GreCOR
GREEN CORRIDOR
Oslo-Randstad

European Union The European Regional Development Fund

The Interreg IVB North Sea Region Programme

GreCOR

Action plan for the development of the green corridor: Oslo - Randstad

REPORT

Action plan for the development of the green corridor: Oslo - Randstad

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Preface

The work reported here has been carried out by WSP Analysis & Strategy (Sweden), Tetraplan (Denmark) and Analyse & Strategi (Norway). The work is part of the GreCOR project -Green Corridor in the North Sea Region- and has been co-funded by the European Regional Development Fund - Interreg IVB North Sea Region Programme.

Mona Pettersson at WSP Analysis & Strategy has been the project leader of the work. Apart from her, Nina Modig, Helena Kyster-Hansen and Julie M. Amlie have worked in the project.

Some of the work reported here, i.e. section 2-6, has been carried out by the same project partners in an earlier study. That study was part of the COINCO II project. Project leader for that part of the work was Kjell-Ove Kalhagen at Analyse & Strategi. In addition to him, Fredrik Dehlin and Julie M. Amlie participated in the project as well as Mona Pettersson and Helena Kyster-Hansen.

1. The GreCOR project

The aim of the project Green Corridor in the North Sea Region, abbreviated GreCOR, is to promote the development of a co-modal transport corridor in the North Sea region. This work has been divided into seven work packages as seen in Figure 1[1]. The work packages include Project Management (WP1), Publicity and Communication (WP2), Inventory and Analysis for Green Corridor Development (WP3), The hubs central role in the Corridor (WP4), PITS: Professional Intelligent Transport Solutions (WP5), Partnership & Strategies (WP6) and Pilot Projects (WP7). For more information about the GreCOR projects and its partners: www.grecor.eu.

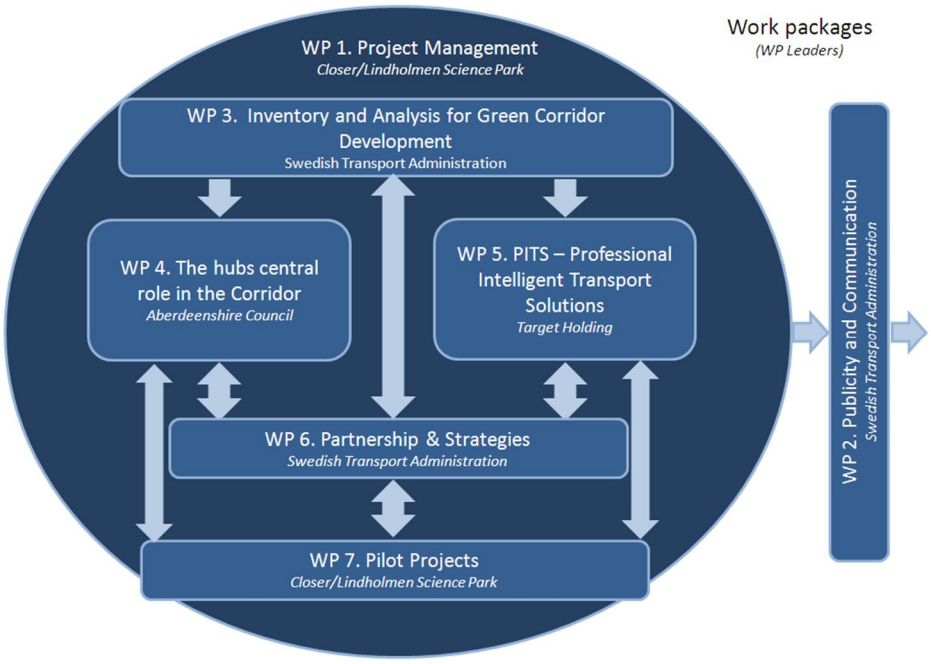


Figure 1 The work packages of the GreCOR project

This report is part of work package 3, i.e. the "Inventory and Analysis for Green Corridor Development". The aim of work package 3 is to "provide the grounds for the development of the first green corridor in the North Sea Region"[2]. The Swedish Transport Administration is the partner responsible for this work package.

[1] Source: http://www.trafikverket.se/PageFiles/84196/work_packages.jpg
Retrieved on the 10. October 2012

[2] Source: http://www.trafikverket.se/Om-Trafikverket/Andra-sprak/English-Engelska/GreCor---Green-Corridor-in-the-North-Sea-Region/Work-packages/Work-package-3---Inventory-and-analysis-for-Green-Corridor-development/
Retrieved on the 10. October 2012

The scope of the work reported in this report is to:

- Define the corridor by identifying start- and end nodes as well as the transport links and key nodes
- Identify the bottlenecks in the transportsystem
- Present information on plans and projects to improve the transport system in the corridor
- Identify "new" measures to solve existing problems in the corridor
- Assess expected effects of the implementation of identified measures and prioritize among them
- Form an action plan for the development of the green corridor
- Suggest interesting projects/initiatives to develop the corridor

The work has been carried out in order to achieve a well-developed green freight corridor in the North Sea Region. The corridor is to be sustainable, efficient and well established.

2. Demand for freight transports and choice of transport modes

In parallel with the economic growth, the demand for transport services is expected to grow. Apart from the effect that this has on the transport demand, the prevailing trend is to have goods stored at a greater distance from the end-customer than before. Storage is therefore concentrated to regional or national hubs. This brings with it an increasing demand for frequent freight transports to the end-customers. It also results in a transport system with few but large hubs with considerable volumes of goods flowing in between them.

A large portion of the expected growth in the transport demand is likely to be handled by an increase in road transports. However, the increasing amount of products produced in Asia for the European market will contribute to an increase in sea transports as well. The forecast for the different transports modes the coming years is presented in Figure 2.

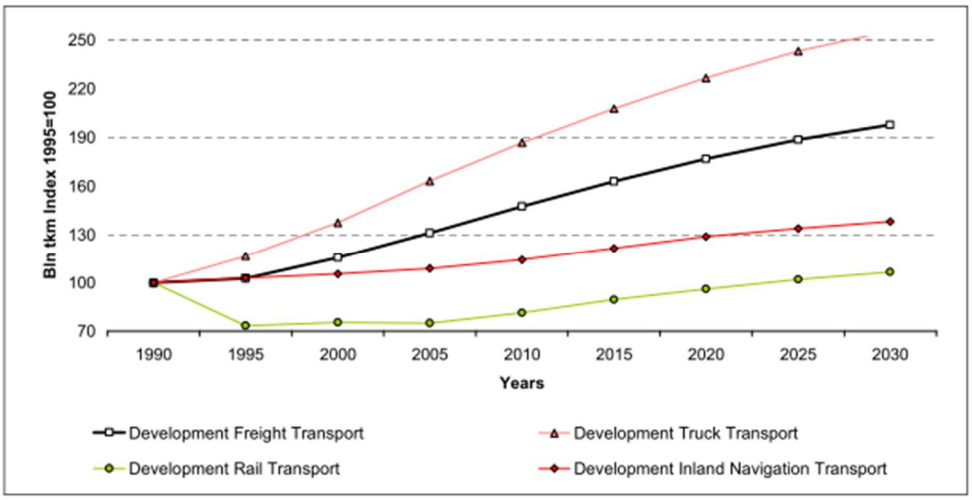


Figure 2 EU freight Transport Indexed Services 1990-2030[3]

Although the forecasted development for rail transports is very modest, the development of green corridors has the potential to change this for the better. The competitiveness of intermodal transports is dependent on the distance in-between sender and receiver. This is due to the fact that intermodal transports generally require terminal handling in the beginning and end of the transport. The longer the distance that the freight is to be transported, the more does one benefit from the reduced transport costs that intermodal transports can provide on longer distances and the costs associated with the terminal handling can then be justified, see Figure 3.

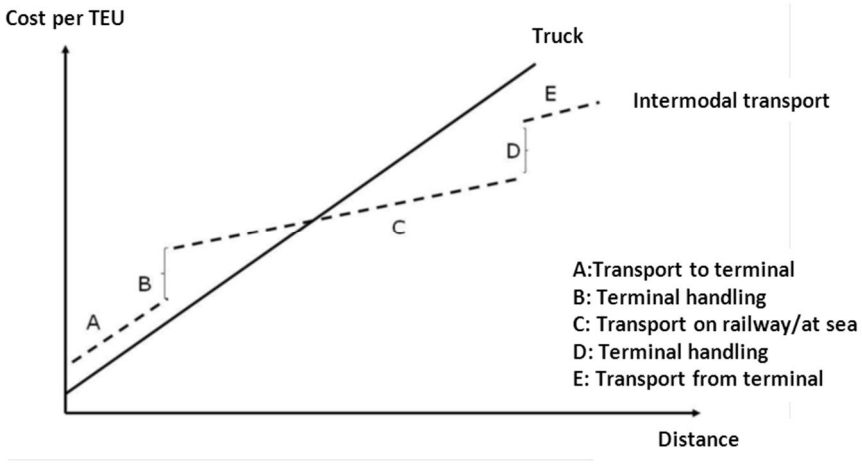


Figure 3 Difference in cost structure for road transports and intermodal transports [4]

[3] STRING-report: "Bottlenecks in the Infrastructure between Scandinavia and Central Europe". Accessed the 3rd of December from http://stringnetwork.org/media/31988/htc_report_bottlenecks_120330_1_.pdf

Apart from the distance between sender and receiver of freight, the volume of goods flowing in-between nodes influences the service and costs associated with the transports. To be able to offer daily train traffic between two nodes for example, a volume of 25-35 000 TEU/year is needed to make it profitable. Thus, depending on the geographical context of nodes, i.e. if it is in a densely populated area with considerable industry or not, the catchment area for freight can vary in size. Due to this, the catchment area for freight in the northern part of the green corridor can be expected to be larger than that of nodes in Germany and Holland for example.

