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SAFETY AND EFFECTIVENESS OF ROAD CARGO TRANSPORT BETWEEN POLAND AND RUSSIA

BEZPIECZEŃSTWO I EFEKTYWNOŚĆ DROGOWEGO PRZEWOZU ŁADUNKÓW W RELACJI POLSKA–ROSJA

Abstract

This article raises the question of the optimal choice based on time, cost and safety, of road cargo routes between Poland and Russia. The analysis includes twelve routes running through Lithuania, Latvia, Belarus and Ukraine depending on the estimated costs and travel time. To choose the optimal route, AHP method was used. The article also addresses the issues of safety and liability of the carrier.

Keywords: *cargo between Poland and Russia*, *transport security*, *liability of the carrier*, *the choice of the optimal route due to time*, *cost and safety*

Streszczenie

W niniejszym artykuleł poruszono zagadnienie wyboru optymalnej – ze względu na czas, koszty i bezpieczeństwo – trasy drogowego przewozu ładunków w relacji Polska–Rosja. Analizie poddano 12 tras przebiegających przez Litwę i Łotwę, Białoruś oraz Ukrainę, w której dokonano kalkulacji kosztów, czasu jazdy. Do wyboru optymalnej trasy zastosowano metodę AHP. W artykule poruszono także zagadnienia bezpieczeństwa i odpowiedzialności przewoźnika.

Słowa kluczowe: *przewóz ładunków w relacji Polska–Rosja*, *bezpieczeństwo przewozu*, *odpowiedzialność przewoźnika*, *wybór optymalnej trasy ze względu na czas*, *koszty i bezpieczeństwo*

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1. Introduction

Road freight transport is still the main mode of transport both in Poland and Europe. The volume of road cargo is shown in Fig. 1. Particularly important is the Polish transport to the East. On the one hand, due to the low fuel prices in Russia and the ability to increase profits, this transport is cost-effective, on the other hand, it is characterized by a high risk, such as theft or lack of return loads. Insurance companies with higher risk awareness of that kind of transportation increased their freight rates for cargo insurance to countries such as Ukraine and Russia. Also, when it comes to opportunities based in the so-called safe parking areas recommended by the IRU (International Road Transport Union) their amount decreases with the distance from the Polish border to the east [6]. It is possible to carry loads from Poland to Russia in several variants, i.e., through Ukraine, Belarus and Lithuania and Latvia. In order to find the best possible option, the analysis of the effectiveness of multiple connections for these countries was made, taking into account driving time, tolls, fuel costs, downtime and security in the parking lots.

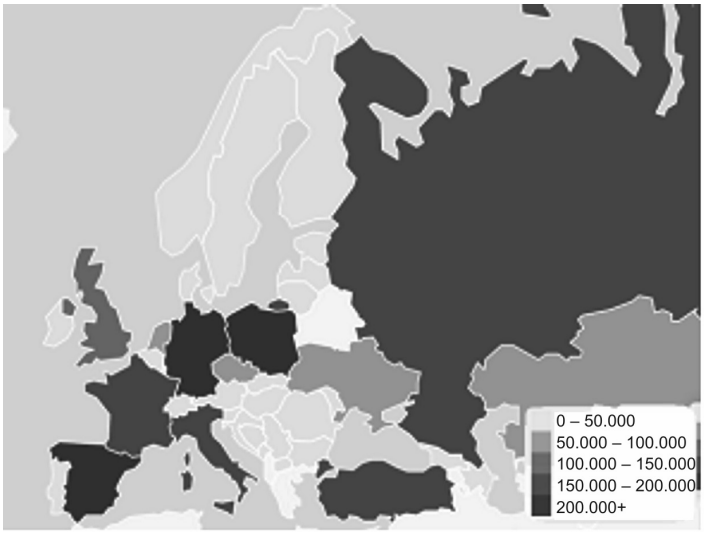

Fig. 1. The volume of road freight transport in Europe data from 2010 (tonne-kilometers in millions) [5]

