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Evaluation of high-standard public transport centres in the Slovak Republic

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Abstract. Despite of increasing volumes of individual passenger transport and growing dependence of the post-socialist societies on the passenger car, public transport is still inevitable for certain communities. Its social and environmental aspects are obvious reasons why public transport remains within the scope of state and regional policies as a mixture of public and commercial services. Long-distance and international overground public transport represents a higher standard of travelling of considerably commercial nature. An important feature of this segment of the public transport is its capability to compete with individual transportation for long-distance journeys. The commercial character of the long-distance public transport should motivate operators to run territorially effective links covering adequately populated communites and regions with high demand for this segment of public-transport services. This study deals with several territorial aspects of the network of long-distance and international bus and train links of public transport in the Slovak Republic. The network of communities having direct access to the high-standard modes of public transport has been identified, revealing some of their spatial patterns and focusing on categorization of urban settlements by selected parameters of high-standard public transport services. The relationship with the population size of the urban settlements is assessed in the study, too.

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1. Introduction

With the post-transformation period in transitive societies of central Europe, including Slovakia, the process of overwhelming the passenger transport market by individual means of transport (passenger cars) has probably come to its final stage, with the modal split increasingly resembling the one visible in most of developed western-European countries. According to the database of the Statistical Office of the Slovak Republic, individual transportation covered 75% of the country's total passenger transport performance in 2012. For example, back in the transformation period in 1995 this was less then 46%. Decreasing capacity of public transport systems, growing fares and a relative drop of fuel prices as well as the liberalization of passenger-car markets were obvious attributes of passenger-transport market trends in all post-socialist countries, which was well described by, e.g., Komornicki (2005), Pucher, Buehler (2005), Marada et al. (2010), and others. While in western Europe the public transport systems have been upgraded continuously throughout the decades, in the European post-socialist societies this upgrading is a matter of contemporary political discussions and a subject of public (and partly also private) investments, especially into railways (Nash, 2010).

Networks of public transport represent a spatially relevant phenomenon, as they consist of lines and nodes that form a web clearly identifying areas of concentration (dense networks, nodes with multiple public transport links, etc.) or places sparsely serviced by the respective means of public transport. These spatial features of the public transport network partly reflex the matrix or territorial organization of human society with all of the relevant attributes (settlement system, transport networks, production areas, location of services, tourism attractions, etc.). In Slovakia, the morphology of the country has predetermined the recent distribution of its population into "natural" transport corridors formed within morphological depressions (see Fig. 1). This pattern of the country's transport networks as an advantage for accessibility of the main transport lines has been evaluated by numerous analyses based on geoinformation techniques, such as Kusendová, Szabová (1998) or Kusendová (2003). Rodrigue et al. (2009: 14) state that "the development of a location reflects the cumulative relationships between transport infrastructure, economic activities and the built-environment." In transition societies, transport networks play one of key roles in the regional development dynamics after the collapse of the communist regimes, and thus have been an inspirative element of geographical research focused on relationship between transport and widely perceived regional and local development. For example, this has been shownby Marada (2003), Kraft (2012), Kraft, Vančura (2009) assessing the relationship between transport and settlement hierarchy in the Czech Republic, Śleszyński (2014) and Stępniak et al. (2013) who analysed the relationship between transport, accessibility and settlement system in Poland or Cudny, Rouba (2012) pointing to the contrast between the perfect geographical position of the Polish city of Łódź and its unfavourable accessibility due to lagging upgrade of transport infrastructure.

Struggle for position of providers in long-distance public transport market in Slovakia is intensifying. Recently, we can observe see attempts of the first independent providers in Slovakia trying to compete with monopolic passenger train company ZSSK on some of the most crowded links Bratislava-Košice, Praha – Žilina – Košice, as reported by the Railways of the Slovak Republic, being the

operator of the railway infrastructure. This supports our attitude that the domestic as well as cross-border long-distance public transport still represents a commercially attractive mode of public transport.

