

# Analysis of Accessibility in Municipalities of the Czech

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This thesis deals with the level of transport services of public transport in municipalities and regions in the Czech Republic. It focuses on the position of public transport in the transport market in comparison with competitive individual car traffic and its impact on potential social exclusion of population. The aim of the thesis is to describe geographical differences in the Czech Republic.

**Keywords:** Mobility, accessibility, measurement of accessibility, public transport, private car traffic.

## 1. INTRODUCTION

One of the most important factors of sustainable development of the territory and the successful operation of the company is good accessibility by public transport in the area. This contributes to the achievement of various social, economic and other opportunities for those who for various reasons cannot secure their mobility individual car transport

## 2. MOBILITY AND TRANSPORT ACCESSIBILITY

Mobility has always been one of the determining elements for the development of the individual and civilization. The shift in the perception of mobility can be clearly seen in the historical development of transport and technological progress, allowing increased ability to overcome resistance area ("friction of space").

Since the original division of human mobility (Urry, J.: *Mobility and Network*, 2010) into five basic types:

- physical mobility - which are different forms of travel, migration, emigration, escapes etc., which take place in real time and space,
- mobility materials, goods and services from producers through wholesale / retail network to end customers and consumers, resulting from the different localization of production

and consumption respectively. concentration of population,

- imaginative mobility through the media, photos, etc.
- virtual mobility, i.e. "travelling" in real time via the Internet, which thus overcomes geographical and social distance,
- mobility is a form of communication through letters, mobile phones and the Internet, which current technologies of modern communication allows people to stay in touch over long distances, almost independently of it (which is largely related to the previous model).

As a result of changes caused by the advent of information technology can be expected to shift research interest from a static space defined locations ("space of places") to new forms of spatial interaction ("space of flows"), or the so. dynamic space formed by the flow of people, goods and finally, the increasing amount of information (Adey, P., 2013; Centre for Regional Development MU Brno, 2014).

The mobility is often confused term availability of transport. These are two concepts, which can be seen as synonyms, but do not necessarily are expressions of the same thing or phenomenon. In terms of transport geography can express these concepts completely different situation. High

levels of mobility may or may not necessarily reflect the high level of availability and conversely a high level of availability may be associated with low levels of mobility (EL-GENEIDY, MA, Levinson DM 2010).

If we compare the city and the greater whole, we can say that in a much better availability eg. service or employment, but mobility can reduce congestion, inefficient public transport, etc. In contrast, in the territory of a larger area can be e.g. take advantage of the higher average speed, but the availability of the destinations are somewhat limited by distance, time or financial costs.

Availability can be defined as the amount of effort that is needed to spend to achieve the objective, but also a number of activities that can be achieved from a specified place. Availability can be viewed from several aspects, such as by means of transport, according to the operational organizational perspective on public and individual, according to the operational technical perspective public and non-public.

Of all the possible combinations for us to watch importance especially non-public individual transport and public transport.

### 3. THE METRIC MEASURE ACCESSIBILITY

#### **The measure of direct Euclidean accessibility**

With this method, it is not necessary to design a chart, use only the Euclidean (air) distance. Best accessibility is the place with the least amount of direct Euclidean distance, which corresponds to the centroid of the target objects.

#### **Road accessibility measure**

The method uses a calculation of the distance along the route transfer, i.e. the length of the paths in the graph. Determining Road distance often derives in a GIS environment using network functions type shortest path.

#### **Time accessibility measure**

The method represents the overall travel time from the investigated sources to all destinations radial manner. The best time accessibility the node (the place) with the smallest amount of time accessibility.

#### **Topological accessibility measure**

Topological accessibility measure use graph theory. For direct methods topological accessibility expresses the number of neighbouring nodes in the

graph that the node with the highest number of neighbours has the best direct topological accessibility. In the method of indirect accessibility the topological distances between nodes are expressed by the number of edges on the shortest path between them. Best indirect topological node accessibility will have a minimum value indicators.

#### **Price measures accessibility**

Price measures are based on accessibility transport costs in the case of individual transport the costs of transport. For public transport are watching the price paid for transportation between locations

#### **Infrastructure accessibility measure**

One important category in the evaluation of transport accessibility are called. Infrastructure accessibility measure. Used to assess the characteristics of the transport infrastructure and its use or a comparative study of the level of transport infrastructure between the respective regions. You can rate the availability of elements of transport infrastructure such as highways and motorways, main railway lines, ports, international airports from a municipality or region.

