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The State of Adaptability of the Romanian Road and Rail Networks to the European TEN-T Transport Networks

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Abstract

Transport is fundamental to an efficient EU economy, but vital connections are currently missing. TEN-T Trans-European Transport Networks are an essential tool to help transport policy achieve the overall objective of a 60% reduction in transport emissions by 2050. Essentially, the TEN-T is a multimodal transport network, making it much easier for passengers and goods to shift from road to rail and other modes of transport. This paper has been written by the authors in an elegant manner, through which the European TEN-T transportation networks are treated. In this way the readers can get acquainted with the number, role and benefits brought by the European TEN-T transport networks. The scientific paper also presents a case study on the state of adaptability of road and rail networks in Romania to the European TEN-T transport networks on December 31, 2024. Conclusions are drawn at the end of the paper.

Keywords: Trans-European Transport Network (TEN-T), Trans-European Corridor, Road Network, Rail Network, Benefit, Development, Adaptability

Introduction

TEN-T policy, the European policy on trans-European transport networks (TEN-T), aims to create the transport infrastructure and interconnections underpinning the single market, ensuring the free movement of goods and people and supporting growth, job creation and EU competitiveness. In the past, transport systems in Europe have largely developed within national borders. This has led to a lack of interconnection of transport networks or a low degree of interconnection at borders or along major corridors. The low degree of interconnection of transport systems is an obstacle to economic growth. Since the 1980s, TEN-T policy has predominantly allocated EU funds to support the development of key European infrastructure projects. And there have been many important success stories. However, particularly in these financially difficult times, there is a need to refocus EU transport spending where it offers maximum added value - to create a strong European core network. The new policy has been developed following a two-year consultation process and sets out a core transport network to be put in place by 2030 to form the backbone of transport in the single market. The funding proposals published today (for the period 2014-2020) also concentrate EU transport funding predominantly on this core transport network, filling in missing links across borders, removing bot bottlenecks and making it smarter. The new TEN-T core network will be supported by a comprehensive network of regional and national routes bringing traffic into the core network. The latter has been largely funded by Member States, with some EU and regional funding possibilities from transport funds, including innovative new financing instruments. The aim is that gradually, by 2050, most of Europe's citizens and businesses will be no more than 30 minutes away from the "tributary" network. Taken as a whole, the new transport network will offer: safer and less congested journeys; smoother and faster travel. The €31.7 billion allocated to transport under the "Connecting Europe Facility" of the MFF (Multiannual Financial Framework) will in practice serve as "seed money" to stimulate additional investment by Member States to complete difficult cross-border connections and links that would otherwise probably not be built. Every €1 million spent at European level will generate €5 million from member governments and €20 million from the private sector. The new policy establishes a smaller and better-defined transport network for Europe. It aims to focus spending on fewer projects that can achieve real EU added value. Member states will also face tougher requirements for common specifications that will work across borders and legal obligations linked to project completion.

1. Literature review, history and state of development

The TEN-T Directives were initially adopted on July 23, 1996, by Decision No 1692/96/EC [1] of the European Parliament and of the Council on Community directives for the development of the trans-European transport network. In May 2001, the European Parliament and the Council adopted Decision No 1346/2001/EC [2], which amended the TEN-T directives as regards seaports, internal ports and intermodal terminals.

In April 2004, the European Parliament and the Council adopted Decision No 884/2004/EC (added to the list by Decision No 884/2004/EC) [3], amending Decision No 1692/96/EC [4], on Community directives for the development of the trans-European transport network. The April 2004 revision was a more fundamental change in TEN-T policies, designed to take account of the enlargement of the EU and the resulting changes in traffic flows [5].

The evolution of TEN-T was facilitated by a 1994 proposal which included a number of priority projects [6].

In December 2013, through Regulations (EU) 1315/2013 (TEN-T Directives) and 1316/2013 (Connecting Europe Facility 1 [7]), The TEN-T network has been defined at three levels, the comprehensive network and the core network, and within the core network, the 9 core network corridors. Each corridor must include three transport modes, three Member States and two cross-border sections. "Corridor platforms" will be created to bring together all relevant stakeholders and Member States. The corridor platform is a governance structure that will develop and implement 'corridor plans' so that work along the corridor, in different Member States and at different stages of completion, can be effectively joined up. Corridor platforms for the core core network corridors will be chaired by European coordinators [8].

On October 17, 2013, nine core network corridors (instead of the 30 TEN-T priority projects) were announced (core network corridors), namely [9]:

Fig 1: Baltic-Adriatic Sea Corridor [24]

1. Baltic - Adriatic Sea Corridor, (Poland - Czech Republic/Slovakia - Austria - Italy) (Figure 1), with a total length of 2,400 km, starts in Gdansk (Poland), via Vienna and ends in the province of Ravenna, Emilia-Romagna (Italy). It is a European initiative to create a high-capacity north-south rail and road corridor linking Gdansk on the Baltic Sea to Bologna and the Adriatic Sea. The line crosses Poland, the Czech Republic, Slovakia, Austria and Italy, connecting highly industrialized areas such as Warsaw and the Upper Silesian Coal Basin, Vienna and south-eastern Austria and northern Italy. It developed out of the Trans-European Transport Network (TEN-T) project No. 23 of the Gdańsk-Vienna rail axis, established in 2003. Transporting 24 million tons of freight a year, the Baltic-Adriatic Sea Corridor is considered one of the most important transalpine lines in Europe. Its history: following an initiative by the Austrian Ministry of Transport in 2006, Poland, the Czech Republic, Slovakia, Austria and Italy signed a letter of intent to extend the TEN-T 23 rail project to form the Baltic-Adriatic Sea Corridor. The objectives of the initiative were to eliminate traffic congestion, create an intermodal link of traffic flows and connect with other major European corridors, eliminate structural and geographical disadvantages for underserved areas (such as the southern Austrian states of Styria and Carinthia), increase the competitiveness of rail transport in relation to road (trucks) and realize the market development potential for passenger traffic along the corridor. In 2009, 14 European countries signed a declaration calling for the realization of the Baltic-Adriatic corridor between Gdańsk and Bologna. At the end of 2008 work started on the first phase of the Austrian Koralm railway between Graz and Klagenfurt, including the 33 km-long Korlam tunnel, the largest infrastructure element of the line. It is expected to be operational by 2025. In 2012, construction started on the Semmering tunnel, scheduled to open in 2030, bypassing the slopes of the Semmering Pass. By the resolution of October 19, 2011, the Baltic-Adriatic Sea Corridor was linked to the TEN-T Rail Baltica project from Warsaw via Kaunas, Riga and Tallinn to Helsinki (including the proposed tunnel between Helsinki and Tallinn). In a discussion with Debora Serrachiani, Member of the European Parliament, on April 24, 2012, the Italian Minister of Infrastructure and Transport, Corrado Passera, reaffirmed the Italian government's commitment to extend the Baltic-Adriatic Corridor to Ancona, 325 km south of Venice.

It is one of the most important trans-European road and rail axes linking the Baltic Sea to the Adriatic Sea, passing through the industrialized areas between southern Poland (Upper Silesia), Vienna and Bratislava, the eastern Alps and northern Italy. This corridor includes major rail projects such as the Semmering base tunnel and the Koralm railway line in Austria, as well as cross-border sections between Poland, the Czech Republic and Slovakia. [8].

