GreCOR
GREEN CORRIDOR
Oslo-Randstad

The Interreg IVB North Sea Region Programme
Investing in the future by working together for a sustainable and competitive region

Green Corridor in the North Sea region
Inventory Report

European Union The European Regional Development Fund

Cover photos: Courtesy of Swedish Transport Administration and SWECO

Title: Green Corridor in the North Sea region – Inventory report

Publishing date August 2014

Publisher: Swedish Transport Administration / SWECO.

Contact: Project Manager, Anna Hansson, anna.hansson@trafikverket.se. Nicklas Hansson, nicklas.hansson@sweco.se

Layout: Swedish Transport Administration/ SWECO

Distributor: Swedish Transport Administration, S-781 89, Borlänge, Sweden.

Executive summary

Work Package-leader: Swedish Transport Administration

General information

This report is a deliverable within work package 3, activity 3:3 of the Interreg IVB project GreCOR. The aim of the report is to create a common view of the current conditions to establish which needs there are within the transport corridor to make it greener, more efficient and safer.

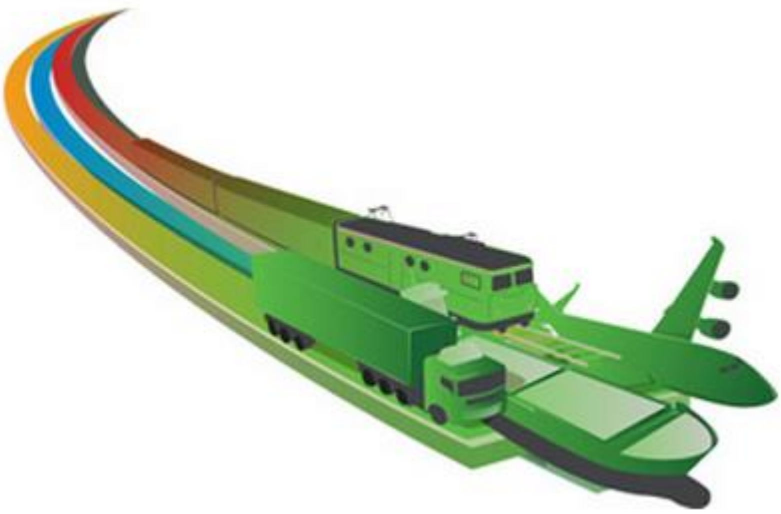
The uniqeness of the GreCOR area is the overlapping of TEN-T corridors (see figure 2). As part of the North Sea region, GreCOR unite the Scandinavian market to large European ports. GreCOR is either the start/end node or overlapping the Scan-Med corridor, North Sea –Baltic corridor, North Sea – Medditeranean, Orient/East - Med and Rhine – Alpine corridor.

All transport modes have different competitive and comparative advantages where they both need to compete and cooperate to achieve suitable and sustainable transport setups. This report visualizes the prevailing conditions in the corridor by transport mode.

The transport mode with most cross-border barriers regarding international traffic is the railway. In the early days, railway infrastructure was constructed with different standards both within the country and compared to other countries. As a consequence of a globalized market and different standards hindering movement, EU now strives for a harmonization of rules and regulations to facilitate efficient cross-border transportation. One example of EU:s effort is a single European train control and communication system called ERTMS.

Most infrastructure related bottlenecks in the corridor due to capacity changes e.g. single track/double track are being eliminated according to planned measures in national documents. Bottlenecks that do exist in the corridor concerns mainly rules and regulations by e.g. standards concerning signalling systems, power supply, vehicle lengths etc.

Content



Green Corridor (GreCOR) in the North Sea Region

GreCOR – Green Corridor in the North Sea Region – is an Interreg IVB North Sea Region project that started 1 January 2012 and will end in June 2015. GreCOR promotes the development of a co-modal transport corridor in the North Sea Region. Important in this collaborative approach, is the that the focus is not only on the corridor itself, but also on secondary networks and the hubs, and the regional hinterland around the Green transport corridor between Oslo and the Randstad area (Amsterdam, Rotterdam, The Hague and Utrecht).

GreCOR has 13 partners and a total budget of 3.7 M€. The overall aim is to improve knowledge about the logistic needs and conditions and develop a strategy for the further promotion of environmentally friendly transports in the corridor. GreCOR focuses simultaneously on infrastructure and logistics for "greening" of transport and to make the region more competitive. The activities in GreCOR and the strategy will be a contribution to the EU objectives for transport as expressed in the White paper from 2011 "Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system"

The work in GreCOR was performed in seven work packages. More information at: www.grecor.eu

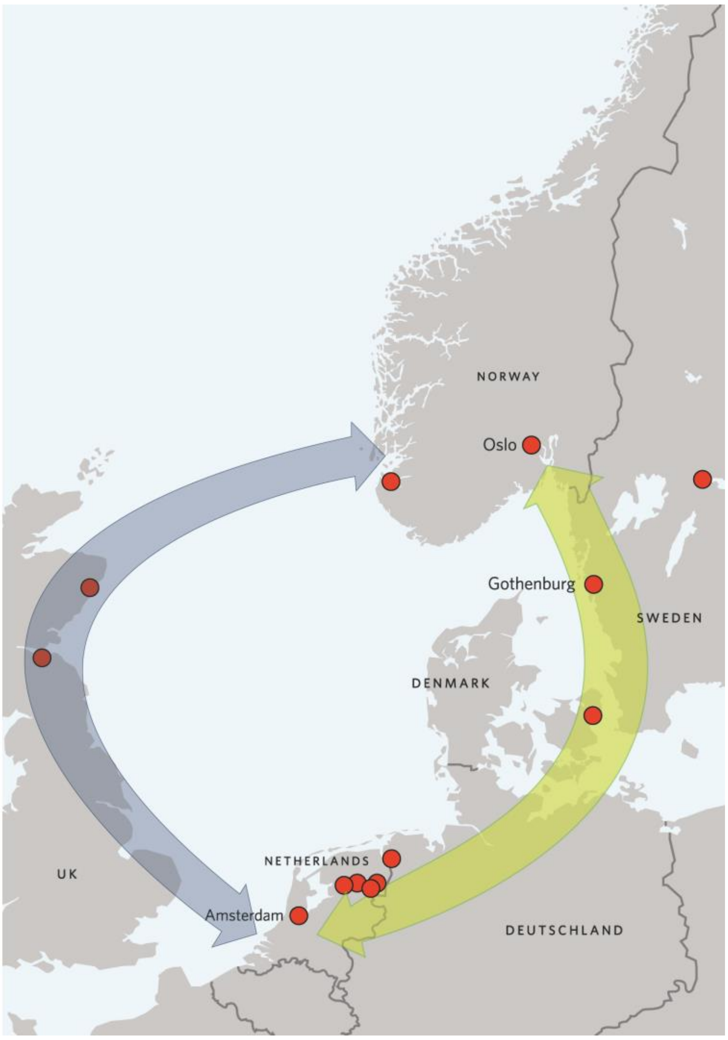


Figure 1. Map of the Corridor including locations of all project partners

Introduction to Work Package 3

This report is part of inventory and analysis for Green Corridor development and will provide knowledge of existing and future conditions.

Developing sustainable transport corridors will increase competitiveness and contribute to a sustainable Europe. These transportation passages and projects are so called Green Corridors. The Green Corridor concept is a European Commission initiative aiming at strengthening the logistics industry's competitiveness and to create sustainable transport solutions, also aiming at developing a "greener" transport policy, which satisfies the climate challenge while increasing European competitiveness.

