Conditions for increased freight flows in the Baltic Sea area

Authors: Olivia Dahlholm, Hannes Englesson, Patrik Fridh, Pernilla Hyllenius Mattison Johan Kerttu & Viktor Lindqvist, Trivector Traffic

Publication date: 2021-05-31

Interreg Central Baltic

European Union
European Regional Development Fund

Conditions for increased freight flows in the Baltic Sea area

By Olivia Dahlholm, Hannes Englesson, Patrik Fridh, Pernilla Hyllenius Mattison, Johan Kerttu & Viktor Lindqvist, Trivector Traffic

Published by: Ahmed Alaeddine, Region Örebro County

Table of contents

List of tables

List of figures

1. Introduction

The Örebro County Region is a partner in the EU-funded Baltic Loop project, which consists of regions along the corridor The Northern Growth Zone. The project involves seven partners from four countries: Finland, Estonia, Latvia, and Sweden and aims to identify bottlenecks in the transport system and develop solutions to minimize travel and freight times for passengers and goods, in addition to contributing in the reduction of greenhouse gas emissions

The aim of this report, within the framework of the Baltic Loop project, is to investigate the current and future challenges that increased passenger and freight flows may entail for today's logistics chains in The Northern Growth Zone. This report provides an overall picture, increased knowledge, and analysis for the following lines, see Figure 1:

- Oslo-Örebro-Stockholm-Helsinki- Saint Petersburg
- Oslo-Örebro-Stockholm-Tallinn- Saint Petersburg
- Oslo-Örebro-Stockholm-Riga- Saint Petersburg

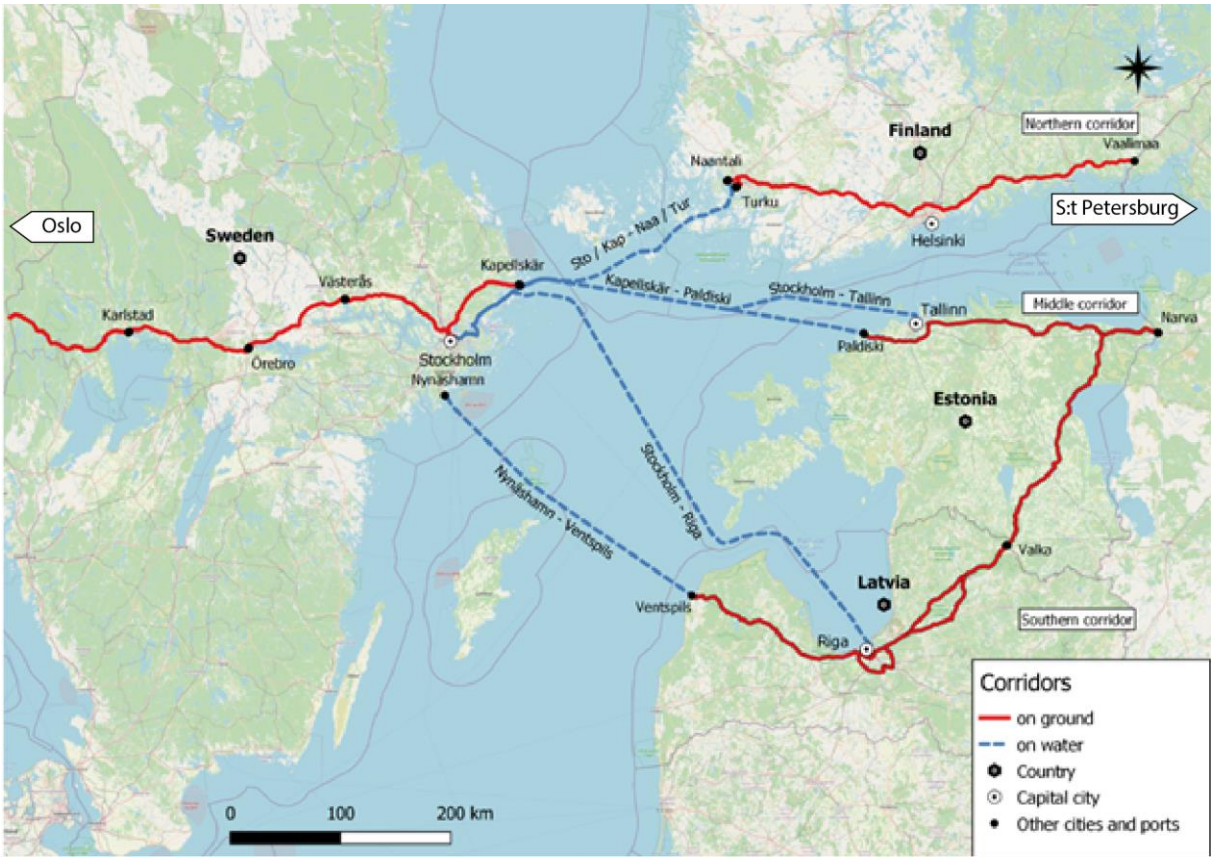


Figure 1 Illustration of the studied corridors within Baltic Loop.

2. Analysis summary

Extensive but difficult-to-understand background studies - which still provides an overview

The background studies that set the basis for this investigation are extensive and span freight transport and, to some extent, also passenger transport by road, rail, and sea, today and in the future. The background studies cover data on transports, challenges, bottlenecks, and measures. A lot of effort has been put into collecting a basis, both through already prepared investigations and via interviews / e-mail contacts and making the current material from the five different countries clear, as well as analysing and producing supplementary action proposals. Thus, there may be details that gone unnoticed, or that have not been included in the background studies, that may affect the analysis. Our hope is that the analysis can provide a general picture and knowledge base that can be used in the continued work.

Trade and freight transport - today and in the future

There is an extensive trade exchange and associated freight transport between countries along the relevant routes and corridors already today. In many of the relations studied, the total volumes of goods are expected to increase sharply in the future, and the increase is primarily expected to take place by road within Europe and via sea transport from China.

Bottlenecks and measures

There are bottlenecks along all the corridors studied. Most bottlenecks are connected to too much traffic along existing infrastructure. With increasing freight transport, these bottlenecks will worsen if nothing is done to remedy this. Thus, an increased capacity is generally needed. A focus on rail / sea to avoid steering more goods to the roads, which then risks reaching the capacity ceiling within a couple of years again, is also needed. There are many proposals for measures, both as proposals and those that are already planned to be implemented or are about to be implemented in the short term. The expected capacity is

thus judged to improve gradually as measures are introduced. However, the increasing freight transport requires continued work on measures even in the long term.

Potential of proposed measures to reduce identified bottlenecks

The different corridors are judged to have a slightly different extents for the current bottlenecks, and in the same way, the proposed measures have different potential to reduce the current bottlenecks. In the corridors Oslo-Örebro-Stockholm and Stockholm-Tallin-St. Petersburg, the proposed measures are considered to have good potential to reduce the current bottlenecks. In the other two corridors, the potential of the measures is more limited, see Table 1.

Table 1 Trivector's assessment of the potential of proposed measures to reduce identified bottlenecks.

Corridor	Type	Bottlenecks	Measures	Assessment
Oslo-Örebro-Stockholm	Road	OOO	OOO	☺
	Rail	OOO	OOO	☺
	Sea	OOO	OOO	☺
Stockholm- Helsinki -St. Petersburg	Road	OOO	OO	😐
	Rail	OOO	OO	😐
	Sea	OOO	OO	😐
Stockholm-Tallinn-St. Petersburg	Road	OO	OO	☺
	Rail	OO	OO	☺
	Sea	OO	OO	☺
Stockholm-Riga-St. Petersburg	Road	OO	O	😐
	Rail	?	?	?
	Sea	O	O	☺

Knowledge gaps

The background studies that provide a basis for the different corridors have a varying degree of detail. In general, the data from Sweden has been more extensive and detailed than from the partner countries Finland and Estonia. The data from Latvia and Russia varies greatly, the Norwegian data is based on a couple of sources of information, while the data from Russia has been largely non-existent.

There are several knowledge gaps in the form of a lack of information, but it is almost impossible to interpret the meaning of this. Lack of information may be because there is no information available or that there is no information of value to convey, for example that there may be no bottlenecks on a certain route or for a certain type of transport. We suspect that there are gaps in knowledge regarding bottlenecks and measures within the railway network in Latvia as the supporting material completely lacks information on this. However, the same may apply to other countries and modes of transport, but it is difficult to comment on this.

Limited background knowledge on passenger transport

The supporting material and background studies report passenger transport to a very small extent. Freight transport and passenger transport, however, use the common road and rail infrastructure, and to some extent also maritime transport infrastructure, and increasing freight and passenger transport thus compete to a large extent for the same capacity. Improvements to freight transport can also benefit passenger transport, and vice versa. Sometimes, however, improvements for one of them can have negative consequences for the other. The available data for the countries in question have not been at the level of detail that it is possible to comment in more detail on this.

3. Background and conditions

Collaborations between actors along cooridors

Örebro County Region collaborates with the following actors on transport and infrastructure (Alaeddine, 2021):

- Mälardalsrådet (The Mälardalen Council)
- Oslo-Stockholm 2.55
- E18-gruppen
- Bergslagsdiagonalen (The Bergslags dialog group)
- Forum för logistik
- Trafikverket, Region Öst (The Swedish Transport Administration, Region East)
- Botniska korridoren (The Bothnian Corridor)
- Conference of Peripheral Maritime Regions
- Business Region Örebro

Important transport corridors in the region

There are several important transport routes in the region, where collaborations take place to ensure efficient transport flows, see examples below.

TEN-T

Important TEN-T (Trans-European Transport Networks) nodes in the Stockholm-Mälar region are the railway terminals in Hallsberg and Stockholm (included in the main network) and the airports in Stockholm (Arlanda and Bromma), Örebro and Nyköping, where, however, only Arlanda is included in the main network. Among the ports, the port of Stockholm is included in the main network, while the ports in Köping, Västerås, Nynäshamn, Södertälje, Oxelösund, Norrköping, Grisslehamn and Gävle are included in the overall network, see Figure 2

(Mälardalsrådet, 2019).

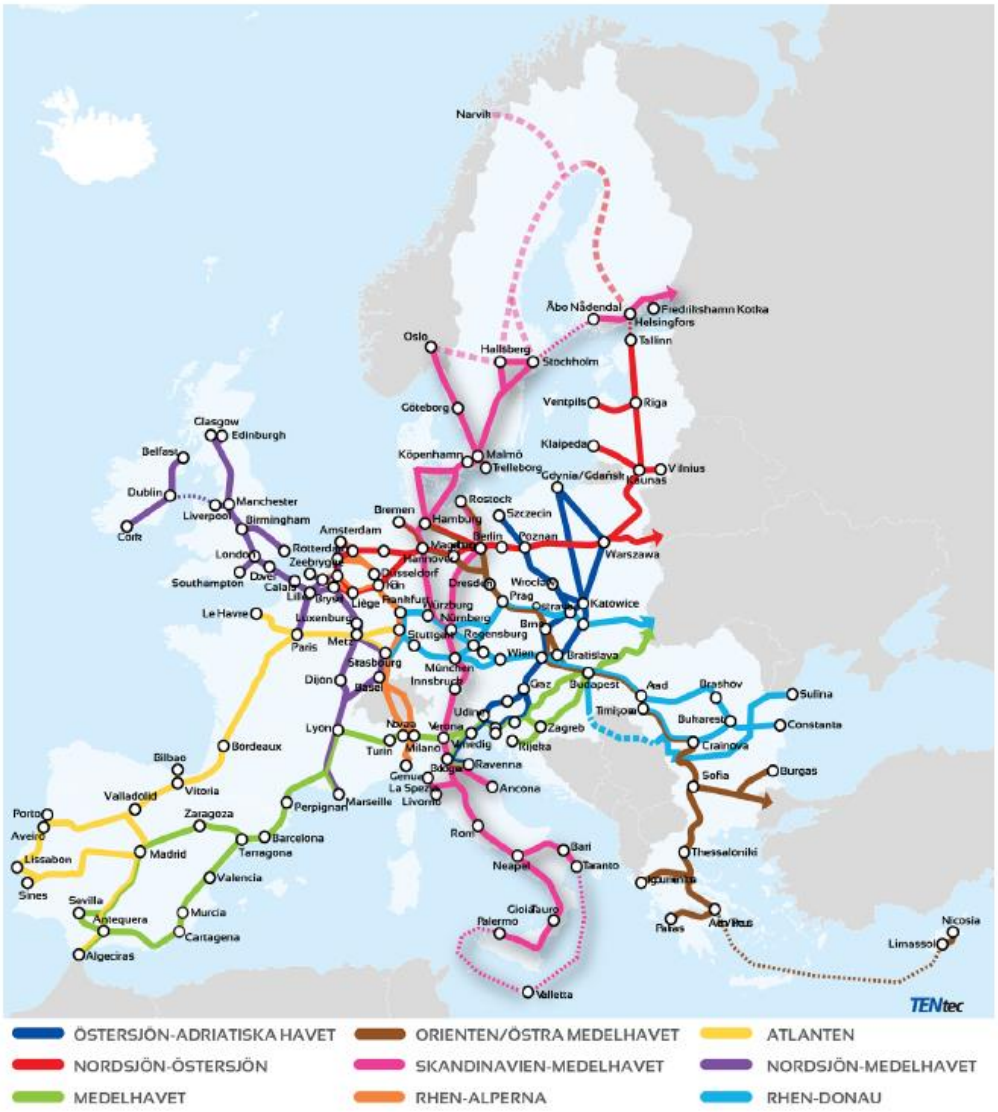


Figure 2 TEN-T's main network. Source: Mälardalsrådet, 2020.

The ScanMed corridor

The ScanMed (Scandinavian-Mediterranean Rail Freight) corridor stretches from Finland and Norway through Sweden, Denmark, Germany, Austria, and Italy to Malta. A fixed link across the Fehmarn Belt will increase the importance of the corridor, as well as a possible new fixed link across the Öresund and a new railway for faster trains between Stockholm and Malmö / Gothenburg. In addition to the corridor collaboration, there are several networks / collaboration initiatives relevant to the Stockholm-Mälar region with a connection to the corridor, such as String and Scandria®. In addition, there is an ongoing effort to improve the railway connections between Stockholm and Oslo (Mälardalsrådet, 2019).

North Sea-Baltic Corridor

The North Sea-Baltic Corridor is a main network corridor that connects the Baltics and Poland with the ports of the North Sea coast through railways, roads, and inland waterways. It is an alternative route for freight flows that otherwise go by maritime transport on the Baltic Sea and which in some cases pass hubs in the Stockholm-Mälar region. The North Sea-Baltic Connector of Regions (NSB CoRe) and Rail Baltica are examples of projects that are run with the aim of further developing the corridor, and which there are reasons for the Stockholm-Mälar region to monitor (Mälardalsrådet, 2019). The north-eastern part of the corridor (through Latvia and Estonia) coincides with the central and southern corridors within The Northern Growth Zone.

When it comes to TEN-T's requirements for rail traffic, many parts of Latvia and Estonia need to be upgraded, especially in terms of electrification, track gauge, and speed. Therefore, a major goal is to upgrade the networks in the Baltic States and create better connections between the Baltic States and the rest of Europe. However, the ERTMS signalling system is an issue that affects all countries along the North Sea / Baltic coast, as it is currently only available in certain parts of Belgium and the Netherlands. (Mälardalsrådet, 2019).

Regarding the road network and inland waterways, most sections meet TEN-T requirements, but significant investments are still needed. A total of € 96 billion is needed for investment in

the North Sea-Baltic corridor by 2030, of which € 37 billion in rail infrastructure, € 34 billion in road networks, € 9 billion in inland waterways, € 8 billion in ports and maritime infrastructure, € 5 billion in airports, and an additional EUR 3 billion in ERTMS, motorways of the sea and other measures. (Mälardalsrådet, 2019)

Figure 3 North Sea-Baltic main corridor. Source: Mälardalsrådet, 2019.

The Baltic Sea area

Regarding maritime transport, both inland waterways and highways of the sea (MoS) are important. Twenty of the ports in TEN-T's main network are located in the Baltic Sea and connect to four different main network corridors (Mälardalsrådet, 2019).

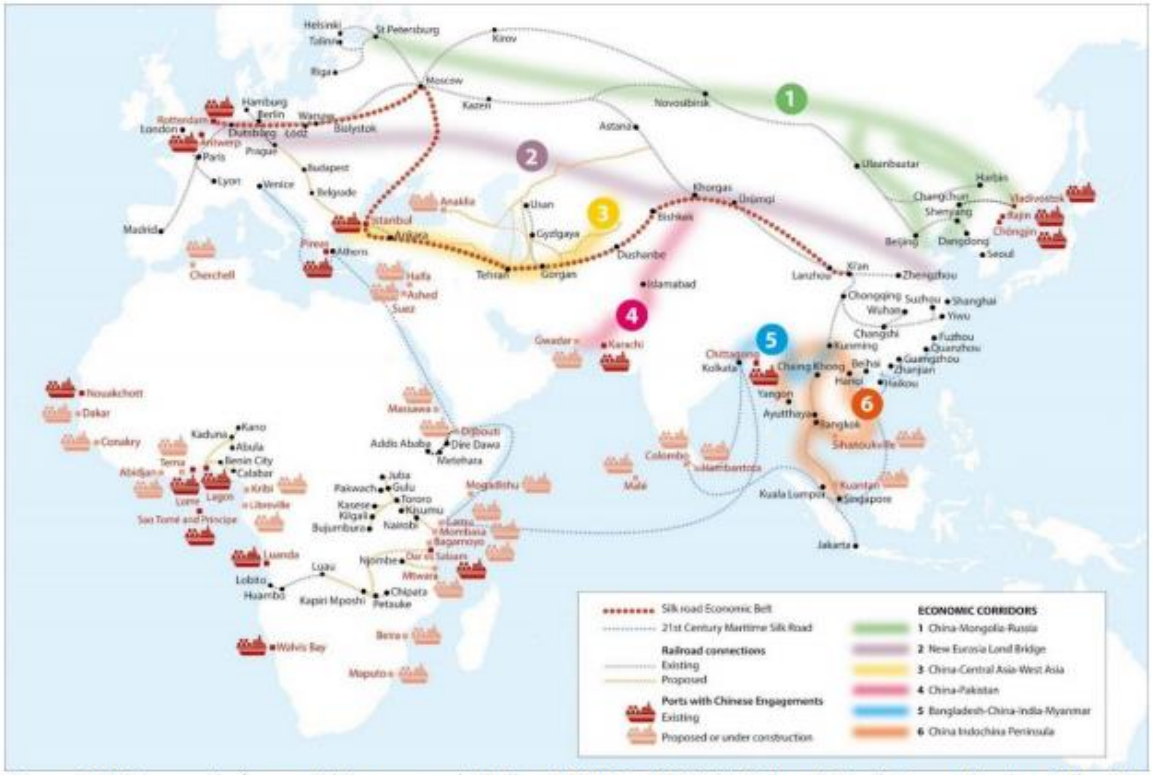
For the Stockholm-Mälar region, connections with Finland and the Baltics, as well as central and northern regions of Sweden, are of particular importance. In addition to connections in the Baltic Sea, most main ports also offer connections, mainly container traffic, via the Kiel Canal to Hamburg, Bremen / Bremerhaven, Wilhelmshaven (DE), Rotterdam and Amsterdam (NL), Zeebrugge, Antwerp (BE) and Le Havre (FR). All are important for transports routes to / from Scandinavia (Mälardalsrådet, 2019).

Belt and Road Initiative (BRI)

The Chinese "Belt and Road Initiative" (BRI), Figure 4, or "One Belt One Road" (OBOR), initiated in 2014, is an important long-term investment program aimed at linking Asia with Europe and Africa and which is likely to to have a major impact on transport flows in Europe, even if it is not a main network within TEN-T. BRI includes six main corridors, one of which runs through Russia to St. Petersburg and thus joins the NGZ. There is no official list of which countries are included in BRI, which makes the geographical extent unclear and changeable (Mälardalsrådet, 2019; Trafikanalys, 2020; OECD, 2018). According to information, the number of participating countries in BRI is up to 140, of which 18 are EU members (March 2021).

Newly built east-west land connections in the form of railways and roads provide faster and more reliable transport than by sea and cheaper transport than by air. Already today, goods are transported on new connections between China and Western Europe and these new transport alternatives may have a major impact on ship traffic and the ports of the Baltic Sea. Improved east-west connections can increase volumes to Russian and Baltic ports in the Baltic Sea and offer competitive alternatives to north-south shipping in Europe (Mälardalsrådet, 2019; Business Sweden, u.å.).

The most current efforts in the immediate area of the four countries Finland, Estonia, Latvia, and Sweden were made in connection with the Transestonia 2020 conference, with roundtable discussions with representatives from China, Kazakhstan, Russia, Estonia, and Sweden. As a result, the Tallinn Declaration was approved, enabling the various countries to strengthen their cooperation to increase freight volumes and develop new business, considering national development programs and international agreements on trade routes between Europe and Asia.



Source: OECD research from multiple sources, including: HKTDC, MERICS, Belt and Road Center, Foreign Policy, The Diplomat, Silk Routes, State Council Information Office of the People's Republic of China, WWF Hong Kong (China).

Figure 4 Corridors within the Belt and Road Initiative (OECD, 2018).

Trade, traffic, and freight flows

Europe accounts for almost three quarters of Sweden's trade, most of which is within the EU. Exchange with our Nordic neighbours and other countries around the Baltic Sea accounts for about 45 percent of total imports and exports. At the same time, trade with East Asia, mainly China, has grown sharply over the past ten years, a development that can be expected to continue, as several long-term forecasts indicate that the world's economic centre of gravity will shift from North America and the EU to Asia. Trade with East Asia today takes place almost exclusively with shipping as a means of transport, but thanks to investments in road and rail connections, in recent years freight transport by land has grown in number, especially by rail. Rail transport from central China to Germany can today be carried out in two weeks (Mälardalen Council 2019, Trafikanalys 2020).

