

UNITISED GOODS TRANSPORT SCENARIOS - in the North Sea Region

Annex 1.2.4 to the Final Report



September 2007

PREFACE

This booklet has been written as part of the SUTRANET project (Work Package 1: Transport Research and Development Network). SUTRANET ('**S**ustainable **T**ransport Research & Development **N**etwork in the North Sea Region') is a project within the framework of the European Commission's (EC's) Interreg IIIB North Sea Programme.

The aim of the booklet is to present some guidelines with regard to intermodal freight transport scenario descriptions in the North Sea Region. The booklet includes the following two case descriptions of scenario building with a view to unitised goods transport:

- ❖ The Southern Norway – Jutland corridor including linkages to the north-western part of continental Europe, with a particular focus on unitised goods flows and the related transport infrastructure.
- ❖ The development of container traffic through the Port of Rotterdam.

A separate SUTRANET paper ('Survey of the Container Port Development in Germany') outlines the development trends for the deep sea container ports in Hamburg, Bremerhaven and Wilhelmshaven.

The booklet introduces - and the case descriptions illustrate - a planning and decision-making methodology that could be adapted and applied as well to other locations and sub-regions of the North Sea Region.

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TABLE OF CONTENTS

	Page
Executive Summary.....	iii
Introduction.....	1
Scenario Methodology.....	1
Scenario Variables.....	2
European Railway Policy.....	3
Case Description:	
The Southern Norway – Jutland – Continental Europe Corridor.....	6
Ports and Route Options.....	6
Categorisation of Variables.....	9
Scenario Forecasts by the Application of Modelling.....	10
Scenario A.....	11
Scenario B.....	12
Quantitative Forecasting in the Two Scenarios.....	14
Railway Network through Jutland.....	17
Short Sea Shipping.....	20
Ferry Links as Infrastructure.....	21
Case Description:	
Container Traffic through the Port of Rotterdam.....	22
The Rotterdam – Rhine Delta.....	22
Scenario A.....	25
Scenario B.....	25
Quantitative Forecasting in the Two Scenarios.....	26
References.....	32

EXECUTIVE SUMMARY

Scenario Methodology

The SUTRANET project has illustrated the development trends regarding goods flows and intermodal freight transport by two case descriptions of unitised goods transport scenarios in the North Sea Region:

- The potential corridor between southern Norway and the western part of the European Continent – including Jutland in Denmark.
- Container traffic through the Port of Rotterdam.

Both case descriptions include two scenarios that describe alternative developments in the North Sea Region:

Scenario A Baseline or “do nothing” or “business as usual” development.

Scenario B Intermodal development and regional integration, which implies a package of proactive policy measures to enhance efficient and sustainable intermodal transport solutions.

Both Scenario A and Scenario B consider modifications in terms of relatively high respectively low economic growth trends, which are influenced by external factors.

Similar scenarios can be elaborated for other locations and sub-regions in the North Sea Region such as transport corridors, seaports or selected intermodal development themes.

Case Description:

The Norway-Jutland-Continental Europe Corridor

The key scenario figures (in tonnes) for Ro-Ro traffic in the corridor are indicated in the table below.

Regional traffic is defined as Ro-Ro traffic between Norway and western Denmark. Transit traffic is Ro-Ro traffic between Norway and the western part of continental Europe (some of it passing through Jutland).

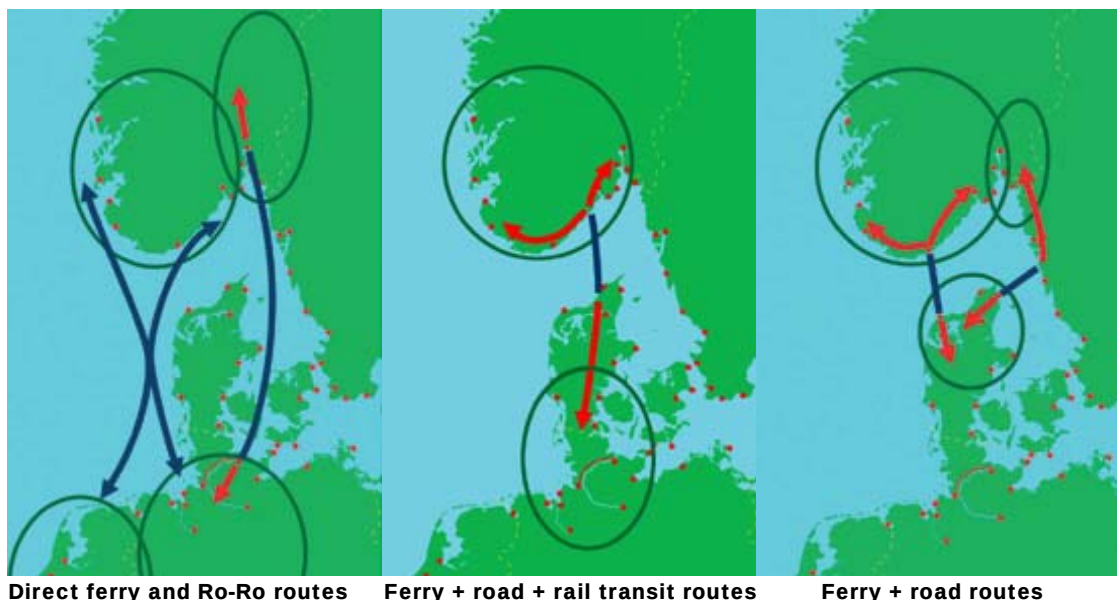
Annual Norwegian Ro-Ro traffic in the corridor (in 1000 tonnes):

	1990 1000 tonnes	2005 1000 tonnes	Growth Factor 1990- 2005	Scenario A 2020		Scenario B 2020	
				Growth factor	1000 tonnes	Growth factor	1000 tonnes
Regional	492	971	1.97	2.0	1,943	2.5	2,429
Transit	627	1,228	1.97	2.0	2,457	2.2	2,671
Total	1,119	2,199	1.97	2.3	4,400	2.0	5,100

Scenario A assumes the same overall growth factor from year 2005 to 2020 concerning Ro-Ro traffic to/from Norway as observed during the period 1990-2005. **Scenario B** assumes slightly larger (about 25%) growth rates for traffic flows to/from Denmark, Schleswig Holstein and Hamburg due to regional integration.

The estimated figures have not included any Norwegian transit traffic passing through southern Sweden, e.g. via Roedby and Trelleborg to/from German Baltic Sea ports.

The corridor involves direct ferry or Ro-Ro routes between Norway and the continental North Sea and Baltic Sea coasts, transit traffic between Norway and Germany through Jutland, and short ferry routes between Norway and North Jutland:



Some of the issues and questions involved in the scenarios are:

- how road pricing/tolls for freight traffic will influence the modal shift;
- different requirements and implications of transit vis-à-vis regional goods flows;
- the future role of railway infrastructure serving unitised goods traffic; and
- the need for a change of the institutional framework to make rail transport competitive and effective.

