Railway Transport Infrastructure on the Eastern Flank of NATO and of Romania

Nică Ioan Flaviu

Technical University of Civil Engineering Bucharest, Lacul Tei Bdv., no 122-124, District 2, Bucharest, Romania, flaviu.nica@utcb.ro; 0009-0005-7819-8496

https://doi.org/10.29227/IM-2025-02-02-108

Submission date: *2025-04-03* | Review date: *2025-04-24*

Abstract

The paper presents the Romanian perspective for the international and national context of the railway transport infrastructure on the Eastern Flank of North – Atlantic Treaty Organization – NATO in the context of an overlap with the border of European Union and also, the new Schengen border. Major connections and junction points on the railway transport infrastructure near the border are studied. The research is the base for a developing map that aims to analysis the major points of railway transport infrastructure, the entire research is made by civilians with open-source information. The results will ensure a general view of the railway transport infrastructure in national and international context. A country at the edge of the European Union, a Schengen border and not least, the first line of the NATO border has a great responsibility, presents numerous risks and needs to be sustained due to the new resettlement of influence spheres in the world and in the European continent.

Keywords: *railway, infrastructure, green transport, NATO, mobility*

1. Introduction

The North – Atlantic Treaty Organization is composed from 32 member states from Europe (30) (fig. 1) and North America (2) and is defined as an international politico - military alliance [1]. The first steps were made in 1949 when twelve states: Belgium, Canada, Denmark, France, Iceland, Italy, Luxembourg, Netherlands, Norway, Portugal, United Kingdon and United States laid the foundation of the present alliance.

Romania is a European country and a full NATO member [2]. The membership invitation was made in November 2002 at the North – Atlantic Treaty Organization – NATO Summit from Prague, Czech Republic together with other six states: Bulgaria, Estonia, Latvia, Lithuania, Slovakia and Slovenia. The official membership came two years later, from 29 March 2004.

