





WITHOUT A CAR AND OVERNIGHT STAY, CAN A VISIT TO A REGIONAL CENTRE BE AN UNATTAINABLE GOAL IN SLOVAKIA?

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Abstract. People need to travel for work, education, shopping, recreation, healthcare and other services. Because not everyone owns or uses a personal vehicle for various reasons, pressure is created to organise public transport as a service of the public interest, which is supposed to eliminate the potential transport-related social exclusion of inhabitants from territories with poor transport accessibility. The subject of the study is an analysis of the daily accessibility by public transport of 8 regional (administrative) centres in Slovakia (Bratislava, Trnava, Trenčín, Nitra, Banská Bystrica, Žilina, Košice, Prešov) from all municipalities of their self-governing regions (during working days and Sundays). We pay attention to regional comparisons of the identified spatial extent of disadvantaged areas by public transport and the quantity of the affected population with the potential risk of their social exclusion also due to the existing state of public transport organisation in individual regions.

Keywords: daily accessibility, potential transport-related social exclusion of inhabitants, public transport-disadvantaged areas, regional centres, Slovakia.

However, the villagers are even among the luckier ones, as there is still a shop with various goods in Veľký Lom, which allows people to get at least the basic necessities. If anybody wants something more, he has to go to the nearest town. He has three options if he does not have a car and wants to return on the same day. He can take the bus at 4:25, 6:30 or 15:10. In the last case, however, he has only half an hour to make the arrangements. At 16:20, the last bus he can take to get home leaves. (Votrubová, 2022, July 27)

Introduction

Spatial justice is a term that, in conjunction with spatial efficiency, is known in Slovakia primarily in connection with the assessment of the territorial-administrative division of the state in 1996 in the context of assessing the accessibility of individual parts of the delimited, very differentiated territories by the area and number of inhabitants (Bezák, 1997; Michniak, 2003, Halás et al., 2017). Its essence is 'relatively sufficient access to a centre for the population of all municipalities which form an administrative unit, and sufficient access to the centre of each administrative unit regardless of its location within the unit' (Halás et al., 2017). This means that the level of spatial

justice is determined primarily by the ability of the inhabitants of small, peripherally located rural municipalities to reach their administrative (district or regional) centres using individual or public transport. The regional centre represents a place that provides employment, education, health, shopping, culture and other opportunities to meet the needs of the residents of the defined administrative regions to an above-average extent (Wendt, 2000). Depending on the level of regional transport accessibility, there is also a spatial differentiation of the degree of spatial equity at the state level. For the state administration, the inhabitants of the regions usually represent a uniform, homogeneous mass, where their partial personal status (age, health, solvency) is not given specific attention. No consideration is given to a group of *vulnerable* who would be more endangered by worse accessibility conditions than the majority group (Hine & Mitchell, 2001). Therefore, research on spatial justice may aim to identify transport-deprived areas where relative geographic location is a key factor in the potential exclusion of residents of peripherally located settlements from enjoying the opportunities provided by *their* regional centres.

Especially in the Anglophone world, the geography of transport in the early 21st century has seen an increased interest in addressing the social impacts of poor transport accessibility, which primarily affects selected *vulnerable* groups living on the urban fringe or in peripheral rural areas (Church et al., 2000; Kenyon et al., 2002; Farrington & Farrington, 2005; McDonagh, 2006; Preston & Rajé, 2007; Stanley & Lucas, 2008; Currie et al., 2009, 2010; Delbosc & Currie, 2011; Engels & Liu, 2011; Kenyon, 2011; Lucas, 2012; Shergold & Parkhurst, 2012; Schwanen et al., 2015; Combs et al., 2016; Hernandez & Titheridge, 2016; Lucas, 2019). Older people with health problems (Casas, 2007) and low income who do not own or cannot use private cars are typical representatives of a vulnerable group of people dependent on the availability and use of public transport to reduce their potential social isolation. In the Anglophone literature, the term *mobility-related exclusion* appears, which Kenyon et al. (2002, pp. 210-211) define as:

The process by which people are prevented from participating in the economic, political and social life of the community because of reduced accessibility to opportunities, services and social networks, due in whole or in part to insufficient mobility in a society and environment built around the assumption of high mobility.

The basic idea, which is verified by experience, suggests that low access to mobility can reduce the opportunity to participate in society, which also negatively affects a person's health and overall sense of well-being (Delbosc & Currie, 2011; Mackett & Thoreau, 2015; Ma et al., 2018). Inspiring ideas about the social impacts of poor transport accessibility for populations living in peripheral areas and/or with limited mobility options are also reflected, with some time lag, in the work of authors from post-socialist states (Horňák & Rochovská, 2014; Gašparović, 2016; Jaroš, 2017; Székely & Novotný, 2020, 2022; Baran & Augustyn, 2021; Charnavalau et al., 2022; van Dülmen et al., 2022) or from other parts of Europe (Binder & Matern, 2020).

Numerous generally spatially differentiated factors influence the transport accessibility of individual areas. In addition to the existence and level of transport infrastructure, car ownership and the possibility to use it actively is one of the decisive factors that fundamentally determine the spatial behaviour of inhabitants and define their spatial radius of action. The combination of spatial marginality and the existence of vulnerable groups of the population whose age, income or health status does not allow them to own or use a private car creates pressure on public transport organisation as a service of general economic interest. People need to travel for work, education, healthcare, shopping, recreation, and other services. By considering economic efficiency, the state and regional governments (in Slovakia) try to meet the needs of all spatially unevenly

distributed inhabitants at different hierarchical levels of the state's territorial and administrative organisation.

The aim of the study is to analyse the daily public transport accessibility of 8 centres of regional self-governments (*krajské mestá*) in Slovakia (Bratislava, Trnava, Trenčín, Nitra, Banská Bystrica, Žilina, Košice, Prešov) from all municipalities, which are located in the (by area incomparable) territories of the respective administrative regions, during the working days and on Sundays (Fig. 1, Table 1). The decisive factor in transport accessibility is not as much distance as travel time, which is a product of the transport mode used and its average speed (Vale, 2013). As speed increases, the area from which inhabitants are able to reach a regional centre in an acceptable time is increasing. The results are influenced not only by the overall size of the territories, whose differentiation is in itself a prerequisite for spatial injustice (Bezák, 1997) but also by the morphology of the territory, the spatial organisation of the settlement structure, the quality of the transport infrastructure and the management of public transport, whose interaction affects through transport accessibility the quality of life of the inhabitants of Slovakia in terms of their potential exclusion from a fully-fledged life in society.

For the identification of negatively perceived *public transport disadvantaged areas*, we use the concept of *daily accessibility* as a decisive criterion for delimitation of territories which suffer from long distances and travel time to the regional centre and/or insufficient organisation of public transport. The aim of the study is to identify municipalities and areas where inhabitants are marginalised or excluded from using public transport services to/from regional centres. Areas in which inhabitants are isolated or only poorly accessible from the employment possibilities, healthcare, education and cultural facilities in *their* regional administrative centres represent serious problems of the balanced and sustainable spatial development of Slovakia. This is because, for a part of the Slovak population, it is indeed true that, especially on weekends, even a short stay of a few minutes in a regional centre can be an unattainable goal for non-drivers who are not interested in overnight stays.

Individual versus public passenger transport in Slovakia as background: a brief overview

The number of motor vehicles in Slovakia increases constantly, but the reasons for the decision to buy a car may change. Once, the purchase of a motor vehicle was a matter of prestige and pointing out the owner's solvency; nowadays, it is, in many cases, a necessary way out of spatial isolation and subsequent social exclusion (Horňák et al., 2016).

