Baltic Loop

Identification of bottlenecks and inefficiencies in transport flows in Baltic Loop East-West corridors with emphasis on maritime logistics

Authors: Irina Wahlström & Yiran Chen, Åbo Akademi University

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1. Background and objectives of the report

1.1. Background

Baltic Loop is a project under the European Union's (EU) Interreg Central Baltic Programme running from April 2019 until June 2021. It involves seven partners from four countries: Finland, Estonia, Latvia and Sweden. The Baltic Sea Region forms a stable geographic area that is economically, politically and sociologically integrated, with a consumer base of approximately 100 million people. The geographic location, long transport distances and growing economy have increased traffic volumes, thus setting new requirements on traffic planning, policies and implementation of "greener" and advanced transport solutions on local, regional and national levels. An advanced and efficient transport network is crucial to ensure the region's continued prosperity, growth and further development.

Figure 1 Illustration of the Baltic Loop Corridors

BALTIC LOOP focuses on solutions to improve and smooth transport flows of both people and goods in three selected corridors running in the West-East direction (Northern, Middle and Southern) within the Central Baltic Region, namely Örebro –Turku/Tallinn/Riga – St. Petersburg. The projects seek to minimise the impact and/or number of different traffic hindrances or bottlenecks. The overall aim is to minimise travel and cargo time in the corridors and to reduce CO_2 emissions.

Apart from the physical transport infrastructure, the fluency of traffic flows and logistical chains also depends on the volumes transported (flow strength), transport distances and number of hindrances and bottlenecks encountered in the logistical chain. The challenges and inefficiencies to tackle and overcome may be either geographical or manmade by nature.

Developing traffic corridors with shortened travel and transport times will also make the corridors more attractive to new businesses and innovations.

1.2. Objectives

This report concentrates on analysing existing and potential cargo flows, hindrances and bottlenecks in three West-East-bound project-defined corridors that extend from Örebro- via Turku/ Tallinn/Riga to St. Petersburg, mainly from a short sea shipping and port-operations perspective within the Baltic Sea and partner regions.

Shipping and ports form central links in the logistics and transport chains and function as important transport nodes in the aforementioned West-East corridors. Sea transportation is international by nature; therefore, the ambition is to identify trends and interdependencies between different transport modes from a cross-border perspective and how foreseen trends will potentially affect sea logistics and the area's entire logistical chains. Örebro is the starting point for all three corridors; thus, this report will especially analyse the transport system (maritime and road transportation) around the Stockholm area and in Sweden in general.

The overall aim is to ensure the region's continued competitiveness and improved connectivity through energy- and cost-efficient measures to reduce transportation times and, above all, to reduce drastically the environmental impact of transportation to the aspired zero emission level.

1.3. Material and methods

The study aims to form an understanding and perception of existing and potential cargo flows and related inefficiencies and bottlenecks in the three Baltic Loop Corridors using the following methodology and main data sources:

1. literature review
2. thematic online questionnaire to map stakeholder views
3. semi-structured interviews with maritime industry[1] and transport infrastructure stakeholders
4. stakeholder input and contribution at Baltic Loop seminars and workshops

1.4. Report structure

Chapter 2 explores the international governance and development of transportation systems mainly on the EU level

Chapter 3 lists trends affecting trade and maritime transportation

Chapter 4 presents data on Swedish cargo transportation, current and projected cargo flows and how the planning and development of the transport system is being executed

Chapter 5 describes the Baltic Loop corridors and cargo flows with a particular focus on maritime transportation

Chapter 6 presents the stakeholder questionnaire results and viewed cargo-flow inefficiencies

Chapter 7 presents the maritime stakeholder interview results on perceived transport bottlenecks and hindrances on a general level

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[1] Limitations: Most of the ports by the Baltic Loop corridors, apart from the Port of Riga and Naantali, are predominantly short-sea ro-ro ports; hence, the primary focus is given to stakeholders and users of this particular shipping sector.

2. International governance and targets for transportation systems

2.1. Trans-European Transport Network (TEN-T)

The Trans-European Transport Network (TEN-T) policy is put together to develop and implement measures to improve connectivity of a Europe-wide network of railway lines, roads, inland waterways, maritime shipping routes, ports, airports and railroad terminals. The trans-European networks shall support the generation of an internal market, enabling free movement of goods, persons, services and capital.

The overall policy objective is to close gaps, remove bottlenecks and technical barriers, and strengthen the European Union's (EU) social, economic and territorial cohesion[2].

Besides the construction of new physical infrastructure, the TEN-T policy supports innovation, new technologies and digital solutions to all transport modes. The objective is to make better use of infrastructure, reduce the environmental impact of transport, enhance energy efficiency and increase safety.

TEN-T comprises two network hierarchies:

- The **Core Network** includes the most important connections, linking the most important nodes. and is to be completed by 2030.
- The **Comprehensive Network** is to cover all European regions by 2050.

The backbone of the Core Network is built from nine Core Network Corridors that are complemented by horizontal priorities, such as the European Rail Traffic Management System (ERTMS) and Motorways of the Sea (MoS)[3].

These nine Core Network Corridors were identified to streamline and facilitate the coordinated development of all transport modes of the TEN-T Core Network. The two complementing Horizontal Priorities, the ERTMS deployment and MoS, were established to carry forward the strategic implementation of the Core Network's objectives. The TEN-T regulation places technical requirements on both the core network and the comprehensive network. Member states are committed to implementing appropriate measures to develop the core network by 2030 and the comprehensive network by 2050.

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[2] Regulation (EU) No 1315/2013

[3] European Commission Motorways of the Seas (2018)

Figure 2 The TEN-T core network corridors *Source: EC*

The development of the nine core network corridors serves as tools for coordinated, cross-border infrastructure planning among EU member states. Each corridor includes at least three traffic modes and two national borders.

EU funding for projects on each Corridor and Horizontal Priority is provided by the Connecting Europe Facility (CEF), an EU funding instrument for strategic investment in transport, energy and digital infrastructure. On the transport side, CEF is dedicated to implementing the TEN-T and to supporting investments in cross-border connections, missing links, digitalisation and sustainability[4]. The CEF programme contributes to implementing the Trans-European Transport Network (TEN-T) by financing key projects to upgrade infrastructure and remove existing bottlenecks whilst also promoting sustainable and innovative mobility solutions.

During the period 2014-2019, CEF Transport has awarded EUR 23.3 billion in grants to co-finance projects of common interest. The CEF funding programme contains a significant maritime Action portfolio, of which Motorways of the Sea constitutes the most important funding priority.

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[4] European Commission (2019)

Completing the TEN-T Core Network requires streamlined measures for TEN-T implementation. The aim is to facilitate the implementation of the Core Network's projects across all transport modes. The Innovation and Networks Executive Agency (INEA) manages the technical and financial implementation of parts of the CEF Programme, Horizon 2020 and previous programmes (TEN-T 2007-2013, Marco Polo).

Motorways of the Sea (MoS) is a horizontal priority and the maritime dimension of the TEN-T. MoS contributes to the development and establishment of a European Maritime Transport Space without hindrances, connecting Core Network Corridors by integrating maritime links with hinterlands and EU Member States. It embodies short-sea routes, ports, associated maritime infrastructures, equipment, facilities and relevant administrative formalities.

MoS are designed to remove bottlenecks in the EU transport system. Their goal is to reduce existing strains in the overcrowded European road networks, improve access to markets, and provide more efficient, commercially viable and environmentally sustainable alternatives to road-only transport. Moreover, MoS aim to introduce new intermodal, maritime-based logistics chains to bring about structural change to door-to-door, integrated transport systems. Maritime transport offers a huge potential to fortify and develop its position as the backbone mode of transport in international trade[5].

2.2. Scandinavian-Mediterranean Corridor

The Scandinavian-Mediterranean (ScandMed) Corridor is an important transport corridor connecting the Nordic countries and Central Europe. The corridor runs in a north-south direction stretching from Finland and Norway via Sweden in the north through Denmark, Austria, Germany, Italy and Malta in the south. The corridor also has an important role regarding connections to Russia via the Baltic Sea ports and Finland, for instance. A request has been sent to the European Commission (EC) to extend the ScanMed Corridor up to northern Sweden and Finland and around the Bay of Bothnia and also along the Örebro-Oslo section.

The most significant projects on the corridor are the Fehmarn Belt Fixed Link and the Brenner Base Rail Tunnel. The cross-border alpine connection located between Germany (Munich) and Italy (Verona) represents a major bottleneck on the corridor and that be alleviated by the construction of the Brenner Base Rail Tunnel when it becomes operational in 2026.

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[5] European Commission, 2018

The Brenner corridor will link together a complex network of high-capacity rail links by removing this bottleneck. Together these networks will help to achieve the environmental objectives set by the EU and ensure the modal shift from road to rail. The cross-border Fehmarn Belt Fixed Link will facilitate the traffic flows in a north-south direction between Central Europe and the Nordic countries through the construction of the new, immersed rail/road tunnel under the Fehmarn Strait between Rødby in Denmark and Puttgarden in Germany. Following the project's completion in 2028, the travel time between Copenhagen and Hamburg will be reduced by approximately one hour and by approximately two hours for rail freight transport[6].

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[6] European Commission (2018)

3. Trends in maritime transport industry

Expeditiously developing digitalisation affects all industries. The shipping sector is a traditional industry that has been slow to adapt digital tools and applications. Moreover, the business and operational landscape is complex and typically characterised by these features and challenges:

- inefficient operations in relation to fuel economy, vessel design parameters, weather conditions and port call planning
- unoptimised vessel capacity utilisation (tramp shipping)
- human factors (erroneous in operations)
- occupational hazards
- inability to match demand and supply
- low profit margins
- long lifecycles of vessels
- high investment costs

Nevertheless, the maritime transport industry has started to undergo a profound transformation catalysed mainly by changing trade patterns, technological development and digital disruption and an expanding environmental agenda. The global trade has typically been exposed to market fluctuations and short-term cyclical factors, but the factors affecting the sector today have become more structural and existential. Environmental sustainability has become a priority on the global policy agenda, putting much-awaited pressure and scrutiny on the maritime industry and, consequently, affecting market dynamics, ports, supply chains and maritime policy governance.

3.1. Trade

More than 80% of world merchandise trade is carried by sea; hence, maritime transport serves a vital role in global transport and supply chains. In 2018, 11 billion tonnes of goods were transported by sea, which is also the all-time high. A clear shift has occurred in the maritime trade structure over the decades, with major bulks and containerised cargo showing the strongest expansion.

International maritime transportation is forecasted to grow by an average annual growth rate of 3.5% over the period of 2019-2024[7]. The expansion is mainly driven by growth in dry bulk, containerised and gas cargoes.

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[7] UNCTAD – Review of Maritime Transport 2019 (2020)

The dynamics of maritime trade are reflected in the development of the global economy and trade, as well as in the following trends and characteristics:

- geopolitical uncertainties (U.S-China trade war, Brexit, political and economic relationship between EU and Russia/Belarus)
- readjustment of the Chinese economy
- new trade patterns (growing e-commerce, land-based infrastructure investments connecting markets, regions and countries also within the TEN-T transport network, circular economy)
- demand and supply (fleet size and capacity, profitability)
- expanding role of technology in transport systems, logistics and value chains (digitalisation, automation and electrification)
- high customer expectations on operational flexibility
- environmental regulation and policy agenda

The Baltic Sea is one of the busiest sea areas on a global scale and predominates in the short sea shipping of goods over deep-sea shipping. The regional trade development does not automatically replicate the global development trends, thus exhibiting a different adaptability and resilience towards unexpected changes. The potential change factors in the geopolitical scene may also be found closer to our own waters, including the political and economic relationships between the EU, Russia and Belarus that result in potential trade sanctions that, needless to say, may have an effect on the maritime trade within the Baltic Sea area.

The ports form important hubs and gateways in logistical chains and international trade, enabling a flow and transfer of goods from ships to land-based transportation modes. With the developing transport industry, the ports' role, scope and provided service level have expanded to include landside and logistics operations. A port's function, role and specialisation depend greatly on the type of goods handled (liquid bulk, dry bulk, other dry cargo), the type and size of the vessels, and its geographic location, connections to land infrastructure and individual business aspirations. Today, many ports have assumed a role as more of a logistics centre offering value-adding services, in addition to the services and functions traditionally rendered. Ports are also increasingly expected to adjust their operations in line with environmental and sustainability considerations to reduce the number of externalities. In most cases, this requires investments in new technologies and infrastructure, as well as re-evaluation of the operational models and long-term vision.

The relationship between ports and the surrounding port city has changed to some extent over time, and many ports or parts of their functions, especially the handling of containers, project cargo and bulk cargo, have been relocated from the cities' centres in response to urbanisation and city expansion. Needless to say, the handling of the aforementioned cargo types often generates externalities and fits in poorly in an urban environment. The new port locations are typically found relatively close to the big hubs and along good traffic connections. A parallel and alternative joint development path is simultaneously occurring, especially in metropolitan areas and their ro-ro[8], where port, residential, business and recreational areas are seeing an increasing functional and structural integration. This, in turn, adds requirements for port operations and traffic management efficiency.

The business model of combined passenger transport and cargo transportation has become an established transport concept over the decades in the Baltic Sea Region, especially between Sweden and Finland but also increasingly between Sweden, Estonia and Latvia. The shipping industry is affected by economic fluctuations but, as evidenced in 2020 and because of the Corona pandemic, this business model has exhibited its vulnerability to unexpected and sudden disturbances, resulting in a collapsing passenger market demand. Approximately two thirds of the ferry companies' revenues derive from the passenger side; as a consequence of the Corona pandemic, this share of the income stream suddenly fell off, and the majority of vessels became obsolete and stayed in their ports. The ferry companies' response to counteract this development was to relaunch new alternative destinations, e.g., from Finland to the Baltic States, or to aggressively market domestic options such as the Åland Islands.

The question is, will the existing business models be reshaped with less emphasis on passenger transportation and will the new builds be relying more on the ro-pax concept with more cargo capacity and downsized passenger services, compared to traditional ferries?

3.2. Technological development and digitalisation

The degrees of digital infrastructure in readiness, integration and adaption vary between countries and industries. The European Union (EU) maintains a Digital Transformation Scoreboard[9] to analyse the prerequisites and actual digitalisation integration level of its member countries. These are measured as the Digital Transformation Enablers' Index (DTEI) and the Digital Technology Integration Index (DTII).

The transport industry overall has digitalised, automated, electrified and more or less transformed the entire sector at an accelerating pace. Shipping companies and ports also need to adapt to the possibilities that the adaptation of new information and communication technologies provide in order to unlock multiple benefits and tackle the industry-specific challenges.

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[8] Ro-ro refers to roll-on/roll i.e. the handling of wheeled cargo such as cars, trucks, semi-trailers etc.

[9] European Commission -Digital Transformation Scoreboard (2018)

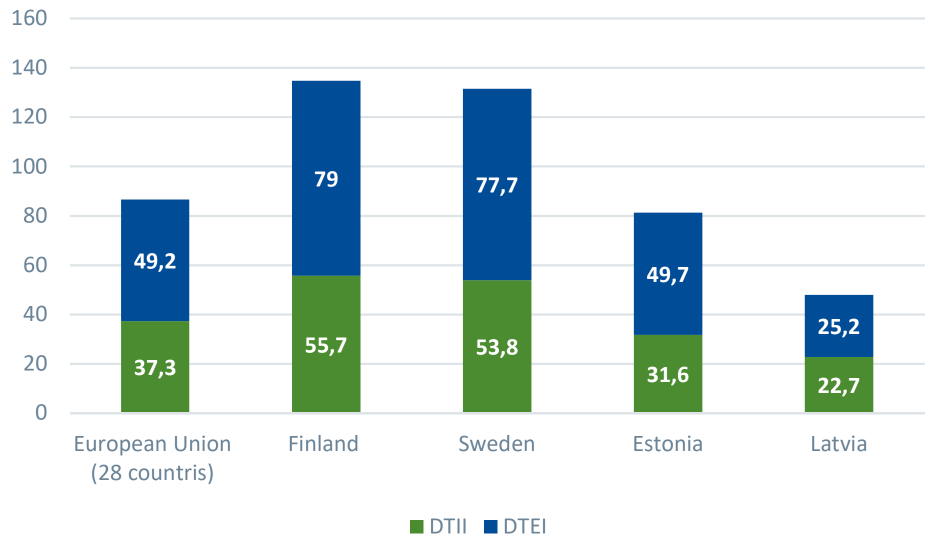

Figure 3 Digital Transformation Enablers' Index (DTEI) and Digital Technology Integration Index (DTII) Source: EC

Intelligent connected transport systems enable vessels, goods and infrastructure to communicate with each other and provide new opportunities to achieve greater sustainability, supply chain traceability, optimised operations, enhanced performance and efficiency, and safer operations throughout the (maritime) supply chain.

Until recently, the shipping industry, including ports, have been anchored firmly in the past and generally formed a discontinuation point in supply chains and supply chain efficiency due to conservative and uncoordinated communication and information transmission methods between the relevant stakeholders.

Ports have also historically been sources of different types of pollution, including emissions and noise, for instance. Ports today face a number of various challenges related to operational efficiency, cost minimisation, security of the port-ship interface and environmental impact.

With the implementation of innovative technologies and digital applications, we are today seeing the concepts of Smart Ships, Smart Ports and Smart Fairways being embraced and developed.

The content and scope of smart ports solutions and strategies vary among ports. There is no "one size fits all" solution. A crucial part of developing a smart port strategy is to identify and map every individual port's distinct processes and specific requirements that can be improved. Nonetheless, the main objective is to manage and merge with big data, artificial intelligence and the Internet of Things (IoT) to optimise port operations sustainably and enhance communication with various actors within and outside the port in order to integrate with the entire supply chain. The digital tools and sensors can be used to forecast the assets' maintenance regime or to find solutions for alternative land-use options. Smart ports can limit their energy consumption and environmental impact by capitalising on renewable energy as sources for electricity and heating of buildings, installation of LED lighting, etc. Automooring of vessels is increasingly being introduced in ports. Today, smart port solutions are mainly promoted and implemented by the port authorities, but a multilevel stakeholder approach and involvement is recommended to maximise the benefits.

A bundle of different types of onboard systems and sensors is being installed on smart ships, whose fused information is increasingly transmitted in real time, facilitated by improved connectivity at remote locations at sea. This data enables an augmented awareness of the vessel's and machinery´s technical condition, maintenance needs and lifecycle stage. Operational and energy efficiency can be optimised (slow steaming, route optimisation, trim adjustment) in changing conditions. Cargo safety can be enhanced through installation of various sensors in the cargo holds. Situational awareness assists and increases navigational safety.

Fairway efficiency and safety can also be improved by means of digitalisation. Both floating and land-based navigational aids can be equipped with sensors and systems for remote monitoring. Today's smart buoy concept, for instance, combines sensor technology and mobile data transmission that can be used to collect information about, for example, water level, wave height and sulphur oxide emissions along the fairway. All in all, digital information flows enable automation of functions and processes that favourably affect safety, environmental and business performance.

3.3. Environmental Agenda and Maritime Regulatory Framework

The CO2 emissions generated by international shipping in 2012 amounted to nearly 800 million tonnes, accounting for 2.2% of global CO_2 emissions[10]. Shipping emissions could increase between 50% and 250% by 2050 in a business-as-usual scenario and an annual growth rate of 3% in international sea trade.

Stricter environmental regulations now place requirements on port operations, ship technology and design, energy efficiency, exploitation of low carbon and zero-carbon energy resources.

Many maritime rules and regulations governing the shipping and maritime industries are developed within the EU or within international bodies such as the United Nations (UN) and its agency, the

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[10] IMO (2020)

International Maritime Organisation (IMO). The IMO is an intergovernmental organisation tasked to regulate all aspects of international shipping, including maritime safety and security, energy efficiency and prevention of shipping-generated pollution.

The United Nations Convention on the Law of the Sea (UNCLOS) defines the rights and responsibilities of nations and forms a framework for setting international standards with regard to all operations targeting seas, oceans, and their marine resources.

Regional organisations such as the Helsinki Commission (HELCOM), a governing body of the Convention on the Protection of the Marine Environment of the Baltic Sea Area, can make recommendations and, in some cases, binding rules for the protection of the Baltic Sea marine environment through intergovernmental cooperation. Rules developed within these organisations may apply generally in a certain geographical area or for a certain type of activity. A variety of measures has been undertaken in recent years to protect the marine environment, both internationally and within the EU.

3.3.1. The European Union

The European Union's (EC's) mission is to ensure the free mobility of people, goods, services and capital within the Union. The EU's maritime transport legislation aims to apply the European Commission Treaty's principle of free movement of services to the EU's sea transport industry. It aims to enhance the functioning of the internal market in the shipping sector by promoting safe, efficient, environmentally sound operations. The EC makes proposals to regulate environmental impacts from shipping to be adopted by the European Parliament and the European Council. Some of these regulations can be more stringent compared to global IMO standards.

The EC coordinates EU positions with its Member States when negotiating and cooperating on regulatory issues in forums such as the IMO. The EC participates in the work relating to safety and the protection of the marine environment and labour standards and is also a contracting party to some of the relevant conventions, notably the United Nations Convention on the Law of the Sea (UNCLOS). Global standards are further set by a number of other key maritime safety conventions, such as the International Convention for the Safety of Life at Sea (SOLAS), the International Convention on Standards of Training, Certification and Watchkeeping (STCW), and the International Convention for the Prevention of Pollution from Ships (MARPOL). The provisions of these agreements form part of European Union law and are, hence, directly enforceable.

The European Green Deal

The European Green Deal (EGD) is a roadmap prepared by the EC for making the EU's economy sustainable and is part of the EC's strategy for reaching the UN's 2030 Agenda and sustainable development goals. The EGD[11] is a political engagement to decarbonise the EU economy by 2050 through a number of measures such as carbon market reforms, changes in energy taxation and further promotion of smart mobility and multimodal freight operations. The latter one involves rail and waterborne transport, including short sea shipping. The EGD forms an integral part of the EC's strategy to implement the UN's Agenda 2030 and the sustainable development goals.

The EU's Maritime Transport Policy up to 2020

The EU's Maritime Transport Policy up to 2020[12] (The Valletta Declaration) was adopted in 2017. Decarbonisation, competitiveness and digitalisation, an effective internal market and a world-class maritime cluster are priorities through which EU wants to ensure global connectivity and the functioning of an efficient internal market. These principles, which aim to ensure that maritime transport remains an attractive mode for transporting both goods and people, while simultaneously becoming even more environmentally friendly, should also serve as a catalyst for investments and innovation.

EU's Marine Strategy Framework Directive

The EU has developed specific strategies, based on geographical and environmental criteria, for the various sea basins, including The Baltic Sea. The EU's Marine Strategy Framework Directive (2008/56/EC), adopted in 2008, is the first EU legislative instrument related to the protection of the marine environment and biodiversity across Europe. The Marine Strategy Framework Directive aims to achieve Good Environmental Status (GES) of the EU's marine waters by 2020 and to protect the resource base upon which marine-related economic and social activities depend. All EU Member States must establish and implement their national programme of measures to comply with the requirements for achieving or maintaining GES by 2020.

Integrated Maritime Policy for the European Union

The EU has placed a strong focus on an integrated use and policy conservation of the marine environment. In 2007, the European Commission presented a Communication on an Integrated Maritime

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[11] European Commission, The Green Deal (2019)

[12] European Commission, Priorities for the EU's Maritime Transport Policy until 2020 (2017)

Policy for the European Union[13] that embodies coherent, cross-policy views on the development of the sea and coastal areas. The integrated maritime policy covers these cross-cutting policies:

- Blue growth[14]
- marine data and knowledge
- maritime spatial planning
- integrated maritime surveillance
- sea basin strategies (Strategy for the Baltic Sea[15])

Based on this policy, the EU wants to achieve a harmonised approach to and competence development, knowledge dissemination, and utilisation and monitoring of ocean resources.

EU Directive on Maritime Spatial Planning

The rapidly increasing demand for maritime space, including, for example, sea transportation, installation of renewable energy equipment, aquaculture tourism, biodiversity and ecosystem conservation and other alternative uses, has emphasised the need to manage water areas more coherently. Maritime spatial planning (MSP) works across borders and sectors to ensure human activities at sea occur efficiently, safely and sustainably, thus moving away from traditional single sector planning. The European Parliament and the Council have, therefore, adopted legislation to create a common framework for maritime spatial planning in Europe. Maritime Spatial Planning is defined in the EU Directive on MSP[16] (Directive 2014/89/EU) and forms a part of the EU's overarching Integrated Maritime Policy.

Blue Growth Strategy

Blue Growth[17] was presented in 2012 by the EU Commission. Blue growth is the long-term strategy to support sustainable growth in the marine and maritime sectors as a whole. This communication highlights five areas that show the direction to achieve sustainable growth and high potential employment within the "blue economy", namely, blue energy, aquaculture sea and coastal tourism, mineral resources and blue biotechnology. The Blue Growth Strategy also provides the essential components to provide marine knowledge and data, to ensure efficient and sustainable management of

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[13] European Commission, Integrated Maritime Policy (2017)
[14] European Commission, Blue Growth (2012)
[15] European Commission, EU Strategy for the Baltic Sea (2009)
[16] The European Parliament and The Council of the European Union establishing a framework for maritime spatial planning (2014)
[17] European Commission, Blue Growth (2012)

activities at sea (maritime spatial planning) and to provide authorities with an integrated maritime surveillance system. In 2013, the EC presented a legislative proposal to set up a CO_2-monitoring, -reporting and -verification (MRV) system for ships calling at EU ports. The proposal, adopted by the European Council and Parliament in 2014, came into force in 2015 and has applied to port calls from 2018 onwards.

3.3.2. International Maritime Organisation

A number of regulatory activities are carried out by the International Maritime Organisation (IMO). It has committed to make the international environmental regulations more stringent by complementing efforts and measures that support and fulfil the UN's 2030 Agenda for Sustainable Development[19] and the 2015 Paris Agreement under the United Nations Framework Convention on Climate Change[20] on global climate change response. The parties of the Paris Agreement commit themselves to actions to keep the increase of the global average temperature to well under 2˚C above the pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C, compared with the baseline year 2008.

The IMO implemented and put two mandatory energy efficiency measures into effect in 2013, namely, the Energy Efficiency Design Index (EEDI) for new ships and the Ship Energy Efficiency Management Plan (SEEMP) for the existing fleet, to increase their energy efficiency and mitigate the CO_2 emissions from shipping. The EEDI sets compulsory energy efficiency standards for new ships built after 2013. EEDI is a specific measure for an individual ship design, expressed in grams of CO_2 per ship's capacity-mile, whose formula is calculated based on a given ship's technical design parameters. The CO_2 levels become more stringent over a five-year interval. The SEEMP, however, is an operational measure that requires existing ships to improve their energy efficiency in a cost-effective manner[21][22].

In 2015, the IMO implemented designated control areas (Baltic Sea, North Sea, East and West coasts of the United States and the Caribbean Sea) with SO_x (0.1%) and NO_x emission limits of for ocean-going vessels. The limits on sulphur oxides have been progressively made more stringent and apply globally from the beginning of 2020 to bring the sulphur limit in fuel oils down from 3.5% to 0.5%. The amendment will prohibit not only the use but also the carriage of noncompliant fuel oil for combustion

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[19] United Nations, 2030 Agenda for Sustainable Development (2015)

[20] United Nations, Paris Agreement (2015)

[21] IMO (2018)

[22] Cames et al. (2015)

purposes for propulsion or operation on board a ship, unless it is fitted with a scrubber, which is an exhaust gas cleaning system[23].

The IMO adopted its initial Greenhouse Gas (GHG) reduction strategy for the shipping industry in May 2018, with emission reduction targets consistent with the Paris Agreement.

The levels of ambition directing the IMO's Initial GHG Strategy include the following:

1. strengthen the EEDI index for new ships and SEEMP for existing ones
2. reduce CO_2 emissions per transport work of international shipping by at least 40% by 2030 and 70% by 2050 and halve the total annual GHG emissions by 2050
3. ensure GHG emissions from international shipping peak and decline and reduce the total annual emissions by at least 50% by 2050 compared to base year 2008, whilst pursuing efforts towards phasing them out

The Initial Strategy sets out a framework for further action, presenting a future vision for international shipping that includes guiding principles for candidate short-, mid- and long-term additional measures.

The candidate short-term measures[24] to be further developed and agreed upon by member states between 2018 and 2023 include:

- strengthening the technical and operational energy efficiency requirements of new and existing ships (e.g., speed optimisation and reduction, EEXI -Energy Efficiency Existing Ship Index[25])
- encouraging the uptake of alternative low-carbon and zero-carbon fuels, including the development of lifecycle GHG/carbon intensity guidelines for relevant fuels and incentive schemes
- establishing port activities and incentives for first movers
- developing and supporting technical cooperation and R&D
- reducing methane slip and emissions of volatile compounds (VOCs)

The candidate mid-term measures to be agreed and decided upon between 2023 and 2030 and the long-term measures beyond 2030 will potentially enable the decarbonisation of the shipping sector in the second half of this century. The IMO is revising its Initial Strategy, which is planned for adaptation in 2023.

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[23] UNCTAD Review of Maritime Transport 2019 (2019)

[24] IMO (2018)

[25] IMO (2019)

3.3.3. National maritime policies and strategies affecting the sector

The EU member states' national maritime strategies and policies must follow and comply with the UN Agendas[26], IMO Conventions and EU regulations and strategies[27]. EU regulations, directives and decisions have greater legal force compared to national laws and decisions. Each member state may, however, choose for themselves how these schemes are implemented.

The national maritime policy and strategy priorities and themes in the four Baltic Loop countries of Sweden, Finland, Latvia and Estonia may vary to some degree due to varying operational and geographic preconditions. Nevertheless, they all must follow and comply with the EU's maritime transport policy priorities until 2020. These include decarbonisation, digitalisation, competitiveness, an effective internal market and a world-class maritime cluster.

The development and operations of the maritime sector are affected and directed not only by national transport or maritime-specific policies, strategies or programmes but also, to a varying degree, by other sectoral policies and strategies, such as:

- socio-economic strategies (national development plans, sustainability strategies, regional policies)
- spatial development policy (regional, local, maritime)
- environmental and energy policies

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[26] UN -2030 Agenda for Sustainable Development (2015)

[27] European Commission – Blue Growth (2017)

4. Transport flows in Sweden

4.1. Foreign trade

The volume of goods transported in Swedish domestic and foreign traffic (export and import) annually exceeds 322 million tonnes. More than 50%, i.e., approximately 181 tonnes, consist of domestic freight. Sweden exported 84 million tonnes and imported 57 million tonnes of goods in 2016[28].

In 2018, Swedish ports handled 179 million tonnes of goods, of which 86%, or 152 million tonnes, were of foreign trade and 14%, or 25 million tonnes, were of domestic trade. The largest cargo types measured in overall tonnes handled consisted of, in descending order, liquid bulk, ro-ro cargo, dry bulk, other cargo and containers[29].

Measured in tonnes, Sweden's main trading partners in export are found in close vicinity and include Germany, the United Kingdom, Finland, Norway, the Netherlands and Denmark. Major export goods, measured in weight, consist of ores (e.g., iron ore) (29%) and refined petroleum products (23%), followed by forest products, including pulp and paper (23%). Imports, however, come largely from Norway, Finland, Germany and Russia and consist mainly of coal, crude oil and natural gas (37%) and refined petroleum products (27%)[30].

Industrial production and consumption generate different geographic cargo flows by the type of commodity and transport modes used. Transports generated by (base) production flow mainly from northern Sweden and Västra Götaland County abroad. The cargo flows of consumer goods are concentrated in populated areas in the southern part of Sweden.

Approximately two thirds of all freight transports are concentrated in five major transport corridors in Sweden, which mainly conform to the defined Swedish sections of the TEN-T's core network[31]. Seen from both a national and international perspective, the major transport routes and nodes stand up well over time[32].

