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***BENCHMARKING OF RO-RO CONNECTIONS  
IN THE BALTIC SEA AND THE NORTH SEA***

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## 1. Background and aim of the study

This benchmarking study is part of the REFEC project (Reinforcing Eastern Finland-Estonia Transport Corridor). The aim of the project is to support the initiation of Loviisa –Kunda ro-ro connection that would make the corridor operational. The project consists of study on the freight potential of Eastern Finland – Eastern Estonia transport corridor and concrete measures to support a ferry connection between Loviisa and Kunda. Furthermore, the socio-economic and environmental impact of the corridor, once operational, is studied. This benchmarking study draws from a report concerning the freight potential of the corridor.

In this study, the aim is to benchmark suitable connections to the anticipated Loviisa-Kunda connection. The benchmarking area is limited to the Baltic Sea and the North Sea. Special attention is paid to features like

- sailing time between the ports
- number and timing of departures
- number of shipping companies and vessels (including types, capacity etc.) operating the connections
- transported volumes

## 2. Overview of ro-ro transports in the Baltic Sea Region

The ports in nine countries located around the Baltic Sea and the North Sea handled 1 045.3 million tons of cargo in the year 2016 (Table 1.). Of this total amount 143.3 million tons was transported with ro-ro mobile units (trucks and semitrailers), equivalent to circa 14 per cent of the total. The share of ro-ro mobile units in the total tonnage was the highest in Sweden and in Denmark, which reflects the importance of ro-ro ferry traffic in the seaborne transport of these countries. (Eurostat).

Table 1. Ro-Ro mobile units and total amount of cargo handled in main ports\* of countries situated around the Baltic Sea in the year 2016. (Source: Eurostat)

Country	Ro-Ro mobile units (mln tn)	total cargo (mln tn)	% of Ro-Ro mobile units
Sweden	46.1	171.3	26.9 %
Germany	35.7	297.1	12 %
Denmark	22.1	84.9	26 %
Finland	17.7	102.7	17.2 %
Poland	8.4	72.5	11.6 %
Estonia	4.6	30.2	15.2 %
Norway	3.4	181	1.9 %
Lithuania	2.8	46.2	6.1 %
Latvia	2.6	59.4	4.3 %
<b>TOTAL</b>	<b>143.3</b>	<b>1 045.3</b>	13.7 % (mean)

\*Main ports are ports handling more than 1 million tonnes of goods annually.

HELCOM's report (2018) illustrates the maritime activities in the Baltic Sea. According to a report, there were over 295 000 visits to the ports of the Baltic Sea region in the year 2015. Of this number almost half (46%) were made by passenger ships. In all there were 7 889 ships operating in the Baltic Sea in 2015. The number of Ro-Ro cargo ships was 242 (3.1 %).

### 3. Implications of REFEC freight potential study

According to a REFEC freight potential study the most important facts that have to be taken into consideration when a new shipping connection is planned were the **frequency and timing of departures**.

Most respondents of the survey argued that there is no need for numerous departures per day; **mostly two departures per day would be enough**. Even more important than the amount of daily departures is **the right timing of the departures**. According to many respondents, departures should take place **in the morning and in the evening**.

Other remarks concern the volume of transported goods. It is normal that the demand for the cargo capacity can be sometimes well above supply, but on the other hand, there can be also quite empty departures. This should be taken into consideration when a new route is planned so that **supply could respond to peak demand**. The interviewees recommended that Loviisa-Kunda should focus on its competitive advantage (in marketing) and provide cargo capacity when there is demand. This implies the possibility to **adjust the frequency if needed**.

Besides the frequency and timing of departures, two other important factors of Loviisa-Kunda route's feasibility emerged in the course of the interviews.

- 1) The first factor related to the cost of transport. According to respondents, the price level should be "right" which means that it should be the same as in current routes or preferably less. It was also highlighted that companies are constantly calculating the total costs of the transportations, and decisions concerning routes are made based on them.
- 2) The second factor related to the specific type of cargo that could be transported in Loviisa-Kunda connection. Hazardous goods, other special goods and oversized cargo were pointed as an example of cargo niche types, which could be transported via Loviisa-Kunda.

