



## ALTERNATIVE CONNECTION BETWEEN TERRITORY OF POLAND AND FAR / MIDDLE EAST COUNTRIES FOR CONTAINERS TRANSPORT

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**ABSTRACT. Background:** The new cyclical service, available on the Polish market, related to the railway connection between Port of Koper and the terminal in Silesia, enables delivery of containers, skipping the Polish and German ports. To "the opening" of a direct connection with the Adriatic Sea arises dilemma that requires the identification of sustainability of the containers' transport to the Polish territories in economical and ecological terms. The key to this problem is a solution of the equation with several unknowns, which include the cost and time of transport, sea freight operator procedures, infrastructure constraints and the interests of local and regional communities. The analysis of the impact area of rail connection Koper - Slawkow was carried within Empiric project. The assumptions and results are described below.

**Material and methods:** Based on the experience of the Slawkow-Koper link's operator and analysis of distances, cost, duration of containers transport, the research has been conducted, intended to estimate the area of influence of ports, located on the shores of the four seas surrounding area of Central Europe: Adriatic, Baltic, Black and North, with particular reference to the Port of Koper. The research used publicly available information, calculators, and disseminated investment plans.

**Results:** Analysis of factors possible to calculate, especially the cost of containers' transport, by adopted assumptions, the study allowed to estimate the theoretical impact area of the Port of Koper. The area covers a large part of Poland, south from the line Szczecin-Brest. Besides aspect of cost impact area has been expanded due to different rail-gauge along the eastern Polish border. Also the environmental aspects indicate south direction of transport containers, as beneficial to the natural environment. As the factors reducing the development of the connections financial policies of the sea freight operators and infrastructure limitations of the northern Adriatic ports were indicated.

**Conclusions:** Based on the results of the research it is clear that a "southern" connection of the Polish territory with the Far East in the case of container transport is a viable and beneficial option, with exception of the interests of the communities related to the Polish ports. It is only a matter of time, related to planned deadlines of upgrading of Adriatic ports, that southern direction of transport will become the direction successfully competing with the 'traditional' ones. An important factor will be the change of sea freight operators' attitude and pricing policies.

**Key words:** containers transport, transport of containers.

In the 2011 year company called Baltic Rail started periodic connection between the Port of Koper (Slovenia) and intermodal terminal located in Dąbrowa Górnicza (South of Poland). This way Poland has been opened to the Adriatic Sea by direct intermodal link. Terminal in Dąbrowa Górnicza was the regional node - gate for national market. In the

near future the importance of terminal can grow, because of plans of Baltic Rail concerning expansion of Koper connection further into the North and East of Europe. This step finally will initiate direct connection which joints Adriatic and Baltic Seas with periodic and stable link. The initiative of single

company has initiated the issue of the impact areas of alternative ports.

The impact area of ports in Poland in case of containers transport was subject of some studies. As example the presentation in scope w TransBaltic project [Andrzejewski 2012] which specifies Koper as alternative port for part of Poland - the rail connection with Koper is indicated as an option for transport of containerized goods from Far East to south voivodeships, for 20 feet containers mainly. Another example is the MDS Transmodal Limited study [MDS Transmodal Limited] indicating Poland as biggest potential market for North Adriatic ports.

The mentioned study estimates the share of containers, transported via Suez to / from Poland, as nearly 70% of whole containers turnover in TEU (2010), which creates huge potential for considered connection. Additionally when compare transport via Koper and "north" ports to the Upper Silesia the reduction of power consumption and emissions of dangerous substances (between the others CO<sub>2</sub> and NO<sub>x</sub>) values is estimated on the level of 25%.

Potential volume of connection stream, expected cost and emission reductions are reasons, justified interest in considered redirection of the containers' flow on the European part of line Far East - Poland.

