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The process of organisation of abnormal road transport on the example of Poland

GABRIEL LESIAK[1], SZYMON MITKOW[2]

[1]Military University of Technology, Doctoral School, 2 gen. S. Kaliskiego Str., 00-908 Warsaw, Poland, gabriel.lesiak@wat.edu.pl

[2]Military University of Technology, Faculty of Security, Logistics and Management, 2 gen. S. Kaliskiego Str., 00-908 Warsaw, Poland, szymon.mitkow@wat.edu.pl

Abstract. The purpose of the article is to characterise the road transport of abnormal loads and the process of obtaining an abnormal transportation clearance as well as to present a method of supporting transport organisation. The authors undertook to characterise road transport of abnormal loads in light of Polish conditions. The current legal environment in Poland, foreign and domestic literature were used in the research for analysis. The planning process for transport of abnormal load with the analysis of requirements specified was performed in a practical manner. In addition, the successive steps of this process were included on a structured algorithm, showing the steps taken in the research methodology. A detailed analysis showed the complexity of abnormal road transport and the challenges it faces. The experience conducted shows that the process of obtaining an abnormal transportation clearance is time-consuming and involves many institutions working together. An analysis of the requirements for abnormal transport shows the process areas that are bottlenecks. Focusing efforts on their proper organisation can ensure safe preparation of transport and effective management of the entire transportation process. The experience conducted to obtain an abnormal transportation clearance allows us to learn and understand this process, which can be a kind of signpost for those organising such transport without the necessary knowledge. The authors conducted an experiment, applying for a hypothetical abnormal transportation clearance to the General Directorate of National Roads and Motorways.

Keywords: abnormal transport, road transport, organisation of transport, transport management
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1. Introduction

Nowadays, Poland and European countries are undergoing economic growth, along which the transportation is developing [1] and the demand for oversize or overweight load transportation is increasing. This relationship is due to the construction of large industrial centres, manufacturing plants or facilities of strategic importance to the country's energy security. During the erection of the aforementioned facilities, it is not uncommon to use gigantic structures, machines or components of great size and weight. The need to erect such structures or install equipment of this type involves moving them between the point of their manufacture or purchase and their final destination. The answer to this need is abnormal loads transport, which is intended to move distinctive loads, the dimensions and weight of which significantly stand out from ordinary goods in the logistics chain. There is no database in Poland that keeps statistics on abnormal transports performed [2]. A representation of the number of transports made can be, in simple terms, the number of abnormal transportation clearances issued for transports. A summary of the number of abnormal transportation clearances issued by the General Directorate of National Roads and Motorways (GDDKiA) in 2020 is shown in Table 1.

Table 1

List of abnormal transportation clearances issued by the Directorate of National Roads and Motorways in 2020

No.	BRANCH OFFICE	2020															
		Total number	By category														Total amount in PLN
			IV				V				VI				VII		
			months												14 days (single)	30 days (multiple)	
			1	6	12	24	1	6	12	24	1	6	12	24			
1.	GDDKiA Central	3541	64	22	32	25	355	247	131	135	160	137	20	38	1881	294	4242140
2.	GDDKiA O/Wrocław	704	1	0	0	0	4	46	20	53	2	24	3	13	436	102	1244890
3.	GDDKiA O/Bydgoszcz	769	0	6	2	2	2	178	12	37	11	118	8	13	356	24	1024770
4.	GDDKiA O/Lublin	396	0	10	3	2	2	29	4	30	1	49	3	14	185	64	699380
5.	GDDKiA O/Zielona Góra	111	0	13	0	6	1	16	2	9	0	2	0	1	24	37	150450
6.	GDDKiA O/Warszawa	1665	0	8	0	4	1	72	42	63	14	166	31	59	900	305	2737440
7.	GDDKiA O/Opole	420	2	11	0	4	1	20	9	29	1	54	3	49	215	22	754940
8.	GDDKiA O/Białystok	102	0	4	1	2	1	9	3	15	0	10	1	5	43	8	159770
9.	GDDKiA O/Rzeszów	518	1	3	1	3	1	75	10	15	2	58	1	26	286	36	842150
10.	GDDKiA O/Gdańsk	530	0	6	1	2	0	107	6	30	3	130	6	27	183	29	862370
11.	GDDKiA O/Poznań	2090	4	15	3	3	5	128	24	70	15	92	26	49	1148	508	3751380
12.	GDDKiA O/Szczecin	480	0	0	1	1	0	37	11	18	0	74	2	12	161	163	737510
13.	GDDKiA O/Łódź	410	0	11	4	3	1	37	6	40	4	57	3	21	201	22	711000
14.	GDDKiA O/Kraków	164	1	0	1	4	4	26	9	27	2	51	8	21	7	3	384700
15.	GDDKiA O/Katowice	599	2	9	0	8	0	92	21	50	2	70	13	59	196	77	1109460
16.	GDDKiA O/Kielce	295	1	2	0	5	2	41	7	21	0	32	4	6	169	5	463730
17.	GDDKiA O/Olsztyn	398	0	1	0	1	1	26	14	18	2	25	2	8	206	94	568810
	Total	13192	76	121	49	75	381	1186	331	660	219	1149	134	421	6597	1793	20444890