- Corridor 1: North Calotte–Norrland Coast–Bergslagen/Mälardalen–Malmö/Trelleborg–continental Europe (red)

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[28] Trafikanalys (2017)
[29] Trafikanalys (2018)
[30] Swedish Transport Administration (2016)
[31] Trafikanalys -Godstransporter i Sverige – en nulägesnalys, (2016)
[32] Swedish Transport Administration - Tillstånd och brister i transportsystemet – underlagsrapport (2017)

- Corridor 2: Göteborg–Stockholm–Oslo (Orange; mainly E20, National road 40, E4 and the Western mainline) with extension from Stockholm eastward)
- Corridor 3: Norway–Gothenburg–Malmö–Continental Europe (Green)
- Corridor 4: West coast–European Continent- rest of the world (Yellow)
- Corridor 5: The East European Continent–Baltic Sea Coast (Blue)

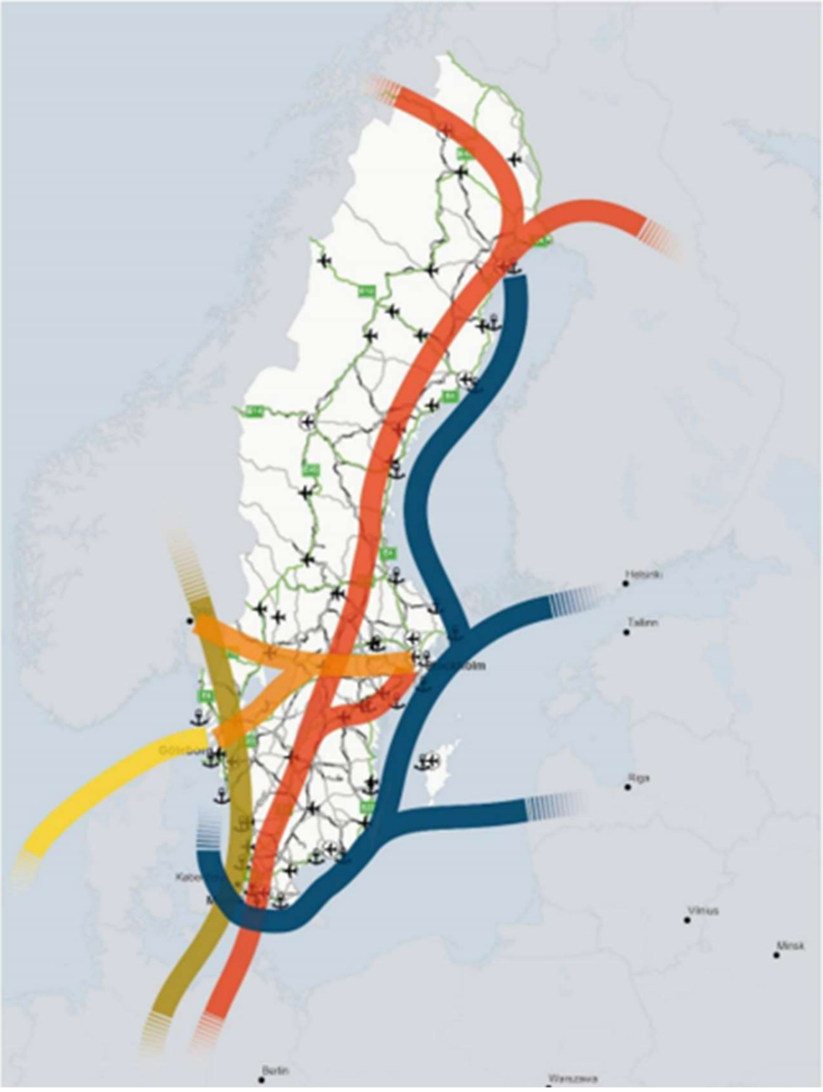

Figure 4 Main transport corridors in Sweden Source: The Swedish Transport Administration

International cooperation and other countries' infrastructure investments can lead to changes in transport flows and transport intensity. Denmark constitutes a transit hub in the Nordic transport system, and its position will further strengthen with the construction of the Danish cross-border tunnel, the Fehmarn Belt connection (connecting Rødbyhavn in Denmark and Puttgarden in Germany) that will increase freight flows by road and rail, especially to Sweden and Norway. Opening the connection means increased transport capacity in the north-south transport axis. At the same time, growing transportation from Sweden via Denmark and Germany will mean that the capacity between Sweden and Denmark will be further strained.

Figure 5 Illustration of the Fehmarn Fixed link *Source: Femern. com*

The Öresund link is expected to reach full capacity utilisation for rail around 2030. The increase in idle flows from the east means that goods in the future may largely be shipped via ports along the east coast[33].

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[33] The Government Offices of Sweden - En nationell godstransportstrategi (2018)

4.2. Transport flows in Örebro and Stockholm- Mälar regions

The three Baltic Loop corridors (Northern, Middle and Southern) all have their starting point in Örebro. Örebro County is in the middle of Sweden and forms a part of the Stockholm-Mälar region located between the metropolitan regions of Stockholm and Oslo. It is traversed by some of the country's largest and most heavily used transport routes for both passenger and freight transport. European roads E18, E20 and national highway 50, the Western main line (Västra Stambanan) and the Bergslagen freight line route pass through the county. The Mälar line (Mälarbanan) has its end point in Örebro County, and the trains on the Svealand line often reach all the way to Örebro County, too. The Hallsberg marshalling yard is Sweden's largest marshalling yard, handling about 300,000 wagons per year.

The Stockholm-Mälar region constitutes the biggest consumer market in Sweden with extensive product production and large transit flows of goods. The Stockholm Mälar region comprises about 40% of Sweden's population and employment. Due to the rapid population growth and international trade exchange, the Stockholm-Mälar region's freight transports are increasing faster than those in the country in general[34].

The transport of raw materials and industrial products in the Mälar region is relatively extensive, while transport of consumer goods and high-value goods dominate in Stockholm County. The large regional distribution networks place special demands on the roads, and rail infrastructure freight transportation to and from the Stockholm region has undergone a successive structural change, whereby some heavy industries have moved out of the region, and the influx of food and consumer goods has increased. Transport of highly processed goods has also increased, as well the need for fast express deliveries as a result of the growing service sector. Waste and recycling transport, e.g., of recycled paper and scrap, has also increased.

Freight flows that have both a departure and a destination point within the region occur almost exclusively by road transport. Road transport is also dominant for domestic freight transport to and from the Stockholm-Mälar region. The railroad is mostly used for arriving goods from southern and western Sweden as well as Upper Norrland.

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[34] Council for Stockholm Mälar region (2017)

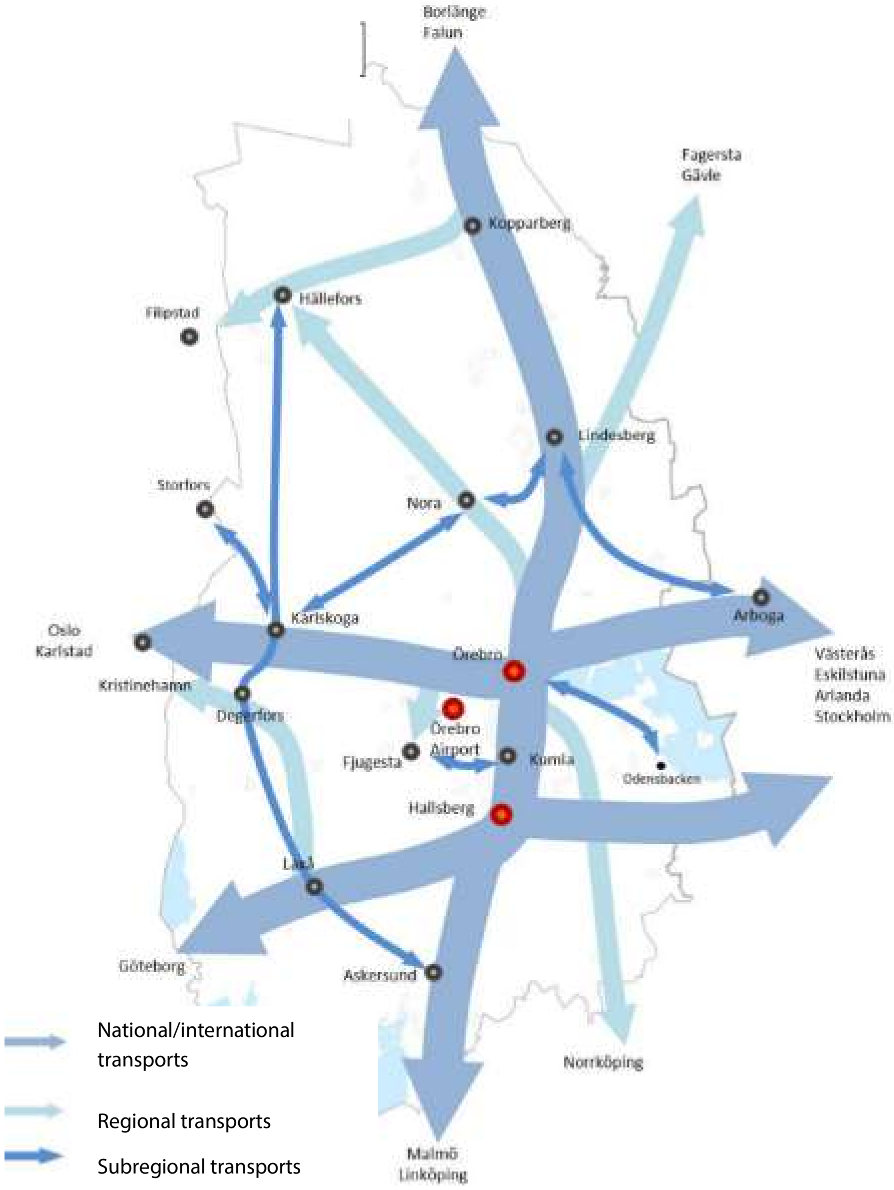

Figure 6 Classification of major transport routes in Örebro County *Source: Mälardalsrådet*

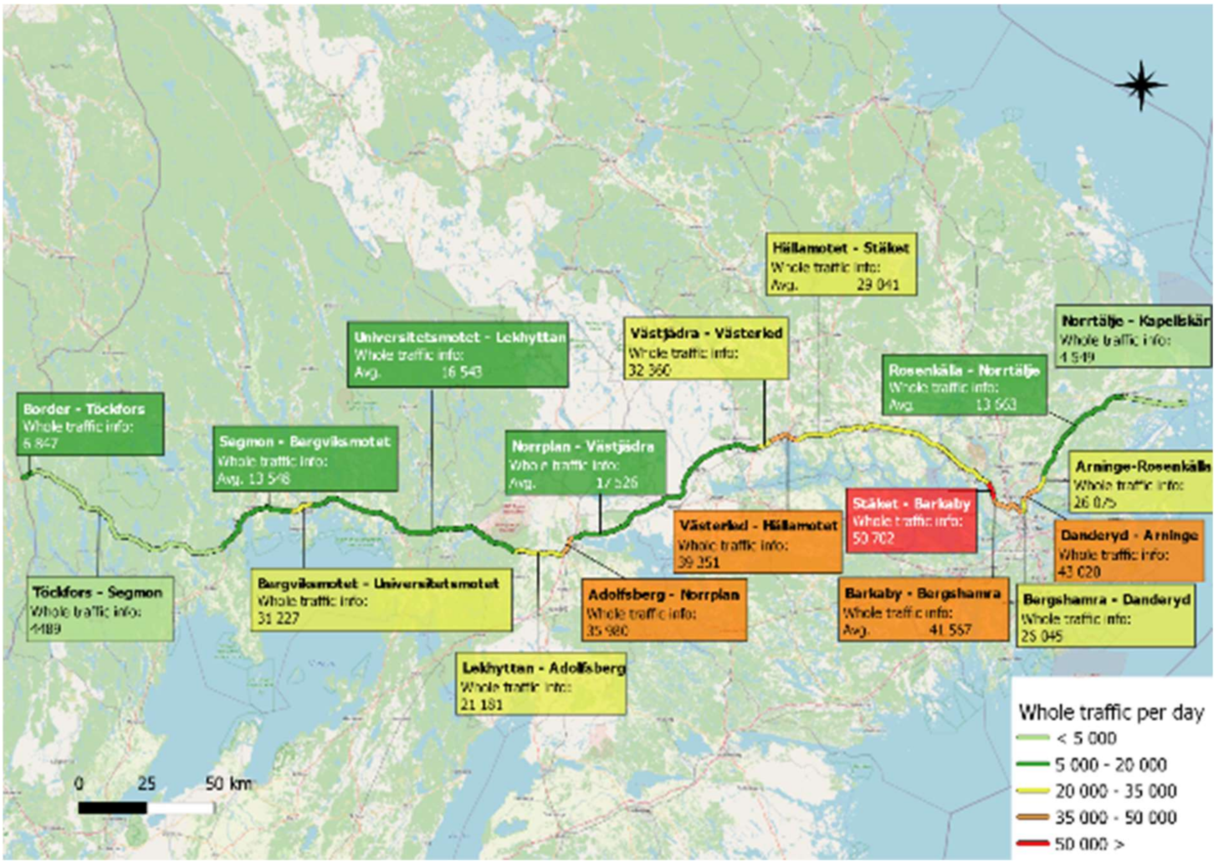

Figure 7 Annual average daily traffic flow on E18

Much of the freight to and from the Stockholm Mälar region is transported by road, and the largest flows are on the European roads (E18, E4, E20, E22), but there are also other important roads for the region, such as highways 50, 51, 55, 56, 68, 70 and 73[35]. The annual average daily traffic on the busiest sections of E18 can reach up to 35 000 -75 000 vehicles, of which approximately 12% consist of heavy gross vehicles[36]. The largest traffic volumes are accumulated on the access roads to Stockholm and on road sections around Örebro, Västerås and Karlstad.

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[35] Mälardalsrådet, Systemanalys, (2017)
[36] Swedish Transport Administration (2020)

The Baltic Sea traffic of the Stockholm-Mälar region ports are of special importance for the region's and country's cargo flows in foreign trade and for connections to and within the Baltic Sea area via the east coast ports. Maritime transport is dominant by volume in foreign trade, while rail is used to and from Germany and other Western Europe. The air freight is small in volume but high in value and serves mainly the high-tech industry's transportation needs.

4.3. Transport modes

Truck transports are concentrated in southern Sweden and to the main roads E4, E6, E18 and E20 that connect three metropolitan areas in Scandinavia (Finland, Sweden and Denmark). Most of the truck traffic in Sweden are domestic transports and operated mainly by Swedish-registered vehicles. Trucks transport 88% of the total domestic freight volumes[37]. Foreign trucks' cabotage transports accounted for just over 393,000 transports in 2016, which correspond to no more than 1.35% of the total number of domestic truck transports in Sweden[38]. Conversely, foreign trucks dominate in foreign trade. Foreign trucks accounted for just over 82% of the volume of road transported foreign goods in 2016. This corresponds to just over 14 million tons of goods to Sweden and almost 13 million tons of goods from Sweden abroad.

The rail transport is interregional or international to a high degree and seldom have the points of departure and arrival in the same county. Domestic rail transport accounts for 9% of the total freight volume, compared to foreign traffic, where railway transport accounts for 15%.

Maritime transport dominates in international trade and carries about 71% of the total freight volume transported. The largest flows are concentrated in a smaller number of ports[39]. Many Swedish ports specialise in handling only certain types of goods. The ports of Göteborg, Brofjorden, Helsingborg, Malmö, Trelleborg, Stockholm and Luleå are the main gateways ports in foreign trade.

Domestic maritime traffic occurs between a few geographical areas. The largest proportion of domestic sea traffic (12%) occurs between the two areas of Haparanda/Skellefteå and the southeast coast. Traffic on Lake Vänern and Lake Mälaren is of limited scope. A total of 685,000 tonnes of goods were transported using inland waterways in 2018. The average transport distance was 63 km, compared to 628 km with domestic sea freight[40].

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[37] Swedish Transport Administration - Tillstånd och brister i transportsystemet (2017)
[38] The Government Offices of Sweden - Nationell godstransportstrategi (2018)
[39] Swedish Transport Administration -Tillstånd och brister i transportsystemet (2017)
[40] Trafikanalys – Sjötrafik 2018 (2019)

4.4. Freight transport projections

Freight transportation has increased in recent decades, especially with regard to long-distance road haulage and international maritime transportation. The European Commission expects freight transport within the EU to increase by 80% between the base year 2005 and 2050, while passenger traffic is expected to grow by 50%[41].

The freight transport work among all transport modes is expected to increase markedly in the future in Sweden. According to the Swedish Transport Administration's forecasts, the freight transport area foresees an annual growth rate of nearly 2% until 2040. Considering the measures and investments presented in the national transport plan for 2018-2029, sea transport and road transport are the modes believed to show the strongest growth, i.e., 1.9% annual growth each, followed by rail transport with an annual growth rate of 1.4%[42].

Freight transport is expected to increase most along the existing main transport routes. The forecast for rail transport, apart from some exceptions such as the Iron ore line (Malmbanan), is relatively modest. Road traffic is projected to grow the most on the European roads between metropolitan areas and along the Norrland coast. The forecast also indicates that sea transportation through the Kiel Canal will intensify compared to the sea transports through Skagerrak. Sea transport between the east coast ports to Russia and the Baltic countries is expected to increase. The opening of the Port of Norvik (member of Ports of Stockholm port family) is likely to support this development further.

Table 1 Transport work (billion tonne kilometres) growth projection for all transport modes during 2012-2040

Year	Sea transport	Road transport	Rail transport
2012 (Base year)	39.4	51.3	21,4
2040	66.8	85.7	31.6
Growth %	69.5%	67.1%	47.7%
Growth % per annum	1.9%	1.9%	1.4%

Source: The Swedish Traffic Administration

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[41] European Commission-Transport 2050: The major challenges, the key measures (2011)

[42] Swedish Transport Administration - Basprognos (2018)

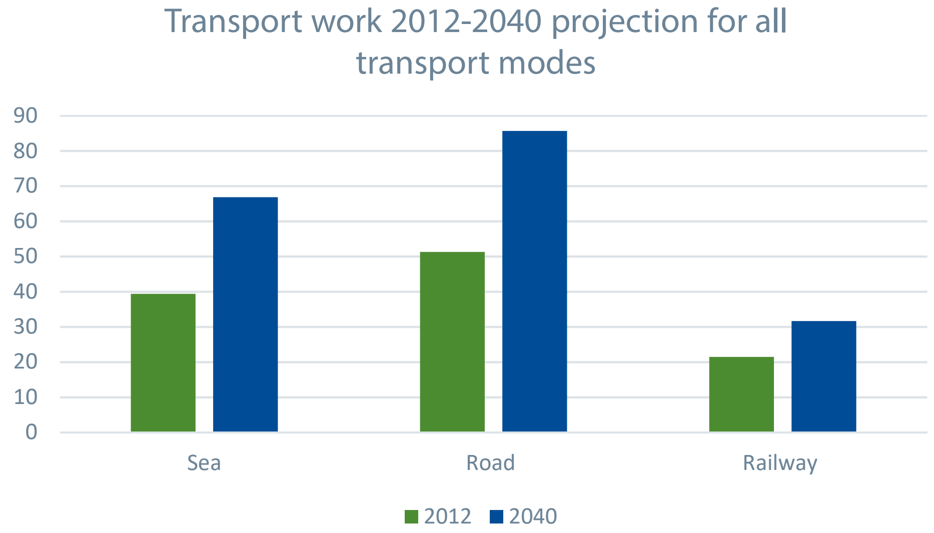

Figure 8 Transport work (billion tonne kilometres) per traffic mode Source: Swedish Transport Administration

International cooperation and other countries' infrastructure investments can lead to changes in transport patterns, both in terms of the size of the flows and the routes and the types of transport the goods take to and from Sweden. The construction of the Fehmarn Link and Brenner Base tunnel are the most important projects being implemented in the ScanMed corridor. The Fehmarn Link will ease and improve the cross-border traffic flows between Germany and Denmark and further the accessibility to the German market from Sweden. However, it may simultaneously further strain the transport capacity between Sweden and Denmark. The existing almost 8 000 metre-long combined railway and motorway bridge, *Öresund Bridge*, is expected to reach full capacity utilisation for rail around 2030. A study on the prerequisites for a fixed link over Öresund between Helsingborg (Sweden) and Helsingör (Denmark), currently operated by ferries, is also currently occurring[43].

The Swedish Government presented in their proposal to the EU Commission in 2018 that the existing "Scandinavia - Mediterranean" core corridor, which today stretches only to Stockholm, should be extended all the way up to the Swedish-Finnish border at Haparanda and to Oslo via Örebro[44]. This would mean that neither Stockholm nor Örebro would be the northern end stations of the corridor for the Stockholm Mälar region but would become traffic nodes with traffic connections in several directions.

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[43] Swedish Transport Administration (2020)
[44] The Government Offices of Sweden (2018)

Today, the further connections of the core corridor extend no longer than to the gateway of Stockholm-Turku sea link.

The Stockholm bypass[45] is a new connection for the European highway (E4) past the Swedish capital, whose construction was started in 2015 and will take around 15 years to finish. The new link, which is approximately a 20-kilometre underground motorway bypass, will connect the southern and northern parts of Stockholm County, relieving the arterial roads and the inner city of traffic and reducing the vulnerability of the Stockholm traffic system. The Swedish Transport Administration (Trafikverket) estimates that the Stockholm bypass will be used by approximately 140.000 vehicles per day by 2035. This bypass could have both positive and negative effects on the western parts of the Stockholm Mälar region in the form of economic growth potential or more traffic and emissions.

Future volume growth in the Stockholm Mälar region is expected to mainly occur in road traffic, partly due to capacity shortages on the railway. A significantly larger proportion of low-cost and non-time-critical goods could potentially be transported by sea, which in a European perspective has been used to a limited extent in relation to Sweden's coastal dimension.

The Council for Stockholm Mälar Region ordered a scenario analysis in 2015 on how land transports would be affected if the transport volumes from road and rail were redistributed and channelled increasingly to/via the ports (without an overall change in overall transport volumes) of the Stockholm Mälar region) until 2030[46].

Scenario 1 considers a simulated port volume growth of 100%; scenario 2 considers a volume growth of 250%. The thickness of the road network sections presented in Figures 9 and 10 indicates the annual average daily traffic; the coloration indicates the projected growth rate. The ports studied included Västerås, Köping and Södertälje, The Ports of Stockholm (Stockholm, Norvik, Kapellskär and Nynäshamn), Gävle, Hargshams, Norrköping, Oxelosund and the Ports of Gotland.

The redistribution of goods volumes to Mälar ports is expected to increase the truck and trailer traffic within the Mälar region and the Stockholm area. Figures 9 and 10 show the road traffic in both scenarios 1 and 2, which indicate significant growth in the south-north (and v.v.) direction from Nynäshamn/Norvik (Highway 73) towards Stockholm and Kapellskär (E18), both representing an anticipated growth of over 30% by 2030. A marked growth of over 10% is also expected on the E4 between Stockholm and Gävle. The west-east axis E20 from Västerås to Stockholm and the E18 from Södertälje-Eskilstuna and v.v. are also expected to see growth beyond 10%. The volumes on the E4 between Gävle and Stockholm are

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[45] The Swedish Traffic Administration, Road construction projects (2020)

[46] WSP Analys Strategi, Scenario – Genombrott sjöfart (2015)

expected to grow between Uppsala and Stockholm (in the southbound direction) as a result of the growing number of containers handled in the Port of Gävle.

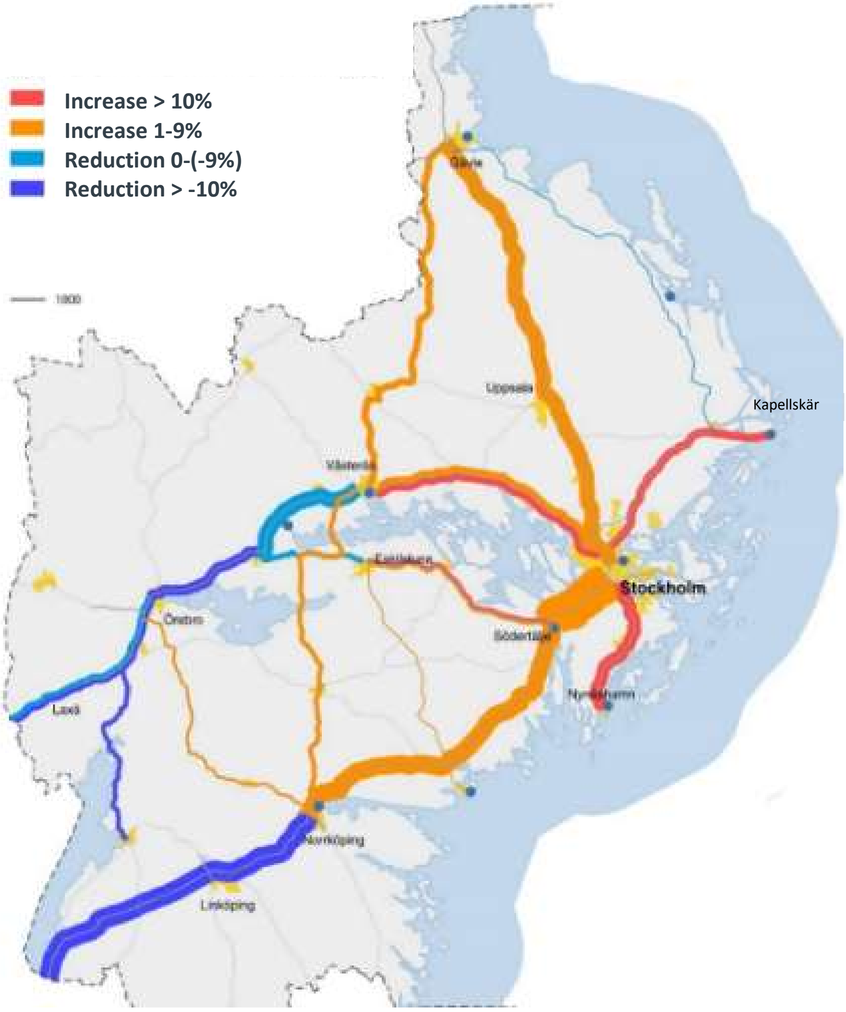

Figure 9 Projected road traffic development in Stockholm Mälar region resulting from simulated 100 % increase in port throughput *Source: WSP Analys & Strategi*

Scenario 2 is an amplification of scenario 1 but also serves as a control to identify sections that are expected to reach critical transport volumes in relation to their capacity, namely, the E4 between Norrköping and Gävle and the E20 between Västerås and Stockholm.

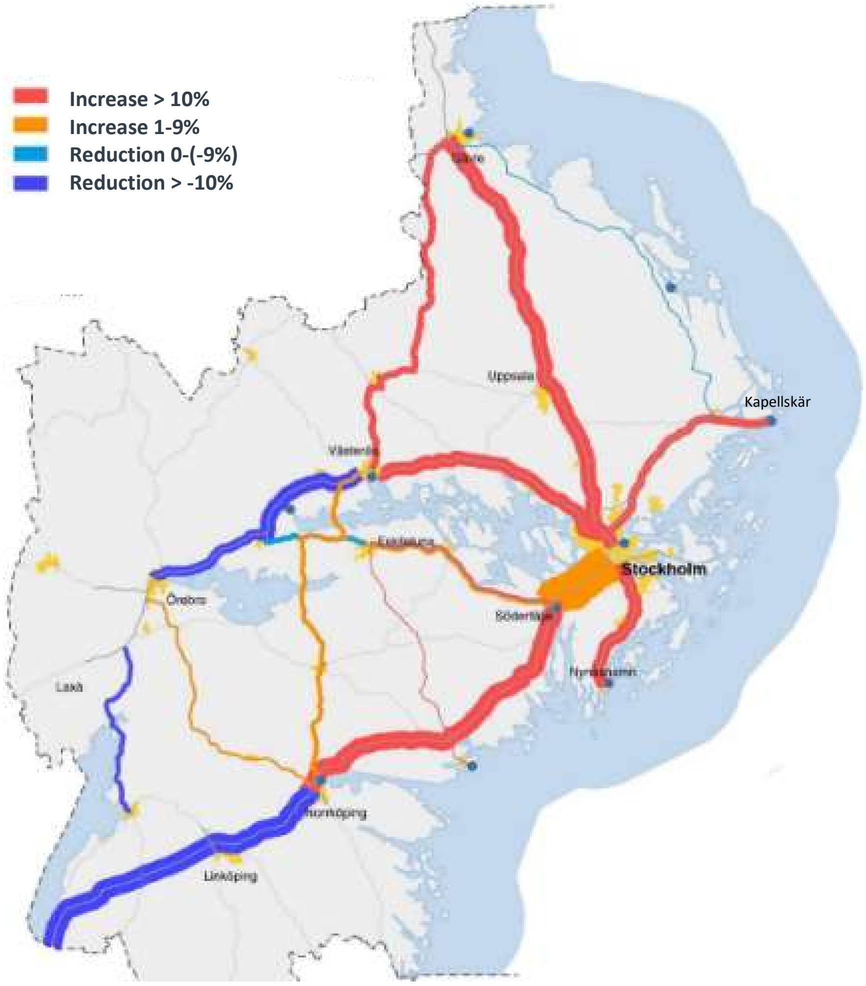

Figure 10 Projected road traffic development in Stockholm Mälar region resulting from simulated 250 % increase in port throughput *Source: WSP Analys & Strategi*

Redistribution of road transport volumes will also lead in some cases to a volume reduction on some roads/road sections and competing ports outside the region. The roads that lead into the region and are expected to see falling transport volumes include Highway 50, the E18/20 west from Köping/Kungsör and the E4 west from Norrköping,

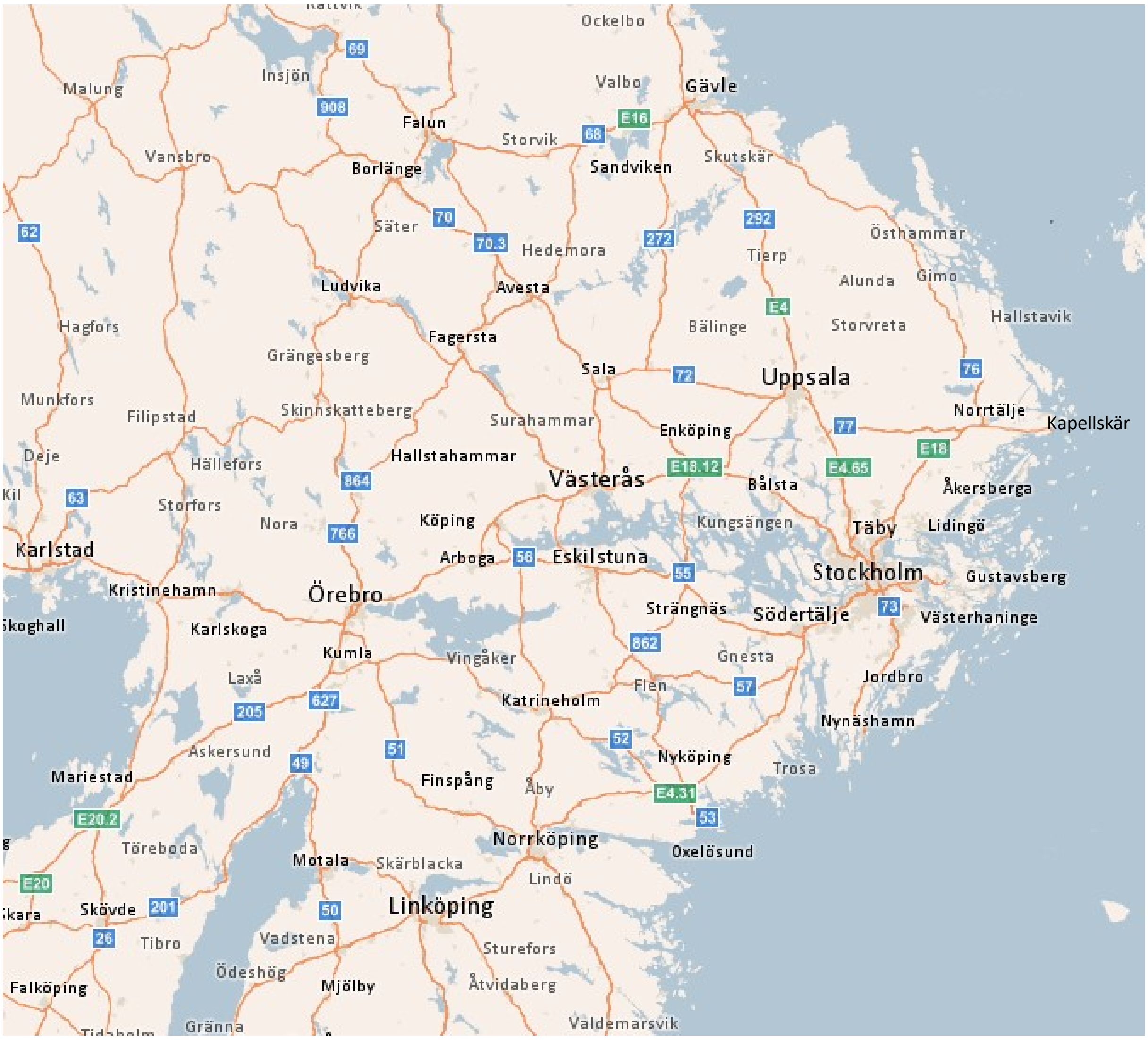

Figure 11 Map of Stockholm Mälar region road network and ports *Source: The Swedish Traffic Administration*

Table 2 Projection on the road traffic development resulting from simulated port throughput growths

Roads with increased traffic projection			
Road	**Between**	**Scenario 1 (100% growth)**	**Scenario 2 (250% growth)**
Highway 73	Stockholm-Nynäshamn (both directions)	32 %	78 %
E18	Stockholm-Kapellskär (both directions)	30 %	74 %
E20	Västerås-Stockholm (eastbound)	15 %	37 %
E18	Södertälje-Eskilstuna (westbound)	13 %	32 %

Roads with decreased traffic projection			
Road	**Between**	**Scenario 1 (100% growth)**	**Scenario 2 (250% growth)**
Highway 50	Motala-Hallsberg	-43 %	> -100%
Highway 50	Hallsberg-Motala	-29 %	-73 %
E20	West Örebrö (eastbound)	-19 %	-48 %
E20	Arboga-Örebro (westbound)	-17 %	-44 %
E4	South Norrköping (southbound)	-13 %	-33 %
E20	South Norrköping (northbound)	-10 %	-25 %

Source: WSP Analys & Strategi

The study predicts some freed railway capacity around and within the Mälar region if goods were to be transferred from the railway freight shuttle shipments to/from Göteborg to the Mälar region's ports. The transfer of goods from railway routes to sea is foreseen to have only a marginal effect on the capacity utilisation of the railway routes in the Mälar region.

