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DEVELOPMENT DYNAMICS OF THE TRANSPORT NETWORK IN MAŁOPOLSKIE VOIVODESHIP IN THE PERIOD 2002–2014

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ABSTRACT

Transport infrastructure is necessary for the proper functioning of the economy and performs a key role in its development. In this paper particular attention was paid to the development of a linear road transport infrastructure. The research is based on the analysis of statistical data from the databases of the Eurostat and the Polish Central Statistical Office (GUS). The values of road density ratios, which are expressed in kilometers of roads per 100 km^2 of the surface area, point to the dominance of Małopolskie Voivodeship over the national average. In respect of annual increases in the length of motorways and expressways, Małopolskie ranks high among western voivodeships, and exceeds the average annual domestic increase by 0.3 km of motorway/ /expressway section. The density of railroads is high – in this aspect only south-western voivodeships rank higher than Małopolskie Voivodship. Water transport in this region was limited to the operation of one waterway. Air transport in the voivodeship is based on the operation of one regional airport in Kraków-Balice.

Key words: transport infrastructure, road network, Małopolskie Voivodeship

INTRODUCTION

A transport network, the main task of which (along with other infrastructure elements) is to satisfy the transport needs of a region, must be developed in proportion to current and future demand. Maladjustment of a transport network and infrastructure to needs brings negative effects in almost all sections of the regional economy and lowers the standard of living of inhabitants. According to Rozkwitalska [2002], the degree of development and quality of a transport infrastructure and the efficient functioning of transport are determinants for access to domestic and foreign markets, as well as the attractiveness of particular regions for domestic and foreign capital. In conclusion, the development of a network as an element of transport infrastructure in the region should be strictly connected with the current and forecast condition of the local, national and world economies. Changes in the world economy, technological progress and the development of logistics force accelerated development of infrastructure. An analysis of the infrastructure condition is the basis for actions ensuring a sustainable transport system [Banet and Rogala 2016].

Infrastructure development may support the process of alleviation of socio-economic problems, e.g. unemployment, by means of, among other factors, creating demand for a workforce during the implementation of investment projects. Often this demand is not short term, taking into account the long period of construction of infrastructural facilities. The implementation of investments in a transport infrastructure may also stimulate the economic development of the region by creating favorable conditions for investors

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or by bringing growth in demand on local markets, through stimulation of, for example, the development of the local building materials industry. In addition, it often generates demand for investment projects accompanying infrastructural projects, e.g. the growing attractiveness of less-developed or even underdeveloped regions through the stimulation of the development of a tourist infrastructure. This situation favorably affects the employment of the local population in the non-agricultural sector. Domańska [2006] indicates the complicated and multidimensional nature of connections between transport infrastructure and regional development and mentions the possibility of the so-called corridor effect in regions where construction of expressways weakens the competitive position of a region.

Closing unprofitable railway lines weakens the competitiveness of rail freight transport for goods, even more, causing the development of substitute branches of transport [Rozkwitalska 2010]. Meanwhile, "the intensification of rail freight carriage as an ecological form of transport is a necessity resulting from environmental protection" [Zielaskiewicz 2009].

Another significant role of infrastructure is its positive impact on international cooperation. An effective transport network system is a factor that stimulates the development of this cooperation. A properly planned and built infrastructure has a positive impact on cooperation between cross-border regions. A good example is the Euroregions: a key element of international economic cooperation and the elimination of differences in levels of socio-economic development.

MATERIAL AND METHODS

The purpose of this paper was to identify changes taking place in the transport infrastructure of Małopolskie Voivodeship in the period from 2002 to 2014. The research covered the linear part of the infrastructure, which is defined as transport routes with engineering equipment existing in the country. In this paper it includes the road network, railway lines, waterways and air corridors. By analyzing the development of the infrastructure, the development of passenger and transport traffic at airport in Kraków-Balice was described.

Presented in this article indicators refers to the quantity of the infrastructure parts. It should be emphasized that the quality of a transport network is an equally important element that should be taken into account during a complex analysis of its condition.

The basic sources of the data covered in the information were the databases of the Eurostat and the Polish Central Statistical Office (GUS).

The measures used in the paper are basic tools in researching the dynamics of economic phenomena. Absolute increases and relative increases with permanent and variable bases were used. For the selected phenomena, one-based and chain indexes were used and expressed in percentage values [Kukuła 2003].