Source: own elaboration based on the data from head office of the General Directorate for National Roads and Motorways

The data in Table 1 show that in 2020 the General Directorate for National Roads and Motorways issued the total of 13,192 abnormal transportation clearances through its branch offices. Half of these are category VII clearances issued for 14 days — that is, for vehicles exceeding the permitted dimensions, weight, and axle loads. These are: the width of 4 m, the length of 30 m, and the height of 4.3 m, respectively with a total actual weight of 60 t and a single drive axle load of 11.5 t. Transports under such a clearance may only be performed along the route specified in that clearance. The conditions for performing the transport are contained in the relevant clearance. The conditions are specified based on: the date and times of transport, the speed of transport, traffic arrangement, protection of service equipment placed in the right of way and ensuring traffic safety. Depending on the needs, the transport can be carried out in a specific lane of way or roadway centerline, including the manner of additional reinforcement for roads or road bridge structure spans, transport speed limits through structures or restriction and elimination of the movement of other vehicles on such a structure [3].

The modelling method can be applied for mapping transportation processes or portions of them [4]. When combined with access to statistical data, it allows us to study the phenomena occurring in transportation and forecast their further direction [5]. The system model is treated as a deliberately and intentionally simplified representation of reality. Its main features are extracted, which are relevant to the chosen research objectives [6]. According to the principle of seeking to simplify the model, features that are irrelevant from a given viewpoint should be omitted during modelling. Simplifying models allows us for clear and transparent presentation of their features. Simulation can be used to explore extensive relationships that exist in a logistics network. In the simulation, a model of the system is created, on which experiments can be then performed and results obtained can be analysed [7]. Modelling methods can be used to improve safety in road transportation [8]. During the organisation of logistics processes, including abnormal transports, appropriate IT tools can be used. In the following part of the work, the method of selecting the right means of transportation for the abnormal cargo under consideration will be presented, using a computer program.

2. Organisation of abnormal loads transport

2.1. Movement of abnormal vehicles

Abnormal transports stand out from common transports [9]. Due to their specifics and market demand, they should be considered as a comprehensive logistic, shipping and transport service, which requires the implementation of a great number of organisational projects [10]. In order to provide it, there should be a specialised staff – or the possibility of outsourcing it – to deal with the preparation, supervision, piloting and provision of maintenance along the route during the transport [11].

Abnormal road transportation is burdened with a number of legal conditions. During its planning, it is necessary to take into account a number of factors affecting the selection of the best transport route and to obtain the required clearance for its implementation [12]. Among the aforementioned factors there are the clearance gage and vertical clearance of roads and civil engineering structures, permissible axle loads or at least the hours during which transport can take place [13]. The condition of road infrastructure is also of great importance, which requires continuous maintenance and improvement, so that road transport can be performed as efficiently as possible [14]. In general, each abnormal load transported requires individual logistical preparation, specialised equipment for loading and unloading, and for the transport itself according to market practice. The movement of an abnormal vehicle can be allowed only after several conditions are met. The abnormal transportation clearance of a relevant category must be obtained that is issued by the way of an administrative decision by the competent authority. A transport clearance is required for vehicles exceeding the following values [9]:

— vehicle width: 2.55 m;
— vehicle length:
  • single vehicle: 12.00 m;
  • with a trailer: 18.75 m;
  • the total length of a road tractor with a semi-trailer: 16.50 m;
  • bus: 15.00 m;
— maximum height with load: 4 m.

Subsequently, the conditions set forth in the respective clearance must be followed when making the transport. In the photograph shown, the loading of a tower component that is part of a wind power plant is carried out using self-propelled hydraulic boom cranes and a specialised multi-axle semi-trailer with an adapter for transporting cylindrical loads. Preparing the transport of such loads is extremely time-consuming, generates high costs and requires considerable labour. Suitable load protection is crucial for safety [15]. An example of an abnormal load is shown in Fig. 1.

