

DRAGO BAGO, B.Eng.

E-mail: drago.bago@zagrebsped.hr

Zagrebšped Ltd.

Vodovodna 20a, HR-10000 Zagreb, Republic of Croatia

NERINA PUŠKARIĆ, B.Eng.

E-mail: nerina.puskaric@fpz.hr

University of Zagreb,

Faculty of Transport and Traffic Engineering

Vukelićeva 4, HR-10000 Zagreb, Republic of Croatia

JOSO VRKLJAN, B.Eng.

Lika ceste Ltd.

Smiljanska 41, HR-53000 Gospić, Republic of Croatia

Urban Traffic

Review

Accepted: Oct. 17, 2005

Approved: Oct. 16, 2006

ORGANIZATION OF PASSENGER TRANSPORT IN TOWN OF ZAPREŠIĆ BY HARMONIZING OPERATOR SERVICES

ABSTRACT

The paper presents the current situation in public passenger transport in the town of Zaprešić. The analysis of the passenger transport in urban and suburban traffic has shown that the carriers providing the service of passenger transport in urban, suburban and interurban traffic act individually, that there is no coordination among them the aim of which would be cheaper, more economical and higher quality public transport of passengers. The activities have been proposed to introduce the traffic technologies in urban, suburban and interurban transport of passengers with the proposal of a unique tariff system.

KEY WORDS

public passenger transport, line operators, tariff system, zones

1. INTRODUCTION

Public passenger transport as the activity within the traffic system has a very important role and significance for satisfying all the mobility requirements of people – citizens.

Constant moving of people that has been caused primarily by going to and returning from work, then shopping, faculty, recreation, cultural needs and other requirements, which are especially indicated in cities as public urban transport of passengers, and because of its importance, is treated as an activity of special social interest.

The study of public transport in the town of Zaprešić is related to determining the strategic orientations that result in higher quality and faster transport at lower costs of operation and better environmental effects.

The study of the current situation includes a summarized presentation of the main elements of traffic supply and demand and the main traffic problems, as well as solutions in accordance with the optimal development of public passenger transport, harmonized with the development of traffic infrastructure and transport needs of the citizens.

2. SCOPE

The scope is the entire administrative area of the town of Zaprešić, which consists of nine settlements out of which four form the urban part, and five form the rural part of the town area. The organization of the public transport is based on the passenger flows, and indirectly on the demographic and economic characteristics of the settlements.

According to the 2001 census, the town of Zaprešić had a total of 23,125 inhabitants.

The availability of public transport as one of the essential factors of the public passenger transport quality for the observed area regarding its density of public transport line network and the density of stops, mainly satisfies the conditions for a good line network according to Dr. Lehner.

3. CURRENT PUBLIC URBAN PASSENGER TRANSPORT

Public urban passenger transport in Zaprešić has a relatively long tradition. Its development started in 1862 by the construction of the railway line Zidani Most – Zaprešić – Zagreb – Sisak.

