

## SPATIAL ASPECTS OF TRANSPORT BEHAVIOUR IN THE CZECH REPUBLIC AFTER 1989

Stanislav Kraft<sup>1</sup>, Jan Prener<sup>1</sup>

<sup>1</sup> Department of Geography, University of South Bohemia in České Budějovice,  
Jeronýmova 10, České Budějovice, Czech Republic, kraft@pf.jcu.cz, jan.prener@gmail.com

### Abstract

The article focuses on the current development of transport and transport behaviour in the Czech Republic in the post-socialist context. Dramatic economic, political and social changes after 1989 related to the fall of the Iron Curtain created new principles of organisation of spatial phenomena and spatial processes. We consider the transport and transport behaviour as a complex and much complicated category. They are inextricably connected with spatial organisation of society. The article is thus aimed on the research of 1) spatial changes in the level of individual automobilisation and 2) spatial changes in the transport mode choice. We use the official statistical data to describe and analyse these aspects of transport behaviour. Special attention is paid to the current trends of car transport development and the changing position of public transport in the transport system of the Czech Republic.

**Key words:** spatial mobility, transport behaviour, commuting to work, automobilisation, Czech Republic.

### INTRODUCTION

Changes caused by economic and social transformation in the Czech Republic and other former socialist states after 1989 affected most socio-economic facts and processes. These changes were accompanied by the emergence of various new concepts often leading to creation of brand new principles of geographic phenomena organisation. Within this context, Hampl (2005) mentions that the 1990s saw not only post-communist but also post-industrial transformation. Both processes created quite unique conditions for the study of transformation dynamics of socio-economic processes. Transport was one of the areas of human activity most profoundly affected by these transformation changes. Transport geography research of the 1990s in most former socialist states of Central Europe thus focused on themes directly related to transport system transformation (Horňák 2006;

Seidenglanz 2007; Marada et al. 2010; Komornicki 2003; Taylor 2003; Korec 1994). Another interesting fact is represented by the finding that transport system transformations in former socialist states of Central Europe became an important theme internationally (Hall 1993; Pucher 1999 and others). The above-mentioned authors focused on key themes such as the increasing numbers of passenger vehicles, reduction of public transport in rural/peripheral regions, issues of automobile transport in cities, building of new transport infrastructures, progress of air transport, etc.

However, considerably lower attention was paid to population mobility and transport behaviour. These are complex categories of transport research by nature, but due to the absence of data only allow for limited monitoring. An increasing number of studies on this theme have only appeared recently (e.g. Komornicki 2011; Kraft 2014). This is connected,

inter alia, with the emergence of a new influence in transport geography called the “mobility turn”. Its introduction was inspired by the efforts of social sciences (especially sociology and cultural studies) to integrate transport and mobility research into a wider social context (Urry 2007; Faist 2013). Hence transport has ceased to be studied by strictly technical methods using mathematical formulas and statistical methods, and new themes have emerged such as individualisation of mobility, roles of GPS technologies or social exclusion generated by transport (e.g. Horňák and Rochovská 2014).

This article aims at several goals. The main goal is to study spatial aspects of transport behaviour in the Czech Republic in the context of post-socialist transformation. Regarding the extensive changes in the transport system of the Czech Republic after 1989 (see below), primary attention is paid to spatial aspects of individual automobilisation (number of passenger cars per 10 inhabitants) in the context of spatial differentiation of use of individual transport modes for commuting to work. This is considered the main form of spatial mobility and therefore the main source of transport information (e.g. Halás et al. 2010). The main emphasis is placed here on development of these indicators in the Czech Republic after 2000. The previous period is only mentioned here through selected statistical indicators, etc. According to their complex nature the results of the present research may not only be used by geographers, but may also inspire sociologists, economists, transport researchers, transport planners, transport policy makers, etc.

The structure of the article is as follows: The theoretical introduction will be followed by theoretical anchoring of the studied issue. Attention will be paid to mobility, transport behaviour and transformation of the transport system of the Czech Republic. The methodological section will define the data and methods used. The main results are summarised in the analytical chapter dealing with spatial aspects of development of individual automobilisation and transport mode choice in the Czech Republic. The final part then synthesises the research results and outlines other themes of research into spatial aspects of transport behaviour in post-socialist states.

## **THEORETICAL BACKGROUND**

The movements of people, goods and information have always been essential components of global and regional issues of transport geography. The current trend of socio-economic processes in our society can be described by increasing mobility, accessibility and spatial dynamics (closer e.g. Knowles 2006; Keeling 2007). Mobility is one of the most important human activities and needs. As is the instance of transport behaviour of the population of individual countries, including commuting or migration. Spatial mobility and transport accessibility are not currently profiled as a monothematic section in research by specialised sciences. Connections with other sciences, such as economics or sociology (Urry 2000; Adey 2009) is especially preferred.

Mobility is labelled as movement in a certain area. There are two basic types of mobility: horizontal and vertical. Vertical movement can be described as a change of social position in society (see the concept of social mobility by Savage 1988). Spatial mobility is a phenomenon which can be described in shorter intervals; even so it is possible to divide it into several types of physical movements. In general, mobility is defined as the ability of motion in space (Hanson 2004). On the other hand, the accessibility is defined as spatial and temporal availability of individual nodes in transport systems. Accessibility is mainly influenced by the geographical location and the tightness of nodes. For example Rodrigue et al. (2006) define accessibility as a measure of the ability of reaching space or other (different) locations. According to Rodrigue et al. (2006) essential notions as locations and distances can be considered. Accessibility is often expressed in various units, such as time, mileage or variables (goods, energy, etc.).

The phenomenon of transport behaviour is one of the key transport categories. Transport behaviour is a complex manifestation of the level of maturity and quality of a transport system. In addition this category is highly individual for every person's mobility and transport behaviour is affected by numerous individual factors of both an objective

and subjective nature. Hunecke (2000) divides these factors to personal and external. Personal (individual) factors are represented by socio-demographic indicators, lifestyle, transport mode availability, etc. External factors, on the other hand, are primarily affected by the environment – location of individual activities (living, work, school, services), distances, topography and other specifics (transport policy, etc.). Therefore transport behaviour can be said to be an extremely complicated and complex category, the research on which has long been one of the basic priorities of various research disciplines (Schwanen et al. 2001). These include not only geography but also for example economics, psychology, sociology, cultural anthropology, etc. Research in the area of transport behaviour therefore tries to understand how people travel, what motivational, cognitive, situational and dispositional factors affect their selection of transport mode, etc. (Dewi 2010).

The basis of this article is analysis of transport behaviour in the post-socialistic context, especially in the Czech Republic. Dynamic spatial changes after 1989 affected most social-economic processes, including transport (Nuhn and Hesse 2006). Transport systems in the post-socialistic countries can be regarded as uncompetitive in comparison with other transport modes in western countries. Transport behaviour in post-socialist countries is still very different, because the transport systems were underdeveloped during the totality (intermodal competition, development of infrastructure or collective transport modes dominance). Moreover, transport behaviour in the former socialist countries was significantly influenced by the state and its transport policy (Pucher 1999). The government aim was the emphasis on the collective and proportional development of the entire economy, including the transport. Therefore, the individual types of transport could not develop practically.

The dominance of public transport in the transport systems of former socialist countries was also reflected in transport studies. Most of them were primarily oriented on the issue of public transport, while the individual transport was studied only rarely. Due to this fact, only a few older studies were

oriented on the issue of transport behaviour. One of the first publications aimed on transport behaviour were studies by Vlček (1964, 1973) focused on the rural areas of Czechoslovakia.

Current research applies to modern methods and issues of transport and transport behaviour. These methods of investigating transport behaviour generate new viewpoints for transport concentration, commuting or travelling. These theoretical concepts are considered essential by authors such as Seidenglanz (2007), Marada et al. (2010), Květoň et al. (2012), Novák and Temelová (2012) or Kvizda and Seidenglanz (2014).

In general, car transport has been one of the most progressive transport modes in the Czech Republic after 1989 (Kraft et al. 2014). The transformation process after 1989 caused unprecedented growth among spatial interaction and an increase in the number of vehicles (Komornicki 2008). Car development-related impacts became a more comprehensive theme of geographical research (Sýkora 2002 or Urbánková and Ouředníček 2006).

However, we can identify some interesting spatial consequences of this development. The increase in the number of vehicles after 1989 is typical for mostly bigger cities and south-west regions of the Czech Republic. The growth of vehicle transport intensity is a very selective indicator of changes in the spatial organisation of transport (Kraft 2011). Thereby it caused an apparent west-east gradient of individual automobilisation in the Czech Republic (number of vehicles per 10 people). The basic factors which influenced this placement include: dispersed settlement system, increased social-economic potential of the Czech population, location of foreign vehicle companies, adoption of modern transport trends from abroad, increased commuting to work to Germany (western borders), changes in urbanisation or the “cult of car”, which is often mentioned by e.g. Urry (1999), etc. On the other hand, a distinctly lower level of individual automobilisation can be described in the Moravian and Silesian regions. In these areas bigger villages with higher populations prevail as opposed to villages in the western part of the

Czech Republic. The population in the Moravian and Silesian regions is very concentrated, so accessibility by public transport is more profitable than in the dispersed settlement systems in the west. Thus we can say that the use of public transport depends on a wide range of objective factors. This assumption was confirmed by Marada et al. (2010), who assume that large villages in Moravia will have better accessibility by public transport than smaller villages in south-west Bohemia.

### **CURRENT TRENDS IN TRANSPORT SYSTEM DEVELOPMENT IN THE CZECH REPUBLIC**

The current spatial organisation of the Czech transport system is a result of a number of processes and mechanisms of change, which have been often associated with the development of the transport sector after the year 1989. This period was characterised by dynamic transformation processes – political, economic and social processes which generally resulted in a considerable reorganisation of the Czech transport system. The transformation of the Czech economy for spatial organisation of society and, by extension, also for spatial organisation of the Czech transport system, was characterised by the fact that it was a post-industrial transformation (from the stage of industrial development of societal systems) but at the same time also a post-socialist transformation (for further details see e.g. Hampl 2005). The combination of both above-mentioned processes had an essential influence on the formation of the current organisation of the transport system in the Czech Republic, creating quite unique conditions for the current study thereof. The result of the transformation processes were new altered demands on the transport system, which had to quickly adapt to the newly formed conditions.

As mentioned by Marada et al. (2010), general transformation processes are strongly linked to the transformation processes in transport. Therefore, it is very difficult to identify whether for instance the on-going suburbanisation processes in the Czech Republic in recent years are the result of the growth of motorisation of its inhabitants, or rather on whether the growth of motorisation was a

consequent phenomenon of suburbanisation. In accordance with Körner (2010) it is possible to identify the key processes conditioning the current spatial organisation of the Czech transport system and generally also the growth of spatial mobility in the Czech Republic:

- **Changes in the size structure of companies** – after 1989, large companies (dominantly industrial) with many employees were quickly reorganised towards more flexible production based on the existence of small and middle sized companies. However, it is far more difficult to provide this with transport services via the public transport, and this led to a considerable reflux of passengers commuting to work from public transport to personal vehicle transport, especially in the course of the 1990s.
- **Growing intensity of people commuting to work and schools** – this mainly relates to the deepening of socio-economic differences in individual regions, increase of unemployment as well as to a considerable differentiation of average salaries (the highest salaries are, in the long-term, in the metropolitan regions of large cities). One specific feature of the transformation era was also an increase of the spatial framework of commuting to work (both of daily and non-daily forms) induced by a more advantageous accessibility of the core regions supported by the development of personal automobilisation and with the construction of high-capacity transport infrastructure (proven by e.g. the work of Hudeček (2008) on the example of several settlement centres).
- **The development of suburbanisation processes** – this is a characteristic current trend of the Czech settlement system representing a developmentally higher phase of the urbanisation process. Residential and commercial activities move beyond the town borders. Suburbanisation processes are traditionally bound with the development of individual automobile transport, since it shows a considerably higher potential of scattered transport services for suburban housing development. At the same time, this is linked to inhabitants and households with higher income, who usually own one or more passenger vehicles.