Based on the triangulation of different sources and data collected in the REFEC freight potential study, the crude estimation **of the potential for the Loviisa-Kunda connection was estimated to be 20 000 - 40 000 ro-ro units**. The basis for the use of Loviisa-Kunda connection would most likely be in the export of Finnish forest industry. Products of the metal and other basic industries are the cargoes that are also exported from the area. The estimations

concerning the cargo shares that could be transferred to Loviisa-Kunda connection from the corridor area ranged from small shares up to half of the export. The cargo shares concerning the import were considered much lower. Eastern Finland Corridor is a strong export region in Finland. The challenge is to organize import to balance the transports. Even if the export is dominating, there is also import to the region, for example raw materials. Uusimaa county is located near the studied region and extra potential could be attained from import volumes of Uusimaa (Loviisa is actually part of Uusimaa county).

## 4. Benchmarking of ro-ro connections in the Baltic Sea Region

### 4.1 Collecting data and choosing the connections for benchmarking

Information on current connections was collected from earlier surveys (for example Ro-Ro & Ferry Atlas Europe 2016) and from shipping company web pages. Due to the continual changes in routing and scheduling, it is challenging to present all-inclusive list of existing connections. However, the aim was to collect as comprehensive data of connections as possible on situation in spring 2019. Western boundary of the targeted area was set to the North Sea where the connections between Norway and Denmark were included.

In all, there were **20 shipping companies** that operate in the selected area and they have **71 point-to-point connections**. Connections which take many days (such from Kemi/Oulu to Lubeck without reloading) were excluded from the data as well as connections which lead outside the Baltic Sea and the North Sea. Collection and ranking of information is explained below phase by phase.

**Phase I:** Collecting data from earlier studies and reports and from shipping company web pages > in total **71 ro-ro and ro-pax connections** in the Baltic Sea and the North Sea.

**Phase II:** Information of sailing hours was collected from the web pages of shipping companies. Thereafter, the connections were ranked by the sailing hours from the shortest to the longest. The shortest was between Helsingor-Helsingborg and Puttgarden-Rodby and the longest between St. Petersburg-Gdynia in this dataset.

**Phase III:** After ranking the connections according sailing time, the connections of five hours or under selected for a closer analysis, i.e. **23 connections in all** (see Table 2.). Information on the selected connections covered the shipping companies operating the connection, frequency, vessel properties (for example type, capacity) and other possible important features.

**Phase IV:** Finally, from 23 connections **6 connections** were chosen for benchmarking based on sailing time, frequency and vessel types.

Criteria for excluding the rest of the connections were

- 1) Too short distance / sailing time (Helsingor-Helsingborg and Puttgarden-Rodby)
- 2) Frequency: too few or too many departures: for example once a week (Helsinki-Paldiski) or up to 10 times per day (Rostock-Gedser).
- 3) Domestic connections (for example Turku-Mariehamn) or several ports on the route (from Långnäs to Kapellskär, when port of departure is Naantali).
- 4) Type of cargo, for example only passengers/cars, and not trucks and/or trailers (Hirtshals-Kristiansand).

**Chosen connections** (marked green in Table 2.) for benchmarking were

1. HIRTSHALS (Denmark) – KRISTIANSAND and LARVIK (Norway)
2. SANDEFJRJORD (Norway) – STRÖMSTAD (Sweden)
3. TRELLEBORG (Sweden) – SASSNITZ (Germany)
4. VARBERG (Sweden) – GRENAA (Denmark)
5. VAASA (Finland) – UMEÅ (Sweden)
6. HANKO (Finland) – PALDISKI (Estonia)

Table 2. 23 connections of which 6 (green) were selected for benchmarking.

PORT	PORT	SAILING HOURS	SHIPPING COMPANY	FREQUENCY	VESSELS / OTHER INFORMATION
Helsingor (DK)	Helsingborg (SE)	0,3			
Puttgarden (GE)	Rodby (DK)	0,8			
Helsinki (FI)	Tallinn (EE)	2	TallinkSilja	every second hour on both directions every day	
Helsinki (FI)	Tallinn (EE)	2	Eckerö Line	3-4 times/day depending on the day of the week	
Mariehamn (FI)	Kapellskär (SE)	2	Viking Line		Turku- Mariehamn-Kapellskär
Rostock (DE)	Gedser (DK)	2	Scandlines	up to 10 times/day, every second hour from early morning until late evening	M/V Berlin and M/V Copenhagen. A capacity of 1,300 passengers and 460 cars.
Gothenburg (SE)	Fredrikshavn (DK)	3	Stena Line	6 times/day on both directions	
Grisslehamn (SE)	Eckerö (FI)	3	Eckerö Line	2-3 times/day on both directions (depending a day /season)	no trucks, trailers
Hanko (FI)	Paldiski (EE)	3	DFDS	mostly twice/day on both directions	Sailor, a passenger ro-ro cargo ship
Hanko (FI)	Paldiski (EE)	3	Transfennica	every second or third day on both directions	

