PLANNING INTEGRATED PASSENGER TRAFFIC FOR VARAŽDIN REGION

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ABSTRACT

In Croatia, there has been a trend of depopulation, and this negative trend has been especially emphasised in rural areas. Apart from social reasons, an additional reason for the decline of population in rural areas is the lack of mobility. Increasing mobility in rural areas can be provided using the concept of integrated passenger traffic where the rail operators are the backbone of the system and the bus operators act as feeders. This approach ensures the financial aspect of the project and transport policy and the operators but also offers high level of transportation services for rural residents. To achieve such a system it is necessary to collect demographic and traffic data. Traffic variables that are determined are the road and rail traffic flows, and then surveys for users of transport. Based on these values integrated passengers traffic can be planned. This paper will show the size of the measured traffic in the areas of Lepoglava and Bednja in the Varaždin County and the possibility of further steps of planning for the creation of integrated passenger traffic.

Keywords: integrated passenger traffic, railway traffic, road traffic, traffic planning

1 INTRODUCTION

In the last two decades the Republic of Croatia has experienced the trend of depopulation, with the trend being especially marked in the rural area. At the level of Europe a decline of population is also taking place, but this refers primarily to the cities (e.g. Germany, Great Britain), whereas in rural area the depopulation has not been thus marked. The reasons for such trends can be found in the mobility of population i.e. the possibility of selecting the transport mode for travelling to major centres. Regional public transport, namely, is extremely developed in the European Union countries, whereas unfortunately in the Republic of Croatia many areas have not even been covered by regional public passenger traffic.

Life in rural area is of higher quality than in urban areas if undisturbed travel from the rural to urban areas is provided, thus allowing fulfilling of certain life necessities (health care, education, culture and similar).

Therefore, it is necessary to study intensively the possibility of improving the mobility of rural population, especially the usage of public passenger transport both by buses and by rail.

Considering the uniformity of the traffic system in the regional traffic railway is the tree trunk of the traffic system with buses being its branches. Such system allows on the one hand optimal transport service for the users, and on the other hand it enables on the technological...
and economic principles the functioning of the transport operators, and eventually satisfaction of the decision-maker.

For such a system to be feasible, it is necessary to determine the demographic and traffic values. The demographic values are necessary in order to analyze the population and to forecast their traffic habits. The traffic values are necessary in order to be able to check the sustainability of the proposed transport model.

While creating new traffic plans it is necessary to use the traffic planning methodology. The methodology steps are:

1. defining the problems and planning frames,
2. creation of statistical and documentation basis,
3. forecasting of social and economic development,
4. forecasting of transport demand,
5. creation and evaluation of plans, and
6. making decisions and determining the policy of plans realization.

Defining of the problems is a necessary step since one has to be aware of them in order to be able to solve them. The frame of planning is necessary in order to set the borders i.e. to provide the possibilities of planning.

The most significant step in the area of transport planning is the collection of statistical and documentation base. In particular different statistical data are collected from the primary and/or secondary databases, both the traffic and the “non-traffic” ones. Without a good statistical picture it is not possible at all to move in the direction of traffic planning, i.e. statistical data are necessary for planning of the sustainable transport system. The documentation base is necessary in order to take into consideration the existing physical plans and general urban plans.

This is followed by the forecasting of the social and economic development of the region, and then by the forecasting of the transport demand as the generator of services in public passenger transport.

It is then possible to develop several versions of plans and to evaluate these plans from several aspects such as: social and economic, ecological ones and the plan feasibility. In the end the decision is made based on the professional results. The decision only is made by the politics which is actually in the position to determine the realization of the selected plan.

2 CATCMENT AREA

The Varaždin County is located in the north-west of the Republic of Croatia. The Varaždin County covers an area of 1,262km² which is 2.2% of the total area of the Republic of Croatia. It has 184,769 inhabitants which is 4.16% of the total population in Croatia. The average population density is 146.5 inhabitants/km² which is double the total population density in Croatia.

The Varaždin County has 275 towns and about half of the population live in the towns with less than 1,000 inhabitants. The next interesting point is extreme dispersion of the towns across the entire County, and especially in marginal western and southern parts.

The traffic network of the county has 92 kilometres of railway lines, 209.6km of state roads and 952km county roads.

The introduction of integrated transport of passengers is a process, which means that it is necessary to start the system of integrated transport of passengers by introducing the pilot lines in order to check the assumptions and validate the model in the controlled area.

Possible areas for the pilot line in the Varaždin County are the City of Lepoglava and the District of Bednja. These two administrative areas form the western border of the County to the neighbouring County of Krapina and Zagorje and towards the Republic of Slovenia.
The City of Lepoglava covers an area of 64.58 km$^2$, with 8,718 inhabitants and population density of 135 inhabitants/km$^2$. The District of Bednja covers an area of 78.01 km$^2$, has 4,765 inhabitants and population density of 61.1 inhabitants/km$^2$.