Compared to the regional public transport, the long-distance and international public transport offers a higher standard of travel to the passenger. White (2009: 178) clearly claims that "...it is in the intercity, or long-distance, sector that the highest quality of public transport service can be found... " Through relevant comfort, usually higher travelling speed and extra services, the long-distance and international public transport represents a successful competitor to individual transport by the car. Respecting these attributes, we can consider this segment of public transport as a high-standard public transportation. As Steg (2003: 33) concludes, "in specific situations travelling by public transport is more attractive compared to driving," stating that long-distance travel between cities is a good example of such situation. Based on these attitudes, one can believe that the direct access to long-distance and international public transport brings advantages to residents, who can use this high-standard mode of transport on a regular base in access to work, services or education located in remote urban centres, regional centres or even foreign metropoles. Thus, the main idea of this paper stems from an elementary thesis that the better and higher long-distance and international public transport capacity, the better the position of the community or town in the overground public transport networks. Recently, a complex study on the long-distance public transport and its territorial dimensions after the end of communist regime in Slovakia was carried out by Horňák (2005), and later partially by Pšenka (2011) who focused mainly on long-distance railway transport. In this context, valuable results are presented by Taczanowski (2012) who emphasizes a positive effect of geographical position of Slovakia's major urban centres for long-distance and international railway transport.

Formally, bus and train links and their schedules are approved and controlled by different authorities of the country. Domestic long-distance bus links are supervised by regional self-governments, international bus links by a central institution - the Ministry of Transport, Construction and Regional Development of the Slovak Republic. On the other hand, network capacities for long-distance trains are approved by the railway network operator – the Railways of the Slovak Republic. While domestic IC trains as well as long-distance bus links are fully commercial, expenses on standard long-distance trains are partly covered by public financial endowments. This complexity brings a lack of co-ordination in time-schedules of both modes of the public transport, as indicated by Gašparík et al. (2012) and some others. Moreover, there is no strict definition of long-distance passenger transport in Slovakia. Act no. 56/2012 Coll. on Road Transportation suggests that due to subsidizing purposes, regional public transport should not exceed 100 km. The Act also defines an international link as the one whose initial or terminal stop or station is located abroad. Act No. 513/2009 Coll. on Railroads sets conditions for operation of international trains in the territory of Slovakia. Long-distance and international bus and train links are subject to special fare order compared to regional transport, and they are also clearly distinguishable in time-schedules. This is one of the facts that enabled us to reach the goals of our study.

The main aim of this study is to identify the settlements (communities) in the territory of Slovakia with direct access to the network of long-distance and international public transport network (buses and trains), with a special focus on urban settlements (communities) of the country and their position within the network. We also tried to identify the hierarchy of urban centres within the network of the long-distance and international public transport network in comparison with their population size.

2. Data and methods

The basic goal of our study was to identify the communities with direct access to the network of long-distance and international public transport links in the territory of the Slovak Republic. A substantial part of the database used in this study was taken from the study made by Struhár (2013), with minor adaptations in the processing of the database (explained below in this study). With the respect to relevant and crucial modes of public transport in the country, both trains and buses were in focus.

The density of railway network (7.5 km/100 km^2) in Slovakia is much lower than the density of road network (about 36 km/100 km^2), but the main urbanized axes of the country's territory are equiped by railways which have concentrated much of the population since the 19th century (Horňák, 2008). Passenger railway transport has witnessed a considerable drop of performances since the collapse of communist regime in the country and in 2012 it carried out only half of the bus-transport performance (based on the data of the Statistical Office of the Slovak Republic). Nevertheless, the average transport distance in passenger train transport in Slovakia is increasing (47 km in 1995, 43 km in 2005 and 55 km in 2012), while the same parameter of the bus public transport oscillates between 15-20 km. This suggests that railway transportation has a strong position in the long-distance and international segments of public transport. Only overground networks of public transport (buses and trains) were taken into account in the following analyzis. Air transportation and river-shipping were not considered.

2.1. Identification of communities servised by long-distance and international passenger transport

Out of country's nearly 2,900 communities, a selection of those being regularly serviced by links of long-distance and international public transport was made. To exclude communities serviced sporadically, e.g., one service a week, we applied a condition of minimum 3 services/week, which cover periodical services before and after weekends and which may well serve for commuting to work on a week base. The number of the services was detected for a common workday and then recalculated to a 24-hour period.

Time-schedules of public passenger train- and bus-transport providers (valid for the year of 2012, available free on the web www.cp.sk) were the principal sources of the data. In our study all relevant public transport services explicitly defined as long-distance and international/crossborder ones were taken into consideration, based on definitions of individual links directly stated in train and bus time-schedules.