Paldiski (EE)	Helsinki (FI)	3	Finnlines	only once a week (Thu), no HKI-Paldiski direction	
Hirthals (DK)	Kristiansand (NO)	3	Color Line	Twice/day on both directions	SuperSpeed1, lane meter 1 990, cars 750
Hirthals (DK)	Kristiansand (NO)	3	Fjordline	Twice/day on both directions	HSC Fjord Cat, catamaran, 900 passengers, 240 cars
Hirsthals (DK)	Larvik (NO)	3	Color Line	Twice/day on both directions	SuperSpeed2, tarilere lanemeter 2 036, cars 764
Strömstad (SE)	Sandefjord (NO)	3	Color Line	Four times/day on both directions.	MS Bohus (462 lane meter), MS Color Viking (490)
Strömstad (SE)	Sandefjord (NO)	3	Fjordline	Twice/day on both directions	MS Oslofjord. The ship can accommodate 1,350 passengers and 370 cars on the crossing.
Trelleborg (SE)	Sassnitz (DE)	4	Stena Line	Twice/day on both directions	Sassnitz, 1701 lane meters (711 m rails), 900 passengers.
Vaasa (FI)	Umeå (SE)	4	Wasalines	Departures vary according to season, high season 4 and low season one crossings	M/S Wasa Express. Lanemeters 1150, passengers 915, cars 450, trucks 65.
Varberg (SE)	Grenaa (DK)	4	Stena Line	Twice/day on both directions (depending on season).	Stena Nautica, 1265 lanemeters, 900 passengers.
Hirthals (DK)	Göteborg (SE)	5	CLdN	Only once a week (Tue). No Göteb.-Hirts. direction	
Hirsthals (DK)	Langesund (NO)	5	Fjordline	Once a day on both directions.	MS Stavangefjord, MS Bergensfjord
Långnäs (FI)	Kapellskär (SE)	5	Finnlines		Naantali- Långnäs Kapellskär
Turku (FI)	Mariehamn (FI)	5	Viking Line		domestic

## 4.2 Analysis of the six selected connections

The six connections for benchmarking are presented figure 1. Routes from Hirsthals (Denmark) to Kristiansand and Larvik (Norway) are treated together. First criterion for connection to be selected for benchmarking was a **sailing time** between ports. For the selected connections special attention was paid to **frequency** and **number of vessels/shipping companies** in the route. Also **number of transported units** and **vessel type and other features** (for ex. vessel capacity in lane meters) operating in each route were studied.



Fig. 1. The six connections for benchmarking (*Halland = port of Varberg and part of Hallands Hamnar and Mukran = port of Sassnitz*). Source: Ro-ro & ferry atlas Europe 2016/17. Baltic Press.

### 1. HIRTSHALS (Denmark) – KRISTIANSAND AND LARVIK (Norway)

Connections from Hirtshals, Denmark to two Norwegian ports, Kristiansand and Larvik, are operated by Color Line. The distance between these two Norwegian ports is 190 kilometers, which takes approximately 2.5 hours to drive by car. According to a shipping company *Color Line Cargo can handle almost every cargo unit including ro-ro, containers, single cars, caravans, buses, camping units and special machines on own wheels or mafi*. In addition to connections between Norway and Denmark, Color Line is operating routes from Norway to Sweden (from Sandefjord to Strömstad which is one of the benchmarked routes) and to Germany (from Oslo to Kiel).

The connection between Hirtshals and Kristiansand is operated by SuperSpeed 1 (Fig.2.). SuperSpeed1 max capacity is 2 400 person, it can take 750 cars and it has **1 990 lane meters for cargo**. The travel time is 3 hours and 15 minutes and there are two daily departures from both ports: from Hirtshals 12:15 and 20:45 and from Kristiansand 8:00 and 16:30 (Fig.3.). The data for the transported ro-ro cargo units is from Statistics Norway, which classifies units into four different groups (Road goods vehicles and accompanying trailers; Unaccompanied road goods trailers semitrailers; Shipborne port-port trailer engaged in goods transport; Other mobile non-self-propelled units). According to Statistics Norway there is **approximately 29 000 units transported yearly** in the route.