Background

The Corridor is a multimodal connection between major cities. The cargo flows in the corridor can comprise complex combination of different load carriers and modes of transports such as rail, road and sea transport. In some cases, the cargo is transported through the entire corridor, but most often it is transported in parts of the corridor to the destined market or the point for shipment. Also several of the major North Sea ports are located along the corridor. The corridor, with its hinterland connections, is important for cargo flows in the whole North Sea region and for a huge number of companies and many millions of citizens. The aim of GreCOR is to improve the transports of cargo flows in a sustainable direction to minimize the environmental impact as much as possible.

The material produced in WP3 will function as benchmark for other Green Corridor projects and public and private stakeholders in other parts of Europe. It will create a common view of which needs there are within the transport corridor to make it greener, more efficient and safer. Effects of the infrastructure measures will be developed including a mapping of which measures that are already planned so far. The sub-activities will focus on the green corridor but the recommendation and conclusions will be general and applicable in other corridors and the transport network as a whole. A close investigation and collection of statistics is a prerequisite for improved knowledge about the freight flows. This will form the basis for decision-making and policies which lead to implementation and development of the functions of the freight transports.

Work package 3 consist of four different activities which results in several sub-deliverables. This report is a first step when mapping the conditions in the corridor as part of 3:3.

- Activity 3:1 – Identification of freight flows and standard development
- Activity 3:2 – Mapping of on-going and planned projects and initiatives in the corridor and its catchment area
- Activity 3:3 – Analysis of bottlenecks and gaps in the transport system of the green corridor and the secondary network
- Activity 3:4 – Develop a general method for how to measure the environmental consequences of the operations in the green corridor including the logistic hubs

Purpose & Aim

The purpose of this report is to create a common view of the current conditions to establish which needs there are within the transport corridor to make it greener, more efficient and safer. It will focus on the green corridor with the purpose of supplying a basis for reports in the GRECOR catchment area. The aim is to form a research and collection of knowledge about current conditions which will form the basis for ongoing work.

The overall aim is that:

- The material produced in WP3 will function as benchmark for other Green Corridor projects and public and private stakeholders in other parts of Europe

Delimitations and focus

The report has a geographical delimitation regarding infrastructure where a connection to national planning documents will be made. The infrastructure includes both primary and secondary networks where the exact content is not discussed.

Work package 3 in GreCOR

The goal in work package 3 is to provide the grounds for the development of the first green corridor in the North Sea Region.

"Seamless transport means moving from a patchwork to network and from supply chains to supply streams."

Pat Cox, European Coordinator for the TEN-T Scandinavian-Mediterranean Corridor

Defining GreCOR as part of other corridors

The aim of the Green Corridors Concept is to create freight corridors of excellence, where large and concentrated freight traffic flows between major hubs and by relatively long distances of transport can be handled in the most efficient, environmentally friendly and business driven manner.

A transport corridor can thereby not only be viewed as a link from A to B but as a combination of transportation networks that link together the same major origins and destinations, see figure below. This report uses the EU-definition which defines a green corridor as follows:

"The concept of transport corridors is marked by a concentration of freight traffic between major hubs and by relatively long distances of transport. Along these corridors industry will be encouraged to rely on co-modality and on advanced technology in order to accommodate rising traffic volumes while promoting environmental sustainability and energy efficiency. Green transport corridors will reflect an integrated transport concept where short sea shipping, rail, inland waterways and road complement each other to enable the choice of environmentally friendly transport. They will be equipped with adequate transhipment facilities at strategic locations (such as seaports, inland ports, marshalling yards and other relevant logistics terminals and installations) and with supply points initially for biofuels and, later, for other forms of green propulsion."[1]

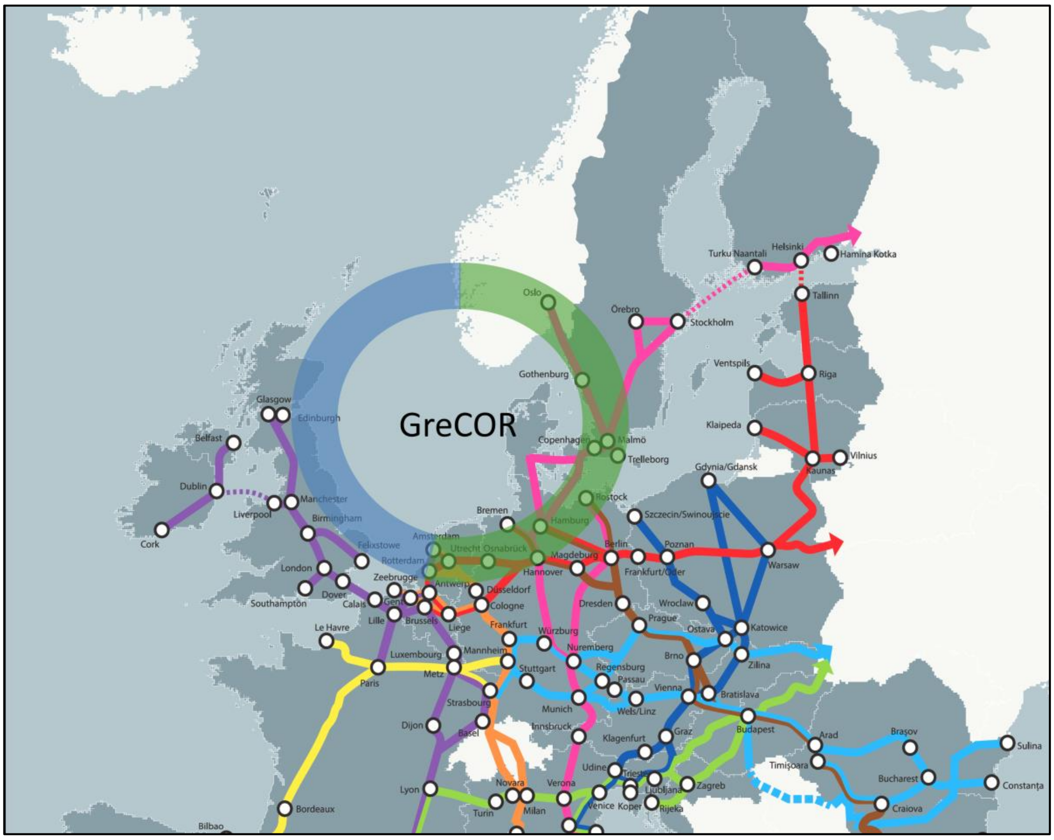


Figure 2. GreCOR in context to TEN-T core corridors, for larger picture see appendix.

[1] EU-definition from the Communication from the Commission Freight Transport Logistics Action Plan (COM(2007) 607 final)

GreCOR as part of the North Sea Region

The GreCOR area is part of a wider context as defined in the chapter above. As the purpose of this report is to create a common view of the current conditions, this part will show the overall layout of the infrastructure connecting GreCOR. The selection must be viewed generally where one line can contain several infrastructure links as specific primary and secondary infrastructure is not visualized.

The original definition of the GreCOR area was in the application described as the route Oslo – Malmö – Copenhagen – Hamburg – Randstad which in this report refers to as the GreCOR core network. The full corridor is however including a wider perspective of all countries and transport modes included in the GreCOR project where RoRo links have been added as a prolonging of the land infrastructure. And although the focus in this report regards the core network, the extended network is needed to show how the corridor interacts with the connecting infrastructure used in the corridor.

