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## Intermodal transport in Poland in 2016

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### ABSTRACT

Nowadays intermodal transport is the foundation of international trade. In contrast to traditional transport, this transport seeks to combine various services and resources, thus contributing to the improvement of the entire distribution process. The basis of the interchangeable method for limiting the consequences of road transport is, as far as possible, intermodal transport. However, it should be noted that the implementation of the described system requires not only direct connection of each branch of transport, excellent knowledge of strengths and shortcomings, but also proposing more effective financial solutions and a better level of services. It is important that intermodal transport may play an important role in the exploitation of trade, as well as transit transport through Poland. In 2016, 35 active terminals were located in Poland: 28 of them are road terminals that served rail - road, while 7 other terminals were sea terminals that served sea - road and sea - rail.

**Keywords:** intermodal transport, types of intermodal transport

### 1. INTRODUCTION

Intermodal transport is the carriage of goods that use at least two means of transport, but one transport unit. The main premise is the combination of long-haul transport loads, as well as improving the time of their delivery via an efficient network of deliveries to the consumer on the local market.

It is worth noting that global intermodal transport consists in transporting products in steel containers with classic dimensions. The most characteristic unit is the Twenty - foot Equivalent Unit. Every year, global container sales amount to nearly 30 000 000 transported

containers (this is converted to nearly 100 000 000 TEU). Over 60% of cargo in containers is transported by sea.

In order to better understand the complexity of the problem of intermodal transport, one should pay attention to the way the container travels. As a standard, this activity starts with the taking of an empty container from the railway terminal. Then, by means of road transport, place the container in the warehouse so that the container can be loaded. After loading, the container is put back on the terminal and the terminal is loaded onto the train. In the next stage, using a train, the container is transported to another terminal. There, the container is taken over and again by means of road transport is substituted for the target warehouse for unloading. When the container is emptied it goes to the container terminal.

All this procedure does not seem to be complicated. However, the costs associated with these activities are important. The occurring costs are not only related to the payment for rail or road transport. These costs also apply to reloading activities that take place on railway terminals, drop off fees and pick ups that are used by container owners. The last of these costs are associated with the payment for possible empty containers from railway terminal to ports.

Although it may seem that the largest part of the costs is rail transport, sometimes the costs related to terminal service are able to exceed the costs of rail transport.

## **2. THE ESSENCE AND TYPES OF INTERMODAL TRANSPORT**

Both multimodal, combined transport and intermodal transport were defined by the authors of the dictionary under the title "Terminology on combined transport"

**Table 1.** Types of transport.

<b>INTERMODAL TRANSPORT</b>	<b>COMBINED TRANSPORT</b>	<b>MULTIMODAL TRANSPORT</b>
transport of goods, which takes place in one and the same loading unit or in a vehicle, in the course of which two or more branches of transport are gradually used without carrying out the transshipment of the goods themselves in shifting branches of transport	it is intermodal transport, in which the main part of the European route is performed by inland navigation, sea transport or rail, while the initial and / or final section of the route is implemented by road transport, which is as short as possible	it is the transport of goods through no less than two branches of transport

Source: Based on data from the Central Statistical Office.