Fig 2: North Sea - Baltic Sea Corridor [25]

2. North Sea - Baltic Sea Corridor, (Finland - Estonia - Latvia - Lithuania - Lithuania - Poland - Germany - The Netherlands/Belgium), (Figure 2), with a total length of 3,200 km, starts in the Finnish capital Helsinki via Warsaw and stops in the province of Antwerp, Flanders, Belgium. It has the following history: the original corridor of the core network was to be called Warsaw - Midlands (route Warsaw

- Poznan - Frankfurt (Oder)) - Berlin - Hannover - Osnabruck - Enschede - Utrecht - Amsterdam/Rotterdam - Felixtowe -Birmingham/Mancester - Liverpool, but following the UK's exit from the European Union (Brexit), the route will no longer reach the British Isles. For this reason it has been extended and redesigned along the current route from Helsinki to the Benelux.

It therefore connects the ports on the eastern shore of the Baltic Sea with ports on the North Sea. This corridor will link Finland and Estonia by ferry, creating modern road and rail transport links between the three Baltic countries on the one hand and Poland, Germany, the Netherlands and Belgium on the other. The corridor also includes inland waterways between the river Oder and German, Dutch and Flemish ports, such as the "Mittelland-Kanal". The most important project is "Rail Baltic", a European standard-gauge railway between Tallinn, Riga, Kaunas and north-east Poland [8];

Fig 3: Mediterranean Corridor [26]

3. ***Mediterranean Corridor***, (Spain - France - Northern Italy - Slovenia - Croatia - Hungary), (Figure 3), with a total length of 3,000 km, starts in the city of Algeciras, Spain, via Lyon - Venice and stops in the city of Miscokolc, Hungary. By rail, the Mediterranean Corridor crosses six countries of the European Union, such as Spain, France, Italy, Slovenia, Croatia and Hungary, over a distance of more than 6,000 kilometers along the route: Almeria - Valencia/Madrid - Zragiza/Barcelona - Marseille - Lyon - Turin - Milan - Verona - Verona - Padova/Venice - Trieste/Koper - Ljublijana - Budapest - Zahony.

It therefore links the Iberian Peninsula to the Hungarian-Ukrainian border. It stretches along the Mediterranean coasts of Spain and France, crosses the Alps east through northern Italy, continues along the Adriatic coast of Slovenia and Croatia, and then heads towards Hungary. Apart from the River Po and several other canals in northern Italy, this corridor is made up of roads and railways. The main rail projects along it are the Lyon - Turin links and the Venice - Ljubljan section [8];

Fig 4: The East/East - Mediterranean [27]

4. Orient/East - Mediterranean Corridor, (Germany - Czech Republic - Austria/Slovakia - Hungary - Romania - Bulgaria - Greece - Cyprus), (Figure 4), with a total length of 3,712 km, starts in Hamburg, Germany, via Budapest - Sofia and stops in the Cypriot capital Nicosia. This corridor will link Central Europe with the maritime interfaces of the North Sea, the Baltic Sea, the Black Sea and the Mediterranean Sea.

It thus links the maritime interfaces of the North Sea, the Baltic Sea, the Black Sea and the Mediterranean Sea, optimizing the use of the ports concerned and the related maritime highways. With the River Elbe as an inland waterway, this corridor will improve multimodal connections between Northern Germany, the Czech Republic, the Pannonian region and South-Eastern Europe. It extends by sea from Greece to Cyprus [8];

Fig 5: Scandinavian Corridor - Mediterranean Sea [10]

5. Scandinavian - Mediterranean Corridor, (Finland – Sweden – Denmark – Denmark – Germany – Austria - Italy), (Figure 5), with a total length of 4,858 km, starts in the Finnish capital Helsinki, via Copenhagen-Munich and stops in the Maltese capital Valletta. Also known as the Scan-Med Corridor for short and also known as the Helsinki-Valletta Corridor, it is the fifth of the nine priority

axes of the Trans-European Transport Network (TEN-T). The Scan-Med Corridor is the longest of the nine main corridors of the TEN-T network, it develops its network from the Seine to the Danube on the following three axes and through the following European cities: 1. Helsinki - Turku - Stockholm - Stockholm - Malmo - Copenhagen - Fehmarn - Hamburg - Hannover; 2. Bremen - Hanover - Kassel - Wurzburg - Nurnberg - Munich - Innsbruck - Brenner - Bozen (Bolzano) - Trento - Verona - Bologna - Rome - Naples - Bari; 3. Napoli - Bridge of strait Messina - Palermo -Valletta. On May 18, 2021, the European Commission confirmed, in an answer to a written question by a Member of the European Parliament, that the Messina bridge (linking Sicily to mainland Italy), is of fundamental importance for the *Green Deal* objective, as it guarantees connectivity and accessibility for all European regions and is at the heart of TEN-T policy. However, it is up to the Italian state to contract the works, to which some EU programs could contribute in the multiannual financial framework 2021-2027 [10].

It is therefore a crucial north-south axis for Europe's economy. Crossing the Baltic Sea from Finland to Sweden and passing through Germany, the Alps and Italy, this corridor links the main urban centres and ports of Scandinavia and continues to the highly productive industrialized centres of southern Germany, Austria and northern Italy, then further on to the Italian ports and Valletta. The most important projects in this corridor are the Fehmarnbelt fixed link and the Brenner Base Tunnel, including their access routes. The corridor extends by sea from southern Italy and Sicily to Malta [8];

Fig 6: Rhine - Alps Corridor [29]

6. *Rhine-Alps Corridor*, (The Netherlands/Belgium - Germany - Switzerland - Italy), (Figure 6), with a total length of 1,300 km, starts in the city of Genoa, Italy, via Cologne and stops in the capital of The Netherlands, Rotterdam (North Holland). It is the sixth of the nine priority axes of the Trans-European Transport Network (TEN-T). It is a rail and road network. The corridor is divided into six sections as follows: 1. Genoa - Milan - Zurich - Basel; 2. Milan - Novara - Novara - Bern - Basel; 3. Basel - Strasbourg - Mannheim - Mannheim - Frankfurt - Cologne; 4. Cologne - Dusseldorf - Utrecht - Amsterdam; 5. Cologne - Liège - Brussels - Brussels - Ghent - Bruges; 6. Liège - Antwerp - Rotterdam.

It is therefore one of the busiest freight transport routes in Europe, linking the North Sea ports of Rotterdam and Antwerp with the Mediterranean basin of Genoa, passing through Switzerland and some of the main economic centers of the Rhine-Ruhr and Rhine – Main - Neckar regions, as well as the conurbation of Milan in northern Italy. This multimodal corridor includes the Rhine as an inland waterway. Key projects include the already partially completed base tunnels in Switzerland and their access routes to Germany and Italy [8];

Fig 7: Atlantic Corridor [30]

7. Atlantic Corridor, (previously known as the Lisbon - Strasbourg Corridor) (Portugal - Spain - France), (Figure 7), with a total length of 8,200 km, starts in the Portuguese capital, Lisbon, via Vitoria - Gasteiz and stops in Strasbourg, France. It is the seventh of the nine priority axes of the Trans-European Transport Network (TEN-T), created to increase rail and road capacity by connecting Portugal, Spain and France, later extended to GermanyWhen completed, the Iberian branch will become one of the main transport networks in the Peninsula, alongside the Mediterranean corridor, and is generally said to be "fundamental for European cohesion", which will include the following sections:1. Algeciras - Bobadilla - Madrid; 2.Sines/Lisabona - Madrid - Valladolid; 3. Lisbon - Averio - Lexioes/Porto; 4. Averio - Valladolid - Vitoria - Vitoria - Bergara - Bilbao/Bordeaux - Paris - Le Havre/Metz - Mannheim/Strasbourg. The corridor is at this date in the following state: progress varies from region to region. In Portugal, for example, the planned rail infrastructure was included in the Ferrovia 2020 initiative unveiled in 2016, but by the end of 2022, only 15% of the construction had been completed. In the Basque Country, the so-called Basque Y (named after the region it crosses and its shape) should be completed and operational by 2030, but the connection from the French side has been delayed and is not planned to be completed until after 2037 [11].