The Stockholm-Mälar region is a national hub in the exchange between the rest of Sweden, Europe, and the world (Mälardalsrådet, 2019). Eastern Central Sweden (Östra MellanSweden) or ECS is an import area rather than an export area when it comes to goods. Since Sweden is an export-dependent country, Swedish exports mainly take place from regions other than ECS. Exports from ECS go mostly to Eastern Europe and Germany, while imports come from all parts of the world (Sweco, 2015). During the last 20-year period, Swedish exports measured in kronor have increased to all countries. The largest growth has been in exports to Norway and Finland (Trafikanalys, 2019).

Norway, Finland, Estonia, Latvia and Russia are important trading partners. Sweden exports goods for SEK 1517.9 billion and imports goods for SEK 1500.7 billion. These countries (Norway, Finland, Estonia, Latvia and Russia) account for 20 percent (Norway 11 percent, Finland 7 percent, Statistics Sweden 2019) of Sweden's export market, i.e., 310 billion of Sweden's export market, see Figure 5 and Figure 6.

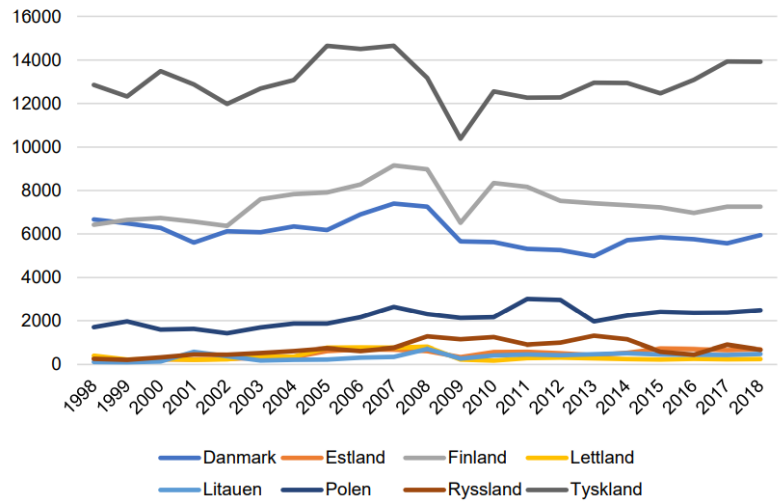


Figure 5 Swedish exports to the countries around the Baltic Sea (1000 tonnes). Source: Statistics Sweden's foreign trade statistics.

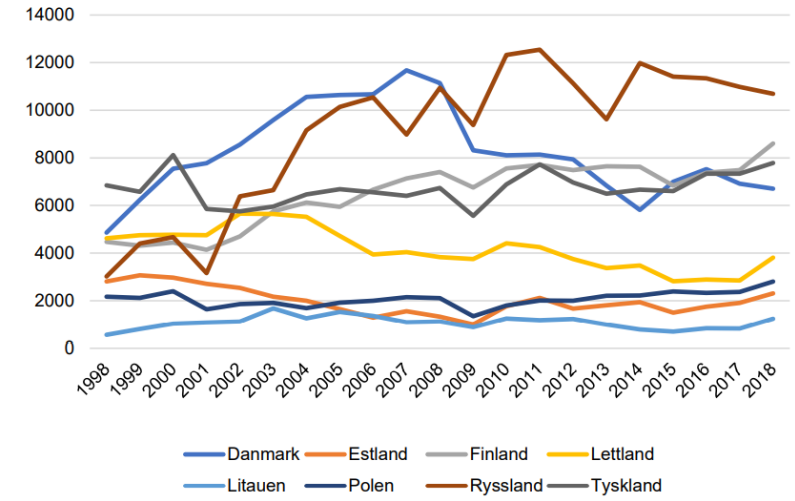


Figure 6 Swedish imports from the countries around the Baltic Sea (1,000 tonnes). Source: Statistics Sweden's foreign trade statistics.

All maritime transports within the Baltic Loop corridors are categorized as short sea shipping and the ports handle both Ro-Ro transports and passenger traffic. Stockholm-Turku dominates traffic between Sweden and Finland, but Kapellskär-Naantali (Finland) and Kapellskär-Tallinn (Estonia) also constitute important routes for freight transport. Ro-Ro shipments in the Baltic Loop countries (Sweden, Finland, Estonia and Latvia) accounted for 29 percent of all Ro-Ro shipments in the EU in 2018 and these shipments also accounted for a dominant market share of all freight shipments in several of the ports concerned: Kapellskär (99 percent), Stockholm (50 percent) and Turku (71 percent) (Chen & Wahlström, 2020).

Mode share per product group

The following section contains a compilation of existing freight flow data available for each transport corridor, divided into the type of goods being transported, and how it is distributed among different modes of transport. The compilation of data gives a picture of the distribution between rail and road for land transport and the type of transport that takes place with maritime transport for example.

Sweden

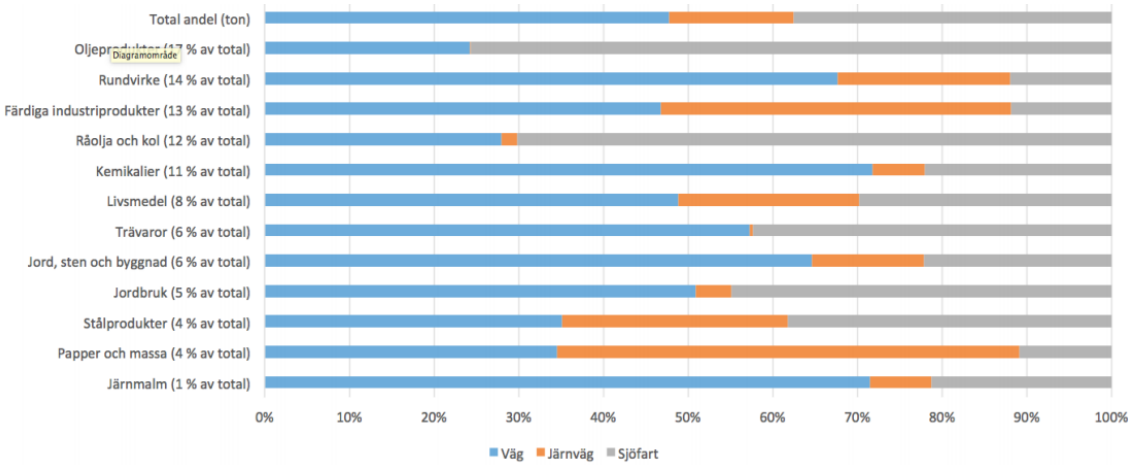


Figure 7 Model-based vehicle shares per product group for incoming goods flows to the Stockholm-Mälar region (tonnes). Source: Samgods.

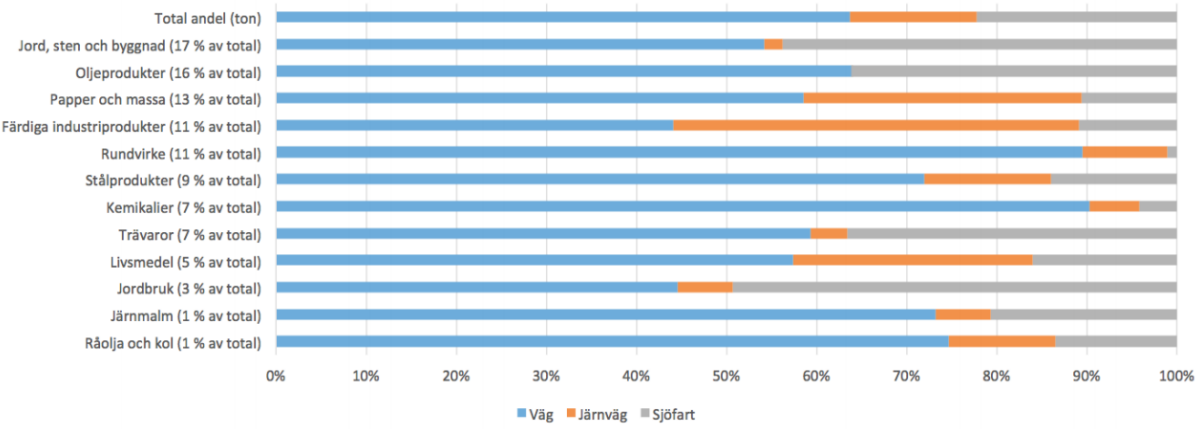


Figure 8 Model-based vehicle shares per product group for outgoing goods flows from the Stockholm-Mälar region (tonnes). Source: Samgods.

Finland

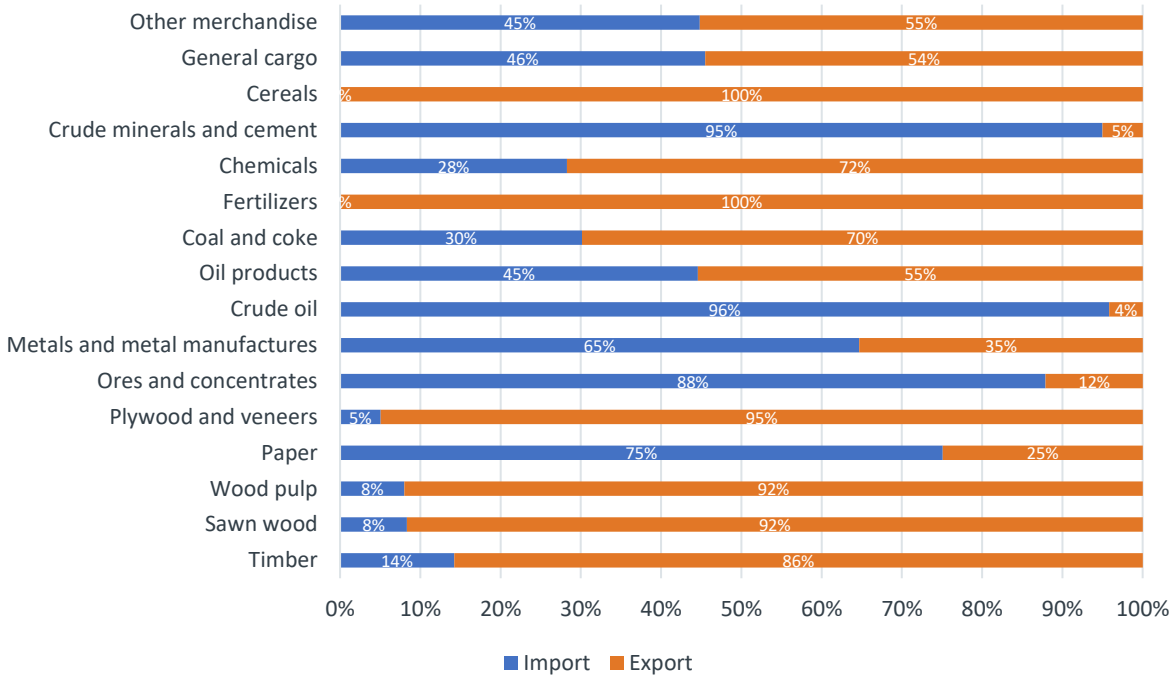


Figure 9 Maritime transports by product group between Sweden and Finland in 2019. Source: https://www.stat.fi/

Latvia

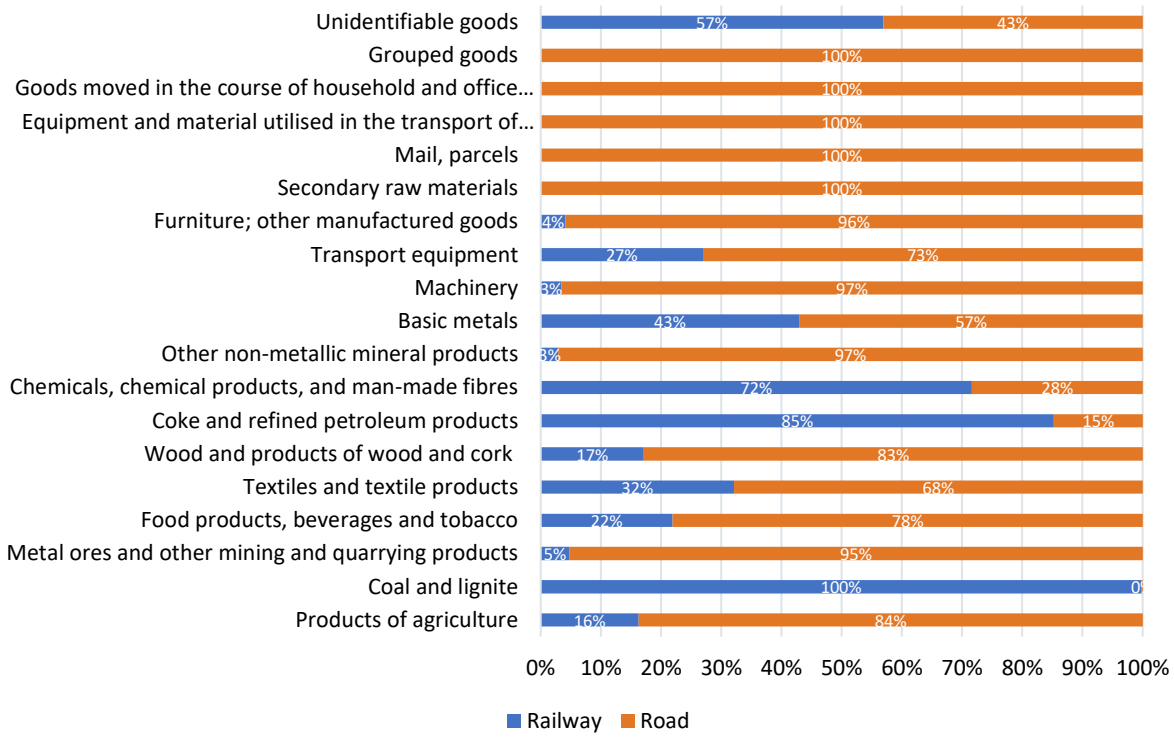


Figure 10 Vehicle shares per commodity group for freight transport by rail and road in Latvia in 2019. Source: https://data.stat.gov.lv/

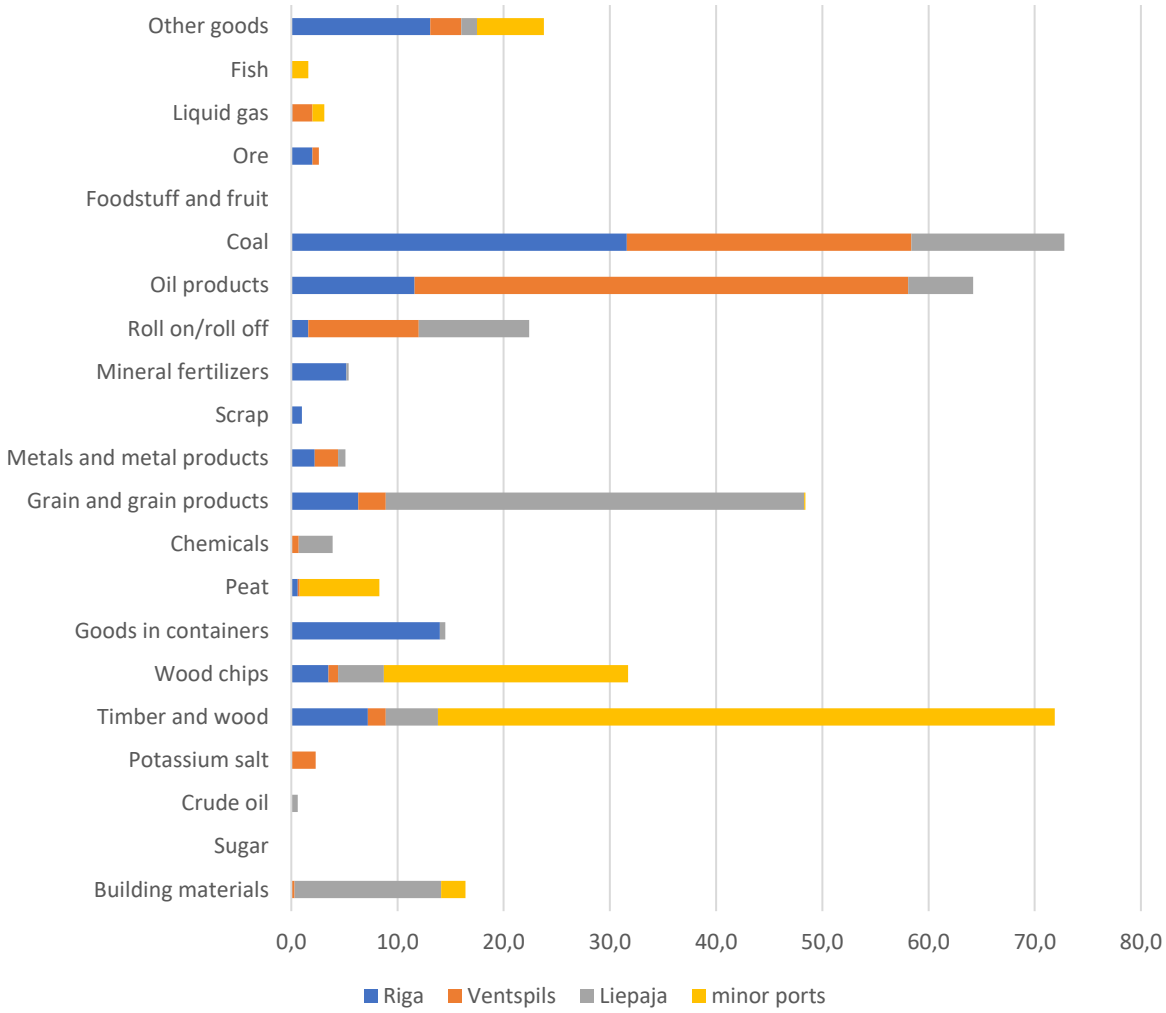


Figure 11 Maritime transport: freight transport per product group through ports, procent of the total cargo turnover per port. Source: hhtps://data.stat.gov.lv/

Estonia

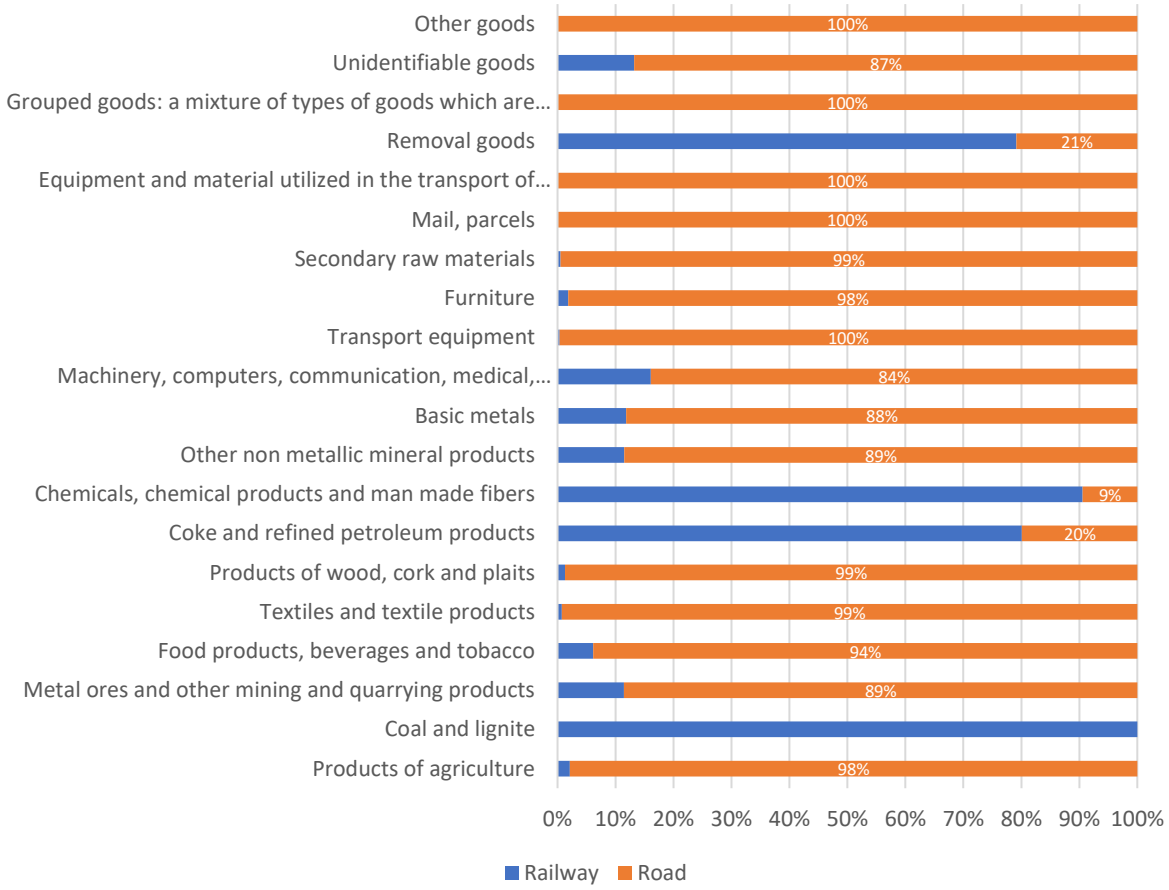


Figure 12 Mode share per product group for feright transport via railwai and road transport in Estonia 2019. Source: hhtp://andmebaas.stat.ee/

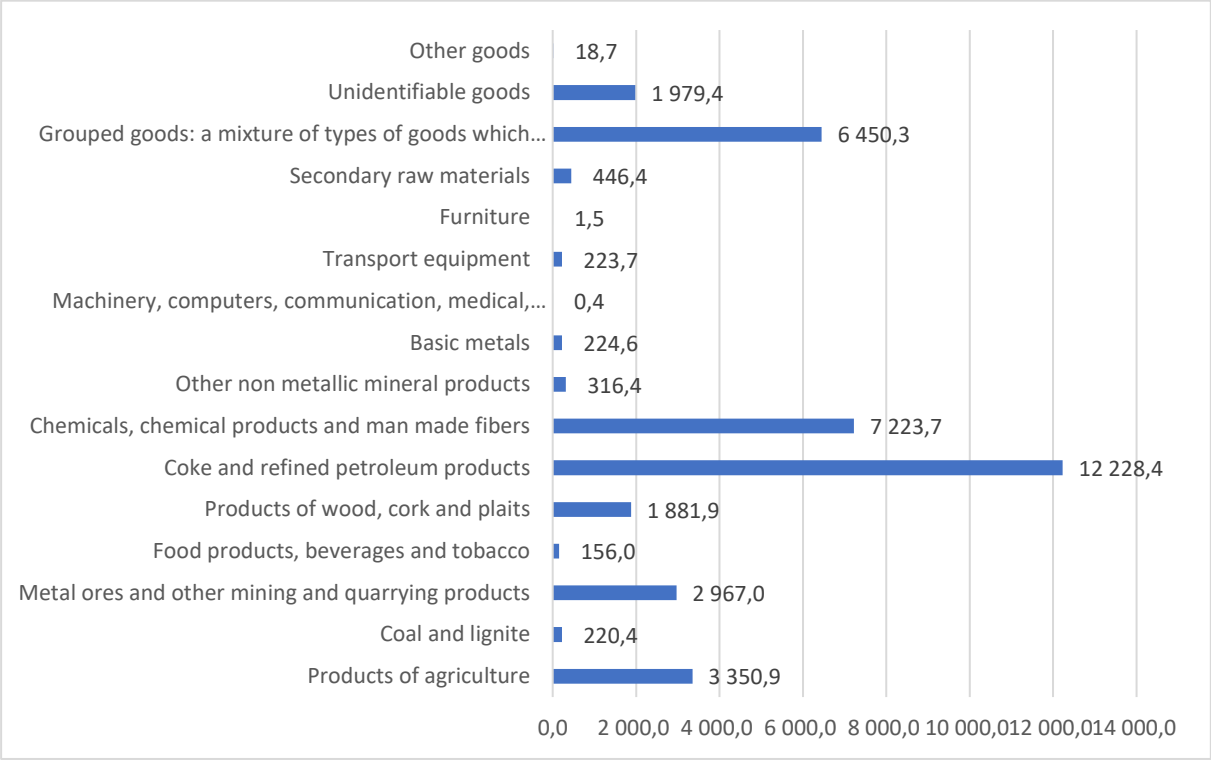


Figure 13 Maritime transport: freight transport per product group through Estonian ports 2019. Source: hhtp://andmebaas.stat.ee/

Future freight flows

The total freight volumes (tonnes) are expected to increase by 65 percent in the Stockholm-Mälar region by 2040. The increase is expected to take place primarily by road, in particular European roads, followed by maritime transport and least by rail. The structure of freight transport is expected to be mostly at similar levels to today. At the same time as there is a need for capacity for more freight trains, there are high ambitions for large-scale regional public transport (Mälardalsrådet, 2020).