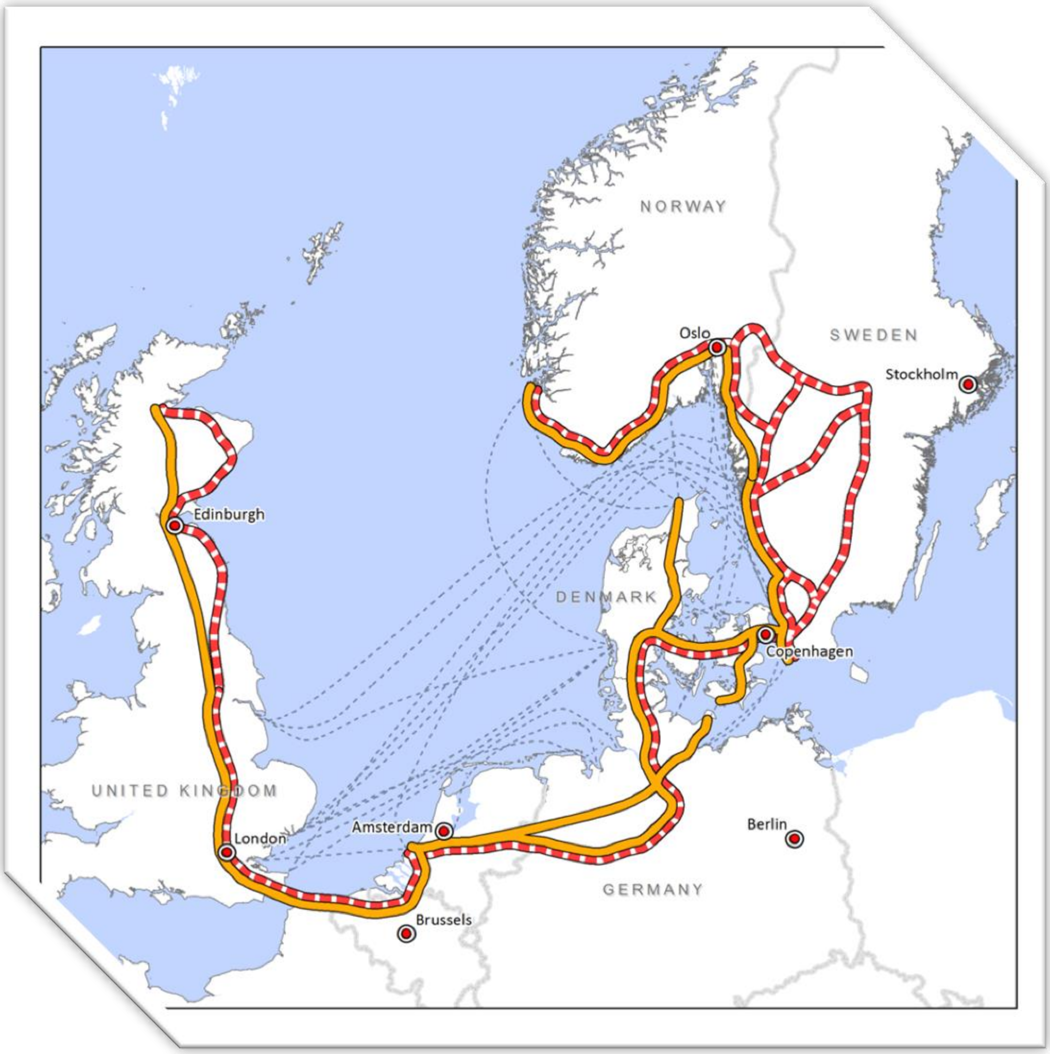


Figure 3. Map of extended GreCOR, red railway, yellow road and blue sea. The infrastructure is mainly ten-t core including connecting links in the North Sea region. The rail and road network in the picture should not be looked as specific infrastructure but as main routes for different modes in the corridor.

Inventory of GreCOR area in the North Sea Region

The purpose of this section is to create a common view of the current conditions to establish which needs there are within the transport corridor to make it greener, more efficient and safer.

Part of the inventory is investigated in-depth in an parallel EU funded project called COINCO North which aimed at investigate the possibilities to connect the regions of Oslo-Gothenburg-Copenhagen to one labor market region by high speed rail, relevant information has been translated and compressed. For an in-depth rail analysis for the COINCO corridor, visit www.8millioncity.com. The following sections will focus on GreCOR core network.

Railway

The transport mode with most barriers regarding international traffic is the railway. In the early days, railway infrastructure was constructed with different standards both within the country and compared to other countries. As a consequence of a globalized market and different standards hindering movement, EU now strives for a harmonization of rules and regulations to facilitate efficient cross-border transportation. One examples of EU:s effort is a single European train control and communication system called ERTMS.

European Rail Traffic Management System - ERTMS

Currently there are more than 20 train control systems across the European Union. ERTMS is an initiative backed by the European Union to enhance cross-border interoperability by using a single European train control and communication system.

Railway in the Corridor

Only a few customers have real life experience of railway transports as the market shares for the transport mode are slim in comparison to other modes. Even though the market is now deregulated allowing any company to operate, there are still only a few companies to choose between. This can be compared to road haulers where there are several hundred companies to choose between.

Railway infrastructure mainly affects three transport parameters; time, train capacity and wagon capacity which also have been highlighted in COINCO. The mapping will thereby focus on:

- Time: Number of tracks, signal system, traffic system, speed, electrification or diesel.
- Train: train weight, train length

- Wagons: weight per meter, load per axle, loading gauge.

Number of tracks

A single railway track requires lots of planning and is often suffering from capacity deficiencies. The trains must pass at passing loops so it is important to plan for every aspect in a train movement. Double track creates about four times higher capacity than single track as the trains can pass on separate tracks. Capacity deficiencies often occur when the tracks are highly utilized preventing trains from passing when traveling with different train speeds. When having four tracks, trains can use different tracks based on speed, thus creating fast tracks and slow tracks which in reality often are passenger and freight trains. (See appendix 1)

Electrification and power supply

Electrified railway lines contribute to more environmentally friendly transports. Electrification also means higher traction, better transport economy and the possibility to increase short-term capacity if the power supply can handle it. All railway lines in the corridor are electrified where Sweden, Norway and Germany have the same power supply: 15kv, 16 2/3 Hz (Alternating Current), Denmark have 25kv, 50 Hz (Alternating Current) and Netherlands have in general 1,5kv 4000 A (Direct Current). The “Betuweroute” between Rotterdam and Germany via Emmerich is equipped with the same power supply as in Denmark 25kv, 50 Hz. The border between Swedish and Danish electrification is at the middle of the Öresund bridge which means that the locomotives passing must be equipped to handle both power supplies. Between Germany and Denmark it is possible to swap locomotives in Padborg. Between Germany and Netherland it is possible to swap locomotives in Venlo, Emmerich and Bad Bentheim.

Traffic Control System

Sweden and Norway have the same signalling systems called automatic train control (ATC). Denmark has a system called ATC-KVB 450, Germany has an ATC called indusi/PZB and Netherland an ATC called ATB. These are four different systems which are not compatible. A train from Norway to Netherlands does thereby need to be equipped to handle four signalling systems and two/three power supplies.

Axle load

A higher permitted axle load is beneficial for freight trains as it enables a higher weight or fewer axles per wagon. It is also beneficial for the locomotives as a higher axle load (adhesion weight) will create a better traction control. The standard in the corridor is 22.5 tons with some freight lines permitting 25 tons.

