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TRAFFIC POTENTIAL EVALUATION OF THE REGIONS IN THE CONTEXT OF RAIL PASSENGER TRANSPORT – A CASE FOR SLOVAK REPUBLIC

ABSTRACT

The contribution includes the necessity to analyse the potential of the regions in terms of rail passenger transport. The main research goal is to propose a new concept of determination and evaluation of the particular factors, which evaluate the region potential. Several research methods are used in research, for example the brainstorming methods, methods of expert estimate, and especially point evaluation method. Firstly, the factors influencing the traffic potential are defined and examined. Secondly, specific ways of monitoring and evaluating particular factors are proposed. The research results form the basis of a new methodology for traffic potential determination in regions. Subsequently the mentioned methodology is applied in practice to the selected regional railway line in Slovak Republic. The potential of this region is expressed by coefficient values of the chosen factors. For example, coefficient of the number of inhabitants is 2.69 and the average value of the adjacent coefficient of the railway stations and stops availability is 1.92. The details are explained in the fourth chapter. The proposals and outputs including practical application represent a new innovative way for region evaluation which has so far not been used anywhere. It can help plan and organise traffic service in the regions.

KEYWORDS

railway transport; potential; region; attractiveness; factors.

1. INTRODUCTION

Nowadays it is necessary to support public passenger transport in all countries and regions because its performance over the past years has been reduced to the detriment of individual motoring, which is

much more popular than the mass public transit of persons. Travel speed and performance, their impact on the environment or energy consumption, have a significant impact on the sustainable development of the society and particular regions. Therefore, it is necessary to understand and analyse in detail the transport processes and needs of passenger transport in each region. Quality transport system and infrastructure contribute to the development of industry, agriculture, and other national economic sectors. This development must be ensured in all regions to achieve the comprehensive development of the state. Therefore, it is important to properly determine the potential of the particular regions and make full use of it [1].

It is possible to determine the potential of the regions from several perspectives and points of view. The aim of the research is to propose a new methodology of the region evaluation. The contribution deals with the traffic potential of the regions while monitoring several factors (geographic, demographic, economic, and tourist) which affect the transport attractiveness and traffic flows in the regions. Particular methods of determining it, including a proposal of new methods and their practical application, are described in the next chapters. The aim of the contribution is to define and apply the new methodology in practice of the traffic potential determination in the regions. The traffic service should be planned with the emphasis on rail transport which must be the main transport system and the key element of a sustainable passenger transport system [2, 3].

2. LITERATURE REVIEW

For proper determination of the traffic potential in the regions and subsequent determination of the suitable traffic service in them, it is important to examine and research the modal shift, sustainable transport system, mobility in cities and regions, traffic service in regions, supporting public passenger transport in regions, and also use of the electromobility and other environmentally friendly transport modes, mainly rail transport for transport development in the regions. There are many scientific publications that deal with this topic.

Regional railway transport is one of the most important aspects that on the one hand contributes to the economic development of a region, but on the other hand can reduce the quality of life with a disproportionate use of transport modes, mainly in larger agglomerations. In the view of society, regional transport is an important contribution to improving the quality of life of the citizens in the region, as well as its competitiveness and optimal use of public resources. This paper examines regional railway transport in the Slovak Republic with respect to different indicators (transport performances, operators, regional railway line length, financing). It aims to understand the factors that influence the economic and social efficiency of regional railway transport. The research was focused on a regional railway line because, when it comes to the main railway line, the costs of the infrastructure for regional and other railway transport cannot be separated. The case study was performed in the Žilina region where districts with different living standards are located. The research shows interesting results. The regional railway line located in the region with a lower living standard showed the best utilisation and the lowest loss. We suggest a synergy aspect for operating a regional railway line which considers the economic and social factors and interrelationships among subjects participating in the rendition of regional railway transport services [4].

The role of transport in population and employment changes has long been debated in the context of urban development, suburban sprawl, decline of central cities, and inter-/intra-metropolitan accessibility [5].

There is a significant number of railway networks within many Central and East European countries operated only by regional lines, usual-

ly with a great difference between travel demand and transportation offer. This difference is reflected in the whole economic balance of the lines of the service there, resulting in an essential input for the assessment of rail system efficiency. This paper is the conclusion of the research and development project of the Czech Technical University in Prague (CTU), Faculty of Transportation Sciences (hereinafter: the Project), which aims to analyse the current status and potential of the regional railway network in the country. The paper presents the characteristics of that segment of the Czech railway network from the perspective of all scopes evaluated within the Project. A general multi-branch categorisation of regional lines is proposed, arising from their technical and economical parameters, as well as potential for travelling [6].

In the study by Clewlow et al. [7] it is concluded that new mobility solutions such as environment-friendly, ecological, and electric cars or e-scooters could help urban transport systems become more equitable in those traditionally underserved areas and help communities gain access to more transportation services. It is very important to support the idea that e-bikes should replace short and medium distance car journeys and contribute to reducing traffic congestion and pollution in urban areas because they place less demand on road space and produce zero emissions whilst in operation [8]. Article [9] examines the impact of the introduction of electric buses and their impact on mobility. It discusses the advantages, disadvantages, charging, and their overall sustainability in operation. Article [10] examines the failures of electric railways in the selected city and their impact on the urban mobility of the population. It proposes an alternative use of taxi services or buses as a consequence of operational traffic management.