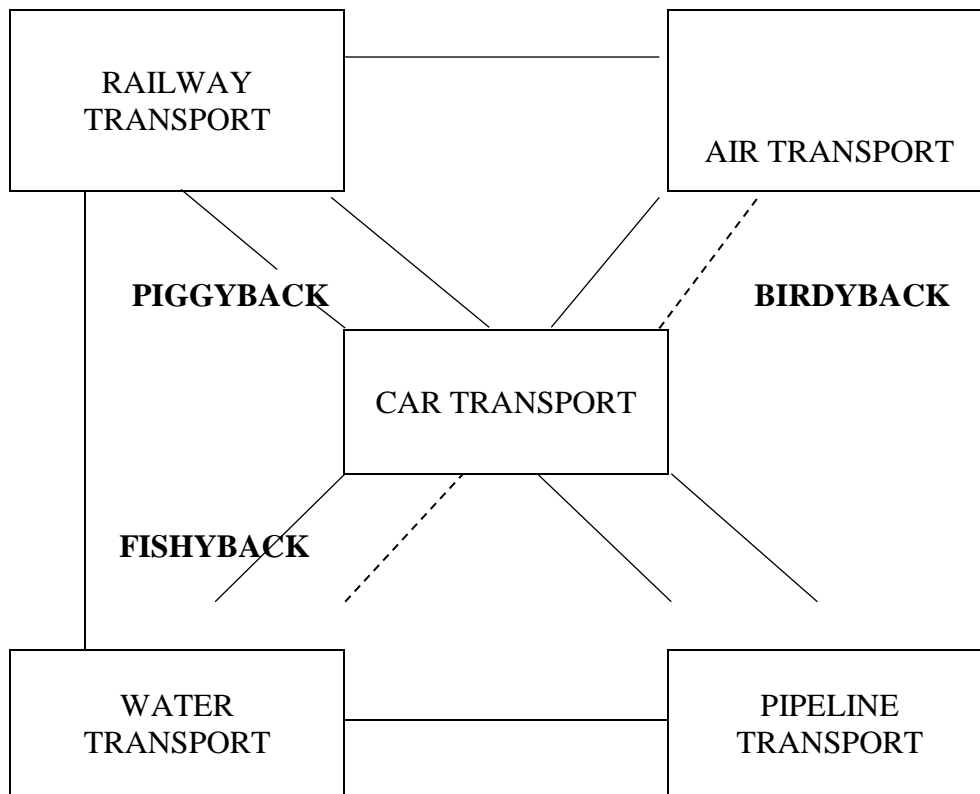
Explain the difference between the transport unit and the load unit. The transport unit should be understood as a single-unit truck, a tractor with a semi-trailer, as well as a lorry with a trailer. Like cargo units, transport units can be transported by other means of transport

without the need to reload goods. The railway wagon is considered to be a transport unit for transport. By contrast, cargo units are to be understood as car semi-trailers, swap bodies and containers, which must be properly adapted for combined transports. [2]

Intermodal transport has contributed to a significant, close-up approach to various modes of transport (air transport is the exception). As a result, favorable conditions have arisen for the internal connection of transport processes. This fact covers the legal, price, technical - technological, documentary and organizational plane. [1]

The following drawing presents the types of intermodal transport. The most well-known ones include road and water transport, car and air transport, as well as pipelines and cars.

The carrier's task in services such as piggyback, fishyback or birdyback is the carriage of the entire caravan without the possibility of reloading goods that is on this trailer by other means of transport. Transport in the piggyback system makes it easier to take advantage of both the availability of a car and the low cost of rail transport. However, transport in the "birdyback" system consists in integrating the accessibility that characterizes the car with the speed of the aircraft. On the one hand, transport in the "fishyback" system consists in using the reachability of the car, and on the other hand, the low cost of transport by waterway.



**Figure 1.** Types of intermodal transport

Source: Own elaboration

### **3. POSSIBILITIES AND DIFFICULTIES OCCURRING IN THE DEVELOPMENT OF INTERMODAL TRANSPORT IN POLAND**

Intermodal transport allows the greatest possible use of essential advantages and maximum limitation of defects of means of transport. [7] Decisions related to the use of several different modes of transport should take into account the overall logistics costs that are associated with individual opportunities.

<b>ADVANTAGES</b>	<b>DISADVANTAGES</b>
broadening the prospects of one-time transport of a larger part of the product	the obligation to use professional equipment that serves both for transshipment and also to enable the transport of multitone cargo units that are outside stationary devices
guarantee punctual and prompt delivery of goods and in particular in international transport	the obligation to supply railway terminals with the appropriate transshipment facilities
minimizing the risk associated with damage to the goods	
the prospect of using different methods of loading and unloading	
reduction of transport costs	
increasing the number of possible transport methods	
increasing the quality and accessibility of transport services	
minimizing the burden on the natural environment	