In Scenario B, incentives are introduced to support sea transport and a fair pricing is implemented on the use of road infrastructure. These measures should aim at reducing existing market distortions and subsequently facilitate a modal shift of transit and long-distance traffic from road to rail and sea. An optimised labour division between the alternative routes and modal options is a guiding principle for the measures to enhance a Scenario B development.

Several international ferry links in the corridor should be seen as an expansion of the national highway/motorway and railway networks. Ferry links represent an inseparable part of the overall infrastructure serving market regulated transport flows.

Revitalisation of Rail Freight Services

The extent of future rail freight services through Jutland represents an uncertain factor. This situation is further accentuated by a range of obstacles such as the lack of a clear national rail policy and strategy, an outdated and inadequate railway infrastructure, a mismatch concerning the institutional and organisational setup in order to separate infrastructure and operations, and a distorted market for rail freight services.

The approach – as suggested in Scenario B - involves an integrated package of measures to address the policy level, the legal and institutional framework, the physical infrastructure, and the market for

operations and services. The measures include a reshaped institutional setup, upgrading and electrification of the railway infrastructure in Jutland and Schleswig-Holstein, and a regulatory framework to sustain a competitive market for freight operators, so as to ensure that future rail freight services through the Jutland corridor will represent a commercially viable and sustainable option.

The Danish Government would need to elaborate a clear strategy plan, master plan and long-term investment plan for the trunk railway network through Jutland. Also the requirements of unitised goods services including the intermodal terminals, and the location and functions of the ports, have to be taken into account.

Future railway network in Scenario B:



RECOMMENDATIONS:

- ✓ **The institutional setup to be reshaped**
- ✓ **A clear strategy and long-term investment plan**
- ✓ **Upgrading and electrification of the railway infrastructure**
- ✓ **A sustainable maintenance organisation**
- ✓ **The road/rail terminal in Taulov to be an independent service provider**
- ✓ **A regulatory framework to ensure a competitive market for freight operators**
- ✓ **Liaison and coordination with German rail authorities and the EC**

Review and reshaping of the institutional setup aims to achieve a clear distinction between the roles and responsibilities of policy decision-making, infrastructure provider functions (including tendering out of construction and maintenance), and regulation of private commercial operators.

The road/rail terminal in Taulov will have to be established as a commercial infrastructure service provider being independent of the individual freight operators.

The regulatory framework has to ensure competitive market conditions for unitised freight operations on the railway network.

Co-operation and coordination on regulation, planning and investments have to be enhanced between the Danish and German rail authorities (notable in Schleswig-Holstein and Hamburg), and by involving the EC level as well.

The regional authorities could work on eventually including the North Jutland-Hamburg rail link as one of the TEN-T priority axes.

Case Description:

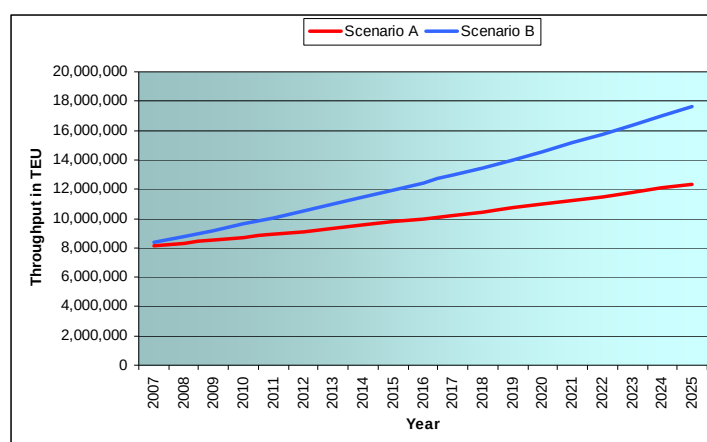
Container Traffic through the Port of Rotterdam

Rotterdam is the largest port in Europe, and - together with Antwerp and Hamburg - it is one of the three main container ports. The port functions as a hub in the international container-line network and plays an important role in the import and export of North-West Europe.



Geographical position of North Sea related container Ports in Germany, Benelux, UK and France

The following graph illustrates the development of container traffic (in the form of annual number of twenty-foot equivalent containers) through the Port of Rotterdam in Scenario A and Scenario B respectively:



Forecasts in scenario A and scenario B

Scenario A implies that no additional investment is made with regard to transport infrastructure or modal shift. For the case of Rotterdam this means that current capacity on the road network will not be

sufficient with a growing flow of goods; that the river Rhine might experience capacity problems due to low water levels in the summer; and that railway links will expand because of the recent opening of the Betuwe rail link (connects Emmerich in Germany with Rotterdam and Europoort in the Netherlands). Investments in large-scale port expansions will not take place, because of a lack of hinterland connections.

Scenario B assumes investments in the hinterland transport network and management of the goods flows to and from the Port of Rotterdam. Rail links to and in the German hinterland will increase in capacity. Water management schemes will increase the capacity of the river Rhine in low water periods. The highway network in the Netherlands will have an upgrade by expansion of the highway A15 and highway A4 (north and southbound), reducing the congestion for trucking. The improvements in hinterland transport and effective deployment of port expansion plans are likely to lead to a higher than proportional growth in Rotterdam as compared to the general trends and Scenario A. Roughly scenario B foresees a doubling of the annual container throughput within 20 years.

Conclusions and Recommendations

Based on the outcomes of the two (extreme) scenarios, the following issues for the Port of Rotterdam become clear.

The potential for growth is favourable, but action has to be taken to make sure that this growth can be handled in Rotterdam. Besides new capacity there is also room and need for more efficient use of all capacity in the port and the hinterland. Most actors can contribute to better usage of capacity.

Whether Scenario A or B will be followed in the coming years is in the hands of:

- The Port Authority; to develop new infrastructure and coordinate actors in transport.
- The national government; to develop hinterland infrastructure.
- The terminals; to make efficient interfaces with rail and barge.
- Rail operators; to develop efficient shuttles to mid-Europe.
- Barge operators; to streamline their operations in the port and make interaction with the terminals more efficient.

Especially for the railways, the capacity is growing in the coming years. A possible obstacle for rail transport is that growth is not equal in the Netherlands and other European countries. The European network has to be able to handle the increased rail transport. Specifically the coordination between the Netherlands and Germany will be a key factor in development of the railway network and services.

The main coordination problems are to be found in the barge transport. There are many small operators in this market, which makes coordination between the barge operator and the deep sea terminal difficult. A co-operative solution from the side of the barge operators might ease the communication with the port terminals, leading to more efficient handling of the barges.

INTRODUCTION

This SUTRANET booklet illustrates the future development trends regarding unit-loaded goods flows and intermodal freight transport by presenting two case descriptions of unitised goods transport scenarios in the North Sea Region:

- The potential corridor between southern Norway and the north-western part of the European Continent – including Jutland in Denmark.
- Container traffic through the Port of Rotterdam.

Emphasis is laid on the case descriptions because coverage of the geographical scope of the North Sea Region as a whole has not been realistic within the limited resources of the SUTRANET project.

Both case descriptions include a “business as usual” Scenario A, and a Scenario B that implies a package of proactive policy measures to enhance efficient and sustainable intermodal transport solutions.