It therefore links the western part of the Iberian Peninsula and the ports of Le Havre and Rouen to Paris and further on to Mannheim/Strasbourg, via high-speed rail lines and parallel conventional rail lines, including the Seine as an inland waterway. The maritime dimension plays a crucial role in this corridor [8];

Fig 8: North Sea - Mediterranean Sea Corridor [31]

8. ***North Sea - Mediterranean Sea Corridor***, (Ireland - United Kingdom - The Netherlands - Belgium - Luxembourg - Marseille (France), (Figure 8), with a total length of 933 km, runs from the Irish capital Dublin via Cork - Le Havre to the Belgian capital Brussels. This multimodal corridor, which includes inland waterways from the Benelux and France, aims not only to provide better multimodal services between the North Sea ports, the river basins of the Meuse, Rhine, Scheldt, Scheldt, Seine, Saône, Rhône and the ports of Fos-sur-Mer and Marseille, but also to better interconnect the British Isles with continental Europe.

So it stretches from Ireland and the north of the UK through the Netherlands, Belgium and Luxembourg to the Mediterranean Sea in the south of France. This multimodal corridor, which includes inland waterways from the Benelux and France, aims not only to provide better multimodal services between the North Sea ports, the river basins of Maas, Rhine, Scheldt, Seine, Saône and Rhône and the ports of Fos-sur-Mer and Marseille, but also to better interconnect the British Isles with continental Europe [8];

Fig 9: Rhine - Danube Corridor, (Germany-Austria-Slovakia-Hungary-Romania with a branch Germany-Czech-Slovakia) [32]

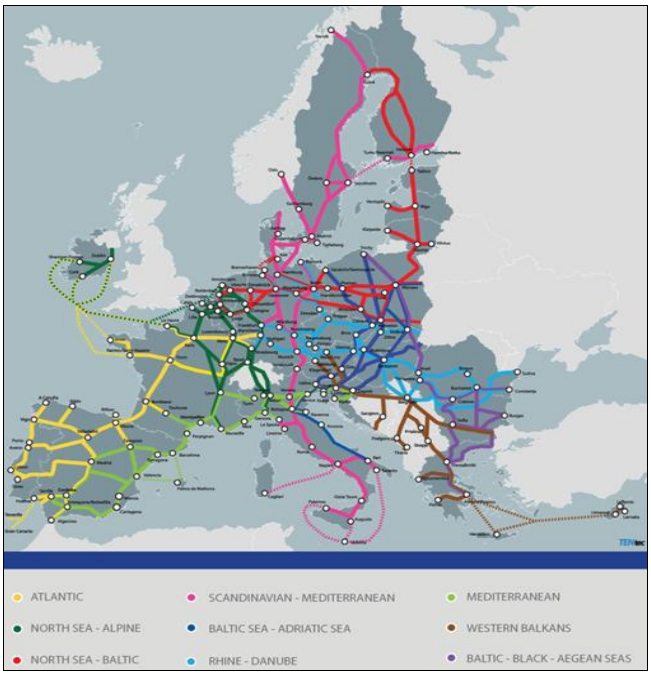

Fig 10: Full picture of the 9 Trans-European Transport Corridors (TEN-T) [12]

9. Rhine - Danube Corridor, (Germany-Austria-Slovakia – Hungary – Hungary - Romania with the Germany – Czech – Czech - Slovakia branch), (Figure 9), with a total length of 2,137 km, starts in Strasbourg, France, via Budapest and stops in the port of Sulina, Romania. Formerly known as the Seine-Danube and Strasbourg-Danube Corridors, it is the ninth of the nine priority axes of the Trans-European Transport Network (TEN-T). The Strasbourg-Danube Corridor develops its network from the Seine to the Danube on the following three axes and through the following European cities: 1. Strasbourg - Stutgart - München - Wels/Linz; 2. Strasbourg - Mannheim - Frankfurt - Wurzburg - Nurnberg - Regensburg - Passau - Welz/Linz; 4. Wels/Linz - Vienna - Budapest - Arad - Brasov - Bucharest - Constanta - Sulina.

In July 2021, by Regulation (EU) 2021/1153 (Connecting Europe Facility 2), the 9 core network corridors were extended, partly significantly (e.g. Atlantic, North-North Baltic, Scandinavia-Mediterranean), while the North Sea-Mediterranean, due to Brexit, changed to Ireland-Belgium-Netherlands and Ireland-France. The main axes are the inland waterways on the Main and the Danube, linking the central regions around the cities of Strasbourg and Frankfurt, passing through southern Germany to Vienna, Bratislava, Budapest and finally the Black Sea; an important branch of this corridor connects Munich to Prague, Zilina, Kosice and the Ukrainian border [8].

In December 2021, the European Commission's proposal for a new regulation on the TEN-T directives (COM 2021/821) included, among other things, for the future, a dissolution of selected corridors of the core network (East-East-Mediterranean, North Sea-Mediterranean), their integration into other corridors (Rhine-Danube, North Sea-Alpine) and the creation of new aligned corridors (Baltic Sea-Black Sea-Egean Sea, Western Balkans).

Links with neighbors [12]:

- The development of TEN-T in the Balkans (Albania, Bosnia and Herzegovina, Kosovo, Montenegro, North Macedonia and Serbia) was entrusted in 2017 to the South East European Transport Community;
- In 2017, it was decided that the trans-European transport networks would be further extended in Eastern Europe to include the Eastern Partnership member states. The furthest eastward extension of the trans-European transport network reached Armenia in February 2019;
- Under the proposal for 2021, links will also lead to the UK, Switzerland, the Southern Mediterranean, Turkey and the Western Balkans;
- In July 2022, it was agreed to link four European transport corridors with the Republic of Moldova and Ukraine and to drop Russia and Brlarus. În figura 10 prezentăm o imagine completă cu cele 9 coridoare de transport transeuropene (TEN-T).

At regional and national level, what we call the comprehensive network will be a tributary of the core network. This comprehensive network is an integral part of the TEN-T policy and will largely be managed by the Member States themselves, with a smaller share of the funds available under the Interconnecting Europe Facility (EIF) and, of course, under regional policy. This is subsidiarity in action. The intention is that gradually, by 2050, the vast majority of Europe's citizens and businesses will be no more than 30 minutes away, in terms of travel time, from this network-fluent. The new TEN-T guidelines go much further than in the past in terms of specifying requirements, including the comprehensive network, so that over time - by 2050 - large parts of the comprehensive network will be joined up in terms of fully interoperable and efficient standards for rail, electric cars, etc. [8].

2. Role and benefits of TEN-T transport networks for European countries

The Trans-European Transport Network (TEN-T) is a European Union project that envisages the creation of a comprehensive network of road, rail and water transport. The network is to connect the transport, telecommunications and energy infrastructure of the Member States throughout the European Union. In addition to interconnecting national networks, the creation of these networks also aims to link the EU's peripheral points with its core area [13].

The role of the Trans-European Networks (TEN-T) is to create a modern and efficient infrastructure connecting Europe's regions and national networks. TEN networks are essential for the proper functioning of the European Union (EU) single market and employment, ensuring the free movement of goods, people and services.

Articles 170 [14], 171 [15] and 172 [16], The Treaty on the Functioning of the European Union provides the legal basis for TENs, which exist in the following three sectors.

Trans-European transport networks (TEN-T) cover projects of common interest to create new or upgrade existing transport infrastructure, remove deficiencies, remove bot bottlenecks and remove technical barriers to transport flows between EU Member States.

