BaSIM – Baltic Sea Information Motorways

SCENARIO ANALYSIS OF NEW MARITIME CORRIDORS

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Preface

The general overview of the BaSIM project

"The BaSIM Project has been initiated in order to promote the concept of the Baltic Sea Motorways, which is one of the key elements in the Northern Dimension transport market. Baltic Sea Motorways are aiming at promotion of maritime transport, multimodality covering also hinterland and logistics in general. Baltic Sea Motorways is a future vision manifested in the strategy of TEDIM, an organization carried by most of the Baltic Sea countries, including Russian Federation, to enhance cooperation and to optimize transport system of the Baltic Sea Region. The vision is implemented by BaSIM, under the TEDIM umbrella and will be one of the first Baltic Sea Motorways projects. BaSIM will create a sustainable basis for investments in the future aiming at solving existing and coming up bottlenecks in the BSR and transnational communication and cooperation.
Therefore BaSIM emphasizes simultaneous actions, which are needed to develop both physical and information infrastructure within the BSR, for an overall improvement of logistics productivity and competitiveness."

"Scenario Analysis of New Maritime Corridors" is a part of Work Package (WP) 3. The vision of the "Scenario Analysis of New Maritime Corridors" is to make a practical / empirical analysis by integrating relevant stakeholders based on framework conditions illustrated through Gdansk – Helsinki, and corridors linking Klaipeda.

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Table of Content

1. INTRODUCTION

Transport corridors and/or sea motorways as part of the logistic chain and short sea shipping thus the search, development and optimisation thereof is very important link new development regions around Baltic Sea. New EU members Baltic Countries: Lithuania, Latvia, Estonia, Poland develop very intensive. Industrial Countries around Baltic Sea such as Denmark, Sweden, Germany, Norway has very big potential possibilities for the trade with new EU Countries and other Countries like Russia, Ukraine, Belarus and other third Countries. It is very important for the new maritime transport corridors and/or sea motorways development as there are big industry and population concentration areas featured around the Baltic Sea, and sea motorways must link production chains and people interests.

Transport networks are very important for shifting the force of markets. Therefore, in the process of EU extension, the priority attention has to be given to the development and modernisation of transport system and one of such Sea Motorways, which link Maritime and shore transport systems. Maritime transport corridors and/or sea motorways are a new adding system to the Trans-European Transport Network.

Sea motorways main elements can be point out as follow:

- Sea motorways as a part of the European transport corridors network;
- Sea motorways as part of logistics network;
- Sea motorways are new adding system to the transport and logistics network;
- New Ro-Ro lines situation in Baltic Sea.

Sea motorways main tasks can be mention as follow:

- Continuation of the European transport corridors;
- Link different European transport corridors;
- Link logistics centres network;
- Optimisation transport links.

New Maritime corridors in Baltic Sea, which could be created, must be study that will be possible to find advantages and disadvantages, check existing and possible bottlenecks and find solutions.

2. NEW MARKETS IN BALTIC SEA REGION (BSR)

Relationship between regions is based on industry activity and population concentration. Sustainable transportation plays very important role for regions co-operation. In other words, all transport system element links in the regions should be optimal and just optimal transport systems development can assist for regions co-operation. There are very important industry and population concentration regions in Europe, such as: Ruhr basin (West Germany), Benelux Countries, Paris region (North France), Milan region (North Italy), Wien region (Austria) and other on West and South side; Baltic Countries (Lithuania, Latvia, Estonia), Moscow, Kiev, Ural and other industry and population concentration regions on East and North side.

New markets for the West and North Europe Companies production opened in Central and East Europe Countries, Asia Countries such as Kazakhstan, Middle Asia Countries (Uzbekistan, Turkmenistan and other), Fare East Countries such as China, especially West part of the China, India, Pakistan and other Countries, for which transport links via Baltic Sea are important and can be used in a case of a good enough organization and legal basis, infrastructure and superstructure as well.

Transport links between mentioned regions exist long time and optimization of the transport links at all and separate transport elements, such as roads, railways, sea motorways, ports, inter-modal terminals, logistics centres, border cross places and other transport system elements on concrete directions should be developed.

Baltic Sea is very intensive development region and main transport links are based on maritime transport corridors.

A lot of Baltic Sea Countries and transit cargo goes via Baltic ports and imply major influence on the Baltic transport system. Regions close to the Baltic that have real influence on the Baltic transport system and average distances from these regions to the Baltic Sea ports are shown in Table 1 (EU Energy and Transport in Figures, 2003).

Table 1: Regions Neighbouring the Baltic Sea and Average Distances to the Ports

Regions	Population, mln.	Distance to Baltic sea, km
West Germany	30	500
Benelux Countries	26	400
Central and East Germany	20	250
Central Poland	10	350
Belarus	10	500
Central Russia	30	1000
North-West Russia	5	600
Central and North Finland	3	300
North Sweden	2	200
Norway	2	500

Main maritime transport corridors directions in Baltic Sea between main industry and population concentration and new markets are basis for the future development transport links.

Figure 1: Baltic Sea Region

Figure 2: Main transport corridors around Baltic Sea and clause to Baltic Sea

Main maritime transport corridors directions in Baltic Sea area between main industry and population concentration and new existing and possible markets around Baltic, which play an important role for the Sea Motorways creation.

As example of the importance of the new markets and link possibilities can be explain on Containers and Ro-Ro transportation via East Baltic ports during last decade.

Table 2: Containers handling in East Baltic ports

Port	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Klaipė-da	39057	36736	32328	28668	39955	51675	71589	118366	174241	214307
Riga	141408	132559	129580	85911	84928	101077	127459	132074	152166	168978
Tallinn	45678	54585	55473	65246	76692	78072	87912	99440	113081	127585
Vents-pils	-	-	862	195	207	-	1044	3688	292	1044
Kalinin-grad	-	654,0	10875	14100	16280	21313	27871	44687	72094	112528
Sankt Peters-burg	121833	145886	165200	188200	209730	480659	580639	656183	776576	1119346
TO-TAL	349134	373988	399447	386364	431070	734532	896514	1056441	1288450	1743788