Increasing the level of spatial mobility has furthermore resulted in spatial scattering of points generating the mobility of persons in the urban regions (e.g. construction of large shopping centres beyond the town boundaries as well as in the proximity of main road communications). For instance Sýkora (2002) and Marada (2006) speak of these connections in more detail. The process of suburbanisation is highlighted even more in commuting to work, schools and services, which generates new sources and destinations while increasing the current spatial mobility of persons, freight and information.

- **The development of new forms of travelling and leisure-time activities** – this is again linked to increased mobility connected to the inhabitant motorisation growth. So, there are new short-term irregular transfers of inhabitants for longer distances related to tourism or movements of inhabitants related to “enjoying the ride” (the phenomenon of so called “cruising journeys” in the U.S. is also referred to by Hanson 2004).

On the basis of the discussion above and with respect to the area of interest, the key processes which alter the current spatial organisation of the Czech transport system are especially changes in the modal split, and hence also changes in the ownership or accessibility to a vehicle by Czech inhabitants.

## DATA AND METHODS

The first stage of the research analysed spatial differentiation of individual automobilisation in the Czech Republic. Municipality is the basic unit of classification of data on the numbers of registered passenger vehicles. On the basis of the electronic database of the Ministry of Transport and the Ministry of the Interior of the Czech Republic providing data on the numbers of passenger vehicles in more than 6 thousand municipalities, basic assumptions and differences in transport behaviour of the Czech population were identified. Due to the different populations of the individual municipalities the level of individual automobilisation was expressed in relative terms as the number of passenger vehicles per 10 inhabitants of a municipality.

The provided database, however, contained a great deal of incorrectness and so the data had to be checked and corrected to correspond to the reality. As the above-mentioned ministries have published these data on the municipal level since 2007 only, this year was taken as the baseline. Another selected milestone was the year 2014, reflecting the current condition. Although the monitored period may appear too short, we believe it is able to sufficiently reflect the main development trends in individual automobilisation and its spatial differentiation in the Czech Republic.

The second research stage then identified changes in the use of individual transport modes in commuting to work. Transport mode selection is a key attribute of transport behaviour. The chosen municipal level assured the high accuracy of this indicator. The subject of the analysis was represented by data on use of transport modes taken from the two most recent population censuses of 2001 and 2011. However, the comparability of data of the two population censuses is limited. The reason is a different definition of the commuter or reporting of commuting as such. While the census of 2001 analysed commuting on the basis of the permanent residence of the commuter, the 2011 census was based on the usual place of residence. In addition the commuting records of 2011 were affected by the loss of about 600 thousand entries which paradoxically resulted in a volume decrease of most commuting streams. Thus relevant information about the places of commuting to work and use of transport modes by the commuters is missing for about 1/3 of the country population. At the same time the use of transport mode as an indicator is limited, for while in 2001 just four basic categories were recorded (vehicle, bus, train and other), in 2011 new categories emerged (vehicle-passenger, bike, public transport, etc.).

Due to these facts the basic data used for analysis of spatial differentiation of transport mode use were relativized to increase their comparability between the two analysed years. The basic indicator was always the number of persons using a particular transport mode (such as a train) for commuting to work per the total number of persons leaving

the given municipality by transport mode. The leaving streams due to their spatial dispersion tended to illustrate natural differences in the use of transport modes much better than incoming streams. Comparison of the years 2001 and 2011 identified the main changes in transport behaviour of the Czech population, albeit only on the basis of the commuting to work indicator. The reason is that in the Czech Republic there are currently no general transport research projects of censuses focusing on this issue. A certain exception is represented by small-scale surveys dealing with the total day mobility of the Czech population (Temelová et al. 2011; Kraft 2014). All recorded home-leaving streams were added together per transport mode and Czech municipality. The categories for use of transport modes for commuting to work in the years 2001 and 2011 included the proportions of people using a passenger vehicle, bus, train and public transport in general for travel to work and back home. We therefore tried to identify basic development trends in transport behaviour of the Czech population through these basic transport categories.

For increased transparency we tried to interpret all results not only on the individual municipality and geographical distribution level, but also on the level of municipality categories. We selected as the best framework for this interpretation structuring of the Czech Republic territory to urban, suburban and rural areas pursuant to Ouředníček et al. (2013).

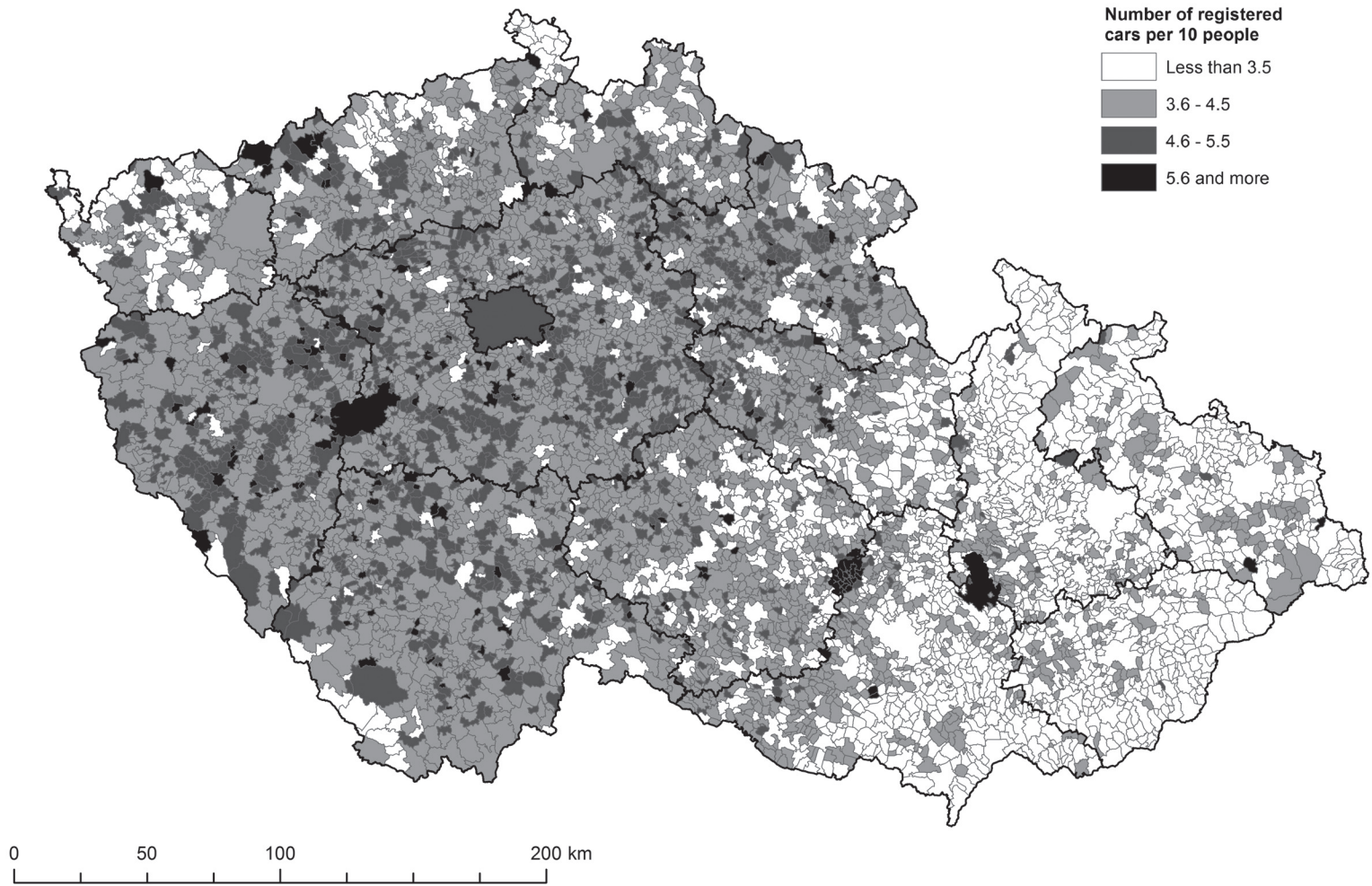
### **SPATIAL ASPECTS OF INDIVIDUAL AUTOMOBILISATION IN THE CZECH REPUBLIC**

Individual automobilisation is one of the basic attributes of transport system maturity and one of the basic assumptions affecting the transport behaviour of the population. In addition, the availability of a passenger vehicle has recently become one of the key assumptions for quality of life. This is especially important in rural areas that are more dependent on vehicles than urban areas. The Czech Republic has seen a significant increase of individual automobilisation in the past 25 years. While in 1990 there were 2.3 passenger vehicles per 10 inhabitants, in 2012 this indicator exceeded

