

ARTICLES

DAILY COMMUTERS IN SLOVENIA

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ABSTRACT

Daily commuters in Slovenia

The paper analyses and explains the phenomenon of daily commutes of workers in Slovenia. The first part of the article presents the daily mobility analysis of workers in the ten biggest employment centers between 2000 and 2009. The results indicate shifts in the daily mobility patterns, which is a result of traffic infrastructure development and socioeconomic changes in the urban system. The second part describes the analysis of the worker's mode of transportation and the reasons for the regional differences. We may notice considerable differences, especially in the distinct decline of public transportation use and the increased motorization of the population. Regional differences are also apparent, particularly in the modal split between the western and eastern part of the country and between larger and smaller towns. This can be explained by varying levels of motorization in individual areas, differences in the public transportation system providers, and numerous ways of work process organization in industrial and service centers.

KEY WORDS

geography of transportation, commuting, modal split, motorization, public transportation, Slovenia

IZVLEČEK

Dnevna mobilnost zaposlenih v Sloveniji

Prispevek analizira in razlaga pojav dnevne mobilnosti delavcev v Sloveniji. V prvem delu prispevka je predstavljena analiza dnevne mobilnosti zaposlenih v desetih največjih zaposlitvenih središčih v obdobju med letoma 2000 in 2009. Rezultati kažejo na spreminjanje vzorcev dnevne mobilnosti, zlasti zaradi razvoja prometne infrastrukture in družbenoekonomskih sprememb urbanega sistema. V drugem delu predstavljamo analizo načina prevoza delavcev in regionalne razloge za razlike. Ugotavljamo obsežne spremembe, zlasti v izrazitem upadu javnega prometa in naraščanju motorizacije prebivalstva. Opazne so tudi regionalne razlike, zlasti v »modal splitu« med zahodom in vzhodom države ter med večjimi in manjšimi mesti. To lahko razložimo z različnimi stopnjami motorizacije posameznih območij, razlikami v ponudbi javnega potniškega prometa in različno organizacijo delovnih procesov v industrijskih ter storitvenih središčih.

KLJUČNE BESEDE

prometna geografija, dnevna mobilnost, modal split, motorizacija, javni promet, Slovenija

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1 Introduction

Human social and economic activities have always been conditioned by movement. The division of labor means the spatial separation of the place of residence and place of work and leads to daily mobility, causes traffic arteries and has a strong impact on the geography of the landscape. The first substantial flows of daily commuting in the developed world date back to the end of the nineteenth century due to the use of the train and other public means of transport; today automobiles have become the common mode of transportation (Dessemontet, Kaufmann and Jemelin 2010). Urry (2007) talks about the real mobility turn that employs many scientific fields, from sociology, spatial planning, transport, history, and others that attempt to explain the reasons for these changes in the mobility of the population.

It is evident that Slovenia has undergone substantial changes regarding structure and the mode of transportation in the last two decades, perhaps even more so than in other countries. The number of registered automobiles has nearly doubled from 1985 to 2005, the percent of workers who use public transport for their daily commuting has decreased from over 64% in 1981 to just 10% in 2001. This has led to increased greenhouse gas emissions of the road traffic in Slovenia, reaching 5,000,000 tons in 2006, which is a 429% increase compared to the year 1986. The exterior traffic costs are accordingly high as well, ranging from 6 to 10% of the entire GDP of Slovenia, with passenger road traffic taking the lead (Božičnik et al. 2004; Plevnik 2008). The impact of the population's increased mobility is also expressed in other ways, not only from the environmental or economic aspect. The automobile-based traffic network is causing the formation of dispersed settlements with a low population density and the subsequent construction of a wasteful traffic and communal infrastructure (Bole 2004 and Uršič 2006).

This paper describes the numeric and spatial changes in worker's mobility in the last decade. The aim is to examine whether the construction of the motorway network as an important factor enabling daily mobility has caused greater mobility flows to employment centers. We will focus on the shifts in the scope of workers' mobility, specifically their numerousness and their alterations to the spatial scope. We will also analyze the daily commuters according to their chosen mode of transportation. The analysis encompasses the entire surface of the country and evaluates the workers' daily commutes in various directions and according to their choice of transportation (modal split). There are considerable differences in choice of transport that differ according to geographical area in Slovenia; for this reason, we tried to determine why regional differences in use of public transport occur with daily commuters.