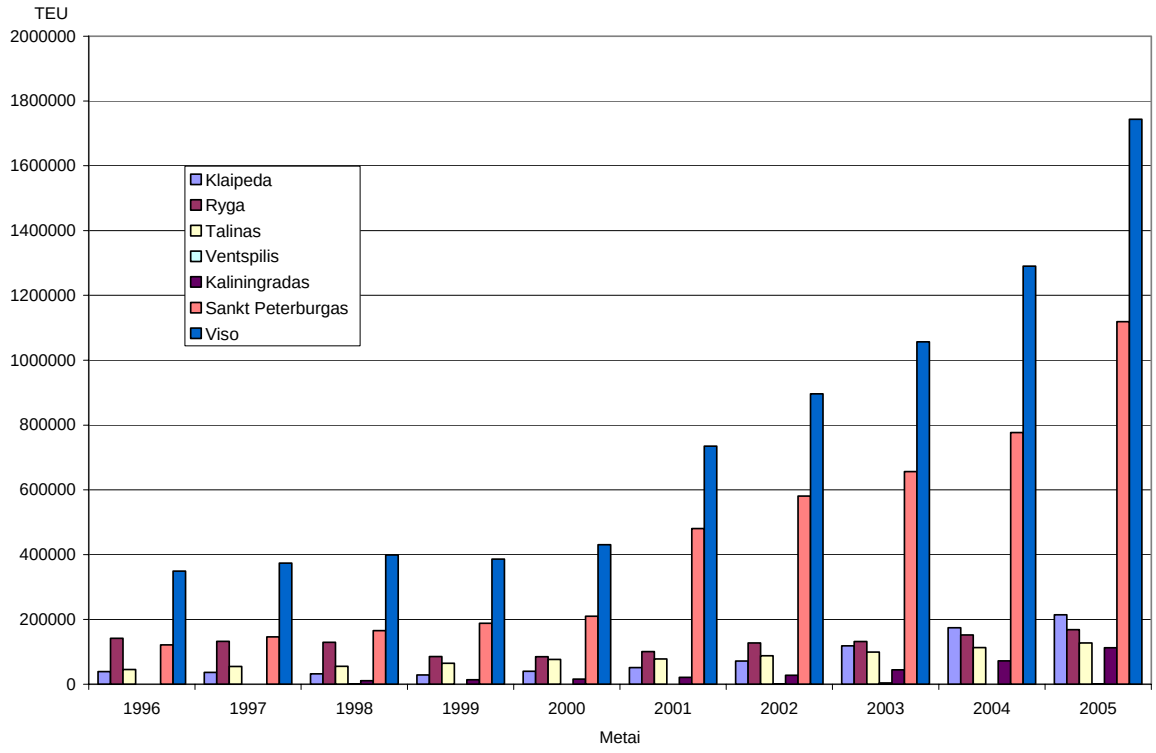

Figure 3: Containers handling in East Baltic ports

As explained on Figure 3, container traffic via East Baltic ports (total flow) was stable from 1996 until 2000 and after 2000 start increase up to 20 – 25 % per year. Stable situation in first period (1996 – 2000) mainly link with two important factors:

- first: at that time were developed containers terminals in many port (Tallinn, Klaipeda, Ventspils, St.-Petersburg and in other ports and port can not work on full capacity;
- second: World economical crisis, which start in main Container region – South – East Asia in 1996, extend up to Baltic region in 1998 – 1999. Economical crisis make influence on regions in different time and it helps for some region did not dramatically decrease volumes.

Period after 2000 was important for the Container business, and in Baltic Sea region as well, because at this time there was a ready number of new Container terminals, especially in East Baltic ports, economy has grown up in some Countries like Lithuania, Latvia, Estonia, Russia and other countries up to 7 – 9 % per year. Relations between Countries Economy, trade and transportation distribute as 1 : 2 : 3 (1 % increase economy or GNP stimulate 2 % trade increasing and for such services request about 3 % more transport services).

In same time containerization, especially in Central and East Europe Countries until 2000 was very low and naturally increasing containerization level together with economy conditions stimulate very fast increase number of containers in East Baltic ports in period after 2000.

Last years (2006 and 2007) shows same tendency in containers transportation via East Baltic ports and such tendency is forecasting for the next few years.

Globalization of the economy and very intensive entry to the globalization processes new EU member States have positive influence on Container traffic and on containerization processes in mentioned Countries.

Ro – Ro transportation via East Baltic Countries has other tendency, because such transportations cover smaller World part (region) and any changes in economy or politics in the region directly influence on Ro-Ro transportations.

Table 3: Ro-Ro units in East Baltic ports

Port	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Klaipė-da	158942	177475	144619	101315	116185	134735	127800	153550	144250	150150
Riga	15396	14868	21211	17847	10460	10884	19173	38716	39303	31850
Liepoja	20429	29462	27148	20444	20856	25173	29263	33627	30231	23400
Tallinn	273659	318105	174700	185170	225200	245200	242900	264800	145800	154000
Total	468246	539910	367678	324776	372701	415992	419136	490693	359584	359400

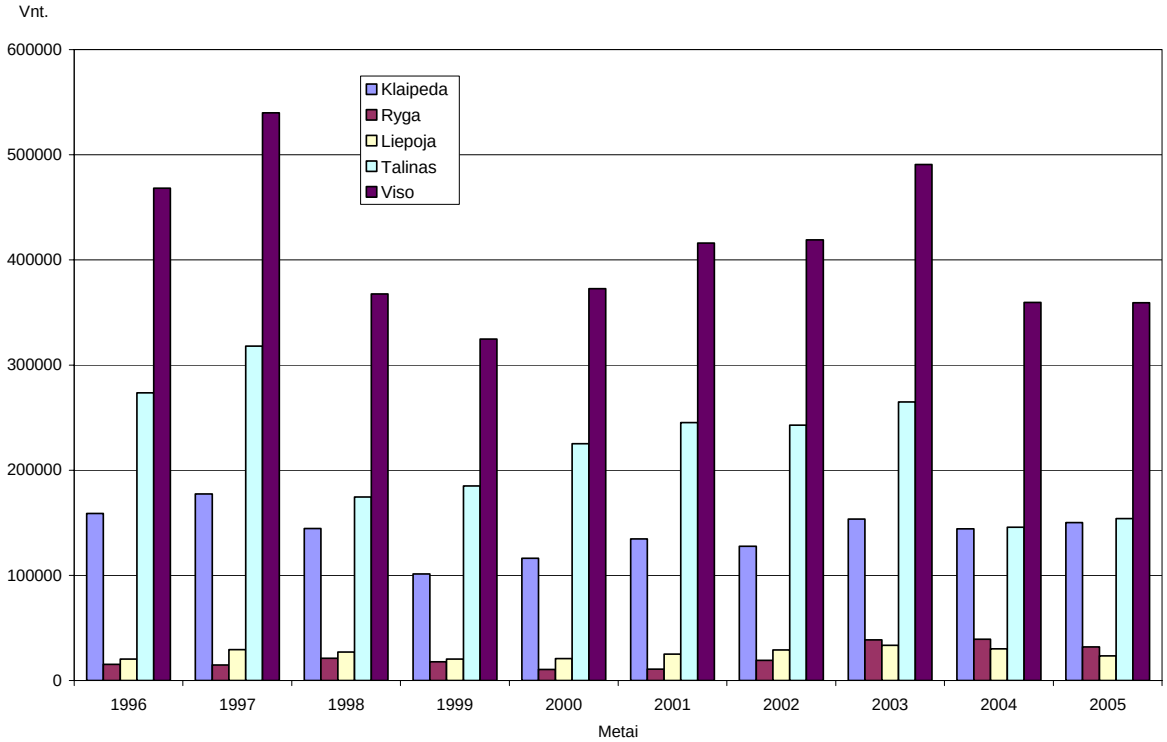

Figure 4: Ro-Ro units in East Baltic ports

As mentioned before, Ro-Ro transportations very much link with processes in concrete region. Economical crisis in 1998 – 1999 in Russia had big influence on neighboring Countries. In Ro – Ro transport units are caring final products for the direct using. This situation link with economical conditions, that means in case of increase economy, increase Ro-Ro transportation as well, in case of economical crisis Ro – Ro transportation react (decrease) immediately.

Ro-Ro transportation via East Baltic ports Statistics explain mention situation, that means in 1998 – 1999 Ro – Ro transportation via East Baltic ports decrease up to 40 % in comparison with previous years.

From year 2000 economy stabilized in region and start increase, Ro –Ro transportation start increase as well, but in 2004 Ro – Ro transportation via East Baltic port decrease again as result of political changes. In year 2004 Poland and East Baltic Countries (Lithuania, Latvia and Estonia) joint to EU and procedures on border between mentioned Countries and old EU Countries change in more easy direction and a lot of trucks turn on the inland transport corridor via Poland.

In 2005, 2006 and 2007 Ro – Ro transportation via East Baltic ports increase again because increase transportation between new EU Countries and old EU Countries in general and not good enough road conditions in Poland back part of the trucks on ferries as well.

In years 2006 and 2007 Ro – Ro transportation via East Baltic ports increase up to 20 – 25 % in comparison with same periods in years 2004, 2005.

3. EXISTING MARITIME LINKS BETWEEN MARKETS IN BSR

For the future development of the Motorways of the Sea, very important take in account existing situation and especially Ro-Ro Maritime transport links in Baltic Sea Region.

Main Ro-Ro operators in Baltic Sea Region are:

- DFDS- " **D**et **F**orenede **D**ampskibs- **S**elskab" (The United Steamship Company)- is the oldest, large shipping company in Denmark, founded in 1866. Today DFDS is a leading North European liner shipping company, listed on the Copenhagen Stock Exchange.

