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Rail Infrastructure in Poland

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Abstract

Objectives: The purpose of this article is to present the state of the railway infrastructure in relation to the possibility of using it for the transport of tracked vehicles. It analyses the rolling stock available to the armed forces and the procedures for carrying out military transport by rail.

Methods: The research method used in this study consists of a review of the literature dealing with the implementation of military transport by rail. Based on the available data and literature, the state of the rail infrastructure in relation to its use for rail transport and the procedures for implementing military transport by rail are presented.

Results: The analysis of the documents made it possible to identify and characterise the state of the railway infrastructure and the directions for its modernisation and development. The article presents rail freight corridors that are particularly important from a defence point of view.

Conclusions: Poland's rail infrastructure is designed for non-military and military purposes. Rail transport is particularly important for the long-distance movement of tracked vehicles. In order to ensure the efficient transport of military equipment in times of crisis and conflict, the Armed Forces constantly carry out peacetime exercises. During the preparation and execution of military rail transport, procedures and activities of interaction with civil authorities are practised. The railway infrastructure is constantly modernised and adapted to the transport of passengers and goods, taking into account the security conditions of the state and the expected support of the allies.

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Introduction

Rail transport in Poland is widely used for freight and passenger transport. This is due to the country's location in Europe, on the route of transport routes connecting Western Europe with Asia - mainly China and Russia. In addition, the topographical conditions favour the construction of railway lines. The mainline railway infrastructure not only connects most cities, but also important industrial centres. Elements of the railway infrastructure are also used by military units and institutions. Sidings and ramps for loading military equipment onto rail transport are located near military units. In carrying out their tasks, the Armed Forces use all available means of transport, including rail transport, which provides conditions for the movement of people, military equipment and supplies.

1. The State of the Railway Infrastructure (Linear and Switch) in Relation to the Possibility of Using It for the Transport of Tracked Vehicles

The railway infrastructure in Poland includes the railway network, station and stop infrastructure, rolling stock and traffic management systems. Poland has an extensive rail network which is mainly managed by the Polish State Railways (PKP) and other local infrastructure managers. Polskie Linie Kolejowe (Polish Railways) is the company that manages the railway infrastructure in Poland. It is responsible for the maintenance of tracks, stations, level crossings and other infrastructure elements. PKP is responsible for planning, modernising and developing the country's rail network. The railway network in Poland consists of lines of both national and international importance. Poland's rail traffic management system is responsible for coordinating train traffic, track safety and infrastructure monitoring. In recent years, Poland has invested heavily in modernising its rail infrastructure. Some of the existing lines have been electrified, enabling more environmentally friendly and efficient transport. Modernisation has also included improving the technical parameters of the tracks, modernising stations and introducing modern signalling systems. Many railway lines are covered by an electronic traffic control system, which allows remote control of semaphores and signals. Rail transport is used extensively by military units, mainly for operational transport. It has the highest capacity of all land transport modes. Heavy tracked military equipment, large numbers of soldiers and supplies are transported over long distances by rail. The possibility of using rail transport for the transport of military units is determined by the utility factors of this type of transport, an important determinant being the availability and condition of the rail network. According to data provided by the Railway Transport Authority in 2021, the length of railway lines in operation by all infrastructure managers was 19,326 km. This data includes both standard gauge and broad gauge lines. The length of electrified railway lines is 12,156 km, which is 62.9% of the length of railway lines in operation in Poland. It should be noted that the length of electrified lines increased by 108 km compared to 2020.