Car ownership is determined not only by the population's solvency but also by the free decisions of individuals who may refuse to buy and use a car for various, highly personal reasons. On the other hand, constraints on car use may be due to the fuel price or the car owner's age and health. Car ownership is associated with higher population mobility and comfort levels when travelling, with significantly higher flexibility in setting and achieving life goals, as well as savings in total travel time. However, the positives of individual transport also coexist with its societal negatives (noise, air pollution, congestion, or a lack of parking space, especially in traffic-exposed areas and at certain hours of the day), which trigger efforts to reduce it significantly (Goliszek, 2022).



Figure 1. Map of administrative division of Slovakia

According to statistical data published on the website of the Ministry of Transport and Construction of the Slovak Republic (MINDOP SR, 2023), 1,533,028 motor vehicles were registered in Slovakia in 1998, and by 2018 their number had increased about 1.9 times to 2,908,214. This means that if in 1998, the degree of motorisation (the number of inhabitants of Slovakia per 1 motor vehicle) was at the level of 3.516, by 2018, this value decreased to the level of 1.873. The existing considerable regional disparities have been reduced quite significantly over the years. If in 1998 the degree of motorisation was in the interval (2.497 – Bratislava region; 4.433 – Prešov region; difference 1.936), then in 2018, the regional values were already in the interval (1.260 – Bratislava region; 2.432 – Prešov region; difference 1.172).

A specific group among motor vehicles are the passenger cars, the growth of which is the most dynamic. If in 1998, 1,196,109 passenger cars were registered in Slovakia; by 2018, their number had increased by more than 1.9 times to 2,321,608. And again, statistical data show that while in 1998, the degree of automobilisation (the number of inhabitants of Slovakia per 1 passenger car) was at the level of 4.507, by 2018, this value had fallen to the level of 2.346. Unequal car ownership again results in the existence of marked regional disparities, which also have been reduced quite significantly over the years. If in 1998, the degree of automobilization was in the interval (2.846 – Bratislava region; 5.525 – Žilina region; difference 2.679), then in 2018, the regional values were already from the interval (1.567 – Bratislava region; 3.000 – Prešov region; difference 1.433).

Unlike individual transport, public transport is not transport described as door-to-door one. There is always some distance to be covered reaching the bus or train stop, and then, after exiting the public transport, some effort and time loss has to be accounted for in getting to the destination (Givoni & Rietveld, 2007). Despite some of its drawbacks, it is still the most used form of transport for a large group of the Slovak population, whether voluntarily or involuntarily. At the same time, top government officials declare efforts to strengthen public transport in order to reduce the negative environmental consequences of increasing individual transport.

Public transport, as a service of general interest, is represented in Slovakia by bus (managed by the individual self-governing regions) and rail transport (managed by the state). The priority of public transport in Slovakia and also in its individual regions is to provide the transport of inhabitants to work, schools, medical and social facilities and to manage transport connections of all municipalities with the district towns of the region, including the regional centre (as in the case of Banská Bystrica region: see BBSK, 2023). In relation to individual transport, public transport,

provided by the state or private companies, is in a complementary and/or competitive position. The increase of the degree of motorisation is therefore reflected in the continuous decline of passengers transported by public transport. We observe differences depending on the mode of transport. For example, while in public road passenger transport, the number of passengers has fallen from 461.8 million passengers to 242.7 million passengers from 2004 to 2018, in rail passenger transport, due to the introduction of free services for selected groups of the population in 2014, there has been a halt in decline, and a subsequent continuous increase in the number of passengers carried – over the same period 2004–2018, the number of passengers has risen from 50.3 million passengers to 77.8 million passengers (STATDAT, 2023). However, public transport in Slovakia has serious problems: economic efficiency and sustainability of public transport are becoming disrupted, and economic difficulties have emerged, which lead to a subsequent reduction of public non-efficient transport lines (connections). This is despite the above-mentioned declared interest of the government in strengthening public transport.

Methodology

From the last reform of the territorial and administrative division of the state (1996), which should try to react to the knowledge about the spatial organisation of society, Slovakia is divided into eight administrative, self-governing regions of NUTS 3 level (Fig. 1, Table 1). Their regional centres (Bratislava, Trnava, Trenčín, Nitra, Banská Bystrica, Žilina, Košice, Prešov) represent the pillars of the settlement structure of Slovakia, the economic growth poles, and the most important centres of commuting.

The aim of the present study was to find out which territories of individual administrative regions and how many people from these regions faced transport disadvantages because of the absence or inconvenience of times available to reach *their* regional centre by public transport. The analysis involved a comparison of the situation during a working day (Wednesday, 18 September 2019) and a rest day (Sunday, 22 September 2019). For the spatial analysis, we used the indicator *daily accessibility*, which denotes the number of people who *can* reach the regional centre within a certain, rationally justified time limit (Gutiérrez, 2001). The limit is usually set at 3 to 4 hours and should not only allow a passenger to make the return journey home on the same day but also provide sufficient time for the activities that the passenger has chosen to carry out during their visit (to the regional centre). If the available time is insufficient for the implementation of the passenger's plans, there would be no reason to make the trip by public transport, not only because of the higher time consumption but also because of higher financial expenses that would be involved if the person was to stay in the destination city (which would include the cost of accommodation). An alternative solution for potential passengers is the use of private transport, which presupposes not only the ownership of a car but also a valid driver's licence (which can be a problem for younger or older people). Another solution is help from relatives and friends, who may be available to people who depend on their assistance when necessary. However, these solutions do not change the essence of the problem – that part of the region and its inhabitants are at a transport disadvantage. In some cases, it is even justified to talk about the impact and (co-)effect of insufficient (public) transport on the transport-related social exclusion of the rural inhabitants of the affected areas (Wendt, 2000; Farrington & Farrington, 2005; McDonagh, 2006; Preston & Rajé, 2007; Currie et al., 2009, 2010; Kenyon, 2011; Lucas, 2012; Shergold & Parkhurst, 2012; Horňák & Rochovská, 2014; Jaroš, 2017; Lucas 2019).

According to Halás et al. (2017), spatial equity in the definition of administrative regions depends on the following factors: (1) the size of a region, (2) the shape (compactness) of a region and (3) the location of a centre within a region. A cursory glance at the map of the administrative division of Slovakia (Fig. 1), or selected regional indicators presented in Table 1, shows significant disproportionality in the size of the delimited administrative regions. The Bratislava Region is the smallest in terms of area; thus, the distances from the most peripherally located municipalities to the regional centre are the shortest. Therefore, it is reasonable to expect that the travel time by public transport from the individual municipalities of the administrative region (its territory surrounds the capital of Slovakia) will also be the shortest when reaching Bratislava as the regional centre. We hypothesise that in comparison with other practically incomparable administrative regions, the Bratislava region will stand out as a significant anomaly in the context of the identified differences in the level of spatial equity.

Table 1. Division of Slovakia into 8 administrative, self-governing regions

Administrative region	Area in km ²	Number of inhabitants	Density of population	Number of municipalities	Number of districts	Regional centre:	
						number of inhabitants	share in regional population
Bratislava (BA)	2,052.6	602,436	293.5	73	8	411,228	68.3%
Trnava (TT)	4,146.3	554,741	133.8	251	7	66,358	12.0%
Trenčín (TN)	4,501.8	594,328	132.0	276	9	55,877	9.4%
Nitra (NR)	6,343.7	689,867	108.7	354	7	78,916	11.4%
Žilina (ZA)	6,808.5	688,851	101.2	315	11	81,494	11.8%
Banská Bystrica (BB)	9,454.0	660,563	69.9	516	13	80,003	12.1%
Prešov (PO)	8,972.8	814,527	90.8	665	13	91,782	11.3%
Košice (KE)	6,754.3	791,723	117.2	440	11	240,433	30.4%
Slovakia	49,034.0	5,397,036	110.1	2,890	79	411,228	7.6%

Source: ŠÚ SR (2011).