The Connecting Europe Interconnection Facility (EIF), a fund initially set up for the period 2014-2020 to stimulate investment in TEN-T and to mobilize funding from both the private and public sectors, has been extended for the period 2021-2027 under the Multiannual Financial Framework.

The money allocated to the program from the EU budget for the transport network is €11.4 billion (plus a transfer of €10 billion from the Cohesion Fund), of which €1.4 billion is for important missing cross-border rail links between cohesion countries. Directive (EU) 2021/1187 streamlines measures to advance the completion of the trans-European transport network by harmonizing the procedures for granting the authorizations needed to implement certain projects. The new "smart TEN-T" rules clarify the procedures that project promoters have to follow in terms of authorization and public procurement for cross-border projects.

It also covers other projects on core network corridors, the total cost of which exceeds €300 million. Projects exclusively related to telematics and other new technologies are not covered by the Directive as their implementation is not limited to the TEN-T core network. However, Member States may apply the Directive to other TEN-T core and comprehensive network projects as part of a broader and more harmonized approach to transport infrastructure projects.

TEN-T aims at coordinated improvements of trunk roads, railways, inland waterways, airports, seaports, inland ports and traffic management systems, providing integrated and intermodal long-distance and high-speed routes. The decision to adopt TEN-T was taken by the European Parliament and the Council in July 1996 [1]. The EU works to promote the networks through a combination of leadership, coordination, guidance and funding on development issues.

The TEN-T network is composed of two levels: a central network to be completed by 2030 and a vast feeder network bringing traffic into it, to be completed by 2050.

The comprehensive affluent network will ensure full EU coverage and accessibility to all regions. The central network will prioritize the most important TEN-T links and nodes so that they become fully operational by 2030. Both layers include all modes of transport: road, rail, air, inland waterways and maritime transport, as well as intermodal platforms.

The TEN-T Guidelines set common requirements for TEN-T infrastructure - with stricter requirements for the core network. This will ensure smooth transport operations throughout the network. At the same time, the policy encourages the implementation of traffic management systems that will optimize the use of the infrastructure and, by increasing efficiency, reduce CO_2 emissions. Implementation of the central network will be facilitated through a corridor-based approach. 10 corridors will form the basis for coordinated infrastructure development within the central network. Covering at least 3 modes, 3 Member States and 2 cross-border sections, these corridors will bring together the Member States concerned as well as relevant stakeholders, e.g. infrastructure managers and users.

European coordinators will chair "corridor platforms" bringing together all stakeholders - these will be an important tool to ensure coordination, cooperation and transparency.

Because transport is essential for an efficient European economy, freight movements are expected to increase by 80% by 2050 and passenger movements by over 50%. Trade is vital for growth. Trade needs transportation. Those parts of Europe without good connections will not prosper.

The central network will connect [9]:

- 94 main European ports with rail and road connections;
- 38 main airports with rail links to major cities;
- 15,000 km of railway lines upgraded for high-speed traffic;
- 35 major cross-border projects to reduce congestion.

This will be the economic driving force of the single market, enabling a truly free movement of goods and people across the Union.

These projects are technically and financially managed by the Innovation and Networks Executive Agency (INEA) [17], which replaced the Trans-European Transport Networks Executive Agency (TEN-T EA) on December 31, 2013. The tenth and newest project, the Rhine-Danube Corridor, was announced for the 2014-2020 financial period.

Taken together, the new transport network will provide [9]:

- safer and less congested travel;
- smoother and faster travel.

The need a new European transport infrastructure policy, stems from the following [9]:

- Transport is a key sector for an efficient European economy;
- By 2050, freight transport is expected to grow by 80% and passenger transport by more than 50%;
- Economic growth depends on trade, and trade depends on transportation. Areas of Europe without good connections will not prosper.

In practice, there are five main categories of problems that need to be tackled at EU level [9]:

1. Missing links, in particular cross-border sections, constitute a major obstacle to the free movement of goods and passengers within and between Member States and between Member States and neighboring countries;
2. Between and within Member States there is a considerable disparity in the quality and availability of infrastructure (bottlenecks). In particular, there is a need to improve east-west connections by creating new transport infrastructure and/or by maintaining, rehabilitating or upgrading existing infrastructure;
3. The transport infrastructure between modes is fragmented. In terms of making multimodal connections, many of Europe's freight terminals, passenger stations, inland ports, seaports, airports and urban nodes leave much to be desired in this respect. As these nodes lack multimodal capacities, the potential and capacity of multimodal transport to remove infrastructure bottlenecks and fill missing links is insufficiently exploited;
4. Investing in transport infrastructure should contribute to meeting the transport sector's greenhouse gas emission reduction targets of 60% by 2050;
5. Different rules and operational requirements are still in place in the Member States, in particular in the field of interoperability, which contributes significantly to barriers and congestion affecting transport infrastructure.

3. Development of the Trans-European Network (TEN-T) in the European Union. Case Study

The European Parliament and the Council of Europe have approved the final form of the regulation underpinning the Trans-European Transport Network (TEN-T). The revised regulation significantly boosts the EU's efforts to build a sustainable and resilient network by setting ambitious targets for European transport infrastructure.

Following formal approval by both co-legislators, the new legislation will enter into force 20 days after its publication in the EU's official journal. The Trans-European Transport Network TEN-T is a European Union project to create a comprehensive network of road, rail and water transport. It will be gradually developed or upgraded in 3 stages: the core network should be completed by 2030, the central network - extended by 2040, and the comprehensive network - by 2050.

The TEN-T network connects 424 major European cities with ports, airports and rail terminals. When TEN-T is completed, it will reduce travel time between these cities. For example, traveling between Copenhagen and Hamburg by train will take two and a half hours instead of the current 4 and a half hours.

The European Union has drafted a revised regulation ***setting ambitious targets for Europe's TEN-T transport infrastructure***, as follows [18]:

- ***Rail travel speed.*** By 2040, TEN-T core passenger rail lines and the extended core network must support trains traveling at speeds of 160 km/h or faster;
- ***European Rail Traffic Management System (ERTMS).*** ERTMS will be deployed throughout the TEN-T network as the single European signalling system, increasing rail safety and efficiency. Old national "Class B" systems will be phased out, stimulating industry investment in ERTMS;
- ***Safe and secure parking.*** By 2040, safe and secure parking areas will be developed on the central and extended core road network, on average every 150 km, ensuring safety and adequate working conditions for professional drivers;
- ***Airport connectivity.*** Major airports transporting over 12 million passengers annually need to be connected by rail over long distances, improving passenger connectivity and making rail a competitive alternative to domestic flights;
- ***Cargo terminals.*** The number and capacity of transhipment terminals will be expanded to meet current and projected traffic requirements. These include accommodating 740 m trains, promoting the shift to sustainable modes of transport and stimulating the combined transport sector in Europe;
- ***Urban Mobility Plans.*** All 432 major cities along the TEN-T network will develop Sustainable Urban Mobility Plans (SUMPs) to promote low- and zero-emission mobility;
- ***European Maritime Space.*** Sector will be integrated with other modes of transport in an efficient and sustainable way. Short sea routes will be modernized, new routes will be created and seaports and their hinterland connections will be further developed. Transport links with neighboring third countries,

including Ukraine, the Republic of Moldova and the six Western Balkan partners, will be improved through the new European transport corridors. In Table 1 we present a situation of European countries, ordered by the total number of kilometers of highway. The ranking has been made on February 01, 2025, from online.

