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GEOGRAPHICAL ORGANIZATION OF THE TRANSPORT SYSTEM IN CZECHIA AND ITS DEVELOPMENT IN THE TRANSFORMATION PERIOD

S. Kraft, M. Vančura: *Geographical organisation of the transport systém in Czechia and its development in the transformation period.* – Geografie–Sborník ČGS, 114, 4, pp. 298–315 (2009). – The article deals with the geographical organization of the Czech transport system and with the changes in the transport hierarchy of settlement centres of Czechia during the transformation period. This paper focuses on long-term development tendencies in the transport hierarchy of settlement centres development, which create the basic framework for further research. It also considers changes of significance and structure in the transport hierarchy of settlement centres between 1990 and 2005 with regard to the trends in the development of the transport sector. The analyses mainly result from the Road transport census and are focused only on changes in the transport system of Czechia at the national level.

KEY WORDS: transport system – transport hierarchy – road transport – transformation period.

1. Introduction

The spatial structure research of transport systems is one of the most fundamental research topics in transport geographical studies. In these studies relationships between transport and the spatial organization of society are usually monitored using hypothesis, that transport and transport interactions reflect general trends in society, mainly in its spatial organization (see e.g. Řehák 1988; Knowles, Hoyle 1998; Keeling 2007 or Marada 2008). The development of this spatial structure is studied less frequently, which enables the demonstrations of this relationship over a long time perspective. The political change of Czechia after the year 1989, brought about many consequentially significant changes in society, which were reflected in many geographical phenomena. As a result there was a formation of a new research paradigm, which can be described as a study of the geographical impacts of social transformation (see discussion in Rodrigue et al. 2006; Nuhn, Hesse 2006; Keeling 2009).

Transport is a crucial economical sector, which is very important for contemporary society and its development. Present society in advanced countries may be characterized as highly mobile and from this point of view dependent on transportation. Like other social-geographic systems, the transport system of Czechia is passing through fundamental quantitative and qualitative changes in its spatial organization, which are related to post-socialistic transformation. These changes are closely interconnected and current changes in the transport system are to some extent connected with simultaneous changes in settlement patterns of Czechia. The major changes in the settlement patterns organiza-

tion can be generally characterized by concentration and deconcentration of population, job opportunities and services (e.g.: Carter 1995; Giuliano 1998; Hanson 2004; Nuhn, Hesse 2006; Hampl 2005). All of these processes are crucial for changes in spatial patterns of human behavior and therefore also for changes in spatial patterns of the Czech transport system. It can be expected that simultaneous changes in geographical organization of society during the transformation period are closely related to changes in geographical organization of the surveyed transport system at all geographical scales, from local to macro-regional scale.

The main aim of this paper is a geographical analysis of changes in the transport hierarchy of Czech settlement centres during the transformation period. Although this research deals only with some parts of the post-socialistic transformation problem and changes in the transport system of Czechia, its main contribution is the geographical interpretation of changes in the Czech transport system. The topic of this paper was influenced by the absence of empirical research of spatial organization of road transport in Czechia and at the same time by the absence of the evaluation of this transport mode in relation to the hierarchy of settlements centres of Czechia. The basic research questions are focused mainly on the questions related to the development of the transport hierarchy of settlement centres in relation to the size hierarchization; on the changing role of settlement centres in terms of the concentration of transport flows and on selective changes in the structure of transport flows of particular centres concerning their horizontal and vertical differentiation. Some of these research topics were already studied by some Czech transport geographers (Hůrský 1978; Víturka 1981; Rölc 2001; Marada 2003, Horňák 2005), but there was no study focused on these topics in the context of post-socialistic transformation.

The partial themes of this research result from the previously mentioned research questions. The analytical part of this paper concentrates on the long-term tendencies in the transport hierarchy of Czech settlement centres development, which creates the basic framework for further evaluations. Within this research the size hierarchization of surveyed settlement centres will be monitored according to hierarchical order and according to the development of this hierarchy in the pre-transformation and post-transformation period. Special attention will be paid to the changes in concentration processes of transport in the monitored centres. The second part of the analytical chapter gives detailed analysis of changes in the transport hierarchy of the settlement centres between 1990 and 2005, which determine the initial and the final phase of the transformation period in Czechia. The analyses are focused mainly on the differentiation of the significance of the monitored centres in terms of their transport importance. The last part of this paper is aimed at the development of transport typology of settlement centres, which would be based on proportional changes in different road transport modes.

Transport is a result of growing spatial mobility, hence we can suppose especially similar tendencies in the transport and settlement hierarchy development (see Hampl et al. 1987, Hampl 2005). It can be expected namely the growing transport dominance of the greatest settlement centres in the nature of their growing complex importance (concentration of job opportunities and services). Regarding to chosen methodology we can then expect distinctive influence of transport sizes by the location of monitored centres in road transport network. In terms of the structural changes in transport hierarchy can be expected the growing share of car transport in all monitored centres and more

distinctive concentration of truck transport into the lower number of surveyed centres.

2. The Importance of Transport in Space and Spatial Structure – theoretical background

Transport is a multidisciplinary object of study of different sciences. Traditionally transport is studied by technical, economical and social sciences. Transport is also a multidimensional activity, the importance of which is in its historical, social, political, environmental and economical perspective (Rodrigue et al. 2006). A few basic models were created based on the relationship between transport and spatial structure. All of these models were created on the basis of observation in countries with different level of transport and settlement systems (e.g. Ghana, Nigeria etc.). The usage of these models in contemporary transport system is thus limited. The most well-known are the Vance model; the Rimmer model and the more complex Taaffe model, which are based on the six stage development of transport networks and related urban hierarchy (see Hoyle, Smith 1998). The Taaffe's model has been modified many times. Modification to European conditions was made by e.g. J. Brinke, who defined four stages in the development of transport networks: localized connections stage, integration stage, intensification stage and selection stage (Brinke 1999).