In case of railway transport, the following categories of long-distance and international trains were considered (with abbreviations used in the time-schedules):

- EN (EuroNight): long-distance train of high quality providing the European standards of night travel
- EuroCity (EC): long-distance train linking crucial European cores providing the high quality in terms of travel speed, comfort and additional board services
- InterCity (IC): international or domestic train of higher quality providing high standard of services and linking crucial centers within the country or centres of neighbouring countries
- Express Trains and Fast Trains (Ex and R): high-standard train, connecting crucial centres within the country or centres of neighbouring countries
- Regional Expres (REX): interstate/domestic express train of higher quality providing the connection of numerous regions
- Fast Regional Trains (Zr): similar to fast trains but with more frequent stops, connecting the urban centres within or outside regions.

Identifying long-distance and international bus links was easier than trains, because all such links are clearly distinguishable in the database available on www.cp.sk. This basic database of the long-distance and international train and bus links was developed by Struhár (2013). The following processing and interpretation of the database presented below in this paper are original and have never been presented before.

2.2. Hierarchy analysis of urban centres by position in long-distance and international passenger transport networks

To analyse the hierarchical position of individual urban centres of the country within the networks of long-distance and international public transport, 3 complex attributes were utilized. The first of the attributes describes the quality of connection. However, its construction is quite simple and gives an information on the network which an individual urban centre is connected to. Most of Slovakia's urban centres are linked with the long-distance bus

network. In accordance with other authors (such as Marada, 2003; Chmelík et al., 2010; Seidenglanz, 2010) we consider access to railways (especially international and long-distance trains) as an extra quality, which offers wider possibilities for long-distance travelling. On the other hand, some of the small towns (such as Fiľakovo or Krompachy) offer only long-distance trains, which hampers the chances of their residents to utilize the long-distance bus networks. Thus, centres with both of the international/long-distance networks (trains as well as buses) were rated with 100 points, centres with direct access to only one of the networks with 50 points, and centres with neither of the networks with 0 points.

The second attribute reflects the quantity of services of the international and long-distance publict transport detected for each urban centre per 24 hours. This parameter is frequently used in most of the studies assessing the quality and supply of public transportation (see Marada, 2003; Marada et al., 2010; Michniak, 2007; Michniak, 2008; Currie, 2010). The city with the highest number of services was Bratislava (406 services per day), on the other hand, there are 13 urban centres (mostly small towns with less then 10,000 residents) being not serviced by the long-distance public transport links.

The third attribute detects the level of integration of individual urban centres into international public transportation. Being included in the network of international public transport brings better opportunities for the residents to access places or regions abroad, which means improved access to foreign labour markets or better education, etc. One has to consider, that some of the international links have only regional crossborder character, covering only communities in neighbouring crossborder regions – these may however help improve accessibility of transborder labour markets or points of tourism. It should be emphasised that the segment of international public transport brings indirect profit especially to numerous poor regions of Slovakia being heavily impacted by effects of post-socialist economic and social transition (see Korec et al., 2005) or later by economic crisis (Križan et al., 2010). These regions suffer from permanent high rates of unemployment and any regular way of access to foreign labour markets is helpful for their residents. For the above mentioned reasons, the number of international/crossborder services (per 24 hours) as a basic attribute reflecting the importance of individual urban centres in the network was utilized. Moreover, to emphasize the difference between regional crossborder links and bus or train connections with important metropoles, a special category of urban centres was identified, having at least one direct international (bus or train) link with any foreign metropole defined as either a capital city or any other foreign city with 100,000 or more inhabitants as of 2011, using the database of the respective national statistical offices. In such cases, the number of relevant international services (per day) was multiplied by 1.5. On the other hand, there were detected 48 urban centres (out of 138 in total) disconnected from the network of international public transportation; these urban centres were assigned a 0 value.

The second and third attibutes were transformed to relative values (0-100). Finally, all three attributes were used to calculate an average value. Since we consider the number of daily services as the most important feature of any public transportation, a weighted value of the second parameter having a weight of 5 was used. The final weighted average value of points enabled us to categorize individual urban centres into 5 categories according to their position within the networks of international and long-distance public transport (see Fig. 2).

The relative value (0-100) was then used as an indicator named "long-distance and international public transport size" (LDIPTS) and compared with relative population size of the urban communities (as a result of transformation of population size data into 0-100 scale). For this purpose, the database of the Statistical Office of the Slovak Republic and the 2011 census databases were used. This was a final part of our analysis (Fig. 3) enabling us to identify discrepancies between population hierarchy and position within the high-standard public transport networks.