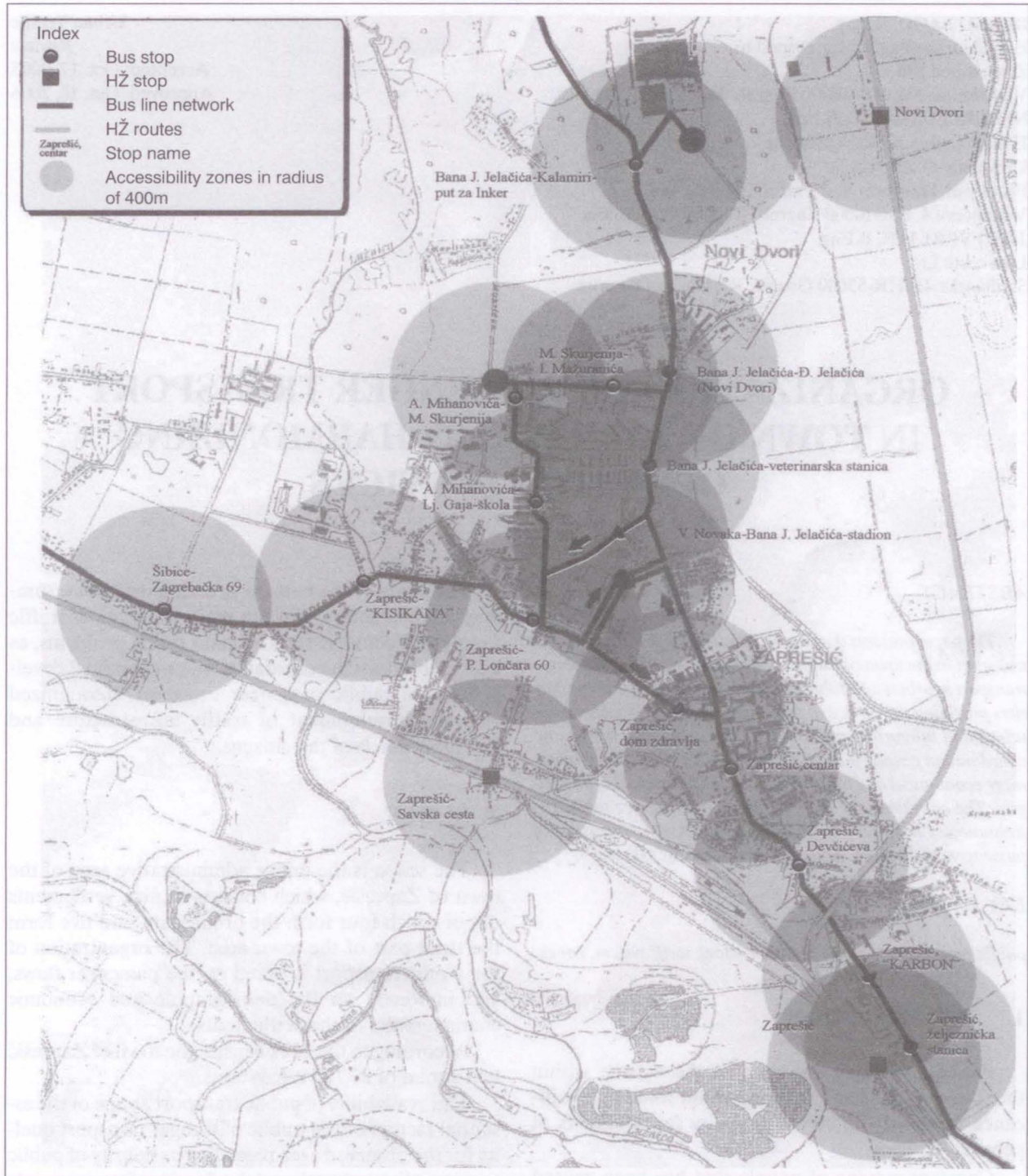


Figure 1 - Graphical presentation of availability of public transport in the town of Zaprešić

From 1886 to 1890 Zaprešić ranked the fourth railway station regarding cargo dispatch and third regarding deliveries of goods on the southern railways.

To the existing railway track since 4 September 1886 the Zagorska railway line was officially open to traffic. Important traffic routes passed also through Zaprešić from Zagreb towards Slovenia and via Krapina to Austria, which have been mentioned as important state roads since 1890.

Today, the public passenger traffic in urban, suburban and interurban traffic in the area of Zaprešić is operated by: ZET, Meštrović prijevoz, CroatiaTrans Zlatar and HŽ (Croatian Railways).

3.1. – PASSENGER TRANSPORT BY ZET

At the beginning of 1955, the Zagreb Electrical Tramway (ZET) started to operate public pas-

senger transport in the area of Zaprešić. The bus transportation is becoming more and more significant both by its availability and by its speed and price.

In Zaprešić, ZET operates passenger transport with seven bus lines the routes of which, apart from Zaprešić, pass through Zagreb and the districts of Bistra and Luka. The share of the route length within the lines expressed in percentages is presented in Table 3.