Scenario Methodology

Building scenarios that describe alternative developments in the North Sea Region (NSR) - for a selected sub-region, transport corridor, seaport or another intermodal development theme - may include the following alternative assumptions:

- A. Baseline or “do nothing” or “business as usual” development (high/low economic growth).
- B. Intermodal development and regional integration (high/low economic growth).
- C. Intermodal development and disintegration.

Both Scenario A and Scenario B consider modifications in terms of relatively high respectively low economic growth trends, which are influenced by external factors.

Scenario C is a “worst case” scenario that is not included in the present booklet, but it is an option for further consideration.

Backcasting and Forecasting:

Forecasting is normally associated with a prognosis based description of alternatives, whilst “backcasting” is a principle applied in the scenario methodology. However, in this particular context it is considered useful to combine these two principles.

Scenario A is a “forecasting” scenario. It extrapolates the present development trends without launching any particular regional policy initiatives to stimulate integration and/or intermodal development.

Scenario B is a “backcasting” scenario. It defines a future situation of enhanced regional integration and an increased role of intermodal and sustainable transport networks, and includes a package of policy measures and initiatives to facilitate this development.

Scenario Variables

The scenario building has been done in close connection with the SUTRANET project’s compilation of statistics and establishment of databases for unitised goods transport flows in the NSR.

The Southern Norway – Jutland – continental Europe corridor case description also includes the elaboration of modelling framework guidelines for freight transport flows through this corridor. Findings of this elaboration are presented in the separate SUTRANET report ‘Transport Flow Modelling Framework Guidelines’.

The range of variables and indicators to be applied to the quantitative and qualitative scenario description depends on the scope and type of the topic selected. In the two case descriptions, year 2020 or year 2025 is selected as the time horizon for quantitative forecasting of variables, because these are based on time series dating only 15-20 years back.

The time horizon for structural and qualitative description can be longer and may include the development until year 2030/2040.

The variables of the scenario descriptions have to be consistent with the zone variables and indicators presented in the report on modelling framework guidelines. Some of the key qualitative, structural and quantitative (statistical) variables are listed below.

Qualitative or structural variables:

- Regional policy strategy and implementation;
- Macro-economic framework;
- Legal and institutional framework;
- Transport policy implementation, including infrastructure investments in various sub-sectors such as port infrastructure, road and railway infrastructure;
- Road pricing.

Some of these variables (or indicators) are interdependent. For example regional policy initiatives will influence the macro-economic framework; changes in the legal and institutional framework, and transport policy implementation, could be viewed as accompanying measures to facilitate an overall regional strategy.

Quantitative variables:

- Population;
- GDP (Gross Domestic Product);
- Foreign trade flows in terms of volumes/weight and value.

The development of quantitative (statistical) variables can be much influenced by any regional policy initiatives and by changes of the macro-economic framework due to external factors.

Motorways of the North Sea initiatives will influence intermodal transport systems in all areas of the NSR, but they will be of particular importance to the development in areas such as western Norway and Scotland, ref. the paper 'Motorways of the Sea: Economic Barriers, Weaknesses and Challenges' (SUTRANET, May 2007). However, in the case of the Norway – Jutland – continental Europe corridor, and the development of container traffic through the Port of Rotterdam and through other deep-sea container ports along the continental part of the North Sea coast, the European railways could play a significant future role as well, such as discussed in the following sub-section.

European Railway Policy

The future role of the railway mode as regards unitised goods transport represents an uncertain factor. Already in 1987 a policy discussion paper on transport in Europe ¹ presented among its four main conclusions that:

- *“Rail transport is at the end of its “product life cycle”. Much would be gained by facing the facts and taking the obvious measures”.*
- *“Road transport of goods will take away all freight traffic from railways, which have already lost all but a small share of it”.*

This pessimistic prediction of the future role of the railways is reflected in Scenario A of the two case descriptions.

However, the European Commission's (EC's) White Paper 'European transport policy for 2010: time to decide' (Office for Official Publications of the European Communities, 2001) proposed three lines of actions to revitalise the railways in Europe:

1. Integrating rail transport into the internal market;
2. Making optimum use of the infrastructure;
3. Modernisation of services.

These lines of action are specified as follows in the EC publication 'Revitalising Europe's Railways' (Office for Official Publications of the European Communities, 2003) to help ease bottlenecks and congestion, and reduce pollution:

¹ Cesars Marchetti, 1987: On Transport in Europe: The Last 50 Years and the Next 20.

- Establishing a fair system of charging for all modes of transport;
- Giving rail priority status in the development of trans-European networks; and most crucially,
- Creating an integrated European railway area.

A proposal for an integrated European railway area was drawn up by the EC in January 2002, further to the rail infrastructure package directives adopted in February 2002.

The EC publication 'Revitalising Europe's Railways' points out that *"...instead of having one transport system the Union has a patchwork of different rail systems that are not integrated or interoperable"*. Notably the national systems have different electrification (power supply) systems, signalling systems and operating rules. This technical fragmentation also involves maximum permissible axle loads, track gauge (for some countries), train lengths, and loading gauge. As an example, the systems of the Danish railways differ from those in the neighbouring countries of Sweden and Germany. The publication further notes that *"...the average commercial speed of international wagon-load freight services on major corridors is typically around 20 kilometres per hour"*.

The 'Revitalising Europe's Railways' publication advises that *"Solving this problem will require technical harmonisation of the different rail components used in the industry or the introduction of new technologies that can cope with the incompatibilities. One example...is the use of multi-current locomotives...Another innovative locomotive...is the diesel-electric locomotive...which can haul freight over different electrical systems, and reach places where no electrification exists, such as ports"*.

According to the above mentioned publication, the "European Rail Research Advisory Council" (ERRAC) has drawn up a year 2020 vision for the railways implying among other things an average speed of 80 kilometres per hour for freight, a 50% cost reduction, and new integrated networks including multi-modal stations and freight on urban networks.

The EC publication 'Trans-European Transport Network – TEN-T priority axes and projects 2005' (Directorate-General for Energy and Transport, 2005) presents 30 priority axes and projects, including the following axes with indirect connections to the NSR transport network:

- No 2: High-speed railway axis Paris-Brussels-Cologne-Amsterdam-London, including connections with Antwerp, Rotterdam and Frankfurt am Main;
- No 5: Betuwe line, connecting Emmerich in Germany with Rotterdam/Europoort;
- No 12: Nordic Triangle railway/road axis, including the Malmoe-Gothenburg-Oslo railway line;
- No 14: West coast main line (UK), including connection with Edinburgh/Glasgow and potential connections with other UK west coast ports such as Hull and Felixstowe;
- No 20: Fehmarn Belt railway axis, including the routes Bremen/Hannover-Hamburg-Copenhagen;
- No 24: Railway axis Genova/Lyon-Frankfurt am Main, including the lines Cologne-Antwerp/Emmerich/Rotterdam;

- No 26: Railway/road axis Ireland/UK/Continental Europe, connecting with Kingston upon Hull and Felixstowe.