The research also involved analytical and descriptive methods.

TRANSPORT INFRASTRUCTURE OF MAŁOPOLSKIE VOIVODESHIP

When analyzing the development of the transport infrastructure of a region, it is worth to become familiar with its socio-economic situation, because this determines the requirements set for infrastructure, and thereby indicates the level of its modernization. Currently, gross domestic product (GDP) per capita is considered as one of the basic determinants of the level of economic development. In the case of Małopolskie Voivodeship, in the examined period it was growing at a pace similar to the average for Poland.

Development of road network in Małopolska Region

The main ratio that should open the analysis of road infrastructure development is road density, which is often used as the diagnostic variable in analysis of the social and economic development of some regions [Jaworska and Luty 2009, Rymuza and Bombik 2014, Majka 2015].

By presenting, in Table 1, data for kilometers of roads per 100 km^2 of the surface area, the overwhelming dominance of Małopolskie Voivodeship over the national average can be seen.

In 2002, the network of this voivodeship was denser by 79.9% than the average for the whole country, while at the end of the examined period this

Table 1. Road density ratios in the period 2002–2014

Specification	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
	kilometers of roads per 100 km^2 of the surface area												
Małopolskie Voivodeship	143.9	141.7	143.3	144.3	145.4	147.3	149.0	147.8	155.8	157.8	159.2	158.9	160.3
Poland	80.0	79.6	80.6	81.2	81.7	82.8	83.5	85.8	87.6	89.7	89.8	91.2	92.0
	kilometers of roads per 10,000 inhabitants												
Małopolskie Voivodeship	67.1	66.2	66.8	67.1	67.5	68.2	68.6	67.9	70.9	71.6	72.1	71.8	72.3
Poland	65.5	65.1	66.0	66.5	67.0	67.9	68.5	70.3	71.1	72.8	72.9	74.1	74.8

Source: Prepared by the authors on the basis of data from the Local Data Bank of the Polish Central Statistical Office (GUS).

dominance fell to 77.3%. In Małopolska Region, the density increased over this period from 143.9 km of roads per 100 km^2 of surface area in 2002 to 160.3 km of roads per 100 km^2 of surface area in 2014, which means an increase of 11.4%. All Polish voivodeships were developing faster, reaching an increase of 15%. The relationships between these values should not be treated as a premise for a slowdown of development because with the high density of the network there is no need for its development at a high pace. Actions should be focused (as necessary) on maintenance and an increase in the quality of already existing routes – in the case of Małopolskie Voivodeship this will be visible after an analysis of the next ratio discussed.

In the analysis of road network density, it may turn out to be important to compare its length with the number of potential users. Compared with other voivodeships, the density of infrastructure in relation to the whole population in Małopolskie Voivodeship was growing more slowly than in the case of the national average. An increase from 67.1 km of roads per 10,000 people in 2002 to 72.3 km of roads per 10,000 people in 2014 gives an increase of 7.7%, whereas for the whole of Poland this change was as much as 14.2%. However, at this point the data concerning population growth should be borne in mind, since dynamic population growth in this voivodeship exceeded the density of infrastructure.

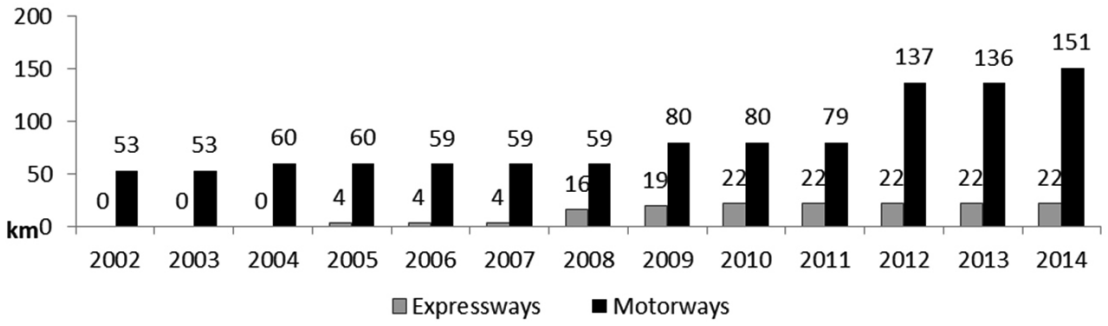

Fig. 1. Length of expressways and motorways in Małopolskie Voivodeship

Source: Prepared by the authors on the basis of data from the Local Data Bank of the Polish Central Statistical Office (GUS).