In addition to the issues discussed above, a number of factors affect the customer's choice of transport mode. Through interviews carried out with goods owners, transport operators and node operators, five factors have been identified as important for customers when considering intermodal transports. These factors are presented below together with examples of challenges associated with them:

- Price – Costs for terminal handling, lack of standardization when it comes to customs fees and transport related fees.
- Punctuality – The effect that disturbances have on transports varies between transport modes. Disturbances in train traffic can become difficult as few options are available when it comes to re-routing traffic. On the other hand, rail traffic can be more reliable than road transports in areas with frequent traffic jams for example.
- Frequency – Road transports have a considerable advantage compared to sea and rail transports when it comes to frequency in transport services from one destination to another.
- Information – There exist a lack of transparency in the transport market regarding different transport alternatives and conditions. Few transport buyers are well informed about intermodal transports.
- Service – Examples of important transport service criteria are transport time, flexibility regarding customer requests and security.

In addition to infrastructure investments, the above mentioned transport challenges can be addressed through a number of initiatives. Examples of areas of interest are improved cooperation between different actors in the corridor, use of IT applications and harmonization of rules and regulations just to mention a few.

[4] COINCO II report: "Forarbeider for etablering av et Pilotprosjekt for en "Green Freight Corridor"/Grönn Korridor mellom Oslo-Göteborg-Rotterdam

3. Green corridors

Green transport corridors consist of a number of links and nodes in a specific geographical area. In year 2007, the EU Commission defined 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."[5]

In their definition, the EU commission highlights a number of important characteristics for green corridors:

- Relatively long distance transports
- Concentration of freight flows along the corridor
- Co-modal transports
- Platform for innovation/advanced technology
- Focus on environmental sustainability/Energy efficiency
- Availability of transshipment facilities at strategic locations

These characteristics have guided the work in defining the green corridor in the North Sea region as presented in the following section.

4. The green corridor in the North Sea Region

In order to define a green corridor, the starting point and ending point of the corridor need to be decided. The main focus was to find potential corridors that connect Scandinavia with the major ports in Northern Europe.

[5] EU-commission (2007), "Freight Transport Logistics Action Plan", page 11. Accessed on the 4th of December 2012: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2007:0607:FIN:EN:PDF

Oslo was chosen as the northern endpoint of the GreCOR corridor. Oslo has significant intermodal resources as both an intermodal port and Norway's main intermodal railway terminal is situated in close vicinity of the city centre. Additionally, both railway and sea transports have potential to increase in terms of export and import to Norway.

Ranstads was chosen as the end-point of the GreCOR corridor. In Ranstad one of the major ports of Europe, Rotterdam is situated where almost 67 million containers were handled in year 2010. The majority of the goods arriving in Rotterdam have its origin in Asia. The goods are then transported from the port to the continent or to Scandinavia via feeder ships, train or truck. Rotterdam port is well suited for loading goods directly on to the railway and in this respect it has the properties of intermodality between vessel and railway. Moreover, Rotterdam has a close cooperation with Duisburg which is the world largest inland port, and is also connected to Germany by the dedicated rail freight route, the Betuweroute.

In a green corridor, it is of importance to have several major intermodal transport nodes that can function as efficient entry and exit points for freight and attract goods to the corridor. To achieve this, the nodes should be able to efficiently tranship large quantities of goods from truck to vessel and/or train. By consolidating freight along the corridor, economies of scale can be achieved in the transport corridor. Based upon these criteria, the following nodes should be part of the green corridor in the North-western Europe:

- **Oslo** – Oslo has good seaway and railway resources as well as a considerable volume of freight that flows through the area.
- **Göteborg** – Port of Gothenburg is the largest port in Scandinavia. The port is connected to the railway and has a strong intermodal profile. Within a radius of 500 km it is possible to reach the capitals Stockholm, Copenhagen and Oslo.
- **Öresund (Helsingborg/Malmö/Trelleborg/Helsingør/ Copenhagen/Aarhus)** – In southern Sweden and eastern Denmark a number of ports handle considerable volumes of goods and possibilities exist to switch between all transport modes. Helsingborg and Helsingør mostly handles trucks. Copenhagen and Malmö port (abbreviated CMP) cooperate and Malmö is linked to the railway networks. Trelleborg is one of the largest Ro-Ro ports in Scandinavia. Aarhus is Denmark's largest container port, with 50% of the country's market share, and it is linked to the railway.
- **Fredericia** – The port is situated in the middle of the triangle area of Denmark. The intermodal terminal of Taulov is located here.
- **Hamburg** - Hamburg is one of the most important areas for trans-shipping goods in Europe. Because of its location in Germany it is

ideal for consolidating goods. Additionally, it is possible to switch between all transport modes in Hamburg.

- **Bremen** – This is the second largest port after Hamburg, and a lot of heavy industry is located close to it. The port has considerable railway resources.
- **Duisburg** – This is the world largest inland port and is closely interconnected to Rotterdam port with both feeder and train.
- **Emmen -** Emmen is a dryport with inland seaway connections to Amsterdam and good access to railways.
- **Amsterdam -** Amsterdam is considered a key logistic hub in the world, with good railway connections.
- **Rotterdam** – Rotterdam is the largest port in Europe and provides good opportunities for railway transports. Port of Rotterdam also cooperates closely with the port of Duisburg.

The nodes of the corridor are illustrated in the following map, see Figure 4.

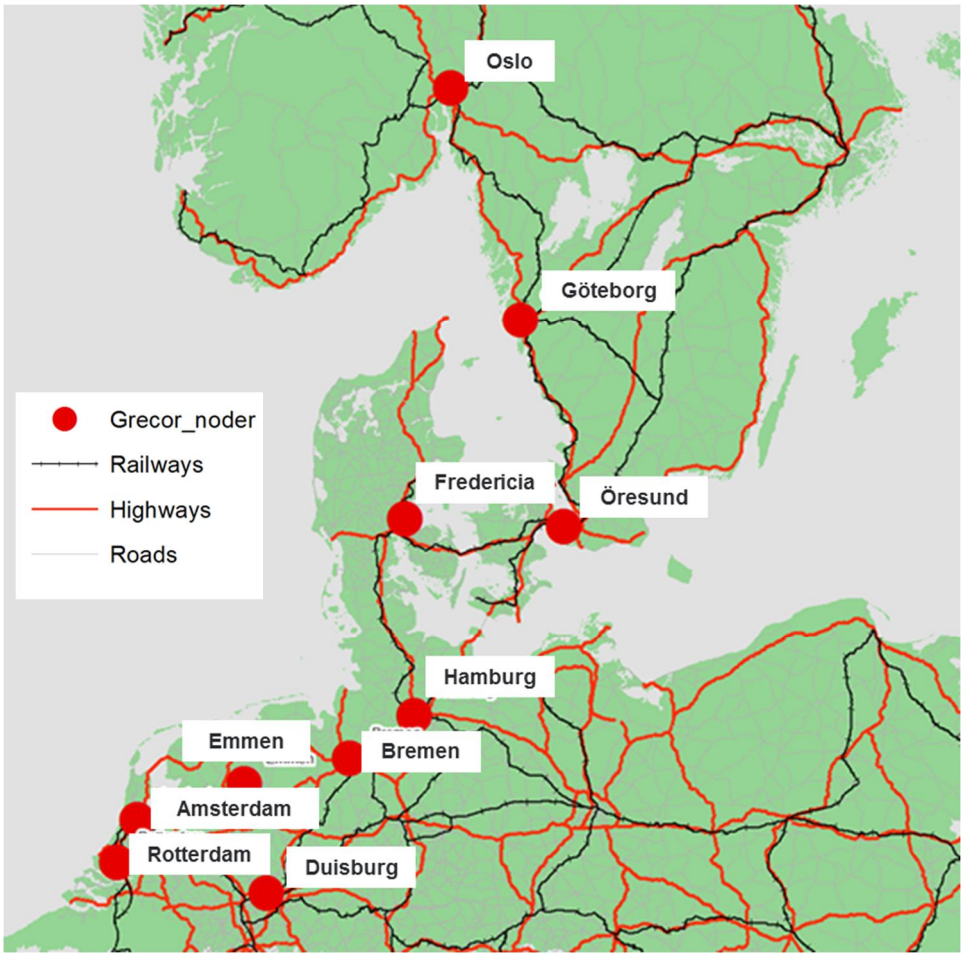


Figure 4 Map of the green corridor

In addition to strategic nodes, infrastructure connecting the nodes is necessary to form an efficient freight corridor. In Figure 5 main roads, rail links and routes for sea transports in the corridor has been marked on a map.

Figure 5 Main road and rail connections

5. Bottlenecks in the corridor

A number of significant bottlenecks exist in the corridor today. In the following sections, these will be presented in relation to which transport mode they affect. When it comes to sea transports, the bottlenecks do not exist on sea but rather in connection to ports and terminals. Thus, problems with sea transports will be covered in the section relating to terminals/ports.

Road

Each day there are disturbances in traffic on over 7 500 kilometres of the road network in Europe due to lack of capacity. Part of this problem relates to the considerable volumes of freight that is transported on roads. A large part of this freight has its origin and destination close to major cities and is often also handled in connection to large hubs. Consequently, freight transports compete with passenger transports for capacity in and around major cities, ports and terminals. The congestion around major cities in the corridor can be seen in Figure 6 that shows the traffic situation on a Thursday morning. In the Netherlands and Germany, the situation is specifically severe. However, bottlenecks exist in and around all major cities in the corridor, e.g. Oslo, Gothenburg, Malmö, Copenhagen, Lübeck, Hamburg, Duisburg and Amsterdam.