Infrastructure planning is also very important for transport development in regions. These problems are connected with capacity issues. More details about the railway infrastructure capacity estimation are mentioned in [11, 12]. There are also lots of articles and scientific studies which have been written about the transport service of a certain area or region and other things related to it. Paper [13, 14] brings a model of serving the area by bus and railway transport within the public transport. Based on mathematical models, it tries to maintain an even service of urban areas with the optimal

use of transitional links. Review [15] deals with the serviceability of areas with a low population density by bus and rail. It compares the advantages and disadvantages of these types of transport. Based on the calibration model, it tries to create an optimal operator structure. The article is also an excellent basis for understanding and reassessing the need for concurrence of bus and rail transport. Paper [16] is exploring transport options for large agglomerations in Canada. Several variables are presented there on the basis of which this transport service should be implemented. Paper [17] analyses the possibility of innovating a sustainable transport system in a certain Italian region. It uses the 2009 economic crisis and the current COVID-19 pandemic as restrictive conditions. Paper [18] deals with the walking distance to the nearest public transport stop. The article describes the importance of this availability in the context of gradually reducing the preferences of individual motoring. Next important topics to consider and develop are railway investment and its impact on regional development and also transport system in rural areas [19, 20].

There are lots of unexplored facts in the railway passenger transport and railway transport geography, so scientific focus of the contribution will be oriented to new progressive proposals in this field of transport science.

3. METHODOLOGY OF THE REGION EVALUATION

For optimal determination of the potential of the certain area or region, it is a priority to identify all relevant factors that influence this potential. Subsequently, it is necessary to be able to correctly determine these factors and to quantify the quantifiable ones correctly. Based on the outputs, it will then be possible to determine a comprehensive universal and generally applicable methodology for assessing the potential of a certain area. Various professional procedures and scientific methods will have to be used for this determination. Subsequently, the methodology will be applied to a selected region in the Slovak Republic. Within the proposal of the methodology and practical application, certain progressive ideas from the paper [21] were used for inspiration.

The proposed procedure consists of two sub-proposals:

- analysis and description of factors influencing the potential of the territory,
- scientific principles for determining the potential of a territory.

3.1 Analysis and description of factors influencing the potential of the territory

Firstly, it is important to define all relevant factors that may affect the potential of the area or region. The potential of the region means its attractiveness from several points of view. As mentioned in the introduction, the contribution deals with the traffic potential of the regions while mostly monitoring geographic, demographic, and economic factors. These factors significantly affect the transport attractiveness and traffic flows in the regions. The contribution focuses mainly on the rail passenger transport potential in the regions [22].

The most important factors influencing the rail passenger transport potential of the region are briefly described below and shown in *Figure 1*. A more detailed analysis of the factors is given in subchapter 3.2 [23]:

- a) Number of inhabitants in the monitored area – This factor is expressed by the number of inhabitants in the certain region. In the case of evaluation of the region in the context of rail passenger transport, it is necessary to consider the population of all settlements (villages, towns, cities) situated on the monitored railway line. The higher the population, the higher the traffic potential of the region.
- b) Availability of the railway stations and stops – This factor is expressed by the distance (in kilometres or metres) of the railway station or stop from the centre of the settlement. The lower this distance, the higher the traffic potential.
- c) Attractiveness of the monitored region – This factor consists of several fields. It is influenced mainly by size and importance of the settlement, the number of jobs, the number of institutions for meeting the basic needs of the inhabitants, and the number of tourist centres. The more such possibilities, the higher the potential of the region.
- d) Overlapping the railway line and the road communication – This factor can be expressed by many ways, details are explained in the second part of the third chapter.

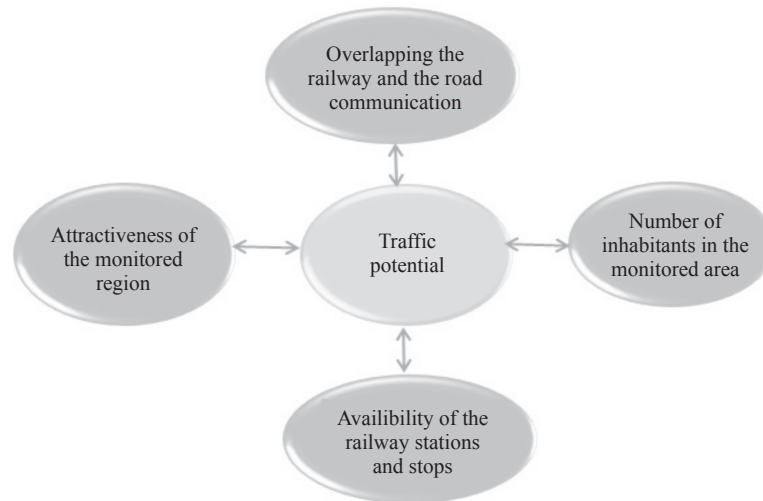


Figure 1 – Synergistic effect among the factors

3.2 Scientific principles of traffic potential determination

Many scientific principles and subsequent expertise which is possible to apply in transport processes and transport geography come from general scientific knowledge in mathematics, physics, or other scientific disciplines. The best known example is the use of Newton's law of gravitation. After modification, it can be used in transport sciences.