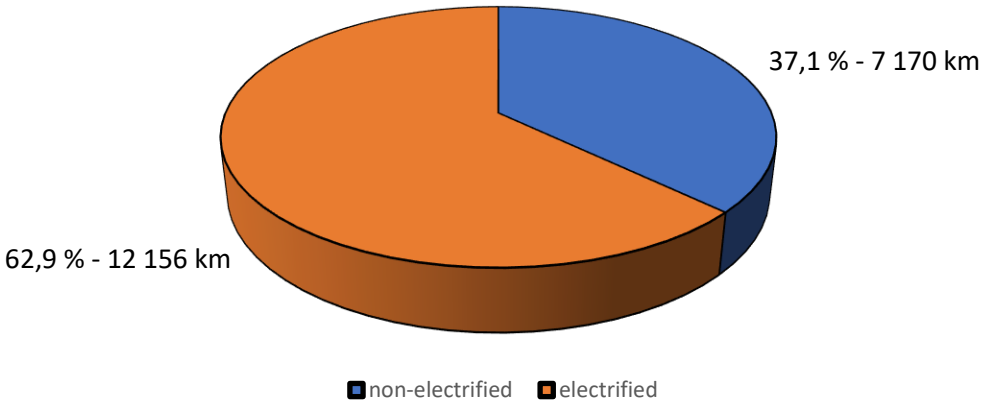

Fig. 1. Structure of rail lines in operation in Poland in 2021.
Source: Own compilation based on data posted at www.dane.utk.gov.pl

Railway lines are also divided into single and double track lines. Single track lines account for 53.8% of the lines in operation in 2021. Single-track lines are particularly important in terms of accessibility and freight capacity. Damage to a line can lead to complete closure to rail traffic. Note the ratio of single-track to double-track lines in each province. Single-track lines predominate in Podlaskie (86%), Podkarpackie (76%) and Warminsko-Mazurskie (72%). Mazowieckie (65%), Łódzkie (63%) and Wielkopolskie (62%) are provinces where double track lines predominate.

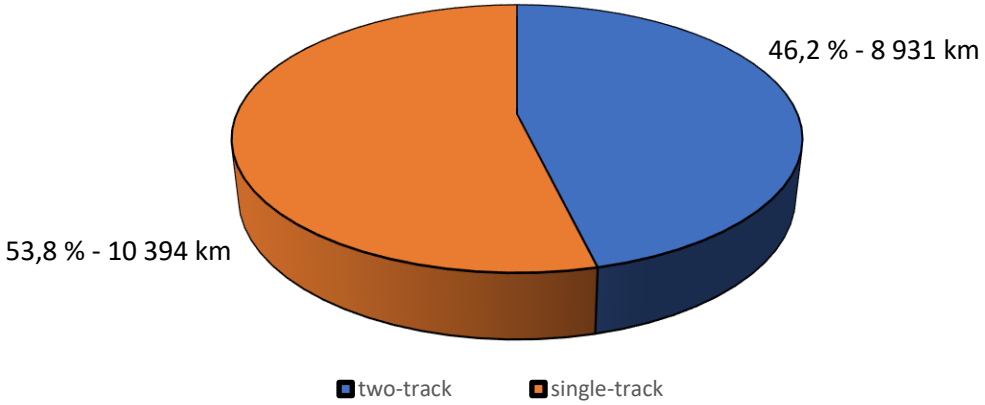

Fig. 2. Type of railroad lines in operation in Poland in 2021.
Source: Own compilation based on data posted at www.dane.utk.gov.pl

In Poland, railway lines are supplied with 3kV DC voltage. Of the total length of electrified lines, 4 078 km were single-track lines and 8 078 km were double-track lines. Electrified single-track lines represented 39.2% of the total length of single-track lines. Electrified double-track lines represented 90% of the total length of double-track lines. The average density of railway lines in Poland in 2021 was 6.2 km/100 km^2.

