

EXAMINATION OF ROMANIA'S ROAD NETWORK IN THE LAST 5 YEARS

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Abstract: *The development of transport can be traced back to the Middle Ages. The plants and manufactories involved in the production of products mainly satisfied local needs. Later, however, with the increase in production volume and the saturation of local needs, the production manufactories sought new markets for themselves. In the beginning, the merchants themselves carried out the delivery of the goods, but the work of the merchants was constantly expanding, and thus it became necessary to use transport companies. In our article, we examine the current situation of road transport in Romania in the last 5 years regarding public roads and highways. We examined the length of the roads in Romania and what place it occupies within the European Union.*

Keywords: *road network; transport; European Union; truck*

JEL classification: L91, N70

1. Generally, Introduction or Background - Importance of transportation

Transportation is an important area of the logistics discipline, during which materials and goods flow between economic units, and as a result, the location of raw materials/products changes. (Kovács – Pató, 2007).

Many people mistakenly use the term transportation as a synonym for transport, but the term transport can only be used in connection with the transfer of goods if it is done using one's own vehicle and not for a fee. (Horváth – Karmazin, 2014). The transport of goods creates the connection between geographically separated sites located in different areas in the logistics system. This also affects the company's internal processes, customer service and relations with suppliers. We are talking about a complex area that significantly influences the level of service available, and this group represents a significant item within the costs.

The delivery of goods can also be carried out with one's own equipment, but it is common to use external service companies that specialize specifically in transportation. The carrier market is generally characterized by strong competition, as third-party service providers are present in large numbers on the market. On the other hand, in the case of transport, the transport company delivers the entrusted goods to the recipient against the fee imposed in the transport contract (Némon – Vörösmarty, 2009). The relationship between the carrier and the carrier is usually established by the freight forwarder. The shipping organization or person usually has

other goods transported by another means of transport for a fee. In some cases, the freight forwarder himself has a fleet of vehicles (usually vehicles suitable for road transport), with which he carries out the transport activity in whole or in part (Szegedi –Prezenszki, 2017).

2. Description of possible shipping methods

The choice of transport method can greatly affect the delivery time and cost. This is also why it is important to carefully choose the mode of transport, as the specific modes of transport have specific characteristics, which basically determine the advantages and disadvantages of the transport in a given time and situation (Némon – Vörösmarty, 2009; Szegedi – Prezenszki, 2017).

We distinguish between the following delivery methods:

- rail transport: Suitable for the transport of bulky goods at a relatively favorable price, typically with a long delivery time. They are usually used by businesses in the long term. Door-to-door delivery is not typical for this mode of delivery, as its use would require a built-in infrastructure.

- road transport: It is a significantly more flexible mode of transport than rail transport, and it also delivers short- and medium-distance deliveries in a short turnaround time, which can be greatly influenced by weather and traffic conditions. Higher shipping costs are to be expected here.

- water transport: a large mass of goods can be transported with this, and a long transit time is required. It is important that it is an environmentally friendly and cheap method of transport. The need for infrastructure is significant, in addition to the fact that exposure to weather conditions is also very high.

- air transport: It is not suitable for receiving a large amount of goods, it typically provides fast and accurate transport of goods over medium and long distances, but it is more expensive compared to other modes of transport.

- pipeline transport: It is equally suitable for short- and long-distance goods transport. They are rarely used for intra-company transport (e.g. fly ash and slag in power plants, and sand in mines). It mainly transports natural gas and mineral oil over long distances. Although the demand for infrastructure is significant, it does not depend on environmental effects, its environmental pollution is minimal and it involves a small specific operating cost.

In our article, we examined the road network in Romania necessary for the transport of goods by road, so we present information belonging to this group in the following. The reason for this is that road transport is also the most common mode of transport in Romania (road freight transport offers the possibility of fast and flexible door-to-door delivery of goods of different weights and sizes) and it is advisable to study this group in more detail.

Road transport is the fastest of all land transport methods, and door-to-door delivery has the biggest advantage. Trucks can usually approach the sites directly, so there is no need for transshipment (Attwood–Attwood, 1992). This mode of transport can be flexibly adapted to the needs of the carriers, while the delivery time is relatively short. The transport vehicles are able to transport almost all types of products, which is due to the wide range of vehicles. Based on a 2010 study, Egri highlighted even the lowest shipping cost feature (Egri, 2010).