Transport significantly shapes the space and spatial structure. The relation between transport and spatial structure can be viewed at three main geographical levels; the global, the regional and the local level (Rodrigue et al. 2006). At the global level transport shapes mainly the formation of international trade and economic specialization of regions. The role of transport at the global level is to interconnect the main world economical centres and also to connect them with their subordinate centres. At the hierarchical level transport flows are supported mainly by air transport or maritime transport. The relations between transport hierarchy and spatial structure on a global scale were studied by e.g. Derudder and Witlox (2009); Graham (1995); Seidenglanz (2008) or O'Connor (2003). The regional level is often comprehended as a national level and the attention is focused on the interconnection of cities within the urban systems. This level is used most frequently in the research of the transport hierarchy. Road or railway transportation, the dominance of which is very strong at the regional level, supports these interactions. The relations between transport and spatial structures in terms of transport hierarchy were studied at this level mainly by Yerra et al. (2007); Hůrský (1978) or Marada (2003, 2008). The different nature of transport interactions is typical for the local level, which is often focused on transport flows in the environment of urban regions and particular cities. These studies are focused not only on human spatial mobility processes (e.g.: Pucher 1999; Hanson 2000) but also on urban transport networks and their hierarchies (Korec 1996).

3. Research methods

In this chapter different approaches to the study of changes of transport hierarchy are discussed. The above mentioned discussion proved relatively close relations between transport and settlement system. The research methods thus

result from transport geography and also from settlement geography. Because this paper is focused only on the significance transport changes in the whole settlement centres system of Czechia in the transformation period, primarily quantitative methods are used for their analyses. Qualitative methods could be used on lower hierarchical levels, for example in the study of micro-regional changes during the reorganization of transport flows in the environment of urban regions (see methods e.g. by Giuliano 1998; Hanson 2004; Muller 2004; Marada 2006; Bruegmann 2008). During the study of the transport hierarchy of settlement centres and its development two main methodological problems occurred. The first problem was the selection of surveyed centres and the second was the selection of transport indicators appropriate for their hierarchization (similarly Viturka 1981; Marada 2003).

Generally a few approaches on how to specify centres for transport geographical analyses could be used. One of the most frequently used approaches is determination of centres based on partial quantitative transport features (e.g.: Řehák 1982; Kozanecka 1980; Derudder, Wittlox 2009) and on complex transport sizes (Hůrský 1978). These authors argue that only a satisfactory number of transport characteristics (e.g.: the number of public transport links or road traffic intensity) are a suitable indicator for the determination of transport centres. The main problem resulting from this approach is the fact that some centres may have a good transport location and so a sufficient number of transport characteristics but their complex value can be sometimes lower. On the contrary, some centres can be situated in a worse transport location and so have an insufficient number of transport characteristics, however their complex value can be higher. Therefore some authors use more comprehensive indicators in their transport geographical studies (see discussion in Rivasplata 2001). The centres researched in this study are taken from Hampl's socio-geographical regionalization of Czechia from 2001 (Fig. 1). Hampl (2005) selected 144 centres at least of micro-regional importance according to their complex

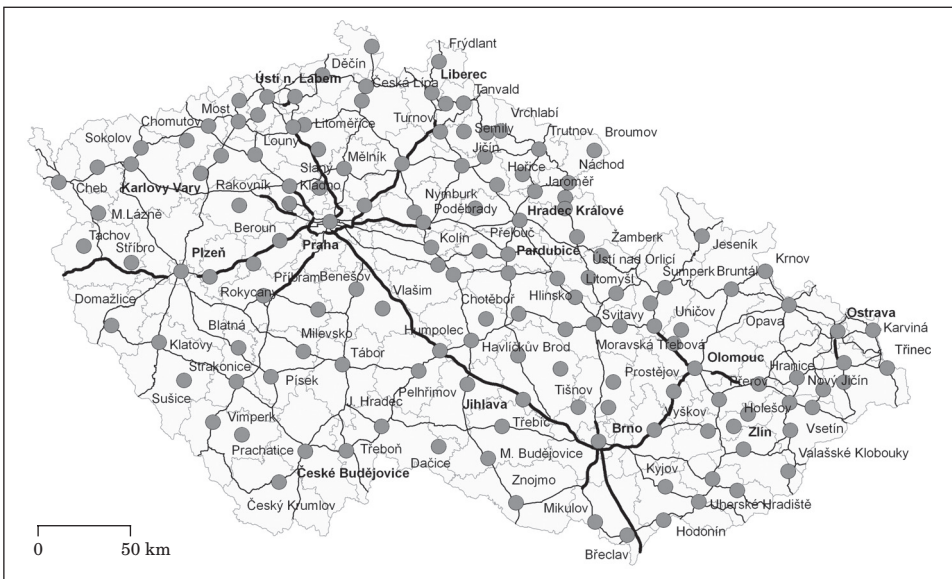


Fig. 1 – Surveyed centres and their location in road networks (2001)

size index. The complex size index is an aggregated indicator based on the residential and labour functions of these centres.

The second methodological problem results from the above mentioned availability and reliability of the used data. The study is focused on the dynamics of the road transport system in Czechia in the transformation period and its relation to the settlement system organization. Unfortunately, there are no comprehensive and detailed surveys of people mobility in Czechia (see e.g. National Travel Survey in Great Britain). Therefore transport geographers usually use the number of public transport connections (Hůrský 1978; Marada 2003; Seidenglanz 2007), or less often they use road transport intensity (Viturka 1975). Regarding the most important transport mode in Czechia we use data from the road transport census conducted every five years by the Road and Motorway Directorate of the Czech Republic. These data are sums of total transport volume (trucks, cars, motorcycles) measured at census points situated on most Czech roads. The transport importance of every centre is expressed by the transport size indicator, which is an average number of vehicles entering or departing the residential area of centres in 24-hour period. Dynamical building of by-pass roads by many settlement centres, perceptible namely by the Road transport census in 2005, causes lower possibility to compare both monitored years. There was chosen the status of road transport network in 1990 as the initial status, always in the light of maximal comparison of transport sizes of centres by all monitored years. The greatest weakness of this transport census is the inability to identify which amount of the total number of traffic is made up of transit transport and which amount is made up of the “real” local transport among centre and its hinterland. The amount of transit transport by centres is influenced mostly by their transport location and their complex importance (see discussion in Hůrský 1978 or Viturka 1975). The lowest amount of transit transport can be expected by the greatest settlement centres (terminal points of the majority of travels) and the smallest centres, which are mostly located in worse transport location. Conversely, the highest share of transit transport we can suppose by the mid-size centres category (relatively good transport location, but lower complex importance). In terms of the dynamics of this amount we can emphasize the growing importance of the transport location of Czechia in the middle Europe. Thus, it can be expected the growing amount of the transit transport namely by the centres located on the main road transport axis.