It is also possible to determine the traffic potential from the existing physical laws and formulas. An important starting point for traffic potential determination should be the electric potential. The electric potential is a scalar physical value that describes the potential energy of a unit electric charge in a constant electric field. It is the potential of the electric field, the amount of work required to transfer the unit electric charge from the reference point with zero potential to a given location. A place with zero potential (reference point) is usually taken to be either an infinitely distant point (common for other potentials, for electricity usually only in theoretical problems) or the Earth's surface. We consider the Earth or material points connected to the Earth to be places with zero levels of electric potential energy. Electric potential energy refers to the system of both charges – the charge that forms the electric field and the charge that moves in this field. The ratio of the electric potential energy E_p , the positive electric charge Q_0 at this point, and the magnitude of this charge determine the electric potential Φ_0 at a given point in the field. We can also assume that the potential energy E_p is equal to the work done W ($E_p=W$) [24]:

$$\Phi_0 = \frac{E_p}{Q_0} = \frac{W}{Q_0} \quad (1)$$

Electric potential determination and mentioned gravitational models are the inspiration for the creation of the following formula, which can be considered as a new progressive gravitational method applicable in regional rail transport. The resulting form of the proposed formula for the calculation of the transport potential (K_p) can be marked as a further modification of Lill's gravitational model. Its form and principles were described and explained in detail in publication by [23]. The formula is as follows:

$$K_p = \frac{\sum_{n=1}^n \frac{A_n}{D_n}}{L} \quad (2)$$

where:

- K_p – traffic potential coefficient [population/km²],
- A_n – the number of inhabitants of the n -th seat of the monitored area [piece],
- D_n – availability of the n -th railway station and stop – its distance from the centre or from its middle [piece],
- L – length of the railway passenger transport route [km].

The new proposed system of traffic potential determination will not be based on any mathematical formulas. The point method is primarily used. Using this method, there are assigned points for all factors from the selected point scale. The method of induction and brainstorming is mainly used for the point evaluation of individual factors and the subsequent creation of a point scale.

Table 1 – Levels of the number of inhabitants

The number of inhabitants	Adjacent coefficient	Verbal expression
0–499	1	Small villages, their traffic potential is low.
500–999	2	Slightly larger villages, their traffic potential is not too high.
1,000–1,499	3	Medium-sized villages with medium high potential.
1,500–1,999	4	Slightly bigger villages with catchment character, their traffic potential is slightly higher.
2,000 and more	5	Large villages or towns, catchment area of the region, their traffic potential is relatively high.

The method of induction is a scientific method, which is one of the main cognitive procedures and the most important form of the reductive reasoning. Induction is one of the basic forms of combining ideas, in which a number of specific unique and special procedures lead to general conclusions. Brainstorming as a creative thinking method was used to solve various problems using the generation of progressive ideas and thoughts. The main goal is to generate as many ideas as possible and then choose the best ones by using imagination. The original solution should then be followed as soon as possible. The Delphic method is also based on brainstorming. It is an expert prognostic method which requires a group solution of a certain problem, based on the opinions, estimates and solutions of groups of selected experts. The mentioned point method can especially be used for the number of inhabitants factor in the monitored area and the availability of the railway station and stop. The new concept of particular factors evaluation influencing the transport potential is presented in the following subchapter.

Number of inhabitants in the monitored area

This factor is very closely related to the factor of demography, while it is appropriate to examine the composition of the population on the basis of age, education, and other important parameters. The mentioned model takes into account the number of inhabitants of individual settlements, villages, and towns that are located in the monitored region near to the railway line. This amount is directly proportional to the traffic potential. The higher the number of inhabitants of individual settlements in the monitored line section, the higher the transport potential. This idea is based on the general basis of gravitational models or methods.

Table 1 contains the division of the particular settlements population into 5 different levels. Each level has an adjacent coefficient (1–5) and a ver-

bal description. The scale intervals of individual levels have been created using the brainstorming methods and on the basis of an expert estimate. It is possible to use it in particular regions and areas where rural settlements predominate. Therefore, it is suitable for use, for example, on a regional railway line where there are lots of villages and small towns, and not in long-distance passenger transport which connects only big towns and cities.