2. Safety of cargo and liability of the carrier

The laws impose on drivers a requirement to include standstills during payable transportation of cargo and people. The reason for the existence of such legislation is the care for the safety of the driver, cargo and other road users. Despite the fact that the legislation provides driver's legal rest enabling him the proper functioning while driving, it does not guarantee safety during standstills. Very often, prescribed rest is made during stops at gas stations, parking lots and unguarded roadsides [10]. Therefore, it is recommended to plan

standstills in places that ensure safety of both the driver and cargo. The list of such parks has been developed by IRU [3]. According to the report of the Polish Chamber of Forwarding and Logistics, more than 73% of transport-forwarding and logistics companies in Poland have at least once become a victim of theft or extortion of goods [9]. In practice, protection against theft of cargo is primarily based on the so-called high-risk goods transport by means of rigid construction such as freezer, isotherm or container, not posting signs on vehicles suggesting the type of cargo and the skillful selection of vehicle standstills places during transit [11].

Responsibility for the transported goods is always on the side of the carrier, so in the case of loss or damage to cargo, they bear the legal and financial consequences. This liability under Article. 65 of transport law excludes the following factors [2]:

- cause attributable to the consignor or consignee,
- forcemajeure,
- giving as incorrect name – incompatible with reality, things excluded from carriage or taken to carriage on special conditions or failure to comply with these terms and conditions by the sender,
- lack of, insufficient or defective packing of the cargo, normally exposed to damage because of their natural properties,
- specific susceptibility to damage because of defects or property,
- loading, stowage or unloading of goods by the sender or the consignee,
- if cargo was damaged by the reasons of the caretaker (supervisor) in the case of carriage which, in accordance with the law or the contract should be supervised.

It should be kept in mind that the actions of third parties such as robberies do not release the carrier from liability. However, through maintaining due diligence and complying with applicable regulations and safety procedures, it is possible to release the carrier from liability in a judicial process.

3. Variants of connections

According to the analysis of the efficiency of cargo between Poland (Wroclaw) and Russia (Kazan), three variants of connection were developed: Poland–Lithuania–Latvia––Russia; Poland–Belarus–Russia; Poland–Ukraine–Russia. For each variant, there were four possible route options: fastest, shortest, cheapest ways with tolls; avoiding toll roads. In all the variants, it was assumed that transport was performed by a single driver.

When analyzing all twelve variants of transport follow the methodology shown in Fig. 2.

For the calculation of fuel costs, average fuel consumption was estimated, depending on the category of the road, based on previous observations from other routes (exploited data directly from the vehicle) which are:

- 32 L/100 km for expressways and highways,
- 34 L/100 km for national roads,
- 36 L/100 km for local roads and main streets,
- 38 L/100 km for other roads.