**Figure 2.** Advantages and disadvantages of intermodal transport.

Source: Own elaboration

Intermodal transport definitely favors the organization and maximization of available transport resources. It is the best choice for traditional transport of large loads on longer routes. In a situation where the route to one consumer is several hundred kilometers, several trucks are replaced by selecting the goods in a larger lot and then sending them by ship, plane or train [4]. The effectiveness of intermodal transport could be seen in Poland in 2008, when the opening of the Celno-Port branch took place in Gdynia. Thanks to the possession of sixteen high-end chassis, Poland is able to effectively carry two standard 20-ton containers at

the same time, the weight of which is nearly 4 600 kilograms. One of the basic advantages of intermodal transport is the speed of transport with the exclusion of unnecessary stoppages. As the best selection of a loading unit for loading brings favorable conditions that improve the supply chain. [5] This allows minimizing costs, time associated with both issuing documentation and reloading operations. The combination of various means of transport intensifies the guarantee of the completion of the order on time. [3] Unnecessary downtimes that truck drivers often encounter are excluded using a shuttle or a turn. [8]

Goods that have been consolidated and then transported by sea or by rail are not exposed to the impact of negative transport conditions. Mainly it is possible damage that could have arisen as a result of a sudden change in driving style or uneven surface. [9]

Despite the obvious advantages of intermodal transport, it also has disadvantages. Undoubtedly, these are costs related to the development and maintenance of infrastructure, which include professional reloading devices, advanced IT systems to modernize the implementation of strategic logistics operations, and help in the overall management of separate orders. [6] Due to the fact that Poland is a transit country, it should be a transport course not only in the east-west direction, but also north-south. The majority of transport corridors run through Poland. However, compared to the possibilities of Poland, the percentage of intermodal transport is too low. It should be noted that in Poland, participation in the intermodal transport market is growing from year to year.

Compared to the first quarter of 2012, the share of intermodal transport in 2014 in the same quarter of the year increased by 6%. According to data from the Central Statistical Office, data from PCC Intermodal SA and PKP Cargo against the substantial progress of intermodal infrastructure, in Poland the presence of intermodal transport using a railway vehicle is just 2.5 - 3%. Currently, a significant part of container transport (roughly 80%) from Polish seaports is carried out by road. It is worth noting, however, that the market in question is characterized by considerable development potential. It is not excluded that over the next few years the volume of intermodal transports may reach the level between 10% and 15%. It is necessary not only to develop later, but also to modernize the rope and point logistics infrastructure. Due to its strategic importance for the growth of intermodal transport, the changes should be the top priority for the authorities at the regional, local and national level. The intermodal transport market in Poland is a young market characterized by constant but small development. Comparing the entire transport of products, an increase in intermodal transport is noticeable. However, in Poland, the share of intermodal transport work in freight transport was almost 5%.

The main goal for the development of intermodal transport in Poland is to create the best economic and financial, legal and organizational conditions as well as technical conditions for intensive development of intermodal transport systems in such a way that their participation in rail transport in 2020 will reach the average level of countries belonging to the European Union with 2000 or 10 - 15% in the tonnage aspect.

The European Commission in the development of transport and logistics strategy documents is trying to solve the problem of increasing traffic congestion as well as improving road safety. One of the first ideas that was published in the White Book was to increase the share of alternative modes of transport for road transport, in particular rail transport. Great emphasis was also put on the use of intermodal transport, where the loads are transported by various means of transport. Intermodal transport is based on consolidation when transporting different modes of transport in integrated cargo units. Above all, one contract for the carriage of goods is signed in intermodal transport, and thus the entire company has the sole responsibility for delivering the goods to the customer (only one), the service can not be partially carried out by another company. The requirement of intermodal carriage is discretisation of the load, which means that only the entire cargo unit can be reloaded.

<b>SPECIFICATION</b>	<b>THOUSAND TONS</b>	<b>THOUSANDS OF ARTS</b>	<b>THOUSAND TEU*</b>
<b><i>TOTAL</i></b>	<b><i>21490,1</i></b>	<b><i>1251,7</i></b>	<b><i>2036,5</i></b>
<i>containers:</i>			
loaded	20647,3	989,2	1626,0
empty	842,8	262,5	410,5
<b><i>Export</i></b>	<b><i>9783,2</i></b>	<b><i>623,8</i></b>	<b><i>1015,9</i></b>
<i>containers:</i>			
loaded	9244,8	441,3	754,3
empty	538,4	182,5	261,5
<b><i>Import</i></b>	<b><i>11706,9</i></b>	<b><i>627,9</i></b>	<b><i>1020,7</i></b>
<i>containers:</i>			
loaded	11402,6	547,9	871,7
empty	304,4	79,9	149,0
<p>* TEU = Twenty – foot Equivalent Unit – it is a standard unit that corresponds to the volume of a 20-x ISO container with dimensions of 20 x 8 x 8.5 ft. It is used to calculate containers that have different lengths, as well as to compare and describe container terminals or ships.</p>			

**Figure 3.** Transhipment of containers at intermodal terminals in 2016 - total sea transport  
 Source: Based on data from the Central Statistical Office.