The driver of an abnormal vehicle is required to exercise extreme caution on the road. In March 2021, an amendment to the regulations governing abnormal transport came into force in Poland, bringing the existing legislation into line with European Union (EU) standards. The classification of categories of abnormal transportation clearances was simplified, which translates into easier planning of an abnormal vehicle routes. Abnormal loads can be picked up even in small towns and then transported through the main transport routes in Poland to a destination in any part of the country. When the new regulations became effective, proceedings were discontinued that were initiated and not concluded with the decision on the imposition of fines for failure to properly authorise the transit of vehicles whose single drive axle loads exceeded 11.5 tons. Single drive axle vehicles with a maximum axle load of 11.5 tons were allowed to travel on all Polish public roads in line with

European standards. However, local road administrators may impose restrictions on axle loads on the roads they manage under certain conditions. The new regulations also brought an increase in fines for exceeding the law. The introduction of the new regulations is a consequence of the Judgment of the Court of Justice of the European Union (CJEU) of March 21, 2019. The CJEU ruled that Poland's system for granting permits for vehicles with single axle loads of up to 11.5 t is incompatible with EU regulations. The judgment imposed an obligation on Poland to amend its national legislation and to take all measures to ensure the correct application of EU regulations [16]. The European Union's approach to transportation is expressed in the sustainability of mobility. It is intended to provide conditions for the free exchange of goods, services and capital, as well as the movement of people. EU requirements that apply to transportation are respectively [17]:

- the need for liberalisation in transportation services;
- implementation of the principles of guided state aid and free competition;
- precise definition of technical, social, safety and also environmental standards;
- adaptation of transportation infrastructure to high quality standards.

Fig. 1. Example of an abnormal load
Source: http://www.transannaberg.pl/en

This approach is intended to promote economic growth and to develop trade. In addition, it is expected to contribute to the development of Europe's competitiveness with the rest of the world in the quality of everyday life of its people.

The transit of an abnormal vehicle may require piloting by a single pilot vehicle when the oversize/ overweight vehicle exceeds one or more of the following values:

— length — 23 m;
— width — 3.2 m;
— height — 4.5 m;
— actual total weight — 60 t.

The piloting should be understood as a set of activities performed on the road by the pilot using the pilot vehicle in order to ensure road traffic safety during the transit of a vehicle. A pilot vehicle is a properly equipped and marked motor vehicle with a gross vehicle weight of up to 3.5 t, except for a motorcycle [3]. Using such a vehicle, the pilot secures the transit of an abnormal vehicle or a column of such vehicles. A column of abnormal vehicles should be escorted by two pilot vehicles – at the front and at the end of the column. Two pilot vehicles should also be used to escort an abnormal vehicle that exceeds at least one of the following values:

— length — 30 m;
— width — 3.6 m;
— height — 4.7 m;
— actual total weight — 80 t.

In this case, the pilot vehicles should move in front and behind the abnormal vehicle. An example of piloting such vehicle is shown in Fig. 2.

Fig. 2. Piloting an abnormal vehicle
Source: https://www.hak.com.pl/hak/artykuly/transport-nienormatywny-cz.-iii.html

As it can be seen in the figure above, a wind turbine rotor blade must be transported and escorted with two pilot vehicles. The permissible length of the abnormal vehicle exceeded — 30 m. The second pilot vehicle can be seen in the distance behind the oversize vehicle. The piloting must be performed in such a manner as to ensure safety and minimise traffic disturbances that may arise while piloting the vehicles. Pilot vehicles should be specially marked and equipped. Pilot vehicles must have two yellow flashing lights, means of radio communication with vehicles being piloted, sound amplification equipment, and a signage board. In addition, such vehicles may be equipped with a searchlight — switched on and off independently of other lights — and a white or yellow light with the word "PILOT" written in black, placed under the board [18]. It should be noted that the obligation to pilot abnormal vehicles in no way slows down the transit, but on the contrary, increases the safety of all road users. Adapting to the pilot's instructions usually takes up to few minutes, and in extreme cases these are the minutes that can have significant impact on traffics safety. Typically, the pilot secures the abnormal vehicle by driving at the rear, while following the maximum left-most outline of the width of the load. In order to prevent the overtaking of an abnormal vehicle, the pilot usually enters the opposite traffic lane and "closes" it. However, it is quite common that, despite the obvious signals given to other road users, drivers of other vehicles try to avoid the "obstacle" they have noticed by overtaking the pilot vehicle on the shoulder [19]. Such drivers cause traffic hazards due to their haste and recklessness.