3. Results and their interpretation

As indicated in some of the earlier studies (Horňák, 2005; Pšenka, 2011), there is a significant complementarity visible in the territorial distribution of both modes (trains and buses) of long-distance

public-transport links in the Slovak Republic, stemming from the uneven distribution of railways. High-quality trains may well serve the communities located along the so-called northern corridor of Slovakia (an international corridor, in Slovakia stretching from Bratislava to Košice via Žilina and Poprad), where a high-capacious double-track railway line can guarantee good travel comfort and relatively high travel speed. Recently, this railway corridor is subject to complex reconstruction to European standard, including also upgrading to higher track speed (up to 160 km/h). Some of the communities along this corridor may profit from a relative high share of international trains, with good accessibility to several Central-European metropoles, providing for instance job opportunities. The same effect can be seen in case of another international railway corridor Prague – Kúty – Bratislava – Nové Zámky – Štúrovo – Budapest, offering high travel comfort and speed and international trains for considerable part of south-western Slovakia (see Fig. 2).

On the other hand, substantial parts of central and north-eastern Slovakia have poor access to railway network, which makes them considerably dependent on links of long-distance bus services. This compensation of the shortage of railways was reported from the socialist period by Podhorský (1974) or Korec (1984), but was even intensified with the launch of liberalization of public transport system in Slovakia back in the 1990's (see Horňák, 2005).

Noticeable is the dense group of small towns and rural communities being serviced mostly by long-distance or even international bus links in southern part of central Slovakia and considerable large areas of eastern Slovakia (see Fig. 1 and 2). In the case of most of these small towns, daily direct links to Bratislava and Prague are important elements improving the local residents' chances to succeed in their search for work. Although this is not a surprising finding at all, it still supports the general notion of lack of labour opportunities and labour migration as one of the livelihood strategies of the economically active population in these regions of the country (for more see Jurčová, 2009; Rochovská, Majo, 2013; Hladký et al., 2014). For these migrants, the supply of long-distance or international public transport services (with affordable fares) represents one of the key and inevitable conditions of their economic survival in the respective regions, as it makes distant labour markets well accessible.