Table 1: European countries ranked by total kilometers of highways [19]

Rank	Country	Kilometers of highway	Rank	Country	Kilometers of highway	Rank	Country	Kilometers of highway
1	Spain	16,204	**18**	**Romania**	**1,276**	**35**	Kosovo	162
2	Germany	12,845	**19**	Czech Republic	1,254	**36**	Luxembourg	152
3	France	11,842	**20**	Denmark	1,205	**37**	Albania	145
4	Italy	6,671	**21**	Ireland	916	**38**	Armenia	134
5	Poland	3,797	**22**	Serbia	866	**39**	Georgia	110
6	England	3,555	**23**	Finland	863	**40**	Belarus	0
7	Portugal	3,080	**24**	Bulgaria	807	**41**	Andora	0
8	Turkey	2,827	**25**	Norway	750	**42**	Estonia	0
9	Netherlands	2,758	**26**	Slovakia	720	**43**	Iceland	0
10	Greece	2,500	**27**	Slovenia	533	**44**	Latvia	0
11	Sweden	2,119	**28**	Lithuania	505	**45**	Liechtenstein	0
12	Switzerland	1,764	**29**	Kazakhstan	490	**46**	Malta	0
13	Belgium	1,747	**30**	North Macedonia	317	**47**	Republic of Moldova	0
14	Austria	1,720	**31**	Cyprus	252	**48**	Monaco	0
15	Hungary	1,527	**32**	Bosnia	200	**49**	Montenegro	0
16	Russia	1,434	**33**	Ukraine	193	**50**	San Marino	0
17	Croatia	1,314	**34**	Azerbaijan	163	**51**	Vatican	0

Figure 11 shows the density of national rail networks on December 31, 2023 (meters of track per km^2).
In 2023, the EU's rail network had 200,947 km of railway lines, with the highest densities in and around major cities and other population centers, data from Eurostat, the EU's statistical office, Show.

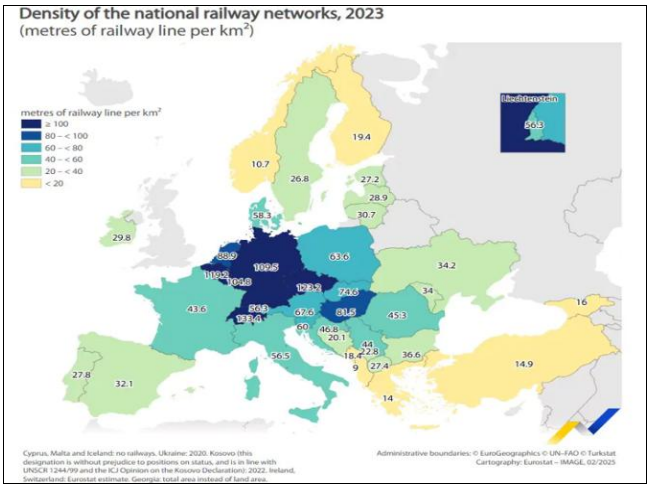

Fig 11: Density of the national railway networks, 2003 (metres of railways per km^2) [20]

The highest density of the rail network was recorded in the Czech Republic, with 123.2 meters of railway lines per km². Other EU countries with high densities were Belgium (119.2 m/km²), Germany (109.5 m/km²) and Luxembourg (104.8 m/km²). At the other end of the scale, the lowest rail densities were recorded in Greece (14.0 m/km²) and Finland (19.4 m/km²). Low densities were also recorded in Sweden (26.8 m/km²), Estonia (27.2 m/km²), Portugal (27.8 m/km²), Latvia (28.9 m/km²) and Ireland (29.8 m/km²). In Romania, the percentage was 45.3%, above Bulgaria (36.6%) but well below Hungary (81.5%). In the EU rail network, high-speed rail lines designed for speeds of 250 km/h or higher often cross national borders, facilitating seamless high-speed travel throughout the EU. This interoperable network has grown significantly over the last decade. From 2013 to 2023, it has expanded by 2,744 km (+47.2%) to 8,556 km. In 2023, Spain leads with 3,190 km of high-speed lines, a 66% increase from 1,919 km in 2013, followed by France with 2,748 km (+35% from 2,036 km), Germany with 1,163 km (+32% from 881 km) and Italy with 1,097 km (+63% from 675 km). Belgium has 211 km of high-speed lines and the Netherlands 90 km (both unchanged since 2013). Denmark has 57 km, to be inaugurated in 2019 [20].

3.1 Development of the Trans-European Networks (TEN-T) passing through Romania

3.1.1 TEN-T road network situation in Romania

In Romania, two of the nine trans-European TEN-T corridors cross the territory through the road transport network, as follows:

- Corridor 4, Orient/East - Mediterranean (Figure 4);
- Corridor 9, Rhine - Danube (Figure 9).

As of June 19, 2024, the situation in Romania was as follows: the Rhine - Danube corridor provides for 1,199 km of motorway in Romania, with a northern branch 828.7 km long, of which 607 km are operable, and a southern branch 370.3 km long, none of which is completed. The Eastern Corridor provides 417 km on Romania's territory, of which 170 km are in operation (Nădlac - Arad - Lugoj). In 2012, the EU Transport Council extended the European TEN-T network with four new road routes, and as a result of this decision the total length of the TEN-T network doubled in road transport mode. These are the motorways (or express roads) [18]:

- Timișoara - Sebes - Turda - Tg. Mures - Iasi - Ungheni;
- Calafat - Craiova - Alexandria - Bucharest;
- Borș - Turda;
- Constanța - Tulcea - Braila - Galati.

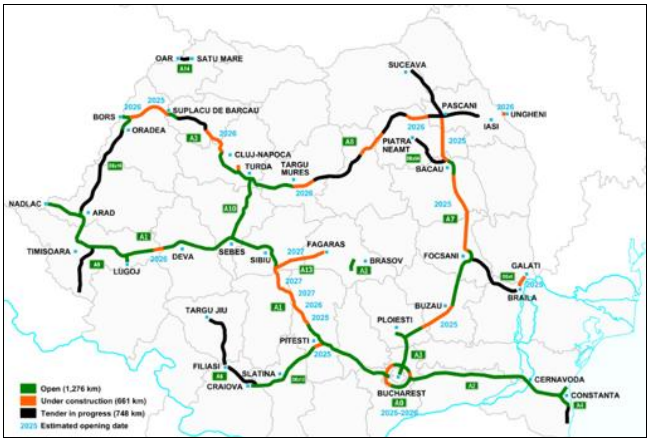

Fig 12: The situation of motorways and express roads in Romania on December 31, 2024 [33]

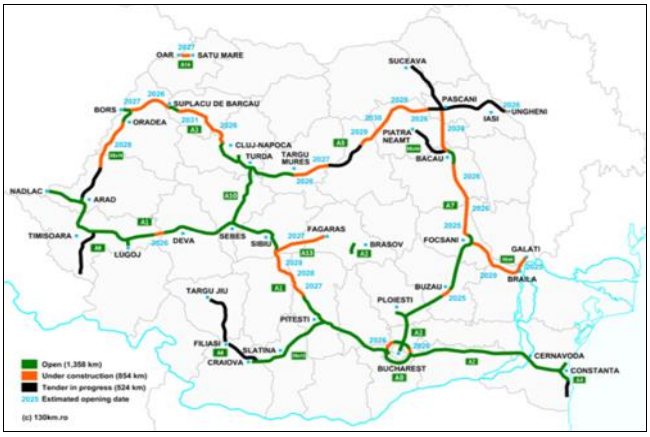

Fig 13: The situation of motorways and express roads in Romania on October 31, 2025 [33]

Figure 12 shows the situation of highways and express roads in Romania on December 31, 2024.