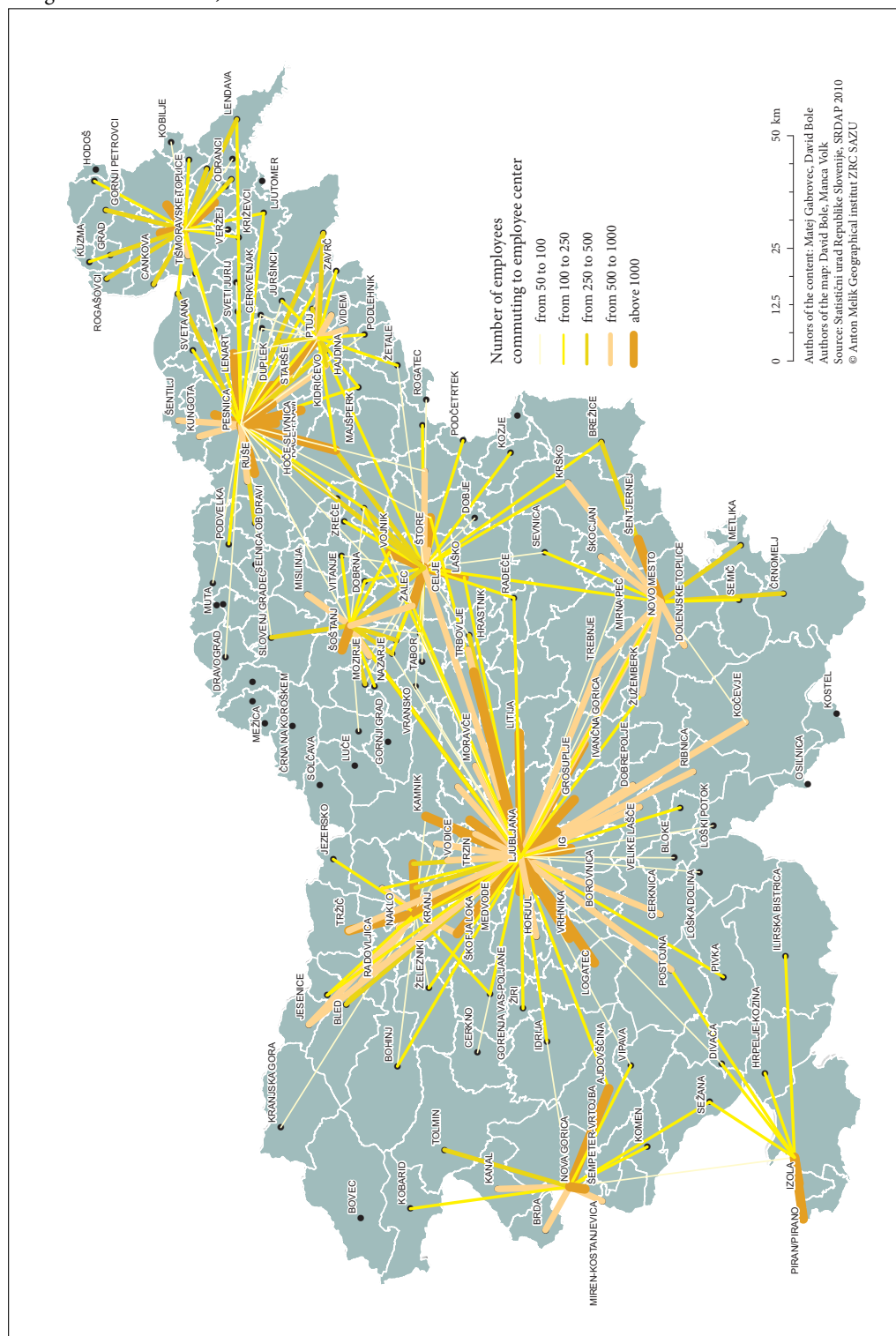
2 Daily mobility analyses from 2000 to 2009

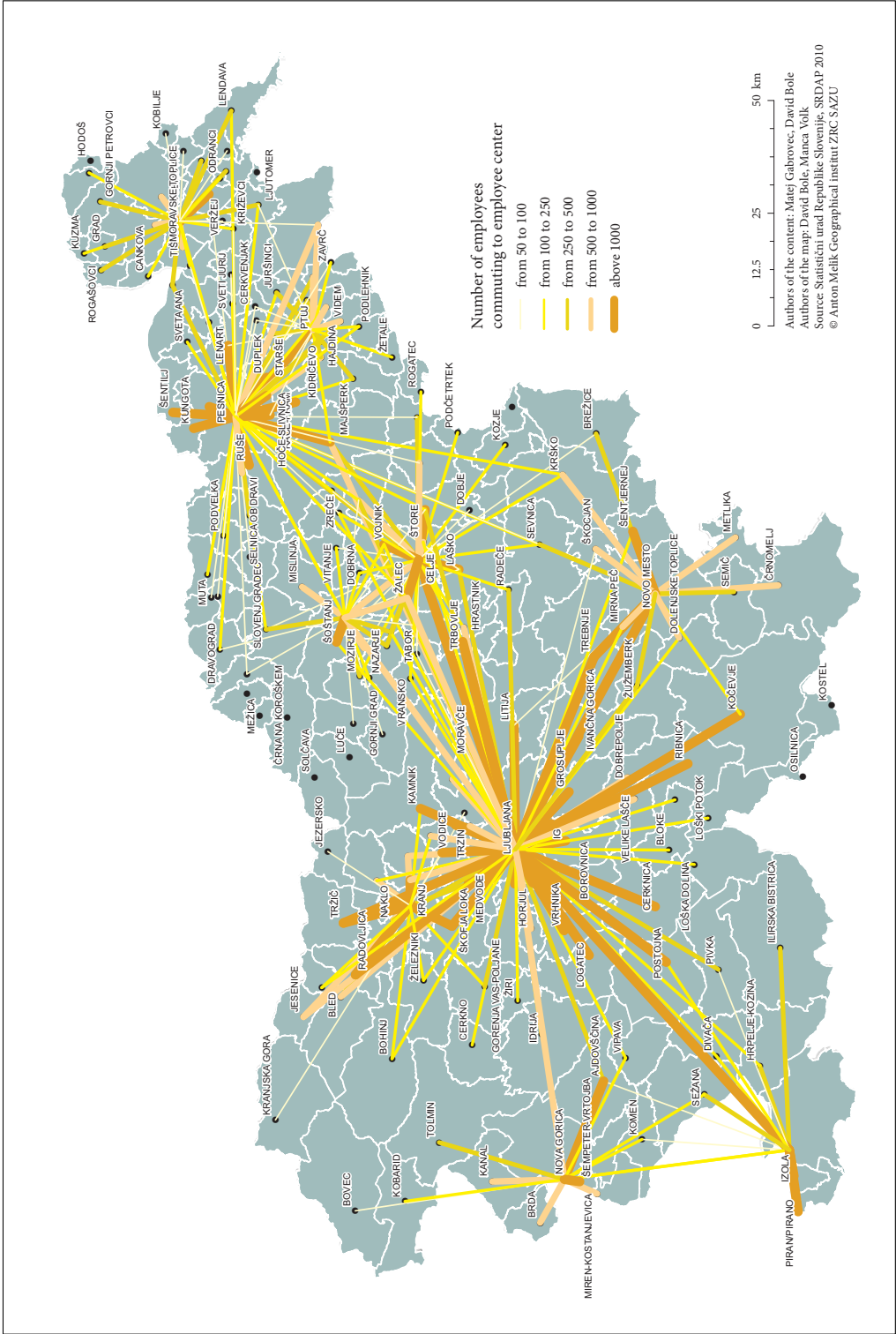
The main source for the illustration of the employment centers' attraction between 2000 and 2009 is the Statistical Register of Employment (SRDAP 2010), where employed persons are listed by place of work and place of residence. However, these registers raise some questions about their exactness. Inconsistencies occur because some companies with several branches or affiliates in various settlements list the seat of the company as the same place of work for all their employees. Discrepancies in place of residence happen because some inhabitants do not state their permanent residence at the address they are actually living. The order of magnitude in these flaws is estimated at 10%. The quality of the data is further analyzed in the monograph *Daily mobility of workers in Slovenia* (Gabrovec and Bole 2009). There is a relatively larger margin of error in some routes where the actual number of commuters is low and the distance between place of work and place of residence is 100 km or more. This problem was quickly solved by simply removing the routes with a suspiciously high number of daily commuters