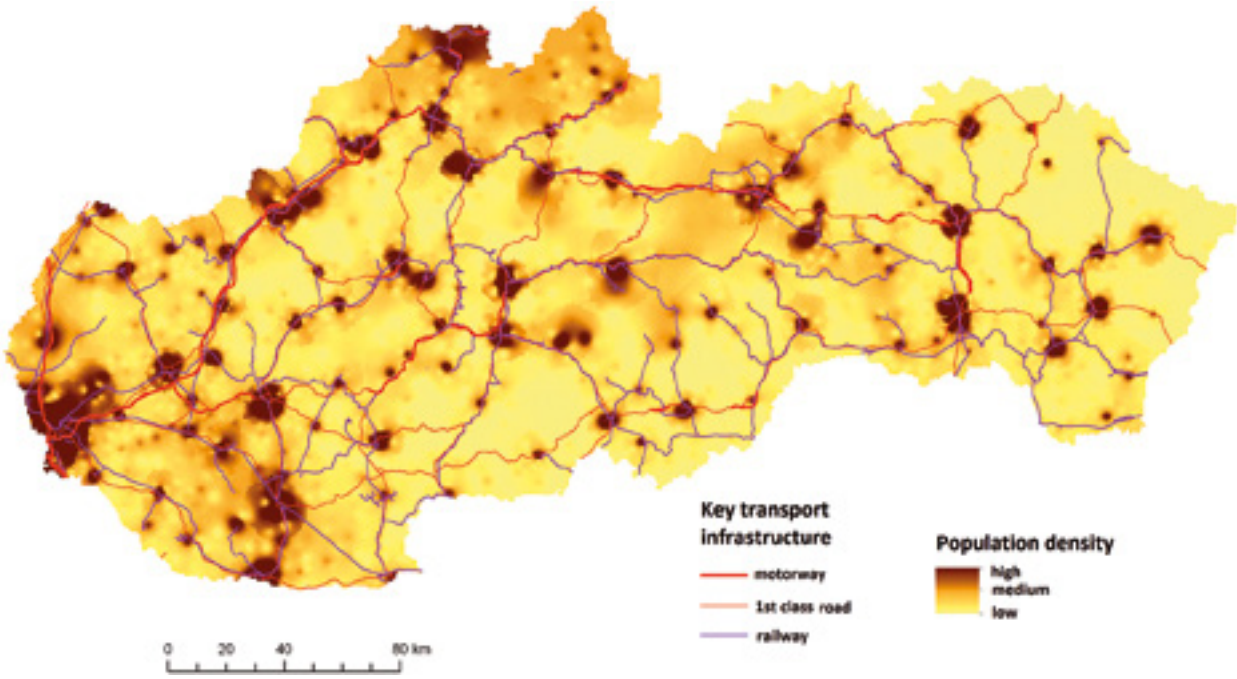

Fig. 1. Spatial distribution of principal transport networks and population density in Slovakia (2011)

Note: Population density generated by IDW - Inverse distance weight within ArcGIS Desctop ver.10.2

Source: Population and housing census (2011), ZB*GIS*®

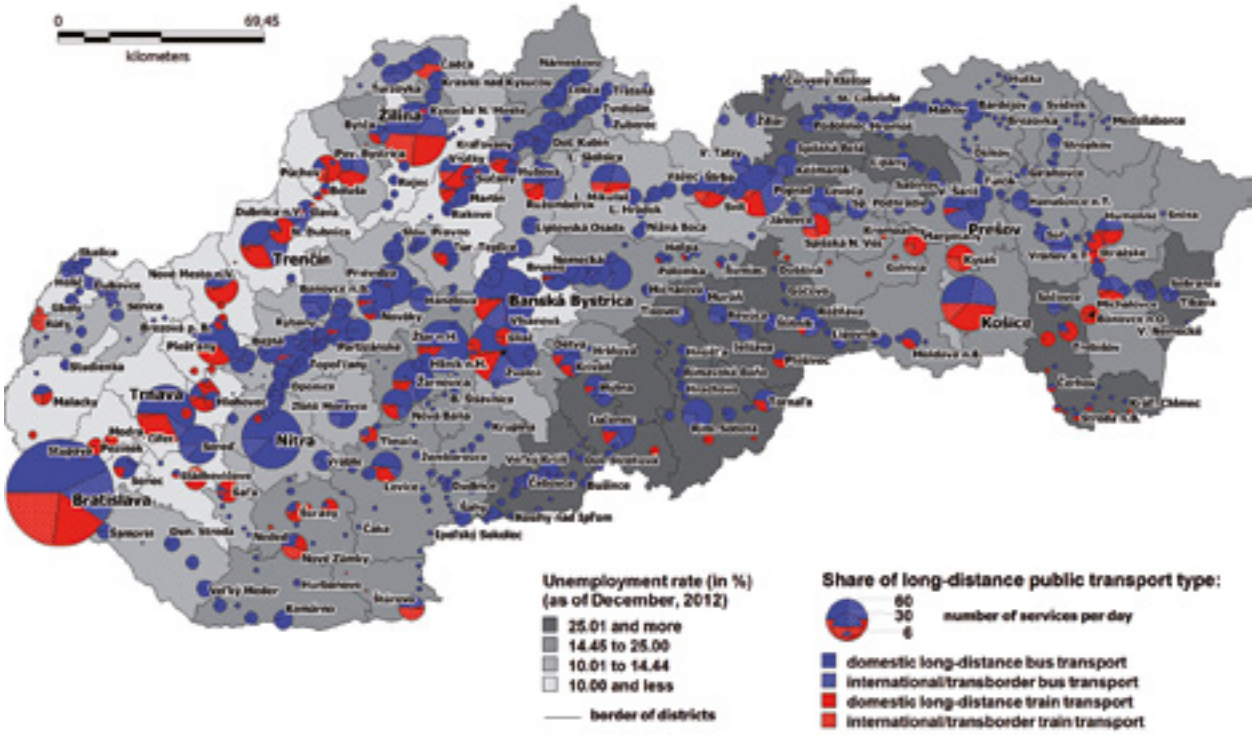

Fig. 2. Centres of long-distance and international public transport and unemployment rate in Slovakia (2012)

Note: National average of unemployment rate = 14,44% (December, 2012)

Source: Time-schedules of public passenger train- and bus-transport providers (available on www.cp.sk, as of 2012), Central Office of Labour, Social Affairs and Family, database on unemployment statistics (as of December, 2012)

Focus on the urban settlements and their position in the network of the long-distance and international public transport networks reveals several noticeable facts. First, there are only few urban communities with no long-distance links (13 towns out of Slovakia's 138 urban communities, see Fig. 3). Their position along the south and western border of the country seems to be rather coincidental, one has to consider their micro-position mostly in the hinterland of major regional centres (such as Bratislava or Trenčín) as the main factor of their exclusion from the networks of high-standard public transport. Most of these small towns have small population-size, only two of them have more than 10 thousand residents (Myjava with over 12 thousand and Nová Dubnica with 11.5 thousand inhabitants).

