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Transport infrastructure of Spain as a factor in tourism development.

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Abstract. This article considers features of functioning of a modern transport network. Transport is an important area of infrastructure supply for the population and the state economy, the key function of which is the movement of people and goods. The current transport complex is subject to contradictory trends: as an infrastructure industry, transport

is located in a position dependent on the production of social goods, and as a special sector of the economy, transport has an important impact on the regional location of production capacity and participates in the process of reproduction part of the system of economic relations. The importance of transport infrastructure in the economy, its development and operating conditions are difficult to overestimate. After all, it is the basis of the supporting framework of territorial social systems of any level. On the current state, level and opportunities for the development of the transport infrastructure depends not only the social and economic growth of territorial economic systems, but also their spatial development. Tourism plays a significant role in the development of transport infrastructure. Europe is one of the most attractive regions for tourists in the world. In turn, Spain is one of the most popular destinations for tourists from around the world as well as for European tourists. Spain plays an important role in tourist traffic in Europe. This is facilitated by its efficient transport and geographical location, developed production infrastructure, as well as historical aspects. Spain is a key country of transit by air and sea with the Americas. The flat terrain promotes the development of road and rail passenger transport across the centre of the country. And given the attractiveness to tourists and direction of tourist flows to the regions of the country, the study of geographical features of transport infrastructure is quite relevant. The peculiarities of the functioning and formation of the transport infrastructure of Spain are considered. The geographical features of the development of the infrastructure of railway, road and sea and air transport of Spain are analyzed. As for the terminals in the regions of Spain, their number also corresponds to the number of airports. Therefore, the largest number of terminals is in the Canary Islands – 9 (all airports have one terminal, except Lanzarote). There are 8 terminals in the airports of Andalusia, where all airports except Malaga have one terminal, in Malaga there are three. The two Madrid airports have 6 terminals, but 5 of them are located at the country's main airport – Madrid-Barajas. Catalonia's airports have 5 terminals, two of which are located in Barcelona El Prat. There are 4 terminals in Galicia – one each in Vigo and La Coruna and two in Santiago de Compostela. There are 4 terminals in Galicia – one each in Vigo and La Coruna and two in Santiago de Compostela. In all other regions, the number of terminals is proportional to the number of airports. An assessment of the level of development of transport infrastructure for tourism in the regions of Spain was conducted. On the basis of quantitative indicators of the analysis of the transport infrastructure of Spain, a point assessment of the level of development of the transport infrastructure of the country's regions for the needs of tourism was carried out. Administrative units are divided into 5 groups: with the highest, high, sufficient, medium and low level of development of transport infrastructure for tourism. Transport infrastructure is most developed in the tourist regions of the country – Catalonia, Andalusia, Madrid, the Canary and Balearic Islands.

Ключові слова: transport infrastructure in tourism, transport complex, transportation, highways, railways, air transport, airports, passenger turnover.

Транспортна інфраструктура Іспанії як чинник розвитку туризму.

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Анотація. Встановлено значення транспортної інфраструктури в господарстві, її розвиток та умови функціонування важко переоцінити. Адже саме вона є основою опорного каркасу територіальних суспільних систем будь-якого рівня. Від сучасного стану, рівня та можливостей розвитку транспортної інфраструктури залежить не тільки соціальне та економічне

зростання територіальних господарських систем, але й їх просторовий розвиток. Значний поштовх для розвитку транспортної інфраструктури відіграє туризм. Європа є одним із найбільш привабливих для туристів регіонів світу. В свою чергу Іспанія є одним з найбільш популярних напрямків як для туристів зі всього світу, так і для європейських туристів. Іспанія відіграє велике значення в туристичних перевезеннях в Європі. Цьому сприяє ефективне транспортно-географічне положення, розвинена виробнича інфраструктура, а також історичні аспекти. Іспанія є ключовою країною в транзитному авіаційному та морському сполученні з країнами Америки. Рівнинний рельєф сприяє розвитку автомобільних та залізничних пасажирських перевезень в середині країни. А враховуючи туристичну привабливість та напрямки туристичних потоків до регіонів країни, дослідження географічних особливостей розвитку транспортної інфраструктури є досить актуальним. Розглянуто особливості функціонування та становлення транспортної інфраструктури Іспанії. Проаналізовано географічні особливості розвитку інфраструктури залізничного, автомобільного, морського та авіаційного транспорту Іспанії. Здійснена оцінка рівня розвитку транспортної інфраструктури для потреб туризму за регіонами Іспанії. На основі кількісних показників аналізу транспортної інфраструктури Іспанії проведено бальну оцінку рівня розвитку транспортної інфраструктури регіонів Іспанії для потреб туризму. Адміністративні одиниці поділено на 5 груп: з найвищим, високим, достатнім, середнім та низьким рівнем розвитку транспортної інфраструктури для потреб туризму. Транспортна інфраструктура найбільше розвинена в туристичних регіонах країни – Каталонія, Андалусія, Мадрид, Канарські та Балеарські острови.

Ключові слова: транспортна інфраструктура в туризмі, транспортний комплекс, перевезення, автомобільні дороги, залізничні колії, авіаційний транспорт, аеропорти, пасажиробіг.

Introduction.

The tourism industry cannot exist without proper transport provision and a developed tourism transport infrastructure. Vacationers who visit any region of the world for tourism or treatment and recreation purposes should receive quality transport services and be able to get to all recreational and tourist facilities, regardless of location.

The importance of transport infrastructure in the economy, its development and operating conditions, is difficult to overestimate. After all, it is the basis of the supporting framework of territorial social systems of any level. On the current state, level and opportunities for the development of transport infrastructure depends not only the social and economic growth of territorial economic systems, but also their spatial development. Tourism plays a significant role in the development of transport infrastructure.

Europe is one of the most attractive regions for tourists in the world. In turn, Spain is one of the most popular destinations for tourists from around the world, including for European tourists. This country plays an important role in tourist traffic in Europe. This is facilitated by the efficient transport and geographical location, developed production infrastructure, as well as historical aspects.

Spain is a key country in transit by air and sea with the Americas. The flat terrain promotes the development of road and rail passenger transport across the centre of the country. And given the attractiveness to tourism and direction of tourist flows to the regions of the country, the study of geographical features of transport infrastructure is quite relevant. Existing geographical studies of transport infrastructure are not in-depth, especially at the regional level; this analysis allows us to argue for the feasibility of studying the transport infrastructure of Spain as a basis for the development of tourist infrastructure.