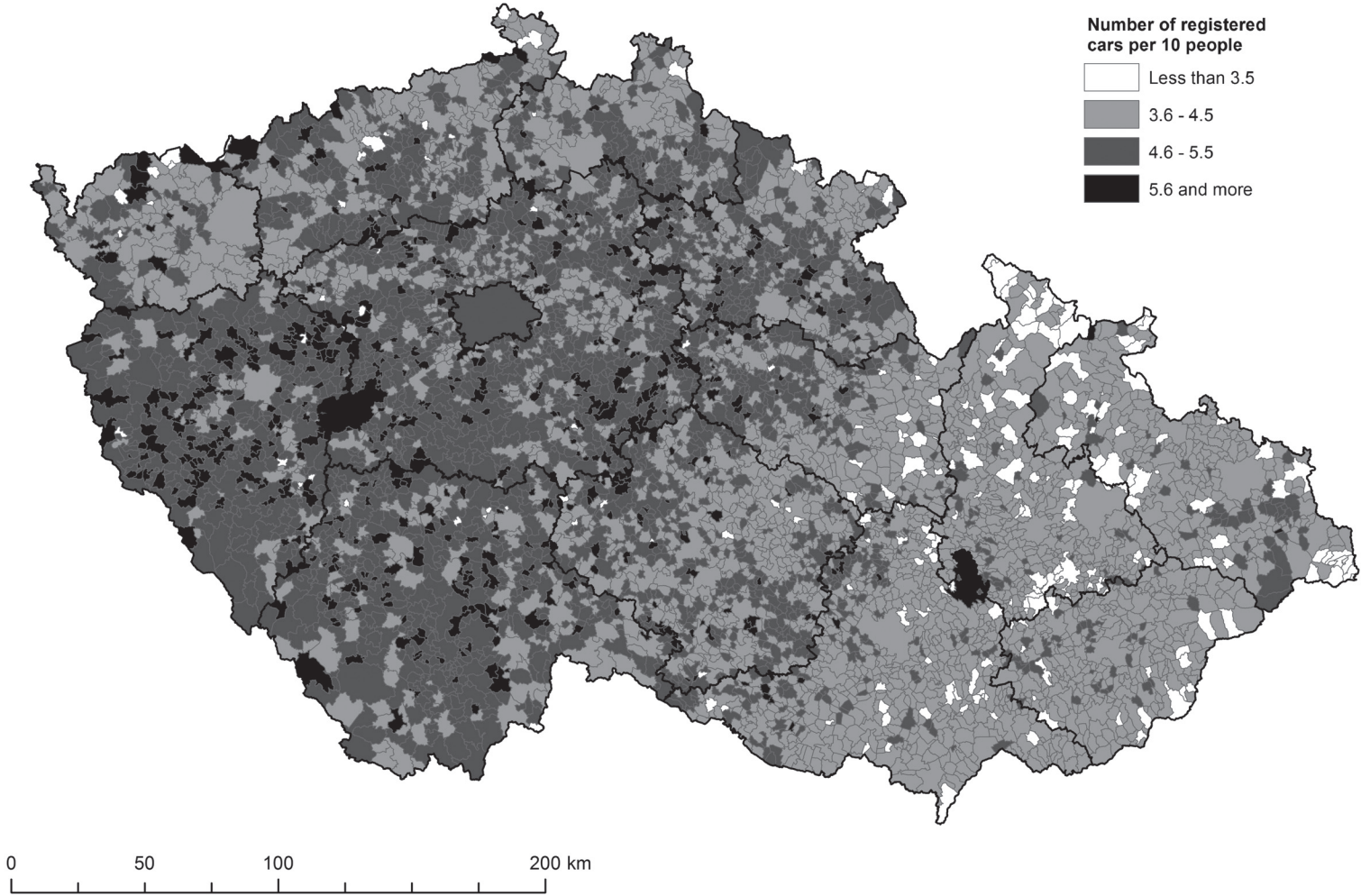
the value of 4.5, thus raising the Czech Republic (and Poland) among the advanced West European countries (Eurostat 2012). In general terms the level of individual automobilisation in the Czech Republic shows significant spatial differentiation (Fig. 1).

While the regions in south-western Bohemia, eastern Bohemia and in the central part of the Czech Republic are characterised by a scattered settlement structure (small villages in small distances from each other), concentrated settlement prevails in Moravia (big villages at greater distances from each other). The spatial dispersion generally generates a higher demand for transport than concentrated settlement, which is easier to serve by public transport. Other limiting factors include the economic advance of the regions, closeness of advanced German regions, lower railway density, etc. The combination of all these factors then causes higher automobilisation of the western regions (Marada et al. 2010). The above described polarity between the west and the east of the Czech Republic is also true for the 2014 period (Fig. 2).

Although flat identification of the main changes from 2007 is less visible, higher automobilisation of western regions of the Czech Republic can still be seen. When comparing dynamics of development of individual automobilisation the highest relative increments can be seen in the Moravian regions (Fig. 3), despite that these regions still appear under-dimensioned in this respect. Municipalities in the Zlínský region and the in the Moravian-Silesian region especially show extremely high values of relative increment. The change index value ranges around 130-150% of the baseline. On the other hand the western regions show a relatively balanced dynamic, which may evidence certain "saturation". On the municipal level a number of western municipalities have also shown higher developmental dynamics. They mainly include municipalities with a lower quality of public transport away from major employment centres (e.g. Chvátal et al. 2011). It can therefore be concluded that a lower quality of public transport in some regions is one of the key factors affecting the need for a passenger vehicle purchase.



**Figure 1** Individual automobilisation in Czech municipalities in 2007. Source: Central Vehicle Register, own processing.



**Figure 2** Individual automobilisation in Czech municipalities in 2014. Source: Central Vehicle Register, own processing.



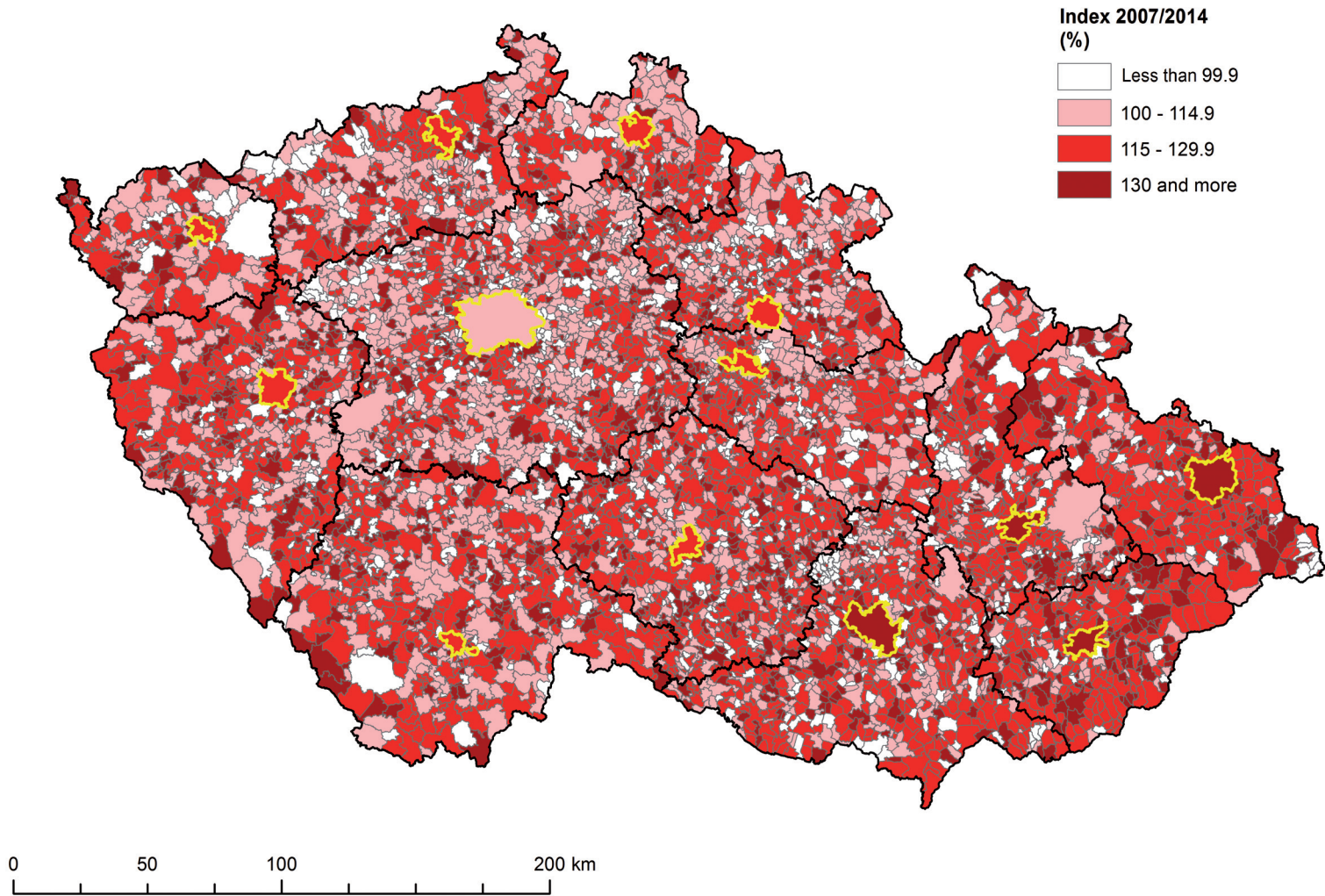


Figure 3 Individual automobilisation in Czech municipalities 2007/2014. Source: Central Vehicle Register, own processing.

**Table 1** Individual automobilisation in particular types of municipalities.  
Source: Ouředníček et al. (2013).

Areas	2007	2014	Index
Rural	4.06	4.65	114.53
Suburban	3.93	4.56	116.03
Urban	3.23	3.96	122.60

An interesting comparison is also provided by a study of automobilisation per municipality type (see Ouředníček et al. 2013). Table 1 clearly shows that the highest level of automobilisation is typical of rural regions where there is a highly increased demand for travel to cities. This demand is more often than not satisfied by passenger vehicles due to often poorly functioning public transport (see also Nutley 1998). Although the individual automobilisation change index for these regions is the lowest (114.5), one can rightly state that Czech rural areas represent the most automobilised parts of the country. The value of 4.65 registered cars per 10 people is above the country mean today. Relatively high automobilisation is also typical of suburban areas of the Czech Republic. Suburbs are also often connected to the city centres by relatively well functioning public transport. Despite this, the suburban population are used to using their cars for their daily trips (Urbánková and Ouředníček 2006). An especially high level of individual automobilisation is typical of the suburban areas of big cities (Prague, Plzeň, České Budějovice, Liberec). A higher level of individual automobilisation is also shown in the suburban areas of big Moravian cities. Urban areas are the least automobilised areas. The key conditioning factors include the existence of public transport in urban areas, easier accessibility of destinations on foot or by public transport, elderly population, lower distances to everyday activities, etc.

## SPATIAL ASPECTS OF TRANSPORT MODE CHOICE IN THE CZECH REPUBLIC

The use of individual transport modes for commuting to work provides important information about the transport behaviour of the Czech population. Due to the nature of the available data this can be analysed down to the municipality level, which allows for a very detailed transport behaviour assessment. Considering the above-mentioned methodological discrepancies of the population census between the years, it is necessary to keep in mind that comparability of the data is not absolute. Despite this we believe that the analysis of spatial differentiation of use of individual transport modes between the years 2001 and 2011 may bring original and substantial information about the change of spatial patterns in the transport behaviour of the population of the Czech Republic. Attention will be paid to the key transport modes – passenger vehicles, public transport in general, trains and buses.

### Use of cars for commuting to work in the years 2001 and 2011

The above-mentioned west-east gradient in individual automobilisation basically corresponds to the use of passenger vehicles in both analysed years. High levels of passenger vehicle use are mainly typical of Bohemian regions, while Moravian regions showed a lower level of passenger vehicle use in 2001 (Fig. 4).

In addition to the above-mentioned factor of regional passenger vehicle availability there are also differences in railway network density, settlement structure, economic situation and probably also lifestyle. In addition to the traditional west-east polarity there is also the relatively lower use of passenger vehicles in the immediate surroundings of the main railway corridors where commuting is better saturated by the available railway transport. This is especially true for the city train lines in the surroundings of Prague, Plzeň, Hradec Králové, etc., where it was railway transport that performed a more significant role in 2001.

On the other hand the increased use of passenger vehicles for commuting to work may be observed in the surroundings of the main road and motorway routes (such as in the surroundings of the D1 motorway) and generally also in areas more distant from the main settlement centres with a lower quality of public transport (Znojmo, Příbram, etc.). In 2011 (Fig. 5) the use of passenger vehicles showed similar trends. Use of a passenger vehicle for commuting to work can be said to generally show an increasing trend. A private automobile thus clearly becomes the most important transport mode used by a substantial proportion of all commuters. The traditional polarity between the west and the east appears to be decreasing. An increased dominant role of private automobile use began to be apparent also in the eastern regions of the Czech Republic in 2011. However, there is a new differentiation level overshadowing this traditional west-east polarity. It is represented by the background of big cities where the relative use of a passenger vehicle appears to be decreasing. This may be attributed to the extending offer of public transport services by the integrated transport systems (Štátná et al. 2015).