Table 2. The density of the network of expressways (km per 1000 km^2) in voivodeships in 2002 and 2014

Specification	Expressways	Motorways	Total	Expressways	Motorways	Total	Increase in cumulative value 2002–2014
	2002			2014			
Łódzkie	0.00	0.97	0.97	11.95	10.30	22.25	21.29
Śląskie	5.08	2.45	7.53	9.39	14.30	23.69	16.16
Lubuskie	1.25	0.00	1.25	10.19	6.38	16.56	15.31
Wielkopolskie	0.27	1.61	1.88	4.94	7.06	11.99	10.12
Kujawsko-Pomorskie	1.28	0.00	1.28	1.95	9.18	11.13	9.85
Małopolskie	0.00	3.49	3.49	1.44	9.95	11.38	7.89
Poland	0.72	1.30	2.02	4.63	4.98	9.61	7.59
Podkarpackie	0.00	0.00	0.00	0.62	6.29	6.91	6.91
Dolnośląskie	0.00	7.51	7.51	3.22	11.12	14.35	6.83
Mazowieckie	0.60	0.00	0.60	4.91	1.78	6.69	6.09
Warmińsko-Mazurskie	0.11	0.00	0.11	5.81	0.00	5.81	5.70
Pomorskie	2.12	0.00	2.12	3.95	3.60	7.55	5.43
Zachodniopomorskie	1.23	0.94	2.17	5.90	1.11	7.01	4.83
Lubelskie	0.00	0.00	0.00	3.16	0.00	3.16	3.16
Świętokrzyskie	2.03	0.00	2.03	4.88	0.00	4.88	2.85
Podlaskie	0.00	0.00	0.00	1.64	0.00	1.64	1.64
Opolskie	0.00	9.04	9.04	0.00	9.36	9.36	0.32

Source: Prepared by the authors on the basis of data from the Local Data Bank of the Polish Central Statistical Office (GUS).

In this research it is significant to analyze statistics concerning roads of high capacity. In the examined period, the length of the network of motorways and expressways in Małopolskie Voivodeship (Fig. 1) increased multiple times.

Progress made in Poland with regard to the share of public roads in the period 2002–2014 is presented in Table 2. In terms of the density of expressways and motorways, Małopolskie Voivodeship does not stand out significantly from well-developed central Polish voivodeships in relation to this aspect. It is worth noting the stagnation in eastern voivodeships (one of the neighbours – Świętokrzyskie as also Podlaskie and Lubelskie Voivodeships).

An important issue is annual increases in the length of expressways. In this respect, Małopolskie Voivodeship is well placed among western voivodeships, and exceeds the average annual national increase in the examined period by 0.3 km of motorway/expressway section.

Development of the network of railroads

Statistically, the rail transport infrastructure of Małopolskie Voivodeship performs well in comparison with the rest of the country. The density of railroads is high – in this respect this voivodeship ranks lower only than south-western voivodeships: neighbouring Śląskie, as well as Dolnośląskie and Opolskie Voivodeships (Fig. 2), that owe their high density of rail infrastructure to their industrial character and, in the case of Opolskie and Śląskie Voivodeships, also to their small surface area.