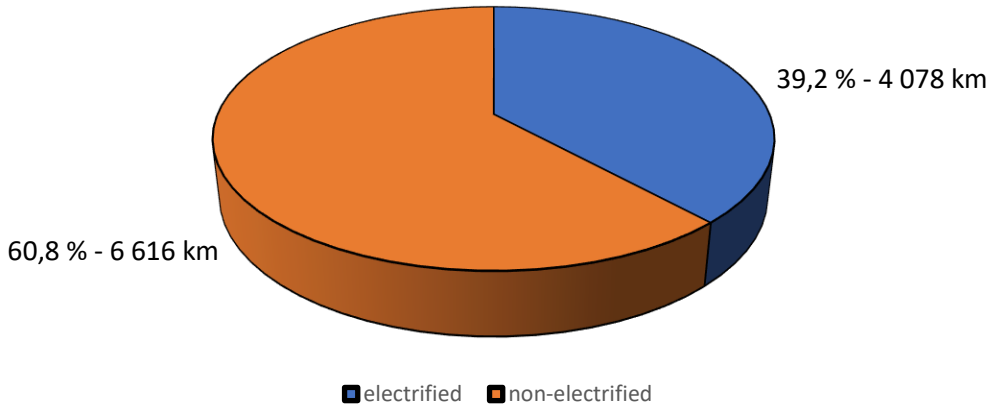

Fig 3. Type of single-track railroad lines in operation in Poland in 2021.
Source: Own compilation based on data posted at www.dane.utk.gov.pl

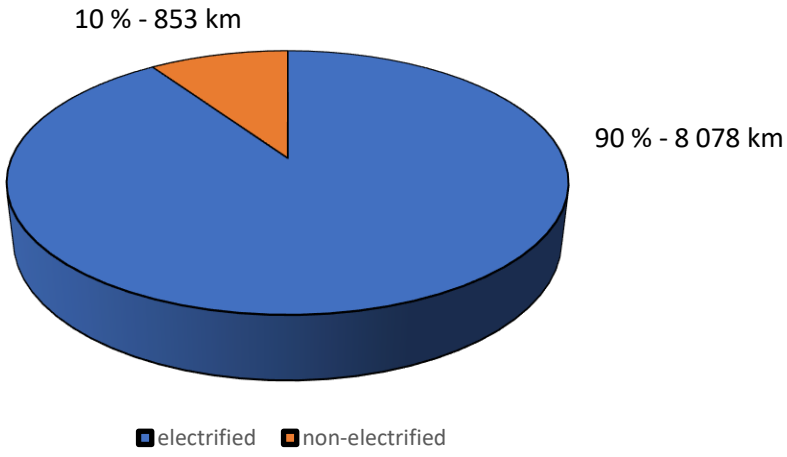

Fig. 4. Type of double-track railroad lines in operation in Poland in 2021.
Source: Own compilation based on data posted at www.dane.utk.gov.pl

When analysing rail transport as a means of military transport, the maximum speeds at which trainsets can travel on certain sections of track are also important. The speeds are considered in the 5 ranges shown: vmax > 160 km/h, 120 km/h < vmax ≤ 160 km/h, 80 km/h < max ≤ 120 m/h, 60 km/h < vmax ≤ 80 km/h and vmax ≤ 60 km/h.

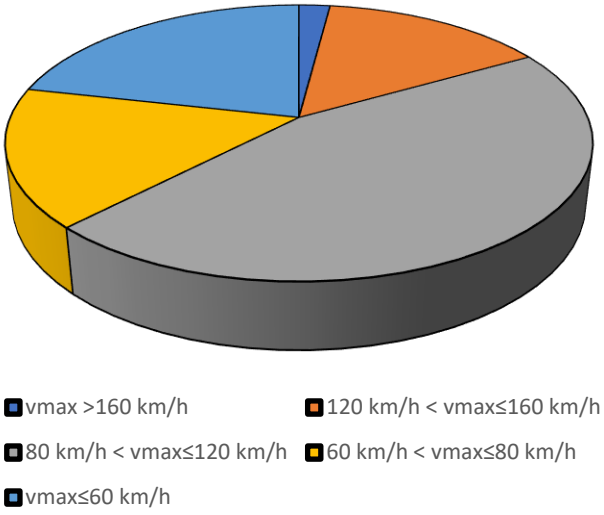

Fig. 5. Structure of railroad lines by permissible speeds of Poland in 2021.
Source: Own compilation based on data posted at www.dane.utk.gov.pl

Under the Cohesion Fund Project No 2004/PL/16/C/PA/001, a Master Plan for Railway Transport in Poland up to 2023 has been developed, which envisages the modernisation of railway lines and the increase of speeds on individual railway sections, as shown in Figure 6 below.