It may be concluded that only two bus lines serve 100% the area of Zaprešić, and line 174 only 69.13% and other lines are below 50% (see Table 3)

Daily lines are organized from 04:00 till 24:00, and night lines are organized from 00:00 to 04:00 o'clock. On workdays Zaprešić is served by 21 buses which realize daily 614 departures, on Saturdays 12 buses that realize 436 departures and on Sundays 7 buses that realize 283 departures.

The backbone of the public transport of passengers in the area of the town of Zaprešić consists of lines that connect the area of the town of Zaprešić with the city of Zagreb and on workdays transport 88% of passengers (18,216 passengers) and the rest of the lines are of rural character and transport 12% passengers (2,500 passengers).

Table 1 - Number of citizens per activities

Town / district	Number of inhabitants	Households:		Students					Employees	
		number of households	inhabitants/ household	primary school	secondary school	faculty	total of schoolchildren	schoolchildren/ number of inhabitants	employee	employee/ number of inhabitants
Zaprešić	23,125	7,273	3.18	2,252	1,109	1,158	4,519	0.20	9,437	0.41

Source: Traffic analysis of the public urban transport of passengers in the town of Zaprešić with neighbouring districts, 2004

Table 2 - Number of inhabitants per settlements:

Town of Zaprešić	Settlements	Number of inhabitants
	Hruševac Kupljenski	453
	Ivanec Bistranski	932
	Jablanovec	1,343
	Kupljenovo	705
	Lužnica	62
	Merenje	158
	Pojatno	1,157
	Šibice	777
	Zaprešić urban part	17,538
Total – town of Zaprešić		23,125

Source: Traffic analysis of the public urban transport of passengers in the town of Zaprešić with neighbouring districts, 2004

Table 3 - Length of the line routes

Line	Total number of km on line	City of Zagreb (%)	Town of Zaprešić (%)	District of Bistra (%)	District of Luka (%)
172 Zagreb (Črnomerec) - Zaprešić	14.6	75.34	24.66	-	-
174 Zaprešić – Žejinci	14.9	-	69.13	-	30.87
175 Zaprešić – Pojatno – G. Bistra	15.45	-	40.13	59.87	-
176 Zagreb (Črnomerec) – G. Bistra	24.5	45.31	24.49	30.20	-
177 Zagreb (Črnomerec) – Poljanica – G. Bistra	23.3	47.64	25.75	26.61	-
181 Trg mladosti – Novi Dvori – Inker – Veliki Vrh	4.9	-	100	-	-
182 Trg mladosti – Šibice	3.1	-	100	-	-
Total		32.95	39.8	22.68	4.57

Source: Traffic analysis of the public urban transport of passengers in the town of Zaprešić with neighbouring districts, 2004

Table 4 - Traffic and exploitation characteristics of ZET bus lines

Line no.	Daily ZET bus lines in town of Zaprešić	Line length km	Number of buses			Bus capacity	Number of depart. on line		
			workday	Sat.	Sun.		workday	Sat.	Sun.
172	Zagreb (Črnomerec) - Zaprešić	14.6	10	5	3	155	270	175	114
174	Zaprešić - Žejinci	14.9	1	1		155	37	29	10
175	Zaprešić - Pojatno - G. Bistra	15.45				155	2	2	
176	Zagreb (Črnomerec) - G. Bistra	24.5	7	4	2	106/155	87	55	32
177	Zagreb (Črnomerec) - Poljanica - G. Bistra	23.3					23	10	8
181	Trg mladosti - Novi Dvori - Inker - Veliki Vrh	4.9	2	1	1	106	37	21	14
	Trg mladosti - Inker	3.5					12	10	
	Trg mladosti - Novi Dvori	1.75					77	61	56
182	Trg mladosti - Šibice	3.1	1	1	1	106	69	73	49
Total			21	12	7		614	436	283

Source: Traffic analysis of the public urban transport of passengers in the town of Zaprešić with neighbouring districts, 2004

3.2. TRANSPORT OF PASSENGERS BY MEŠTROVIĆ PRIJEVOZ AND CROATIATRANS ZLATAR

As mentioned, there are two more public road passenger carriers, and these are Meštrović prijevoz and Croatiatrans, Zlatar.