It is an advantage that the loading time can be calculated, which is important in the case of JIT (Just in Time) systems in situations where consumers control the loading time, for example during construction work it is very important that the raw material to be used arrives on time (Benson et al., 1994)

In addition to countless advantages, road freight transport also has disadvantages. One of the biggest disadvantages is that it is highly dependent on environmental influences (such as traffic jams, weather, etc.). Compared to rail transport, road transport has a higher specific energy and labor demand, and in addition, the polluting and environmentally damaging effect is also significant or significantly greater than that of surface transport. Disadvantages include weekend delivery bans and route restrictions, which make it difficult to transport and thus make it difficult for goods to reach their destination (Egri, 2010).

Presentation of Romania

Romania is located in Central and Eastern Europe. In the middle of the country, you can see the mountain ranges of the Carpathians, which stretch 2/3 of their entire length in the territory of the country. In addition, other defining geographical and economic elements of Romania are the Danube and the Black Sea. Two-thirds of the length of the Danube flows through the territory of the country. It also has 190 km of coastline on the Black Sea. From an economic point of view, these geographical features significantly advance Romania. It is bordered by five neighboring countries and the Black Sea. Hungary and Serbia to the west, Ukraine to the north, Bulgaria to the south, and Moldova and the Black Sea to the east. With an area of 238,391 square kilometers and a population of more than 19 million people, it is the eighth largest and seventh most populous country in the European Union. Romania has been a NATO member since 2004, and since 2007 Romania has been a member of the European Union. Romania is made up of 41 counties and Bucharest, the capital of Romania (it has more than 1.9 million inhabitants). The country is divided into 4 economic macro-regions and 8 regions.

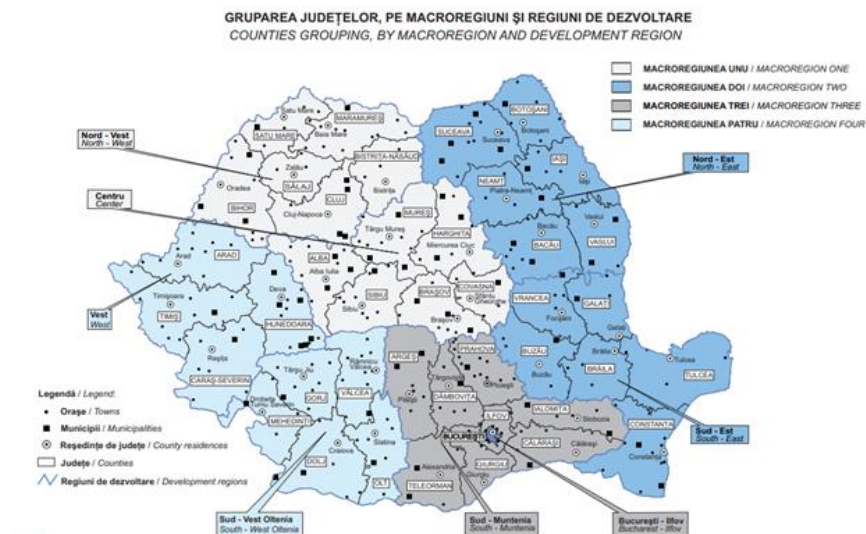


Figure 1: Administrative areas of Romania
Source: Romanian Statistical Office

A region consists of 4-6 counties (Figure 1) and 2 regions make up a macroregion. The "1. Macroregion" consists of two regions: the North-West and the Central region. The North-West region consists of 6 counties: Bihor, Bistrița-Năsăud, Cluj, Maramureș, Satu Mare, Sălaj. The counties of the Central Region are: Alba, Brașov, Covasna, Harghita, Mureș, Sibiu. THE 2. Macroregion" consists of North-East and South-East regions. The counties of the North-East region are: Bacău, Botoșani, Iași, Neamț, Suceava, Vaslui. THE 3. Macroregion" consists of South Muntenia and Bucharest-Ilfov regions. Argeș, Călărași, Dâmbovița, Giurgiu, Ialomița, Prahova, Teleorman counties belong to South Muntenia, while only Ilfov county and the capital belong to the Bucharest-Ilfov region. The 4th Macroregion also consists of 2 regions, South-West Oltenia and the Western region. Counties belonging to South-West Oltenia: Dolj, Gorj, Mehedinți, Olt, Vâlcea. The counties of the Western region are the following: Arad, Caraș-Severin, Hunedoara, Timiș. (Romanian Statistical Office, 2023).