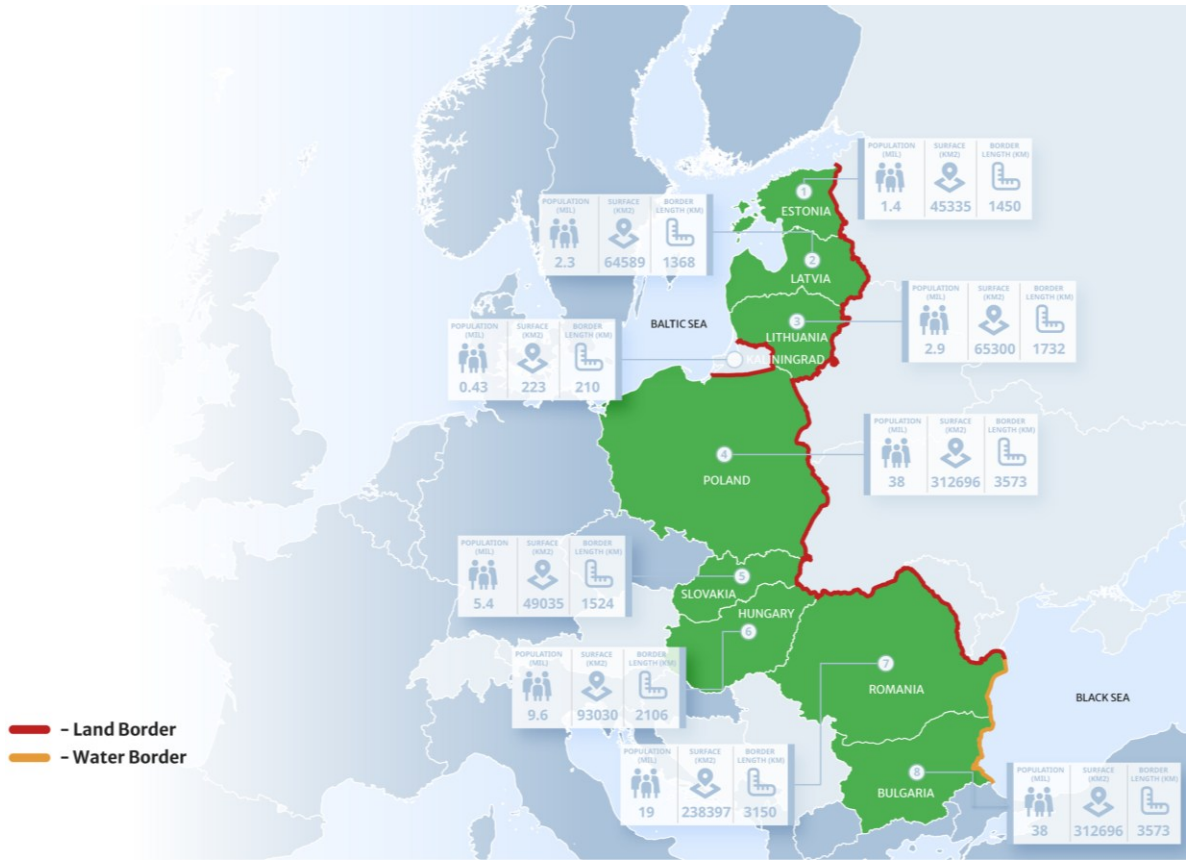

Fig. 1 North Atlantic Treaty Organization – NATO and the Eastern Flank

2. Eastern Border of NATO flank and national border distribution

The so-called Eastern Flank of Nato is made from eight countries: Estonia, Latvia, Lithuania, Poland, Slovakia, Hungary, Romania, Bulgaria, from the Baltic Sea in the north to the Black Sea in the South.

The total length of border - Eastern Flank is approximately 4342 kilometres between Narva-Jõesuu in Estonia at the Russian border and Tarevo (Rezovo) in Bulgaria at the Turkish border. The entire length can be divided in land border for approximately 4209 kilometres and water border for approximately 571 kilometres.

Also, an additional border of 438 kilometres is with the Russian Kaliningrad region, divided for 227 kilometres with Lithuania and for 210 kilometres with Poland, so including this length results a total of 4780 kilometres.

The total border length for each country (table 1) and the length allocated for Eastern Flank of NATO can be divided for each country (figure 1) length as following:

- Estonia a total border length of 4451 kilometres, distributed in 324 kilometres along the Eastern Flank of NATO, meaning approximately 7% of the entire flank;
- Latvia a total border length of 1866 kilometres, distributed in 437 kilometres along the Eastern Flank of NATO, meaning approximately 9% of the entire flank;
- Lithuania a total border length of 1732 kilometres, distributed in 729 kilometres along the Eastern Flank of NATO, meaning approximately 15% of the entire flank, including a length of 227 kilometres from the Russian Kaliningrad border;
- Poland a total border length of 3511 kilometres, distributed in 1163 kilometres along the Eastern Flank of NATO, meaning approximately 24% of the entire flank, including a length of 210 kilometres from the Russian Kaliningrad border;
- Slovakia a total border length of 1682 kilometres, distributed in 98 kilometres along the Eastern Flank of NATO, meaning approximately 2% of the entire flank;
- Hungary a total border length of 2106 kilometres, distributed in 128 kilometres along the Eastern Flank of NATO, meaning approximately 3% of the entire flank;
- Romania a total border length of 3398 kilometres, distributed in 1523 kilometres along the Eastern Flank of NATO, meaning approximately 32% of the entire flank;
- Bulgaria a total border length of 2245 kilometres, distributed in 378 kilometres along the Eastern Flank of NATO, meaning approximately 8% of the entire flank;

Tab. 1. Border lengths for each country

Country	Total border length [km]	Eastern flank border [km]
Estonia	4451	324
Latvia	1866	437
Lithuania	1732	729
Poland	3511	1163
Slovakia	1682	98
Hungary	2106	128
Romania	3398	1523
Bulgaria	2245	378
Total length of border	20991	4780

The distribution of border length of each eastern flank country (fig. 2) and the percentage of kilometres (fig. 3) compared to the total length of country border is presented graphically below.

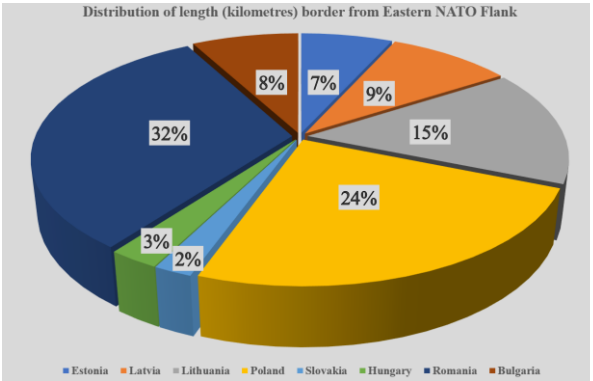

Fig. 2. Distribution of length (kilometers) for each country on the eastern flank of NATO

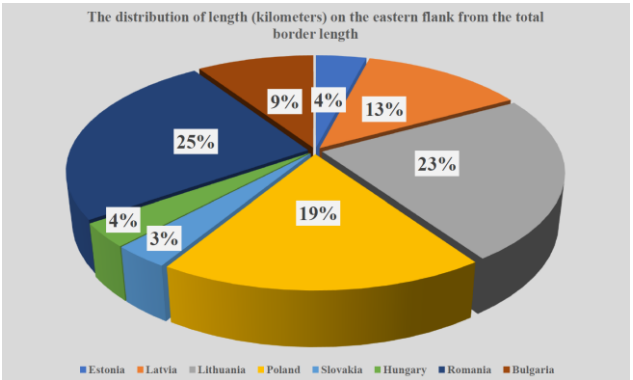

Fig. 3. Distribution of length (kilometers) on the eastern flank compared to the length of country border

The border length of each country on the eastern flank of NATO means a vulnerability for the entire flank and the longest borders are for Romania, Poland and Lithuania, representing more 70% from the entire length, including the Kaliningrad region.