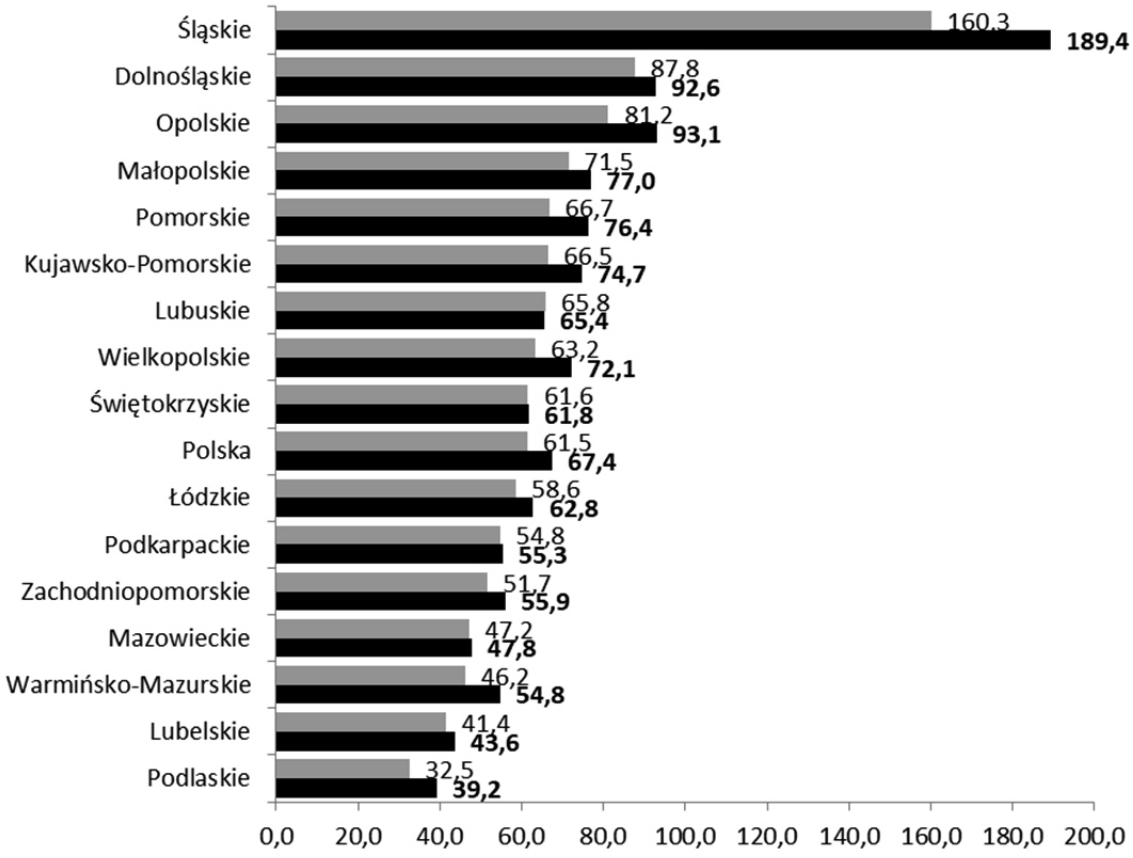

Fig. 2. Density of the network of railway lines (km per 1,000 km^2) by voivodeship between 2002 and 2014

Source: Prepared by the authors on the basis of data from the Local Data Bank of the Polish Central Statistical Office (GUS).

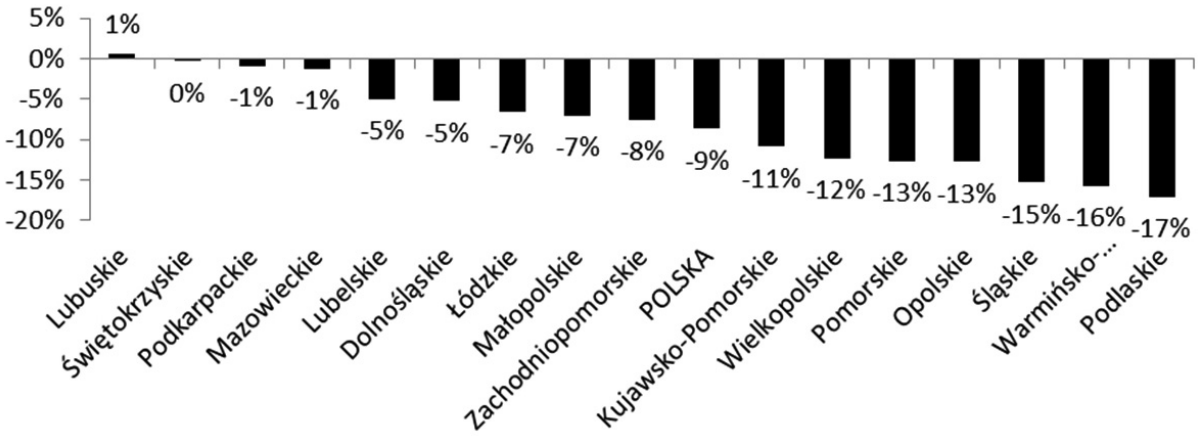

Fig. 3. Dynamics of the density of rail network (km per 1,000 km^2) between 2012 and 2014

Source: Prepared by the authors on the basis of data from the Local Data Bank of the Polish Central Statistical Office (GUS).

In Figure 3 it can be seen that Małopolskie Voivodeship was reducing the number of operating rail lines more slowly, by about 2% less than the national average. During the examined two-year period their density fell by 7%.