  Freight activities are operated in DFDS Tor Line. The main customer groups consist of international transport and shipping companies and manufacturers of large quantities of industrial goods whose logistics include a significant element of transport by sea.

- Scandlines - is the largest ferry company in the southern part of the Baltic. Scandlines operates 12 passenger and freight ferry lines between Denmark and Germany, Denmark and Sweden, Sweden and Germany, to the Baltic States and inside Denmark.

- TT line -is a privately-owned group of shipping lines and has been running a direct ferry service between Germany and southern Sweden since 1962. With an average age of seven years, the TT Line Ferries represent the most modern fleet servicing the Sweden route. TT Line customers have a choice of up to 20 departures a day between Germany and Sweden.

- Finnlines - is one of the largest European shipping companies specialized in liner cargo services. Finnlines also provides port services mainly in Helsinki, Turku and Kotka. Finnlines offers regular ro-ro liner services in the Baltic Sea between Finland and ports in Central Europe and Scandinavia, in the North Sea between

Finland and ports in Great Britain, Belgium and the Netherlands, as well as in the Bay of Biscay between Finland and Spain.

and other operators, which keep more than 80 % of the Ro-Ro market in BSR.

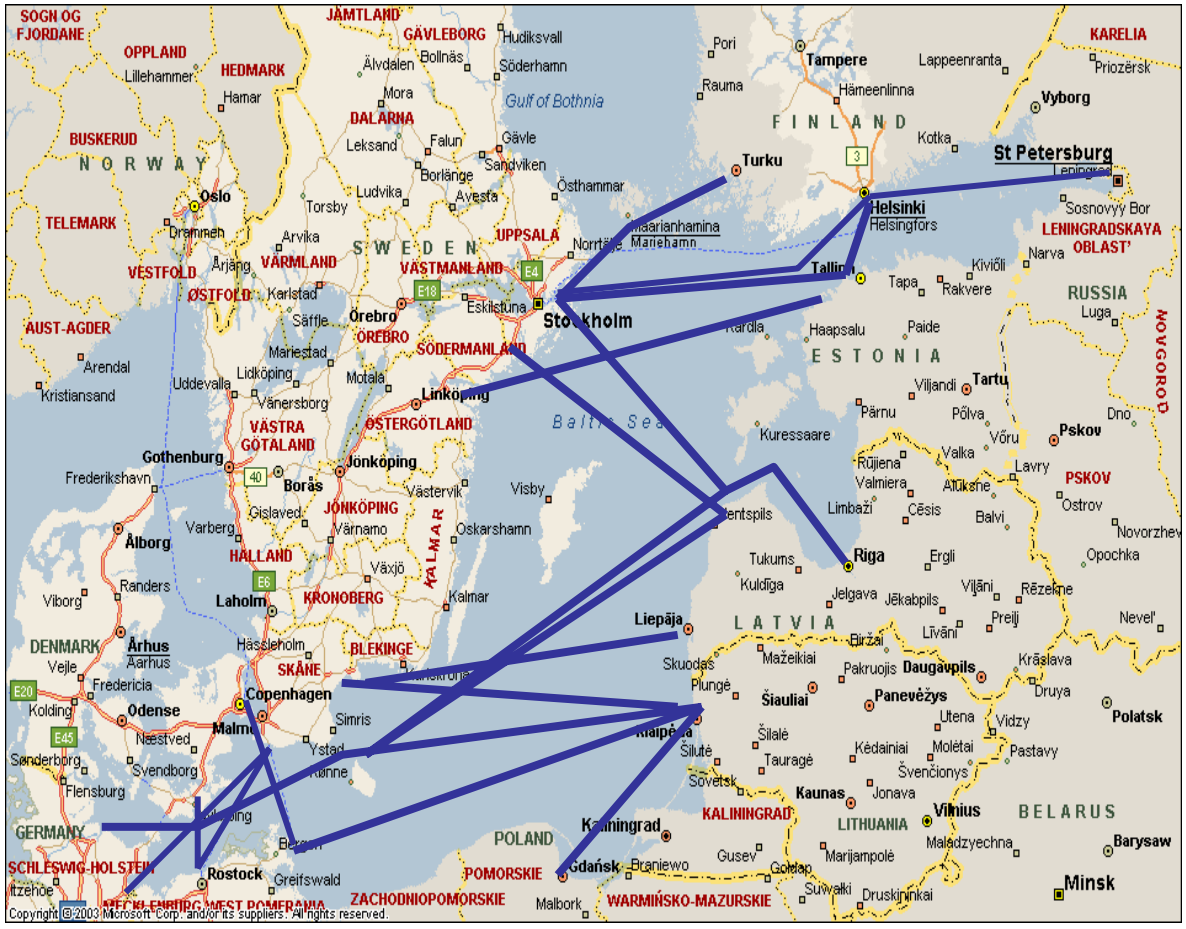

Figure 5: Main Maritime transport corridor directions in Baltic Sea.

Baltic Sea Ro – Ro shipping line network develop very well and depends Sea regions has very concrete directions, that means in general main direction is East – West, but in South – West part of the Baltic Sea privileged North – South direction. Density of the Ro-Ro shipping lines in South – West part is very high because in this part of the Baltic is much higher concentrate industry and population.

Correlation between population, industry and transport network are direct and it is main reason different density of the transport network in different parts of the Baltic Sea.

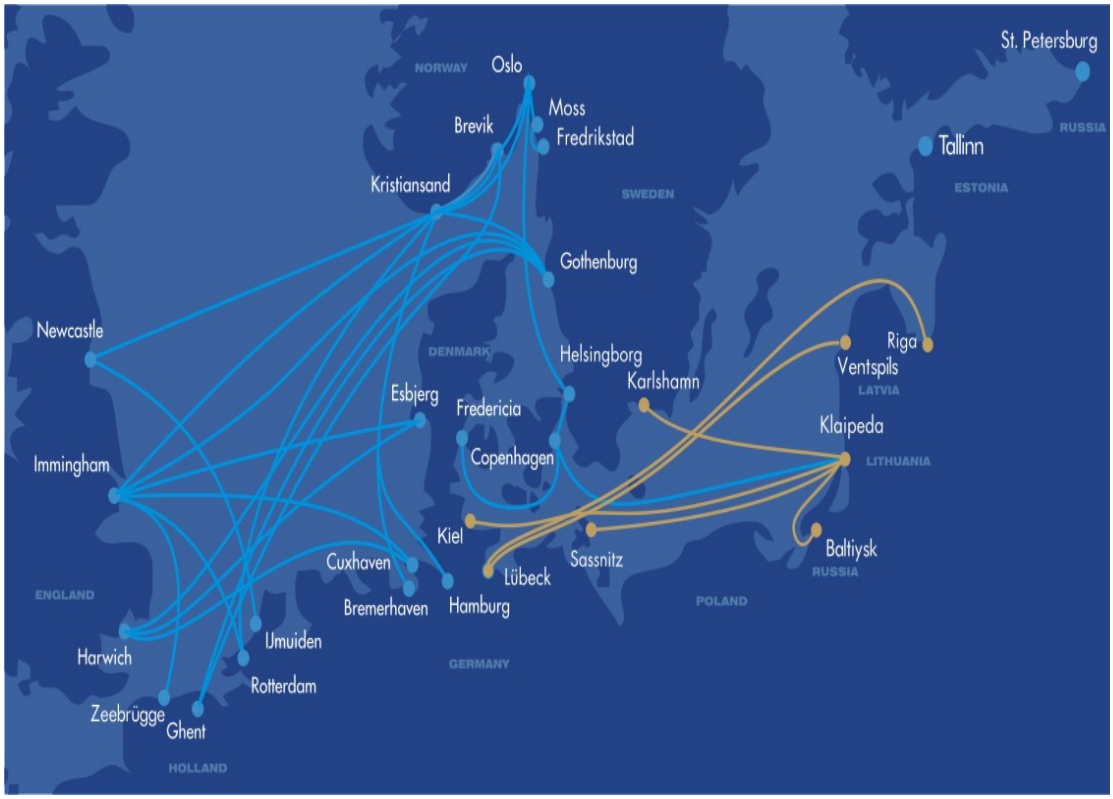

Figure 6: DFDS Ro-Ro network in Baltic and North Seas

As example of the Ro-Ro shipping lines, which operate DFDS Company, network density, correlate with population and industry density in Baltic Sea region.