On the other side, for spatially large areas, we hypothesise that peripherally located municipalities, found in the remote parts of the regions, may be exposed to public transport disadvantages and their inhabitants may find it difficult to travel to the centre of the region, fulfil their duties or satisfy their requirements/needs, and return home in one day.

For testing the hypothesis, a database was created in which 16 characteristics have been assigned to each of the 2,890 municipalities (Table 2). These variables have been used to express the daily accessibility of 8 regional centres to individual municipalities in the boundaries of individual administrative regions of Slovakia during a typical working day (Wednesday) and a rest day (Sunday). When collecting data from the timetables (CP, 2019), which provides information on the arrival and departure times of trains and buses and urban mass transport connections, we used the procedure and rules that are described in detail in our previous study dedicated to the identification of public transport-disadvantaged rural areas from the Banská Bystrica self-governing region (Székely & Novotný, 2022, p. 5).

Table 2. Transport characteristics for individual municipalities in the 8 self-governing regions in Slovakia

1. Wednesday as a regular working day	2. Sunday as a day off
1.1. Morning departure time of the 1st bus (train) from the traveller's home municipality in the direction to the regional centre	2.1 Morning departure time of the 1st bus (train) from the traveller's home municipality in the direction to the regional centre
1.2 Arrival time to the regional centre	2.2 Arrival time to the regional centre
1.3 Travel time to the regional centre	2.3 Travel time to the regional centre
1.4 Departure time of the last bus (train) from the regional centre in the direction the traveller's home municipality (time of arrival is until midnight)	2.4 Departure time of the last bus (train) from the regional centre in the direction the traveller's home municipality (time of arrival is until midnight)
1.5 Arrival time to the traveller's home municipality (until midnight)	2.5 Arrival time to the traveller's home municipality (until midnight)
1.6 Travel time to the traveller's home municipality	2.6 Travel time to the traveller's home municipality
1.7 The total time of return travel	2.7 The total time of return travel
1.8 The total time in the regional centre	2.8 The total time in the regional centre

Source: extracted (and calculated) from timetables (CP, 2019).

The data matrixes of 72 x 16 (Bratislava region), 250 x 16 (Trnava region), 275 x 16 (Trenčín region), 353 x 16 (Nitra region), 314 x 16 (Žilina region), 515 x 16 (Banská Bystrica region), 664 x 16 (Prešov region) and 439 x 16 (Košice region) were then created, consisting of data extracted (and calculated) from the timetables (CP, 2019), concerning the daily accessibility of 8 regional centres from individual municipalities in 8 NUTS 3 administrative regions. The matrixes were necessary for statistical and spatial analyses and for subsequent interpretation of the individual partial results (the earliest possible arrival time at the regional centres, the latest possible departure time from the regional centres, total available time in the regional centres, total return travel time to/from the regional centres). These partial results were subsequently used to create an aggregated *Transport disadvantage index*, which has already been successfully used in the delimitation of the public transport disadvantaged areas of the Banská Bystrica region (Székely & Novotný, 2022).

When creating the aggregated and synthetic indicator *Transport disadvantage index*, points were assigned to individual municipalities in Slovakia based on the above-mentioned four analysed indicators. The procedure was as follows: considering the Slovak context, the values of the indicators were divided into relatively realistic thresholds – these thresholds play a role in the motivation to make a trip to a regional city by public transport (Table 2). The values of each indicator were divided into five classes: the municipalities with the best values of the indicator being assigned to class 1 and the municipalities with the worst values to class 5. The resulting index for a given municipality represents the average value of the four sub-indicators and is derived from the formula:

$$Rd = \frac{\sum_{i=1}^n Ri}{n}$$

where *Rd* is the *Transport disadvantage index* of the municipality itself, *Ri* are the values of the individual sub-indicators and *n* is the number of these indicators (in our case *n*=4). The values of the resulting index range from 1 to 5, as with the sub-indicators (Table 3), and the higher the value, the more transport disadvantaged the municipality is.

Table 3. Point ranking of the values of the sub-indicators*

Ranking (points)	First arrival	Last departure	Travel time	Time in regional centre
1	before 5:30 a.m.	after 8:30 p.m.	0 - 90 min.	more than 12 hours
2	5:31 - 7:30 a.m.	4:31 - 8:30 p.m.	91 - 180 min.	8 - 12 hours
3	7:31 - 9:30 a.m.	2:31 - 4:30 p.m.	181 - 360 min.	4 - 8 hours
4	after 9:30 a.m.	before 2:30 p.m.	more than 360 min.	less than 4 hours
5	no connection	no connection	no connection	no connection

* Ranking – number of points corresponding to a given interval; first arrival – the earliest possible arrival time at the regional centre; last departure – the latest possible departure time from the regional centre; travel time – the total time required for the journey there and back; time in regional centre – total available time in the regional centre.

Results

Transport disadvantage index – national level

We divided the municipalities into four result classes based on the *Rd* index values (Table 4). The threshold values of the *Rd* index defining each class were set so that within each class, after rounding, they corresponded to the ‘definition’ value for that class (i.e. 1 for class 1, 2 for class 2, etc.). Values at the borderline (1.5; 2.5; etc.) were always assigned to the lower category (i.e. if for a given municipality there are values of four sub-indicators e.g. 1, 1, 2, 2 – the municipality still belongs to class 1). Formally speaking, this creates up to 5 classes. However, we merged *Rd* values within the interval 3.51 – 4.50 with class 3 – both because of its low frequency (only about 1% of the municipalities) and because of the interpretive similarity.

Table 4. Share of municipalities and inhabitants in each class based on *Rd* index values

Class (<i>Rd</i>)	Wednesday		Sunday	
	Number of municipalities	Number of inhabitants	Number of municipalities	Number of inhabitants
1 (1.00 – 1.5)	1,161 (40.3%)	2,572,876 (60.0%)	798 (27.7%)	2,179,613 (50.8%)
2 (1.51 – 2.5)	1,400 (48.6%)	1,594,494 (37.2%)	1,159 (40.2%)	1,577,830 (36.8%)
3 (2.51 – 4.5)	312 (10.8%)	123,215 (2.9%)	493 (17.1%)	390,774 (9.1%)
4 (4.51 – 5.0)	9 (0.3%)	360 (0.008%)	432 (15.0%)	142,728 (3.3%)

Class 1 consists of municipalities with an index value of up to 1.50. They represent the localities best connected by public transport with the centre of the administrative region, from which the inhabitants can travel to and from the centre on a daily basis for any purpose without major obstacles. During a typical working day in the middle of the week, it applies to commuters from approximately 40% of the municipalities in the whole country (Fig. 2) and the share of the total number of inhabitants is up to 60% (Fig. 3). This shows that the municipalities located in the immediate vicinity of regional centres have disproportionately larger populations. While the average number of inhabitants per municipality in the Slovak Republic is less than 1,500, municipalities in this class have (in the case of Wednesday), on average about 2,200 inhabitants (up to 2,700 inhabitants on Sunday).