The map presented in Figure 12 shows the motorway and express road projects in Romania as of December 31, 2024 and Figure 13 shows their situation as of October 31, 2025. The situation is based on the latest available information. The analysis of the data presented in Figures 12 and 13 shows that in Romania, between January 1, 2025, and October 31, 2025, only 82 kilometers of high-speed roads were put into use. The map of motorways and express roads includes both routes in operation (marked in green) and those under construction (orange) or under tender (black). The map includes only highways and open express roads in the execution or tender stage. We do not include routes at the stage of proposals, feasibility studies, etc. as these are very often modified, postponed or canceled. The map is updated quarterly or when new routes are opened.

The state of work to date is as follows: some of these highways have become operational, but others are still under construction. For example, the Borș - Turda highway is part of the *„Transylvania highway"* (A 3) which is still not fully ready today, even though it was 20 years since work started in May this year. Similarly, the Calafat - Craiova - Alexandria – *„Bucharest highway"*, also known as the *"Southern highway"*, is a long-delayed project, still in the documentation preparation phase. The Constanța - Tulcea - Brăila - Galați high-speed road is also not finalized. For the Constanța - Tulcea technical design deadline is this month, 26 months later than the original deadline of April 2022.

As for the Tulcea-Brăila express road, the National Road Infrastructure Management Company says it will be ready by the end of this year. Also delayed is the project for t he 304 km-long Târgu Mureș - Iași - Ungheni highway (A8). It was only in February this year that the motorway company signed a contract with the Turkish constructor Nurol for the design and execution of the Târgu Mureș - Miercurea Nirajului section. The section in question is 24.4 km long and has a contractual term of 6 months for design and 24 months for execution.

Also, for the Pașcani - Iași - Ungheni segment, it was only at the beginning of this year that the environmental permit was obtained and the feasibility study was finalized, and the highway section is now entering the actual design procedure. It should be noted that the sections from Târgu Mureș to Miercurea Nirajului and from Leghin to Târgu Neamț to Moțca/DN2 (about 30 km) are included in the National Recovery and Resilience Plan, which means that they must be completed by the end of 2026.

Motorway	Route	Status	Open (km)	Under construction (km)
A0 - Bucharest Ringroad	Bucharest Ringroad		72.5	28.2
A1 - Bucharest - Nadlac	Bucharest - Nadlac		486.4	92.1
A2 - Sun Motorway	Buc. - Constanta		202.8	0.0
A3 - Transylvania Motorway	Bucharest - Bors		203.4	138.2
A4 - Constanta Bypass	Ovidiu - 23 August		21.8	0.0
A6 - Lugoj - Calafat	Lugoj - Calafat		10.5	0.0
A7 - Ploiesti - Siret	Ploiesti - Siret		148.1	187.1
A8 - Union Motorway	Tg.Mures - Ungheni		0.0	170.1
A9 - Timisoara - Moravita	Timisoara - Moravita		0.0	0.0
A10 - Sebes - Turda	Sebes - Turda		70.0	0.0
A13 - Sibiu - Bacau	Sibiu - Bacau		0.0	68.0
A14 - North Motorway	Oar - Suceava		0.0	10.8
DEx4 Expressway	Turda - Dej		5.0	0.0
DEx5A Expressway	Bacau - Piatra Neamt		0.0	0.0
DEx6 Expressway	Focsani - Galati		0.0	85.8
DEx12 Expressway	Craiova - Pitesti		121.2	0.0
DEx16 Expressway	Arad - Oradea		16.5	73.4
TOTAL			1,358.1	853.7

Color map: ■ open; ■ under construction; ■ planned.

Fig 14: The situation of highways and express roads in Romania on October 31, 2025 [33]

Figure 14 shows the situation of highways and express roads in Romania on October 31, 2025.

3.1.2 Situation of the TEN-T rail network in Romania

The Romanian rail network is divided into interoperable and non-interoperable infrastructure. Interoperable railway infrastructure is that which can be connected to the trans-European railway infrastructure, managed in accordance with the provisions on free access for railway operators and developed in accordance with the technical interoperability rules adopted at European level. Non-interoperable railway infrastructure is that for local traffic, connected or not to the interoperable railway infrastructure, managed and developed on the basis of specific internal regulations. Depending on the technical characteristics of the lines and the maximum permissible speed, traffic sections are classified into categories which have an influence on the charging system.

As of December 31, 2024, the Romanian railway network had a total length of 19,629.00 km, of which 13,442.00 km of current and direct lines and 6,187.00 km of station lines. Out of the 19,629.00 km of railways lines, 17,429.00 km belong to the public rail infrastructure and 2,400.00 km of railways lines belong to the private infrastructure. Of the total of 19,629.00 km of railways lines, 4,787.00 km are non-interoperable railway lines (3,853.513 km of current and direct lines and 933,922 km of lines from stations). Lines are connected by 25,100 equivalent switches and crossings. On the public rail network there are 17,694 bridges and culverts with a total length of approx. 190.70 km and 188 tunnels with a total length of approx. 64.00 km in total length. The gauge of the Romanian rail network is the European (standard) gauge of 1,435 mm [21].

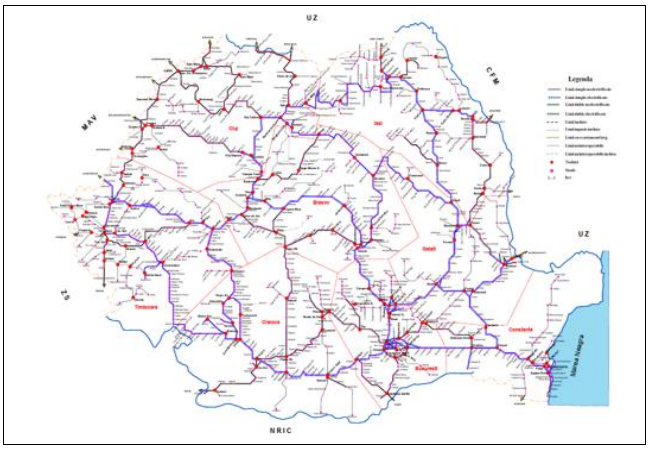

Fig 15: Map of the Romanian rail network on December 31, 2024 [21]

Figure 15 shows a map of the Romanian rail network on December 31, 2024.

In Romania, the TEN-T rail network largely coincides with the route of the main rail trunk lines and the main intermodal links. Two of the 11 international rail freight corridors cross Romania:

- Corridor 4, Orient/East - Mediterranean (Figure 4);
- Corridor 9, Rhine - Danube (Figure 9).

Coridorul The Orient/East - connects the south-eastern part of Europe with the North Sea ports of Germany through Central Europe and crosses eight EU Member States: Austria, Bulgaria, Czech Republic, Germany, Greece, Hungary, Romania and Slovakia. On Romanian territory, the route of the East/East-Mediterranean rail corridor covers most of the route of the 900 main line, including the Timișoara - Arad section up to the Hungarian border and the Craiova - Calafat section up to the Bulgarian border.

In addition, the Rhine - Danube Corridor is the main link between the east and west of continental Europe and runs along the following routes [18]:

- Strasbourg - Mannheim - Frankfurt - Nürnberg - Wels;
- Strasbourg - Stuttgart - Munich - Salzburg - Wels - Vienna - Bratislava - Budapest - Arad - Arad - Brasov - Craiova - Bucharest - Constanta;

Čiernanad Tisou (Slovak/Ukrainian border) - Košice - Žilina - Horní Lideč - Prague - München/Nürnberg.