Meter load

For high density freight transports, meter load is an important parameter. The meter load simply enables goods to be packed more densely which in turn is connected to the transport economy. In Norway, the general standard is 6.6 tons/meter. Sweden has a bit lower standard of 6.4 tons/meter while Denmark, Germany and Netherlands in general have 8.0 tons/meter.

Speed

The maximum permitted train speed is of importance when lowering transport times over long distances but it has a higher impact on passenger trains than freight trains since freight trains often has a upper limit of 100 km/h. the speed is in reality, mainly due to traffic control systems and braking.

Train lengths

The most important factors when discussing train lengths are infrastructure, equipment and rules and regulations. Besides traction, important factors as braking ability, braking rules, passing loops and signalling system needs to be taken in consideration. Within the corridor the prescribed maximum lengths in the rail network statements are around 750 meters – 850 meters although the infrastructure will mainly not allow such long trains, making the average length in the corridor around 600 meters. Even with the same conditions the braking rules are different between countries, forcing the driver to manually adjust the brakes at borders.

Load Gauge

The loading gauge is the outer dimensions of the load unit. For volume goods this is the limiting factor besides axle load and meter load. The load gauges are referred by letters (width x height) where Germany, Netherlands and Denmark in general permits G2 (3,15 m x 4,65 m), Sweden permits A (3,4 m x 4,65 m) and on some parts C (3,6 m x 4,83 m) and Norway permits M (2,86 m x 4,595 m)

Intermodal gauge

When loading an intermodal unit as trailer, container or swap body to a rail wagon, the width is 2.60 and thereby is height often the limiting factor when comparing to the permitted loading gauge. These transports are coded with UIC codes as Pocket/Container including a three digit number of the height above road surface. The gauge is based on a standard pocket wagon with maximum of 33 cm height above top of rail. The most common P/C 410 does thereby allow 4,1 m trailer and 3,25 m swap body.

Table 1. The table below shows general data in the GreCOR area for railway traffic. *normal train lengths **theoretical length in network statements

	Norway	Sweden	Denmark	Germany	Netherlands
Length	850 m**	630 m*	835 m**	740 m*	750 m**
Power supply	15 kV 16 2/3 Hz	15 kV 16 2/3 Hz	25 kV 50 Hz	15 kV 16 2/3 Hz	1,5 kV, 4000 A / 25 kV 50 Hz
Loading gauge	M	A,C	G2	G2	G2
Traffic Control system	ATC	ATC	ATC-KVB 450	Indusi	ATB/ ERTMS
Meter/Axle load	6,6 / 22,5	D2	D4	D4	D4
Intermodal gauge	P/C 410	P/C 400 P/C 450	P/C 410	P/C 410 P/C 405	P/C 410

Planned measures in railway

This section covers a selection of interesting planned railway measures along the corridor. On EU level, it is decided that ERTMS will be implemented when new railway tracks are constructed or large reconstructions take place. The six transnational freight corridors in Europe shall be equipped with ERTMS before year 2020.

Norway

In accordance to EU, Norway has extensive plans to introduce ERTMS as the new signaling system. Other rail network plans in the corridor are renewing of overhead contact line (Lilleström – Matrand, Moss - Konsjö & Ski - Mysen). New passing loops and upgrading along the Kongsvinger rail line (Handlingsprogram 2014)

Sweden

Planned rail investments along the Swedish parts of the corridor are directed toward increased power supply Kil – Öxnered and increased capacity by additional track towards port of Gothenburg. Investments are also directed to a new tunnel under the city of Varberg and an additional track between Varberg – Hamra making the entire distance Gothenburg – Malmö with double track. In the region of Scania, the passing loops between Åstorp – Teckomatorp are extended with additional track between Ängelholm and Romares. The new tunnel through Hallandsåsen will create increased capacity and a better route for heavy transports. (Regeringskansliet)

Denmark

The Danish rail infrastructure plans are mainly directed to Copenhagen – Fehrman where a new railway line will be created (Copenhagen – Ringstad) and an extra track will be created the remaining stretch. The whole distance will also be electrified and with a joint effort with Germany, a bridge will be created over the Fehrman belt. Along the main line, there are plans to create an extra track between Vamdrup – Vojens making the stretch double track. Along the main line, the distance Taulov – Padborg and the "little belt bridge" will be upgraded. (bane.dk)

Germany

The German rail investments in the Corridor are mainly directed to upgrading the railway line from Fehrman belt to Hamburg with plans of electrification and additional track Hamburg – Lübeck. Other investments are directed to minor stretches of upgrading and additional track e.g. between Lauenbrück – Isernhagen and Neumünster – Bad Oldesloen. Investments with a direct effect on cross border traffic in Emmerich where additional track is created towards Duisburg and at Venlo with plans to widen the stretch to two tracks (Kaldenkirchen-Dülken and Rheydt – Odenkirchen) creating better capacity. (bmvbw.de)

Netherlands

The main freight related rail infrastructure plans are directed towards an increase in transnational extension towards Germany in Zevenaar. Where there are plans to replace the power supply to 25 kV (ERTMS prepared) and also connecting Zevenaar – Emmerich with ERTMS. (ProRail 2015)