Another shipping company, Fjordline, is also operating in this route. HSC Fjord Cat is a catamaran that operates twice per day on both directions. Its capacity is 900 passengers and 240 cars., It was, however, excluded from the benchmarking since it does not transport freight.



Fig.2. SuperSpeed 1, a passenger ro-ro cargo ship operating between Hirtshals and Kristiansand (Source: Color Line’s webpage).

Kristiansand - Hirtshals	Hirtshals - Kristiansand
<b>26 April 2019</b>  08:00 – 11:15 M/S SuperSpeed 1 16:30 – 19:45 M/S SuperSpeed 1	<b>26 April 2019</b>  12:15 – 15:30 M/S SuperSpeed 1 20:45 – 23:59 M/S SuperSpeed 1

Fig.3. There are two daily departures from both ports (Source: Color Line web site).

**Hirtshals - Larvik** connection is operated with SuperSpeed 2 (Fig.4.). Its maximum capacity is 2 000 person, it can take 764 cars and **2 036 lane meters for cargo**. The crossing takes 3 hours and 45 minutes and there are two daily departures from both ports: from Hirtshals 12:45 and

22:15 and from Larvik 8:00 and 17:30 (Fig. 5.). The number of transported units is twice as large as in Hirtshals-Kristiansand route, **58 00 transported ro-ro units** per year.



Fig.4. SuperSpeed 2, a passenger ro-ro cargo ship operating between Hirtshals and Larvik (Source: Color Line’s webpage).

Hirtshals - Larvik	Larvik - Hirtshals
<p>26 April 2019</p> <p>12:45 – 16:30 M/S SuperSpeed 2</p> <p>22:15 – 02:00 M/S SuperSpeed 2</p>	<p>26 April 2019</p> <p>08:00 – 11:45 M/S SuperSpeed 2</p> <p>17:30 – 21:15 M/S SuperSpeed 2</p>

Fig.5. There is two daily departures from both Hirtshals and Larvik (Source: Color Line’s webpage).

## 2. SANDEFJORD (Norway) – STRÖMSTAD (Sweden)

Color Line is also operating the route from Sandefjord in Norway to Strömstad in Sweden. The travel time is 2,5 hours, which save 254 kilometers of driving according to a shipping company. Sandefjord-Strömstad route has less transported units than two Color Line’s connections between Denmark and Norway. **The number of transported units is approximately 16 000** (Statistics Norway). There are two vessels operating on the route: M/S Bohus’s (Fig.6.) with max capacity of 1 218 person, 240 cars and **462 lane meters for cargo**. Color Viking’s (Fig.6.) max capacity is 1 773 person, 370 cars and has **lane meter 490 for cargo**. There are **four daily departures from both ports every 3-3.5 hours** (Fig.7.).

Fjordline is also operating this route. M/S Oslofjord has two departures for both directions, but it takes only passengers and cars, and no freight.



Fig.6. M/S Bohus and Color Viking are operating between Sandefjord (NO) and Strömstad (SE) (Source: Color Line’s webpage).

Strömstad - Sandefjord	Sandefjord - Strömstad
29 April 2019	29 April 2019
10:00 – 12:30 M/S Bohus	07:00 – 09:30 M/S Bohus
13:40 – 16:10 M/S Color Viking	10:00 – 12:30 M/S Color Viking
17:00 – 19:30 M/S Bohus	13:30 – 16:00 M/S Bohus
20:00 – 22:30 M/S Color Viking	17:00 – 19:30 M/S Color Viking

Fig.7. There is four daily departures from both Strömstad and Sandefjord every 3-3.5 hours (Source: Color Line’s web site).

### 3. TRELLEBORG (Sweden) – SASSNITZ (Denmark)

There are two routes operated by Stena Line in this benchmarking: Trelleborg–Sassnitz and Varberg–Grenaa. Stena Line is operating 21 ferry routes, and during 2017 it transported approximately 7.4 million passengers, 1.7 million cars and 2.1 million freight units.

The connection between Trelleborg and Sassnitz is operated by Stena Line’s MS Sassnitz (Fig.8.), which has passenger capacity of 900, car capacity is 220 and **freight capacity is 990 lane meters** (and 711 m rails). The travel time is four hours. There is **one daily departure from both ports**: from Sassnitz in the afternoon/evening and from Trelleborg morning/early afternoon. Departure times vary a little according by the day of the week (Figure 9). In addition, public holidays can make a break to the timetable.