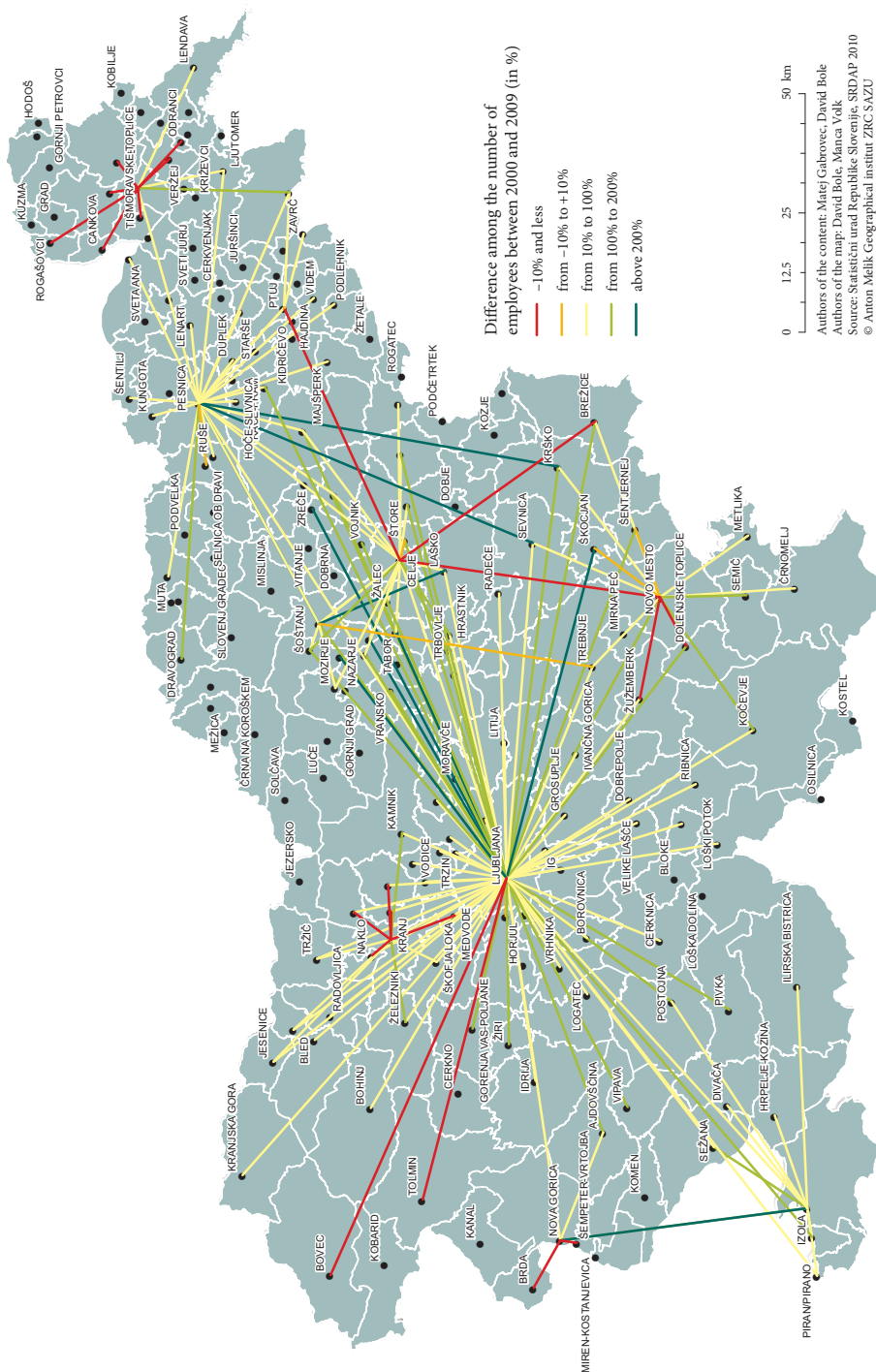
Figure 1: Attraction of the ten biggest employment centers in 2000. ►

Figure 2: Attraction of the ten biggest employment centers in 2009. ► str. 174

Figure 3: Change of employment centers' attraction from 2000 to 2009 in relative values. ► str. 175







between very remote municipalities (for example Lendava–Ljubljana) and not taking them into account. We determined the elementary spatial unit to be the municipality, more precisely, the 192 municipalities as they existed in 2000 and we then examined the commuter flows for the ten largest employment centers in Slovenia. The power of the employment centers, also described as the scope of daily mobility, was illustrated by connecting the originating municipality with the target municipality with a straight line (route). This is a simple method used to examine the regional composition and the power of individual employment centers and their spatial scope. The maps show (Figures 1 and 2) all the one-way routes with more than 50 commuters.

