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RATIONALIZATION OF PUBLIC ROAD PASSENGER TRANSPORT BY MERGING BUS LINES ON THE EXAMPLE OF ZADAR COUNTY

ABSTRACT

This study consists of the analysis of public passenger transport in Zadar County, that is, transport on the County and school lines and suggestions of transport rationalization. The rationalization comprises the application of the County and school lines integration, as well as suggestions of other measures which aim to reduce transport costs financed by Zadar County. The objectives to rationalize public passenger transport have been defined, all County transport lines of schoolchildren and other passengers have been analysed as well as actual deficiencies in the city, County and school transport needs. Road transport infrastructure, carriers and transportation vehicles have been analysed. The future transport demand has been reviewed and the prediction of passengers on lines has been provided. Within the next five to ten years no relevant changes will take place, meaning that the balance in transport supply and demand will not be disrupted significantly. This study presents the measures for transport cost reduction and increase in the safety level in the performance of public transport.

KEY WORDS

public passenger transport, transport rationalization, consolidation of County and school lines, passenger forecast on routes/lines

1. INTRODUCTION

The transport system of the wider metropolitan area on the Croatian territory of the Republic consists of the subsystems for road, rail, sea, air and water transport. Within the road subsystem, we can distinguish transit[1] for personal use (individual and business transport) and public line passenger transport. The public County line passenger transport as well as transport of schoolchildren, are one of the subsystems under the county jurisdiction. Since there are numerous lines for transport done by carriers-concessionaires, many complex issues occur, such as proper distribution of lines and creation of timetable in space and time, issues concerning transport availability and motor pool.

The mentioned problem area has been partly regulated by the law, but the problem which diminishes the quality of transportation process can be seen on a daily basis.

It is necessary to create an optimal system of public passenger transport using the articulated strategy. It would lead to increase of transport quality and reduction of the expenses at the same time.

The rationalization of the passenger transport is performed using the analysis of transport lines and passengers in internal road transport[2], based on the field research, modelling and interpretation of results and proposals concerning cost reduction and recommendations to conduct strategies to increase the availability and transport quality. In this work, Zadar County has been covered as an example of the area of research. The aims and the methodology of the work are presented next and the performance of public passenger transport on the County and school lines has been analyzed. Furthermore, a prediction of the population movement has been made based on both economic factors and demographic analysis predicting population growth. The rationalization comprises the application of the County and school lines integration.

2. OBJECTIVES AND METHODOLOGY OF RATIONALIZATION OF LINE PASSENGER TRANSPORT

Public transport of passengers and schoolchildren on a wider geographical area, in Zadar County as well, is a complex and compound transport system with many interweaving subjects, among which the most significant are the state and county department, as grantors and owners of the infrastructure, carriers-concessionaires, station owners and passengers. The transport process includes the bodies of Departments of Internal Affairs, Croatian Roads sub-stations, County Road Administration, as well as districts and local communities. The mentioned transport process includes also the Vehicle centres, their technical substations in charge of technical inspections of vehicles, Croatian auto-club and a variety of other public and private subjects.

The objectives which have to be accomplished throughout the rationalization process, have been sorted out into basic and additional objectives. Some basic objectives include:

- Suggestions of modifications and amendments of passenger transport on the County road lines.
- Suggestions of modifications and amendments of routes in the transport of schoolchildren on the school routes/lines.
- Possibilities of merging the county passenger transport and school bus routes, that is, rationalization of transport system to the level of the best transport quality including availability, frequency and transport safety with the least possible transport expenses (fixed and variable).
- Considering possibility of decreasing costs paid by the state and county administrations.
- To create a script showing transport demand in the past decade based on demographic, economic and traffic indicators of the county and the micro-region.

As supplement to the basic objectives additional objectives are defined:

- To decrease external expenses in the transport process (waste of time while waiting, idling, reduction of fuel consumption, traffic safety expenses, expenses for ecological pollution, fumes, noise, vibrations).
- Flexibility in transit concerning real needs of citizens and schoolchildren, both primary and secondary schoolchildren.
- Setting up a county passenger database (route control, filled up level of vehicles, other statistic data).
- Greater interaction between traffic demand and supply
- Other traffic- economic and technical suggestions with the aim of renewing and increasing the traffic fleet (mini buses and buses, other road vehicles), improvement in the quality of infrastructure (stop lines and terminals, possibility for better marking on state, county and local roads) on which traffic process takes place.

To realize the set objectives, it is necessary to:

- analyze all the county lines for transport of schoolchildren and other passengers;
- analyze the movement of passengers and schoolchildren on particular lines/routes;
- analyze all the lines of transportation of schoolchildren in the county;
- analyze the actual deficiencies in transportation needs of cities, districts and schools;
- suggest solutions to improve the functioning of county public transport;
- provide such solutions which would produce optimum results in relation to traffic demand and supply.

In order to achieve the set objectives, it is necessary to use the knowledge of experts of various traffic professions, technologists, economists, demographers and other professions for better resolution of this interdisciplinary problem.

The methodology for the rationalization of public road passenger transport consisted of surveys, counting and interviewing the passengers, statistic analysis and modelling.

The methodology for the rationalization has been divided into three stages of research. During the first stage, passenger counters are placed on the selected bus stations and they mark the departures and arrivals of buses according to the given counting sheets. The second stage is counting passengers on the selected bus lines/routes, including their entries and exits on all of the routes during morning and afternoon peak load. As the third stage of research, we used the data on school routes/lines received through school polling. It is significant at this stage to interview all included subjects, that is, bodies responsible for transport in cities and municipalities.