According to Baltic Port List (2014), the amount of trucks and trailers handled in Sassnitz port is approximately 20 000. In comparison with Sassnitz, the amount of truck and trailers that are handled in Trelleborg is multifold, approximately 650 000 units. There are six routes from Trelleborg, while from Sassnitz there is just one more roro connection (to Rønne, DK). We

assume, however, that the cargo traffic, **20 000 units**, is dominantly between Sassnitz and Trelleborg, whereas the Sassnitz –Rønne is mainly for passengers and their cars.



Fig.8. Sassnitz is running between Trelleborg and Sassnitz twice a day (Source: Stena Line’s webpage).

SASSNITZ-TRELLEBORG				TRELLEBORG-SASSNITZ			
Dep.	Status	Arrival		Dep.	Status	Arrival	
<b>MON 29.4.2019</b>				<b>MON 29.4.2019</b>			
15:30		19:45	<a href="#">Sassnitz</a>	08:00	Sailed	12:15	<a href="#">Sassnitz</a>
<b>TUE 30.4.2019</b>				<b>TUE 30.4.2019</b>			
No sailings this day				No sailings this day			
<b>WED 1.5.2019</b>				<b>WED 1.5.2019</b>			
No sailings this day				No sailings this day			
<b>THU 2.5.2019</b>				<b>THU 2.5.2019</b>			
17:30		21:45	<a href="#">Sassnitz</a>	08:15		12:30	<a href="#">Sassnitz</a>
<b>FRI 3.5.2019</b>				<b>FRI 3.5.2019</b>			
13:45		18:00	<a href="#">Sassnitz</a>	08:00		12:15	<a href="#">Sassnitz</a>
<b>SAT 4.5.2019</b>				<b>SAT 4.5.2019</b>			
17:30		21:45	<a href="#">Sassnitz</a>	09:15		13:30	<a href="#">Sassnitz</a>
<b>SUN 5.5.2019</b>				<b>SUN 5.5.2019</b>			
15:30		19:45	<a href="#">Sassnitz</a>	09:45		14:00	<a href="#">Sassnitz</a>

Fig.9. There is one daily departure from both Sassnitz and Trelleborg (Source: Stena Line’s webpage).

#### 4. VARBERG (Sweden) – GRENAA (Denmark)

The route between Varberg and Grenaa is operated by Stena Nautica, with capacity of 900 passengers, 324 cars and it has **1 265 lane meters for cargo** (Fig.10.). The crossing time is 4 hours and 15 minutes. **Departures are twice a day from both ports:** from Varberg to Grenaa in the morning and in the evening and from Grenaa to Varberg in the afternoon and around the midnight (Fig.11.). According Baltic Port List 2014, **the number of transported units in**

**the route per year is 39 000.** The shipping company web site points out that from the route there is an easy access to the important hubs in the southern part of Sweden and in Mid-Jutland. From Varberg it will only take you a few hours to your final destination and from Grenaa it is only a one hour's drive to Denmark's second largest city, Århus, and the important transport centres just south of the city.



Fig. 10. Stena Nautica is operating between Varberg (SE) and Grenaa (DK) (Source: Stena Line's webpage).

VARBERG - GRENAA				GRENAA - VARBERG			
Dep.	Status	Arrival		Dep.	Status	Arrival	
<b>MON 29.4.2019</b>				<b>MON 29.4.2019</b>			
08:50	Sailed	13:15	<a href="#">Stena Nautica</a>	01:00	Arrived	06:15	<a href="#">Stena Nautica (c)</a>
19:45		00:05	<a href="#">Stena Nautica</a>	14:20		18:45	<a href="#">Stena Nautica</a>
<b>TUE 30.4.2019</b>				<b>TUE 30.4.2019</b>			
07:00		11:25	<a href="#">Stena Nautica</a>	01:00		06:15	<a href="#">Stena Nautica</a>
19:45		00:05	<a href="#">Stena Nautica</a>	14:20		18:45	<a href="#">Stena Nautica</a>
<b>WED 1.5.2019</b>				<b>WED 1.5.2019</b>			
07:00		11:25	<a href="#">Stena Nautica</a>	01:00		06:15	<a href="#">Stena Nautica</a>
19:45		00:05	<a href="#">Stena Nautica</a>	14:20		18:45	<a href="#">Stena Nautica</a>
<b>THU 2.5.2019</b>				<b>THU 2.5.2019</b>			
07:00		11:25	<a href="#">Stena Nautica</a>	01:00		06:15	<a href="#">Stena Nautica</a>
19:45		00:05	<a href="#">Stena Nautica</a>	14:20		18:45	<a href="#">Stena Nautica</a>
<b>FRI 3.5.2019</b>				<b>FRI 3.5.2019</b>			
07:00		11:25	<a href="#">Stena Nautica</a>	01:00		06:15	<a href="#">Stena Nautica</a>
19:45		00:05	<a href="#">Stena Nautica</a>	14:20		18:45	<a href="#">Stena Nautica</a>
<b>SAT 4.5.2019</b>				<b>SAT 4.5.2019</b>			
No sailings this day				No sailings this day			