In this study data from road transport censuses from 1980, 1985, 1990, 1995, 2000 and from the last transport census in 2005 are analysed according to all available categories (trucks, cars, motorcycles and all road transport volumes) to illustrate basic tendencies of the transport hierarchy development in pre-transformation and post-transformation time. The database was provided by the Road and Motorway Directorate of the Czech Republic. The basic indicator for the evaluation of the transport size of centres is a relative transport value, which reflects the sum of all transport volume entering or departing the centre (all centres – 10,000). The qualitative changes in transport hierarchy of the surveyed settlement centres system are also analysed. Long-term tendencies and changes in the transport hierarchy of settlement centres are evaluated using the size hierarchization and by its comparison with the rank-size rule, which can serve as a reference model for distinguishing the level of hierarchization (Marada 2008).

4. Results

4.1. Long-term tendencies in transport hierarchy development

The present state of road transport and its geographical organization in Czechia is a result of the long-term emergence of this transport mode, from the geographical perspective mainly in relation to the size hierarchization and to concentration of transport in monitored centres. To describe the general patterns between transport and geographical organization of society, road transport censuses from 1980s to the present were analysed. These data were further completed with the data from Viturka's study (1975) analyzing hierarchical organization of road transport according to the road transport census from the year 1973. Special attention is paid to the size hierarchization of the monitored centres according to all available road transport modes (truck transport, car transport and other transport) regarding the evaluation of which road transport mode is hierarchically more progressive and which mode is conversely more spatially and hierarchically dispersed. The size hierarchization of the first 98 centres related to rank-size rule according to all road transport modes is demonstrated in Table 1.

Size hierarchization of the surveyed centres according to the total transport value demonstrates some basic tendencies in the development of the transport hierarchy from a long term point of view. First, it is necessary to refer to the constantly growing hierarchization of the monitored centres according to their relative transport size. The centres according to the complex size are much more hierarchically developed, which is a result of the difference between complex and transport size. The reason is mainly the fact that traffic flows are less concentrated in space than population or job opportunities. The comparison of

Tab. 1 – Size hierarchization of surveyed centres according to all road transport modes

Categories (order of centres)	Relativized sizes (First centre = 100)									
	Complex size		Relative transport size							
	1991	2001	1973	1980	1985	1990	1995	2000	2005	Index 2005/ 1980
1.	100	100	100	100	100	100	100	100	100	100.0
2.–4.	83	74	120	119	109	128	129	124	106	89.1
5.–12.	50	49	194	199	184	202	208	187	171	85.9
13.–34.	93	85	400	397	368	393	385	324	289	72.8
35.–98.	112	104	783	711	650	731	668	553	475	66.8
DH	89.3	92.1	18.6	19.8	20.5	20.3	21.8	25.5	26.9	135.9

Source: Viturka (1975); Hampl (2005), Road Transport censuses 1980–2005

Notes: 1. Degree of hierarchization (DH) = 100 times [(size of the 1st–4th centre) / (size of the 13th–98th centre)]. The degree of hierarchization indicator demonstrates the size of the largest centres in proportion to the size of middle and small centres. Values lower than 100 correspond to a lower degree of hierarchization than presumed by the rank-size rule, values higher than 100 correspond to a higher degree of hierarchization.

2. The data relating to the transport census from 1973 are taken from Viturka's study (1975). This study was made using different methodology. The possibility to compare these data with other data is therefore lower.

Tab. 2 – Size hierarchization of surveyed centres according to truck transport

Categories (order of centres)	Relativized sizes (First centre = 100)								
	Complex size		Relative transport size						
	1991	2001	1980	1985	1990	1995	2000	2005	Index 2005/ 1980
1.	100	100	100	100	100	100	100	100	100.0
2.–4.	83	74	162	145	157	147	124	112	69.1
5.–12.	50	49	264	221	250	249	173	169	64.0
13.–34.	93	85	507	423	460	427	307	288	56.8
35.–98.	112	104	900	764	853	733	473	429	47.7
DH	89.3	92.1	18.6	20.6	19.6	21.3	28.7	29.6	159.1

Source: Hampl (2005), Road Transport censuses 1980–2005

Note: DH = Degree of hierarchization

complex and transport hierarchy reveals different features of both the indicators. Hierarchization of a complex size in all monitored years shows that only the last size category (35th–98th centre) is in its size equivalent to the dominance of the first centre (Praha). Other categories are hierarchically underdeveloped, which is a result of the long historical development of the settlement patterns in Czechia (see Hampl 2005). On the contrary, the size hierarchization of transport features shows different tendencies. Each category of transport size outweighs the size of the first centre. However, some evident tendencies in the development of the transport hierarchy during the monitored years are revealed. The growing significance of the biggest centres is evident (above all the growing significance of the first centre (Praha). Conversely, the lower hierarchical scale showed a radical decrease of transport size (from 783 in 1980 to 475 in 2005). A more relevant indicator for this evaluation is an indicator of the degree of hierarchization (see notes under table 1). This indicator refers to the gradually growing significance of the biggest centres in Czechia (18.6 for the year 1973 and 26.9 for the year 2005) which is a result of more considerable concentrations of transport flows and transport infrastructure into the biggest centres. Very interesting is also the comparison of the transport hierarchy development before and after 1989. The transport hierarchy of surveyed centres is least developed in 1990. It could be a result of the planned socialistic development of settlement centres in the 1970s and the 1980s, which largely leveled off the development of natural hierarchization tendencies, especially the development of the highest category of centres in the settlement structure (see e.g.: Hampl, Gardavský, Kühnl 1987). Another reason for this interpretation is, for example, the stagnation of road transport intensities in 1990 (in total values), which was a consequence of the Czechoslovak economy stagnation in the second half of the 1980s.