Not surprisingly, the best average relative value scored the capital city of Bratislava, being the key economic and social metropole of the country (category 1, see Fig. 3). Generally, Bratislava has an extremely dominant position within the country, as declared by numerous studies (see for example Halás, Klapka, 2012; Korec, 2013). This fact is supported by studies focused on transport networks, for example by Michniak (2008) showing that Bratislava has and extra position when international public transport connections are considered or by Horňák, Pšenka (2013) who demonstrate that Bratislava has traditionally the top position in mutual public transport connections among the group of Slovakia's urban centres. However, some studies argue that geographical position of the capital city of Slovakia is significantly peripheral (if geometrical position within the country is regarded, see Hurbánek, 2005). Category 2 embraces all other regional centres (Trnava, Nitra, Trenčín, Banská Bystrica, Žilina, Prešov and Košice – all of them are political centres of the respective self-governing regions) and several smaller towns, which represent important transport nodes (Ružomberok, Poprad, Zvolen, Žiar nad Hronom).

The identified relative size of urban centres within the network of long-distance and international

public transport links not always reflects the population size of the respective community. Some of rather small towns with population reaching less than 10 thousand show a considerably high position within the high-standard public transport (such as Vrútky or Leopoldov with high relative values of LDIPTS), but this predominantly results from their position in the international railway network. Moreover, numerous domestic long-distance links are led towards Slovakia's capital city, thus even small towns located in the main corridors from eastern and central Slovakia to Bratislava may take advantage of these links. Žarnovica and Nová Baňa are good examples of rather small towns located in one of the main corridors connecting Bratislava and Košice, which caused their high relative LDIPTS. This is also the reason, why poisitions of the two key metropoles of eastern Slovakia (Košice and Prešov) seem to be underevaluated from this point of view (see Fig. 4). Similar effect was interpreted by some other studies (such as Horňák et al., 2013). Impact of border position is observable, too. Some of the minor towns with small population located along the state border may seem to be overestimated in terms of their hierarchy (see Fig. 2 and 3). The first reason is a frequent transborder traffic generated by "regional" commuters within border regions, where ties within the transborder territory are strong due to various reasons. This is observable in the case of small Slovak towns of Holíč or Skalica, where traditional relationships (including commuting to work and local tourism) across the western border line with border regions of Czechia induce frequent transborder journeys or in eastern Slovakia with strong relationship between Michalovce, Sobrance and Ukrainian city of Uzhhorod (local shopping tourism). In some cases (such as Štúrovo in the south or Kúty in the west of the country) the high freqence of international trains is also a result of regular operational routine of the railway-transport operators.