Figures 1 and 2 illustrate the daily mobility of workers in 2000 and 2009. The workers' commute routes show the extensive range especially to Ljubljana, in part also Maribor and Celje. In addition, there proved to be important connections between the employment centers that lie closer to one another. A high level of commuters' spatial mobility was observed especially to the north of Ljubljana in the Ljubljana Basin due to the high level of urbanization or metropolization (Ravbar 1997, 86) and the well-developed motorway and railway connections. A similar conclusion could be drawn in the Drava Plain, where in addition to Maribor, Ptuj was determined to be an important secondary employment center. In 2009 we could observe the expansion of the spatial »scope« of individual employment centers into neighboring municipalities, as well as an increase in the number of commuters between the employment centers themselves. Such are the routes Koper–Ljubljana, Celje–Ljubljana, and Novo mesto–Ljubljana. The most evident reason may be the construction of traffic infrastructure, specifically the completion of motorway sections between these centers. It is interesting to note that besides being a target municipality, it has also become the originating municipality of workers: the number of workers on the routes Ljubljana–Celje and Ljubljana–Koper has more than doubled in the years from 2000 to 2009 (from 200 to approximately 400 workers).

The employment centers Ljubljana and Maribor stand out as the ones with the most increased scopes. It is interesting to note that the scope of the routes in both cases did not only move along the newly-constructed motorway sections, but also along areas where the traffic connections did not improve substantially. In the case of Ljubljana's attraction, an increase can be noticed in the municipalities to the south and in Maribor to the north of the city.

Figure 3 displays the changes in attractiveness according to relative values (shares). It illustrates even more clearly the routes where the biggest changes in worker's mobility occurred. The most noticeable increase can be observed on the route Ljubljana–Celje, where the worker's mobility scope more than doubled in 2009 in comparison to 2000. A 100% increase could also be noted in the worker flows from the Slovenian Littoral, Lower Sava Valley and Lower Carniola regions towards Ljubljana. Important motorway sections had been completed on all the mentioned routes, which enabled better accessibility in the direction of Ljubljana. Other employment centers also saw certain alterations; however, these were not as distinct when compared to Ljubljana. A decrease could be noted only on routes that once lead to important industrial companies. This is an example of shifting the currents of workers' daily mobility combined with economy restructuring from the manufacturing to the service sector; the decrease of mobility to industrial centers was namely followed by an increase in mobility to service centers.

2.1 Reasons for shifts in workers' daily mobility

Improvement of objective and subjective traffic accessibility:

The first characteristic is that motorway construction obviously influences a consequential increase of the workers' scope of mobility. The maps indicate axes where the number of employed commuters increased drastically in absolute as well as in relative values. This refers specially to the following axes:

Koper–Ljubljana, where the completion of the motorway section to the town of Koper shortened the travel time by approximately 15 minutes, which is psychologically evidently enough to remove the »resistance« when contemplating commuting to work.

The construction of the motorway tunnels (in 2005) evidently increased the workers' mobility between the Celje and the Ljubljana region. There was also a drastic increase of worker currents from the municipalities around Celje towards Ljubljana.

The same period also saw the opening of the completed A2 motorway in Lower Carniola in the direction Obrežje, making Krško accessible in an hour and ten minutes. The maps clearly indicate that the absolute shares of workers in Ljubljana commuting from the municipalities of Krško and Trebnje increased drastically and the relative numbers in smaller municipalities.

We may also observe that the increase in the other employment centers was substantially less distinctive than in the case of Ljubljana. The improvement and completion of the traffic network has strengthened Ljubljana's central role, as some past studies have predicted (Gulič and Plevnik 2000). The mobility to the other regional centers changed to a lesser degree. However, it is not only the objective travel time that plays an important role with regard to accessibility, but also the subjective comprehension of the accessibility. Even though the construction of a certain motorway section moves an employment center only a few minutes closer, the comprehension of the accessibility is apparently much greater. An additional increase in motorway use was contributed by implementing the vignette system, thus further stimulating a better comprehension of the employment centers' accessibility.

Socio-economic changes in the municipalities:

The second characteristic is not related to construction or improvement of the traffic network. Some routes reveal a high increase in commuter numbers without any enhancements to the traffic infrastructure. This increase can be ascribed to the basic socioeconomic changes within the urban system (Bole 2008). In the case of some routes the cause is the spreading of suburbanization influences and consequently an increased mobility between satellite places and the central place of work – an example of this being the route Hoče–Maribor. In other cases the mobility to remoter employment centers is increasing due to the originating municipalities' economic crisis. The municipality of Šentilj lost almost a third of all its jobs and simultaneously caused an increase in commuting to the nearby Maribor for more than 300 workers in the period 2000–2009. The same goes for employment centers that are losing their scope of employed commuters; the crisis and job cuts of workers in the food-processing and textile industries in Murska Sobota most likely led to a decrease in mobility of workers from neighboring suburban municipalities.

Changes in hierarchy between regions:

The third characteristic relates to the increasingly obvious connections between regions. Regional centers do not necessarily have a uniform hinterland; they are more and more intertwined and integrated. The connections between the regional centers increased drastically in the examined time period. The important commuter flows extend beyond »regional« borders and form a uniform urban network. Other authors have come to similar conclusions, for example in Switzerland, where it was discovered that not only the mobility patterns within the regions change, but also the patterns between the regions themselves (Dessemontet, Kaufmann and Jemelin 2010); in other words that the hierarchy between individual regions changes.

Changes in hierarchy within regions:

The differences in mobility within regions are also important. Based on urban-geographic research it may be estimated that the inhabitants of regional centers increasingly commute to work to secondary employment centers within as well as outside the regions. Commuter flows are becoming so increasingly dispersed that more and more workers from a certain regional center commute to smaller neighboring employment centers in various industrial zones that are emerging on the outskirts of towns. A similar process has already been described with the examples of the Ljubljana (Bole 2008) and Maribor regions (Drozg 2006) and they point to the establishment of a polycentric formation of regions or a kind of »regional city« where the hierarchical organization of the settlements within the region changes and »balances« out. The improved traffic accessibility has a two-sided effect on the employment center: it means that more and more workers are commuting to an employment center from in the wider region but also enables the inhabitants of the employment center itself to commute outside of it.

