3.0 Scandria Investment Strategy

Infrastructure Improvements in the Scandria Corridor

Baltic Sea Region Project #026
“Scandinavian-Adriatic Corridor for Growth and Innovation”

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<td>Responsible Partner</td>
<td>Swedish Transport Administration</td>
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<tr>
<td>Author</td>
<td>Svante Berg/John McDaniel (Ramböll Sverige AB)</td>
</tr>
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1 Introduction

The Scandria Corridor from Scandinavia via Eastern Germany and further south is the shortest connection between the Adriatic Sea, Central Europe and Scandinavia. Highly-productive and innovative regions and efficient North-South Connections link more than 110 million people in eleven European states and eight capitals.

The Scandria Corridor stands for safe, efficient and environmentally sound transport. It supports innovative logistics solutions, relying on intermodal transport and first-class transport links. But most of all it is a dynamic business region, connecting the most advanced knowledge-driven economies throughout Europe.

The main output for the SCANDRIA WP 3 – Quality of transport Infrastructure – is to prepare a “SCANDRIA investment strategy” in the corridor, bringing single strategies together in three fields of action:
- development of intermodal nodes (Action 3.1)
- improvements in the rail network (Action 3.2)
- optimised heavy goods vehicle traffic (Action 3.3).

The Investment strategy relies mostly on the partial outputs from the single WP3-actions and other WP within the Scandria project. The ambition is to determine investment needs, show investment projects, assess the results of case studies and pilot projects and give recommendations on transnational planning, implementation and harmonisation of investments in the transport infrastructure in the corridor. The inputs from the case studies within WP3 are conclusions and proposed investments and measures within their field of action that could be adopted in the corridor.

The strategy is not a complete strategy covering all possible desired infrastructure investments. Instead it has the form of an “Infrastructure Improvement plan” that focuses on investment and measures with the purpose of “greening” the corridor. It’s a strategy on how to take measures that develop the corridor towards more efficient, environmental friendly and cost effective ways of transportation.
2 Summary and conclusions

“Sound green infrastructure facilitates economically viable solutions and at the same time helps to improve environmental conditions”.

When viewing the conclusions from the three different work packages relating to intermodal terminals, rail networks and heavy truck improvements, it is clear that the Scandria Corridor is not a sustainable corridor today. This being said, it is extremely important to look beyond today’s situation into the future where many significant changes will take place for the transport sector as a whole, and more importantly within the Scandria Corridor specifically.

“Green transport corridors promote the development of a ‘greener-oriented’ transport system. They endorse the EU vision towards an integrated and sustainable transport system. Green Corridors provide the most environmentally-friendly, sustainable, efficient and safest connection for freight transport in Europe.” (Tetraplan et.al.).

Green logistics are very important regarding climate change. The demand for efficient transport is growing among customers and thus among logistics operators. They can benefit from using the Scandria Corridor. The project is analyzing several innovative solutions for logistics and which – among other topics – contributes to the “greening” of the Corridor.

The building of the Fehmarnbelt fixed link by the year 2021 is probably the single most important infrastructure development in the region and central to the Scandria Corridor and concept. It will not only provide shorter travel times but also facilitate improved logistics and lead to lower transport costs. Furthermore, a number of other necessary infrastructure improvements on either side of the Southern Baltic Sea will further support the Scandria Corridor, some of which are already in the National plans but also others highlighted in the Scandria study. Among these, “Corridor East”, a new north-south rail freight corridor is being established by 2019 by integrating the former West and East German railway networks, and will significantly expand capacity in the Scandria Corridor while relieving congestion elsewhere.

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A transport solution is only as strong as its weakest link, and therefore improvements are also essential at strategic (inter)modal terminals throughout the corridor as well as non-infrastructure measures in order to realise the corridor’s potential including harmonization of passenger ticketing systems between Germany, Denmark and Sweden. Organisational changes will also need to be improved as well as attitudes of transport companies and shippers along the corridor.

All freight forecasts point to increased volumes in the Scandria Corridor for all transport modes helping to make the Scandria Corridor a cost-efficient corridor in the future.

When looking into the future, towards say the year 2050, it is extremely important to also consider the situation with environmental and technological changes. The EU White paper 2011 “Roadmap to a Single European Transport Area” - Towards a competitive and resource efficient transport system points to a European future where larger proportions of long-distance passenger and freight transport is shifted from road transport to rail and sea. It is therefore important that the Scandria Corridor uphold this vision of the future and develop systems that can cope with higher rail volumes.

Last, but not least, a multimodal Green corridor is also of importance for maritime transport (mostly ferries) and also for trucks. In order to facilitate the corridor, improvements are also needed at road bottlenecks, through e.g. ITS solutions, or safe parking stops or reliable fuel filling stations.

In short, the following points highlight the MOST important aspects necessary to develop the Scandria Corridor (the order does not represent a ranking):

Rail Transport Solutions and Intermodal Nodes

- In order to greatly improve the situation, and potential, for greener rail transport a number of far-reaching issues need to be resolved and improved. One such issue is the organizational problems between companies and countries. There needs to be a combined effort within the rail sector, such as coordination of time-tables and ticketing which is today unnecessarily complicated. This includes improvements within country as well as between countries.

The sub-task “Optimized connection of intermodal terminals in Berlin-Brandenburg to north-south-transport” pointed out that many companies have unsuccessfully attempted rail connections between the Berlin region and Scandinavia. This has led to negative attitudes towards rail solutions which will need to be improved, and practical and credible transport logistics developed. Information and marketing of successful solutions is a way to spread the positive message, but also to promote feedback regarding positive or negative experiences.

- Rail transport also has different technical standards for freight transport. In order for the corridor to function efficiently as a whole unified infrastructure standard for axle-load, train length, train mass/height, braking performance etc. should implemented. Specifically the technical standard of the Fehmarnbelt link is important. According to early indications, as well as more recent recommendations, the technical standard of the Fehmarnbelt should not be a lower standard than that of the Öresund link.

- Additionally intermodal terminals are necessary as hubs for the Scandria Corridor. The study has highlighted several critical points including the need for improved land-based terminals in Wustermark/Berlin and in Frankfurt (Oder) as well as port-based intermodal terminals at Rostock, Gedser and Trelleborg. Other strategic terminals mentioned in the study are Køge/ Høje Taastrup, Malmö, Helsingborg, Halmstad, Ystad and Swinousjcie.

Heavy Goods Vehicle Traffic

- Bottlenecks in the road networks, specifically for trucks, using e.g. ITS-solutions, is necessary for the corridor to develop and be accepted. It is not possible to develop standard ITS-solutions that can be developed and applied at all problem locations, however, location-specific solutions should be developed. Work package 3.3 has shown that in two example locations there are significant improvements using ITS-technology. A network of responsible organizations should be enhanced in order to learn from one another but also to help facilitate ITS solutions within the Scandria Corridor. Information about road closures or heavy congestion could be useful so that alternative routes can be considered before the obstacle is actually reached. For example an earlier stop can be made or an alternative strategic route chosen instead.

- Implementation of re-fueling stations along the entire corridor would be necessary. As no standard fuel system exists today there would be the need for multiple fuel types.
It is important that the distance between re-fueling stations is not too much, thus making the Scandria Corridor attractive to truck drivers.

- Theft and damage of trucks at overnight stops is an increasing problem and monitored safe locations with facilities at strategic points could be a solution. Today there is no sign of National agencies taking an active role with this, but they are supporting in principle. The main difficulty with this solution is to make the overnight stations economically viable. The study “Secure parking in the Scandria Corridor – a policy paper” concludes that it is only a matter of time before authorities take this issue more seriously and that the Scandria Action plan should support the establishment of secure parking sites in the corridor.