The development and size hierarchization of the monitored centres according to the truck transport size (Tab. 2) was also evaluated. Truck transport is more oriented on transit transport and therefore it can be expected that this transport mode will be more selective and hence more hierarchically developed. From the point of view of the transport hierarchy dynamics the significant progressive hierarchization is revealed especially in the last two transport censuses in 2000 and 2005. There is also an evident decrease of the

Tab. 3 – Size hierarchization of surveyed centres according to car transport

Categories (order of centres)	Relativized sizes (First centre = 100)								
	Complex size		Relative transport size						
	1991	2001	1980	1985	1990	1995	2000	2005	Index 2005/ 1980
1.	100	100	100	100	100	100	100	100	100.0
2.–4.	83	74	106	99	124	126	126	107	100.9
5.–12.	50	49	179	171	197	201	191	171	95.5
13.–34.	93	85	352	349	384	375	331	292	83.0
35.–98.	112	104	627	599	704	646	572	486	77.5
DH	89.3	92.1	21.0	21.0	20.6	22.1	25.0	26.6	126.7

Source: Hampl (2005), Road Transport censuses 1980–2005

Note: DH = Degree of hierarchization

transport significance of the lower hierarchical categories in comparison to the size of the first centre. The most considerable decrease is seen in the last size category (35th to 98th centre). In comparison to 1980, this category decreased its transport size by more than half to 47.7. Most interesting is the development of the degree of hierarchization of the whole complex. In 1980 the truck transport was compared to other road transport modes the least hierarchically developed transport mode (degree of hierarchization value = 18.6). On the contrary in 2005 this transport mode was the most hierarchically developed (value = 29.6). It could be proved for example by the more evident concentration of truck transport into the biggest settlement centres and by the weakening of former customer-supplier relations, which were shaped mainly by truck transport (index value = 159.1), on the lower hierarchical scales.

The size hierarchization of settlement centres according to the car transport size is evaluated in Table 3. The monitored indicator shows similar tendencies as in the above mentioned characteristics in comparison with the complex size. The car transport size shows substantially lower hierarchization than complex indicators. A special exception is a relatively lower transport size of the second hierarchical category in 1985, which is higher again in the following years. The degree of hierarchization by car transport in the pre-transformation time is probably higher than by truck transport. It results from a relatively high degree of automobilization of the urban districts (the biggest centres) in this period, the dominance of which was after 1990 more rapidly decreased by the spatial development of the car transport, first in the Bohemian regions, later in the Moravian regions. The development index 2005/1980 is obviously the lowest of all monitored road transport modes and that's why car transport is the least hierarchically developed transport mode.

4.2. Main changes in the transport hierarchy of settlement centres

The transport hierarchy of the Czech centres in year 1990 is a start-up phase of the detailed research and of course it reflects the previous socialistic development (Fig. 2). The most important transport centres in 1990 were the

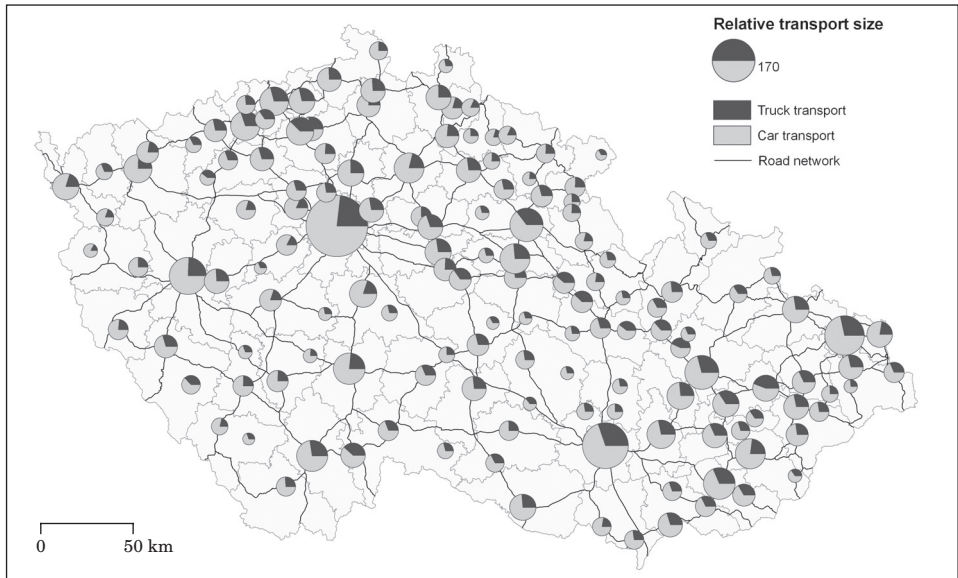


Fig. 2 – Transport hierarchy of settlement centres of Czechia (1990)

biggest settlement centres of Czechia (Praha, Brno, Ostrava, and Plzeň). Their transport importance arises mainly from their natural complex value in the whole settlement system. The fact that among the centres of the highest hierarchical level suddenly appear centres of relatively less complex value (Uherské Hradiště, Tábor, Mladá Boleslav), is the main feature of this hierarchy. Their importance for transport is influenced mainly by their good transport location within the road transport network (similarly for public transport e.g. Marada 2003).

On the contrary, centres of relatively more complex value, which are situated in worse transport location (e.g. Tachov, Dvůr Králové nad Labem, Uničov), appear on the lowest levels of the transport hierarchy. Good or bad transport location therefore most influences the difference between transport hierarchy and settlement hierarchy of the surveyed centres. The twenty biggest and smallest transport centres according to their relative transport size in 1990 are shown in Table 4.

The difference between transport and settlement hierarchy causes substantial differences in the order of centres according to the transport and complex size. Among the centres most advantaged by their transport location is Třeboň (the difference between transport and complex hierarchical order is over 87 points), Lovosice (over 82 points), Poděbrady (over 72 points), Nový Bor and Čáslav (both over 55 points). This advantage can be influenced by different factors (e.g. spatial differentiation of road transport modes in Czechia or public transport quality). However, the road transport location factor is the most important one. On the other hand, among centres that are most disadvantaged by their transport location are Sokolov (over 74 points), Blansko (over 71 points), Kadaň (over 58 points), Dvůr Králové (over 55 points) Krnov and Litvínov (both over 53 points). All of these centres show lower relative transport size than complex size. These centres often lie away from important transit roads and therefore are least influenced by transit or irregular transport.