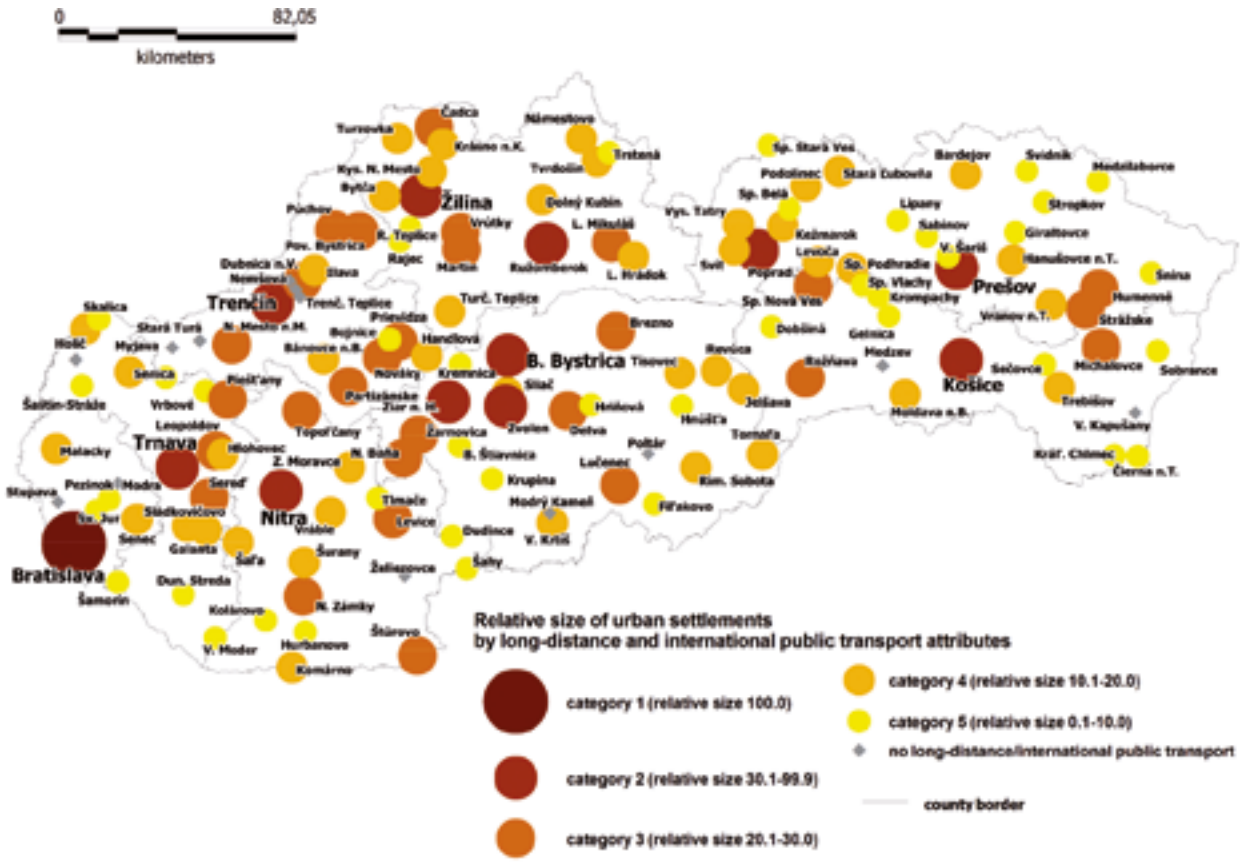

Fig. 3. Categorization of urban centres of Slovakia by relative long-distance and international public-transport size (2012)
Source: Time-schedules of public passenger train- and bus-transport providers (available on www.cp.sk, as of 2012)