3 Description of Work package 3 "Quality of Transport Infrastructures"

The main output for the SCANDRIA WP 3 – Quality of transport Infrastructure – is to prepare a "SCANDRIA investment strategy" in the corridor, bringing single strategies together in three fields of action:
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3.1 **Work Package 3.1 “Intermodal node development”**

This work package consists of five case studies investigating intermodal hubs and a proposed common concept strategy for development of intermodal nodes in the Scandria Corridor. The case studies, which are described partially below, and described in detail in the case-specific study reports, describe the current transport situation, the planned and desired infrastructure measures, and the potentials for further development of intermodal transport solutions. In some cases, as the one of Berlin Brandenburg, intermodal train connections have been proposed and analysed relating to practical issues and economic aspects of operation.

![Figure 3.1 The location and geographical scope of the five case studies.](image)

**3.1.1 Distribution centres Berlin-Brandenburg**

Within the European Union’s SCANDRIA project, a case study was conducted to outline strategies in order to improve the connections of the intermodal terminals in the Berlin-Brandenburg area in a north-south direction. The obvious way to achieve this is to create new intermodal train connections in a north-south direction via the Berlin-Brandenburg region.

The current situation is that there is available rail capacity in a north-south direction in the Berlin-Brandenburg region, making the Scandria Corridor an interesting rail transport alternative to the Hamburg-Munich axis. Furthermore, Berlin itself is a high economical hot-spot for transport demand, along with Frankfurt (Oder). Despite this, there are no regularly scheduled direct train connections from the Berlin-Brandenburg region today in a north-south
direction. A combination of the lack of direct services and the physical barriers of the Baltic Sea in the north and the Alps/Erzgebirge in the south make transport operations costs and transport times less appealing than in the east-west direction.

The project surveyed the potential for direct scheduled train connections in a north-south direction and resulted in the analysis of various alternatives:

- Rostock – Koper/Sezana
- Rostock – Frankfurt (Oder) – Štuj na Labem
- Wustermark – Ulm – Mortara

The study suggests that two different (competing) locations are promising as intermodal hubs, one in Frankfurt (Oder) and the other one near Berlin, probably at Großbeeren or Wustermark.

Figure 3.2 The train connections analyzed, respectively designed, within the scope of this study
3.1.2 The ports of Gedser and Køge

The two locations, Gedser and Køge, were carefully selected for further analysis due to their roles as important clusters and nodes for organising freight transport along the Scandria Corridor. These two locations have been assessed for their future potential for improving intermodal transport solutions in the Scandria Corridor. The study has aimed at analysing the present situation regarding freight movements in and around the ports of Køge and Gedser, as well as looking at the potential for developing and strengthening the potential for future intermodal solutions.

Analysis of the port of Køge as a potential intermodal hub showed that today most of the freight is to/from the island of Bornholm. However, looking from a broader perspective the Scandinavian Transport Centre nearby should be included as well. These locations together handle almost three million tonnes annually today. Despite this the activities are uncoordinated and company-specific.

![Figure 3.3 The transport corridor Køge-Gedser in Region Zealand](image)

Today only the intermodal terminal at Høje Taastrup exists on Zealand. This terminal was expanded in 2011 and provides intermodal train services to western Denmark, western
Germany and northern Italy. A recent study by the Danish Transport Administration in 2010 concluded that there would not be substantial growth in this market and that the existing terminal could handle the future growth. However, the assessment also said that a new study was necessary to look at the situation after the Fehmarnbelt link is built. The Scandria project has therefore investigated alternative solutions, particularly solutions in Gedser and Køge.

Should a new intermodal terminal be established in Køge, more possibilities with respect to linking transit and international trains in the Scandria Corridor will be possible, giving way to both transit and international trains on the new line. Later on, a potential establishment of a fixed link between Elsinore in Denmark and Helsingborg in Sweden could bring around more capacity in the transport corridor, especially if supplementing the existing Scandria Corridor with the new Ring 5 corridor between Elsinore and Køge – thereby bypassing the Greater Copenhagen.

3.1.3 Intermodal nodes in the Skåne Region

The Region of Skåne, in southern Sweden, is very closely tied to Greater Copenhagen and has very good transport infrastructure. A large proportion of transported goods are transit, i.e. they pass through the region without having an origin or destination in the region. There are a number of strategic ports in the region, Helsingborg (ferry port and container port), Karlshamn (industrial port, energy port and ferry port), Malmö (vehicle port, energy port and some containers) and Trelleborg (ferry port). Helsingborg primarily has connections to Denmark, Trelleborg to Germany and Poland and Karlshamn to the Baltic States. The most important intermodal terminals in Region Skåne are located in Malmö, Helsingborg and Trelleborg.

In terms of the strategic nodes in a north-south Scandria Corridor both the connecting infrastructure and the functionality of the intermodal nodes are important. In Southern Sweden, the Port of Trelleborg stands out. It is situated advantageous in the southernmost part of Sweden with great ferry connections to Germany and Poland. With the planned expansion of the port, the adaptation of the rail yard and improvement of the rail connections to and from the port by 2015, Trelleborg will continue to be a very good node in the corridor. The intermodal terminals in Hässleholm (planned) and Älmhult could be loading/unloading points in the north-south corridor. The terminals are both connected to Trelleborg (via Malmö) via the Southern Main Line, where expansions are planned to allow for a higher
transport quality and reliability. Älmhult already has established freight train shuttles that are southbound to Hässleholm, Trelleborg, Malmö and Helsingborg. Hässleholm is situated very well and the municipality has hopes to develop the planned intermodal terminal to a dry port for ports in Southern Sweden.

As an alternative to the Port of Trelleborg, other ports in southern Sweden could be considered. Here Malmö and Helsingborg could be of interest. Leading more of the traffic through Denmark to Malmö or Helsingborg could relieve the traffic in the southernmost part of Sweden around Trelleborg. Malmö is already an important ferry port for freight to Germany, and the intermodal terminal in Malmö, Logistikcentrum, is located in the port area with potential for more intermodal transports. The Port of Helsingborg has also established an intermodal terminal with daily train shuttles leaving for other parts of Sweden as well as Norway and Europe. And with the opening of Jernhusen’s intermodal terminal in Helsingborg in 2011 this node could be of interest in a Scandria Corridor even before a HH-connection is decided upon.

3.1.4 The ports of Halmstad, Falkenberg, Varberg

The main purpose of this task is to describe the potential of the ports in the region of Halland – Halmstad, Varberg and Falkenberg and potential to develop as intermodal nodes.

The report finds that these three Halland ports all have functioning rail connections, but that investments are required to meet future demands and adjust the track systems and, where appropriate, road connections to harmonise with the city’s development plans.

Today, there is regular rail traffic to and from the ports and the neighbouring industries. This is mainly in the form of conventional wagonloads. Halmstad is the port that has gone furthest in developing rail traffic, with a shuttle for container and ro-ro units as well as a rail service for transporting imported cars. Given the ports’ existing volumes and the extensive lorry traffic, on the E6 in particular, the report concludes that there is a theoretical potential for establishing combi-traffic, chiefly in Varberg and Halmstad, which currently already handle unitised freight on quays. Combi-trains cannot be justified solely by current sea volumes, because the volumes are too small and irregular. The ports and their owners must therefore complete a number of tasks in order to achieve success and develop into profitable intermodal nodes:

- Switch volumes that currently go by lorry to combi
- Increase their share of the unitised freight market
• Develop the combi-terminals and rail connections
• Keep cost levels down despite the investments
• Help companies needing to transport unitised freight by sea become established in the port or its vicinity

In view of all the major issues to be addressed, and the extensive plans for further investments, the report concludes that the owners must ask themselves one further question:

• Could co-operation between the Halland ports contribute to increased regional and local competitiveness while making better use of existing resources?