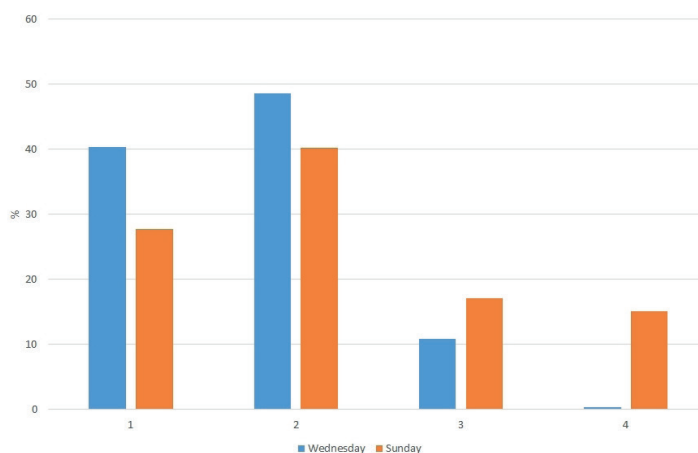


Figure 2. Share of municipalities in each class of *Rd* index – whole Slovakia (explanation for 1–4 in Table 4)

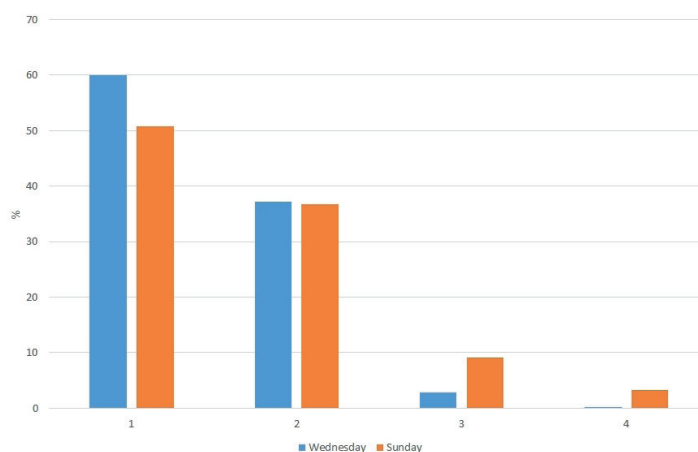


Figure 3. Share of inhabitants in each class of *Rd* index – whole Slovakia (explanation for 1–4 in Table 4)

Potential commuters (living in municipalities with convenient transport access to the regional centre, either because they are near or are on the main routes converging on the centre) are able to arrive at the regional centre before 5.30 a.m. can arrive on time for a morning working shift that begins at 6:00 a.m. In terms of working commuters, we assumed the need for at least 10 hours in the individual regional centres. This time is available to economically active inhabitants of municipalities of this class because they can stay at the regional centre until 8:30 p.m. This latest possible departure time from the individual regional centres is helpful, especially for persons attending business or private dinners or those participating in cultural and/or sporting events that begin later in the afternoon and evening. For those travelling by public transport and with a permanent stay on the territories of Class 1 municipalities, travel time is also unlikely to be an issue as the travel time to/from the regional centre will not exceed the more or less accepted 90 minutes.

Municipalities with *Rd* index values between 1.51–2.50 form Class 2, which is the most numerous on a typical working day (48.5% of municipalities) and is approaching the previous Class 1 in terms of population (however, the average size of a municipality – approximately 1,140 inhabitants –

is already significantly lower). These are municipalities with limited 'daily accessibility', where inhabitants are still relatively well placed to travel within a day to and from the regional centre, but most of them are unlikely to be willing to undertake such a journey on a daily basis, especially in view of the greater distance and the associated increase in necessary travel time. The journey to the regional administrative centre for the inhabitants of these municipalities takes more than one hour and the length of the travelling time thus becomes the most significant limiting factor.

However, from most of these municipalities, it is possible to reach the regional centre by public transport before 7:30 a.m., which is a time that would allow not only pupils and students from more distant surroundings to attend classes starting at 8:00 a.m., but also selected employees who start later, or who have flexible working hours or part-time job, to have a real opportunity to participate in working process in the regional economic centre. The requirements of such activities are also met by the fact that passengers can spend at least 8 hours in the regional centre and the last connection leaves between 4:30 and 8:30 p.m.

Class 3 is made up of municipalities with an *Rd* index value of 2.51 – 4.0. The municipalities of this class form on Wednesday approximately one tenth of Slovakia's municipalities, but only about 3% of the population lives in them. Thus, these are mostly small municipalities with an average population of less than 400 inhabitants.

From Class 3 municipalities, most people arrive at the regional centre after 7:30 a.m. Therefore, pupils and students from these municipalities cannot count on public transport and they are excluded from participating in education in regional centres. The transport-related exclusion problem may also affect the capacity of some rural commuters to work in the centre of the administrative region.

Potential passengers from these remote rural municipalities who do not have a direct connection to home and who have to change transport lines more times find that, if they want to be home before midnight, they must leave the regional centre before 4.30 p.m. The necessary early departure time from the regional centre also significantly limits employment or education options.

Some activities related to the regional centre, which require shorter time and attendance at the centre is not required until after 10.00 a.m. (e.g., business negotiations, a visit to the office or to a specialist doctor), expanding the number of potential visitors, including residents of the small municipalities of this Class 3.

Class 3 municipalities are characterised by problems associated with a phenomenon referred to as the 'tyranny of distance'. The time taken to cover the distance between these municipalities on the periphery of the administrative regions and their regional centres usually exceeds two hours. Therefore, despite the theoretical possibility, residents will only choose to travel by public transport in extreme cases, and they have to cope with such an extreme public transport-related disadvantage by using alternative forms of transport, if possible.

Finally, municipalities with a *Rd* value greater than 4 form Class 4. These are municipalities from which it is not even theoretically possible to make a round trip to a regional centre by public transport within one calendar day. Either public transport to the small, peripherally located municipality does not run in the morning and/or evening, or public transport schedules are set in such a way that they do not allow even a short stay in the regional centre. On a weekday, we identified only 9 extremely public transport disadvantaged municipalities with a total of 'only' 360 inhabitants (Fig. 4). However, in contrast to Wednesday, the situation on Sunday with the accessibility of the regional centre becomes considerably more complicated for the residents of particular administrative regions.

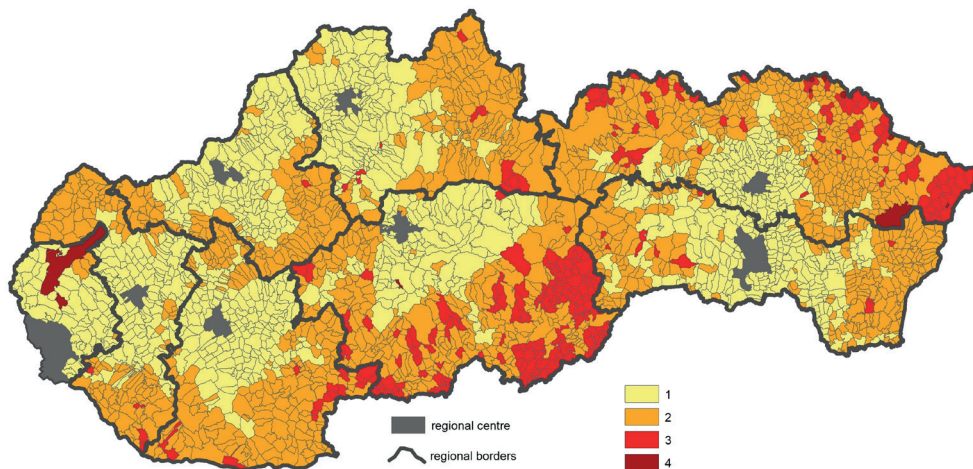


Figure 4. Transport disadvantage index R_d – Wednesday. 1 – zone without transport disadvantage, 2 – zone with medium level of transport disadvantage, 3 – zone with high level of transport disadvantage, 4 – zone with extreme level of transport disadvantage

Sundays, and the activities that are held in the regional centres on that day, have their own specific features. In particular, work is significantly reduced, affecting only a small proportion of passengers. The younger generation, for example, those attending college, have no reason to stay in the centres for the whole day. However, it is an ideal time for meeting with family and friends, and various cultural and sporting events can attract visitors from wider areas.