Research methods.

The study uses literary, analytical, comparative, mathematical and statistical methods and the method of scientific systematization.

The purpose of the work is to characterize the transport infrastructure of Spain as one of the main factors for the development of tourist infrastructure.

Results and their analysis.

It is known that the tourism industry, given its significant impact on the economic and social development of the country, the branching of economic ties, needs regulation, support and careful control by the state (Boyko, Horozhankina, Hrushka, Korneyev, Nebaba, 2020). The main body that regulates all transport relations in the country is the Ministry of Development of Spain (Ministerio de Fomento de España, 2020). It is a governing body responsible for the preparation and implementation of state policy on land transport infrastructure, air and maritime jurisdiction of the state, control and management and regulation of transport services of administrative services, management and direction of all postal and telegraph services, development and direction of public services, which are related to astronomy, geodesy, geophysics and mapping, investment planning and programming, which are related to the above services. The structure of the Ministry of Development includes the State Secretariat for Infrastructure, Transport and Housing and Communal Services, which in turn has the General Secretariat for Transport. It has separate units that are responsible for a particular mode of transport: the General Directorate of Civil Aviation, the General Directorate of the Merchant Navy, the General Directorate of Land Transport. The powers of the General Directorate of Land Transport include the regulation of relations in road, rail and pipeline transport. In addition to the Ministry of Development, each mode of transport has public and private companies that control the organization of transportation (Renfe Operadora, 2020).

Tourism in Spain has become a sphere of implementation of market mechanisms, a source of replenishment of state and local budgets, the distribution of financial flows (Podlepina, 2013).

The seaports of Spain are subordinated to the public organization Public Ports (Puertos del Estado, 2020). The company implements the government's port policy, coordinates and monitors the efficiency of the port system, which consists of 28 port authorities that manage 46 ports of general interest (International Air Transport Association, 2020).

In the field of rail transport there is an operator Renfe (Renfe Operadora, 2020), which is the state railway network of Spain. The length of the network is 15,000 km. Most of the railway lines have a wide gauge (1668 mm), which is wider than the Ukrainian (1520 mm) and European (1435 mm) track width. Part of the network, the AVE high-speed rail, which has a standard European track width. The company was founded on January 24, 1941 at the same time as the nationalization of the Spanish railways. To create a competitive transportation market, on January 1, 2005, RENFE was divided into an infrastructure management agency (stations, tracks, signaling, etc.) (ADIF) and the operating company RENFE (Renfe Operadora), which provides freight and passenger transportation (Chaika, 2016).

Infrastructure and road transport are controlled by SEITT – the State Land Transport Infrastructure

Company. It aims to build and control the operation of roads (Puertos del Estado, 2020).

Spanish public airports are subordinated to the public organization Spanish Airports and Aeronautics (Aeropuertos Españoles y Navegación Aérea (Aena)). Aena is a Spanish state-owned company that operates public airports in Spain. The company operates 46 airports and 2 helicopter ports in Spain and participates through its subsidiary Aena Internacional, managing 15 airports in Europe and America. This makes it one of the leaders in terms of passenger volume in the world. Aena operates all airports of interest to public aviation in Spain, as well as air navigation at some private and some air bases in a mixed regime with the Spanish Armed Forces (Aeropuertos Españoles y Navegación, 2020).

Aena's subsidiary is ENAIRE, which is an air navigation manager in Spain and the Western Sahara, certified to provide control of routes, approaches and airport services. It is responsible for controlling air traffic, aeronautical information and communication networks, navigation and surveillance necessary for airlines and their aircraft to fly safely, smoothly and in an organized manner for Spanish airspace (ENAIRE, 2020).

The first railways in Spain were built in 1848 and have been developing rapidly since then. The total length of railways is 15,931.08 km as of 2019 (Fig. 1).

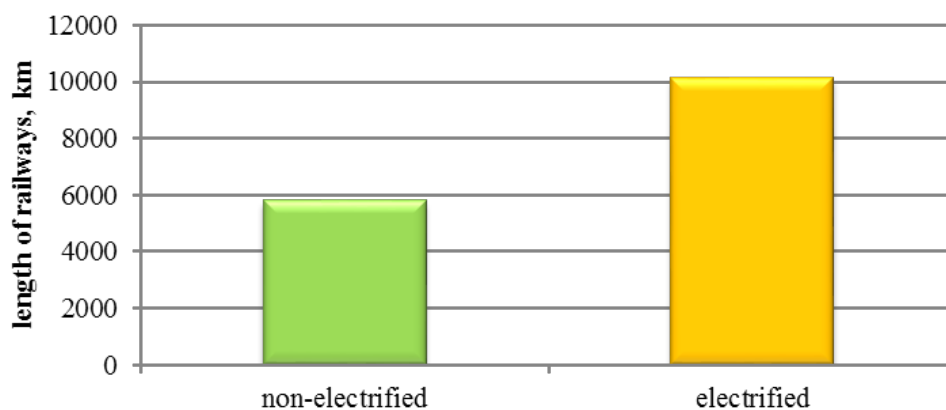


Fig. 1. Railways of Spain in 2019 (Renfe Operadora, 2020)

The length of electrified railways is more than 10,000 km, ie twice as long as non-electrified ones. The largest length of railways is in the largest regions of Spain – Castile and Leon, Andalusia, Castilla-La Mancha (more than 2000 km each) and in each of these regions the length of electrified railways is greater. These regions in terms of length of railways are followed by the autonomous regions of Catalonia, Aragon and Galicia. The share of electrified railways is particularly high in Catalonia, where the railroad runs

along the Mediterranean resorts of the Costa Brava (International Civil Aviation Organization, 2020).

The length of the railways in Valencia is more is than 900 km, where the railways also run along the tourist resorts of the Costa Blanco. In Extremadura, Madrid and Asturias, the length of the railway is about 600–700 km. Extremadura has no electrified railways at all, and is one of the least economically developed and most sparsely populated areas of Spain.

And for Madrid and Asturias, given their area, this length of railways is quite great. In Madrid, most of the

country’s railways intersect, given the city’s functions, and in Asturias the railroad runs along the Atlantic coast. About 90 % of Madrid’s railways are electrified. The situation is somewhat similar with Asturias in the Basque Country. The length of the railway is slightly shorter (560 km), but it also runs along the coast and major cities of the region and almost the entire railway is electrified. The smallest lengths of railways are typical for the smallest regions – La Rioja and the Balearic Islands (about 110 km each). In the Balearics, there is a railway only on the largest island of Mallorca and it performs tourist functions. There are no railways in the Canary Islands at all, nor in Ceuta with Melilla.