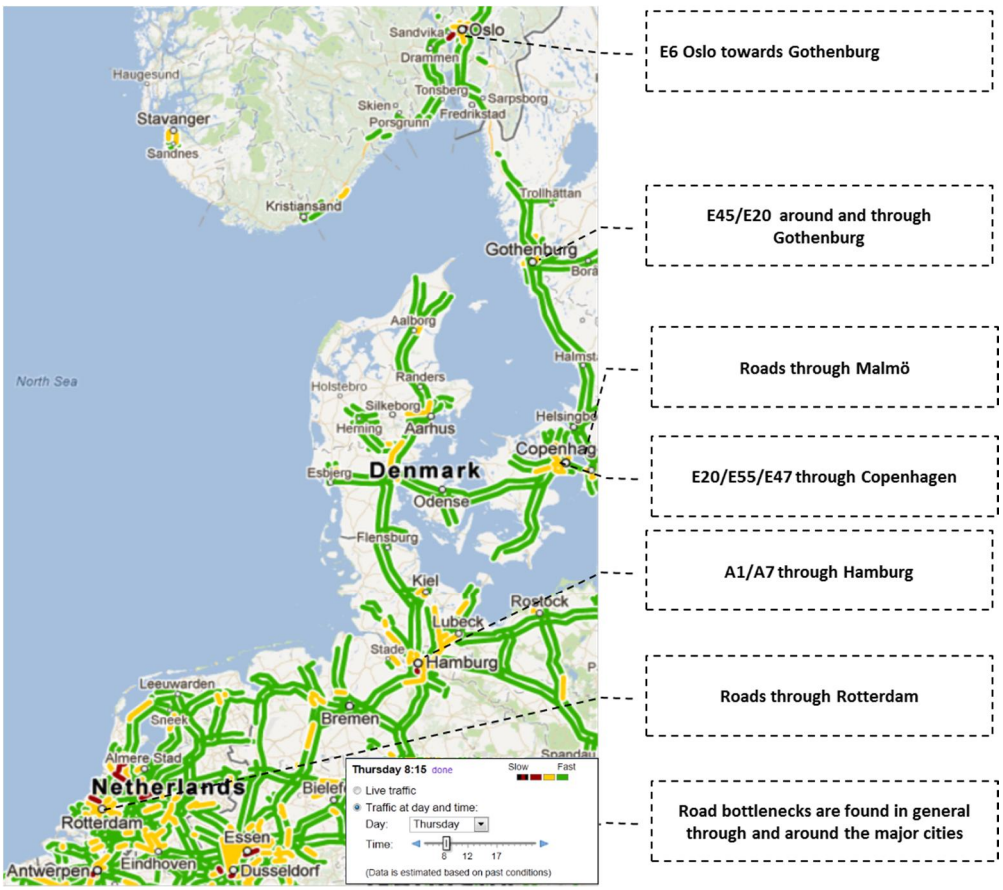


Figure 6 Bottlenecks/ Road traffic in the corridor on a Thursday at 8.15 am.

Rail

Bottlenecks in the rail network connecting Oslo with Rotterdam are mainly related to stretches of rail with single-tracks, capacity deficiencies and different signalling-/power supply systems. Major bottlenecks exist on the following geographical locations:

- **Oslo – Ski (NO):** 100% capacity utilization at peak hours. Mostly passenger trains. To be able to increase the number of freight trains on the tracks, double tracks are needed.
- **Sandbukta – Halden – Öxnered (NO/SE):** Single tracks with relatively high capacity utilization during peak hours.
- **Gothenburg (SE):** Trains accesing and leaving the central station in Gothenburg/ the industry areas north of Gothenburg/ the Port of Gothenburg all intersect and the capacity utilization is therefore very high north of Gothenburg. Also east and south of Gothenburg does the frequency of passenger and freight trains limit the opportunity to increase freight transports on rail.
- **Skania (SE):** Single rail tracks for freight trains between Åstorp – Teckomatorp – Kävlinge and limited opportunities for trains to overtake

other trains. When the Hallandsåstunnel opens an increase in train frequency is expected. This will require more opportunities for trains to overtake other trains and also necessitate improvements on existing infrastructure.

- **The Öresund bridge (SE/DK):** An increase in number of freight trains will cause capacity problems. Today, excess capacity exists but not at requested times. A new tunnel or bridge between Helsingborg and Helsingör would relieve the pressure on the existing Öresund bridge. This is being investigated but earliest date for the construction of such a tunnel or bridge would be year 2030.
- **Kastrup airport (DK):**The construction of tracks at the Kastrup airport necessitates that freight trains have to cut across tracks for passenger trains. This results in a significant, local capacity drop.
- **Copenhagen – Padborg (DK):** Along the existing railway route for freight trains passing through Denmark, two single track stretches exist that delimit the capacity. Additionally, variations exist regarding the power supply of trains (diesel and electricity). The speed with which freight trains pass through Denmark is therefore low. Today, it takes just as long for a train to pass through Denmark as it takes for trucks (if these use the ferry passage between Rödby and Puttgarten).
- **Hamburg (DE):** DB Netze, who owns the railway infrastructure in Germany, has identified the railway inbetween Uelsen and Stelle on the stretch from Hamburg to Hannover as a bottleneck with capacity defizits.
- **Betuweroute (DE/NL):** The dedicated freight transport railway between the German border and Rotterdam is well equipped. However, due to unsatisfactory infrastructure and a lack of application of the ERTMS in Germany, the full capacity of the Betuweroute cannot be used.

In addition to the logistical challenges already mentioned, bottlenecks related to power supply systems exist. In Norway, Sweden and Germany the power supply system is similar, i.e. 15kV 16 2/3 Hz. In Denmark and the Netherlands another power supply system is used (25kV 50Hz). An exception from this is the Betuweroute in the Netherlands that use the same system as in Germany.

On the positive side, the track width is the same, 1435 mm, in all countries in the corridor. Additionally, a standard for signalling systems, the European Rail Traffic Management System, have been developed. However, a lot of investments have to be made and implementation work carried out before the full benefits of the system will be noticeable.

There are many factors that affect the capacity on rail, e.g. number of tracks, maximum weight, maximum length, maximum speed and minimum required distance between trains. Many of these factors are related to exisiting rules and regulations for train traffic. Hence, one of the major challenges with rail traffic that cuts across national borders is the differences in rules and regulations in the countries.

All the above mentioned bottlenecks in the rail systems along the corridor are highlighted in Figure 7.

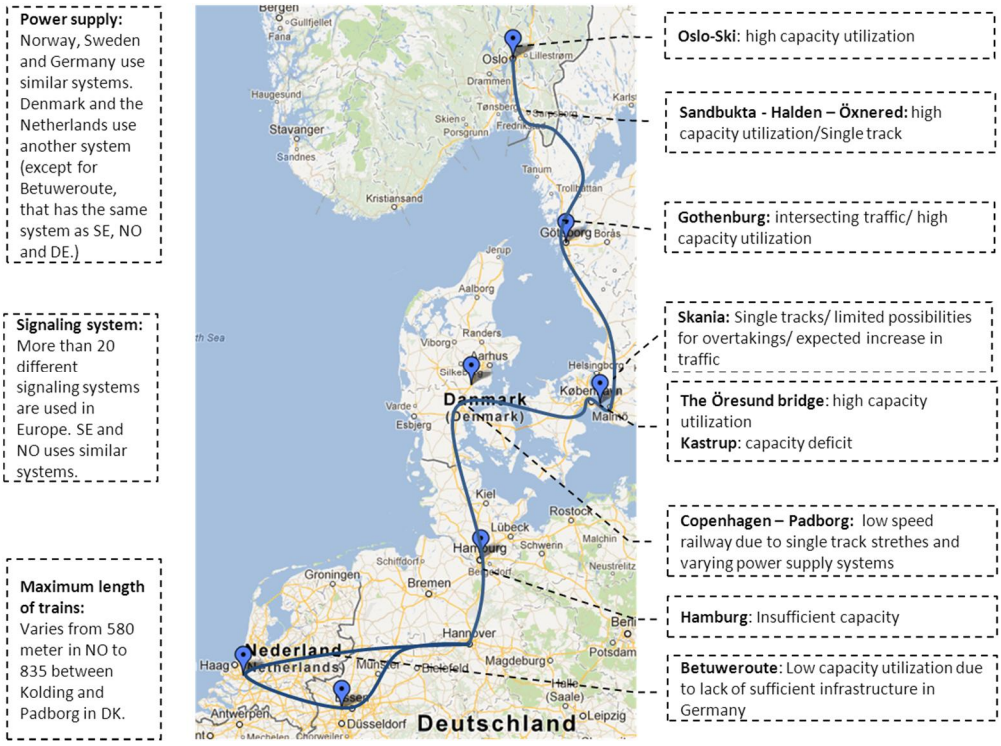


Figure 7 Bottlenecks in the railway network between Oslo and Rotterdam

Terminals/Ports

Bottlenecks related to terminals and ports can be attributed to lack of capacity or inefficiencies in the nodes.

When it comes to ports, a number of studies argue that it is the infrastructure connecting the port with it hinterlands that will pose the biggest challenge in the future (if port expansions are made as planned). Additionally, competition for land close to existing terminals and ports can also cause problems as these often are located close to city centres.

The efficiency in nodes are affected by for example the layout, type and number of cranes, administrative routines and access/exit points. Another factor that influence the efficiency is the closeness to transport operators.

The following terminals and ports have been identified as bottlenecks in the corridor:

- **Olso/Alnabru terminal (NO):** The terminal is already being used to 80 % of its maximum capacity. To increase the volumes of freight flowing through the terminal, an expansion is needed as well as investments in the surrounding infrastructure.
- **Port of Gothenburg (SE):** The railway connecting between the port and the main Swedish railway network is a bottleneck. Only a single track is

available and its technical standard is low. In addition, the Marieholm bridge needs to be crossed to access the railway connection to the port. The bridge has limited opening hours and constitutes a weak link in the system.