Tab. 4 – The biggest and smallest centres according to their Relative Transport Size (1990)

Order	Centre	Relative Transport Size	Order	Centre	Relative Transport Size
1.	Praha	527.3	125.	Polička	31.3
2.	Brno	290.7	126.	Semily	30.7
3.	Ostrava	218.0	127.	Uničov	29.5
4.	Plzeň	191.5	128.	Lanškroun	27.6
5.	Olomouc	161.9	129.	Nový Bydžov	27.1
6.	Hradec Králové	155.2	130.	Milevsko	27.0
7.	Uherské Hradiště	139.6	131.	Blatná	26.6
8.	Tábor	139.0	132.	Tachov	26.5
9.	České Budějovice	133.8	133.	Frýdlant	26.3
10.	Zlín	126.1	134.	Dvůr Králové n. L.	26.2
11.	Mladá Boleslav	124.6	135.	Valašské Klobouky	25.5
12.	Pardubice	124.2	136.	Velké Meziříčí	25.5
13.	Most	118.8	137.	Frýdlant n. Ostr.	25.1
14.	Teplice	115.5	138.	Sedlčany	25.0
15.	Vyškov	111.8	139.	Bystřice n. Pern.	24.3
16.	Karlovy Vary	110.3	140.	Hlinsko	23.6
17.	Lovosice	106.3	141.	Chotěboř	23.1
18.	Benešov	105.0	142.	Hořovice	21.1
19.	Prostějov	103.8	143.	Prachatice	20.0
20.	Opava	98.6	144.	Broumov	16.8

Source: Transport census 1990

Note: Relative Transport Size = all transport volumes entering or departing the centre; all centres = 10,000.

The obvious line character of important supra-regional transport centres is evident. Some main transport axis of Czechia with higher transport integrity can be differed: České Budějovice – Tábor – Benešov – Praha; Cheb – Karlovy Vary – Ústí n. Labem – Děčín; Praha – Roudnice – Lovosice – Teplice; Praha – Mladá Bleslav – Turnov – Jičín/Liberec; Praha – Poděbrady/Kolín – Hradec Králové/Pardubice; Hradec Králové – Svitavy – Brno/Olomouc; Brno – Vyškov – Prostějov – Olomouc – Hranice – Ostrava; Hodonín – Uherské Hradiště – Zlín/Kroměříž – Přerov.

The transport hierarchy of the Czech settlement centres was evaluated analogously (Fig. 3) according to the latest Transport census in Czechia in 2005. This year is regarded as the last phase of the transformation period. Among the most important transport centres are again the biggest settlement centres of Czechia (Praha, Brno, Ostrava and Plzeň), but their dominance over the following centres is relatively lower. In this respect is the decrease in the transport size among the first four centres and the following centres more continuous. The above mentioned difference between transport hierarchy and settlement hierarchy can be illustrated by the fact, that in the highest hierarchical levels appear again centres with relatively lower complex value (Prostějov, Mladá Boleslav, Frýdek-Místek and Hranice). These centres are advantaged by their good transport location and often are the

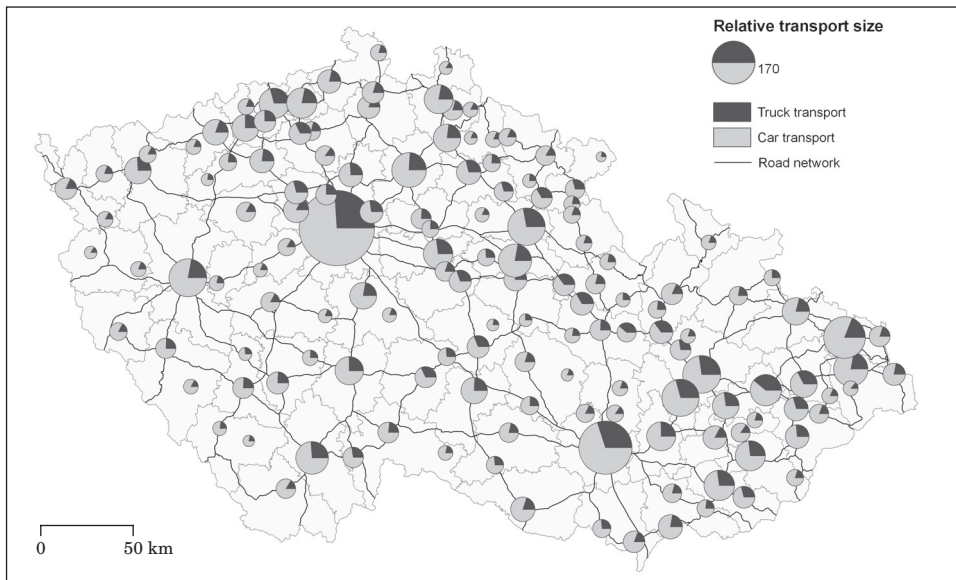


Fig. 3 – Transport hierarchy of settlement centres of Czechia (2005)

most important traffic intersections in Czechia. On the other hand, there are centres with the smallest value of their relative transport size (Chotěboř, Prachatice, and Broumov). The relative transport size value of the first centre (Praha) was over 527.3 in 1990 and over 757.2 in 2005. On the contrary, relative transport size value of the last centre (Broumov) was over 16.8 in 1990 but only 13.0 in 2005. The growing variation interval between maximal and minimal relative transport size is evident within the surveyed centres system. This proves the growing significance of the first centre. Twenty biggest and smallest centres according their relative transport size in 2005 are shown in Table 5.