3. ANALYSIS OF TRAFFIC IN THE AREA OF COVERAGE

To obtain a better insight into the existing condition of public road transport, the following has to be analyzed:

The analysis of the current state in the public passenger transport on a wider geographical area consists of:

a) Lines/routes (review of available documentation, permits, itineraries, arrivals and departures of buses from the most significant stations in the county) and the passenger analysis on these routes (occupancy level of buses, supply and demand relation,

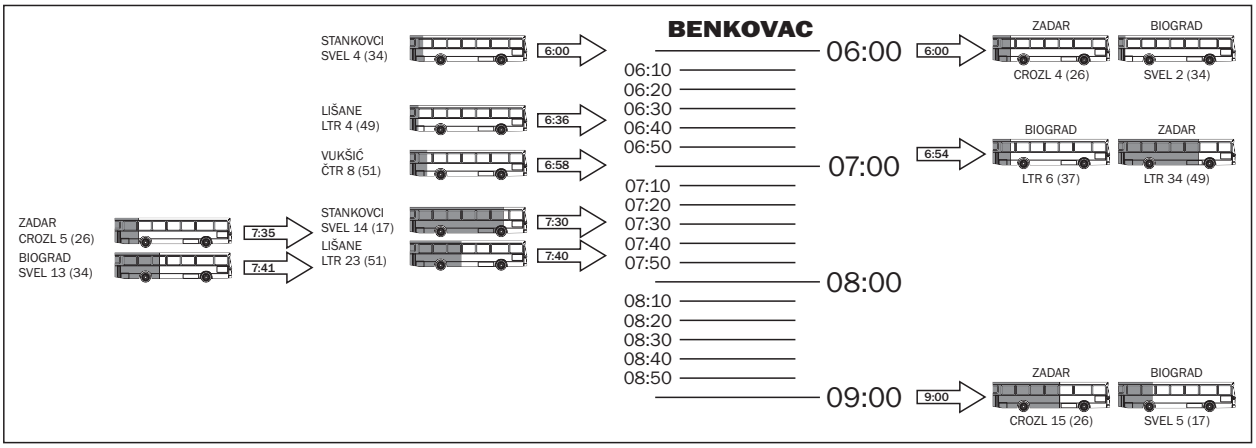

Figure 1 - Arrivals, departures and occupancy level of the buses on the selected stations (example from 6 a.m. to 9 a.m.)

Source: The Institute of Transport and Communications, Zagreb 2001

passenger movement on the routes/lines throughout the day).

b) The quality of passenger transport according to data from cities, municipalities and carriers in the area of coverage.
c) City reports on the quality of the county bus line transport and infrastructure.
d) Municipality reports on the transport quality on the county bus routes and infrastructure.
e) Analysis of transport quality according to data received from passenger and bus counting on the selected bus station in the area of coverage

The scale is divided into 10-minute intervals from 6 a.m. until departures at 11 p.m. The bus arrivals are presented on the left side, while departures are presented on the right side. Each bus is assigned the station from which it has arrived, as well as the destination station, and the name of the carrier performing the transport.

While analysing the passengers, the passenger flow on the selected number of routes is analysed in relation to all active routes/lines. The routes which are not analyzed are seasonal or occasional. *Figure 2* presents graphs with all details concerning the routes:

1) Line/route number according to the county permit.
2) Route/line name.
3) Name of the carrier performing the transport.
4) Time of the bus departure from the initial station and time of arrival to final station.
5) Graph of the driving distributed by minutes.
6) Total length of the trip from the initial to final kilometre.
7) Passenger flow at stations (number of passengers entering and exiting the bus, occupancy level of buses).
8) Names of stations on the observed itinerary marked with ordinal numbers.
9) Bus capacity with the outline of all the seats and standing places.
10) Average bus occupancy with passengers.
11) Maximum passenger occupancy covering complete itinerary.
12) Graphic presentation of the occupancy level of the bus between the stations.

The bus capacity presented above consists of seats and standing places. Maximum occupancy shows the relation between the total capacity and maximum passenger occupancy on a selected route/line. The average occupancy is the relation between the offered capacity and average total occupancy of the bus covering the whole itinerary.

In this case, the transport of schoolchildren has been analysed, using the data ceded by Zadar County, carriers performing transport of schoolchildren and data obtained from the survey conducted in schools.

The received data include the number of primary schoolchildren and the number of those travelling on a certain route/line, as well as the total number of trips to particular schools.

The base of the passenger analysis on the routes for transport of schoolchildren is the analysis of available documentation and research done on the field. Here, the need for more frequent bus stopping on unmarked stops (especially on non-urban roads where the population is not grouped) should be taken into consideration. It is necessary to distinguish full price payment for tickets when students use transportation for extra-curricular activities, as opposed to regular transportation to school and back. Student behaviour should also be taken into consideration, for improper students' behaviour can negatively affect the driving time as well as the life-cycle of a bus.

Furthermore, additional research of County and school lines has been made and five groups can be distinguished: passengers, lines, vehicles, road infrastructures and carriers (*Table 1*). This Table contains all the problems that the mentioned groups are facing.