Meštrović prijevoz in the area of the town has five bus lines that use traffic infrastructure and terminals like ZET. On workdays the Meštrović prijevoz buses realize 220 departures, on Saturdays 136 and on Sundays 58.

The mentioned lines in the area of Zaprešić overlap with the ZET bus lines, passengers in the area of Zaprešić hardly use the services of Meštrović prijevoz and the reason lies in the unsigned agreement of the town and the carrier as well as low quality of the transport means. Therefore, the role of Meštrović prijevoz as well as Croatiatrans Zlatar is negligible for the public transport of the citizens of the town of Zaprešić.

Only one bus line of Croatiatrans Zlatar passes through the administrative region of the town. The mentioned bus lines are mainly used by the inhabitants of the neighbouring districts.

3.3. PASSENGER TRANSPORT BY HŽ

Railway transport in the town area is operated by HŽ from the Zagreb Main Railway Station toward Zaprešić, and the passenger stops are: Savska, Novi Dvori, Kupljenovo and Zaprešić station which is in Corridor X, at the diverging point of Corridor Xa within the Zagreb County, and on the high-level serviceability line as part of urban and suburban traffic of the city of Zagreb.

The daily total number of departures on the line Dugo Selo - Zagreb - Zaprešić - Savski Marof is 78,

and on the line Zagreb - Zaprešić - Zabok - Varaždin there are daily 33 departures. The train capacities that run on the mentioned lines range from 450 to 720 passengers. Most of the trains on the lines are EMV series 611, a total of 24.

Because of their technical and exploitation characteristics the mentioned trains are not the most suitable ones for urban and suburban operation, for the following reasons:

- low technical performance;
- high train mass (146t);
- low acceleration (0.45m/s²);
- inadequate structure of bodies (relation of seats and standing places);
- inadequate door width;
- inadequate design of steps complicating the loading/unloading of passengers.

The main advantage of railway transport in relation to bus transport - travel speed - has not yet come to its full realization because of the following reasons:

- insufficient capacities of trains regarding the current demand do not insure satisfactory comfort of travelling in peak periods;
- unsatisfactory, variable, and scarce sequence of train departures, especially in off-peak periods on workdays and on Saturdays and Sundays. This makes it impossible to achieve good time coordination of bus and rail transport;
- physical dislocation of rail terminal regarding the main origins of traffic demand and the bus stops;
- lack of a tariff union of the bus and rail transport.

In spite of the mentioned data on the relation from Zaprešić to Zagreb the number of transported passengers is relatively large.

