

THE IMPORTANCE OF LOADING TERMINALS IN THE DEVELOPMENT OF INTERMODAL TRANSPORT

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Abstract

The European transport policy assumes the growth of intermodal transport utilization within cargo haulage. Systematic increase of cargo weight and performed haulage operations using the concept of intermodal transport has been noticed in Poland. However, its share in total volume of transported goods is still relatively low. One of the main factors supporting or decelerating the intermodal transport development is related to the existing intermodal loading terminals network. Within this field, one must underline not only the number and location but also a series of other parameters that affect the level of the performed terminal-based services. On this basis, the objective of the paper is identification of main features of terminals that are important in view of the development of intermodal transport and to present the condition of Polish loading terminals network from the standpoint of further development of intermodal transport in the country.

Keywords: Intermodal transport, intermodal loading terminal, ITU, terminal parameters

1. INTRODUCTION

The need for intermodal transport development is emphasized in many documents and strategic projects related to transport within the EU. However in practice, utilization of intermodal transport in Poland is still low, even though it shows growing tendency. Many publications describe barriers decelerating the development of this form of haulage and underline potential directions of changes that could contribute to popularization of the idea of inter-branch cargo transport using one, fixed loading unit. The existing intermodal loading terminals are identified among key factors that positively or negatively affect the development of intermodal transport. These are the places that have proper capabilities facilitating loading operations of intermodal transport units (ITU) between various transport branches. Many analyses underline the existence of loading terminals as a condition for the development of intermodal transport. This assumption is completely true; however, one must emphasize that except for the number or location of the terminals, their parameters are very important issue, which are characteristic features that describe operations of a given object on the market.

In Poland, road and railway haulage is the key type of intermodal transport. Thus, the paper will focus on terminals operating within this transport framework. The paper will also identify terminal parameters that affect the form and level of implemented tasks. Based on this, they shape the role played by a single terminal within the whole transport network and affect the importance of the existing terminals network for the development of intermodal transport. These parameters will be identified based on publications analyses, road and railway loading terminals existing in practice and interviews with experts. The analysis covering 35 terminals in Poland will be performed considering the specified, most important features. Therefore, the objective of the paper is identification of main features of terminals that are important in view of the development of intermodal transport and to present the condition of Polish loading terminals network from the standpoint of further development of intermodal transport in the country.

2. THE ROLE OF TERMINALS IN THE DEVELOPMENT OF INTERMODAL TRANSPORT

Loading terminals are specified as transfer points, main nodes within the transport network. Loading and storage services concerning intermodal transport units (ITU) are performed here [1]. From different

perspective, they are presented as concentration points that allow for transferring cargo between any types of transport. Except the basic service, i.e. loading, it is more often underlined that current terminals are equipped with a series of solutions and devices that allow to perform many value added services, e.g. storage of empty units, regular maintenance and repair, filling and emptying, cleaning intermodal transport units [2, 3].