Fig. 11. Varberg – Grenaa has two departures per day from both ports (Source: Stena Line web site).

## 5. VAASA (Finland) – UMEÅ (Sweden)

The connection between Vaasa and Umeå is operated by Wasaline. M/S Wasa Express (Fig. 12.) has maximum capacity of 915 passengers, 450 cars and 65 trucks and it has **1 150 lane meters for cargo**. According to a company web site there are *200 000 passengers/year and cargo 300 000 tons/year*. The number of transported trucks and trailers is **slightly over 14 000 units** (Statistics Finland). **The schedule has strong seasonal variation** (for example in year 2019 ten different timetables) **and also by different days of the week** (Fig. 13.). For example in May there is **two to four crossings** between Vaasa and Umeå (Fig. 13.). The fastest crossing takes 4.5 hours, but like in the number of departures, there is also variation in travel times. The shipping company is currently procuring a new vessel which should be in operation in 2021.



Fig. 12. M/S Wasa Express is running between Vaasa and Umeå (Source: Wasaline web site).

#### NOTE

We maintain the right to make changes.

All times are local.

25.1 – 2.5 2019

18 – 22.4.2019 Easter

3.5 – 31.5 2019

1.6 – 26.6 2019

20 – 23.6.2019 Midsummer

27.6 – 11.8 2019

25.7-29.7.2019 Football cup weekend

12.8 – 22.12 2019

23.12 2019 – 2.1 2020

Christmas 2019

Fig. 13. In 2019 there are ten different timetables, which changes according to a season (Source: Wasaline's webpage).

#### 6. HANKO (Finland) – PALDISKI (Estonia)

The connection between Hanko and Paldiski is operated by DFDS RoPax vessel Sailor, which capacity of 1 400 lane meters. (Fig. 14.). Sailing time of the connection is **3-3.5 hours**. There are **1-2 departures per day** from both ports (except on Saturday, when there is no service, Fig. 15.). Departures are early in the morning (4:00/5:00) or late in the evening (22:00/23:00), but also in the daytime (13:00 and 18:00). The route serves mainly cargo transport to which the schedule is adapted. The number of transported units in the route is approximately **42 000** (Traficom).



Fig. 14. DFDS's RoPax vessel Sailor (Source: DFDS's webpage).

	Paldiski-Hanko		Hanko-Paldiski	
	Departure	Arrival	Departure	Arrival
Monday	04:00	07:30	23:00	02:30*
Tuesday	05:00	08:30	13:00	16:00
Tuesday	18:00	21:00	23:00	02:30*
Wednesday	05:00	08:30	13:00	16:00
Wednesday	18:00	21:00	23:00	02:30*
Thursday	05:00	08:30	13:00	16:00
Thursday	18:00	21:00	23:00	02:30*
Friday	05:00	08:30	23:00	02:30*
Saturday	-	-	-	-
Sunday	17:30	21:00	22:00	01:30*

Fig.15. Timetable between Paldiski and Hanko (Source: DFDS's webpage).

## 5. Summary and conclusions

### Volume of transported units

Concerning the anticipated connection between Loviisa and Kunda, it has been assumed that the amount of transported units could be approximately from 20 000 to 40 000 per year. According to the cargo potential report, the most of this amount would come from the forest industry, but also products of the metal and other basic industries would comprise a part of the amount. In the benchmarked connections the amount on transported units are from

14 000 to 58 000 while the average is approximately 31 000 units per year (Table3.). The type of goods that are transported in the routes were not covered in this benchmarking.

Table 3. Number of transported units in the benchmarked connections.