Road transport accounts for the largest part of passenger and freight traffic in Romania. Romania's road network consists of international roads, national roads and county-maintained roads. The maintenance of national roads is the responsibility of the "Direcția Regională de Drumuri și Poduri". Roads in Romania are named with a combination of letters and numbers, sometimes letters are added to the numbers to distinguish road sections. The highest roads are marked with the letter "A" (as in *autostradă*), which indicates highways. For example, there is a 558 km long road section on the A1 highway: Bucharest-Pitești- Széban-Déva-Temesvár-Arad-Nagylak-Hungary (M43). Unfortunately, the works are only partially finished. The approx. 100 km section between Déva and Lugoj has not yet been completed, because there is a road section of approx. 13 km long, and a 2.13 km tunnel built on this section is missing. The works are expected to start at the end of this year, so handover is still expected later. A later handover is also expected for the A3 highway Bucharest - Ploiești - Brasov - Sighsvár - Marosvásárhely - Cluj - Zilah - Nagyvárad - Bors - Hungary (M4), as only a fraction of the 603 kilometers, 167 km, has been completed.

Second highest road DEx as Drumuri Express, which indicates expressways. This is followed by Drumuri Naționale called DN, which can be translated as national roads, their numbers range from DN1 to DN79 and are maintained by the "Regional Directorate of Roads and Bridges". Roads marked E belong to the European road numbering system. The E60 road, for example, goes through France, Switzerland, Austria, Hungary and all of Romania to end at Constanța, the largest Romanian port city on the Black Sea. DJ (Drumuri județene) is the sign of county-maintained roads, which are under maintenance or construction by the counties and their municipalities.

Roads marked DC (Drumuri Comunale) are mostly unpaved roads and roads that are interesting from a tourist point of view. All roads in Romania are subject to payment, whether they are marked A or even DC, as we enter the territory of Romania, the "Rovinieta" is mandatory for all types of vehicles, which can be used throughout the country, on any marked road, even on the highway. The toll can be

redeemed until midnight on the day of entry at any gas station, border crossing point, via SMS or online (Transtellex, 2022; Romania, 2023).

The European Union road situation

The length of the motorway in Romania is 931 km, which is roughly half of the road network in neighboring Hungary (Figure 2).

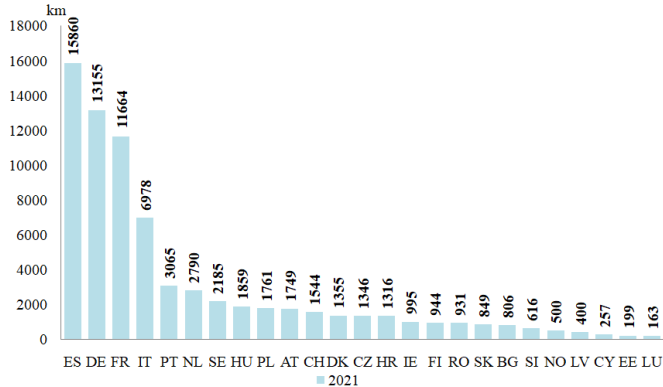


Figure 2: The length of motorways in the European Union member states in 2021
 Source: Own calculation based on Eurostat 2023a

The average length of motorways in the European Union is 2,931 kilometers, to which the motorways of Spain, Germany and France contribute greatly. Examining each of the EU member states, it can be established that half of the EU member states are located below 1,346 km, and 50% above. Unfortunately, Romania does not reach this value, so it can be concluded that Romania's highway infrastructure requires improvements in the future. In the ranking, Romania was ahead of Slovakia, Bulgaria, Slovenia, Norway, Latvia, Cyprus, Estonia and Luxembourg (Luxembourg 163 km).