However, this list of projects excludes axes with the particular aim of serving peripheral parts of the North Sea Region, such as the Norway-Jutland corridor.

The EC publications addressing the railway issue do not reflect any particular awareness about the institutional and organisational obstacles which currently exist at the national and EU levels.

Case Description:

The Southern Norway – Jutland – Continental Europe Corridor

Ports and Route Options

The potential corridor for unitised and intermodal freight transport flows between Norway and continental Europe involves the geographical area and the North Sea ports located in the corridor as indicated in Figure 1:



Figure 1: Ports in the Norway – Jutland – continental Europe corridor

The traffic through the corridor could be divided into the following types:

- Regional goods flows between Norway and Jutland (by RoPax² and Ro-Ro³ vessels).
- Transit flows between Norway and continental Europe (by RoPax and Ro-Ro vessels).
- Container feeder flows between Norway and continental Europe (by Lo-Lo⁴ feeder vessels).

Figure 2 presents some of the route options - in principle - through the corridor:

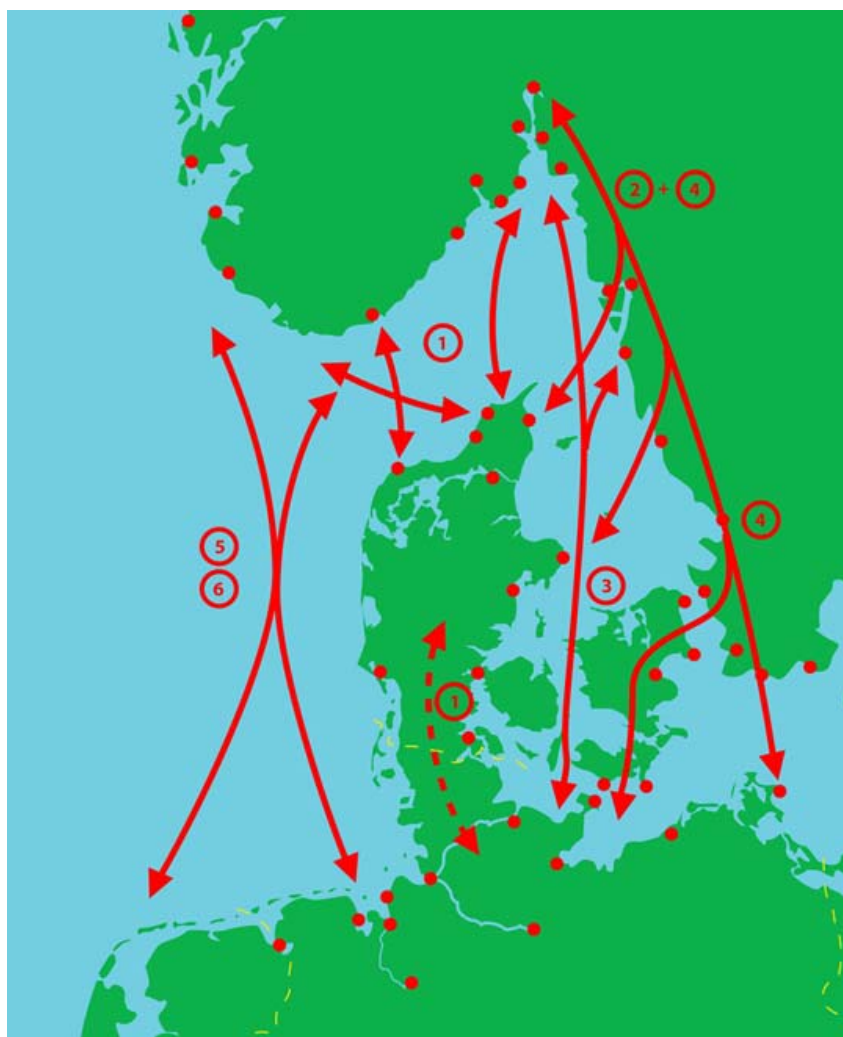


Figure 2: Route options in the corridor

The alternative routes that could serve these flows consist of (ref. also the report ‘Transport Flow Modelling Guidelines’):

² Combined passenger and freight ferries (for roll-on/roll-off of accompanied trailers and semi-trailers).

³ Freight ferries (for roll-on/roll-off of accompanied trailers and semi-trailers).

⁴ Feeder vessels for lift-on/lift-off of containers.

1. Direct and relatively short RoPax and Ro-Ro routes between southern Norway and North Jutland.
2. Overland route through Sweden to Gothenburg/Varberg and RoPax ferry routes from there to Jutland.
3. Long RoPax and Ro-Ro ferry routes between southern Norway/Gothenburg and seaports on the German Baltic Sea coast. This group of routes also includes Norwegian transit traffic via the Gothenburg-Kiel route.
4. Overland routes through western Sweden via ferry ports in Malmoe and Trelleborg to the Baltic Sea coast of Germany; or through western Sweden and Scania/Zealand via the ferry ports in Gedser and Roedby to the Baltic Sea coast of Germany.
5. Long RoPax and Ro-Ro ferry routes between southern Norway and seaports on the German, Dutch and Belgian North Sea coasts.
6. Container feeder routes between ports in southern Norway and deep sea container ports at the German, Dutch and Belgian North Sea coasts. It should be mentioned that some of this container feeder traffic may flow between Oslo/Gothenburg and the deep sea ports either via the Kiel Canal or via the North Sea.

Traffic to/from Norway on the route through western Sweden via the ferry ports in Scania (Trelleborg, Ystad) to the Baltic Sea coast of Poland is not included in the above list.

The identification of ports to become nodes in the primary or secondary maritime network connected with Motorways of the North Sea, notably in Southern Norway, is one of the variables to be considered. Furthermore the following issues and questions are involved:

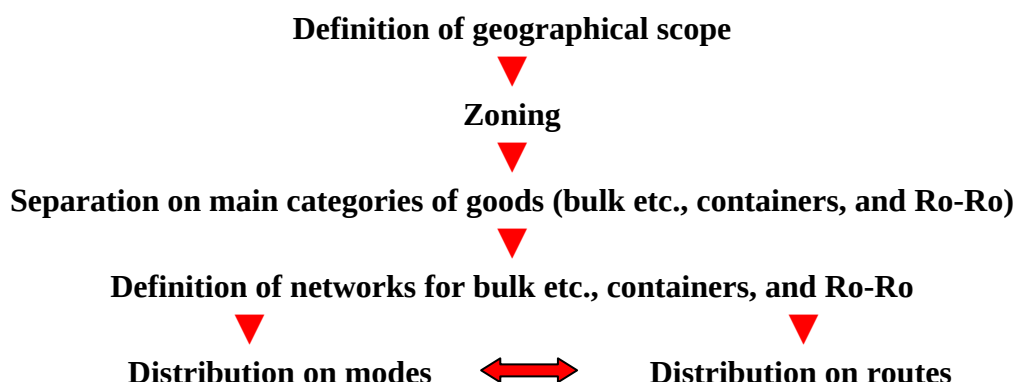
- how road pricing for freight traffic – through Jutland, western Sweden and Germany - will influence the modal shift;
- development trends as regards containerisation;
- commercial and environmental aspects of transit versus regional goods flows through Jutland;
- the future role of railway infrastructure serving unitised goods flows in the corridor; and whether there is a need for a change of the institutional framework to make railway transport competitive and effective.