3. Eastern flank of NATO in Romania: Development Regions of Romania and Regional Railway Administration

The Eastern Flank of NATO in Romania has considerable border length and it is distributed mainly in three development regions of Romania (fig. 4) [3]:

- First Region: North – East with the counties: Bacau, Botosani, Iasi, Neamt, Suceava, Vaslui;
- Second Region: South – East with the counties: Braila, Buzau, Constanţa, Galaţi, Tulcea, Vrancea;
- Sixth Region: North – West with the counties: Bihor, Bistriţa-Năsăud, Cluj, Maramureş, Satu-Mare, Sălaj.

The border line, following the eastern flank, has approximately 1523 kilometres and can be divided in two zones, by land and by water:

- On land for a total length is approximately 1330 kilometres and starts in the county of Satu Mare on the north of our country and follows to the east counties as Maramures – Suceava – Botosani – Iasi – Vaslui – Galati, finishing in Tulcea county;
- On water for a total length of approximately 193 kilometres starts in the county of Tulcea and finishes in Constanta county.

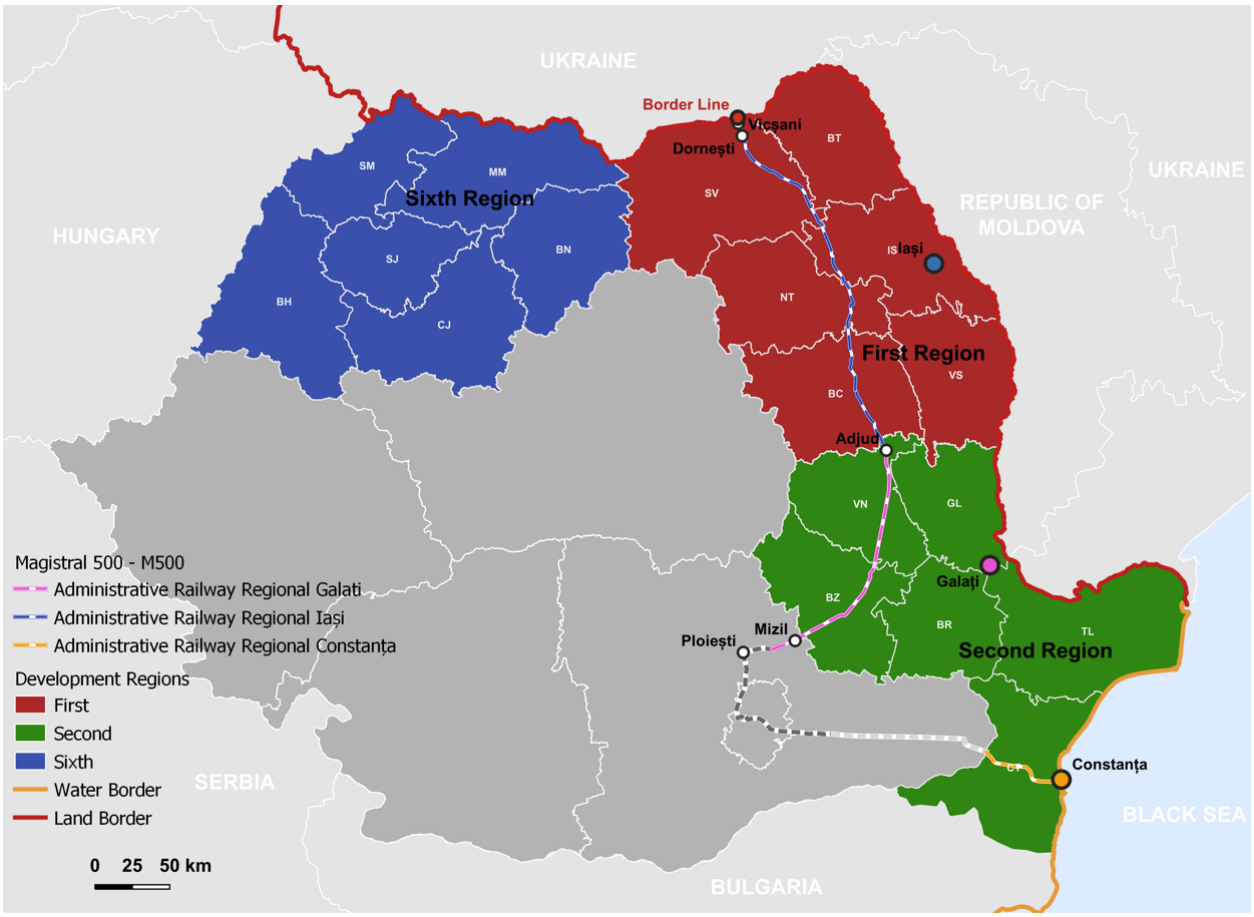

Fig. 4 Magistral 500 – M500 distribution along: Development Regions from Romania and Administrative Railway Regionals