Compared with working days, the reasons for travelling then are different, and a decrease in the number of passengers is natural; a reduction in public transport connections should be rational. Nevertheless, the impossibility of reaching the regional centres from 432 rural municipalities (approximately 15% of municipalities in Slovakia, which create Class 4 on Sunday) is a sign of the extreme public transport-related social exclusion of their inhabitants. Generally, the absence of suitable public transport connections to/from the regional centres affects small (average size 330 inhabitants per municipality), peripherally located rural municipalities situated away from the main transport lines. This negatively affects approximately 143,000 inhabitants (i.e. 3.3% of the whole number of inhabitants of Slovakia, according to the 2011 Census (ŠÚ SR, 2011).

If we assume that most of the social events that might be of interest to inhabitants of the entire region start in the afternoon or evening on Sundays, then the need to leave the centre earlier will also negatively affect residents of another cca. 17% of municipalities of Slovakia which are classified as Class 3. These relatively large public transport-disadvantaged territories are represented by small rural municipalities (790 inhabitants on average) and the potential public transport-related social exclusion affects approximately 390,000 persons (about 9% of the entire population living outside regional centres, respectively 7% if we count the population of the whole Slovakia). We can conclude that difficulties caused by organising public transport to and from the eight regional centres on a non-working day may contribute to the social exclusion of a relatively small number of the population (12.5%; respectively 10% if we also count the population of the regional centres), but a relatively large rural part of the country (represented approximately 32% of municipalities) should be considered as a public transport disadvantaged territory (Fig. 5).

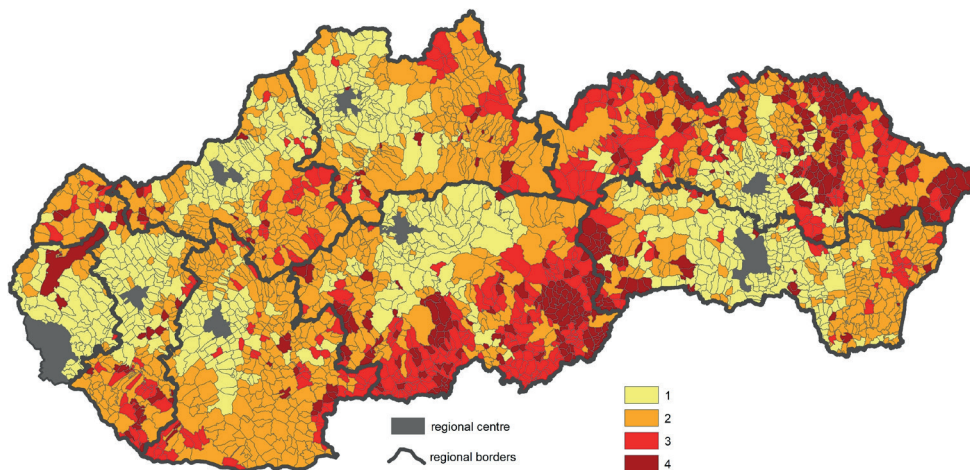


Figure 5. Transport disadvantage index R_d – Sunday. 1 – zone without transport disadvantage, 2 – zone with medium level of transport disadvantage, 3 – zone with high level of transport disadvantage, 4 – zone with extreme level of transport disadvantage

On the other hand, 87% of the inhabitants (concentrated in approximately 68% of municipalities representing Classes 1 and 2) can consider visiting Sunday's sporting or cultural events that end before 8:30 p.m. And 50% of inhabitants living in the vicinity of the regional centres can extend their programme during the rest day until 10:30 p.m.

Transport disadvantage index – regional level and interregional comparisons

In the regional comparison (Figs. 6-9), we see the exceptional position of the Bratislava region, where most of the municipalities belong to the zone without transport disadvantages on Wednesday. The other regions can be grouped into three groups. For the Trnava, Trenčín and Žilina regions, it applies that more than 50% of their municipalities belong to this zone; for the Košice and Nitra regions, it is more than 40%. The worst situation is the Prešov and Banská Bystrica regions, where less than 30% of municipalities belong to the zone without transport disadvantages. The number of municipalities also confirms the spatial differentiation of administrative regions with a high level of transport disadvantage (Class 3). In most regions, their number does not exceed 5% of the total number of municipalities in the region. Only in the Prešov region (14%) and Banská Bystrica region (33%), i.e. in territories that have been economically less developed for a long time, do such municipalities have a higher share. In the Banská Bystrica region, the total number of inhabitants of such municipalities is approximately 67 thousand inhabitants (11.5% of the regional population) and in the Prešov region – approximately 34 thousand inhabitants (4.5% of the regional population).

On Sunday, the situation worsens in all regions, with a similar distribution. In the Bratislava region, again, over 80% of the municipalities in terms of our assessment do not experience a transport disadvantage, and only two municipalities experience a higher level of disadvantage (Classes 3 and 4). Of the other regions, more than 30% of municipalities fall into Zone 1 in the case

of the Trnava, Trenčín, Žilina and Košice regions, while in the case of the Nitra, Prešov and Banská Bystrica regions, the share is only about 20%. On the contrary, less than 20% of municipalities in the Trenčín, Nitra and Žilina regions belong to the zones with high to extreme public transport disadvantages, while in the Trnava and Košice regions, their share is slightly higher (20-25%). Zones with a high to extreme level of transport disadvantage are again most widespread in the Prešov region (48%) and Banská Bystrica region (56%). In these two regions a significant number of inhabitants face such unfavourable conditions for travelling by public transport - over 150 thousand inhabitants in the Banská Bystrica region (26% of the regional population) and over 170 thousand inhabitants in the Prešov region (24% of the regional population).

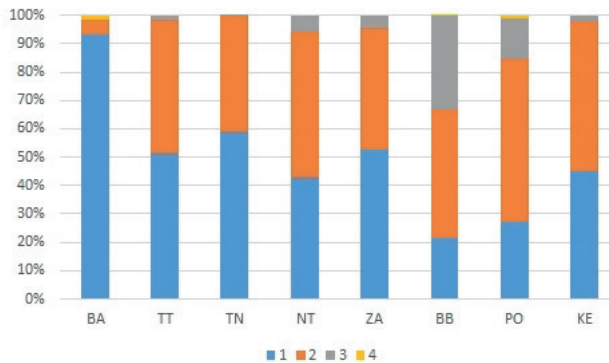


Figure 6. Share of municipalities in each *Rd* index Class – regional disparities on Wednesday (explanation for 1–4 in Table 4)

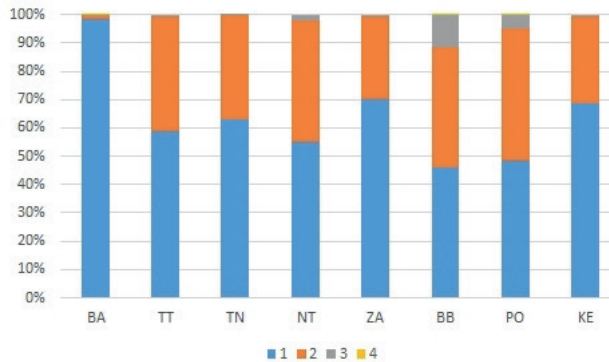


Figure 7. Share of inhabitants in each *Rd* index Class – regional disparities on Wednesday (explanation for 1–4 in Table 4)