3 Modal split to work

The main source of the data on the mode of commuting to work and the choice of transportation is the population census, carried out in 2002. The census information may be somewhat dated, but they are the only data on the commuters' choice of daily transportation for the entire country. The data also enable comparisons with the same data from 1981 and 1991. In this chapter only those daily commuters are examined who do not work in the same place as their permanent residence. If we took into consideration the commuters who live and work in the same settlement, the shares of automobile users would be lower.

A peculiar feature of the Slovenian form of daily commuting is the high percent of automobile use, a consequence of which is the uncompetitiveness of the public transport system's travel times. According to the 2002 census, 78% of daily commuters travel to work by car, with an additional 7% as passengers. Only about a tenth of all commuters use the public transport system. In 2003, a survey sampling was carried out in Ljubljana and its gravitational hinterland about travel habits. The journeys were analyzed according to the purpose, choice of transportation and the time of day. The results for the modal split in the municipalities that tend to gravitate toward Ljubljana in terms of employment were very similar to the census results; 76% of commuters to work were drivers in their own automobiles. A more favorable modal split was shown with the commute of workers in the Ljubljana city municipality, where 58% of the commute were driving a personal automobile (Guzelj and Košak 2003).

Slovenia ranks on top of the EU regarding the use of automobiles. The European statistical data shows that in 2007, 86.2% traveled kilometers of the land transport were driven in automobiles. The

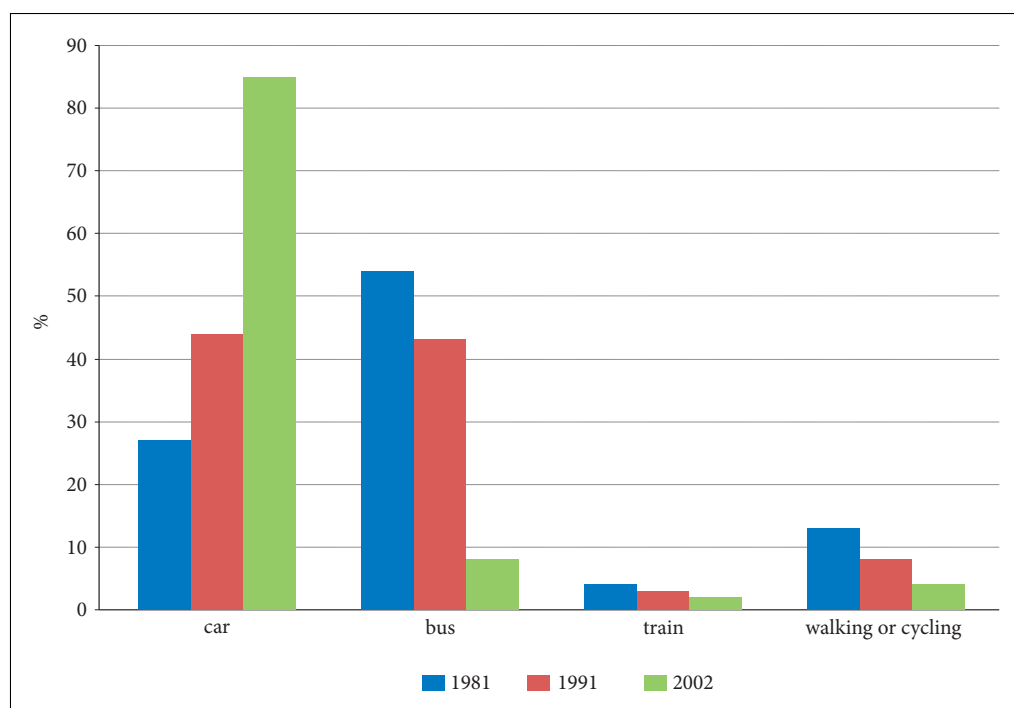
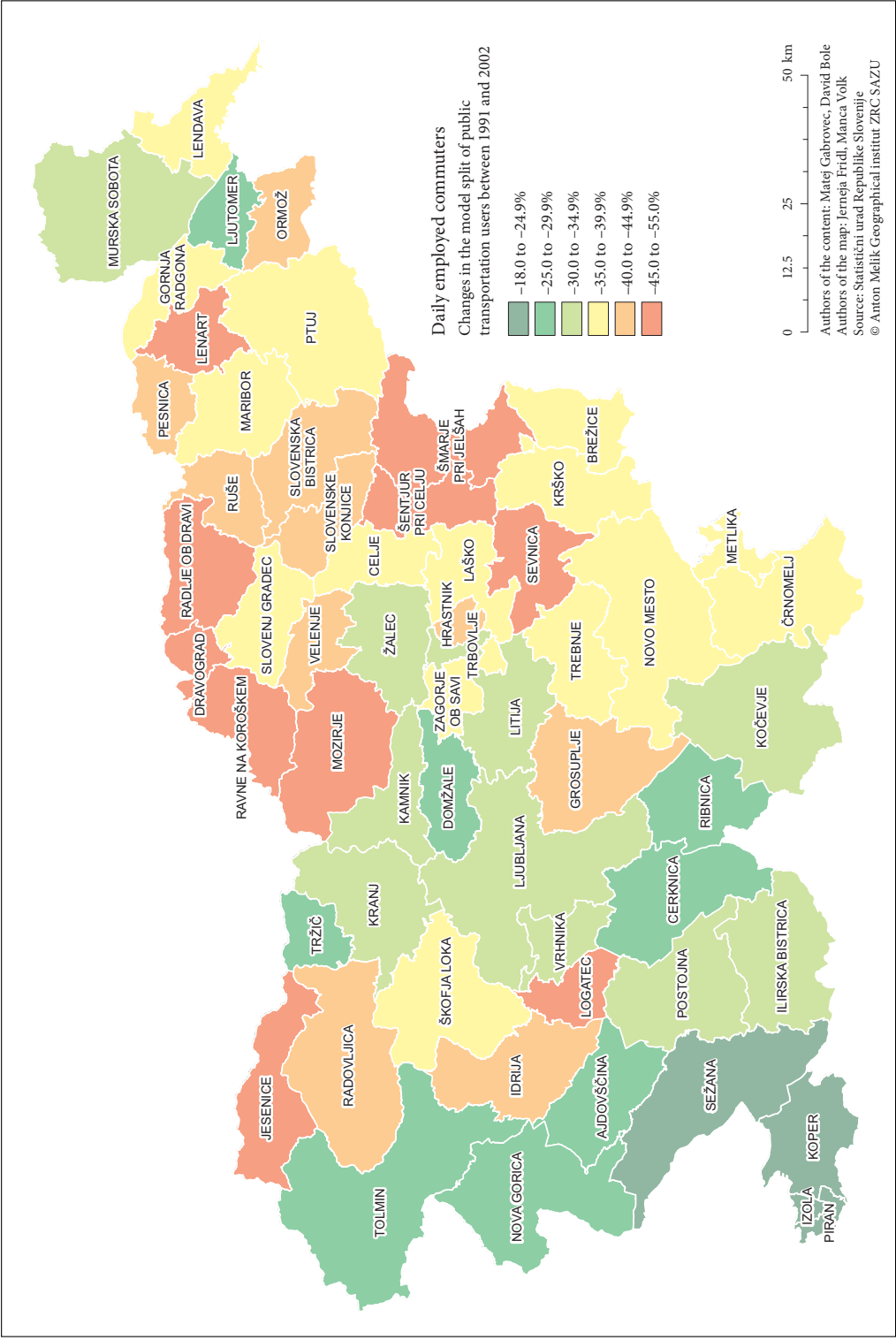