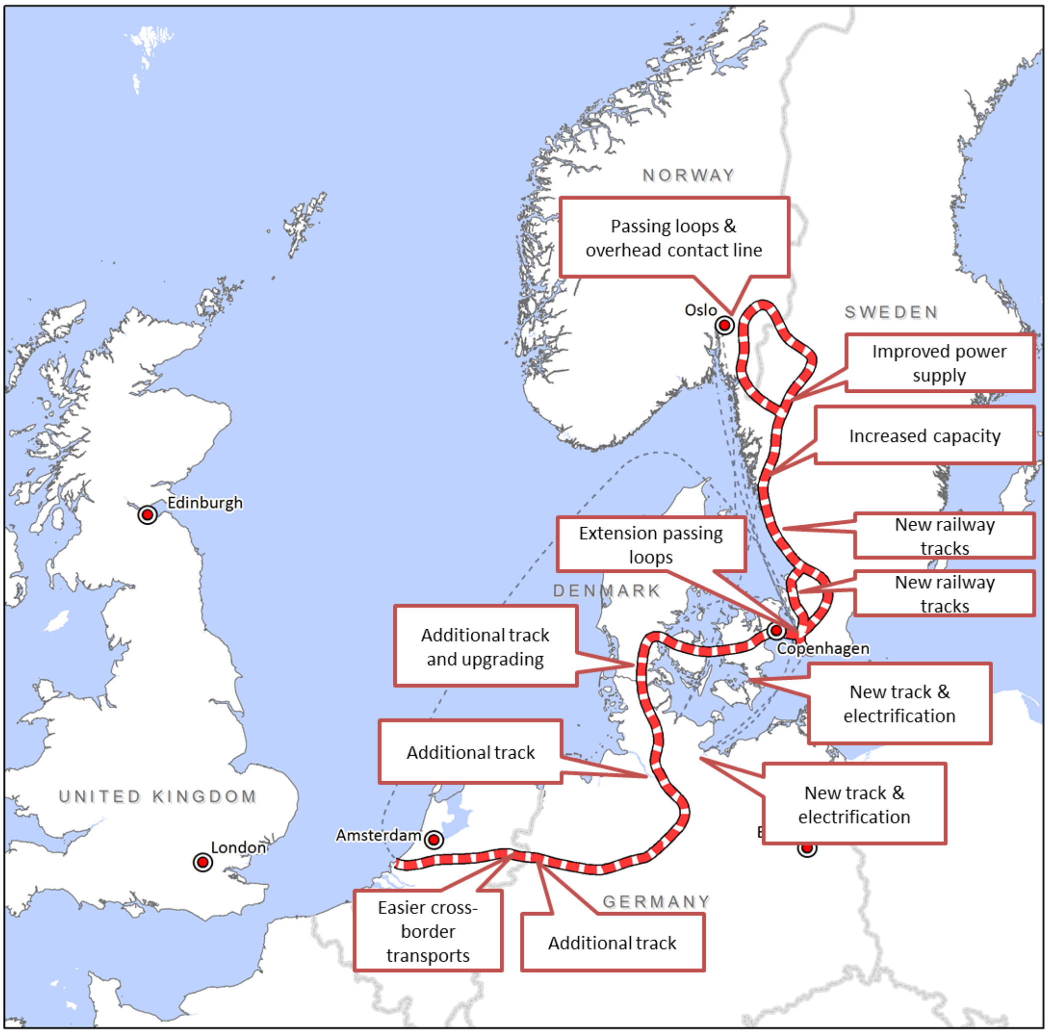


Figure 4. Only railway, including planned measures

Road Transport

Truck transport is a transport mode with high flexibility for small loads and is thereby a transport mode included in almost every supply chain offering door-door solutions. The below investigated parameters are compiled in table 2.

Speed

All trucks (over 3.5 t) in Europe should be equipped with a speed regulator. The regulator will control that the truck cannot pass 90 km/h even though the permitted speed in the countries are only 80 km/h.

Dimensions

The dimensions of a road unit are limited in height, width and length with differences between countries. Existing combinations are related to existing dimensions of load units. In Sweden, both increased height and length is permitted, allowing for combinations up to 25.25 m long and 4.5 m high. In Norway, the permitted length is increased to 19.5 m as the Nordic geography and climate requires a larger safety margin between the drawbar trailers and because the majority of tractors have three axles. In Denmark, Germany and the Netherlands the permitted length is 18.75 m allowing two swap bodies or a trailer. (2.35 m is dedicated for the cabin and 0.75 m for the clutch.) The maximum width is 2.55 m, for refrigerated cargo 2.60 m is allowed.

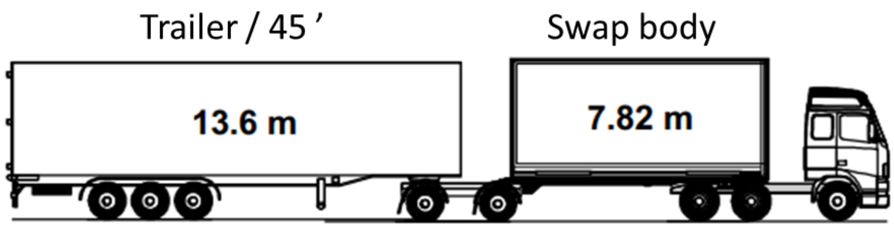


Figure 5 Truck combination allowed in Sweden

Weight

Weight is an important factor for road abrasion and road safety. The countries along the corridor have different rules and regulations about maximum restrictions but the common denominator is 11, 5 tons per drive axle and 10 tons on a non-drive axle. Norway permits up to 6 axles and 50 t, also 56 t for timber transport between 21.5 and 22 meters with at least 7 axles. Sweden permits 7 axles and 60t while Denmark up to 7 axles and 54 t. In Germany, the maximum weight is restricted to 40 t. Netherlands have, under specific conditions, EMS (European Modular System) combinations that may have a maximum length of 25.25 m and maximum mass of 60 t, otherwise the limit is 50 t. (International transport forum/OECD)

Environment/ Alternative fuels

Alternative fuels are the choice of any fuel other than the traditional selections that is gasoline and diesel. Alternative fuels can be biodiesel, electricity, ethanol, hydrogen, natural gas and propane etc. The most extensive networks in the corridor consist of compressed natural gas (CNG). Other mid-range networks exist with Liquified natural gas (LNG), Hydrogen with a limited amount of filling stations available. Other, upcoming fuels are BioDME (residue from paper & pulp industry) and Biodiesel.

Road Fees & Charges

A united road toll exists for domestic trucks in Sweden, Denmark and Netherland which is depending on Euro classification and number of axles. A user charge paid in one of these countries is also valid for journeys in the other member countries road network. Germany, who initially was part of the road toll, has created their own system called Maut which instead depends on the distance covered and euro classification. The data is collected via an On-Board Unit (OBU) that needs to be installed. In Norway, tolls are paid when passing toll stations for (roads, cities and ferries) all over the country. Since 2013, all heavy vehicles must be equipped with an automated tag called AutoPASS. The same fee system is equipped on the Öresund bridge between Sweden and Denmark.

Abnormal freight by road

When transporting freight with larger dimensions or heavier load then what is stated above, it is considered an abnormal freight. Each country along the corridor has its own national authority deciding if the dispensation application is accepted or rejected making cross-border traffic both expensive and time-consuming. The European Commission has now created guidelines for the procedure and contacts in each country to make cross-border transports in EU easier. The average time for receiving permission varies from 1 day (Denmark) to 7 days (Germany). (European Commission)

Congestion

There is an overall problem with traffic congestions in big cities all over the world. In a recent report by INRIX[2] the most congestion intensive countries in Europe was identified with Netherlands on a second place and Germany on 7th place. In the top 25 most congested cities, Rotterdam (6), Hamburg (21), Amsterdam (15) and Haag (25) qualify. Sweden and Norway have introduced congestion charges for traffic in Oslo and Gothenburg. Denmark has a different approach and instead the government wanted to reduce the train-ticket prices and improve the efficiency of public transportation through the nation. In Germany, the discussion to introduce congestion charges or vignettes is started and in Netherlands the use of road pricing is introduced where the driver pay a fee per kilometre dependent on which car you have, in which area you are driving and which time during the day.

Table 2. The table below shows general data in the GreCOR area for road traffic.

	Norway	Sweden	Denmark	Germany	Netherlands
Height	4,5 m	4,5 m	4,0 m	4,0 m	4, 0 m
Width	2,55 m (2,60 m)	2,55 m (2,60 m)	2,55 m (2,60 m)	2,55 m (2,60 m)	2,55 m (2,60 m)
Weight	50 t (56 t)	60 tons	54 t	40 t (44 t)	50 t (60 t)
Length	19,5 m	25,25 m	18,75 m	18,75 m	18,75 m
Speed	80 km/h	80 km/h	80 km/h	80 km/h	80 km/h

2 http://scorecard.inrix.com/scorecard/

Planned measures road

This section covers a selection of interesting planned road measures along the corridor. On EU level, there are of today common rules for maximum driving time and minimum rest periods for drivers. The market was through EU opened to allow cabotage.