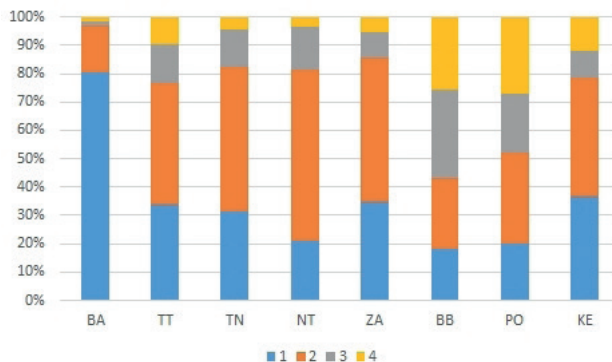


Figure 8. Share of municipalities in each *Rd* index Class – regional disparities on Sunday (explanation for 1–4 in Table 4)

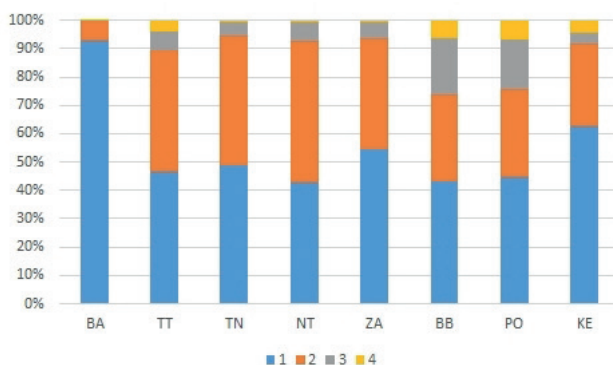


Figure 9. Share of inhabitants in each *Rd* index Class – regional disparities on Sunday (explanation for 1–4 in Table 4)

From Fig. 4 and Fig. 5 it is possible to identify intra-regional differentiation in terms of the distribution and extent of zones with a higher level of public transport disadvantage for all administrative regions of Slovakia. During the working day, more extensive spatial concentrations of such disadvantaged municipalities (Class 3 and 4) are visible, especially in the southern part of the Banská Bystrica region (districts of Rimavská Sobota, Revúca, Veľký Krtíš), in the NE of the Prešov region (districts of Snina, Medzilaborce, Svidník) and in the NW of the Prešov region (districts of Stará Ľubovňa and Kežmarok). Occasionally, we find such municipalities in the Žilina region in Orava, Liptov and Turiec, as well as in the southern part of the Trnava region and Nitra region.

We observe more significant differences on Sunday. The distribution of zones is naturally influenced by the size and shape of the region, as well as the relative geographic location of the regional centre in relation to the other municipalities of the administrative region. The degree of transport deprivation tends to increase with distance, while regularity tends to be positively skewed by the eventual multimodality of transport links. The distribution of *Rd* index values shows the specific features of each region. The worst situation is in the Banská Bystrica region, where, based on the individual partial analyses and the final synthetic analysis, it is possible to identify basically two separate regions and the connectivity by public transport between its southern part (districts

of Veľký Krtíš, Lučenec, Poltár, Rimavská Sobota, Revúca) and the regional centre is very limited on Sundays (Székely & Novotný, 2022).

Zones with no or low levels of disadvantage are formed close to regional centres. However, their extent varies from case to case. This can be observed very clearly in the case of the Prešov region, within which we identify such a zone (compared to other regional centres) only in a limited area (the Prešov district and adjacent parts of the districts of Vranov nad Topľou, Bardejov, Sabinov and Levoča) on Sundays. Most of them fall into zones with a higher level of transport disadvantage, even in the case of municipalities located relatively close to Prešov. At the same time, the location of Prešov within the region is not too eccentric, so the results indicate reserves in the existing public transport system from the passengers' point of view.

Besides Banská Bystrica, we observe the influence of the eccentric location of the regional centre in the case of Žilina, Nitra and Trenčín. In the case of the Košice region, we can observe a higher concentration of transport-disadvantaged municipalities in the western part (Rožňava district). The specific situation is in the Trnava region with a ring shape surrounding the Bratislava region (Trembošová & Kohutiar, 2021), where we can identify three separate territories based on the *Rd* index values. While the surroundings of Trnava fall into zones with a low level of disadvantage, territories in the northern part of the region (Skalica, Senica) as well as in the south (Dunajská Streda, Galanta) are connected to Trnava to a significantly lower extent (in many cases, the connection between a given municipality and Trnava is only possible indirectly with a transfer in Bratislava, which increases travel costs and the time spent in buses and/or trains as the distance increases). The results thus suggest an internal spatial incoherence of the Trnava region, as Bezák (2001) pointed out using data about commuting.

Discussion and conclusions

The research approach, the chosen methodological procedure and the results achieved, which can be viewed from several perspectives, are usually discussed. Investigating the public transport accessibility of regional centres of Slovakia from the municipalities located in the territories they manage is a complex problem. It concerns not only transport accessibility itself, which is quite widely elaborated in the Central European area, especially in Poland (e.g. Więckowski et al., 2014; Rosik & Stępnik, 2015; Śleszyński, 2016; Rosik et al., 2017), as well as issues of administrative division in the context of spatial justice (Bezák, 1997) and potential spatial differentiation in the level of socio-economic development (Wendt, 2000). At the same time, it draws attention to the social implications of the lack of accessibility of regional centres by public transport on the inhabitants potentially at risk of social exclusion. The perception of the level of vulnerability and its differentiation depending on the personal characteristics of individuals and their spatial allocation with respect to the geographical location of centres is a challenge for the behavioural focus of further research. In line with existing knowledge, we assume that the perception of mobility demands in terms of individual satisfaction of life needs (the impact of transport on social exclusion) will also depend on the social status of individuals and their subsequent perception of the problem of 'exclusion' and its relevance in terms of individual satisfaction (Jaroš, 2017).

Owning and using a car, in most cases, shortens the travel time between locations and significantly expands the possibilities of participation in the life of society, along with reducing the risk of transport-related social exclusion of the population. This is especially true for residents from peripheral rural areas, where the insufficient size and location of municipalities lying

outside the main transport routes open up a kind of modified 'first and last mile' problem (e.g. Zuo et al., 2020): due to the economic unprofitability of their servicing by the provider of public transport, the principle of spatial justice is usually confronted with the principle of spatial efficiency when negotiating with their customer. The result is an economically rational reduction of connections, the replacement of which is not satisfactorily addressed in Slovakia. This complicates mobility, especially for people in the category of vulnerable persons, who are limited in covering distances on foot or by bicycle. Although in our case, we have chosen a distance of 2 km from the municipality centre as the threshold for accepting transport accessibility (Székely & Novotný, 2022, p. 5), a part of the municipalities, especially during non-working days, are part of a Class of extreme transport disadvantage. This is mainly due to the inevitable overcoming of several kilometres of distance to public transport stops lying outside the spatially marginalised area. In exceptional cases, it is common practice to enlist the help of people close to them who act as informal 'taxi drivers'. Following this model, a suitable solution to overcoming the 'first and last mile' when visiting regional centres from municipalities disadvantaged by public transport could be subsidised taxibus service which represents a relatively widespread demand-responsive service in Europe (e.g. Davison et al., 2014) and some administrative regions of Slovakia are already testing this service experimentally.

The priority of public transport in the regions is to provide the transport of inhabitants to work, schools, medical and social facilities and to manage transport connections of all municipalities with the district towns of the region, including the regional centre (e.g. BBSK, 2023). It is obvious that it will be hypothetically easier to fulfil these tasks in smaller and more densely populated areas. The results of our study show this hypothetical assumption has been fulfilled and the problem of public transport disadvantaged areas has appeared in the largest and, at the same time, the most sparsely populated regions of Slovakia: the Banská Bystrica region and the Prešov region. Both territories have long had the status of the economically least developed administrative regions of Slovakia, and an emphasis on political criteria influenced the demarcation of the Banská Bystrica region in particular and did not reflect functional spatial relations (Halás & Klapka, 2017; Székely & Novotný, 2022). The consequence is the existence of inner, intra-regional peripheries with lower levels of accessibility by public transport. These are relatively large territories from which potential travel for a Sunday cultural or sporting event held in a regional centre is only possible for local residents when owning a car and/or (alternatively) when actively engaging in cooperation and mutual non-profit support and help for members of rural localities. Friendly relations between its members and active engagement in solving individual problems of community members can represent a significant barrier to the negatively perceived real (potential) threat by the multi-dimensional social exclusion from the side of the inhabitants from the public transport disadvantaged areas.