3.1.5 Inn road Freight Terminal Jyväskylä, Finland
The purpose of this task is to get an idea of the potential for combined transport solutions in the Jyväskylä region, in central Finland, and to see if there is a sufficient market for these transports and what kind of commitment would be required from logistics service providers and logistics service users.

The shipping companies interviewed point out the slow progress in the development process of new intermodal routes in Finland, and claim that one of the reasons is the poorly deregulated market for rail transport in Finland. Ports and terminal operators are very positive to the idea, but have no means to organise the transports themselves. The opinions are however divided regarding the reasons why intermodal trains are not profitable, and as to why there are so few initiatives.

There are many regional development centres taking steps for promoting railway transports in their region. These projects should be co-ordinated better and aim for more concrete steps for starting the combined transport services. The customers are interested in greener corridors, if… the price is the same or lower, the transit time is reasonable and the frequency of the service(s) is sufficient. A most positive thing for Jyväskylä is that both the railway operator (VR), several ports and several shipping lines, see the service Helsinki - Jyväskylä as the next item on the agenda. The indicated rate levels and daily frequency of the service are sufficient for starting the service. The units will be mostly containers and as Scandria’s main port Rostock handles only a limited amount of containers, the Jyväskylä unit train needs to serve not only Scandria but other corridors as well. Main ports like Hamburg, Bremerhaven, Rotterdam and Antwerp will be important partners for Jyväskylä.
3.1.6 **The Common Strategy on the development of Intermodal nodes**

The case studies in Sweden, Denmark and Germany have provided information relating to the main freight transport and traffic flows in the Scandria Corridor and indications on the strategic role of selected hubs within the corridor.

The overall freight flows between Germany (including transit) and Scandinavia in the Scandria Corridor is today significantly divided between a “Danish” and a “Swedish” route.

The road freight transport flows through or in the Danish part of the Scandria Corridor do not include any substantial volumes of transit traffic to and from Sweden/Norway via Zealand. The major part originates from or is destined for Zealand and in particular around Greater Copenhagen.

All the freight transport flows to and from Zealand via the Gedser-Rostock ferry link is road based and is mainly destined for or originates from Southern and Eastern Europe. The ferry link predominantly carries self-propelled trailers and trucks due to the short sailing time and short turn-around time in the ports.
The freight transport flow from the ports in Southern Sweden – mainly Trelleborg, is dominated by goods originating from or destined for the Southern and Central parts of Sweden. The freight flows are dominated by traffic and transport volumes on trucks and unaccompanied trailers on-board the ferries connecting Trelleborg, Ystad and Karlshamn with German ports in Rostock and Sassnitz. Due to the sailing time and turn-around time in the ports, it is efficient and possible to use unaccompanied trailers for the hauling and forwarding companies.

The case studies from Sweden and Denmark has identified large volumes destined for or originating from locations in Southern and Eastern Europe. The road based traffic is dominating this transport and is carried out mainly by single trucks or by self-propelled trailers. In relation to train based intermodal transport, it is the share of trailer traffic that is
interesting since it represents a unitised transport that in principle can be transferred to trains. In a separate study by Öresund Logistics (Öresund Logistics, 2010), there has been identified a potential for establishing a coordinated and consolidated transport system between auto part manufacturers in Southern and Central Sweden to customers in the Czech Republic on road transport, which could be transferred to rail based transport on more consolidated terminals in Germany. This scenario is also plausible for transported volumes originating from or destined to Zealand via Gedser-Rostock. However, this transfer requires a more widespread use of trailers designed for being transferred by reach stackers or gantry cranes at the intermodal terminals.

Strategic (intermodal) nodes in the Scandria Corridor

The Scandria Corridor is characterised by being divided by the sea in the Western part of the Baltic Sea. Therefore a number of ferry connections and ports play an important and strategic role in the transport network that constitutes the corridor. Also a number of land-based terminals play a potential role for the future development of rail based intermodal transport.

Based on the case studies a number of strategic (intermodal) nodes for the Scandria Corridor have been identified:

**Port of Trelleborg**

The Port of Trelleborg is the main gateway for Ro-Ro traffic between Sweden and the European Continent – especially via the ferry link to Rostock. The port has a medium-sized intermodal terminal transferring unaccompanied trailers between shuttle trains and ferries. The port also handles large numbers of unaccompanied trailers that arrive or depart by truck. The port is the location for additional logistics services and serves as a major consolidating point for freight traffic between Sweden and the European Continent.

**Port of Gedser**

The Port of Gedser serves today as a “drive-through port”, with a strong focus on minimizing the time friction for the passing road freight traffic. Due to the intense sailing schedule, the turnaround time in the port is put to an absolute minimum, which makes the high frequency possible with the available number of ferries. However, this also constrains the possibilities for transferring unaccompanied trailers on the ferries and thereby becomes a barrier for developing intermodal transport solutions in the Port of Rostock based on trailer traffic.
A change in ferry scheduling could improve the potential for developing a “Danish leg” to a Scandinavian feeding of a train based intermodal concept via the intermodal terminal in the Port of Rostock.

**Port of Rostock**

The most important German port within the Scandria Corridor (measured by transhipped mass) is the port of Rostock. Rostock also is the third-most important port in sea transport to Scandinavia (after Hamburg and Lübeck, which are both, not part of the Scandria Corridor).

The Port of Rostock in many ways serves as a node and roundtable for the freight transport by sea and road between Scandinavia and the European Continent – especially the Southern and Eastern parts. Not only has the port the traditional function of handling the unloading and loading of the ferries, but some of the trucks and trailers never leave the port, but are loaded on-board some of the several other ferry links connecting Rostock with several ports in the Baltic Sea.

The port has put an active role in developing the logistics activities in the port and together with potential forwarding companies and train operators scanned the market potential for developing new train based intermodal serviced feeding into and from the ferry links in the port.

**The intermodal terminals at Wustermark and Frankfurt (Oder)**

According to the case study of Berlin-Brandenburg, Berlin is the most dense economical centre in the region, and therefore a region with a high potential for transport demand. A second concentration can be found around Frankfurt (Oder), in Brandenburg, as well as on the Polish side of the border. These regions are of special interest, when developing intermodal transport solutions, as significant demand for transport services can be expected to emerge from these areas.

Based on these findings, the case study propose a future development of especially the intermodal terminals at Wustermark and Frankfurt (Oder) in the Berlin-Brandenburg Region as of special significance for the development of train based intermodal transport in the Scandria Corridor. Two separate intermodal train concepts are proposed, which both are closely linked to the Scandinavian parts of the Scandria Corridor via the Port of Rostock:

Rostock – Frankfurt (Oder) – Ústí nad Labem
This train concept could cut costs for an intermodal transport chain from Hässleholm to Ústí nad Labem by up to 30% by using a train from Rostock to Ústí nad Labem instead of using trucks along the complete line.

By connecting the port of Rostock to Berlin-Brandenburg, this train also connects the Berlin-Brandenburg region to Scandinavia and opens the Berlin-Brandenburg region as a hinterland region for the port of Rostock by intermodal means.