Maintenance of railway lines is a tendency that has brought about benefits, not only in the examined period but it may also be favorable in the future.

Development of water transport network

Owing to restrictions resulting from the land form of Małopolskie Voivodeship, the water transport network in this region was limited in the examined period to the operation of one waterway, known as the upper Vistula river waterway. This waterway has quite a limited capacity – its route through the voivodeship consists of sections classified into as many as four different classes of waterway. Unfortunately, it is a classic example of constraints resulting from the land form. The introduction of new inland waterways in the case of upland land form would require huge expenditure, disproportionate to the benefits.

The limited possibilities for making use of the advantages of water transport are a serious impediment for Małopolskie Voivodeship. Inland water transport, due to its strongly limited adverse environmental impact and high efficiency of expenditure, is a good alternative to other, more expensive and less environmentally friendly forms of transport of cargo.

Development of air transport infrastructure

Air transport infrastructure in Małopolskie Voivodeship is based mainly on the operation of the only large airport in the region – John Paul II International Airport Kraków-Balice. The airport is situated favorably in relation to the network of airways. There are six permanent airways around the airport. The airport has only one runway. This stays invariable from many years. Transport of passengers and cargo is presented for illustrating changes in the air transport. Dynamic growth of the airport in the period 2002–2014 shows statistics in Table 3.

After a period of stagnation lasting until 2003, when about 500 thousand passengers were handled annually, Poland's accession to the European Union caused an explosive growth in the number of passengers handled (Fig. 4). In 2005, the number of passengers, when compared with the previous year, increased by as much as 88.6%.

The years of the beginning of the world economic crisis (2008–2009) were a period of stagnation in the development of the airport in Kraków-Babice [Rydzykowski 2010]. The number of passengers handled decreased, although the share of the airport in Kraków-

Table 3. Transport of passengers and cargo at the airport in Kraków-Balice in the period 2002–2014

Specification	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Passengers (thousands of people)													
Arrivals	241	283	405	775	1 160	1 505	1 444	1 323	1 414	1 489	1 698	1 806	1 897
Departures	245	283	408	793	1 194	1 542	1 465	1 341	1 429	1 512	1 722	1 836	1 917
Transit	15	27	28	17	13	21	15	16	20	12	19	6	4
Total	501	593	841	1 586	2 367	3 068	2 924	2 680	2 864	3 014	3 439	3 648	3 818
Cargo (t)													
Loading operations	676	880	698	615	851	1 043	844	1 021	1 392	1 408	240	187	713
Unloading operations	911	1 192	1 108	1043	1 163	1 494	1 582	1 363	1 414	1151	342	279	716
Total	1 586	2 071	1 806	1 658	2 014	2 537	2 427	2 384	2 806	2 559	582	466	1 429

Source: Prepared by the authors on the basis of data from the Local Data Bank of the Polish Central Statistical Office (GUS).

-Balice in terms of carriage of passengers in Poland was not falling significantly, and since 2008 it accounted for around 14% of carriage of passengers throughout Poland (Fig. 4). Certainly, this results from the fact that other airports were struggling with similar problems. In 2014, the airport handled the highest number of passengers so far: approximately 3.8 million.

Transport of cargo has never been a priority in the operation of the airport in Kraków-Balice. While in the years 2002–2011 an unstable and slow, but visible, development of the volume of handled tonnage could be noted (Table 3), in 2012 this volume plummeted by as much as 77% (Fig. 4).