In order to develop intermodal transport and its competitiveness in relation of the dominating direct road transfers, it is important to properly design terminals so that they could meet the requirements concerning throughput, efficiency and quality [3]. A. Caris, C. Macharis, G.K. Janssens [4] mention the necessity to build intermodal terminal network with the major gravity focused on determination of the number and location of individual points and construction of a system of interconnections between the designed transport nodes. Many papers emphasize the meaning of terminals for the development of intermodal transport. Special attention is paid to location of terminals as a factor affecting efficiency and effectiveness of intermodal transport. The studies performed by E. Przybylska, M. Kruczek and Z. Żebrucki [5] point to the increase of the loading terminals number and development of their equipment as one of the main conditions related to development of intermodal transport. However, to be more specific on the subject, it is necessary to notice that the role of individual nodal points of the network is not identical. It results from parameters characterizing individual terminals. Requirements put before the terminals are given in the available papers. J. Ližbetin and Z. Čaha [3], first underline the time spent by ITU at the terminal and then the safety, rate and the lowest possible cost of loading. Requirements to be satisfied by the loading terminals within intermodal transport are also given in the European Agreement on important international combined transport lines and accompanying objects (AGTC) [6] concluded in Geneva in 1991 and applicable in Poland since 2002. It identifies terminals important for the international intermodal transport located in: Gdańsk, Gdynia, Gliwice, Cracow, Łódź, Małaszewicze, Poznań, Pruszków, Szczecin, Świnoujście, Warsaw and Wrocław. Moreover, it includes the minimum requirements concerning intermodal network terminals. They mostly concern time of service at the terminal, throughput and length of tracks as well as location facilitating easy and fast road access and ensuring good connection with the main long distance railway lines. It also emphasizes the minimum length of tracks for intermodal transport, which in case of current lines is 600 m and for the newly built and as a target value - 750 m [6]. In publications, the meaning of intermodal transport is conditioned on their functionality, e.g. the option of horizontal and vertical handling of transport units. Moreover, one draws attention to innovative technologies used at the terminals, e.g. innovative horizontal loading systems such as Modalohr [7]. In Poland, within the area of intermodal transport, there is a shortage of modern and innovative solutions of this kind, which fact results in clear dominance of containers within the structure of handled intermodal transport units, loaded within the scope of traditional vertical loading. In 2017, they represented 97.43 % of all handled ITUs [8]. Particularly important issue affecting the terminals potential is their capability for handling various ITUs, both containers, swap bodies, trailers or the whole vehicle combinations. In case of containers, it is necessary to point out the adaptation of terminals to handle various types of such units, both in the context of their dimensions and transported cargo (e.g. refrigeration containers, containers for hazardous materials). Throughput is one of the most important parameter that affects the role played by a terminal within the transport network. It depends, among other things, on the total time in transit an ITU / vehicle spends at a terminal and partial operating times of individual tasks. They represent the basic indicator for multi-criteria assessment of terminals. Moreover, important indicators concerning assessment of terminals operation efficiency include: handling equipment rate utilization, storage ITU, energy consumption rate, equipment performance, equipment haul, truck waiting rate, terminal occupancy, maintainability indicator, reliability indicator, system utilization rate, personnel distribution rate [7]. Another important parameter concerning terminals that affect the role they play in intermodal transport is loading operations rate. This category includes terminals: of international character - operating as hubs, of loading rate exceeding 70 thousand TEU; European - from 30 thousand to 70 thousand TEU and railway - below 30 thousand TEU [9].

Analysis of publications, reports, operations of loading terminals and interviews with experts allow for identifying terminals parameters that have significant impact on the role played by such points within intermodal



transport network and opportunity for further development of intermodal transport (**Table 1**). Strength of impact of individual parameters was assessed using a three-point scale: 1 - low impact, 2 - average impact, 3 - high impact.

Table 1 The importance of terminal parameters for the development of intermodal transport [own study]

Lp.	Terminal parameter	The impact of the parameter on	
		the position of terminals in the transport network	development of intermodal transport
1	Total area of the terminal	2	1
2	Terminal storage area	2	1
3	Supported ITU units	3	3
4	Supported branches of transport	3	3
5	Used reloading systems (ro-ro, lo-lo, ro-la)	2	3
6	Number and length of railway loading and unloading tracks	2	3
7	Arrangement of terminals (along or outside transport corridors)	3	3
8	Density of transshipment terminals in the region	1	3
9	Location in / outside the industrialized region	2	1
10	The scope of value-added services	2	2
11	Reloading capacity [in TEU]	3	3
12	Connection with motorways / expressway and main railway lines	3	3
13	Quantity and modernity of reloading devices	2	2
14	Efficiency of reloading devices	2	2
15	ITU service time	2	2
16	System of permanent intermodal connections	2	3
17	Space restrictions for further development	1	2
18	Number of connection points	2	1

To sum up and with reference to **Table 1**, one must notice that the parameters of terminals existing in the country have significant impact on both the location of individual terminals within transport network and future development of intermodal transport. However, it is important that not all parameters have the same strength within these two areas. Some of them (total area of a terminal, storage area, location within a region with high concentration of production operations, number of transfer stations) will be more important for the role played by a single terminal within the whole transport network. On the other hand, other ones (density of terminals within a region, number and length of tracks, space limit concerning further development, system of fixed connections, used loading systems) will be especially important for further development of intermodal transport within the country. However, half of the indicators play the same important role both in the location of a terminal within the network and in further development of intermodal transport (handled branches of transport and ITUs, location of terminals in relation to transport corridors, performance of value added services, loading capacities, connection with line infrastructure, ITU handling time, number, modernity and throughput of loading devices).