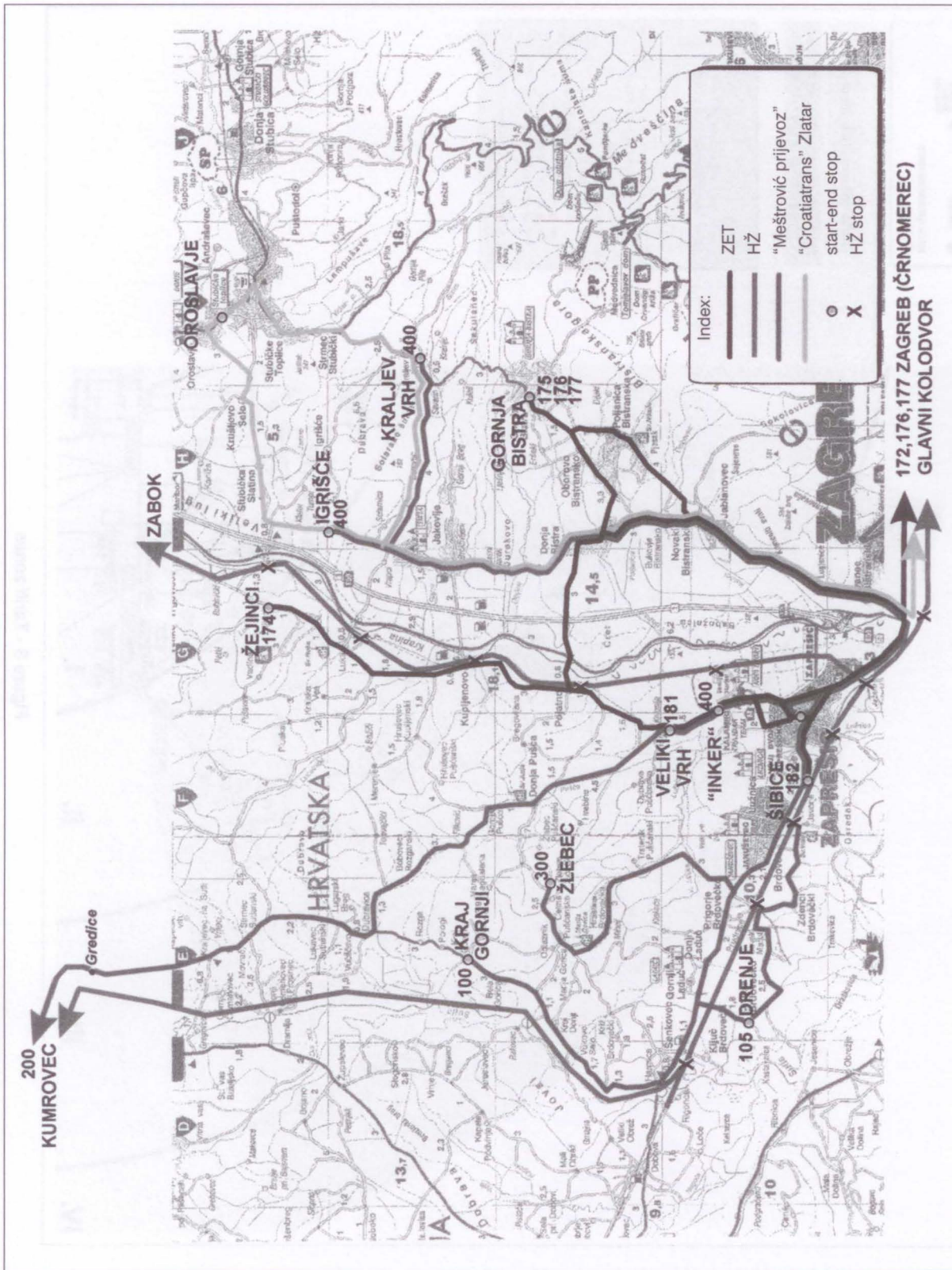


Figure 2 - Bus lines and HŽ (Croatian Railways) in the town of Zaprješić

4. TARIFF SYSTEM

The current tariff system for the public passenger transport in the town of Zaprješić has been set in such a way that each of the carriers: ZET, Meštrović prijevoz,

Croatiatrans Zlatar and HŽ have each their own tariff system.

The tariff system of ZET in the town of Zaprješić is the component part of the traffic tariff area of ZET. The transport in the area of Zaprješić is charged ac-