- **Malmö freight train terminal (SE):** Capacity shortage at the entry/exit point of the terminal. Need for more tracks at the intermodal terminal.
- **Hamburg – port and terminal (DE):** In addition to the bottleneck at road A7, other problematic areas for freight transports in and around Hamburg are the tunnel under Elbe, the rail track between Hamburg and Lübeck as well as the inland waterways on Elbe. Furthermore, the capacity of the second largest marshalling yard in the world, i.e. Maschen Marshalling Yard, situated in the northern part of Hamburg is scarce. Limitations also exist in regards to the capacity of the Hamburg-Harburg railway station in Hamburg. This is related to the crossing of passenger trains with freight trains going to and from the harbour.
- **Duisburg terminals (DE):** Duisburg has three large intermodal terminals and is the largest dry-port in Europe. However, the warehouse capacity in the area is limited and there is a lack of equipment for unloading and loading goods. Moreover, railway tracks without supply of electricity poses a problem at intermodal terminals. These bottlenecks are especially severe during morning rush hours.
- **RSC Rotterdam Waalhaven (NL):** There is a high capacity utilization in the terminal. Together with disturbances caused by lack of train drivers and locomotives, this results in a reduced utilization of available track capacity.

The above mentioned bottlenecks are all visualized in Figure 8.

Figure 8 Bottlenecks in terminals and ports

6. Infrastructure development in the corridor

Some of the above mentioned bottlenecks in the corridor will be eliminated through infrastructure projects that are planned to be carried out in the nearest future. These will be presented in this section and remaining bottlenecks will be highlighted.

Road

- **E6 Oslo towards Gothenburg**
  Planned: The road between the Norwegian border and Gothenburg is to be improved by upgrading it to motorway standard all the way.
  Proposed: Additional lane for public transports and freight transports is proposed in the Norwegian National Transport Plan (NTP) 2014-2023.
- **E45/E20 around and through Gothenburg**
  Planned: New tunnel under the river running through Gothenburg is planned.
- **Roads through Malmö**
  No planned or proposed infrastructure projects.

- **Roads in and around Copenhagen (E20/E45/E47)**
  Proposed: New ring road west of Copenhagen. New tunnel or bridge between Helsingborg and Helsingör or improvements on existing Öresundbridge (Malmö – Köpenhamn).
  Planned: New ring road east of Copenhagen to develop the connections to the port. Improvements on the motorway from Helsingör to Copenhagen.
- **Roads in and around Hamburg (A1/A7)**
  Planned: Additional lanes on the A7 road in the north-west of Hamburg.
- **Roads in and around Rotterdam**
  No planned or proposed infrastructure projects.

Rail

- **Oslo – Ski**
  Planned: New double track railway primarily for passenger transports (NTP 2014-2023). To relieve the existing bottleneck, a connection between the new tracks and the Alnabru terminal is also needed. This is being analyzed at the moment.
- **Sandbukta – Halden**
  Proposed: Double tracks are being analyzed.
- **Halden – Öxnered**
  Planned: Upgrading of existing power supply and signaling system.
- **Gothenburg**
  Planned: Large investments are planned – double track railroad between Trollhättan and Gothenburg, railway tunnel under the city center of Gothenburg, new railway bridge and track between the port and the main railway network.
- **Skania**
  Planned: The Hallandsåstunnel is planned to open in year 2015. It will increase the capacity and double the potential freight weight on the rail tracks. Improvements of existing rail infrastructure between Åstorp and Teckomatorp is to be made.
- **The Öresund bridge**
  Proposed: Investigations are being made regarding a new tunnel or bridge solution between Helsingborg and Helsingör. Alternatively, the existing Öresund bridge is proposed to be rebuild to increase its capacity.
- **Kastrup airport**
  Planned: Upgrade the railway carrying freight past Kastrup Airport with a seperate track/ extra track.
- **Copenhagen –Padborg**
  Planned: A general upgrade of the existing rail network between Copenhagen and Padborg is to be made. A new electrified double track railway is under construction between Copenhagen and Ringsted.

Additionally, the Fehrmanbelt connection between Rödby in Denmark and Puttgarden in Germany is to be built and will relieve the pressure on the Copenhagen – Padborg railroad.

- **Hamburg**
  Planned: Improvement of the existing infrastructure between Puttgarten – Lübeck – Hamburg is planned as well as the construction of an additional rail track (from single to double track). The construction of an additional eastern freight corridor from Uelzen to Regensburg is also planned to relieve the existing corridor.
- **Betuweroute**
  Planned: Improvements on existing infrastructure between the border NL/DE and Oberhausen.
  Proposed: Additional tracks between the border NL/DE and Oberhausen.
- **Power supply systems**
  No planned or proposed projects to use similar power supply systems in the whole corridor.
- **Signaling systems**
  Planned: Plans to implement the ERTMS in Norway, Sweden, Denmark and Holland.
  No plans or propositions have been made to implement the ERTMS in Germany.

Terminals/Ports

- **Oslo/Alnabru**
  Planned: Increased capacity for handling containers in the port of Oslo.
  Proposed: Further investments in the Alnabru railway terminal to add capacity. Improvements on the fairways to the ports of Oslo and Borg.
- **Port of Gothenburg**
  Planned: Improved road connections to the port. New railway track (from single to double track) and railway-bridge between the port and the main railway network.
- **Malmö freight train terminal**
  Planned: Investments in additional capacity at the terminal.
- **Port of Hamburg**
  Planned: Improvement in the rail infrastructure between Lübeck and Hamburg.
- **Duisburg**
  Planned: Extra storage capacity and additional railway tracks are to be built. In spite of these investments, a lack of capacity is expected to exist in year 2020.
- **RSC Rotterdam Waalhaven**
  Proposed: No direct investments in the RSC Rotterdam (Waalhaven)

terminal are planned but a proposed expansion of the ECT Euromax terminal in Rotterdam (Maasvlakte) could reduce the effect of the bottleneck.

Remaining bottlenecks

If all approved projects are carried out as planned, a number of the identified bottlenecks will still be remaining in year 2020.

On road, it is uncertain how the traffic situation in the **Malmö/Copenhagen** area will be in ten years. This is related to the alternative chosen to increase the capacity for road traffic between Sweden and Denmark and where it will be situated. Whether the capacity increase between Helsingborg and Helsingör or between Malmö and Copenhagen is highly relevant for how the traffic situation will be.

Additionally, no planned or proposed infrastructure projects have been identified in the **Rotterdam** area. Thus, the traffic situation will largely be the same as today in the future.

If freight transports on rail increase in the corridor, one of the remaining bottlenecks in the rail network in the corridor will be the **connection between Norway and Sweden**. Double tracks have been proposed on the Norwegian side but on the Swedish side of the border the approved projects are limited to upgrading of existing, single-track infrastructure.

Also in **Skania**, the situation after the opening of the Hallandsås tunnel is uncertain. An increase in freight traffic might cause problems as the possibilities to overtake other trains are limited in the area.

Just as for road traffic, the situation for rail traffic is uncertain **between Sweden and Denmark**. Depending on the selection of solution for increasing the capacity in the area, the situation can vary.

Uncertainties regarding rail traffic do also exist for **Denmark and the north of Germany**. This is related to the Fehrmanbelt connection and its influence on the rail traffic.

Bottlenecks related to the **Betuweroute** will still exist on the German side of the border as they for example have no plans to implement ERTMS.

The differences in **rules and regulations** for rail traffic and the variations in **power supply systems** that exist today will still be a problem for rail traffic in the corridor in the future.

When it comes to bottlenecks in terminals and ports, the **Port of Hamburg** will still have difficulties related to the hinterland infrastructure in the future.

In spite of the planned investments in storage capacity and new rail tracks in **Duisburg**, capacity related to freight handling and storage is forecasted to be lacking in year 2020.

Also in **Rotterdam**, there is likely to be a continued lack of terminal capacity for freight handling.

The bottlenecks that are likely to remain in the corridor have all been indicated in Figure 9 Remaining bottlenecks in the corridorFigure 9.

Figure 9 Remaining bottlenecks in the corridor

7. Measures of interest for the development of the green corridor

Apart from investments in infrastructure in the corridor, a large number of measures can be undertaken to develop the green corridor. To be able to identify suitable measures it is of importance to keep in mind those characteristics of green corridors that was proposed by the EU commission and mentioned previously. The characteristics are:

- Relatively long distance transports
- Concentration of freight flows along the corridor
- Co-modal transports
- Platform for innovation/advanced technology
- Focus on environmental sustainability/Energy efficiency
- Availability of transshipment facilities at strategic locations

Since the definition of green corridors was proposed by the European Commission, a number of efforts have been made to develop the concept of green corridors further. One such attempt is made in the Macroregional

Transport Action Plan (2012 edition)[6], that was developed as part of the TransBaltic project[7]. In the plan it is proposed that the concept of green corridors and their development should take into account that:

"... they must be attractive for the shippers and show reliability, reduced congestion and low operational costs."

"Green and efficient multimodal corridors are expected to provide better operational conditions than in the 'conventional' transport network, based primarily on road connections and with no intermodal facilities available."

"Green and efficient multimodal corridors shall contain a governance structure to coordinate actions aimed at improvement of infrastructure, services, policies and regulations. It should gather corridor-related public and private stakeholders, including: shippers, infrastructure providers, transport service providers, public policy-makers and financing institutions. Such a structure is instrumental in combating hard (e.g. infrastructure) and soft obstacles (e.g. regulations and administrative practices) hindering the efficient flow along the corridor, including incompatible rules and regulations, to result in reduced transit times and costs and mitigated environmental and social impacts."