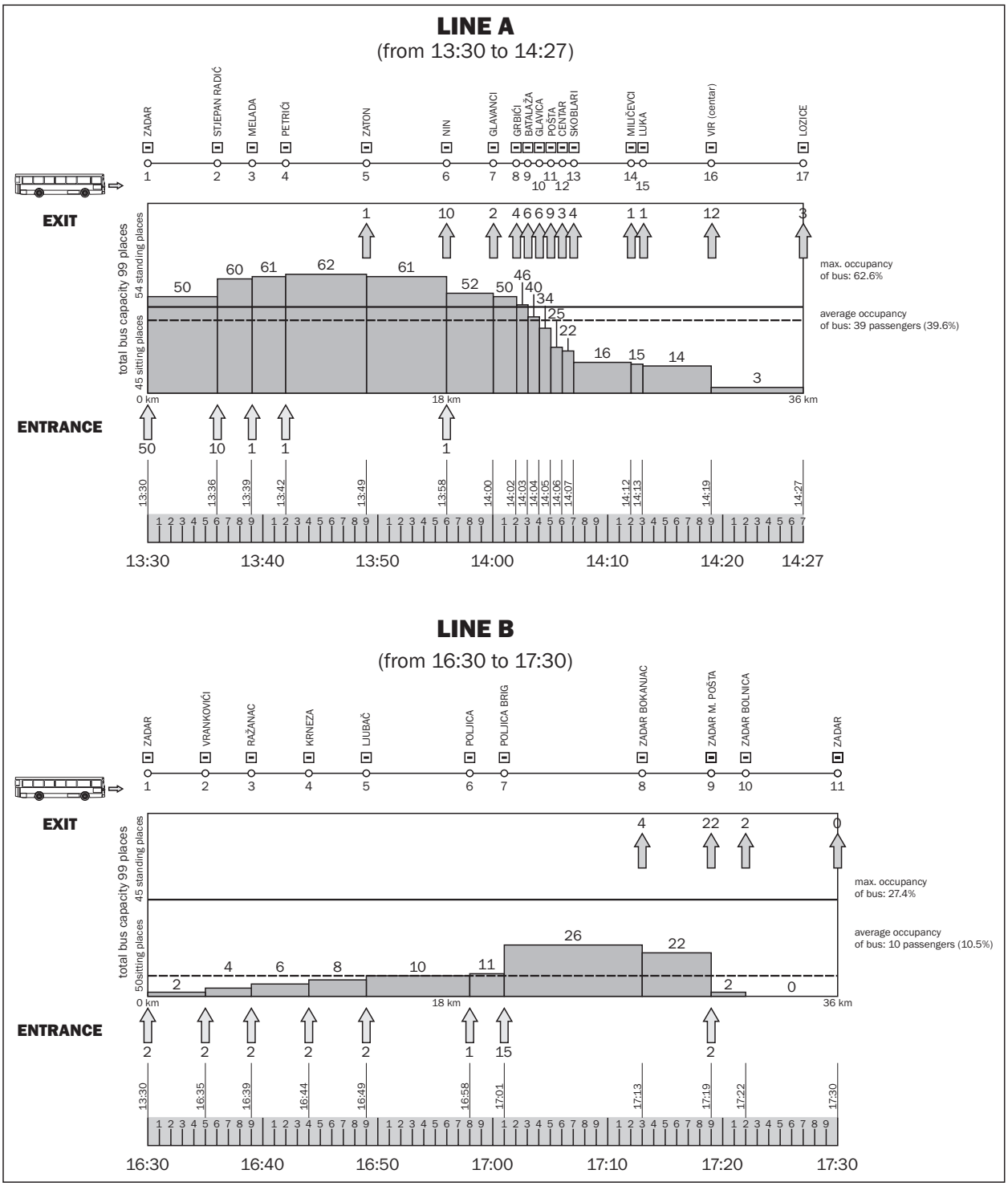

Figure 2 - Example of bus occupancy level regarding capacity

Source: The Institute of Transport and Communications, Zagreb, 2010

4. PASSENGER FORECAST ON ROUTES

While making passenger forecast, the following should be taken into consideration: economic development and demographic analysis.

The economy of Zadar County is based on tourism, traffic, particularly maritime, agriculture, fishery, industries, handicraft and services. The economic activity in the region takes place through active participation of 2,151 enterprises and 5,490 manual trades. On the average, there is an enterprise or a trade per every 21 inhabitants in the County.

A great part of private and public infrastructure in Zadar County has been demolished or mined. Besides

Table 1 - Research results, results of surveys and interviews for the analyzed groups on County and school lines in Zadar County- disadvantages and problems on lines

Analyzed group	Considered bus lines	
	County lines	School lines
Passengers	– creating unique timetables for all carriers and availability of data – connection with bus stops of other lines (intercounty and city) – expensive rides on interregional and other lines – low frequency on the County line in certain areas	– educating drivers about driving safety and operating the vehicle during transportation of children – needs for frequent stopping on unmarked stations (mostly on non- urban roads where population is not grouped) – full price payment for a ticket when using the County line for extracurricular activity
Lines	– line disadvantages, especially those with low or no profitability – potentially the same passengers on the parts of interregional routes	– lack of certain lines due to school and extracurricular activities of schoolchildren – inflexibility of carriers on certain lines regarding timetable
Vehicles	– lack of comfort (air conditions) – crowd at peak times – age of the motor pool	– age of the motor pool, failures and delays caused by failures, worn out condition and bus malfunction – bus comfort – inability to seat all children, comfort (air condition, safety belts)
Infrastructure	– poor or no equipment of bus stations in the County – lack of timetables – low level of passenger safety (especially on unmarked stops) – unbuilt bus stops and laybys – unmarked bus stops on roads – unbuilt bus turnaround points – destroyed traffic infrastructure in areas affected by the Homeland War	– unbuilt bus stops and laybys (lack of bus stop shelters, timetables, traffic signalization) – unmarked bus stops on road – unbuilt bus turnaround points
Carriers	– problems in financing the purchase of vehicles – high purchase price of the vehicles – financing needs of unprofitable routes/lines – problems due to constant price growth of fuel and lubricants	– need for a longer duration of the concession for transport of schoolchildren – problems due to constant price growth, especially fuel and lubricants – legislative provisions on bus quality – financing problems, high purchase prices of vehicles – behaviour of schoolchildren during transport, education of children as prevention of destruction of the vehicles

Source: The Institute of Transport and Communications, Zagreb, 2010

Zadar, other parts of the County show a marked depopulation trend. Gross domestic product (GDP) within Zadar County was USD 3,943 in 2004, while the Croatian average was USD 7,732.

Until 2009 the economic recovery had been noticed, particularly in enterprises and smaller and midsized companies which are the most promising along with tourism. Unfortunately, due to the latest economic recession in the Republic of Croatia, the recovery has been stopped.

Negative demographic changes are a significant factor which determines the demand of passenger transport services, that is, transport capacity on the whole. The demand for transport capacity depends on a variety of demographic factors, to begin with the number of inhabitants, age structure, population mobility and their transport needs, for travelling to school, work or private purposes.