SPECIFICATION	20'		40'		45'	
	thousand tons	thousands of arts	thousand tons	thousands of arts	thousand tons	thousands of arts
<b>TOTAL</b>	<b>7352,3</b>	<b>483,0</b>	<b>13277,9</b>	<b>704,1</b>	<b>859,9</b>	<b>64,6</b>
<i>containers:</i>						
loaded	7077,7	361,5	12839,6	591,5	730,0	36,2
empty	274,6	121,5	438,3	112,6	129,9	28,4
<b>Export</b>	<b>2865,8</b>	<b>239,8</b>	<b>6338,8</b>	<b>351,9</b>	<b>578,6</b>	<b>32,1</b>
<i>containers:</i>						
loaded	2631,5	135,3	6053,4	277,8	559,9	28,2
empty	234,3	104,5	285,4	74,1	18,8	3,9
<b>Import</b>	<b>4486,5</b>	<b>243,2</b>	<b>6939,2</b>	<b>352,2</b>	<b>281,3</b>	<b>32,5</b>
<i>containers:</i>						
loaded	4446,2	226,2	6786,2	313,7	170,1	8,0
empty	40,3	17,0	153,0	38,5	111,1	24,5

**Figure 4.** Container reloading in intermodal terminals in 2016 - maritime transport - containers

Source: Based on data from the Central Statistical Office.

<b>SPECIFICATION</b>	<b>THOUSAND TONS</b>	<b>THOUSANDS OF ARTS</b>	<b>THOUSAND TEU*</b>
<b><i>TOTAL</i></b>	<b><i>13804,5</i></b>	<b><i>844,6</i></b>	<b><i>1373,6</i></b>
<i>containers:</i>			
loaded	13065,5	625,5	1025,8
empty	739,1	219,1	374,8
<b><i>Export</i></b>	<b><i>6541,1</i></b>	<b><i>414,3</i></b>	<b><i>676,4</i></b>
<i>containers:</i>			
loaded	6162,8	305,4	499,0
empty	378,3	108,9	177,4
<b><i>Import</i></b>	<b><i>7263,4</i></b>	<b><i>430,3</i></b>	<b><i>697,2</i></b>
<i>containers:</i>			
loaded	6902,6	320,1	526,8
empty	360,7	110,2	170,4
<p>* TEU = Twenty – foot Equivalent Unit – it is a standard unit that corresponds to the volume of a 20-x ISO container with dimensions of 20 x 8 x 8.5 ft. It is used to calculate containers that have different lengths, as well as to compare and describe container terminals or ships.</p>			

**Figure 5.** Transhipment of containers at intermodal terminals in 2016 - total rail transport  
 Source: Based on data from the Central Statistical Office.



SPECIFICATION	20'		30'		40'		45'	
	thousand tons	thousands of arts	thousand tons	thousands of arts	thousand tons	thousand of arts	thousand tons	thousands of arts
<b>TOTAL</b>	<b>5230,7</b>	<b>313,7</b>	<b>385,6</b>	<b>19,0</b>	<b>7705,5</b>	<b>481,5</b>	<b>482,8</b>	<b>30,4</b>
<i>containers:</i>								
loaded	5007,5	224,5	358,4	12,1	7258,7	367,7	440,7	21,3
empty	223,1	89,2	27,1	6,9	446,7	113,8	42,1	9,1
<b>Export</b>	<b>2553,9</b>	<b>151,9</b>	<b>130,4</b>	<b>8,2</b>	<b>3635,2</b>	<b>238,9</b>	<b>221,7</b>	<b>15,3</b>
<i>containers:</i>								
loaded	2448,0	112,4	113,3	3,8	3403,9	179,1	197,6	10,1
empty	105,9	39,5	17,1	4,4	231,3	59,8	24,1	5,2
<b>Import</b>	<b>2676,8</b>	<b>161,8</b>	<b>255,2</b>	<b>10,8</b>	<b>4070,3</b>	<b>242,6</b>	<b>261,1</b>	<b>15,1</b>
<i>containers:</i>								
loaded	2559,5	112,1	245,1	8,3	3854,8	188,6	243,2	11,2
empty	117,2	49,7	10,1	2,5	215,5	54,0	18,0	3,9