The above documented differences in centres order according to their complex and transport size were also revealed by previous evaluation. Good transport location influences namely Lovosice (over 69 points), Mohelnice (over 65 points), Litomyšl (over 60 points), Čáslav (over 59 points) and Hranice (over 53 points). The most dynamic growth is typical for centres situated on the R35 or the I/35 road (Olomouc, Mohelnice, Litomyšl, Vysoké Mýto, Hradec Králové), which is an alternative road for the most used motorway the D1. On the other hand, the most disadvantaged centres concerning the transport location are Sokolov (over 63 points), Litvínov (over 59 points), Dvůr Králové (over 54 points), Příbram (over 51 points) and Kadaň (over 50 points). Although these disproportions are very significant, certain joining between both types of hierarchy during the transformation period can be seen.

4.3. Transport typology of settlement centres

The previous analyses were oriented namely on the significance of changes in the transport hierarchy of settlement centres during the transformation period, which can be rated as primary and more obligatory. The structural

Tab. 5 – The biggest and smallest centres according to their Relative Transport Size (2005)

Order	Centre	Relative Transport Size	Order	Centre	Relative Transport Size
1.	Praha	757.2	125.	Sušice	28.9
2.	Brno	377.9	126.	Dačice	28.8
3.	Ostrava	230.1	127.	Uničov	28.7
4.	Plzeň	191.2	128.	Nový Bydžov	27.4
5.	Olomouc	190.6	129.	Vlašim	27.4
6.	Hradec Králové	185.8	130.	Lanškroun	27.2
7.	Prostějov	183.2	131.	Hořovice	26.5
8.	Mladá Boleslav	159.5	132.	Vimperk	26.3
9.	Frýdek-Místek	155.6	133.	Sedlčany	25.7
10.	Pardubice	148.3	134.	Dvůr Králové n. L.	25.4
11.	České Budějovice	142.8	135.	Semily	23.2
12.	Hranice	129.2	136.	Blatná	22.8
13.	Teplice	122.8	137.	Hlinsko	22.6
14.	Uherské Hradiště	122.4	138.	Frýdlant	22.5
15.	Ústí nad Labem	122.1	139.	Tachov	21.4
16.	Zlín	120.0	140.	Podbořany	20.5
17.	Kolín	115.9	141.	Bystřice n. Pern.	20.2
18.	Liberec	112.8	142.	Chotěboř	18.9
19.	Vyškov	110.8	143.	Prachatice	17.4
20.	Tábor	107.5	144.	Broumov	13.0

Source: Transport census 2005

Note: Relative Transport Size = all transport volumes entering or departing the centre; all centres = 10,000.

changes can be ranked as secondary changes, which indicate proportional changes in particular road transport modes in the monitored centres. The structural changes of settlement centres are researched using the created transport typology from 1990 and 2005, regarding to changes in proportion of particular transport modes in all road transport volume (modal split). These changes are therefore evaluated dynamically and are always related to the actual modal split. There are particular changes in modal split between 1990 and 2005 evident. The modal proportion in 1990 is 27.4 percent for truck transport, 71.0 percent for car transport and 1.6 percent for motorcycles. Analogical values for 2005 are 24.2; 75.3 and 0.5 percent. The proportion of these modal splits is very similar at all monitored geographical levels, which proves their equal proportionality (similarly Viturka 1981).

The transport typology of settlement centres was created based on modal split proportions for centres with marked truck transport share, centres with marked car transport share and blended centres, which mostly conform to the arithmetical average values. The centres with marked truck transport share in 1990 are all centres with 35.0 and more percent of their modal split allotted to truck transport (33.0 and more percent for the year 2005). Analogously, the centres with marked car transport share are all centres with 78.0 and more percent of their modal split allotted to car transport (80.0 and more percent

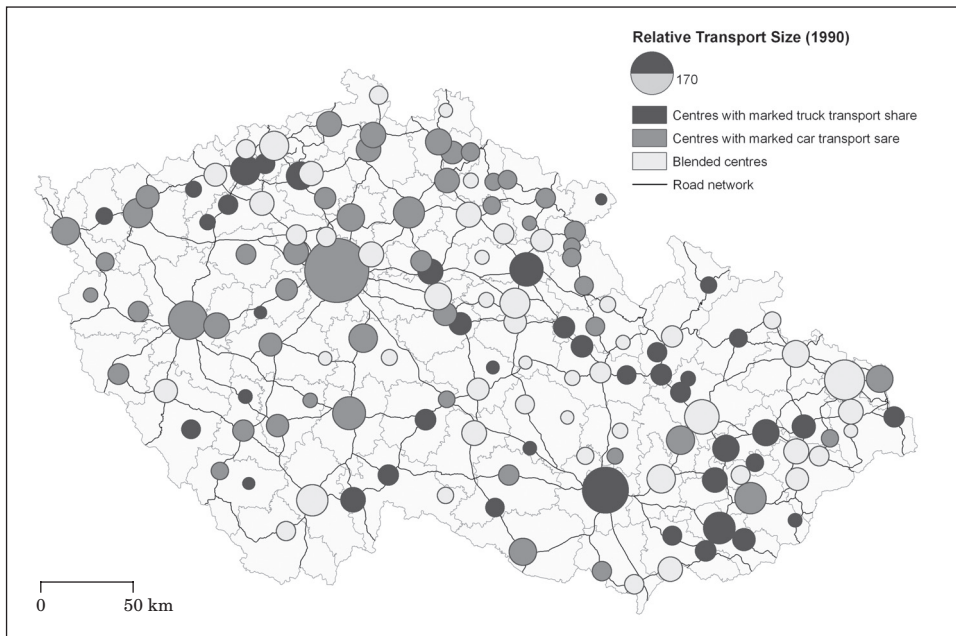


Fig. 4 – Transport typology of settlement centres of Czechia (1990)

for 2005). Blended centres are centres, which correspond with the above mentioned categories. Transport typology of settlement centres was created for both monitored years (Fig. 4 and 5).