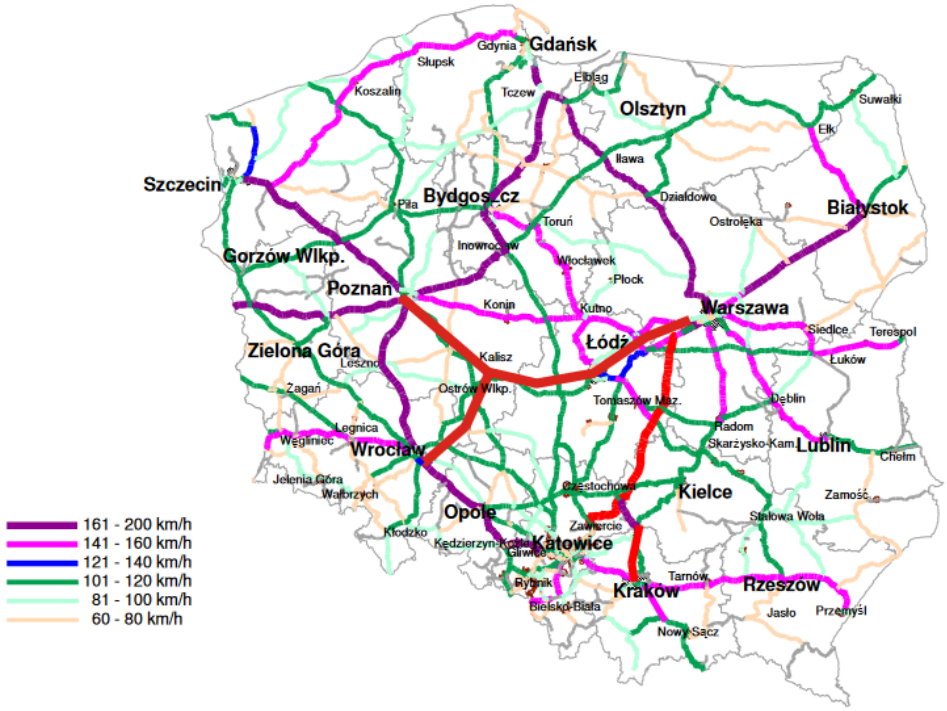

Fig. 6. Planned speeds on Poland's rail network in 2030.
Source: www.plk-sa.pl

Of particular importance for Poland's defence are the RFC rail freight corridors. They are a European project aimed at increasing the attractiveness of rail transport. The 2010 European

Parliament and Council (EU) regulation on a European rail network for competitive freight obliged Poland to implement them. There are currently 11 RFC rail freight corridors in Europe. Three of them run through Poland - Corridor No. 5 (RFC 5) Baltic - Adriatic Sea, Corridor No. 8 (RFC 8) North Sea - Baltic Sea and Corridor No. 11 (RFC 11) Amber - Amber. Considering the current political and military situation in Europe, from a strategic point of view, rail transport routes are important for the realisation of rail transport and supply. On 10 November 2015, the Baltic-Adriatic freight corridor was launched. The route of the corridor is shown in Figure 7. The corridor includes the following railway infrastructure managers

- PKP Polskie Linie Kolejowe S.A. - Poland,
- SŽCZ (Správa železnic, státní organizace - Czech Republic,
- ŽSR (Železnice Slovenskej Republiky) - Slovakia,
- ÖBB-Infra (ÖBB-Infrastruktur Aktiengesellschaft) - Austria,
- SŽ-Infrastruktura (Slovenske železnice-Infrastruktura, d.o.o.) - Slovenia,
- RFI (Rete Ferroviaria Italiana) - Italy.