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Dear Konrad,

ever since we met, you've always been a person for me who likes to explore new places and new people in their unadulterated, authentic environment. You liked the peripheries, the places we often sought out together. And while talking to people we tried to understand and encourage, at least a little, in their bleak situation. With open eyes, you perceived the world in its differentiation and spatial uniqueness. You travelled a lot and so the issue of transport accessibility was very close to you. After all, you needed some way to reach those unknown places which, through their inhabitants and their life situation, gave you so many impulses for your scientific work. We travelled many kilometres together: by car, by bicycle or on foot. We could literally feel how the relative geographical location of the areas we visited determines people's life aspirations and destinies. May this study, which I am writing with my colleagues with the memory of our joint exploration of the peripheral regions and localities of Slovakia and their very often marginalized inhabitants, be an expression of gratitude for your friendship and presence in my, Daniel and Ján lives.

Dear Konrad, Honour to Your Memory.

Vlado



Figure 10. Konrad Czapiewski and Vladimír Székely during their first common field trip in Slovakia (2005)
(Photo D. Ďuriš)

References

- Baran, M., & Augustyn, D. J. (2021). The Evaluation of Transport Exclusion in the Peripheral Cross-Border Areas of Central Europe in the Context of Applicability of Information-Based Carpooling. *Sustainability*, 13, 3440. <https://doi.org/10.3390/su13063440>
- BBSK (2023). Plán dopravnej obslužnosti Banskobystrického samosprávneho kraja (2007/2008). DIC Bratislava, s.r.o. Retrieved from <https://www.bbsk.sk/storage/app/media/strategicke-dokumenty/doprava/bbsk-pdo-2008.pdf>
- Bezák, A. (1997). Priestorová organizácia spoločnosti a územno-správne členenie štátu. *Acta Universitatis Matthiae Belii, Geografické Štúdie*, 3, 6–13.
- Bezák, A. (2001). O regionálnych trhoch práce, nových krajoch a tokoch nezamestnaných (On regional labour markets, new administrative regions and unemployment flows). *Geografický časopis*, 53(4), 295–305.
- Binder, J., & Matern, A. (2020) Mobility and social exclusion in peripheral regions, *European Planning Studies*, 28(6), 1049–1067. <https://doi.org/10.1080/09654313.2019.1689926>
- Casas, I. (2007). Social exclusion and the disabled: An accessibility approach. *The Professional Geographer*, 59(4), 463–477. <https://doi.org/10.1111/j.1467-9272.2007.00635.x>
- ŠÚ SR (2011). Výsledky Sčítania obyvateľstva, domov a bytov 2011. Bratislava: Štatistický úrad Slovenskej republiky.
- Charnavalau, A., Szymańska, E. J., & Czapski, G. (2022). The Impact of Transport Exclusion on the Local Development of Biała County. *Sustainability*, 14, 5674. <https://doi.org/10.3390/su14095674>
- Church, A., Frost, M., & Sullivan, K. (2000). Transport and social exclusion in London. *Transport Policy*, 7(3), 195–205. [https://doi.org/10.1016/S0967-070X\(00\)00024-X](https://doi.org/10.1016/S0967-070X(00)00024-X)
- Combs, T. S., Shay, E., Salvesen, D., Kolosna, C., & Madeley, M. (2016). Understanding the multiple dimensions of transportation disadvantage: The case of rural North Carolina. *Case Studies on Transport Policy*, 4(2), 68–77. <https://doi.org/10.1016/j.cstp.2016.02.004>
- CP (2019). Timetables. Retrieved from www.cp.hnonline.sk
- Currie, G., Richardson, T., Smyth, P., Vella-Brodrick, D., Hine, J., Lucas, K., Stanley, J., Morris, J., Kinnear, R., & Stanley, J. (2009). Investigating links between transport disadvantage, social exclusion and well-being in Melbourne – preliminary results. *Transport Policy*, 16(3), 97–105. <https://doi.org/10.1016/j.tranpol.2009.02.002>
- Currie, G., Richardson, T., Smyth, P., Vella-Brodrick, D., Hine, J., Lucas, K., Stanley, J., Morris, J., Kinnear, R., & Stanley, J. (2010). Investigating links between transport disadvantage, social exclusion and well-being in Melbourne – updated results. *Research in Transportation Economics*, 29(1), 287–295. <https://doi.org/10.1016/j.retrec.2010.07.036>
- Davison, L., Enoch, M., Ryley, T., Quddus, M., & Wang, C. (2014). A survey of demand responsive transport in Great Britain. *Transport Policy*, 31(1), 47–54. <https://doi.org/10.1016/j.tranpol.2013.11.004>
- Delbosc, A., & Currie, G. (2011). The spatial context of transport disadvantage, social exclusion and well-being. *Journal of Transport Geography*, 19(6), 1130–1137. <https://doi.org/10.1016/j.jtrangeo.2011.04.005>
- Engels, B., & Liu, G.-J. (2011). Social exclusion, location and transport disadvantage amongst non-driving seniors in a Melbourne municipality, Australia. *Journal of Transport Geography*, 19(4), 984–996. <https://doi.org/10.1016/j.jtrangeo.2011.03.007>
- Farrington, J., & Farrington, C. (2005). Rural accessibility, social inclusion and social justice: towards conceptualisation. *Journal of Transport Geography*, 13(1), 1–12. <https://doi.org/10.1016/j.jtrangeo.2004.10.002>
- Gašparović, S. (2016). Theoretical Postulates of Transport Disadvantage. *Hrvatski Geografski Glasnik*, 78(1), 73–95.
- Givoni, M., & Rietveld, P. (2007). The access journey to the railway station and its role in passengers' satisfaction with rail travel. *Transport Policy*, 14(5), 357–365. <https://doi.org/10.1016/j.tranpol.2007.04.004>
- Goliszek, S. (2022). Private car transport or public transport? The study of daily accessibility in Szczecin. *Geografický časopis*, 74(4), 337–356. <https://doi.org/10.31577/geogrcas.2022.74.4.17>

