

THE REALITY AND STRATEGIES FOR A SUSTAINABLE MODAL-SPLIT

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ABSTRACT

The development of new technologies at the turn of the millennium has driven the contemporary world to move in an unprecedented way. This phenomenon is evident on different spatial levels – from local, through urban and regional levels up to the massive movements of people, goods and vehicles on a continental scale. Mankind's being released from his immediate spatial dependence on his place of residence and work and encouraged by a variety of modal options and means of transport is one, though not the only factor leading to the current excessive degree of mobility. Land use and the distribution of human activities in urban areas have significant impacts on the development of mobility.

In the paper submitted, the development of the settlement structure in Slovakia is analyzed, along with its impact on the time-spatial changes of the demographic profiles of various size categories of urban settlements. The overall impacts of these changes on urban environments are also documented through the development of the volume of traffic, which is growing rapidly in relation to the antecedent economic, social and political transformations.

In the conclusion of the article, possible strategies for the future development of transport in Slovakia, which should be directed towards the sustainability and well-being of the society, are pointed out.

1. INTRODUCTION

The primary reason for this transformation of transport was industrial production, which required the concentration of residential and work functions in the same territory, along with the availability of different transport options. However, the emergence of new production methods and service-oriented economies supported by modern information and communication technologies is resulting in a deconcentration of settlement structures. In recent decades, the dispersion of housing, work and services can be observed in the surroundings of large cities. Paradoxically, the extent of metropolitan areas is growing, but the population in core areas is declining. This phenomenon of "shrinking cities" could first be observed in the highly developed countries of North America and Western Europe, but it is gradually spreading to the emerging countries of Central Europe and finally to developing countries as well. Today, the quality of life of urban residents is significantly affected by extensive congestion. These observations can also be compared with similar developments in the Czech Republic, with which Slovakia was tied economically, socially and politically for more than 70 years in the 20th century.

1.1. Settlement-creating processes - previous progress

The process of urbanization in the 20th century resulted in a massive movement of populations into larger cities, due to their better housing and job opportunities.

Urbanization is a process of concentrating economic and cultural life in cities at the expense of rural areas. It also led to changes in the lifestyle of rural populations when they started to live like city dwellers. The high number of people in the countryside was largely

reduced; people left the agricultural sector to work in the industrial sector. The process of urbanization was conducted in accordance with the principles of a centralized system of settlement, where the population centers of the district of local importance were located. The main investment events, business opportunities and related facilities were also located there. On the basis of the former urban concept, medium-sized cities (20-50,000 inhabitants) were purposefully formed and evenly distributed throughout the territory of Slovakia. The development of larger towns (with a population over 50,000) was supported. Four cities developed into sizes of nearly 100,000 inhabitants: Prešov, Nitra, Žilina and Banská Bystrica. Only two cities, Bratislava and Košice had a population of over 100,000. In the last decade, the development of urbanization in Slovakia has changed significantly. There is a concentrated form of deconcentration with certain suburbanized tendencies, by which part of the population in cities is moving to satellites in their suburban area.

1.2. Changes in Settlements

Uncontrolled urbanization in many places has caused a huge increase in the immigrant population, a lack of accommodation capacity and a very low quality of life. This process, characterized by the influx of populations from the surrounding villages and smaller settlements into cities, was replaced by the process of suburbanization. The breaking point was different in parts of the world. The development of demographic characteristics can demonstrate the process of suburbanization. An increase in the urban population of the Czech Republic was reported in 1991; in that year there was a point when the trend in the creation of settlements changed. This led to the gradual stabilization of the urban population and consequently a slight decrease, which indicates the process of suburbanization. One of the causes of this phenomenon was the expansion of private car use and the associated ability to overcome greater distances in less time. In cities, the use of motor vehicles is reflected in the landscape of the layout of an urban area. The spatial expansion of cities is now an actuality, and this trend is continuing in almost all European cities.

Suburbanization in the rest of the world appeared much earlier than in the Slovak Republic. Among the first were American cities, which at the present time have an urban sprawl type of housing. This is one of the traditional forms based on solving a system of transport - transport by the individual car. The car has become an integral part of human life, and it is



Figure 1 The Suburbs against the city

not unusual to spend many hours in the daily commute from home to work and back. Individual car traffic is gradually becoming one of the biggest problems in urban planning. The situation in the Slovak and Czech Republics clearly documents demographic characteristics such as population movements, migration, distribution, and population movements within a residential structure. Transport characteristics provide a numerical graph of the transport behavior of a population.

Figure 2 shows the evolution of the population in settlements larger than 20,000 inhabitants. The progress of the settlement processes in the Czech Republic is clearly visible; this development is very similar to that of Slovakia, but in Slovakia the time has accelerated by an entire decade. The reason for this phenomenon could be the shifting trend of the Eastern states and the influence of the socio-political situation in the country, when the division of Czechoslovakia happened in 1993.