The national transport infrastructure railway administration it is organized in eight administrative regionals [4] and the distribution, taking into account the development regions of Romania at the eastern flank border includes:

- Iasi Administrative Railway Regional, located in Iasi City
- Galati Administrative Railway Regional, located in Iasi Galati
- Constanta Administrative Railway Regional, located in Iasi Constanța

The Romanian railway route that overlaps with the European corridor Baltic Sea – Black Sea and also, is located in the Eastern side of Romania and NATO eastern flank is the magistral 500 – M500, technically called. It is distributed between Ploiesti city, located on the Third Development Region and under the Bucharest Administrative Railway Regional and border line, located on the north (east) side of the country, on the First Development Region and under the Iasi Administrative Railway Regional.

The distribution of railway line, M500, on the eastern flank of NATO in Romania, between Ploiesti and border line, corelated with the development regions from Romania are:

- Ploiesti – Mizil, approximately 34 kilometres, all distributed in Prahova county;
- Mizil – Adjud, approximately 155 kilometres, distributed along two counties: Buzau County – approximately 75 kilometres and Vrancea County – approximately 80 kilometres;
- Adjud – border line, approximately 248 kilometres, distributed along four of six counties: Bacau – approximately 82 kilometres; Neamt – approximately 31 kilometres; Iasi – approximately 39 kilometres; Suceava – approximately 96 kilometres;

The distribution of railway line on the eastern flank of NATO in Romania, corelated with the Administrative Railway Regionals and the magistral 500 – M500 are:

- Iasi Administrative Railway Regional - approximately 248 kilometres;
- Galati Administrative Railway Regional - approximately 155 kilometres;
- Constanța Administrative Railway Regional - approximately 64 kilometres;
- Bucharest Administrative Railway regional – approximately 34 kilometres.

The European Transport Corridor that overlaps with the eastern flank of NATO in Romania and also, the regional transport infrastructure in Romania is the newly created Baltic Sea – Black Sea [5] corridor that starts in Tallin (Estonia), and fallows the cities: Riga (Letonia) – Kaunas (Lithuania) Bialystok (Poland) – Lublin (Poland) – Rzeszow (Poland) – Bacau (Romania) – Buzau (Romania) – Ploiesti (Romania) – Bucharest (Romania) – ending in Romania in Constanta Port (Romania) and also continuing in other countries to the final end point in Athens (Greece).

Some particularities of the rail corridor near Romania are at the two splitting points where the proposed corridor goes beyond the border of the European Community at (fig. 5):

- Rzeszow (Poland) is a splitting point to: Kosice (Slovakia) and to Lviv (Ukraine). The foreseen connection to Ukraine has also a splitting point in Lviv to: Port Odesa (Ukraine) and also to Siret (Romania);
- Pascani (Romania) is a splitting point to: Ungheni (Romania), passing through Iasi and Chisinau (Moldova) to the end point in Port Odessa (Ukraine) and to Port Constanta (Romania) passing thru Bacau, Ploiesti, Bucharest.