Thus, in addition to the characteristics of green corridors that were introduced by the European Commission, the TransBaltic action plan emphasizes that green freight corridors:

- Need to be attractive to transport buyers and provide better operational conditions than "normal" freight transports
- Necessitates the development of "soft issues", like rules and regulations, in addition to overcoming "hard obstacles", e.g. infrastructure.
- Requires a government structure to coordinate all parts of the corridor and push for the development of the corridor

Apart from the above mentioned characteristics, other areas that have been suggested to be taken into account in the development of green corridors are for example traffic safety, security and working climate.

Proposed measures (non-exhaustive)

In order to create an action plan, numerous measures, that have the potential to contribute to the development of the corridor in alignment with the

[6] http://www.ipprvs.org/wp-content/uploads/2012/09/TransBaltic-MTAP-2012-edition-5.09.pdf
Retrieved on the 10. October 2012
[7]See http://www.transbaltic.eu/

characteristics presented above, were identified. As the overall performance of the corridor is depended both on the efficiency in which operations are carried out in individual links or nodes and how well they work together, the aim and scope of the identified measures varies.

The identified measures have been divided into four main categories based on what part of the corridor that they target, see Figure 10[8]. The four categories are:

1. **The corridor network (links and nodes)** – Measures within this category are to promote collaboration between transport modes and/or the optimal use of respective transport modes (including the hubs).
2. **Transport techniques** – Measures within this category are focused on the features and properties of equipment used in transport operation, e.g. trucks, port handling and cranes.
3. **Transport/Logistics solutions (business models)** – The measures that belong to this category focuses on the integration/collaboration of different partners and stakeholders in the corridor to optimize "green" business performance.
4. **Policy and regulations –** Measures that fit into this category are focused on how regulatory bodies/policy makers can contribute to the development of a green transport corridor.

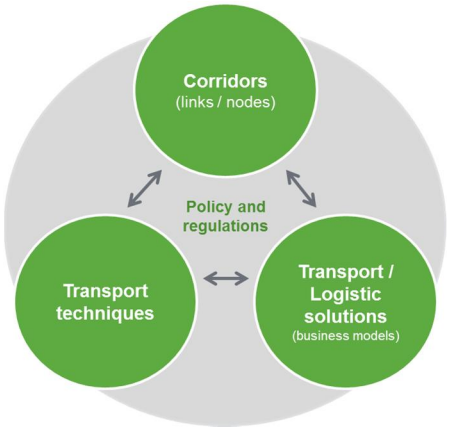


Figure 10 Categories of measures

[8] The categorization is made in alignment with the categorization of green corridor projects presented in the document "Green Corridors Criterias" (8th June 2012) published by the Swedish Transport Administration. See http://publikationswebbutik.vv.se/upload/6169/2011_040_green_corridors_criterias_02.pdf

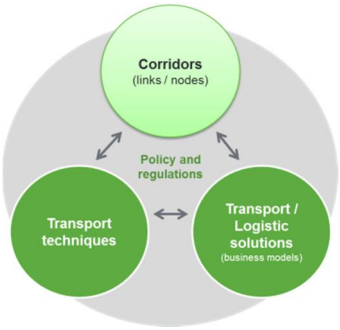
In the following sections, Figure 10 will be used to highlight which of the project categories the presented measures primarily target. Important to notice is that the measures presented here do not include planned and proposed investments in infrastructure in the corridor. These were instead discussed in Section 6 in this report.

Apart from listing the identified measures, the expected effects of the implementation of the measures as well as important stakeholders, critical factors and catalysts will also be presented.

The aspects that are presented are:

- WHY – explains why the measure is of interest for the corridor development
- IMPACT – expected effects of the implementation of the measure
- WHO – important stakeholders that need to get involved
- CRITICAL FACTORS – obstacles that needs to be handled successfully
- CATALYST – things that can facilitate the implementation

The expected effects are also presented in tables in the appendix of this report.



Corridors (Links/Nodes)

The potential of a transportation network is heavily affected by the infrastructure and resources that constitute the network.

Measures proposed to increase the efficiency in the corridor, i.e. its nodes and links, are:

1. Measures aimed at **reducing the effect of disturbances in train traffic** to increase the competitiveness of freight trains
    - WHY: To increase the competitiveness of rail freight transports
    - IMPACT: More robust rail transports
    - WHO: Transport and node operators, national governments, corridor management structures
    - CRITICAL FACTORS: Potentially increased costs. New solutions/processes required.
    - CATALYST: National initiatives. Initiatives from the corridor management structure.

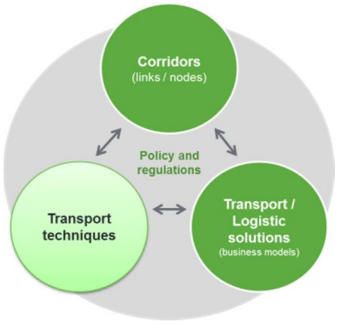
2. **Differentiation of freight rates to level demand** over time, to better utilize existing infrastructure, i.e. cheaper transports during hours of low traffic
    - WHY: To increase resource utilization in the corridor network
    - IMPACT: More freight can be transported through bottlenecks in the corridor network. Costs associated with investments in new infrastructure can possibly be avoided.
    - WHO: Transport and node operators, corridor management structures
    - CRITICAL FACTORS: Increased administration
    - CATALYST: Initiatives from the corridor management structure

3. Support measures to introduce "**green corridor trains**" to increase the frequency of rail bound freight transports in the corridor, in order to provide better rail services to the market.
    - WHY: Increase resource utilization in the rail corridor network and attract more freight to rail transports
    - IMPACT: Increased competitiveness for freight transports on rail due to increased frequency of service. Chance to reduce emissions and reduce congestion on roads. Facilitate selection of transport mode
    - WHO: National governments, corridor management structures, train operators
    - CRITICAL FACTORS: Competition for rail resources between goods transports and commuter trains. Legislation, e.g. required distance between trains.
    - CATALYST: Initiatives from the corridor management structure

4. Measures aimed at **increasing the through-put of terminals**, e.g. through alternating terminal layouts, increased opening hours and optimization of processes for transferring freight from one transport mode to another.
    - WHY: Increase the competitiveness of transport modes that are reliant on terminal handling to allow the most efficient and environmental friendly transport mode to be used in the corridor.

- IMPACT: Reduced costs and environmental impact. Facilitates free selection of transport mode
- WHO: Node operators, universities and research organisations
- CRITICAL FACTORS: Competition for attractive land areas in densely populated areas might hamper expansion and reconstruction plans
- CATALYST: Initiatives from the corridor management structure

5. **Benchmarking of corridor nodes** to identify areas of improvement and allow comparisons to be made throughout the corridor.
    - WHY: Efficient intermodal transports in the green corridor is reliant on well-developed handling of goods in the nodes.
    - IMPACT: Best-practice solutions can be identified and applied to increase the efficiency in the corridor nodes. Reduced costs and increased utilization of resources.
    - WHO: Node operators, corridor management structures
    - CRITICAL FACTORS: Cooperation from node operators. Costs and difficulties of developing criteria to be compared.
    - CATALYST: Initiatives from the corridor management structure



Transport techniques

Apart from providing well-developed freight transports in the corridor, the idea with green corridors is to make the freight transports more environmental friendly. One way to achieve that is through technical development of the resources in the transportation network.

Measures within the area of transport techniques that can contribute to the development of the Green Corridor in the North Sea Region:

6. Development of **new techniques to facilitate transfer of goods from one transport mode to another**
    - WHY: Reduce “friction” in the corridor network to increase utilization of the most optimal transport mode for each transport
    - IMPACT: Increased efficiency in terminal handling and thereby reduced operational costs. Facilitate free selection of transport mode.
    - WHO: Node operators, universities and research organisations

- CRITICAL FACTORS: Costs and time for development of new knowledge and implementation of new techniques.
- CATALYSTS: R&D funding. Education of engineers and researchers.

7. Development of **new techniques to allow more efficient short-distance transports**, e.g. the new cargo-vessel developed in the project CargoXpress[9]
    - WHY: Efficient short-distance transports are of essence in expanding the catchment area of the corridor and thereby attract more goods.
    - IMPACT: Reduced costs and environmental impact. Facilitates free selection of transport mode.
    - WHO: Universities and research organisations, private companies (transport operators)
    - CRITICAL FACTORS: Costs and time for development of new knowledge, new technology and implementation of these
    - CATALYSTS: R&D funding. Education of engineers and researchers.

8. Equipment for **supply of electricity to vessels in ports**[10] to reduce emissions and noise pollution
    - WHY: To reduce emission from vessels in ports
    - IMPACT: Reduced environmental impact
    - WHO: Port operators, universities and research organisations, standardisation bodies, EU/national governments/corridor management structures
    - CRITICAL FACTORS: Development of standard for the power supply. Investment costs.
    - CATALYSTS: Initiatives from the corridor management structure. Competition among ports. R&D funding.

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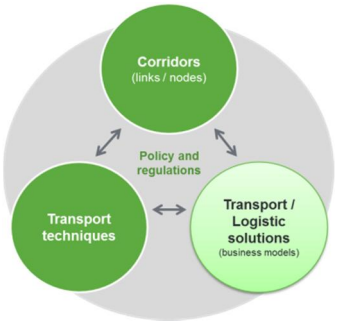
[9] See http://www.cargoxpress.eu/

[10] A standard for onshore power supply to vessels in ports, i.e. the IEC/ISO/IEEE 80005-1, was established in July 2012 by the International Organization of Standardization (ISO). Also see the website of The World Port Climate Initiative (WPCI) that provides practical information on onshore power supply for seagoing vessels: http://wpci.iaphworldports.org/onshore-power-supply/index.html

9. Develop **new techniques to reduce the energy consumption required for freight movements (all transport modes)**, e.g. alternative fuels/batteries and vessels equipped with solar panels and/or sails.
    - WHY: Reduce emissions and increase vehicle efficiency
    - IMPACT: Reduced environmental impact. Reduced costs for freight movements. Reduced reliance on non-renewable energy sources.
    - WHO: Vehicle and vessel producers, universities and research organisations, transport operators, EU/national governments, corridor management structures.
    - CRITICAL FACTORS: Considerable R&D and implementation costs. Trains and vessels are generally used for a long period of time. Infrastructure for supply of alternative fuels.
    - CATALYSTS: EU/National rules and regulations. Potential cost reductions due to reduced fuel consumption. Reduced access to oil/Increased fuel prices. Initiatives from the corridor management structure.