Evaluation facilities and transport infrastructure of the spatial distribution of different methodology, however, is very complex and must take into account many factors, which stood under the current form of transport infrastructure. Infrastructural measures are affected not only by its geographic location, but also the historical development of the territory and infrastructure, economic indicators, natural conditions and land use, type of settlement and other social factors.

In the case of infrastructure measures is the object evaluation of traffic accessibility in relation to the population that possesses or not, the possibilities of its use for a variety of spatial interactions and activities.

### 4. SETTLEMENT SYSTEM AND PERIPHERALS

Transport accessibility of settlements in a certain region affects their hierarchical organization of the network. With the growing number of sites connected with the environment and its importance is growing (Brink, J., 2010), because hierarchically highest part of the transport infrastructure bind to seat the highest hierarchical level (DŤUPINOVÁ, E. et al. 2008). Other indicators, such as coefficients of the density of

transport networks, or indicators hierarchy of the road network serving a closer evaluation of the transport network, the authors describe Mirvald S. (2008) in Seidenglanz (2009) and J. Brink (2010).

In addition to the concept accessibility (transport accessibility) to be in the works dealing with the development of transport infrastructure and properties also meet with the concept of connectivity, as the interconnection of the two places in the transport network. Deviativity concept determines the degree of deviation from a particular transport links theoretically the shortest possible connection. Together they serve to structurally morphological characteristics evaluation transport network, quality comparison between different transport networks or to assess its evolution over time.

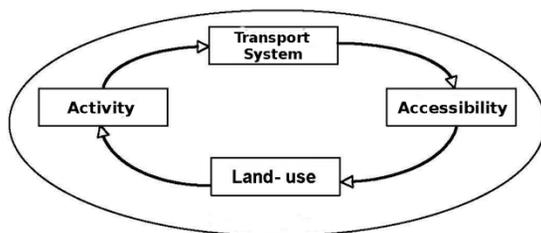


Fig. 1. Relation accessibility, space and structuring activities.

Source: Giuliano (2004) in Kylián (2010).

The diagram shows the relation between transport infrastructure, transport links and activities in the area. Changes in transport infrastructure leading to changes in the transport system and the subsequent improvement or worsening of accessibility, which can also manifest a change in the spatial arrangement of social activities.

The intensity of transport links between different locations can reflect the true intensity of the socio-economic linkages between both settlements, but also the entire region. Transport as a factor enabling the implementation of the interactions within a geographical area, can make or conversely dampen the process of creating and shaping metropolitan areas, therefore, involve closed nodal regions. So often stands behind the creation of multilateral linkages between the core region, its background and the intense linkages even within the metropolitan area when called, metropolitanisation process.

Transportation availability and infrastructure measures play in defining the periphery significant role. We proceed from the assumption that the time

and accessibility infrastructure is of great importance for the formation of functional urban regions. Poor (time), transport accessibility is the cause as a consequence of impaired competitiveness of the region. This is manifested primarily employment, services, education, health and culture. Also, the core area, however, may face some of dependence, especially in the areas of recreation, leisure or a quality environment.

## 5. DEFINITION OF PERIPHERALS IN CZECH REPUBLIC

To study the most important centres of settlement system and their regional cluster analysis was used, in which were included demographic and socioeconomic indicators (population decline, the proportion of people in older age, percentages of persons according to educational attainment, etc.).

Part of the study was to determine the differences in temporal availability of settlement centres as regional centres and local centres operating regions, which are assessed in the publication "Accessibility functional urban regions and urban areas in the Czech Republic" (MAIER, K. - DRDA, F. - MULÍČEK, O. - SÝKORA, L., 2010). The aim was to assess the influence completed or planned major transport investments on access to centres using individual car and the (corridor) railway transport.

More recent studies of the issue is worth mentioning models of alternative future states centre catchment areas, urban regions and integrated settlement systems through individual and public transport.