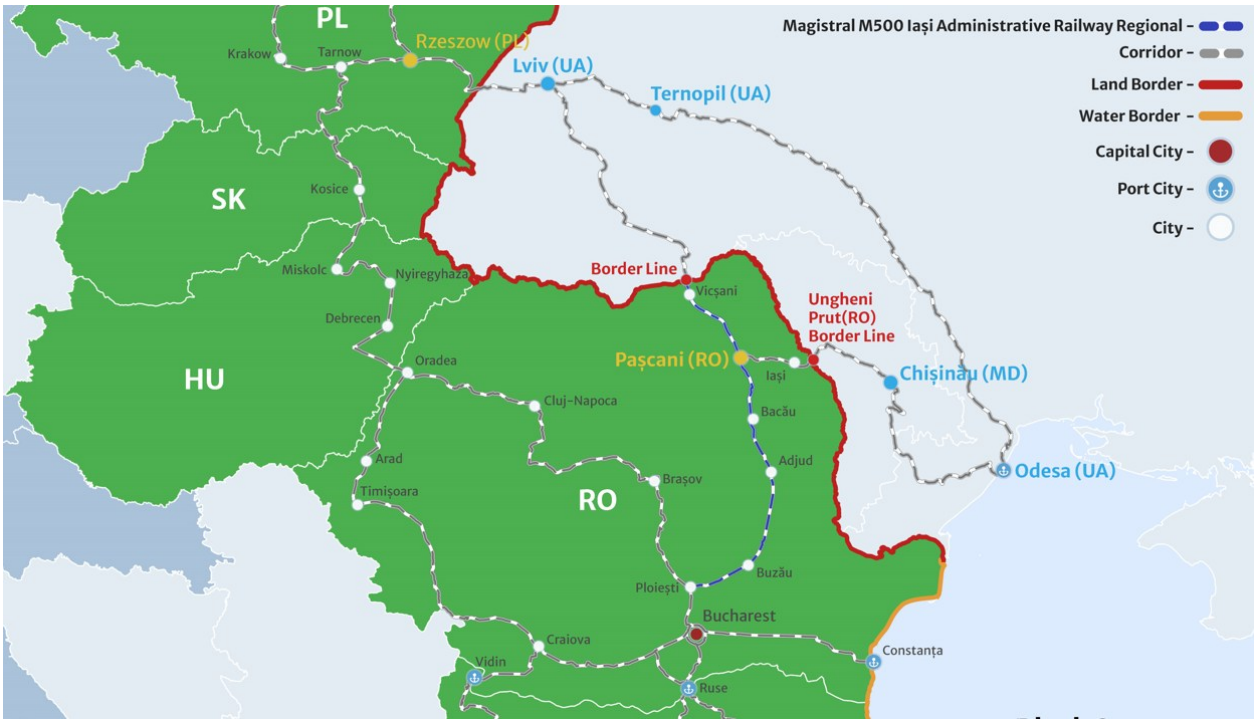

Fig. 5. BBC Railway Corridor in Romania and Magistral 500 – M500 from Romania

The European Community created European Transport Corridor (ETC) the newly railway corridor Baltic Sea – Black Sea – Aegean Sea (BBA) that connects the seas to Port Constanta in Romania through Ukraine and also, Port Odessa through Poland or Romania (Pascani – Iasi) and Moldova (Ungheni Prut – Chisinau).

4. Railway transport infrastructure in the eastern NATO flank in Romania

The railway transport infrastructure in the region follows the technical called magistral 500 – M500 in Romania, which starts from Bucharest Nord – Ploiesti Sud – Focsani – Adjud – Roman – Pascani – Darmanesti – Vicsani.

The Romanian authorities with the great support from the European authorities have multiple projects to modernize the railway infrastructure in the area as follows:

- Ploiesti Triaj, Prahova County – Focsani, Vrancea County [6]

The present length between the two sectional points is approximately 143 kilometres, the railway line is double track, electrified and the railway gauge is normal gauge – 1435 mm.

The present route it is made in 180 minutes due to the technical condition of the track.

- **Focsani, Vrancea County – Roman, Neamt county** [7]

The present length between the two sectional points is approximately 147 kilometres, the railway line is double track, electrified and the railway gauge is normal gauge – 1435 mm.

The present route it is made in 130 minutes due to the technical condition of the track.

- Roman station, Neamt County – Pascani station, Iasi County – Iasi station, Iasi County – Ungheni Prut/Border line, Iasi County [8]

The present length between the two sectional points is approximately 140 kilometres. The route, following the national railway classification can be divided in three sections:

- Roman station - km 345+268 – Pascani station - km 387+460, magistral 500 – M500, with a total railway connection length of approximately 42.19 kilometres the railway line is double track, electrified and the railway gauge is normal gauge – 1435 mm;

The present route it is made in 70 minutes due to the technical condition of the track.

- Pascani station - km 0+000 – Iasi station - km 75+663, magistral 600 – M600, derivation 606, with a total railway connection length of approximately 75.66 kilometres the railway line is double track, electrified and the railway gauge is normal gauge – 1435 mm;
- Iasi station - km 75+663 / 407+737 – Ungheni Prut station/border line - km 429+053, magistral 600 – M600, with a total railway connection length of approximately 22 kilometres, which is also divided in two sections, between:
    - Iasi station and Socola station, with a total railway connection length of approximately 4.35 kilometres the railway line is double track, electrified and the railway gauge is normal gauge – 1435 mm;
    - Socola station and Ungheni Prut/border, with a total railway connection length of approximately 17 kilometres the railway line is simple track, non - electrified and the railway gauge is double 1435 mm and 1520 mm.

The line between Pascani station and Iasi station assures the connection between the two main magistrals from the region magistral 500 – M500 and magistral 600 – M600, continuing to the eastern border to Moldova.