**Figure 6.** Container reloading at intermodal terminals in 2016 - rail transport - containers  
 Source: Based on data from the Central Statistical Office.

<b>SPECIFICATION</b>	<b>THOUSAND TONS</b>	<b>THOUSANDS OF ARTS</b>	<b>THOUSAND TEU*</b>
<b><i>TOTAL</i></b>	<b><i>12865,2</i></b>	<b><i>829,7</i></b>	<b><i>1395,7</i></b>
<i>containers:</i>			
loaded	12053,8	586,8	996,4
empty	811,4	242,9	399,4
<b><i>Export</i></b>	<b><i>5952,9</i></b>	<b><i>393,5</i></b>	<b><i>664,9</i></b>
<i>containers:</i>			
loaded	5502,3	263,7	444,1
empty	450,6	129,8	220,8
<b><i>Import</i></b>	<b><i>6912,3</i></b>	<b><i>436,2</i></b>	<b><i>730,8</i></b>
<i>containers:</i>			
loaded	6551,5	323,1	552,3
empty	360,8	113,1	178,5
<p>* TEU = Twenty – foot Equivalent Unit - it is a standard unit that corresponds to the volume of a 20-x ISO container with dimensions of 20 x 8 x 8.5 ft. It is used to calculate containers that have different lengths, as well as to compare and describe container terminals or ships.</p>			

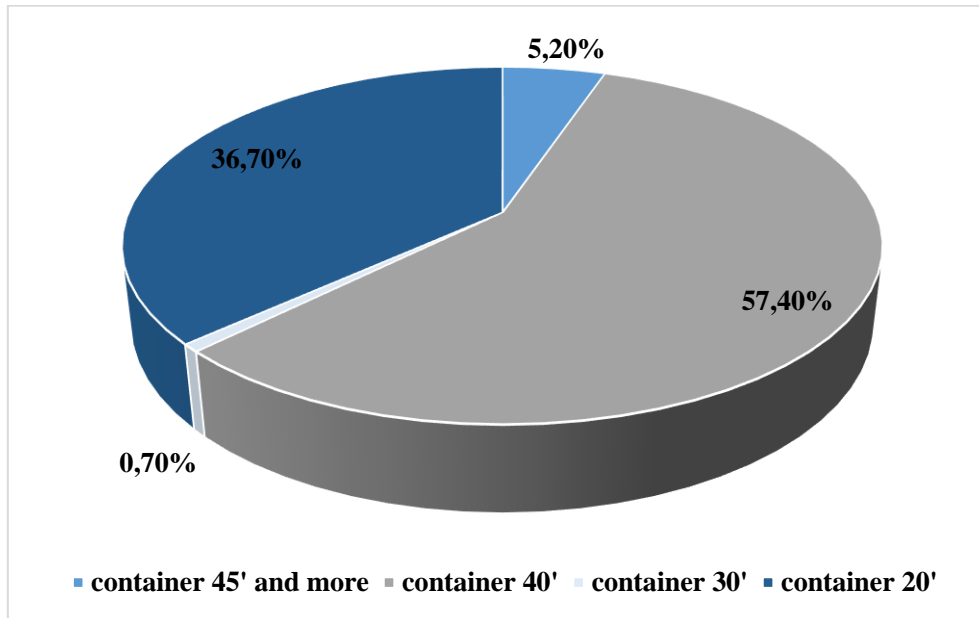
**Figure 7.** Transshipment of containers in intermodal terminals in 2016 - total road transport  
 Source: Based on data from the Central Statistical Office.