After evaluating and assigning the coefficient to all settlements in the monitored region, it is necessary to make a comprehensive assessment of the population factor. The procedure will be such that the average will be calculated from the particular adjacent coefficients of all settlements. The average value of all coefficient values can be in the range from 1 to 5. Subsequently, it is necessary to make the even mathematical distribution of all values into 5 final levels. These levels will be the basic output of the population factor evaluation in the monitored region. Their values and description are in Table 2. Interval width for particular coefficient value levels is calculated according to the following formula:

Table 2 – Levels of the final coefficient values and its verbal expression

Final coefficient value levels	Verbal expression
1.00–1.79	Population of the region is relatively low
1.80–2.59	Population of the region is slightly lower
2.60–3.39	Population of the region is medium-high
3.40–4.19	Population of the region is slightly higher
4.20–5.00	Population of the region is relatively high

$$h = \frac{b-a}{n} \quad (3)$$

where:

h – interval width,

b – upper limit of the interval,

a – lower limit of the interval,

n – number of proposed levels.

This means in practice:

$$h = \frac{5-1}{5} = 0.8$$

Availability of the railway station and stops

Availability of railway station or stop can be expressed in several ways. The first way of expressing availability is the determination of the distance of the railway station or stop from the target objects of transport, which can be housing estates, industrial centres, or the centre of a town, city, or village. This factor is indirectly proportional to the transport potential, which means that the closer the railway station or stop is to the mentioned objects, the higher the frequency of passengers expected on them, and vice versa, the further away from them, the lower passenger frequency is expected. Even if you follow the mentioned factor, which is justified especially in the case of regional and suburban transport where the location of railway stations and stops has a significant impact on transport performance. However, in the case of long-distance transport and transport service of larger towns or cities, the location of the railway station or stop does not have a very significant impact on transport performance as in the previous case.

Another important factor is the availability of the railway stations and stops. The concept of its evaluation is similar to the case of the previous factor. *Table 3* contains the division of the particu-

lar availability values into 5 different levels. Each level has also an adjacent coefficient (1–5) and a verbal description. The scale intervals of individual levels have been created using the brainstorming methods and on the basis of an expert estimate as in the previous case. Specifically, they were based on the basic standards of accessibility according to the relevant legislation of the EU and the Slovak Republic. According to the Decree of the Ministry of Transport and Construction no 5/2020 Coll. § 5 item a) a special accessibility standard for suburban transport is defined by expressing the maximum walking distance of 1,500 m. In order to make it mathematically more advantageous to create 5 levels of availability, the stated value was increased to 1,600 m and subsequently became the lower limit of the last level. Consequently, it was mathematically easy to create 4 levels, while the fifth level is not bounded from the upper limit

The next procedure will be the same as for the previous factor. The average value of adjacent coefficients of all railway station and stops availabilities can be in the range from 1 to 5. Subsequently, it is also necessary to make the even mathematical distribution of all values into 5 final levels as in the previous case. These levels will be the basic output of the availability of the railway stations and stops in the monitored region. Their values and description are in *Table 4*.

Overlapping the railway and the road communication

As road transport represents the most significant competition for the rail transport, it is very important to monitor the concurrence of road communication with the railway line. For rail transport, it is favourable when the overlap with the road is minimal.

Table 3 – Levels of the availability

Availability value (km)	Adjacent coefficient	Verbal expression
0–0.39	1	Distance from railway station or stop to the settlement center is very short, availability is excellent.
0.40–0.79	2	Distance from railway station or stop to the settlement center is relatively short, availability is very good.
0.80–1.19	3	Distance from railway station or stop to the settlement center is medium long, availability is average.
1.20–1.59	4	Distance from railway station or stop to the settlement center is quite long, availability is not good.
1.60 and more	5	Distance from railway station or stop to the settlement center is very long, availability is poor.

Table 4 – Levels of the final coefficient values and its verbal expression

Final coefficient value levels	Verbal expression
5.00–4.20	Availability of the railway stations and stops in the region is absolutely insufficient.
4.19–3.40	Availability of the railway stations and stops in the region is quite poor.
3.39–2.60	Availability of the railway stations and stops in the region is sufficient.
2.59–1.80	Availability of the railway stations and stops in the region is good.
1.79–1.00	Availability of the railway stations and stops in the region is very good.

Therefore, the traffic potential should logically be the highest between settlements on such railway line sections where there are no direct road connections or where there are no direct bus services. Monitoring this factor is also strongly justified especially in regional and suburban transport, but also in long-distance transport, where significant competition is mainly represented by motorways, expressways, and 1st class roads, connecting major centres.

The overlapping of bus and rail transport will be monitored in particular within the framework of the above-mentioned issues. Overlapping is a situation where a bus and train connection is operated from point A to point B in an interval of five minutes, usually along the same route. This situation occurs mainly because the buyer of railway passenger transport is the Ministry of Transport and the buyer of suburban bus transport is the self-governing region in many countries. In the case of the analysis of the mentioned factor, as well as in the comparison of the number of connections between particular transport points, graph theory will be used. A graph is an abstract mathematical object given by a set of vertices V (also called nodes) and a set of edges E between the pairs of vertices. Within the mentioned research, only oriented graphs will be monitored. The oriented graph $G=(V, E)$ is defined by the set of vertices V and the set of edges E , which form ordered pairs $e=(u, v)$ of vertices from V . A practical example will be given in chapter 4 on a specific case [25].