According to the TEN – T corridors the connection between Roman – Iasi – Ungheni Prut is part of the TEN – T Core.

- Pascani, Iasi County – Darmanesti, Suceava County [9]

The present length between the two sectional points is approximately 71 kilometres. The route can be divided in two zones by the railway line, between:

- Pascani station – Suceava Nord station, magistral 500 – M500, with a total railway connection length of approximately 64 kilometres the railway line is double track, electrified and the railway gauge is normal gauge – 1435 mm;
- Suceava Nord station – Darmanesti station, magistral 500 – M500, with a total railway connection length of approximately 7 kilometres the railway line is simple track, electrified and the railway gauge is normal gauge – 1435 mm;

The present route it is made in 210 minutes due to the technical condition of the track.

- Darmanesti, Suceava County – Vicsani, Suceava County - Border line [10]

The present length between the two sectional points is approximately 34 kilometres, the railway line is simple track, non - electrified and the railway gauge is normal gauge – 1435 mm.

At the moment Romanian authorities, through Romanian Railway Administrator – CFR S.A, has signed contracts for feasibility studies for the entire length between Ploiesti station , Prahova County – Pascani station, Neamt County – Darmanesti station, Suceava County for a total length of approximately 404 kilometres and between Pascani station, Neamt County – Iasi station – Ungheni Prut station/border line, Iasi County for a total length of approximately 97 kilometres, so a total of approximately 501 kilometres, divided in four subsections, with a total value of: [11]

- Subsection 1: Ploiești-Triaj train station – Focșani train station, total length of 143 kilometres and the value of 15.960.000 lei excluding VAT;
- Subsection 2: Focșani train station – Roman train station, total length of 147 kilometres and the value of 19.260.000 lei excluding VAT;
- Subsection 3: Roman train station - Iasi train station – border line, total length of 140 kilometres and the value of 16.500.000 lei excluding VAT;
- Subsection 4: Pașcani train station – Dărmănești train station, total length of 71 kilometres and the value of 8.400.000 lei excluding VAT;

Also, a contract for work was launched for the third time for the electrification and rehabilitation between Darmanesti train station and Vicsani train station to the border line, for: simple track modernisation – approximative 35 kilometres and electrification for approximative 32 kilometres for the entire value of 197.800.000 lei.