The study of the number, structure, space distribution and arrangement gives essential basis, for example, to plan the number of schools or number of bus routes.

The population projection of a county, city or municipality should be one of the basic starting points concerning the future development of the observed area, and for that they must be related to the projection at the state level.

Since demographic development highly influences the society functioning, the demographic movements, which are frequently forecast by using cohort-component method, should provoke fairly large attentiveness, in the first place, among those with political and social responsibility for a certain area. These “future forecasts” require not only analytic-methodological but also theoretical demographic knowledge as well.

Being distinctive from the rest of Croatia, Zadar County is expecting a sustained increase of population in the next 15 years. Since the increase is not going to be equal (more elderly people, fewer children), the age structure of the population will be the most significant factor of transport demand. The assumption has been made that pupils are those who use bus transport the most, that is, the population aged 14 (primary-school children) to 19 (high-school children). The working population uses bus transport services, and their participation in the total number of passengers depends more on economic and socio- economic than on demographic factors.

Considering demographic stagnation and the declining population number on the Croatian territory and constant increase in fuel price, it is difficult to predict the growth rate in passenger numbers with high reliability. It is generally considered that the increase of fuel price affects the growth of GDP negatively, as well as the growth of individual transport.

Passenger forecasting, particularly in conditions such as those in Zadar County, is based on the present and future mobility demands, attempts to anticipate the future movement needs of the population, research on the county routes, schoolchildren transportation and on the guidelines for demographic development.

The results show that the total number of the residents on the islands will decrease by 17.9% but this reduction will not be distributed equally by age groups. The proportion of children, young people, especially high-school population aged 15 to 19 (64.7%) will decrease the most while the proportion of elderly people will increase, especially those over 80 years. Although Zadar County is an area to which people migrate at the moment, the same cannot be said for its islands. The projections for the islands have been created assuming zero net migration which might not suit the reality, but it is believed that increased connectivity could affect at least retention of the existing population on the islands.

Projections of the population in coastal cities and municipalities show increase of population but in this coastal area as well the number of people aged 15 to 19 will be reduced by 12%. The number of primary-school children will not change. The number of people aged over 65 will increase by approximately 25% within the younger old age and even by 60% among people older than 80.

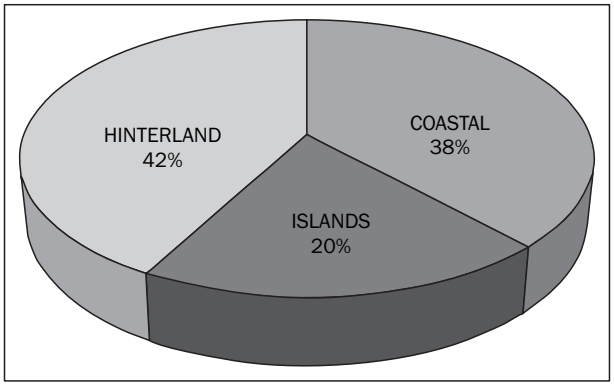

Figure 3 - Structure of the present population by geographical units in Zadar County

Source: The Institute of Transport and Communications, Zagreb, 2010

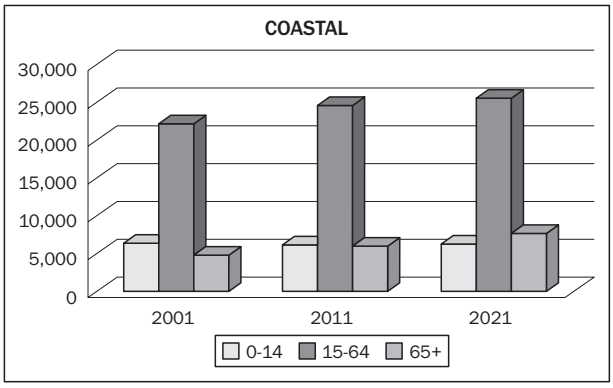

Figure 5 - Projection of the population in the coastal area in Zadar County

Source: The Institute of Transport and Communications, Zagreb, 2010

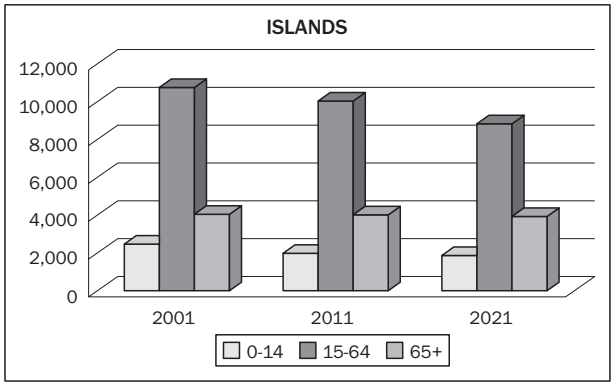

Figure 4 - Projection of the future migration trends on Zadar County islands

Source: The Institute of Transport and Communications, Zagreb, 2010

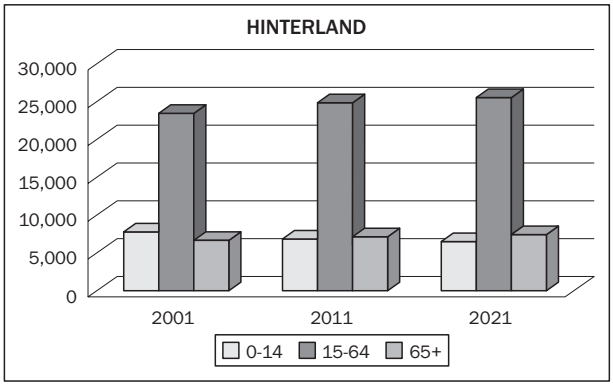

Figure 6 - Projections of inhabitants in hinterland of Zadar County

Source: The Institute of Transport and Communications, Zagreb, 2010

The projections of inhabitants in the hinterland of Zadar County are presented here. The municipalities that are located along the Novigrad Sea are included in the Zadar hinterland for they are drawn deeper into the mainland. According to the projection, the population of Zadar inland will slightly increase in number by 3.7% until 2021. In this case as well, the number of children will be cut, mostly among those aged 0 to 4. All youth groups aged 5 to 19 will suffer decline within the period from 2001 to 2021.