Model dealing with assessment centres with transport links to public transport was intended to be found in the Czech Republic areas on the basis of that kind of traffic have a higher predisposition to each other daily interactions (mono-centric respectively polycentric). Should confirm or refute the fact that the quality of transport links between centres and their functional organization into polycentric settlement systems, there is a relatively strong correlation.

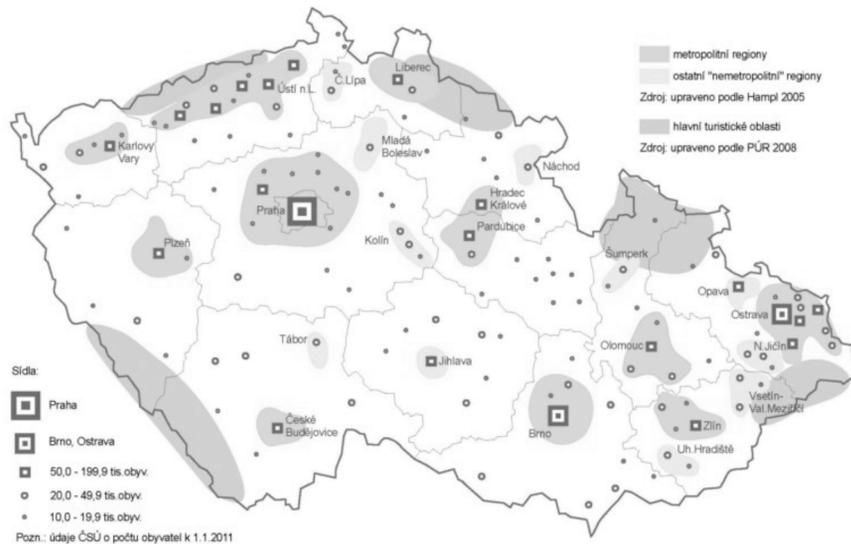


Fig. 2. Metropolitan regions and major headquarters over 10,000 inhabitants  
 Source: Plan of transport service territory trains nationwide transport - principles of long-distance transport orders for the period 2012-2016

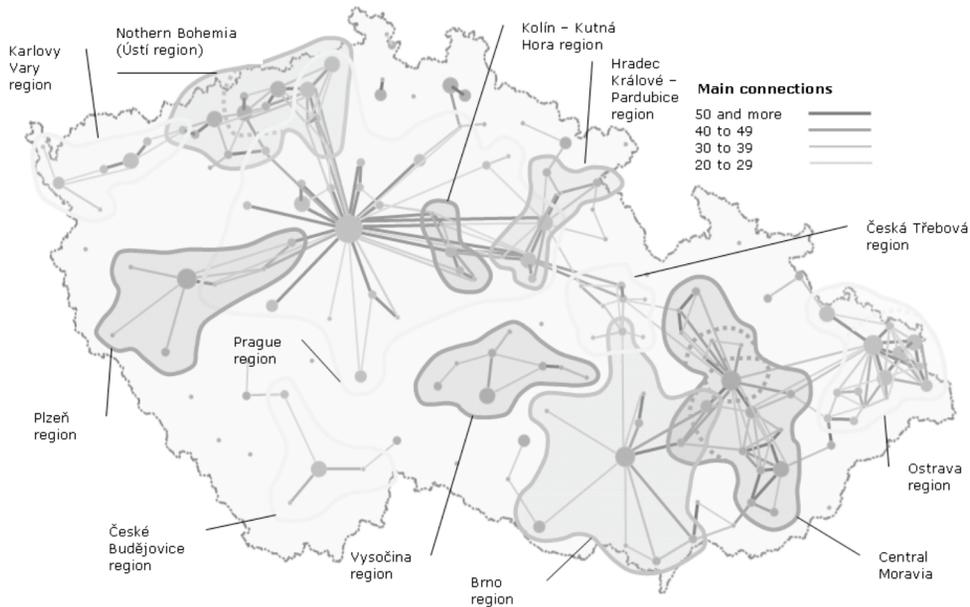


Fig. 3. Demarcation of regions based on the configuration of transport linkages  
 Source: Centre for Regional Development MU Brno (2014).

### 6. PUBLIC MASS TRANSPORT

Subsidization public transport is historically based on two distinct and often conflicting objectives. The first is to provide basic mobility for all people, especially those disadvantaged traffic. The second is to provide effective compensation for passenger cars, which should lead to a reduction in dependence on individual car use and associated externalities, including environmental impacts, congestion etc.