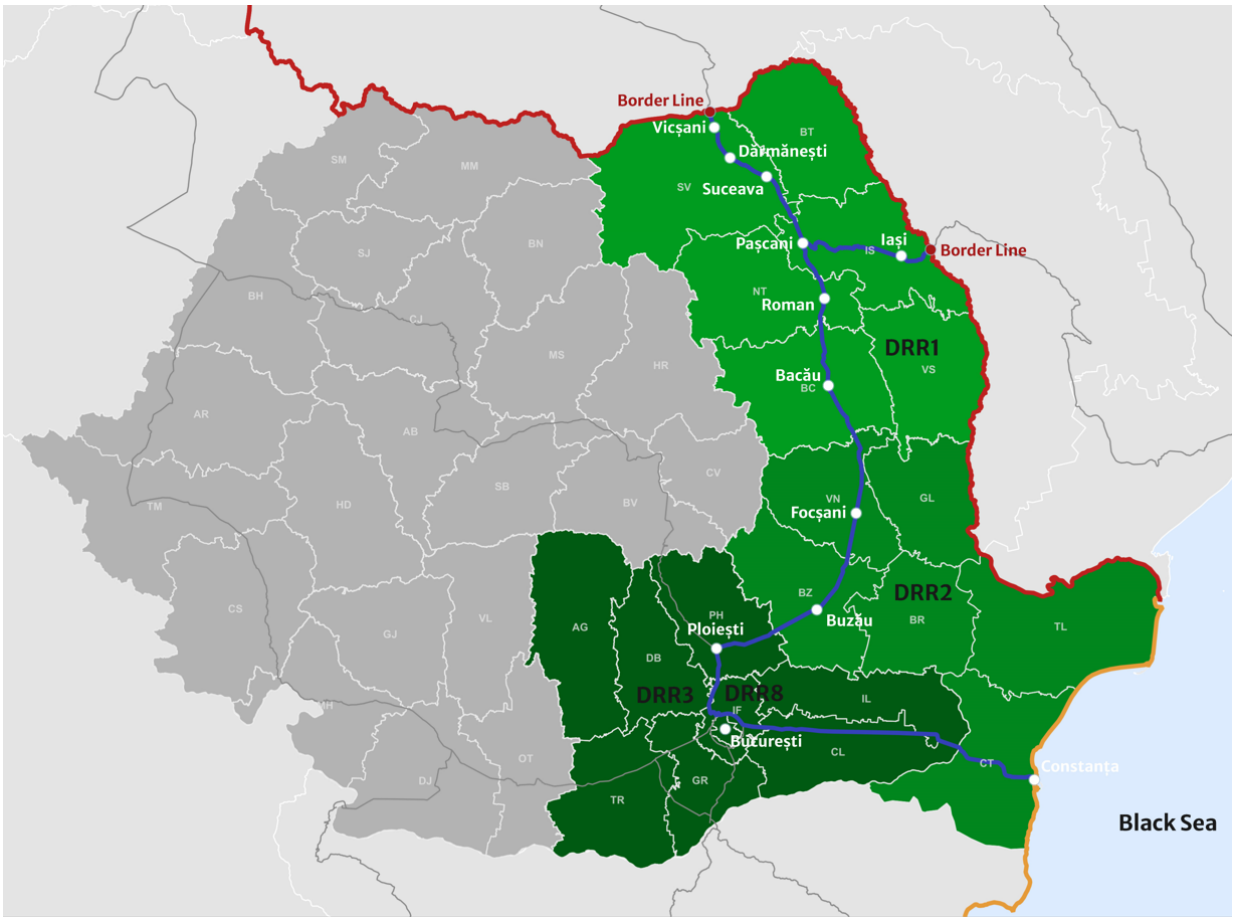

Fig. 6. Modernization map of railway infrastructure from Romania, following the Eastern Flank

Following the railway line magistral 500 – M500, from Ploiesti, Prahova County to the border line – Vicsani, Suceva County, in the present condition of the railway track the total travel time for a passenger train is approximately 600 minutes, for a total railway length of approximately 438 kilometres.

The railway route that connects the Eastern Flank of NATO to other countries goes thru Constanta Port, so follows the route from Ploiesti, to Bucharest and then to Constanta Port.

3. Conclusion

The entire border length of the Eastern Flank of North – Atlantic Treaty Organization – NATO, both on land and water, is approximately 4343 kilometres, excepting the land border with Kaliningrad region. The distribution of border kilometres presents that more the 35% is in Romania and the next country according to the exposed border is Poland with almost 22%, excepting the land border with Kaliningrad region. More than 55% of land border on eastern Flank is located in two countries and in Romania is the longest border from the eastern flank of NATO, meaning an exposed area which leads to a significative national risk. Also, from all countries on the eastern flank, Romania – 46% and Lithuania – 42%, from the entire country border line have the highest percentage allocated to the eastern flank.

From the eight development regions from Romania, three are located at the eastern flank of NATO border as follows: Sixth Development Region – at the north of our country, First Development Region – starting from the north, north – east and then to the east and Second Development Region – east to the south – east on the Black Sea border line.

The railway transport infrastructure from the region – eastern Romanian region, corelated with the European corridos that are under construction and development follows just the first two development regions from Romania and three administrative railway regionals: Iasi, Galati and Constanta. The national railway magistrals that are in the Eastern Flank of NATO and on the Romanian Development Regions at the eastern border are distributed for 53% on the First Region, 47% on the Second Region, divided for 33% along M500 and another 14% along M800.

For Romania, if we take into account the high percentage of exposed border line, the lack or the gap of transport infrastructure, both road [12] and railway can work both as an advantage, because it is a hard way to travel in our country without a modern transport infrastructure and as an disadvantage, because the eastern region from Romania is one of the undeveloped national region and from Europe, with a high degree of depopulation.

One of the issues is the lack of correlation between the development regions from Romania and the Administrative Railway Regional from Romania and another is that after three years of armed conflict at our border the Romanian authorities did not start any major modernisation of the railway infrastructure, despite that the entire military circulation is done almost integrally on railway transport infrastructure.

Taking into account the geographical position and the BBA Railway Corridor (Baltic Sea – Black Sea – Aegean Sea) Romania can be a regional hub for freight transport and also, military with the proper development of the railway transport infrastructure with one important point at Pascani City.

The present development of the railway transport infrastructure is just on the studies phase after three years of armed conflict at our border, so a very slow acting although the European authorities ensured the funding and the entire eastern Romanian side has no challenges regarding the works, such as art works, tunnels and bridges.

At the moment the entire length between Ploiesti - Vicsani (border line) and from the Pascani, the splitting point, through Iasi, until border line are approximately 501 kilometres. For the entire length are ongoing feasibility studies for only approximately 24000 euro/kilometre and just one launched tender for works on single track modernisation of approximately 33 kilometres for approximately price of 1.2 million/kilometres. Also, in the Second Development region the Romanian authorities have launched tenders for works that will assure the connectivity almost to the Bulgarian border [13].