Centres with marked truck transport share in 1990 are mainly bigger transport centres (Brno, Uherské Hradiště, Hradec Králové etc.), which are concentrated on the main transport networks of Czechia, especially on west-east transport routes, which reflects the main orientation of transport flows. Centres with marked truck transport share are concentrated in the northwest of Czechia which is connected with bigger industrialization of these regions, whose transport interactions were based mainly on truck transport. Very interesting is the concentration of centres with marked share of car transport. There are also bigger transport centres in this group (Praha, Plzeň, Karlovy Vary, and Mladá Boleslav), but the highest concentration of these centres is only in the Bohemian regions (not Moravian) which is a result of local higher degree of individual automobilization. The last evaluated category includes the blended centres, whose modal split proportion is bigger than the average share of Czechia. In this category, there are mainly mid-sized transport centres, whose modal split proportionality is influenced namely by their transport location on important inter-regional transport routes.

The transport typology of settlement centres of Czechia is shown in figure 5. The increase in truck transport share in centres located on the R35 (I/35) road is interesting. It indicates the growing significance of this transport axe in truck transport and growing transit transport load of these centres with direct relation to the negative environmental impacts. Among centres with marked truck transport share in 2005 are also the biggest settlement centres (Praha, Brno, Olomouc, Hradec Králové), which corresponds to the above mentioned empirical evidence of progressive concentration of truck transport into

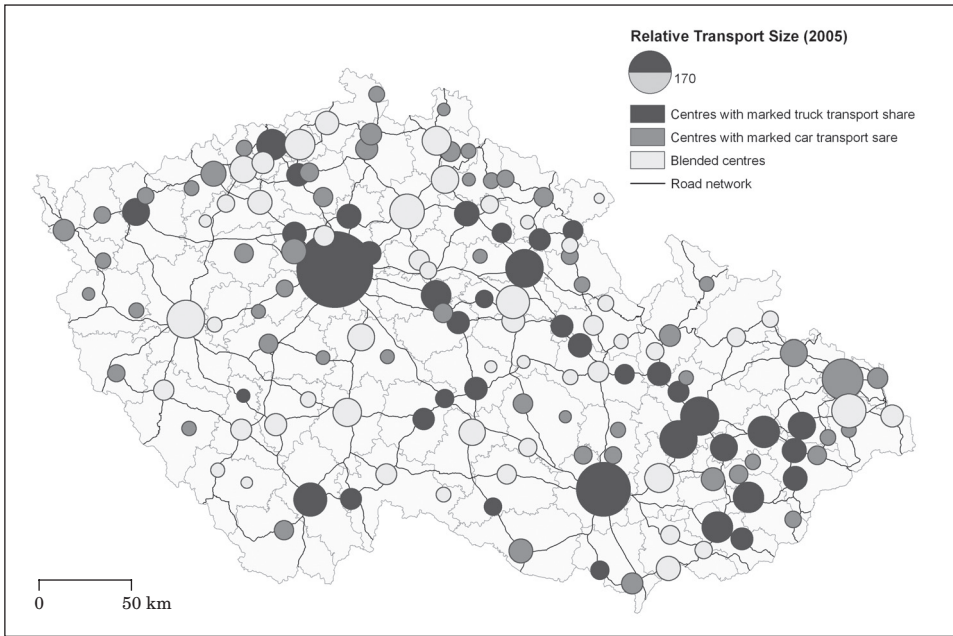


Fig. 5 – Transport typology of settlement centres of Czechia (2005)

the biggest centres. Significant changes occurred in centres with marked car transport share in 2005. Among these centres are mid-sized transport centres and small transport centres (except Ostrava), which are located mainly in worse transport locations (Tachov, Nový Bydžov, Sušice), in the northwest border regions of Czechia (e.g.: Sokolov, Ostrov, Kadaň, Litvínov) and in the proximity of the biggest centres (Tišnov, Blansko, Boskovice, Beroun, Kladno, Vlašim etc.). The only exception is Ostrava, whose modal split is influenced by relatively lower share of truck transport and higher degree of automobilization. The blended centres category in 2005 is more spatially and hierarchically dispersed compared to 1990. Among these centres are especially centres located on important inter-regional transport routes.

5. Conclusion

The above mentioned empirical analyses proved relatively strong dynamics of the development of the geographical organization of the Czech transport system during the transformation period. All monitored problems can be summarised in the following conclusions:

1. After monitoring of long-term tendencies in the transport hierarchy of Czech settlement centres, we can stress the deepening of the transport hierarchy, which is however modally unequal. The most progressive road transport mode in terms of this deepening process is the truck transport, which was during the monitored years gradually concentrated into lower number of centres. On the contrary, the most hierarchically dispersed transport mode is car transport which is a result of its spatially dispersed distribution and its orientation on common needs.

2. The transport hierarchy of Czech settlement centres between 1990 and 2005 went through significant quantitative and qualitative changes. Among the most significant changes can be included the growing variation interval of maximal and minimal relative transport size, which indicates growing value of the biggest transport/settlement centres and decreasing value of the smallest centres. The approximation of transport hierarchy to the general trends in settlement patterns simultaneously causes the reduction of the difference between transport hierarchy order and settlement hierarchy order, which is probably connected with the growing demand of Czech households for cars.
3. The structural changes in the transport hierarchy can be expressed by the transport typology of surveyed centres. This monitoring evidently proved more significant concentration of transport flows (mainly by truck transport) into the biggest settlement centres and environmental load of the transport centres located on the main transport routes of Czechia. These transport routes are mainly of northwest-southeast orientation.

In conclusion, we must again point to the fact that there is no comprehensive database for the monitored transport mode available. Due to this fact the research topics can be studied only implicitly and with a certain degree of generalization. The results of this research can be also used for the practical demonstration of the by-pass roads building necessity by monitored centres. These analyses can thus serve as a basis for environmentally oriented regional planning and regional policy.