Transport/Logistic solutions (business models)

Transportation networks generally consist of a large number of sub-systems operated by different producers, distributors and transport operators. Depending on how successful actors in these networks integrate their operations, the efficiency of logistics processes and the actors' profitability will vary.

Identified measures aimed at improving the transport/logistic solutions:

10. Increased **cooperation between buyers of similar freight transport services**
    - WHY: To increase resource utilization in the system
    - IMPACT: Increased fill-rates. Reduced emissions and numbers of transports. Reduced congestion on network links. Improved transport balances between different geographical areas. Lower transport costs.
    - WHO: Transport buyers, transport and node operators, corridor management structures, certification bodies
    - CRITICAL FACTORS: Delivery demands – time. Rules and regulations regarding cooperation between companies.

- CATALYSTS: Initiatives from the corridor management structure. Profitability demands for companies/Demand for cheaper transports. Environmental awareness/Certification demands.

11. Enhanced **cooperation between different transport operators**
    - WHY: To increase resource utilization in the system
    - IMPACT: Increased fill-rates. Reduced emissions and numbers of transports. Reduced congestion on network links. Improved transport balances between different geographical areas. Lower transport costs.
    - WHO: Transport and node operators, corridor management structures, certification bodies, EU/National governments
    - CRITICAL FACTORS: Delivery demands – time. Rules and regulations regarding cooperation between companies.
    - CATALYSTS: Initiatives from the corridor management structure. Profitability demands for companies/Demand for lower transport costs. Environmental awareness/Certification demands

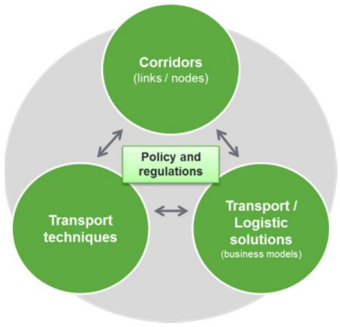
12. **Freight brokers** that work with all transport modes
    - WHY: To increase resource utilization in the system and reduce environmental impact
    - IMPACT: Increased fill-rates. Reduced emissions and numbers of transports. Reduced congestion on network links. Improved transport balances between different geographical areas. Lower transport costs.
    - WHO: Transport buyers, transport and node operators, private entrepreneurs (transport brokers), corridor management structures, certification bodies, EU/national governments
    - CRITICAL FACTORS Competition between transport operators. Rules and regulations regarding cooperation between companies.
    - CATALYSTS: Initiatives from the corridor management structure. Profitability demands for companies/Demand for lower transport costs.. Environmental awareness/Certification demands.

13. **Corridor logistics advisors** that can provide help to freight buyers, transport operators and others on how to act to benefit the most when using the green corridor
    - WHY: To attract freight to the corridor and facilitate use of the corridor
    - IMPACT: Facilitate for/Give advice to all involved parties in the corridor as to how to best realize the corridors full potential. Increased corridor competitiveness. Increased fill-rates, reduced emissions etc.
    - WHO: Transport buyers, transport and node operators, corridor management structures, certification bodies
    - CRITICAL FACTORS: Cost and set-up time, time for establishing services on the market.
    - CATALYSTS: Initiatives from the corridor management structure. EU initiatives.

14. **Educate freight transport buyers** in supply chain management/logistics to **encourage them to plan and book transports as early as possible**
    - WHY: To improve planning and utilization of resources
    - IMPACT: Increased fill-rates. Reduced emissions and numbers of transports. Reduced congestion on network links. Improved transport balances between different geographical areas. Lower transport costs.
    - WHO: Transport buyers, transport and node operators, corridor management structures, educational bodies
    - CRITICAL FACTORS: Difficult to change established behaviors
    - CATALYSTS: Initiatives from the corridor management structure. Marketing/Information. Environmental awareness/Certification demands.

15. **Facilitate comparison of freight alternatives**, e.g. time, cost and environmental impact
    - WHY: To improve the efficiency of the corridor network
    - IMPACT: Increased system transparency that allows all transport modes and operators to compete on similar terms. Reduced congestion on network links. Possibility to highlight environmental aspects of different transport alternatives.

- WHO: Transport buyers, transport and node operators, corridor management structures, information tool provider
- CRITICAL FACTORS: Existence of and access to data - Transport and node operators reluctance to share information. System costs.
- CATALYSTS: Corridor initiative



Policy and regulations

Apart from obvious organizational groups like transport buyers and logistics service providers, it is also important to improve cooperation with interest groups, the EU and national authorities for example.

Measures within the area of policy and regulations that can contribute to the GreCOR development:

16. Changes of regulations to allow increased frequency of trains at major railways by **reducing the required distance between trains** for example.
    - WHY: Optimize the use of the rail infrastructure.
    - IMPACT: Increases the rail transport capacity. Possible reduction of emissions and congestion on roads.
    - WHO: EU/national governments, corridor management structures.
    - CRITICAL FACTORS: Considerable R&D and implementation costs
    - CATALYSTS: Initiatives from the corridor management structure. R&D funding. Education of engineers and researchers.

17. **Regulations of emissions** similar to the limits for the Sulphur content of shipping fuels[11]
    - WHY: To reduce emissions
    - IMPACT: Reduced emissions
    - WHO: EU/national governments, corridor management structures
    - CRITICAL FACTORS: Considerable R&D and implementation costs

[11] See http://cnss.no/eu-parliament-approves-cleaner-shipping-fuels-legislation/

- CATALYSTS: Initiatives from the corridor management structure. R&D funding. Education of engineers and researchers

18. **Certification/Rewarding mechanisms to enhance the use of green transport alternatives** in the corridor
    - WHY: Enhance the use of green transport alternatives in the corridor
    - IMPACT: Reduced emissions
    - WHO: Transport buyers, transport and node operators, corridor management structures, certification company
    - CRITICAL FACTORS: Introduction of certification/rewarding system to the market, Possible increased transport costs
    - CATALYSTS: Initiatives from the corridor management structure, National/EU initiatives

19. To increase the competitiveness of rail transports, measures aimed at **improving the flexibility of processes that regulates rail transports,** e.g. the scheduling of time slots, are of value.
    - WHY: To increase the competitiveness of rail transports
    - IMPACT: Make it easier for companies to use rail transports without too much planning in advance
    - WHO: National governments, authorities, rail operators
    - CRITICAL FACTORS: Costs and work of changing existing administrative systems, National and international rules and regulations
    - CATALYSTS: The sharing of risks and costs inflicted by changes, National and international rules and regulations

20. **Harmonization of regulations and rules throughout the corridor**, e.g. allowed freight weight and vehicle measures
    - WHY: To increase the efficiency in the system
    - IMPACT: Corridor credibility, Equal operational terms for all involved parties
    - WHO: EU/National governments, interpreters of rules and regulations

- CRITICAL FACTORS: Costs for development and implementation, Considerable number of organizations are involved
- CATALYSTS: Initiatives from the corridor management structure, Market demand

21. **Measure the transport development in the corridor** to be able to estimate the effect of implemented measures/solutions and to observe the development of the corridor over time.
    - WHY: To detect changes in the corridor network over time and evaluate the effect of measures undertaken
    - IMPACT: The development of the corridor will be based on correct information, Possibility to predict outcomes of measures undertaken in the corridor in the future, Collect vital information on the use of the freight corridor to be able to prioritize measures and action planned for the corridor
    - WHO: Transport buyers, transport and node operators, corridor management structures, EU/National initiatives
    - CRITICAL FACTORS: Difficult to get access to required data, No models exist that can be used to estimate the flows on the total length of the corridor
    - CATALYSTS: Initiatives from the corridor management structure, EU/National initiatives

22. **Adjust costs to promote "green" transport alternatives** in the corridor, e.g. via taxes and regulations of fuel price
    - WHY: To reduce emissions
    - IMPACT: Reduced emissions, Reduced reliance on fossil fuels, Impact of bottlenecks in the systems might alter
    - WHO: Transport buyers, transport and node operators, corridor management structures, EU/national governments
    - CRITICAL FACTORS: Unpopular with support measures that favor some transport modes over others, Costs
    - CATALYSTS: EU/National initiative, Initiatives from the corridor management structure

23. Changes of regulations to allow **alternative vehicle configurations for road transports** to reduce transport emissions and fuel consumption per tonne kilometer.

- WHY: Reduce emissions and increase vehicle efficiency
- IMPACT: Reduced emissions and fuel consumption per tonne kilometer. Possibility of reduced congestion on roads.
- WHO: Vehicle producers, universities and research organisations, national governments
- CRITICAL FACTORS: Costs and time for changes of rules and regulations as well as development of new technologies and implementation of these
- CATALYSTS: EU/National initiative, Initiatives from the corridor management structure, R&D funding, Education of engineers and researchers.

8. The proposed measures

To get a better overview of the expected effects of the proposed measures, they have all been compiled in the following table. In the table it is highlighted in which of the four areas below their implementation can be expected to have an effect:

1. Market offer – The transport market in the corridor, e.g. effects on transport prices and/or the attractiveness of a particular transport mode when compared with other.
2. Efficiency – The utilization of the transportation network, for example effects on the capacity of the system
3. Reliability – Minimize disturbances in the transportation network
4. Energy & emissions – Reduce the impact that freight movements in the corridor have on the environment

In those cases where measures are expected to affect the above criteria, this has been marked with an X in the table.