By sharing a train-set with the proposed Rostock – Koper/Sezana train (compare above) both train-concepts could benefit from cost reductions. Such a combination also shows possible synergies between different SCANDRIA work-packages. The train-concept is shown to be economically feasible and could later be extended to up to three departures per week (starting with one departure per week as a spin off from the Rostock – Koper/Sezana train).

Wustermark – Ulm – Mortara

A connection between Wustermark and Mortara via Ulm was drafted to utilize the potentials from Wustermark to Ulm ascertained by IPG and Wagener & Herbst within the SoNorA project. The train could be combined with a train-concept from the EU Alpine Space project Transitects that would run between Ulm and Mortara. The combined train-concept is shown to be economically feasible and shows the possible synergies between different European Union projects.

This train would start with two departures per week and be extended to a third departure per week.
3.2 Work Package 3.2 Rail transport solutions

The basis for this summary are the various sub-task reports within Scandria, and the concept summary notes for Work Package 3.2 on rail transport, more specifically the following case-studies:

- Elimination of infrastructure bottlenecks in the corridor
- Fehmarnbelt and connecting rail links
- Interoperability of train systems and operating practices
- Railway lines Gedser – Copenhagen
- Ferry connection South Sweden – Sassnitz/Rostock

3.2.1 Infrastructure bottlenecks

The principal aim of this study has been to define the market and the transport standard in the studied corridors. The current transports and infrastructure have been analysed as well as the future development and the planned investments. An analysis has been conducted to identify bottlenecks and weak links, and scenarios for future development have been presented.

Estimates of rail freight forecasts have been analyzed and the growth rates differ by country, however all Scandria countries are anticipated to have significant increases, with the exception of Finland.
It should be noted that Figure 3.5 shows the rail freight flows in 2006, but that there are some anomalies in the diagram, namely that the main flow between Ånge and Hallsberg is through Avesta-Krylbo, not Falun. Furthermore, the rail ferry line Stockholm-Åbo has now ceased and also that Umeå-Önsköldsvik-Sundsvall is in place.

Detailed analysis of bottlenecks by country has been carried out in the study “Elimination of infrastructure bottlenecks in the corridor”, including many explanatory figures and tables. The study concludes that in general there is no common standard, or common plan, for future investments in the Scandria Corridor between the countries. For new construction and upgrading of infrastructure, the opportunity to apply bold, forward-looking standards should
be seized. These standards should be as high as, or higher than, those used on connecting corridors and networks.

Capacity constraints in the form of single track sections exist on several of the lines in the Scandria Corridor. It would be desirable to accelerate track duplication to improve both capacity and fluidity on these lines. In the short term, construction of additional and longer sidings would add capacity and flexibility.

Large differences in speed reduce capacity, creating a need for additional sidings even on double tracks. Significant discrepancies of technical standards still exist between the various national railway networks. The 25 ‰ grade at Halden, being twice as steep as other grades on the Oslo-Göteborg line, restricts train mass on this line or necessitates an additional locomotive. Easing this grade to 12 ‰ would eliminate this constraint.

The international function in the rail corridor is strong for freight between Sweden and Germany and the European continent but rather weak between the other countries. The national freight function by rail is also rather strong in Sweden.

With the overall aims of enabling efficient, reliable and sustainable passenger and freight transportation meeting the needs of passengers and shippers, while accommodating modal shift in accordance with the goals of the EU, and based on review of transportation trends and forecasts present transportation system performance and standards present national infrastructure plans the Scandria Project (WP 3.2) has identified the following needs for railway improvement beyond the present national transportation infrastructure plans, which should be investigated with high priority for inclusion in the plans.
Table 3.1. Scandria rail infrastructure improvement priorities [KTH]

<table>
<thead>
<tr>
<th>Description</th>
<th>Time horizon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kokkola – Seinäjoki, Pohjois-Louko – Lielähti: extension of double track</td>
<td>≈ 2030</td>
</tr>
<tr>
<td>Haug – Halden: double track</td>
<td>≈ 2025</td>
</tr>
<tr>
<td>Sarpsborg – Skålebol: loading gauge SE-C; intermodal gauge P/C 450</td>
<td>≈ 2015</td>
</tr>
<tr>
<td>Järna – Nyköping – Linköping: new link, ≥ 320 km/h</td>
<td>≈ 2025</td>
</tr>
<tr>
<td>Hallsberg – Degerön: completion of double track</td>
<td>≈ 2021</td>
</tr>
<tr>
<td>Ångelholm – Ästorp – Teckomatorp – Kävlinge – Arlöv: additional passing</td>
<td>By 2015</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>sidings, longer sidings for 835 m trains</td>
<td></td>
</tr>
<tr>
<td>Åstorp – Teckomatorp: centralised traffic control</td>
<td>By 2015</td>
</tr>
<tr>
<td>Lund – Flackarp: quadruple track</td>
<td>≈ 2020</td>
</tr>
<tr>
<td>Lockarp – Trelleborg: longer sidings for 880 m trains</td>
<td>By 2015</td>
</tr>
<tr>
<td>Peberholm – Kastrup: freight bypass, ≤ 12 ‰</td>
<td>By 2021</td>
</tr>
<tr>
<td>Kastrup station: capacity for four passenger trains simultaneously to stop at</td>
<td>≈ 2020</td>
</tr>
<tr>
<td>platforms</td>
<td></td>
</tr>
<tr>
<td>Kastrup – København H: clearances for vehicle gauge SE-C (same as Øresundsbron) on four tracks</td>
<td>≈ 2021 (when introducing ERTMS)</td>
</tr>
<tr>
<td>Koge – Næstved: electrification, upgrade for ≥ 200 km/h</td>
<td>By 2021</td>
</tr>
<tr>
<td>Puttgarden – Lübeck: upgrade for ≥ 200 km/h</td>
<td>By 2021</td>
</tr>
<tr>
<td>Lübeck – Bad Kleinen: electrification, upgrade for ≥ 200 km/h</td>
<td>By 2021</td>
</tr>
<tr>
<td>Bad Kleinen: connecting track (wye) (Bobitz) – (Lübstorf)</td>
<td>By 2021</td>
</tr>
<tr>
<td>Bad Kleinen – Holthusen – Ludwigslust: upgrade for ≥ 200 km/h</td>
<td>By 2021</td>
</tr>
<tr>
<td>Lübeck – Büchen – Lüneburg: electrification, longer sidings for 835 m trains</td>
<td>By 2021</td>
</tr>
</tbody>
</table>
Over the last few decades it has become more difficult to develop good rail passenger connections between Berlin and Scandinavia, mainly for two reasons, the first the expansion of the low-price airlines and the other the privatization of the ferry services, who have prioritized road-ferry combinations. However, there are a number of measures to change this balance, most significantly the rail infrastructure improvements between Berlin and Rostock, rail improvements on the Danish side and, of course, the building of a new fixed link between Denmark and Germany, the Fehmarnbelt link.
Table 3.2 Comparison of travel times (hrs) between Berlin and Copenhagen

<table>
<thead>
<tr>
<th></th>
<th>Car</th>
<th>Air</th>
<th>Train</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copenhagen - Berlin</td>
<td>6:00 to 6:30</td>
<td>3:00</td>
<td>6:45</td>
</tr>
<tr>
<td>Copenhagen - Hamburg</td>
<td>4:30 to 5:00</td>
<td>3:00</td>
<td>4:40</td>
</tr>
</tbody>
</table>

The realization of the fixed link across the Fehmarnbelt and the modernization of the hinterland connections will cut travel times between Berlin and Copenhagen significantly. Already with a basic connection via Hamburg direct trains can run between Berlin and Copenhagen in 4 hrs 20 minutes. Investments in Germany (electrification of the Lüneburg – Bürchen – Lübeck and Bad Kleinen – Lübeck lines) would give an approx. 60 km shorter route than via Hamburg. These alternative routes could cut travel times by 20 and 35 minutes and bypass the congestion at Hamburg.