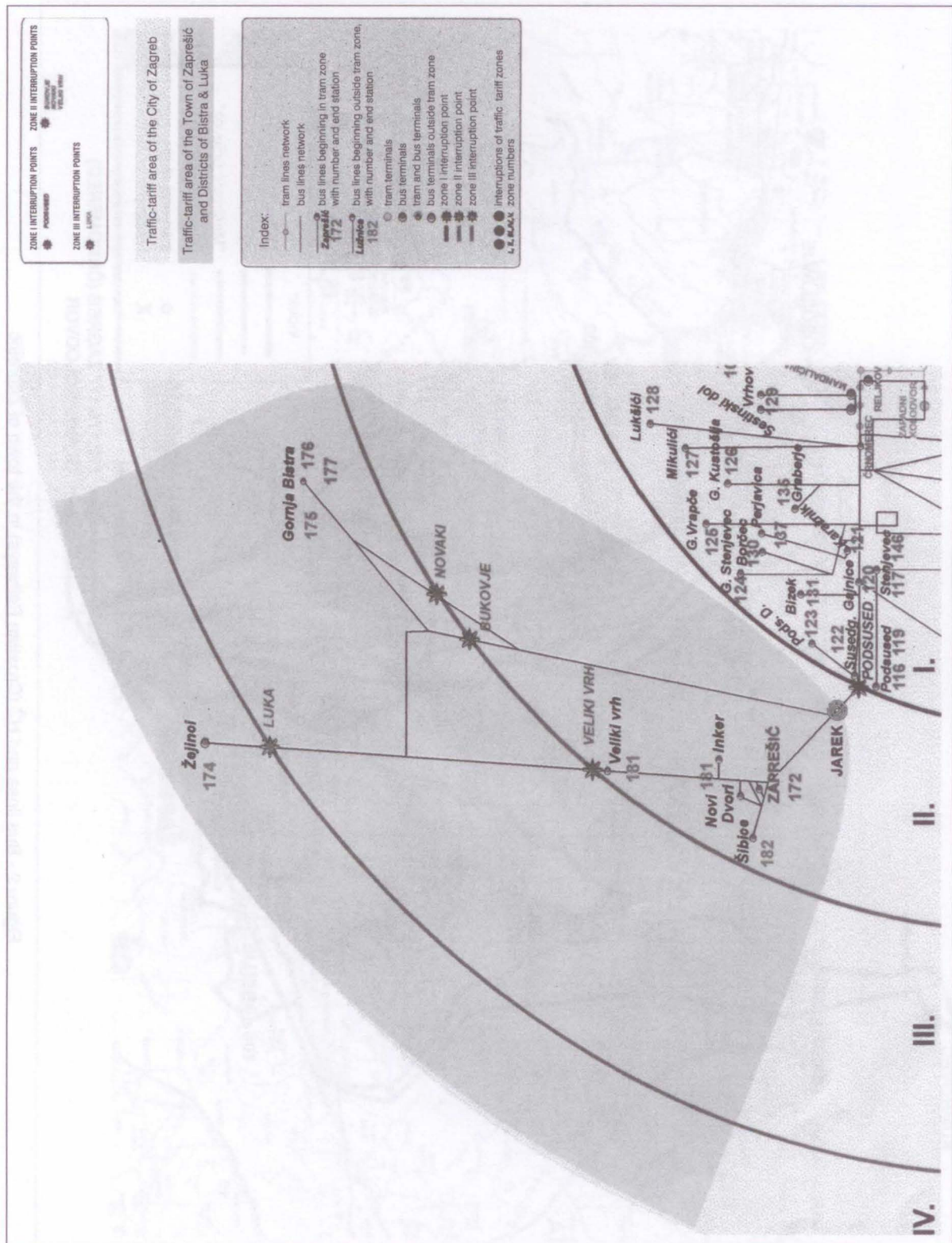


Figure 3 - Tariff zones

According to a mixed system with season tickets being part of the unique tariff system, and single tickets are covered by the zone tariff system of ZET which consists of five tariff zones in the form of concentric circles with the origin in the centre of the city of Zagreb.

The first tariff zone covers a diameter of about 20km with all the bus and tramway lines of the Zagreb urban area. From the border of the first tariff zone, every nine kilometres one kilometre is the determined border of the new zone. Most part of the traffic area of the town of Zaprješić is located in the second tariff

zone and only a small part of the area is in the third tariff zone.

For the town of Zaprešić and the neighbouring districts, Meštrović prijevoz applies the zone tariff system which is divided into five zones with the origin in Zaprešić and Zaprešić is in the first zone. The Croatian Railways (HŽ) apply in urban and suburban passenger transport in the area of the city of Zagreb and the Zagreb County the so-called relation tariff model which is partly adapted to the local organization conditions and mutual distance of stops. The starting tariff range applied by HŽ is from 0 to 10km. The ticket subscribers as well as the amounts of fares for several rides are determined on the relational principle.

4.1. Types of fares

In the area of the town of Zaprešić the passenger transport is charged by using the following types of fares:

- season fares that may be monthly and annual season tickets;

- individual fares bought onboard vehicle or outside vehicle;
- connection monthly and annual fares.

It may be concluded from the price according to ZET and price for passengers that for the area of the town of Zaprešić the season tickets for schoolchildren, students, pensioners and social cases the town grants subsidies in the amount of HRK35 per ticket monthly (see Table 5).