In same time in South part of the Baltic Sea operate other Shipping Companies and as result Ro – Ro shipping lines network in South part of the Baltic is much higher as in any other place in the Europe.

High density of the Ro – Ro shipping lines in combination with good road and railway network in Countries around Baltic Sea make ideal conditions create Sea Motorways with very flexible conditions.

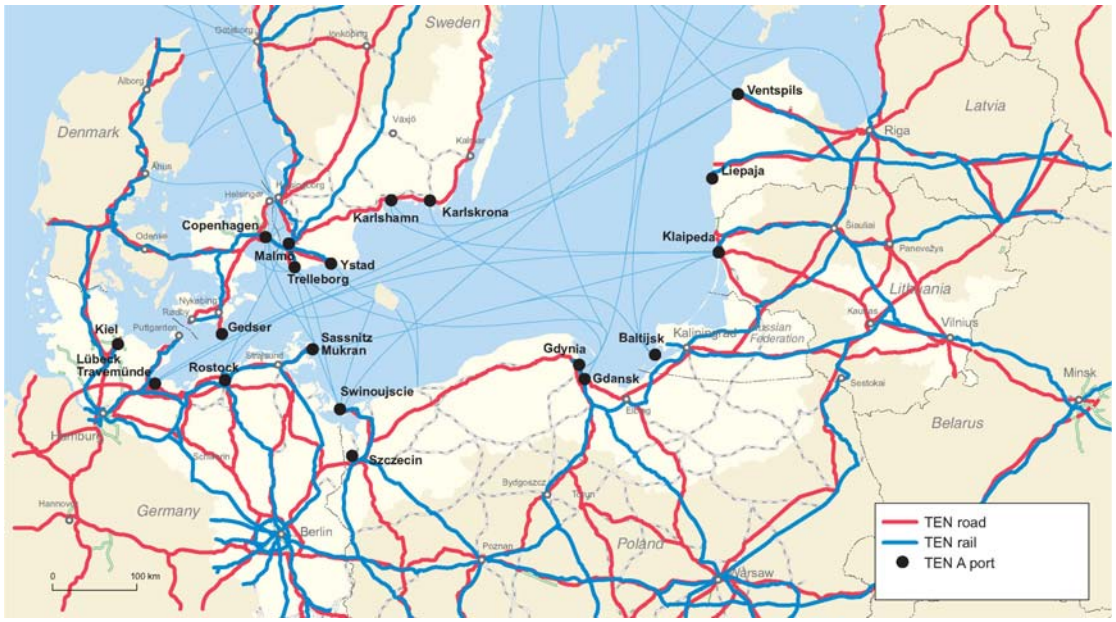

Figure 7: Ro – Ro shipping lines and road and railway network in Countries around South part of the Baltic Sea.

In same time TNT roads, railways and ports, explain on figure 7 are link partly with Ro – Ro shipping lines, but in same time no agreed network. Network, which can cover all region can be organize on basis Sea Motorways ideas, in which must be included technical, technological, organizational and legal elements, that will be possible to find fastest and with optimal costs transportation possibilities in all Baltic Sea region.

Ro – Ro operators, such as Scandlines, TT Line and others add Ro – Ro network in the Baltic Sea region.

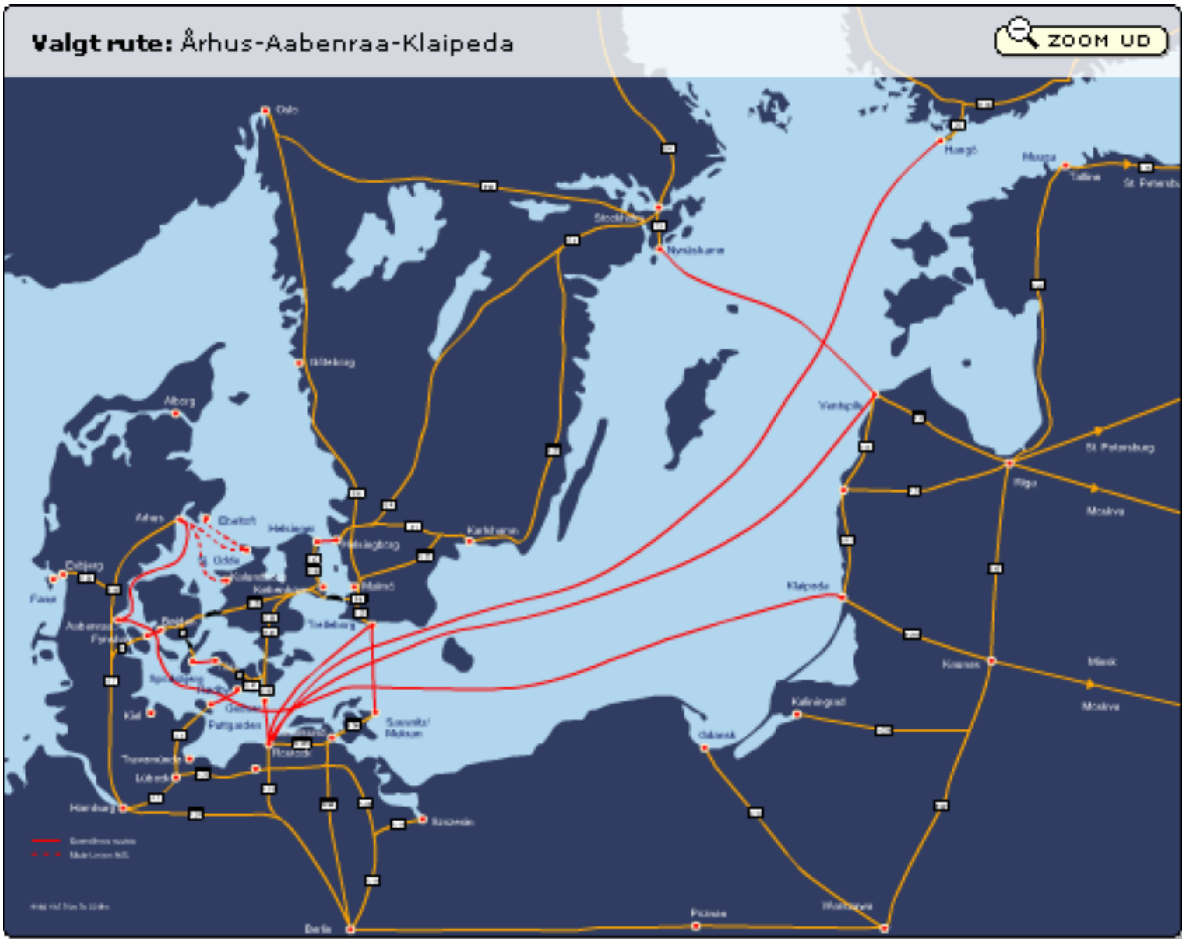

Figure 8: Scandlines network in Baltic Sea and South Baltic network.

Scandlines network very good develop in South – West part of the Baltic Sea and together with road and railway network, has good possibilities link main West Europe industry and population regions.