The route of the Rhine - Danube railway corridor on the Romanian territory covers the sections of the 800 (Bucharest North - Ciulnița - Fetești - Medgidia - Constanța - Mangalia) and 900 (Bucharest - Videle - Roșiori Nord - Craiova - Filiași - Drobeta-Turnu Severin - Caransebeș - Lugoj - Timișoara), as well as a large part of the 200 (Brașov - Podu Olt - Sibiu - Vințu de Jos - Simeria - Arad - Curtici) and 300 (Bucharest North - Brașov - Sighișoara - Teiuș - Războieni - Cluj-Napoca - Oradea). 300 km of modernized railway estimated at the end of 2023 CFR S.A., that it will open to traffic in 2024. The only one fully modernized and in service is the Bucharest - Constanța rail route. For the modernization and electrification of the Constanta - Mangalia section (43 km), the tender was only launched in April this year. On the Bucharest - Craiova route, extensive modernization works are being carried out, financed by non-reimbursable PNRR funds, and their aim is to increase the speed of passenger trains to 120 km/h, below the TEN-T target of 160 km/h. Also, this month, the tender was launched for the modernization of another 74.25 km of railway on the Craiova – Drobeta-Turnu Severin - Caransebeș section, the estimated value of the two contracts (design and execution) is 4.87 billion lei, excluding VAT, for Lot 4 Drobeta-Turnu Severin - Băile Herculane (41.16 km) and Lot 5 Băile Herculane – SP (stop point) Poarta (32.63 km). As for the construction site on the Brașov - Sighișoara railway route, opened a few years ago (126 km, contracts worth 5.8 billion lei signed in 2020), we still have years to wait until the works are completed. The physical stage of works is about 30%. One reason for the poor progress of works was also the increase in prices of construction materials. For example, on the Brasov - Apața section, the winning bid was made in 2017, after which three years were lost in appeals. It was only in February this year that the Ministry of Transport succeeded in indexing to 2022 prices. The same applies to the Apața - Cața section. Also in 2024, in April, the Ministry of Transport announced that it had issued the building permit for modernization works on 48 km of railway between Arad and Timisoara, and on another 6 km in the Arad area. The contract, which is financed by the PNRR, is worth 2.18 billion lei, excluding VAT, and provides for a 36-month execution period. In October last year, work began on electrification and modernization of the Cluj-Napoca - Oradea - Episcopia Bihor route, with the building permit being issued for Lot 2 Aghireș-Poieni. The electrification and rehabilitation of the Cluj-Napoca - Oradea - Episcopia Bihor railway line is divided into four lots: Lot 1 Cluj-Napoca - Aghireș, Lot 2 Aghireș - Poieni, Lot 3 Poieni - Aleșd, Lot 4 Aleșd - Hungary Border. In 2023 CFR SA (Romanian railways SA), removed speed restrictions totaling 555 kilometers, but new ones totaling 764 kilometers were introduced [18].

The year 2025 started with a negative record for Romanian rail transport compared to road transport: the number of modernized km of railways is half that of motorways and express roads. In an election year, politicians have done their best to cut ribbons on express roads, while work on rail infrastructure has proceeded only by inertia.

In three decades the Romanian railroads have managed to modernize only 633.22 km of the more than 10,000 km railway network. According to data provided in October last year by the National Railway Company CFR SA at the request of Club Feroviar, Romania has modernized 362.56 km with pre-accession European funds, on the Bucharest-Constanta and Bucharest-Predeal routesWith post-accession funds, only 208.04 km have been modernized so far: Frontieră – Curtici – Arad - Km 614 and Simeria - Sighisoara. To these must be added the 2.9 km of new

railway line to Henri Coandă Bucharest International Airport. We could also mention here the almost 5 km of new railway line between Golenți and the New Europe Bridge at Calafat-Vidin. As I was saying, last year another 54.72 km of modernized railway track were approved, so that, adding up the total, 633.22 km of the total Romanian railway network of 10,611 km have been modernized in Romania so far. We don't need to do the math, as it's easy to see that the figure is just over half of the 1,269.87 of highways and express roads. And even if we subtract the 113 km of highway that were built in Romania before 1989 (Bucharest-Pitești and Fetești-Cernavodă) the gap is still wide [22].

Train speeds in Romania break negative records: 45 km/h. More than half of the wagons and locomotives need to be scrapped and 85% of the lines should be rehabilitated.

The subsidy for CFR is halved. On Sunday, February 25, Europa Liberă will publish a report on the state of Romanian Railways. The average speed of the 1,100 passenger trains running in Romania in 2023 was 45.6 km/h, according to data provided to free Europe by railway passenger transport [23].

4. Conclusions

The development of TEN-T high-speed road networks in Romania is directly influenced by the state of development of the expressway and motorway network. The data researched by the authors shows that construction work on these roads in Romania, related to the development of the Rhine-Danube trans-European corridor (Corridor 9, Figure 9), is progressing slowly. This is due to the investment policies pursued by the Romanian authorities in this area.

The revision of the TEN-T has four main objectives. First, it aims to green transport by ensuring an adequate infrastructure base to alleviate traffic congestion and to reduce greenhouse gas (GHG) emissions and air and water pollution by making each mode of transport more efficient and facilitating more transport activity through more sustainable forms of transport. In particular, it aims to facilitate an increase in the share of rail, short sea shipping and inland waterways, with a view to a more sustainable modal structure of the transport system and thus reduce its negative externalities. Secondly, it aims to facilitate smooth and efficient transport, promote multimodality and interoperability between TEN-T transport modes and better integrate urban nodes into the network.

Eliminating bot bot congestion and missing links as well as improving multimodality and interoperability within the European transport system will contribute to the completion of the internal market. Thirdly, the revision aims to increase the resilience of the TEN-T to climate change and other natural hazards or man-made disasters. TEN-T networks need to be resilient to the potential negative effects of climate change, to protect public investment and ensure their continued use in the new climate; they should also support climate neutrality by integrating the costs of greenhouse gas emissions into the cost-benefit analysis. Last but not least, the review points to the need to improve the effectiveness of TEN-T governance tools, to optimize reporting and monitoring tools, and to review the design of the TEN-T network.

This revised TEN-T policy should aim to build a reliable, fluid and high-quality trans-European transport network, ensuring sustainable connectivity across the European Union without physical gaps, bottlenecks or missing links by 2050. This network will contribute to the smooth functioning of the internal market, to the economic, social and territorial cohesion of the EU territory and to the objectives of the European Green Pact. It should be developed gradually, in stages, with intermediate deadlines in 2030 and 2040.

The vision for the year 2030 is to expand/modernize the transport infrastructure throughout Romania in order to improve connectivity between the country's regions and with the rest of the European Union.

To speed up the implementation of transport projects on the TEN-T network, the executive in Bucharest amended the legislation a year ago, imposing shorter deadlines for obtaining the necessary permits and authorizations. The maximum duration of the authorization procedure is 4 years and includes the period allocated for the elaboration of technical-economic documents, the approval of technical-economic indicators, the securing of land necessary for the implementation of the project, expropriations, as well as any other specialized studies necessary in the process of obtaining the permits, agreements and authorizations.

Another new element introduced by the European Commission for the 2021-2027 programming period relates to Military Mobility, a component that has also been introduced in the Connecting Europe Facility Regulation 2021-2027 (CEF 2.0). The increase of military mobility is one of the 17 commitments undertaken by our country when joining the Permanent Structural Cooperation (PESCO) and is also a top-level commitment adopted at the NATO Summit in June 2018. From a military mobility perspective, there is a need to increase the transportation capacity of national and foreign armed forces and their adjacent transportation in the context of EU regional security. In the framework of the POT 2021-2027, a portfolio of priority actions will be established at the level of priority axis (as appropriate), for all modes of transportation, respecting the military requirements imposed and taking into account the dual-use justification to be assigned to future projects, namely the civilian justification and the military justification. In the current geo-political and military context, both the Romanian Armed Forces and those of the NATO and EU nations have expressed their intention to use all modes of transportation, projects in the field of military mobility being complex, multidisciplinary projects with an inter-institutional approach.