4.5. Transport system development in Sweden

The planning and implementation of measures that improve the transport systems by satisfying different traffic demands, contributing to good accessibility to nodes and enabling efficient transport solutions, is a complex process that engages a number of multilevel actors and sectors of the society. The operation and ownership of services also vary, covering both private and public actors. The planning and development process needs to be executed in a holistic and integrating manner that considers all levels (local, regional, national and international) of the transport systems.

The newest national plan for the transport system and for the frameworks for county transport plans for the period 2018–2029 were adapted by the Swedish Government in 2018. The total financial framework amounts to SEK 622.5 billion, with an additional SEK 90 billion to come from congestion and other fees.

The plan relies on the Swedish Traffic Administration proposal covering all transport modes, and it outlines prioritised measures that should be included in the national plan for the coming 12 years. The proposal is based on an extensive analysis of the existing infrastructure, its condition and identified bottlenecks and deficiencies (see Appendix IV on deficiencies in East Central Sweden/Örebro). The plan focuses especially on measures reducing the environmental impact, such as shifting goods from roads to other "greener modes", that is, rail and sea traffic and restoration and improvement of railway infrastructure. The improvement of transport systems and elimination of hindrances and bottlenecks can imply various measures related to land use, utilisation and operation of a particular transport service, and vehicle and transport infrastructure development. The national plan aims holistically towards a transition to a fossil-free welfare state, an increase in housing and an improved business environment. In the preparation phase of the plan, actors such as regional and county authorities are involved in a dialog and comment on the plan proposal.

4.5.1. Regional transport infrastructure priorities in the Stockholm Mälar region and Region Örebro County

In their review of the plan proposal for the national transport system[47], Region Örebro County (RÖC), e.g., emphasised the importance of a cross-border perspective and a systems view to strengthen the international transport corridors in the country by underlining, e.g., the Stockholm-Oslo connection's significance as part of the TEN-T ScanMed corridor. RÖC also stated that Sweden has been passive with regard to EU transport infrastructure targets for railways, including those for a minimum train length of 750 m and minimum train velocity of 100 km/h for cargo trains. RÖC also urged the Swedish Government to consider Finland and Norway's proposal to extend the European core network corridor further north and around the Gulf of Bothnia.

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[47] Region Örebro County (2017)

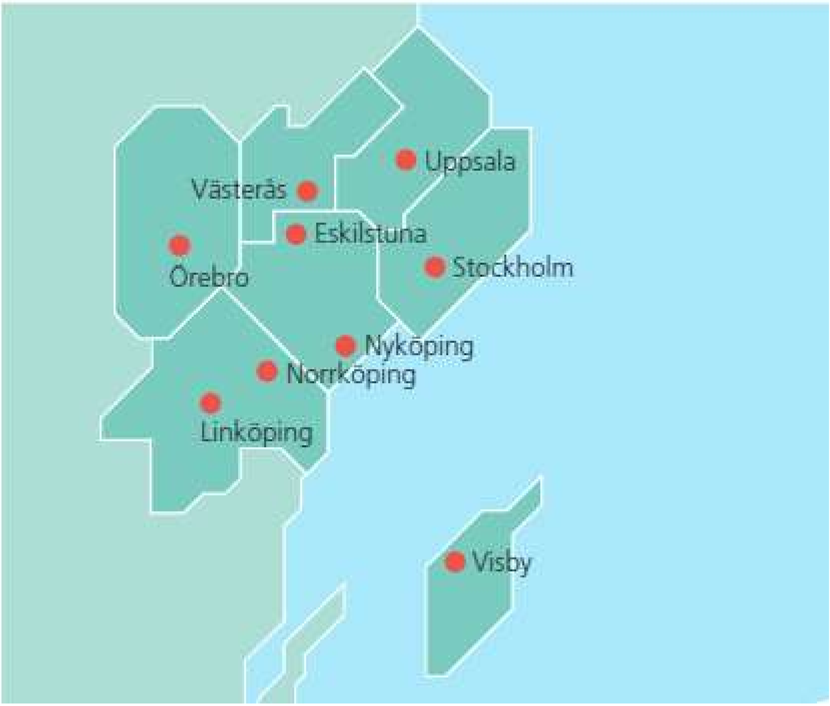

Figure 12 Counties of Stockholm- Mälar region *Source: Mälardalsrådet*

The Council for Stockholm-Mälar region, speaking for seven counties in the Stockholm-Mälar region with shared interests and priorities (including transport system development), identified and listed the following needs, hindrances and bottlenecks affecting traffic safety, capacity and conditions in their communication and response to the Swedish Government's proposal regarding the national plan.

The Council of Stockholm-Mälar region communicated the following shared, prioritised functions:

- better accessibility from node cities to the main traffic corridors leading to Stockholm
- improved horizontal accessibility within the region
- better accessibility and interconnectivity that increasingly relies on rail traffic as a basis – development of a high standard and high-capacity regional public transport system
- effective freight handling and supply of goods, with growing capitalisation of rail and sea transports

Table 3 Traffic bottlenecks and prioritised development measures of transport infrastructure in Stockholm Mälar region

RAILWAY	Challenge/bottleneck	Measure proposal
Mälarbanan	Insufficient capacity on Arboga-Hovsta route	Capacity for increased traffic on the Arboga-Hovsta route.
	Insufficient passenger capacity and goods transport capacity in Örebro and Västerås	Rebuilding of the track area in Örebro central and Västerås central for more passenger capacity and to free capacity for goods
Hallsberg marshalling yard	Insufficient capacity for goods volumes and longer trains	
ROAD	**Challenge/bottleneck**	**Measure proposal**
E4	Insufficient capacity	Expanded capacity north of Stockholm by road and to Arlanda
E18	Increasing capacity on the Köping - West Jädra route	Increased accessibility and traffic safety

The Swedish Government has decided that the Swedish Transport Administration should continue to investigate the shortcomings of the routes, nodes or equivalent listed here, with the next planning round and plan revision in mind:

- Bergslagen - Oxelösund, capacity and loadbearing - Ore transports
- Stockholm - State border - Oslo, insufficient capacity and long travel times
- Stockholm metropol-accessibility-, environmental- and capacity shortcomings in transport system
- Southern Stockholm region, insufficient capacity in the railway system and,
- E4/E20 bridge crossing the Södertälje canal–vulnerability
- Coast to coast railway, insufficient capacity, timeliness and robustness
- Hjulsta bridge, passage for larger vessels to Mälar ports

5. Baltic Loop Corridors

BALTIC LOOP focuses on solutions to improve and smooth the transport flows in three selected corridors running in the west-east direction (Northern, Middle and Southern) within the Central Baltic Region, namely Örebro –Turku/Tallinn/Riga – St. Petersburg. The three Baltic Loop Corridors have their starting point in Örebro (including the section extensions to the Oslo and St. Petersburg), part of the Stockholm Mälar region in Sweden. The main focus of this report is on sea freight transportation and port operations, particularly from a short sea (ro-ro) shipping perspective but also to a certain degree on road freight transportation, because it forms the cargo and customer base for ro-ro services. Annex II mostly presents the data on land connections and inland freight flows due to the large amount of information.

Figure 13 Visualisation of west-east running Baltic Loop Corridors

Each Baltic Loop corridor has the following distinct sections:

NORTHERN CORRIDOR

- Oslo-Örebro-Stockholm (inland transport)
- Kapellskär-Naantali (maritime transport, ports)
- Stockholm-Turku (maritime transport, ports)
- Turku/Naantali-via Helsinki-Vaalimaa-St. Petersburg (inland transport)

MIDDLE CORRIDOR

- Oslo-Örebro-Stockholm (inland transport)
- Stockholm-Tallinn (maritime transport, ports)
- Tallinn-Narva St. Petersburg (inland transport)

SOUTHERN CORRIDOR

- Oslo-Örebro-Stockholm (inland transport)
- Stockholm-Riga (maritime transport, ports)
- Ventspils-Riga (inland transport)
- Riga -Valka- Narva-St. Petersburg (inland transport)
- Nynäshamn-Ventspils (maritime transport, ports)

5.1. The Northern Corridor

The Northern corridor has the following sections:

- Örebro-Stockholm (inland transport)
- Kapellskär-Naantali (maritime transport, ports)
- Stockholm-Turku (maritime transport, ports)
- Turku/Naantali-via Helsinki-Vaalimaa (inland transport)

5.1.1. Örebro-Stockholm/Kapellskär

The section from the Norwegian border via Örebro to Stockholm provides all transport modes and multiple transport services, presented in Table 4. Appendix III presents more detailed statistics on freight flows.

Table 4 Transport modes and services provided along the Northern Corridor in Sweden

Measure	Unit	Quantity / Description	Notes, data source
Freight transport modes available	**Road:** E18 **Rail:** Mälarbanan, Svelandsbanan, Västra Stambanan, Värmlandsbanan, Kongsvingerbanan **Maritime:** Kapellskär, Stockholms hamnar, Nynäshamn, **Air:** Arlanda Airport, Bromma Airport, Eskilstuna Airport, Örebro Airport, Karlstad Airport	Road 511 km Rail 395 km Maritime x Air x	Swedish Transport Administration Swedish Maritime Administration Swedavia, Eskilstuna Logistik and Etablering AB Region Örebro Council, Kumla muni-cipality, Karlskoga municipality, Karlstad municipality
Multi-modal transport hubs	**Rail-Road:** Oslo, Alnabrun, Hallsberg, Eskilstuna, Årstad, Katrineholm **Inland port-rail-road** Västerås, Köping, Kristinehamn **Seaport-rail-road** Stockholms hamnar Nynäshamn		

The main road artery of the Northern Corridor (also Middle and Southern) is the E18, which is over 500 km long. The annual average daily traffic on the E18[48] varies roughly between 1 700-75 300 vehicles (average 25 400, median 19 600). The corresponding counts for heavy goods vehicles range from 110-9 000 (average 3 000, median 2 750), corresponding to a 12% average (14% median) of the total traffic. The heavy traffic is concentrated in city approaches along the E18, namely Karlstad, Örebro, Västerås and the Stockholm approaches.

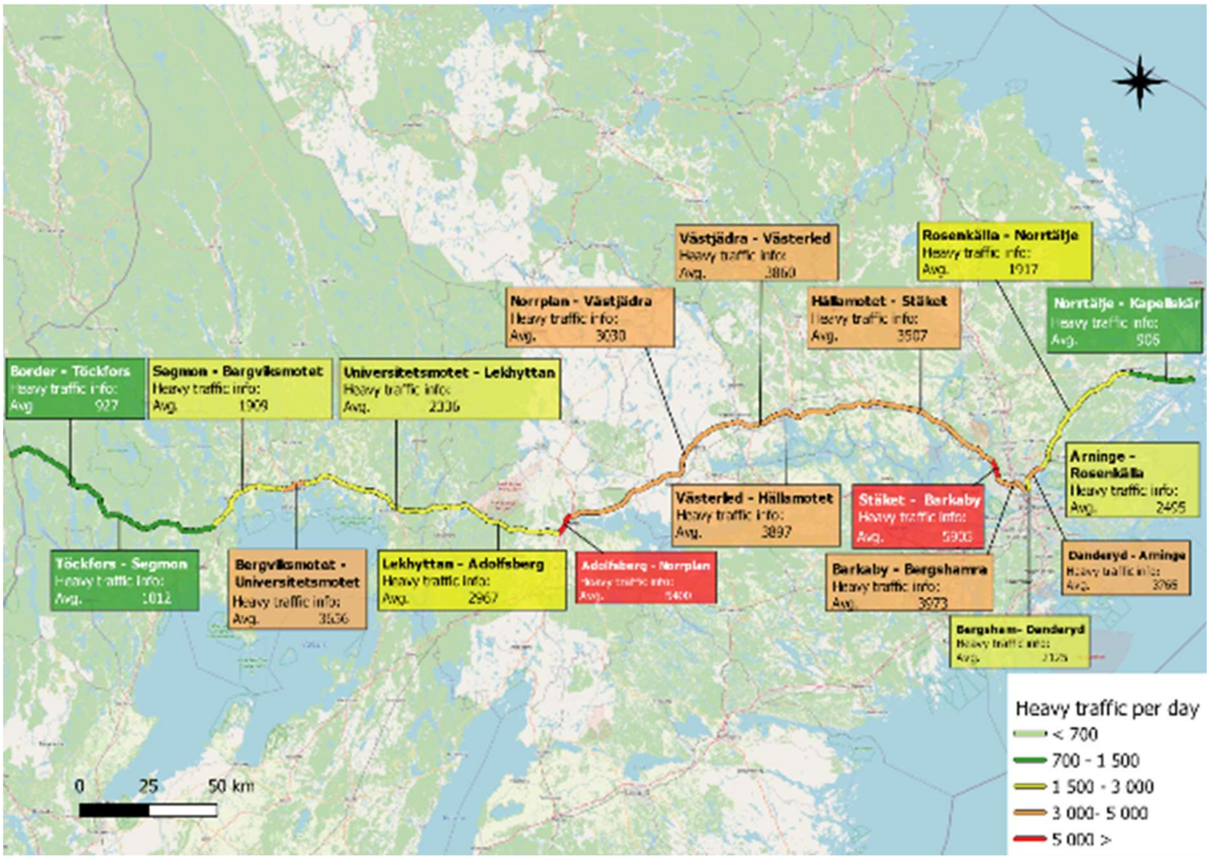

Figure 14 Heavy goods traffic on E18 (Sweden)

Figure 15 illustrates the identified bottlenecks on the E18 on the Oslo-Stockholm axis: low accessibility, insufficient capacity and infrastructure (interchanges), heavy traffic running through city centres resulting in congestions, reduced traffic safety, and unnecessary emissions.

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[48] Swedish Transport Administration (2019)

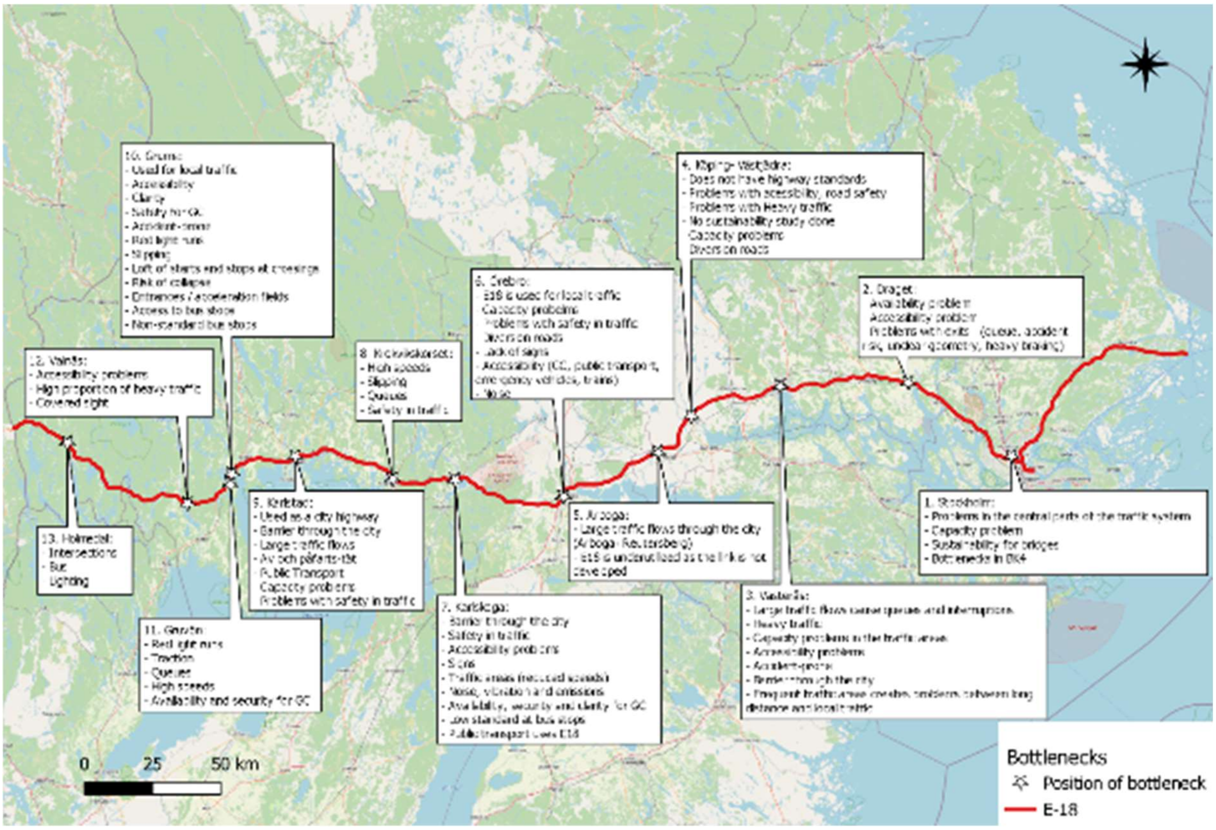

Figure 15 Traffic bottlenecks along E18 (Sweden)

5.1.2. Ports of the Northern Corridor

The Northern Corridor ports are the ports of Kapellskär and Stockholm in Sweden and the ports of Naantali and Turku in Finland.

Table 5 Ports and sea routes of the Northern Corridor

Corridor	Departure port	Arrival port	Travel time	Dist (nm)	Operators
Northern	Stockholm (via Åland)	Turku	11 h	170	TallinkSilja, Viking Line
	Kapellskär (via Åland)	Naantali	7 h	113	FinnLink

Port of Stockholm (Port of Origin for the Northern, Middle and Southern Corridors)

The Port of Stockholm belongs to the TEN-T core transport network ports and consists of several distinct harbour areas within the City of Stockholm, of which Värtahamnen, Frihamnen and Stadsgården are the most commercially prominent ones.

Stadsgården harbour *Source: Ports of Stockholm*

Värtahamnen and Stadsgården form the largest port areas in Stockholm and offer extensive ferry traffic to Finland and the Baltic States. Värtahamnen have services to Turku, Helsinki, Tallinn and Riga and Stadsgården correspondingly have services to Turku and Helsinki. Frihamnen, which is located close to Värtahamnen, have a weekly ferry connection to St. Petersburg via Helsinki and serves together with Stadsgården as the main seasonal cruise harbours.

Värtahamnen. *Source: Ports of Stockholm*

Table 6 Infrastructure of Port of Stockholm

Värtahamnen & Frihamnen **59°20′ N 18°6′ E**	Number of Berths: 14
	Quay depth: 6.0-11.0 m
	Total Quay Length: 1 500 m
Stadsgården & Masthamnen **59°19′ N 18°5′ E**	Number of berths: 7
	Total Quay Length: 1 300 m
	Quay depth: 7.2-9.4 m

Two of the leading cruise-ferry companies in the Baltic Sea, TallinkSilja and Viking Line, operate regular liner traffic with four daily departures between Stockholm and Turku with a fleet whose average age is 16 years. The harbours in Stockholm City handled 4.7 million tonnes of goods in 2019, of which 3.4 million tonnes consisted of inward and 1.3 million of outward transports.

Table 7 Port of Stockholm general overview

PORT	**Stockholm**	Full-service port. Fuels. Hub for sea traffic to/from Finland, Estonia, Latvia.
Annual turnover	4.7 Mt	
Types of cargo	General cargo, Dry bulk , Liquid bulk	
Trucks and trailers	172 212	
Number of cargo vessels/ferries served	4 661	
Passengers	12.1 million (of which 1.1 million cruise passengers)	Consolidated statistics for all Ports of Stockholm harbours

The Port of Stockholm handles all cargo types, although there is a clear dominance in ro-ro services, representing approximately half of the total cargo volume, i.e., 2.34 million tonnes. The throughput of trucks and trailers amounted to 172 000 units, of which over a quarter (27%) consisted of trailers.

Table 8 Port of Stockholm gross freight volumes per commodity group

(1000 t)	**SWEDEN**	***Stockholm***
Total	**170 556**	**4 722**
Inwards	94 060	3 422
Outwards	76 496	1 300
Ro-Ro (trucks and trailers)	**42 716**	**2 343**
Inwards	22 407	1 340
Outwards	20 475	1 002
Dry bulk total	**29 355**	**921**
Liquid bulk total	**57 763**	**349**
Other general cargo total (excl. trucks and trailers)	**22 361**	**585**

The Port of Stockholm serves as a port of origin to all three Baltic Loop Corridors. The largest cargo volumes are fed in descending order to the Northern Corridor to Finland (0.6[49] million tonnes), followed

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[49] Of the total outflow ro-ro traffic of 0.89 million tonnes to Finland, Turku represents a share of 0.61 million tonnes or approximately 70%.

by the Southern Corridor to Latvia (0.46 million tonnes) and the Middle Corridor to Estonia representing (0.07 million tonnes). Ro-Ro services cover 91% of the total traffic in the Northern Corridor to Finland, 51% in the Middle Corridor to Estonia and 40% in the Southern Corridor to Latvia.

Table 9 Breakdown of overall and ro-ro cargo flows from Port of Stockholm feeding into the Baltic Loop transport corridors

(1000 t)	**FINLAND (Northern Corridor)**		**LATVIA (Southern Corridor)**		**ESTONIA (Middle Corridor)**	
FROM	SWEDEN	Stockholm	SWEDEN	Stockholm	SWEDEN	Stockholm
Total	**13 621**	**2 219**	**5 382**	**462**	**2 886**	**274**
Inward	6 401	1 251	4 670	412	2 237	198
Outward	7 220	968	7 12	50	649	76
Ro-Ro	**4 075**	**2 017**	**1 281**	**184**	**954**	**141**
Inward	2 162	1 127	817	137	599	76
Outward	1 914	888[50]	464	462	352	66

The current operating fleet on the Stockholm-Turku route has an average passenger capacity of 2 725 passengers and a total daily capacity of approximately 10 900 passengers. The total daily car deck capacity is approximately 1 600 passenger cars or 4 400 lane metres. The average journey time is nine hours, and the turnaround time in ports is around one hour.

The ferry route between Stockholm and Tallinn is operated once a day by TallinkSilja. The average lane metre capacity of the car deck is 1 065 metres with a passenger capacity of 2 500 pax. The vessels' average building year is 2007.

The Stockholm-Riga connection is also operated by TallinkSilja with daily departures. The average lane metre capacity of the car deck is 985 metres with a passenger capacity of 2 500 pax. The vessels' average building year is 1996.

Connections:

Road: E18 Örebro-Stockholm/Kapellskär

Rail: Yes (Värtan-Frihamnen)

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[50] Includes the outflow volume of 0.282 thousand tonnes shipped to Helsinki.

Bottlenecks, inefficiencies and special features:

- congested roads, traffic jams particularly on the E18 on the Oslo-Stockholm axis (particular points of delays in Karlstad (Värmland) and Västerås)
- lack of road safety and accessibility on the E18
- traffic affects the health and living environment in the urban areas along the E18 with pollution in the form of noise, vibration and air pollution
- large vehicle volumes contribute to large emissions
- shrinking port land area and crowded traffic flow despite Intelligent Traffic System
- safety of rest areas for truck drivers

Completed and planned development measures:

Completed:

A major reconstruction of Värtahamnen occurred in 2013-2016. It was part of a large urban development project (construction of housing, offices and development of surrounding infrastructure), the Stockholm Royal Seaport:

- Berths were relocated further out towards the sea to give way for city expansion (85 000 sqm).
- The City of Stockholm gained 85 000 sqm of land in conjunction with the reconstruction.
- New smart (Intelligent Traffic System) and green measures (Onshore Power Supply, Installation of Led lighting) were implemented.
- The passenger terminal enlarged and modernised and opened for the public.

Planned:

The Stockholm bypass[51] is a new connection for the European highway (E4) past the Swedish capital, whose construction was started in 2015 and will take around 15 years to finish. The new link, an approximately 20-kilometre underground motorway bypass, will connect the southern and northern parts of the Stockholm county, relieving the arterial roads and the inner city of traffic and reducing the Stockholm traffic system's vulnerability.

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[51] The Swedish Traffic Administration, Road construction projects (2020)

Port of Kapellskär (Port of Origin for the Northern and Middle Corridors)

The Port of Kapellskär belongs to the TEN-T comprehensive network ports and is situated on Sweden's eastern coast, 90 km north of Stockholm, 90 km east of Uppsala and 20 km east of Norrtälje. It has a central role in the fast sea freight connection between Sweden and Finland (Naantali) and Estonia (Paldiski).

Port of Kapellskär. *Source: Ports of Stockholm*

Table 10 Infrastructure of Port of Kapellskär

59°43´ N, 19° 04´ E
Number of berths: 5
Total quay length: 1 020 m
Max depth: 9 m

The Port of Kapellskär functions as a ferry port offering both ro-ro freight and passenger transportation. Kapellskär has five berths varying between 130-245 metres (average 200 m), totalling an overall quay length of 1 020 metres.

Table 11 Port of Kapellskär general overview

PORT	**Kapellskär**	
Annual turnover	2.65 Mt	
Types of cargo	General cargo	
No of trucks and trailers	192 888	
Number of cargo vessels/ferries served	2 072	
Ferry passengers	12.1 million (of which 1.1 million cruise passengers)	Consolidated statistics for all Ports of Stockholm harbours

The Port of Kapellskär handled altogether 2.6 million tonnes of goods in 2019, of which approximately 1.2 million tonnes were outward and 1.5 million tonnes inward transports. The goods handled in Kapellskär were solely ro-ro goods. The overall number of trucks and trailers totalled 193 000 units, of which trailers represented approximately one tenth (9.9%).

Table 12 Port of Kapellskär gross freight volumes per commodity group

(1000 t)	SWEDEN	*Kapellskär*
Total	**170 556**	**2 646**
Inwards	94 060	1 456
Outwards	76 496	1 190
Ro-Ro (trucks and trailers)	**42 716**	**2 609**
Inwards	22 407	1 429
Outwards	20 475	1 181
Dry bulk total	**29 355**	**0**
Liquid bulk total	**57 763**	**0**
Other general cargo total (excl. trucks and trailers)	**22 361**	**0**

Of the 1.2 million tonne outflow cargo, 0.9 million tonnes were distributed via the Northern Corridor to Finland and 0.3 million tonnes via the Middle Corridor to Estonia. The cargo flow in the Northern Corridor is well balanced in both directions, whereas there is a rather significant surplus of inflow transports via the Middle Corridor from Estonia to Sweden.

FinnLink operates to Naantali twice a day. The average age of the vessels on this service is 16 years, with an average lane metre capacity of 3 640 metres and a passenger capacity of 470 pax.

Table 13 Breakdown of overall and ro-ro cargo flows from Port of Kapellskär

	FINLAND (Northern Corridor)		ESTONIA (Middle Corridor)	
FROM	SWEDEN	Kapellskär	SWEDEN	Kapellskär
Total	**13 621**	**1 817**	**2 886**	**829**
Inward	6 401	918	2 237	537
Outward	7 220	899	649	290
Ro-Ro	**4 075**	**1 798**	**954**	**811**
Inward	2 162	903	599	524
Outward	1 914	895	352	287

DFDS Seaways offers one daily departure from Kapellskär to Paldiski with a 1999-built vessel with a 2 300 lane metre and 327 pax passenger capacity. TallinkSilja also operates on the same route with a 1999-built cargo vessel and a 2 087 lane metre capacity.

Connections:

Road: E18

Rail: no

Bottlenecks, inefficiencies and special features:

- The current layout of the port field area is not optimal.
- The waiting areas for trucks are limited in the port area.

- The port's location is 90 km north of Stockholm and transports (road haulage) coming from southern Sweden have very limited driving time. Any small disturbance or delay in traffic *en route* may, with high likelihood, cause customers to miss ship departures.
- Truck drivers' resting hours may not be reached on the Kapellskär-Naantali route, which effectively means that the drivers need to rest not too long after disembarkation.

Completed and planned development measures:

Completed:

The Port of Kapellskär underwent a refurbishment and expansion project in 2013-2016 to increase the port's efficiency and to meet the needs of growing vessel traffic, larger vessels and cargo volumes. The 3-year project involved the construction of a new, 245 metres long pier and reconstruction of two existing ones, increasing the overall number from three quays to five quay-berths. The port's logistics area was enlarged to now total 200 000 square metres. The entire port surface area nearly doubled in size. The port also installed Onshore Power Supply.

Planned:

The Ports of Stockholm and the Port of Naantali, with the shipping company Finnlines as coordinator, applied for EU financing by which the Port of Kapellskär will be modernised to better meet current and future customer needs and service requirements. The upgrade will include auto-mooring capabilities, quayside provision of onshore power for vessels and the planning of new passenger facilities. The Port of Kapellskär will, hence, better adapt to the larger vessels that Finnlines plan to introduce between Kapellskär and Naantali in a few years[52].

Port of Turku

The Port of Turku belongs to the TEN-T core transport network ports. The geographic area of the Port of Turku comprises water areas, piers, field areas and traffic infrastructure covering 225 hectares of land.

The port is divided into four functional port areas: Linnanaukko, Passenger Harbour, Western Harbour and Pansio Harbour. The Passenger Harbour serves as the base for the Turku-Stockholm ferry services. The main fairway leading to the port is 10 meters deep. The total length of all berths is 5,000 meters, with depths varying between 6 and 10 meters.

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[52] Ports of Stockholm – Press release (2020)

Table 14 Infrastructure of Port of Turku

60° 26' N, 22° 13' E
Land areas: 225 ha
Water areas: 1 045 ha
Main fairway:10 m depth
Total quay length: 5 000 m
Ro-ro berths: 13
Railways: 18.5 km

The total cargo volume handled in 2019 amounted to 2.2 million tonnes[53], of which approximately 111 000 tonnes were derived from domestic inbound shipments mainly from the Sköldvik refinery.

Port of Turku. *Source: Port of Turku*

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[53] Port of Turku (2020)

The export and import volumes in foreign trade are well balanced. The main destination ports of Turku in domestic traffic, although representing small volumes, included the Åland Island ports; Mariehamn and Långnäs.

Table 15 Port of Turku general overview

PORT	**Turku**	
Annual turnover	2.2 Mt	
Types of cargo	General cargo	Main hub for passenger traffic to Sweden
Trucks and trailers	106 623	
Number of cargo vessels/ferries served	1 972	
Ferry passengers	3.1 million	

The largest single commodity group in foreign trade comprises goods categorised as general cargo (1.5 million tonnes) that is mainly carried with trucks and trailers on the ferries, representing approximately 70% of all goods handled. There is a slight surplus in outward cargo. The Port of Turku handled all in all 107 000 trucks and trailers in 2019[55], of which trailers constituted approximately one quarter.

Table 16 Port of Turku gross freight volumes per commodity group

(1000 t)	**FINLAND**	***Turku***
Total	**113 742**	**2 133**
Inwards	52 973	1 071
Outwards	60 769	1 062
Ro-Ro (trucks and trailers)	**11 810**	**1 504**
Inwards	7 675	653
Outwards	4 739	851
Dry bulk total	**30 192**	**39**
Liquid bulk total	**38 450**	**112**
Other general cargo total (excl. trucks and trailers)	**15 022**	**348**

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[55] Port of Turku (2020)

Table 17 Breakdown of overall and ro-ro cargo flows of Port of Turku

(1000 t)	**SWEDEN (Northern Corridor)**	
From	FINLAND	Turku
Total	**13 324**	**1 427**
Inward	7 238	639
Outward	6 085	788
Ro-Ro	**4 007**	**1 379**
Inward	1 866	606
Outward	2 142	773

The Port of Turku is the second biggest passenger port in Finland and is the largest passenger port in the Finland-Sweden traffic with its approximately 3.1 million annual passengers (incl. domestic traffic of approximately 0.6 million[56] passengers).