3. STATE OF POLISH LOADING TERMINALS AS A FACTOR IN THE DEVELOPMENT OF INTERMODAL TRANSPORT

In Poland, the number of loading terminals increased within the past few years. According to the list available on UTK site (*Office of Railway Transport*), the number of operating objects is 35 (UTK data from 2016 shows 31 terminals). The greatest number is located in the following Voivodeships: Łódzkie (6), Wielkopolskie (5), Śląskie (4), Pomorskie (4). Most of the objects is located near large and important urban agglomerations; moreover, they fit well in the routes of the TEN-T transport network corridors. However, the major problem is still the insufficient number of loading terminals in eastern Poland - Warmińsko-Mazurskie Voivodeship does not have any terminal, Podlaskie and Podkarpackie Voivodeships have one road and railway terminal each. This fact is especially unfavourable in the situation of dynamically growing trade with eastern Europe and Asia. Also the concept related to the development of the New Silk Road using land routes significantly reducing delivery time in relation to sea route, creates a series of challenges concerning the necessity to develop loading terminals in the eastern regions of the country. The density of the existing structure of terminals operating in Poland is 1 terminal per 8 933.71km² (in 2015 - 1 per 10 086.42km²). As stated by UTK (*Office of Railway Transport*) [11], in well developed countries (e.g. Germany), average density is 4.2 terminals per ca. 10 thousand km², i.e. 2 381km² per single terminal (in Poland 10 thousand km² translates to 1.12 terminals). The greatest density of terminals is located in Śląskie and Łódzkie Voivodeships, which are the closest to the best developed countries within this scope (Śląskie - 3 083km² per single terminal; Łódzkie - 3 036km² per single terminal). When converting to 10 thousand km² this amounts respectively: Śląskie Voivodeship - 3.24 terminals, Łódzkie Voivodeship - 3.29 terminals. The mentioned data is exemplified in **Figure 1**.

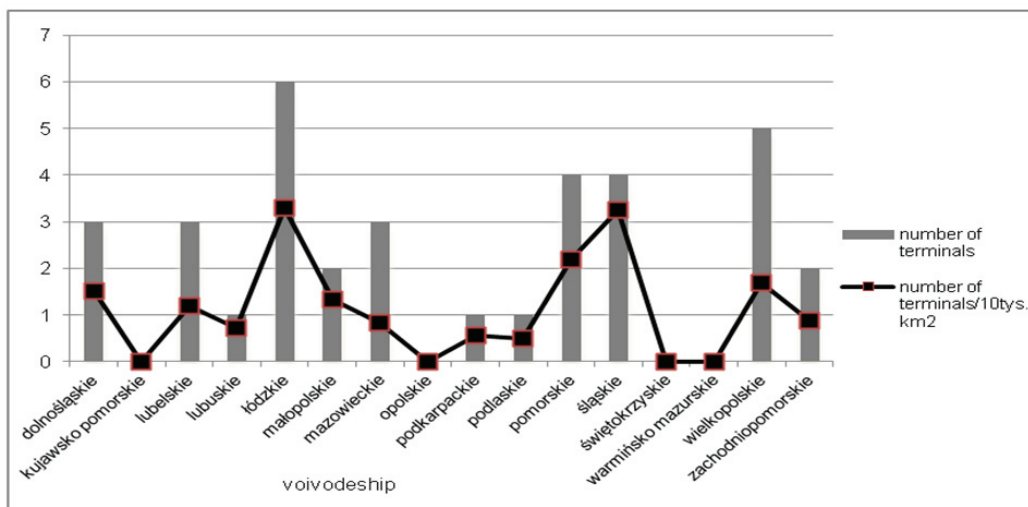


Figure 1 Structure of intermodal road - rail terminals by voivodeship [own study based on UTK data]