Due to the demographic aging the number of elderly population (aged 80 and over) will significantly increase, and in this respect Zadar hinterland remains indistinguishable from the rest of the County.

The passenger forecast is based on the present and future needs for mobility, that is, on research of County line travels, transport of schoolchildren and demographic development guidelines.

Regarding demographic stagnation and decrease in population on the whole territory of the Republic Croatia, as well as continuous increase in fuel prices, it is difficult to predict with certainty the growth rate in passenger numbers. It is generally assumed that the mobility increases proportionally with GDP. However, the increase in fuel prices affects very adversely the growth of GDP and the growth of individual transport. Approximately 80% of economic activities are located in six cities, while the rest is distributed within 28 municipalities in Zadar County, meaning that the most of traffic activities will be done within the cities and city approaches.

5. PASSENGER TRANSPORT RATIONALIZATION ON COUNTY ROUTES

Rationalization of passenger transportation at Zadar County level as a wider geographical area is possible but should be seen through the following:

1) When possible, to integrate county line transportation with transport of schoolchildren.
2) It is essential to include a wide range of potential carriers with appropriate vehicles, especially for the routes on which a fewer number of children and passengers is transported (special line transport[3]):
   - a personal vehicle should be used for transport of max. 4 passengers (4+1); there is a possibility of carpooling or car-sharing, ride- sharing where certain organizations make their vehicles available to group rides which reduces the travelling[4] expenses. Such solutions have been already recognized over the last 30 years, so they could be adopted in Croatia as well;
   - a station wagon should be used for max. 8 passengers (8+1);
   - minibuses should be used for max. 25 passengers (22) or other appropriate vehicles, depending on the mini bus capacity;
   - a bus or more buses should be used for more than 25 (22) passengers.
3) Certain part of the line transportation can be integrated and optimized by cooperation of carriers on the county and inter- county roads and state routes:
   - through the possibility of using a unique map. This will particularly come to the fore when introducing a single tariff system linked to satellite navigation and modern technologies that are already available;
4) It will be possible and essential to achieve optimization due to the increase in fuel prize and aging population, throughout the sustainable development and decrease of external expenses caused by the private use of vehicles;
5) Long-term optimization will take place in accordance with the development in the public transport including rail and maritime traffic;
6) Increase of public transportation quality along with the increase in fuel prices will lead to reduced use of private vehicles and increased use of public transportation;
7) Long-term transportation can be optimized by the state aids and not by the county, city or municipalities; that is, a redistribution of tax funds is required, from the state level to county, city, municipalities;
8) Increased concessions to carriers to minimum 5 years (that is to 7), to create job security and to stimulate purchase of quality vehicles. The European Union guidelines recommend state aids when purchasing environmentally-friendly vehicles that run on gas or other versions of hybrid engines.

6. POSSIBILITY OF MERGING COUNTY PASSENGER ROUTES AND SCHOOL-BUS ROUTES

The analysis of the county routes in Zadar County as a wider geographical area has shown the position of routes and the occupancy of the buses throughout the day (see Figures 7 and 2) . All County routes under concession are presented as well as their length and position. In general, the positions of county routes of public transport lead to the following conclusions:

- Most of the routes[5] on which the largest number of passengers are carried, are set radially toward the centre of the County, the city of Benkovac and the city of Biograd, that is, they connect north-eastern parts of Zadar County with the coastal area;
- Island routes and inland routes in Zadar County, near coastal areas are set tangentially as well,