Fig. 7. Corridor No. 5 (RFC 5) Baltic - Adriatic Sea
Source: www.plk-sa.pl

On 14 January 2019, the "Amber" freight corridor No. 1 connecting Poland, Slovakia, Hungary and Slovenia was saved. The southern end of the corridor begins at the port of Koper on the Adriatic Sea in Slovenia and ends in the north at Warsaw and the Polish-Belarusian border at Terespol, as shown in Figure 8. The corridor includes the following railway infrastructure managers:

- PKP Polskie Linie Kolejowe S.A. - Poland,

- ŽSR (Železnice Slovenskej Republiky) - Slovakia,
- GYSEV - Győr-Sopron-Ebenfurti Vasút Zrt./ Raab-Oedenburg-Ebenfurter Eisenbahn AG - Hungary,
- MÁV Magyar Álllamvasutak Zrt. - Hungary,
- VPE Vasúti Pályakapacitás-elosztó Kft.) - Allocating Authority, Hungary,
- SŽ-Infrastruktura (Slovenske železnice-Infrastruktura, d.o.o.) - Slovenia.

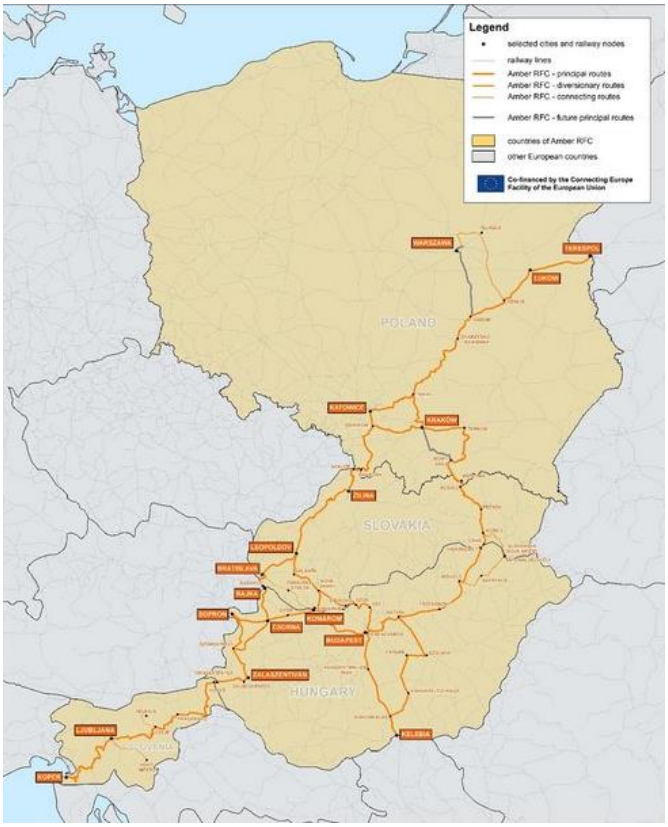

Fig. 8. Corridor No. 11 (RFC 11) Amber - Amber
Source: www.plk-sa.pl

The third freight corridor through Polish territory was launched on 10 November 2015. In 2020, the North Sea-Baltic Sea corridor has been extended to Latvia and Estonia, as shown in Figure 9. The corridor includes the following railway infrastructure managers:

- PKP Polskie Linie Kolejowe S.A. - Poland,
- AB "LTG Infra" - Lithuania,
- DB Netz AG - Germany,
- Infrabel, Société Anonyme de Droit Public - Belgium,
- ProRail B.V. - Netherlands,
- Správa železnic, státní organizace - Czech Republic,
- VAS "Latvijas dzelzceļš" - Latvia,
- AS "LatRailNet" - Latvia,

– AS Eesti Raudtee - Estonia.