Attractiveness of the monitored region

As part of monitoring the attractiveness of the area, it is possible to monitor several sub-factors. They relate in particular to the importance of the particular settlement in terms of individual areas of its focus, sectors of the economy, various possibilities, and so on.

For the purposes of this research and the proposal of the mentioned methodology, two main sub-factors are relevant, which are as follows:

- tourism in the region and the settlements,
- number of jobs and unemployment in the region.

The sub-factor “tourism in the region and the settlements” is based on the assumption that there are more tourist attractions in the area, it is possible to consider a higher number of tourists, which increases the traffic potential. Exact determination of the tourist attractions number is relatively complicated. Therefore, the proposed sub-factor is based on the number of accommodated tourists in the monitored area and districts according to the current Statistical Yearbook of Regions.

The subfactor “number of jobs and unemployment in the region” is also an important criterion that can significantly affect the transport performance as well as the transport potential of the territory. The more jobs in the monitored area, the assumption is that there will be more transport needs in order to commute to work. However, in the case of higher unemployment in the monitored area, the transport potential will decrease. This sub-factor will monitor the unemployment rate of the territory.

4. CASE STUDY FOR SLOVAK REPUBLIC

After the proposal of the theoretical concept and methodology for region evaluation, it is important to present a quality practical application of the proposed issue. The region in the south of central Slovakia is selected as an example. The region is called Novohrad. There is an adjacent railway line Lučenec–Utekáč to the mentioned region. It is shown in red in *Figure 2*.

Subsequently, it is necessary to examine the number of inhabitants in particular villages and towns, and the availability of individual railway stations and stops. The potential of the region will be examined in terms of rail passenger transport, so these two factors will be detected in the case of settlements where the railway line passes. These settlements, their number of inhabitants, and availability of their railway

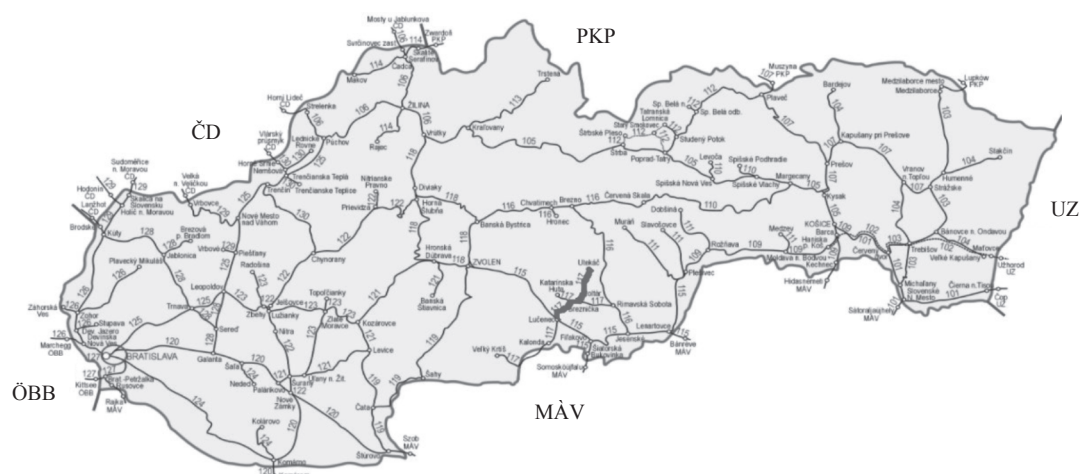


Figure 2 – Railway line Lučenec - Utekáč

stations and stops are shown in Table 5. The table also contains the adjacent coefficients to individual values. Finally, the arithmetic average is calculated from these coefficients. Based on the final average coefficient value, it will then be possible to determine the specific level at which the region is located in terms of rail passenger transport potential.

Table 5 shows that average value of adjacent coefficient of the number of inhabitants is 2.69 so it belongs to the third yellow level. It can be stated that the population of the region is medium-high. The average value of adjacent coefficient of the railway

stations and stops availability is 1.92 so it belongs to the fourth “pale green” level. Availability of the railway stations and stops in the region is good.

After the evaluation of these two factors, it is possible to analyse the factor overlapping the rail passenger transport and bus transport. As mentioned in the third chapter, graph theory will be used to monitor this factor. The result will be a graphical illustration of overlapping.