Some infrastructure investments may be realised beyond the year 2020/25, such as the fixed railway and motorway link across the Fehmarn Belt between Denmark and Germany (ref. T-TEN project No 20). However, in both scenarios there is a possibility that the implementation of this project will be accelerated, so that the fixed motorway and railway link across the Fehmarn Belt could be opened between year 2015 and 2020. An agreement of implementation was reached in August 2007 between the Danish Government and the German Federal Government. This agreement, however, implies that the Danish state and tax payers take the sole responsibility for the state guaranteed loans that are envisaged to finance the works.

The case description in the following sections provides a particular assessment of the future potentials of unitised goods flows served by the railways, and also points out the importance of the regulatory framework requirements and infrastructure function of short ferry routes, e.g. between Norway, Sweden and Jutland.

Categorisation of Variables

As presented in the report on modelling framework guidelines, the selection of variables to describe the scenarios for unitised goods flows appear at different levels. The assumptions and the definition of scope etc. have to be considered in the following modelling steps:



Whilst the SUTRANET report on modelling guidelines consider both the demand and supply side, and all unit load categories, this case description will focus on the supply side and will be confined to Ro-Ro traffic.

Future investments in transport infrastructure and systems outside but related to the Norway – Jutland – continental Europe corridor will affect the framework conditions in both scenarios, such as illustrated in Figure 3 below:



Figure 3: The Northern Maritime Corridor and the Coastal Trunk Road (E39) in Norway compared with the Nordic Link concept

(Sources: Transportplan 2007-2019, Vestlandsraadet, 08-09-2006; Nordic Link brochure, 2000)

The future network serving Ro-Ro traffic depends particularly on investments in ports and railway infrastructure, and on the institutional and regulatory set-up for railway traffic. As a consequence, a main variable for a scenario description of the Ro-Ro network is the situation

at year 2020 and beyond of railway infrastructure improvements and the institutional and regulatory framework for goods transport by railway through the corridor.

It also has to be considered that the container and Ro-Ro markets to some extent are interactive and competitive. Thus the developments with regard to containerisation will affect Ro-Ro traffic as well.

Scenario Forecasts by the Application of Modelling

The description of some zoning principles to be taken into account is presented in the report on modelling framework guidelines. The networks to be defined as constituting options for serving Ro-Ro traffic in the corridor have to include all relevant road, ferry and railway links and nodes, and both reflecting the existing and future optional situations.

So far the modelling development efforts in Germany and the Scandinavian countries have concentrated on road transport and the national networks. Cross border networks have only been defined in case of a need to analyse the impact of large infrastructure projects such as the already implemented fixed link across the Oeresund between Copenhagen in Denmark and Malmoe in Sweden, and the planned fixed link across the Fehmarn Belt between Denmark and Germany.

The report on modelling framework guidelines advises to elaborate freight transport modelling and data which enables an assessment of transport networks and projects involving present and future maritime links and future railway network services in the corridor. The SUC modelling tool⁵ presented in this report includes a spatial GIS-based tool for visualisation and assessment of costs and competition within freight transport. The two basic types of changes applied by the SUC model are changes to the network (e.g. in the form of improved port services and new sea links) and changes to the costs (e.g. in the form of road pricing).

The spatial presentation is done in the form of uniform bands of “isocost” maps that show different cost levels for the accumulated cost of transport from a given location using the shortest possible (in this case the least expensive) route. Figure 4 shows an example of such a map which presents the calculated costs for intermodal transport services originating in Oslo.

Most interesting on this map is the area around and to the north of Hamburg. It can be seen how the isocost bands stretched by the E45 motorway through Jutland and Schleswig-Holstein meets with the isocost band “beach headed” in both Kiel and Lübeck. This indicates a very tight competition between the routes going via northern Jutland and via western Sweden.

⁵ The SUC (“Spatial Unfolding of Costs”) model has been further developed for SUTRANET by J. Kronbak (University of Southern Denmark, 2007).

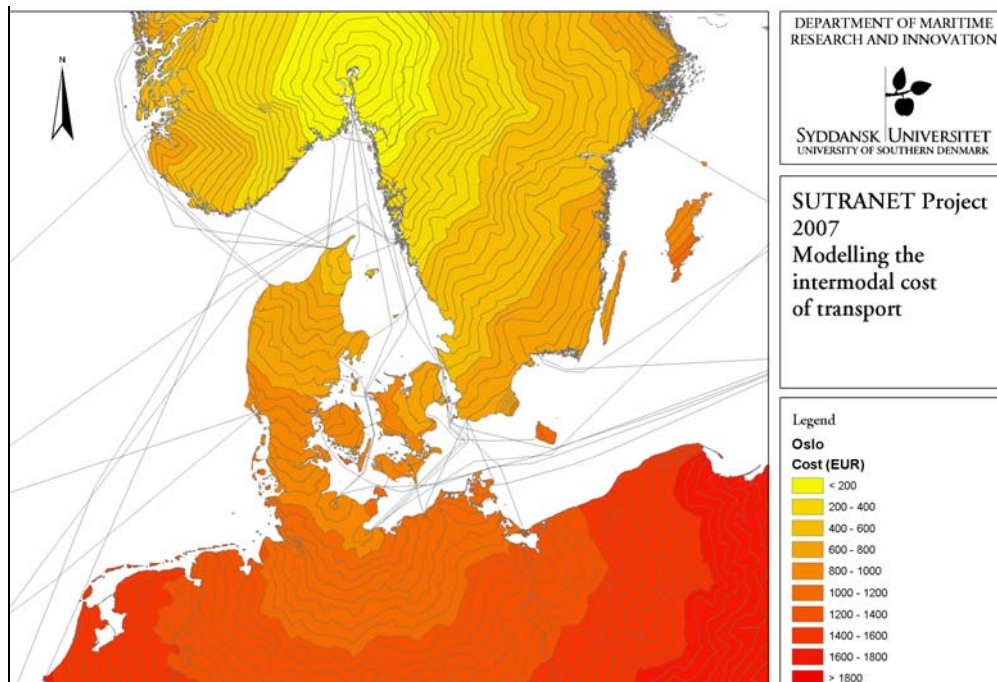


Figure 4: Map of intermodal transport costs via Oslo

In its present form the SUC modelling tool focuses on road and short-sea transport, but it can easily as well include other modes like railways and inland waterways.

Scenario A

Scenario A follows the trends reflected by recent events (e.g. investment decisions in Hirtshals Port and the freight operator Railion's closure down of rail services through Jutland). The big question mark concerning the future situation is illustrated in Figure 5. Scenario A, however, anticipates that in the future there will be no unitised goods transport services by railways between Taulov/Aarhus and the ferry ports in Hirtshals and/or Frederikshavn.