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GEOGRAFICKÁ ORGANIZACE DOPRAVNÍHO SYSTÉMU V ČESKU
A JEJÍ VÝVOJ V TRANSFORMAČNÍM OBDOBÍ

Dopravní systém Česka prošel v průběhu transformačního období, stejně jako ostatní sociogeografické systémy, zásadními kvantitativními a kvalitativními změnami v jeho prostorové organizaci. Hlavním cílem příspěvku je proto geografická analýza změn v dopravní hierarchii středisek osídlení Česka v průběhu transformačního období. Přestože se jedná pouze o parciální problematiku ve výzkumu dopadů společenské transformace po roce 1989, význam tohoto sledování spočívá zejména v geografické interpretaci makroregionálních změn ve zmíněném dopravním systému. Vzhledem k dostupnosti zdrojových dat a výraznější dynamice tohoto druhu dopravy se práce zaměřuje právě na změny a dopady vyvolané rostoucím významem silniční dopravy v Česku. Silniční doprava lze zajisté považovat vzhledem k její dominanci v dopravním systému Česka za její klíčové dopravní odvětví. Právě tomuto druhu dopravy však bylo v geografických studiích zatím věnováno relativně málo pozornosti, především z důvodu nedostatků existujících statistik o silniční dopravě a jejím geografickém rozložení. Mnohem více poznatků bylo publikováno v oblasti geografické organizace veřejné hromadné dopravy v Česku, ke které existuje sice bohatší, přesto však stále nedostačující, datová základna.

Zaměřené práce vychází zejména z absence empirických výzkumů v prostorové organizaci silniční dopravy na území Česka a zejména z absence hodnocení tohoto druhu dopravy ve vztahu ke střediskové hierarchii Česka v období transformace. Na základě výše uvedené diskuze se práce snaží odpovědět na některé základní výzkumné otázky vycházející z teorií geografické organizace společnosti. Především se jedná o otázky týkající se vývoje dopravní hierarchie středisek z pohledu velikostní hierarchizace; o měnící se roli středisek z hlediska koncentrace dopravních proudů a selektivní změny ve struktuře dopravních proudů jednotlivých středisek se zřetelem k jejich horizontální a vertikální diferenciaci.

Dílicí témata sledování vychází z předešlých výzkumných otázek. V analytické části se příspěvek nejprve zaměřuje na dlouhodobé tendence ve vývoji dopravní hierarchie sledovaných středisek, které tvoří základní rámec pro následující hodnocení. V rámci tohoto hodnocení je pak sledována především velikostní hierarchizace středisek podle hierarchických pater a vývoj této hierarchie v předtransformačním a transformačním období, vždy ve srovnání s hierarchizací středisek podle hodnot komplexní velikosti. Zvláštní pozornost je věnována změnám v koncentračních procesech v dopravě ve sledovaných střediscích a jejich obecným souvislostem. V další části se příspěvek zaměřuje na detailní analýzu změn v dopravní hierarchii středisek mezi roky 1990 a 2005, které rámcově ohraničují počátek a konec transformačního období a vycházejí především z dopravních censů provedených Ředitelstvím silnic a dálnic ČR. Analýzy se zaměřují na dvě různá hodnocení. Jedná se především o významové změny v dopravní hierarchii středisek osídlení Česka mezi sledovanými roky, jež lze označit za primární a v jistém smyslu i geograficky závažnější. V další kapitole jsou pak hodnoceny změny strukturální, které lze označit za sekundární, neboť nereflktují samotné změny v dopravní hierarchii středisek, ale spíše jejich kvalitativní stránku. Strukturální změny v dopravní hierarchii středisek jsou v příspěvku vyhodnocovány pomocí vytvořené dopravní typologie pro oba sledované roky.

Střediska osídlení Česka byla převzata z práce Hampl (2005). Hodnoceno je tak 144 středisek alespoň mikroregionálního významu, která byla vymezena na základě posledního populačního censu z roku 2001 podle jejich populačního a pracovního významu. V příspěvku jsou dále využity údaje z výsledků Sčítání silniční dopravy pořizovaných v pětiletých cyklech Ředitelstvím silnic a dálnic ČR z let 1980–2005.

V rámci sledování dlouhodobých tendencí ve vývoji dopravní hierarchie středisek osídlení Česka (tab. 1–3) lze zdůraznit především prohlubující se hierarchii, která je však modálně nerovnoměrná. Nejprogressivnější dopravní mód z hlediska tohoto prohlubování je nákladní silniční doprava, která se ve sledovaném období nejvíce koncentrovala do menšího počtu středisek. Naopak hierarchicky nejvíce rozptýlený dopravní mód je osobní doprava jako výsledek jejího výraznějšího prostorového rozptýlení a orientace na běžnější potřeby společnosti. Dopravní hierarchie středisek osídlení Česka mezi léty prošla mezi léty 1990 a 2005 významnými kvantitativními i kvalitativními významovými změnami (tab. 4 a 5). Mezi nejvýznamnější změny lze zařadit rostoucí variační rozpětí maximální a minimální relativního dopravního významu, které indikuje rostoucí úlohu největších dopravních/sídelních

středisek a oslabování středisek nejmenších. Přiblížení dopravní hierarchie obecným trendům v sídelním systému zároveň způsobuje konvergenci asymetrie mezi sídelní a dopravní hierarchií. Strukturální změny v dopravní hierarchii mohou být vyjádřeny pomocí vytvořené dopravní typologie (obr. 4 a 5). Toto sledování evidentně prokázalo výraznější koncentraci dopravních toků (zejména u nákladní dopravy) do největších středisek osídlení a environmentální zatížení středisek ležících na hlavních dopravních tazích Česka. Tyto tahy jsou orientovány zejména ve směru severozápad–jihovýchod.

- Obr. 1 – Střediska zahrnutá do šetření a jejich poloha v silniční síti (stav k roku 2001)
- Obr. 2 – Dopravní hierarchie středisek osídlení Česka v roce 1990. V legendě shora: relativní dopravní velikost, nákladní doprava, automobilová doprava, silniční síť.
- Obr. 3 – Dopravní hierarchie středisek osídlení Česka v roce 2005. V legendě shora: relativní dopravní velikost, nákladní doprava, automobilová doprava, silniční síť.
- Obr. 4 – Dopravní typologie středisek osídlení Česka v roce 1990. V legendě shora: relativní dopravní velikost, střediska s podílem na trhu nákladní dopravy, střediska s podílem na trhu automobilové dopravy, silniční síť, smíšená centra.
- Obr. 5 – Dopravní typologie středisek osídlení Česka v roce 2005. V legendě shora: relativní dopravní velikost, střediska s podílem na trhu nákladní dopravy, střediska s podílem na trhu automobilové dopravy, silniční síť, smíšená centra.

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