2.2. Obtaining the abnormal transportation clearance

In order to investigate and characterise the process of issuing the abnormal transportation clearance, the author filed the application to the relevant institution — the General Directorate of National Roads and Motorways (GDDKiA) for the purpose of the research paper. The abnormal load, the transport of which will be hypothetically considered is a transformer weighing 89 t. In order to transport such a heavy load, it is necessary to use suitable means of transport. After selecting a specialised transport set consisting of a ballast tractor and a low-loading semi-trailer, the weight of the overweight vehicle is 148 t. The dimensions of the set including load are respectively: length — 35.00 m, width — 3.85 m, and height — 4.55 m. The transport would be between two provinces in Poland, from the city of Kutno to Warsaw. Accordingly, the application should be submitted to the competent branch office, where the start of the transport is — in this case, it was the Łódź Branch Office of the General Directorate of National Roads and Motorways, therefore the staff of this branch office reviewed and accepted the proposed transport route and agreed it with other road administrators. The loading site was located at Wschodnia 2 Street in Kutno and the unloading site was at Mory 8 Street in Warsaw. Thus, both the Łódź Branch Office of the General Directorate of National Roads and Motorways

and the Kutno City Hall and the Warsaw Branch Office of the General Directorate of National Roads and Motorways together with the Warsaw Municipal Roads Authority participated in the review and acceptance process for the route. In practice, if the route leads through roads under the authority of multiple road administrators, the process of agreeing on the route of transport becomes significantly longer. The route shown in Fig. 3 was proposed.

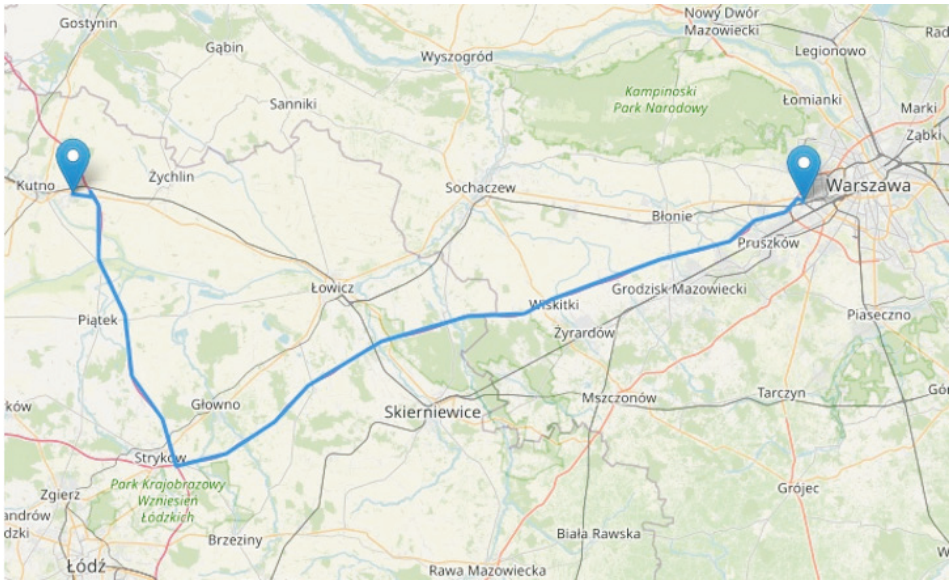


Fig. 3. The transport route proposed by the author
Source: https://www.wyznacz-trase.pl/wyznaczanie-trasy

The route proposed in the figure above runs almost entirely through the A1 and A2 motorways and the S8 expressway — the transportation routes with the most favourable parameters for roadway width or clearance under engineering structures and signage on the road. In order to specify the technical and functional requirements for Polish roads, the legislation introduced a division into the following classes [20]:

- motorways designated with the symbol "A";
- expressways designated with the symbol "S";
- fast traffic trunk roads designated with the symbol "GP";
- trunk roads designated with the symbol "G";
- service roads designated with the symbol "Z";
- local roads designated with the symbol "L";
- access roads designated with the symbol "D".

This division is important from the point of view of the movement of abnormal vehicles, especially due to their dimensions. For example — class A roads have 3.75 m wide lanes, whereas class S roads have 3.5 m wide lanes.

The Łódź Branch Office of the General Directorate for National Roads and Motorways proposed a slightly modified route than that proposed by the author. Taking safety into account, the abnormal vehicle was diverted to a parallel route with less traffic. It is shown in Fig. 4.