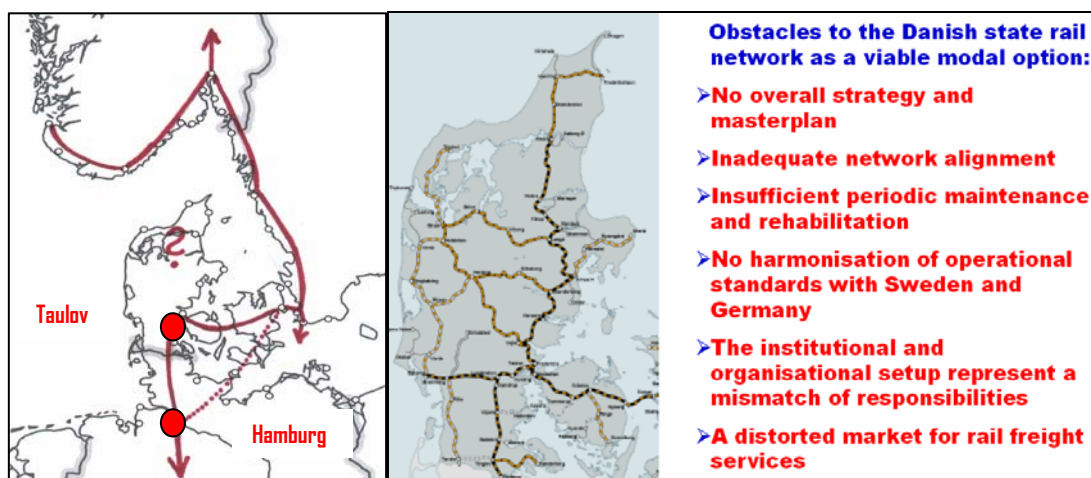


Figure 5: No unitised freight transport services by rail through Jutland

(Sources: SUTRANET seminar presentation, 2007; www.bane.dk, Banedanmark 2006)

The nearest points of connection to the railway infrastructure network will be in the ports of Aarhus and Fredericia (with connection to the road/rail terminal in Taulov). In this case it is unlikely that any railway transport of unitised transit goods between Norway and Germany will be carried out through Jutland.

If and when a fixed link for motorway and railway has been built across the Fehmarn Belt between Denmark and Germany, it can also be expected that the road/rail terminal in Taulov will cease to exist as an intermodal terminal handling unitised goods transport by rail. In this case transit of unitised goods by rail from Taulov to Hamburg through Schleswig-Holstein will cease as well.

As per year 2020 the main characteristics of Scenario A will be:

- No relatively increased regional interaction and trade between Norway, Jutland, and Schleswig-Holstein / Hamburg.
- No viable unitised freight transport services by rail have been established through Jutland.
- No significant road pricing has been introduced for goods by lorries using the motorways and highways through Jutland and Western Sweden.
- Average travel speed for lorries on the highway/motorway network has been reduced by 20% due to increased congestion on several sections of the network.
- Maut⁶ taxes through Germany have been increased by 100%.
- Fuel prices have increased by 50%.
- No significant change in fuel consumption per tonne/unit-km road (for lorries) or per tonne/unit-nautical mile (for vessels).

There may be a growing awareness among Ro-Ro service operators of the need to mitigate increased fuel consumption costs by demanding more energy efficient vessels. However, the commercial trend for the ship builders to introduce these types of vessels at the market will not be fully implemented during the next 15 years.

Scenario B

Scenario B reflects a relative increase in regional trade and commercial interactions across the Kattegat and Skagerrak, and a proactive public policy as regards port development and railway infrastructure investments in the corridor. Scenario B envisages that an upgraded railway infrastructure is extended from the existing road/rail terminal in Taulov to the ferry port of Hirtshals and maybe to the ferry port of Frederikshavn. Commercially competitive unitised freight services by rail will be established from the ports in North Jutland via Taulov to Hamburg (Maschen), ref. Figure 6.

⁶ The Maut or Lkw-Maut is a distance-dependent road tax on lorries introduced as per 1 January 2005 on all German motorways and on other German main roads with frequent traffic.

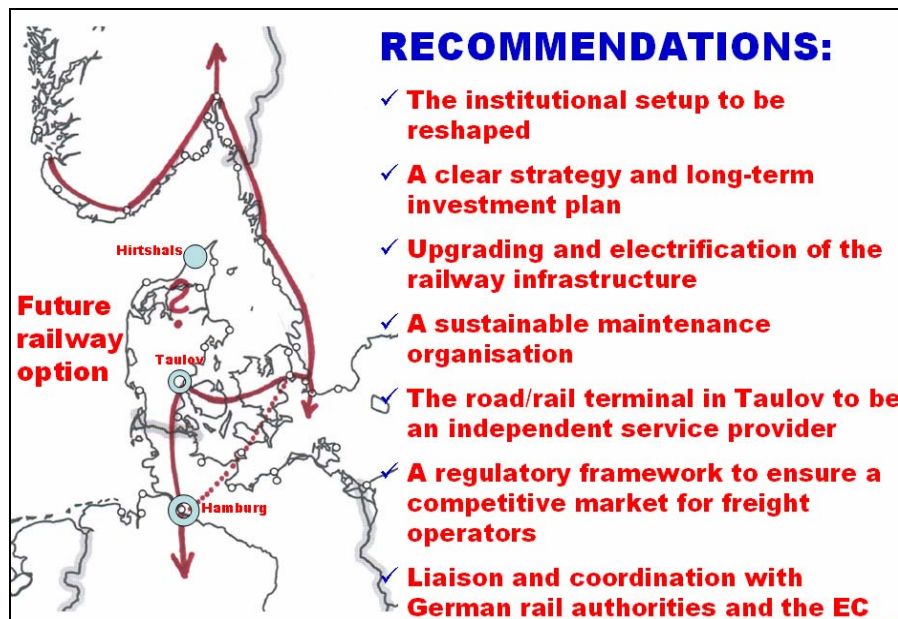


Figure 6: Unitised freight transport by rail through Jutland - a viable commercial option in the future

As per year 2020 the main characteristics of Scenario B will be:

- Relatively increased regional interaction and trade by approximately 25% between Norway and Jutland / Schleswig-Holstein / Hamburg.
- Freight transport service by rail established through Jutland (Hirtshals/Frederikshavn – Taulov – Hamburg/Maschen).
- Rail terminal and transport technology adapted to the cost-efficient handling and carriage of unit loads (semi-trailers, swap bodies and containers).
- The rail transport market has become competitive, and interoperability between Sweden, Denmark and Germany is improved.
- Road pricing has been introduced for transit of goods by lorries through Denmark and western Sweden (half the level of the Maut).
- Average travel speed for lorries on the highway/motorway network reduced by 20% due to increased congestion (as for Scenario A).
- Maut taxes through Germany increased by 200%.
- Fuel prices have increased by 50% (as for Scenario A).
- No significant change in fuel consumption per tonne-km for lorries (same as for Scenario A).
- Fuel cost per tonne/unit-nautical mile for vessels remains stable, i.e. the increase of fuel prices is compensated by more energy efficient propulsion.

There might be a concentration of Ro-Ro services on a fewer Norwegian ports compared to the current situation.