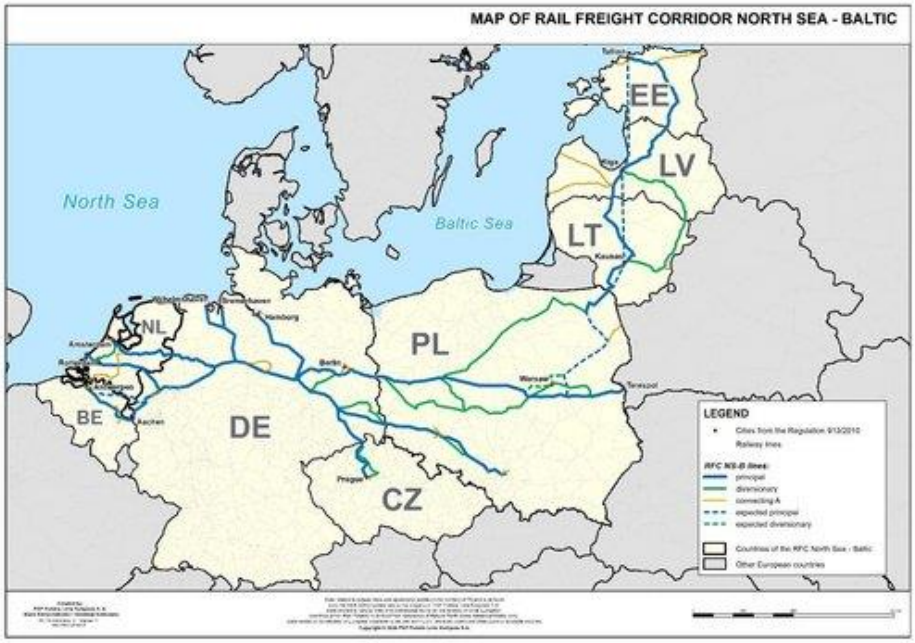

Fig. 9. Corridor No. 8 (RFC 8) North Sea - Baltic Sea.
Source: www.plk-sa.pl

2. Rolling Stock Designed to Carry Tracked Vehicles

Poland's rolling stock consists mainly of electric, diesel and diesel-electric multiple units and locomotives. PKP and other railway companies use various types of passenger and freight cars, including sleeping cars, restaurant cars, container cars and tank cars. Ground forces form the backbone of the Armed Forces of the Republic of Poland. They include armoured, mechanised and motorised units. The most important vehicles in the equipment of the units, which determine their firepower, are tanks, infantry fighting vehicles, howitzers and wheeled armoured personnel carriers. A particular challenge for military transport is the transport of tracked vehicles. The military transport of tracked vehicles requires special wagons adapted to military tasks.

In 2021, 1,376 eclectic locomotives, 1,741 diesel locomotives and 71 double-drive locomotives will be available to freight operators. For the transport of tracked vehicles, platform wagons on bogies of special construction are used - type S. These are wagons of the Slmmps series, designed for a speed of 100 km/h, for the transport of goods of concentrated weight and tracked vehicles, in particular for vehicles with a track width of 3,550 mm AND a weight of 60 t. The vehicles are loaded from side or front loading ramps.

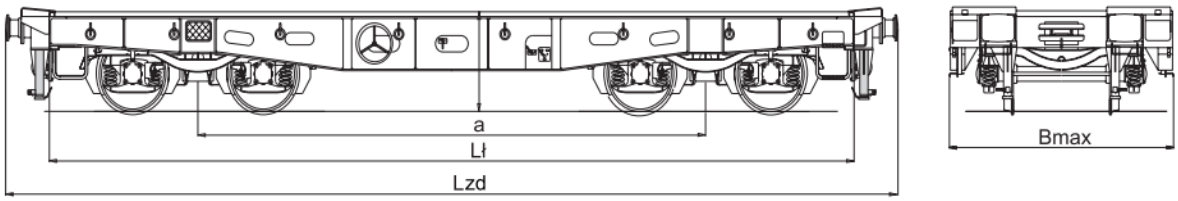

Fig. 10. The Slmmps Wagon.
Source: www.dane.utk.gov.pl

In 2021, PKP Cargo will have a total of 80 platforms of the Slmmps series performing transport tasks throughout Europe. Taking into account the number of trains launched annually for the Polish Armed Forces, this number is clearly insufficient to meet the needs of the military. The Ministry of Defence has reported the need to purchase 70 platform coaches with a load capacity of up to 70 tonnes and 6 passenger coaches. PKP Intercity took delivery of the first of the wagons ordered by the Ministry of Defence in 2021. The 8 wagons for the Ministry of Defence were built by FPS H. Cegielski. They are 6 special class 2 carriages without compartments for the transport of persons (soldiers) and 2 special class 2 carriages with compartments for the transport of a convoy. The cost of each car is about 13 million zlotys.