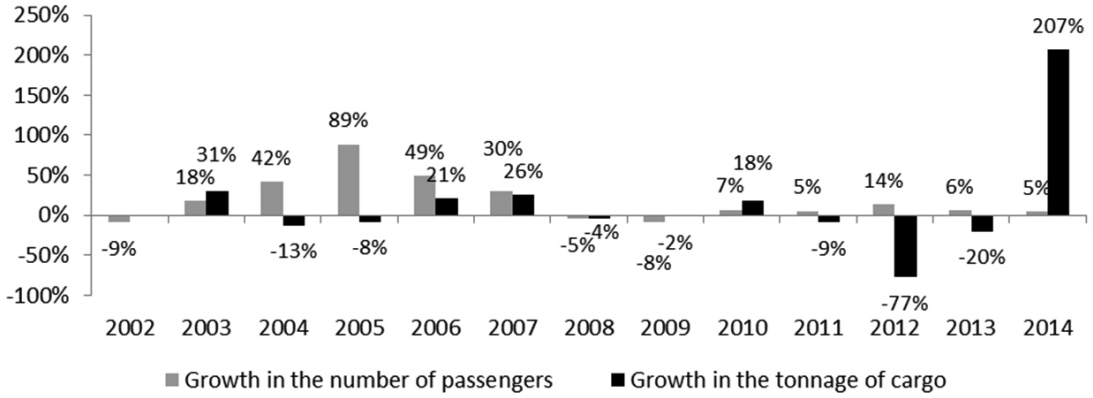

Fig. 4. Development of air traffic in Małopolskie Voivodeship in the period 2002–2014 (percentage changes in the number of passengers and cargo tonnage as compared to the previous year)

Source: Prepared by the authors on the basis of data from the Local Data Bank of the Polish Central Statistical Office (GUS).

CONCLUSIONS

The geographical location of Małopolskie Voivodeship between strongly-developed, industrial western regions and slightly underdeveloped eastern regions would suggest a degree of development at the level of its neighbors. This statement is true, although this voivodeship is closer to better-developed regions.

In terms of the development of the carriage service in which road transport is dominant, the road network satisfies the reported demand. Right from the beginning of the examined period, the density of roads, both per surface area and population was high. The development did not achieve the highest values in Poland according to these conversion factors, which can be explained by the concentration of actions on modernization of roads, instead of on further densification.

In terms of the density of expressways, throughout the whole examined period, Małopolskie Voivodeship was maintaining a level similar to very highly-developed western voivodeships.

The general European tendency to eliminate less frequently-operated railway lines was reflected in changes in the condition of this infrastructure in most Polish voivodeships (in total approximately 9% of these were liquidated in the years 2002–2014). In contrast, in Małopolskie Voivodeship the rail network decreased in the examined period by 7%, which is a moderate decrease on the national scale. In consequence, this provides greater scope for actions in the future, if rail transport – an environmentally friendly transport system – becomes competitive again. This could take place as a result of the development of mechanisms making it possible to use its advantages more effectively.

The network of waterways in Małopolskie Voivodeship is very poorly-developed, and in the examined period covered only one waterway, with very limited

capacity. However, it should be taken into account that this branch of transport has encountered substantial constraints rooted in the landform of the Małopolskie Voivodeship, which, along with small funds, is a strong barrier to its development.

By analyzing the condition of the air transport network in the examined period, an unambiguous conclusion can be drawn: in the period 2004–2006, this mode of transport was developing at a very high pace. Growth in demand for international carriage, as a result of Poland's accession to the European Union, was an impulse for gradual expansion of the only large airport in the region: aiport in Kraków-Balice. Consequently, since 2008, Małopolskie Voivodeship has handled as much as approximately 14% of passenger carriage in Poland, which makes it possible to conclude that not only has the infrastructure satisfied local demand, but also part of the demand of the neighboring voivodeships.

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DYNAMIKA ROZWOJU SIECI TRANSPORTOWEJ WOJEWÓDZTWA MAŁOPOLSKIEGO W LATACH 2002–2014

STRESZCZENIE

Infrastruktura transportowa jest niezbędna do prawidłowego funkcjonowania gospodarki i pełni kluczową funkcję w jej rozwoju. W pracy szczególną uwagę zwrócono na rozwój liniowej infrastruktury samochodowej. Wartości współczynnika zagęszczenia sieci dróg, wyrażony w kilometrach dróg w przeliczeniu na 100 km^2 powierzchni województwa, wskazują na zdecydowaną przewagę Małopolski nad średnią krajową. Pod względem rocznych przyrostów długości autostrad i dróg ekspresowych Małopolska zajmuje wysoką pozycję wśród zachodnich województw, przewyższając średni krajowy przyrost roczny o 0,3 km odcinka autostrady/drogi ekspresowej. Zagęszczenie dróg kolejowych jest bardzo duże – Małopolskę pod tym względem wyprzedzają jedynie południowo-zachodnie województwa. Transport wodny w tym regionie ograniczał się do funkcjonowania jednej drogi wodnej. Infrastruktura transportu powietrznego w województwie opiera się na funkcjonowaniu jedynego dużego portu lotniczego w regionie – w Krakowie-Balicach.

Słowa kluczowe: infrastruktura transportu, sieć dróg, województwo małopolskie