PORT A	PORT B	RORO UNITS		RORO (average circa)	CARS (average circa)
		2017	2018		
Hirtshals (DK)	Kristiansand (NO)	30 017	27 500	29 000	190 000
Hirtshals (DK)	Larvik (NO)	54 471	62 352	58 000	105 000
Sandefjord (NO)	Strömstad (SE)	15 828	15 953	16 000	229 000
Trelleborg (SE)	Sassnitz (DE)	643 398* (2014)	20 318 (2014)	20 000	n.a.****
Varberg (SE)	Grenaa (DK)	39 193 (2013)**	38 634 (2014)***	39 000	33 000
Vaasa (FI)	Umeå (SE)	14 247	14 193	14 000	44 000
Hanko (FI)	Paldiski (EE)	42 000	42 000	42 000	no cars in practise

\* This figure includes all units handled in the port of Trelleborg (2014). Since there are six roro connection to Trelleborg the volume transported to Sassnitz remains unknown.

\*\* Volume handled in Varberg (has roro connection only to Grenaa)

\*\*\* Volume in Grenaa (has roro connection only to Varberg)

\*\*\*\* Car volume cannot be separated from Sassnitz-Rönne route.

Sources: Baltic Port List (2014), Statistics Norway, Statistics Finland, Traficom

### Number of departures

In the cargo potential study concerning Loviisa-Kunda connection, a recommendation from the survey and interviews was that there should be at least one departure from both ports per day. In general, there were two departures from both ports in the surveyed ports. Exception to this was Sandefjord-Strömstad which is the shortest route of the benchmarked connections (four daily departures from both ports) and Sassnitz-Trelleborg (one daily departure from both ports). Timetables are not stable - seasonal variation and public holidays can make changes to timetables.

### Timing of departures

The cargo potential study raises the timing of departures as important as the number of departures. In these benchmarked connections the departure times vary considerably, and no definitive trend can be seen in them. On the other hand, some hours are more preferred

than others (Fig.16.). In general the shipping companies here seem mainly serve the passengers which affects the timetables. For example, the connection between Vaasa and Umeå is operated twice per day in low season, but four times per day in high season. If variations over a 24-hour period are explored, there are only two departures in night-time: Grenaa-Varberg at one o'clock and Paldiski-Hanko at four/five o'clock.

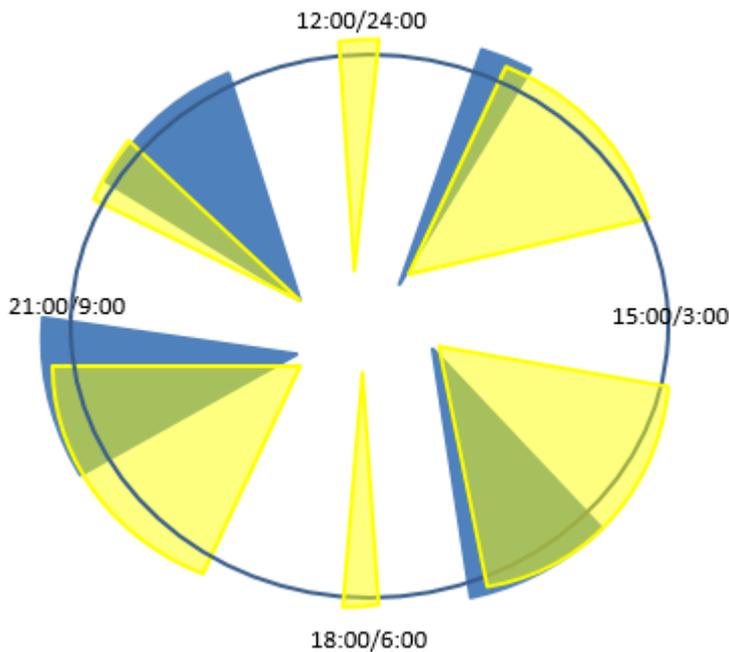


Fig. 16. Yellow illustrates departures in daytime (7-9, 10, 12, 13-14:30, 15:30-17:30, 18) and blue in the evening and night (20-21, 22-23, 01, 04-05).

### Vessel capacities and load factors

Lane meters of the vessels operating in the connections vary over fourfold: from under 500 to over 2000 lane meters (Table 4.). The maximum person capacity of vessels varied also quite markedly, from 900 to 2 400 person. The mean value of eight vessels is approximately 1 300 lane meters. In the cargo potential report it was estimated that a vessel size with 1 200-1 400 lane meters could be a feasible solution for Loviisa-Kunda connection. This vessel size would even allow some flexibility for growing volumes.