#### **Use of buses for commuting to work in the years 2001 and 2011**

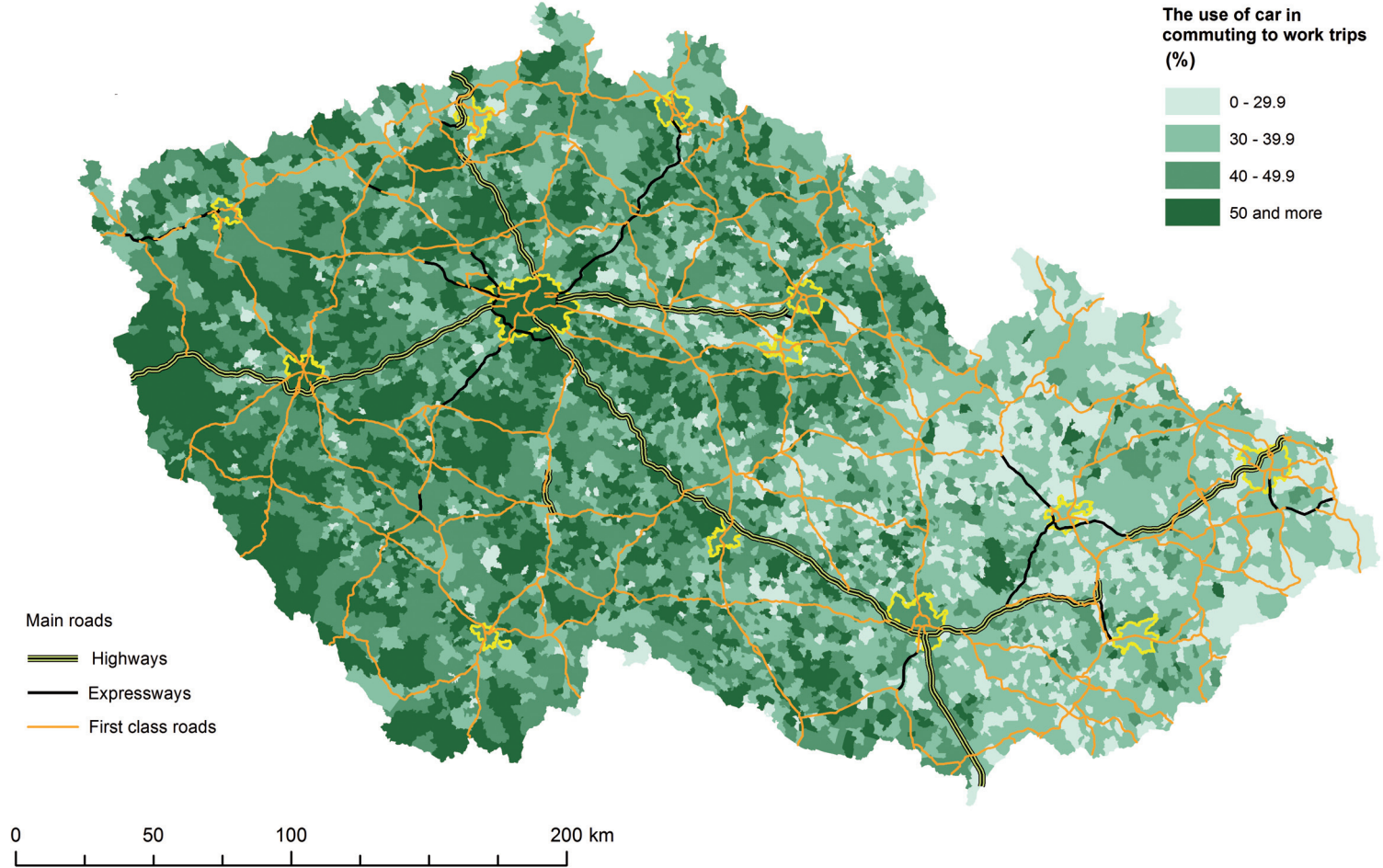
Bus transport has been a traditional pillar of public transport in the Czech Republic, although its transport performance has been decreasing continually since the early 1990s. The relevance of bus transport is obviously higher in regions with a lower railway network density. Fig. 6 documents a higher use of buses in less automobilised regions of the Czech Republic in 2001. The highest relevance of bus transport in that period may be seen in the eastern parts of the country in the areas distant from railway routes. On the other hand the use of bus transport is lower in central and western Bohemian regions. This corresponds to the above-mentioned results of surveys on the level of automobilisation and use of passenger vehicles. Bus transport is clearly more often used for commuting over greater distances. It is intuitively clear that bus transport dominates

within the radius of 10-30 km from the biggest settlement centres, of course in areas not served by railway.

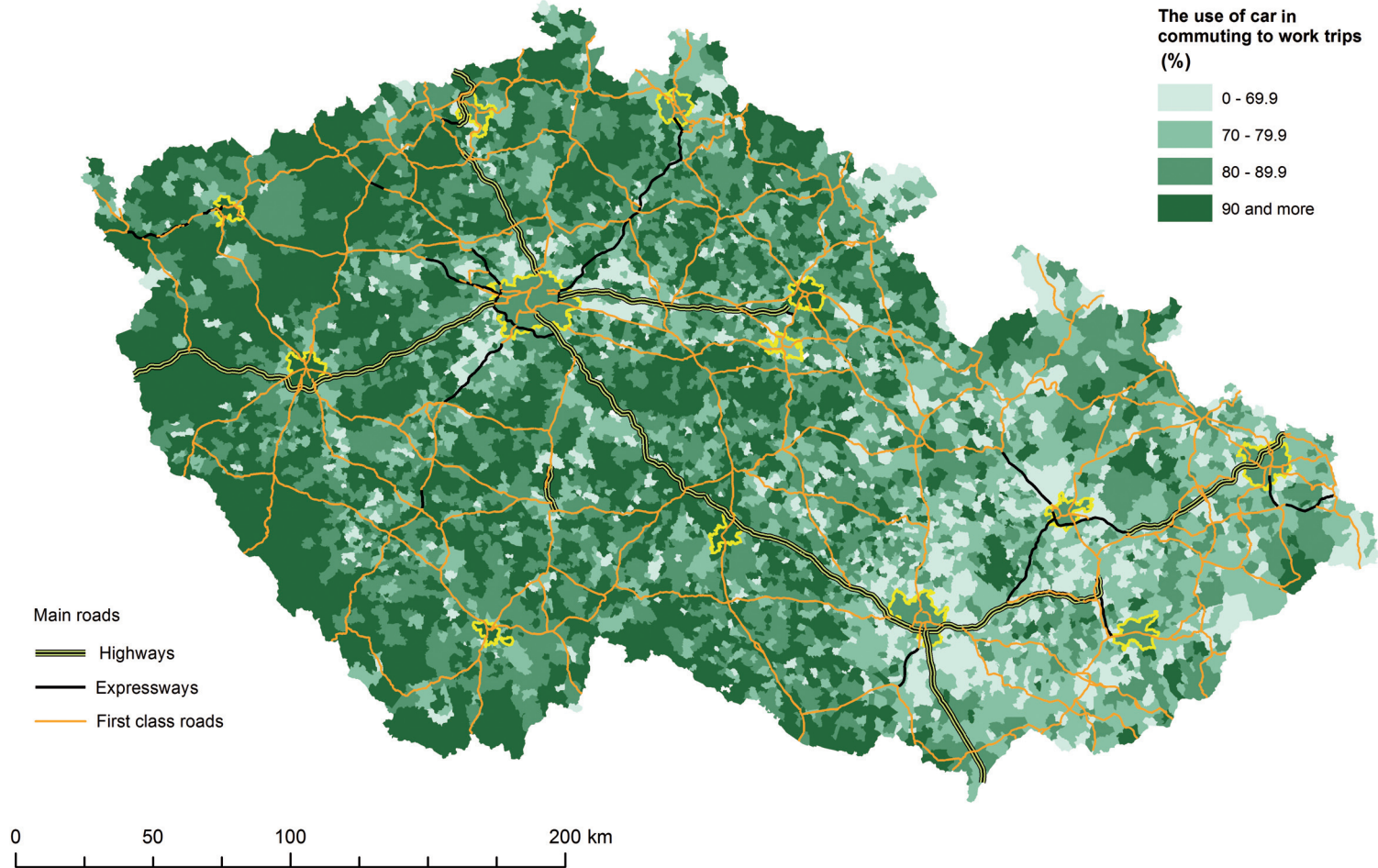
Virtually the same differentiation factors apply to the period 2011 (Fig. 7). Nevertheless, the general use of bus transport has decreased since 2001. The highest reduction of bus transport use has been noticed in western and central regions of the Czech Republic. In 2011 bus transport may be stated to only perform the role of an accessory transport mode in most parts of the country. The traditionally stronger position of bus transport has been retained in peripheral regions with lower automobilisation and worse socio-economic characteristics (such as Jeseník).