Figure 4: Modal split to work in 1981, 1991, and 2002 (Pelc 1988; Population census 1991; 2002).

Figure 5: Change in the use of public transportation of commuters from 1991 to 2002. ►



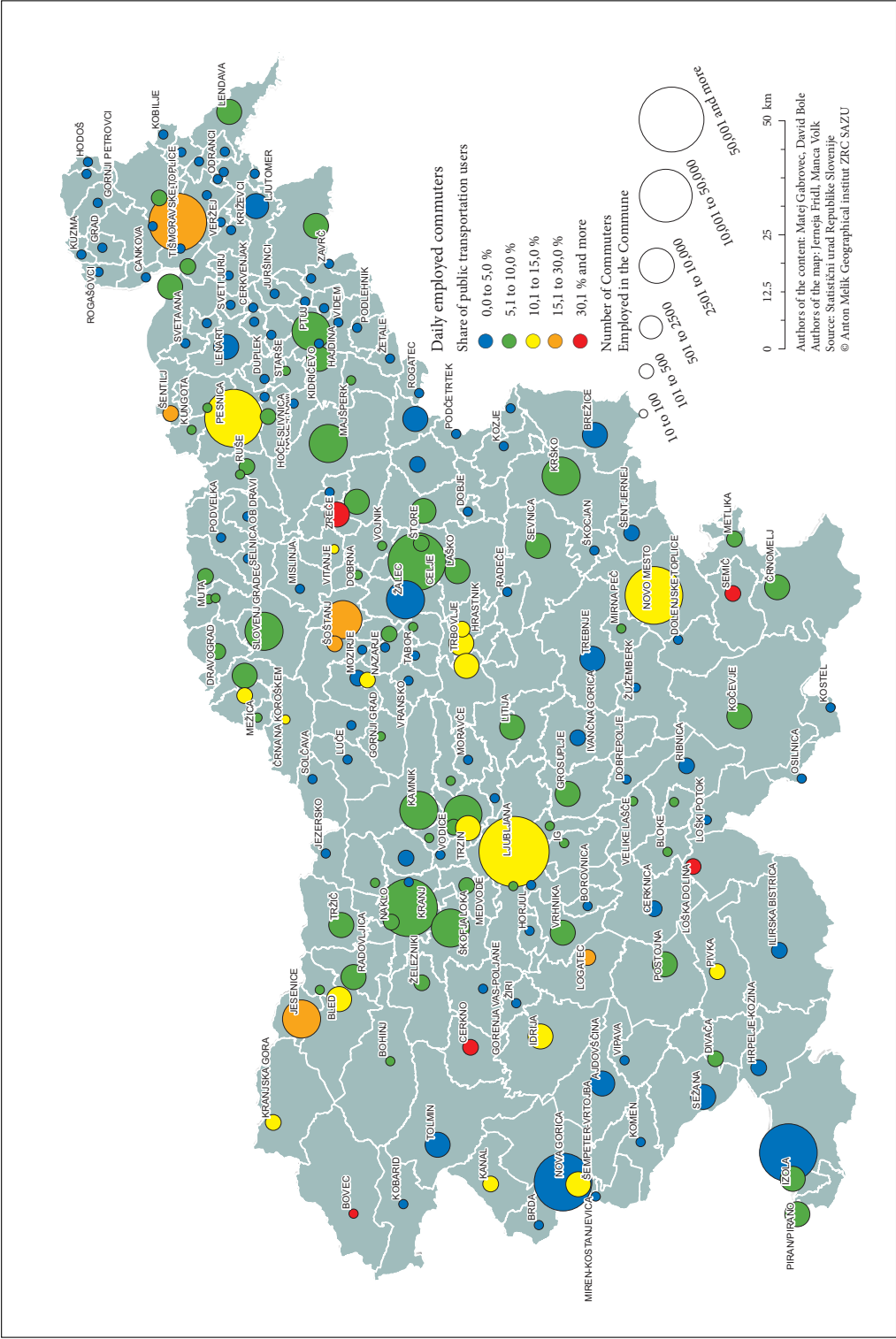
European average is 81.9% and is exceeded only in Lithuania (EU Energy and transport in figures 2010). The rapid decline of the public transportation's role and the increased motorization are high even for European standards, which is especially worrying from the aspect of sustainable spatial development. With 514 cars per 1000 inhabitants, Slovenia ranks higher than the European average (470) and resembles the state in Austria (513) and Germany (504) (EU Energy and transport in figures 2010). The level and spatial arrangement of motorization is a good indicator of the economic circumstances and the values of the society as a whole. Municipalities in the Slovenian Littoral stand out, where according to data by the Statistical Office of Slovenia from 2010, the level of motorization is between 500 and 600 automobiles per 1000 inhabitants. Another such municipality is Trzin near Ljubljana, where the level was the highest in Slovenia (708). Suburbanized municipalities and economically more successful city municipalities are defined by above-average ratings; under-average are mainly older industrial centers which are facing numerous problems (population aging, unemployment, low income) and the least developed rural areas in Slovenia. The access to an automobile seems to be the value of society that dictates the standard of life, as the areas with the highest motorization in Slovenia have the lowest unemployment rate and the highest income. This process has been reversed in environmentally more »friendly« countries where the level of motorization is decreasing despite the high living standard, mostly due to the strengthening of environmental consciousness.