There are defined particular settlements in the graph vertices, and the number of bus connections during working days/weekends is defined on the

Table 5 – Evaluation of the factors on the Lučenec – Utekáč railway line

Tariff point	Number of inhabitants	Adjacent coefficient	Availability of stations and stops	Adjacent coefficient
Lučenec	27,739	5	0.82	3
Opatová pri Lučenci	2000	5	0.30	1
Veľká Ves	441	1	1.10	3
Kalinovo	2,249	5	0.40	2
Breznička	743	2	0.40	2
Zelené	450	1	0.60	2
Poltár	5,584	5	0.30	1
Slaná Lehota	350	1	0.65	2
České Brezovo	464	1	0.52	2
Zlatno	472	1	0.73	2
Kokava nad Rimavicou - Liešnica	100	1	0.40	2
Kokava nad Rimavicou	2,825	5	0.60	2
Utekáč	923	2	0.30	1
AVERAGE VALUE		2.69		1.92

Table 6 – Matrix of bus and rail transport overlapping on working and free days

	Lučenec	Opatová pri Lučenci	Veľká Ves	Kalinovo	Breznička	Zelené	Poltár	Slaná Lehota	České Brezovo	Zlatno	Kokava nad Rimavicou	Utekáč
Lučenec	-	38/8	16/5	22/5	23/5		25/7	5/0		6/0	3/0	
Opatová pri Lučenci	38/8	-	0/0	6/0		5/0		0/0	3/0		2/0	
Veľká Ves	16/5	0/0	-	17/5	15/5	17/5	18/5		1/0		0/0	
Kalinovo	22/5	6/0	17/5	-	21/5	20/5			4/0		2/0	
Breznička	23/5		15/5	21/5	-	22/5	23/5		5/0		3/0	
Zelené	25/7	5/0	17/5	20/5	22/5	-	35/10	5/0		9/1		4/1
Poltár			18/5		23/5	35/10	-	10/1				
Slaná Lehota	5/0	0/0				5/0	10/1	-	10/1		9/1	4/1
České Brezovo		10/1		-	10/1	10/1						
Zlatno		3/0	1/0	4/0	10/1		-					
Kokava nad Rimavicou	6/0	9/1						-	13/3			
Utekáč	3/0	2/0	0/0	2/0	3/0		4/1		13/3	-		

graph edges. Firstly, it is necessary to prepare a matrix in tabular form (Table 6), which aims to clearly display the examined parameters.

The first number in the table indicates the number of connections between two settlements on a working day (indicated by the symbol Ω in the timetables). The second number indicates the number of connections between the two settlements on

Saturdays, Sundays, and on holidays (marked with the symbol a). There is no connection between the selected settlements in the boxes marked in red and thus it serves as an alternative for use in railway transport. Figure 3 graphically shows the problem of overlapping of bus and rail transport on the Lučenec–Utekáč railway line (in this direction) using an edge-oriented digraph.

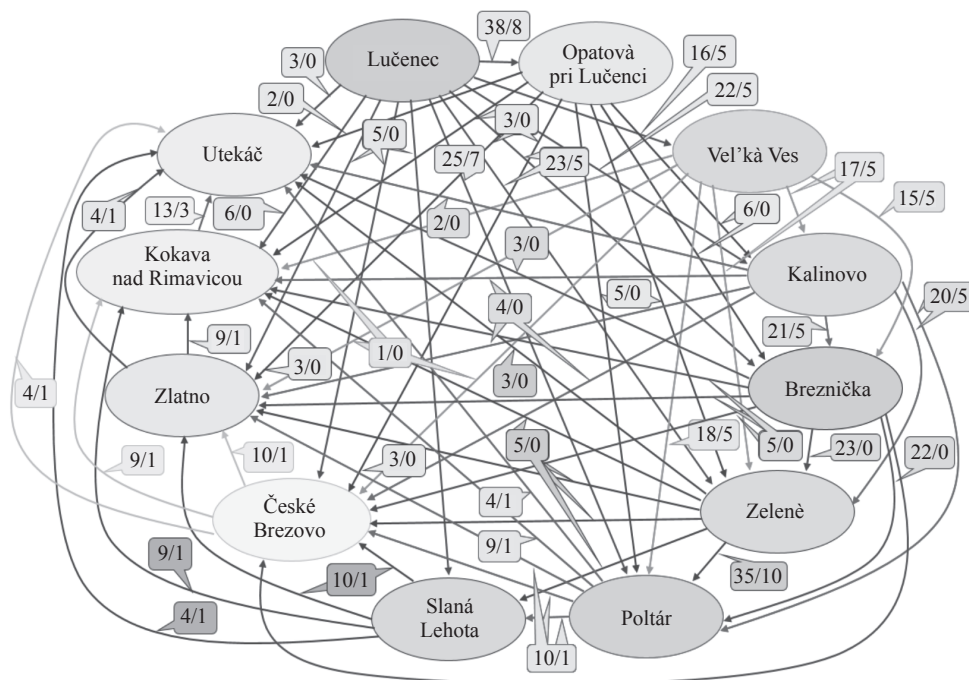


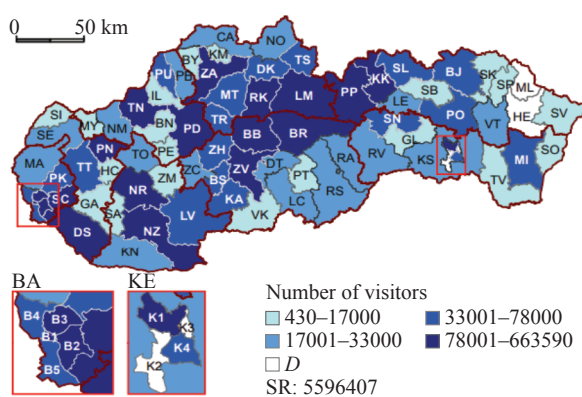
Figure 3 – Graphical representation of overlapping