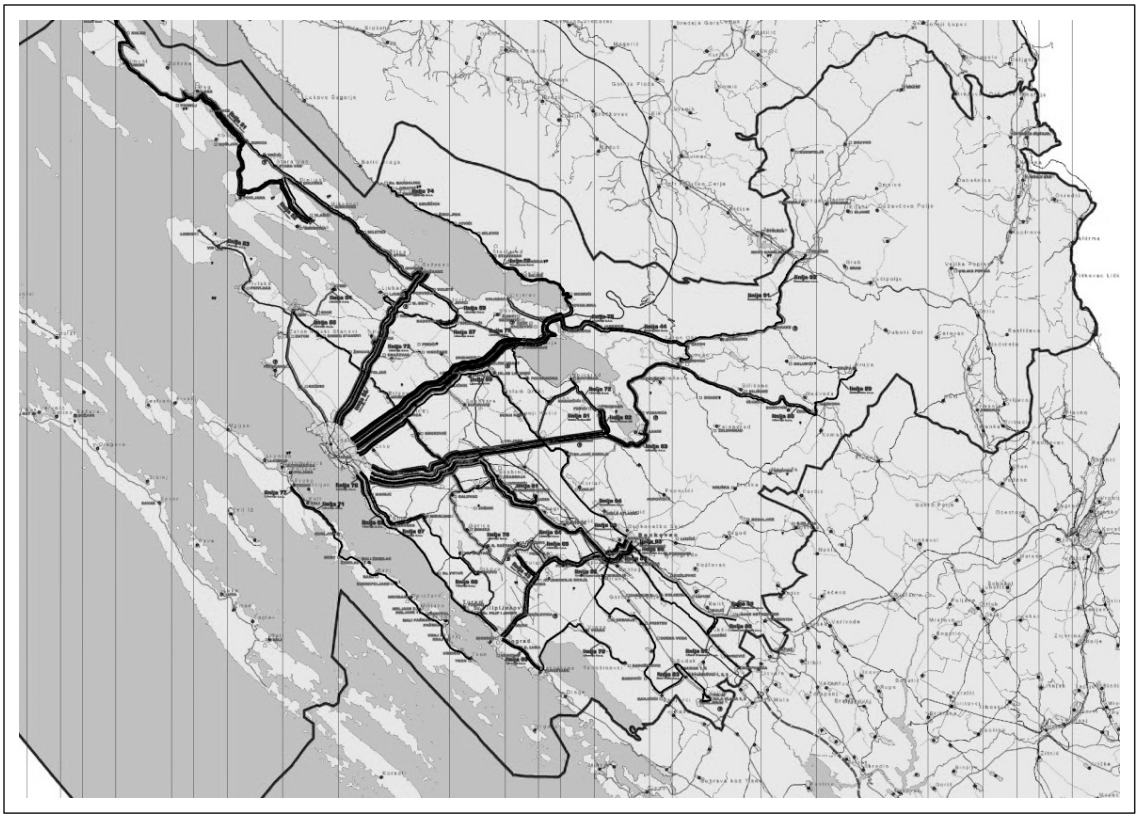

Figure 7 - Graph of the county routes in Zadar County

Source: The Institute of Transport and Communications, Zagreb, 2010

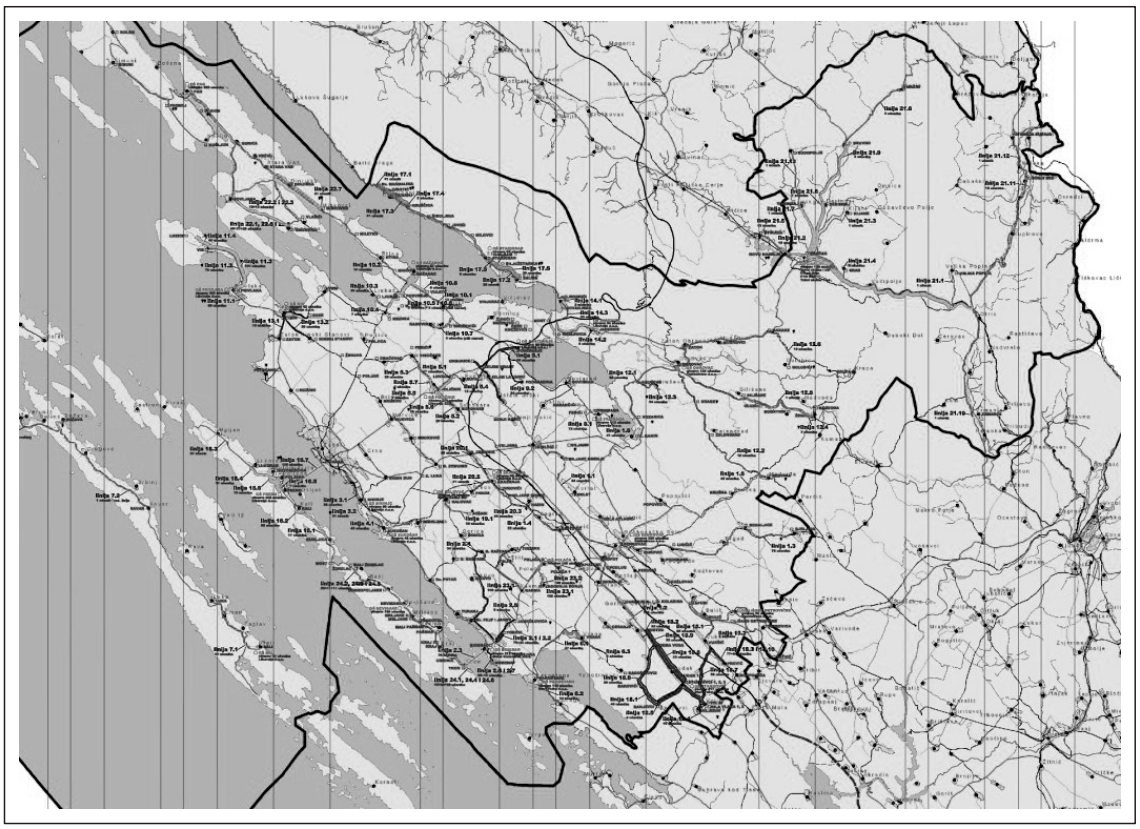

Figure 8 - Schoolbus routes in Zadar County area

Source: The Institute of Transport and Communications, Zagreb, 2010

connecting the north-eastern parts with the south-east;
- There are no county routes connecting the north-eastern pool from Benkovac and county routes on the whole territory of Gračac;
- All of the county routes are in direct function or connect the city of Zadar and the inland, and the island routes are connected by maritime traffic;
- The existing route distribution in most cases is set according to traffic demand and eventually it will have to be adjusted to the passengers;
- Besides the bus station in Zadar which has a good position and provides high-quality service, the rest of the stations in the County are neglected and in need of extensive renovation.

Schoolbus routes in Zadar County have been analyzed using the given statistical data and analysis of questionnaires submitted by the primary school administrations and local authorities (see *Figure 8*).

All bus lines in the County are presented, as well as their length and position. After analyzing all the County lines for passenger transport and transport of schoolchildren, they have been merged (see *Figure 9*).