#### **Use of trains for commuting to work in the years 2001 and 2011**

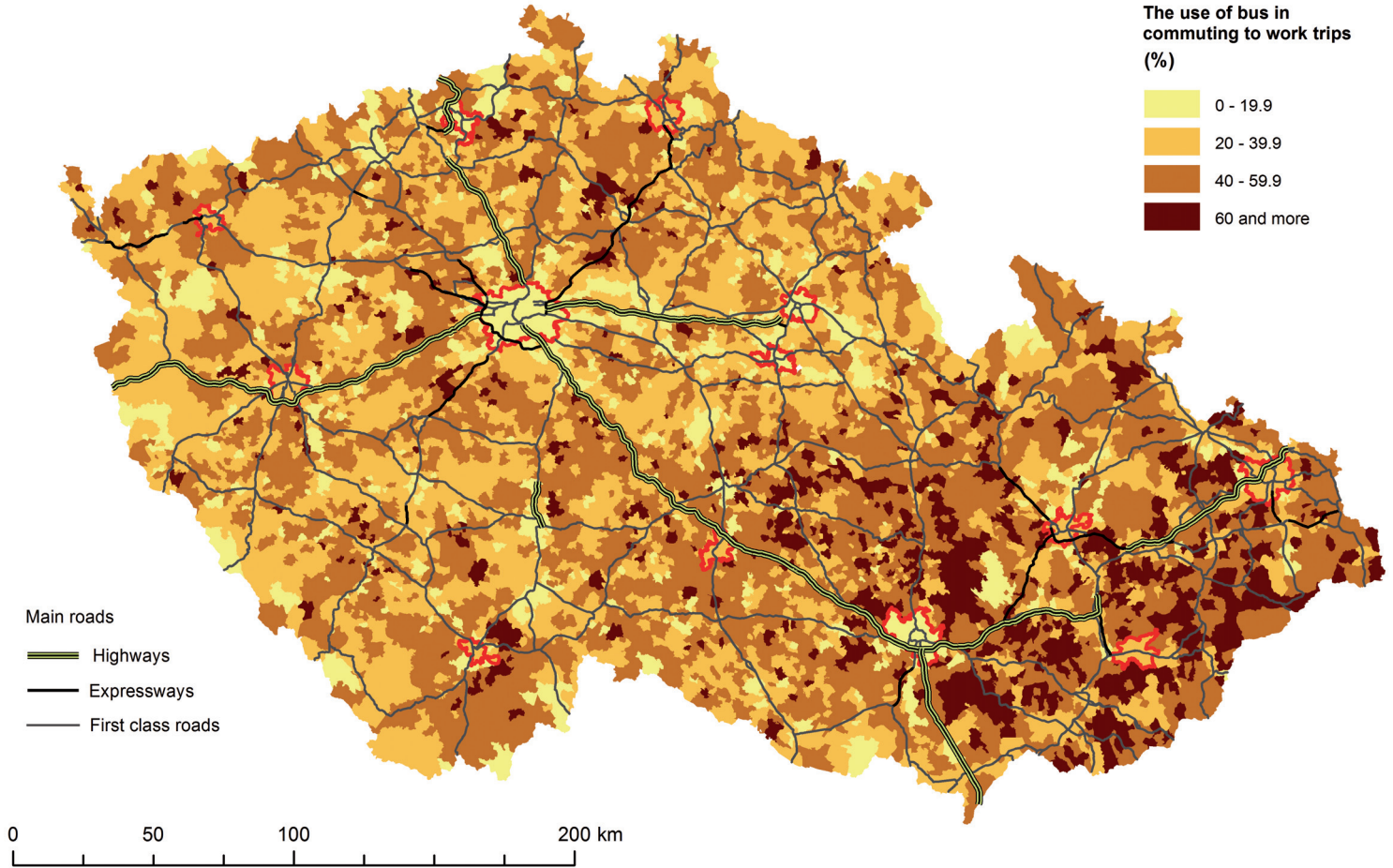
Unlike the previously mentioned transport modes, the level of railway transport use shows a clear linear arrangement (Fig. 8). Its use is strongly spatially selective. The basic limiting factor is the proximity of a railway route. There is also a significant influence of the hierarchy of railway lines. While the level of railway transport use is often higher than 50% in the case of the main railway lines with high train intensity, in the surroundings of less frequented railway lines the level of use of this transport mode often ranges only between 10-25%. A specific role was already performed by railway transport in 2001 in servicing suburban areas (such as of Prague, Brno or Olomouc). This trend was even stronger in 2011 (Fig. 9). Railway transport maintains stable or sometimes even growing trends in the Czech Republic, especially in servicing the suburbs of big metropolitan areas (Seidenglanz et al. 2014). Despite a certain reduction of its overall importance for commuters, this transport mode can be seen to record the least change in the intercensal period. The stable share of railway transport within the overall transport service is therefore one of the basic attributes of the current transport system of the Czech Republic, which is also evidenced by the data on transport performance of the individual transport modes (Transport Yearbook 2013).



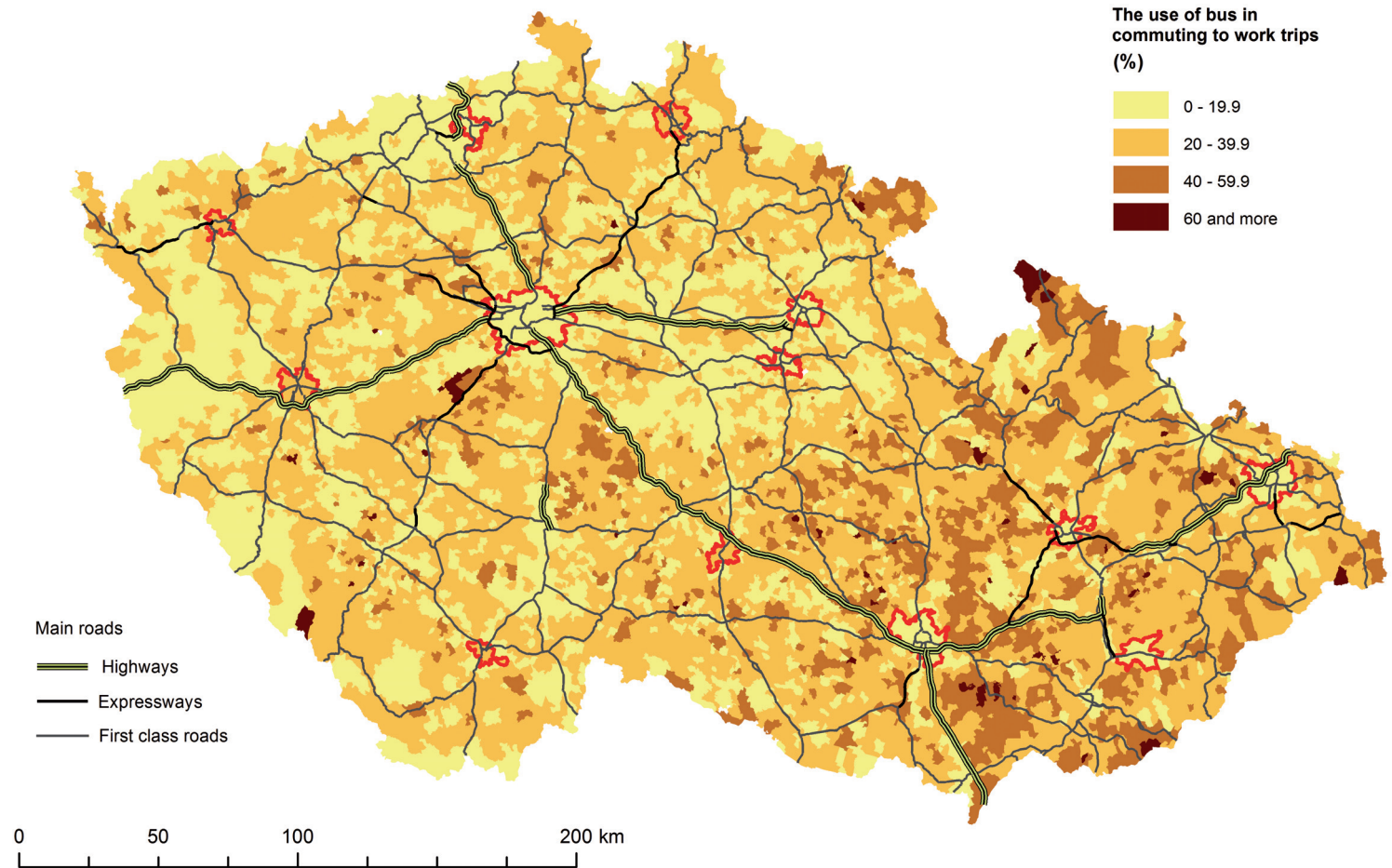
**Figure 4** The use of car in commuting to work trips (2001). Source: Population and Housing Census 2001, own processing.



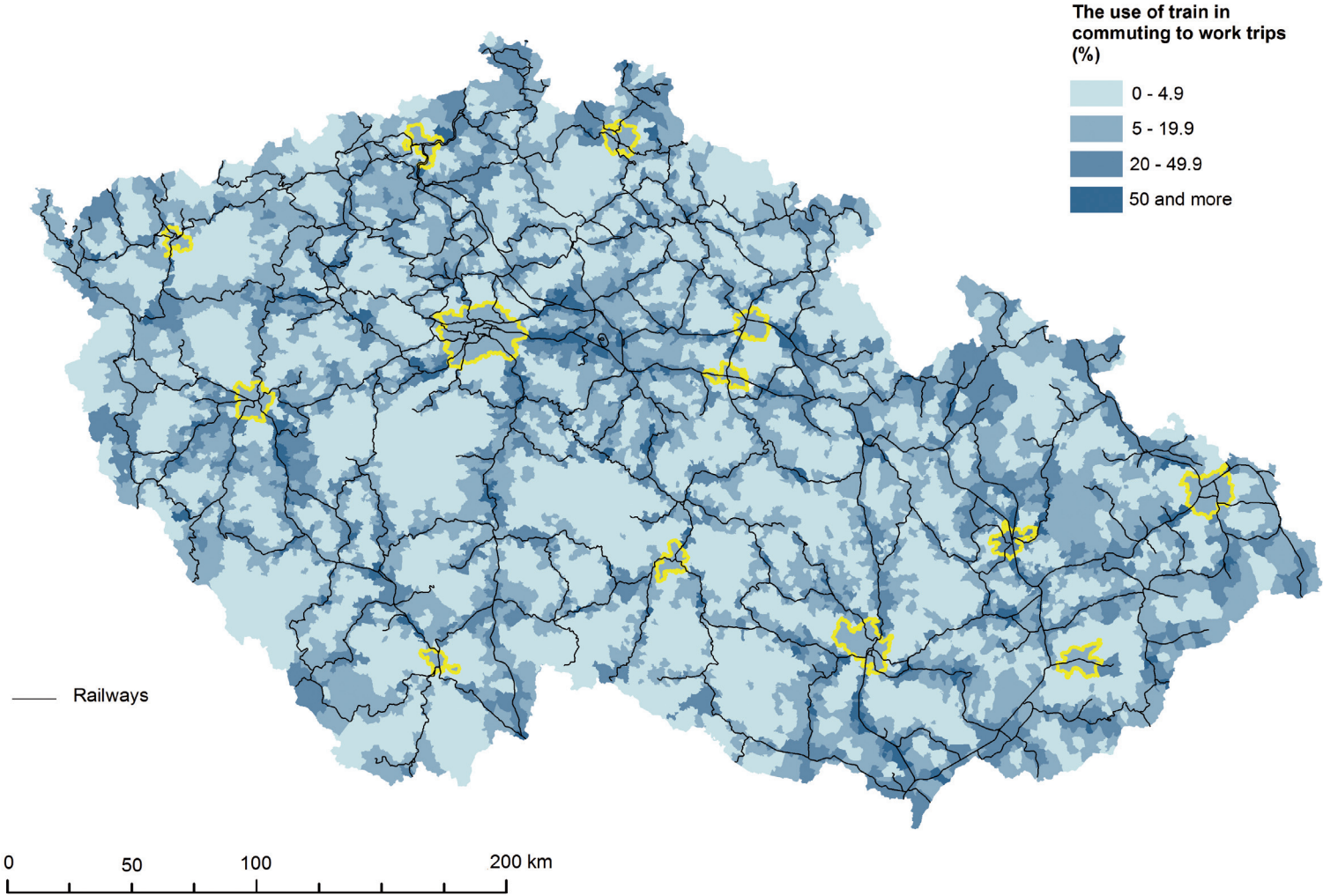
**Figure 5** The use of car in commuting to work trips (2011). Source: Population and Housing Census 2011, own processing.



**Figure 6** The use of buses in commuting to work trips (2001). Source: Population and Housing Census 2001, own processing.