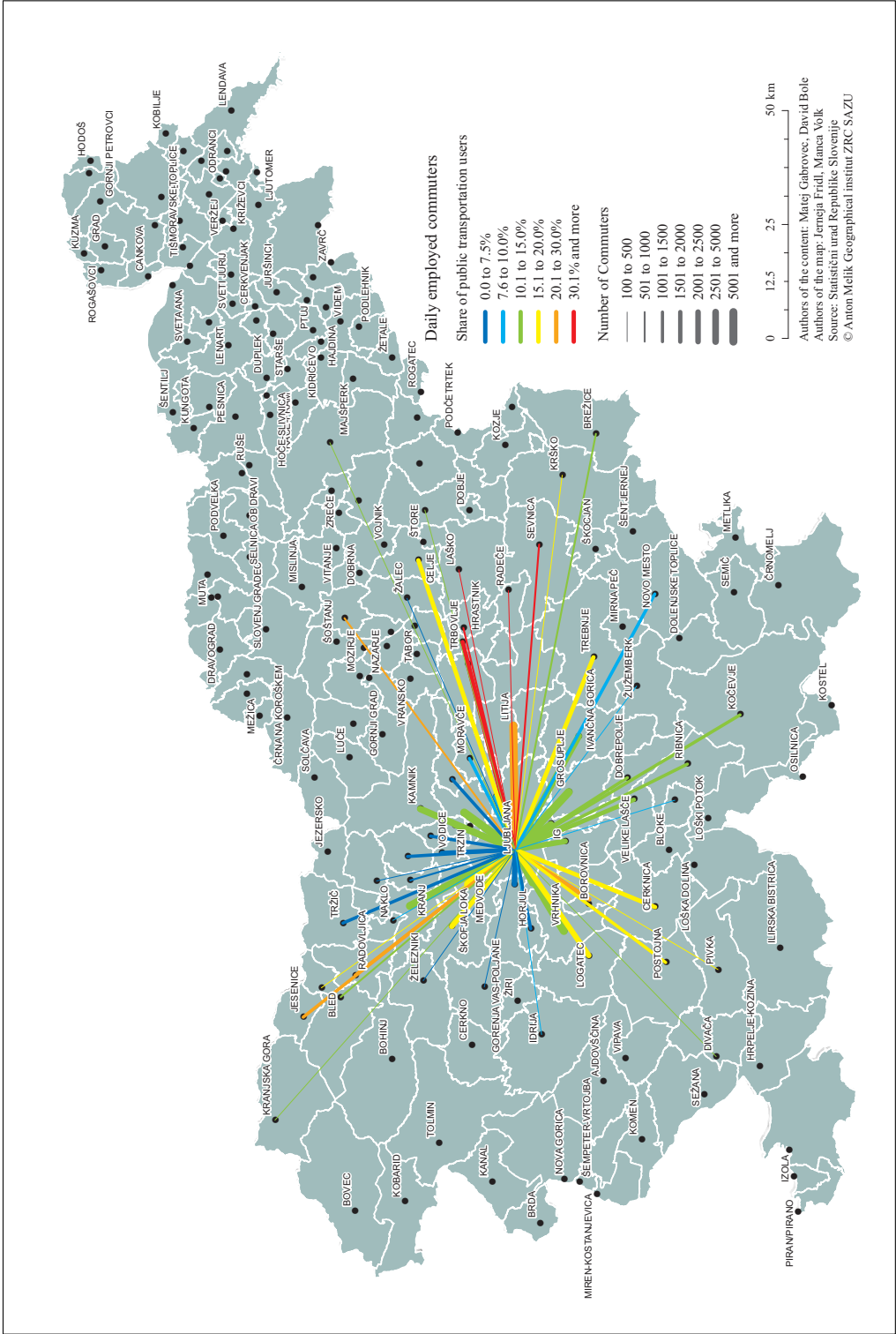
More troubling than the current state of transportation choice in Slovenia is the worrying trend of change in the last two decades. Figure 4 indicates a rapid growth of automobile use for commuting to work on account of more sustainable ways like using the public transportation system and non-motorized forms of traffic. The nineties saw especially fast changes, when the use of automobiles doubled on account of the public transportation system that lost four fifths of its daily commuters during this time. The railway saw less of a decrease, mainly because of lower prices and competitive travel times in comparison to bus transportation. The ratio of drivers to passengers is also unfavorable with car commuters; according to the data from the 2002 census it was 10 : 1. The changes of the modal split mark important regional differences. Figure 5 demonstrates a smaller decline of commuters by public transportation system in the west of Slovenia than the central region. A great decline can be observed particularly in the areas where the public transportation system is quite perfected and its use above-average. This leads to the conclusion that individual regions in Slovenia are in different developmental stages regarding the change of transportation. In western Slovenia the rapid decline of public transportation use already started before 1991, so the change is understandably less noticeable in the studied period. There seems to exist a certain time lapse. The gradual increase of automobiles in families means that one of the parents (or both together) commute to work by car in the first phase; in the second phase they each commute by separate cars; in the third phase, students also stop using the public transportation system and commute with their parents and get their own cars in their senior year of high school. In this way it is possible to simplify and say that western Slovenia is reaching the third phase, with a rapid decrease of public transportation among high school and university students, while eastern Slovenia is still in phase two. In this part of the country the commuters are using public transportation less and less, while the students are not following these tendencies yet. The abovementioned is a description of the period 1991 to 2002; the trends most likely continued after the census year, but there are no statistical data available.