Figure 9 has been created using the analysis of the county passenger transportation. The possibility of transporting students on the existing routes has been

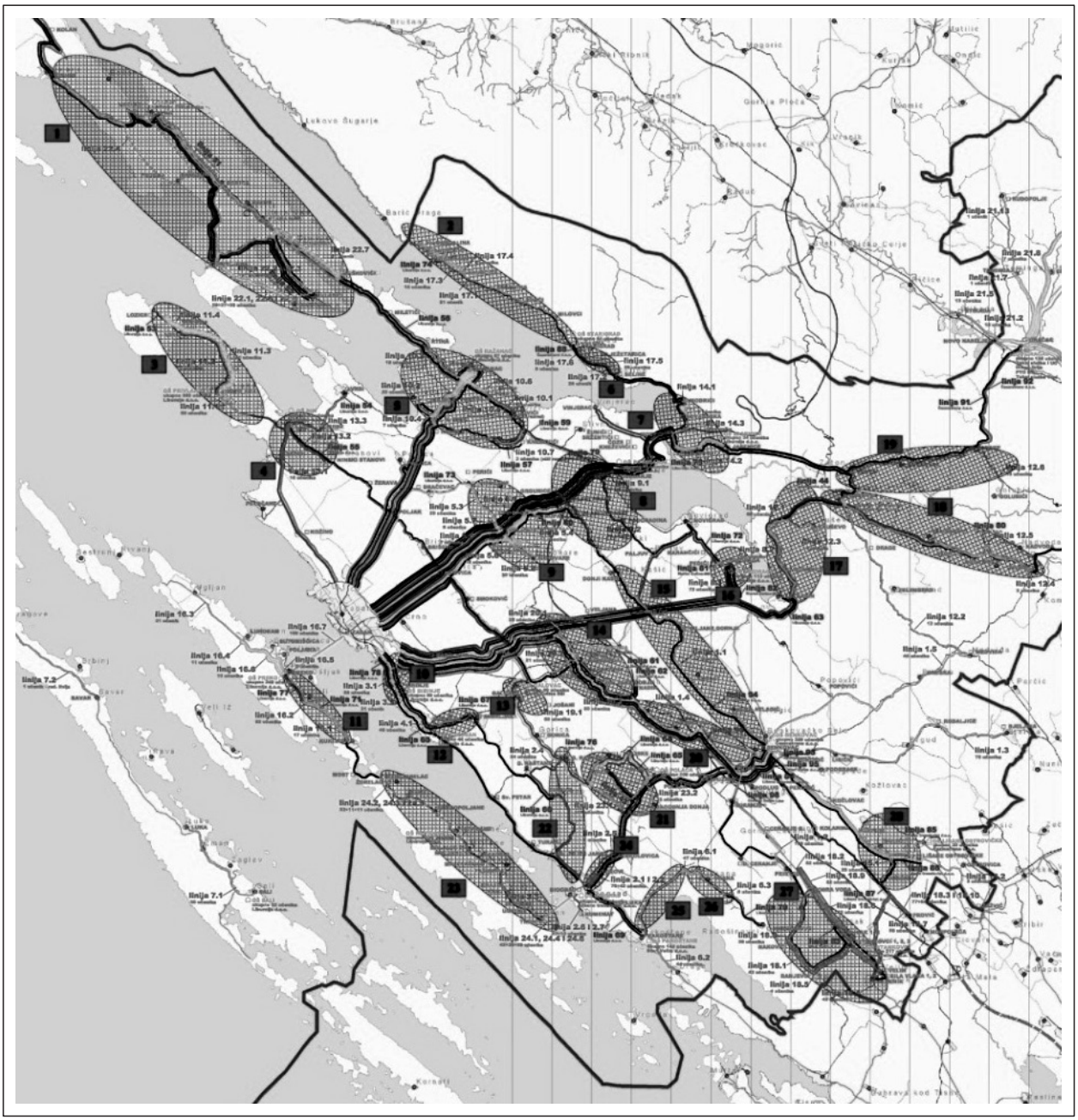

Figure 9 - Areas with possible merging of school and county bus lines in Zadar County

Source: The Institute of Transport and Communications, Zagreb, 2010

tested in 28 areas of overlapping. The areas where merging is possible are marked by ellipses and there are 28 of them. According to the existing Regulations on the conditions to be met by vehicles transporting children, where all devices should be within the bus (safety belts included), there are almost no buses in Croatia that meet the requirements listed.

If all the motor pools were equipped with a tracking system it would make movement monitoring easier. There is an option to indicate the occupancy of the bus, which means that traffic demands can be foreseen and the strategies concerning vehicle capacity could be brought in advance from the Dispatch Centre.

7. PASSENGER TRANSPORTATION FUNDING

The transportation process in road traffic includes the transportation of people and substrates, on determined and free routes, by public or private vehicles on the public road infrastructure. Since the transport work is done, the transport process alone is considered to be a product which has its price. The transportation price includes fixed expenses (purchase of vehicles, paid fee for using the infrastructure, construction of facilities, loans and interests, maintenance of the motor pool, salaries) and the variable expenses (fuel, lubricants).

When it comes to public passenger transportation, it includes transportation of passengers, road network, rail transport system, water and air routes.

Within mass transportation of passengers, particularly in the cities worldwide, public transportation is co-financed with the purpose of creating the appropriate price and stimulating the use of public rather than private transportation. Special types of transport are also co-financed (transport of schoolchildren) while other transportation types are self-financed, such as County bus routes, etc.

However, recent developments in increasing the cost price of transportation will necessarily lead to a greater use of urban and suburban traffic and even inter-county and international traffic. Forecasts like these have already been presented in the White Paper of the Traffic Development prepared by the European working group.

Similarly, in most Croatian Counties, including Zadar County, school routes used for transportation of primary schoolchildren and the first grade of secondary school, are financed by the county and partly by municipalities. The county bus lines operate commercially and after obtaining concession for a route, a carrier is not entitled to subsidies.

According to the existing available data, the projection of transportation expenses in the next three years can be done, that is, until time when all the primary schools and secondary school students will have cost-free transportation, financed by the county.

The County passenger transportation consists of fifty routes operated by carriers-concessionaires. These routes are financed through the market.

According to the available data and results of earlier research, we can distinctly see certain intervals on routes which are on the verge of profitability and are not profitable. The carriers compensate such routes with the incomes from profitable routes to cover the cost of the difference. However, there are no subventions for low-profitable bus routes.

In the future it will be essential to subsidize transportation on such routes, particularly in inland and on the islands. According to the indicators, especially the increase of fuel price, none of the transportation companies will be able to survive without state aids.

Therefore, it will be crucial to create special resources to fund that purpose. One of the important conditions to keep the population in a particular area is available transportation.