SPECIFICATION	20'		30'		40'		45'	
	thousand tons	thousands of arts	thousand tons	thousands of arts	thousand tons	thousand of arts	thousand tons	thousands of arts
<b>TOTAL</b>	<b>3922,5</b>	<b>277,5</b>	<b>38,0</b>	<b>1,2</b>	<b>8153,6</b>	<b>492,9</b>	<b>751,1</b>	<b>58,0</b>
<i>containers:</i>								
loaded	3706,1	185,1	37,9	1,2	7669,2	367,0	640,5	33,6
empty	216,4	92,5	0,1	0,0	484,4	125,9	110,6	24,5
<b>Export</b>	<b>1889,4</b>	<b>128,7</b>	<b>38,0</b>	<b>1,2</b>	<b>3764,9</b>	<b>234,9</b>	<b>260,7</b>	<b>28,7</b>
<i>containers:</i>								
loaded	1787,7	84,5	38,0	1,2	3515,2	171,1	161,5	6,9
empty	101,7	44,2	0,0	0,0	249,7	63,8	99,2	21,8
<b>Import</b>	<b>2033,1</b>	<b>148,8</b>	<b>0,1</b>	<b>0,0</b>	<b>4388,7</b>	<b>258,0</b>	<b>490,4</b>	<b>29,4</b>
<i>containers:</i>								
loaded	1918,4	100,5	-	-	4154,0	195,9	479,1	26,7
empty	114,7	48,3	0,1	0,0	234,7	62,1	11,4	2,7

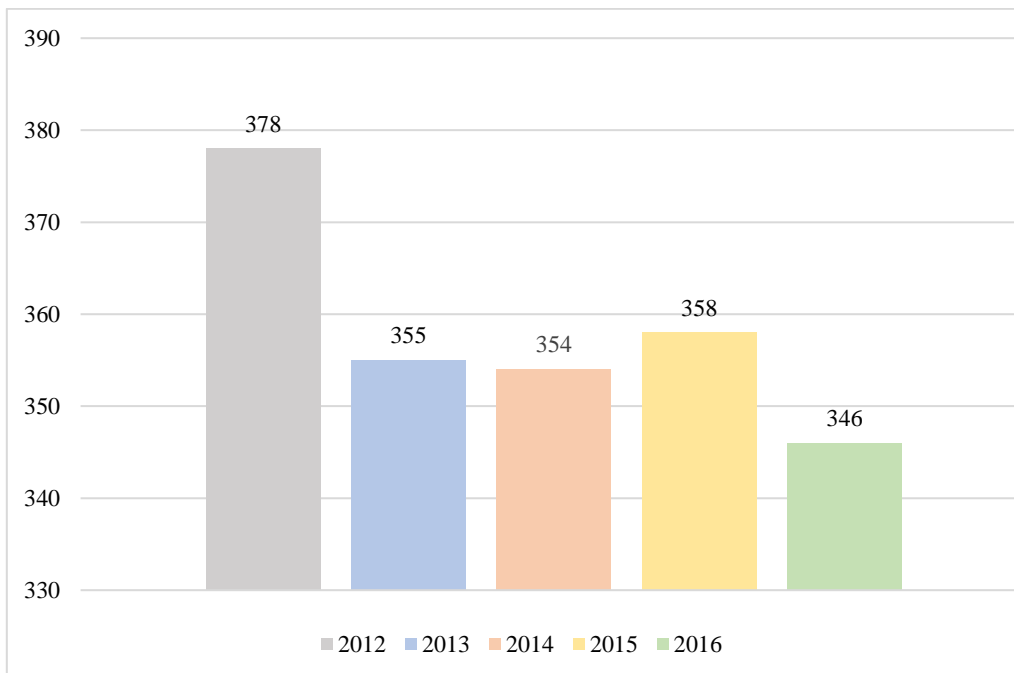
**Figure 8.** Transhipment of containers in intermodal terminals in 2016 - road transport - containers

Source: Based on data from the Central Statistical Office.

The total annual trans-shipment terminal capacity in intermodal terminals in 2016 amounted to 8 300 000 TEU, including 2 700 000 TEU in land terminals and 5 600 000 TEU in sea terminals. In turn, the degree of utilization of their trans-shipment capacity in land terminals amounted to 45.7%, and at sea terminals - 63.3%. In intermodal terminals in 2016, 48 200 000 tons of containerized cargoes were reloaded. 12 900 000 tons were handled by road transport, 21 500 000 tons by sea, and 13 800 000 tons by rail.