The analysed 35 intermodal terminals handle road and railway haulage; among them, six objects can be also classified a sea terminals, four objects additionally perform services related to inland navigation. Two objects are clearly visible against the background of all the analyses points: BCT - Bałtycki Terminal Kontenerowy Gdynia and Deepwater Container Terminal DCT Gdańsk SA. This is related to the fact that these points represent main node within the intermodal network that uses the developing sea transport. They have the greatest utility parameters within the scope of total area, storage area, maximum annual loading capabilities. Moreover, they have the greatest share in maximum annual loading capabilities in relation to all operating terminals (in 2015 - 43.79 %). Except for the two mentioned objects, terminals with lower parameters within this scope are dominating. In case of total area, 23 objects among all of them (66 %) have the area not exceeding 10 ha; moreover 32 out of 35 terminals (91 %) have the storage area up to 5 000 TEU, including 21 objects (60 %) with 2 500 TEU. However, maximum annual loading capabilities not exceeding 100 thousand

TEU concern 19 terminals (54 % among all object). Analysis of terminals from the standpoint of available railway tracks used for loading and unloading, shows that the level within this area is low. There is a problem related to handling the trains of length exceeding 600 m, and this is a problem even more important due to the fact the EU indicates the length of track about 750 m in order to handle full train sets. Low parameters related to track length negatively affect effectiveness and profitability of haulage, thus this is one of the most important parameters to improve when thinking about future development of intermodal transport. Performing various value added services by the analysed terminals is a positive aspect of their operations. Many objects offer developed package of services oriented at handling containers, these are: cleaning and washing, repairs, weighing, sealing, marking, offering connection stations for refrigerating containers, protection of containers with precious cargo and containers tracking. A positive aspect at terminals in Poland is the continuously growing number of fixed international connections mostly to Italy, Slovenia, Germany, Belgium, the Netherlands. However, there are still terminals that do not regularly handle fixed transport lines or that only have national connections. This significantly reduces a terminal potential and negatively affects intermodal transport development. All the analysed terminals perform containers loading and storage services, however they miss the option to handle other ITUs. Among 35 terminals, 13 objects (38 %) reported the capacity to handle containers only; only one has the capacity to reload vehicle combinations which fact causes that the RoLa systems are not developed in Poland. Moreover, not all terminals perform all operations concerning less popular units, such as: refrigerating containers, tank containers, containers with hazardous or precious materials, High Cube containers. This fact is a major challenge for the development of loading terminals and intermodal transport. To sum up, one showed the most important advantages and drawbacks existing within the Polish terminals network. Main advantages include: increase in number and density of terminals, significant number of terminals in central Poland, noticed systematic development of terminals, developed value added services, location in relation to TEN-T transport network corridor, good location - strategic location in the country and relatively good access to infrastructure. However, the main drawbacks are: technical condition of terminals, missing efficient loading equipment, insufficient length of loading and unloading tracks, relatively low number of regular and fixed international connections, limited throughput of terminals, unused potential and loading capabilities of terminals, uneven location of terminals (shortages in the eastern part, lack of adaptation to handle various ITUs and missing modern loading systems).

4. CONCLUSION

Development of intermodal transport is strongly conditioned on the network of existing, intermodal loading terminals. Both, their number, density of arrangement among individual regions and numerous parameters characterizing operating activities of an object are very important. In Poland, in spite of the noticed growth of loading terminals number, the situation is still not good. This is mostly related to uneven arrangement of terminals within the country and still low level of their parameters. In particular poor adaptation of terminals to handle various ITUs (except for containers), failure to satisfy the AGTC standards by railway sidings of length less than 600 m, low number of proper and effective loading equipment is noticed. Considering significant role played by loading terminals in the development of intermodal transport, it is necessary to further develop and modernize them. Development of the infrastructure in the eastern Poland is especially important because it will enable utilization of transit location of Poland in Europe and growth of trade exchange with Eastern Europe and Asia countries. Improvement within the scope of line road infrastructure is also important in order to achieve the required throughput and communication availability without which the terminals lose their value. Euroterminal in Sławków is an example of a terminal with insufficient line road infrastructure, generating problems within the scope of terminal access, in case of which current access infrastructure is a decelerating force for its development. It is also necessary to develop and improve line railway infrastructure which fact allows for starting new connections and improving the operating speed and trade rate of trains. Moreover, development of parking tracks for trains awaiting loading at a given terminal is also an important issue. It is necessary to further adapt terminals to handle all types of ITUs and improve the throughput of performed



services. Taking the next steps in order to allow improvement of technical condition of terminals, their modernization and increase of throughput will be the factor positively affecting the size of the performed intermodal haulage.

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