According to Trafikanalys' (2020) model calculation, goods transports from China are underestimated by almost 20 percent in the Swedish Transport Administration's forecast for 2040. It may sound like a lot, but seen over the entire period, it is no dramatic difference. Most of these volumes will probably go by sea, primarily via Gothenburg, where the current national transport plan handles many of the bottlenecks for outbound transport. A very small proportion of goods transports from the east to Sweden are expected to go by rail and then probably across the Baltic Sea via ports in Finland, Russia, or the Baltics.

China and Russia are the dominant players on the land bridge between the EU and Asia and their growing political ambitions can lead to risks such as a politicized economy and protectionism.

According to Sweco's (2018) forecast for freight traffic volumes (kTon), freight flows in the Oslo-Stockholm route will almost double by 2040. The capacity investigation indicates that

the expected number of trains that pass and pass the Oslo-Stockholm route in 2040 will be expanded if train traffic is spread out around the clock.

An increase in both imports and exports to / from Sweden is expected from large parts of the world until the year 2040, see Figure 14.

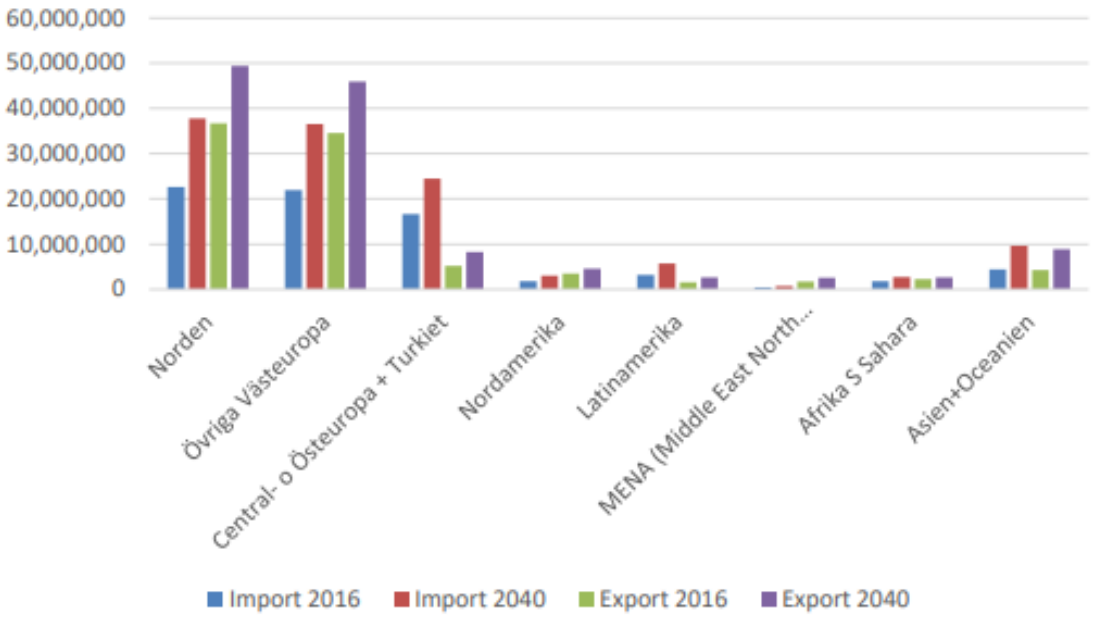


Figure 14 Exports and imports 2016 and 2040 according to REF18 & OECD (tonnes per year). Source: Forecast for freight transport 2040 - The Swedish Transport Administration's Basic Forecasts 2020. Publication number: 2020: 125

Overall analysis

There is an extensive trade exchange and associated freight transport between countries along the relevant routes already today. The total volumes of goods are expected to increase

sharply in the future, and the increase is primarily expected to take place by road within Europe and via maritime transport from China.

4. Challenges with increased freight flow - current situation and bottlenecks

Compilation of bottlenecks

The most common causes of delays according to Wahlström & Chen (2020) are linked to weather, heavy loads, and capacity problems, see Figure 15. These causes have been identified within the framework of Baltic Loop's assignment through interviews with actors within the routes to identify causes of delays and overall bottlenecks in the corridors (Wahlström & Chen, 2020; Wahlström, 2020).

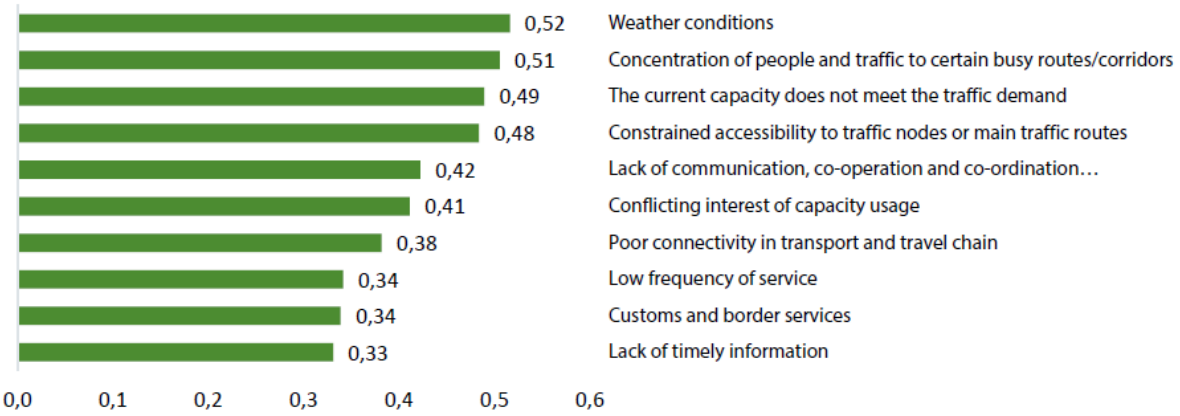


Figure 15 The most common causes of delays in the corridors. Source: Wahlström & Chen (2020).

Wahlström (2020) groups and defines bottlenecks as follows:

- **Institutional bottlenecks:** lack of communication and cooperation between relevant stakeholders
- **Operational bottlenecks:** capacity constraints, infrastructural conditions
- **Technical bottlenecks:** challenges linked to existing digital tools and implementation of new solutions

Examples of different types of bottlenecks in the different categories are presented below.

Institutional bottlenecks

- Inadequate cooperation along transport chains and insufficient alignment of different interests are seen as one of the most important bottlenecks for transport flows and the development of the transport system.
- Incomplete feedback and communication between infrastructure users and infrastructure planners means that needs and requirements are not fully met and sub-optimal solutions are provided.
- The flow of information in the ports is fragmented and complex due to lack of coordination and data integration. Digital solutions are not adapted to the requirements, needs and challenges of the specific ports, which makes the benefits of investing in new digital solutions unclear. Instead, the ports are awaiting standardized solutions from outside.
- Lack of trust when it comes to sharing data or lack of will to try new solutions also affects opportunities for digitization and efficiency.
- Cross-border transport to and from Norway and Russia requires a lot of administration, which can be solved through digital documents in Norway but not always in Russia.[1]
- The competitiveness of maritime shipping is hampered by high fees for maritime pilots (to finance the Swedish Maritime Administration) and a lack of maritime pilots

[1] Intervju med Jenny Emerén, VD för Handelskammaren Mälardalen.

in the event of illness, which leads to high costs and reduced service for companies that use maritime transport.[2]

- Lack of compatibility between different digital transport systems results in a lot of paperwork, especially for cross-border transport.

Operational bottlenecks

- Weather conditions have a major impact on all transport infrastructure:
    - Loading and unloading of dry bulk / bulk goods can be delayed or completely made impossible by precipitation, which leads to a longer time for reloading.
    - Poor visibility and winter road conditions affect all land transport, especially road transport.
- Insufficient infrastructure capacity causes congestion and delays, especially on access roads to major port cities during rush hour.
- Systems for communication and customs clearance, with different solutions for different modes of transport.
- Cross-border infrastructure investments are being neglected as a result of the countries having different priorities and a lack of a common picture of the infrastructure around the Baltic Sea.[3]

Technical bottlenecks

[2] Intervju med Jenny Emerén, VD för Handelskammaren Mälardalen.
[3] Intervju med Jenny Emerén, VD för Handelskammaren Mälardalen.

- Poor compatibility between different systems and organizations limits the flow of information.
- Communication and information exchange between different marine carriers still largely consists of analogue, manually transmitted data (telephone, fax, etc.) as different systems are not compatible with each other. Customs clearance is carried out on different, non-interconnected platforms, which requires manual entry or paper documents to meet legal requirements for documentation.
- Varying formats of data make data sharing a problem even if different companies and organizations approve it.

Bottlenecks connected to different corridors

Bottlenecks are presented below for the following parts:

- Oslo-Örebro-Stockholm: Common part for all three studied routes
- Northern Corridor: Stockholm-Helsinki-St. Petersburg
- Middle corridor: Stockholm-Tallinn-St. Petersburg
- Southern Corridor: Stockholm-Riga-St. Petersburg

Reservations regarding knowledge gaps

The basis for the different lanes is of varying degree of detail, which can also be seen in future chapters in this document. In general, the data from Sweden has been more extensive and detailed than from the other countries.

Knowledge gaps are often linked to a lack of information, and it is almost impossible to interpret the meaning of a lack of information. Lack of information may be due to the lack of information available or that there is no information of value to convey.

Bottlenecks linked to geographical location

About 50 bottlenecks can be connected to a geographical location in the Oslo-St Petersburg route, see Figure 16. Bottlenecks connected to each corridor are described in more detail below.

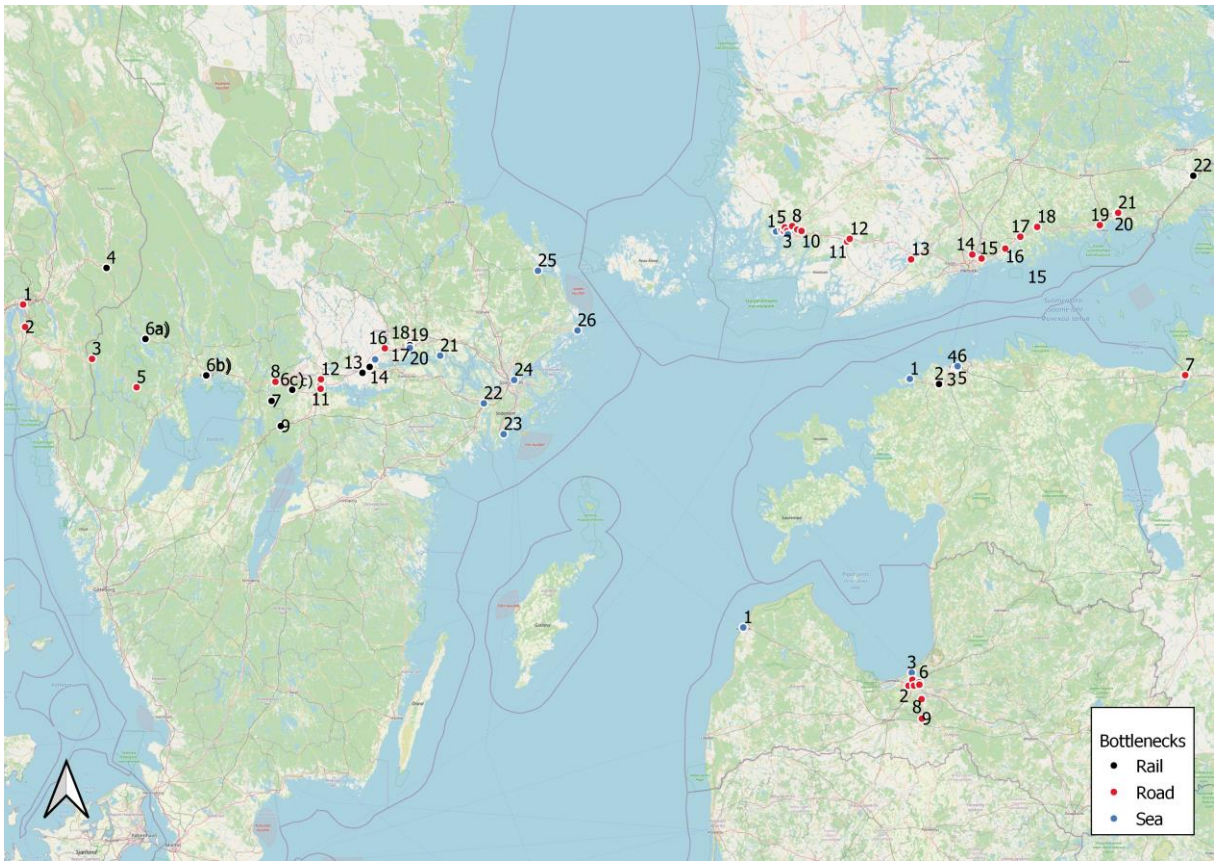


Figure 16 Identified bottlenecks in the Oslo-Saint Petersburg corridor

Oslo-Örebro-Stockholm: Common to all three corridors

The Oslo-Örebro-Stockholm stretch is common to all three corridors, see Figure 17.

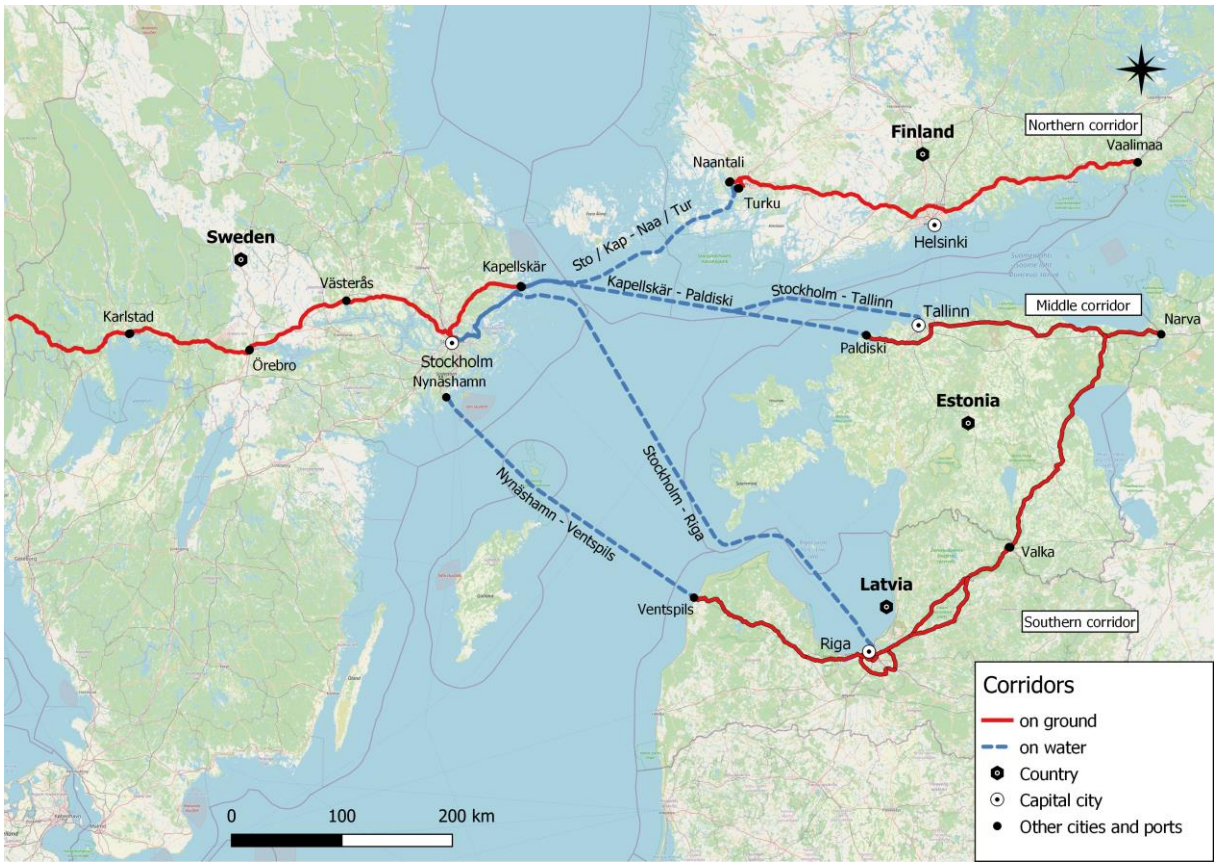


Figure 17 All corridors within the route Oslo-St. Petersburg.

General bottlenecks – Oslo-Örebro-Stockholm

Roadways

According to Nils Alm, Swedish Transport Administration, the varying national requirements for winter tires between Sweden and Norway (Nor 3PMSF all axles, Sve M + S on all axles) constitute an overall bottleneck.

Railways

According to Mattias Landin, community developer at Region Värmland, there are several overall obstacles and problems for freight transport by rail:

- The long allocation process (18 months) for train paths for freight transport requires a long advance of the transport operators and sometimes leads to allocated train paths not being used as the intended transports are distributed at short notice and may be performed by another operator or with another mode of transport.
- Track charges have been raised very sharply, to contribute to the financing of maintenance and new construction, which makes it difficult to transfer freight transport to rail.
- There is a lack of long-term cross-border collaborations and investments.
- New Oslo-Stockholm railway infrastructure is needed. In the short term, clear guidelines are needed for how to improve the existing railway.

Bottlenecks connected to physical location - Oslo-Örebro-Stockholm

There are many bottlenecks connected to physical locations on the Oslo-Örebro-Stockholm route, see Figure 18. The bottlenecks are primarily on the Swedish side and within all three modes of road, rail, and sea transport, see

Table 2.

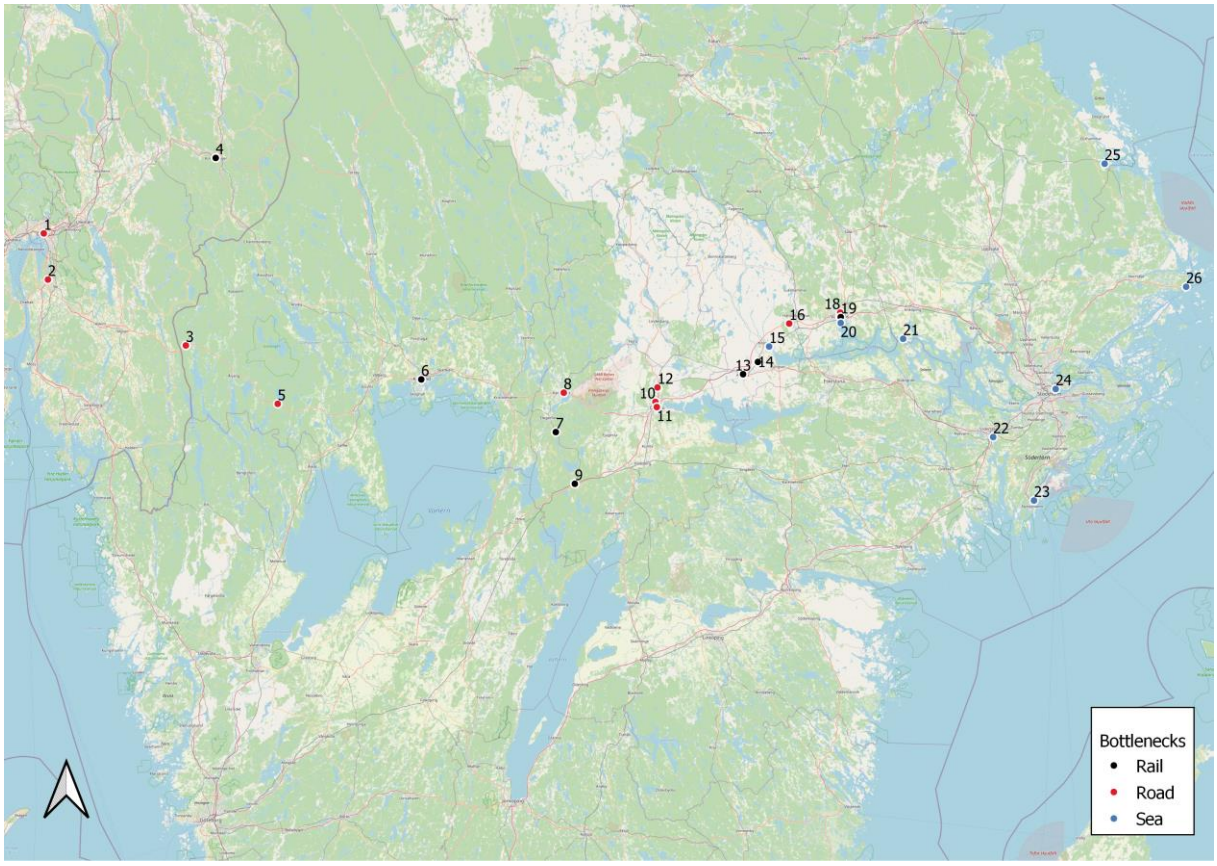


Figure 18 Identified bottlenecks within the corridor Oslo-Örebro-Stockholm.

