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THE IMPACT OF PROPOSED PRICES ON THE PUBLIC TRANSPORT PROVIDERS AND PASSENGERS FOR INTEGRATED TRANSPORT SYSTEM IN KOSICE REGION

The article deals with the price construction for integrated transport system as the key part of integration because it has the impact on the involved public transport providers and passengers, but also for the third very important part – the self-government regions or cities as the orders of public transport services. The data in this article are used for integrated transport system in Kosice region in Slovakia where the process of integration is in the preparing phase.

Keywords: *Integrated public transport, integration, tariff, tickets, parameters, price, passenger.*

1. Introduction

The process of integration is very difficult. The tariff system is the key part of it because it has the financial impact on the passengers and their decision to use or not to use the public passenger transport for their regular but also irregular journeys. The tariff system has to be solved comprehensively. Each part of tariff system follows the other one and they influence each other. It is necessary to analyse the current tariff system of transporters who will be involved in the integrated transport system. Following proposal of tariff system should be attractive for passengers and simultaneously financially interesting for transporters and municipalities. The tariff integration together with transport integration should make the public passenger transport more attractive and should provide increasing number of passengers.

2. The development of integrated transport system creation

The development of integrated transport system for Kosice region has begun in the 1999 when the test operation of integrated transport system started with integration of railway, bus and urban transport. It was focused mainly on the passengers - employees of US Steel Kosice, the biggest employer in the region with more than 10,000 employees. From 2001 the normal operation started but due to the negative financial results the operation of this integrated transport system ended.

However, the city of Kosice and the self-government region has continued to work on the solution of public transport in this area. In 2004 the Agreement about the cooperation was signed in which the city, region, and the provider of railway transport in the region declared willingness to cooperate in the process of providing the integrated public transport. In other steps, some studies and projects were realized with the cooperation with also regional bus transporters. Also, in this time, the coordinator of integrated transport system has been established but for now it does not provide its function. The function of coordinator is now represented by the department of transport of the Kosice self-governing region [1].

3. The process of price construction

The process of tariff integration is very complicated. It affects all the involved subjects, providers, passengers and it can be the key part of integration success.

Within the project of Kosice self-government region which was focused on the analyses and preparing phase of integrated transport system the problematic of tariff integration was solved too. The basic parts of tariff integration were set and the basic price construction was defined for the need of additional solutions.

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3.1 The tariff zones

Firstly, the area of Kosice region was divided into the 114 tariff zones (Fig. 1). The cities and villages were assigned according to the various criteria from which the most important was: the transport relations, the transport infrastructure, the distances, etc. It was the first and basic area division and it is supposed that the changes will be necessary during the process of tariff construction [2 and 3].
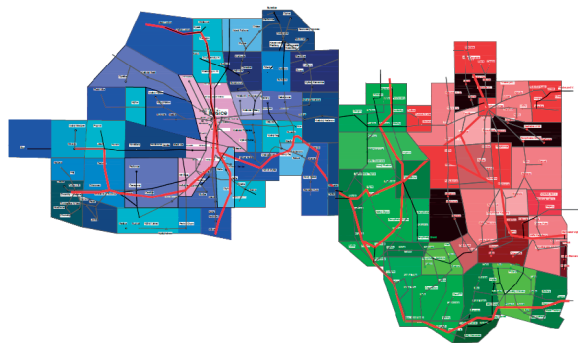

Fig. 1 First proposal of tariff zones. Source: authors

3.2 The basic price construction

The price structure should be based on the both basic prices as well as the proposed parameters for season tickets either on the basis of passenger journeys number for a given period or of traveled distance. The construction of price has to allow to make the changes for the individual ticket types independently and also it has to allow the vertical and horizontal price degression as according to equation:

$$P_T = BM \ . \ P_J \ . \ P_D$$

where: P_T price of ticket,
BM basic module,
P_J parameter value for discount fare according to the number of journeys,
P_D parameter value for discount fare according to the traveled distance.

The setting of the basic ticket price creates the basis for the price construction for all the tickets [4 and 5].