To summarise:

The policy measures in order to realise or enhance a development following Scenario B will include a change of the institutional and legal framework to make this development more

favourable, and implementation of a package of transport policy measures such as proactive road pricing, targeted investments in selected ports and in railway infrastructure, and commercial incentives to be offered to maritime services.

Quantitative Forecasting in the Two Scenarios

The following graphs present the development of Ro-Ro traffic between Norway and Jutland, and foreign trade between Norway and Denmark during the period 1990-2005:

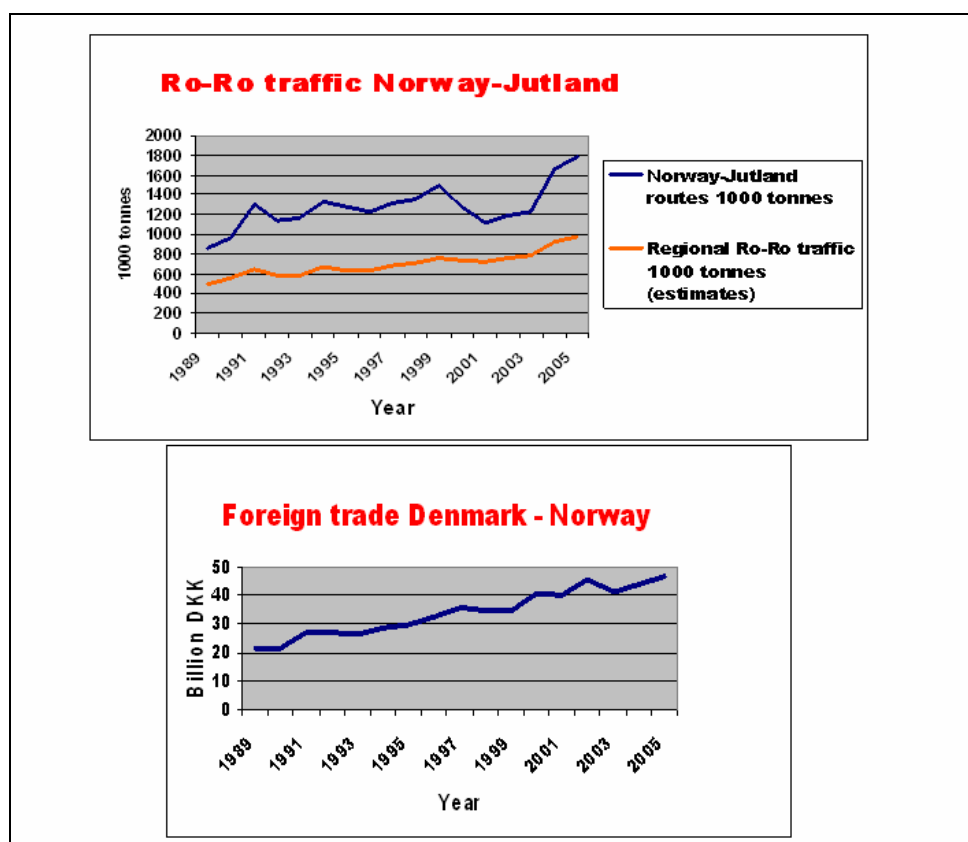


Figure 7: Ro-Ro traffic Norway-Jutland and foreign trade Denmark-Norway during 1990-2005

(Source: SUTRANET, 2007: Modelling Framework Guidelines)

Regional traffic is defined as Ro-Ro traffic between Norway and western Denmark (Jutland and Funen). Transit traffic is Ro-Ro traffic between Norway and the western part of continental Europe.

The graphs indicate that a modelling regression relation could be established between trade flows Denmark-Norway as an independent statistical variable and regional Ro-Ro traffic between Norway and Jutland as the dependent statistical variable. This correlation could be even better if the trade flows are regionalised, e.g. as to be confined to trade between Norway and western Denmark. The total Ro-Ro traffic (regional + transit) on the routes connecting Norway and North Jutland depends also on the competitive situation between alternative

routes and modes for attracting transit traffic between Norway and Germany, and on trade development between Norway and continental Europe. As an example, the opening of the Great Belt link in year 1997/98 and the Oeresund Link in year 2000 may to some extent have affected the flow distribution on optional routes.

Scenario A assumes the same overall growth factor from 2005 to 2020 concerning Ro-Ro traffic to/from Norway as observed during 1990-2005. **Scenario B** assumes slightly larger (about 25%) growth rates for traffic flows between Norway, Denmark, Schleswig-Holstein and Hamburg due to regional integration, but the same growth rate as in Scenario A for the rest of the traffic between Norway and continental Europe. These assumption for Scenario A and Scenario B could be supplemented by a sensitivity analysis of e.g. 20% lower or higher growth due to fluctuations in economic growth triggered by external factors.

Based on the time series presented in the report on modelling framework guidelines, this implies the key figures in tonnes presented in Table 1.

Table 1: Annual Norwegian Ro-Ro traffic in the corridor (in 1000 tonnes):

	1990	2005	Growth Factor	Scenario A		Scenario B	
	1000 tonnes	1000 tonnes	1990-2005	Growth factor	1000 tonnes	Growth factor	1000 tonnes
Regional	492	971	1.97	2.0	1,943	2.5	2,429
Transit	627	1,228	1.97	2.0	2,457	(2.0)	2,671
Total	1,119	2,199	1.97	2.0	4,400	2.0	5,100

(Statistical sources, see: SUTRANET, 2007: Modelling Framework Guidelines)

The estimated figures have not included any Norwegian transit traffic passing through southern Sweden, e.g. via Roedby and Trelleborg to/from German Baltic Sea ports.

Estimates of the Geographical Distribution of flows

The corridor is roughly divided into the following zones:

- Western Norway NO1
- Eastern Norway NO2
- Western Denmark (Jutland and Funen) DK1
- Schleswig-Holstein and Hamburg DE1
- Remaining part of western Europe CO1.

The distribution between zone NO1 and zone NO2 of goods flows to/from Norway is estimated to be 25% and 75% respectively. This estimate is based on the SUTRANET databases (Annex 2 in the 'Statistics Report Norway' and the 'Statistics Report Denmark') for Ro-Ro traffic reported in year 2004.

Norwegian traffic is estimated to be distributed (both for zone NO1 and zone NO2) on the other zones as follows:

DK1	44%
DE1 + CO1	56%

This estimate is also based on the above mentioned SUTRANET databases. There is no available information on the distribution of Norwegian Ro-Ro flows between zone DE1 and zone CO1. A “guesstimate” could be that the transit traffic (56% of total) is distributed with 35% to zone DE1 and 65% to zone CO1. These distribution figures apply to year 2005 and to Scenario A in year 2020.

It is assumed – due to lack of information based on origin/destination surveys - that there is no change in the relative distribution during time, except for Scenario B. The Scenario B figures for year 2020 assume a relative increase of 25% in favour of regional traffic and traffic to/from Schleswig-Holstein and Hamburg (to/from zone DK1 and zone DE1). The remaining Norwegian transit figures (to/from zone CO1) are estimated to be the same as for Scenario A.