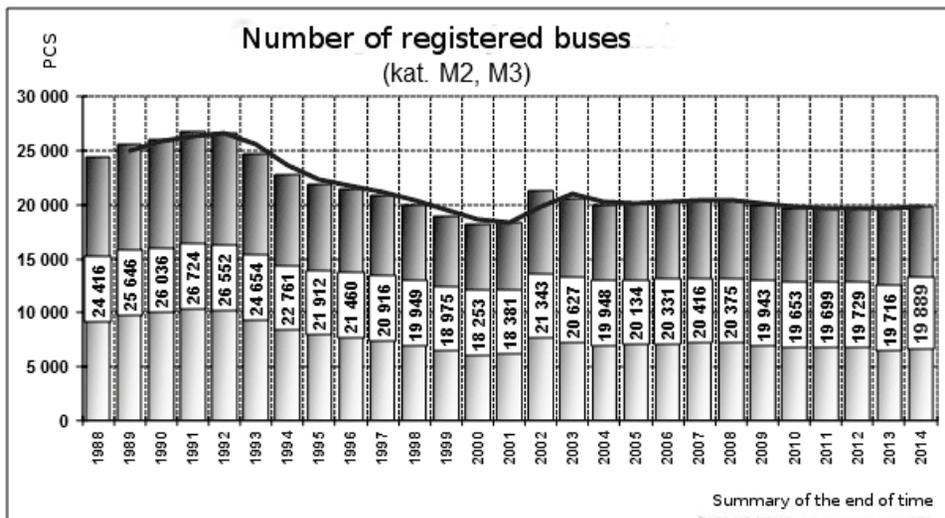


Fig. 4. Composition of the fleet in Czech Republic.

Source: [www.autosap.cz/zakladni-prehledy-a-udaje/slozeni-vozoveho-parku](http://www.autosap.cz/zakladni-prehledy-a-udaje/slozeni-vozoveho-parku)

7. INDIVIDUAL CAR TRANSPORT

In today's transportation needs of the population of the Czech Republic has a private car traffic the highest potential for implementation, since the bulk of public transport modes now often cannot at present spatial organization of socio-economic activities, especially in the ongoing de-concentration tendencies of population and employment opportunities to compete.

For the user has an individual transport number of indisputable advantages that public transport cannot offer. Important aspects include comfort, privacy and freedom of deciding when and which way the path will be carried out, the technological development of the vehicle fleet (e.g. a decline in fuel consumption, telecommunication systems, etc.).

8. REGIONAL DIFFERENCES IN CAR OWNERSHIP IN THE CZECH REPUBLIC

Czech Republic has a considerable regional differences in the growth and value of individual car ownership. Above-average long-term exhibits in Prague and surroundings. Nowadays, thanks to the economic and regional impact is even more significant difference Prague. This reflects the other factors significantly affect individual car ownership such. Commercial and residential suburbanization or higher wages. According to estimates in Prague from 10 to 15% of all passenger car business, i.e. registered here, the headquarters of companies, but in fact used in other regions of the Czech Republic. This causes a disproportionately high increase in individual