Table 3.3 Fehmarnbelt traffic

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Passengers/year</td>
<td>abs.</td>
<td>% abs.</td>
<td>abs.</td>
<td>% abs.</td>
</tr>
<tr>
<td>Rail passengers</td>
<td>352.000</td>
<td>5.5%</td>
<td>638.000</td>
<td>8.4%</td>
</tr>
<tr>
<td>Car passengers</td>
<td>4.058.000</td>
<td>63.6%</td>
<td>4.781.000</td>
<td>63.4%</td>
</tr>
<tr>
<td>Bus passengers</td>
<td>1.248.000</td>
<td>19.6%</td>
<td>1.423.000</td>
<td>18.8%</td>
</tr>
<tr>
<td>Walk-on pass</td>
<td>718.000</td>
<td>11.3%</td>
<td>711.000</td>
<td>9.4%</td>
</tr>
<tr>
<td>Passengers/year</td>
<td>6.376.000</td>
<td>100%</td>
<td>7.553.000</td>
<td>100%</td>
</tr>
<tr>
<td>Passengers/day</td>
<td>17.468</td>
<td>20.693</td>
<td>26.721</td>
<td>6.028</td>
</tr>
<tr>
<td>Cars/day</td>
<td>3.718</td>
<td>4.995</td>
<td>7.496</td>
<td>2.551</td>
</tr>
<tr>
<td>Buses/day</td>
<td>88</td>
<td>112</td>
<td>129</td>
<td>17</td>
</tr>
</tbody>
</table>

Forecast figures by the FTC show significant increases in rail passenger volumes across the Fehmarnbelt link, and a market share of up to three times that of today. This will of course involve new markets as well as strengthening of existing ones.

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3 WP 5.21 “Basic description of corridor functionality”

4 Source: Fehmarnbelt Traffic Consortium (FTC)
Furthermore, it is not sufficient with the existing National planned infrastructure, but further improvements are also required to increase capacity and robustness on connecting lines in the corridor, such as:

- additional double track Haug – Halden for the passenger and freight flow between Norway, western Sweden, Denmark and Germany;
- a new line Järna – Norrköping – Linköping and for the passenger flow between eastern Sweden, Denmark and Germany;
- completing double track Hallsberg – Degerön for the freight flow between northern Sweden, Denmark and Germany;
- upgrading of the freight route Ängelholm – Ästorpm – Teckomatorp – Kävlinge – Arlöv to handle the freight flow between Norway, western Sweden and Denmark;
- completing quadruple track Lund – Flackarp for the passenger flows between Norway, Sweden, Denmark and Germany;
• upgrading the Øresund link to handle four passenger trains simultaneously at Kastrup station, investigating a freight bypass with westbound gradient not exceeding about 12 ‰ to facilitate heavier freight trains between Sweden, Denmark and Germany, and tracks with the same vehicle gauge (SE-C) as Øresundsbron into København H.;
• upgrading and electrifying the line Køge – Næstved to give flexibility in routing passenger and freight trains between mainly Denmark and Germany, including the traffic of a possible new container terminal at Køge;
• upgrading the Storstrøm bridge for the passenger and freight flows between Scandinavia and Germany;
• upgrading and electrifying the line Lübeck – Bad Kleinen including a connecting track toward Schwerin for passenger trains between Scandinavia and eastern Germany;
• upgrading and electrifying the line Lübeck – Büchen – Lüneburg for freight trains between Scandinavia and southern Germany.

Figure 3.8 Scandria Corridor railway improvement priorities [KTH]
After the realization of Fehmarnbelt-Link, it must be uncomplicated for railway companies to get allowance for locomotives and multiple units (=TRIEBWAGEN) to cross German-Danish and Danish-Swedish borderlines. Cheap solutions for railway companies without technical problems as an alternative to ERTMS must be possible. To realize a connection between long distance trains from Berlin to regional trains of Zealand (regional trains via Puttgarden to Zealand) it is preferable to position the interface between the electrical systems inside the station of Puttgarden (not in tunnel), because dual-system locomotives and multiple units are too expensive for interregional trains and diesel coaches will not be permitted in the Fehmarnbelt tunnel.

Important infrastructure measure and bottlenecks:

- After completion of the fixed Fehmarnbelt travel times between Berlin and Copenhagen with direct long distance trains could be essentially shorter compared with the today standards (from 6 ¾ hours to about 4 hours). The Fehmarnbelt-Tunnel can help to change the modal split from air to rail, but additional measures from the hinterland connection to Berlin Region are necessary.
- Gaps in electrification between Lübeck and Bad Kleinen and Lübeck – Büchen – Lüneburg must be closed to have a possibility of bypassing the bottleneck of Hamburg for ICE- and time sensible freight trains.
- After the realization of Fehmarnbelt - Link one bottleneck will be the single track section between Puttgarden and Lübeck, which according to the international agreement is to be double tracked 7 years later. The upgrading to two tracks must be realized earlier.
- In middle and long term bigger change in modal split from air to rail is possible by reducing travel time travel Berlin – Copenhagen down to 3 ½ hours. To realize this aim an upgrading of Ludwigslust – Holthausen and Schwerin – Lübeck up to 160 km/h is necessary. Upgrading of Lübeck – Puttgarden up to 200-230 km/h is important to reach this travel time.
- A corridor for freight trains is needed with the same new technical standard of fixed Fehmarnbelt (Axle load, train length, train mass/height between Lübeck – Schwerin/Rostock/Bützow – Güstrow and Berlin.
3.2.3 Interoperability of the rail system

Recommended best common practice

The following is a recommended best common practice to be used for upgraded or new railway links. It is based largely on the best standards in use today in the Scandria Corridor, and aims to enable the main transportation flows in the corridor to follow one common standard. It corresponds largely to the standards in effect on the existing Oresund link, hence the called “Oresund standards”.

Table 3.4. Recommended best common practice for Scandria Corridor rail links

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Recommended best common practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passenger train speed</td>
<td>( \geq 200 \text{ km/h} ) (upgraded), ( \geq 320 \text{ km/h} ) (new)</td>
</tr>
<tr>
<td>Freight train speed</td>
<td>( 100 \text{ km/h (night)}, 120 \text{ km/h (day)} )</td>
</tr>
</tbody>
</table>
| Freight train length    | Single train: 730 m (P), 835 m (5GP), 880 m (G)  
Double train: 1460 m (P), 1670 m (5GP), 1760 m (G) |
| Wagon mass on \( \leq 10 \% \) | Single train: loco+(=)5200 tons (screw couplers)  
Double train: loco+(=)5200 tons +loco+(=)5200 tons (screw couplers) |
| Loading gauge           | Rectangular (flat top): 3.15 m \( \times \) 4.83 m, specific links 3.60 m \( \times \) 4.83 m (SE-C) |
| Intermodal gauge        | 2.60 m \( \times \) 4.33 m (P/C 400), specific links 2.60 m \( \times \) 4.83 m (P/C 450) |
| Meter load              | \( \geq 8.3 \text{ m} \) |
| Axle load               | \( \geq 25 \text{ tons} \) |
| Gradient                | \( \leq 12.5 \% \) |
| Wagon brake ratio       | SS \( \geq 80 \% \) |

The Fehmarnbelt link should be an least the same standard as the Öresund link with the following technical standard:

- Train speed: \( \leq 200 \text{ km/h} \)
- Train length: \( \leq 1000 \text{ m} \)
- Loading gauge: 3.60 m \( \times \) 4.83 m “flat top” (SE-C) when ERTMS will be introduced
- Intermodal gauge: 2.60 m \( \times \) 4.83 m (UIC P/C 450)
- Meter load: \( \leq 8.3 \text{ tons/m} \)
- Axle load: \( \leq 25 \text{ tons} \)
- Gradient: \( \leq 12.4 \% \) westbound on bridge part, new freight bypass Peberholm - Kastrup proposed
Non-infrastructure improvements

Unified brake tables between Germany and Sweden.