In order to see the European road network, it was necessary to examine the total road length of each member state in 2021 (Figure 3).

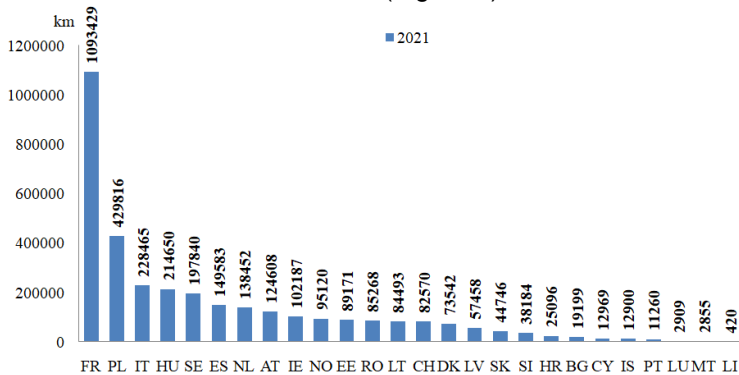


Figure 3: The length of the road network of the European Union member states in 2021

Source: Own editing based on Eurostat 2023b

France has the largest road network in the EU (Figure 3), followed by Poland. Hungary was also in 4th place in this survey, while Romania was in 12th place. The total road network in Romania is approximately 85,000 km, which is due to its geographical features of high mountains and untouched natural areas and forests. If we examine the proportion of highways, it can be concluded that Portugal has the highest proportion of highways (approximately 30%) of the total road length. Portugal is followed by Spain, with almost third volume (10.6%). It was interesting to see from the survey that Estonia was in last place with 0.2%. Hungary is in 5th place from the back, and Romania is ahead of Hungary in this case, since the highway accounts for 1.1% of the total road length in Romania (only 0.9% in Hungary). The European Union average is 3.4%, and the median value based on the calculations is 1.7%. These calculated values will be available in the near future with future developments and support.

The following comparison concerned the development of freight charges for the member states of the European Union in 2019 and 2020 (Figure 4). The general freight charges are given by the individual member countries in their own currency, but it is increasingly common in Europe to make calculations in Euros. It's easier for businesses to sell their services in euros, because if they do international shipping, they don't have to deal with daily exchange rate fluctuations. In our calculation, the 2020 average of the 27 countries of the European Union gives 100% and we compare the countries individually to this base year.

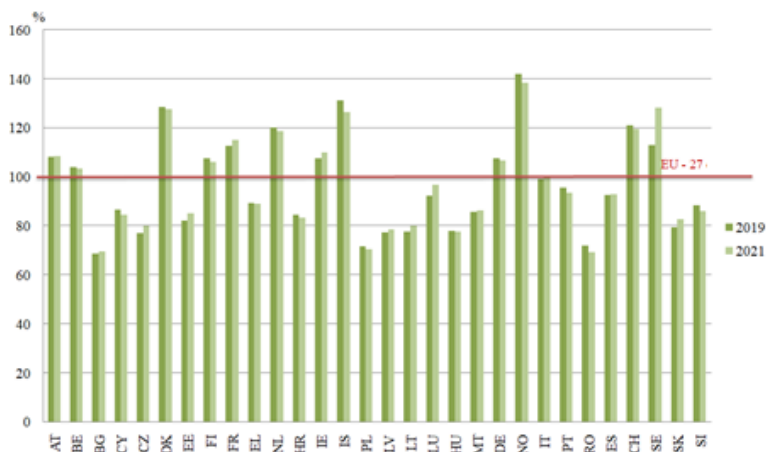


Figure 4: Development of freight charges compared to the EU 27 average
Source: Own editing based on Eurostat 2023c

They work in Norway with the highest freight charges, since the amount of freight charges there was 138.5% of the EU average in 2021. The lowest freight rates were in Bulgaria, as freight rates in 2019 were 68.5% of the European Union average (but by 2021, Bulgarian companies have raised freight rates to 69.4%). In relation to

Romania, businesses reduced their prices, so the country fell below Bulgarian prices.