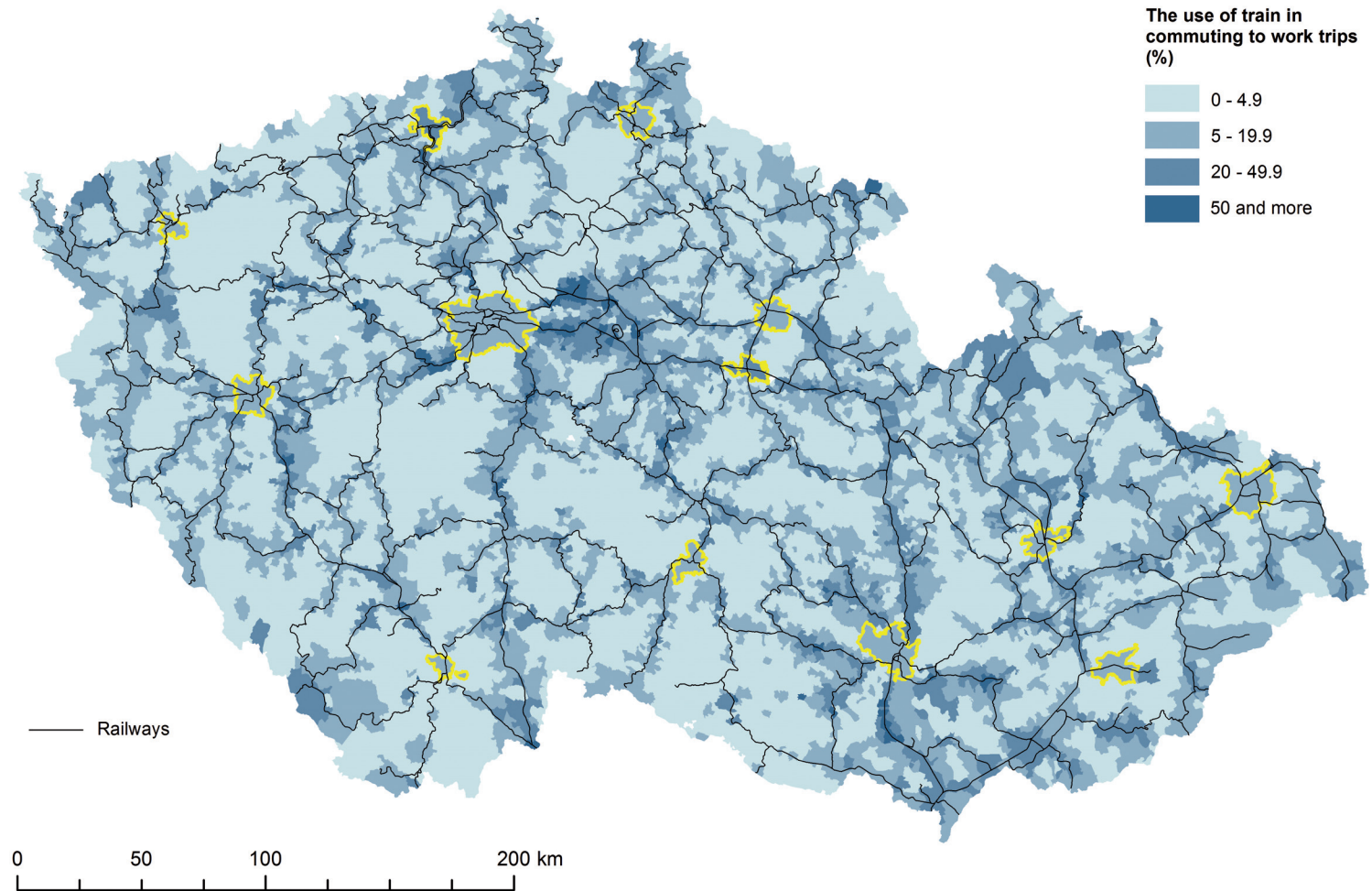


**Figure 7** The use of buses in commuting to work trips (2011). Source: Population and Housing Census 2011, own processing.

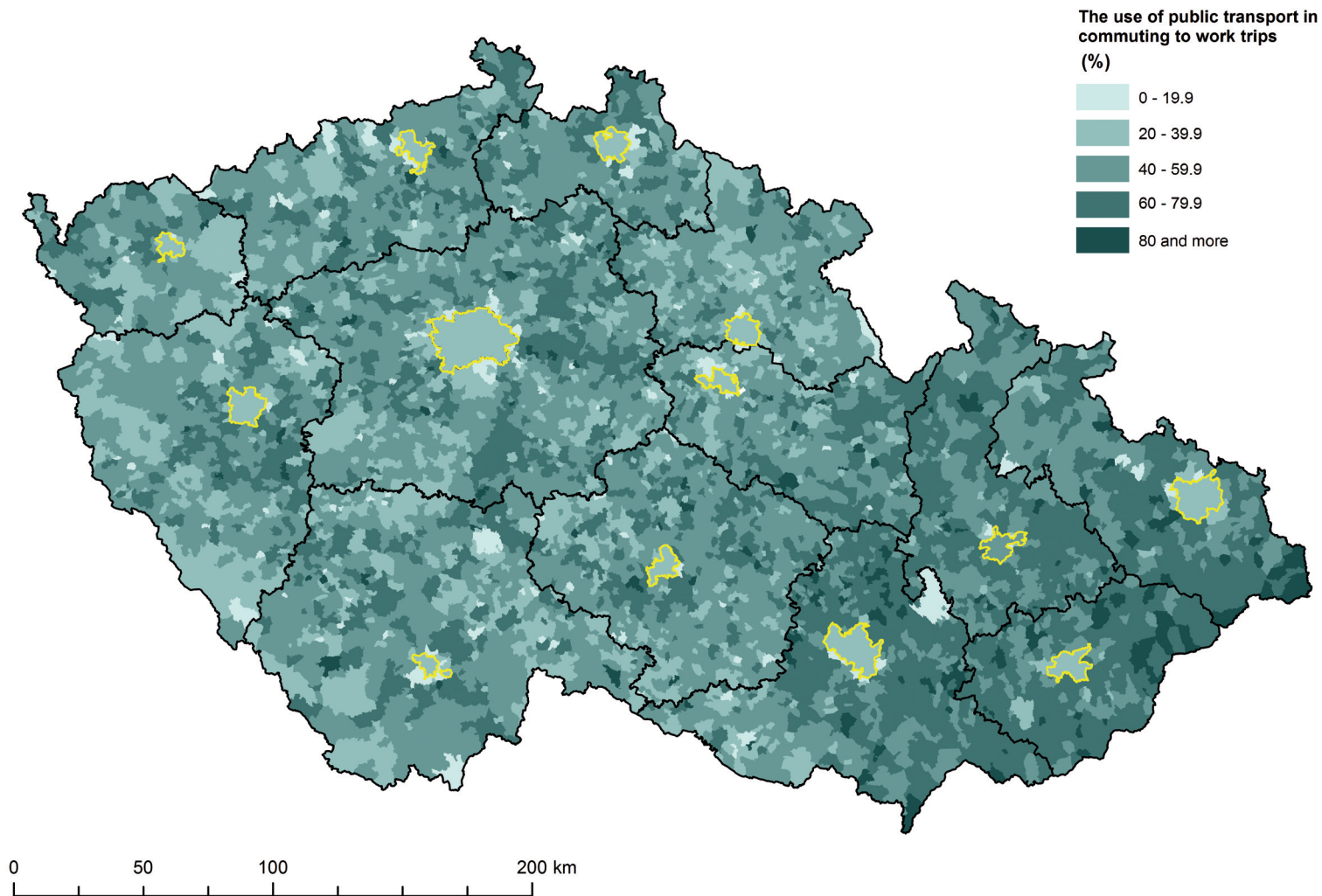


**Figure 8** The use of trains in commuting to work trips (2001). Source: Population and Housing Census 2001, own processing.

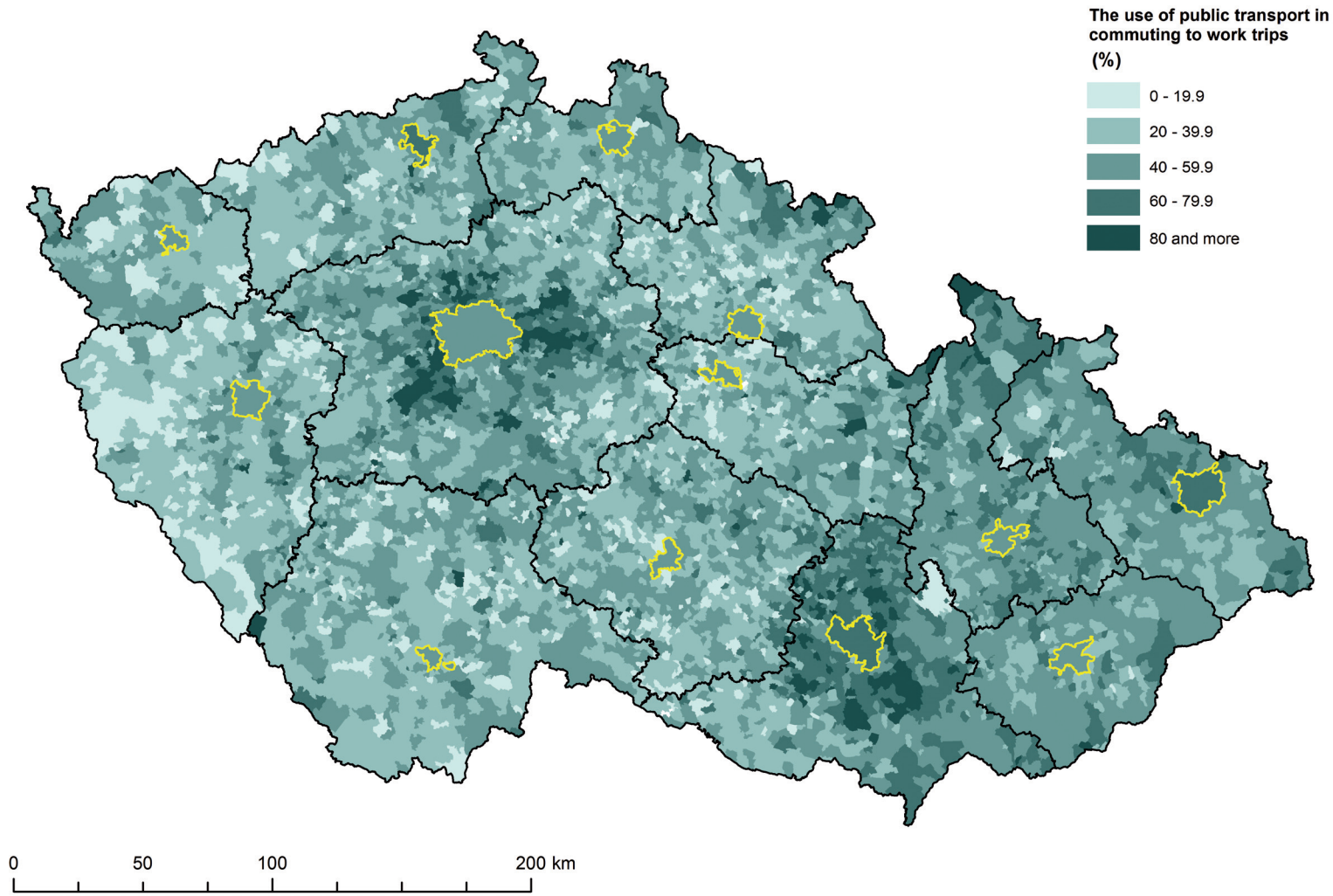




**Figure 9** The use of trains in commuting to work trips (2011). Source: Population and Housing Census 2011, own processing.