The passenger traffic comprises four daily ferry departures between Turku and Stockholm and the Baltic Sea's seasonal cruise traffic. Two of the leading cruise-ferry companies in the Baltic Sea, TallinkSilja and Viking Line, operate regular liner traffic between Turku-Mariehamn/Långnäs (Åland Islands), Sweden, with a fleet averaging 16 years of age.

The current operating fleet on the Turku - Stockholm route has an average passenger capacity of 2 725 passengers and a total daily capacity of approximately 10 900 passengers. The total daily car deck capacity is approximately 1 600 passenger cars or 4 400 lane metres. The average journey time is nine hours, and the turnaround time approximately one hour.

Connections:

Roads to/from the ports of Turku and Naantali:

The E18 road in Finland forms a road connection from the Ports of Turku and Naantali through the Helsinki metropolitan area to the Vaalimaa border crossing at the eastern border. The average daily road traffic is the highest around the urban areas of Turku, Helsinki and Kotka.

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[56] Traficom (2019)

Railway to/from the ports of Turku and Naantali:

The Ports of Turku and Naantali both have railway infrastructure that connects to Finland's main railway network, reaching the entire country and further to Russia. Despite the existing infrastructure, freight transports have almost entirely ceased, due partly to the fact that Valtionrautatiet (VR -the Finnish Government owned railway company) has concentrated on serving industrial export mass transports. Additionally, VR´s terms and terms of carriage require a minimum of five wagon consignments that few customers can reach with their nonrecurring transportation needs.

On the passenger side, there are regular, twice daily railway connections to the Port of Turku’s two cruise-ferry terminals at ship arrivals and departures.

Bottlenecks, inefficiencies and special features:

- narrow fairway limiting simultaneous (oncoming) operations of several vessels
- traffic congestions in Raisio city centre and E18/E8 interjunction
- Turku ring road bottlenecks
- shortage of nearby parking/resting areas for trucks
- limited line-up/waiting areas for trucks in the port area
- traffic arrangements in the port during arrivals and departures
- have limited opportunities for port-based industries to establish themselves in the immediate vicinity of the port due to the shape of the port area and the surrounding settlement
- seasonal peaks (holidays, summer) that cause capacity conflicts between cargo and passenger traffic (passenger vehicles receive priority for car deck capacity during holidays)
- space capacity and traffic arrangements of the port being tested during high season due to two ferry companies’ almost simultaneous arrivals and departures
- VR’s full train transport conditions and requirements have reduced the train traffic to nonexisting
- rigid, manual and overlapping reporting systems (Portnet, AREX) to authorities

Completed and planned development measures:

The major road connections leading to the ports of Turku and Naantali have undergone major upgrading measures in recent years. Additionally, plans to further improve road sections are progressing towards completion. These include, e.g., the improvement measures taken on the E18 and E8. The most significant road development project in Southwest Finland is the improvement of the Turku ring road. The Turku ring road constitutes a part of the E18, Finland’s most important international road connection stretching from Turku via Helsinki to Vaalimaa at the eastern border.

One of the most important improvement ring road locations and objects entail the E18 and E8 intersection in Raisio through which the traffic from the ports of both Naantali and Turku need to pass in order to access the Turku ring road. The development project will include replacement of the existing intersection with a three-level junction, traffic rearrangements in Raisio city centre, as well as a tunnel construction. The planned start is believed to be in 2021. A preliminary plan has also been prepared for the section between Naantali and Raisio as part of the Turku ring road development project.

Nevertheless, the aforementioned improvements of the E18 have not yet fully eliminated the traffic jams experienced mainly by the port´s road haulage customers. Much of this heavy traffic passes through the street network of grid plan areas, thus not only adversely affecting traffic safety and flows but also causing disturbing noise around residential areas.

Port of Naantali (part of the Northern Corridor)

The Port of Naantali is one of two TEN-T core transport network ports in Finland’s Southwestern corner. From a geographic perspective, it is only 15 kilometres away from the Port of Turku by road and even closer by sea or when seen from air. It connects to the same transport networks as the Port of Turku.

Port of Naantali. *Source: Suomen ilmakuva/Port of Naantali*

The Port of Naantali comprises three distinct port areas: Main Harbour, Luonnonmaa Harbour, and Fortum Industrial Harbour, covering altogether 24 hectares of land. The water areas of the Port of Naantali amount to 597 hectares. The Port of Naantali's fairway depth is 15.3 metres, which enables port calls of fully loaded 105 000 dwt:n (dead weight tonnes) oil tankers. The Main Harbour and Luonnonmaa Harbour belong to the municipal port company Port of Naantali Ltd., whereas the oil harbour functions independently as a separate, privately owned industrial port.

Table 18 Infrastructure of Port of Naantali

	Main harbour (Kantasatama)			Luonnonmaa		
		Length	Depth		Length	Depth
Quays	Dry bulk	400 m	13,0 m	Dry bulk	123 m	7,5 m
	Dry bulk/liquid bulk	150 m	8,0 m	Dry bulk	50 m	7,5 m
	Ro-ro	178 m	7,2 m		-	-
	2-sided ro-ro finger pier	175/145 m	9,0 m	-	-	-

The main harbour area functions as the base for Finnlines' Naantali-Kapellskär ferry traffic and Rederi Lillgaard's Naantali-Långnäs cargo traffic. The main harbour also has quays for dry bulk goods, such as coal shipments. The port has 16 berths totalling in length up to 1 320 meters.

The Port of Naantali's operations fulfil the transportation needs of passengers (travelling by car), general cargo (trucks and trailers) and surrounding industries (bulk cargoes). It is the third largest ro-ro port in Finland after Helsinki and Hanko.

The overall gross freight volume handled in the Port of Naantali in 2019 amounted to approximately 7.6 million tonnes[57] (this includes shipments to and from the Neste oil refinery), of which 4.5 million tonnes consisted of inward and 3.0 million of outward shipments. The inward dominance in cargo volumes is explained by large import shipments of crude oil that come predominantly from Primorsk in Russia. The largest single commodities consisted of crude oil, general cargo and oil products in descending order[58].

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[57] Port of Naantali (2020)

[58] Statistics Finland (2020)

Table 19 Port of Naantali general overview

PORT	**Naantali**	
Annual turnover	7.6 Mt	
Types of cargo	Liquid bulk, Dry bulk, General cargo	Ropax port. Fuels, refinery. Main hub for Nordic and Åland Island transports.
Trucks and trailers	117 000	
Number of cargo vessels/ferries served	1 345	
Ferry passengers	171 000	

The share of international transports of the port's total cargo volumes handled was 75% equalling 5.67 million tonnes, whereas the domestic traffic (mainly coastal distribution of fuels and transports to Åland Islands) was 25%, equalling close to 1.9 million tonnes.

Table 20 Port of Naantali gross freight volumes per commodity group

(1000 t)	FINLAND	*Naantali*
Total	**113 742**	**7 588**
Inwards	52 973	4 543
Outwards	60 769	3 047
Ro-Ro (trucks and trailers)	**15 382**	**1 930**
Inwards	7 317	923
Outwards	8 066	1 007
Dry bulk total	**30 192**	**763**
Liquid bulk total	**38 450**	**4 808**
Other general cargo total (excl. trucks and trailers)	**15 022**	**88**

General cargo is being transported mainly in trucks and trailers on ro-ro vessels in the Finland-Sweden and v.v. traffic. The Port of Naantali had a throughput of 104 400 trucks and 12 600 trailers in 2019[59]. The share of trailers equals approximately one tenth (11%) of all ro-ro units.

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[59] Statistics Finland (2020)

Table 21Breakdown of overall and ro-ro cargo flows of Port of Naantali

(1000 t)	**SWEDEN**	
From	FINLAND	Naantali
Total	**13 324**	**1 929**
Inward	7 238	917
Outward	6 085	1 012
Ro-Ro	**4 007**	**1 780**
Inward	1 866	874
Outward	2 142	907

The Port of Naantali has regular ro-ro liner and passenger traffic to Kapellskär (Sweden) operated by FinnLink's two daily departures with possible stopovers at the Port of Långnäs (Åland Islands). The journey time to Kapellskär takes between 8-9 hours, depending on the departure. The turnaround time of the vessels in both Naantali and Kapellskär is roughly 3-3.5 hours. The FinnLink fleet's average building year is 2004, equalling an average age of 16 years. The average passenger capacity is 470 pax; the average freight capacity is 3 600 lane metres.

The Port of Naantali also functions as a throughput port for both dangerous goods and oversized transports, whose transportation is not permitted or technically possible or that is prohibited through Stockholm's city centre, for example. Over half of Finland's unitised dangerous goods transports pass through the Port of Naantali. The alternative route to transport oversized goods to Sweden is by driving through Haparanda or to rely on multiphase reloading and shipment arrangements. Most of the service traffic from the mainland to Åland Islands Långnäs also passes through Naantali.

Bottlenecks, inefficiencies and special features:

- traffic jams in Raisio city centre and the E18/E8 interjunction
- Turku ring road discontinuity point at Kausela
- insufficient interjunction capacity on road 185 at the Perno and Ihala interjunctions
- discontinuity point in heavy traffic flow on national road 40 around Raisionlahti
- shortage of nearby parking/resting areas for trucks
- shortage of waiting areas for trucks in port area
- VR full train transport conditions and requirements
- limited ability to expand the port functions and areas

Completed and planned improvement measures:

Completed:

- dredging and deepening the main channel up to 15,3 m
- constructing the new ro-ro berth with double-stack adjustable ramps and mooring devices
- enlarging the adjoining area for trucks and trailers
- renovating the old bulk quays
- lengthening the ro-ro berth by 50 metres
- installing the waste water reception system
- improving the road connections and access to the port

Planned:

- rearrangement of the port waiting and check-in areas
- installation of an automooring system[60] to speed up ship maneuvering in the port, reduce the environmental impacts of vessel traffic, and improve occupational safety of personnel
- implementation of an onshore power supply for vessels

Regarding the port approach, the interchanges of Perno and Ihala on road 185 will undergo acute improvement measures. The traffic volume has increased significantly during the last couple of years, mainly because of transports to the Mayer shipyard located in Perno. The daily traffic volume rises to 11 600- 14 300 vehicles, of which 900 represent heavy traffic; hence, the interjunction capacity no longer matches the traffic volumes. The construction work was initiated in 2019 and will be completed in 2020[61].

As part of the E18 Turku ring road improvements, other measures on national road 40 will also be undertaken, such as the construction of four new intersections (Ruona, Temppelivuori, Krookila and Raisionkaari) built along the 9-kilometre long section between Naantali and Raisio. The ring road (national road) will be upgraded to a four-lane road from the east side of the Ruona interchange to downtown Raisio [62].

The main goals of the upgrading and construction measures include:

- improving the functionality of the E18 road as part of the TEN-T- core network
- eliminating discontinuity points in heavy traffic flow around Raisionlahti

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[60] Port of Turku (2019)
[61] Finnish Transport Infrastructure Agency (2020)
[62] Finnish Transport Infrastructure Agency (2020)

- ensuring an adequate level of transport services despite growing traffic volumes
- significantly reducing the number of accidents
- clarifying the structure of the ring road and parallel connections

5.1.3. Naantali/Turku-Vaalimaa

The overall length of the road connection E18 from Naantali/Turku via Helsinki to Vaalimaa is approximately 362/347 km.

The annual average daily traffic of heavy goods traffic on E18 ranges from approximately 500-8 040 vehicles (average 2 980, median 2 240), corresponding to a 9-22% share (average 11%, median 11%) of total traffic. The highest heavy goods vehicle counts are registered on Ring Road III around the Helsinki area and on the Turku ring road.

Table 22 Overview of transport services provided

Measure	Unit	Quantity / Description		Notes, data source
Freight transport modes available	km	Road	Naantali 361km/ Turku 347 km	Finnish Transport Infrastructure Agency, VR Group, Port of Naantali, Port of Turku, Finavia, City of Turku
		Rail	x[63]	
		Maritime	x	
		Air	x	
Multi-modal transport hubs	Port of Naantali	Transport modes: seaport–road - (rail[64])		Port of Naantali
	Port of Turku	Transport modes: seaport-road - (rail[65])		Port of Turku
	Turku airport	Transport modes: air-road (-sea port)		Finavia
	Helsinki-Vantaa airport	Transport modes: air-road		Finavia

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[63] Mainly passenger services
[64] No regular railway cargo services
[65] No regular railway cargo services

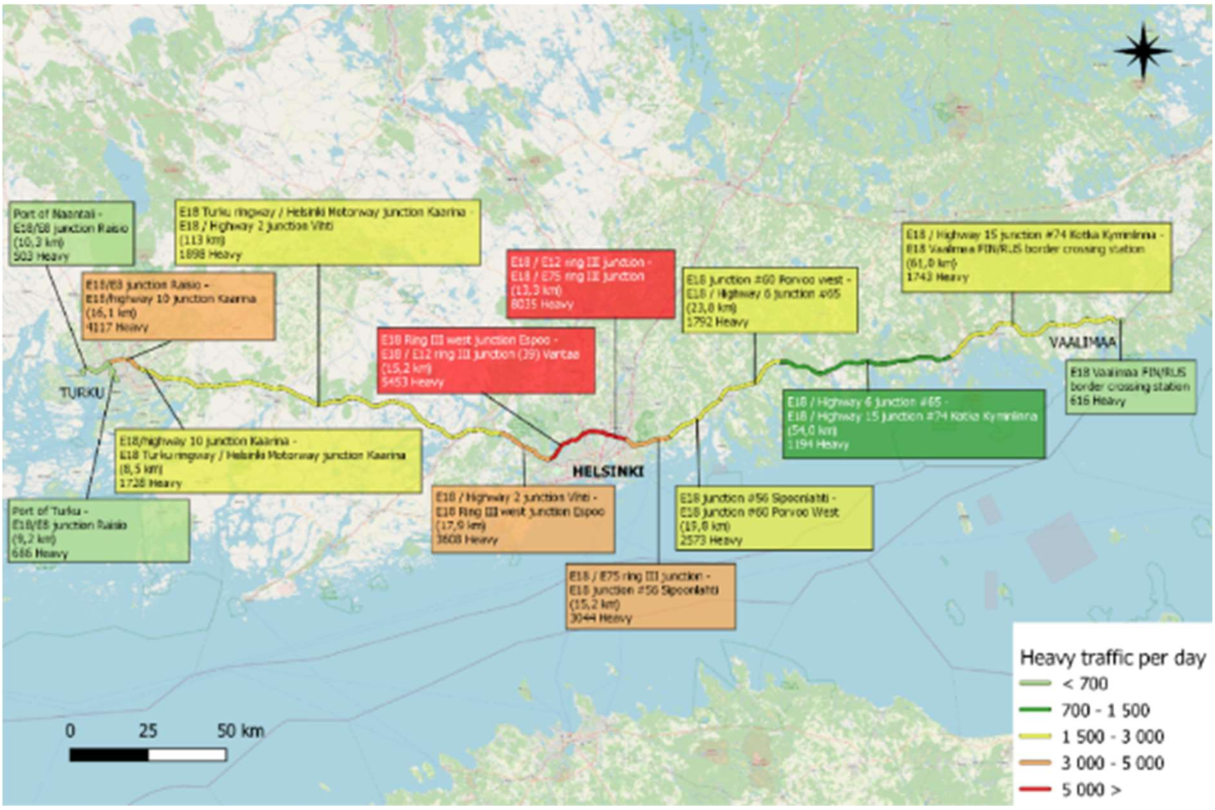

Figure 16 Annual average daily heavy load traffic on E18 (Finland)

5.2. The Middle Corridor

The Middle Corridor includes the following sections:

- Örebro-Stockholm/Kapellskär (inland transport)
- Stockholm-Tallinn (maritime transport, ports)
- Kapellskär- Paldiski (maritime transport, ports)
- Tallinn/Paldiski - Narva (inland transport)

5.2.1. Paldiski-Tallinn-Narva

The overall length of the road connection from Paldiski to Narva is 273 kilometres. It covers the E265 from Paldiski to Tallinn (Keila), Tallinn ring road (Keila and Nehatu) and the A1 from Tallinn (Nehatu) to Narva. The overall annual average daily traffic between Paldiski and Narva varies between 1 670 and 32 380 vehicles, average being 10 090 and median 8 310. The annual average daily traffic ranges from 290 to 4 010, average being 1 230 and median 830.

Table 23 Overview of transport services provided

Measure	Unit	Quantity / Description	Notes, data source
Freight transport modes available	km	Road 273 Rail 259 Maritime x Air x	Estonian Road Administration Estonian Railways Ltd Estonian Maritime Administration Port of Tallinn, Tallink Silja Line, Tallinn Transport Department, Põhja-Eesti Public Transport Centre
Multi-modal transport hubs	Paldiski North Port	Transport modes: seaport-rail-road	Paldiski North Port
	Port of Paldiski South	Transport modes: seaport-rail-road	Port of Tallinn
	Port of Tallinn (Old City Harbour)	Transport modes: seaport-rail-road[66]	Port of Tallinn
	Tallinn Airport	Transport modes: air-road	Tallinn airport

The annual average daily traffic of heavy goods traffic on the A8 from Paldiski to Keila range from 290-1 080 vehicles (average 630, median 620), corresponding to a 3-23% share (average 10%, median 8%) of the total traffic. The highest heavy goods vehicle counts were registered around Keila and close to the Port of Paldiski.

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[66] Kopli and Balti Jaam stations in the city centre

The annual average daily traffic of heavy goods vehicles on the Tallinn ring road vary between 710 and 4 010 vehicles (average 2 430, median 2 500) corresponding a 7-25% share (average 17%, median 18%) of the overall traffic. The highest and fairly even heavy goods vehicle counts were registered from 10 km after Keila.

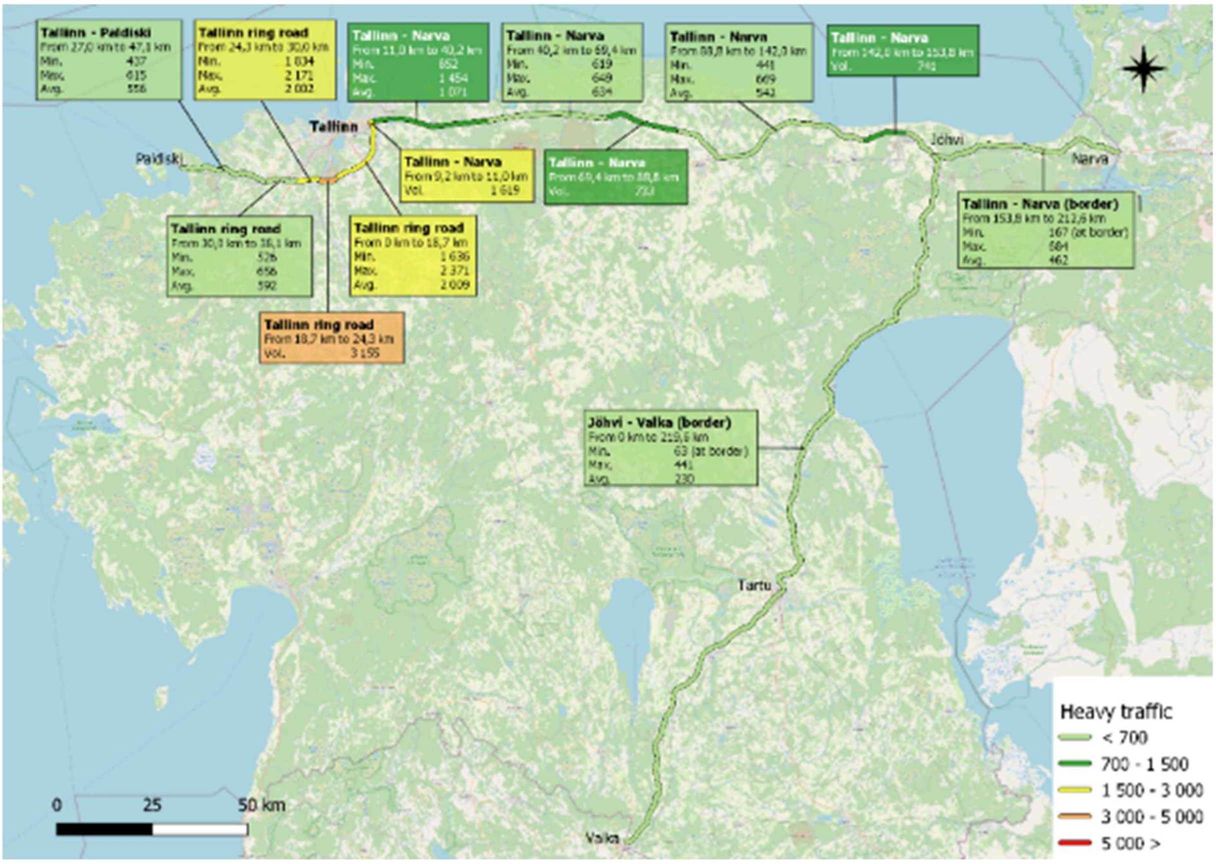

Figure 17 Annual average daily heavy load traffic along between Paldiski-Tallinn-Narva, in Estonia

The E20 from Tallinn to Narva has an annual average daily traffic count ranging from 290-2 790 heavy vehicles goods vehicles (average 990, median 820), accounting for a 8-17% share (average 12%, median 12%) of total traffic.

5.2.2. Ports of the Middle Corridor

The Middle Corridor ports include the ports of Kapellskär and Stockholm in Sweden (described earlier in section 5.1.2.) and the ports of Tallinn Old City Harbour and Paldiski South in Estonia.

Table 24 Ports and sea routes of the Middle Corridor

Corridor	Departure port	Arrival port	Travel time	Dist. (nm)	Operators
Middle	Stockholm (via Åland)	Tallinn	17 h	237	TallinkSilja
	Kapellskär	Paldiski South	9.5-11 h	156	TallinkSilja, DFDS Seaways

Port of Tallinn (part of the Middle Corridor)

The Port of Tallinn consists of four separate harbours, namely, Old City Harbour, Saaremaa Harbour, Muuga, and Paldiski South, the latter two being pure cargo harbours.

Table 25 Port of Tallinn general overview

PORT	**Port of Tallinn Paldiski South**	
Annual turnover	19.6 Mt	Consolidated statistics for all Port of Tallinn harbours
Types of cargo	Liquid bulk, General cargo, Dry bulk	
Trucks and trailers	n.a.	
Number of cargo vessels/ferries served	7 600 (of which1 600 pure cargo vessels)	
Passengers	10.6 million	Consolidated statistics for all Port of Tallinn harbours

The consolidated overall cargo turnover in 2019 for all harbours belonging to the Port of Tallinn rose to approximately 20 million tonnes, of which 12 million tonnes consisted of outward transports and 8 million of inward transports, which caused some imbalance in the trade. The Port of Tallinn's harbours handle all cargo types. The passenger and ferry/ro-ro traffic, which is generally well balanced, is concentrated in Old City harbour.

Table 26 Port of Tallinn consolidated freight volumes per commodity group

(1000 t)	ESTONIA	*Tallinn*
Total	**34 371**	**19 637**
Inwards	10 875	7 750
Outwards	23 496	11 887
Ro-Ro (trucks and trailers)	**4 622**	**4 622**
Inwards	2 392	2 392
Outwards	2 230	2 230
Dry bulk	**8 084**	**4 516**
Liquid bulk	**15 246**	**7 368**
Other General Cargo total (excl. trucks and trailers)	**3 713**	552

Tallinn Old City Harbour

The Old City Harbour belongs to the TEN-T core transport network ports. The Old City Harbour serves both passengers and ro-ro cargo. Old City Harbour is the biggest passenger harbour in Estonia with approximately 10 million yearly passengers served by two separate passenger terminals, Terminal A and Terminal D.

The harbour’s land territory covers 55 hectares, and the water area totals 94 hectares. The harbour has altogether 24 berths totalling almost 5 000 metres. The maximum depth is 11 metres.

Table 27 Infrastructure of Tallinn Old City Harbour

59° 27' N , 24° 46' E
Land areas: 56 ha
Water areas: 94 ha
Number of berths: 24
Total quay length: 4 986 m
Max. depth: 11 m
Max. length of a vessel: 340 m

Old City Harbour (Port of Tallinn). *Source: Port of Tallinn*

Tallinn offers regular liner services to Stockholm, Helsinki and St. Petersburg operated by five different ferry companies with approximately 5 500 annual ship arrivals.

The ferry route between Tallinn and Stockholm is operated daily by TallinkSilja. The average lane metre capacity of the car deck is 1 065 metres with a passenger capacity of 2 500 pax. The vessels' average building year is 2007.

Connections:

Road: E20 (to Rakvere and Narva), E265 (Paldiski)

Rail: In Tallinn City Centre (Kopli and Balti Jaam)

Bottlenecks, inefficiencies and special features:

- undesirable ro-ro heavy traffic in the old city area due to traffic congestion, noise and pollution disturbing the cultural values of a medieval town
- ferry traffic requiring much spatial room, thus encapsulating/isolating the port area to a "logistical area"
- undeveloped data exchange between stakeholders, transport modes and countries
- limited communication between stakeholders about development of optimal infrastructure solutions from a holistic city planning perspective
- limited, fractioned and missing long-term transport infrastructure planning - execution
- passenger train traffic using higher share of capacity than is available for sharing, therefore slowing freight train traffic[67]
- one-track railroad sections constitute bottlenecks
- Balti Jaam railways station
- safety of rest areas for truck drivers

Completed and planned development measures:

The Port of Tallinn is heavily investing in innovation and digital solutions, including the following:

- Smart Port – Traffic management in port and automatic check-in for passengers with vehicles
- Single Window and Logistics X-road – Digitising data exchange in the logistics chain
- BIM – Digital engineering of buildings and facilities
- FlexPort – port management program, based on the enterprise resource planning platform
- e-Noses – Electronic monitoring of air quality
- Onshore power supply for vessels

The Port of Tallinn has implemented "Smart Port" technologies and digital solutions to minimise the effects of road traffic pulses and congestions in the city traffic. These Smart Port solutions include, e.g., traffic management and automatic check-in for passengers with vehicles to improve the customer experience by shortened waiting times and check-in procedures.

The Port of Tallinn published its Masterplan 2030 covering the Old City Harbour area in 2017. The plan lays a foundation for long-term and detailed development planning of the port area. This plan aims to integrate the physical closed port area with other surrounding port city-related activities (semipublic

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[67] Estonian Railways –Annual Report 2019

area) and areas of urban development (public areas). The overall goal is to create a harmonised, integrated functional area combining commercial, socio-economic, spatial and environmental aspects to provide maximum added value to the seaside area[68].

Paldiski South (part of the Middle Corridor)

Paldiski South Harbour is the second biggest cargo port in Estonia after Muuga, located 45 km west of Tallinn. Despite its function, size, location and membership in the Port of Tallinn port family, it lacks TEN-T transport network status.

Paldiski South Harbour (Port of Tallinn) Source: Port of Tallinn

The harbour focuses on Estonian export and import cargo and transit cargo, such as new passenger cars going further to Russia. The Paldiski South Harbour territory covers 119 hectares of land with a water area of 147 hectares. The harbour has 10 berths totalling 1 850 metres. The maximum depth is 14.4 metres.

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[68] Port of Tallinn (2020)

The Paldiski South Harbour handles predominantly ro-ro cargo, scrap metal, timber, peat and oil products. It has become an important stop for international container lines and the Baltic Sea ro-ro shipping lines[69].

Table 28 Infrastructure of Paldiski South Harbour

59° 20' N , 24° 05' E
Land areas: 118,7 ha
Water areas: 147 ha
Number of quays: 10
Total quay length: 1 850 m
Max. depth: 14.5 m

DFDS Seaways offers one daily departure from the Port of Paldiski South to Kapellskär with a 1999- built vessel with a 2 300 lane metre and 327 pax passenger capacity. TallinkSilja operates on the same route also with a 1999-built cargo vessel with a 2087 lane metre capacity.

Connections:

Road: E 265 to Tallinn. E 265 follows the Estonian National Road 11 (Tallinn ring road) and part of Estonian National Road 8 (from Keila to Paldiski).

Railway: yes

Bottlenecks, inefficiencies and special features:

- The Paldiski South Harbour is the second largest cargo port in Estonia, but it is not part of the TEN-T core transport network, which hinders improvement to the connecting road and rail infrastructure (no CEF funding possibilities), thus limiting the harbour's potential.l
- There is limited capacity on the railway network from Paldiski to Tallinn; hence, cargo transports (including dangerous goods) from Paldiski are run through the old city centre during the nighttime, causing noise nuisance[70] among the residents.

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[69] Port of Tallinn (2020)
[70] RailFreight.com (2019)

- The capacity of the Paldiski-Ülemiste railway section is sufficient in relation to current cargo volumes, but in case of a significant increase in cargo turnover in the ports of Paldiski, it may become a potential bottleneck in the future.
- The Harbour lacks authority commitment to improve the transport infrastructure (the construction of a railroad bypass).
- Queue formation of trucks on the Estonian-Russian border.
- The safety of rest areas for truck drivers ought to be improved.

Completed and planned development measures:

The Paldiski South Harbour has long-term development opportunities and potential that includes the construction of a quay for handling over-sized goods such as wind park components, establishment of a 34 ha industrial park and development of a logistics centre.

The low road infrastructure capacity in the Port of Tallinn Old City Harbour was solved by the construction of the Reidi road in 2019.

5.3. The Southern Corridor

The Southern Corridor includes these sections:

- Oslo-Örebro-Stockholm (inland transport)
- Stockholm-Riga (maritime transport, ports)
- Ventspils-Riga (inland transport)
- Riga-via Valmiera-Valka- Narva-St. Petersburg (inland transport)
- Nynäshamn-Ventspils (maritime transport, ports)

The overall length of the road connections from Ventspils via Riga to the Estonian border is between 350-385 km depending on the route choice. It covers the following sections: the A10 from Ventspils to Riga and the A2 Riga- Sigulda - Igaunijas robeža (Veclaicene) or the A3 Inčukalns - Valmiera - Igaunijas robeža (Valka).

5.3.1. Ventspils-Riga

The annual average daily traffic of heavy goods traffic on the A10 road sections range from 350-4 370 (average 1 440, median 950), corresponding to an 8-18% share (average 13%, median 13%) of total traffic. The highest heavy goods vehicle counts are registered around the Riga metropolitan area.

Table 29 General overview of transport services provided

Measure	Unit	Quantity / Description	Notes, data source
Freight transport modes available	km	Road 186 Rail 189 Maritime x Air x	Latvian State Roads Latvian Railways Freeport of Ventspils Freeport of Riga Riga International Airport
Multi-modal transport hubs	Freeport of Ventspils	Transport modes: seaport-rail-road	
	Freeport of Riga	Transport modes: seaport-rail-road	
	Riga International Airport	Transport modes: air-road	

5.3.2. Riga-Valka

The road section A2 [Rīga - Sigulda - Igaunijas robeža (Veclaicene)] of Riga-Valka has an annual average daily traffic count ranging from 3 710-4 510 heavy goods vehicles (average 4 120, median 4 120), accounting for an 11-17% share (average 16%, median 16%) of total traffic.