Shipping companies list the cargo capacity in lane meters and car capacity in number of cars. Number of cars multiplied with 5 meters gives the total lane meters available in vessel. Based on vessels' lane meters for cargo, load factors were calculated. For cargo, the load factors varied from approximately one fifth to half of the maximum capacity whereas the car load factor tended to be lower (Table 5.). However, the most relevant indicator is the overall average (cargo and cars) load factor which settled for around 20-50%. It must be noted that these figures are very indicative in nature due to different factors. Firstly, the figures are rounded, and especially the seasonally varying number of departures may lead to inaccuracy.

Secondly, the data is also from different years which also affects the calculation. Furthermore, we cannot either guarantee that the vessels and their capacities are accurate since the data is collected from available web sources. However, in spite of these reservations, the results give a broad idea of the use of the fleet in the studied connections.

Table 4. Lane meters (cargo), person and car max capacity of vessels operating in the benchmarked routes.

VESSEL	LANE METERS	PERSONS, MAX CAPACITY	CARS, MAX CAPACITY
M/S Bohus	462	1 218	240
M/S Color Viking	490	1 773	370
Wasa Express	1 150	915	450
Stena Nautica	1 265	900	324
Sailor	1 400	n/a	n/a
Sassnitz	990	900	220
SuperSpeed 1	1 990	2 400	750
SuperSpeed 2	2 036	2 000	764

Table 5. Load factors of roro capacity for the cargo, cars and total in the benchmarked routes.

PORT A	PORT B	load factor for cargo	load factor for cars	load factor for cargo + cars
Hirtshals (DK)	Kristiansand (NO)	18 %	18 %	27 %
Hirtshals (DK)	Larvik (NO)	35 %	10 %	28 %
Sandefjord (NO)	Strömstad (SE)	20 %	27 %	33 %
Trelleborg (SE)	Sassnitz (DE)	49 %	n.a. (car volume cannot be separated from Sassnitz-Rönne route)	49 % (cargo only)
Varberg (SE)	Grenaa (DK)	37 %	7 %	37 %
Vaasa (FI)	Umeå (SE)	20 %	9 %	19 %
Hanko (FI)	Paldiski (EE)	49 %	n.a. (no cars in practise)	49 % (cargo only)

### Number of shipping companies

Between Hirtshals and Larvik/Kristiansand and between Sandefjord and Strömstad there are two shipping companies operating in the connections. Fjordline was excluded from the study because the used vessel types are catamarans with no cargo capacity. In the rest of the benchmarked connections there is only one shipping company operating in the connection.

### Balance of import and export

Balancing import and export is an important issue to consider when a new route is planned. This was mentioned as a challenge in the Eastern Finland – Eastern Estonia freight potential study. Statistic Norway provides accurate data on the volume of loaded and unloaded freight. On this basis the trade between Norway and Denmark (Kristiansand and Larvik) is in a quite good balance; import from Norway is slightly over half of the trade, and export is then slightly under the half. Between Norway (Sandefjord) and Sweden (Strömstad) there is more distinct difference in the trade. Norway's share of the import was 55-60 % and of export 40-45%. As for Hanko-Paldiski the import is 53% and export 47% of the number of units, whereas Vaasa-Umeå the export is slightly bigger (52%) while import is 48% (Traficom 2018 statistics). There is no public accurate data on the other benchmarked connections. In summary, the cargo traffic seems to be fairly well in balance for those routes where the data is available.

### Special cargo types

The freight potential report highlighted a possibility to transport special goods in the anticipated Loviisa-Kunda connection. Hazardous goods, other special goods and oversized cargo were pointed as an example of cargo types, which could be transported via Loviisa-Kunda. All shipping companies operating in the benchmarked connections informed that they have capability to transport a wide range of over dimensioned units. Reservations for such type of cargo must be made well in advance. Furthermore, most of the dangerous goods (IMDG) can be transported onboard. However, a written notice and IMDG/ADR documentation must be provided for validation in advance, for example at least 6 hours prior to departure and for evening and night departures not later than 4 hours prior to departure.

To conclude, there are similar type of ro-ro connections in the Baltic Sea/North Sea like the anticipated Loviisa-Kunda connection, which are operated successfully. Based on the findings of this study, it can be presumed that Loviisa-Kunda route is also a viable connection for transporting ro-ro cargo between Finland and Estonia, especially if supported with the passenger car traffic.

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