Table 2 Description of identified bottlenecks within the corridor Oslo-Örebro-Stockholm.

ID	Description	Type	Country

1	Oslo area - lack of accessibility at certain times, need for lanes for heavy traffic towards ports and railway terminals	Road	Norway
2	Poor accessibility on the E18 Vinterbro-Oslo.	Road	Norway
3	The toll station at Hån, customs station at 61 between Sweden and Norway, is closed at night, which means that truck traffic does not cross the border unhindered throughout the day.	Road	Sweden
4	Kongsvingerbanen (Oslo-Riksgränsen) - Limited capacity and speed, mainly due to lack of long meeting tracks. This is planned to be remedied during the planning period (2018–2029).	Rail	Norway
5	Varying road standard. On the Norwegian side, there is a motorway standard up to the border. On the Swedish side, it is 80 km of curvy country road from Grums to the Norwegian border. Coordination around improvement measures on E18 is deficient.	Road	Sweden
6	Sections of railway between Oslo-Stockhom constitute bottlenecks like the Gränsbanan Arvika-Lilleström (6A), the entire section Kristinehamn-Kil (6B, Värmlandsbanan), and the Nobelbana Kristinehamn-Örebro (6c) which are regarded as bottlenecks and primarily require double tracks in several places along single tracks.	Rail	Sweden
7	Lack of capacity regarding the connection with intersecting train paths and conflicts with traffic on the Västra stambanan in Laxå. The capacity shortages on the Laxå-Kristinehamn section will persist as no measures are planned during the planning period.	Rail	Sweden
8	Poor usability for goods due to bridges that do not support BK4 in Karlskoga. No action is planned.	Road	Sweden
9	Lack of reliability in train traffic on the Värmland line (Riksgränsen-Laxå)	Rail	Sweden
10	Shortcomings in the capacity of the E18 through Örebro.	Road	Sweden

11	Poor usability for goods due to bridges that do not support BK4 in Örebro. No action is planned.	Road	Sweden
12	Inadequate connection of Godsstråket through Bergslagen to Mälarbanan in Hovsta.	Road	Sweden
13	The significant shortage in Arboga linked to capacity is expected to be partially remedied as it is planned for platform extension within the planning period.	Rail	Sweden
14	On the section Örebro-Västerås (Mälarbanan), capacity (single track) is lacking in several places.	Rail	Sweden
15	There are significant shortcomings in capacity and safety in the fairway to the Port of Copenhagen, but measures are underway in the current plan.	Sea	Sweden
16	The bottleneck Köping-Västjädra on E18 must be removed through double files.	Road	Sweden
17	Lack of reststop opportunities for commercial traffic through Västerås. No action is planned.	Road	Sweden
18	Shortcomings in the capacity of the E18 through Västerås.	Road	Sweden
19	Capacity problems in Västerås C. The number of trains arriving and departing from the station will increase sharply, which will lead to an increased load at the station. No measures are planned to solve this problem during the planning period.	Rail	Sweden
20	There are significant shortcomings in capacity and safety in the fairway to the port of Västerås, but measures are underway in the current plan.	Sea	Sweden
21	There are remaining shortcomings in safety and capacity regarding the possibility of crossing the Wheel Bridge with ships in the so-called Mälarmax size.	Sea	Sweden

22	The traffic at Södertälje harbor is increasing and thus also the need to be able to operate the harbor with larger vessels.	Sea	Sweden
23	The new port in Norvik requires capacity strengthening in the road network.	Sea	Sweden
24	Port of Stockholm - Reducing area for port area and congestion in traffic, despite the application of ITS.	Sea	Sweden
25	Hargshamn: The port is taking measures to be able to handle an increase in freight volumes from Bergslagen. In order to benefit from the measures, measures are also required in the fairway.	Sea	Sweden
26	Kapellskär: The port's location 90 km north of Stockholm means that transports from the south must pass Stockholm, which entails a risk of minor delays due to traffic conditions, which in turn can lead to serious consequential delays if the transports miss ship departures. Suboptimal design of the port area, with limited capacity for waiting trucks in the port area.	Sea	Sweden

Supplementary information - Oslo-Örebro-Stockholm

In general, the Swedish road network does not have capacity problems except in the big cities and during rush hour:

- In eastern Central Sweden, the large capacity shortages are estimated to be in connection with Stockholm. Capacity problems may increase in line with forecast traffic growth (+ 50 percent passenger car traffic in Stockholm 2010–2030) (Sweco, 2015).

At the same time, the analysis is made that the road network on the Norwegian could possibly handle both future growth of freight transport if the railway capacity is not expanded to meet this development, but also a total transfer of freight from railway to road in the event that rail transport does not work.

- The overall goal of transferring freight transport from road to rail and shipping is a major challenge, however, as the railway in Norway has lost market share, both due to competition from truck traffic and lack of trust in rail transport due to inadequate infrastructure leading to delays and cancellations. .

On the Swedish side, the Swedish Transport Administration's compilation (2021) of forecasted traffic and planned infrastructure investments 2018–2029 shows that capacity utilization is and will be high on the Norwegian-Laxå border route. High-capacity utilization means difficulties in meeting the transport operators' wishes for traffic and a high sensitivity to disturbances and it is difficult to get times for maintenance. On the Örebro-Stockholm section, capacity utilization is lower and there are more possible routes to choose from, see Figure 19.

In terms of the two busiest hours per day, however, capacity utilization also entails certain restrictions on the Örebro-Stockholm section (Swedish Transport Administration 2019).

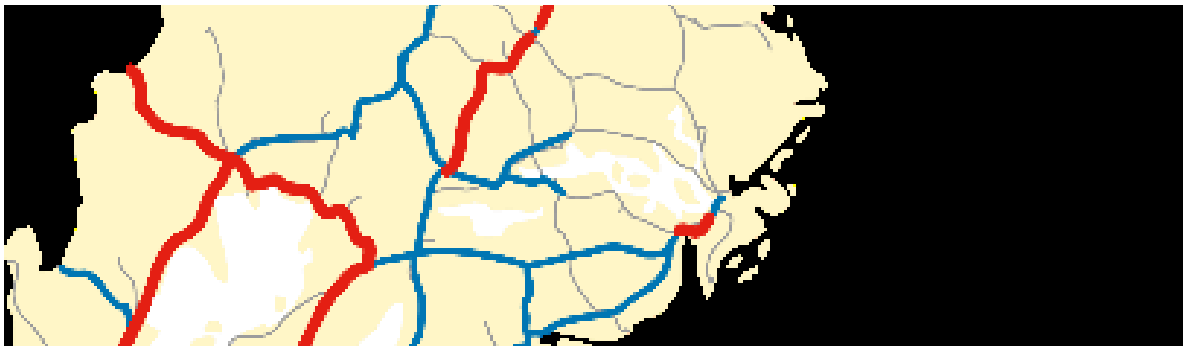


Figure 19 Swedish Transport Administration 2021 (cropped and enlarged). Red lines mean high capacity utilization and risk of disruption.

Within the Baltic Loop, a report was produced (2020) on measures for the Oslo-Stockholm route. The report lists the most important measures for the development of railway traffic capacity, punctuality, and travel times, with targets for 2030 and 2040. If proposed measures are indicative of existing shortcomings, the following bottlenecks appear today:

- Lack of efficient nodes for traffic type reloading (combined terminals) and specific points for multimodal reloading.
- There is a lack of a nationwide forecast model for the societal benefits of rail transport.
- Deficiencies in transport coordination, due to deficiencies in information / communication between different actors.

According to the Swedish Transport Administration (2021), the biggest bottlenecks are the following:

- Capacity problems in Västerås C. The number of trains arriving and departing from the station will increase sharply, which will lead to an increased load at the station. No measures are planned to solve this problem during the planning period (2018–2029).
- The high-capacity utilization limits the possibility of using long (750 m) freight trains all the way from the national border to Stockholm and the problems are expected to remain on the entire Värmland line even at the end of the planning period in 2029.

In 2019, Sweco carried out an analysis of the capacity of the Oslo-Stockholm railway line with a forecast year of 2040. The inquiry finds that capacity limitations arise during peak traffic in four congested sectors, see Figure 20:

- The Stockholm area
- The Oslo area
- Örebro-Hovsta (especially problematic, see above)
- Arvika-Kristinehamn

Figure 20 Capacity in the railway network in peak traffic 2040 (Sweco 2019).

Maritime transport

The lack of fairways for deep-sea vessels is not considered to lead to a significant bottleneck, as it is considered doubtful that such large vessels would be in demand in the corridors in question.

According to the Swedish Transport Administration's capacity analysis (2012, 2021), there are currently the following shortcomings in fairways and ports, as well as planned measures:

- The fairway into Stockholm harbor is pointed out as a named shortage due to lack of capacity and safety (Swedish Transport Administration 2012, Sweco 2015).
- Truck drivers risk not having time to get up for a sufficiently long rest period on the Kapellskär-Naantali section, which means that they are instead forced to pause close to arrival on the Finnish side (Wahlström & Chen, 2020).

The Northern Corridor: Stockholm-Helsinki-St. Petersburg

The northern corridor Stockholm-Helsinki-St. Petersburg is shown in Figure 21.

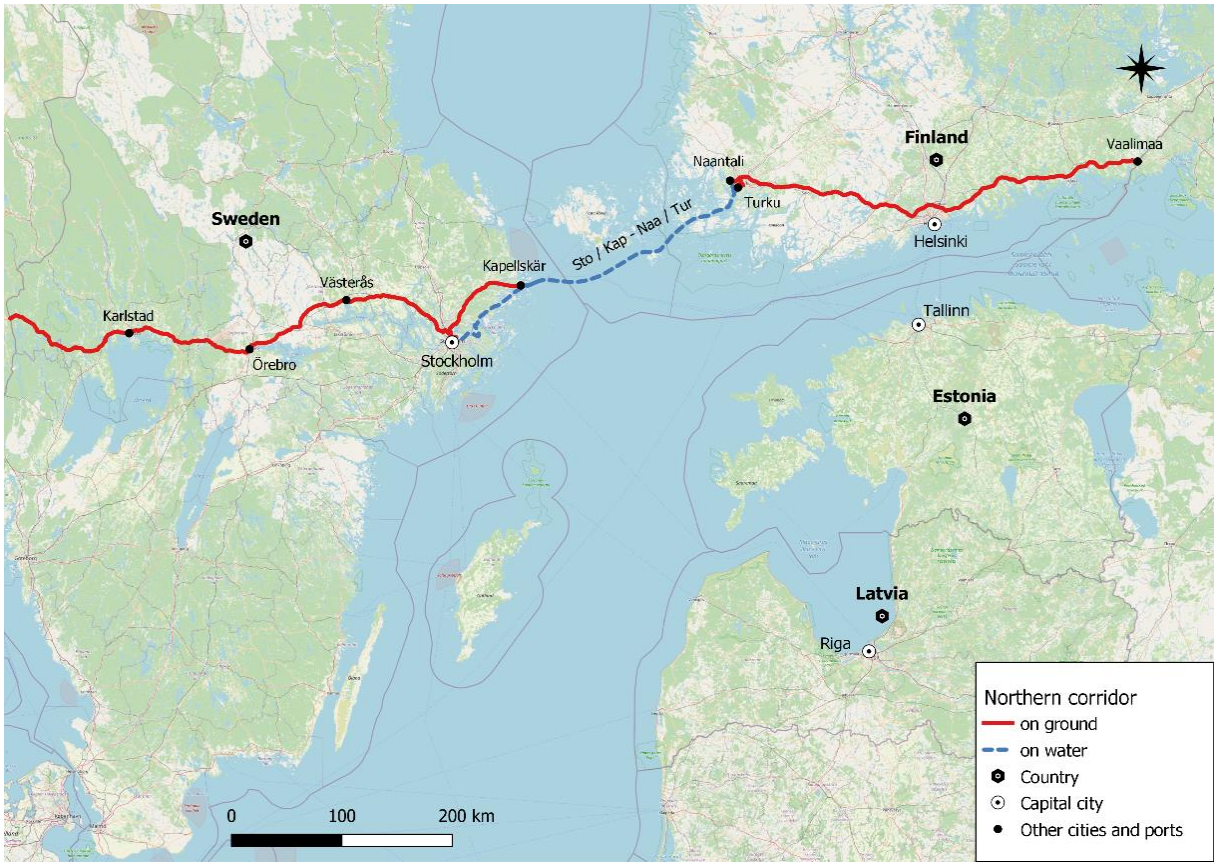


Figure 21 Illustration of the northern corridor: Oslo-Örebro-Stockholm-Helsinki-Saint Petersburg.

General bottlenecks

The following general shortcomings and bottlenecks are reported by transport operators in the corridor (Wahlström & Chen 2020):

- Delays (bottlenecks) in transport in Finland are reported by transport operators mainly to be congested on the Turku / Turku and Helsinki ring roads (Ring III), especially in rush hour traffic.
- Waiting times for ships for transport Naantali-Kapellskär and Turku-Stockholm.
- Insufficient number of freight lines and insufficient frequency of transports between Finland and Sweden.
- Inadequate winter road maintenance on the road network.
- VR's (train operator) concentration on forest, chemical and metal products, and their requirements for at least 5 train carriage shipments (which is too large volumes for most transport customers), has made train traffic to the ports almost non-existent.
- Stiff manual and partially overlapping systems for reporting to authorities (Portnet, AREX).

Bottlenecks connected to physical location - Stockholm-Helsinki-St. Petersburg

There are many bottlenecks connected to physical locations on the Stockholm-Helsinki-St. Petersburg route, see Figure 14. The bottlenecks are largely grouped around Helsinki but are also found along the entire route, and mainly refer to road transport, see Table 3.

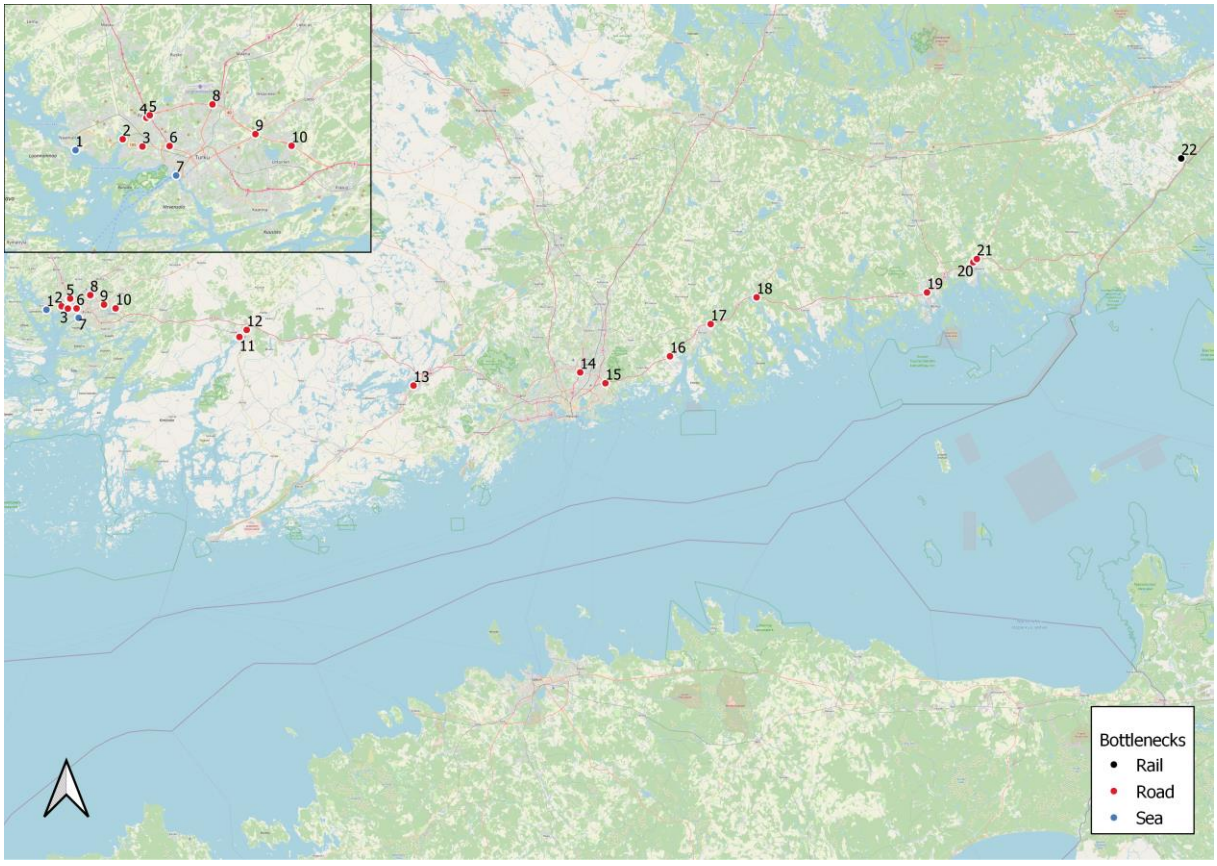


Figure 22 Identified bottlenecks within the corridor Stockholm-Helsinki-Saint Petersburg.

Table 3 Description of identified bottlenecks within the corridor Stockholm-Helsinki-Saint Petersburg.

ID	Description	Type	Country
1	Naantali port: • Limited parking space for queuing trucks into the port. • Inadequate traffic solutions in the port, during arrival and departure.	Sea	Finland
2	Discontinuity in the ring road at Raisionlahti (Turku ring road / highway 40).	Road	Finland
3	Insufficient capacity at the intersections between road 185 and intersecting roads at the height of Perno.	Road	Finland
4	Crowding in central Raisio / Reso	Road	Finland
5	Congestion at the intersection (traffic junction) E18 / E8.	Road	Finland
6	Turku-Raiso: accessibility problems from the port to the E18	Road	Finland
7	Åbo port: • Narrow fairway that limits the number of simultaneous ships that can call at the port. • Limited parking space for queuing trucks into the port. • Inadequate traffic solutions in the port, during arrival and departure. • The port's design and surrounding buildings limit the possibilities for port-based activities to establish themselves in the immediate vicinity of the port. • Seasonal peaks in passenger traffic (holidays, summer time) cause limiting freight capacity as passenger traffic is prioritized on car deck.	Sea	Finland

	• The simultaneous arrival and departure of two ferry companies from the port means a burden on the port's spaces and traffic solutions.		
8	Delays (bottlenecks) in transport in Finland are reported by transport operators mainly to be congested on the Turku / Turku ring road, especially in rush hour traffic.	Road	Finland
9	Turku: discontinuity in the ring road at Kausela, and at Raisionlahti (Turku ring road / highway 40).	Road	Finland
10	Tuulissuo-Avanti industrial area: temporary reconstruction of E18 (2020–2023) affects accessibility to / from the industrial area	Road	Finland
11	Meriniitty / other industrial areas: poor accessibility via 110 and 224 to E18 from the industrial area	Road	Finland
12	Road 52: Slow driving times from / to road 52 to E18. The last section of Salo's ring road is being planned.	Road	Finland
13	Road 25: accessibility problems	Road	Finland
14	Delays (bottlenecks) in transport in Finland are reported by transport operators mainly due to congestion on the ring road around Helsinki (Ring III), especially in rush hour traffic.	Road	Finland
15	Road 103 / E18 / RING III: Traffic from the port of Vuosaari - queuing on the E18 due to large traffic volumes.	Road	Finland
16	Road 148: Accessibility problems to / from Sköldvik	Road	Finland
17	Road 170 and surrounding intersections: High traffic flows with traffic problems	Road	Finland
18	The intersection between road 6 / E18: queue formation	Road	Finland

19	E18 from Pyhtää municipal border to Kyminlinna-Hovila-Karhula: accessibility problems	Road	Finland
20	The intersection between road 26 / E18: accessibility problems	Road	Finland
21	The intersection between road 371 / E18: accessibility problems	Road	Finland
22	Freight transport by rail across the border from Russia to Finland is often 1 km long or more, which today cannot be handled on the Finnish side due to too short siding at the border station in Vainikkala. Today, therefore, the Finnish operator has to divide transport into several train sets, which limits rail transport through Finland.	Rail	Finland

Supplementary information – Stockholm-Helsinki-St. Petersburg

Roadways

- Lack of nearby rest areas for truck drivers, which complicates compliance with driving and rest rules.
- Vulnerability and congestion are mainly linked to the roads around Helsinki, see Figure 23.