This matrix shows the connections between settlements by buses. To eliminate the overlapping, it is necessary to find the conformity between the operation of trains and buses in different time positions. There are red and black numbers. Black numbers represent the number of direct bus connections between particular settlements during working days and red numbers represent the number of direct bus connections between particular settlements during Saturdays, Sundays, and holidays.

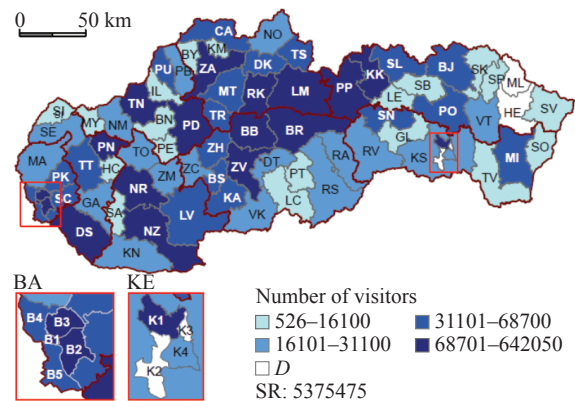
The last observed factor is the attractiveness of the monitored region which consists of tourism in the region and unemployment in the region. If we want to examine these subfactors, it is necessary to define districts where the railway line is located. These are the districts of Lučenec (LC) and Poltár (PT). Tourism in all Slovak regions are shown in the Figure 4. There are outputs from the Statistical Year-

book of the Regions of Slovakia, chapter Tourism, scheme M 18-1 expressing the number of visitors in accommodation establishments in individual districts for the years 2017 and 2018 (see Figure 4).

Particular districts are divided into four colour groups according to the number of visitors. The regions marked in dark are among the most attractive for tourists, which is very important to take into account when planning traffic services in the railway lines and to ensure optimal connection of tourist attractions in them [26, 27]. Figure 4 shows that Lučenec district attractiveness in terms of tourism is below average, whereas the monitored district was included in the second worst tourist attractiveness level of four levels based on relevant statistical data in 2018 and in the first worst tourist attractiveness level in 2017. Poltár district attractiveness in terms

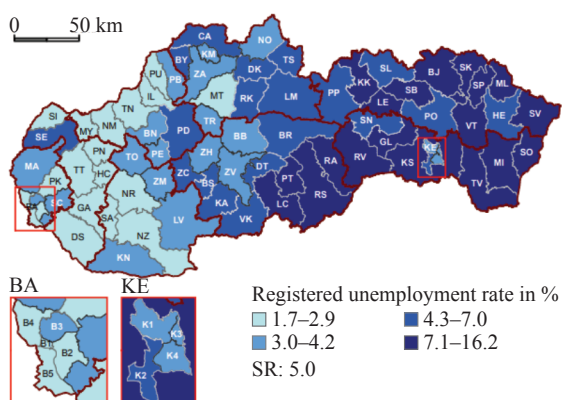


a) Visitors in accommodation establishments in districts 2018

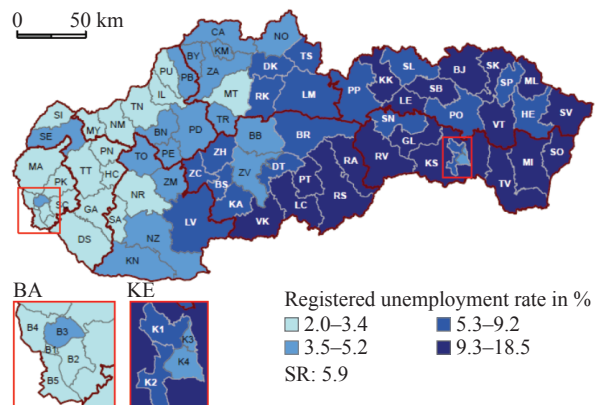


b) Visitors in accommodation establishments in districts 2017

Figure 4 – Tourism in particular districts in Slovakia in 2018 and 2017 [26, 27]



a) Registered unemployment in district as at Dec.31, 2018



b) Registered unemployment in district as at Dec.31, 2017

Figure 5 – Labour market in particular districts in Slovakia in 2017 and 2018 [27, 26]

of tourism is significantly below average whereas the monitored district belonged to the first worst tourist attractiveness level in 2017 and 2018.

As in the case of the previous sub-factor, the second sub-factor – number of jobs and unemployment in the region – will also be based on the Statistical Yearbook of the Regions of Slovakia, chapter Labour market, scheme M 3-1. There is also a comparison of particular districts in Slovakia in 2017 and 2018. In this case, the light-marked districts represent a low unemployment rate, so it is possible to consider higher traffic potential and traffic flows in them, especially for daily commuters, which must also be taken into account when planning traffic services [26, 27].