Spain currently has more than 1,500 km of high-speed rail lines connecting Madrid with Malaga, Seville, Valencia, Barcelona, Valladolid, Tarragona, Zaragoza, Alicante and Ferrol. In 2013, a high-speed line was built connecting Spain with France. Night trains run from Spain to Paris, Lisbon, Geneva, Zurich, Milan.

If the program for the development of Spanish high-speed rail lines is implemented, by 2022 Spain will have 7,000 km of high-speed rail lines (according to national practice, these include lines with a speed of 200–250 km / h), which allow you to get from the provinces to Madrid in less than 3 hours and to Barcelona in 4 hours.

The distance of 630 km from Madrid to Barcelona is covered by a high-speed train in 2 hours and 38 minutes; taking into account the tourist passenger flow, this is the busiest route in Spain. Most of the railway network is owned by the state-owned company Adif, and rail traffic is regulated by the state institution RENFE. Regional companies (FEVE, FGC, Euskotren, FGV, SFM) also participate in this market (Renfe Operadora, 2020).

It should be noted that passenger traffic accounts for only 6.5 % of traffic, which is a rather low figure. In 2019, 576.1 million passenger journeys were made by Spanish railways. The distribution of passengers during the year is uneven (Fig. 2).

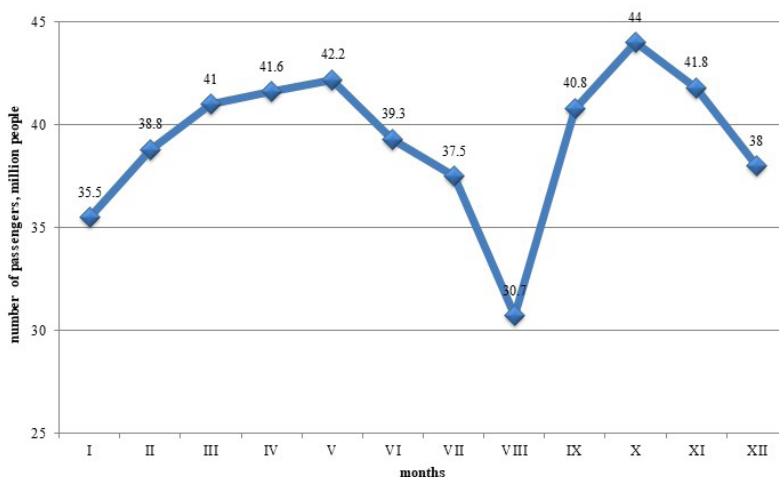


Fig. 2. Monthly dynamics of passenger traffic on Spanish rail transport in 2019 (Renfe Operadora, 2020)

Spain is the fourth largest country in Europe (after Russia, Ukraine and France) and has a fairly flat terrain. Due to this it has a fairly extensive network of roads and high rates of passenger transport by road. As of 2019, the total length of roads in Spain was 165,484

km, ie the density of the road network is 0.33 km / km². Most roads are under the jurisdiction of the autonomous regions (43 %), slightly fewer are in municipal ownership (41 %) and another 16 % of roads are state-owned (Fig. 3).

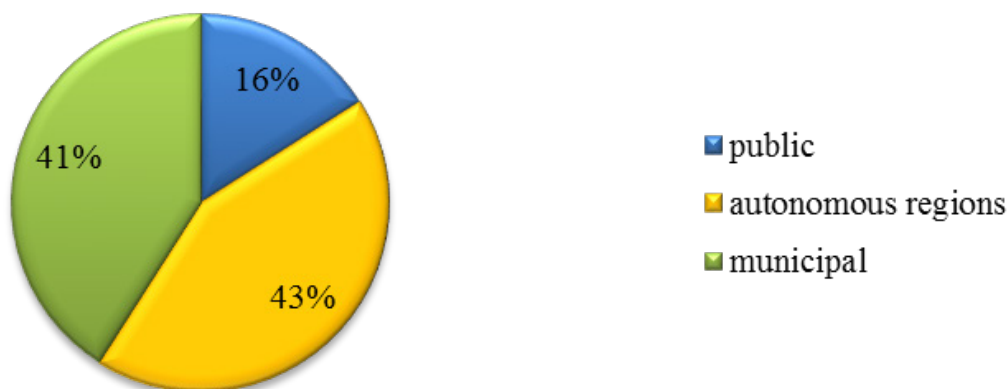


Fig. 3. Subordination of roads in Spain in 2019 (Renfe Operadora, 2020)

There is an extensive road network, with cars carrying about 90 % of passenger traffic. In 2019, 28 million people were transported in Spain by intercity buses between the Autonomous Communities. The largest value is typical for Madrid – 7.7 million passengers, which is more than the population of the region. This situation is natural given that Madrid is the capital of Spain, a cultural, tourist, economic and business center. In second place by this indicator is Castile-la-Mancha (5.8 million people). Given the fact that there are no significant airports in the region, and its administrative center Toledo is in close proximity to Madrid, this area has the largest flow of passengers. In third place is also the neighbouring region of Madrid, Castile and Leon (3.1 million passengers). More than 1 million passengers were transported by intercity buses in Andalusia, the Basque Country, Extremadura, Aragon, Valencia and Catalonia. Most of these are tourist regions and have significant flows of tourists, which explains this figure. More than 500,000 passengers used bus services in Cantabria, Murcia, Asturias and La Ríos, and the lowest rates were in Galicia and Navarre (260,000 and 111,000 respectively). For the Balearic Islands and the Canary Islands, this figure is not available at all, as it only includes traffic between the Autonomous Communities).

But if we talk about the average distance of transportation, then this figure will be the largest in

Galicia and Navarre, (509 km and 426 km, respectively). Galicia is one of the most remote regions of the country, and Navarre is in the Pyrenees, so the distance will be the longest. Just over 300 km is the average distance travelled in Catalonia, Andalusia, Asturias and Valencia and 200 km each in Madrid and the Basque Country. It is the capital and coastal autonomous region, where many tourists are very mobile, and therefore often travel, and therefore the figure here will be higher than the average in Spain (190 km). In Murcia, Aragon, Castile and Leon, La Rios, Extremadura and Cantabria, the average distance for one passenger is 120–190 km. These regions are closer to the capital and the flow of tourists here is smaller compared to other regions. The lowest indicator in Castile-La Mancha is 57 km. As already noted, Toledo the administrative center of Castilla-La Mancha is in close proximity to Madrid and without its own airport. It is a major historical and cultural city. In addition to occupying a large area, Castilla-La Mancha borders Andalusia, Valencia and Aragon, which also reduces the average distance traveled.