Permitted train speed as a function of brake performance is determined by national tables in each country. Despite the brake systems being standardized by international standards, when crossing a border and using national tables, the permitted speed comes out differently. It is common for a train to have to reduce speed when crossing a border, which limits infrastructure capacity and extends transit times, making shipment by rail less attractive. Just as the brake systems are standardized internationally, national operating rules and brake tables also need to be standardized.

Short term measures to promote use of railway in combination with ferry services in the Baltic Sea. The target groups are travelers and tourists who are not time-sensitive. Experience has been drawn from the North Sea Islands on the German coast. Ferry line companies in the Baltic Sea are today only orientated towards car users.

The main conclusions from this study are:

Solution for Rostock - for train passenger (small - scale investments):

- Direct bus line Rostock Hbf - Rostock Harbor ferry terminal
- Platform for IC/ICE - trains in Rostock Harbor
- One ticket: train - bus - Ferry Boat – train Attractive flexible network-tickets including all trains, buses, ferries, public transport in Scandinavia (like the “Swiss travel system”)

Additionally, coordinated Time-tables could be developed:

- Berlin - Rostock - Gedser/Trelleborg/Helsinki/Tallin
- Berlin - Sassnitz - Trelleborg/Bornholm/Klaipeda
- Berlin - Stettin - Swinemünde – Ystaad/Bornholm/Kopenhagen
Figure 3.9 Ferry routes regarding improved connectability between rail and ferry

The results are the culmination of moderated round table-discussions and interviews including:

- Ferry boat companies: TT, Scandlines, Polferries, Unity
- Railway companies: DB, Interconnex, PKP Intercity, PR, SJ, DSB
- Ministries of transport: Mecklenburg Vorpommern, Brandenburg, Berlin
- City of Rostock
- Harbor companies
- Tourist agencies of Sweden, Denmark, Bornholm, Finland and Berlin

### 3.2.4 Railway lines Gedser - Copenhagen

The purpose of this study is to analyze the possibilities of improving traffic connection towards Gedser by re-establishing the railway connection from Nykøbing Falster. Rail Net Denmark estimates that a complete renewal of the Gedser railway line, including crossings and interlocking systems will cost around 200 million DKK (27 million Euros). Today bus line 740 services the route along the old railway track, and has around 108,000 passengers annually. Following the analysis of the possible development of the future passenger potential, it is assessed that with an improved connection it should be possible to attract about 205,000 passengers in 2020.
The general conclusion is that without huge increases in passengers, many times higher than even the optimistic estimations, or a substantial decrease in costs, there is no viable business option. Electrification is not a credible alternative as Nykøbing – Gedser is expected to have small traffic flows is not a through-link in the network and other lines should be of higher priority.

3.2.5 Interoperability of train systems

One of the major components for development of an integrated concept on optimizing rail traffic in the corridor is to ensure the interoperability of the train systems, both from the infrastructure’s and the vehicle’s point of view. The case study therefore will be focused on the following issues:

Definition of interoperability according to the Directive 2008/57/EC on Interoperability of the Rail System within the community and the Technical Specifications for Interoperability (TSI’s) and description of general procedures of cross-acceptance.

Analysis of the state of the art of existing interoperable rail services between Germany and its neighboring countries e.g. passenger high speed rail services with special view in experiences to overcome obstacles in authorization.

3.2.6 The Integrated concept on optimizing rail traffic in the corridor

Due to historical, political and geographical reasons the region of Berlin/Brandenburg has a poor accessibility in rail transport to the prospering regions of Scandinavia.

Up to 2050 international frame conditions of long distance transport and energy will change dramatically entering the post-fossil age. GHG (green-house gas) must be reduced in transport. One answer is given in the White Paper Transport 2050 of European Commission: Revitalization of railway transport based on renewable energy, extending of the high-speed-network, improvement of frame conditions for railway transport and reducing obstacles of trains crossing border lines.

The transport of freight and passengers within the SCANDRIA-Corridor is not sustainable today. Railway transport does not play an important role today. Especially in the corridor Malmö/Copenhagen – Berlin railway companies have lost big market share after the privatization of ferry-companies in the 1990’s.
To shift the modal split to rail several infrastructural and non-infrastructure measures in Germany, Denmark and Sweden are necessary. The planned measures of national governments are not sufficient. Several remaining bottlenecks can be identified.

The building of the Fehmarnbelt fixed link will increase the potential for the corridor in general and rail transport specifically. Shorter transport times and cost reduction will be an effects of this, however to really make full use of the link other infrastructure rail measures are essential. A number of critical improvements have been highlighted in the study including connections between Berlin and the ferry ports on the South Baltic Sea.

Furthermore, it is not sufficient with the existing National planned infrastructure, but further improvements are required to increase capacity and robustness on connecting lines in the corridor, such as:

- additional double track Haug – Halden for the passenger and freight flow between Norway, western Sweden, Denmark and Germany;
- a new line Järna – Norrköping – Linköping for the passenger flow between eastern Sweden, Denmark and Germany;
- completing double track Hallsberg – Degerön for the freight flow between northern Sweden, Denmark and Germany;
- upgrading of the freight route Ångelholm – Ästorp – Teckomatorp – Kävlinge – Arlöv to handle the freight flow between Norway, western Sweden and Denmark;
- completing quadruple track Lund – Flackarp for the passenger flows between Norway, Sweden, Denmark and Germany;
- upgrading the Øresund link to handle four passenger trains simultaneously at Kastrup station, investigating a freight bypass with westbound gradient not exceeding about 12 ‰ to facilitate heavier freight trains between Sweden, Denmark and Germany, and tracks with the same vehicle gauge (SE-C) as Øresundsbron into København H.;
- upgrading and electrifying the line Køge – Næstved to give flexibility in routing passenger and freight trains between mainly Denmark and Germany, including the traffic of a possible new container terminal at Køge;
- upgrading the Storstrøm bridge for the passenger and freight flows between Scandinavia and Germany;
- upgrading and electrifying the line Lübeck – Bad Kleinen including a connecting track toward Schwerin for passenger trains between Scandinavia and eastern Germany;
- upgrading and electrifying the line Lübeck – Büchen – Lüneburg for freight trains between Scandinavia and southern Germany.
Non infrastructure problems to be solved:

Non infrastructure improvements of railway transport do not cost much money and must have the first priority:

- Supporting cooperation between railway, ferry, public transport companies and port authorities to realize an intermodal Intercity System with optimized and coordinated timetables and attractive combi-tickets (rail-ferry-rail or rail-bus-ferry-rail).
- Improvement of interface in the ferry terminals to minimize ways for foot passengers with luggage.
- Introduction of a common integrated timetable information system including all ferry connections, public transport, trains and regional busses of Germany and Northern Europe.
- A change of railway-fare system is necessary towards a European transparent and attractive system. The isolated national orientated Swedish “X-2000” fare system from SJ (with cheaper prices only available in Sweden) must be integrated into a common European fare system with DB; DSB and PKP. It should be no problem to buy tickets from Berlin to Stockholm via Fehmarnbelt, Rostock-Gedser, Sassnitz-Trelleborg or Swinoujscie-Ystad. In the first step fare-offers from DB/DSB like “Europe Special South Sweden” must be extended from Malmö and Göteborg to Stockholm, Oslo and Helsinki.
- Swinoujscie will be more important for passenger and freight transport from Berlin in the future after the upgrading of the railway connection via Szczecin up to 160 km/h and after the realization of the direct railway connection via “Karnin Bridge”. Swinoujscie offers a good interface for foot passengers using trains. In Ystad little improvements of interface are necessary.
- The future of the Sassnitz – Trelleborg train ferry appears uncertain. Except for the night train between Berlin and Malmö, Sassnitz-Mukran will not play any role for foot passengers due to the decision of Mecklenburg-Vorpommern that regional trains will not be offered in the future to Mukran Railway station. In Rostock improvements for foot passengers could be realized using the EU project INTERFACE and must be communicated.
3.3 Work Package 3.3 Heavy Goods Vehicle traffic

The third part of Work Package 3 is related to various road transport related issues including ITS-solutions, alternative fuels for trucks and truck stops. Within ITS case-studies were performed in the cities of Malmö and Gothenburg to investigate potential for using ITS to improve motorway bottlenecks, event parking and environmental traffic messages. The study on alternative fuels has looked at the possibility to have alternative renewable fuels along the entire Scandria Corridor and the truck stop study to analyse how safe truck stops could be set-up in the corridor.

3.3.1 Intelligent Transport Solutions, Malmö

The purpose of the case study is to analyze existing and future mobility on the E6 through the junction at Petersborg in Malmö and how this can be improved with the possible help of ITS solutions. Focus of the study is primarily on heavy traffic leads to the development of concrete proposals that can potentially be implemented within the framework of national or European programs such as Easy-Way/Viking. The study investigates the existing situation without the ITS devices, including different forecasts and traffic growth scenarios. It also deals with measures to increase capacity and throughput of traffic.

The study has investigated the potential effects of different ITS measures including:

- Road assistance
- Ramp metering
- Video cameras
- Variable Speed Limits (VSL)
- Dynamic traffic information panels
- Automatic speed enforcement (ATK)
- Urban road pricing

It was found that ALL measures had positive effects on traffic, in terms of accessibility and/or road safety. This shows that with the correct measure implementation it is possible to improve existing problems or alleviate future problems using good ITS solutions. Similar solutions, according to the local situations, could also be applied to other problem and bottleneck areas along the Scandria Corridor.
3.3.2 Effects on traffic of environmental messages, Gothenburg

The purpose of this case-study was to evaluate the effects on average speed when drivers are informed about hazardous level of air pollution and asked to reduce their speed. This was carried out by a combination of actual speed measurement and by use of a driver survey. The road chosen was a semi-urban and urban highway with three lanes, motorway control system, with variable message signs and variable speed limit, where the default speed limit is 90 km/h. For this test a new type of sign was created.

Tests were carried out with and without reduced speed limit to 70 km/h. The conclusions from the test were that 70 per cent of drivers had seen the sign and message, that 90 per cent of them understood the meaning of the message and that ONLY 55 per cent of the drivers who had seen the sign and message stated that they actually reduced their speed. In another test this percentage rose to 65 % where dynamically reduced speed limits were used.

The drivers who had reduced the speed estimated the reduction to 13 km/h by average, although the actual measured reduction was far less, on average a few per cent (messages and maximum speed figures gave an 8% speed reduction). After reading the explanatory test about air pollution in the questionnaire, about 60 per cent of the drivers who had not reduced their speed in the tests stated that they will do so next time.

The conclusion from this test is that it was actually the text on the sign that caught the drivers attention, that driver want an actual speed limit number and that messages should only be used when necessary, i.e. at times when pollution actually occurs.

Figure 3.10 Message signs for reduced speeds due to pollution levels

3.3.3 Case study “Event parking”, Gothenburg

The purpose of this case-study was to investigate the potential environmental improvements of aiding traffic to disperse following a major event. The aim was to improve the main routes
with the minimum of traffic jams and least possible impact on public transport. The specific objectives were specified as:

- Reduce environmental impact
- Reduce travel times
- Minimize disruption of traffic on public transport
- Profitability for each traffic segment

One solution was using static signs, this was the cheapest solution but also the least flexible, and difficulty if incidents occur during the dispersion. Another solution was to use electronic signs to redirect traffic to alternative routes from the city, and the ability to interactively improve the situation; however this solution needs power sources to the signs and take more place as well as requiring maintenance. The third solution was a totally integrated solution where information from car-park occupancy levels, registered events, traffic measuring stations etc could be used to alleviate traffic problems before they become serious using real-time information. This is the most costly solution needing operators and high maintenance. The study looked at different solutions and methods and concluded that more analysis was needed in order to express a firm conclusion.

3.3.4 Alternative fuels in HGV transport

The purpose of the study was to define possibilities and obstacles for a market development of an infrastructure for liquefied biomethane for supporting long haulage trucks equipped with dual-fuel technology within the Scandria Corridor. There are a number of reasons that the power train technology, called dual-fuel, and the fuel liquefied biomethane are identified as potential competitors to conventional diesel trucks:

- Renewable potential.
- Improved environmental performance.
- Good vehicle properties in terms of durability, vehicle driving range, serviceability, etc.
- Improved possibility to distribute the fuel to an infrastructure of refueling stations.
- Acceptable economy, i.e. competitive compared to diesel and other alternative fuels.
- Good fuel availability if using both biomethane and natural gas.

The study has focused on the three central issues in order for the process to work, namely the fuel, the vehicle and the customer. More details are available in the sub-task reports, but the main conclusions are:
• LBG and LNG should be seen as complementary. A demonstration project with a limited number of vehicles could theoretically be supplied by LBG but a European market solution will be based on LNG complemented by LBG.

• To promote a high percentage of biomethane a well-defined certificate system must be developed, one that allows for biomethane to be injected into the grid while LNG is physically delivered during the refueling.

• Currently there is already the potential to supply the Scandria Corridor with LNG. In addition LBG will also be provided in the corridor. The expected increase in use of LNG in Europe will further support the development of road distribution of LNG and LBG to refueling stations and it will also support the development of LNG/LCNG and LCNG stations.

• The number of vehicle choices is low but it should be sufficient for a demonstration project. More models are expected after 2013-2014 when EURO VI will be in power. Power train development pathways in compliance with EURO VI include both dual-fuel and spark ignited technologies.

• Lack of standards for LBG/LNG components, refueling processes and fuel quality prevents the development of a European LBG/LNG market for trucks. A demonstration project with international focus would be suitable as a test bed for field testing and for developing suitable market solutions.

• Development of a Scandria LBG/LNG corridor is already taking place in Sweden while the German market is one of the most difficult markets in Europe when it comes to introducing LBG/LNG for heavy duty trucks.

• From a market perspective the development of a Scandria Corridor for LBG/LNG would not become the first choice for the parties interested in LBG/LNG. Instead a corridor between initiatives in the Netherlands and Sweden seems to be a more suitable location for the first corridor.

• The expected call from the EU for “Demonstration of heavy duty vehicles running with liquefied methane” will be an opportunity to take the next steps in developing a Scandria Corridor for LBG/LNG. But as a consequence the competition between corridor initiatives will increase.