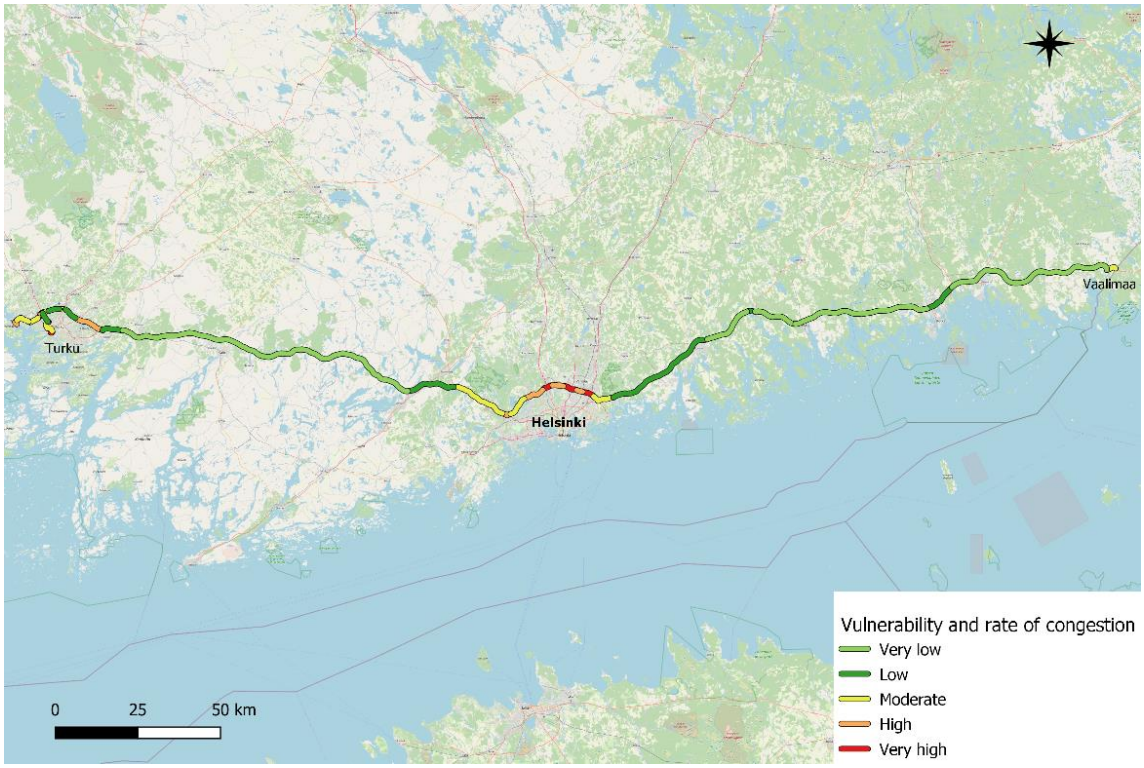


Figure 23 Vulnerability and congestion along the E18 in Finland. Source: Turku University of Applied Sciences.

Railway

- Switching between Sweden and Finland makes it difficult for rail transport between the countries, and along the entire route.

The Middle corridor: Stockholm-Tallinn-St. Petersburg

The Middle corridor Stockholm-Tallinn-St. Petersburg is shown in Figure 24.

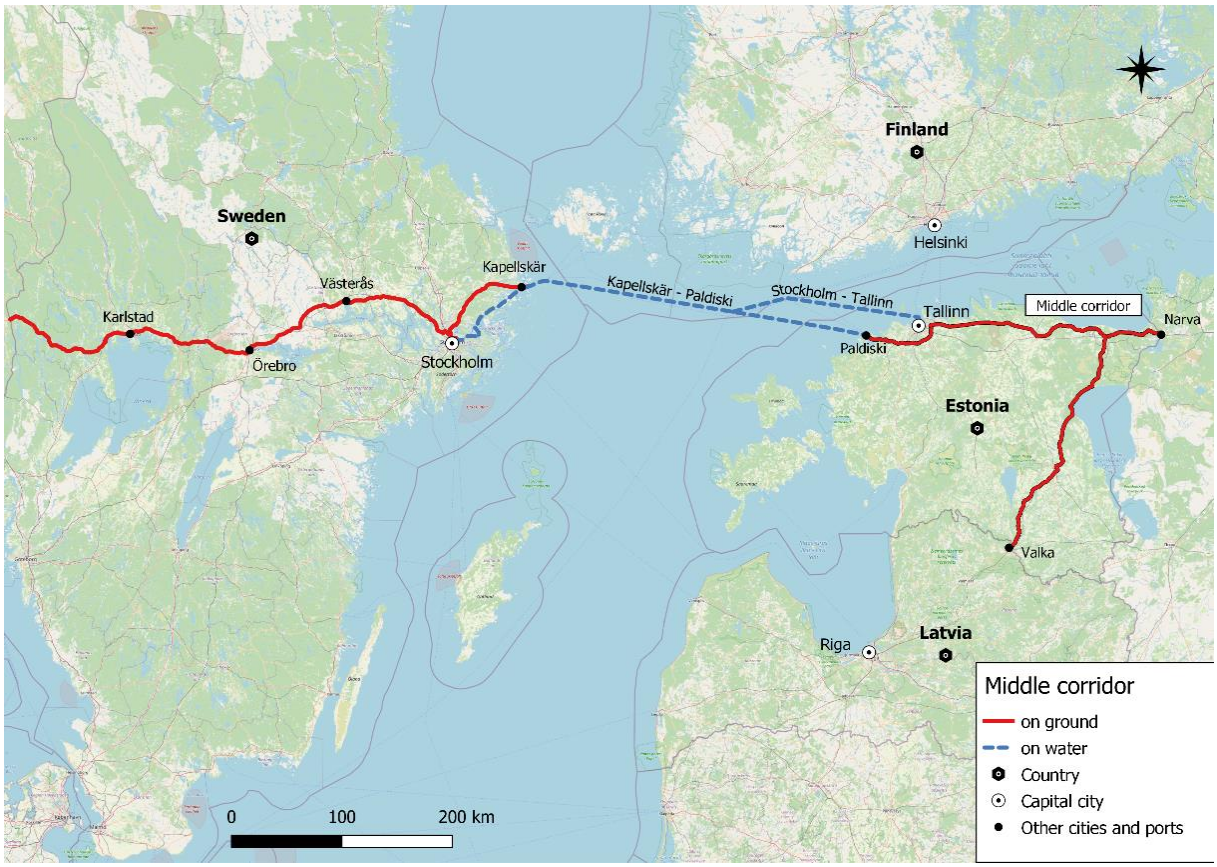


Figure 24 Illustration of the Middle corridor: Oslo-Örebro-Stockholm - Tallinn - Saint Petersburg

General bottlenecks

- There are major political implications regarding transport through Estonia, as Russia's interests are to channel freight transport via Ust-Luga (Russia) and Kaliningrad

(through Lithuania). There are clear intentions from actors on both sides of the Estonian-Russian border to work towards a common strategy for freight transport through St. Petersburg. Petersburg, but these have long been opposed at the political level.[4]

- Time-consuming processing at customs clearance, on arrival in Sweden and between Russia and Estonia. In the latter case for both freight and passenger transports on trains that are forced to stand still for up to an hour. On the Estonian side, they have started with pre-bookable digital queues for customs stations, which has shortened the processing times.

[4] Interview with Arthur Raichmann, Business Development manager, AS Eesti Raudtee, Estonian Railways Ltd

Bottlenecks connected to physical location - Stockholm-Tallinn-St. Petersburg

There are several bottlenecks connected to physical locations on the Stockholm-Tallinn-St. Petersburg route, see Figure 17. With one exception, the bottlenecks are grouped around Tallinn, and are found in all three modes of road, rail, and sea transport, see

Table 4.

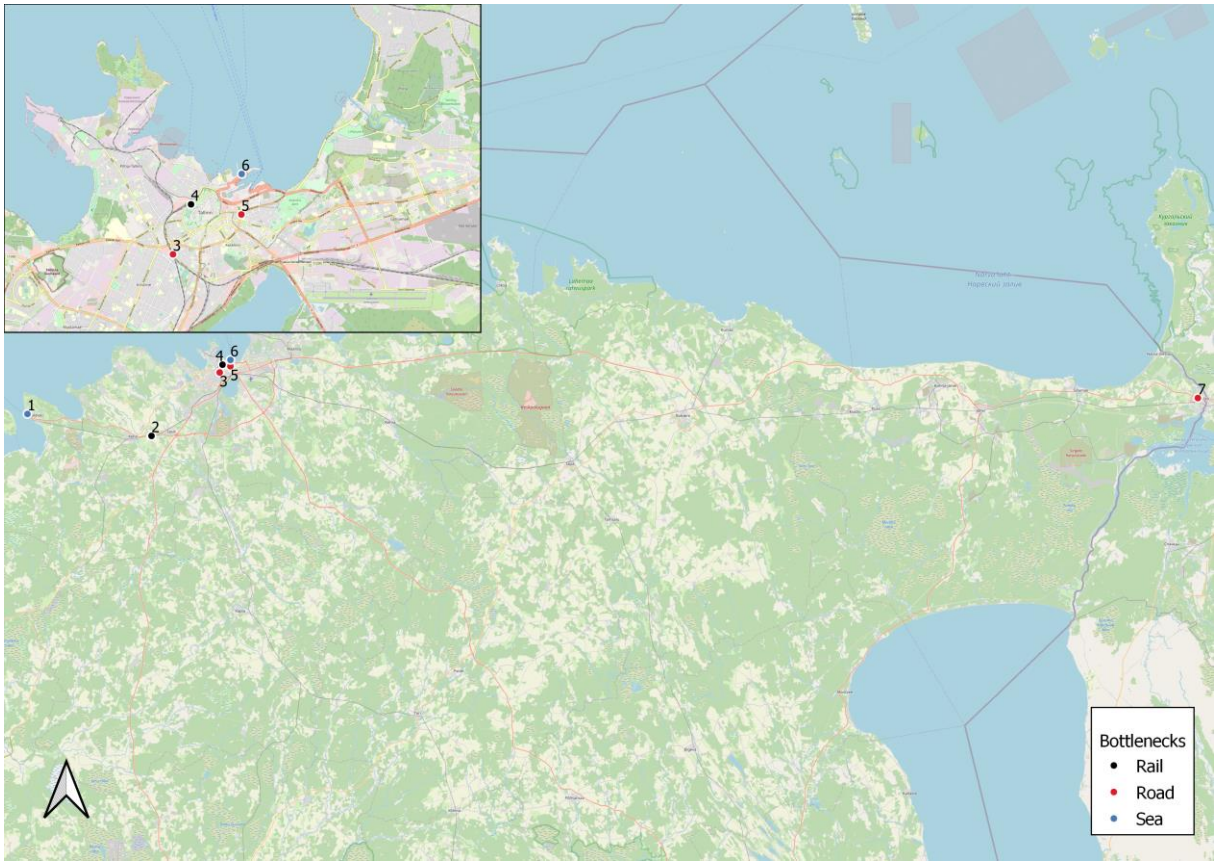


Figure 25 Identified bottlenecks within the corridor Stockholm-Tallinn-Saint Petersburg.

Table 4 Description of identified bottlenecks within the corridor Stockholm-Tallinn-Saint Petersburg.

ID	Description	Type	Land
1	Lack of railway infrastructure creates bottlenecks for the ports, especially in Paldiski. The port / port authority lacks an authority commitment to improve the infrastructure in the form of a railway bypass.	Rail/ Sea	Estonia
2	The Paldiski-Ülemiste railway connection is a potential bottleneck if volumes from the port of Paldiski increase, partly due to the route, which means that freight transport disturbs residents at night.	Rail	Estonia
3	The Paldiski-Tallinn connection means that freight transport passes through central Tallinn and residential areas, which means disruptions and restrictions for freight transport.	Road	Estonia
4	Balti Jaam railway station in central Tallinn has reached its capacity ceiling and needs modernization and new connection tracks and upgraded traffic management systems at railway crossings in central Tallinn.	Rail	Estonia
5	The importance of tourism and the cultural environment in central Tallinn makes large volumes of heavy traffic unsuitable, for example ro-ro transport in combination with passenger traffic. Makes demands on new business models at ferry operators.	Road	Estonia
6	Tallinn: Ferry traffic's large space requirements mean that the port area becomes a delimited / isolated logistics zone.	Sea	Estonia
7	Delays on the Tallinn-St. Petersburg and queuing for trucks in Narva on the Estonian-Russian border: E20 Tallinn-Narva (part of the TEN-T network).	Road	Estonia

Supplementary information - Stockholm-Tallinn-St. Petersburg

Railway

- In general, lack of capacity and narrow time channels makes it impossible to plan functioning freight transport by rail.
- Forest products (wood and paper) from Finland and Sweden are mainly used by shipping, partly due to a lack of confidence in the functionality of the Estonian and Baltic railways.
- Sections with single tracks on the Paldiski-Tallinn-Narva section. Increased speeds and double-track Paldiski-Tallinn are required.
- Passenger traffic uses such a large proportion of the capacity on the railway that freight transport is limited.

Maritime transport

- The planned Rail Baltica connection (Kaunas-Tallinn) is being built with a gauge of 1435 mm, while the existing railway in Estonia has 1520 mm, which could create compatibility problems. Planned logistics centers in Soodevahe and Muuga can be a solution to this.

- Inadequate exchange of information between actors, modes of transport and countries.

- Tallinn: Limited communication between different actors regarding the development of the infrastructure from an overall urban planning perspective.

- Tallinn: Ferry traffic's large space requirements mean that the port area becomes a delimited / isolated logistics zone.

- Tallinn: Limited and fragmented long-term planning of the infrastructure.

- Tallinn: Unsafe rest areas for truck drivers.
- The fact that Paldiski is not part of the TEN-T network prevents CEF funding for the development of connecting road and rail networks, which limits the port's potential.

The Southern Corridor: Stockholm-Riga-St. Petersburg

The southern corridor Stockholm-Riga-St. Petersburg is shown in Figure 18.

Figure 26 Illustration of the southern corridor: Oslo-Örebro-Stockholm-Riga-Saint Petersburg.

The southern corridor includes the following sections / lanes (Wahlström & Chen, 2020):

- Oslo-Örebro-Stockholm (land transport)
    - Norvik-Ventspils (maritime transport och ports)
        - Ventspils-Riga (land transport)
    - Stockholm-Riga (maritime transport och ports)
        - Riga-via Valmiera-Valka- Narva-St. Petersburg (land transport).

General bottlenecks

No regular delays are reported for freight transport on the routes Riga-Ventspils and Riga-Valmiera-Valka, but what occurs are temporary events that cause bottlenecks, as well as waiting times in port. The delays are reported

to stem from the traffic situation on road sections on the Riga ring road, as well as on road A10 towards Tukums and roads A1 and A2 to the east. Long waiting times for ships in the port of Ventspils are also reported to reduce transport efficiency. Additional reported causes, deficiencies (Wahlström & Chen 2020):

- Increased road traffic due to increased passenger and freight traffic to and from Riga.
- Inadequate investment in the national road network.
- Lack of wildlife fencing, causing collisions.
- Lack of cross-border public transport and air connections in the east-west direction.
- Need for information on cross-border transport flows.
- Lack of communication and cooperation between different actors (including municipalities and academic institutions) when it comes to planning that affects transport. This leads to a lack of cooperation to solve challenges in terms of freight transport, public transport, and to bring about major infrastructure projects around Riga.
- Lack of long-term perspective in transport planning leads to changing goals and priorities for each new political term.

- The transport sector is not treated as one and the same sector, but as separate parts without any overall strategy and common goal.
- There is currently no working business model and infrastructure for e-commerce. There is no facility for packaging and picking and bulk transports are not handled.
- There is no strategy for freight traffic to and from St. Petersburg, as the quantities of goods and the frequency of transports are very unstable. No detailed analysis has been made of this situation.

Bottlenecks connected to physical places - Stockholm-Riga-St. Petersburg

There are many bottlenecks connected to physical locations on the Stockholm-Riga-St. Petersburg route, see Figure 19. With one exception, the bottlenecks are collected in and around Riga and mainly refer to road transport, see Figure 27 and Table 5.

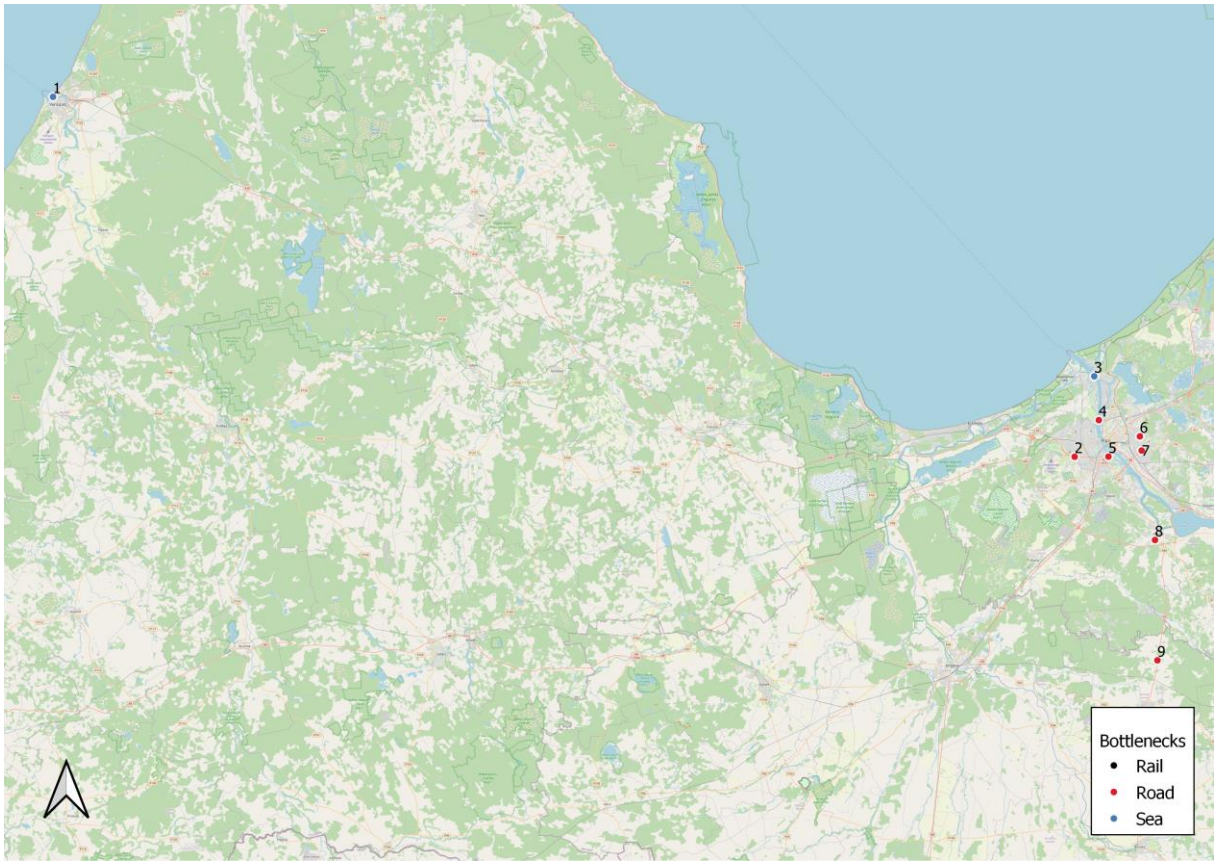


Figure 27 Identified bottlenecks within the corridor Stockholm-Riga-Saint Petersburg.

Table 5 Description of identified bottlenecks within the corridor Stockholm-Riga-Saint Petersburg.

ID	Description	Type	Country
1	Insufficient parking for trucks and ramp for loading ships in Ventspil's harbor.	Sea	Latvia
2	A10: Problems in traffic junctions where motorways cross each other, partly due to a high flow of commuting cars to / from Riga. The ring road has only one lane in each direction.	Road	Latvia
3	The port of Riga is located on both sides of the river Daugava, which means that trucks are forced to drive around Riga on the ring road (about 1 hour drive) to access both parts of the port.	Sea	Latvia
4	All road transport of both goods and people is hindered by the fact that it is not possible to cross the port and the river Daugava north of central Riga ("missing northern crossing"). The result is that all traffic is diverted on Riga's ring road south of the city or through central Riga.	Road	Latvia
5	The heavy traffic reduces the passability and driving speeds on the Riga ring road. In addition, there are two sections on the ring road where congestion occurs due to deficiencies in the infrastructure (bridge + traffic signals in combination with high vehicle flows).	Road	Latvia
6	A2 / 3: Problems in traffic junctions where motorways cross each other, partly due to a high flow of commuting cars to / from Riga. The ring road has only one lane in each direction.	Road	Latvia
7	Despite restrictions on freight transport through central Riga, a large number of lorries still pass through or in connection with the city center, especially in connection with the port area, which impairs air quality, causes disruption and has a negative effect on road safety.	Road	Latvia
8	Ķekava: there are major traffic problems at the new bypass at Kekava south of Riga.	Road	Latvia

9	Via Baltica (E67 Kaunas-Riga-Tallinn) there are major traffic problems, which will hopefully be relieved somewhat when Rail Baltica is completed and some freight transport can move to the railway.	Road	Latvia

Supplementary information - Stockholm-Riga-St. Petersburg

Roadway

Delays are reported to result from the traffic situation on road sections on the Riga ring road, as well as on road A10 towards Tukums and roads A1 and A2 to the east (Wahlström & Chen 2020). In general, the heaviest congested transport sections are around Riga, on the A10 (Riga-Ventspils) and A2 motorways (Riga-road A3 and Valka). The flows decrease significantly with the distance from Riga, towards Ventspils and towards Valka (Cimdiņš et. Al., 2020), see Figure 28.