## **POTENTIAL IMPACT AREA OF REPRESENTATIVE PORTS**

The potential of the Koper-Sławków connection (after relocating the connected terminal in 2012) as regional node and its influence on region was the subject of the impact analysis on a macro-regional level in the frames of the EMPIRIC project (Enhancing Multimodal Platforms, Inland Waterways and Railways Integration in Central Europe, the project is implemented through the priority 2 of CENTRAL EUROPE Programme "Improving accessibility to, and within, Central Europe" and is co-financed by the European Regional Development Fund, EMPIRIC is led by the Venice Port Authority /

Italy and the project consortium consists of 12 partners including Institute of Logistics and Warehousing / ILiM from Poland), which has been developed to support the start-up and improvement of multimodal connections from/to North Adriatic Ports with Central Europe hinterland. One of the more significant results of the study was the definition of impact areas of the four seas "surrounding" the area of Poland.

The ports of Baltic and North Seas are closest to the area of Poland. Does it mean that they are the best solutions in case of shipment from all over the world? When consider the sea freight from America or West Europe there is no discussion - ports of North Germany and Benelux, with feeders (or direct) connection with polish ports are the only reasonable solution. But one look on the map of Europe creates doubts - what about freight from Far East, what about Mediterranean Sea? Should ships to/from that direction go as usual around the whole West Europe? Why? Let's consider the freights from countries of Southern and Eastern Asia only.

## **IDENTIFICATION OF FACTORS AFFECTING THE AREA OF THE CONNECTION'S INFLUENCE**

To determine the impact areas of sea surrounding area of Poland the two most important factors very identified. First one is the cost of transport, second one the time of transit, both considering from the place of shipment (countries of Southern and Eastern Asia) to the end customer.

The main assumption is no difference of other features of transports via different sea or direction, like safety or additional cost of, for example, handling.

The potential impact area of the connection has been determined on the basis of:

- identification of major streams of goods in intermodal transport for the connection;
- financial efficiency of freight using the subject connection as compared with alternative routes and methods of freight organisation;

- time efficiency of freight.

The above factors are fundamental criteria in the decision-making process related to delivery or shipment of goods. Other factors, including local interests or politics, are less significant. Some entrepreneurs agree to additional costs or the extension of transit time, provided that freight is carried out by domestic partners. The so-called "local patriotism" is also reflected in the operation of political organisations and local government bodies, promoting preferential treatment of local or domestic entrepreneurs.

## **IDENTIFICATION OF SIGNIFICANT LIMITATIONS**

There are a number of practical limitations that affect the shape of the impact area. Major limitations include:

- comparable rates for freight of 1 TEU from China to any European port, regardless the freight distance, other factors related to business policies of ship-owners, forwarders and carriers,
- limitations of the ports related to the shallow water passage, which requires earlier partial unloading of containers in neighbouring ports or involves feeder transport, resulting in an overall extension of freight duration;
- throughput of rail lines,
- price competition.

In the long run, however, such limitations can be mitigated. For instance the Ministry of Economic Development and Technology of Slovenia will spend 15.7 million Euros (including cohesion fund subsidies) on dredging the water-way in the Port of Koper (from 11.4 to 15 m), thus enabling access to the port to ships with a larger draught. This shall improve navigational safety and increase the competitiveness and appeal of the Port of Koper. The project shall be completed by April 2015. Similarly in the long term a possible increase in the stream of cargo via the ports of southern Europe and competition on freight market shall enforce the diversification of rates for freight.

The cargo capacity of trains in terms of the stream transshipped is not the limitation. According to Market study on the potential cargo capacity of the North Adriatic ports system in the container sector [MDS Transmodal Limited]: The RailNetEurope corridors provide a nearly-complete core hinterland rail network for NAPA (North Adriatic Ports Association). At the same time the study indicates bottlenecks, influencing the further development of rail links for freight from the Far East, to eliminate in long term.

It should be stressed that the impact area has been determined with the assumption that above limitations will be mitigated in the near future.

Another limitation is the change in wheel gauge at the border of the westernmost countries of the former Soviet Union. The change significantly hinders transport across historic borders and affects the impact areas of ports.

Additional limitation, which has to be considered, is geographical considerations, e.g. location of mountain ranges, rivers and the temporary freezing of seas. However, the discussed impact area is so saturated with transport infrastructure (the land part) that such limitations have no substantial effect on the impact area.