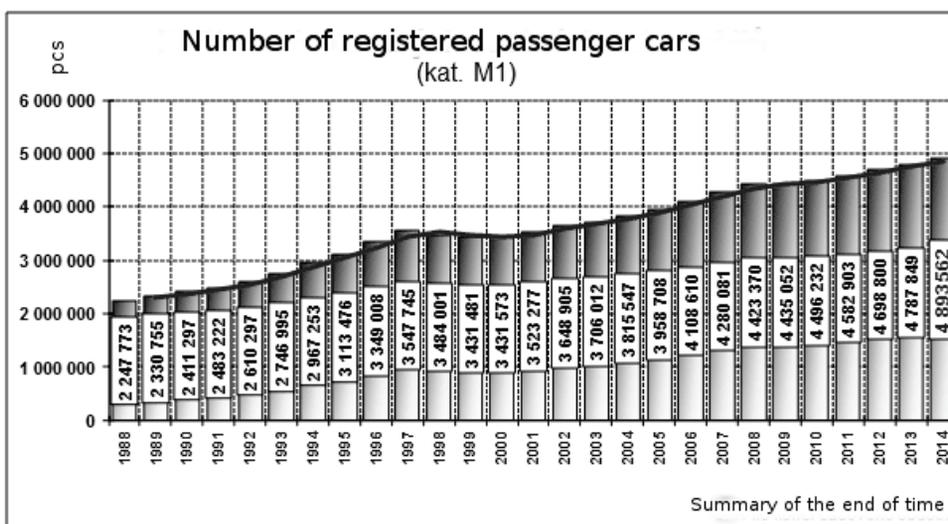


Fig. 5. Development of the number of registered cars in the Czech Republic

Source: [www.autosap.cz/zakladni-prehledy-a-udaje/slozeni-vozoveho-parku](http://www.autosap.cz/zakladni-prehledy-a-udaje/slozeni-vozoveho-parku)

motoring to other regions.

Conversely, a low degree of individual car ownership can be found in the Zlin and Olomouc and Moravia-Silesia region in comparison to Pilsen, Central Bohemia and South Bohemia, although in the case of these Moravian and Silesian regions can observe an increase in the number of passenger cars and related indicators. And it follows that the Moravian and Silesian regions are more focused on the use of public transport.

## 9. NEGATIVES LIMITED MOBILITY

Limited mobility and inability to adapt to new requirements leads to social exclusion. Mobility has become a sort of social demand and highly appreciated the value of the person. In close connection with this inability to meet these requirements becomes from limited mobility social stigma acquiring a strong negative connotations. In the case of social exclusion is the interplay of many factors, resulting in the denial of access by individuals and a group of citizens to have the means to his private and public life due to partially or totally limited mobility in society, which is based precisely on the high mobility. It is not a lack of opportunities, but lack the ability to reach these opportunities and use their potential.

Peripheral nature and limited opportunities for mobility, discriminates against certain groups of the population called unwanted deprivation. The lack of mobility of the population and can be found mainly in small towns and villages of the peripheral area or region. The possibility and ability of the population to adapt to the new conditions are to a certain extent selective and in everyday life causes complications, especially the less mobile population. A population that is not entitled to quality transport accessibility by public transport is free of car ownership subject to the aforementioned social exclusion. The low level of mobility to people relying on public transport is also known by the term "mobility gap".

The walking or commuting distance to other functions of daily mobility of the population (services, education, medical care) significantly affects the appearance of settlements and the region and the availability of the features should match the limited mobility of certain population groups. So you can think about the degree of mobility and geographic extent of human activities during the day. It depends on the individual mobility of individuals, locating resources and spatial distribution of activities at the site.

They are particularly at risk socially weakest groups of the population such as seniors or families with young children who are struggling with limited mobility in the peripheral locations of regions, but also in areas without adequate amenities.

Deployment of social groups in relation to the possibilities of public transport and access to job opportunities, both public and private services or education and cultural institutions are among the factors creating regional differences in quality of life in the context of (not only) in the Czech Republic.

## 10. AREAS WITH POOR SERVED BY PUBLIC TRANSPORT

In typical rural environment of western, southern, central Bohemia and the Czech-Moravian Highlands, which was dominated by small towns with relatively large distances between them, the relative equipment in passenger cars greater than for example in southern Moravia and Silesia. There are larger seat, both in terms of cadastral acreage and population and is so advantageous to operate public transport, due to a higher number of potential customers.

Rural regions of Bohemia, then typically along the border region Vysocina and the Central Bohemian and Pardubice region, along the border with Austria, the Bohemian Forest, southwest of Prague in the north of Kladno, Melnik or east of Mlada Boleslav are characterized by low-density rail network, but also a range of buses is not too high. The share of cars in this area is also rather mediocre. Much better is the hinterland of large cities and especially Prague, where the highest proportion of cars in the Czech Republic.

The biggest problems are caused by inadequate and inappropriate frequency of connections, and poor transport infrastructure, especially for potential users of pedestrian residential and commercial satellites. The consequence of these processes is growing polycentric urban cores and Regions. For this reason, it is obvious transition of lateral transport connections to the centrifugal and centripetal relations, and thus to change the "star" model (starfish-shaped structure) model "spidery" ("spiders web structure"). Due to the difficult transport service are the residents of these localities, like people living in peripheral regions, the referral constraints on supply connections or are due to dysfunctional public transportation are forced to buy a car.