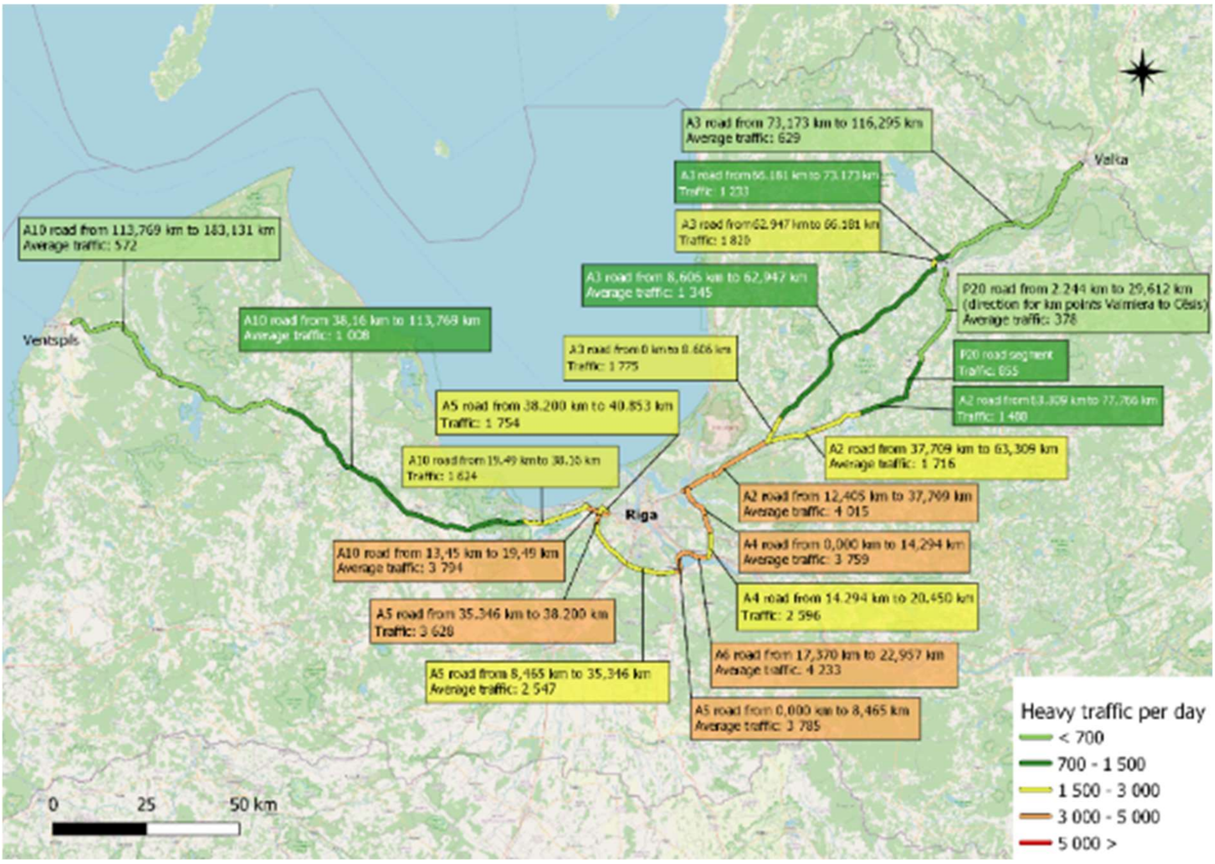

Figure 17 Annual average daily heavy load traffic between Ventspils-Riga-Valka, in Latvia

The road section A3 [Inčukalns - Valmiera - Igaunijas robeža (Valka)] of Riga-Valka has an annual average daily traffic count ranging from 610-1 870 heavy goods vehicles (average 1 260, median 1 260).

Table 30 General overview of transport services provided

Measure	Unit	Quantity / Description		Notes, data source
Freight transport modes available	*km*	Road	195.6	Latvian State Roads
		Rail	166	Latvian Railways
		Maritime	x	The Freeport of Riga
		Air	x	Riga International Airport
Multi-modal transport hubs	The Freeport of Riga	Transport modes: seaport-railroad		
	Riga International Airport	Transport modes: air-road		

5.3.3. Ports of the Southern Corridor

The Southern Corridor port include the ports of Stockholm (described earlier in section 5.1.2.) and Nynäshamn in Sweden and the Latvian ports of Riga and Ventspils.

Table 31 Ports and sea routes of the Southern Corridor

Corridor	Departure port	Arrival port	Travel time	Dist. (nm)	Operators
Southern	Nynäshamn	Ventspils	8.5-10 h	171	Stena Line
	Stockholm	Riga	17 h	276	TallinkSilja

Nynäshamn (Ports of Stockholm)

The Port of Nynäshamn is located 60 kilometres south of Stockholm. There are international connections from Nynäshamn to the central and southern Baltic Sea ports (Ventspils, Gdansk) and a domestic route to Gotland.

Port of Nynäshamn. *Source: Ports of Stockholm*

Table 32 Port of Nynäshamn general overview

PORT	**Nynäshamn**	Part of Ports of Stockholm, Construction of Port of Norvik
Annual turnover	1.88 Mt	
Types of cargo	General cargo	Ferry port (Latvia, Poland), refinery, LNG terminal
Trucks and trailers	132 910	
Number of cargo vessels served	1 909	
Ferry passengers	12.1 million (of which 1.1 million cruise passengers)	Consolidated statistics for all Ports of Stockholm harbours

The harbour serves both passenger and ro-ro traffic. The operational area covers the ports in the central and southern Baltic Sea area. The Port of Nynäshamn has three berths equalling a total quay length of 570 metres.

Table 33 Infrastructure of Port of Nynäshamn

58° 91' N , 17° 96' E
Land areas: n.a.
Water areas: n.a.
Number of berths: 3
Total length of quays: 570 m
Max. depth: 7-8 m

The Port of Nynäshamn handled 1.88 million tonnes of cargo in 2019. The number of trucks and trailers totalled 133 000 units, of which trailers represented a share of approximately one quarter. The total number of ship arrivals rose to 1909 calls.

Connections:

Road: access to national road 73 and E4.

Rail: Two weekly services

Completed and planned development measures:

The construction of the Port of Norvik (part of Ports of Stockholm) was completed in May 2020. The port project responds to the growing need to supply goods to the Stockholm region. The container port functions at Frihamnen in Stockholm have now been relocated to Norvikudden Nynäshamn, 50 km south of Stockholm and a few kilometres north of Nynäshamn. The harbour covers a land area of 44 hectares and serves both ro-ro and container traffic. The port is connected to the railway network, enabling train ferry services. Two weekly container transportation services are currently provided. The port has a fairway depth of 16.5 metres, a total quay length of 1 400 metres, and seven berths, of which 4-5 will be container berths. The port is capable of annually handling approximately 500 000 containers and 200 000-350 000 ro-ro units when at full capacity[71].

Port of Norvik (Ports of Stockholm). *Source: Ports of Stockholm*

A business park and a logistics centre are being built in association with the port. The total investments are estimated to reach SEK 1.7 billion. The total annual capacity of the port is 8.5 million tonnes.

The Freeport of Riga (part of the Southern Corridor)

The Freeport of Riga is part of the EU's TEN-T core transport network ports. The Freeport of Riga is situated on both banks of the River Daugava, covering 15 kilometres in length. Riga is Latvia's biggest port and the Baltic States' second biggest port with a cargo turnover that reached almost 31 million tonnes in 2019. The overall cargo transhipment capacity, however, amounts to 63 million tonnes annually.

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[71] Nicklas Ebersson at Forum för Nordiskt Järnvägssammarbete Webinar held 31.8.2020

Freeport of Riga. *Source: Freeport of Riga*

Table 34 Freeport of Riga general overview

PORT	**Freeport of Riga**
Annual turnover	32.8 Mt
Types of cargo	Dry bulk, General cargo, Liquid bulk
Trucks and trailers	77 434
Number of cargo vessels served	3 345
Ferry Passengers	868 700

Table 35 Infrastructure of the Freeport of Riga

56° 95' N, 24° 10' E
Land areas: 1962 ha
Water areas: 4 386 ha
Maximum vessel draught: 15 m
Total length of berths: 18 km

The outward transports in the Freeport of Riga clearly dominate, representing in excess of 80% of the total cargo turnover. Almost two thirds of the cargo handled in the Freeport of Riga consist of dry bulk, followed by other general cargo and liquid bulk. Up to 70% of the Freeport of Riga cargo turnover comprises transit cargo forwarded to or received from the Commonwealth of Independent States (CIS).

Table 36 Freeport of Riga gross weight volumes per commodity group

(1000 t)	LATVIA	*Riga*
Total	**57 249**	30 625
Inwards	8 456	5 104
Outwards	48 793	25 520
Ro-Ro (trucks and trailers)	**1 912**	141
Inwards	735	27
Outwards	1 178	114
Dry bulk total	**33 028**	20 103
Liquid bulk total	**14 545**	3 748
Other general cargo total (excl. trucks and trailers)	**3 869**	2 784

The Freeport of Riga had a throughput of 71 037 trucks and 6 397 trailers, the share of trailers representing approximately one tenth (8%) of all ro-ro units. The number of vessels accommodated in 2019 amounted to 3 489.

The Riga-Stockholm connection is operated once a day by TallinkSilja. Its journey time is approximately 17 hours. The average lane metre capacity of the car deck is 985 metres with a passenger capacity of 2 500 pax. The vessels' average building year is 1996.

Table 37 Breakdown of overall and ro-ro cargo flows of the Freeport of Riga

(1000 t)	**SWEDEN**	
From	LATVIA	Riga
Total	**4 983**	**2 261**
Inward	802	273
Outward	4 180	1 988
Ro-Ro	**1 440**	**141**
Inward	509	27
Outward	932	114

Connections:

Road: A2 Riga- Veclaicene, A3 Riga-Valka, A10 Riga-Ventspils

Rail: The Port of Riga is part of the East–West cargo transportation Corridor that is linked to the Trans-Siberian Railway. The Port of Riga can integrate with the 1 520 mm rail gauge transportation system used, e.g., in Russia and China.

Bottlenecks, inefficiencies and special features:

- The Freeport of Riga is located on both sides of the River Daugava; hence, trucks must drive around Riga city (1 hour) using the ring road to access the port area on the other side.
- The Riga ring road is currently a 1+1 lane road and slow at certain sections.
- Many of Riga's regional, local roads and city streets have not been developed to meet today's mobility and transport requirements.
- It is highly dependent on Russian and Belarusian transhipments.
- Russia increasingly directs cargo flows via its own ports.
- Energy shift –challenges exist to find alternative cargo flows to substitute for traditional fossil fuel shipments.
- The Freeport of Riga exhibits a notable export domination.

Completed or planned development measures:

The Freeport of Riga Authority will invest in extensive renovations of its land and water infrastructure in 2020, amounting to a total of EUR 14.6 million. The investments will be channelled to develop roads, bridges and overpasses, the reconstruction of the port's railway infrastructure, and reconstruction of berths and bank support structures[72].

Other projects affecting the rail, road and port freight flows, according to the "Riga Metropolitan Area Mobility Spatial Vision",[73] include the construction of an intermodal freight terminal in Salaspils (without passing through Riga City centre) as part of the Rail Baltica Project and a branch to the Riga airport. The planned implementation will occur during 2023-2026. The North Transport Corridor project is included in Riga's long-term project list, whose implementation and funding options are still open. The construction of the North Transport Corridor entails the construction of a 30-kilometre road section that will cross the Daugava River. The reconstruction of Vidzeme Highway A2 section is also identified as a major future road project in the Riga metropolitan area.

The Freeport of Ventspils (part of the Southern Corridor)

The Freeport of Ventspils belongs to the TEN-T core transport network ports. The Freeport of Ventspils is located in northwestern Latvia by the Baltic Sea. The port accommodates 57 piers with a total pier length of close to 11 000 metres.

Table 38 Infrastructure of the Freeport of Ventspils

57° 20,9' N, 21° 29,3' E
Land areas: 2 451 ha
Water areas: 243 ha
Main fairway:
Pier length: 11 km
No of piers: 57 pcs

The liquid bulk berths have a depth of 17.5 metres, whilst the depth in dry bulk berths and general cargo berths are 16 and 14.5 metres, respectively. The berths can accommodate vessels of 240-275 metres length.

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[72] Freeport of Riga (2020)
[73] Riga Planning Region (2019)

Freeport of Ventspils. *Source: Freeport of Ventspils*

The Freeport of Ventspils handled 19.6 million tonnes of cargo in 2019, of which 17 million tonnes consisted of outflow cargo and 2.6 million tonnes of inflow cargo, thereby representing a clear imbalance in transport directions.

Table 1 The Freeport of Ventspils general overview

PORT	**Freeport of Ventspils**
Annual turnover	19.6 Mt
Types of cargo	Liquid bulk, Dry bulk, General cargo
Trucks and trailers	84 600
Number of cargo vessels served	1 520 (604 Ventspils-Nynäshamn)
Ferry Passengers	232 400

The Freeport of Ventspils handles all cargo types,[74] i.e., liquid bulk, dry bulk and general cargo. Half of the cargo handled in Ventspils consists of liquid bulk, the majority of which fall under the category of oil and oil products.

Dry bulk commodities form the next biggest cargo type with approximately a 40% share, which mostly includes coal and coke. Outward liquid and dry bulk transports dominate the port's cargo turnover. Ro-ro traffic represents only a modest share of the total cargo volume. A dominance in outward transports is also observed here.

Table 39 Freeport of Ventspils gross freight volumes per commodity group

(1000 t)	**LATVIA**	***Ventspils***
Total	**57 249**	**19 599**
Inwards	8 456	2 598
Outwards	48 793	17 002
Ro-Ro (trucks and trailers)	**1 912**	**1 299**
Inwards	735	484
Outwards	1 178	817
Dry bulk	**33 028**	**7 438**
Liquid bulk	**14 545**	**10 231**
Other general cargo (excl. trucks and trailers)	**3 869**	**625**

Ventspils handled 84 620 trucks and trailers in Ventspils-Nynäshamn traffic and 232 400 passengers, of whom 71 800 were truck drivers in 2019. Ventspils had 1 520 ship arrivals altogether, of which 604 were port calls of Ventspils-Nynäshamn traffic.

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[74] Freeport of Ventspils (2020)

Table 40 Breakdown of overall and ro-ro cargo flows of the Freeport of Ventspils.

(1000 t)	SWEDEN	
From	LATVIA	*Ventspils*
Total	**4 983**	**1 929**
Inward	802	509
Outward	4 180	1 420
Ro-Ro	**1 440**	**1 299**
Inward	509	484
Outward	932	817

Connections:

Road: A10 Ventspils-Riga (E22)

Rail: Ventspils is on the East-West railway Corridor and is part of the Eurasian transport system. There are four daily services (2 in each direction) on the Ventspils-Riga section. The railway is single track and a nonelectrified connection. The types of cargo carried are liquid bulk (50%), dry bulk (38%) and general cargo (12%).

Bottlenecks, inefficiencies, special features:

- Highly dependent on Russian and Belarusian transhipments
- Russia increasingly directs cargo flows via own ports
- Energy shift – challenges exist to find alternative cargo flows to substitute traditional fossil fuel shipments
- Notable export domination

Completed and planned development measures:

The Freeport of Ventspils Authority is currently extending the area between the motor and rail bridges where two universal terminals have been built. Future plans also include expansion of the port area towards the sea. An area slightly over 100 ha is currently allocated for the development[75].

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[75] Freeport of Ventspils (2020)

6. Stakeholder questionnaire results

An online questionnaire survey was conducted during November and December in 2019. Each Baltic Loop partner identified and listed its national stakeholders representing both public and private actors who provide services within the transport infrastructure administration and planning and cargo and passenger transportation sectors. The questionnaire was drawn up so it could adapt to and cover all partner countries, corridor sections and transport modes. It gathers together the survey results on general level shapes, firstly, for an understanding of the preconditions for smooth transport and, secondly, for comprehension of the perceived transport bottlenecks and inefficiencies among the respondents.

The questionnaire survey was conducted to meet the following objectives:

- to evaluate the transportation services and operations on selected Corridors;
- to identify the main hindrances to smooth transport flows;
- to highlight areas where improvements are needed for more efficient traffic flows.

Örebro was established as the starting point for all three transport Corridors, with extensions to Oslo from Sweden and to St. Petersburg from Finland, Estonia and Latvia.

The total number of online survey responses was 93. Table 41 presents the distribution of responses received per partner country. Appendix II presents the questionnaire's results in more detail.

Table 41 Response distribution per partner country

Country	Responses
Finland	38
Sweden	21
Latvia	27
Estonia	7
Total	93

The multi-choice answers to the stakeholder online questionnaire were analysed quantitatively. For the quantitative analysis, each multi-choice response option was given a numerical coefficient between 0 to 1: 0 for not relevant, 0.25 for insignificant, 0.5 for relatively significant, and 1 for significant.A median value was calculated to measure stakeholder priorities for general comparison. The overall results were obtained using the following equation:

$$Final\ value = \frac{\sum Corresponding\ answer\ values}{Total\ number\ of\ answers} \qquad \text{Eq. 5-1}$$

For instance, if a question gathered answer options and distributions of significant altogether five (5) answers, relatively important two (2) answers, insignificant one (1) answer, and not relevant three (3) answers, the final result would be 0.57 (see Eq. 2-2).

$$\frac{5 * 1 + 2 * 0.5 + 0.25 * 1 + 3 * 0}{5 + 2 + 1 + 3} = 0.57 \qquad \textit{Eq. 5-2}$$

A qualitative analysis was furthermore carried out based on open answer options in the questionnaire and in interviews carried out with different stakeholders.

6.1. Characteristics of respondents

The online questionnaire gathered 93 responses altogether, of which 27 (29%) were received from Latvia, 38 (41%) from Finland, 21 (23%) from Sweden and 7 (8%) from Estonia. The respondents represented public institutions, non-governmental organisations (NGO) and private companies operating in the transport sector.

The majority (67%) of Latvian respondents represented public sector actors, whilst private sector and NGOs accounted for 28% and 4%, respectively. The Latvian respondents mainly operate on roads and railway. Public entities at the international level cover both passenger and freight transport services. Public entities at the local, municipal and regional levels are responsible for passenger transport and infrastructure. National public entities represent mainly transport infrastructure managers.

The Finnish respondents, however, were dominated by the private sector actors (87%), whereas the public sector and NGOs respondents accounted for 10% and 3% each. The absolute majority of the Finnish respondents represented road haulage companies operating both on national and international levels.

The Swedish respondents represented mostly public entities (76%) followed by private sector actors (24%). The targeted respondents in the Mälardal region mainly (76%) represented organisations operating on regional and national levels providing public transportation. Half (50%) of the private companies operate on the international level.

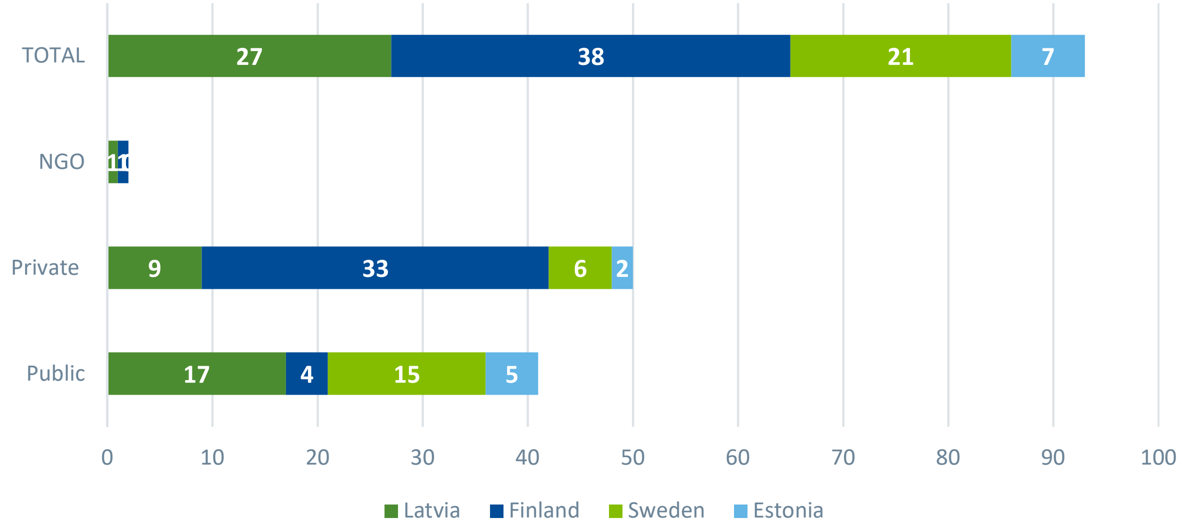


Figure 17 Distribution of respondents by country and legal form of organisation

In the Estonian respondents' case, the majority (71%) represented the public sector entities responsible for transport infrastructure and freight transport. The majority of the respondents operate on national and international levels.

The spread of the transport services provided (freight transport, passenger transport and transport infrastructure) among the respondents showed a relatively even distribution in Latvia and Sweden. Infrastructure actors dominated in both cases, even though the share of freight transport actors in Sweden was equally large.

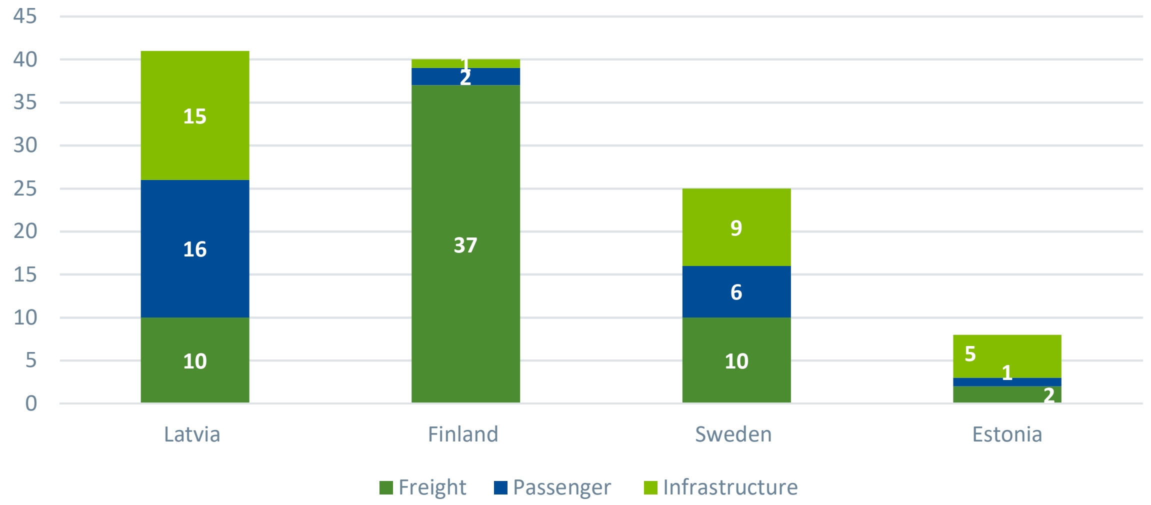


Figure 18 Transport services provided by respondents

Almost all respondents in Finland were providing freight transport services. The total number of replies here exceeds the total number of respondents, as one respondent can be involved in or offer services for both passenger and cargo transportation. The Estonian respondents were mainly involved with public transport infrastructure services. Figure 20 illustrates a more detailed division of operational subsector representation among all respondents.

Stakeholder responses from all transport subsectors were received, with road transportation covering over half, followed by rail, maritime and air transportation, and urban passenger transportation. Many respondents reported operating in more than one subcategory. Road haulage companies, for instance, mainly roll on roads but frequently also use various maritime routes and ferry services when transporting freight in international trade. Likewise, transport infrastructure respondents regularly deal with questions covering all transport modes in the transport systems.

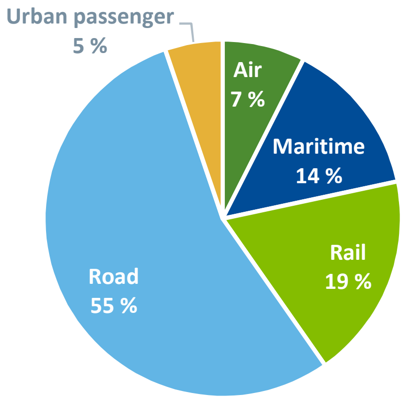


Figure 19 Operated transport sub-sector

6.2. Occurrence of delays

Two thirds of all Baltic Loop questionnaire respondents have experienced delays regularly or sometimes. Close to one third, conversely, have rarely encountered delays and 2% never have.

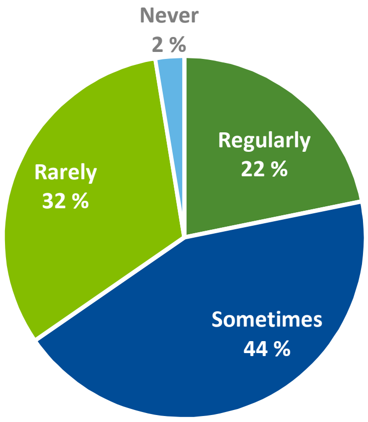


Figure 20 Frequency of experienced delays

The proportions vary somewhat, however, when examined on national levels. Only 40% of the Latvian respondents have experienced delays regularly or sometimes, whereas the share is much bigger in both Finland with a 70% share and Sweden with an 88% share. In Estonia 50% of the respondents have encountered delays regularly or sometimes.

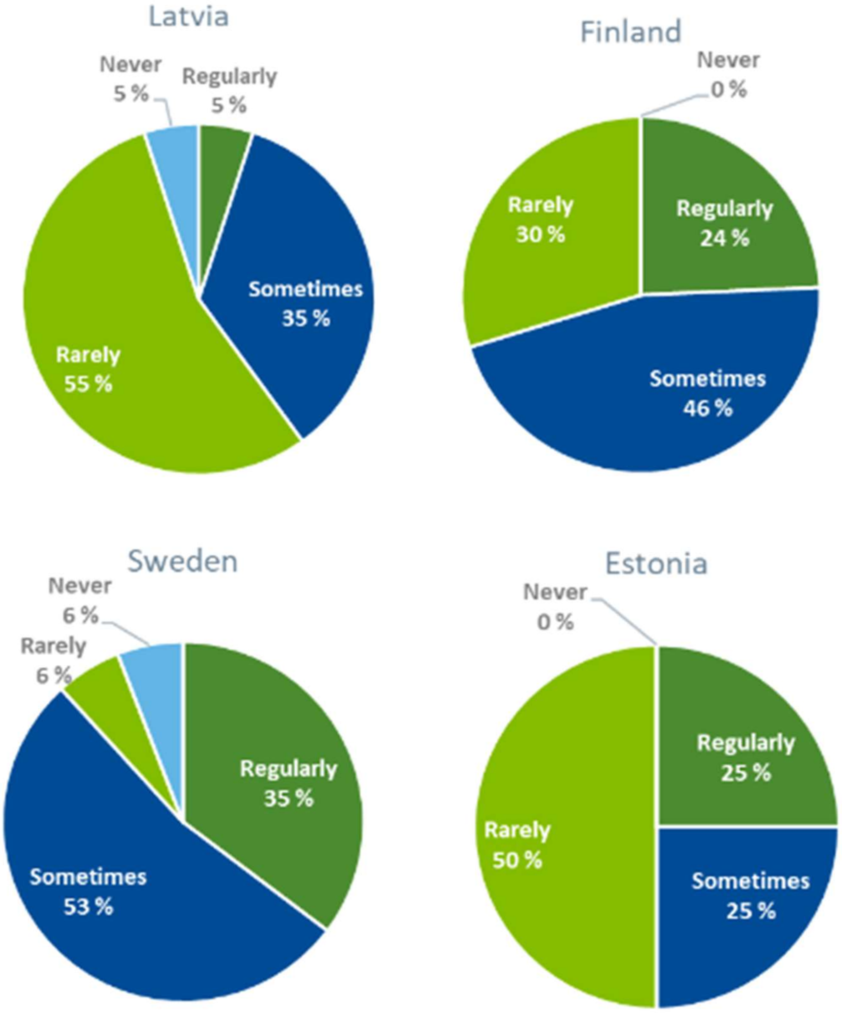


Figure 21 Frequency of experienced delays per country

6.3. Causes of delay

Quantitative analysis

Based on the questionnaire, the major causes for delays in the traffic systems are related to weather conditions, capacity issues such as insufficient capacity (e.g., traffic network and fairway dimensions, road load limits), concentration of traffic on certain routes (future traffic growth), constrained accessibility and conflicting interests between cargo and passenger transport.

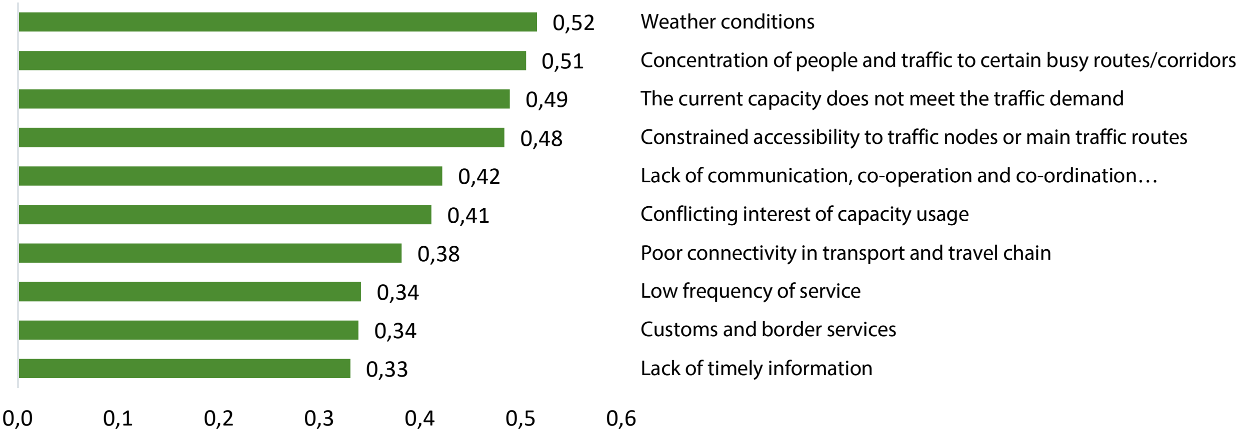


Figure 22 Major causes of delays

Weather conditions ranked high in Finland and Latvia, whereas the opposite could be observed in Sweden and Estonia. Lack of communication, cooperation and coordination between public authorities and other stakeholders also ranked high, particularly in Finland and Estonia, but were also relatively high in Latvia. However, this factor was ranked among the three least affecting factors in Sweden. The main causes of delays in Sweden were clearly related to capacity issues. Customs and border services was identified as the number one cause of delays in Estonia. Appendix II presents the national level priorities and results individually and in more detail.

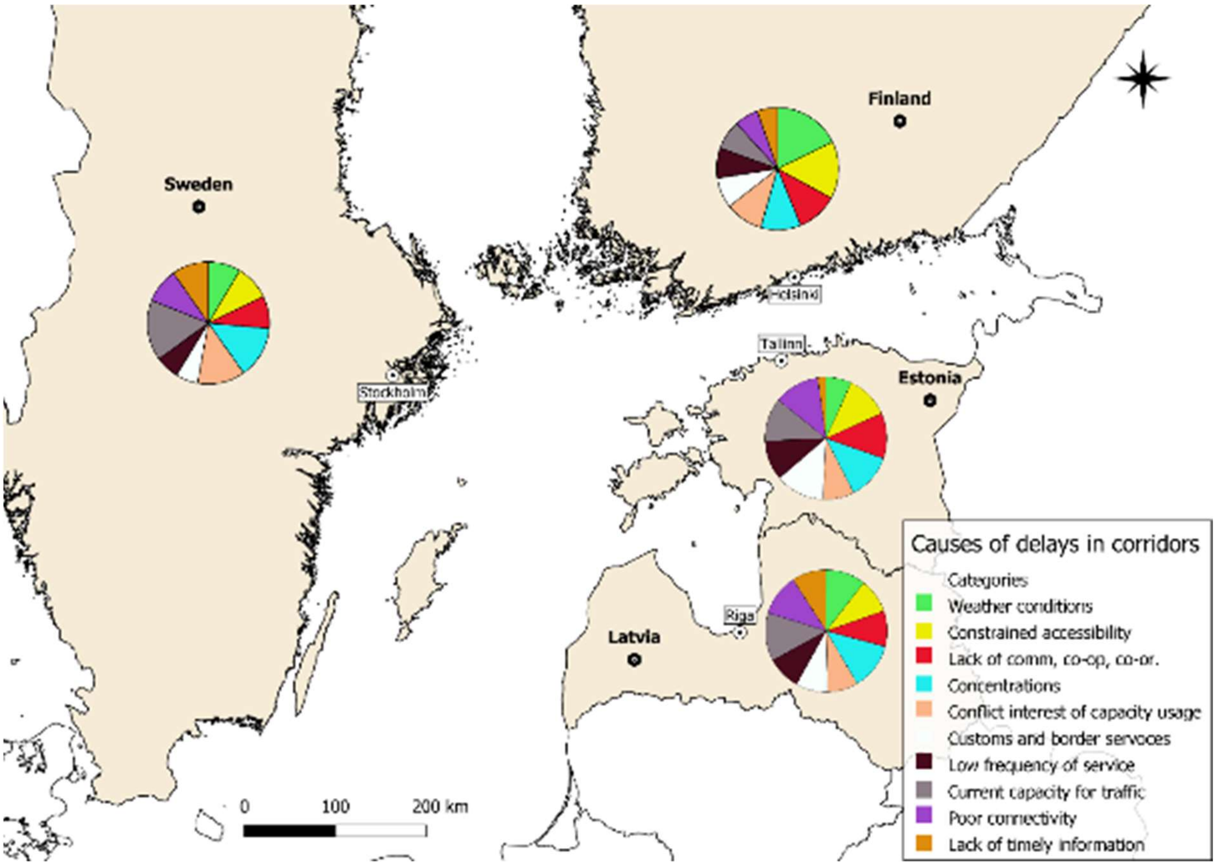


Figure 23 Breakdown of delay causes per country

Qualitative analysis

Delays in Latvia (Southern Corridor) are reported on the national road sections leading from Riga to Baltezers, Tukums and on the Riga ring road. Delays on the road connection to Minsk (Belorussia) were also reported. From a maritime perspective, waiting times in the ports on the Ventspils-Nynäshamn route were mentioned as a transport flow inefficiency. Other reported reasons iare the following:

- technical condition of vehicles
- increasing intensity of road transport as the number of inhabitants and entrepreneurs travelling to and from Riga city increases.
- insufficient funding for the development of the national road network

- nonexisting barriers for wildlife cause safety issues such as collisions

Overall, there are no indications about regular delays for freight transport services on the Riga-Ventspils or the Riga-Valmiera-Valka sections of the Southern Corridor. Respondents did not identify any specific section of the Southern Corridor with notable delay problems. This indicates that the transport infrastructure capacity in the section is generally sufficient, and only some local improvements might be needed. The current capacity of the transport system may not meet the future traffic demand, however.

