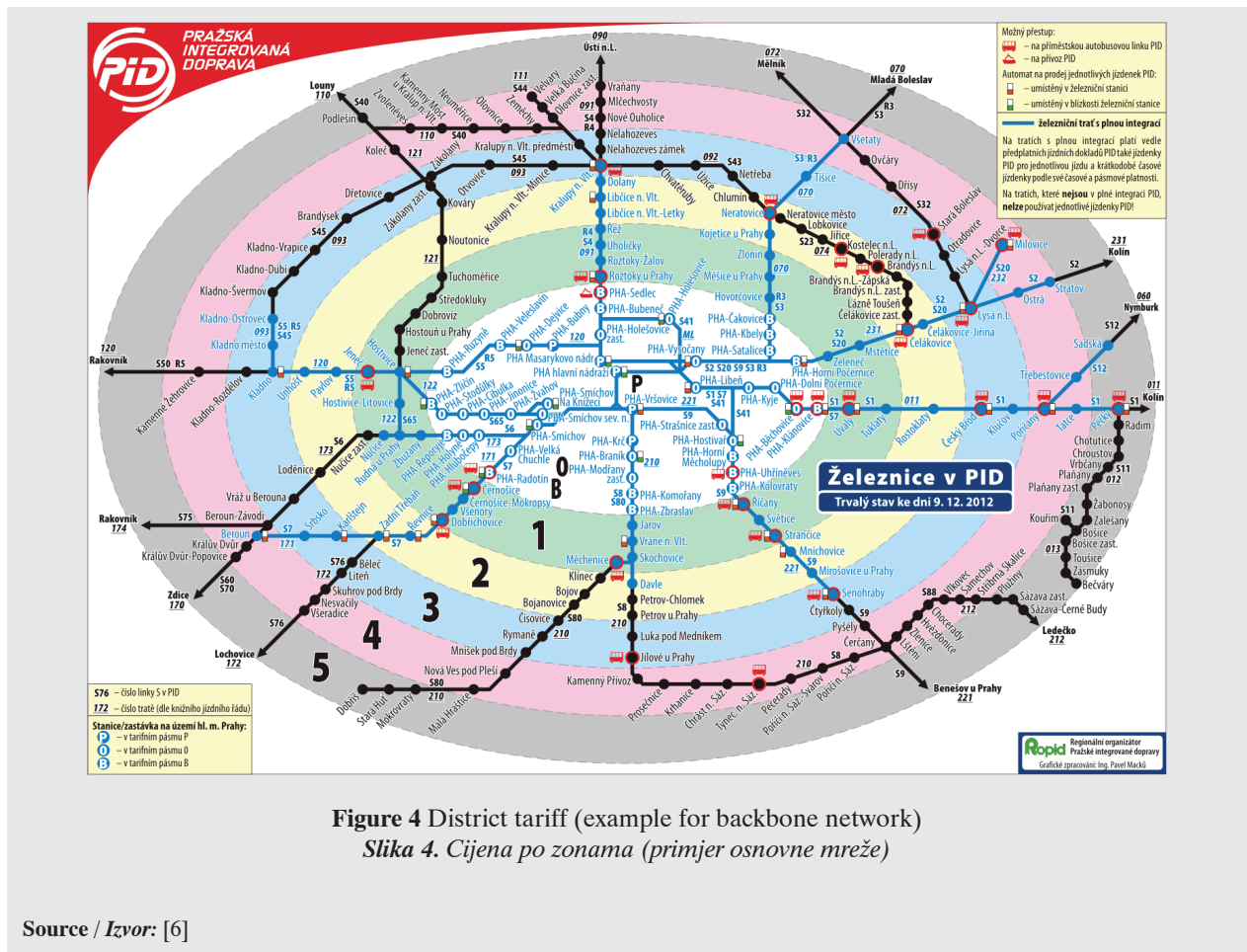


Figure 4 District tariff (example for backbone network)  
Slika 4. Cijena po zonama (primjer osnovne mreže)

Source / Izvor: [6]

Table 3 Comparing of ticket price in relation Český Brod – Prague  
Tabela 3. Usporedba cijene karte na relaciji između Český Broda i Praga

Relation between Český Brod – Prague			
mode of transport		price (CZK)	price (EUR)
without IPTS (train)	public transport in city A	0	0
	Train	53	2.12
	public transport in city B	32	1.28
Total:		<b>85</b>	<b>3.4</b>
without IPTS (bus)	public transport in city A	0	0
	Bus	40	1.6
	public transport in city B	32	1.28
Total:		<b>72</b>	<b>2.88</b>
with IPTS		<b>54</b>	<b>2.16</b>

Source / Izvor: Author / Autor

In table 3, the ticket price is compared whether the passenger uses the tariff of the IPTS or not. The relation between Český Brod and Prague is chosen as an example. For the conversion from CZK to EUR, the following rate of exchange is used: CZK 25 = EUR 1.

ROPID (Regionální Organizátor Pražské Integrované Dopravy = Regional Organizer of Integrated Public Transport of Prague) or-

ganizes the public transport including an economical transport, creates the IPTS and develops it. They also cooperate with every part of the IPTS, prepare agreements on public transport and then control the fulfillment of these agreements. ROPID creates plans of regional tariff and check-in systems. At the same time they arrange grants and proceeds of transportation.

## 4 CONCLUSION

For the creation of some IPTS, it is necessary to have a demand for transportation. The first step in forming the IPTS is to create a useful OD-matrix, because by means of such a matrix it is possible to observe the main direction of the journey of potential passengers. After that, the participants have to plan a basic network in the area. The network is created by railway tracks as the backbone network and by road lines as a supplementary network. If the area is formed the timetables can be

scheduled, which have to be original, and it is also necessary to choose a tariff. The overall result has to be beneficial for every participant – for passengers on top and for carriers on a basic level. In the IPTS tariffs have to be uniform, as well as information, selling and check-in system and the system of quality of services. In the above mentioned chapter, three types of the IPTS in use in the Czech Republic were presented. For the sake of comparison ticket prices, with or without the IPTS, were listed in the tables in every chapter.

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