According to the European transport policy, through Regulation 1315/2013, the European transport network is structured on two levels: core network and comprehensive network, the highest level of infrastructure planning within the EU.

High-speed railways have expanded significantly over the past decade in the European Union's rail network, growing by 2,744 km (47.2%) to 8,556 km between 2013 and 2023, according to data released Thursday by the European Statistical Office (Eurostat).

Romania ranks below the European average for the infrastructure and transport sector in all investment and infrastructure analysis criteria, according to the latest European Transport and Infrastructure ScoreBoard (2019). Thus, compared to the European average in 2018, Romania ranked last in terms of road quality (with a score of 2.96), and below the European average in terms of rail service efficiency (3.06), port service efficiency (3.93), and air transport service efficiency (4.68).

According to the Economic Forum Report 2019, Romania ranks 119 out of 141 countries analyzed in terms of the quality of road infrastructure. Romania ranks last in Europe in terms of the number of highway km per 100,000 inhabitants in 2019, with 848.12 km of the 17,091 km length of the national interest road transport network of national interest being at highway level (Eurostat).

At 2017 level, the average speed on national roads was 70 km/h for passenger cars and 64 km/h for heavy goods vehicles. For the TEN-T network, the length-weighted speed was 76 km/h for passenger cars and 69 km/h for heavy goods vehicles on the core TEN-T network and 68 km/h for passenger cars and 64 km/h for heavy goods vehicles on the overall TEN-T network.

On 19 June 2024, the situation in Romania was as follows: the Rhine - Danube corridor foresees 1,199 km of motorway in Romania, with a northern branch 828.7 km long, of which 607 km are operational, and a southern branch 370.3 km long, none of which is completed. The Eastern Corridor provides 417 km in Romania, of which 170 km are in operation (Nădlac - Arad - Lugoj).

On December 31, 2024 Romania had a total of 1,275.9 km of motorway built and put into service. 623 km were in the execution phase and 730 km were in the public tender phase.

The infrastructure deficit is reflected in low mobility, insufficient connectivity in some regions with a major impact on regional disparity (e.g. North-East region), high transit traffic in many localities without bypasses, long waiting times at border crossings. A number of sections of the TEN-T road network are not built to the appropriate standards for the level of traffic and the connection they are intended to provide, resulting in long journey times and traffic jams on the main transport routes. This leads to poor interconnection of the main economic and urban centers and with other intermodal transport nodes such as ports and airports. Some areas show poor accessibility to transport networks, with further investment needed in national and county roads.

Services offered by Romanian rail transportation are uncompetitive and unprofitable. The main shortcomings noted in the services provided are: long waiting times in travel timetables; long travel times influenced by frequent stops; poor quality of rolling stock; high prices and poor quality of service in stations. Inefficient use of rolling stock as well as the quality of rolling stock leads to a low level of service to passengers. There is a need to clearly define the level of service for the primary network (frequency, performance indicators, etc.), reduce waiting times at stations, develop attractive train schedules, improve passenger services, ensure adequate programs and funds for rail infrastructure maintenance, integration with other modes of transport at urban/regional level.

For the 2021-2027 programming period, in the context of the endorsement at EU level of the European Green Pact, the development of rail transport becomes essential to achieve the sustainability objectives set out in the EU strategy. The rail sector makes a substantial contribution to the EU economy, directly employing more than 1 million people (railway undertakings, infrastructure managers). The European rail system carries around 1.6 billion tons of freight and 9 billion passengers every year.

The considerable decrease in the technical speed of rail travel is indicative of the current degraded state of rail infrastructure. The technical speed of trains has increased only on certain sections of the European corridors through Romania that have been upgraded, in particular Corridor IV Curtici-Bucuresti-Constanța.

Travel speeds of up to 160 km/h can be reached on the sections of railways that are part of the TEN-T corridors and have been upgraded. However, due to restricted areas and outdated rolling stock, average commercial and travel speeds are low. Thus, in the period 2016-2018, when comparing the average travel speed of passenger trains on the entire railway network with the average travel speed on the modernized railway sections (Bucharest-Constanța, Bucharest-Câmpina and Curtici-km 614), there was an increase of about 20 km/h in the average travel speed (average technical average travel speed) on the sections where the modernization works were carried out, with the exception of Curtici - km 614.

On the Bucharest - Constanta section, which is 225 km long, the maximum speed limit is 160 km/h. However, on this section, the speed is lower due to speed restrictions (on the Danube bridges, on certain slopes or curves, as well as in non-rehabilitated stations such as Ciulnița, Fetești or Constanța. According to the information provided by CFR SA, for IR (interregio) trains, which run non-stop and have a total travel time of 2 hours, the maximum speed is 112.5 km/h, which is also influenced by the speed restrictions described above. The condition is that the rail operator must be able to provide locomotives and wagons able to cope with the maximum line speed of 160 km/h. CFR SA states that, in reality, CFR Travels has a limited number of such trainsets.

At present, significant disparities remain in terms of network size in relation to traffic demand and insufficient financial resources to maintain and operate the network to adequate quality standards.

CFR is carrying out major rail network modernization projects addressing all aspects: lines, signaling installations, traction installations, telecommunication installations, level crossings, safety, environment, etc.

On December 31, 2024, only 194.77 km of railway lines have been inaugurated through modernization.

In thirty years, Romania has managed to modernize only 633.22 km of the railway network, which has a total length of over 10,000 km.

For the year 2023, the average commercial speed for passenger trains was 44.71 km/h, and for freight trains it was 15.86 km/h," CFR Infrastructura's response reads".

In 2026, Romania's road infrastructure is estimated to reach a record level of development, with over 240-250 km of new motorways and expressways that could be inaugurated this year. This significant expansion will influence the increase in average travel speed, especially on major routes such as the A7 (Moldova Motorway) and A0 (Bucharest Ring Road).

There is no single official figure defining the "average speed" across Romania's entire road network in 2026, but recent data from the Ministry of Transport and relevant associations indicate a significant improvement due to the expansion of the high-speed road network.

The average speed is influenced by the record expansion of the network, which is forecast to reach over 1,660 km by the end of 2026. In 2026, a record number of kilometers (between 245 and 285 km) are expected to be opened to traffic, particularly on the A7 (Moldova Highway) and A0 (Capital Ring Road) segments.

In 2026, Romania's railway infrastructure is undergoing intensive modernization, particularly on the main corridors, resulting in segmented average speeds: high on the new sections (120-160 km/h) and low on the rest of the network that has not been upgraded (e.g., Pan-European Corridor IV, Arad-Sighișoara), trains run at technical speeds of 120-160 km/h).

In 2026, significant works are expected to be completed, with some sections allowing higher speeds, but most passenger trains (InterRegio) reaching average commercial speeds of around 80 km/h on modernized routes (e.g., Dacia between Arad and Sighișoara).

However, in 2026, rail passengers will experience a major contrast between the newly modernized sections (optimal speeds) and the rest of the network, where average commercial speeds remain modest, with improvements being felt only in specific areas, not across the entire infrastructure.

Considering the problems identified by us in this scientific paper, according to many media sources, it appears that on January 1, 2026, the average speed of passenger trains will be 45 km/h, and that of long-distance InterRegio trains will be close to 55 km/h. On the Bucharest–Craiova route, via Videle, the 209 km are covered in 3 hours and 50 minutes or even 4 and a half hours. Between Caransebeș and Timișoara, the 98 km are covered in 2 hours and 25 minutes at best, and trains that stop everywhere take more than 3 hours and 10 minutes. On the Timișoara–Arad line, the fastest trains take 89 minutes to cover 57 km, and the slowest take 2 hours and 20 minutes.

5. References

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