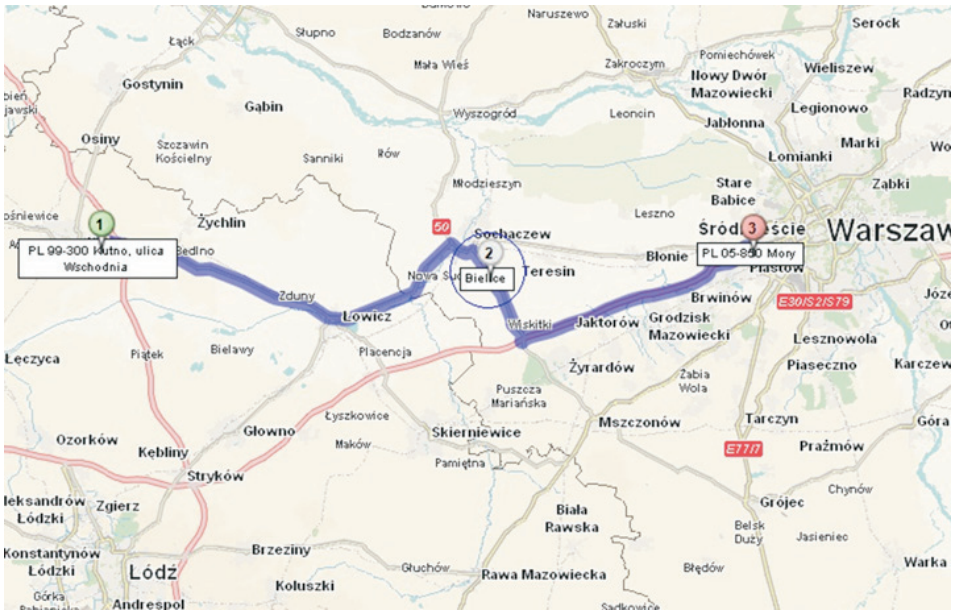


Fig. 4. The transport route proposed by the author
Source: PTV Map & Guide software

According to the figure above, the transport would be via the DK92 and DK50 national roads and the S8 expressway, while bypassing motorways. The new route was approved. A prerequisite for approval of the route was an expert's report on the possibility of crossing two engineering structures: a flyover in the town of Łowicz at km 398 + 188 of DK 92; and a bridge in the town of Maurzyce at km 392 + 645 of DK 92. Reports on the possibility of crossing individual engineering structures are prepared by the Bridges Department of the General Directorate of National Roads and Motorways in each branch office. Having received the technical reports from the Bridges Department of the National Roads and Motorways Branch in Łódź, a positive decision was made regarding the possibility of the abnormal vehicle transit and the proposed route was approved. During the process of exchanging documentation, a letter was sent from the Łódź Branch Office to the Warsaw Branch Office and

the Kutno City Hall to agree on the proposed transport route. The Warsaw Branch Office of the General Directorate for National Roads and Motorways, on the basis of letters exchanged with the Łódź Branch Office and the Municipal Roads Authority in Warsaw, has approved the route within its area of responsibility. An employee of this unit included the following in the document sent: parameters of the vehicle, the application data, and the proposed transit route. Then, an abnormal transportation clearance was issued as a final step. Putting in order the process described above, it is illustrated in a graphical algorithm, in Fig. 5.