According to the last 2001 census in the working contingent the area of the City of Lepoglava had 34% migrants, and the area of the District of Bednja had 39% migrants. Since in the last decade certain industrial plants in the observed area have been closed down, the share of migrants significantly increased. The majority of the population migrates from this area into other parts of the Varaždin County, especially to the City of Varaždin (employment, health, education, culture, etc.) and then also to the town of Ivanec (employment).

Since no systemic analysis of the traffic system functioning is being carried out, it is necessary to perform a number of activities regarding data collection necessary for the reorganization of the public passenger transport. Therefore, it is necessary to collect the following:
1. demographic data,
2. transport network – supply,
3. transport flows – demand.

From the aspect of inhabitant-passengers the most important is the transport demand since it reflects the desire, the need for travelling. Naturally, if there is no adequate supply in public transport of passengers, the demand cannot be satisfied and the passengers change the mode of transport. In particular a trend is being recorded of the shift from the public transport to personal transport by cars, which is negative from the financial, social and ecologic viewpoint.

Data collection can be classified into the following groups:
1. demography,
2. survey of mobility,
3. road traffic, and
4. rail traffic.

The demographic data can be collected by using the Censuses and different databases of the counties, cities and districts. Of course, certain data that are needed in the traffic planning have not been necessarily collected by standard procedures and therefore additional population surveys are necessary. This group includes the surveys of mobility such as:
1. cordon survey,
2. survey of preferences,
3. survey of satisfaction with transport service, and
4. journey diary survey.

This is followed by the collection of data of certain transport modes i.e. bus and rail traffic.

3 ROAD TRAFFIC ANALYSIS

The analysis in road traffic is carried out from two aspects:
1. road infrastructure, and
2. road carriers.

The road infrastructure in the observed area consists of the state road, county roads and local roads. The general condition of the state road is satisfactory, with betterment made several years ago. The county and local roads are in good condition requiring reconstruction on certain sections. In order to establish the pilot line of integrated passenger transport it is necessary to determine the road traffic flows. The determination of the traffic flows is done by the count method on the optimally selected intersections. Within the catchment area the following intersections are defined:
1. Trakošćan,
2. Bednja,
3. Lepoglova 1,
4. Lepoglava 2,
5. Lepoglava 3, and
6. Žarovenica.

Traffic count was carried out in the morning shift from 5h to 8h and in the afternoon shift from 12h to 18h.

Resulting from the carried out analysis the road traffic route load was obtained, which is presented in Figure 3. Figure 3 shows the results of passenger car counts since these are potential switchers to public passenger transport.

It is interesting to note extremely busy local traffic in the area of the City of Lepoglava and there are significant flows that can be determined towards the city of Ivanec and further towards the City of Varaždin.

Another aspect of road traffic analysis are road carriers. In the catchment area the public passenger transport is operated by the Company “Autobusni promet Varaždin”. A total of 16 bus lines with 70 departures are in operation. Figure 4 shows the geographic distribution of bus lines. The passenger count in the buses was carried out in the same periods of traffic counts on the roads. The counts were carried out by mobile counters that counted entry/exit of passengers at all stops in the catchment area.
4 ANALYSIS OF RAILWAY TRAFFIC

Analysis in rail traffic is carried out from two aspects:
1. railway infrastructure, and
2. railway carrier.

Railway infrastructure consists of the local railway line Varaždin – Lepoglava – Golubovec. The length of the railway line is 34km, the axle load to Golubovec is 20t/os, whereas the maximal speed on the line is 60km/h. Since the railway line from Varaždin to Lepoglava is of lowland character, the installation of the signal-safety instruments facilitates speed increase to 120km/h. The line is operated by passenger and freight trains. The infrastructure manager is HŽ Infrastruktura.

The passenger transport is operated with 7 train pairs. Usually, diesel railcars HŽ 7121 (Macosa) and HŽ 7122 (Šved) are used. The travel time from Lepoglava to Ivanec is 10', and to Varţdin it is 35'. The passenger counting in trains was carried out by mobile counters on the entire railway line from Varaždin to Lepoglava. They carried out the counts in the morning period on two train pairs and in the afternoon period on three train pairs.

![Figure 4: Morning trains](image)

![Figure 5: Afternoon trains](image)

5 POSSIBILITY OF INTRODUCING PILOT LINE

When the statistical base is collected, a number of activities is started such as: grouping, selection, and data analysis. Then the collected data are evaluated. Parallel, the documentation base is studied, as the fundamental document in traffic planning.

This can be followed by the planning of the pilot line in the catchment area. The first step is to define the stakeholders in planning. The following stakeholders can be defined:
1. population,
2. carriers,
3. infrastructure managers,
4. decision-makers, and
5. civil society.