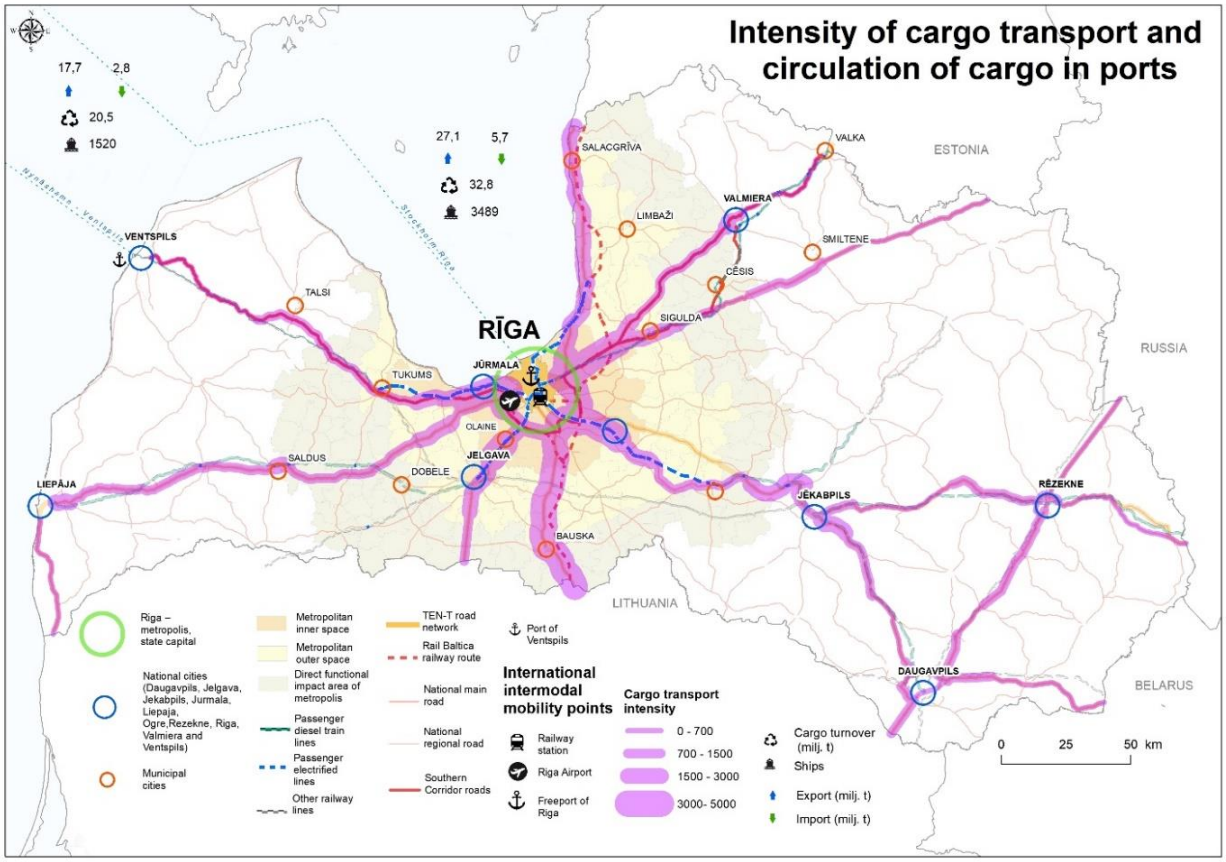


Figure 28 Illustration of important freight routes within Latvia (AC Konsultācijas, Ltd, 2021).

Railway

No bottlenecks linked to rail transport in Latvia have been identified in the supporting material obtained. This may be due to knowledge gaps or the fact that there are no bottlenecks in the railway network.

Maritime transport

- The overall challenge for Latvian ports if freight volumes increase is not the capacity of the ports, but the connections to land-based transport to take the goods to / from the port.

According to Greencarrier (transport operator), there are two main bottlenecks for shipping between Sweden and Latvia:

- Political tensions between Sweden and Russia mean that transports operated by Russian operators do not reach the port.
- The small volumes of goods that travel by land from China mean that there is no basis for frequent departures between Sweden and Latvia, which reduces the usefulness of shipping for freight transport Sweden-Russia.

Bottlenecks and shortcomings in the ports of Riga and Ventspil (Wahlström & Chen 2020):

- The ports are heavily dependent on transport from Belarus and Russia. Russia is increasingly choosing to direct freight transport via its own ports (eg Kalininingrad).
- There is an imbalance in import-export, where exports dominate.

5. Proposals for measures for increased capacity

The basis for this assignment presents many measures to improve the capacity for freight transport in the three lanes. The measures are partly of a general nature and partly measures linked to a geographical location.

Several of the measures are already planned measures, and some may be in the process of being implemented or have already been implemented, as some of the investigations are several years old. In addition, Trivector has also developed several proposals for complementary measures. All measures developed by Trivector need to be studied in more detail to investigate its relevance and feasibility.

General measures

The following general measures for more efficient transport have been identified in the documentation received from the project partners:

- New contract models for increased flexibility, competition, and innovation, especially in shipping, which are characterized by long exclusive contracts (Wahlström, 2020).
- Public-Private Partnerships (PPP) for increased collaboration and investment planning. (Wahlström, 2020).
- Standardization of communication and information to collect data in a similar way to enable automatic systems for optimizing traffic flows to and from ports and border controls (Wahlström, 2020).
- Implementation of the ERTMS signalling system to achieve interoperability in the European railway network. In Sweden, there are two CEF-funded projects that will equip 332 locomotives with the necessary instruments. The projects will be implemented by the Swedish Transport Administration 2017 to 2020 resp. 2023 (Mälardalsrådet, 2019).

- Rail Baltica, a railway infrastructure project in the North Sea-Baltic corridor, which aims to integrate the Baltic states into the European railway network. With a length of 870 km, the new railway link covers Poland, Lithuania, Latvia, and Estonia. The project, which is prioritized by the EU, will remove bottlenecks for passenger and freight transport, expand cross-border connections and promote modal integration and interoperability. The construction phase will start in 2019 and will be completed in 2026 (Mälardalsrådet, 2019).

- Driverless transport solutions in ports and cities and development of other innovative logistics solutions for increased efficiency (informant in Finland / Baltics).

Trivector has identified proposals for complementary comprehensive measures for more efficient freight transport:

- Collaboration forum for Baltic Sea ports to standardize system selection, interfaces, and handling of information, etc., to minimize time consumption and manual work linked to ship traffic between the ports in the Baltic Sea.
- Customs cooperation to facilitate cross-border transport, primarily by road, preferably linked to political cooperation and negotiations at international level.
- Shorten the allocation process for train paths in Sweden through a simpler and more agile handling to facilitate transfer from road to railway.
- Reduced fairway charges to promote domestic water traffic and thereby relieve the road and rail network.
- Review the ships 'arrival times at ports to reduce the load on the Baltic Sea ports' spaces and traffic solutions.
- Dry port and train commuter concept, for example with dry port collaborations and train commutes for the ports of Stockholm, like the port of Gothenburg. The concept can also be spread further in NGZ via collaboration forums with the Baltic Sea ports.
- Initiation of cooperation for railway connection St Petersburg - Stockholm - Oslo, e.g. a northern variant of the east-west railway connection that is under development by

the International Railway Union (UIC), alternatively a route via the port of Murmansk (see the corridor Stockholm-Helsinki-St Petersburg).

Measures linked to geographical location

About 40 measures can be connected to a geographical location in the route Oslo-St Petersburg, see Figure 21. Measures connected to each corridor are described in more detail below.

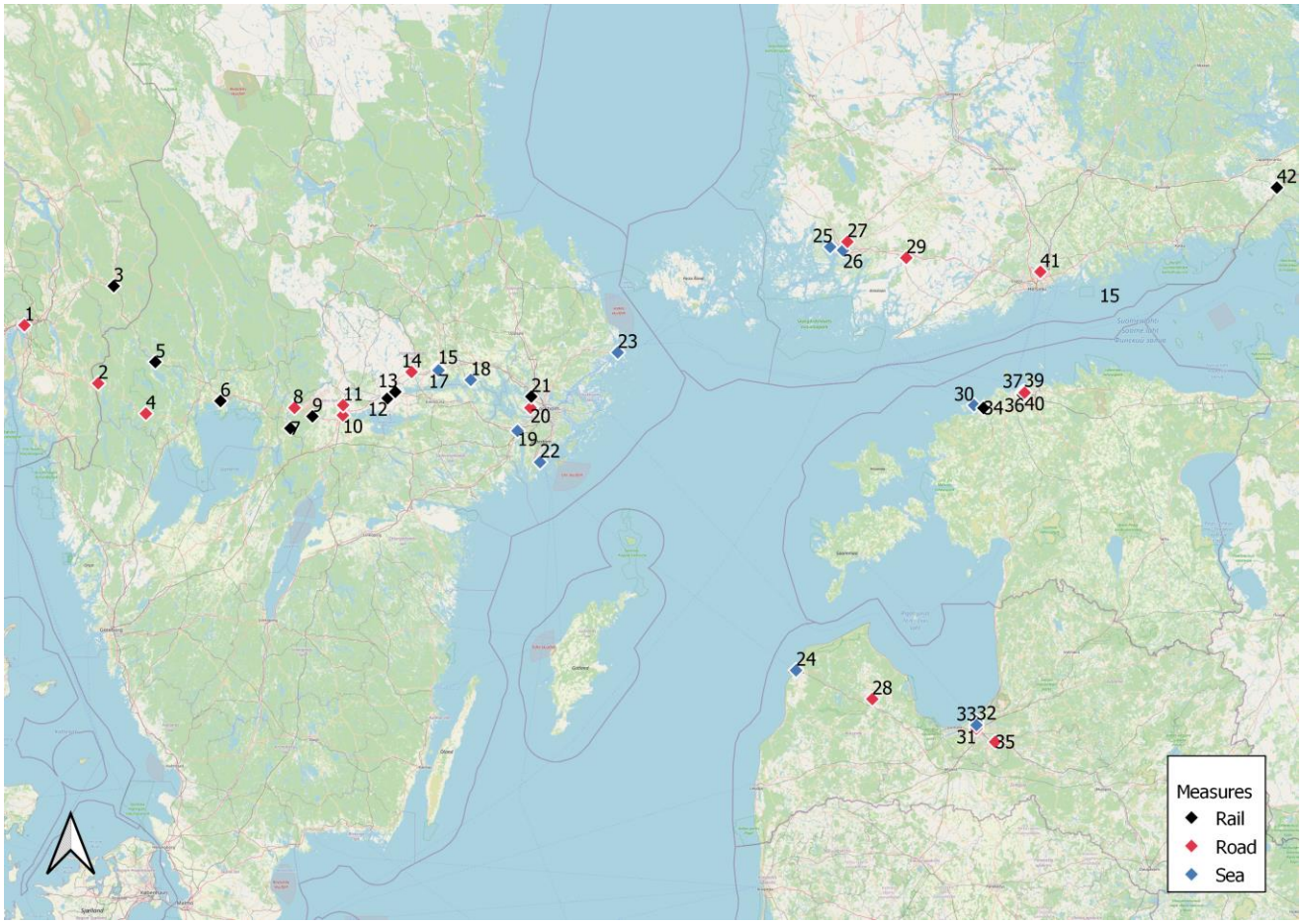


Figure 29 Identified measures within the corridor Oslo-St. Petersburg.

Measures along the Oslo-Örebro-Stockholm corridor

Measures along the Oslo-Örebro-Stockholm corridor are presented in Figure 30 and are described in more detail in Table 6. Most of the measures are proposed in Sweden as the basis for the Norwegian side has been limited in this investigation. The measures concern improvements for road, rail, and sea transport.

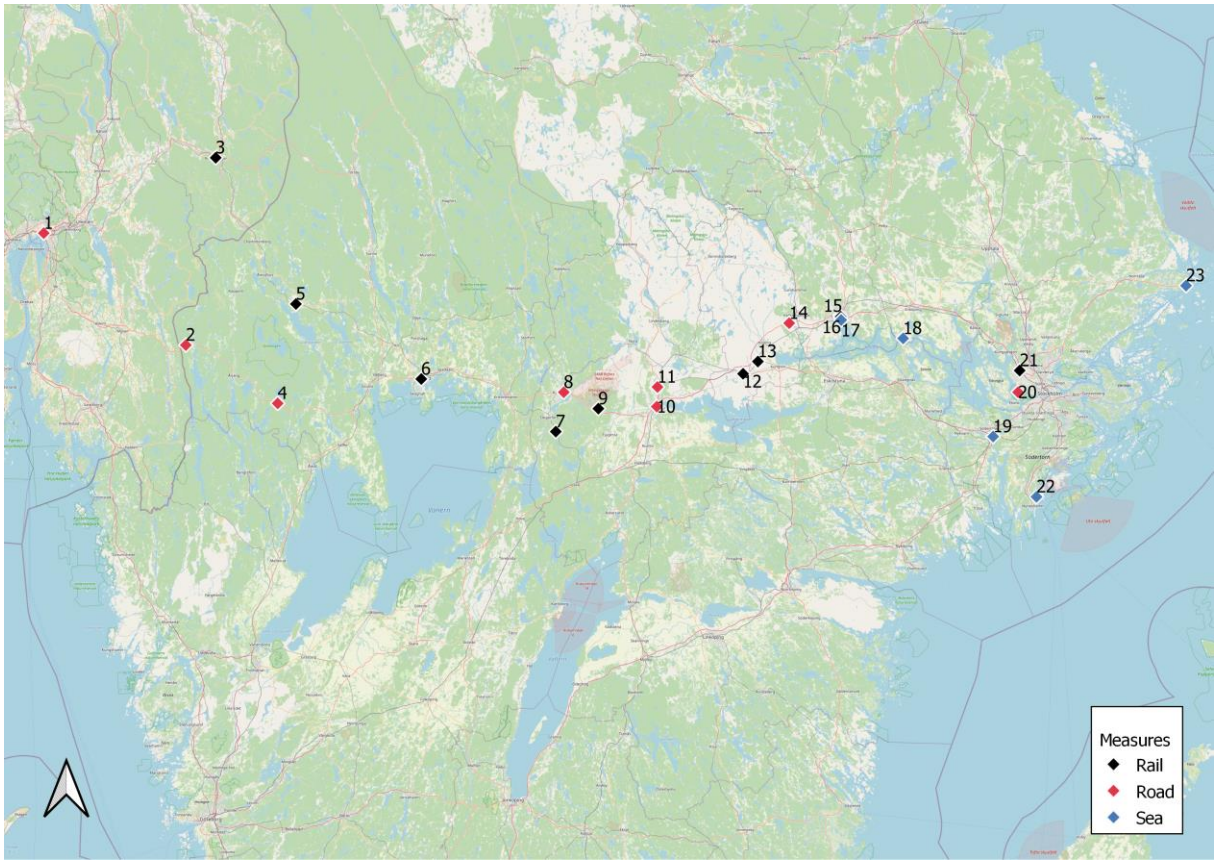


Figure 30 Identified measures within the corridor Oslo-Örebro-Stockholm.

Table 6 Description of identified measures within the corridor Oslo-Örebro-Stockholm.

ID	Measure	Source	Country	Type
1	Oslo area - extra lanes for heavy traffic towards ports and railway terminals	Trivector	Norway	Road
2	Open 24 hours a day at the customs station at Hån on road 61 between Sweden and Norway	Trivector	Sweden	Road
3	Extend the meeting tracks on the Kongsvinger line (Oslo-Riksgränsen) for increased capacity and speed	Trivector	Norway	Rail
4	Improve the road standard from Grums to the Norwegian border.	Trivector	Sweden	Road
5	The Arvika – Lilleström Gränsbanan. New railway with the aim of improving the possibilities for transport between Stockholm and Oslo and improved capacity in the existing railway network.	Trivector	Sweden / Norway	Rail
6	Double track in locations along the Kristinehamn-Kil section (Värmlandsbanan)	Trivector	Sweden	Rail
7	Improved capacity regarding the connection with intersecting railways and conflicts with traffic on the Västra stambanan in Laxå.	Trivector	Sweden	Rail
8	Upgraded bearing capacity class on bridges in Karlskoga so that they can handle BK4.	Trivector	Sweden	Road
9	Nobelbanan Kristinehamn-Örebro. New railway with the aim of improving the possibilities for transport between Stockholm and Oslo and improved capacity in the existing railway network.	Trivector	Sweden	Rail

10	Upgraded bearing capacity class on bridges in Örebro so that they can handle BK4.	Trivector	Sweden	Road
11	Improved connection of Godsstråket through Bergslagen to Mälarbanan in Hovsta.	Trivector	Sweden	Road
12	Fix capacity deficiencies in Arboga through a platform extension in Arboga Bangård.	Trivector	Sweden	Rail
13	Upgrade to double track at locations on the Örebro-Västerås section (Mälarbanan).	Trivector	Sweden	Rail
14	Build a motorway (double lanes) on the E18 between Köping and Västjädra.	Trivector	Sweden	Road
15	Create break opportunities for commercial traffic through Västerås.	Trivector	Sweden	Road
16	Reconstruction of Västerås C for increased safety and capacity.	Trivector	Sweden	Rail
17	Västerås Port: • There is already today an inland vessel shuttle for container traffic between Stockholm Norvik and the port of Västerås (departures 2 times / week). This can be given more departures or implemented in more places to relieve the road network and contribute to the transfer of goods from road to other modes of transport. • Set up ferry departures between Västerås - Naantali, for less land traffic through Stockholm and longer rest periods so drivers can continue driving directly (Trivector)	Baltic Loop/ Trivector	Sweden	Sea

18	Capacity and safety-enhancing measures to enable passage at Hjulstabron with ships in the so-called Mälarmax size.	Trivector	Sweden	Sea
19	Enable traffic on Södertälje harbor with larger vessels due to increased traffic. Ro-Ro line to the east.	Trivector	Sweden	Sea
20	Bypass Stockholm, which relieves the road network around the capital and reduces the vulnerability of the road system, will be completed around 2030.	Baltic Loop	Sweden	Road
21	Mälarbanan is expanded from two to four tracks to increase capacity. Mälarbanan is connected to Ostkustbanan and Citybanan. The Mälar line is the only line that is expected to have an improved situation in the future, on other lines capacity utilization will increase.	Sweco 2015	Sweden	Rail
22	The recently completed port of Norvik (Nynäshamn) complements the port infrastructure in the Stockholm region.	Baltic Loop	Sweden	Sea
23	Modernization of the port in Kapellskär with: • System for automatic mooring • Shore power for ships and • New passenger facilities, which increases the capacity to receive larger passenger ships from Naantali within a few years.	Baltic Loop	Sweden	Sea

Supplementary information for the corridor Oslo-Örebro-Stockholm

Increased maritime transport has a great potential to be a part of the long-distance transports to / from the region. Increased maritime and barge traffic in Lake Mälaren and

along the coast also have great potential to develop the region's freight transport towards a higher sustainability. At the same time, however, this means that the load on certain road sections increases due to increased road traffic to and from the ports (Mälardalsrådet, 2020a; 2020b).

Measures along the Northern corridor: Stockholm-Helsinki-St. Petersburg

Measures along the Stockholm-Helsinki-St Petersburg corridor are presented in Figure 31 and are described in more detail in Table 7. All measures along this corridor are in Finland. Measures in Sweden have been included in the Oslo-Örebro-Stockholm corridor. The supporting material from the Russian side has been limited and no measures are therefore proposed here. The proposed measures concern improvements to road, rail, and maritime transport.

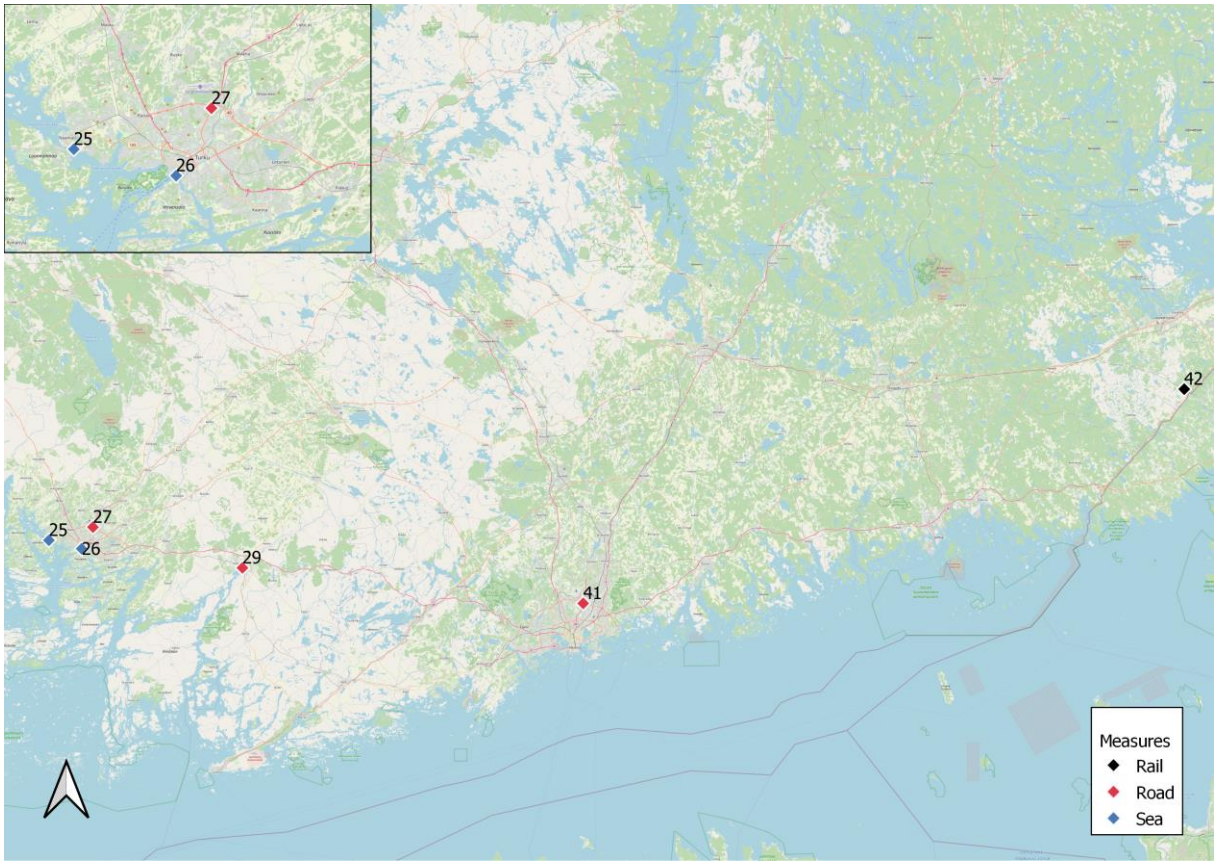


Figure 31 Identified measures within the corridor Stockholm-Helsinki-St. Petersburg.