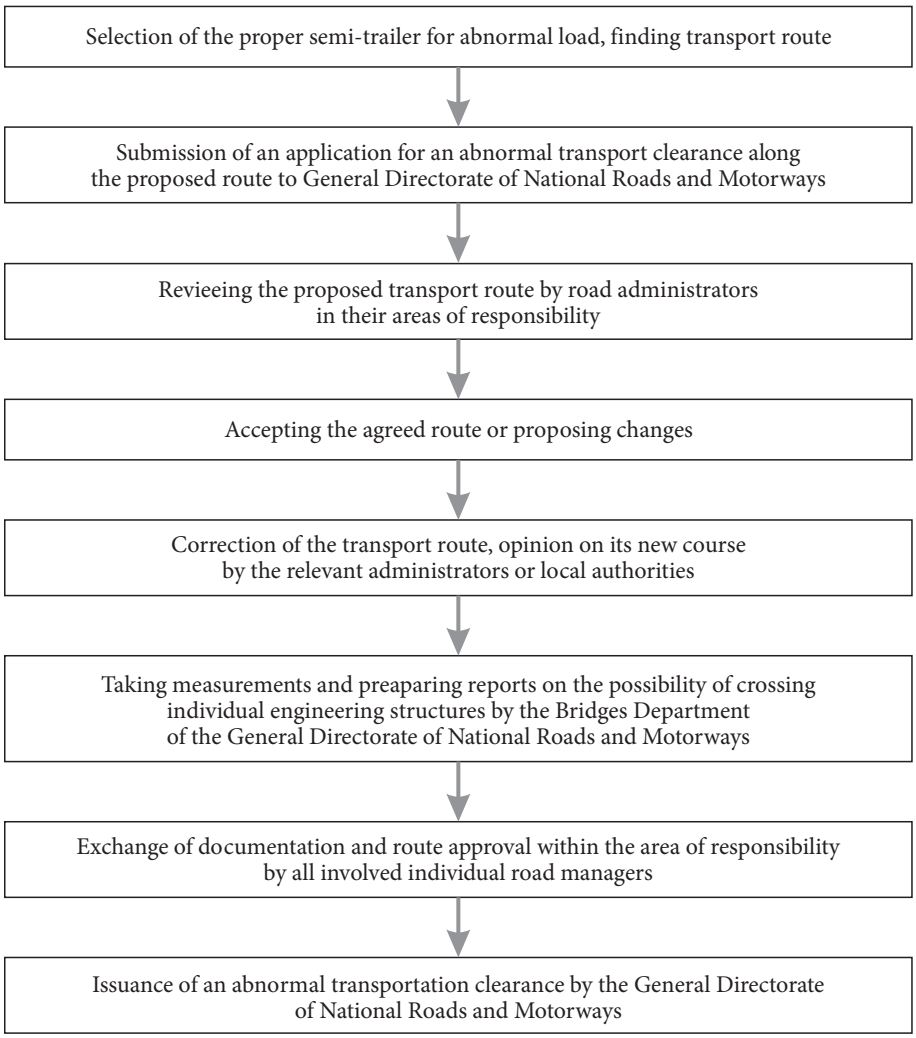


Fig. 5. Algorithm for obtaining the abnormal transportation clearance
Source: Authors own elaboration

As it can be seen, the entire process of agreeing on a transit route is complex. The initial route proposal, submitted by the applicant for an abnormal transportation clearance, may be amended as in the case presented. Subsequently, respective branch offices of the General Directorate for National Roads and Motorways and relevant road administrators agree on the possibility of transport along the designated route. Following the final agreement of these authorities, an abnormal transportation clearance may be finally issued. It should also be noted that this is a time-consuming process. When planning the movement of an abnormal vehicle, sufficient time should be scheduled for the permitting process.

3. Method of computerised selection of means of transport for an abnormal loads

For practical application of the IT tools in the movement of abnormal vehicles, the method of choosing proper trailer was created in Microsoft Excel. The method is intended to select a semi-trailer suitable for the load under consideration. It is therefore based on load parameters entered into the table, which should be done in the first step. The semi-trailer suitable for the load is selected from among the products of Goldhofer, the market leader in the production of semi-trailers adapted to the transportation of oversize or overweight loads. Examples of load parameters are, respectively: weight of 70 t, length of 8 m, width of 3.5 m, and height of 4 m. Knowing the parameters of the load to be transported, the method will indicate which semi-trailers will be suitable for its transportation from among the created database. For this purpose, the "IF" function and the "AND" function was used. These functions are shown in Fig. 6.

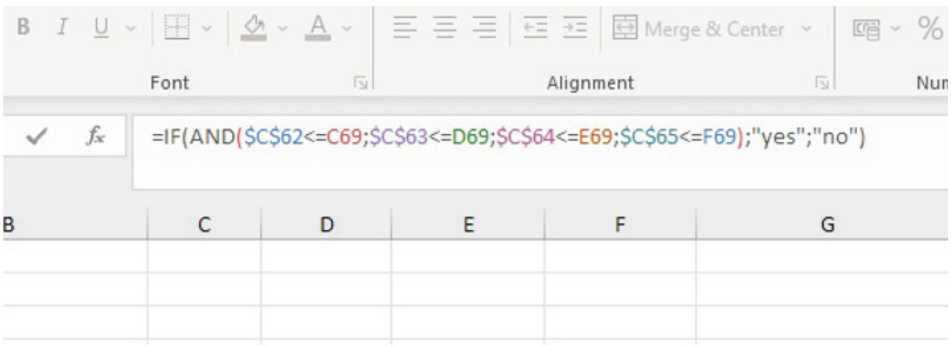


Fig. 6. Functions used to create the method
Source: MS Excel spreadsheet

The "IF" function is one of the most popular functions in Excel, which provides the opportunity to create logical comparisons of values to expected results. Thus, the function has the ability to generate two results. The first result is obtained if the comparison is true, and the second result is obtained if the comparison is false. In contrast, the "AND" function is used to check whether all conditions or logical tests are met. The conditions are entered in the function input field following the name, which if true, the function returns the value TRUE, if at least one of the conditions is not true, the function returns the value FALSE. Combining the "AND" function with the "IF" function makes it possible to check the truth of statements and conditions simultaneously. The use of this function allowed the creation of a semi-trailer selection method, which is shown in Fig. 7.