It may be stated that the price of individual fares depends on the place of purchase, zone for which it is purchased, and depends on whether it is the daily or night ride (see Table 6).

It may be concluded that the presented types and prices of individual and monthly season tickets according to zones and categories of passengers (workers', schoolchildren, and pensioners').

Joint season ticket of Meštrović prijevoz and ZET can be used in the area of Zaprešić on line 172 Zaprešić – Črnomerec and on all tram and bus lines of ZET in the first tariff zone of the city of Zagreb.

It may be stated that the price of individual and return tickets does not depend on the category of passengers.

Table 5 - Pricelist of monthly ZET fares

Monthly ticket			
Type of ticket	Area of validity	Price acc. to ZET pricelist (HRK)	Price paid by passengers (HRK)
general	Area of the town of Zaprešić	210.00	210.00
	Zaprešić and 1st zone of the city of Zagreb	385.00	385.00
schoolchildren	Area of the town of Zaprešić	146.00	111.00
	Zaprešić and 1st zone of the city of Zagreb	195.00	120.00
student	Area of the town of Zaprešić	102.20	77.70
	Zaprešić and 1st zone of the city of Zagreb	136.50	84.00
pensioner	Area of the town of Zaprešić	133.00	98.00
	Zaprešić and 1st zone of the city of Zagreb	181.00	131.00
social	Area of the town of Zaprešić	146.00	111.00
	Zaprešić and 1st zone of the city of Zagreb	195.00	145.00

Source: Traffic analysis of the public urban transport of passengers in the town of Zaprešić with neighbouring districts, 2004

Table 6 - Prices of individual ZET fares

Zone	Price of individual fare in daily traffic (HRK)		Price of individual fare in night traffic (HRK)	
	outside vehicle	onboard vehicle	outside vehicle	onboard vehicle
1	6.50	8.00	13.00	16.00
2	13.00	16.00	26.00	32.00
3	19.50	24.00	39.00	48.00
4	26.00	32.00	52.00	64.00
5	32.50	40.00	65.00	80.00

Source: Traffic analysis of the public urban transport of passengers in the town of Zaprešić with neighbouring districts, 2004

Table 7 - Price of Meštrović prijevoz fares

Zone	Individual (HRK)	Monthly MP fare (HRK)				Monthly MP – ZET fare (HRK)		
		workers	schoolchildren	primary schoolch.	pensioners	workers	schoolchildren	pensioners
1	7.00	200.00	180.00	120.00	180.00	535.00	340.00	340.00
2	12.00	290.00	180.00	120.00	215.00	625.00	340.00	375.00
3	14.00	330.00	180.00	120.00	215.00	665.00	340.00	375.00
4	16.00	370.00	210.00	120.00	275.00	705.00	370.00	435.00
5	18.00	410.00	240.00	120.00	300.00	745.00	400.00	460.00

Source: Traffic analysis of the public urban transport of passengers in the town of Zaprešić with neighbouring districts, 2004

Table 8 - Pricelist of monthly and annual connection tickets for the 1st zone (Zaprešić – Zagreb)

	Monthly connection tickets (HRK)	Annual connection tickets (HRK)	Individual single tickets (HRK)	Return tickets (HRK)
Workers	130.00	1,300.00	9.00	18.00
Schoolchildren and students	81.00	810.00	9.00	18.00
Pensioners	81.00	810.00	9.00	18.00

Source: Traffic analysis of the public urban transport of passengers in the town of Zaprešić with neighbouring districts, 2004

5. PROPOSAL OF THE PUBLIC PASSENGER TRANSPORT TECHNOLOGY

Public passenger transport in the area of Zaprešić, depending on the type of travel can be divided into three groups:

- urban travel,
- interurban travel,
- rural travelling.

Since public passenger transport in the area of the town of Zaprešić is operated by several carriers and different traffic means of road and railway transport. It is necessary to introduce new transport technologies, first of all combined transport.