In addition to regular intercity bus services for the needs of the population in Spain, there are various other carriers. In 2019, their total number was 68,894 units and most of them are taxis, or car rental companies (Fig. 4).

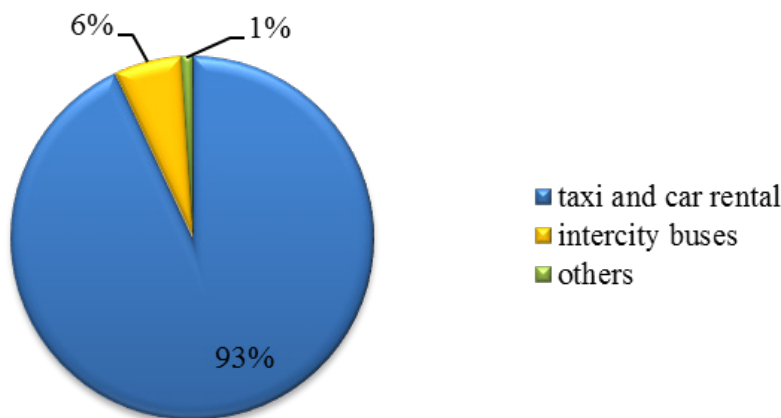


Fig. 4. Passenger carriers of Spain in 2019 (Renfe Operadora, 2020)

Spanish maritime transport has developed quite strongly due to its advantageous geographical location. For the most part, this applies to freight traffic, where the country is a leader among other European countries (in the top five), but in terms of passenger traffic, Spain also has a high rate (8th place in Europe). There are ports in all regions of Spain that have access to the Mediterranean Sea or the Atlantic Ocean. The largest number of ports is in Andalusia (Algeciras, Almeria Mortil, Malaga, Cadiz, Huelva and Seville, which is located on the River Guadalquivir, but can accommodate ships). There are 4 ports in Galicia (Ferrol-San Sibrao, La Coruna Vilagarcia, Vigo), three ports in Valencia (Valencia, Alicante, Castellon), two in Catalonia (Barcelona, Tarragona), Asturias (Aviles, Gijón) and

the Canary Islands (Santa Cruz de Tenerife and Las Palmas). There is one port each in Cantabria (Santader), the Basque Country (Bilbao), Murcia (Cartagena) and the Balearic Islands (in Palma de Mallorca). There are also ports in Ceuta and Melilla (International Air Transport Association, 2020).

In 2019, 32.7 million passenger journeys were made by sea. Two thirds of the traffic is accounted for by cabotage and one third by international traffic (Fig. 5). Given that Spain has two island units and Ceuta and Melilla, which are located on the African continent, this figure corresponds to the passenger flow in the country. But international traffic is also important, as many cruise routes pass through Spain.

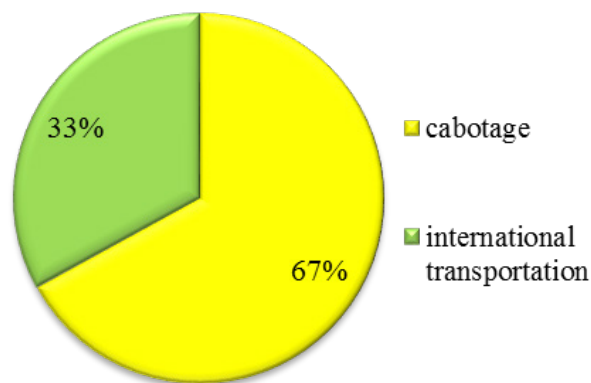


Fig. 5. The ratio of passenger transport by sea in Spain in 2019 (Renfe Operadora, 2020)

If we consider the transportation of sea passengers by region, the first places are occupied by Andalusia, the Canary Islands and the Balearics, as here are the largest ports in Spain in terms of passenger traffic. The islands are dominated by cabotage, and in Andalusia – international. In fourth place is Catalonia, where most of the traffic is in the port of Barcelona and a small share in Tarragona (dominated by international traffic). And in fifth place is Valencia, where the largest ports are Valencia and Alicante. Due to the large international traffic in the central city of Costa Blanca Alicante and cabotage traffic in the administrative center of the Valencia region, the overall ratio in the region is uniform. Other regions (Galicia, Cantabria, Basque Country and Murcia) have low sea passenger traffic (200–300 thousand passenger journeys each), and the lowest rate is in Asturias, despite the presence of 2 ports – 36 thousand passengers.

All international civil airports in Spain are subordinated to the public organization of Spanish Airports and Air Navigation Aena. There are 46 such airports in Spain and they are located in all regions of the country, as well as in Melilla. The largest number of airports is located in the Canary Islands – 8 units. In the Canary Islands, airports are located on all the 7 largest islands (Tenerife, Gran Canaria, Gomero, Hierro, Fuerteventura, Lanzarote, Palma). Tenerife has two international airports – Tenerife South and Tenerife North. The largest airport in the Canary Islands is Gran Canaria, which is located in Las Palmas de Grand Canaria. In second place after the Canary Islands in the number of airports is Andalusia – the second largest region and the first in population, in the south of Andalusia is one of the most popular tourist regions of the country (Costa de Almeria, Costa Tropical, Costa del Sol and the Costa de la Luz). There are 6 international airports in Andalusia (Almeria, Granada Hayen, Cordoba, Malaga, Seville, Jerez). The largest airport in the region is Malaga Airport.

There are 4 international airports in Catalonia, Castile and Leon and the Balearic Islands. The largest airport in Catalonia is Barcelona El Prat, it is the second largest in size and passenger traffic in Spain. Also in Catalonia, airports are located in Girona, Reus and Sabadell. Castile and Leon is the largest region in Spain, but given that it is located in the middle of the country and has no access to the seas and oceans; economically it is not very developed. The largest airport here is in the administrative center – Valladolid, there are also airports in Burgos, Leon and Salamanca. The largest airport in the Balearic Islands is the airport of the administrative center and the largest island – Palma de Mallorca. Among the four largest islands of the Balearic Islands (Mallorca, Menorca, Ibiza, Formentera), an airport is absent only on Formentera. On Mallorca, in addition to the main airport, there is also an airport in Palma de Mallorca, in Maracchi (San Bonet Airport). Taking into account the tourist flows, the airports of Ibiza and Menorca are quite large (Aeropuertos Españoles y Navegación, 2020).