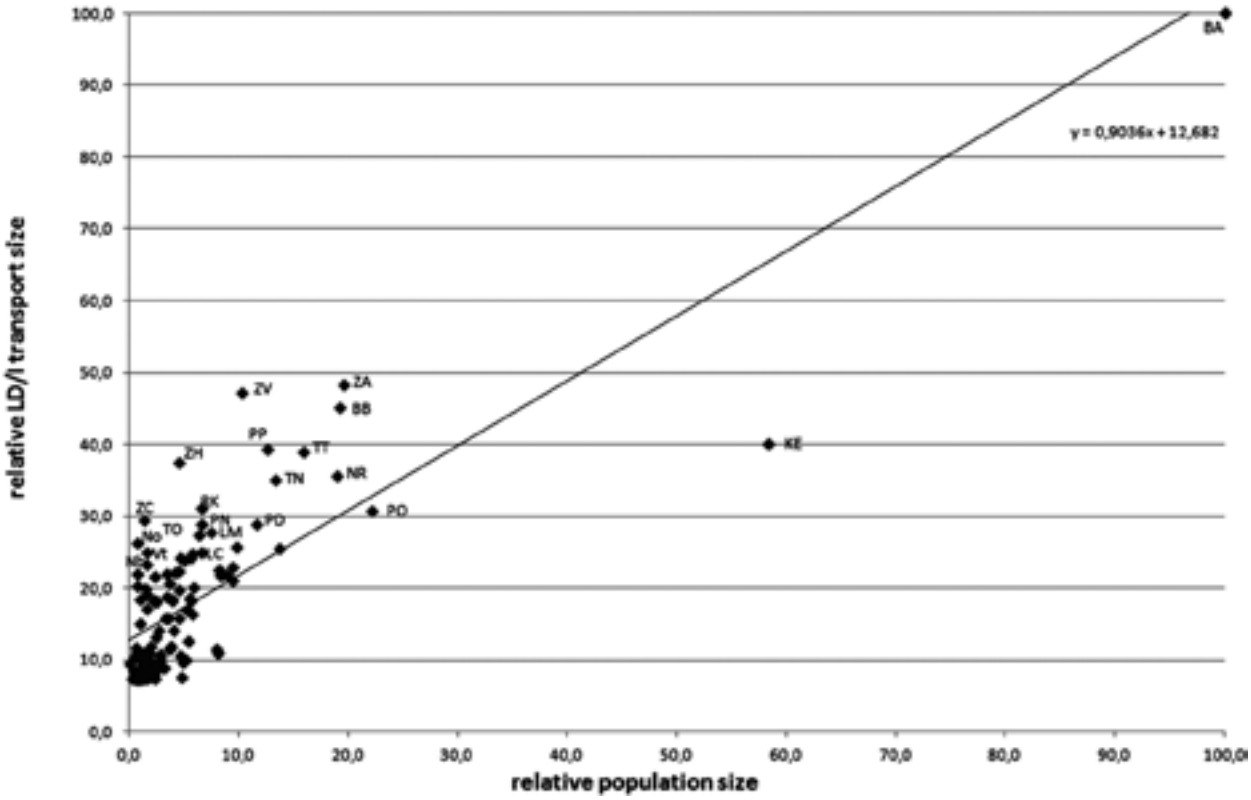

Fig. 4. Relationship between long-distance and international public transport size of the urban centres in Slovakia and their population size

Notes: BA=Bratislava, BB=Banská Bystrica, KE-Košice,LC=Lučenec, LM=Liptovský Mikuláš,Nb=Nová Baňa, No=Nováky, NR=Nitra, PD=Prievidza, PN=Piešťany, PO=Prešov, PP=Poprad, TO=Topoľčany, TT=Trnava, Vt=Vrútky, ZA=Žilina, ZC=Žarnovica, ZH=Žiar nad Hronom, ZV=Zvolen
Urban centres with no long-distance/international public transport links were excluded.

Source: Population and housing census (2011), time-schedules of public passenger train- and bus-transport providers (available on www.cp.sk, as of 2012)

4. Conclusions

Nowadays the public transport system in Slovakia plays both the commercial as well as social role in the society. Its spatial structure enables us to understand some of the relationships between (public) transport and the system of settlement. Our study covered only selected aspects of the long-distance and international overground public transport in the Slovak Republic, with focus on territorial features. The main outcomes of our analyses are as follows:

1. The apparent dominance of densely populated main corridors between western and eastern Slovakia caused mainly by natural conditions (morphology of the surface) is visible in the territorial scheme of the high-standard public transport network. These main corridors are well-equipped with railways which makes them more exposed to international railway transport (especially in the north and south-western part of the country). Thus, most of the key urban centres and regional metropoles are well-serviced by the long-distance and international trains.
2. On the other hand, high-standard bus links cover a considerable part of the country and compensate the absence of railways in some regions. More importantly, bus links serve as a crucial connection of numerous relatively small rural communities in economically and socially lagging regions of central and eastern Slovakia with no or sparse accessibility of railways and high unempoyment rates. Here, the long-distance bus

transport may partly play a social role as it may serve as a connection to attractive labour markets elsewhere in or outside of the country.

3. Considering the group of 138 cities and towns, the relative position within the networks of the long-distance and international public transport reflects both the population size as well as the transport position. Most of the key metropoles of the country (cities with over 50 thousand residents) have important positions within the long-distance transport network, with Bratislava being the top node. Many small urban centres (with 10 thousand residents or even less) show a relatively high position within the ranking due to their position in one of the key country's transport corridors. The transport position, however, was not a subject of this analysis and would deserve a detailed research.

As indicated above, the topic analysed in the paper brings many challenges that might be an inspiration for future studies. A deeper insight into the regional aspect of the high-standard public transport may help reveal some relationships between quality of life, livelihood strategies, and role of public transport in foreign labour migration. An analysis of geometrical position within the transport network can show the effect of a settlement's location on its importance in a particular segment of transport networks. The segment of long-distance and international public transport represents a scene where the commercial aspect may be quite attractive for state-operated, but also independent providers. Recently, the segment of railway transport is facing a high interest of various operators which may give rise to a development of new services, revolutionary time-schedules, and new travel-times in the forthcoming years. These changes will bring interesting shifts into the territorial structure of the long-distance and international public transport that might be inspirative for transport geographers in the future.

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