Delays in Sweden (Northern Corridor) are predominantly encountered on the E18 on the Oslo – Stockholm axis. Particular points of delays included Karlstad (Värmland) and Västerås. National highway 50 also constitutes a problem when reaching Örebro from the north. Delays in rail traffic close to Örebro were also identified. Road maintenance and construction work were listed as factors causing occasionally serious delays along road sections in the southern and western parts of Sweden, i.e., regions with high international transport flows.

The main causes for delays in Finland (Northern Corridor) were experienced on the ring roads around Turku and Helsinki (Ring Road III) due to congested roads, especially during rush hours. Waiting times in the ports prior to ship departures between Naantali and Kapellskär and Turku and Stockholm were considered causes of delays, as well as an insufficient number and frequency of cargo lines between Finland and Sweden. Increasing road traffic with consequent traffic jams in the Helsinki area and the inadequate condition of roads and insufficient winter maintenance were also considered major causes of delay.

The road connection from Tallinn to St. Petersburg in Estonia (Middle Corridor) was identified as a connection causing not only delays but also queue formations of trucks in Narva at the Estonian-Russian border. The cross-border transition has been improved by implementing an electronic queue management system and constructing waiting areas on the Estonian side. The low road infrastructure capacity in the Port of Tallinn Old City Harbour was solved by constructing the Reidi road in 2019. The separation of passenger flows, i.e., relocation of freight traffic (trucks) from the city centre, is not realisable due to the ferry operators' business models that combine ro-ro cargo and passenger transportation. The capacity of the Paldiski-Ülemiste railway is recognised as a potential future bottleneck if cargo volumes from the Port of Paldiski increase significantly. The railway cargo transports occur during nighttime, which causes unwanted noise pollution that disturbs the citizens.

6.4. Conditions for smooth transport flows

Quantitative analysis

Traffic safety, the physical condition of the transport infrastructure being used, adequate infrastructure capacity and good accessibility were considered the most important criteria by all respondents for enabling smooth transport flows. These criteria function as prerequisites for operational efficiency and service speed, which also ranked high.

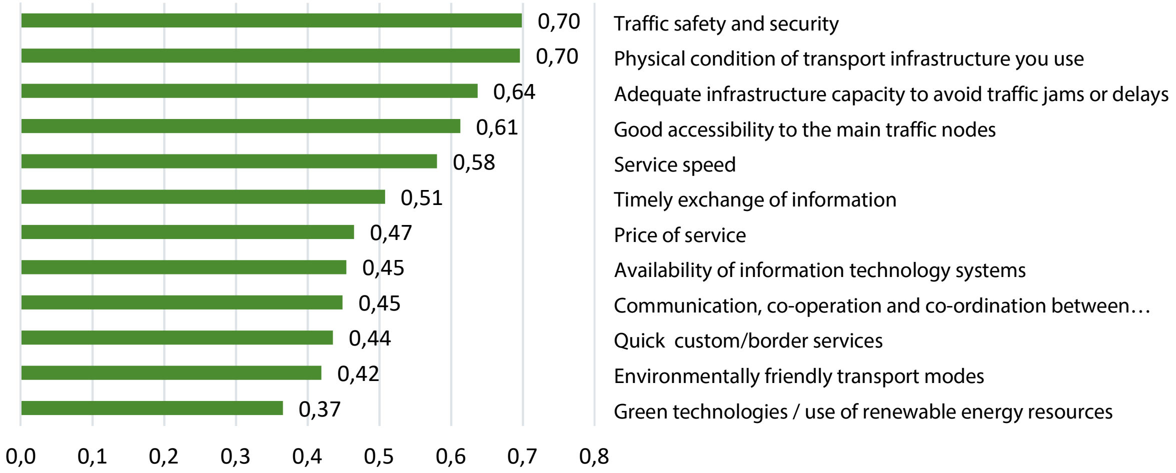


Figure 24 Conditions for smooth transport flows

Traffic safety and security was recognised either as the first or second priority enabling smooth traffic flows on the national level. The physical condition of the transport infrastructure being used and adequate infrastructure capacity were ranked among the Top 3 priorities in Latvia, Finland and Sweden. Despite some national variations, environmental aspects such as green technologies, use of renewable energy resources and environmentally friendly transport modes were ranked fairly low among the three aforementioned countries. A possible explanation for this phenomenon could be that many road haulage companies, for instance, are small in size and show small margins; hence, environmental aspects and investments in greener solutions may not be of top priority. In Estonia, conversely, the importance of greener values can be observed from the Top 1 ranking of environmentally friendly transport modes. A surprising contradiction was that quick custom and border control was not highly prioritised as an enabling or prerequisite criterion for smooth transport flows; in Estonia' s case, especially, it was ranked as the most significant cause of experienced delays. Appendix II presents the national level priorities and results individually and in more detail.

Qualitative analysis

Among the free answers from Finland, information on which routes the high capacity transport trucks can take was a sought-after service for road haulage companies. Higher vessel cargo capacities were thought to allow more trucks to be transported at a desired departure, rather than having to wait for the next departures in the ports.

6.5. Hindrances of transport infrastructure development

Quantitative analysis

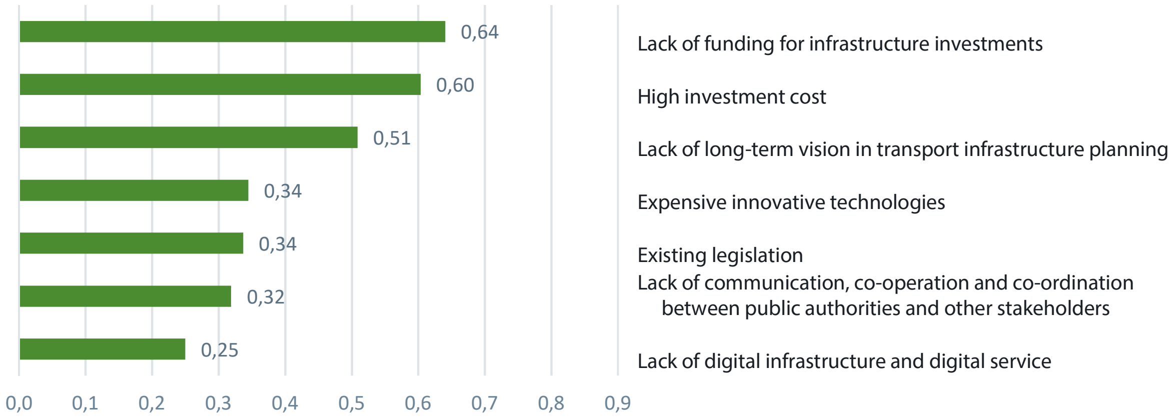


Figure 25 Hindrances of transport infrastructure development

Lack of funding and high investment costs were coupled by the respondents as the main hindrances to transport infrastructure development. The lack of long-term infrastructure planning and existing legislation on a political and regulative level were also grouped as significant development hindrances.

On an individual country level, Latvian respondents listed the existing legislation and the lack of funding for infrastructure investments as equally high hindrances. Lack of digital infrastructure was considered the least hindrance to infrastructure development, although this hindrance was ranked as the third most important hindrance in Latvia.

Of the respondent countries, only Sweden has so far undertaken a 12-year plan for transport infrastructure development, thus enabling more holistic, long-term planning. A corresponding scheme is in the planning process in Finland.

Qualitative analysis

Among the free answers from Latvia was this suggestion that the inland road connections (Riga-Malmiera-Valka/Ventspils-Riga-Minsk) be converted from dual carriageways into two-lane roads. Border control issues, such as the states' failure to agree on the location of the new Narva border crossing station (currently in the city centre) and insufficient staffing at the border controls, were also regarded as hindrances to transport infrastructure development. Additionally, nature reserve areas were considered to affect the development of transport infrastructure on some level. Competition between transport modes for public funding was also mentioned among the answers.

Among the free answers from Finland, the lack of four-lane sections on the Turku ring road was considered a hindrance and mentioned often. The road infrastructure development plans are not thought to consider enough the needs and requirements (such as the actual space needs) that the heavy traffic sets on the infrastructure. Appendix II presents the national level priorities and results individually and in more detail.

6.6. Potential solutions

Quantitative analysis

Potential solutions for improving traffic flows in the international transport corridors were directly in line with the assessed major causes of delays described under the earlier survey result section, "Experienced delays". Increased infrastructure capacity, improved accessibility to logistical terminals and main traffic routes, as well as improved infrastructure capacity and traffic safety, were regarded as one of the most potential solutions to improve traffic flows. Increased use of IT systems, timely exchange of information and digitalisation ranked as an entity above the average, providing a potential solution for improved transport flows in international transport corridors.

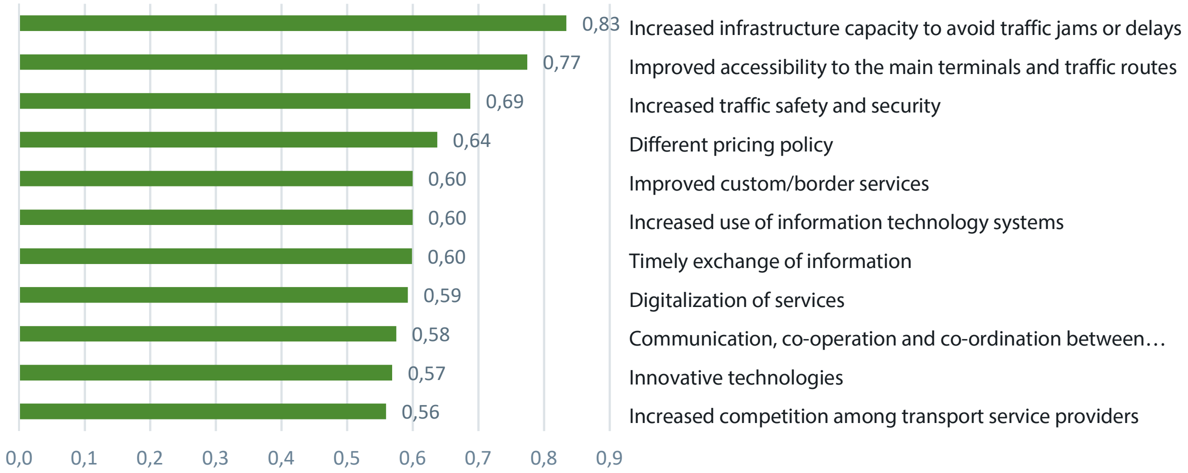


Figure 26 Potential solutions improving traffic flows in international transport corridors

Qualitative analysis

Among the Latvian free answers, upgrading the road parameters, e.g., the carrying capacity and wider trade areas, were suggested to improve the traffic flows. The availability of preannounced information on routes where long trucks drive (inland transport Helsinki-St. Petersburg) was mentioned as an improvement solution in Finland. Appendix II presents the national level priorities and results individually and in more detail.

7. Maritime stakeholder interview results

Cargo-flow bottlenecks and hindrances related to ports were mainly gathered through personal interviews conducted with port authorities, shipping companies and regional/city planning administrations and by holding workshops, seminars and webinars.

With regard to overall maritime infrastructure capacity, ports seldom constitute themselves major bottlenecks that take the shape of limited cargo handling capacity or fairway limitations. Generally speaking, the situation is quite the opposite. Ports adjust well in most cases to changing customer needs, e.g., growing ship sizes, to ensure customer and business retention in a highly competitive market. However, seasonal variations in demand between ferry customers, i.e., both passengers and freight, may coincide and conflict. Priority is often given in such situations to passenger traffic with its accompanying vehicles, thus limiting the available car deck capacity of freight transporting trucks.

Shrinking port land areas can constitute an emerging concern due to urban expansion and construction of residential areas. Hence, many ferry/ro-ro ports have started to introduce smart traffic management systems to overcome the problem of insufficient truck line-up areas, thus ensuring efficient traffic flows of vehicles within the port. Traffic management systems are an example of smart port solutions that have gradually been implemented in ports. Data from various actors in the shipping ecosystem (shipping companies, port authorities, freight forwarders, operators, etc.) are integrated to enable, for example, the recognition and verification of given booking data (plate number recognition, verification of loads carried and vehicle measures), automation of check-in procedures and guidance to the correct waiting lane. These functions drastically reduce the time spent in ports prior to ship departure. Furthermore, ports have little desire to function as truck parking lots and waiting areas but would rather see the port area being used efficiently and vehicles drive directly onboard without stops, enabled by a slot system.

The loading and unloading of dry bulk ships may be slowed down in mixed or dry bulk ports by insufficient or outdated port technology such as cranes and conveyors or by a lack of weatherproofing. The loading/unloading procedures of dry bulk cargo are highly dependent on weather conditions to avoid causing damage such as corrosion, contamination or water damage to goods.

The bottlenecks connecting land infrastructure affect the cargo flows and transport times of trucks to and from ports. Speed variations, rush hour traffic, discontinuation points in road transport infrastructure capacity, for instance, cause congestion and traffic jams, thus delaying transport times and, ultimately, the overall efficiency and business performance of the road haulage companies. Traffic safety is further impaired by traffic discontinuation points and weakened traffic infrastructure conditions and maintenance. The number, quality and safety of rest areas for truck drivers along the main road arteries constitute a challenge in some places.

Mandatory documentation and reporting procedures to authorities vary among the ports, from more or less manual inputs to digital/electronic integrated, single window systems. Notification and clearance processes to authorities can be a complicated and time-consuming process. Many procedures still require parallel and repetitive functions over different information channels, because the information systems used by relevant stakeholders are not interoperable. This calls for digital platform and data format harmonisation.

Many inefficiencies can be pointed out, especially with regard to dry bulk transportation, from a supply chain and environmental perspective. These include, for instance, the lack of shipment coordination of several customers' batches, resulting in partially loaded vessels or ballast journeys. This, in turn, translates to unnecessary emissions, which is not in line with shippers' growing requirement for environmentally sustainable solutions and responsible goods carriers.

The benefits that digitalisation can generally bring to port operations is receiving growing attention, and the implementation of various solutions is starting to gain speed. The preconditions and degree of digitalisation, however, vary between ports and countries. The choice of the digital solutions implemented depends on the type of port in question and its individual core functions and needs. Many ports find it challenging to discern which digital solutions are the most suitable and how to keep up with the system maintenance and lifecycle assessment in a fast-evolving IT environment. Staff training is also regarded as a time-consuming effort.

The development and execution of transport systems is often considered short-sighted from a national policy point of view; hence, it lacks a long-term vision and strategy. Lack of dialog and cooperation between stakeholders (transport authorities and regional planning authorities, other public and private stakeholders) to plan and implement a holistic and well functioning co-existence and transport infrastructure is regarded as impairing the planning of a well-functioning and unhindered transport system. National shipping regulations also need harmonising to provide equal business opportunities, regardless of the national flag.

8. Conclusion

This report has focused on cargo flows and hindrances mainly related to ro-ro sea transportation and ports along the three Baltic Loop Corridors running in the west-east direction.

The three Baltic Loop corridors (Northern, Middle and Southern) all have their starting point in Örebro. Örebro County lies in the middle of Sweden and forms a part of the Stockholm-Mälar region, located between the metropolitan regions of Stockholm and Oslo.

Shipping and ports form central links in the logistics and transport chains and function as important transport nodes in the transport corridors, whose cargo flows cannot be viewed in isolation. Shipping and cargo flows are impacted to a high degree by change factors such as intensifying environmental regulation, demographic development, geopolitical settings, global trade and technological development. As evidenced during 2020, unexpected trade shocks such as a global pandemic can also severely disrupt the existing trade settings.

Ports are affected to a high degree by the future development of land-based transport volumes, transport capacity and the planning and execution of transport infrastructure projects on international, national and regional levels.

However, when shipping and port operations are viewed from an intrinsic efficiency perspective, much work is still needed to minimise the number of inefficiencies, such as unoptimised port calls, long waiting and dwelling times due to uncoordinated operations and disintegrated data management, especially regarding the more irregular dry bulk shipments. Although the ferry/ro-ro schedules are regular and punctual, the efficiency and speed of port traffic flows and loading/unloading procedures can be further shortened and streamlined through information integration, aided by digital tools.

The relationship and dynamics between the ports and the cities has changed to some extent over time, and many ports or part of their functions, especially those handling containers, project cargo and bulk cargo, have been relocated from the hub cities within metropolitan areas in response to urbanisation and city expansion.

A parallel and alternative joint development path has been occurring simultaneously. Ports, residential, business and recreational areas are seeing an increasing functional and structural integration to eliminate conflicting interests related to land use or other urban challenges. Ferry/ro-ro ports' shrinking port areas and ship arrival/departure-generated traffic pulses typically constrain the inner city road network of hub cities, especially as the ship schedules often coincide with the city's rush hour traffic. This calls for better and more integrated traffic management systems and coordination inside the port and between the port and city.

Longer commuting distances and growing freight transport cause a growing concentration of traffic on certain routes leading to/from metropoles. This, in turn, may cause capacity conflicts between passenger and cargo transportation, congestion, delays and safety risks. Many of the Baltic Loop metropolitan areas are augmenting and improving their ring roads capacities or even seeing totally new ring roads being constructed to alleviate severe capacity issues.

A poor transport connectivity chain may be a significant hindrance to freight transport services for those using multimodal transport modes. The national governments should support and commit themselves more strongly to the EU ambition to capitalise on inland waterways and railway transportation as environmentally friendlier alternatives to road transportation. Many ports have an existing railway infrastructure, but the low or nonexisting utilisation levels have meant that the infrastructure is not receiving government funding for maintenance in many cases, whereby the infrastructures have progressively deteriorated. Hence, an undeniable mismatch and status quo situation prevails between the set EU goals and the national measures taken.

Ports' geographic locations, distance and capacity to connecting land infrastructures and the opening of new transport routes influence where transport flows are directed and channelled. The transport time, flexibility and frequency also play a crucial role for cargo owners when choosing a transport alternative. Sea transportation can generally be made more attractive to cargo owners by ensuring that sea freight is a cost-competitive alternative to other transport modes. Cost competitiveness can be pursued through route optimisation, higher loading rates and cargo coordination.

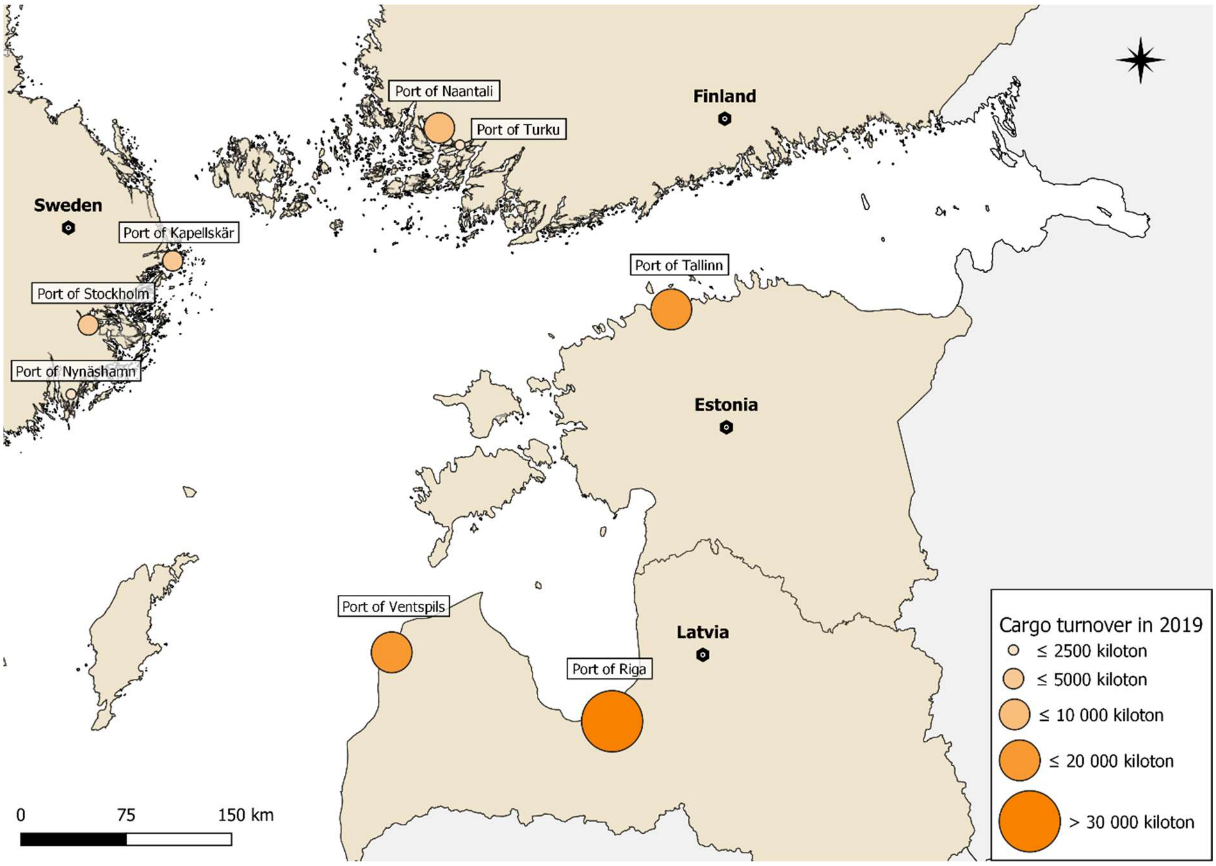
Freight transportation is changing with new trade patterns and integration of markets, regions and countries. The development has so far moved towards more efficient transport arrangements through increased capacity in both infrastructure and load carriers, increased cargo unit and infrastructure robustness to stand up well in international competition. Reliability of just-in-time supply chain deliveries has also formed the characteristics and development of freight transportation. At the same time, traffic safety requirements are high and reduced climate impact is a requirement, which challenges all sectors and industries to shift towards fossil-free systems. Consequently, the freight structure of sea transportation and dry bulk ports, in particular, will change due to the decreasing use of coal, for instance. At the same time, an opportunity for compensating fuels may arise.

Digitalisation is the key to improving port functions, processes and data management of the entire port community and has a role as an enabler in reaching environmental targets. Today, ports still constitute a discontinuation point in real-time supply chains´ information exchange and transparency. Data collaboration should extend beyond the port boundaries to cover all relevant private and public actors and bodies involved in various processes within the supply chain from the factory door to the end receiver. This integration should cover all transport modes and extend over country borders within the entire EU to begin with. Further efforts are needed to unlock the full potential of the opportunities offered by digital technologies.

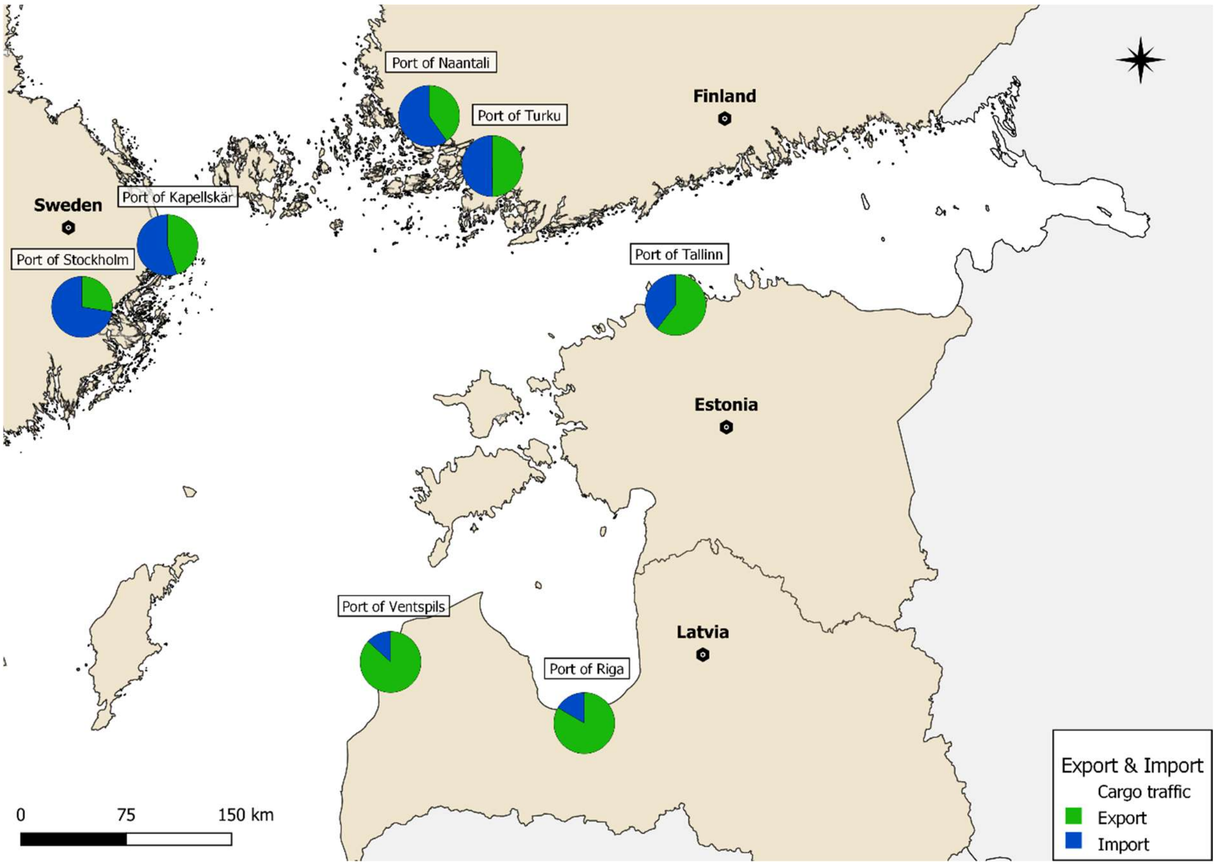
The planning and implementation of well-functioning traffic/transport systems is a complex and multilayered process covering many measures and elimination of transport hindrances and bottlenecks. It affects many actors and sectors (users, planners, authorities and administrations) of the society on all levels. Thus, the process needs to involve and encourage all stakeholders, to a greater extent, to develop more open and transparent communication, better cooperation and a stronger commitment to establish a coordinated, long-term vision and holistic approach to transport system planning.

APPENDIX I: Visualisation of Baltic Loop port goods volumes

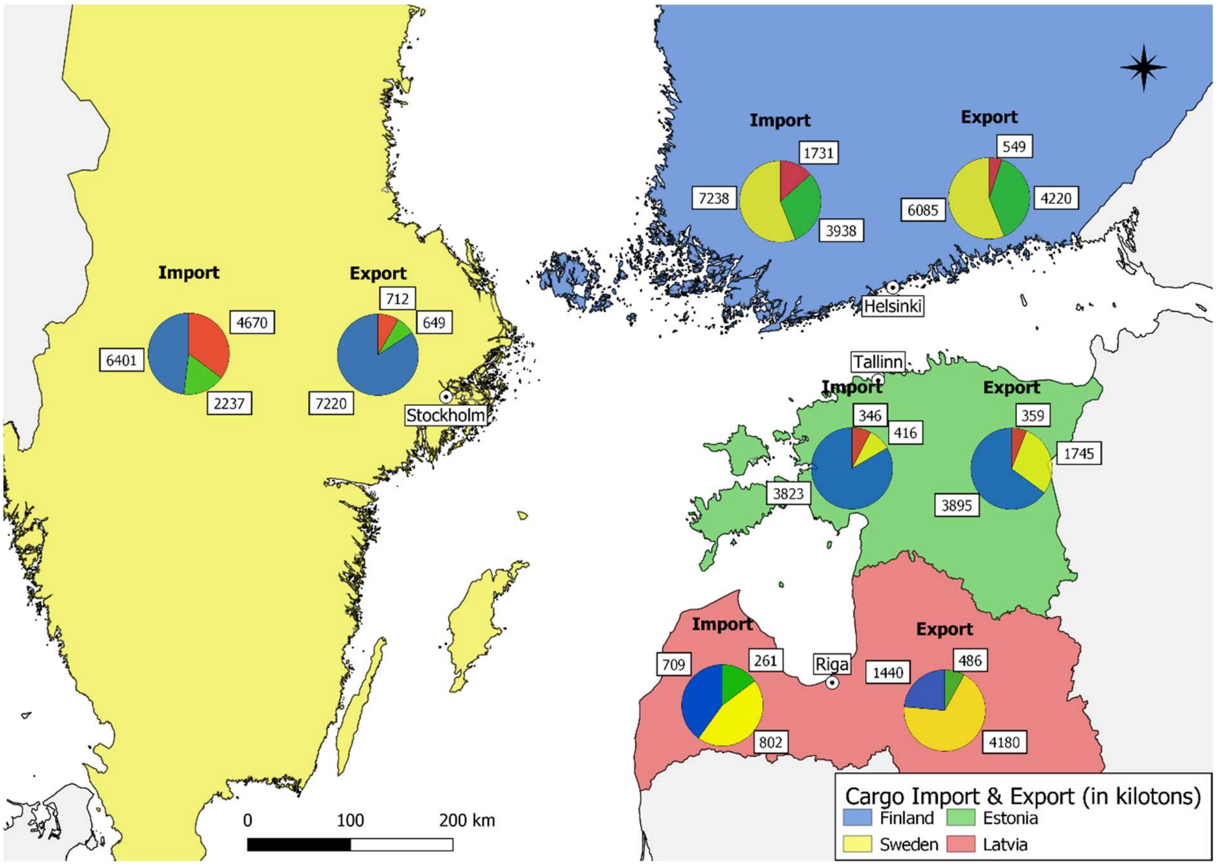
a. Cargo turnover of Baltic Loop ports



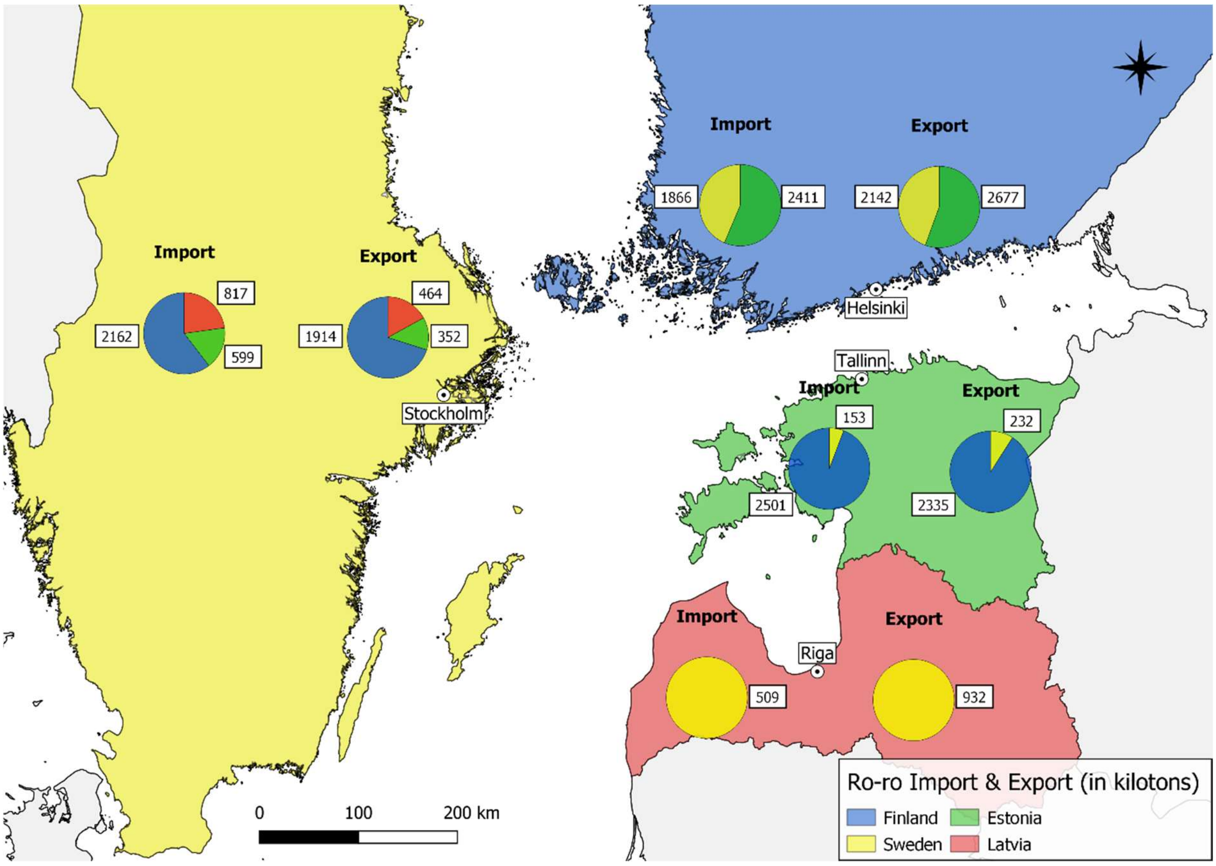
b. Import/export balance of Baltic Loop ports