Three international airports are located in the Basque Country and Galicia. The largest airport in the Basque Country is Bilbao Airport, which is the historic center of the region. The second largest airport is San Sebastian, and the airport of the administrative center of Vitoria-Gasteiz is only the third largest. The largest airport in Galicia is the administrative center of Santiago de Compostela, and the airports are located in the largest cities in the region – Vigo and La Coruna.

The most important characteristic of the airport infrastructure is the number of runways (defined rectangular section of the land aerodrome, prepared for landing and take-off of aircraft), as it determines the ability of the airport to receive aircraft at the same time. Their total number in Spain is 62. Another important technical (infrastructural) characteristic is the number of terminals for passenger service, of which there are 55 in Spain (Fig. 6).

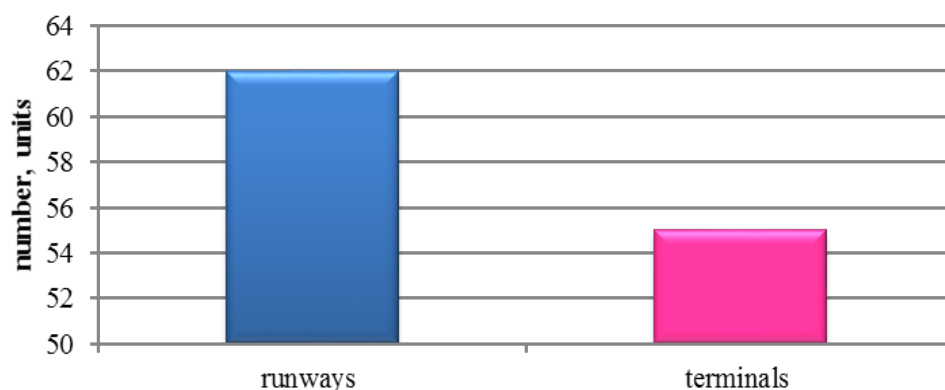


Fig. 6. Technical infrastructure of Spanish airports (Aeropuertos Españoles y Navegación, 2020)

Regular and charter flights to and from airports in Spain are operated by 163 airlines, which have connections with 358 cities in 121 countries. The largest number of airlines is represented in Barcelona – 90, in second place is Madrid-Barajas – 81. According to this indicator, Barcelona's leadership is due to the significant share of charter flights that take tourists to the resorts of the Costa Brava and Costa Dorada. In third place is the resort of Palma de Mallorca with 71 airlines. 58 airlines are represented at the largest airports in the Canary Islands – Gran Canaria and Tenerife South. Andalusia's largest airport, Malaga, has 53 airlines and another airport in the Canary Islands, Fuerteventura, has more than 50 airlines (52). More than 40 airlines are represented at the "resort" airports of Ibiza, Lanzarote and Alicante, another 37 airlines operate in Menorca. The major cities of Valencia and Bilbao have 28 and 22 airlines, respectively. There are about 20 airlines operating from Andalusia's Almeria and Seville airports, as well as at La Palma. 11–13 airlines are represented in Reus, Santiago de Compostela, Jerez, Tenerife North and Girona. More than 5 airlines operate at the airports of Asturias, Murcia, Santander, Zaragoza, Vigo, Granada Jaen and Valladolid. Two to four airlines are represented in La Coruna, Salamanca, Melilla, San Sebastian, Hierro and Pamplona. In the other 12 airports of the country there is only one airline.

From the country's largest airports, Madrid-Barajas and Barcelona, planes fly to the largest number of countries – 74 and 62, respectively. Therefore, the number of cities to which the aircraft travel is the largest – more than 200. In third place by these indicators is the airport of Palma de Mallorca, which connects with 174 cities in 30 countries.

Next is a group of "tourist" airports – Malaga, Gran Canaria, Tenerife South and Alicante, the planes of which have connections with 26–28 countries and 120–140 cities. From Valencia Airport, planes also fly

to more than 20 countries, but the number of cities is much smaller – 83. There are connections between Fuerteventura, Lanzarote and Ibiza airports with more than 80 cities, Menorca has connections with 71 and Girona has connections with 50.

The number of countries of destination from each of these airports is 15–19, and all of them are also airports that serve tourist resorts. By air, Seville is connected with 65 cities in 14 countries. Slightly lower figures characterize another historical and cultural city of Spain – Bilbao 13 countries and 44 cities. The airports Almeria, La Palma, Santiago de Compostela, Santander, Reus, Asturias and Murcia each connect approximately 20–30 cities in about 10 countries, while 5–6 countries and more than 10 cities are connected by the airports of Jerez, Zaragoza, Albacete, Tenerife North and Vigo. Most flights from these cities are domestic flights.

Granada-Jaen, Salamanca, La Coruna, Vitoria and Pamplona airports are connected with the cities of 2–3 countries. Flights from Madrid-Cuatro Vientos, Valladolid, Melilla, San Sebastian Airport, Hierro, Badajoz, Sabadell and San Bonet only fly through Spain, but they have destinations in several cities. La Gomera, Leon, Lognoro-Agoncillo, Cordoba, Burgos and Huesca Pyrenees airports each fly to only one city in Spain.

In 2019, there were 22 airlines based in Spain, including 12 commercial airlines for passenger transport, companies that operate cargo flights, as well as companies that provide private charter flights. Spain's largest airlines are Iberia, Vueling Airlines, Volotea, Air Europa, Air Nostrum, Iberia Express, Binter Canarias, Air Europa Express and Wamos Air (Aeropuertos Españoles y Navegación, 2020).

Most airline headquarters are based in Madrid (8 units), 4 airlines are located in Barcelona, the Canary and Balearic Islands, another one is in Zaragoza and Valencia. As for hubs (transport operating hubs of airlines), the leader is also Madrid-Barajas (Fig. 7).