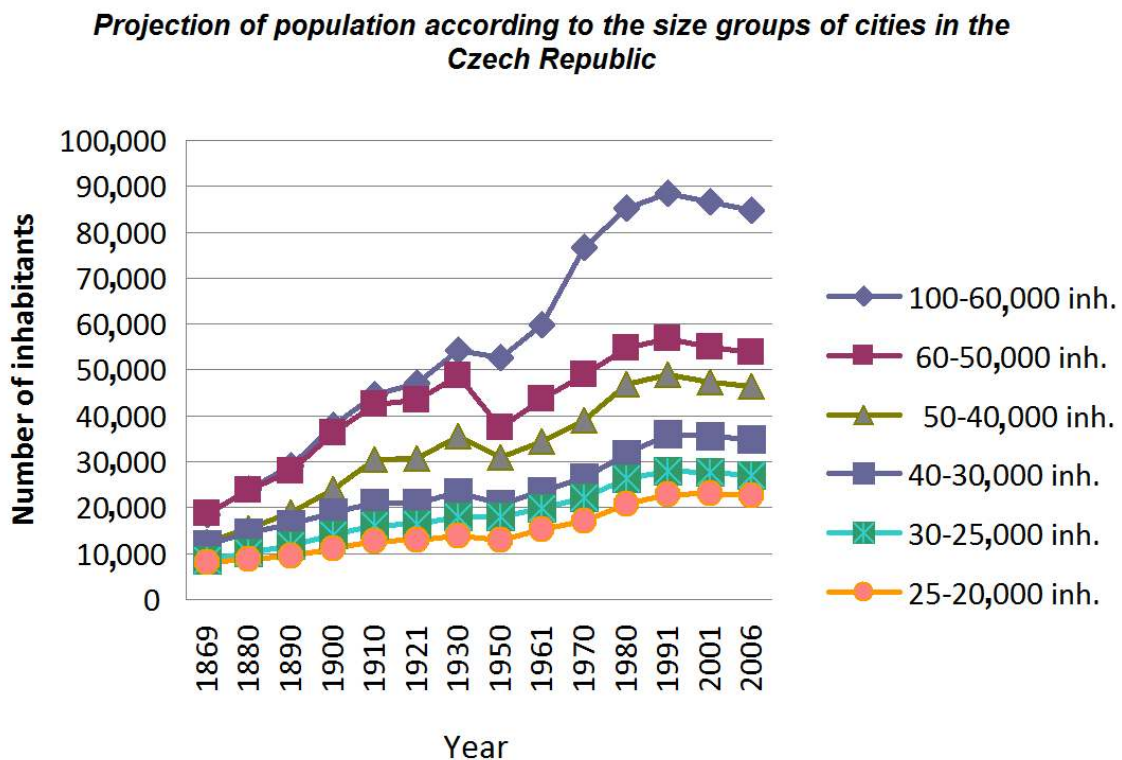


Figure 2 Projection of population according to the size groups of cities in the Czech Republic

1.3. Current situation

1.3.1. The influence of demographic changes on mobility needs and their modes

Demographic changes are a newly formed problem, which has begun to affect the mobility of urban areas in Europe. Increasing number of citizens use a car, not just the economically active inhabitants, but also seniors who are abandoning less energy-intensive modes such as walking, cycling, public transport and services involving a combination of several modes [4]. Europe faces an aging generation using automobiles, where an increasing number of seniors use a car for their everyday mobility. Current alternatives to private car use are advantageous, if they are easily manageable, comfortable, safe, accessible and affordable and if their quality is at least satisfactory. Current population trends suggest that the migration of people is more pronounced in smaller cities, which are unable to withstand the weak economy and high unemployment. On the other hand, big cities with their urban complexes and metropolitan residents are not

losing many inhabitants, and it is not expected that they will lose many in the future. The rising share of older groups, however, requires new approaches, especially in public transport.

1.3.2. Traffic characteristics

The traffic characteristics which reflect the current development of transport are represented in this paper by traffic volumes and the performance of transport in passenger transport. There is also growth in freight claims resulting from the effects of globalization, which is due to the increasing distance between the production site and consumption site. The transportation of goods on the territory of Slovakia has a rising trend in road transport and a decreasing trend in the use of railway transport. Development has greatly been influenced by the economic crisis, which has reduced the overall volume of transported goods.

The development of a modal split (between the public and individual transport of passengers) tends to threaten the functional transport system due to congested roads and the disproportionate negative effects of transport on the environment on the one hand and the lack of sales and an over-dependence on subsidies for public transport on the other.

Traffic problems are mainly concentrated in urban areas. The share of public transport to individual transport was around 80:20 in the early 90s; at the present time it is approximately 50:50. The interconnection of urban, suburban and regional transport is not good enough and does not create the conditions for a greater use of cycling and other ecological modes. The reasons for this trend are the increasing availability of private transport and a more rapid improvement of the road infrastructure compared with the rail infrastructure. The rail carriers are not responding adequately with an offer of quality services.

The number of passengers and freight capacities are shown in the following tables. The tables clearly illustrate the trends in individual countries in different modes. The rising trend is in addition to individual car transport and also air transport, which is an increasingly used mode for the transportation of persons.

Table 1 Passenger transport in the Slovak Republic

	2000		2005		2008		growth/decrease 2008-2000
	mil.pers.km	%	mil.pers.km	%	mil.pers.km	%	mil.pers.km
Rail public transport	2870	7.7	2,182	5.5	2,296	5.6	-574
Road public transport	8435	22.6	7,525	19.0	6,446	15.6	-1,989
Urban public transport	1173	3.1	1,399	3.5	1,370	3.3	197
Inland waterway transport	4	0.01	4	0.01	3	0.01	-1
Air transport	932	2.5	2,465	6.2	4,650	11.3	3,718
Individual road transport	23929	64.0	25,824	65.2	26,395	63.9	2,466
Public passenger transport	12733	34.1	13,575	34.3	14,915	36.1	2,182
Non-public passenger transport	24657	65.9	26,039	65.7	26,516	63.9	1,859
Total passenger transport performance (mil. pass-km)	37390	100.0	39,614	100.0	41,281	100.0	3,891