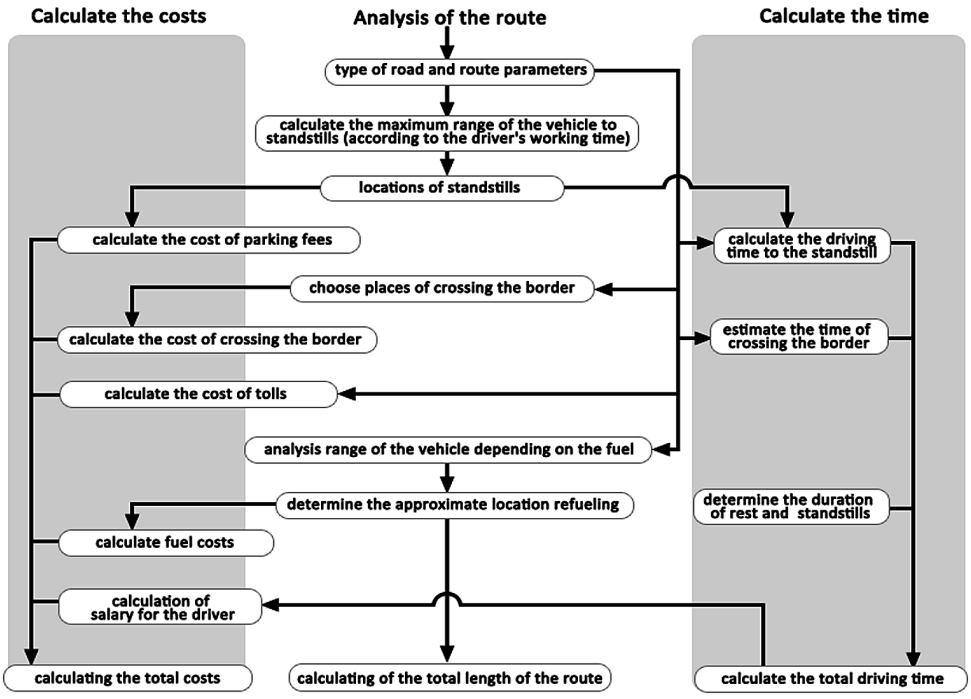

Fig. 2. Methods of analysis developed variants (own study)

The vehicle used by the company meets the emission standard Euro 5. Fuel unit costs were assumed as the average prices in force in that country (Table 1).

Average speeds assumed depending on road category:

– 85 km/h for expressways and highways,
– 70 km/h for national roads,
– 40 km/h for local roads and main streets,
– 35 km/h for other roads.

Table 1

Average fuel prices in the country [7]

	Price [currency/l]	Price [8] [PLN/l]
Poland	5.46 PLN	5.46
Lithuania	76.50 BYR	2.87
Latvia	4.37 LTL	5.30
Belarus	0.90 LVL	5.40
Ukraine	9.90 UAH	3.80
Russia	26.14 RUB	2.72

Movement time of the vehicle is scheduled for one driver in accordance with the current legislation, such as the law on drivers' working time [1]. Resulting from the driver's rest,

standstills have been planned to ensure maximum safety for the driver and cargo. Wherever it was possible and a longer standstill was necessary, it was planned to use parks recommended and approved as safe by the IRU organization. Short rest periods, i.e. 15–30 min were planned to provide minimum safety for the driver and cargo and to reduce the cost of paid car parks.

The planning of the transport variant which takes into account these types of standstills could be done only for the route through Belarus. For the two other variants on Russian territory, it was not possible to provide a safe option in all cases, and both routes are characterized by a greater threat than the route through Belarus. For the different analyzed solutions, the most preferred option, in terms of cost and time, is the route shown in Table 2. However, among all these presented alternatives, the best variant is the route between Poland, Belarus and Russia.

For the different variants analyzed, the most favorable option in terms of cost and time were the routes shown in Table 2, where the best solution is to use the route Poland–Belarus––Russia.

Table 2

Summary of the total cost and time of transportation for variants

	Lithuania and Latvia (shortest)	Belarus (fastest)	Ukraine (the cheapest with toll)
Total travel time including stops [h]	87	86	109
Distance [km]	2736	2639	3242
Total costs [PLN]	4460	4700	5142

Plan of routes shown in Table 2 is shown in Fig. 3 together with indications of standstill locations.

Fig. 3. The most favorable option for the analyzed alternative routes (own study)

Due to the diversity of the criteria, for selecting the optimal route AHP method [4] (*Analytic Hierarchy Process*) was used to compare the presented options. There are four main criteria taken into account: travel time; total cost; risk of delays at borders; safety (Table 3).

Table 3

Selection criteria for route variants

Criterion	Lithuania and Latvia	Belarus	Ukraine
Drivingtime [h]	87.00	86.00	109.00
Total cost [zł]	4460.00	4700.00	5142.00
Risk of delays at borders	Large	Medium	Small
Safety	Poor	Good	Poor

The range of scores for each criterion was assumed between 1 and 9. A score of 1 means no priority (the same preference)and 9 is an indisputable advantage (preference).The matrix of priority criteria takes the form shown in Table 4.

Table 4

The matrix of priority criteria

	Drivingtime	Total cost	Risk of delays at borders	Safety
Drivingtime	1	1	1/3	3
Total cost	1	1	1/2	3
Risk of delays at borders	3	2	1	2
Safety	1/3	1/3	1/2	1
Sum	16/3	13/3	7/3	9

However, the matrix of alternative route preference takes the form shown in Table 5.