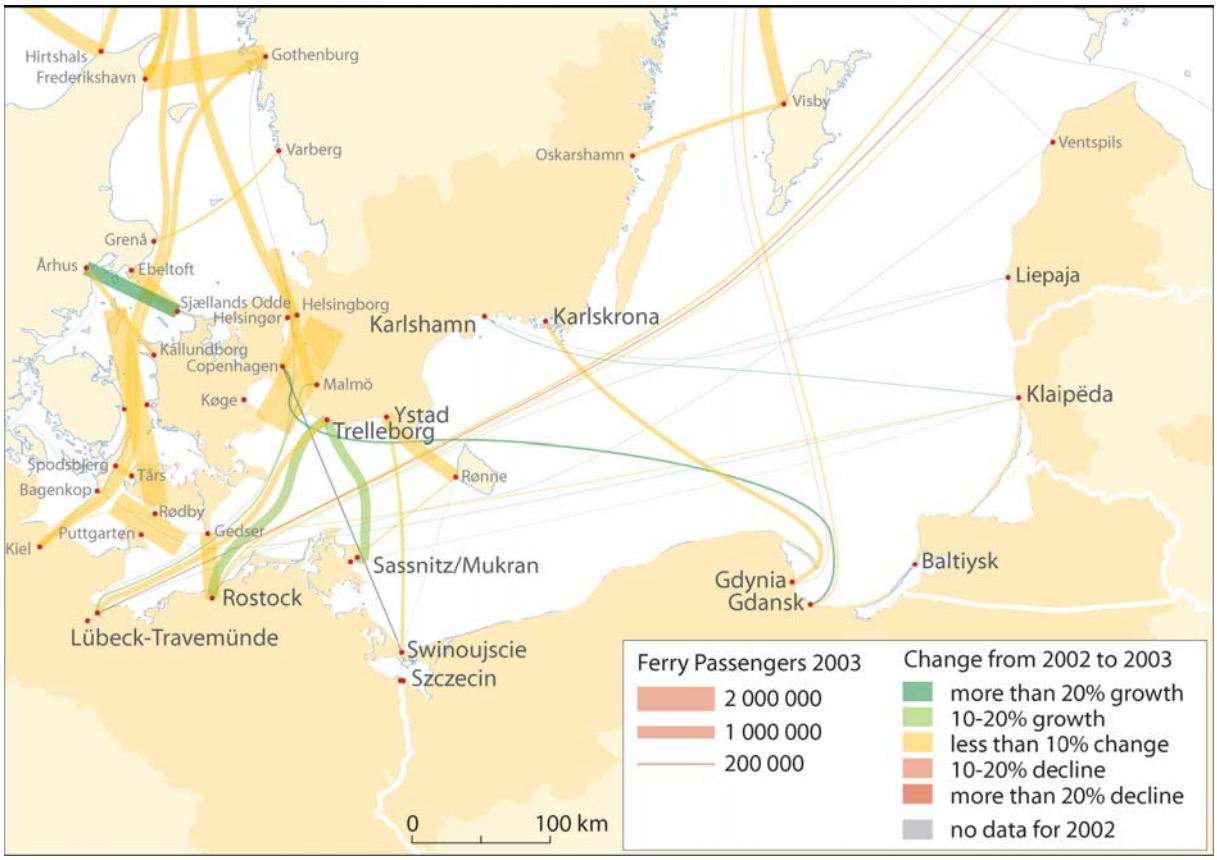

Figure 9: Main directions (Sea transport corridors) in South Baltic

Analysis of the existing situation should assist find advantages and disadvantages of the existing situation in Ro-Ro transportation and take optimum solutions during creation process of the Motorways of the Sea.

4. NEW TRANSPORT CORRIDORS (SEA MOTORWAYS) CREATION

Sea motorways as part of the logistics or supply chain in which is maritime part, should optimize transportation costs, decrease transportation time and increase cargo (goods) safety.

New maritime transport corridors or Sea motorways must compete with existing transport corridors. Theoretical study and practical calculations results, which can be used for the evaluation and take decisions in creating new transport corridors or sea motorways are presented in this section.

Traditional and existing transport corridors are very important, but in same time infrastructure development in many Countries and regions such as terminals, roads, railways, axes to the terminals, make additional possibilities to create new maritime or transport corridors at all. Sea motorways as new added value element, which have the main four elements: technical, technological, organizational and legal, should play the important role for spreading cargo flows and creating new transport directions or transport corridors.

Theoretical basis for the correct existing and new transport corridors evaluation, is very important to take decisions for the maritime industry and transport associates invest in new transport corridors creation, because investments in this sector economy are very high.

Long time studies in various projects, such as BaSIM, were studied economical, technical and other aspects, possibilities of creating new transport directions. Theoretical basis, which is presented in this section, many times were discussed on various Conferences and Workshops and extract of this basis is presented in there.

Traditional transport corridors for inter modal cargo transportation in Baltic Sea play the main role and ports, such as Klaipeda, Tallinn, Riga on East side of the Baltic and Stockholm, Trelleborg, Kiel, Travemünde, Rostock, Gdynia on West and South part of the Baltic Sea.

In the same time other ports, terminals and axes to the terminals from public road and railway network and network itself development very fast and new ports like Ventspils, Liepaja, Paldiski, Baltijsk and other on East side of the Baltic Sea and ports like Linköping, Karlskrona, Karlshamn, Swinouisce and other ports on West and South part of the Baltic Sea develop new terminals, axes from terminals to public road and railway network and have more or less equal conditions as traditional ports.

Correct evaluation possibilities of the transport corridors or Sea motorways are very important for research and practical tasks.

European Commission decision in November 2006, selected the main axes to the ports and Sea motorways (Figure 10), rises new ideas regarding transport directions and corridors.

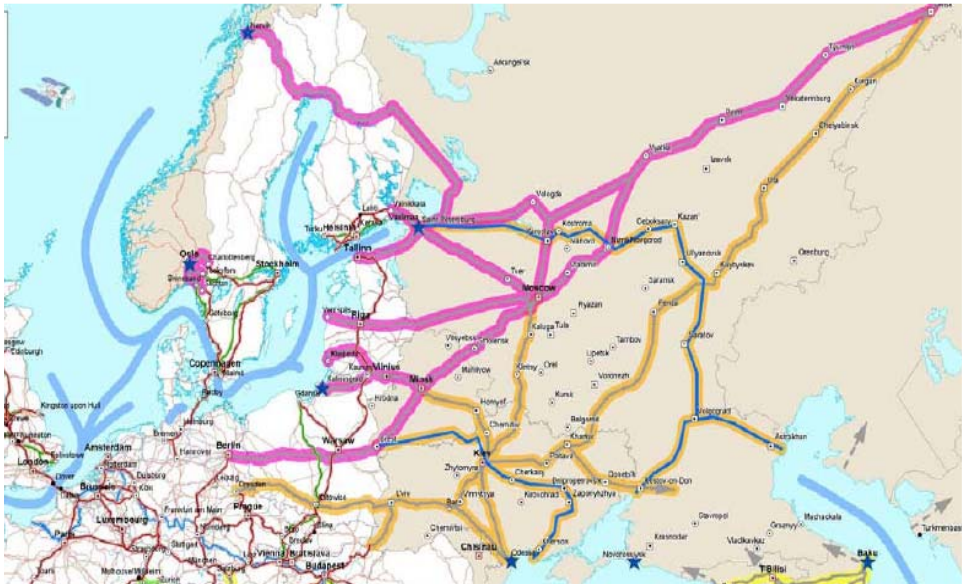

Figure 10. The major axes and Sea motorways approved by European Commission.

Correct evaluation models, which can assist in evaluating and finding the main comparison results of the different corridors from origin until destination places of the goods, are one of the main reasons, together with new cargo flows as result of the development of Countries economical activity, created new transport corridors or Sea motorways.

Cargo flow is increasing and the new port terminals and axes to the public roads and railway networks are the main reason for the new transport corridors and Sea motorways creation.

For the transport corridors evaluation is taken Gauss distribution and there are three the main factors: costs of the transportation, time of the delivery and cargo safety.