Table 7 Description of identified measures within the Stockholm-Helsinki-St. Petersburg corridor.

ID	Measures	Source	Country	Type
25	Naantali port: • New physical structure to handle check-in and transport waiting for ships. • Extended parking space for queuing trucks into the port. • InstAlltion of automatic mooring system for increased speed for ships in the port, reduced climate impact and increased work environment safety. • Shore power for ships. • Establish ferry departures between Västerås - Naantali, for less land traffic through Stockholm and longer rest periods so drivers can continue driving directly (Trivector)	Baltic Loop/ Trivector	Finland	Sea
26	Turku port: • Extended parking space for queuing trucks into the port.	Trivector	Finland	Sea
27	Road connections to Turku and Naantali ports have been upgraded in recent years and further plans nearing completion, eg upgrading of the Turquoise ring road (E18): • The E18 / E8 intersection in Raisio just north of Turku handles through traffic that must be passed by traffic to and from the ports of Naantali and Turku. Planned measures will begin in 2021 and include replacing the existing traffic area, a new traffic line in central Raisio and a tunnel.	Baltic Loop	Finland	Road

29	Meriniitty / other industrial areas: Improved accessibility via 110 and 224 to E18 from the industrial area.	Trivector	Finland	Road
41	Measures aimed at reducing congestion on the Helsinki ring road (Ring III), especially in rush hour traffic.	Trivector	Finland	Road
42	Longer siding at the border station in Vainikkala to enable longer train sets (1 km or more) to be handled on the Finnish side of the border.	Trivector	Finland	Rail

Supplementary information - Stockholm-Helsinki-St. Petersburg

The straightest route from East Asia to Sweden is via Russia. The state-owned Russian railway company RZD states that it prioritises the development of international transit transport and points out that the Trans-Siberian Railway is an important link for freight traffic between Asia and Europe (Trafikanalys, 2020).

- According to the RZD, several measures have been taken to simplify the procedure at border crossings and customs clearance, such as a simplified system for declaring goods in containers. New IT systems make it possible to track trolleys and containers in real time.
- RZD also highlights a northern variant of the east-west link that is under development by the International Railway Union (UIC). This corridor extends from the northeastern United States and Canada (Boston and Halifax, respectively) via the port of Narvik and then by rail through Sweden, Finland, and Russia, where the corridor reaches the ports on the Pacific Ocean via the Trans-Siberian Railway. Alternatively, the corridor ends through Kazakhstan for further travel towards China (Trafikanalys, 2020).
- To avoid the change of gauge between Sweden and Finland, an alternative route can go via the port of Murmansk, which means that the corridor does not pass Finland or Sweden. The corridor is a faster alternative to shipping goods across the Pacific for

transportation between the interior of China to the north-eastern parts of the United States and eastern Canada. The route goes mostly through sparsely populated areas and the bottlenecks are few (Trafikanalys, 2020)

Measures along the Middle corridor: Stockholm-Tallinn-St. Petersburg

Measures along the Stockholm-Helsinki-St Petersburg corridor are presented in Figure 32 and are described in more detail in Table 8. All the measures in this corridor are in Estonia. Measures in Sweden have been included in the Oslo-Örebro-Stockholm corridor. The supporting material from the Russian side has been limited and no measures are therefore proposed here. The proposed measures concern improvements to road, rail, and maritime transport.

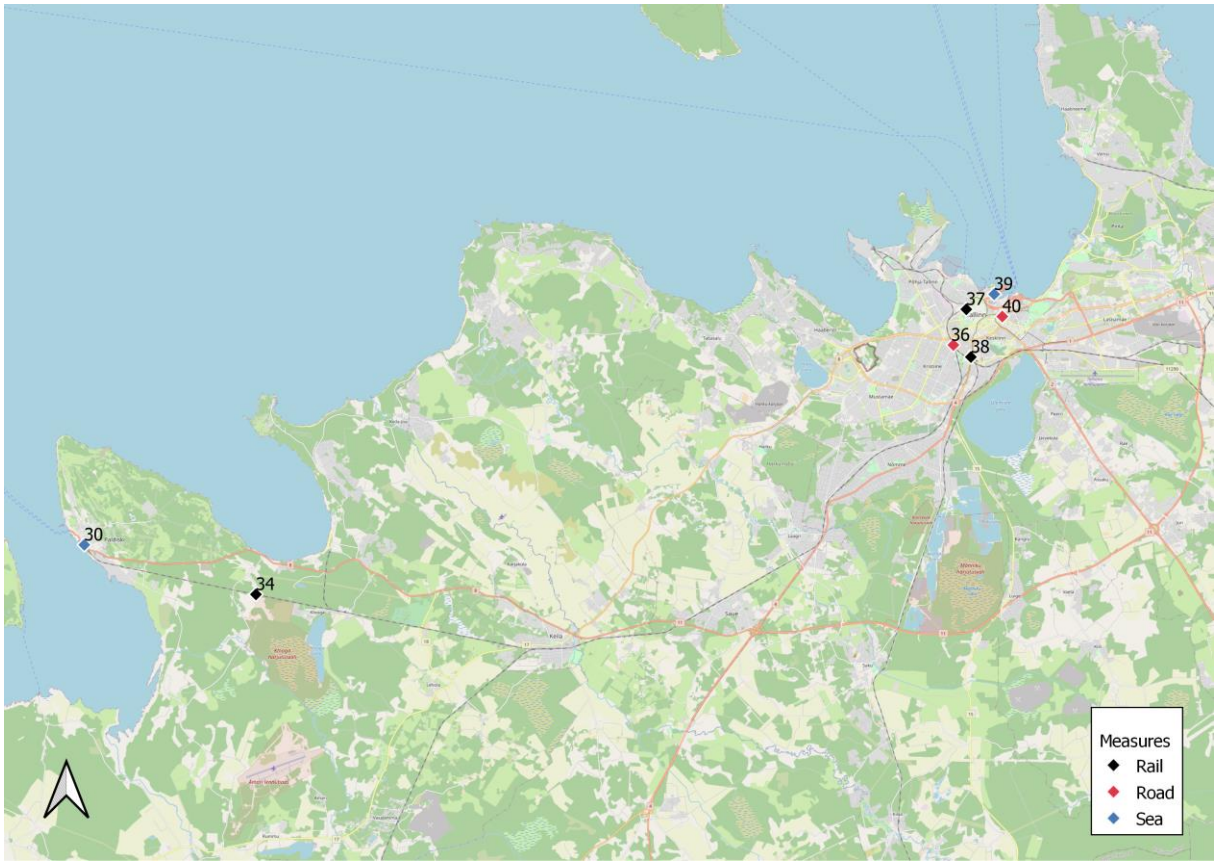


Figure 32 Identified measures within the corridor Stockholm-Tallinn-St. Petersburg.

Table 8 Description of identified measures within the corridor Oslo-Örebro-St. Petersburg.

ID	Measures	Source	Country	Type
30	The port of Paldiski: • is considered to have the potential to develop in the longer term with a new industrial park and logistics center (34 ha) • new quay to receive large, awkward deliveries, such as wind turbine components • Improved railway infrastructure in Estonian ports, especially in Paldinski • Give the port authority a mandate to build a railway bypass	Baltic Loop	Estonia	Sea
34	In parallel with the reconstruction of the Lääne-Harju railway (including Tallinn-Paldiski), a new signaling system is being installed that provides increased speed and capacity.	Baltic Loop	Estonia	Rail
36	Create another transport route for freight transport between Paldinski and Tallinn to avoid going through central Tallinn and residential areas.	Trivector	Estonia	Road
37	Capacity building measures at Balti Jaam station in Tallinn: • modernization • new connection tracks • upgraded traffic management system at railway crossings in central Tallinn	Trivector	Estonia	Rail
38	Tallinn's railway ring will reduce freight traffic bottlenecks and provide increased transport options for passenger transport to cities and workplaces in the region.	Baltic Loop	Estonia	Rail

39	New digital solutions in the port of Tallinn, for example: • Smart Port - Traffic management in the port and automatic check-in of passengers and vehicles • Single Window and Logistics X-road - Digitization of data exchange in logistics chains • FlexPort - "port management system" (port management program) • Shore power for ships	Baltic Loop	Estonia	Sea
40	New business models at ferry operators to avoid the impact of heavy traffic on tourism and cultural environments in central Tallinn.	Trivector	Estonia	Road

Supplementary information – Stockholm-Tallinn-St. Petersburg

Railway

- Increased government activity and financing for better functioning infrastructure are reported by contractors and companies as a prerequisite for making major investments attractive, including in connection with the port of Paldiski.
- A solution for rail transport can be a strong cooperation with sufficient volume in the form of freight flows to be able to negotiate good terms for transport to and through Russia.

Possible time savings

According to Kareel Kose (email correspondence) at the Union of Harju County Municipalities, project partner in the Baltic Loop project, the following possible time savings on bottlenecks and challenges are solved:

- For passenger transport, it is possible to reduce the travel time by train Tallinn-Narva by about 50 minutes. With a direct connection to Tallinn's port or airport, it is possible to reduce travel times by an additional 1 hour.
- For freight traffic, it is possible to reduce the transport time by 1–1.5 days through better customs processing and digital documentation.
- Better railway connections to Paldiski have the potential to reduce the time by another 1 day.

The Southern corridor: Stockholm-Riga-St. Petersburg

Measures along the Stockholm-Riga-St Petersburg corridor are presented in Figure 33 and are described in more detail in Table 9, with source reference for a more comprehensive description. All the measures in this corridor are in Estonia. Measures in Sweden have been incuded in the Oslo-Örebro-Stockholm corridor. The supporting material from the Russian side has been limited and no measures are therefore proposed here. The proposed measures relate to improvements for road and sea transport.

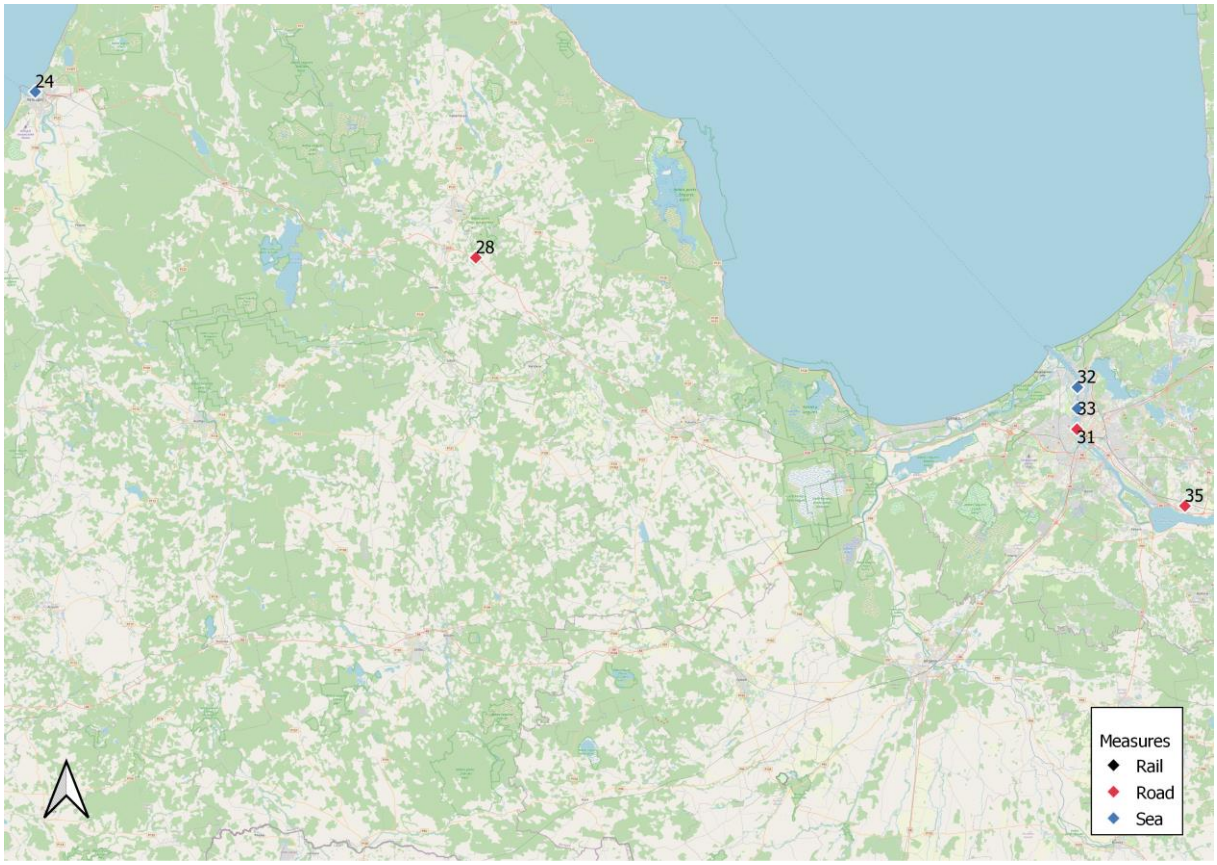


Figure 33 Identified measures within the corridor Stockholm-Riga-St. Petersburg

Table 9 Description of identified measures within the corridor Stockholm-Riga-St. Petersburg.

ID	Measures	Source	Country	Type
24	The port of Ventspils: • is being expanded and additional areas (100 ha) are allocated for further development. • parking space for trucks and ramp for loading ships in Ventspil's harbor.	Baltic Loop	Latvia	Sea
28	Maintenance and improvement measures of the infrastructure on the Riga-Ventspils section are underway (2021–2023).	Baltic Loop	Latvia	Road
31	A new road link across the Daugava and the reconstruction of part of the A2 motorway are further future road links that are of great importance for transport	Baltic Loop	Latvia	Road
32	The port of Riga is being upgraded (started in 2020) with, among other things, new road connections, bridges, crossings, railway infrastructure and new berths.	Baltic Loop	Latvia	Sea
33	Internal barge traffic in the port of Riga, so that trucks do not have to drive around to reach both sides of the port.	Trivector	Latvia	Sea
35	A new intermodal freight terminal in Salaspils, south of Riga is planned for 2023–2026, which enables transhipment from land to shipping without having to pass central Riga	Baltic Loop	Latvia	Road

Supplementary information - Stockholm-Riga-St. Petersburg

Public transport needs to be developed to relieve the road network and in particular the ring road around Riga (Cimdiņš et. Al., 2020).

- Public transport lanes are proposed to increase the competitiveness of bus traffic vis-à-vis the car, as well as the possibility of offering passenger trains in Riga-Ventspils.
- The frequency for both buses and trains must increase to make public transport an attractive alternative to the car and thereby relieve the road network.
- The capacity of buses to and from Riga needs to increase during rush hour to attract more passengers.
- Development of regional mobility hubs in the form of large bus and train stations.
- During rush hour, to reduce travel time can the number of stops on certain routes be reduced.
- Ticket systems, timetables, and routes also need to be reviewed and updated to transfer passengers from private cars.

Accessibility problems on the road network often have to do with traffic accidents, which can be addressed with a collection of different measures, such as (Cimdiņš et. Al., 2020):

- Surveillance systems with speed cameras, in combination with signage, protective barriers, road markings, and limited opportunities to turn, for increased traffic safety.
- Tougher legislation and penalties for driving tired.
- More parking spaces for both trucks and cars on sections where many accidents occur.
- Review of speed limits and implementation of variable speed limits on sections where the weather affects visibility.
- Wildlife fencing on more stretches.

Possible time savings

Overview of possible time savings for Riga-Ventspils and on the Riga ring road (Rudolfs Cimdiņš, Riga planning Region, email correspondence):

- For public transport Riga-Ventspils, the travel time today is approximately 170–185 minutes, which could be reduced to 150 minutes if train traffic was reintroduced on the route.
- On Riga's ring road today, there is no well-functioning public transport that connects the city. With new, prioritized bus lines, there is potential for further travel time savings.
- For freight traffic in Riga-Ventspils, the travel time today is approximately 175 minutes, which could be reduced to 150–160 minutes, if traffic increases on the Riga-Tukums section.
- For freight traffic on the Riga ring road, the travel time today is approximately 60–70 minutes, which could be reduced to 55 minutes, provided that the traffic in the traffic areas increases.

Impact assessment of proposed measures

To assess the effect of the identified action proposals, a workshop was conducted in May 2021. The participants in the workshop consisted of consultants from Trivector and officials from the Örebro Region. Prior to the workshop, the Finnish, Latvian, and Estonian project partners also had the opportunity to assess each measure via an Excel file that was sent out via email.

The participants in the workshop were asked to make an estimate of the time savings for freight traffic within the country where measures can be implemented (see column

"Country" in Table 10 below), where the scale for the assessment was low, medium, high. Each assessment was then assigned a numeric value, where:

- Low = 1
- Medium = 2
- High = 3

By assigning a value, the average for each measure could then be calculated and a proposal for classification of the measure's effect made. The impact assessment applied below is based on the following score range:

- Low: 1.0 – 1.5
- Medium-low: 1.51 – 2.0
- Medium-high: 2.01 – 2.5
- High: 2.51 – 3.0

At the workshop, each individual measure was then discussed, and the working adjusted the proposed assessment (based on the average) if needed. All measures were discussed and given a final impact assessment (see column "WS" in Table 10 below). For a more detailed summary of all respondents and their assessment, see Appendix 1. Note that the names of all respondents are anonymised in the detailed summary.

Regarding the effect of the measures and subsequent time savings for freight traffic within the corridor, the workshop group judged that measures on the railway network are provide good time savings compared with the other modes of transport, road, and maritime transport.

Table 10 The result of the impact assessment made during the workshop in May 2021.

ID	Measures	WS	Measure category	Country	Type
Ö1	New contract models for increased flexibility, competition and innovation, especially within the Sea, which are characterized by long exclusive contracts.	Medium-low	General measure	All	All, primarily sea
Ö2	Public-Private Partnership (PPP) for increased collaboration and investment planning.	Medium-low	General measure	All	All
Ö3	Standardization of communication and information to collect data in a similar way to enable automatic systems for optimizing traffic flows to and from ports and border controls.	Medium-high	General measure	All	All
Ö4	Improved compatibility between different digital transport systems, to reduce paperwork and increase knowledge of freight transport, especially in cross-border transport.	Medium-high	Digital	All	All
Ö5	Driverless transport solutions in ports and cities and the development of other innovative logistics solutions can contribute to increased efficiency.	Medium-low	General measure	All	All
Ö6	Implementation of the ERTMS signaling system for interoperability in the European Rails Network. In Sweden, there are two CEF-funded projects that will equip 332 locomotives with the necessary instruments. The projects will be implemented by the Swedish Transport Administration 2017 to 2023.	Low	Digital	All	Rail
Ö7	Collaboration forums for the Baltic Sea ports' standardizing system selection, interfaces, and handling of information, etc. Minimize time consumption and manual work linked to ship traffic between the ports of the Baltic Sea.	Medium-high	General measure	All	Sea
Ö8	Customs (toll) cooperation to facilitate cross-border transport - primarily by road.	Medium-high	General measure	All	All, primarily road
Ö9	Facilitate the transfer of road to rail - for the Swedish part, freight traffic on rail must be simpler and more agile ("The long allocation process (18 months) for train paths for freight transport requires long anticipation of the transport operators and sometimes leads to allocated train paths not being used")	Medium-high	General measure	Sweden	Rail
Ö10	Reduced fairway charges can promote domestic traffic on water and relieve the Road and Rails network. Differentiate model for cheaper domestic traffic.	Medium-high	General measure	All	Sea
Ö11	Shift arrivals in the schedule to alleviate congestion for Baltic Sea port spaces and traffic solutions	Medium-low	General measure	All	Sea
Ö12	Dry port and train commuter concept: Can Stockholm ports work with dry port collaborations and train commutes, like the port of Gothenburg? The concept can also be spread further in NGZ via collaboration forums with the Baltic Sea ports	Medium-high	General measure	All	All
Ö13	Rail Baltica is a railway infrastructure project that is part of the Nordsea - Baltic corridor. It aims to integrate the Baltic States into the European	High	Infrastructure	Estonia, Latvia	Rail

	Railway Network. With a length of 870 km, the new Rail link covers Poland, Lithuania, Latvia, and Estonia.				
1	Oslo area - extra lanes for heavy traffic towards ports and railway terminals	Low	Infrastructure	Norway	Road
2	Open 24 hours a day at the customs station at Hån at Road 61 between Sweden and Norway	Low	Service	Sweden	Road
3	Extend the meeting tracks on the Kongsvingerbana (Oslo-Riksgränsen) for increased capacity and speed	High	Infrastructure	Norway	Rail
4	Improve the road standard from Grums to the Norwegian border.	Low	Infrastructure	Sweden	Road
5	The Gränsbana Arvika-Lilleström. New railway with the aim of improving the possibilities for transport between Stockholm and Oslo and improved capacity in the existing railway network.	High	Infrastructure	Sweden / Norway	Rail
6	Double track in several places along the Kristinehamn-Kil section (Värmlandsbanan)	High	Infrastructure	Sweden	Rail
7	Improved capacity regarding the connection with intersecting train roads and conflicts with traffic on the Västra stambanan in Laxå.	Medium-high	Infrastructure	Sweden	Rail
8	Upgraded bearing capacity class on bridges in Karlskoga so that they can handle BK4.	Low	Infrastructure	Sweden	Road
9	Upgraded bearing capacity class on bridges in Örebro so that they can handle BK4.	Low	Infrastructure	Sweden	Road
10	Nobelbanan Kristinehamn-Örebro. New railway with the aim of improving the possibilities for transport between Stockholm and Oslo and improved capacity in the existing railway network.	High	Infrastructure	Sweden	Rail
11	Improved connection of Godsstråket (the freight corridor) through Bergslagen to Mälarbanan in Hovsta.	Medium-high	Infrastructure	Sweden	Road
12	Fix capacity deficiencies in Arboga through a platform extension in Arboga Bangård.	Medium-low	Infrastructure	Sweden	Rail
13	Upgrade to double track at several locations on the Örebro-Västerås section (Mälarbanan).	High	Infrastructure	Sweden	Rail
14	Build a motorway (double lanes) on the E18 between Köping and Västjädra.	Low	Infrastructure	Sweden	Road
15	Create rest stop opportunities for commercial traffic through Västerås.	Low	Infrastructure	Sweden	Road
16	Reconstruction of Västerås C for increased safety and capacity.	Medium-low	Infrastructure	Sweden	Rail
17	Port of Västerås: There is already an inland vessel shuttle for container traffic between Stockholm Norvik and the port of Västerås (departures 2 times / week). Such a solution can be implemented in more places or to a greater extent to relieve the road network and contribute to the desired transfer of goods from Road to other modes of transport. If possible, set up ferry departures between Västerås - Naantali. Less land traffic through Stockholm and longer time for drivers to rest so that they can continue driving directly.	Medium-low	Infrastructure	Sweden	Sea