In 2021, freight charges in Romania will reach only 69.1% of the EU average. Thanks to this, in 2021, Romania is the cheapest among the member states of the European Union in terms of freight charges. Hungary is not the most favorable country in terms of freight charges, but after Romania, Bulgaria and Poland, the prices in our country are the lowest, reaching 77.6% of the average freight charges in the European Union. In 2021, similar to Romania, businesses in Hungary also minimally reduced freight and forwarding fees compared to the prices of 2019.

In order to get an adequate picture of the situation in the European Union, it is necessary to examine the age composition of the fleet of trucks performing the services. It can be seen that nearly half of the truck stock in the European Union is older than 5 years, and nearly 40% is older than 10 years (Eurostat 2023d). In France, Germany, the Netherlands, Austria and Sweden, the proportions are about the same between the four age groups, while in Belgium, Lithuania and Slovenia the proportion of old cars is very low, with the first three age groups mostly dominating. On the other hand, in Cyprus and Romania, 70% of the population is made up of old 10-20-year-old cars. Even though Hungary can't boast either, as 48% of its truck stock is made up of 10-20 year old vehicles, it still has a newer vehicle fleet than neighboring Romania.

So, based on the calculations, it turned out that Romania's truck stock is the second oldest in the EU after Cyprus. On the other hand, Hungary has a relatively younger equipment park, similarly to Spain, Portugal, Finland, Poland, Latvia and Malta.

The analysis of public roads and motorways in Romania

Romania is a big competitor for Hungary in terms of shipping and transportation. In many cases, Hungarian companies entrust a Romanian contractor with carrying out the transport/shipping activity instead of Hungarian contractors.

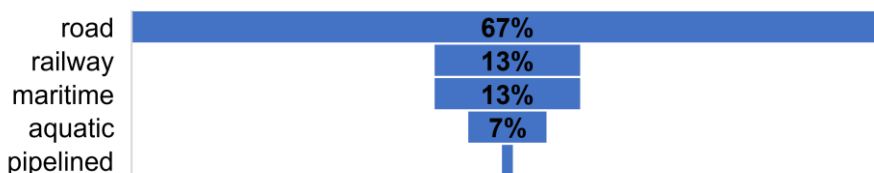


Figure 5: Distribution of freight transport by mode of goods transport in 2021

Source: Own calculation based on Inssie (2023a) data

In 2021, most goods were transported by road in Romania as well (Figure 5). 67% of the moved goods were transported by road. The second most popular mode of transport was rail transport, which accounts for 13%. Proximity to the coast did not

matter much for shipping, as only 1% of all shipments occurred (roughly the same amount as pipeline shipping). Air transport has no relevance in Romania.

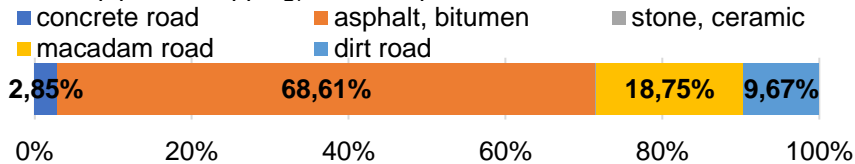


Figure 6: Distribution of the road network in 2021 by type of road surface
 Source: Own edit based on Inssie (2023b) data

Romania's total road network in 2021 was 86,199 kilometers, the largest percentage of which is asphalt or bitumen (about 68.61% of the entire Romanian road network is asphalt and bitumen). The second largest proportion is macadam road, which accounts for 19% of the total road surface (in Hungary, only 9.67% is undeveloped road or dirt road). To a small extent, concrete roads, stone and ceramic pavements still appear on the roads in Romania (2.85%), which is only 0.1% of the road length in Romania (Figure 6).

It can therefore be concluded that Romania's road network is developed, the road network consists of the largest percentage of completed asphalt roads, which have been continuously built in recent years (the number of asphalt roads increased by 4% compared to the base year 2017), dirt roads, macadam roads, and concrete roads were gradually replaced by this modern type of road surface.

The next investigation concerned the length of the highways. It can be concluded that the construction of highways and motorways has shown an increasing trend in recent years, but this amount is still far below the EU average. The length of expressways accounts for only 1.08% of the entire road network. Compared to the base year of 2016, an increase of almost 25% can be observed, which represented an average annual increase of 4.5%.