## **THE DETERMINATION OF THE CONNECTION'S EXPECTED IMPACT AREA**

For the purpose of the analysis, instance ports were selected, as representative of particular sea:

- Koper (the Adriatic Sea),
- Odessa (the Black Sea),
- Hamburg (the North Sea),
- Gdańsk (the Baltic Sea).

Considering freight from any direction and distance / time of transport to / from nearest considered port, excluding limiting factors (such as differences in wheel gauge in the East and in the West), a division of the Baltic -

Adriatic corridor on the impact areas of individual ports is shown in Figure 1.

Borders of the impact areas run along the western, southern and south-eastern borders of Poland. The impact area of the port of Gdańsk, apart from whole Poland, includes the small north-western part of Ukraine, almost the whole territory of Belarus (except its south-eastern part) and obviously, Lithuania, Latvia

and Estonia and the Kaliningrad Region; it cannot be assumed, however, that the latter regions shall be serviced by Gdańsk.

A hypothetical division between the Hamburg and Koper impact areas runs along the Prague-Nurnberg line and between the Koper and Odessa impact areas - along the western border of Ukraine and Romania.



Source: ILiM own study based on maps.google.pl

Fig. 1. Estimated impact area of ports (freight from undetermined directions)

Rys. 1. Szacowany obszar oddziaływania portów (fracht z nieokreślonych kierunków)

Table 1. Distances and freight transit times from Shanghai to considered ports  
Tabela 1. Dystanse i czas frachtu z Szanghaju do rozważanych portów

Port		Distance [Nm]		Estimated duration of freight [days]	
shipment	Collection		<i>Difference Shanghai-Koper</i>		<i>Difference Shanghai-Koper</i>
Shanghai	Koper	8,439	-	24,1	-
	Odessa	8,288	- 151	24,7	0,5
	Hamburg	10,657	2,218	31,7	7,6
	Gdańsk	10,998	2,559	32,8	8,6

Source: www.searates.com

The situation is different when we consider only the stream of goods delivered to Europe from the Middle and Far East. In this case, the difference in distance of freight between the ports in Koper and in Gdańsk is as much as 2 550 nautical miles. Distances and theoretical transit times (not resulting from freight timetable and possible stops in intermediate ports) are shown in Table 1.

Considering the values in the above table and the average speed in rail freight in transit and target countries, the delivery to Hamburg or Gdańsk via Koper (by sea to Koper and further on by rail) is on average shorter by a couple of days, as compared with the direct

sea freight (assuming transshipment in all ports takes the same amount of time).

The impact areas of ports being considered, taking into account only the transit time from Shanghai, are shown in Figure 2. Due to the slightly shorter transit time to Koper, the division line Koper-Odessa was moved to the east. Assuming that recipients/senders value delivery time the most, the area of Europe subject to discussion can be divided into only two impact areas: the Adriatic Sea ports and Black Sea ports. The interesting thing is that the border between the two impact areas separates areas with various wheel gauge (except Romania), and thus limitation due to changing wheel gauge does not apply here.



Source: ILiM own study based on maps.google.pl

Fig. 2. Estimated impact areas of the ports in relation to the time of TEU delivery to the customer (Far Eastern freight)

Rys. 2. Szacunkowe obszary wpływu portów w relacji do czasu dostawy TEU do klienta (fracht z Dalekiego Wschodu)



Source: ILiM own study based on maps.google.pl

Fig. 3. Estimated impact areas of the ports in relation to the cost of TEU delivery to the customer (Far Eastern freight)  
Rys. 3. Szacunkowy obszary wpływu portów w relacji do kosztu dostawy TEU do klienta (fracht z Dalekiego Wschodu)

However, in the case of freight from the Far East, a reduction in transit time by ca. one week is not always a decisive factor. This is in contrast to overall costs of freight, where the cost factor is always the most crucial.