As the basic module the basic value of the single ticket is used within the one zone. It is the basis for the fares when the

The selected travel distances and current prices from Kosice to the villages in the region and the number of proposal zones and price for one zone according to the current price by regional bus transport

Table 1

Village	Bus		Railway		Number of zones	Price for 1 zone
	km	price	km	price		
Malá Ida	11	0.90			2	0.45
Šemša	16	1.1			3	0.37
Hodkovce	17	1.1			3	0.37
Nováčany	20	1.3			3	0.43
Rudník	26	1.7			4	0.43
Jasov	29	1.7			4	0.43
Poproč	32	1.9			4	0.48
Medzev	36	2.1			5	0.42
Vyšný Medzev	39	2.1			5	0.42
Štos	50	2.6			6	0.43
Nižná Hutka	13	0.9			2	0.45
Nižná Myšľa	17	1.1	15	0.86	3	0.37
Vyšná Myšľa	16	1.1	17	0.94	3	0.37
Olšovany	14	1.1			3	0.37
Vyšný čaj	17	1.1			3	0.37
Ruskov	19	1.3	22	1.16	3	0.43
Ďurkov	16	1.1			3	0.37
Nižný Čaj	21	1.5			4	0.38
Blažice	22	1.5			4	0.38
Bohdanovce	19	1.3	19	1.2	4	0.33
Rákoš	23	1.5			4	0.38
Slančík	31	1.9			5	0.38
Slanec	27	1.7	29	1.46	5	0.34
Nový Salaš	31	1.9			5	0.38
Slanská Huta	34	1.9			5	0.38
Slanské NM	30	1.7			5	0.34
Kalša	33	1.9	34	1.66	5	0.38

Source: [8,9,10], *authors*

passenger travels through more zones as well as for the fares of season tickets.

For the basic module the three values were selected, 0.50 Eur (Variant 1), 0.45 Eur (Variant 2) and 0.40 Eur (Variant 3). They were determined on the basis of the average value of one zone (Table 1). This value was the result of an analysis of the proposed zones and the current values of fares for transport by regional bus transport calculated for one zone. Other higher values were determined on the assumption that the price for the single ticket is supposed to be higher that the prices of season tickets [6].

For the first draft proposal of prices 10 regional zones were considered as the basis for other evaluation steps. The combination "Kosice city" (urban transport) - "regional zone" (regional bus/railway transport) was not considered in this first step.

On the base of above mentioned the three variants of the values of single tickets were calculated for the transportation through the different number of zones. The values were calculated without the vertical price degression - case A, and with the vertical price degression - case B (Tables 2a and 2b). The vertical degression supposes that the price of ticket decreases with the tariff distance or with the number of zones. In this case 5 cents is the value of which the price of the single ticket decreases with the higher number of zones.

The proposed prices in this first step were compared with the current prices of regional bus transport. The railway regional transport was not compared because there are more connections by bus transport to all the towns and villages in the region. The part from this comparison is shown in Table 3.

As it can be seen from Table 3 the comparison of all the variants of proposed single tickets with the price for the bus

Comparison of proposed prices for single tickets and current bus transport prices   Table 3

Village	Bus		Railway		Number of zones	Price for 1 zone	Comparison of proposed tariff with current prices within bus transport					
	km	price	km	price			V1	V2	V3	VsD1	VsD2	VsD3
Malá Ida	11	0.9			2	0.45	1	0.9	0.8	0.95	0.85	0.75
Šemša	16	1.1			3	0.37	1.5	1.35	1.2	1.4	1.25	1.1
Hodkovce	17	1.1			3	0.37	1.5	1.35	1.2	1.4	1.25	1.1
Nováčany	20	1.3			3	0.43	1.5	1.35	1.2	1.4	1.25	1.1
Rudník	26	1.7			4	0.43	2	1.8	1.6	1.85	1.65	1.45
Jasov	29	1.7			4	0.43	2	1.8	1.6	1.85	1.65	1.45
Poproč	32	1.9			4	0.48	2	1.8	1.6	1.85	1.65	1.45
Medzev	36	2.1			5	0.42	2.5	2.25	2	2.3	2.5	1.8
Vyšný Medzev	39	2.1			5	0.42	2.5	2.25	2	2.3	2.5	1.8
Štos	50	2.6			6	0.43	3	2.7	2.4	2.75	2.45	2.15
Nižná Hutka	13	0.9			2	0.45	1	0.9	0.8	0.95	0.85	0.75
Nižná Myšľa	17	1.1	15	0.86	3	0.37	1.5	1.35	1.2	1.4	1.25	1.1
Vyšná Myšľa	16	1.1	17	0.94	3	0.37	1.5	1.35	1.2	1.4	1.25	1.1
Olšovany	14	1.1			3	0.37	1.5	1.35	1.2	1.4	1.25	1.1
Vyšný čaj	17	1.1			3	0.37	1.5	1.35	1.2	1.4	1.25	1.1
Ruskov	19	1.3	22	1.16	3	0.43	1.5	1.35	1.2	1.4	1.25	1.1
Ďurkov	16	1.1			3	0.37	1.5	1.35	1.2	1.4	1.25	1.1
Nižný Čaj	21	1.5			4	0.38	2	1.8	1.6	1.85	1.65	1.45
Blažice	22	1.5			4	0.38	2	1.8	1.6	1.85	1.65	1.45
Bohdanovce	19	1.3	19	1.2	4	0.33	2	1.8	1.6	1.85	1.65	1.45
Rákoš	23	1.5			4	0.38	2	1.8	1.6	1.85	1.65	1.45
Slančík	31	1.9			5	0.38	2.5	2.25	2	2.3	2.5	1.8
Slanec	27	1.7	29	1.46	5	0.34	2.5	2.25	2	2.3	2.5	1.8
Nový Salaš	31	1.9			5	0.38	2.5	2.25	2	2.3	2.5	1.8
Slanská Huta	34	1.9			5	0.38	2.5	2.25	2	2.3	2.5	1.8
Slanské NM	30	1.7			5	0.34	2.5	2.25	2	2.3	2.5	1.8
Kalša	33	1.9	34	1.66	5	0.38	2.5	2.25	2	2.3	2.5	1.8