Norway

In Norway, plans are to build a new tunnel (Manglerudstunnelen) improving the connection between E6 to the freight terminal Alnabru and the south port. Expansions of roads 22 with a new bridge across Glomma will increase capacity. Large investments are assigned road E18 between Oslo and the national border which is part of the “Nordic triangle”, these investments are set to increase the capacity along the stretch while also making it mid-separated. (Handlingsprogram 2014-2017)

Sweden

The main plans in Sweden are the upgrade of road E6 (Tanumshede – Pålen) to motorway standard and expansion of road E20 (Gothenburg – Stockholm) which will be motorway and mid-separated lanes with two files in both directions. Together with new infrastructure in and around the city of Gothenburg to ease congestion e.g. a new tunnel and a new bridge over Göta älv etc. (Regeringskansliet)

Denmark

Along the corridor through Denmark, plans are to expand the motorway E20 between (Greve S - Solröd S) and (Nørre Aaby – Middelfart) with extra lanes. New access roads to the motorway are built near Odense and a new bridge over the bay of Køge. Between Rødby – Puttgarden a new motorway bridge will be finalized in 2021. (www.vd.dk)

Germany

German investments in the corridor are planned around the city of Hamburg and along the main routes of A1 which will be widened including new motorway interchanges and junctions. New motorway junctions are also planned on some of the minor roads; A 23 (Horst / Elmshorn and Hohenfelde) and A31 (Dörpen and Rhede). A bypass at road B68 in Badbergen will remove traffic from the city centre and roads B403 (Nordhorn – Neuenhaus) and B214 (Hastrup – Grönlohe) will be upgraded. (Federal Transport Infrastructure Plan 2003)

Netherlands

Most road projects in the Netherlands are related to extension, renewal or renovation to increase mobility for road traffic. The projects with a major impact on the transport system are integration of A1/A6/A9/A10 Schiphol-Amsterdam-Almere to increase expansion of residential areas and new access roads. A bypass road A9 around the center of Badhoevedorp will be constructed and an extension of the motorway A28 at (Utrecht-Amersfoort). (MIRT)

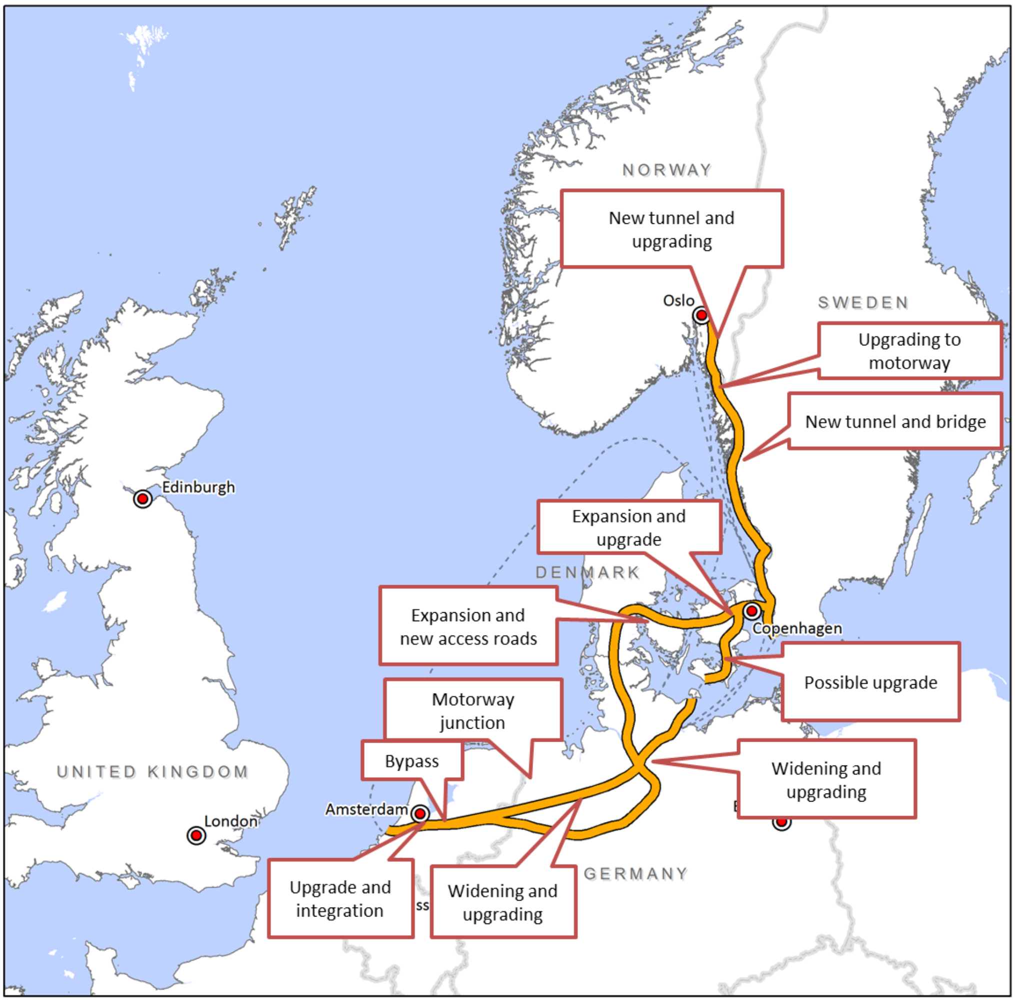


Figure 6. Only core road, including planned measures

Sea Transports

The North Sea is a busy place as far as shipping goes, with over a 1000 ships occupying these waters at any given time. Most of the traffic is concentrated to the area between the larger ports of Antwerp, Rotterdam and Hamburg, because of the large volumes of cargo and goods that these ports handle every day. (CNSS) The sea transports can be divided into two categories; inland shipping and short sea shipping with different rules and regulations and size.

Inland Waterways

In Sweden, as of right now inland operating vessels are required to fulfil the same standards as ships operating out at sea. This has led to companies and other actors neglecting inland shipping in favor of other transport modes. A proposition has now been put forward, regarding the implementation of the EU directive in this matter, and some stakeholders believe this will help increase the competitiveness of inland shipping and help relieve congested road and railway systems of some traffic.

In other places along the corridor, especially in Germany and the Netherlands, the status of inland shipping is much greater and a recent study showed that almost 30% of transports in the Netherlands are made by inland shipping vessels. The ports in these countries make great use of this from shipping to and from the port, along the Rhine River in particular. According to another study the largest capacity reserves, of the three analysed transport modes (road, rail, inland waterway), are found in inland shipping whereas both rail and road are in places operating above their foreseen capacity, which causes obstructions and congestion. (VTI 2012)

Analyses have been conducted in order to try and determine external costs, which are cost affecting a third part i.e. pollution and noise etc. of different transports modes and the result presented in one of these studies is that the external costs of inland shipping are substantially lower than those of road and rail. (PLANCO 2007)

Large ports in the corridor

EU is heavily dependent on its ports as the ports handles over 74 percent of all merchandise exchanged with the rest of the world. (European Commission, 2014) The majority of the large ports in Europe are part of the corridor with Rotterdam handling over twice as much freight (in weight) compared to both Antwerpen and Hamburg. For further information about freight handled in GreCOR ports, see Cargobank report.

SECA directives

According to the International Maritime Organisation (IMO), a stricter environmental regulation for shipping will be introduced within the Baltic Sea, North Sea and English Channel in 2015, the area is called; the classified Issue Control Area for sulphur with abbreviation SECA. From 2016 there will also be stricter nitrogen regulations (VTI, 2012).

This regulation stipulates that the allowed sulphur content in fuel shall decrease from 1 % to 0.1 % in 2015. The effect of the directive is an increase in cost as shippers need to invest in new/redesigned ships and/or cleaner and more expensive fuels, and as consequence it is predicted that goods will be transferred from sea to land transports.

Increased fuel costs are added into the price of transport through adjustments in the contract, but affect the competitive position towards other modes of transport (VTI, 2012). Estimated increased transport costs by 20-30 % have been calculated. Manifested in terms of cargo reported an increase by 20-100 € / ton.