The following assumptions concerning the costs of TEU freight were assumed in order to determine the impact areas of ports:

- sea freight: 0.48 EUR/km,
- rail freight: 0.55 EUR/km,

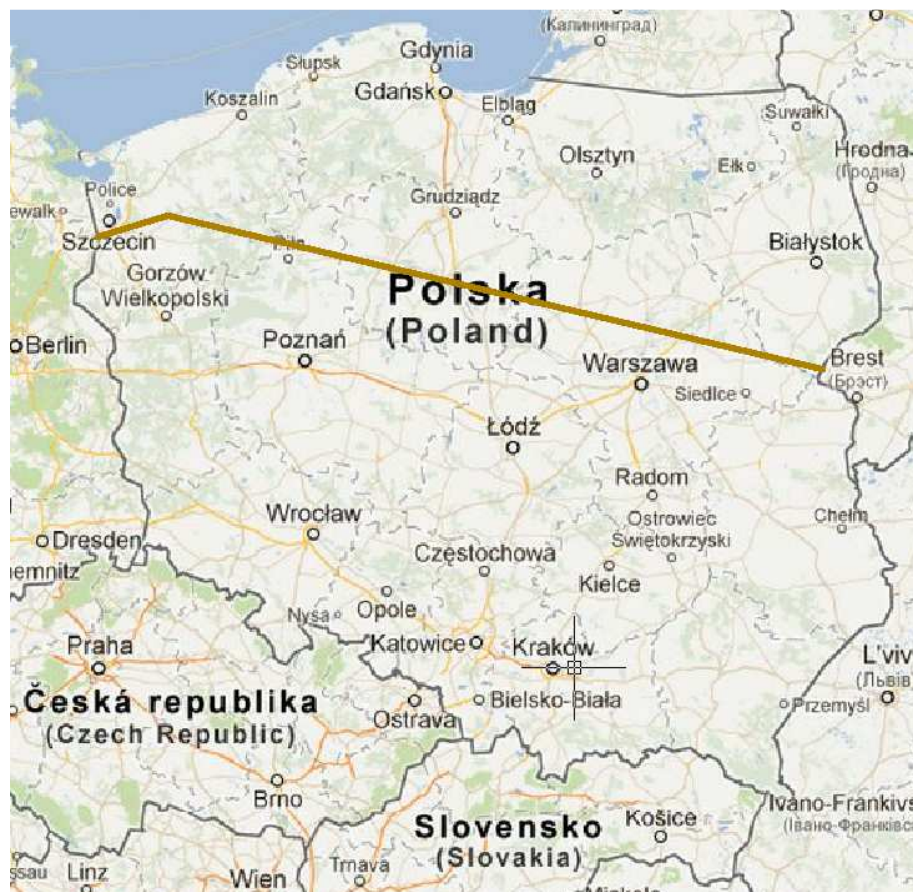
Average rail freight rates were determined based on suppliers' price lists for the last two years (2011-2012). Distances of sea freight were taken from the global shipping costs calculator.

Costs relating to road transport (terminal-customer and customer-terminal) were omitted since the distance from the terminal to the end customer is independent from the port of transshipment.

Under such assumptions, without considering additional limitations, impact areas of selected ports are as shown in Figure 3.

Considering the transport costs (and time of delivery), the impact area of Koper and Odesa extend significantly to the north. The central part of Poland can be equally well serviced by Koper and by Odesa. The analysis proves that in both cases this is a cheaper and faster solution than the use of Baltic ports or Hamburg. Only the areas of northern Poland and northern Germany strongly "gravitate" towards the Baltic Sea and the North Sea ports.

When consider the Polish territory only, thanks to differences in wheel gauge, the impact area should be extended by the area of eastern Poland. Finally Figure 4 shows economically justified and delivery-time efficient impact area of the Adriatic Sea, represented by Port of Koper. The area covers bigger part of Poland, southern from the line Szczecin-Brest, including cities like Warszawa, Poznań, Łódź, Kraków and whole Silesia.



Source: ILiM own study based on maps.google.pl

Fig. 4. Estimated impact area of the Port of Koper in Poland (freight from the Far East)  
Rys. 4. Szacunkowy obszar wpływu portu w Koprze (transport z Dalekiego Wschodu)

After expected development of ports in the Szczecin region the division line will be moved in its west part insignificant to the north, but it will not have considerable influence on the result of research.

Finally when consider time and cost of delivery of containers from the Middle and Far East with described assumptions the significant part of Poland should be server by north ports of Adriatic Sea. The influence of port Gdańsk and in the future port in the Szczecin region will be limited to the voivodeships with direct access to the sea.