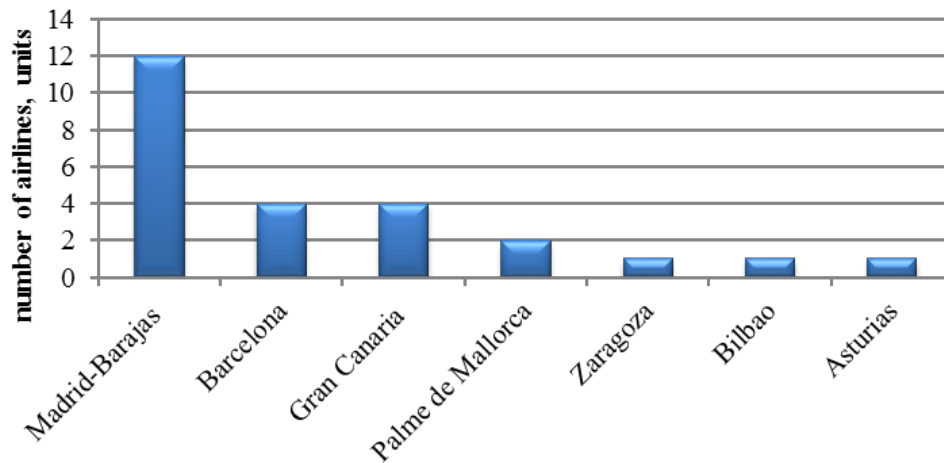


Fig. 7. Hubs of Spanish airlines

(La Sociedad Estatal de Infraestructuras del Transporte Terrestre, 2020; Ministerio de Fomento, 2020)

Transportation by air is constantly growing. This is influenced by factors such as increased tourist flows, the presence in the market of low-cost airlines (airlines that provide air passenger services at prices relatively lower than traditional airlines) and improving living standards.

In 2015, more than 167 million passenger journeys were made, in 2019 this figure was 203 million journeys, ie the volume of passenger traffic increased by more than 17%. In the structure of traffic, international passengers are in the lead over the population of Spain (Fig. 8).

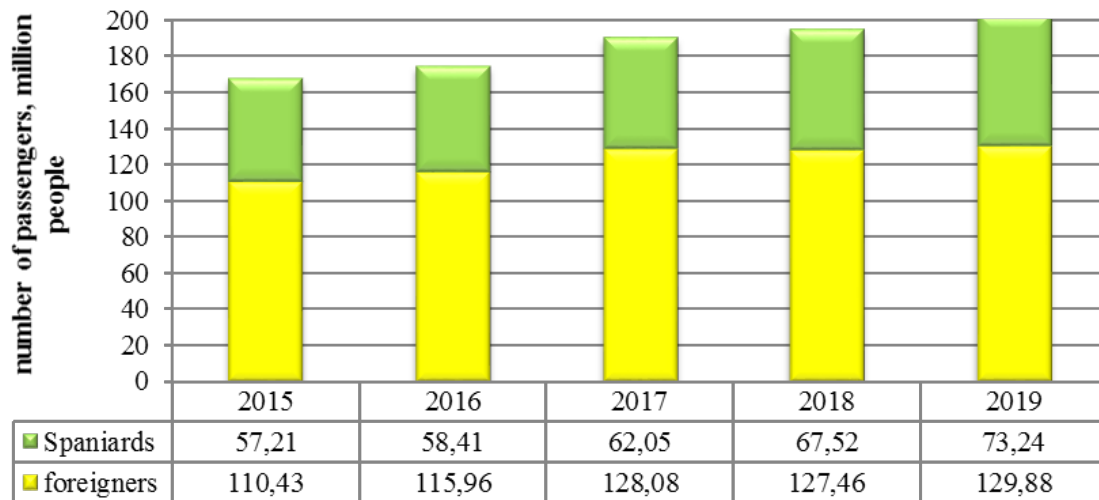


Fig. 8. Passenger traffic at Spanish airports for the period 2015–2019

(Renfe Operadora, 2020)

Spaniards make up just over a third of all people served by airports (34–35%) and this share has been constant over the last five years (Renfe Operadora, 2020). This ratio is explained by the size of the country and the lack of need of the indigenous population to use air transport, as well as tourist flows to the resorts of Spain, which create a significant share in passenger traffic.

The majority of passenger traffic on air transport is caused by tourist flows and this indicator is reflected in the monthly dynamics. The 5 months of the warm period of the year (May–September) account for more than 50% of passenger traffic. The maximum value is typical for June and August – more than 27 million people. The minimum values are observed in January and February – 14 million people (Fig. 9).

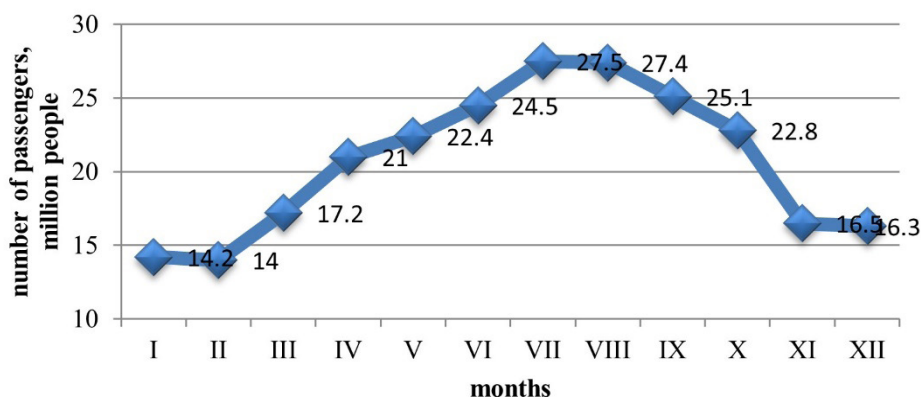


Fig. 9. Monthly dynamics of passenger traffic on Spanish air transport in 2019 (Renfe Operadora, 2020)

The analysis of the components of the transport infrastructure of Spain by individual modes of transport made it possible to identify the uneven development in the regions of the country. In order to assess the level of development of Spain's transport infrastructure for tourism, the method of scoring will be the most appropriate. This technique is widely used in tourism and geographical research.

Theoretical principles for scoring are covered in the work of O. O. Beidyk (Beidyk, 2001). The scientist notes that the evaluation score is the ordinal number of a group of phenomena, processes, objects that are ranked, limited by certain limits of their intensity or manifestation. Under the score scale, the author proposes to understand the quantitative classification or division of certain phenomena, processes or objects that are continuously and gradually increasing or decreasing into groups.