Due to the cost reduction, the carriers are not abolishing routes yet, but their intention is to reduce the numbers of departures on routes, particularly on long distances where the number of passengers is low.

8. CONCLUSION

The Counties in the Republic of Croatia allocate great funds to subsidize public line transport of schoolchildren and other passengers. The transportation funding problem has been growing rapidly with the increasing fuel prices. The additional burden is the obligation to finance transport of children attending the first year of secondary schools. Cost reduction and possible savings can only be found in public transport cost reduction. Therefore, a new model of cost reduction in the case of Zadar County has been presented. It includes some reduction measures.

An analysis of all lines for transport of schoolchildren and other passengers has been done. A hundred interviewers have been engaged to count the passengers, to make the analysis of the bus occupancy and to interview them. Additional research has been done by using surveys among all primary schools and carriers in the County. The major problems are poor frequency of the county line on certain areas, that is, lack of lines, especially those of poor or no rentability, lack of timetables, connectivity with stations of other lines, frequent bus stopping and frequent stops at unmarked bus stops (especially on non-urban roads where population is not grouped), the age of the vehicles, low safety level for passengers, inadequate comfort (lack of air conditioning), crowds at peak times, poor or non-existing equipment of bus stations or bus stops in the County, problems

in financing the purchase of vehicles, high purchase prices of vehicles, etc.

The analysis of the present condition of County line transport indicates significant problems at the county level. Lack of passengers on routes is obvious, especially on parts of the routes connecting smaller places distant from Zadar and the larger ones. Inter-county transport takes place on parts of the county routes, so potentially the same passengers use these routes.

Furthermore, the projection of the transport demand based on the economic factors and the demographic projection of the population movement has been done. It is assumed that the population growth will produce the same number of passengers, if other factors do not change and if there are no drastic changes in the lifestyle or spatial distribution. According to the demographic analysis the population of most towns and cities in Zadar County will increase within the period from 2001 to 2021.

The projections are not made for each city or municipality separately but they are grouped into three categories: islands, coastal area and hinterland. Based on this, there will be no significant change in the number of passengers on lines by more than 5% and this will not disrupt the transport demand and supply.

The biggest reductions in public transport of passengers can be done by merging county and school lines, that is, by transport of schoolchildren on the existing county transport lines. This has been examined and confirmed in the case of 28 areas of overlay.

Some other measures which can easily be implemented have been stated here, such as carpooling, use of mini buses, vans, introduction of unified tariff system on the County territory, improvement of transport quality, increasing concessions to carriers to five years for the purchase of environmentally-friendly vehicles.

Rationalization within passenger transport on the county and school lines, if supported by state, could give even more significant results. State support, such as subventions, would significantly reduce external expenses of road passenger transport by individual vehicles, providing better quality of road transport.

When determining the prices of public city transport, it should be taken into consideration that transportation expenses grow when public urban transportation is used insufficiently. It actually means that all the development concepts and strategies should include the system of co-financing, especially of city and suburban transport. It is essential to attract as many as possible of those passengers who use their private vehicles for transport. This can be achieved through comfort, frequency and travel speed and stimulating price. Moreover, it is significant to be able to use different measures to discourage the use of personal vehicles, especially carrying single persons.

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SAŽETAK

RACIONALIZACIJA JAVNOG CESTOVNOG PRIJEVOZA PUTNIKA OBJEDINJAVANJEM AUTOBUSNIH LINIJA NA PRIMJERU ZADARSKE ŽUPANIJE

Rad se sastoji od analize javnog prijevoza putnika u zadarskoj županiji, odnosno prijevoza na županijskim i školskim linijama te prijedlozima racionalizacije prijevoza. Racionalizacija se sastoji od primjene integracije županijskih i školskih linija te prijedloga ostalih mjera u cilju smanjenja troškova prijevoza koje financira zadarska županija. Definirani su ciljevi za racionalizaciju javnog prijevoza putnika, a za njihovu realizaciju analizirane su sve linije županijskog linijskog prijevoza školske djece i ostalih putnika i analizirani su stvarni nedostaci u prijevoznim potrebama gradova, općina i škola. Također je napravljena analiza cestovne prometne infrastrukture te prijevoznika i prijevoznih sredstava. Temeljem gospodarske analize županije i projekcija kretanja stanovništva dat je osvrt na buduću prijevoznu potražnju, odnosno napravljena je prognoza putnika na linijama. U sljedećih pet do deset godina neće doći do značajnije promjene broja putnika na linijama što znači da se neće značajnije poremetiti ravnoteža u prometnoj ponudi i potražnji. U radu su date mjere za smanjenje troškova prijevoza i povećanje razine sigurnosti u odvijanju javnog prijevoza putnika.

KLJUČNE RIJEČI

javni putnički prijevoz, racionalizacija prijevoza, integracija županijskih i školskih linija, prognoza putnika na linijama

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1. Transport in road traffic is any transport of passengers or cargo, including driving of empty or unloaded vehicles.
2. Transport in internal road traffic is transport on the territory of the Republic of Croatia.
3. Special line transport is the transport of a certain group of passengers and it is performed on the basis of a written contract between the customer and the carrier and where the carrier pays the costs of transportation. Law on Road Transport (Article 44) regulates special line transport of passengers and it is determined as transport of schoolchildren to school and back, transport of disabled people, passengers who require medical care, workers travelling from place of residence to place of work. Special line transport of passengers is

normally performed by buses but it can exceptionally be carried out by car (8+1), that is, by special vehicles on the basis of a written agreement between the customer and the carrier. The integral part of the contract is the passenger list which has to be present in the vehicle while it is performing transport of passengers. It is forbidden to transport passengers who are not listed on the passenger list.

4. Taxi transport is transport of passengers done by car.
5. Passenger line is a line on which transport from the initial to the final bus terminal is carried out, that is, transport from the initial to the final bus station with included obligatory bus stops and bus stations determined by the timetable.

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