Source: authors

Proposal of single ticket prices without degression   Table 2

2a)

Number of zones	Prices for single tickets (EUR)		
Case A	V1	V2	V3
1	0.50	0.45	0.40
2	1.00	0.90	0.80
3	1.50	1.35	1.20
4	2.00	1.80	1.60
5	2.50	2.25	2.00
6	3.00	2.70	2.40
7	3.50	3.15	2.80
8	4.00	3.60	3.20
9	4.50	4.05	3.60
10	5.00	4.50	4.00

2b)

Number of zones	Prices for single tickets (EUR)		
Case B	VsD1	VsD2	VsD3
1	0.50	0.45	0.40
2	0.95	0.85	0.75
3	1.40	1.25	1.10
4	1.85	1.65	1.45
5	2.30	2.05	1.80
6	2.75	2.45	2.15
7	3.20	2.85	2.50
8	3.65	3.25	2.85
9	4.10	3.65	3.20
10	4.55	4.05	3.55

Source: authors

transport show many differences. The red color of price means that the price is lower than current price. The blue color of price means that the price is the same and the black color means that the price is higher than current price. But as it was already mentioned it is very important at least to provide the level of price or to provide lower price for commuters.

4. The proposal of basic season tickets

For adjusting the season ticket prices for integrated transport system it is needed to propose the value of parameters for

discount fare according to the number of journeys, tariff distances or number of zones [5, 6].

The proposal of parameter for fare discounting according to the number of traveled zones:
- Its adjustment will result from the tariff structure, or the size of tariff zones for a given tariff structure.
- Its value will decrease with the more traveled zones or/and from the certain distance the value of this parameter will be constant.
- In the case of season tickets the value of this parameter will be lower than in the case of single tickets and the difference will depend on the basic fare adjustment.

The proposal of parameter for fare discounting according to the number of journeys:
- Its adjustment will result from the range of season tickets proposed for integrated transport system.
- Its value will be constant for journeys regardless of the number of zones or for the journeys for the higher number of zones the lower value of this parameter can be proposed.
- With longer duration of season tickets the value of parameter will be lower.
- The parameter will represent an advantage of season tickets that will provide the use of season tickets by passengers as much as possible.

The parameter for fare discounting according to the number of journeys was proposed on the base of the experiences from existing integrated transport systems in Europe, but mainly from the cases of integrated transport systems in the Czech Republic, South Moravian Integrated Transport System and Integrated Transport System of Moravian-Silesian Region.