- Gutiérrez, J. (2001). Location, economic potential and daily accessibility: an analysis of the accessibility impact of the high-speed line Madrid-Barcelona-French border. *Journal of Transport Geography*, 9(4), 229–242. [https://doi.org/10.1016/S0966-6923\(01\)00017-5](https://doi.org/10.1016/S0966-6923(01)00017-5)
- Halás, M., & Klapka, P. (2017). Functionality versus gerrymandering and nationalism in administrative geography: lessons from Slovakia. *Regional Studies*, 51(10), 1568–1579. <https://doi.org/10.1080/0343404.2016.1215602>
- Halás, M., Klapka, P., Bačík, V., & Klobučník, M. (2017). The spatial equity principle in the administrative division of the Central European countries. *PLoS ONE*, 12(11), e0187406. <https://doi.org/10.1371/journal.pone.0187406>
- Hernandez, D. O., & Titheridge, H. (2016). Mobilities of the periphery: Informality, access and social exclusion in the urban fringe in Colombia. *Journal of Transport Geography*, 55, 152–164. <https://doi.org/10.1016/j.jtrangeo.2015.12.004>
- Hine, J., & Mitchell, F. (2001). Better for Everyone? Travel Experiences and Transport Exclusion. *Urban Studies*, 38(2), 319–332. <https://doi.org/10.1080/00420980020018619>
- Horňák, M., & Rochovská, A. (2014). Do mesta čoraz ďalej – dopravné vylúčenie obyvateľov vidieckych obcí Gemera (Further into the Town – Transport Exclusion of Rural Settlements Residents in the Gemer Region). *Geographia Cassoviensis*, 8(2), 141–149.
- Horňák, M., Kresáň, L., & Rochovská, A. (2016). Osobný automobil v domácnosti: symbol sociálneho statusu alebo nevyhnutnosť? *Geografia*, 24(1), 15–19.
- Jaroš, V. (2017). Social and transport exclusion. *Geographia Polonica*, 90(3), 247–263. <https://doi.org/10.7163/GPol.0099>
- Kenyon, S. (2011). Transport and social exclusion: access to higher education in the UK policy context. *Journal of Transport Geography*, 19(4), 763–771. <https://doi.org/10.1016/j.jtrangeo.2010.09.005>
- Kenyon, S., Lyons, G., & Rafferty, J. (2002). Transport and social exclusion: investigating the possibility of promoting inclusion through virtual mobility. *Journal of Transport Geography*, 10(3), 207–219. [https://doi.org/10.1016/S0966-6923\(02\)00012-1](https://doi.org/10.1016/S0966-6923(02)00012-1)
- Lucas, K. (2012). Transport and social exclusion: Where are we now? *Transport Policy*, 20, 105–113. <https://doi.org/10.1016/j.tranpol.2012.01.013>
- Lucas, K. (2019). A new evolution for transport-related social exclusion research? *Journal of Transport Geography*, 81, 102529. <https://doi.org/10.1016/j.jtrangeo.2019.102529>
- Ma, L., Kent, J. L., & Mulley, C. (2018). Transport disadvantage, social exclusion, and subjective well-being: The role of the neighborhood environment – evidence from Sydney, Australia. *The Journal of Transport and Land Use*, 11(1), 31–47. <http://dx.doi.org/10.5198/jtlu.2018.1008>
- Mackett, R., & Thoreau, R. (2015). Transport, social exclusion and health. *Journal of Transport & Health*, 2(4), 610–617. <https://doi.org/10.1016/j.jth.2015.07.006>
- McDonagh, J. (2006). Transport policy instruments and transport-related social exclusion in rural Republic of Ireland. *Journal of Transport Geography*, 14(5), 355–366. <https://doi.org/10.1016/j.jtrangeo.2005.06.005>
- Michniak, D. (2003). Dostupnosť okresných miest na Slovensku. *Geografický časopis*, 55(1), 21–39.
- MINDOP SR (2023). Dopravné prevádzkové ukazovatele podľa regiónov. Ministerstvo Dopravy Slovenskej Republiky. Retrieved from https://www.mindop.sk/files/statistika_vud/reg_prev_ukazovatele.htm#k10
- Preston, J., & Rajé, F. (2007). Accessibility, mobility and transport-related social exclusion. *Journal of Transport Geography*, 15(3), 151–160. <https://doi.org/10.1016/j.jtrangeo.2006.05.002>
- Rosik, P., & Stępnia, M. (2015). Monitoring of changes in road potential accessibility at municipality level in Poland, 1995–2015. *Geographia Polonica*, 88(4), 607–620. <http://dx.doi.org/10.7163/GPol.0036>
- Rosik, P., Pomianowski, W., Goliszek, S., Stępnia, M., Kowalczyk, K., Guzik, R., Koloś, A., & Komornicki, T. (2017). *Multimodalna dostępność transportem publicznym gmin w Polsce (Multimodal public transport accessibility of Polish gminas/municipalities (MULTIMODACC))*. Warsaw: Instytut Geografii i Przestrzennego Zagospodarowania PAN.
- Schwanen, T., Lucas, K., Akyelken, N., Solsona, D. C., Carrasco, J.-A., & Neutens, T. (2015). Rethinking the links between social exclusion and transport disadvantage through the lens of social capital. *Transportation Research Part A*, 74, 123–135. <http://dx.doi.org/10.1016/j.tra.2015.02.012>

- Shergold, I., & Parkhurst, G. (2012). Transport-related social exclusion amongst older people in rural Southwest England and Wales. *Journal of Rural Studies*, 28(4), 412–421. <https://doi.org/10.1016/j.jrurstud.2012.01.010>
- Stanley, J., & Lucas, K. (2008). Social exclusion: What can public transport offer? *Research in Transportation Economics*, 22(1), 36–40. <https://doi.org/10.1016/j.retrec.2008.05.009>
- STATDAT (2023). Štatistický úrad Slovenskej republiky. Retrieved from <http://statdat.statistics.sk>
- Székely, V., & Novotný, J. (2020). Accessibility of regional centre in the light of the number of used public transport lines: transport-disadvantaged rural areas from central Slovakia. *Rural Areas and Development*, 17, 55–69. <https://doi.org/10.30858/RAD/2020/17.0400>
- Székely, V., & Novotný, J. (2022). Public transport-disadvantaged rural areas in relation to daily accessibility of regional centre: Case study from Slovakia. *Journal of Rural Studies*, 92, 1–16. <https://doi.org/10.1016/j.jrurstud.2022.03.015>
- Śleszyński, P. (2016). A synthetic index of the spatio-temporal accessibility of communes in Poland. *Geographia Polonica*, 89(4), 567–574. <http://dx.doi.org/10.7163/GPol.0074>
- Trembošová, M., & Kohutiar, S. (2021). The impact of transport on regional development in the Trnava self-governing region. *Prace Komisji Geografii Komunikacji PTG*, 25(2), 18–26. <http://doi.org/10.4467/2543859XPKG.22.007.16265>
- Vale, D. S. (2013). Does commuting time tolerance impede sustainable urban mobility? Analysing the impacts on commuting behaviour as a result of workplace relocation to a mixed-use centre in Lisbon. *Journal of Transport Geography*, 32, 38–48. <https://doi.org/10.1016/j.jtrangeo.2013.08.003>
- van Dülmen, C., Šimon, M., & Klärner, A. (2022). Transport poverty meets car dependency: A GPS tracking study of socially disadvantaged groups in European rural peripheries. *Journal of Transport Geography*, 101, 103351. <https://doi.org/10.1016/j.jtrangeo.2022.103351>
- Votrubová, K. (2022, July 27). Reportáž z vidieka – Slovenské dediny postupne vymierajú a zvrat je už, zda sa, nemožný. *Postoj*. Retrieved from <https://www.postoj.sk/111007/slovenske-dediny-postupne-vymieraju-a-zvrat-je-uz-zda-sa-nemozny>
- Wendt, J. (2000). Dostępność komunikacyjna ośrodków władzy wojewódzkiej. *Prace Komisji Geografii Komunikacji PTG*, 6, 183–203.
- Więckowski, M., Michniak, D., Bednarek-Szczepańska, M., Chrenka, B., Ira, V., Komornicki, T., Rosik, P., Stępnik, M., Székely, V., Śleszyński, P., Świątek, D., & Wiśniewski, R. (2014). Road accessibility to tourist destinations of the Polish-Slovak borderland: 2010-2030 prediction and planning. *Geographia Polonica*, 87(1), 5–26. <http://dx.doi.org/10.7163/GPol.2014.1>
- Zuo, T., Wei, H., Chen, N., & Zhang, C. (2020). First-and-last mile solution via bicycling to improving transit accessibility and advancing transportation equity. *Cities*, 99, 102614. <https://doi.org/10.1016/j.cities.2020.102614>