Table 2 Passenger transport in the Czech Republic

	2000		2005		2008		grown/decrease 2008-2000
	mil.pers.km	%	mil.pers.km	%	mil.pers.km	%	mil.pers.km
Rail public transport	7,300	7.23	6,667	6.14	6,803	5.91	-497
Public bus transport	9,351	9.26	8,607	7.93	9,351	8.12	0
Air transport	5,865	5.81	9,736	8.96	10,749	9.33	4,884
Inland waterway transport	8	0.008	18	0.017	17	0.015	9
Urban public transport	14,541	14.4	14,935	13.75	15,881	13.79	1,340
Road public transport	37,065	36.7	39,963	36.8	42,801	37.16	5,736
Individual car transport	63,940	63.3	68,640	63.2	72,380	62.84	8,440
Individual car transport + public transport	73,291	72.56	77,247	71.13	81,731	70.96	8,440
Total passenger transport performance (mil. pass-km)	101,005	100.0	108,602	100.0	115,181	100.0	14,176

The modern era has resulted in considerable achievements, and that is also true of the automotive industry. The very invention of the automobile has brought about great changes in the distribution of activities in the urban area, but its increasing availability and ease of use have caused serious problems for public transport in its efforts to compete with the automobile.

Table 3 Advantages and disadvantages of individual and public transport

Car - advantages	Public transport - disadvantages
<ul style="list-style-type: none"> • Possibility to easily transport luggage • High degree of psychological safety • Considerable degree of privacy • Seats are guaranteed • Good protection against the weather • The walking distance is generally less than 400m • Easy boarding • Temporal and local flexibility 	<ul style="list-style-type: none"> • Problems with the transport of large and bulky luggage • Low degree of psycho-social safety • Lack of privacy • The seats are not guaranteed • Often no protection against the weather at transit stops • Walking distance is often greater than 400 m • There can be problems with boarding the vehicle
Car - disadvantages	Public transport - advantages
<ul style="list-style-type: none"> • Need parking spots at places of arrival and departure • The risk of accidents 	<ul style="list-style-type: none"> • No problems with parking • Low risk of accidents • Generally reliable travel schedule • Low frequency of connections

Development of passenger and motor vehicle equipment in the SR

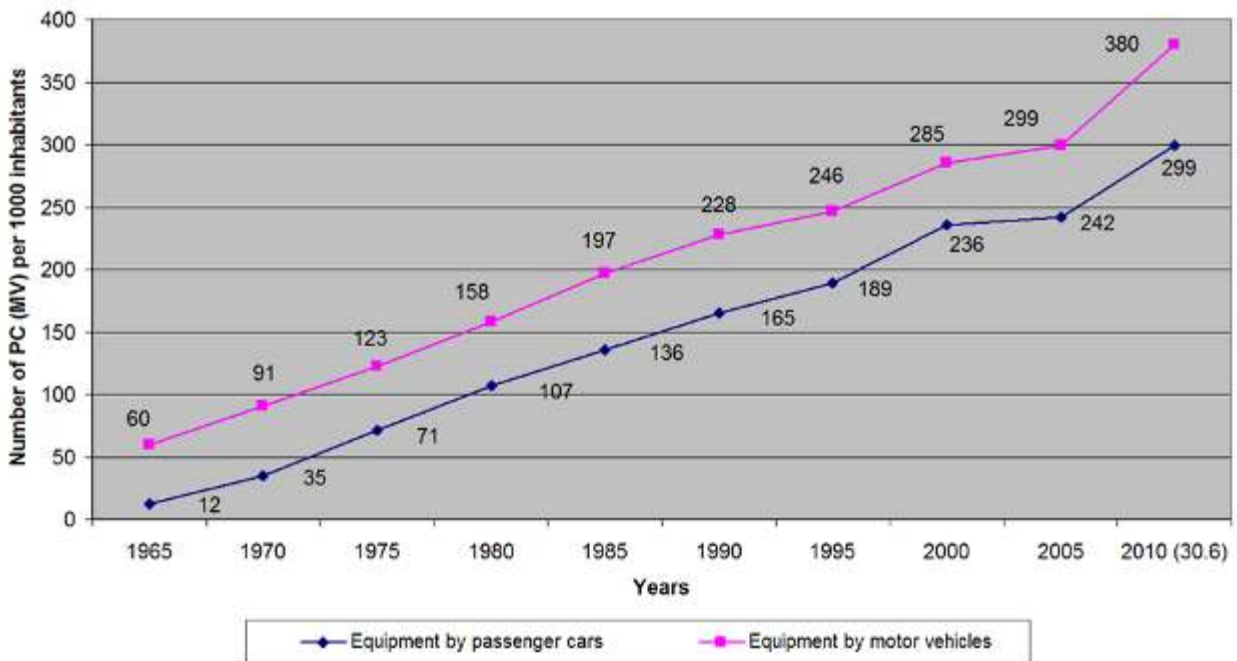


Figure 3 Development of passenger and motor vehicle equipment in Slovakia

The continuing increase in the number of motor vehicles in the Slovak Republic highlights the availability of cars for conventional households. Daily commutes to work using a car is causing more and more congestion, which results in a lack of parking capacity in urban centers, residential areas and workplaces. The inappropriate placement of an activity - housing, jobs, or recreation - can especially cause complications in transport, so it is important to rationally distribute these activities in any initial proposal with the appropriate transport connections.

Traffic volumes are obtained from the traffic census (in the Slovak and Czech Republics, they are conducted every five years). The last census was in 2010, but its results are still not available, so the charts below show only the increase in traffic volume between 2000 and 2005. The term "total traffic volume" is understood to mean the total traffic intensity upon each entry into a residence on radial roads as measured from a direction outside a town.