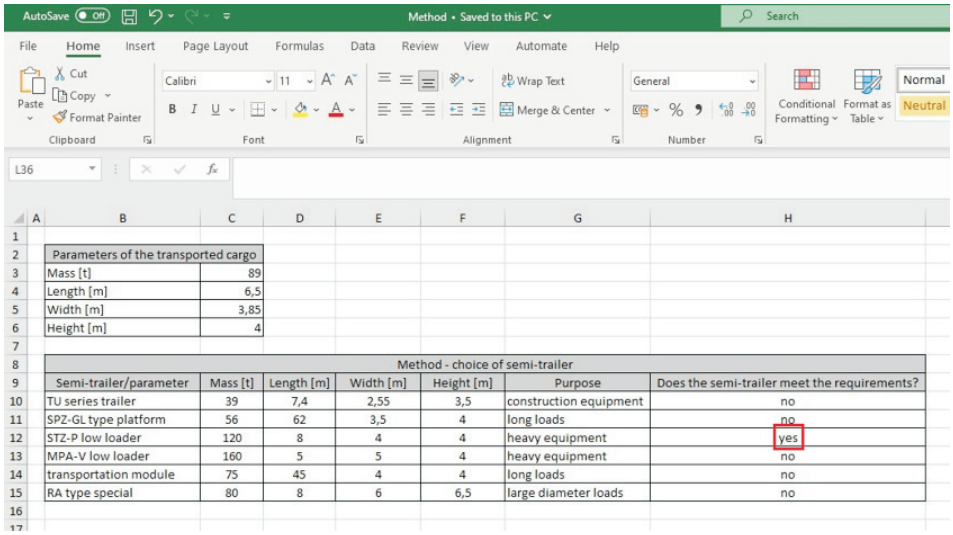
	Parameters of the transported cargo	
	Mass [t]	70
	Length [m]	8
	Width [m]	3,5
	Height [m]	4

Method - choice of semi-trailer						
Semi-trailer/parameter	Mass [t]	Length [m]	Width [m]	Height [m]	Purpose	Does the semi-trailer meet the requirements?
TU series trailer	39	7,4	2,55	3,5	construction equipment	no
SPZ-GL type platform	56	62	3,5	4	long loads	no
STZ-P low loader	120	8	4	4	heavy equipment	yes
MPA-V low loader	160	5	5	4	heavy equipment	no
transportation module	75	45	4	4	long loads	yes
RA type special	80	8	6	6,5	=IF(AND(C3<=C15;C4<=D15;C5<=E15;C6<=F15);"yes";"no")	

AND(logical1; [logical2]; [logical3]; [logical4]; [logical5]; ...)

Fig. 7. Principle of operation of the method
Source: MS Excel spreadsheet

The presented method checks whether there is a means of transport in the semi-trailer database suitable for transporting a load with the given parameters using the aforementioned functions. The method compares load and semi-trailer parameters. If values of all individual load parameters are less than or equal to the corresponding semi-trailer parameters, then the semi-trailer in question is suitable for transporting the load in question. In such a situation, the cell "Does the semi-trailer meet the requirements?" will show "yes". If any of the load parameters is greater than the corresponding semi-trailer parameter, a "no" message will appear in the indicated cell. Knowing the previously presented load parameters for which the transportation clearance is requested, as well as the main parameters of the characteristic semi-trailers, it is possible to make computer selection of a means of transport for abnormal load. In an earlier part of the work, an application was made to the General Directorate for National Roads and Motorways for a permit to transport a specific cargo — a transformer. In order to test the correctness of the method presented here, the abnormal cargo parameters were entered into the spreadsheet. The results of the method are shown in Fig. 8.



Parameters of the transported cargo	
Mass [t]	89
Length [m]	6,5
Width [m]	3,85
Height [m]	4

Method - choice of semi-trailer						
Semi-trailer/parameter	Mass [t]	Length [m]	Width [m]	Height [m]	Purpose	Does the semi-trailer meet the requirements?
TU series trailer	39	7,4	2,55	3,5	construction equipment	no
SPZ-GL type platform	56	62	3,5	4	long loads	no
STZ-P low loader	120	8	4	4	heavy equipment	yes
MPA-V low loader	160	5	5	4	heavy equipment	no
transportation module	75	45	4	4	long loads	no
RA type special	80	8	6	6,5	large diameter loads	no

Fig. 8. Verification of the semi-trailer selection method
Source: MS Excel spreadsheet

Having entered the transformer parameters into the spreadsheet and used the "IF" and "AND" functions, the method indicated which semi-trailer would be suitable for transporting the abnormal load in question. The selected means of transportation is a low-loading semi-trailer of the STZ-P type. The selected semi--trailer is presented in Fig. 9.