**Figure 10** The use of public transport in commuting to work trips (2001). Source: Population and Housing Census 2001, own processing.



**Figure 11** The use of public transport in commuting to work trips (2011). Source: Population and Housing Census 2011, own processing.

### **Use of public transport in general for commuting to work in the years 2001 and 2011**

Finally we tried to analyse the use of public transport as a whole in the years 2001 and 2011. The analysis was based on aggregated bus and railway transport data. As was shown in the previous analyses, these two transport modes are often complementary. With regard to this fact we consider it relevant to evaluate the changes in transport behaviour of the Czech population with consideration of the complementary use of public transport. The results are also important for all affected institutions studying conceptual and application options for the use of public transport in the regions. It is also necessary to note that in relation to the growing availability of passenger vehicles in the Czech Republic the relevance of public transport slowly keeps decreasing, which may entail a number of undesirable social, economic as well as environmental aspects.

The year 2001 (Fig. 10) is characterised by the west-east polarity of use of public transport. Basically the lowest use of public transport is again typical of western and central regions of the Czech Republic. Use of public transport increases in the eastward direction. The highest level of public transport use is seen in the easternmost parts of the country. Use of public transport in the east therefore often ranges between 60-80%. The key factors of this status include the already mentioned thesis on the different settlement structure of the regions, density of the railway and bus networks, economic advance of the regions as well as the lifestyle and specific transport behaviour of the population. Another relevant factor is the location of the municipalities from the transport point of view with, for example, municipalities lying on railway routes showing higher utilisation of trains in 2001. In 2011 different patterns of public transport use may be identified again (Fig. 11). The traditional difference between the eastern and western parts of the Czech Republic is newly overshadowed by another differentiation level – the relative transport position. This is more than ever before emphasised today by the introduction of integrated transport systems (Ivan and Boruta 2010). Therefore, in 2011 the use of public transport visibly increased in the suburban areas of big cities. The main reasons

for this can be seen in the spread of the integrated transport systems and other issues related to private vehicle transport in cities (lack of parking capacity, traffic congestion and related time losses, etc.). This situation is mainly clear in the surroundings of cities with established and well-functioning integrated transport systems (Prague and Brno). Some municipalities in these regions even showed a growth index higher than 130%. Traditionally relatively high levels of use of public transport are typical of peripheral regions of the Czech Republic with accumulation of more unfavourable socio-economic indicators (Jesenik etc.).

Synthetic evaluation of changes in spatial patterns of transport mode use in commuting to work is documented in Tables 2 and 3. However, we would like to repeat once again that the quantitative data are not absolutely comparable due to the difference in commuter records in 2001 and 2011 (see above). Despite this, in our opinion, it is still possible to identify the main changes in transport behaviour of the Czech population from the spatial perspective. The already mentioned high automobilisation of the rural areas of the Czech Republic is accompanied with a high level of use of automobile transport. Already in 2001 rural areas showed a relatively high level of use of private vehicles (42.8% of commuters), with a further increase of this indicator to nearly 72% in 2011. This *inter alia* documents a decreasing relevance and quality of public transport in rural regions. People are therefore often forced to use the spatially and temporally more flexible vehicles. Analogically a significant decrease of relevance of public transport from 52% to less than 39% may be observed. Due to the nature of the enumeration what may further be assumed is increased intermodal transport in the sense of P+R. Thus citizens of rural areas, often commuting across long distances to big cities, frequently use their vehicles to get to the city outskirts from where they continue to travel by public transport. The relatively low use of railway transport in rural regions is given by a lower railway network density in the rural areas. Interesting characteristics are shown in suburban areas. Due to the continuous spread of the trend towards suburban dwelling in the Czech Republic since the late 1990s, the results of 2001 cannot be considered absolutely

**Table 2** Transport mode use in different types of regions in 2001.

Source: Population and Housing Census 2001, Ouředníček et al. 2013, own processing.

Areas	Car	Public transport	Train	Bus
Rural	42.8	52.0	10.2	41.8
Suburban	40.8	50.7	12.0	38.8
Urban	38.2	49.8	16.6	33.3

**Table 3** Transport mode use in different types of regions in 2011.

Source: Population and Housing Census 2011, Ouředníček et al. 2013, own processing.

Areas	Car	Public transport	Train	Bus
Rural	71.7	38.7	7.2	25.7
Suburban	68.9	47.9	8.8	23.1
Urban	66.8	56.9	15.3	25.7

specific. Nevertheless, already in 2001 suburban areas tended to use passenger vehicles more than cities. This is logical as suburban dwelling is mostly sought by higher income groups where ownership of one or more vehicles per family is typical. The dominance of passenger vehicles was manifested in 2011 as well, when suburban areas recorded nearly 69% of commuters using a passenger vehicle as the dominant transport mode.

Urban areas are, on the other hand, rather characterised by a relatively lower use of automobile transport (38% in 2001 vs. 67% in 2011). In urban areas commuters' transport needs are more saturated by alternative transport modes. This is given by the existence of city transport, usually lower distances necessary for reaching the work site, and the existence of alternative transport modes. The most frequently used alternative transport mode in cities is bicycle, which is often used by up to 10% of commuters. Bicycle commuting performs a relatively important role in big cities with suitable morphological conditions (České Budějovice, Pardubice, Hradec Králové, Olomouc, Zlín). Public transport as a whole has been losing its position in all categories. More stability is shown by selective railway transport, while bus transport generally lost its position overall between the years 2001 and 2011. The

only exception is represented by urban areas where its relevance has increased. This again proves the relatively good function of public transport in cities, further supported by the deployment of integrated transport systems.

## CONCLUSIONS

The transport behaviour and spatial mobility of the population is an extremely complicated issue. In addition this category is highly individual for every person's transport behaviour and is affected by numerous influencing factors of both objective and subjective nature. The present study therefore did not aim at a detailed analysis of development of transport behaviour in the Czech Republic after 1989. On the other hand, its aim was to point out certain statistical sources which may be considered relevant for the overall evaluation of changes in the transport behaviour of the Czech population. The intention of the present study was implemented from the spatial perspective for we believe that transport behaviour is strongly related to the environment, thus showing clear geographical differences. These differences were followed by means of data of individual automobilisation of Czech municipalities in the years 2007 and 2014, and by means of data on transport mode usage by commuters as recorded by

censuses in 2001 and 2011. The main results can be summarised into the following main points:

- The Czech Republic is characterised by a traditional west-east gradient in passenger vehicle availability. Most registered passenger vehicles are recorded in cities. However, spatial evaluation by means of relative indicators clearly shows that municipalities situated in western and central parts of the Czech Republic show much higher levels of automobilisation than municipalities in the eastern parts of the country. The principal factors conditioning this status are seen in the different settlement structure of the regions, their economic advance, closeness of economically advanced foreign regions, cultural differences, etc. (compare to Marada et al. 2010). Comparisons of development dynamics reveal that eastern regions of the Czech Republic were characterised by higher dynamics in the years 2007-2014, with a still prevailing traditional west-east polarity pattern. High dynamics have newly been discovered in small rural (peripheral) municipalities where the passenger vehicle is often the only mode available allowing for the fulfilment of daily transport needs (including travels to services, leisure time travels, etc.).
- The west-east gradient is also visible in the use of individual transport modes in commuting to work. It is mainly true about the use of passenger vehicles. This characteristic significantly correlates with the results of the individual automobilisation analyses. While the use of automobile transport as the dominant transport mode is clear in western and central parts of the Czech Republic, eastern parts show increasing trends towards the use of public transport. However, in the context of developmental change assessment one can generally state that the relevance of public transport decreased overall between the years 2001 and 2011 with the accompanying growing dominance of passenger vehicle travel.
- Despite this, new differentiation levels have recently emerged and are beginning to affect the traditional west-east polarity in transport behaviour. Our findings have revealed that in urban and especially suburban areas the traditional use of a passenger vehicle has partly been reduced

in favour of a return to a higher level of public transport use. The results of the commuter census in 2011 show that the highest dynamic of public transport use has been demonstrated by regions which have integrated transport systems deployed. These systems by nature provide for the comfortable travel of citizens of suburban areas to the city centres by their set timetables, unified tickets for different transport modes, etc. In relation to increased transport problems in cities (parking, congestion and other problems), the effective intervention of local transport policy into the division of transport labour between individual and public transport have begun to be positively manifested.

Due to the above-declared complexity of transport behaviour this article only represents a baseline evaluation of spatial aspects in the transport behaviour of the Czech population. For a deeper understanding this theme must be addressed in a more complex and multidisciplinary manner. At the same time it is assumed that a detailed survey engaging a selected population sample will allow for better understanding of the transport behaviour of people in a greater overall aspect. In the first place we will focus on understanding the motives for transport mode selection, the main barriers to mobility of specific population groups and the social perception of mobility and transport under the transforming conditions of the Czech Republic.

#### Acknowledgment

This research was supported by Grant Agency of the University of South Bohemia (grant No. GA JU 162/2013/S).

#### References

- Adey, P. 2009: *Mobility*. Taylor&Francis.
- Boruta, T., Ivan, I. 2010: Public Transport in Rural Areas of the Czech Republic – Case Study of the Jeseník Region. *Moravian Geographical Reports*, 18 (2), 9-22.
- Chvátal, F., Kuchyňka, J., Muliček, O., Seidenglanz, D., Strnadová, D. 2011: Analýza dopravní obslužnosti v obcích ČR. In: *Dopravní obslužnost měst a regionů*.