In case of Gauss distribution, the main factors' dependences can be expressed as follows:

$$\sum P = \lim_{pii \in n} opt\,, \qquad (1)$$

$$\sum T = \lim_{ti \in n} \min\,, \qquad (2)$$

$$\sum S = \lim_{si \in n} \max\,, \qquad (3)$$

Where: P, T, S - main factors (cost, time, safety);

p_i, t_i, s_i - costs, time and safety in separate transport corridor elements n.

Unified evaluation on basis dependences (1) – (3) can be expressed as follow:

$$G = k_P \sum P + k_T \sum T + k_S \sum S\,, \qquad (4)$$

Where: k_P, k_T, k_S - main factors weight coefficients.

Weight coefficients depend of the type of cargo (goods) and can be calculated as matrices (in case, if enough data) or can be found on basis of experts' evaluation. Dependence of the weight coefficients can be explained as follow: for the small and very expensive goods, like gold, jeweller minerals and so on, in transportation safety factor is much more important as other factors and in this case safety factor's weight coefficient should be very high. For such types of the goods like food, delivery time is more important as other factors and in this case time factor weight coefficient should be more high as other weight coefficients and so on.

For the typical inter modal cargo cost factor weight coefficient could be 0,30 – 0,45, time factor weight coefficient could be 0,20 – 0,30, safety factor weight coefficient could be 0,10 – 0,20. In any cases sum of the weight coefficients must be equal to 1.

TIME				PRICE	SAFETY	Motorways of Sea EVALUATION COEFFICIENT Comparison with other
Motorways of the Sea		**HOURS**	**TOTAL**	**TOTAL, EUR**	**MARKS**	
Loading		2	48,0	1520	4	0,96
To port (road or rail)	Distance 300	4,3				
Number of border crossing		1				
Sailing distance between ports	Distance 450	25,0				
Sailing in ports area		4				
Loading and unloading		8				
To destination place (road or rail)	Distance 300	3,75				
Road (railway)		**Hours**	**Total**	**Total, EUR**	**Marks**	
Loading		2	57,3	1840	3	
Driving	Distance 1786	31,3				
Border crossing number		4				
Driver refresh time		20				

Figure11. Transport corridors evaluation model

In Transport corridors Simulation model is taken Sea Motorway situation in which distance from original place up to port 300 km, driving average speed 70 km/h, loading transport

units in original place 2 hours, 1 border crossing place (in port), sailing time in ports areas 4 hours (including mooring operations), loading and unloading operations in ports together with waiting time and time for formalities for the transport unit takes 8 hours, distance between ports 450 n.m, average sailing speed 18 knots, distance on other shore from port to destination place 300 km, average driving speed 80 km/h.

Shore transport corridor has distance 1786 km, necessary cross 4 borders, driver refresh time according regulations 20 hours, average driving speed 57 km/h.

Transportation costs (prices) is taken on basis real investigations and is 1520 EUR in case Sea Motorways situation and 1840 EUR in case shore transport corridor using (calculated separately and were include in Simulation model for the evaluation transport corridors.

Safety factors are based on Insurance Companies data and evaluate as marks (from 1 to 5, 5 is best result).

Finally is calculated evaluation coefficient as different between Sea Motorway situation and Shore transport corridor situation. In presented example evaluation coefficient of the Sea Motorway in comparison with shore transport corridor is 0,96, that means Sea Motorway is 4 % better as Shore transport corridor.

In case is taken in account truck's depreciation and drivers working hours, Sea motorway is more useful as shore transport corridor.

5. NEW POSSIBLE MARITIME CORRIDORS BETWEEN EXISTING AND NEW MARKETS IN BSR

New possible Maritime transport corridors mainly link traditional maritime links and markets and new reality request create new Maritime transport corridors (Sea Motorways), which are important for new markets.

Figure 12. Existing transport corridor Klaipeda – Karlshamn and Klaipeda – Gdansk and possible maritime transport corridors

The shipping line between Klaipeda and Karlshamn could be in feature as direct explanation of the sea motorways implementation possibility.

Investigation of all cargo turnovers through maritime transport corridors and/or sea motorways is not quite correct since only specific cargo or goods transit has real influence

on sea motorways. Ro-Ro and container transportation via ports could be taken as the basis for the sea motorways investigations.

Request Ro-Ro ships voyage time in hours and days between South – West Baltic ports (traditional market) and new markets (East and North – East Baltic Sea ports) depends Ro-Ro ships speed is presented on table 4.

Table 4. Ro-Ro ships voyage time in hours and days between South – West Baltic Ports (traditional markets) and new markets (East and North – East Baltic Sea ports)

Port	16 knots	20 knots	24 knots
Kaliningrad	58 h = 2,4 d.	50 h = 2,1 d.	45 h = 1,9 d.
Klaipeda	64 h = 2,6 d.	55 h = 2,3 d.	48 h = 2,0 d.
Liepaja	68 h = 2,8 d.	58 h = 2,4 d.	51 h = 2,1 d.
Ventspils	75 h = 3,1 d.	65 h = 2,7 d.	58 h = 2,4 d.
Riga	98 h = 4,0 d.	83 h = 3,5 d.	74 h = 3,0 d.
Tallinn	110 h = 4,6 d.	93 h = 3,8 d.	82 h = 3,4 d.
Helsinki	116 h = 4,8 d.	98 h = 4,0 d.	86 h = 3,6 d.
St.-Petersburg	144 h = 6,0 d.	122 h = 5,1 d.	107 h = 4,5 d.

Request Ro-Ro ships voyage time in hours and days between South Sweden ports Karlskrona or Karlshamn and East Baltic ports Klaipeda, Kaliningrad or Liepaja, which are potential ports for the Sea Motorways creation on first stage depends Ro-Ro ships speed is presented on table 5.

Table 5. Ro-Ro ships voyage time in hours and days between South Sweden ports Karlskrona or Karlshamn and East Baltic ports Klaipeda, Kaliningrad or Liepaja

Port	16 knots	20 knots	24 knots
Klaipeda	43 h = 1,8 d.	38 h = 1,6 d.	34 h = 1,4 d
Kaliningrad	46 h = 1,9 d.	41 h = 1,7 d.	36 h = 1,5 d.
Liepaja	43 h = 1,8 d.	38 h = 1,6 d.	34 h = 1,4 d.

New direction as basis of the new regions development can be point out South –East and North – East Baltic Sea regions cooperation that means Poland and Finland and Maritime transport corridor on this direction.

Ro-Ro connection on this direction exist in past, but in new conditions such as Poland and Finland are EU members, transportation requirements increase and this direction is very important for the MoS development.

Table 6. Connection between ports of Gdansk/Gdynia and Helsinki-Hanko

Connection between ports of Gdańsk/Gdynia and Helsinki-Hanko

Ports		Operator	Agent	Ship	frequency
Gdynia	*-Helsinki*	Finnlines	Finnlines Polska	Ro-ro	6/week
Gdynia-	*Lubeka -Hanko*	Transfennica	Transfennica Polska	Ro-ro	3/week
Gdansk	*-Hanko*	Euro Marine Carrier	MAG	Ro-Ro cars	every 8 days
Gdansk-	*St. Petersburg -Helsinki*	Containerships	Containerships	Container ship	2/week

Connection between **Gdńsk/Gdynia – Finland** operated by 3 shipsowners
„Finnlines", „Transfennica", „Euro Marine Carrier"
„Containerships" - container transport only

Transport elements on Poland - Finland direction, which exist today, are shown on table 7 below.