3. Procedures for the Implementation of Military Transport by Rail

Rail transport is divided into central and regional transport. Central transports cover the areas of responsibility of at least two Regional Logistics Bases. Regional transports are carried out in the area of responsibility of one Regional Logistics Base. In order to carry out military transport by rail, logistical planning is carried out to meet the transport needs of the Polish Armed Forces. The main role in the planning process is played by the Headquarters for Transport and Movement of Troops - the Centre for Coordination of Movement of Troops. Together with the Military Transport Commands, it plans the movement of its own and allied troops within the country. Together with public administrations, railway managers, transport agencies and companies, it establishes rules for the movement of military equipment. The purpose of rail transport planning is to designate loading and unloading stations, determine the number and type of rail vehicles required for the transport, analyse the technical and operational possibilities of the railway lines and the economic justification of the transport, set deadlines and make arrangements with carriers.

The military unit prepares the request for military rail transport and submits it via the service route to the territorially competent authorities for transport and movement of troops. It agrees with the territorially competent JTCR on the plan of loading of the transport and then submits an order for wagons to the loading station, indicating the card numbers from the Catalogue of Gauge of Military Vehicles and Equipment "Sketchbook" for equipment with exceeded loading gauge, and attaches a request for individual timetable. The normative documents specify the deadlines for submission of requests for centralised transport to the Chief of Transport and Movement of Troops, who notifies the territorially competent Military

Transport Commands and Military Economic Branches. DU-4.4.1(B) of the Regulation on Troop Transportation by Rail indicates the following:

- by the fifteenth of a given month for the first decade of the following month,
- by the twenty-fifth of a given month for the second decade of the following month,
- by the fifth day of a given month for the third decade of that month,
- not less than thirty-five days before transporting extraordinary shipments (cargo with exceeded gauge or cargo requiring specialized rolling stock, etc.).

Requests for regional transport are submitted to the Department of Transport and Troop Movement and HNS of the Regional Logistics Base, which notifies the territorially competent Military Transport Commands and Military Economic Branches, observing the deadlines:

- by the fourteenth of a given month for the first decade of the following month,
- by the twenty-fourth of a given month for the second decade of the following month,
- by the fourth day of a given month for the third decade of that month,
- not less than thirty-five days before transporting extraordinary shipments (cargo with exceeded gauge, cargo requiring specialized rolling stock, etc.).

The conditions set out in the supplementary document, which extends the provisions of the doctrinal document, allow complex requirements to be analysed. The correctness of the choice of loading and unloading stations, the availability of the expected rolling stock, the technical and operational capabilities of the railway lines and the economic justification of transport by rail are evaluated.

Conclusion

Rail transport in Poland is in a constant state of development and adaptation to EU policies. Of fundamental importance is the process of modernising railway lines in terms of energy infrastructure and increasing permissible speeds on individual sections. Analysing the statistical data, it can be concluded that the trend and direction set by the managers of the railway sections is aimed at improving the current situation. However, these processes are relatively slow, which leads to the degradation of the railway infrastructure and weakens the competitiveness of rail transport in relation to other modes of transport. However, the modernisation of existing infrastructure elements alone will not significantly affect the attractiveness of rail transport, especially when considering the use of military tracked vehicles for transport. With the expansion of existing military units and the creation of new ones, it is necessary to take into account the relocation of units and the military equipment used in them during the construction of new railway lines. Poland is a member of the European Union and NATO, which determines the possibility of determining the likely direction of the threat. The railway infrastructure should ensure the ability to quickly load, move and efficiently unload military equipment used by the Polish Armed Forces and allied countries.

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