Calculated prices for season tickets in Euros   Table 4

Number of zones	Case A – without degression				Case B – with degression			
	V1	Monthly	Quarterly	Yearly	V1	Monthly	Quarterly	Yearly
1	0.50	14.00	36.40	126.00	0.50	14.00	36.40	126.00
2	1.00	28.00	72.80	252.00	0.95	26.60	69.16	239.40
3	1.50	42.00	109.20	378.00	1.40	39.20	101.92	352.80
4	2.00	56.00	145.60	504.00	1.85	51.80	134.68	466.20
5	2.50	70.00	182.00	630.00	2.30	64.40	167.44	579.60
6	3.00	84.00	218.40	756.00	2.75	77.00	200.20	693.00
7	3.50	98.00	254.80	882.00	3.20	89.60	232.96	806.40
8	4.00	112.00	291.20	1008.00	3.65	102.20	265.72	919.80
9	4.50	126.00	327.60	1134.00	4.10	114.80	298.48	1033.20
10	5.00	140.00	364.00	1260.00	4.55	127.40	331.24	1146.60
Number of journeys	1	40	120	480	1	40	120	480

Source: authors

On the base of all these foreign experiences and facts the following values of parameter were proposed:
- - monthly ticket - 28times of single ticket,
- - quarterly ticket – 2.6times of monthly ticket,
- - yearly ticket - 9times of monthly ticket.

The parameters were later used for calculation of season ticket prices for all variants. Table 4 shows the calculated prices for variant 1. This variant was selected mainly for the hypothesis that the prices of the single tickets should be higher than the prices of season tickets. As Table 3 shows variant 1 provides higher prices than current regional bus transport prices which give more opportunities to vary with season ticket calculation.

5. The impact of proposed prices

The process of tariff integration has to include also the verification whether and how the prices will be changed for the passengers and if they are acceptable for passengers but also for all the involved subjects.

As the example of verification the direction Kosice – Moldava nad Bodvou was selected as the case study because it is the direction on which the biggest employer – the U. S. Steel Kosice company is situated. Because of inhabitants commuting from region to this company the new transfer terminal has been built in Moldava nad Bodvou. So it is very important direction.

The common regular passenger with no social discount was considered.

Regional bus transport:
- Source of journey: bus station Moldava nad Bodvou
- Destination of journey: bus station Kosice
- There are 3 different ways of line with 29 km, 31 km and 33 km. For 29 km distance the price is 1.70 Eur, in the case of using the card it is 1.61 Eur. For 31 km and 33 km distance the price is same and it is 1.90 Eur, in the case of using the card 1.82 Eur.

The railway transport:
- Source of journey: railway station Moldava nad Bodvou
- Destination of journey: railway station Kosice
- The tariff distances in this case is 31 km and the price for single ticket is 1.80 Eur.
- If the commuters use the weekly track ticket (11.70 Eur) or monthly track ticket (39.60 Eur), and if it is supposed that commuter makes 10 journeys per week or 40 journeys per month, then the price is 0.585 Eur/1 journey or 0.495 Eur/journey.

The integrated transport system - the proposed prices (Table 4):
If the variant 1 is considered, it means the case of the highest prices, and the example of passenger who travels through 3 zones

and through 4 zones, the following prices are calculated per one journey:

Calculated prices for season tickets in Euros — Table 5

Type of ticket		€/journey
		Regional bus transport
single one way ticket paid by card		1.82
Railway transport		
one way single ticket		1.80
track return ticket		
weekly		0.59
monthly		0.50
Integrated transport system		
Variant 1 - basic modul 0.50 Eur		
Variant:	A-without D.	B - with D.
Ticket	3 zones	
single	1.5	1.4
monthly	1.05	1.4
quarterly	0.91	1.21
yearly	0.79	1.05
Ticket	4 zones	
single	2	1.85
monthly	0.98	1.30
quarterly	0.85	1.12
yearly	0.74	0.97

Source: authors

It can be seen from Table 5 that the value for one journey is lower in the case of season tickets proposed for integrated transport system regardless of considered variant than the value for one journey by regional bus transport or single ticket in the case of railway transport.

6. Conclusion

The proposal of the basic module for single tickets and season tickets is based on the analysis of current prices of public transport providers in the region with the main focus on the regional bus transport and from the first selection of the area into the tariff zones. In the next steps of process it will be necessary:
- to verify the zoning of area, its impact on prices for all existing possible connections,
- to solve the value of basic module as well as other parameters with all the involved public transport providers regarding to their current prices, the range of tickets (there are not the season tickets for regional bus transport),

- to propose the method of calculating the price for combined tickets, it means tickets for using the regional transport with combination of the urban public transport,
- to calculate the expected revenues in the case of expected numbers of passenger using the single or season tickets.

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