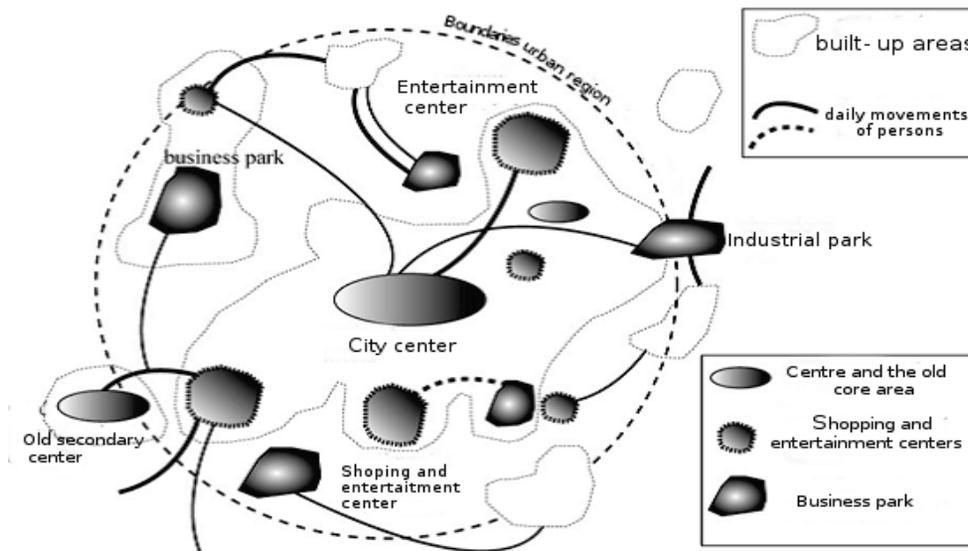


Fig. 6. Transport relations in the city.  
 Source: Centre for Regional Development MU Brno (2010).

The result of rising living standards and insufficient supply of public transport increases the level of car ownership in the country. Passenger car became, among other things, a symbol of freedom and a certain social status, for the population living in regions with poor served by public transport and a necessity, without which it would seriously hinder their mobility and access to basic needs and activities. Now in peripheral regions with low population density and small settlements accessibility and mobility is very important because in larger cities it is possible to provide a range of needs and without travelling means of transport.

### 11. REGION CENTRAL MORAVIA (OLOMOUC - ZLÍN)

Effect of polycentric settlement system, which is characterized by higher average population size of municipalities and denser transport infrastructure is also reflected in the lowlands of Central Moravia, from Uherske Hradiste to the area Mohelnice north of Olomouc or northeast if Hranice. Despite the size of Olomouc (110,000 inhabitants) within the settlement system of the Czech Republic, mezoregions falls short of that size in the number of municipalities or residents, as is the case with similarly large and important cities. One of the reasons is the competition of cities like Prerov (46,500 inhabitants), Prostějov (less than 50,000 inhabitants), but also smaller towns like Hranice (20,000 inhabitants). Among the important centers linkages daily frequencies

can be set off even those who it belongs to the Zlin region. Northwest of Zlin is located next seat mezoregions of this area, Kromeriz (30,000 inhabitants.), relational interdependence between Holesov (12,700 inhabitants) and other centres - Hulin (7,700 inhabitants) or Chropyn (CSO, 2014).

On the example of mezoregional centre of Olomouc is evident daily commute from a range of approximately 20 to 30 kilometres from Olomouc, which corresponds to the availability of public transport service lines and at the same time distant from the selected cities connected to the high-quality transport infrastructure and integrated transport system with commuting to 50-60 min. From the villages in the near of Olomouc, Prostějov and Prerov is a high proportion of people commuting into the city catchment (often between 50 and 80%). Obviously the dominance of Olomouc most evident in the number of occupied posts, which cannot compete with other centres. The situation is slowly changing facilities in smaller centres such as Litovel, Mohelnice, Zabreh or Unicev, where the proportion is still around 40 to 60%. ("Plan transport services in the Olomouc Region, 2012").