Based on the total traffic volumes, it is possible to gauge the desirability of living in a city, which can be expressed using the following formula:

$$D = \sum (I_1 + I_2 + I_3 + \dots + I_n) \quad [\text{veh./24 hours}] \quad (1)$$

expl.:

D- total traffic volume [veh./24 hours]

I_i – the intensity of road traffic on a highway entering a city [veh./24 hours]

The highest rise in traffic volume of the cities can be seen in the group of 60,000-100,000 inhabitants. The lowest rise has been experienced by towns with less than 25,000 inhabitants (Figures 4, 5).

Traffic volumes in various groups of settlements in Slovakia

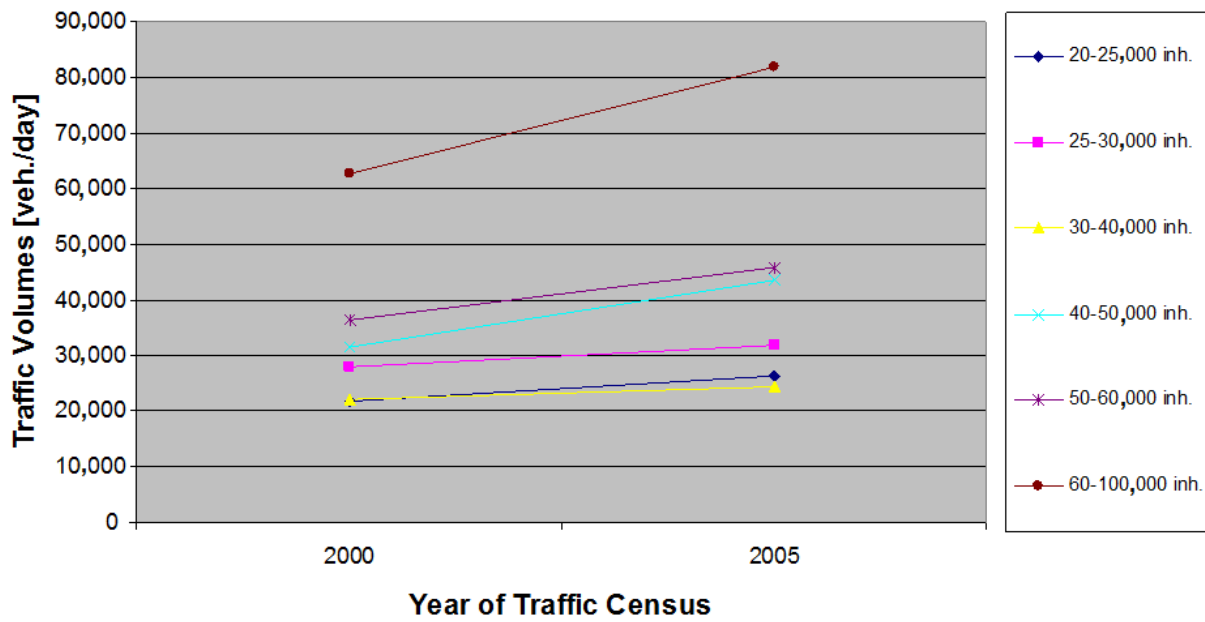


Figure 4 Traffic volumes in various groups of settlements in Slovakia

Traffic volumes in various groups of settlements in the Czech Republic

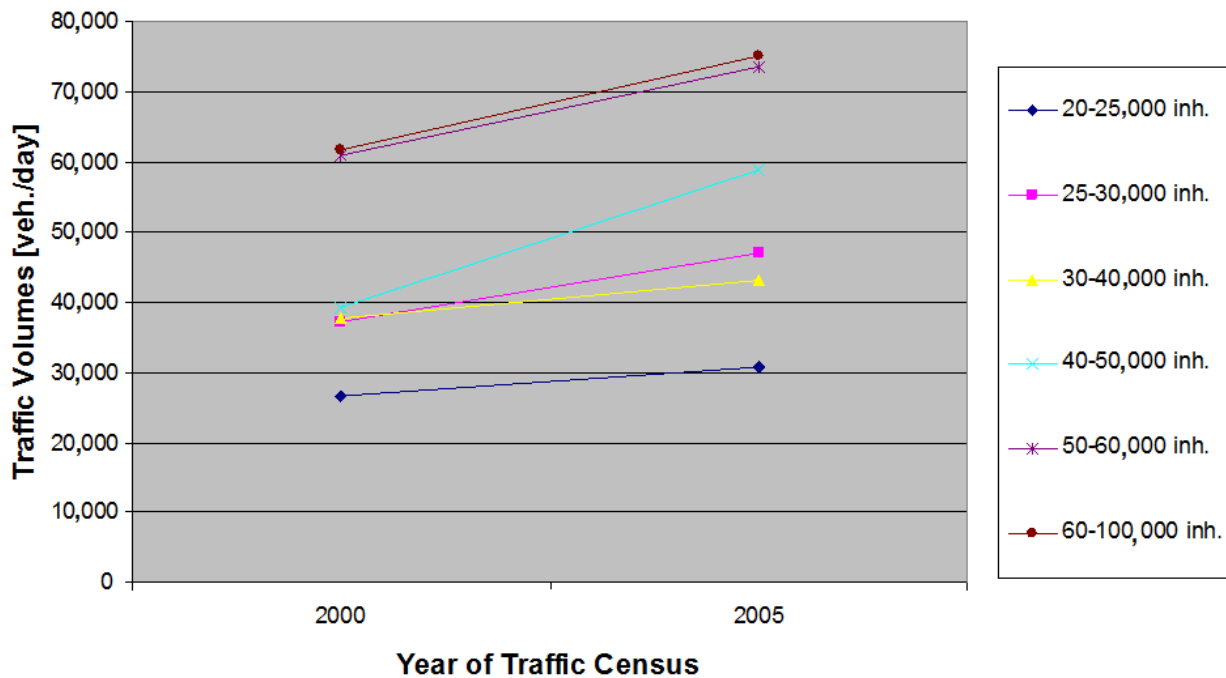


Figure 5 Traffic volumes in various groups of settlements in the Czech Republic

2. SETTLEMENT STRUCTURE OF SLOVAKIA AND THE CZECH REPUBLIC

The settlement structure of the Slovak Republic is specific with a high proportion of settlements smaller than 2,000 inhabitants (about 85%). The settlement structure is dominated by the rural population - 95.2% (2,745 villages), while municipalities amount to 4.8% (138 municipalities). Despite the fact that the total population of the urban population (56.5%) exceeds rural settlements, there is still a very significant proportion of the population in rural settlements (43.5%).

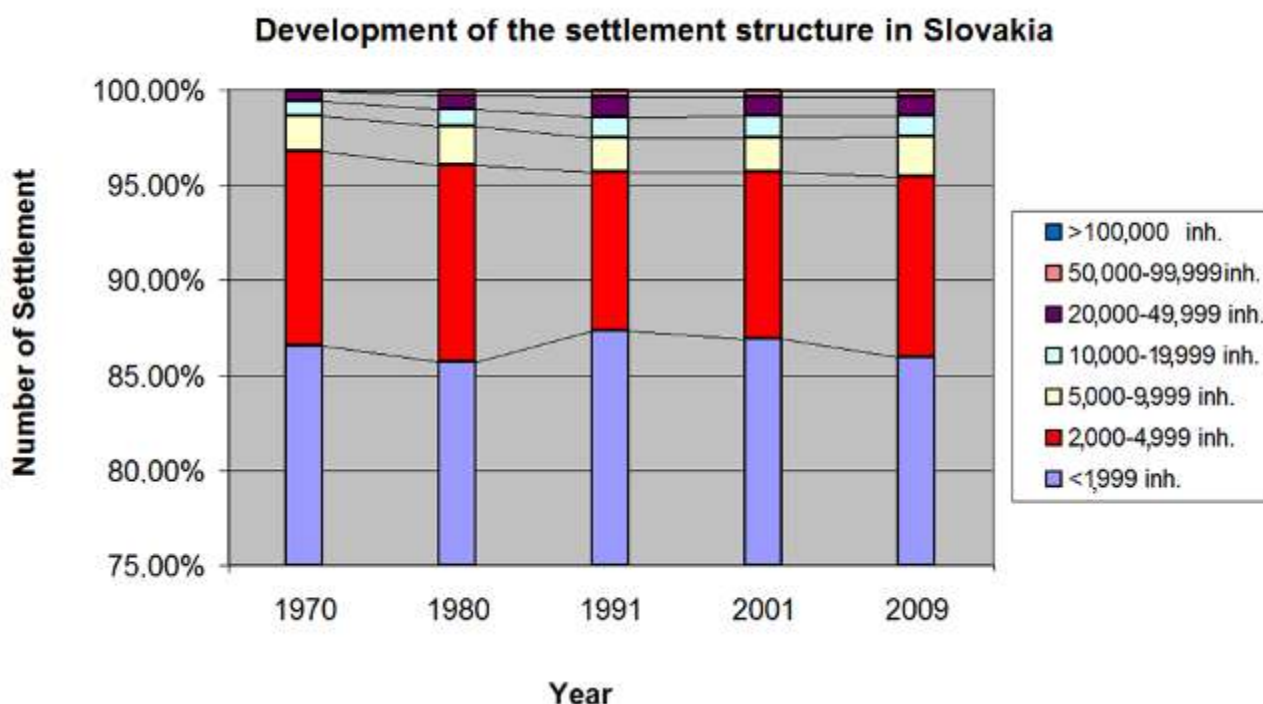


Figure 6 Development of the settlement structure in Slovakia

In terms of settlements, the main part of the urban structure is created by the mid-sized and small cities, but in terms of population the medium and large cities (over 50,000 inhabitants), where nearly 25% of Slovak inhabitants live, are more important.

The settlement structure of the Slovak Republic has changed over several decades. Not only have new municipalities been formed, but also the original towns in various size categories have been rearranged. The number of municipalities with less than 2,000 inhabitants has especially increased. This process is attributed to the onslaught of people from larger cities who are moving into the countryside for affordable, better-quality housing. It is also possible to observe a decrease in the population of large cities, which, despite the need for daily commuting, move to the suburbs or small villages located in their proximity.

The main characteristics of the changes in settlement structures are the number of inhabitants in a municipality which is affected by population movement. This movement can be divided into natural population growth and migration. In the Slovak and Czech Republics this movement is monitored annually and graphically depicted. Figure 7 indicates that the largest increases in population migration are located in the Bratislava and Košice regions - the areas of the two largest cities in Slovakia. A significant amount of migration is also taking place in the border regions where people are daily commuting to work abroad. Similarly, in the Czech Republic, the highest rate of immigrants is around the

capital city and around centers of economic activities such as Brno, České Budějovice, and cities in the north of Bohemia on the border with Germany.