Transport Economy

A clear trend of the shipping activities is the transition towards larger vessels when transporting goods over the sea. Economy of scale is certainly applicable as the new larger ships have less energy consumption per tonnage and are therefore more cost effective than their smaller counterparts. However, the number of ships calling ports is decreasing. These trends can be traced back to increasing fuel prices and new environmental regulations, which forces shipping companies to become more cost effective.

LNG bunkering facilities

To which extent ports can provide LNG to incoming vessels has become increasingly important and the importance will only continue to increase as the new sulphur emission limits come in to play in Europe. Therefore it is becoming more essential that ports have installed the appropriate infrastructure to face this increasing demand. Using LNG also contributes to reduced emissions of greenhouse gases. However, in order to make the necessary changes, i.e. constructing infrastructure to support the use of LNG and modifying the ships for this new propellant, will require large investments. At this point in time, there are not that many ports equipped to supply this fuel and ships might find LNG supply quite scarce along the corridor. There are however exceptions, e.g. Rotterdam is currently operating a LNG terminal to supply incoming vessels as well as other terminals in the area. Rotterdam and Port of Gothenburg have also initiated cooperation towards conjoint rules and regulations for handling with development towards fuelling where ship-ship will be possible. (Port of Gothenburg)

On-shore power supply (OPS)

On-shore power supply is a system developed to eliminate the use of auxiliary engines of ships, while at berth. It works by hooking ships up to a land-based power grid that supplies the ship with power. This system is designed to help reduce fuel usage in ports, thus reducing emissions as well as noise. It does require infrastructural investments as well as some modification to the ships to make them compatible with the technology. Best potential has harbours with the same ships frequently calling. An OPS is already installed and operational along the west coast of Sweden, in some of the major ports. This technology is also utilized in Norway and the Netherlands, however only limited to a few harbours. In Germany and Denmark this technology cannot be found along the corridor route. OPS can be used with different voltages and this varies from port to port. This lack of standardisation is hindering a fast and wide implementation.

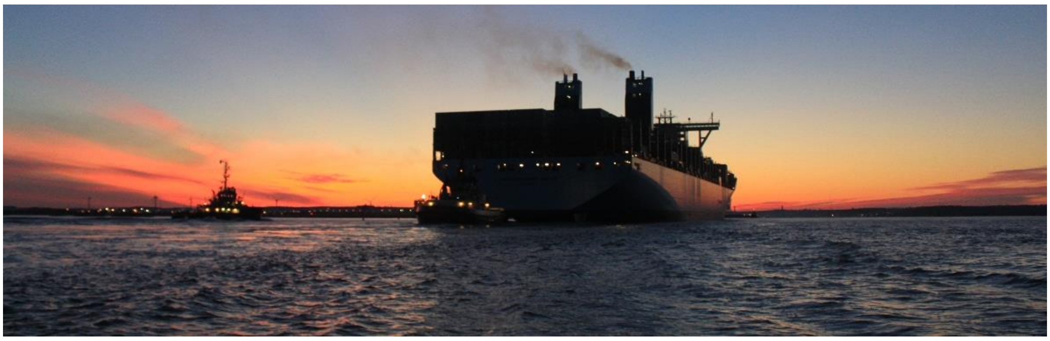


Figure 7. Picture of container ship (courtesy of Swedish Transport Administration)

Planned Measures Sea

The majority of the ports have several planned measures ongoing to create better connections to the port, both from a land and sea perspective. The ports also work constantly to create a better use of facilities and other measures to meet the customer needs. Depending on the project there are both public and private financiers. This section covers a selection of interesting public and public-private funded planned sea measures along the corridor.

Norway

Port of Oslo is one of the strategic ports of Norway where investments are placed towards deepening of the waterway leading up to the port of Oslo to about 14 meters. Also port of Risavika will be getting a deeper waterway from 12 to 18 meters. (Nasjonal transportplan)

Sweden

Sweden has many of their strategic ports within the GreCOR area where Port of Gothenburg is the largest based on volume. Local land-based infrastructure projects are ongoing towards better connections to the port of Gothenburg and in the national transport plan the only planned project is deepening of the waterways to the passenger car port of Wallhamn. (Regeringskansliet)

Denmark

In Denmark, there is no specific Planning Act for its sea space but their Marine Policy Strategy stresses the need for a Maritime Spatial Planning document which now is being investigated. The association Danish Ports has however proposed a document listing several important infrastructure measures mainly directed towards better connection by land to port areas.

Germany

Major investments are directed towards increased hinterland infrastructure connections to German ports by both rail and road. Also deepening of the waterways towards port of Hamburg and Bremerhaven are planned together with inland waterways as the Kiel Canal. (Federal Transport Infrastructure Plan 2003)

Netherlands

Many maritime projects are ongoing in the Netherlands for inland and coastal waterways. Planned projects in the GreCOR area are among other, new locks and integrated traffic management in the North Sea canal to ensure nautical safety and smooth passage. Other projects are upgrading of inland waterways to increase the allowed barge classification, elimination of narrow profiles Amsterdam – Rhine canal and deepening of the waterway Amsterdam – Lemmer. (MIRT)

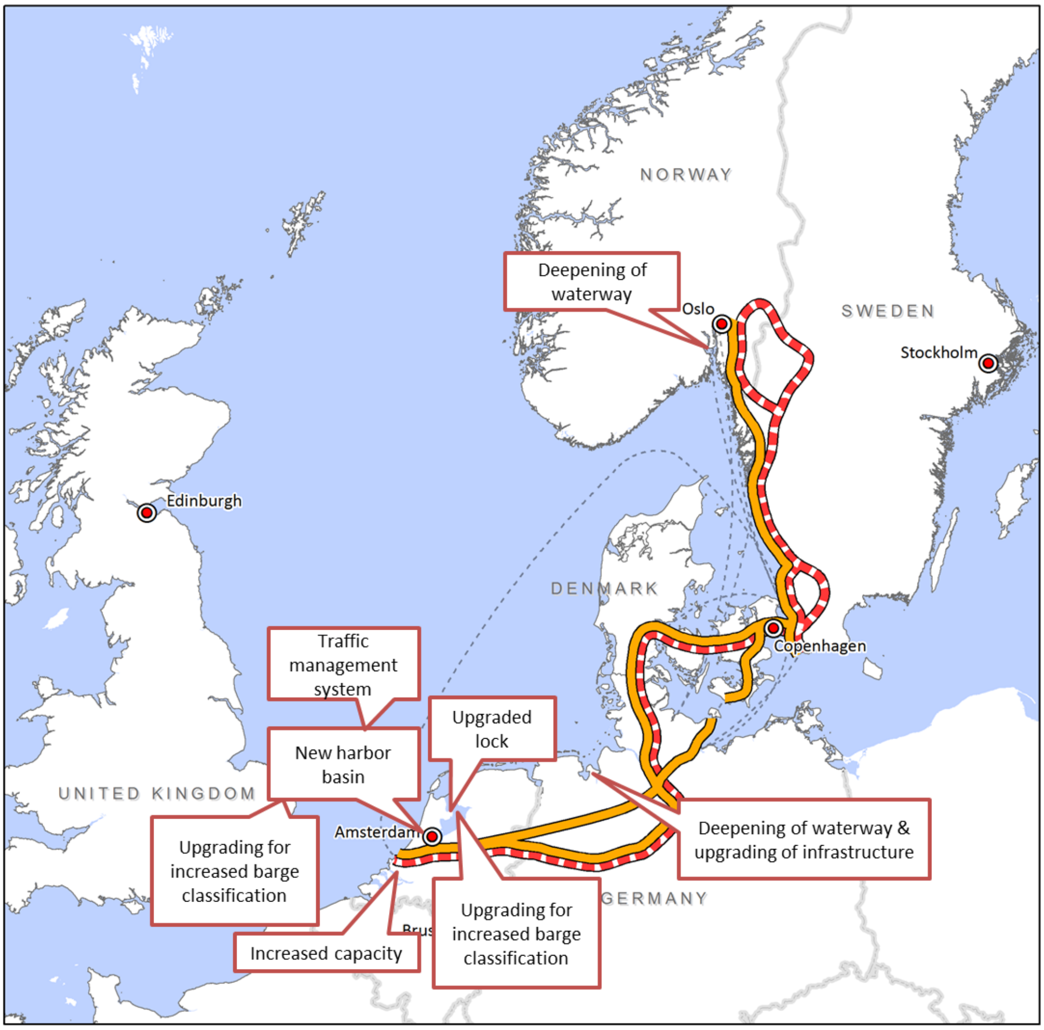


Figure 8. Planned public measures for maritime infrastructure.