## CONCLUSIONS

Concluding the area of Poland in bigger part should be server, when considering containers transport form Far East, by ports located in the north part of the Adriatic Sea.

The determined potential impact area covers most area of Poland despite the publications connected with NAPA indicated only the closest countries (geographical hinterlands [MDS Transmodal Limited]) as potential market for mentioned ports. The limitations of the development of south direction transport are technical parameters of the ports in mentioned area and policies of the ship or freight operators, which do not differentiate rates of the shipments of TEU from the East to particular port in Europe.

The growth of the flow volume, development of ports and transport infrastructure should lead to change of the rules and further development of the connection. As example can be indicated the Korean car factories, located in Slovakia, which are served from south direction. It is worth to indicate, that distance between polish

border and Kia factory in Żylin, is less than 50 km.

South link expansion may not gain social acceptance, especially of entities interested in the development of Polish sea ports. However, the anticipated reduction in emissions and energy consumption fully justifies promoting of the link.

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## ALTERNATYWNE POŁĄCZENIE TRANSPORTU KONTENERÓW POMIĘDZY TERYTORIUM POLSKI ORAZ KRAJAMI DALEKIEGO / ŚRODKOWEGO WSCHODU

**STRESZCZENIE.** **Wstęp:** Nowa dostępna na polskim rynku cykliczna usługa, związana z kolejowym połączeniem portu w Koprze z terminalem na Śląsku, umożliwi dostarczenie kontenerów z pominięciem polskich i niemieckich portów. Wobec otwarcia bezpośredniego połączenia z Morzem Adriatyckim powstaje dylemat, wymagający identyfikacji zrównoważonego w sensie ekonomicznym i ekologicznym kierunku transportu kontenerów na tereny Polski. Klucz do tego problemu to rozwiązanie równania z kilkoma niewiadomymi, do których należy zaliczyć koszt i czas transportu, procedury operatorów frachtów morskich, ograniczenia infrastruktury, a także interesy lokalnych i regionalnych społeczności. W ramach realizacji projektu Empiric przeprowadzona została analiza wpływu kolejowego połączenia Koper - Sławków, której założenia i wyniki zostały opisane poniżej.

**Metody:** Na podstawie doświadczenia operatora połączenia Koper-Sławków oraz analizy dystansów, kosztów, czasu trwania frachtów i transportu kolejowego kontenerów, powstało badanie, mające na celu oszacowanie obszaru wpływu poszczególnych portów, zlokalizowanych u wybrzeży czterech mórz, otaczających obszar środkowej Europy: Adriatyckiego, Bałtyckiego, Czarnego i Północnego, ze szczególnym uwzględnieniem Portu Koper. Do badań wykorzystane zostały ogólnodostępne informacje, kalkulatory oraz upowszechnione plany inwestycyjne.

**Wyniki:** Analiza czynników możliwych do kalkulowania, zwłaszcza kosztu transportu kontenerów, przy przyjętych założeniach, pozwoliła oszacować teoretyczny obszar wpływu Portu Koper, który obejmuje znaczną część naszego kraju, na południe od linii Szczecin- Brześć. Poza aspektem kosztowym obszar oddziaływania został poszerzony w związku z różnicą rozstawu torów wzdłuż wschodniej granicy Polski. Także aspekty ekologiczne wskazują na południowy kierunek transportu kontenerów, jako korzystniejszy dla środowiska naturalnego.

Jako czynniki ograniczające rozwój połączenia należy wskazać politykę finansową operatorów frachtu morskiego oraz ograniczenia infrastruktury portów północnego Adriatyku.

**Wnioski:** Na podstawie wyników badań należy stwierdzić, że "południowe" połączenie terenu Polski z Dalekim Wschodem w przypadku transportu kontenerów jest rozwiązaniem opłacalnym i korzystnym, z zastrzeżeniem interesów społeczności związanych z polskimi portami bałtyckimi. Jest tylko kwestią czasu, związanego z planowanymi terminami modernizacji portów adriatyckich, żeby południowy kierunek transportu stał się kierunkiem z powodzeniem konkurującym z "tradycyjnymi" kierunkami. Istotnym czynnikiem będzie zmiana stanowiska (i cenników) operatorów frachtów morskich.