c. Import/export balance per origin and destination country



d. Import/export balance (ro-ro traffic) per origin and destination country

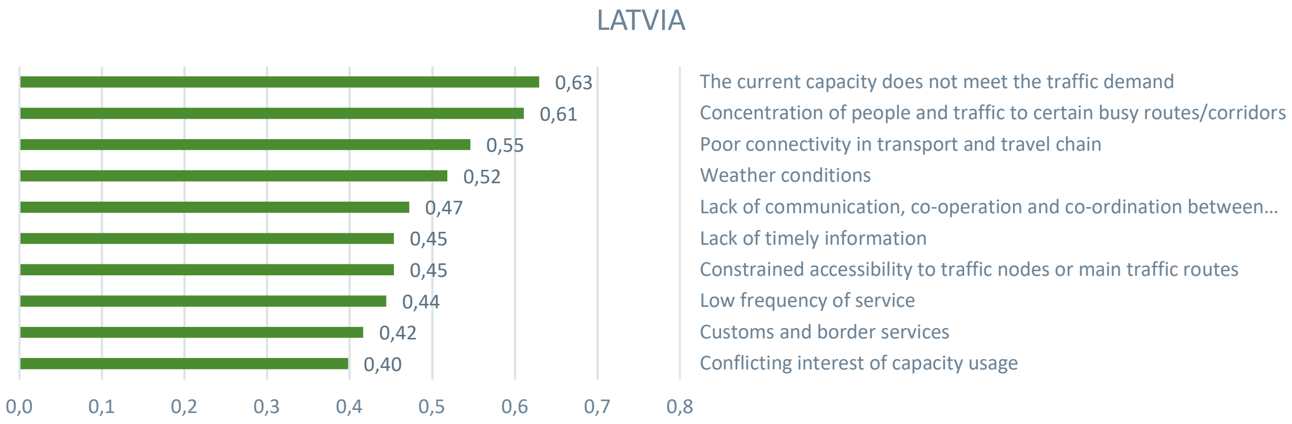


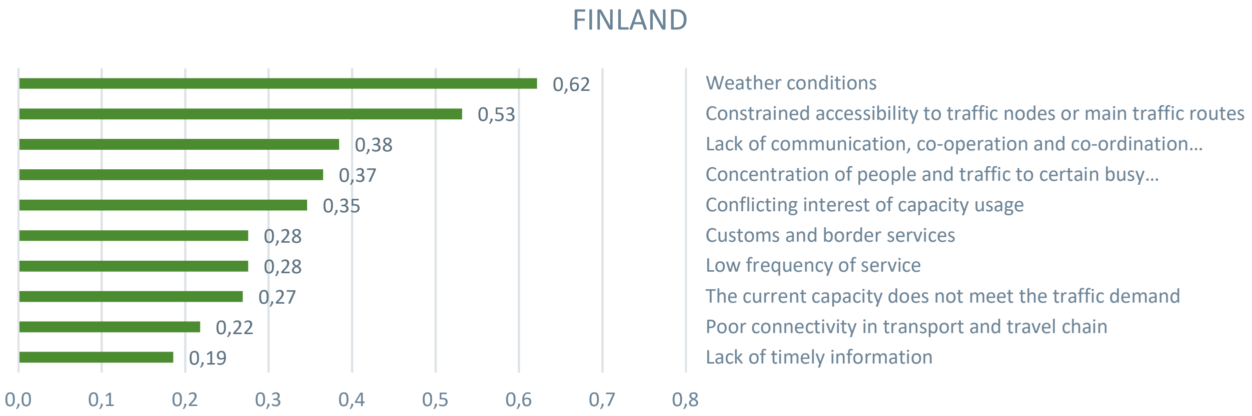
APPENDIX II: National level quantitative questionnaire results

A. What are or (could be) the major causes of delays in transport corridors?

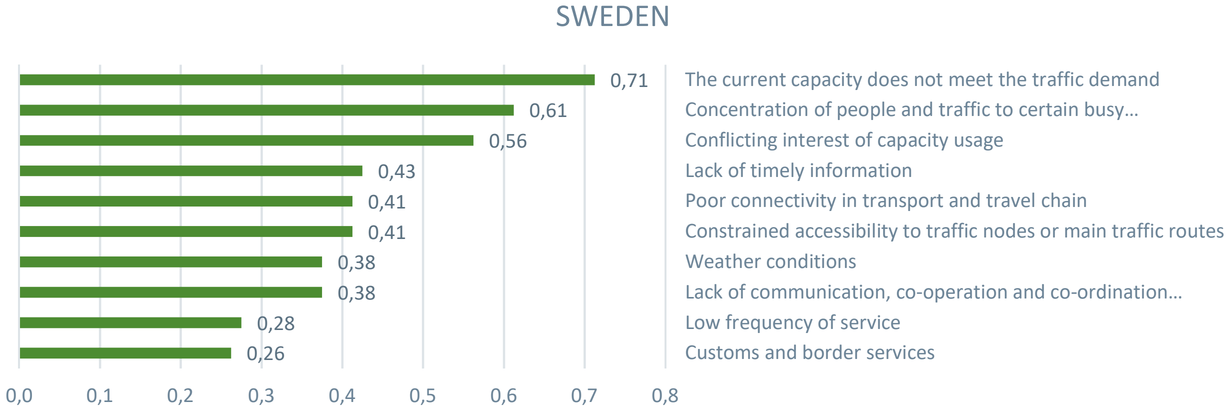
LATVIA		FINLAND	
The current capacity does not meet the traffic demand	0,63	Weather conditions	0,62
Concentration of people and traffic to certain busy routes/corridors	0,61	Constrained accessibility to traffic nodes or main traffic routes	0,53
Poor connectivity in transport and travel chain	0,55	Lack of communication, co-operation and co-ordination between public authorities and other stakeholders	0,38
Weather conditions	0,52	Concentration of people and traffic to certain busy routes/corridors	0,37
Lack of communication, co-operation and co-ordination between public authorities and other stakeholders	0,47	Conflicting interest of capacity usage	0,35
Lack of timely information	0,45	Customs and border services	0,28
Constrained accessibility to traffic nodes or main traffic routes	0,45	Low frequency of service	0,28
Low frequency of service	0,44	The current capacity does not meet the traffic demand	0,27
Customs and border services	0,42	Poor connectivity in transport and travel chain	0,22
Conflicting interest of capacity usage	0,40	Lack of timely information	0,19
SWEDEN		**ESTONIA**	
The current capacity does not meet the traffic demand	0,71	Customs and border services	0,61
Concentration of people and traffic to certain busy routes/corridors	0,61	Lack of communication, co-operation and co-ordination between public authorities and other stakeholders	0,57
Conflicting interest of capacity usage	0,56	Poor connectivity in transport and travel chain	0,57
Lack of timely information	0,43	Concentration of people and traffic to certain busy routes/corridors	0,57
Poor connectivity in transport and travel chain	0,41	Constrained accessibility to traffic nodes or main traffic routes	0,54
Constrained accessibility to traffic nodes or main traffic routes	0,41	The current capacity does not meet the traffic demand	0,54
Weather conditions	0,38	Low frequency of service	0,50
Lack of communication, co-operation and co-ordination between public authorities and other stakeholders	0,38	Lack of timely information	0,39
Low frequency of service	0,28	Conflicting interest of capacity usage	0,39
Customs and border services	0,26	Weather conditions	0,32

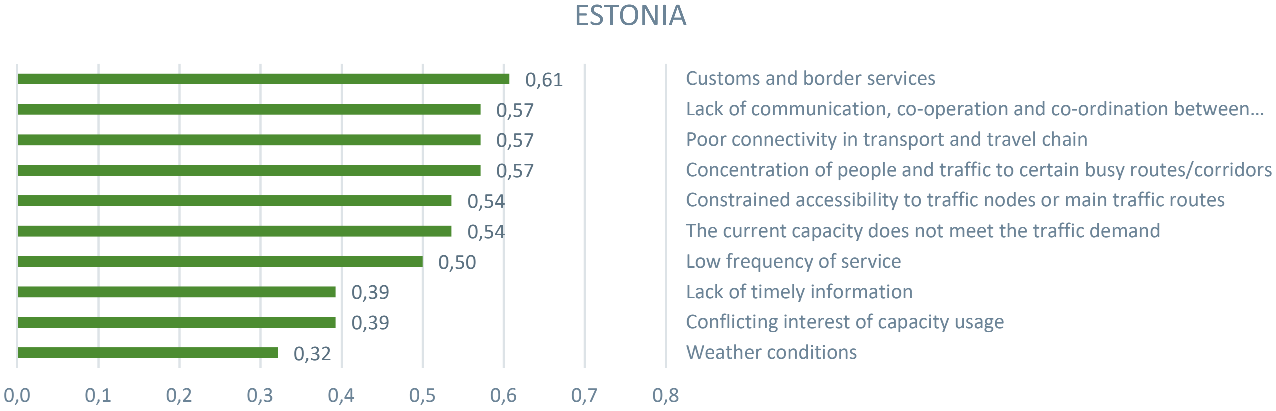
A. **What are or (could be) the major causes of delays in transport corridors? (cont. from previous page)**





A. What are or (could be) the major causes of delays in transport corridors? (cont. from previous page)

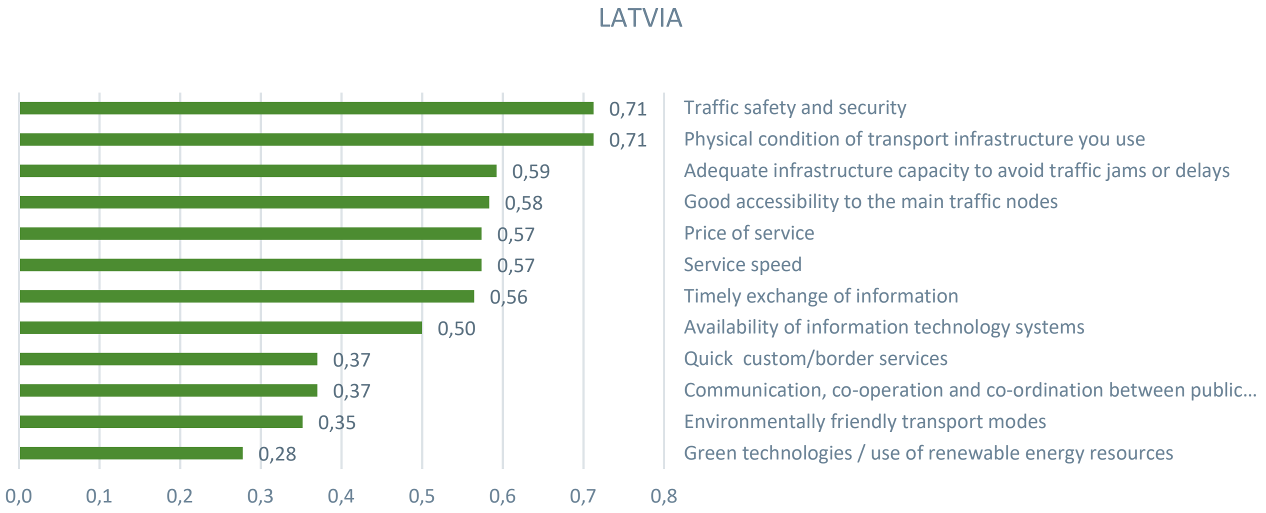


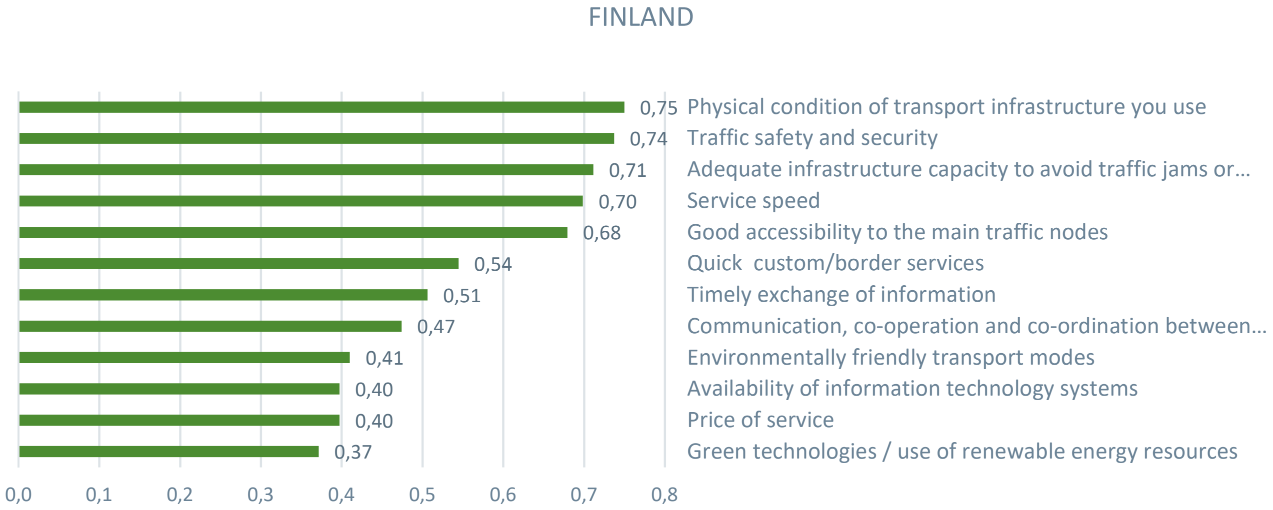


B. How important for your organisation are the following criteria to ensure your transport operations/services on the corridor?

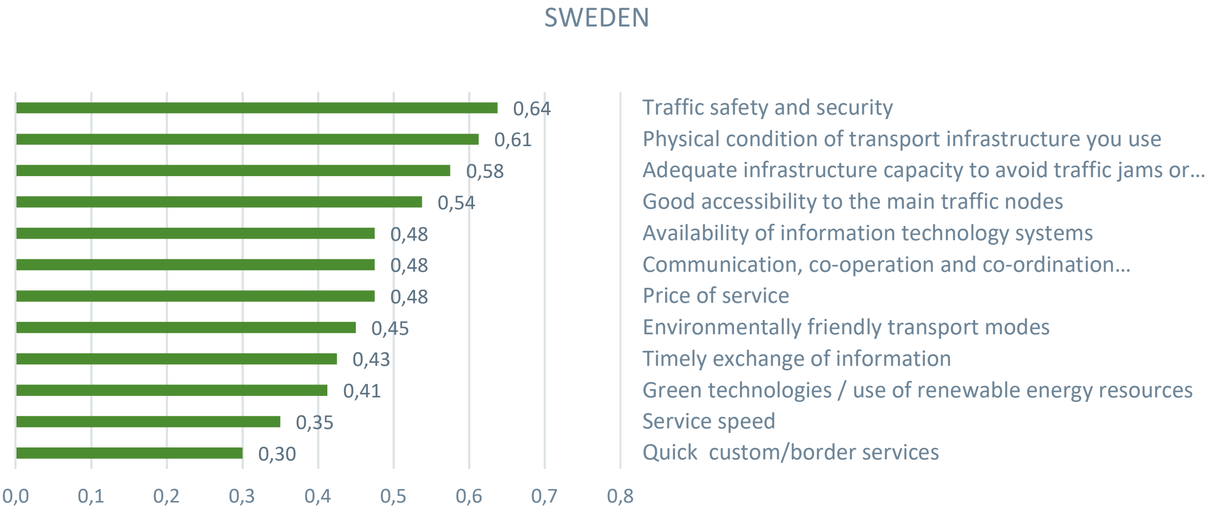
LATVIA		FINLAND	
Traffic safety and security	0,71	Physical condition of transport infrastructure you use	0,75
Physical condition of transport infrastructure you use	0,71	Traffic safety and security	0,74
Adequate infrastructure capacity to avoid traffic jams or delays	0,59	Adequate infrastructure capacity to avoid traffic jams or delays	0,71
Good accessibility to the main traffic nodes	0,58	Service speed	0,70
Price of service	0,57	Good accessibility to the main traffic nodes	0,68
Service speed	0,57	Quick custom/border services	0,54
Timely exchange of information	0,56	Timely exchange of information	0,51
Availability of information technology systems	0,50	Communication, co-operation and co-ordination between public authorities and other stakeholders	0,47
Quick custom/border services	0,37	Environmentally friendly transport modes	0,41
Communication, co-operation and co-ordination between public authorities and other stakeholders	0,37	Availability of information technology systems	0,40
Environmentally friendly transport modes	0,35	Price of service	0,40
Green technologies / use of renewable energy resources	0,28	Green technologies / use of renewable energy resources	0,37
SWEDEN		**ESTONIA**	
Traffic safety and security	0,64	Environmentally friendly transport modes	0,64
Physical condition of transport infrastructure you use	0,61	Traffic safety and security	0,61
Adequate infrastructure capacity to avoid traffic jams or delays	0,58	Service speed	0,61
Good accessibility to the main traffic nodes	0,54	Adequate infrastructure capacity to avoid traffic jams or delays	0,57
Availability of information technology systems	0,48	Good accessibility to the main traffic nodes	0,57
Communication, co-operation and co-ordination between public authorities and other stakeholders	0,48	Physical condition of transport infrastructure you use	0,57
Price of service	0,48	Green technologies / use of renewable energy resources	0,54
Environmentally friendly transport modes	0,45	Timely exchange of information	0,54
Timely exchange of information	0,43	Availability of information technology systems	0,54
Green technologies / use of renewable energy resources	0,41	Communication, co-operation and co-ordination between public authorities and other stakeholders	0,54
Service speed	0,35	Quick custom/border services	0,46
Quick custom/border services	0,30	Price of service	0,39

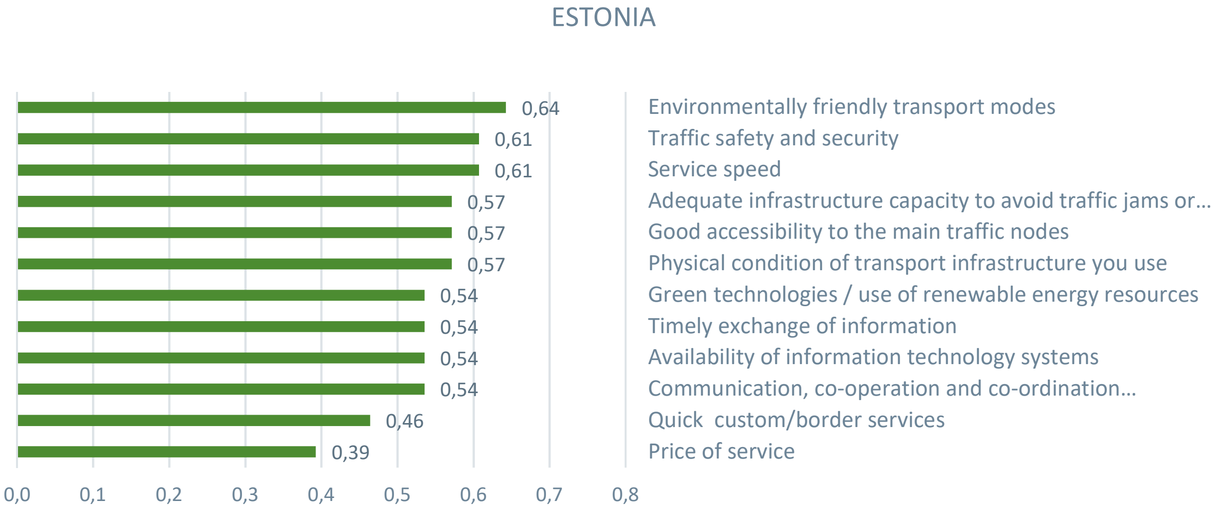
B. How important for your organisation are the following criteria to ensure your transport operations/services on the corridor? (cont. from previous page)





B. How important for your organisation are the following criteria to ensure your transport operations/services on the corridor? (cont. from previous page)

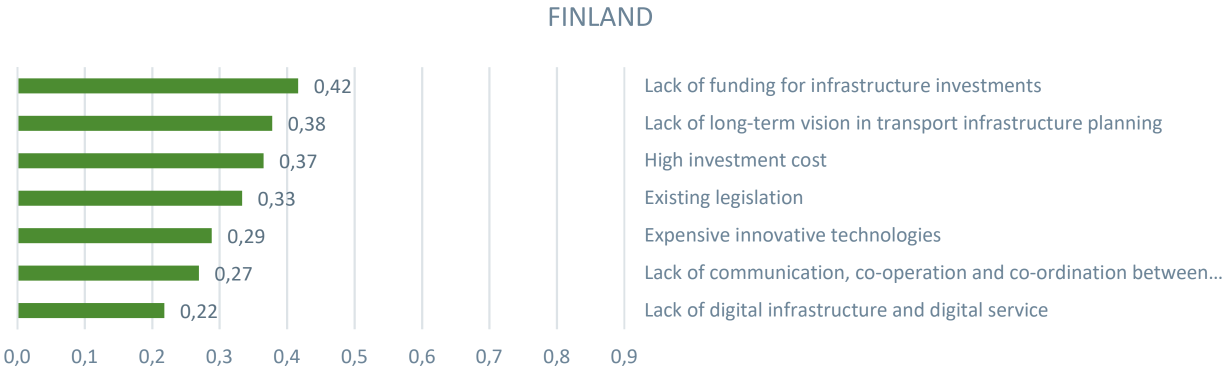


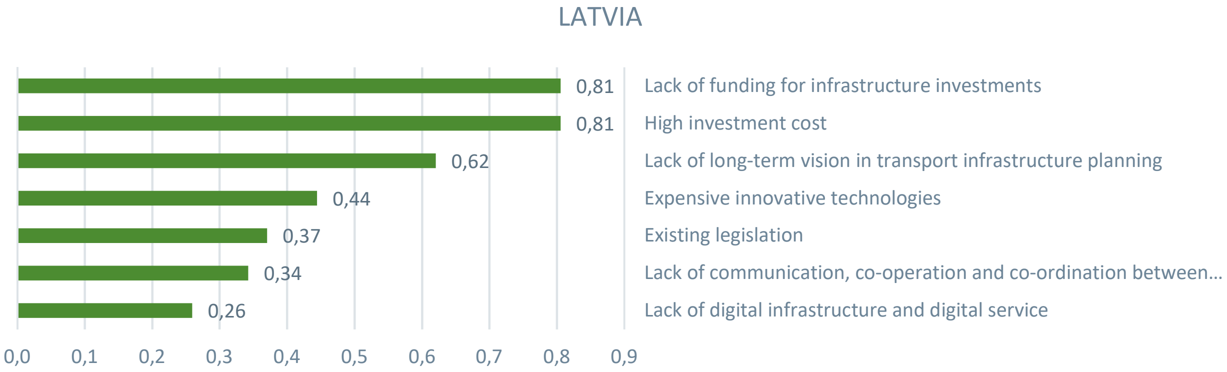


C. What are the main hindrances of transport infrastructure development?

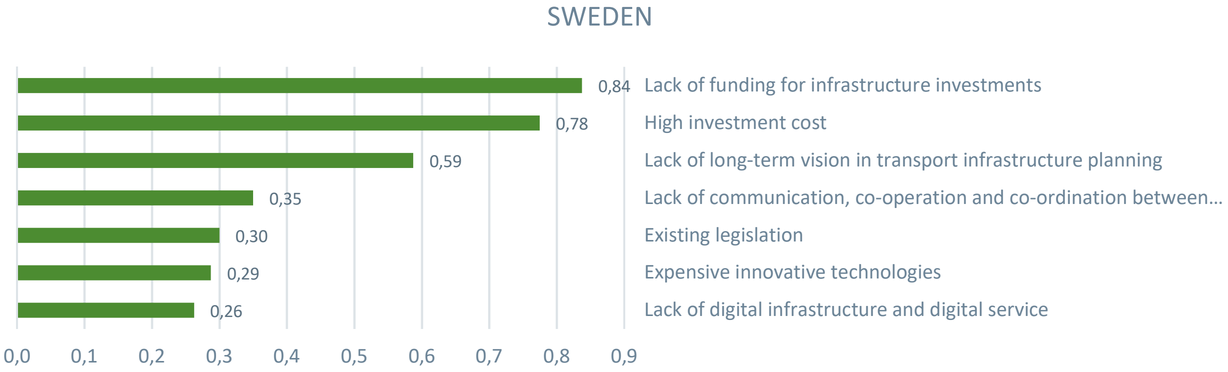
LATVIA		FINLAND	
Lack of funding for infrastructure investments	0,81	Lack of funding for infrastructure investments	0,42
High investment cost	0,81	Lack of long-term vision in transport infrastructure planning	0,38
Lack of long-term vision in transport infrastructure planning	0,62	High investment cost	0,37
Expensive innovative technologies	0,44	Existing legislation	0,33
Existing legislation	0,37	Expensive innovative technologies	0,29
Lack of communication, co-operation and co-ordination between public authorities and other stakeholders	0,34	Lack of communication, co-operation and co-ordination between public authorities and other stakeholders	0,27
Lack of digital infrastructure and digital service	0,26	Lack of digital infrastructure and digital service	0,22
SWEDEN		**ESTONIA**	
Lack of funding for infrastructure investments	0,84	Lack of long-term vision in transport infrastructure planning	0,79
High investment cost	0,78	High investment cost	0,68
Lack of long-term vision in transport infrastructure planning	0,59	Lack of communication, co-operation and co-ordination between public authorities and other stakeholders	0,57
Lack of communication, co-operation and co-ordination between public authorities and other stakeholders	0,35	Lack of funding for infrastructure investments	0,54
Existing legislation	0,30	Lack of digital infrastructure and digital service	0,54
Expensive innovative technologies	0,29	Expensive innovative technologies	0,43
Lack of digital infrastructure and digital service	0,26	Existing legislation	0,18

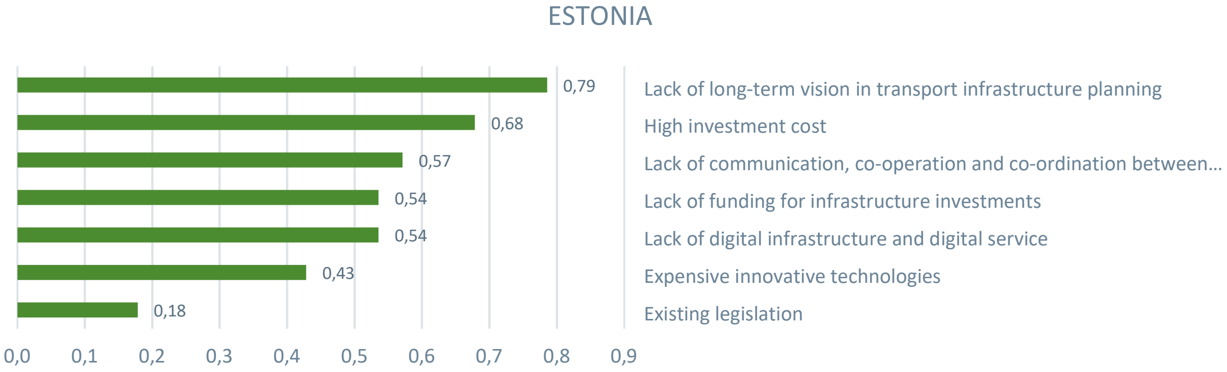
C. What are the main hindrances of transport infrastructure development? (cont. from previous page)





C. What are the main hindrances of transport infrastructure development? (cont. from previous page)

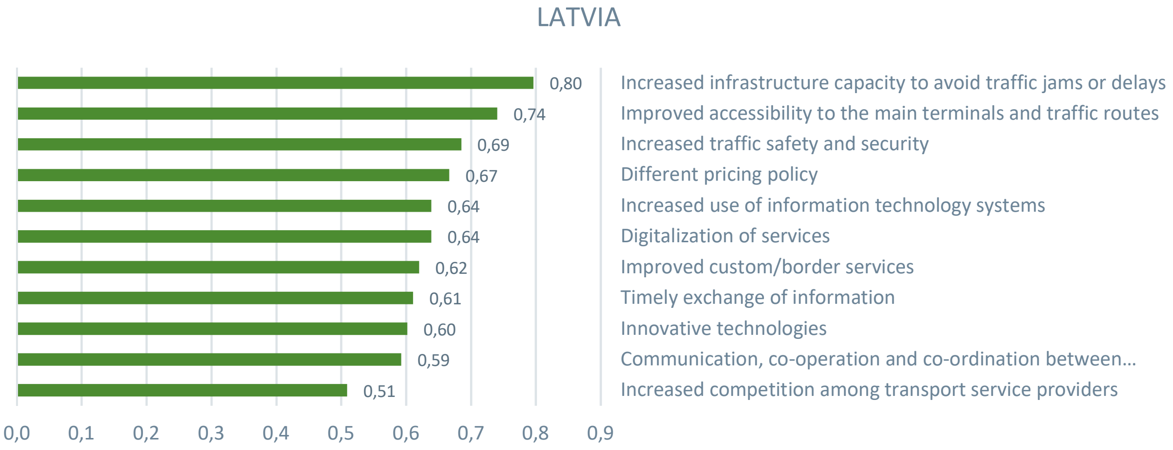


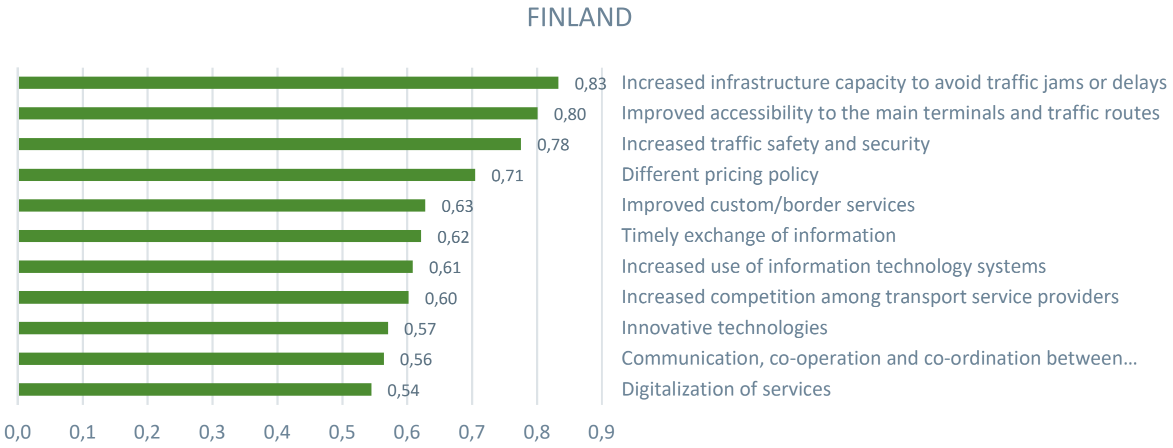


D. What (and to what extent) could improve traffic flows in the international traffic corridors?

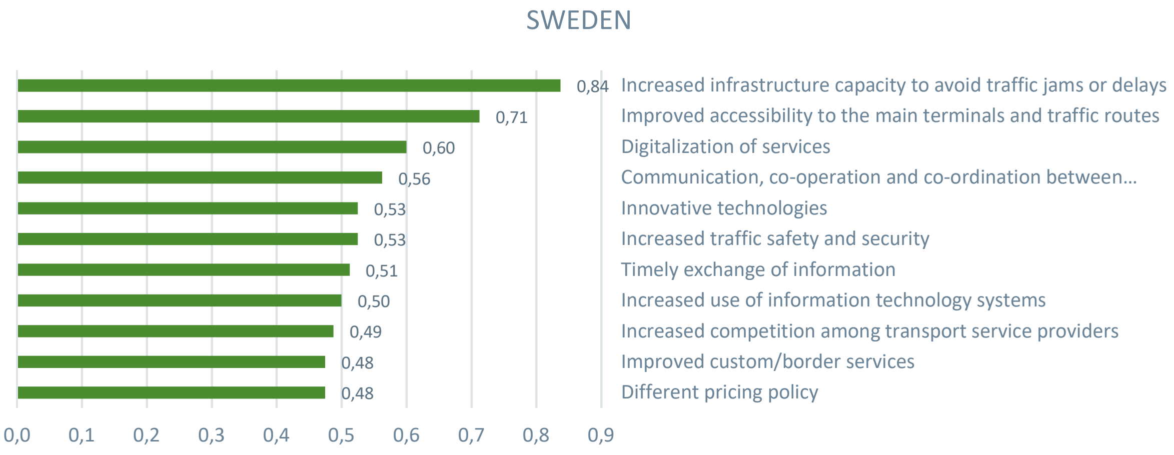
LATVIA		FINLAND	
Increased infrastructure capacity to avoid traffic jams or delays	0,80	Increased infrastructure capacity to avoid traffic jams or delays	0,83
Improved accessibility to the main terminals and traffic routes	0,74	Improved accessibility to the main terminals and traffic routes	0,80
Increased traffic safety and security	0,69	Increased traffic safety and security	0,78
Different pricing policy	0,67	Different pricing policy	0,71
Digitalization of services	0,64	Timely exchange of information	0,62
Increased use of information technology systems	0,64	Improved custom/border services	0,63
Improved custom/border services	0,62	Increased use of information technology systems	0,61
Timely exchange of information	0,61	Increased competition among transport service providers	0,60
Innovative technologies	0,60	Innovative technologies	0,57
Communication, co-operation and co-ordination between public authorities and other stakeholders	0,59	Communication, co-operation and co-ordination between public authorities and other stakeholders	0,56
Increased competition among transport service providers	0,51	Digitalization of services	0,54
SWEDEN		**ESTONIA**	
Increased infrastructure capacity to avoid traffic jams or delays	0,84	Improved custom/border services	0,89
Improved accessibility to the main terminals and traffic routes	0,71	Increased use of information technology systems	0,89
Digitalization of services	0,60	Digitalization of services	0,82
Communication, co-operation and co-ordination between public authorities and other stakeholders	0,56	Communication, co-operation and co-ordination between public authorities and other stakeholders	0,79
Increased traffic safety and security	0,53	Innovative technologies	0,75
Innovative technologies	0,53	Improved accessibility to the main terminals and traffic routes	0,79
Timely exchange of information	0,51	Increased infrastructure capacity to avoid traffic jams or delays	0,75
Increased use of information technology systems	0,50	Timely exchange of information	0,68
Increased competition among transport service providers	0,49	Increased traffic safety and security	0,64
Improved custom/border services	0,48	Increased competition among transport service providers	0,57
Different pricing policy	0,48	Different pricing policy	0,57