Fig. 9. STZ-P type low-loading semi-trailer
Source: http://www.jensen-media.de/webgalerie/goldhofer/goldhofer_news_Bauma/source/seite_5_stz-p10.html

The semi-trailer shown here has 10 steering axles, allowing for a more efficient distribution of the centre of gravity of the load being transported. Once the route was set out and the means of transportation selected, the next step is to apply for the abnormal transportation clearance according to the procedure outlined earlier. Only after obtaining the clearance, it can be commenced to transport the load and complete the transportation task.

4. Conclusions

When conducting the research included in the article, available legal documents, domestic and foreign literature on the issues considered in the paper were analysed. They allowed us to conclude that the process of planning the movement of abnormal loads is complex, fraught with many conditions, and requires cooperation of many individual units for it to occur. This phenomenon can be seen especially during the practical application for an abnormal transportation clearance. This action made it possible to go through the entire procedure accompanying this process in a practical way. Contact with specialists involved in the permitting process allowed the authors to significantly deepen their knowledge in the subject matter in question. The main conclusion drawn from these discussions is that the process of agreeing a transit route between different road administrator can add up to a week to the time it takes to obtain the clearance. In addition, each road administrator may request a different transit route. It takes a very long time from the creation of a transportation need to the final unloading of an abnormal load at the destination place depending on how demanding the load is. From the point of view of movement planning, the transportation route is extremely important. In order to select the optimum option, it is necessary to spend a lot of time analysing each of them. A great number of conditions can be characterised that limit the accessibility of a given route, which include the presence of bridges, roundabouts or even road islands and signs. The occurrence of such objects along the transit route entails the necessity of slowing down the entire transport, so that the obstacle can be overcome in a safe manner for the load and road infrastructure. It is also often the case that it cannot be avoided to disassembly an object, which also translates into longer transit times. Any adaptation work that needs to be done along the transit route also affects the final cost of performing the transportation service.

The presentation of a method of computerised selection of a trailer suitable for a load with the considered parameters showed that the use of IT tools can be a useful support in the movement of abnormal loads. A distinctive feature of abnormal loads is the requirement for special transportation means for their transport. Semi-trailers used to transport such loads are distinguished by their modularity, increased payload capacity or simply by the number of axles. Thanks to the use of modern technological solutions, it becomes possible to transport a load of great weight or

very large dimensions, such as length. Computer science is an extremely extensive field that is currently widely used in logistics. By creating mathematical models, computer supported methods or performing simulations, logistic decision-making processes can be effectively supported. By creating them, it is possible to better learn and understand features of objects investigated, while reducing costs.

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Gabriel Lesiak https://orcid.org/0000-0001-9398-865X
Szymon Mitkow https://orcid.org/0000-0003-2845-2589

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G. LESIAK, S. MITKOW

Proces organizacji drogowych przewozów nienormatywnych na przykładzie Polski

Abstrakt. Celem artykułu jest scharakteryzowanie drogowego transportu ładunków nienormatywnych w świetle polskich warunków, a także procesu uzyskiwania zezwolenia na przejazd pojazdu nienormatywnego oraz przedstawienie metody wspomagającej organizację przewozu. W badaniach do analizy wykorzystano aktualny stan prawny w Polsce, literaturę zagraniczną oraz krajową. W sposób praktyczny zrealizowano proces planowania przemieszczenia ładunku nienormatywnego z dokonaniem analizy stawianych przed nim wymagań. Kolejne kroki tego procesu zawarto na uporządkowanym algorytmie przedstawiającym działania podjęte w ramach metodyki badań. Szczegółowa analiza pokazała złożoność drogowego transportu nienormatywnego oraz wyzwań, które przed nim stoją. Z przeprowadzonego doświadczenia wynika, że proces uzyskiwania zezwolenia na przejazd pojazdu nienormatywnego jest czasochłonny i angażuje wiele współpracujących ze sobą instytucji. Analiza wymagań stawianych transportowi nienormatywnemu pokazuje obszary tego procesu, które są wąskimi gardłami. Skupienie wysiłku na ich właściwej organizacji może zapewnić bezpieczne przygotowanie przewozu i efektywne zarządzanie całym procesem transportowym. Autorzy przeprowadzili doświadczenie, występując z wnioskiem o wydanie zezwolenia na hipotetyczny przejazd drogowy pojazdu nienormatywnego do Generalnej Dyrekcji Dróg Krajowych i Autostrad. Przedstawiono metodę doboru środka transportowego i zweryfikowano jej działanie na rozpatrywanym przykładzie. Przeprowadzone w praktyce doświadczenie uzyskania zezwolenia na przejazd pojazdu nienormatywnego pozwala poznać i zrozumieć ten proces, co może być drogowskazem dla organizujących przewozy tego rodzaju bez niezbędnej wiedzy.

Słowa kluczowe: transport nienormatywny, transport drogowy, organizacja transportu, zarządzanie transportem

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