On the basis of *Figure 5*, where attractiveness in terms of number of jobs is shown, it can be stated that both districts are also significantly below average. Both monitored districts belonged to the group of districts with the highest unemployment of four groups based on relevant statistical data in 2017 and 2018.

5. CONCLUSION

The contribution dealt with the proposal of a new methodology for the regions evaluation in the context of regional rail passenger transport. Professional and scientific studies and contributions were analysed in the first part of the article, which address the issue of region attractiveness and subsequently transport planning and transport services. Based on that, a new concept of assessing the regions attractiveness was subsequently proposed. This concept was based on the identification of four main factors. There is a significant synergistic effect among them. Each factor had its own way of being analysed and evaluated. Subsequently, the evaluation of these factors was performed in a specific region. The main purpose of the contribution was to point out the traffic potential of the region in terms of the potential of regional rail passenger transport. An analysis of the above factors was subsequently prepared on the Lučenec–Utekáč railway line from this point of view. The average value of the adjacent coefficient of the number of inhabitants is 2.69, so it belongs to the third yellow level. The average value of adjacent coefficient of the railway stations and stops availability is 1.92, so it belongs to the fourth “pale green” level. Evaluation of the factors in the region showed that this region is

comprehensively not a very attractive region in the Slovak Republic. This fact must be taken into account when planning transport services in the region.

However, the most important thing to consider is rail transport as the main transport system in this region. Therefore, it is necessary to link the assessment of the regions attractiveness with the system of traffic service planning. The contribution proposes a new innovative methodology for traffic potential evaluation of the regions in the context of rail passenger transport. The main advantage of the methodology is the possibility to quantify precisely the final value of the monitored region potential. Subsequently, this region can be assigned to one of the five proposed levels. At the same time, there is a significant practical contribution to propose the traffic services concept in the region. Other insights and implications point out that the mentioned methodology is universal with the possibility of use in regions around the world. The theoretical benefits mainly consist in the enrichment of the transport processes science, specifically in the proposal and application of new elements of the point evaluation method. Some similar proposals were presented in many publications, but it is necessary to propose new ways with higher quality features. Emphasis must be placed on a sustainable environmentally friendly transport system. It is also appropriate to consider electromobility, electric buses, and other modern systems and means of transport. All the ideas will be the subject of further scientific research by the authors in the future.

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**HODNOTENIE PREPRAVNÉHO
POTENCIÁLU REGIÓNOV
V KONTEXTE ŽELEZNIČNEJ OSOBNEJ
DOPRAVY – PRÍPADOVÁ ŠTÚDIA
PRE SLOVENSKÚ REPUBLIKU**

ABSTRAKT

Za ostatné roky bolo prijatých viacero opatrení na komplexný rozvoj jednotlivých regiónov vrátane verejnej osobnej dopravy v nich. Hlavným cieľom je vytvoriť trvalo udržateľný systém verejnej osobnej dopravy vo všetkých regiónoch ako plnohodnotnej alternatívy k individuálnej automobilovej doprave. Uvedený príspevok poukazuje na nevyhnutnosť analyzovať potenciál regiónov v podmienkach železničnej osobnej dopravy. Jeho základným výskumným cieľom je návrh nového konceptu stanovenia a hodnotenia určitých faktorov, na základe ktorých je následne možné hodnotiť potenciál regiónu. V rámci výskumu je použitých viacero výskumných metód, napríklad metóda brainstormingu, Delfská metóda, metódy expertného odhadu, metódy indukcie, no najmä bodová metóda hodnotenia. V prvej časti príspevku sú definované a vysvetlené faktory vplyvajúce na prepravný potenciál. V ďalšej časti sú navrhnuté špecifické spôsoby sledovania a hodnotenia jednotlivých faktorov. Výsledky výskumu sú základom novej metodiky pre stanovenie prepravného potenciálu v regiónoch. Následne je uvedená metodika prakticky aplikovaná na vybranú regionálnu železničnú trať v Slovenskej republike v regióne Novohrad. Potenciál predmetného regiónu je vyjadrený prostredníctvom hodnôt koeficientu vybraných faktorov. Napríklad koeficient počtu obyvateľov je 2,69 a priemerná hodnota príslušného koeficientu dostupnosti železničných staníc a zastávok je 1,92. Detaily výpočtov sú vysvetlené v štvrtej kapitole. Návrhy a výstupy metodiky vrátane jej praktickej aplikácie ponúkajú nový inovatívny spôsob pre hodnotenie regiónov, ktorý zatiaľ nebol nikde prezentovaný. Uvedené výstupy môžu pomôcť k efektívnejšiemu plánovaniu a organizovaniu dopravnej obsluhy v regiónoch.

KLÚČOVÉ SLOVÁ

železničná doprava; potenciál, región; atraktivita; faktory.

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