When the realization of an integrated transport system of the Olomouc region merged with formerly isolated systems that were already in the region operated. Olomouc region's integrated transport system in operation since 1997, in the vicinity of the boundary in Moravia Zabreh Moravia and Sumperk since 2001. Since 2003 also

in Prostějov and Prerov. From the following year transport system fully covers the Olomouc region.

In contrast, the Zlin region currently lacks a functioning integrated transport system (except for the cities of Zlin and Otrokovice in the area of public transport), which may in some areas be negatively reflected not primarily the lack of continuity of rail and bus services. In the near city mezoregions, the town of Zlin to 76.9 thousand. the inhabitants of the village are handled very well, as evidenced by the number of individual connections or low average commuting time. This is essentially a village in the hinterland of Zlin and Otrokovice (19,300 inhabitants). Of the larger and more important, for example, one can appoint Napajedla (7,700 inhabitants) Vizovice (4,500 inhabitants) or Frystak (CSO, 2012).

Zlin itself has long been at a disadvantage compared with other (regional) cities absence of a highway, or at least the speed connections, which changed in 2010. The main interregional transport demand from Zlin metropolitan region faces Prague, followed the direction to Brno (about 2/3 of the power to the capital), and has a higher distance in Olomouc and Ostrava region (Czech Statistical Office, 2012). In terms of daily commuting frequencies are significant links with Uherske Hradiste agglomeration, where the main core area consists of Uherske Hradiste (26,400 inhabitants), Stare Mesto (6,800 inhabitants) and Kunovice (5,300 inhabitants) and South part of the Olomouc region near Prerov. Well are accessible village just near road no. 49 towards Vizovice or no. 55 towards Prerov, respectively Uherske Hradiste, especially the bus service as a direct train connection was introduced only in recent times, that is to conduct research from 2010.

Plays a big role and influence of the rail corridor (no. 330) Breclav - Prerov, the amount of connections improves the availability of Zlin rail transport, and in many cases having to change Otrokovice, which they are as a seat of one of the major employers also very frequent target of labour commuting. Transport services not only in terms of availability of Zlin, but effective organization of interregional possibly regional level, unfortunately complicates the position of Zlin in the rail network. Additionally, the railway line from Otrokovice over Zlin to Vizovice no longer complies with the requirements for quality, perhaps rather decent combination of these settlements.

In the outlook next year expects to expand transportation capacity and electrification of the

whole section ("General Plan Update Transport Zlin region, Design visionary concepts", 2010). Then it is probably more complications unrealized extension of the railway from Vizovice to Valasska Polanka. It is this missing section will adequately complement the rail network in the Zlin region and could contribute to improved serviceability southeast and especially the eastern region along the border with Slovakia by railway. Looking the rail network Zlin region, the difference compared with the South Moravian, Moravian-Silesian and the Olomouc, Brno forms the natural node radially converging networks. The same is true in the Olomouc region in the event of two major nodes Prerov and Olomouc or Moravian a stroke and spinal centre in Ostrava. To some extent, however, also played a role expanse of individual regions, the Zlin Region is significantly smaller than the above region.

Zlin Region lead, while two major tracks (except track no. 330 have the track no. 280 from Hranice, across Valasske Mezirici to Horni Lidec), but the connection is only possible through a more regional electrified monorail route no. 303 from Kojetin over Hulin, Holesov to Valasske Mezirici. This railway represents the average share of passenger rail transport regular commuting between about 46-63%, especially in the section Kromeriz - Valasské Mezirici.

Rail transport in the Zlin region involved in serving the territory of 77 towns and villages, in which the lives of over 400 thousand people, which is 67.9% of the population of the region. The railway passenger transport is strengthening its competitiveness against the individual automobile transport conditional reconstruction of selected tracks with a view to increasing average travel speed and advanced security system, the frequency of connections and offers high-quality transport. The next step is finding the concept but also in organizing an integrated transportation system for areas where there is a joint offer bus and rail ("General Plan Update Transport Zlin region, Design visionary concepts", 2012).