The purpose of introducing new transport technologies is to achieve a mode shift in the majority of passengers in public transport from bus to rail transport in interurban passenger public transport between Zaprešić and Zagreb.

Such application of transport technology would use all the comparative advantages of rail traffic, which are first of all reflected through energy saving, environmental sustainability as both faster and safer transport, because bus transport of passengers during peak periods in public transport is very slow because of traffic congestion.

In order to apply new transport technologies in public passenger transport in the area of Zaprešić, it is necessary to build the infrastructure, which means first of all the construction of a bus terminal in order to establish harmonious operation in the traffic sys-

tem, which means first of all the connection of rail and bus traffic.

In order to achieve the abovementioned conditions the carrier association would have the following tasks:

- coordination among transport participants,
- tariff determination,
- revenue distribution,
- transport organization,
- users' information,
- distribution of subsidies.

For a higher-quality operation of carriers it is necessary to establish standardization and unification of transport means and equipment, in order to create conditions to found a carriers' association.

6. CONCLUSION

Harmonization of the relations among carriers as well as the introduction of new transport technologies into public passenger transport in the area of the town of Zaprešić would result to a greater extent in the mode shift of passenger transport from road to rail thus using all the comparative advantages of railway traffic, such as environmental effects, shorter travel time, increased safety and reduction of traffic congestion.

The joining of carriers ZET, Meštrović prijevoz, Croatiatrans Zlatar and HŽ into a unique association would enable establishing of a unique tariff model where different transport modes would be highly co-

ordinated and integrated into a unique system of capacity supply in the wider urban and suburban area, which would result in the increase of the level of passenger transport in this area. The service charging system should be technologically harmonized among the carriers that act in the area of the town of Zaprešić.

DRAGO BAGO, dipl. ing.

E-mail: drago.bago@zagrebsped.hr

Zagrebšped d.o.o.

Vodovodna 20a, 10000 Zagreb, Republika Hrvatska

NERINA PUŠKARIĆ, dipl. ing.

E-mail: nerina.puskaric@fpz.hr

Sveučilište u Zagrebu, Fakultet prometnih znanosti

Vukelićeva 4, 10000 Zagreb, Republika Hrvatska

JOSO VRKLJAN, dipl. ing.

Lika ceste d.o.o.

Smiljanska 41, 53000 Gospić, Republika Hrvatska

SAŽETAK

ORGANIZACIJA PRIJEVOZA PUTNIKA U GRADU ZAPREŠIĆU HARMONIZACIJOM PONUDE OPERATORA

U radu je prikazano postojeće stanje javnoga prijevoza putnika na području Zaprešića. Analizom javnoga prijevoza putnika u gradskom i prigradskom prometu uočeno je da

prijevoznici koji obavljaju djelatnost prijevoza putnika gradskoga, prigradskoga i međugradskoga prometa djeluju individualno, da između njih nije uspostavljena kvalitetna koordinacija čiji bi cilj bio jeftiniji, ekonomičniji i kvalitetniji javni prijevoz putnika. Predložene su aktivnosti za uvođenje prometne tehnologije u gradskom, prigradskom i međumjesnom prijevozu putnika s prijedlogom jedinstvenoga tarifnoga sustava.

KLJUČNE RIJEČI

javni putnički prijevoz, linijski operateri, tarifni sustav, zone

LITERATURE

1. **Štefančić G.:** *Tehnološki procesi u cestovnom prometu*, authorized lecture, postgraduate study – FPZ, 2004
2. **Županović, I.:** *Tehnologija cestovnog prometa*, Faculty of Traffic and Transport Sciences, University of Zagreb, Zagreb, 1986
3. **Vurdelja, J.:** *Tehnološki sustavi integralnog i multimodalnog transporta*, authorized lecture, post-graduate study, Faculty of Traffic and Transport Sciences, 2001
4. *Prometna analiza javnoga prijevoza putnika grada Zaprešića sa susjednim općinama*, Zagreb, 2004, prometno tehnička služba ZET-a
5. *Stambeno-komunalna monografija Zaprešić*, Zagreb, 1990, Samoupravna interesna zajednica stanovanja i komunalnih djelatnosti Zaprešić