The decrease of public transportation system users as well as users of non-motorized forms of traffic is a consequence of the traffic policy in this period, which focused mostly on the construction of new motorway infrastructure and dealt with the railway and public transportation infrastructure and other sustainable forms of traffic only on a declarative level. Consequentially, using the public transportation system has been assigned a derogatory meaning; for most Slovenians, it is seen as a service

Figure 6: Share of daily commuters who travel to work by means of public transport in municipalities according to the place of work in 2002. ►

Figure 7: Employed daily commuters by routes between municipalities in 2002. ► str. 182





intended only for underage pupils and the people who cannot afford an automobile. The Eurobarometer research further supports this way of thinking, in which EU citizens were asked whether they would use automobiles if the cost of fuel doubled. According to the research, Slovenians were the least prepared to change their habits, as only 9% of the interviewed people said they would drive substantially less and as many as 47% said they would drive just as frequently (Attitudes ..., 2006). The public transporters in Slovenia adapt their services to the users who do not have any other means of transport. On most routes the services are so poor from the aspect of a commuter with flexible working hours that they are only partly useable. There has not been enough attention paid to public transport on a national level; more ambitious projects started only in 2007 and they are still in the planning phases (Gabrovec and Lep 2007; Gabrovec and Bole 2009).

The choice of transportation when commuting to work and school differs greatly according to regions and municipalities in Slovenia. The percent of daily commuters who travel to work by bus or train exceeds 30% on certain routes, but has decreased below 1% in others. This data clearly shows that workers use public transportation for commuting to work only on those relatively few routes where it can compete with automobiles with regards to time and price.

Figure 6 shows a very low percent of public transport users in western Slovenia and in the Littoral, where it practically never exceeds 10%. This is a consequence of a higher level of motorization in this part of Slovenia and a sufficient number of parking spaces in both regional centers, Koper and Nova Gorica. On the other hand we can observe some smaller employment centers with shares of public transport that exceeds 30%. These are individual industrial centers where a large portion of the employees work in local factories. They are mostly companies with more than a thousand workers that organize bus transportation for their own workers or they collaborate with transport providers with coordinating time tables. Cerklje, Loška dolina, Semič, and Zreče stand out. In all these cases one employer stands out that provides more than half of the jobs in the municipality. The map also indicates a more favorable modal split in larger towns that are also regional centers than in smaller municipalities. Larger cities are connected with their hinterlands better; at the same time the increase of automobiles is contained by the shortage of parking spaces. It is also easier to organize public transportation in towns where the work process is uniform and the beginning and end of the work day is the same for the majority of workers: this is a common case in industrial factories, while the work process is less predictable in the service industry and the organization of public transport is consequently more challenging.

When analyzing the choice of transportation on individual routes, the frequency and speed of the public transport are key. Figure 7 demonstrates the percentages of public transport users on individual routes. The map indicates a few characteristics described above: the low percentage of public transport users in the Littoral and high percentages in industrial centers, especially routes towards Novo mesto, Velenje, and Murska Sobota. The most heterogeneous is Ljubljana, where the proportions of the shares on certain routes can be up to 1:5. The highest percent of public transport users are from the municipalities in the Central Sava Valley and Borovnica. These are exclusively routes with good railway connections. The travel times of passenger trains on these routes are comparable to automobiles or they are even shorter; in addition the frequency is suitable – there are trains to Litija leaving every half hour. It is therefore evident that a quality railway connection can be competitive. The municipalities Vodice and Komenda have the lowest shares of public transportation users in the direction Ljubljana. Both municipalities lack railway transportation and bus transportation is unsuitable because buses do not use motorways as automobiles do (Gabrovec and Bole 2009).

4 Conclusion

In the last decades Slovenians are traveling greater and greater distances to commute to work and school. This statement is supported by the census data from 1981, 1991, and 2002 as well as the statistical

registers that keep the workers' information on the place of residence and place of work. Despite greater traveled distances, the travel time has been constant in the last twenty-five years. At first glance this realization is exciting. The possibility to overcome greater distances on a daily basis expands the commuters' choice of jobs and schools, but also shopping centers and options for daily trips. This indirectly increases the quality of life. However, a more detailed analysis reveals the negative sides of the described progress. The public transport speed has been constant in the examined period. Its users have therefore not gained anything; not only that, their travel times are now slower than commuters in automobiles. The difference in automobile and public transport speed has constantly grown in the past decades. This is predominantly a consequence of motorway infrastructure construction and a simultaneous neglect of railways. With this, the public transportation system has become less competitive with time and its services have decreased because of less demand. The decreased competitiveness of the public transportation system has also led to a drastic decrease of its use: the percent of daily commuters to work with the public transportation system has decreased from 58% in 1981 to 10% in 2002 and the percent of automobile commutes has increased from 27% to 85% in 2002. The increase in automobile use has a negative impact on the environment. In addition, the increased dependence on automobiles has led to fewer public transport services and has also had negative social consequences. Those inhabitants who cannot afford to use an automobile due to health, financial, or other reasons are witnessing a decrease of their accessibility to work, education, treatment, and recreation. This contributes to greater social exclusion in society.

There are great regional differences in daily mobility changes in Slovenia. These differences are on the one side connected to the economic development and on the other to different measures of the traffic policy. The analysis of regional differences and individual good practices enables coordinated spatial and traffic planning that will promote sustainable forms of mobility.

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