Air transport

In today's transport system all modes of transportation have comparative advantages and disadvantages where they both cooperate and compete with each other. Air transports are mainly competitive when transporting high-value goods over long distances. High value goods have specific demands on short lead times, high security and surveillance.

There are mainly three ways to transport air freight; as belly-cargo, by freighter or by land based modes of transport. The networks are built as “Hub and Spoke” systems where the air freight operator’s network is typically a single hub operation, this as a result of regulations up until 1993 which prevented the development of hubs outside of the national territory. The regulations are now lifted and the air freight operators can expand within the EU.

The demand for air freight is mainly limited by cost, typically priced 4–5 times compared to road transport, 7-8 times compared to rail and 12 – 16 times compared to sea transport. Commodities shipped by air thus have a high value per unit or are very time-sensitive, such as documents, pharmaceuticals, fashion garments, production samples, electronics consumer goods, and perishable agricultural and seafood products. (The World Bank 2009)

Air freight is thereby not used extensively as a transport mode within the corridor, but the airports function as important connective hubs as they enable intermodal shift for door to door deliveries.

The future of air transport is predicted, in the short run, as a consequence of higher fuel prices are expected to result in slower growth of air cargo traffic or even in a possible downturn. Over the longer run, traffic should continue to grow, but air freight will increasingly be integrated into multimodal supply chains that provide a better balance between cost and time.

Figure 9. Air-freight plane. (source: howstuffworks.com)

The Terminals role in the corridor

A transport terminal is an interchange site, a node on a transport network. An intermodal terminal is a site where mode is changed, generally road/rail or road/barge. These can be as simple as a rail siding (basically just a spur of rail track off the main line) with a small area for a mobile crane or reach stacker to lift the cargo, or it may be a large area with several tracks and large gantry cranes.

Figure 10 shows a small intermodal terminal in Minden, near Hannover in Germany. It is a trimodal terminal operating barge, sea and road transports. It has two reach stackers for container handling and space for stacking both full and empty containers in the terminal area. The terminal buildings are for logistics services such as storage, loading, cleaning of containers etc.

Figure 10. Small intermodal terminal at Minden, Germany, (Source: mindener-hafen)

The size of an intermodal terminal will depend on its role and how many functions it provides. Trains coming from the mainline will often need to be marshalled in yards beyond the perimeter of the terminal itself. They may need to be split into sections for different parts of the terminal or simply because many terminals are not long enough to handle a full length train. This is especially the case in the United States with very long trains reaching over 10,000ft in some cases (meaning that, with double-stacking, US trains can reach capacities of 650 TEU, compared to around 80-90 TEU in Europe). Additional staff and shunting locomotives are required for this purpose, before the wagons are in place for unloading and loading to commence. Then the train sections will be brought into the site and onto the handling tracks, some of which will be under cranes and others which will be just for marshalling or storage.

An intermodal terminal can be operated by a transport provider as part of their transport network or it can be operated by a dedicated terminal operator handling trains from multiple individual rail operators. A terminal requires a small office building, and will often provide some basic services such as container cleaning and maintenance and some space for an empty depot. The basic function of the terminal is to change mode, thus it can be a site where many trucks bring or collect containers to and from the rail head. In addition, intermediate supply chain activities can be performed there. It could be very basic, such as some container stripping and reloading, or combining small loads into groupage loads, or LCL (less than container load) into FCL (full container load). These operations are performed in a container freight station (CFS). This would normally be the limit of what would be provided in even a large intermodal terminal. Beyond that, there will either be individual organisations or 3PLs with their warehouse or distribution centre located nearby, or these buildings could be grouped together in a large logistics platform, which is a multi-user site with shared facilities.

For an intermodal terminal to be successful, regular traffic is required, which generally means a large amount of production or consumption nearby with a suitable distance to origin or destination to support regular long-distance trunk hauls where rail or barge is the natural mode. Various break-even distances have been suggested in the literature (usually averaging at around 500 km), but the reality is that it depends on operational considerations. The longer the distance, the more likely that the increased handling costs of changing mode from road to rail/barge will be offset by the cheaper per-unit transport cost. However, this depends on the quality and capacity of the intermodal infrastructure as well as suitably scheduled services at the right departure and arrival times, without unnecessary delays along the route. It also depends on the total quantity of cargo as such services will not be economic unless they achieve high utilisation in both directions. For these and other reasons, road haulage still retains a large proportion of medium and even long-distance flows.

Inland terminals can be developed according to different strategies, involving differing motivations, actors, functions and logistics models. They can be close to the port, mid-range or distant. They can be built to ease port congestion or for reasons of hinterland capture and port competition. They can be developed by port authorities, port terminal operators and transport providers such as rail operators or third-party logistics providers (3PLs), or they can be developed by public bodies, whether national, regional or local. They can be designed on a rail-based strategy of generating economies of scale on high-capacity, long-distance links. By contrast, they can be road-based short-distance satellite terminals to ease port congestion or facilitate fast-track customs clearance.

The potential success of intermodal transport services relies on the logistics model of the clients and the relations with transport actors such as rail operators and port terminal operators. Monios (2013; 2014) applied governance theory to the relationship between intermodal terminals and logistics platforms, developing a 4-level framework:

1. The developer of the terminal (e.g. municipality, real estate developer, rail operator)
2. The operator of the terminal (e.g. independent terminal operator, rail service operator, 3PL)
3. Internal operation model (relation between terminal and logistics planning)
4. External operation model (relation between terminal and others, e.g. rail service operators, 3PLs, ports, shippers)

These four levels must be understood when planning a new terminal because the business model of the operational terminal will determine its success, and thus must be part of the initial decision to fund a terminal development. Government funders want to achieve modal shift by removing barriers to rail freight such as upfront costs, sunk costs and availability of suitable terminal locations, rail authorities want to provide sufficient capacity and quality of infrastructure for freight operators, rail regulators want to ensure fair competition and open access to infrastructure and terminals. Operators will only enter the market and provide services if they believe they can operate profitably, but government agencies must decide how to incentivise this market entry without granting monopoly power to an operator that would inhibit fair competition with other operators.

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Appendix 1

GreCOR in context to the TEN-T corridors

Appendix 2

Map overview of railway infrastructure in the GreCOR area.

GreCOR
GREEN CORRIDOR
Oslo - Randstad

Contact

anna.hansson@trafikverket.se
nicklas.hansson@sweco.se

www.grecor.eu

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