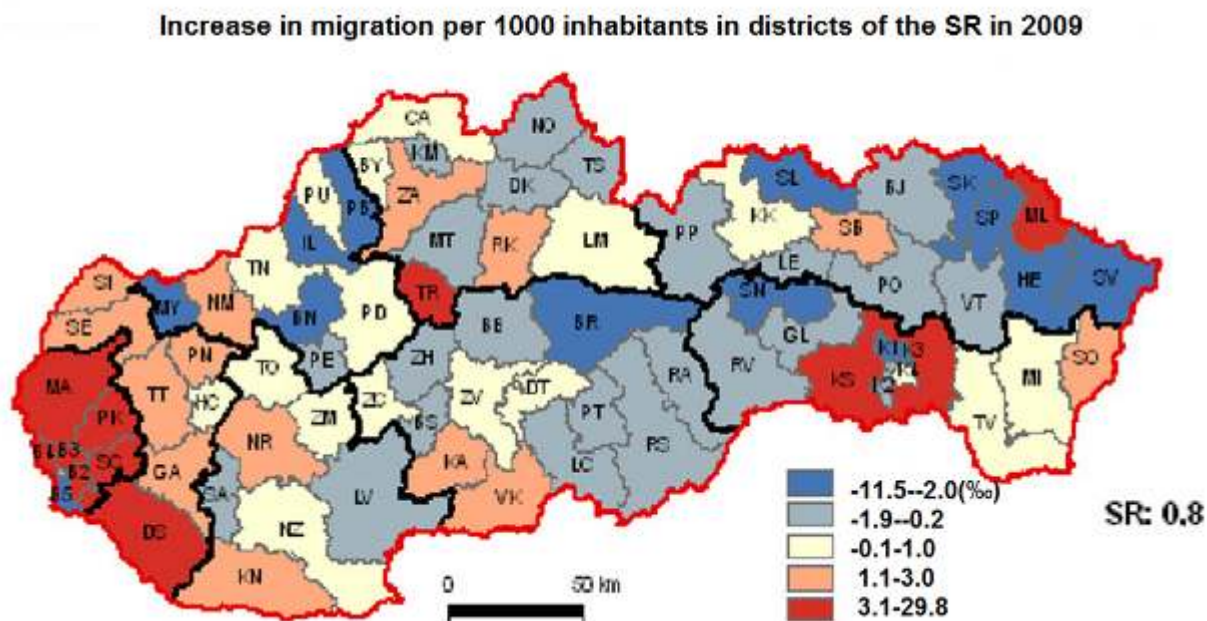


Figure 7 Increase in migration per 1000 inhabitants in districts of the SR in 2009

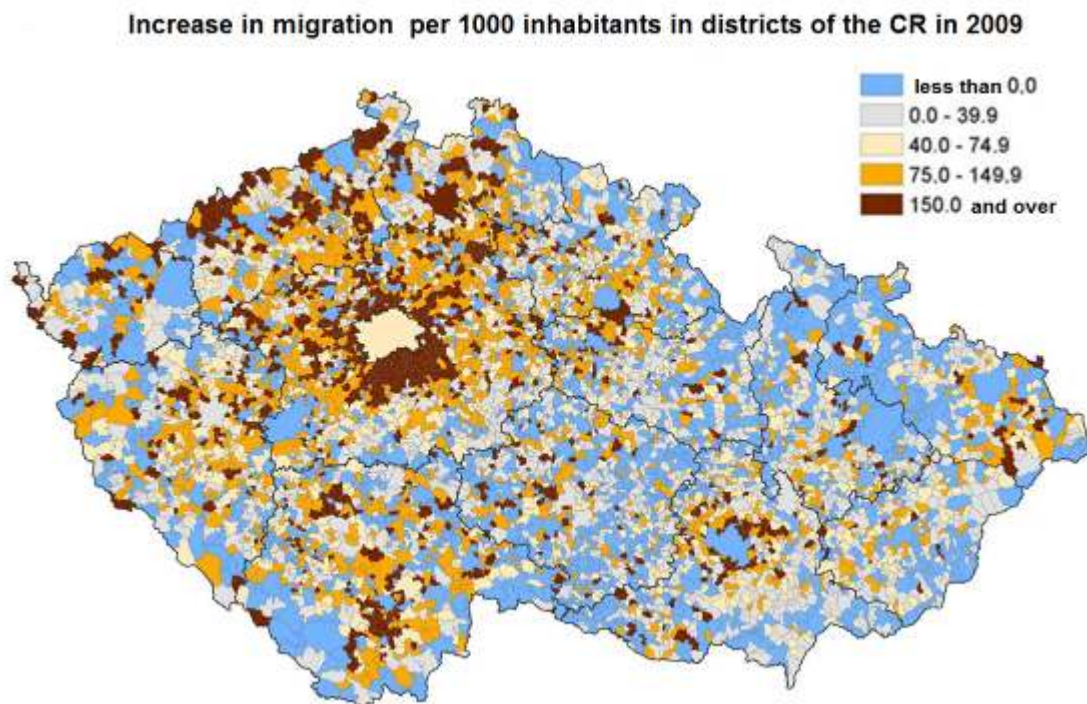


Figure 8 Increase in migration per 1000 inhabitants in districts of the CR in 2009

3. SUBURBANISATION

The current condition of the communication network is characterized by a large volume of traffic and congestion, especially in the large cities - urban districts of regional and national significance. This phenomenon is caused not only as a result of the increase in the degree

of motorization, but is also due to the impact of population migration from the cities in the form of associated communities, villages or cities and their availability. On a closer examination of the situation taking place in Czech and Slovak cities [2] with a population of 20,000 to 100,000, one can observe an interesting phenomenon. It has already been described in many publications - suburbanization. Suburbanization means people moving from cities or towns of a greater importance to surrounding municipalities and villages. These villages are usually located at a distance corresponding to an acceptable daily commute to workplaces, which remain in the city. This trend is most obvious in cities with higher populations. People keep their employment in big cities, because despite the time spent commuting, it is still profitable. This is reflected in the volume of traffic at the entrances to cities. The volume of traffic thus increases not only due to the increasing degree of motorization, but also to the increase in new drivers, who originally moved only within a city or who previously used public transport.