Table 7. Connection between Gdansk/Gdynia and Helsinki

Connection between Gdańsk/Gdynia and Helsinki

Ship details	Amber	Finnforest	Inowroclaw
Type:	**ro-ro**	**ro-ro**	**ro-ro**
Built year:	**1992**	**1978**	**1980**
Built place:	**Rissa**	**Ulsan**	**Rauma**
GT:	**6719**	**15525**	**14786**
NT:	**2016**	**4702**	**4435**
DWT metric tons:	**5400**	**8429**	**7203**
Length, o.a./p.o. (m):	**122**	**156.00/137.00**	**137.18/126.50**
Breadth, moulded (m):	**19**	**22.60**	**23.00**
Draft, summer (m):	**6,17**	**7.30**	**7.54**
Speed (knots):	**16**	**17.0**	**17.0**
Total lane length (m):	**1260**	**2100**	**1403**
Container cap. (TEU):	**268**	**481**	**404**
Reefer cont. cap.:	**24**	**60**	**40**
Ice Class:	**1A Super**	**1A**	**1A**
Ownership:	**Chartered**	**Chartered**	**Chartered**

6. ANALYSIS OF THE POSSIBLE NEW MARRITIME CORRIDORS IN BSR

Main transport corridors, especially on East Cost of Baltic Sea play very important role for the co-operation East and West market, especially new EU Countries and old EU members. In same time East market which include CIS, Middle Asia and Fare East Countries. Main transport corridors around Baltic Sea are presented on figure 13.

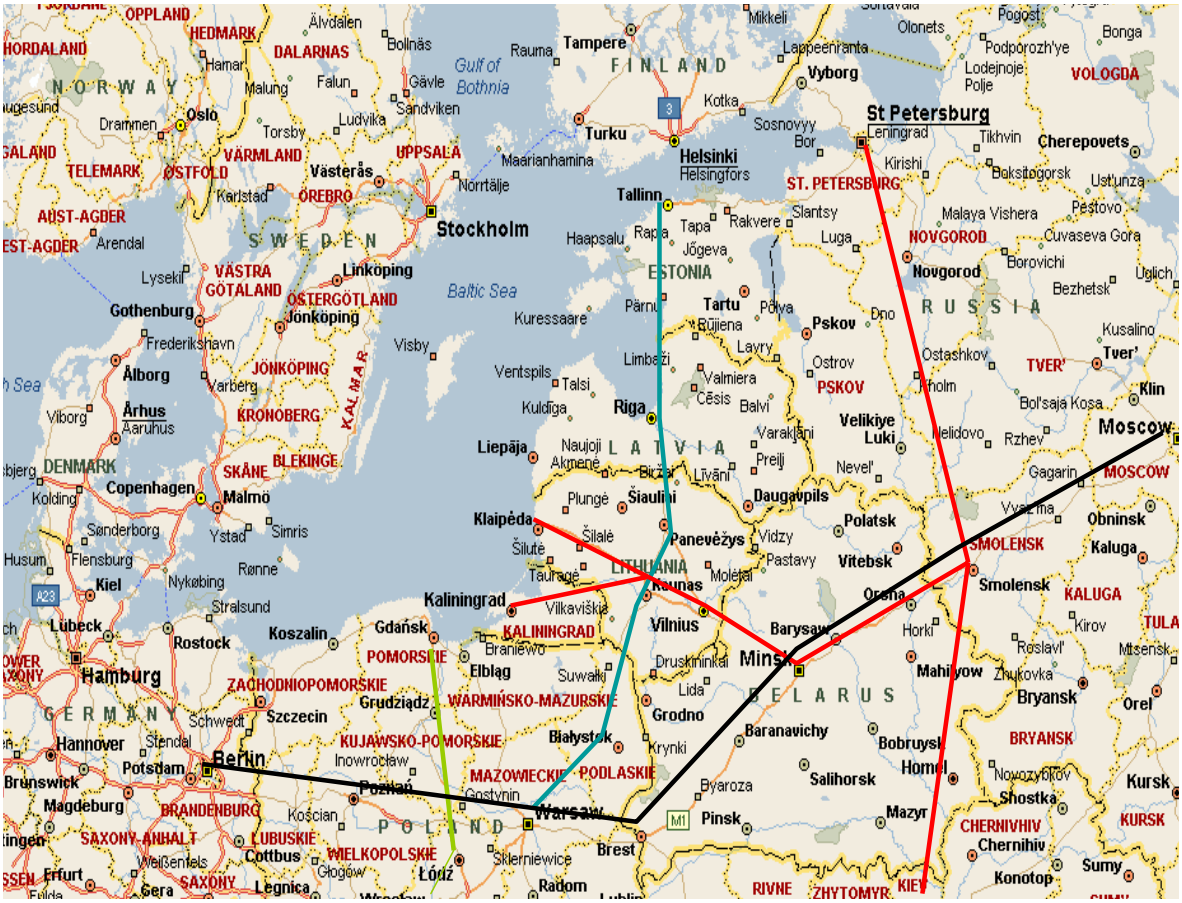

Figure 13: Main European transport corridors on East Baltic part.

Based on the information and following the methodology presented in this report, calculations for the different profiles are to be made, such as Ro-Ro development in different Baltic Sea regions, ships voyage time between different ports, time and safety

factors, for instance, for a road transport unit between Vilnius and Hanover in case of use of sea way (potential sea motorway) and inland ways, maritime transport corridors between Lübeck and Ventspils and maritime transport corridor between Gdansk and Helsinki – St.-Petersburg, and finally are made complex evaluations of the concrete transport corridors.

Ro-Ro transport dynamic for the directions on transport corridor No. IX and other directions are spread as follows:

- Kaliningrad, Klaipeda, Liepaja are included in transport corridor No. IX direction (West – East direction);
- second direction – Riga direction (West – East direction), include Riga and Ventspils ports.;
- third direction – South – North direction (South West part of the Baltic and Finland Bay ports).

As shown, the main Ro-Ro direction is the direction of Transport corridor No. IX and the reason of such dynamic is good Ro-Ro shipping lines connections, good road network eastward from the Baltic ports and lighter hydro meteorological conditions in comparison with other directions. Table 7 does not include Ro-Ro flows between Central and Northern part of Sweden to Helsinki and Tallinn – Helsinki routes.

Voyage time of the Ro-Ro ships between the main population and industry concentration regions located close to the South-West of the Baltic, and Eastern Baltic and Finland Bay ports based on the methodology presented in this report are produced and shown before.

Results show how the weekly timetable depends, and that best position of having ports is transport corridor No. IX, as sailing speed depends on this direction where it is possible to make 3 voyages per week per one Ro-Ro ship.

Fast ferries have not been investigated meanwhile, yet they could be very perspective in future especially en route between South-West Baltic region and South-Eastern Baltic ports.

On the basis of the existing cargo flows and dynamics of the development of different commodities it is possible to find tendencies and forecast transport flows. As example is presented container flow forecasting for the Klaipeda port in case investments used for the container terminal development.

Forecasting container flow for the Klaipeda port on basis multi-criteria forecasting method. (Paulauskas V. 2005)

Table 8. Forecast of the container flow for the port of Klaipeda

Year	Liner fore-casting method	*M* value in case investments in terminal	*M'* value in case without investments	Forecasting container flow in case *M* value	Forecasting container flow in case *M'* value
2006	185636	0,96	0,96	178000	178000
2007	208060	0,91	1,00	190000	208060
2008	230484	0,92	1,10	212000	235532
2009	252908	0,84	1,05	213000	265553
2010	275332	0,72	0,94	201000	258812
2011	297756	0,72	0,94	215000	279891
2012	320180	0,77	1,00	247000	320180
2013	342604	0,81	1,05	276000	359734
2014	365028	0,83	1,08	303000	394230
2015	378452	0,83	1,08	320000	408728

Based on the methodology used herein, road transport voyage from Vilnius (Lithuania) to Hanover (North Germany) has been considered, when using transport corridor with potential sea motorway Ro-Ro ferry Klaipeda – Kiel, Klaipeda - Karlshamn and inland transport corridor via Poland. Results of these investigations as example are offered (showed)

Table 9. Voyage Vilnius – Hanover investigation results

Transport Corridor	One-Way Trip Time consumption, hours	Costs (Basic Prices), EUR	Safety Factor: Positive Probability
By Ro-Ro ferry Klaipeda – Kiel	36	998	0,988
Inland transport corridor via Poland	48	1200	0,973
By Ro-Ro ferry line via Karlshamn	30	1020 (1255)	0,985

Ro-Ro ferry speed is taken as per conventional ferry with the same 22 -24 knots speed on both directions.