**Słowa kluczowe:** transport kontenerów.



## ALTERNATIVE VERBINDUNG FÜR DEN CONTAINERVERKEHR ZWISCHEN POLEN UND DEN LÄNDERN DES FERNEN / NAHEN OSTENS

**ZUSAMMENFASSUNG. Einleitung:** Die auf dem polnischen Markt neue, zyklische, im Zusammenhang mit der Eisenbahn-Verbindung zwischen dem Hafen in Koper (SLO) und dem Terminal in Schlesien (PL) in Betrieb genommene Dienstleistung ermöglicht die Beförderung von Containern ohne die Inanspruchnahme der polnischen und deutschen Häfen. Angesichts der Eröffnung einer direkten Anbindung an die Adria entsteht ein Dilemma, das die Ermittlung des im wirtschaftlichen und ökologischen Sinne nachhaltigen Container-Transports in Richtung Polen erforderlich macht. Der Schlüssel zur Lösung dieses Problems ist eine Lösung der Gleichung mit mehreren Unbekannten, zu denen man die Kosten und die Zeit des Transportes, Prozeduren von Seefracht-Operateuren, Einschränkungen seitens der Infrastruktur und die Interessen der lokalen und regionalen Gemeinschaften zählen muss. Im Rahmen der Ausführung des Projektes Empiric wurde eine empirische Analyse der Auswirkungen der Bahnverbindung Koper - Slawkow durchgeführt; deren Annahmen und Ergebnisse werden im Folgenden beschrieben.

**Methoden:** Auf Grund der Erfahrung des Betreibers der Bahnverbindung Koper - Slawkow und der Analyse von Entfernungen, Kosten und Dauer des Fracht- und Container-Transportes auf Schiene entstand eine Studie, der die Einschätzung von Auswirkungen der an vier Meeren (an der Adria, an der Ostsee, am Schwarzen Meer und an der Nordsee) im mitteleuropäischen Raum lokalisierten Seehäfen, unter der besonderen Berücksichtigung des Hafens von Koper, zugrunde lag. Für die Zwecke der Untersuchungen wurden allgemein zugängliche Informationen, Kalkulatoren und bekanntgemachte Investitionspläne in Anspruch genommen.

**Ergebnisse:** Die Analyse der kalkulierbaren Einflussfaktoren, insbesondere der Kosten des Container-Transportes, erlaubte bei festgelegten Annahmen, den theoretischen Einflussbereich des Seehafens von Koper einzuschätzen. Der Bereich umfasst den bedeutenden, südlich der Linie Szczecin-Brest gelegenen Landesteil Polens. Abgesehen vom Kosten-Aspekt wurde der Einflussbereich dieses Hafens im Zusammenhang mit dem Unterschied der Gleis-Breite der polnischen Ostgrenze entlang ausgebreitet. Die ökologischen Aspekte weisen auch auf die südlich orientierte Richtung der Container-Beförderung als die vorteilhaftere für die Umwelt hin. Als die die Entwicklung dieser Verbindung einschränkende Einflussfaktoren muss man die Finanzpolitik der Seefracht-Betreiber sowie vorhandene Einschränkungen der Infrastruktur der Seehäfen an der nördlichen Adria nennen.

**Fazit:** Auf Grund der Ergebnisse kann festgestellt werden, dass die "südliche" Anbindung Polens mit dem Fernen Osten in Bezug auf die Container-Beförderung eine sich lohnende und vorteilhafte Lösung darstellt, allerdings unter Berücksichtigung der Interessen der mit den polnischen Ostsee-Häfen verbundenen Lokalgemeinschaften. Es bleibt also die Frage der Zeit, die man für die Modernisierung der adriatischen Häfen braucht, bis die südliche Richtung des Container-Transportes die Richtung werden wird, die mit den "traditionsmäßigen" Richtungen erfolgreich im Wettbewerb steht. Ausschlaggebend wird die Veränderung der Betrachtungsweise (und der Preislisten) seitens der Seefracht-Betreiber sein.

**Schlüsselwörter:** Containerverkehr, Transport von Containern.

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