	Corridors					Transport tequniques				Transport/logistic solutions						Policy and regulation							
	Reduce the effect of disturbances in train traffic	Differentiation of freight rates to level demand	Green corridor trains	Increase through-put of terminals	Benchmarking of corridor nodes	New techniques to facilitate transfer of freight between transport modes	More efficient short-distance transports	Land-based power supply to vessels in ports	New techniques to make freight movements more energy efficient	Cooperation among transport buyers	Cooperation among transport operators	Freight brokers that work with all transport modes	Corridor logistics advisors	Educate transport-buyers to book transports earlier	Comparison of freight alternatives	Reduced required distance between trains	Rules and regulations to reduce emissions	Certification/Rewarding mechanisms	Flexibility of processes that regulates rail transports	Harmonization of rules and regulations	Measure the transport development	Adjust costs to promote environmental friendly transports	Alternative vehicle configurations for road transports
Market offer	X	X	X	X	X	X	X		X	X	X	X	X		X	X	X	X	X	X	X	X	
Efficiency	X	X		X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X
Reliability	X										X									X	X		
Energy & emissions			X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

9. Corridor management

Disregarding from which measures or suggested pilot projects that are selected to develop the corridor, a considerable challenge will be to identify who is to take responsibility for this work.

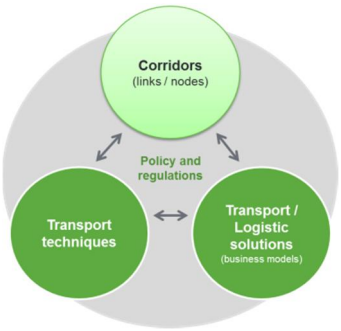
To successfully create a corridor management structure a number of considerations need to be taken into account[12]. Power, resources and accountability need to go hand in hand in the corridor. This means that those who have the power to decide what actions should be undertaken in the corridor should also have the resources to carry them out and the responsibility for the outcomes. Additionally, coordination is vital in corridors. Stakeholders and actions need to be well coordinated to achieve positive development. Apart from coordinating interested stakeholders and actions, it is also important to make sure that all essential parties in the corridor get involved. A significant part of successful corridor management is strong leadership, i.e. clear visions, action plans and coordination. It is also important to achieve lasting procedural changes in the corridor to become successful. A tool to make sure that visions are shared, action plans fulfilled and coordination achieved in a corridor is the use of formalized agreements. Additionally, communication at all levels, involving all actors in the corridors is a key factor for success. To achieve development in a transport corridor, it is advised that a bottom-up approach is applied. Thus, one shall look at the resources that are available in the corridor and based on that form goals to reach.

10. Pilot projects

Apart from finding a way to address the question of how to best manage the development of the corridor between Oslo and Randstad, we propose that a number of development projects are initiated.

Our suggestions are based on discussions within the group behind this work, ideas and information from other green corridor and transport development projects as well as input from those involved in the GreCOR-project. The suggestions have however not been discussed with transport operators and transport buyers in the corridor.

The suggested pilot projects are here presented without any prioritization being made in-between them.

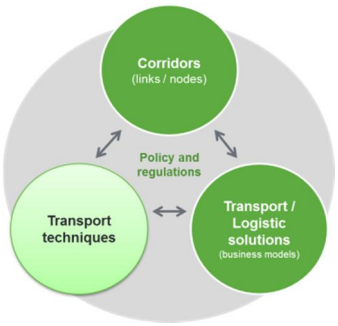


Corridor: Benchmarking of corridor nodes

To assess how efficient the different nodes in the corridor perform compared to each other, is of importance in the corridor development work. The situations in the links are well-known, as the infrastructure often is owned and regulated by the national governments. Additionally, plans for

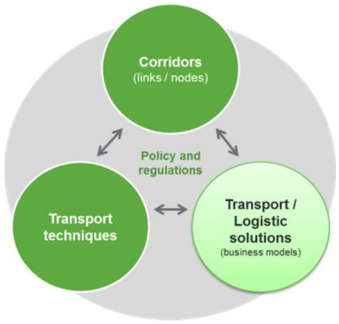
[12] See the material of Maria Öberg presented at one of the Bothnian Green meetings at http://www.bothniangreen.se/wp-content/uploads/2012/10/120912-13-WP6-partner-meeting-pori.pdf

maintaining and improving infrastructure are made on a regular basis. With increased knowledge of difficulties and possibilities present in the nodes of the corridor, it becomes easier to improve the overall performance of the corridor.



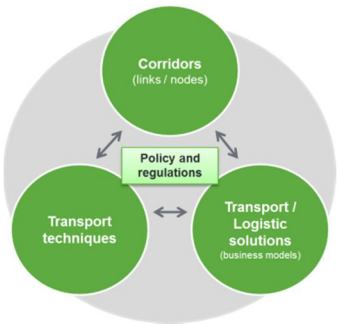
Transport techniques: Land-based power supply to vessels in ports

Ships in port use their engines to support functions that need energy. This generates both noise disturbance and toxic emissions from incinerating diesel or heavy fuel oil. Instead, shorepower can be used. This means the shore side provides electricity to ships a berth and allows the ships engines to be switched off. To make this work, both port and ship must be properly equipped. A problem to overcome is the ship´s difference in voltages and frequency which means the port must be equipped to meet different demands.



Transport/Logistics solutions: Transport/Information brokers

To ensure the most efficient use of the resources available in the corridor network, it is suggested that a transport broker function is organized. The brokers are to work in a similar manner as brokers of sea transports work today, but across all transport modes. The brokers need to have specialized knowledge of the operators and conditions that prevail in the corridor and how different transports in the corridor can be executed in the most efficient and environmental friendly way. To enable the development of transport brokering in the corridor, an information platform, like the one to be developed in WP5, can play an important role.



Policy and regulations: Alternative vehicle configurations for road transports

To reduce transport emissions and fuel consumption per tonne kilometre, it is of interest to test alternative vehicle configurations (on road). This could encompass longer vehicles, heavier vehicles and higher vehicles for example. The configuration of vehicles is to a large extent decided by existing rules and regulations. Hence, to be able to test other solutions to find more environmental friendly alternatives it is necessary to alter or make exceptions from existing rules and regulations.

Policy and regulations: Reduced distance between trains

In order to further optimise the use of the rail infrastructure, there are different measures that could be taken. One of them would be to reduce the distance between trains, between the blocks, in order to fit in more trains on the same stretch simultaneously, without hazarding the safety. Holland has

successfully implemented this some years ago. This also implies that the speeds of different trains should be as similar as possible.

Policy & regulations: Green Corridor certification course (Green Card)

In order to improve the knowledge of green corridors, their potential and also to attract goods, we suggest that some sort of education should be offered to interested parties. It can for example provide information about tools that can be used to book corridor transports, the requisites for successful co-modal transports and certification possibilities related to reduced environmental impact of freight transports. The certification course is suggested to be a mandatory part of rewarding systems developed for the corridor.

Policy & regulations: The GreCOR Shippers' Council

An international shippers' council is suggested to be formed to manage the freight transport interests along the stretch of the corridor. The council is to represent transport buyers and operators and have representatives from all modes of transport. The main objectives of the council are suggested to be:

- Collect information on current and future regulations/legislative initiatives that will affect the corridor
- Work for the harmonization of rules and regulations along the corridor
- Be responsible for the development of the green corridor and encourage analyses related to the development

Similar initiatives can be found both on a national level and on a cross-border level, e.g. European Shippers' Council (http://www.europeanshippers.com/) and Swedish Shippers Council (http://www.transportrad.se/).

The pilot projects suggested here addresses different parts of the corridor and also different actors. They can be implemented separately one by one but together they constitute a plan for how to create a green corridor and how to measure the progress in it. One thing the proposed pilot projects have in common is that the majority of them require some form of Corridor management to implement the pilot projects and to be maintained. We therefor strongly recommend this to be the first action undertaken.

11. Appendix

Here you find a complied presentation of the proposed measures, their expected effects and implementation requirements/pre-requisites.

WHAT	1. Measures aimed at reducing the effect of disturbances in train traffic
TARGET	Rail links and nodes
WHY	To increase the competitiveness of rail freight transports
IMPACT	More robust rail transports
WHO	Transport and node operators, national governments, corridor management structures
CRITICAL FACTORS	Potentially increased costs New solutions/processes required
CATALYSTS	National initiatives Corridor initiatives

WHAT	2. Differentiation of freight rates to level demand (lower rates for transports during hours of low traffic for example)
TARGET	Links in the corridor network
WHY	To increase resource utilization in the corridor network
IMPACT	More freight can be transported through bottlenecks in the corridor network Costs associated with investments in new infrastructure can possibly be avoided
WHO	Transport and node operators, corridor management structures
CRITICAL FACTORS	Increased administration
CATALYSTS	Corridor initiatives

WHAT	3. Increased frequency of trains at major rail routes in the corridor
TARGET	Links in the corridor network
WHY	Increase resource utilization in the rail corridor network and attract more food to rail transports
IMPACT	Increased competitiveness for freight transports on rail due to increased frequency of service Chance to reduce emissions and reduce congestion on roads Facilitate selection of transport mode
WHO	National governments, corridor management structures, train operators
CRITICAL FACTORS	Competition for rail resources between goods transports and commuter trains Legislation, e.g. required distance between trains
CATALYSTS	Corridor initiatives

WHAT	4. Measures aimed at increasing the through-put of terminals
TARGET	Nodes in the corridor network
WHY	Increase the competitiveness of transport modes that are reliant on terminal handling to allow the most efficient and environmental friendly transport mode to be used in the corridor
IMPACT	Reduced costs and environmental impact Facilitates free selection of transport mode
WHO	Node operators, universities and research organisations
CRITICAL FACTORS	Competition for attractive land areas in densely populated areas might hamper expansion and reconstruction plans
CATALYSTS	Corridor initiatives