3.1. Factors in the Origin of Suburbanization

Suburbanization usually means the growth of a city by spatial expansion in the surrounding rural and natural landscapes. It does not concern every expansion of a built-up area, but developments around a town, which are characterized as loose, sparse and scattered. Suburbanization is associated with a much lower degree of density than exists in the city. It is characterized by independent or studio, flats and, one and two-storey family houses with private gardens, which usually form socially homogeneous residential zones, as well as strip commercial development and industrial parks, which are often located under highways and other major communication axes or near their intersections.

Suburbanization sometimes also means creating suburbs, i.e., specific types of suburban towns. In the United States entirely new settlements were created, which disrupted the traditional balance and relationship between large cities and rural farms. In Europe, however, because the long-engrained structure of the population usually does not produce a completely new seat (except for some new towns such as Milton Keynes in England or Lelystad in The Netherlands), the development occurs on the edges of existing small towns and rural municipalities in the surroundings of big cities. The emerging suburban area may reach a scale where it fully absorbs and breaks down the character of the original settlement and is dominated by new features.

In the United States it is relatively easy to find the connections between the suburbs and suburbanization. In Europe and the Czech Republic, the situation is more complicated. Suburbanization usually does not lead to the creation of a new type of seat, but involves changing the existing one. The suburbanization in the Czech and Slovak Republics is better seen as a process that leads to the creation of new types of buildings and land use within existing settlement structures [7].

The impact of suburbanization in the United States was assessed by the study "Costs of Sprawl - Revisited" (1998, 2002). It deals with changes in transportation in relation to the type, density and localization of developments. It examines the costs of physical, financial, and social time, both at the individual and community levels as well as the whole society. As negative consequences, the development of urban sprawl in transport identifies:

- increased transport costs,
- increased mileage,
- longer travel time,

- increased number of journeys by car,
- higher costs to a family as a result of individuals travelling by car,
- more expensive and less effective public transport,
- noise, pollution, traffic jams, accidents, etc.

The construction of local roads, bypasses, feeder roads, highways and parking lots constantly increases the pressure on land surfaces, resulting in radical and irreversible changes in land use. The cost of construction and the maintenance of a transport infrastructure are a major burden on public budgets, which are left with almost no money for public transport. Moreover, it has been shown that the large-scale expansion of road capacity does not solve the problem of overcrowding in a network because new roads induce new traffic flows, which had been maintained before the construction by another method [6].

3.2. The Consequences of Suburbanization in Traffic

Cities also suffer from the displacement of pedestrians by cars. Cars eliminate roads, sidewalks, plazas and waterfronts. The reason is the desire to go everywhere by a car, which people often associate with a feeling of freedom. However, a denser population in a city requires less travel and more space remains for undeveloped land and wildlife.

Specialization and the segregation of different work areas leads to an expansion of the distance between homes and workplaces. Because these processes are taking place mostly in an uncoordinated manner and independently of the existing transport system, the distance is increasing, which results in more car use and is to the detriment of public transport. It is a gradual process that causes public transport to lose importance and eventually disappear. The result is that many categories of people (mostly elderly people), have even worse access to transport, and spatial mobility decreases. However, cities have begun to restore the priority of public transport by improving its quality and ordering separate lanes for public transport. Nevertheless, the share of public transport is decreasing, and the proportion of car users is growing.

When comparing the distribution of populations by the type of sector in which they work, we can see that the primary sector devoted to agriculture is constantly falling. The secondary industrial sector is reducing production; the tertiary sector (services) and the quaternary sector (education, development) is rapidly developing. The increasing role of the tertiary sector contributes to the migration of population into small towns. Where both extra space land and labor are found, migrants and companies are providing services. These trends are stimulating an enormous amount of development in the transmission of remote data (faxes, mobile phones, computer networks, the internet, telecommunication satellites, etc.). The management of companies and financial operations is possible from remote locations through telecommunications technology. "Teleworking" may also be understood as working from home. We can say that we are working in our home office a few days a week. One of the main benefits of working from home is saving the time that the staff spends commuting to work. According to forecasters, "teleworking" may terminate the spillover of the population from rural to urban areas because there are solid reasons why workers do not want to be in the city. There still remains the question of in which direction humanity is going. Should a person abandon daily contact with the outside world, which enables an employee to be at work every day or sit with colleagues? Can the world of the Internet replace the real world?

4. STRATEGIES - FUTURE TRANSPORT DEVELOPMENTS FOR THE CZECH AND SLOVAK REPUBLICS

The main Czech and Slovak strategic documents that indicate the direction of future developments are "The Transport Strategy for the Transport Development of the Slovak Republic Till the Year 2020" and "The Transport Policy Document for the Czech Republic in the Years 2005-2013". These documents deal with an analysis of the problematic issues in the transport sector and identify possible solutions. These are the documents that define the basic long-term objectives, priorities for the development of transport in Slovakia and the Czech Republic, and the tools and resources necessary to achieve the stated goals. The vision of these strategies is to provide a high quality, accessible and integrated transport infrastructure, competitive transport services, user and environmentally acceptable transport and energy-efficient and safe transport by 2020.