**Figure 9.** Transshipment of containers at land and sea terminals.  
Source: Based on data from the Central Statistical Office.



**Figure 10.** Intermodal transport - average distance in 2012 - 2016 [km]  
Source: Own elaboration

In the total number of containers reloaded at land and sea terminals, 40 'containers prevailed, which gives 57.4%, 30' containers' share amounted to 0.7%, 20 'containers reached 36.7%, and 45' containers and more amounted to 5.2 %. Compared to road transport, the costs related to railway transport are still not low. Rail is especially difficult to compete because it does not charge money for motorways. Taking into account the average commercial speed and the quality of parameters, container transports that take place over short distances are not efficient. The profitability of intermodal transport by rail increases with the transport section.

The situation in 2016 on the intermodal transport market shows the perspective of future development of the described transport branch. However, for further development to be possible, it is extremely important to guarantee many years of, but above all, constant support for intermodal transport.

#### **4. CONCLUSIONS**

In summary, it should be noted that both current technology and technology create unlimited potentials that we are not always able to use. Intermodal transport also offers such opportunities, which in its concept is an effective integration of the advantages of various modes of transport, while taking into account economic and ecological requirements and premises.

The inclusion of these elements in intermodal transport is not excluded due to the cooperation in transport. Among other things, thanks to the synergistic use of the best attributes and properties of various modes of transport, combining them into one chain, the described form of transport should be distinguished by a high reputation of services and low costs. In its premises, it should affect the minimization of the excessively large share of road transport as well as the reduction of polluted air. Currently, it is this ecological dimension that is an extremely important element describing this type of transport. In contrast to road transport, intermodal transport facilitates the transport of much larger freight volume, in particular in international exchanges. In addition, it is part of the implementation of the concept of sustainable development of the European transport system, which is focused on the use of environmentally - friendly transport solutions. It is important to specify the maximum delivery time and place the container terminal that will be used. It is impossible to hide that the time that is necessary for the terminal to reach the place is translated into the rate of transport. In the case of terminals located in the city center, this rate does not always express the real costs associated with transport service. Quite often the client has no influence on the aspects presented. Before the transport is completed, the customer can not access this type of information every time. The only thing that the customer can influence is communication with the intermodal operator. A greater likelihood of successful transport ends in a situation where both the operator and the customer put as much commitment as possible.

#### **References**

- [1] Alicke, K., Modeling and optimization of the intermodal terminal mega hub. *OR Spectrum*, issue 1, 2002, p. 1-17.
- [2] Ballis, A. and Golias, J., Towards the improvement of a combined transport chain performance. *European Journal of Operational Research*, Volume 152, Issue 2, 16 January 2004, Pages 420-436

- [3] Bruns, F., & Knust, S. Optimized load planning of trains in intermodal transportation. *OR Spectrum*, 34, 2012, p. 511-530.
- [4] Caris, A., Macharis, C., & Janssens, G., Decision support in intermodal transport: A new research agenda. *Computers in Industry*, 64(2), 2013, p. 105-112.
- [5] Cullinane, K. and Toy, N., Identifying influential attributes in freight route/mode choice decisions: a content analysis. *Transportation Research Part E*, 36(1), 2000, p. 41–50.
- [6] Dullaert, W., Maes, B., Vernimmen, B. and Witlox, F., An evolutionary algorithm for order splitting with multiple transport alternatives. *Expert Systems with Applications*, 28(2), 2005, p. 201-206.
- [7] Janic M., Modelling the full costs of an intermodal and road freight transport network. *Transportation Research Part D: Transport and Environment*, Volume 12, Issue 1, 2007, p. 33-40.
- [8] Macharis C., Janssens G., Caris A., Decision support in intermodal transport: A new research agenda. *Computers in Industry*, Volume 64, Issue 2, 2013, p. 105-110.
- [9] Vernimmen, B. and Witlox, F., The inventory-theoretic approach to modal choice in freight transport: literature review and case study. *Brussels Economic Review / Cahiers Economiques de Bruxelles*, 46(2), 2003, p. 6-27.