The above results have been checked within more than 30 transport companies that use all the three transport corridors, and they confirmed the presented results to be realistic in case the companies would pay taxes as due everywhere and road transport units drive according to the regulations.

Maritime transport corridors between Gdansk and Helsinki – St. Petersburg, and maritime transport corridor between Ventspils and Lübeck main parameters are presented.

Table 10. Main transport corridor between Gdansk and Helsinki – St.-Petersburg parameters. (Baltic Sea region maps)

Basic points	Distance, km	Transport means	Conditions	Remarks
Gdansk - Helsinki	950	Sea	Good	Ro-Ro ferry
Helsinki –St.-Petersburg	300	Sea	Ice winter	Ro-Ro ferry
Gdansk - Klaipeda	200	Sea	Good	Ro-Ro ferry
Klaipeda - Tallinn	620	Road	Good	
Tallinn - Helsinki	90	Sea	Good	Ro-Ro ferry
Helsinki –St.-Peterburg	430	Road	Good	
Klaipeda –St.-Petesburg	900	Road	Different	50% good road

Table 11. Main transport corridor between Ventspils and Lübeck parameters. (Baltic Sea region maps)

Basic points	Distance, km	Transport means	Conditions	Remarks
Lübeck - Ventspils	730	Sea	Good	Ro-Ro ferry
Lübeck - Trelleborg	270	Sea	Good	Ro-Ro ferry
Trelleborg - Norrkoping	480	Road	Good	
Norrkoping - Ventspils	300	Sea	Good	Ro-Ro ferry

For the complex evaluation, weights of the factors, as example can be used:

- price with weight coefficient 0,35;
- time with weight coefficient 0,20;
- safety with coefficient 0,25;
- hydro metrological conditions in with weight coefficient 0,1;
- border crossing with weight coefficient 0,05 (after 1st of May 2004 safety control according ISPS Code);
- other factors with weight coefficient 0,05.

Evaluation of the transport corridors Vilnius and Hanover as example are presented in table 12 below (the results to be considered as guiding indication, since every single case requires additional study and decisions regarding factors to be included and respective weights of the factors).

Evaluation of the transport corridors between Vilnius and Hanover when using an inland transport corridor via Poland and Ro-Ro ferries via Kiel and Karlshamn as maritime transport corridor and/or sea motorway.

Table 12. Evaluation of the transport corridors between Vilnius and Hanover

Factors and Weights	Transport Corridor with Ro-Ro Ferry via Karlshamn	Transport Corridor with Ro-Ro Ferry via Kiel	Inland transport Corridor via Poland
Price factor	0,85	0,84	1,0
Weight of the price factor	0,35	0,35	0,35
Time factor	0,62	0,75	1,0
Weight of the time factor	0,20	0,20	0,2
Safety factor	0,988	0,985	1,0
Weight of the safety factor	0,25	0,25	0,25
Hydro-meteorological factor	1,0	1,0	0,95
Weight of the hydro meteorological factor	0,1	0,1	0,1
Border crossing factor	1,0	1,0	0,93
Weight of the border crossing factor	0,05	0,05	0,05
Other factors	1,0	1,0	1,0
Weight of the other factors	0,05	0,05	0,05
Correlation coefficient	0,95	0,95	0,95
TOTAL	0,914	0,937	1,043

Factors were calculated as the best result divided to other results.

Based on the results received as provided in Table 12, we may conclude that a transport corridor with Ro-Ro ferry via Karlshamn with the existing possibilities, is the best if compared with a transport corridor via Kiel at ca.2,5 %, and in comparison with inland transport corridor it shows better at ca.14,1 %.

Karlshamn and Karlskrona are located very close to the main roads network in Sweden, and this position ensures very fast passage to Copenhagen and reach of other regions.

The second field of maritime transport corridors and/or sea motorways activities where reserves for extensive cooperation could be found in the areas of transport investigation as well as transport practical activities is the development of modern logistics centre network

throughout the Baltic Sea Region. The networking of logistics centres will have a positive effect on maritime transport corridors and/or sea motorways in these respects:

- Increased mobility of freight using efficiently various possibilities of interconnection between different transport modes;
- Increasing the use of existing infrastructure;
- Increasing of the quality of transport services;
- Creation of new permanent jobs;
- The efficient use of modern information and communication technology;
- Better business conditions for small and medium transport companies.

Common multilateral investigations and studies will be very functional for all parties aiming to reveal possibilities and ways on how to develop the intermodal transport, create and optimize maritime transport corridors and/or sea motorways and network the best links between the multiple countries on the Baltic Sea Region.

New sea motorways and new maritime transport directions based on new challenges and changes in the Countries around Baltic Sea. Methodology, which is described in Feasibility Report can be used for the Sea motorways and maritime transport corridors planning and evaluation and as example is presented in Appendix.

Analysing the Gdansk- Helsinki (with connection to St. Petersburg) corridor by integrating relevant stakeholders (incl. Spatial planning)

Transport corridors, including Sea motorways, between Gdansk and Helsinki with connection to St.-Petersburg, as example, was evaluate on basis methodology, which is presented in Feasibility Report. As well as transport corridors between Lübeck and Ventspils evaluation was made on basis same methodology.

For the evaluation ports, prices and other parameters are indicate as follows:

- Gdansk (G); Klaipeda (K); Tallinn (T); Helsinki (H); St.-Petersburg (P); Lübeck (L); Trelleborg (T); Nineshamn (N); Ventspils (V)

- Sea: Price – 0,58 EUR/km; Speed – 18 kn; Safety – 0,00002S;
- Road: Price – 0,81 EUR/km; Speed – 50 km/h; Safety – 0,0001S

Results of the evaluation as examples are presented in table 13 for the transport corridors between Gdansk and Helsinki – St.-Petersburg and in table 14 for the transport corridors between Lübeck and Ventspils.

Table 13. Evaluation of the transport corridors between Gdansk and Helsinki – St.-Petersburg if are using different transport corridors.

Factor	G – H - P	G – K – T – H - P	G – K – P
Price (0,4)	0,71	1	0,83
Time (0,4)	1	0,86	0,67
Safety (0,2)	0,45	1	0,85
Complex	0,774	0,994	0,770

Table 14. Evaluation of the transport corridors between Lübeck and Helsinki – Ventspils if are using different transport corridors.

Factor	L – V	L – T – N – V
Price (0,4)	1	0,59
Time (0,4)	1	0,87
Safety (0,2)	1	0,40
Complex	1,0	0,664

Received complex evaluation shows the best possible solutions.

7. CONCLUSIONS

- Motorways of the Sea make first steps and start to play important role in Europe. New markets around Baltic Sea and in regions, which are important for the Baltic Sea, create new possibilities and potentials.
- Based on this report it can be stated that evaluation of the MoS advantages and disadvantages regarding new Maritime transport corridors between new markets are important for the promotion of the MoS.
- Motorways of the Sea can influence on changes existing supply systems and transport directions between existing and new markets, but it must be explain by exact examples and calculations.
- Motorways of the Sea can assist to activate economics of the regions and Countries and create new markets.
- From the analysis in this report it can be seen that new transport corridors, in which maritime part is included, in many cases are more privileged in comparison with existing shore transport corridors.
- Methodic presented in this paper can be used for the transport corridors evaluation and taken final decisions of creating new transport corridors (Sea motorways).
- Example, presented in this paper and dialogue with the relevant stakeholders shows a good accurancy of the calculations.

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