Travel behavior patterns closely connect with social and individual values and attitudes and are also linked to major societal trends such as aging populations and the assumption of a suburban life style. Vehicular traffic is environmentally harmful (emissions, noise, erosion, pollution of soil and water); however, individual mobility is an important element of personal liberty for citizens. It cannot be assumed that every citizen can have a car, which is especially true of children, seniors and handicapped people, who rely on public transport.

Therefore, a fundamental priority of the Slovak Republic's policy is to apply the "co-modal approach" - the effective use of various modes and their connections in order to optimize the transport system and the efficient use of transport modes for a more favorable environment. This policy has many goals, for example, to realize interchange stations in important city centers for public transport and include constructing park-and-ride parking for individual cars. This type of investment will prepare the conditions for the implementation of main passenger traffic by the railway transport, and sending traffic to the interchange stations will implement the bus transport. This policy would like to realize a combined mode of transport with the possibility of interchanging from cars to public transport.

Recently, nationwide support was found for the completion of an east-west highway at the expense of improving the railways throughout the Slovak Republic. If this is the correct approach, it will be evaluated in the future. Unfortunately emphasizing road transportation leads to a greater dependence on the automobile and a higher level of road use.

In the Czech Republic, the priority is to achieve an appropriate modal split between transport modes by ensuring the same level of conditions in the transport market. Cities should develop their transport systems in order to be effective in meeting needs as well as to be environmentally friendly. It is necessary to promote public, bicycle and pedestrian transport and build an infrastructure for public transport and related non-motorized transport. The state will encourage the purchase of public transport vehicles in accordance with the legislation supported by the public. Public transportation systems in cities will be joined together into integrated systems with all kinds of suburban traffic and the introduction of telematics for the management and reporting of information about public transport traffic. In the field of private car traffic, it will be necessary to apply modern methods for management services, including telematics, to regulate traffic through the organization and management of transport and parking (including pricing), or charge for entry into the city's centers.

Measures (the Czech and the Slovak Republic):

- Develop the conditions of transport services to form the spine of a transport system with the railways.
- Provide public support only to carriers who are economically stable and able to provide transportation services in the required quality and services which are guaranteed.
- Establish a methodology for providing transport services as public service obligations.
- Expand the geographical scope and functionality of the Integrated Transport System ITS (including methodological support to improve the management and coordination of activities between the modes).
- Continue legislative support for the establishment and improvement of the functionality of the ITS.
- Promote the creation of information and telematic systems in public transport.
- Connect the state to the building of a pan-European multimodal information system.
- Ensure comparable taxation and pricing of rail and bus services in the country.

CONCLUSION

The modal split of Slovakia has a clearly declining character, which is to the disadvantage of public transport. The cause of this phenomenon is mainly the transport behavior of the population. It is affected by several significant factors in the socio-demographic and economic spheres. The higher levels of car availability and the transportation of goods over long distances using road transport are the most significant reasons why public transport is losing its competitiveness.

The Strategy of the Slovak Republic suggests efforts to control the modal split and reduce the growing trends in the transport of goods by road and rail transport preferences, but it is still not enough. The individual charts and pictures represent current trends in the development of both demographic and transportation characteristics, but unfortunately they are not positive for the sustainable development of our cities.

The above text implies that if we would like to keep the cities growing and not harm the environment, as well as promote mobility for immobile people by trying to follow the principles of modern transport, it is necessary to:

- ✓ institute a stable network of public transport with effective support, for example, an integrated transport system
- ✓ regulate individual development, with an emphasis on population density, in order to apply public transport principles
- ✓ motivate inhabitants to remain in the city and not commute every day from the suburbs
- ✓ avoid resolving individual car traffic at the expense of other transport modes and encourage the public to walk, cycle and take public transport
- ✓ support the construction of transport measures that will maximize a preference for public transport

The results of such measures should be a favorable traffic situation for pedestrians, cyclists and the residents of villages and towns. Rules should exist that limit road use to transporting goods over long distances and support the preference of a rail system as a traffic hub and water, air and road transport as an alternative supplement.

REFERENCES

1. Czech Republic - Ministry of Transport : Transport Politics of the Czech Republic for the Years 2005-2013, June 2005, 64 pp.
2. Příhodová, M.: Traffic-Urban Characteristics of the Settlement Structure – thesis (in original: Dopravně urbanistické charakteristiky sídel Disertační práce – teze), VŠB-TU Ostrava and STU Bratislava, 2008
3. PUČHER, J.: Transformation of Urban Transport in the Czech Republic, 1989–1998. Transport Policy, 1999. 6, 225–236 pp.
4. Schmeidler, K. et al.: The Problems of an Elderly Population (in original: Problémy stárnoucí populace) Novpress, Brno, 2009, 180 pp., ISBN:978-80-87342-05-3
5. Schmeidler, K.: The Influence of Transport on the Development of Settlements in the 21st century, Growing Mobility and an Urban Structure (in original: Vliv dopravy na rozvoj osídlení a měst XXI.století, rostoucí mobilita a urbanistická struktura) Urbanism and Land Development (Urbanismus a územní rozvoj), edition VI 3/2003
6. Stohr, K.: Shrinking City Syndrome, The New York Times, February 5, 2004
7. Urban Areas and Integrated Urban Transport, in: Technical Committee Report C 2.3, PIARC, 23rd World Road Congress, Paris, 2007.
8. <http://www.ssc.sk>, <http://www.csu.cz>
9. <http://www.statistics.sk>, <http://www.rsd.cz>
10. Ministry of Transport of Slovakia: The Strategy of the Development of the Slovak Republic till 2020 (Stratégia rozvoja dopravy Slovenskej republiky do roku 2020)