Points can be:

- a) integers, when they are set, are assigned (simple points);
- b) any real numbers, when they are calculated as a percentage of the maximum value (complex points) (Beidyk, 2001).

It is necessary to distinguish scores from measurements expressed in points. Score scales are used not only in the assessment of any phenomena and properties (often qualitative) of certain objects, but also in the measurement – in the quantitative expression of the degree of their manifestation. Therefore, there are evaluation scores and "measuring" scores (the concept of "measuring" score is conditional) (Beidyk, 2001).

The application of the scoring methodology was used to analyze the level of development of transport infrastructure for the needs of tourism in the regions of Spain. The expediency of this technique is that it allows you to evaluate indicators that cannot be estimated using absolute quantitative values, as well as to compare the phenomena characterized by different units.

The scoring process consists of five stages:

1. Definition of evaluation indicators – signs (factors) by which the level of development of transport infrastructure will be estimated;
2. Development of evaluation scales, including the selection of evaluation criteria for each indicator of the studied phenomenon, determination of the factor load (significance coefficients) of each indicator in the form of an evaluation factor table;
3. Obtaining individual assessments of specific indicators (factors) on the basis of developed criteria;
4. Obtaining general (integrated) assessments;
5. Analysis of the obtained estimates and ranking of the regions of Spain by the level of development of transport infrastructure for tourism.

To score the level of development of transport infrastructure in Spain for tourism, 20 indicators were selected, which are divided into 4 groups (Table 1).

The first group consists of five indicators that characterize the infrastructure of road transport, the second group – three indicators that characterize rail transport, the third group consists of one indicator of the number of seaports (sea transport), the fourth group includes five indicators that characterize air transport infrastructure and the fifth group of indicators characterizes passenger traffic. These indicators are divided into a separate group, as the volume of passenger traffic is directly proportional to the quality of transport infrastructure and characterizes its ability to receive passengers, most of whom are tourists.

Taking into account the provided factor load on each indicator, the maximum total score that is possible in the categories "Road transport" is 20, "Railway transport" – 13, "Sea transport" – 8, "Air transport" – 20, "Passenger transport" – 20. The maximum possible score is 81. This distribution of points and factor load reflects the importance of a particular mode of transport in the structure of passenger traffic and the attractiveness of use for tourists. The maximum number

Table 1. Estimation factor table of indicators of the level of development of the transport infrastructure of Spain for the needs of tourism

Indicator, units of measurement	Factor load	Conditions for evaluating the indicator in points					
		5	4	3	2	1	0
1.1. Length of highways, km	0.8	> 20000	10000–19999	5000–9999	1000–4999	< 999	
1.2. The share of motorways in the total length of roads,%	0.8	> 15.0	10.0–14.9	7.0–9.9	5.0–6.9	< 4.9	0
1.3. Density of highways, km/km ²	1	> 0.60	0.50–0.59	0.40–0.49	0.30–0.39	< 0.29	0
1.4. Carrier companies (taxi and car rental), units	0.8	> 10000	5000–9999	1000–4999	100–999	< 99	
1.5. Carrier companies (intercity buses), units	0.6	> 500	300–499	100–299	50–99	< 49	
2.1. Length of railways, km	1	> 2000	1000–1999	500–999	200–499	< 199	0
2.2. The share of electrified railways in the total length of railways,%	0.6	100	80–99	60–79	50–59	< 49	0
2.3. Density of railways, km/thousand km ²	1	> 70.0	50.0–69.9	40.0–49.9	20.0–39.9	< 19.9	0
3.1. Number of seaports, units	1.6	> 5	4	3	2	1	0
4.1. Number of airports, units	1	> 5	4	3	2	1	
4.2. Number of terminals, units	0.6	> 9	7–8	5–6	3–4	1–2	
4.3. Number of airlines, units	0.6	> 80	60–79	40–59	10–39	< 9	
4.4. Flight directions (countries), units	1	> 50	20–49	10–19	5–9	< 4	
4.5. Flight directions (cities), units	0.8	> 200	100–199	30–99	10–29	< 9	
5.1. Number of passengers transported by intercity buses (between autonomous districts), thousand people	0.6	> 5000	2000–4999	1000–1999	500–999	< 499	0
5.2. Number of passengers transported by city bus, million people	0.6	> 300	200–299	100–199	50–99	< 49	
5.3. Number of passengers transported by rail, thousand people	0.8	> 100000	50000–99999	10000–49999	1000–9999	< 999	0
5.4. Number of passengers transported by sea, thousand people	0.8	> 5000	2000–4999	1000–1999	100–999	< 99	0
5.5. Number of passengers transported by air, thousand people	0.6	> 50000	10000–49999	1000–9999	100–999	< 99	
5.6. Share of international air transport,%	0.6	> 80.0	50.0–79.9	20.0–49.9	10.0–19.9	< 9.9	

of points scored by the regions of Spain is 63.2 points, the minimum – 15.0 points. Taking into account the following indicators, all administrative units of Spain are divided into 5 groups according to the level of development of transport infrastructure for tourism (Fig. 10):

1. Highest – more than 50 points (3 regions);
2. High – 40–49 points (5 regions);

3. Sufficient – 30–39 points (6 regions);
4. Average – 20–29 points (3 regions);
5. Low – less than 19 points (1 region).

That is, almost 80 % of the administrative-territorial units of Spain have high scores for transport infrastructure, which in turn is one of the main factors in the development of tourism in the country.

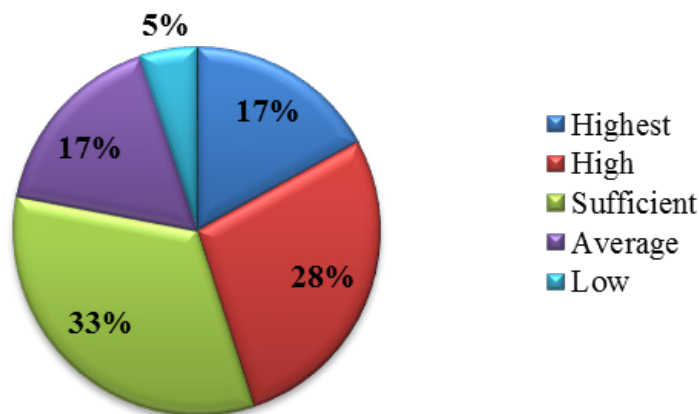


Fig. 10. Ratio of Spanish regions in terms of the level of transport infrastructure development for tourism needs

Assessing the current state of development of transport infrastructure for tourism, we can say that the infrastructure is most developed in the tourist regions of the country – Catalonia, Andalusia, Madrid, the Canary and Balearic Islands, as there is a need to constantly update and develop it to attract more tourists, who contribute to the country's GDP.