Table 5

The matrix of alternative routes preferences

	Drivingtime		
	Lithuania and Latvia	Belarus	Ukraine
Lithuania and Latvia	1	1	4
Belarus	1	1	4
Ukraine	1/4	1/4	1
	Total cost		
	Lithuania and Latvia	Belarus	Ukraine
Lithuania and Latvia	1	1/3	6
Belarus	3	1	3
Ukraine	1/6	1/3	1
	Risk of delays at borders		
	Lithuania and Latvia	Belarus	Ukraine
Lithuania and Latvia	1	1/3	5
Belarus	3	1	2
Ukraine	1/5	1/2	1
	Safety		
	Lithuania and Latvia	Belarus	Ukraine
Lithuania and Latvia	1	3	1/3
Belarus	1/3	1	1/3
Ukraine	3	3	1

As a result of the three variants AHP analysis, according to the criteria and score factors presented, the following final scores were obtained:
– Final score for Belarus: 0.46,
– Final score for Lithuania and Latvia: 0.36,
– Final score for Ukraine: 0.18.

Therefore, taking into account not only the cost and time, but also the safety and risks of waiting at the border, we may conclude that, according to these criteria, the optimum route is the route Poland–Belarus–Russia.

4. Route details

The route chosen by the AHP analysis runs through the Polish, Belarus and Russian territories. It is scheduled for 6 short stops and a stop in Terespol at the Belarus-Poland border. On the border of Belarus–Russia it is not required to wait for passage. Detailed information about the route is shown in Table 6.

Table 6

Detailed information about the route variant Poland-Belarus-Russia

Location	Distance [km]	Drivingtime	Parking fee [zł]	Action
Wrocław (PL)	–	–	–	Start
Duchnów (PL)	370	4 h 28 min	–	Short standstill
Terespol (PL)	168	2 h 17 min	–	Crossing the border
Brest (BY)	10	0 h 12 min	–	Short
Baranovichi (BY)	215	1 h 54 min	453	Rest
Borisov (BY)	225	2 h 03 min	–	Short
Orsha-Smoleńsk (BY)	170	1 h 58 min	–	Crossing the border
Khlystovka (RU)	19	0 h 15 min	83	Rest
Uvarovka (RU)	310	4 h 30 min	–	Short
Bakovka (RU)	140	2 h 01 min	94	Rest
Standstill (RU)	140	2 h 00 min	–	Short
Kstovo (RU)	297	3 h 32 min	88	Rest
Standstill (RU)	300	3 h 30 min	–	Short
Kazań (RU)	275	3 h 54 min	–	Stop

In conclusion, the chosen variant of route through Poland–Belarus–Russia can be characterized by:
– Total driving time with standstills: 86 h,
– The total distance: 2639 km
– Total cost (4700 zł) which includes:
– tolls: 997.79 zł,
– fuel: 2534.40 zł,
– parking fee: 718 zł,
– the salary of the driver: 450 zł.

For the entire length the analyzed route allows the use of secure parking for long standstills which reduces the risk of cargo theft or damage. Short standstills can take place at any convenient location without additional dangers.

5. Conclusions

In this paper, twelve cargo road routes between Poland and Russia through Lithuania, Latvia, Belarus and Ukraine were analyzed. Standstills required by law were planned to be realized in safe parking areas. The optimal route (due to time, cost and safety) was chosen with the use of the AHP method. It proved that the optimal solution is the route through Belarus. In addition, the second alternative route passing through Lithuania and Latvia with similar characteristics was set. Although this route is cheaper, it does not allow parking at secured car parks in Russia. The analysis guarantees a good starting point for the final design and routing of cargo between Poland and Russia.

The chosen route has been revised and based on real cargo transport. Execution of the route planned by these guidelines was made possible by the courtesy of one of the Malopolska transport companies, which is engaged in the carriage of cargo, inter alia, in relation to routes from Poland to the east and south.

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