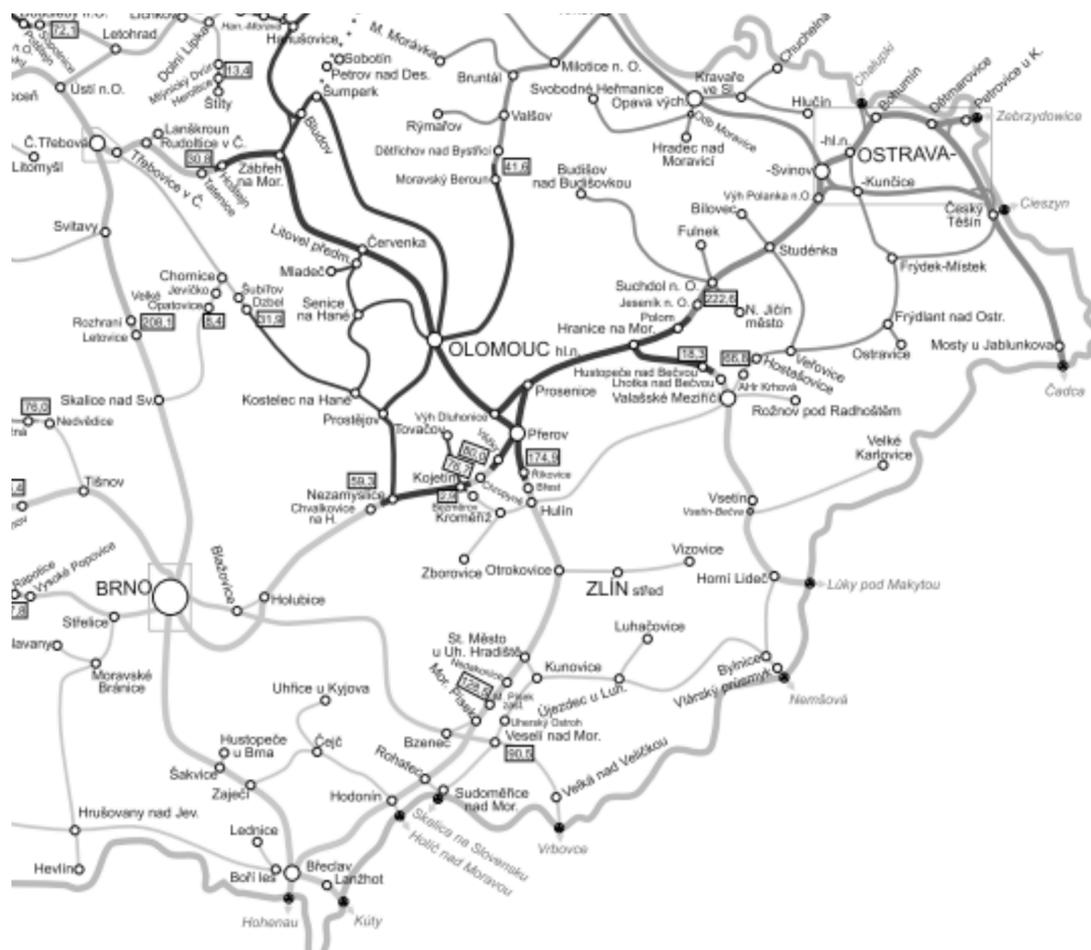


Fig. 7. Rail infrastructure in Moravia and Silesia.  
Source: SŽDC, 2014.

## 12. CONCLUSION

The situation in the field of public transport in the Czech Republic greatly differentiated. This reflects the large number of factors that affect it and enter its functioning within the company. Large differences exist between the different areas of Bohemia, Moravia and Silesia. A similar situation also between urban and rural regions urbanized.

The evaluation of serviceability and all access to it, it is probably even more difficult. On the one hand, to some extent can be satisfied with the data on timetables and numbers of connections, drive time or number of serviced sites. Such information austere but in some respects do not reflect the actual population trend and its mobility.

The issue of public transport and in addition to the perspective of transport can also be seen, for example, from a social perspective. And will always exist people who are unable for various reasons to own a car, there will always be people living in peripheral, low-populated areas where

you never make any highway or high-speed rail. And yet these people will need to reach places where they can find work, education, medical care and cultural activities. Therefore, it cannot decline passenger numbers taken as a signal to interference joints and reduction services. It must be through administrative and ultimately financial barriers to seek and try to find the solutions they need, so that each had a population of Czech Republic at least minimal access to public transport.

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