Conclusions.

The modern transport infrastructure of Spain has undergone a long period of development. The network of highways was most developed in the twentieth century. The history of railways in Spain begins in the nineteenth century with the construction of the first railways and continues to this day, making it one of the most important elements of society and economies in Spain. Occupying a favourable geographical position, Spain has always been one of the first places in the world for the development of maritime transport. The rapid development of air transport is one of the most characteristic elements of the recent evolution of the Spanish transport system. As of 2019, the total length of Spanish railways was 15,931.08 km, two-thirds of which are electrified. The greatest length of the railways is in the largest regions of Spain: Castile and Leon, Andalusia, Castile-La Mancha. The share of electrified railways is particularly high in Catalonia, where the railroad runs along the Mediterranean resorts of the Costa Brava. Spain currently has more than 1,500 km of high-speed rail lines connecting Madrid with Malaga, Seville, Valencia, Barcelona, Valladolid, Tarragona, Zaragoza, Alicante and Ferrol. The largest amount of traffic is to Madrid and Catalonia – about 79 % of all traffic by rail (more than 240 million passenger journeys each). Here are the largest cities in Spain, and Catalonia is also a tourist region. Rail transport infrastructure is well developed in the country, but given the short distances across the country, rail transport is not as popular as road transport.

In 2019, the total length of roads in Spain was 165,484 km. The Spanish road network is mainly centralized in 6 directions, connecting Madrid with the Basque Country, Catalonia, Valencia, Andalusia, Extremadura (roads towards Portugal) and Galicia. In addition, highways run along the Atlantic and Mediterranean coasts. Carriage of passengers by car accounts for about 90 % of traffic. For the needs of

the the population of cities and tourists, the number of which is annually greater than the population of the country, Spain has an extensive network of urban transport and intercity bus transport. In addition to regular intercity bus services for the needs of the population in Spain, there are various other carriers. In 2019, their total number was 68,894 units and most of them are taxis, or car rental companies. Road transport is very popular in Spain.

Maritime passenger transport has become more developed in Spain on the Mediterranean coast due to cruises and internal transport to the island autonomous districts. In 2019, 32.7 million passenger journeys were made by sea. Two-thirds of shipments are for cabotage and one-third for international traffic. According to 2019, the largest number of traffic falls on the port of Balearic Islands in Palma de Mallorca in the Balearic Islands. This is followed by the port of Andalusia Algeciras and the port of Santa Cruz de Tenerife in the Canary Islands. Together, these three ports account for more than 50 % of passenger traffic by sea in Spain.

The country's largest airports are Madrid Barajas and Barcelona El Prat, which are located in the country's largest cities. Slightly smaller airports are the so-called "tourist" airports – Malaga, Palma de Mallorca, Gran Canaria, Alicante and Tenerife South. They serve tourist resorts and have a well-developed infrastructure. In total, from the airports of Spain you can reach 358 cities in 121 countries. The largest loads fall on the regions of Madrid, Catalonia, the Canary Islands, the Balearics, Andalusia and Valencia, which serve more than 90 % of air passengers.

On the basis of quantitative indicators of the analysis of the transport infrastructure of Spain, a point assessment of the level of development of the transport infrastructure of the regions of Spain for the needs of tourism was carried out. Administrative units are divided into 5 groups: with the highest, high, sufficient, average and low level of development of transport infrastructure for tourism. Transport infrastructure is most developed in the tourist regions of the country – Catalonia, Andalusia, Madrid, Canary and Balearic Islands, as there is a need to constantly update and develop it to attract more tourists, who contribute to the country's GDP.

References

- Aeropuertos Españoles y Navegación, 2020. Retrieved from: <http://www.aena.es>.
- Beidyk, O.O., 2001. Rekreatsiino-turystski resursy Ukrainy: Metodolohiia ta metodyka analizy, terminolohiia, raionuvannia [Recreational and tourist resources of Ukraine: Methodology and methods of analysis,

terminology, zoning]. Kyiv: Publishing and Printing Center «Kyiv University», 395 (in Ukrainian).

- Boyko, Z., Horozhankina, N., Hrushka, V., Korneyev, M., Nebaba, N., 2020. Analysis of the market of international tourist services of Ukraine (for the period 2007–2017).

- Journal of Geology, Geography and Geoecology. Volume 29, Issue 4, 647–655.
- Chaika, L.P., 2016. Transportna heohrafiia [Transport geography]. Kovel: KPEK Lutskoho NTU, 90 (in Ukrainian).
- ENAIRES, 2020. Retrieved from: <https://www.enaire.es>.
- International Air Transport Association, 2020. Retrieved from: <http://www.iata.org>.
- International Civil Aviation Organization, 2020. Retrieved from: <https://www.icao.int>.
- La Sociedad Estatal de Infraestructuras del Transporte Terrestre, 2020. Retrieved from: <http://www.seittsa.es>.
- Ministerio de Fomento, 2020. Retrieved from: <http://www.fomento.es>
- Podlepina, P. O., 2013. Zakordonnyi dosvid orhanizatsii turyzmu na suchasnomu etapi (na prykladi Ispanii) [Foreign experience in organizing tourism at the present stage (on the example of Spain)]. Bulletin of Kharkiv National University named after V.N. Karazin. Series: International Relations. Economy. Local lore. Tourism. № 1086, Issue 2, 169–174 (in Ukrainian). Retrieved from: http://nbuv.gov.ua/UJRN/VKhMv_2013_1086_2_35
- Puertos del Estado, 2020. Retrieved from: <http://www.puertos.es>.
- Renfe Operadora, 2020. Retrieved from: <http://www.renfe.com>.
- Rudakevych, I. R., 2009. Suspilno-heohrafichni problemy rozvytku transportnoi infrastruktury velykoho mista (na materialakh oblasnykh tsestriv Zakhidnoho rehionu Ukrainy) [Socio-geographical problems of development of transport infrastructure of a big city (on materials of the regional centers of the Western region of Ukraine)]. – Lviv: Ivan Franko National University of Lviv, 210 (in Ukrainian).