- Dewi, A.** 2010: *Research on factors affecting travel behavior on choice of transportation means for working activity*. MA thesis, Karlstads University.
- Faist, T.** 2013: The mobility turn: a new paradigm for the social sciences? *Ethnic and Racial Studies* 36 (11), 1637-1646.
- Halás, M., Kladivo, P., Šimáček, P., Mintálová, T.** 2010: Delimitation of micro-regions in the Czech Republic by nodal relations. *Moravian Geographical Reports* 18 (2), 16-22.
- Hall, D.** 1993: Impacts of economic and political transition on the transport geography of Central and Eastern Europe. *Journal of Transport Geography* 1 (1), 20-35.
- HAMPL, M.** 2005: *Geografická organizace společnosti v České republice: transformační procesy a jejich obecný kontext*. UK v Praze, Praha.
- Hanson, S.** 2004: The Context of Urban Travel – Concepts and Recent Trends. In **Hanson, S., Giuliano, G.** eds. *The Geography of Urban Transportation*, The Guilford Press, New York, 3-29.
- Hornák, M.** 2006: Pozícia železničnej dopravy na Slovensku – stagnácia alebo úpadok? *Národohospodársky obzor* 6 (4), 16-24.
- Hornák, M., Rochovská, A.** 2014: Do mesta čoraz ďalej – dopravné vylúčenie obyvateľov vidieckych obcí Gemera. *Geographia Cassoviensis* 8 (2), 141-149.
- Hudeček, T.** 2008: Model časové dostupnosti individuální automobilové dopravy. *Geografie* 113 (3), 140-153.
- Hunecke, M.** 2000: *Ökologische Verantwortung, Lebensstile und Umweltverhalten*. Asanger, Heidelberg.
- Keeling, D.** 2007: Transportation Geography: new directions on well-worn trails. *Progress in Human Geography* 31 (2), 217-225.
- Knowles, R.** 2006: Transport shaping space: differential collapse in time-space. *Journal of Transport Geography* 14 (3), 407-425.
- Komornicki, T.** 2003: Factors of development of car ownership in Poland. *Transport Reviews* 23 (4), 413-431.
- Komornicki, T.** 2008: Changes of car ownership and daily mobility in selected Polish cities. *Geografický časopis* 60 (4), 339-362.
- Komornicki, T.** 2011: *Przemiany mobilności codziennej Polaków na tle rozwoju motoryzacji*. PAN IGiPZ, Warszawa.
- Korec, P.** 1994: System of Transport in Petržalka, its Function and Problems. *Acta Facultatis Rerum Naturalium Universitatis Comenianae. Geographica* 34 (1), 13-21.
- Körner, M.** 2010: Změny v dopravních vazbách a jejich vliv na dopravní infrastrukturu. *Urbanismus a územní rozvoj* 13 (5), 46-57.
- Kraft, S.** 2011: *Aktuální změny v dopravním systému České republiky: geografická analýza*. PhD. thesis, Department of Geography, Masaryk University, Brno.
- Kraft, S.** 2014: Daily spatial mobility and transport behaviour in the Czech Republic: Pilot study in the Písek and Bystřice nad Pernštejnem regions. *Human Geographies - Journal of Studies and Research in Human Geography* 8 (2), 51-67.
- Kraft, S., Marada, M., Popjaková, D.** 2014: Delimitation of nodal regions based on transport flows: case study of the Czech Republic. *Quaestiones Geographicae* 33 (2), 139-150.
- Květoň, V., Chmelík, J., Vondráčková, P., Marada, M.** 2012: Developments in the public transport serviceability of rural settlements with examples from various types of micro-regions. *AUC – Geographica* 47 (1), 51-63.
- Kvizda, M., Seidenglanz, D.** 2014: Out of Prague: A week-long intermodal shift from air to rail transport after Iceland's Eyjafjallajökull erupted in 2010. *Journal of Transport Geography* 37 (2), 102-111.
- Marada, M.** 2006: Dopravní vztahy v Pražském městském regionu. In **Ouředníček, M.** ed. *Sociální geografie Pražského městského regionu*, 64-78.
- Marada, M., Květoň, V., Vondráčková, P.** 2010: *Doprava a geografická organizace společnosti v Česku*. Česká geografická společnost, Geographica, Praha.
- Novák, J., Temelová, J.** 2012: Každodenní život a prostorová mobilita mladých Pražanů: pilotní studie využití lokalizačních dat mobilních telefonů. *Sociologický časopis* 48 (5), 911-938.
- Nuhn, H., Hesse, M.** 2006: *Verkehrsgeographie – Grundriss, Allgemeine Geographie*. Paderborn.
- Ouředníček, M., Špačková, P., Novák, J.** 2013: *Metodika sledování rozsahu rezidenční suburbanizace v České republice*. Ministerstvo životního prostředí České republiky, Praha.

- Pucher, J.** 1999: The Transformation of Urban Transport in the Czech Republic, 1988-1998. *Transport Policy* 6, 225-236.
- Rodrigue, J.-P., Comtois, C., Slack, B.** 2006: *The Geography of Transport Systems*. Routledge, New York.
- Savage, M.** 1988: The missing link? The relationship between spatial mobility and social mobility. *The British Journal of Sociology* 39 (4), 554-577.
- Schwanen, T., Dijst, M., Dieleman, F.M.** 2001: Leisure Trips of Senior Citizens: Determinants of Modal Choice. *Tijdschrift voor Economische en Sociale Geografie* 92, 347-360.
- Seidenglanz, D.** 2007: *Dopravní charakteristiky venkovského prostoru*. PhD. thesis, Department of Geography, Masaryk University.
- Seidenglanz, D., Chvátal, F., Nedvědová, K.** 2014: Comparison of Urban and Suburban Rail Transport in Germany and in the Czech Republic. *Review of Economic Perspectives* 14 (2), 165-194.
- Sýkora, L.** ed. 2002: *Suburbanizace a její sociální, ekonomické a ekologické důsledky*. Ústav pro ekopolitiku, Praha.
- Šťasná, M., Vaishar, A., Stonawská, K.** 2015: Integrated Transport System of the South-Moravian Region and its impact on rural development. *Transportation Research Part D: Transport and Environment* 36, 53-64.
- Temelová, J., Novák, J., Pospíšilová, L., Dvořáková, N.** 2011. Každodenní život, denní mobilita a adaptační strategie obyvatel v periferních lokalitách. *Sociologický časopis / Czech Sociological Review* 47 (4), 831-858.
- Urbánková, J., Ouředníček, M.** 2006: Vliv suburbanizace na dopravu v Pražském městském regionu. In **Ouředníček, M.** ed. *Sociální geografie Pražského městského regionu*. Praha, 79-95.
- Vlček, I.** 1964: Dopravní spojení venkovských sídel se středisky. *Geografie* 69 (3), 200-212.
- Urry, J.** 2007: *Mobilities*. Polity Press, Cambridge.

*Data sources:*

- Central Vehicle Register  
Population and Housing Census 2001  
Population and Housing Census 2011

## Résumé

### Prostorové aspekty dopravního chování v České republice po roce 1989

Politická, ekonomická a společenská transformace po roce 1989 v České republice i v dalších bývalých socialistických státech vyvolala celou řadu změn. Tyto změny se dotkly drtivě většiny jevů a procesů vázaných na společnost. Jedním z odvětví, které bylo těmito transformačními procesy ovlivněno relativně nejvíce, byl sektor dopravy. Transformace dopravních systémů v postsocialistických státech se tak stala jedním z klíčových témat výzkumu nejen dopravních geografů. Hlavní pozornost výzkumů byla zaměřena především na jevy a procesy, které bezprostředně souvisely s transformací dopravy (redukce veřejné dopravy, růst významu individuální automobilové dopravy apod.). Menší pozornost však byla věnována komplexnějším otázkám dopravy a mobility obyvatel. Příkladem může být absence výzkumu dopravního chování z pohledu geografie. Výzkumu tohoto fenoménu se začala věnovat pozornost až v relativně nedávné době.

Hlavním cílem článku je analýza prostorových aspektů dopravního chování v České republice v kontextu postsocialistické transformace. V analytické části je proto pozornost zaměřena na dva podstatné aspekty dopravního chování – individuální automobilizaci a volbu dopravního prostředku. Jedná se o komplexnější kategorie dopravy, které jsou klíčové pro pochopení klíčových změn a aktuálních trendů ve vývoji celého odvětví dopravy. Kromě dalších významných specifíků je zároveň důležité, že oba sledované fenomény vykazují celou řadu prostorových specifíků a pravidelností. Analýza prostorových aspektů dopravního chování je proto klíčová pro pochopení důsledků postsocialistické transformace a současných vývojových trajektorií v prostorové mobilitě obyvatel v České republice.

Vzhledem k absenci některých datových podkladů využíváme pro analýzu dopravního chování v České republice data z centrálního registru vozidel České republiky spravovaného Ministerstvem dopravy ČR a Ministerstvem vnitra ČR. Na úrovni jednotlivých obcí jsou dostupné informace až od roku 2007.



Tento rok byl proto stanoven jako výchozí. Druhým sledovaným časovým horizontem pak byl rok 2014, který odráží současný stav. Byť se tedy jedná o poměrně krátkou časovou periodu, domníváme se, že v ní lze identifikovat důležité prvky změn v současném dopravním chování české populace. Druhým používaným zdrojem dat jsou pak data o dojížděcí obyvatel za prací ze SLDB 2001 a 2011. Byť se informace o volbě dopravního prostředku vztahují pouze k dojížděcí obyvatel za prací a do škol, považujeme je za dostatečně informativní. Ve druhé části jsou proto analyzovány prostorové změny v dopravním prostředku využitém při dojížděcí obyvatel za prací mezi roky 2001 a 2011.

Z hlediska prostorové diferenciaci stupně individuální automobilizace lze potvrdit obecněji známé skutečnosti o vyšší automobilizaci regionů českých než moravských. Míra individuální automobilizace obcí vyjádřená počtem registrovaných osobních automobilů na 10 trvale žijících obyvatel totiž vykazuje zřetelnou západovýchodní polaritu. V České republice existuje tradiční západovýchodní gradient vybavenosti osobními automobily. Absolutně nejvíce registrovaných aut se nachází ve městech. Při prostorovém hodnocení pomocí relativních ukazatelů se však jasně ukazuje, že obce ležící v západních a centrálních částech České republiky vykazují mnohem vyšší míry automobilizace než obce ležící ve východních částech. Hlavní podmiňující faktory vidíme v rozdílech v sídelní struktuře regionů, ekonomické vyspělosti, blízkosti vyspělých sousedních regionů, kulturních diferencích apod. (srovnání s Marada et al. 2010). Z hlediska srovnání dynamiky vývoje se ukazuje, že východní části České republiky vykázaly v letech 2007 až 2014 vyšší dynamiku, nicméně tradiční vzorec západovýchodní polaritě přetrvává. Nově se začíná ukazovat, že vysoká dynamika je rovněž v menších venkovských (periferních) obcích, kde je osobní automobil často takřka jedinou možností realizovat své každodenní potřeby (včetně dojížděcí za službami, cestování v rámci volného času apod.).

Západovýchodní gradient je patrný i ve využívání jednotlivých dopravních prostředků při dojížděcí za prací. Zřejmý je zejména u využívání osobních automobilů. Tato charakteristika významně koreluje

s výsledky stupně individuální automobilizace. Zatímco využívání automobilové dopravy jako dominantního dopravního módu je zřejmé v západních a centrálních částech České republiky, východní části pak vykazují zvýšenou míru využívání veřejné dopravy. V kontextu hodnocení vývojových změn lze však poznamenat, že mezi roky 2001 a 2011 došlo k významnému snížení role veřejné dopravy a růstu dominance osobních automobilů.

Přesto se ukazuje, že v posledním období dochází ke vzniku nových diferenciálních rovin, které tradiční západovýchodní polaritu v dopravním chování začínají ovlivňovat. Podle našich zjištění lze totiž v městských a zejména suburbánních regionech pozorovat obrat od tradičního využívání osobního automobilu zpět k relativně vyššímu využívání veřejné dopravy. Na základě výsledků dojížděcí obyvatel za prací z roku 2011 totiž vykazují nejvyšší dynamiku využívání veřejné dopravy zejména regiony, které jsou součástí integrovaných dopravních systémů. Ty ve své podstatě poskytují komfortní cestování obyvatel z příměstských oblastí do měst v podobě taktového jízdního řádu, jednotné jízdenky na různé dopravní módy atd. V souvislosti s růstem dopravních problémů ve městech (problémy spojené s parkováním, kongescí apod.) se tak začínají pozitivněji projevovat účinné zásahy lokální dopravní politiky do dělby přepravní práce mezi individuální a veřejnou dopravou.

---

**Article received** October 14, 2014

**Accepted for publication** November 20, 2014

**Please cite this article as**

Kraft, S., Prener, J. 2014: Spatial aspects of transport behaviour in the Czech Republic after 1989. *Acta Universitatis Palackianae Olomucensis, Facultas Rerum Naturalium, Geographica* 45 (2), 53–77.

**Article available on-line at**

<http://geography.upol.cz/geographica-45-2a>