If we examine the distribution of expressways by macro-region in the year 2021, it can be concluded that the 3rd Macro-region has the most motorways (Insse, 2023). The members of this region are the capital and Ilfov county, as well as Arges, Călărași, Dâmbovița, Giurgiu, Ialomița, Prahova and Teleorman, thus the catchment area of the capital. The next in line is the 4th Macroregion, which includes the West and South-West Oltenia regions, including the counties of Arad and Temes and Hunyad, among others. However, there is a huge gap between the capital region and the Western region, since not a single kilometer of highway was built in the South-West Oltenia region in 2021. By focusing on this area, it would be possible to reach the Black Sea by highway. The fewest motorways can be observed in the 2nd Macroregion in the Eastern and North-Eastern regions of the country, which is actually the territory of the old Romania. Only 10% of the total length of the highway can be found in this section. In these regions, a total of 94 kilometers of expressways can be observed only in Bacău and Constanța counties, of which 74 kilometers, being a port city, are in Constanța county.

Figure 7 illustrates the length of highways up to 100 km. Although the Bucureșt-Ilfov region clearly stands out from the rest, it should be noted that 22 kilometers of highways fall on the capital's 240 km² area, so there are 9.1 km of highways per 100 km² area in the capital, which raises the regional average by 4.6 km/100 km². It is

clear that the length of highways and motorways in the other regions is insignificant compared to the regional conditions. With the exception of the capital region, none of the regions reaches one kilometer, what's more, the data of the South-West Oltenia region is exactly equal to zero, because in this region not a single kilometer of highway has been built, creating a big gap between the capital and western regions. The north-eastern region also only has a 20 km highway section, which is located in Bacău county, so the expressway network per 100 km² of this region can be reduced to almost zero, this value is exactly 0.05 km/100 km².

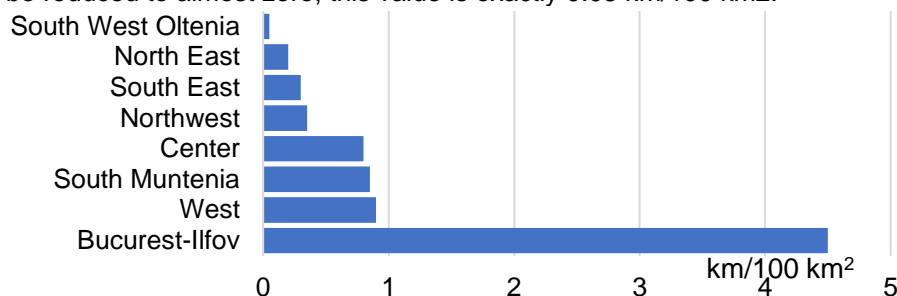


Figure 7: length of motorways per 100 km² by region in 2021

Source: Own calculation based on Inssie (2023c) data

The last part of the research was the examination of the truck stock in Romania. The research revealed that Romania has an aging fleet of vehicles. Unfortunately, the proportion of modern, young 2-5 year old trucks is negligible (5% of the examined population). Cars aged 2-5 years make up 10%, while cars 5-10 years old make up 17% of the total fleet in Romania. The largest proportion are 10-20-year-old vehicles, the number of which is approximately 564,000 (68% of the population).

5. In conclusion

Based on the prepared calculations, it can be concluded that compared to Hungary, Romania has shown a greater development trend based on the development of public roads in the last 5 years. Romania had a total of approximately 87,000 kilometers of road network based on 2021 data. Comparing the road networks of Hungary and Romania, it can be concluded that the road density is much higher in Hungary than in Romania. The length of the road network per person prepared by us is also below the European Union average in Romania.

In Romania, the amount of nationally maintained road networks and the amount of asphalt roads are below the EU average. The reason for this is, on the one hand, the national legislation, because while in Hungary a settlement can only be classified as a city if all its main roads are paved, this is not the case in Romania. In Romania, even in the 1990s, the city classification could be obtained where the population exceeds 10,000 people (regardless of the road network of the area).

In our research, we also examined the number of highways in Romania, where we came to the conclusion that the length of highways in Romania does not even reach

1%. Even though the development trend of Romania's road network was better, the length of the highways still does not reach even half of the length of the Hungarian expressway network.

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