WHAT	5. Benchmarking of corridor nodes
TARGET	Nodes in the corridor network
WHY	Efficient intermodal transports in the green corridor is reliant on well-developed handling of goods in the nodes
IMPACT	Best-practice solutions can be identified and applied to increase the efficiency in the corridor nodes Reduced costs and increased utilization of resources
WHO	Node operators, corridor management structures
CRITICAL FACTORS	Cooperation from node operators Costs and difficulties of developing criteria's that are to be compared
CATALYSTS	Corridor initiatives

WHAT	6. Development of new techniques to facilitate transfer of goods from one transport mode to another.
TARGET	Transport techniques
WHY	Reduce "friction" in the corridor network to increase utilization of the most optimal transport mode for each transport
IMPACT	Increased efficiency in terminal handling and thereby reduced operational costs Facilitates free selection of transport mode
WHO	Node operators, universities and research organisations
CRITICAL FACTORS	Costs and time for development of new knowledge, new technology and implementation of these
CATALYSTS	R&D funding Education of engineers and researchers

WHAT	7. Development of new techniques to allow more efficient short-distance transports.
TARGET	Transport techniques
WHY	Efficient short-distance transports are of essence in expanding the catchment area of the corridor and thereby attract more goods.
IMPACT	Reduced costs and environmental impact Facilitates free selection of transport mode
WHO	Universities and research organisations, private companies (transport operators)
CRITICAL FACTORS	Costs and time for development of new knowledge, new technology and implementation of these
CATALYSTS	R&D funding Education of engineers and researchers

WHAT	8. Land-based power supply to vessels in ports
TARGET	Transport techniques
WHY	To reduce emission from vessels in ports
IMPACT	Reduced environmental impact
WHO	Port operators, universities and research organisations, standardisation bodies, EU/national governments/corridor management structures
CRITICAL FACTORS	Development of standard for the power supply. Investment costs.
CATALYSTS	Corridor initiatives Competition among ports R&D funding Education of engineers and researchers

WHAT	9. New techniques to reduce the energy consumption of freight movements
TARGET	Transport techniques
WHY	Reduce emissions and increase vehicle efficiency
IMPACT	Reduced environmental impact Reduced costs for freight movements Reduced reliance on non-renewable energy sources
WHO	Vehicle and vessel producers, universities and research organisations, transport operators, EU/national governments, corridor management structures
CRITICAL FACTORS	Considerable R&D and implementation costs Trains and vessels are generally used for a long period of time Infrastructure for supply of alternative fuels
CATALYSTS	EU/National rules and regulations Potential cost reductions due to reduced fuel consumption Reduced access to oil/Increased fuel prices Corridor initiatives

WHAT	10. Cooperation among buyers of similar transport services
TARGET	Transport/logistics solutions
WHY	To increase resource utilization in the system
IMPACT	Increased fill-rates Reduced emissions and numbers of transports Reduced congestion on network links Improved transport balances between different geographical areas Cheaper transports
WHO	Transport buyers, transport and node operators, corridor management structures, certification bodies
CRITICAL FACTORS	Delivery demands – time Rules and regulations regarding cooperation between companies
CATALYSTS	Corridor initiatives Profitability demands for companies/Demand for cheaper transports Environmental awareness/Certification demands

WHAT	11. Cooperation among transport operators
TARGET	Transport/logistics solutions
WHY	To increase resource utilization in the system
IMPACT	Increased fill-rates Reduced emissions and numbers of transports Reduced congestion on network links Improved transport balances between different geographical areas Cheaper transports
WHO	Transport and node operators, corridor management structures, certification bodies, EU/National governments
CRITICAL FACTORS	Delivery demands – time Rules and regulations regarding cooperation between companies
CATALYSTS	Corridor initiatives Profitability demands for companies/Demand for cheaper transports Environmental awareness/Certification demands

WHAT	12. Freight brokers that work with all transport modes
TARGET	Transport/logistics solutions
WHY	To increase resource utilization in the system and reduce environmental impact
IMPACT	Increased fill-rates Reduced emissions and numbers of transports Reduced congestion on network links Improved transport balances between different geographical areas Cheaper transports
WHO	Transport buyers, transport and node operators, private entrepreneurs (transport brokers), corridor management structures, certification bodies, EU/national governments
CRITICAL FACTORS	Competition between transport operators Rules and regulations regarding cooperation between companies
CATALYSTS	Corridor initiatives Profitability demands for companies/Demand for cheaper transports Environmental awareness/Certification demands

WHAT	13. Corridor logistics advisors
TARGET	Transport/logistics solutions
WHY	To attract freight to the corridor and facilitate use of the corridor
IMPACT	Facilitate for/Give advice to all involved parties in the corridor as to how to best realize the corridors full potential Increased corridor competitiveness Increased fill-rates, reduced emissions etc.
WHO	Transport buyers, transport and node operators, corridor management structures, certification bodies
CRITICAL FACTORS	Cost and set-up time, time for establishing services on the market
CATALYSTS	Corridor initiatives EU initiatives

WHAT	14. Encourage/Educate transport-buyers to book transports as early as possible
TARGET	Transport/logistics solutions
WHY	To improve planning and utilization of resources
IMPACT	Increased fill-rates Reduced emissions and numbers of transports Reduced congestion on network links Improved transport balances between different geographical areas Cheaper transports
WHO	Transport buyers, transport and node operators, corridor management structures, educational bodies
CRITICAL FACTORS	Difficult to change established behaviours
CATALYSTS	Corridor initiatives Marketing/Information Environmental awareness/Certification demands

WHAT	15. Facilitate comparison of freight alternatives
TARGET	Transport/logistics solutions
WHY	To improve the efficiency of the corridor network
IMPACT	Increased system transparency that allows all transport modes and operators to compete on similar terms Reduced congestion on network links Possibility to highlight environmental aspects of different transport alternatives
WHO	Transport buyers, transport and node operators, corridor management structures, information tool provider
CRITICAL FACTORS	Existence of and access to data - Transport and node operators reluctance to share information System costs
CATALYSTS	Corridor initiative

WHAT	16. Reduced distance between trains
TARGET	Policy and regulations
WHY	Optimize the use of the rail infrastructure
IMPACT	Increases the rail transport capacity Possible reduction of emissions and congestion on roads
WHO	National governments, train operators
CRITICAL FACTORS	Rules and regulations
CATALYSTS	National initiatives Corridor initiatives

WHAT	17. Rules and regulations aimed at reducing emissions
TARGET	Policy and regulations
WHY	To reduce emissions
IMPACT	Reduced emissions
WHO	EU/national governments, corridor management structures
CRITICAL FACTORS	Considerable R&D and implementation costs
CATALYSTS	Corridor initiatives R&D funding Education of engineers and researchers

WHAT	18. Certification/Rewarding mechanisms
TARGET	Policy and regulations
WHY	Enhance the use of green transport alternatives in the corridor
IMPACT	Reduced emissions
WHO	Transport buyers, transport and node operators, corridor management structures, certification company
CRITICAL FACTORS	Introduction of certification/rewarding system to the market Possible increased transport costs
CATALYSTS	Corridor initiatives National/EU initiatives

WHAT	19. Improve the flexibility of processes that regulates rail transports
TARGET	Policy and regulations
WHY	To increase the competitiveness of rail transports
IMPACT	Make it easier for companies to use rail transports without too much planning in advance
WHO	National governments, rail operators
CRITICAL FACTORS	Costs and work of changing existing administrative systems National and international rules and regulations
CATALYSTS	The sharing of risks and costs inflicted by changes National and international rules and regulations

WHAT	20. Harmonization of rules and regulations related to transports throughout the corridor
TARGET	Policy and regulations
WHY	To increase the efficiency in the system
IMPACT	Corridor credibility Equal operational terms for all involved parties
WHO	EU/National governments, interpreters of rules and regulations
CRITICAL FACTORS	Costs for development and implementation Considerable number of organizations are involved
CATALYSTS	Corridor initiatives Market demand

WHAT	21. Measure the transport development in the corridor
TARGET	Policy and regulations
WHY	To detect changes in the corridor network over time and evaluate the effect of measures undertaken
IMPACT	Ground the work on the development of the corridor on correct information Possibility to predict outcomes of measures undertaken in the corridor in the future Collect vital information on the use of the freight corridor to be able to prioritize measures and action planned for the corridor
WHO	Transport buyers, transport and node operators, corridor management structures, EU/National initiatives
CRITICAL FACTORS	Difficult to get access to required data No models exist that can be used to estimate the flows on the total length of the corridor
CATALYSTS	Corridor initiatives EU/National initiatives

WHAT	22. Adjust costs to promote environmental friendly transport alternatives in the corridor
TARGET	Policy and regulations
WHY	To reduce emissions
IMPACT	Reduced emissions Reduced reliance on non-renewable fuels Impact of bottlenecks in the systems might alter
WHO	Transport buyers, transport and node operators, corridor management structures, EU/national governments
CRITICAL FACTORS	Unpopular with support measures that favour some transport modes over others Costs
CATALYSTS	EU/National initiative Corridor management

WHAT	23. Alternative vehicle configurations on road
TARGET	Policy and regulations
WHY	Reduce emissions and increase vehicle efficiency
IMPACT	Reduced emissions and fuel consumption per tonne kilometer. Possibility of reduced congestion on roads.
WHO	Vehicle producers, universities and research organisations, national governments
CRITICAL FACTORS	Costs and time for changes of rules and regulations as well as development of new technologies and implementation of these.
CATALYSTS	EU/National initiative, Corridor initiatives, R&D funding, Education of engineers and researchers.