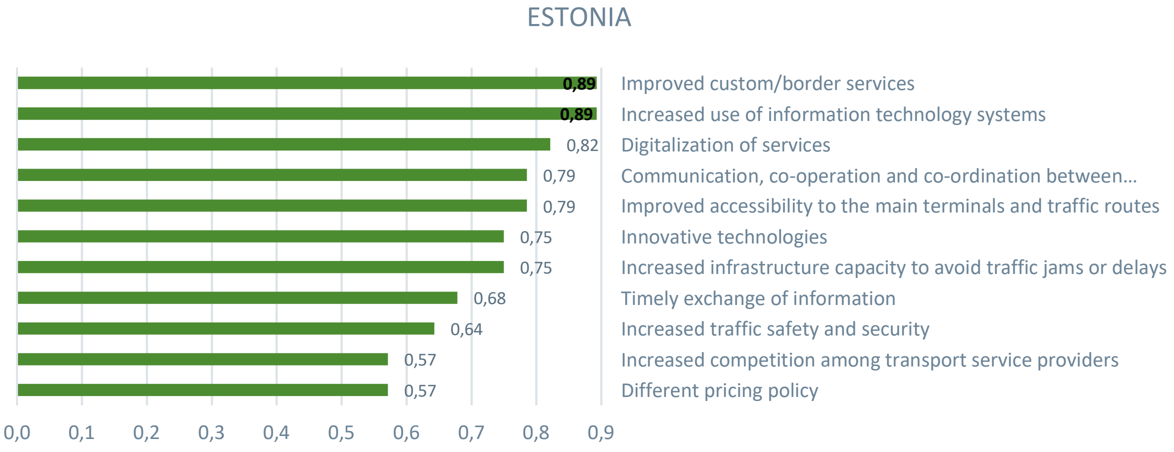
D. What (and to what extent) could improve traffic flows in the international traffic corridors? (cont. from previous page)





D. What (and to what extent) could improve traffic flows in the international traffic corridors? (cont. from previous page)





APPENDIX III: Baltic Loop Corridor inland freight flows

NORTHERN CORRIDOR

1. Örebro- Stockholm

Measure	Unit	Quantity / Description	Notes, data source
Freight transport modes available	Km **Road:** E18 **Rail:** Mälarbanan, Svelandsbanan, Västra Stambanan, Värmlandsbanan, Kongsvingerbanan **Maritime:** Kapellskär, Stockholms hamnar, Nynäshamn **Air:** Arlanda Airport, Bromma Airport, Eskilstuna Airport, Örebro Airport, Karlstad Airport	Road 511 km Rail 395 km Maritime x Air x	Swedish Transport Administration Swedish Maritime Administration
Multi-modal transport hubs	**Rail-Road:** Oslo, Alnabrun, Hallsberg, Eskilstuna, Årstad, Katrineholm **Inland port-rail-road** Västerås, Köping, Kristinehamn **Seaport-rail-road** Stockholms hamnar Nynäshamn		

<table>
<tr><th colspan="4">Road</th></tr>
<tr><td>Road</td><td>E18</td><td>Töcksfors-Kapellskär</td><td></td></tr>
<tr><td>Road capacity</td><td>Number of lanes per direction</td><td>Mostly 2-lane motorway</td><td></td></tr>
<tr><td>Allowed max speed (heavy goods vehicles)</td><td>Km/h</td><td>80 km/h on motorway (E18). 40-60 km/h through Kapellskär.</td><td></td></tr>
<tr><td>Average travel time</td><td>Hours, minutes</td><td>6 h</td><td></td></tr>
<tr><td>Annual average daily traffic on the main road
Percentage of heavy goods vehicles on the main road</td><td colspan="2">Vehicles per day
<table>
<tr><th colspan="3">Road E18</th></tr>
<tr><th>Section</th><th>AADT</th><th>Heavy goods vehicles</th></tr>
<tr><td>Border-Töckfors</td><td>6 847</td><td>14 %</td></tr>
<tr><td>Töckfors-Segmon</td><td>4 489</td><td>23 %</td></tr>
<tr><td>Segmon-Bergviksmotet</td><td>13 548</td><td>14 %</td></tr>
<tr><td>Bergviksmotet-Universitetsmotet</td><td>31 227</td><td>12 %</td></tr>
<tr><td>Universitetsmotet-Lekhyttan</td><td>16 543</td><td>13 %</td></tr>
<tr><td>Lekhyttan-Adolfsberg</td><td>21 181</td><td>14 %</td></tr>
<tr><td>Adolfsberg-Norrplan</td><td>35 980</td><td>15 %</td></tr>
<tr><td>Norrplan-Västjädra</td><td>17 526</td><td>17 %</td></tr>
<tr><td>Västjädra-Västerled</td><td>32 360</td><td>12 %</td></tr>
<tr><td>Västerled-Hällamotet</td><td>39 351</td><td>10 %</td></tr>
<tr><td>Hällamotet-Stäket</td><td>29 041</td><td>12 %</td></tr>
<tr><td>Stäket-Barkaby</td><td>50 702</td><td>12 %</td></tr>
<tr><td>Barkaby-Bergshamra</td><td>41 567</td><td>10 %</td></tr>
<tr><td>Bergshamra-Danderyd</td><td>26 045</td><td>8 %</td></tr>
<tr><td>Danderyd-Arninge</td><td>43 020</td><td>9 %</td></tr>
<tr><td>Arninge-Rosenkälla</td><td>26 075</td><td>10 %</td></tr>
<tr><td>Rosenkälla-Norrtälje</td><td>13 663</td><td>14 %</td></tr>
<tr><td>Norrtälje-Kapellskär</td><td>4 549</td><td>20 %</td></tr>
</table>
</td><td>Swedish Transport Administration</td></tr>
</table>

Railway			
Railway **+ number of tracks** **+ max speed**	Mälarbanan (Stockholm-Västerås-Örebro) Svealandsbanan (Stockholm)Järna-Eskilstuna-Arboga(-Örebro) Västra Stambanan/Värmlands banan (Stockholm-Hallsberg-Laxå)-Karlstad-Charlottenberg Kongsvingerbanan (Charlottenberg-Kongsvinger-Oslo) Värtabanan	1-2 tracks (electrified), 100 km/h 1-2 tracks (electrified), 100 km/h 2 tracks/1-2 tracks (electrified), 100 km/h 1 track (electrified), 100 km/h 1 track (electrified)	
Daily traffic[76]	Trains per day in each direction	**Mälarbanan;** 3-26 trains **Svealandsbanan;** 6-21 trains **Västra Stambanan;** 3-67 trains **Värmlandsbanan;** 26-39 trains	Swedish Transport Administration.
Types of cargo		Unit goods, oil, other liquid bulk, forest products, iron & steel products, other dry bulk and other cargo.	

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[76] Swedish Transport Administration https://www.trafikverket.se/contentassets/95276b3e6eab4e1185933d5ce96bca30/2019/sammanstallning_tagdata_jnb_2021_1901018.xlsx

2. Naantali/Turku-Vaalimaa

<table>
<tr><th>Measure</th><th>Unit</th><th colspan="2">Quantity / Description</th><th>Notes, data source</th></tr>
<tr><td rowspan="4">Freight transport modes available</td><td rowspan="4">km</td><td>Road</td><td>Naantali 362km/ Turku 343 km</td><td rowspan="4">Finnish Transport Infrastructure Agency,
VR Group,
Port of Naantali,
Port of Turku,
Finavia,
City of Turku</td></tr>
<tr><td>Rail</td><td>x[77]</td></tr>
<tr><td>Maritime</td><td>x</td></tr>
<tr><td>Air</td><td>x</td></tr>
<tr><td>Multi-modal transport hubs</td><td>Port of Naantali</td><td colspan="2">Transport modes: sea port –road - (rail[78])</td><td>Port of Naantali</td></tr>
<tr><td></td><td>Port of Turku</td><td colspan="2">Transport modes: sea port-road - (rail[79])</td><td>Port of Turku</td></tr>
<tr><td></td><td>Turku airport</td><td colspan="2">Transport modes: air-road</td><td>Finavia</td></tr>
<tr><td></td><td>Helsinki-Vantaa airport</td><td colspan="2">Transport modes: air-road</td><td>Finavia</td></tr>
</table>

Road			
Road	**E18**	Naantali/Turku-Vaalimaa	
Road capacity	Number of lanes per direction	Mostly 2 lanes. 1 lane per direction on the easternmost part of Turku Ring Road (under construction 2019-2023) and last kilometers to Port of Naantali. 3 or more lanes on Helsinki Ring Road III.	Naantali/Turku-Vaalimaa
Allowed max speed	Km/h	Max 90 km/h on motorways	Heavy goods vehicles
Average travel time	Hours, minutes	Approx. 5 h 25	Includes compulsory resting times

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[77] Limited irregular railway freight transports

[78] No regular railway cargo services

[79] No regular railway cargo services

		Road E18				
Annual average daily traffic on the main road **Percentage of heavy goods vehicles on the main road**	Vehicles per day	**From km**	**To km**	**AADT**	**Heavy goods vehicles**	Finnish Transport Infrastructure Agency Statistics Year 2019
		10.3	16.1	37 092	11 %	
		16.1	24.6	14 160	12 %	
		24.6	137.6	18 612	10 %	
		137.6	155.5	41 957	9 %	
		155.5	170.7	48 687	11 %	
		170.7	184	71 744	11 %	
		184.0	199.2	34 596	9 %	
		199.2	219.0	28 592	9 %	
		219.0	242,8	18 672	10 %	
		242.8	296.8	9 868	12 %	
		296.8	296.8	13 620	13 %	
		296.8	357.8	2948	21 %	

MIDDLE CORRIDOR

1. Paldiski-Tallinn-Narva

Measure	Unit	Quantity / Description	Notes, data source
Freight transport modes available	km	Road: 273 km Rail: 259 km Maritime: x Air: x	Estonian Road Administration, Estonian Railways Ltd, Estonian Maritime Administration, Port of Tallinn, Tallink Silja Line, Tallinn Transport Department, Põhja-Eesti Public Transport Centre
Multi-modal transport hubs	Paldiski North Port	Transport modes: sea port-rail-road	Paldiski North Port
	Port of Paldiski South	Transport modes: sea port-rail-road	Port of Tallinn
	Port of Tallinn (Old City Harbour)	Transport modes: sea port-rail[80]-road	Port of Tallinn
	Tallinn Airport	Transport modes: air-road	Tallinn airport

Road			
Road	**E265**	Tallinn Ringroad A11 Tallinn (Keila)-Paldiski A8	
Road capacity	Number of lanes per direction	Tallinn ringroad mainly 2 lanes Tallinn-Paldiski mainly 1-lane road	
Allowed max speed (heavy gross vehicles)	Km/h	90 km/h	
Average travel time	Hours, minutes	30 min Keila-Paldiski 40 min Keila-Nehatu	

---

[80] Kopli and Balti Jaam stations in the city centre

<table>
<tr>
<td>Annual average daily traffic on the main road

Percentage of heavy gross vehicles on the main road</td>
<td>Vehicles per day</td>
<td>
<table>
<tr><th colspan="4">Road A11</th></tr>
<tr><th>From km</th><th>To km</th><th>AADT</th><th>Heavy goods vehicles</th></tr>
<tr><td>0</td><td>4.9</td><td>12 587</td><td>19 %</td></tr>
<tr><td>4.9</td><td>8.7</td><td>14 024</td><td>18 %</td></tr>
<tr><td>8.7</td><td>10.3</td><td>11 792</td><td>21 %</td></tr>
<tr><td>10.3</td><td>11.1</td><td>16 072</td><td>16 %</td></tr>
<tr><td>11.1</td><td>15.1</td><td>21 550</td><td>17 %</td></tr>
<tr><td>15.1</td><td>18.7</td><td>17 429</td><td>19 %</td></tr>
<tr><td>18.7</td><td>24.3</td><td>15 776</td><td>25 %</td></tr>
<tr><td>24.3</td><td>26.2</td><td>16 703</td><td>19 %</td></tr>
<tr><td>26.2</td><td>30.1</td><td>11 460</td><td>21 %</td></tr>
<tr><td>30.1</td><td>32.4</td><td>10 518</td><td>7 %</td></tr>
<tr><td>32.4</td><td>36.1</td><td>9 377</td><td>10 %</td></tr>
<tr><td>36.1</td><td>38.1</td><td>9 917</td><td>8 %</td></tr>
</table>
<table>
<tr><th colspan="4">Road A8</th></tr>
<tr><th>From km</th><th>To Km</th><th>AADT</th><th>Heavy goods vehicles</th></tr>
<tr><td>11.3</td><td>12.2</td><td>19 946</td><td>5 %</td></tr>
<tr><td>12.2</td><td>13.6</td><td>15 038</td><td>4 %</td></tr>
<tr><td>13.6</td><td>15.1</td><td>12 116</td><td>4 %</td></tr>
<tr><td>15.1</td><td>18.4</td><td>10 284</td><td>4 %</td></tr>
<tr><td>18.4</td><td>22.3</td><td>7 944</td><td>4 %</td></tr>
<tr><td>22.3</td><td>25.1</td><td>8 571</td><td>4 %</td></tr>
<tr><td>25.1</td><td>27.0</td><td>10 686</td><td>8 %</td></tr>
<tr><td>27.0</td><td>29.2</td><td>8 314</td><td>9 %</td></tr>
<tr><td>29.2</td><td>31.9</td><td>6 148</td><td>14 %</td></tr>
<tr><td>31.9</td><td>36.0</td><td>5 499</td><td>13 %</td></tr>
<tr><td>36.0</td><td>40.3</td><td>3 502</td><td>23 %</td></tr>
<tr><td>40.3</td><td>45.7</td><td>2 960</td><td>21 %</td></tr>
<tr><td>45.7</td><td>47.2</td><td>3 122</td><td>17 %</td></tr>
</table>
</td>
<td>A11-Tallinn ringroad (Nehatu-Keila) part of E265

https://www.mnt.ee/sites/default/files/content-editors/Failid/Liiklusloendus/2019/7_lisa_5-7_sagedused_2019_v2.pdf

A8 -Tallinn- Paldiski part of E265</td>
</tr>
</table>

<table>
<tr><th colspan="4">Road</th></tr>
<tr><td>Road</td><td>A1</td><td>Tallinn–Narva</td><td>211 km</td></tr>
<tr><td>Road capacity</td><td>Number of lanes per direction</td><td>Mainly 2 lanes but 1-lane sections exist</td><td></td></tr>
<tr><td>Allowed max speed (heavy gross vehicles)</td><td>Km/h</td><td>90 km/h</td><td></td></tr>
<tr><td>Average travel time</td><td>Hours, minutes</td><td>2h 45 min</td><td></td></tr>
<tr><td>Annual average daily traffic on the main road

Percentage of heavy goods vehicles on the main road</td><td>Vehicles per day</td><td>
<table>
<tr><th colspan="4">Road E20</th></tr>
<tr><th>From km</th><th>To km</th><th>AADT</th><th>Heavy goods vehicles</th></tr>
<tr><td>9.2</td><td>11.0</td><td>32 375</td><td>9 %</td></tr>
<tr><td>11.0</td><td>13.7</td><td>29 087</td><td>9 %</td></tr>
<tr><td>13.7</td><td>26.4</td><td>18 142</td><td>9 %</td></tr>
<tr><td>26.4</td><td>40.2</td><td>12 165</td><td>11 %</td></tr>
<tr><td>40.2</td><td>52.0</td><td>10 324</td><td>11 %</td></tr>
<tr><td>52.0</td><td>69.4</td><td>8 109</td><td>12 %</td></tr>
<tr><td>69.4</td><td>88.8</td><td>6 663</td><td>14 %</td></tr>
<tr><td>88.8</td><td>92.9</td><td>4 775</td><td>18 %</td></tr>
<tr><td>92.9</td><td>97.2</td><td>5 719</td><td>14 %</td></tr>
<tr><td>97.2</td><td>100.8</td><td>4 643</td><td>17 %</td></tr>
<tr><td>100.8</td><td>101.3</td><td>6 055</td><td>13 %</td></tr>
<tr><td>101.3</td><td>109.7</td><td>5 929</td><td>14 %</td></tr>
<tr><td>109.7</td><td>118.8</td><td>4 517</td><td>15 %</td></tr>
<tr><td>118.8</td><td>128.0</td><td>4 239</td><td>16 %</td></tr>
<tr><td>128.0</td><td>137.6</td><td>4 348</td><td>16 %</td></tr>
<tr><td>137.6</td><td>141.9</td><td>4 411</td><td>15 %</td></tr>
<tr><td>141.9</td><td>153.8</td><td>6 179</td><td>17 %</td></tr>
<tr><td>153.8</td><td>157.3</td><td>6 071</td><td>11 %</td></tr>
<tr><td>157.3</td><td>159.6</td><td>13 671</td><td>8 %</td></tr>
<tr><td>159.6</td><td>162.9</td><td>11 216</td><td>8 %</td></tr>
<tr><td>162.9</td><td>167.2</td><td>7 824</td><td>9 %</td></tr>
<tr><td>167.2</td><td>174.5</td><td>7 617</td><td>11 %</td></tr>
<tr><td>174.5</td><td>183.3</td><td>7 295</td><td>14 %</td></tr>
</table>
</td><td>Tallinn-Narva

https://www.mnt.ee/sites/default/files/content-editors/Failid/Liiklusloendus/2019/7_lisa_5-7_sagedused_2019_v2.pdf</td></tr>
</table>

		183.3	187.7	8 739	8 %	
		187.7	194.3	7 314	10 %	
		194,3	203.9	6 086	12 %	
		203.9	209.2	8 177	8 %	
		212.6	212.6	1 667	17 %	

Railway			
Railway		Tallinn-Paldiski	48 km
Number of tracks		Single track 28,9 km Double track 18,8 km	
Electrified railway	-	Yes x No	
Average speed	km/h	80 km/h	
Daily traffic	Trains per day	n.a.	
Types of cargo		Fertilisers, Mineral fuels (liquid), Chemical products, Oil shale, Mineral fuels (solid), Bulk goods. Of total annual cargo volumes 70 % Russian transit traffic.	Estonian Railways Ltd

Railway			
Railway		Tallinn-Narva	210 km
Number of tracks		Single track 134,9 km Double track 74,7 km	
Electrified railway	-	Yes No x	57 km electrified
Average speed	km/h	80 km/h	
Daily traffic	Trains per day	Approx. 10	5 in each direction
Types of cargo		Fertilisers, Mineral fuels (liquid), Chemical products, Oil shale, Mineral Fuels (solid), Bulk goods. Of total annual cargo volumes 70 % Russian transit traffic.	Estonian Railways Ltd

THE SOUTHERN CORRIDOR

1. Ventspils-Riga

Measure	Unit	Quantity / Description		Notes, data source
Freight transport modes available	km	Road	186	Latvian State Roads
		Rail	189	Latvian Railways
		Maritime	x	Freeport of Ventspils
		Air	x	Freeport of Riga
				Riga International Airport
Multi-modal transport hubs	Freeport of Ventspils	Transport modes: sea port-rail-road		
	Freeport of Riga	Transport modes: sea port-rail-road		
	Riga International Airport	Transport modes: air-road		

Road						
Road	**A10**	Riga – Ventspils				186 km
Road capacity	Number of lanes per direction	2 lanes (0-4 km) 3 lanes (5-12 km) 1 lane (13-186 km)				3 lanes till Priedaine junction Main part of the road 1-lane
Allowed max speed	Km/h	80 km/h				Heavy goods vehicles
Average travel time	Hours, minutes	2 hours 50 minutes				
Annual average daily traffic on the main road **Percentage of heavy goods**	Vehicles per day	**Road A10**				Year 2019
		From km	**To km**	**AADT**	**Heavy goods vehicles**	
		13.5	15.4	48 540	9 %	
		15.4	19.5	41 316	8 %	
		19.5	38.2	12 994	13 %	

vehicles on the main road		**38.2**	44.7	11 404	11 %	
		44.7	62.9	87 00	13 %	
		62.9	80.3	5 233	18 %	
		80.3	91.4	6 353	15 %	
		91.4	113.8	5 049	16 %	
		113.8	151.0	3 020	18 %	
		151.0	181.4	2 688	17 %	
		181.4	183.1	3 860	9 %	
Accidents	Number of black spots	5 black spots identified on the section				

Railway				
Railway		Riga – Ventspils		189 km
Number of tracks	single track			
Electrified railway	-	Yes		
		No	x	
Average speed	km/h	60 km/h		
Daily traffic	Trains per day	4 trains		(2 in each direction)
Types of cargo[81]		General, liquid cargoes (oil products, liquid gas), containers		https://www.ldz.lv/sites/default/files/2_Tarifi_kravu.pdf

2. Riga-Valka

Measure	Unit	Quantity / Description		Notes, data source
Freight transport modes available	*km*	Road	195.6	Latvian State Roads, Latvian Railways, The Freeport of Riga, Riga International Airport
		Rail	166	
		Maritime	x	
		Air	x	

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[81] Latvian Railroads

Multi-modal transport hubs	The Freeport of Riga	Transport modes: sea port-rail-road	
	Riga International Airport	Transport modes: air-road	

Road		
Road	**A3** Inčukalns - Valmiera - Igaunijas robeža(Valka) **A2** Rīga - Sigulda - Igaunijas robeža (Veclaicene)	116 km 39 km
Number of lanes per direction	2 lanes (0-39 km) 1 lane (116 km)	2 lanes till Sigulda
Km/h	80 km/h	Heavy goods vehicles
Hours, minutes	2 hours 30 minutes	
Vehicles per day **Percentage of heavy goods vehicles on the main road**		A3 Inčukalns - Valmiera - Igaunijas robeža(Valka) A2 Rīga - Sigulda - Igaunijas robeža (Veclaicene) Year 2019

Road A3

From km	To km	AADT	Heavy goods vehicles
0.0	8.6	9 370	19 %
8.6	39.1	5 642	22 %
39.1	62.9	6 066	23 %
62.9	66.2	10 403	18 %
66.2	73.2	6 017	21 %
73.2	92.3	3 288	19 %
92.3	116.3	2 274	27 %

Road A2

From km	To km	AADT	Heavy goods vehicles
12.4	14.1	40 994	11 %
14.1	21.5	29 463	14 %
21.5	37.7	21 845	17 %

<table>
<tr><th colspan="4">Railway</th></tr>
<tr><td>Railway</td><td>Rīga – Lugaži – Valsts robeža</td><td></td><td></td></tr>
<tr><td>Number of tracks</td><td>single track</td><td></td><td></td></tr>
<tr><td>Electrified railway</td><td>-</td><td><table><tr><td>Yes</td><td></td></tr><tr><td>No</td><td>x</td></tr></table></td><td></td></tr>
<tr><td>Average speed</td><td>Km/h</td><td>60 km/h</td><td></td></tr>
<tr><td>Daily traffic</td><td>Trains per day</td><td>4 trains</td><td>(2 in each direction)</td></tr>
</table>

APPENDIX IV: Bottlenecks and deficiencies affecting Örebro County

Deficiencies identified by the Swedish Traffic Administration[82] affecting the Region Örebro County (starting point of all three Baltic Loop transport corridors) transport system:

A. Traffic corridor: (Oslo, Norway)–Karlskoga–Örebro–Västerås–(Stockholm)

The following infrastructure is included:

Road: E18

Railway: Mälaren line (Mälarbanan), Värmland line (Värmlandsbanan)

Fairway: Fairway 901-904 leading to the port of Köping and Fairway 901-907 to the port of Västerås

The function and general condition of the traffic corridor

Regional expansion and the growing population in the Stockholm-Mälar region result in growing transport needs in the area, with Stockholm as the focal point, but also on the long-distance Värmland-Stockholm and Oslo-Stockholm transportation axes. The functional relationships between expanding cities north of Lake Mälaren including Karlstad, Örebro and Västerås and Uppsala have strengthened. The development of logistics centers and terminals north of Stockholm and partly in the Arlanda area is a significant milestone for the freight transportation sector. The stretch between Örebro- Gräsnäs junction (Arboga) forms a part of both the E18 and the E20. The E18 forms an important passage leading from the Metropolitan Stockholm and northern Mälardalen to the southwestern Sweden.

Significant shortcomings identified

E18

The Köping – Västjädra section has lowered accessibility compared to the rest of the road between Örebro and Stockholm due to a lack of capacity. The route has also significant deficiencies in robustness. Accidents may cause long traffic stops, resulting in redirection of traffic to road networks with accessibility and road safety problems.

Significant deficiencies in thoroughfare robustness in *Västerås and Örebro* have been identified. The deficiencies become particularly apparent at rush hours, when accidents cause long traffic stops and lowered accessibility..

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[82] The Swedish Traffic Administration (2018)

Karlskoga's thoroughfare with several planar traffic light intersections have safety-related deficiencies. Three thoroughfares of the E18 exhibit significant health deficiencies due to noise.

Örebro, Västerås and Karlskoga throughfares have many interjunctions causing clashes between long-distance and local traffic, leading to impaired usability, capacity and safety. The primary issue is queue formations, which markedly slow down the traffic flow along the E18. The queuing problem contributes to frequent occurrences of rear-end accidents.

Mälaren Line railway (Mälarbanan)

Shortcomings exist in *Västerås* in terms of freight yard capacity and usability.

The capacity constrain on *Hovsta – Kolbäck* railway section is caused by scarce possibilities to pass other trains. The Mälar Line and the freight railway line from Bergslagen cross at Hovsta, thus lowering the capacity, punctuality and robustness.

The facilities in *Örebro* show shortcomings in capacity, both in relation to freight and passenger traffic due to intersecting railway lines, failing train turnaround flexibility and shortage of platform locations.

Delayed maintenance on the track's subsections of *Västerås- Dingtuna, Kolbäck- Köping, and Kolsäng* may entail a risk of lowered load-bearing capacity and speed limitation, which in turn affects the overall robustness and capacity.

Värmland line (Värmlandsbanan)

Värmland line is an important link between the Stockholm-Mälar region and the country's western parts The track has significant capacity shortages at the *Laxå* operating site, which constitutes an intersection between the Western main line and the Värmland line. This leads to shortcomings in passenger and freight traffic capacity towards Värmland as well as for long-distance passenger and freight traffic to and from Gothenburg.

Fairway 901-904 to Port of Köping, fairway 901-907 to Port of Västerås

Hjulsta bridge (part of highway 55) has shortcomings in safety and usability in a scenario in which the maritime traffic on Lake Mälar is growing and bigger vessels call at ports such as Västerås. The existing passage through the bridge opening is too narrow for the largest vessels. The opening of the bridge causes queues, especially during the summertime. The entire highway 55, including the bridge passage, will be reviewed with regard to infrastructure quality.

B. Traffic corridor: (Göteborg)–Örebro/Hallsberg–Eskilstuna–(Stockholm)

The following infrastructure is included:

Road: E20

Railway: The Western main line, Svealand line

The function and general condition of the traffic corridor

The corridor is important for both passenger traffic and freight transport and is characterised by intensive and long-distance commuting by both car and railway. Hallsberg is a central transport hub, mainly for goods on rail. The inter-regional connections make it possible to easily reach the Stockholm metropolitan area by train and car from the southern side of Lake Mälaren. The corridor constitutes an important section for the traffic infrastructure redundancy between the East Central Sweden and the west coast connection, especially concerning road traffic. The cities *en route*, such as Hallsberg, Örebro, Eskilstuna and Katrineholm, have become important nodes for freight logistics. Combi-terminals, serving the needs of rail transport, are developed at several locations, including the so-called Dryport operations for the Port of Gothenburg.

Significant shortcomings identified

E20

The E20 is a horizontal connection between Stockholm, northern Mälardalen and southwestern Sweden. Significant shortcomings exist on the E20 that passes through Örebro (joint stretch with E18) with regard to capacity, punctuality and robustness. The traffic also causes significant noise problem. The road is in heavy use and serves high daily traffic volumes, i.e., up to 50.000 vehicles per day. Stationary queues are typically formed during rush hours at the busiest traffic sections.

Robustness deficiencies exist on the route between Gröndal and Eskilstuna. When traffic incidents occur, queues are formed causing long stops in the traffic flow. Furthermore, the traffic capacity is about to reach its critical point.

The Western main line

The Western main line is the only track link between the Stockholm-Mälar region and the Gothenburg region and, hence, is of great importance and national interest both for passenger and freight transport. The Western main line connects Hallsberg, Sweden's largest ranger farm, with the port of Gothenburg and is an important route for all of Sweden's business community.

The Western main line has shortcomings in capacity, robustness, usability, punctuality and safety due to the existing signal systems and lack of track solutions that enable the handling of various train types and service speeds. Laxå station fails in functionality with regard to the Värmland line and the Western main line.

The Svealand line

The Svealand line forms a link from Örebro County to the southern part of Mälardalen and Stockholm. There are significant deficiencies in capacity, usability and robustness in Eskilstuna. The infrastructure in Eskilstuna limits the efficient handling of the freight and passenger traffic mix. Noise also constitutes a health risk in Eskilstuna.

Capacity and robustness deficiencies exist on the Eskilstuna – Rekarne railway section. The same applies to Folkesta-Eskilstuna if measures are not taken to improve the maintenance of this particular section.