The modernisation of the railway infrastructure at the border lines has a lot of challenges and needs to take into account one major implication regarding the interoperability, so from the main parameters the most important is the gauge [14], because the neighbours are still using large gauge of 1520 mm.

Being a country at the border of all major points such as: NATO border, Schengen Border [15] and European community border and having neighbours [16] that want to become a part of the European Community puts as on great position that can be used to assure the country development and can work as an engine for the development of the entire region [17] [18] , with the significative implication of Romanian authorities and the Romanian specialists.

Acknowledgments

This work was supported by a National Research Grants of the UTCB, project number GnaC ARUST 2024 - UTCB 06.

References

1. NATO. Welcome to NATO. Available at: https://www.nato.int/nato-welcome/index.html (Accessed: 09 March 2025).
2. Ministry of Foreign Affairs of Romania. Romania in NATO and the EU. Available at: https://www.mae.ro/node/46982 (Accessed: 09 March 2025).
3. Law regarding the regional development of Romania. Available at: https://legislatie.just.ro/Public/DetaliiDocument/53040 (Accessed: 09 March 2025).
4. Romanian Railways (CFR). List of Management Personnel. Available at: https://cfr.ro/lista-persoanelor-din-conducere/ (Accessed: 09 March 2025).
5. European Commission. Annex 3 – Baltic, Black and Aegean Sea Corridors. Available at: https://transport.ec.europa.eu/document/download/b1977e9a-0289-46f6-ae6e-9d032b7acb9c_en (Accessed: 09 March 2025).
6. Feasibility study Ploiesti – Focsani, https://e-licitatie.ro/pub/notices/ca-notices/view-c/100433734 accessed 09.03.2025
7. Feasibility study Focsani – Roman, https://e-licitatie.ro/pub/notices/c-notice/v2/view/100067245, accessed 09.03.2025.
8. Feasibility study Roman – Pascani – Iasi, https://www.e-licitatie.ro/pub/notices/c-notice/v2/view/100067302, accessed 09.03.2025.
9. Feasibility study Pascani – Darmanesti, https://e-licitatie.ro/pub/notices/ca-notices/view-c/100411391, accessed 09.03.2025.

References

10. Darmanesti – Vicsani Railway Project. Available at: https://www.e-licitatie.ro/pub/notices/c-notice/v2/view/100186417 (Accessed: 09 March 2025).
11. Romanian Railways (CFR). Annex 12.b – 2025 Network Development Plan. Available at: https://cfr.ro/files/ddr/EN%202025/Annex%2012.b.pdf (Accessed: 09 March 2025)..
12. F. I. Nica, and M. G. Lobaza and G. Andries," Development of Road Transport Infrastructure on the Eastern Flank of NATO and of Romania", manuscript for the 10th Anniversary World Summit: Civil Engineering-Architecture-Urban Planning Congress (CAUSummit 2025)
13. F. I. Nica, "The Romanian coastal area and green transport infrastructure", E3S Web of Conferences, volume 608/2025, 05024, EU-CONEXUS EENVIRO Research Conference - The 9th Conference of the Sustainable Solutions for Energy and Environment (EENVIRO 2024), doi: 10.1051/e3sconf/202560805024.
14. F. I. Nică, " Railway border connections, double railway gauge in Romania during Ukraine crisis and development possibilities", AIP Conference Proceedings Volume 2928, Issues 1, 7th World Multidisciplinary Civil Engineering-Architecture-Urban Planning Symposium – WMCAUS 5-9 September 2022, Prague, Czech Republic, https://doi.org/10.1063/5.0170536.
15. F. I. Nică," Schengen railway border of European Community and connection points", MATEC Web. Conf., Volume 396, 07003 8th World Multidisciplinary Civil Engineering-Architecture-Urban Planning Symposium – WMCAUS 2023, Prague, Czech Republic, https://doi.org/10.1051/matecconf/202439607003.
16. M. Kurhan, D. Kurhan, N. Hmelevska, "A Systematic Approach to Designing High-Speed Railway Track: European Perspective", Transport means – Proceedings of the Internation Conference, Volume 2024-October, pp. 47-51, 2024. Doi: 10.5755/e01.2351-7034.2024.P47-51.
17. M. Kurhan, D. Kurhan, N. Hmelevska, "Enhancing Railway Section Capacity, during Expansion of the European Railway Network", Acta Polytechnica Hungarica, Volume 22, Issue 4, pp. 159-171, 2025. Doi: 10.12700/APH.22.4.2025.4.10.
18. F. I. Nică, "Developing railway link in central region of Romania" IOP Conference Series: Materials Science and Engineering, Volume 960, 5th World Multidisciplinary Civil Engineering-Architecture-Urban Planning Symposium – WMCAUS 15-19 June 2020, Prague, Czech Republic, doi:10.1088/1757-899X/960/2/022002.