18	Capacity and safety-enhancing measures to enable passage at Hjulstabron with ships in the so-called Mälarmax size.	Medium-low	Infrastructure	Sweden	Sea
19	Enable traffic on Södertälje harbor with larger vessels as a result of increased traffic. Ro-Ro line to the east.	Medium-high	Infrastructure	Sweden	Sea
20	Bypass Stockholm, which relieves the Road Network around the capital and reduces the vulnerability of the Road system, will be completed around 2030.	Medium-low	Infrastructure	Sweden	Road
21	Mälarbanan expansion from two to four tracks, which will increase capacity considerably. Mälarbanan is connected to Ostkustbanan and Citybanan. Mälarbanan is the only line that is expected to have an improved situation in the future, on other lines capacity utilization will increase.	High	Infrastructure	Sweden	Rail
22	The recently completed port of Norvik (Nynäshamn) complements the port infrastructure in the Stockholm region.	Medium-low	Infrastructure	Sweden	Sea
23	Modernization of the port in Kapellskär with systems for automatic mooring, shore power for ships and new passenger facilities, which increases the capacity to receive larger passenger ships from Naantali within a few years.	Medium-high	Infrastructure	Sweden	Sea
24	The port of Ventspils is being expanded and additional areas (100 ha) are allocated for further development. Parking space for trucks and ramp for loading ships in Ventspils port.	Medium-low	Infrastructure	Latvia	Sea
25	Naantali port: New physical structure to handle check-in and transport waiting for ships. Extended parking space for queuing trucks into the harbor. Installation of automatic mooring system for increased speed for ships in the port, reduced climate impact and increased work environment safety. Shore power for ships. If possible, set up ferry departures between Västerås - Naantali. Less land traffic through Stockholm and longer time for drivers to rest so that they can continue driving directly.	Medium-low	Infrastructure	Finland	Sea
26	Port of Turku: Extended parking area for queuing trucks into the port.	Low	Infrastructure	Finland	Sea
27	Road connections to Turku and Naantali ports have been upgraded in recent years and further plans are nearing completion, including the upgrading of the Turku ring road (E18).	Medium-high	Infrastructure	Finland	Road
28	Ongoing maintenance and improvement measures of the infrastructure on the Riga-Ventspils section (2021–2023).	Medium-low	Infrastructure	Latvia	Road
29	Meriniitty / other industrial areas: Improved accessibility via 110 and 224 to E18 from the industrial area	Low	Infrastructure	Finland	Road
30	The port of Paldiski is judged to have the potential to be developed in the longer term with a new industrial park and logistics center (34 ha) new quay to receive large, awkward deliveries, such as wind turbine components. Improved rail infrastructure in Estonian ports, especially in Paldinski. Give the port authority a mandate to build a Rail Bypass.	High	Infrastructure	Estonia	Sea
31	A new road connection over Daugava and rebuilding of part of the A2 motorway are further future road connections that are of great importance for transport	Medium-high	Infrastructure	Latvia	Road

32	The port of Riga is being upgraded (started in 2020) with, among other things, new road connections, bridges, crossings, railway infrastructure, and new berths.	High	Infrastructure	Latvia	Sea
33	Internal barge traffic in the port of Riga, so that trucks do not have to drive around to reach both sides of the port.	Low	Other	Latvia	Sea
34	In parallel with the rebuilding of the Lääne-Harju-Rail (including Tallinn-Paldiski), a new signalling system is being installed that provides increased speed and capacity.	High	Infrastructure	Estonia	Rail
35	A new intermodal freight terminal in Salaspils, south of Riga is planned for 2023–2026, which enables transhipment from land to sea without having to pass central Riga	Medium-high	Infrastructure	Latvia	Road
36	Create another transport route for freight transport between Paldinski and Tallinn to avoid going through central Tallinn and residential areas.	Medium-low	Infrastructure	Estonia	Road
37	Capacity-enhancing measures at Balti Jaam Rails Station in Tallinn: modernization, new connection tracks, and upgraded traffic management systems at Rails crossings in central Tallinn.	Medium-high	Infrastructure/ Digital	Estonia	Rail
38	Tallinn's railway ring will reduce freight traffic bottlenecks and provide increased transport options for passenger transport to cities and workplaces in the region.	High	Infrastructure	Estonia	Rail
39	The Port of Tallinn is investing in new digital solutions, including: Smart Port - Traffic management in the port and automatic check-in of passengers and vehicles. Single Window and Logistics X-road - Digitization of data exchange in logistics chains. FlexPort - "port management system" (port management program). Shore power for ships.	Medium-high	Digital	Estonia	Sea
40	New business models for ferry operators to avoid the impact of heavy traffic on tourism and cultural environments in central Tallinn.	Low	Other	Estonia	Road
41	Measures aimed at reducing congestion on the Helsinki ring road (Ring III), especially in rush hour traffic.	Medium-low	Infrastructure	Finland	Road
42	Longer siding at the border station in Vainikkala to enable longer train sets (1 km or more) to be handled on the Finnish side of the border.	Medium-low	Infrastructure	Finland	Rail

6. Recommendations going forward

This study provides an overall picture of bottlenecks in the transport system and proposals for measures in the regions along the corridor Oslo-Örebro-Stockholm-Helsinki-St. Petersburg. There are many bottlenecks already today, at the same time as the flow of goods is expected to increase in the future. To meet the challenge that increased freight flows requires continued cooperation, both at regional and national level, between the countries, as the total effect along the routes is based on efforts being made in several countries. By continuously updating the data on which bottlenecks and proposed measures are available, gradual improvements are achieved if investments are made at the same time.

At the same time as long-term decisions are needed, the importance of agile action is important as freight transport is strongly dependent on several different factors that individual countries or regions have difficulty influencing (trade patterns, production capacity, etc.). Through how you act, conditions are also created for freight transport to take place in a climate-smart way. Rail transport generally produces less greenhouse gas emissions, for example.

Within the project, the identified bottlenecks have been valued by partners both east and west of the Baltic Sea. It seems clear that the shortcomings in the railway network are the ones that are given the highest priority to remedy. This is followed by streamlining of operations in the ports and the establishment of dry ports in strategic nodes. There is generally a greater acceptance among the partners to greatly promote truck traffic east of the Baltic Sea compared to west of the Baltic Sea.

The continued work should be concentrated on increasing the capacity of the railway between Oslo and Arboga, where the expansion of long meeting tracks (750 meters), double tracks and two new railways (Gränsbanan and Nobelbanan) are proposed. The three ports that stand out on the Swedish side are Kapellskär, Norvik, and Södertälje. Of these, Norvik and Södertälje are connected to the railway network. Södertälje is best located in relation to the railway because Norvik's railway connection runs via the busy Nynäs line. Today, Norvik has a connection with about four trains per day and direction. If the port of Södertälje is to

be used for transhipment from railway to ship, it will be most reasonable to use the Sveland line as a connection between Arboga and Södertälje, a conclusion that also applies if Norvik is chosen as transhipment from railway to ship.

To the east of the Baltic Sea, in addition to a general upgrading of the railway network, it is important to have good railway connections to the ports of Naantali, Tallinn, and Riga.

Dry ports are mentioned as interesting for streamlining operations in the marinas. Dry ports can, for example, be located outside Riga and Tallinn and centrally in Sweden in, for example, Närke.

Streamlining of ports should be done by reducing customs formalities and, above all, introducing new electronic systems to shorten the lead times for the passage of goods through the port. Measures mentioned are standardization of communication and information to collect data in a similar way to enable automatic systems for optimizing traffic flows to and from ports and border controls and to improved compatibility between different digital systems for transport, to reduce paperwork and increase knowledge on freight transport, especially for cross-border transport.

For truck traffic, not as many high-priority measures emerged, apart from the efficiencies in the ports as above, but it is worth pointing out that truck flow is probably best directed north of Lake Mälaren and via Kapellskär and Finland towards St. Petersburg to avoid larger identified bottlenecks. This means that for truck traffic, the route north of Lake Mälaren should be given priority in the first place.

The conclusion is to prioritize measures that contribute to good opportunities to use the railway on land in combination with shipping across the Baltic Sea to create an efficient, high-capacity, and sustainable transport corridor between Oslo and St. Petersburg.

Appendix 1. Individual answers from workshops regarding impact assessment of action proposals

Table 0 Respective respondents' impact assessment prior to the workshop in May. Please note that the answers are anonymised.

ID	Measures	WS	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11
Ö1	New contract models for increased flexibility, competition and innovation, especially within the Sea, which are characterized by long exclusive contracts.	Medium-Low	Low	Medium	Low	Medium	Low			Medium	Medium	Medium	Medium
Ö2	Public-Private Partnership (PPP) for increased collaboration and investment planning.	Medium-Low	Low	Medium	Low	Medium	Low			Low	Medium	High	Medium
Ö3	Standardization of communication and information to collect data in a similar way to enable automatic systems for optimizing traffic flows to and from ports and border controls.	Medium-High	Low	Medium	Low	High	Low			High	High	High	High
Ö4	Improved compatibility between different digital transport systems, to reduce paperwork and increase knowledge of freight transport, especially in cross-border transport.	Medium-High	Low	High	Medium	High	Medium			High	Medium	Medium	High
Ö5	Driverless transport solutions in ports and cities and the development of other innovative logistics solutions can contribute to increased efficiency.	Medium-Low	Low	Medium	Low	Low	Medium			Medium	Medium	Medium	Medium
Ö6	Implementation of the ERTMS signaling system for interoperability in the European Rails Network. In Sweden, there are two CEF-funded projects that will equip 332 locomotives with the necessary instruments. The projects will be implemented by the Swedish Transport Administration 2017 to 2023.	Low	Low	Low	Low	Low	Medium				Medium	Medium	Medium
Ö7	Collaboration forums for the Baltic Sea ports' standardizing system selection, interfaces, and handling of information, etc. Minimize time consumption and manual work linked to ship traffic between the ports of the Baltic Sea.	Medium-High	Low	Low	Low	Medium	Low	Medium		High	Medium	Medium	Medium
Ö8	Customs (toll) cooperation to facilitate cross-border transport - primarily by road.	Medium-High	Low	High	Medium	Medium	Low			High	High	Medium	High
Ö9	Facilitate the transfer of road to rail - for the Swedish part, freight traffic on rail must be simpler and more agile ("The long allocation process (18 months) for train paths for freight transport requires long anticipation of the transport operators and sometimes leads to allocated train paths not being used")	Medium-High	Low	Low	Low	High	Medium						
Ö10	Reduced fairway charges can promote domestic traffic on water and relieve the Road and Rails network. Differentiate model for cheaper domestic traffic.	Medium-High	Low	Medium	Low	Medium	Low	Medium		Low	Medium	High	Medium

Ö11	Shift arrivals in the schedule to alleviate congestion for Baltic Sea port spaces and traffic solutions	Medium-Low	Low	Medium	Low	High	Low	Medium		Medium	Medium	Medium	Medium
Ö12	Dry port and train commuter concept: Can Stockholm ports work with dry port collaborations and train commutes, like the port of Gothenburg? The concept can also be spread further in NGZ via collaboration forums with the Baltic Sea ports	Medium-High	Low	Medium	Low	High	Medium			High	Medium	Medium	Low
Ö13	Rail Baltica is a railway infrastructure project that is part of the Nordsea -Baltic corridor. It aims to integrate the Baltic States into the European Railway Network. With a length of 870 km, the new Rail link covers Poland, Lithuania, Latvia, and Estonia.	High	High	High	Medium	High					High	High	High
1	Oslo area - extra lanes for heavy traffic towards ports and railway terminals	Low	Low	Medium	Low	Low	Medium						
2	Open 24 hours a day at the customs station at Hån at Road 61 between Sweden and Norway	Low	Low	Low	Low	Medium	Low						
3	Extend the meeting tracks on the Kongsvingerbana (Oslo-Riksgränsen) for increased capacity and speed	High	High	High	High	Medium	High						
4	Improve the road standard from Grums to the Norwegian border.	Low	Medium	Low	Low	Low	Low						
5	Double track in several places along the Kristinehamn-Kil section (Värmlandsbanan)	High	High	High	Medium	Medium	High						
6	Improved capacity regarding the connection with intersecting train roads and conflicts with traffic on the Västra stambanan in Laxå.	Medium-High	Medium	Medium	Low	Medium	Medium						
7	Upgraded bearing capacity class on bridges in Karlskoga so that they can handle BK4.	Low	Low	Low	Low	Low	Medium						
8	Upgraded bearing capacity class on bridges in Örebro so that they can handle BK4.	Low	Low	Low	Low	Low	Medium						
9	Improved connection of Godsstråket (the freight corridor) through Bergslagen to Mälarbanan in Hovsta.	Medium-High	Medium	Medium	Medium	Medium	High						
10	Fix capacity deficiencies in Arboga through a platform extension in Arboga Bangård.	Medium-Low	Low	Medium	Low	Medium	Medium						
11	Upgrade to double track at several locations on the Örebro-Västerås section (Mälarbanan).	High	High	High	High	High	High						
12	Build a motorway (double lanes) on the E18 between Köping and Västjädra.	Low	Low	Medium	Low	Low	Medium						
13	Create rest stop opportunities for commercial traffic through Västerås.	Low	Low	Low	Low	Low	Low						
14	Reconstruction of Västerås C for increased safety and capacity.	Medium-Low	Medium	Low	Medium	Medium	Low						
15	Port of Västerås: There is already an inland vessel shuttle for container traffic between Stockholm Norvik and the port of Västerås (departures 2 times / week). Such a solution can be implemented in more places or to a greater extent to relieve the	Medium-Low	Medium	Medium	Medium	High	High	High					

	road network and contribute to the desired transfer of goods from Road to other modes of transport. If possible, set up ferry departures between Västerås - Naantali. Less land traffic through Stockholm and longer time for drivers to rest so that they can continue driving directly.												
16	Capacity and safety-enhancing measures to enable passage at Hjulstabron with ships in the so-called Mälarmax size.	Medium-Low	Medium	Medium	Low	Medium	Medium	Medium					
17	Enable traffic on Södertälje harbor with larger vessels as a result of increased traffic. Ro-Ro line to the east.	Medium-High	Medium	Medium	Medium	Medium	Medium	Medium					
18	Bypass Stockholm, which relieves the Road Network around the capital and reduces the vulnerability of the Road system, will be completed around 2030.	Medium-Low	Low	Medium	Low	Medium	Medium						
19	Mälarbanan expansion from two to four tracks, which will increase capacity considerably. Mälarbanan is connected to Ostkustbanan and Citybanan. Mälarbanan is the only line that is expected to have an improved situation in the future, on other lines capacity utilization will increase.	High	High	Medium	High	High	High						
20	The recently completed port of Norvik (Nynäshamn) complements the port infrastructure in the Stockholm region.	Medium-Low	High	Low	Medium	Medium							
22	Modernization of the port in Kapellskär with systems for automatic mooring, shore power for ships and new passenger facilities, which increases the capacity to receive larger passenger ships from Naantali within a few years.	Medium-High	Low	Medium	Low	Medium	Medium	Medium					
23	The port of Ventspils is being expanded and additional areas (100 ha) are allocated for further development. Parking space for trucks and ramp for loading ships in Ventspils port.	Medium-Low	Low	Medium	Low	Medium		Low			Medium	Medium	Medium
24	Naantali port: New physical structure to handle check-in and transport waiting for ships. Extended parking space for queuing trucks into the harbor. Installation of automatic mooring system for increased speed for ships in the port, reduced climate impact and increased work environment safety. Shore power for ships. If possible, set up ferry departures between Västerås - Naantali. Less land traffic through Stockholm and longer time for drivers to rest so that they can continue driving directly.	Medium-Low	Medium	Medium	Medium	Medium		Medium					
25	Port of Turku: Extended parking area for queuing trucks into the port.	Low	Medium	Medium	Medium	Medium		Low					
26	Road connections to Turku and Naantali ports have been upgraded in recent years and further plans are nearing completion, including the upgrading of the Turku ring road (E18).	Medium-High	Low	Medium	Low	Low		High	High				

27	Ongoing maintenance and improvement measures of the infrastructure on the Riga-Ventspils section (2021–2023).	Medium-Low	Low	Medium	Low	Low		Medium		Medium	Medium	Medium
28	Meriniitty / other industrial areas: Improved accessibility via 110 and 224 to E18 from the industrial area	Low	Low	Low	Low	Low		Medium				
29	The port of Paldiski is judged to have the potential to be developed in the longer term with a new industrial park and logistics center (34 ha) new quay to receive large, awkward deliveries, such as wind turbine components. Improved rail infrastructure in Estonian ports, especially in Paldinski. Give the port authority a mandate to build a Rail Bypass.	High	High	Medium	High	High		High		Medium	High	
30	A new road connection over Daugava and rebuilding of part of the A2 motorway are further future road connections that are of great importance for transport	Medium-High	Low	Medium	Low	Medium		High		High	Medium	Medium
31	The port of Riga is being upgraded (started in 2020) with, among other things, new road connections, bridges, crossings, railway infrastructure, and new berths.	High	Medium	Medium	Medium	High		Medium			High	High	Medium
32	Internal barge traffic in the port of Riga, so that trucks do not have to drive around to reach both sides of the port.	Low	Low	Low	Low	Medium		Low			Medium	Medium	Medium
33	In parallel with the rebuilding of the Lääne-Harju-Rail (including Tallinn-Paldiski), a new signalling system is being installed that provides increased speed and capacity.	High	High	High	High	High				High	High		
34	A new intermodal freight terminal in Salaspils, south of Riga is planned for 2023–2026, which enables transhipment from land to sea without having to pass central Riga	Medium-High	Low	Medium	Medium	High		High		High	High	High
35	Create another transport route for freight transport between Paldinski and Tallinn to avoid going through central Tallinn and residential areas.	Medium-Low	Low	Low	Low	High		High	Medium	High		
36	Capacity-enhancing measures at Balti Jaam Rails Station in Tallinn: modernization, new connection tracks, and upgraded traffic management systems at Rails crossings in central Tallinn.	Medium-High	High	Medium	Medium	Low			Medium	Medium		
37	Tallinn's railway ring will reduce freight traffic bottlenecks and provide increased transport options for passenger transport to cities and workplaces in the region.	High	High	Medium	Medium	High			High	High		
38	The Port of Tallinn is investing in new digital solutions, including: Smart Port - Traffic management in the port and automatic check-in of passengers and vehicles. Single Window and Logistics X-road - Digitization of data exchange in logistics chains. FlexPort - "port management system" (port management program). Shore power for ships.	Medium-High	Low	Medium	Medium	Medium		High		Medium	Medium	

39	New business models for ferry operators to avoid the impact of heavy traffic on tourism and cultural environments in central Tallinn.	Low	Low	Low	Low	Low		Medium	Medium	Medium
40	Measures aimed at reducing congestion on the Helsinki ring road (Ring III), especially in rush hour traffic.	Medium-Low	Low	Low	Low	Medium		High		
41	Longer siding at the border station in Vainikkala to enable longer train sets (1 km or more) to be handled on the Finnish side of the border.	Medium-Low	Medium	Medium	Medium	High				
5	The Gränsbana Arvika-Lilleström. New railway with the aim of improving the possibilities for transport between Stockholm and Oslo and improved capacity in the existing railway network.	High								
9	Nobelbanan Kristinehamn-Örebro. New railway with the aim of improving the possibilities for transport between Stockholm and Oslo and improved capacity in the existing railway network.	High								

References

Alaeddine, A., Nordkvist, L. (2020) Bottlenecks and solutions on E18 in Sweden. Baltic Loop

Alaeddine, A. (2021) Workshop report. Cooperation dialogues in transport sector in the region of Stockholm-Mälardalen

Baltic States Unit (2020) Introduction to the Baltic States

Chen, Y., Wahlström, I. (2020) Recommendation report on methods, actions, and ICT solutions linked to enhanced information visibility and transmission processes for improving the cargo flow efficiency of the BSR maritime transportation and port op-erations. Åbo Akademi University. Baltic Loop

Cimdiņš, R., Potapova, K., Stepančuks, A. (2020) Traffic flows and potential non-technical solutions in Baltic Loop Southern corridor in Latvia territory. Baltic Loop

Mälardalsrådet (2020a) Storregional systemanalys 2020. STOCKHOLM-MÄLARREGIONEN

Mälardalsrådet (2020b) Storregional systemanalys. STORREGIONAL GODSSTRATEGI 2020 FÖR STOCKHOLM-MÄLARREGIONEN STRATEGIER OCH ÅTGÄRDER

Mälardalsrådet (2020c) 11 ställningstaganden för internationell tillgänglighet och konkurrenskraft. Rapport från En Bättre Sits temagrupp. Internationell tillgänglighet och konkurrenskraft

Sweco (2015) RAPPORT RESOR OCH TRANSPORTER I ÖSTRA MELLANSWEDEN. UPPDRAGSNUMMER 7000568

Sweco (2018) KAPACITET I JÄRNÄGSSTRÅKET OSLO-STOCKHOLM ÅR 2040

Trafikanalys (2020) Transporter i österled Rapport 2020:1

Wahlström, I., Chen, Y. (2020) Identification of bottlenecks and inefficiencies in transport flows in Baltic Loop East-West corridors with emphasis on maritime logistics. Åbo Akademi University. Baltic Loop