• There are many obstacles and uncertainties to overcome before the construction of a LBG/LNG corridor can be initiated but it is still seen as one of the most promising replacements for fossil diesel.

• The LBG/LNG corridor should be developed by gathering the most committed and interested players in the value chain.
The results show many obstacles before refueling stations to cover the whole corridor can be in place, however, the study also points out many opportunities.

Main challenges:

- Standards for fuels and technologies for Liquefied methane is not yet developed.
- Supply of OEM trucks running on LBG/LNG
- Market introduction of LBG/LNG in Germany.

Main opportunities:

- Fuel can be made available if combining Liquefied Biomethane (LBG) with Liquefied Natural Gas (LNG) and a green certificate system that includes both compressed and liquefied methane.
- Trucks for LBG/LNG are available and more models are expected to be launched coming years as Euro VI is introduced.
- The Scandria refueling infrastructure should be seen in as a part of a larger corridor system.
- Swedish actors are already today developing a national refueling infrastructure for LBG/LNG.

3.3.5 Safety of Truck Stops

The idea of safe parking spaces has been spreading throughout Europe in the past 10-15 years. Safe parking is a concept intended to resolve a number of different and growing problems that goods transporters and truck drivers have experienced during the last 20 years. The need for better facilities for protection of valuable cargo and drivers, better and more frequent parking facilities for drivers including car service, overnight accommodation (to avoid violating the resting rules), with access to alternative fuel stations etc. Two key projects were highlighted: SETPOS and LABEL, which are key elements in the development of secure parking sites in Europe. These together give a European truck parking information portal, which offers searchable overviews and many details on parking areas in 40 countries.

Among the different project proposal in the Scandria Corridor, the development of secure parking sites can with the necessary support from Scandria partners be valid project.

Secure Parking sites can:

- Provide a safe and secure service for transport in general
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- A more efficient transport center for different kinds of specialized services on the transport chain – for example servicing new transport modes – logistic services, communication facilities, oversized trucks service, dry port facilities etc.
- Combine different solutions within future transport demand – alternative fueling systems, reloading capacity etc.

3.3.6 The Concept for optimized heavy goods vehicle and traffic

Here are some recommendations relating to optimized heavy goods vehicles for the Scandria Corridor:

Creation of an ITS experience exchange group –

Local and regional parties within Scandria involved in ITS-signing activities meet and work together. The tasks of the group should include: Experience exchange, Harmonization, Technology, Coordination of technical requirements in procurement process, Co-ordination of separate but complementary projects

Set-up of common projects in case need is defined.

Execution of traffic information exchange projects -

Specific projects for applications of communication of traffic information eg. TV-screens with traffic information on ferries, mobile apps, websites available in several languages, support for commercialization of the site www.truckinform.eu developed by the SETPOS/LABEL Projects and additional services based on the content in the database.

ITS-based solutions for Trucks stops –

There are truck stops available along Scandria Corridor. These can be developed by adding new services. A first level would be TV-screens in the cafeteria with traffic information. Additional levels are reservation services, information regarding refueling stations for alternative fuels (LNG/LBG and other) etc. If new truck stops/secure parking are built these should be supported to have highly developed ITS solutions.

Supportive actions to provide biomethane for transport purposes -

Projects supporting availability of biomethane is expected to be needed in order to meet the demand if LNG/LBG market develops. The projects should have focus on: - Upgrading of biogas to bio-methane (injection and/or LBG). - Developing of a trading system for biomethane - including liquefied methane.
Evaluations of LNG/LBG road-trains as complementary solution to rail or ‘electric roads’ –

LNG/LBG road-trains have to be evaluated for use as alternatives to new rail-road capacity or electric roads. If evaluated in terms of cost, benefit, functionality, lead-time, etc. it seems that LNG/LBG road trains might be a competitive solutions for providing the transport services.

4 Infrastructure development in the Scandria Corridor

“Green transport corridors promote the development of a ‘greener-oriented’ transport system. They endorse the EU vision towards an integrated and sustainable transport system. Green Corridors provide the most environmentally-friendly, sustainable, efficient and safest connection for freight transport in Europe.”

Work Package 3 “Quality of transport Infrastructure” focuses on the improvement of the quality of transport infrastructure in the corridor where the goal is to develop an efficient, modern and high-performance transport corridor in accordance with the European “Green Freight Transport Corridor” concept.

The building of the Fehmarnbelt fixed link by the year 2021 is probably the single most important infrastructure development in the region and central to the Scandria corridor and concept. It will not only provide shorter travel times but also facilitate improved logistics and lead to lower transport costs. Furthermore, a number of other necessary infrastructure improvements on either side of the Southern Baltic Sea will further support the Scandria Corridor, some of which are already in the National plans but also others highlighted in the Scandria study. The latest indications are that the Fehmarnbelt link will have a technical standard at least as good as the Öresund link facilitating a high standard through the whole Scandria Corridor. A transport solution is only as strong as its weakest link, and therefore improvements are also essential at strategic (inter)modal terminals throughout the corridor as well as non-infrastructure measures in order to realize the corridor’s potential including harmonization of passenger ticketing systems between Germany, Denmark and Sweden. Organizational changes will also need to be improved as well as attitudes of transport companies and shippers along the corridor.
When looking into the future, towards say the year 2050, it is extremely important to also consider the situation with environmental and technological changes. The EU White book points to a European future where larger proportions of long-distance passenger and freight transport is moved from road transport to rail and sea. It is therefore important that the Scandria corridor uphold this vision of the future and develop systems that can cope with higher rail volumes. Last, but not least, a multimodal Green corridor is also of importance for maritime transport (mostly ferries) and also trucks. In order to facilitate the corridor, improvements are also needed at road bottlenecks, through e.g. ITS solutions, or safe parking stops or reliable fuel filling stations.

Heavy Goods Vehicle Traffic Solutions to solve bottlenecks in the road network, specifically for trucks, is necessary to develop for the corridor using e.g. ITS-solutions. As no standard fuel system exists today there would be the need for multiple fuel types. It is important that the distance between re-fueling stations is not too much, thus making the Scandria corridor attractive to truck drivers.

Rail Transport Solutions and Intermodal Nodes In order to greatly improve the situation, and potential, for greener rail transport a number of far-reaching issues need to be resolved and improved. There needs to be a combined effort within the rail sector, such as coordination of time-tables and ticketing which is today unnecessarily complicated. This includes improvements within country as well as between countries.

The study pointed out that many companies have unsuccessfully attempted rail connections between the Berlin region and Scandinavia, which has led to negative attitudes towards rail solutions which will need to be improved, and practical and credible transport logistics developed. Information and marketing of successful solutions is a way to spread the positive message, but also to promote feedback regarding positive or negative experiences. Rail transport also has different technical standards for freight transport. In order for the corridor to function efficiently as a whole the same infrastructure standard for axle-load, train length, train mass/height etc should be the standardized. Additionally intermodal terminals are necessary as hubs for the Scandria corridor. The study has highlighted several critical points
including the need for improved land-based terminals in Wustermark/Berlin and in Frankfurt (Oder) as well as port-based intermodal terminals in the corridor.

Poor transport infrastructure or inefficient transport services are reflected in longer time of delivery and higher direct transport costs. Green improvement in infrastructure makes a big difference to the costs of trading. It also leads to improved access to services like health and education, generates employment and enhances a country’s ability to trade while reducing the costs of goods and services.
5 Final words

Without the enormous effort put into the Scandria project by many experts covering different disciplines and representing various public and private organisations, this study would not have been at all as successful. It also shows that cross-border cooperation between partners adds to a greater added value, much like the Scandria Corridor itself.

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