The population is also the reason why a pilot line is started and therefore it is necessary to include the population in the planning process. Particularly since the change in the usual habits in travel methods are expected. As for example shift from using personal transport to using public transport or combination of public carriers (train – bus). The population should be actively informed about the project itself in order to avoid the creation of unnecessary resistance in introducing the pilot lines. In communication with the population, the advantages of integrated system have to be emphasised, such as:
- larger number of departures,
- shorter travel time,
- unique schedule,
• unique fare, and
• higher level of service.

The possible drawbacks of the integrated system are changes from mode to mode, but due to the mentioned advantages the changes can add to monotonous migrations.

In the integrated transport system there are at least two carriers (in the region of Styria sixty carriers are included 60 prijevoznika, and in the region of Stuttgart forty carriers). The carriers need to be informed about the system functioning method and what this brings them in relation to the past operation technology. In principle, in bus transport there is a decrease in the number of lines, but an increase in the number of departures on the lines, whereas in rail traffic the frequency of departures increases. It is of special significance to harmonise the schedule, which means creating the possibility of contacts of different carriers at places of integration with exchange of passengers. The probably most important aspect for the carriers is the share of revenues. The revenues should be divided according to actual passengers, i.e. there should be an information system for the sales and control of fares. In this way it is possible to ensure the transparency of revenues division. The division of revenues that should be completely avoided is according to the keys – number of departures, capacity of the means and the similar.

The infrastructure managers have to have the information about integrated passenger transport planning on time in order to be able to include in their plans of regular and investment maintenance the infrastructure facilities that are necessary for the operation of the integrated passenger transport.

The decision-makers, i.e. colloquially, the politics has to be included from the beginning into the processes of planning, opening to traffic and maintaining of the system of integrated passenger transport. It is especially significant that the integrated passenger transport provides long-term solution to the mobility of the population, thus gaining positive social image.

Civil societies (organizations) are relatively new on the social scene of the Republic of Croatia, but are extremely important and influential especially in the area of ecology. It is precisely in the system of integrated passenger transport that the ecology is one of the major advantages in relation to bus transport. Therefore, the civil society associations are an additional positive stimulator of the processes of introducing the integrated transport of passengers.

A striking example is the Trakošćan – Lepoglava – Varaždin relation. On this relation it is possible to use bus line which travels between 75 min to 95 min. Unfortunately in the morning hours, due to congestion of traffic entering Varaždin, delays of even up to 15 minutes are frequent.

The passengers can be redirected to using a bus and then a train changing at Lepoglava. In this case the travel time by bus from Trakošćan to Lepoglava is 20 min, then it is necessary to ensure 10 min for change, and then follows the ride by train to Varaždin which takes 35 minutes. Thus, the total travel time with the change amounts to 65 min. It should be specially emphasised that the train has no problems when entering Varaždin during the morning peak hours.

The passenger thus saved absolute 10 minutes in one direction, which is relatively 15% of the travel time. The passenger saves daily 20 minutes. The bus carrier has a lower but reliable turnaround, not joining the city crowd, and in fact needs fewer means for larger work. The railway carrier increases the frequency of departures and carries a larger number of passengers.

Globally, all the participants in the system of integrated passenger transport can have benefits. Indeed, what is needed to start a pilot line is only good will of all the participants.
CONCLUSION

Over the last twenty years a depopulation trend has been marked in rural environments. A significant factor of such a situation is a decrease in the mobility of rural population. The depopulation issue is extremely negative for the society, first of all large spaces are left without population, and second, the population in the cities is growing enormously. There are many reasons which make life in the rural area of higher quality, of course, under the condition that mobility is provided.

The integrated transport system is an efficient method of solving population stability. It has the following advantages: larger number of departures, shorter travelling times, unique schedule, unique fares and higher level of service.

The establishment of the integrated passenger transport system should be carried out through phases with clear controlled mechanisms. First, it is necessary to form a statistical and documentation base. Especially important is to collect the statistical data, both the traffic and the "non-traffic" ones. Data collection should encompass road and rail infrastructure, then passenger counts in road and railway traffic, and determining of the traffic flows in road and rail traffic.

The starting of the pilot line has to be founded on the collected and analyzed data. Only in this way can the sustainability of the system functioning both from the technological as well as the financial aspect be ensured.

Another very important element of introducing the pilot line is the inclusion of all the stakeholders into the very process of planning. The stakeholders interested in introducing the pilot line, and later in the system of integrated passenger transport are: inhabitants, carriers, infrastructure managers, decision-makers and civil society. Each of the mentioned groups from their own aspect have to be informed about the advantages and the drawbacks of the system.

Thus, the pilot line has to be founded on the data collected in the field, analyses of the documentation base and on the interaction with all the stakeholders.

LITERATURE

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