These assumptions imply the following origin/destination (OD) matrices of the goods flows indicated in 1000 tonnes:

Year 2005 (base year):

Zones	DK1	DE1	CO1	Sum
NO1	243	107	200	550
NO2	728	322	599	1,649
Sum	971	429	799	2,199

Scenario A, year 2020:

Zones	DK1	DE1	CO1	Sum
NO1	486	215	399	1,100
NO2	1,457	645	1,198	3,300
Sum	1,943	860	1,597	4,400

Scenario B, year 2020:

Zones	DK1	DE1	CO1	Sum
NO1	608	268	399	1,275
NO2	1,821	806	1,198	3,825
Sum	2,429	1,074	1,597	5,100

It should be emphasised that the distribution and scenario figures for year 2020 are extremely rough estimates. A follow-up is required to complement the available statistics with systematic periodic origin/destination (OD) surveys, e.g. carried out every 4th year.

Railway Network through Jutland

As mentioned previously, the future role of the railways as regards transport of unitised freight in the corridor represents an uncertain factor.

National Railway Policy

As from 2006, most of the unitised freight transport services by rail through Jutland north of Aarhus/Taulov have terminated. On the other hand, it is expected that the Danish Government will eventually invest in a renewal of the railway infrastructure in Jutland, with a particular focus on improving public intercity passenger services and mobility. The same could be expected as to the railway infrastructure through Schleswig-Holstein. Such a renewal would also open up for improved and commercially viable unitised freight transport services by rail through the corridor between the ferry ports in North Jutland and Hamburg. This development is reflected in Scenario B.

The network in year 2020, as a result of revitalisation and upgrading of the railway infrastructure and services in the corridor, is illustrated in Figure 8.



Figure 8: The Scenario B network for future rail freight services through Jutland

However, a range of institutional and infrastructure improvements is required to make future rail services viable (see the following sub-sections).

The Current Situation

As illustrated in Figure 5, unitised goods services by rail is presently not a commercially viable option.

The process of separating infrastructure from operations on the Danish state railway network started in 1996/97 by breaking up the Danish State Railways (DSB) into a ministerial department in principle being responsible for infrastructure ("Banestyrelsen"), and an organisation being responsible for operations (the remaining elements of the DSB organisation). However, this restructuring process has not as yet been effectively accomplished.

In 2003, the sector planning and regulatory tasks were transferred from "Banestyrelsen" to a new body "Trafikstyrelsen" that is a ministerial department responsible for the ferry and rail transport sub-sectors. As a consequence, policy implementation, planning and overall monitoring is currently carried out by the responsible Ministry of Transport and Energy through its department "Trafikstyrelsen".

In 2004, the remaining part of "Banestyrelsen" was transformed to the organisation "Banedanmark". This organisation is fully state-owned and established with a board and a director, with the aim to manage, maintain and develop the Danish state's railway network, i.e. "Banedanmark" is dedicated the role as infrastructure service provider. The responsibilities include the tasks to manage and monitor the traffic on the railway network, to elaborate the overall time schedules, to distribute capacity to the rail operators, and to collect fees from the operators for the use of the railway infrastructure.

In 2005, a new common operational centre was established as a co-operation between DSB and "Banedanmark". DSB is in principle a commercial operator but still a fully state-owned company.

Institutional Obstacles

The following obstacles exist as concerns the Danish state railway network.

Policy level:

The Danish ministry responsible for the transport sector has not - since some planning initiatives in 1996/97 - presented an overall strategy and a master plan in order to guide future investments in the railway sector. Focus and concern of policy decision-makers is currently on routine and emergency maintenance of the existing network, and on the need for capacity increase on a heavily congested section of the network between Copenhagen and Ringsted (in the direction of the Great Belt link).

Physical Infrastructure:

The network alignment (the “tracé”) through Jutland dates back to the mid-1800s, and the alignment and curvature is inadequate on some key sections to meet the functional requirements of present and future rail operations.

The physical infrastructure (including rails and embankment) has dilapidated on several sections due to insufficient periodic maintenance and rehabilitation interventions during the last 20 years period.

Electrification of the trunk network through Jutland was decided in the mid-1990s. However, this upgrading was never implemented. In addition, the electrical tracking system used on the Danish network is not compatible to the systems used in e.g. Sweden and Germany, which further hampers interoperability.

Similar problems as mentioned above characterise the rail network through Schleswig-Holstein between the Danish/German border and Hamburg.

Institutional and organisational setup:

A mismatch exists as concerns the specification of responsibilities and functions between the policy decision-making level, the infrastructure service provider role, the road/rail terminal operators and the commercial rail service operators.

The responsibilities of the Ministry and its department “Trafikstyrelsen” vis-à-vis “Banedanmark” (as infrastructure service provider) and DSB (as a state-owned commercial operator) have still to be clarified and developed.

“Banedanmark” currently remains with a mix of infrastructure service provider responsibilities and an inherited function as a state-owned contractor. Tendering of construction work and larger maintenance works has not yet (end-2007) been systematically carried out.

A Distorted Market for Rail Freight Services

The role of the Danish State Railways (DSB) as a commercial and privatised operator is not as yet consolidated, although tendering out of passenger services on a competitive basis now includes several other operators. As to the freight sector, the road/rail terminal in Taulov was initially the responsibility of DSB. The control of the terminal has been transferred to the freight operator “Railion” that is an off-shoot of the German state railways (Deutsche Bahn). The commercial company “Railion” has established itself in a position enabling it to dominate the freight market services in the corridor. In 2006, Railion closed down its freight transport services through Jutland in order to concentrate on offering services through western Sweden. As a consequence, the combined road/rail terminal in Taulov (Jutland) is not as yet in a position to function adequately as an effective infrastructure service provider ensuring independency of the individual freight operators which are using or could use the terminal.

Short Sea Shipping

A further development of short sea shipping is expected both in Scenario A and Scenario B.

The increasing congestion on the road networks forces transit traffic to shift from overland routes to direct and long maritime routes. This applies to Scenario A in particular but also to Scenario B, such as illustrated on Figure 9:



Figure 9: Direct RoPax and Ro-Ro routes between Norway and continental Europe

The increase in short-sea shipping and the technological development regarding terminal handling and vessel types is further enhanced and accelerated in Scenario B.

In both scenarios, it is assumed that within the next 20 years most of the Ro-Ro transit traffic between Norway and continental Europe, except for traffic to/from the northern part of Schleswig-Holstein, will shift from the ferry routes between Norway and Jutland to existing direct maritime routes, such as Oslo/Gothenburg – Kiel, and to new direct routes through the North Sea between southern and western Norway and ports on the North Sea coast of Germany and/or the Netherlands/Belgium.

As to container traffic, the feeder ships between Norway and the deep-sea ports may specialise more on transshipment, whilst a growth could be experienced regarding containers carried by Ro-Ro vessels.

Ferry Links as Infrastructure

Several international ferry links should be seen as an expansion of the national roadway and railway networks. Similar to the Motorways of the Sea routes, ferry link infrastructure represents an inseparable part of the overall infrastructure serving market regulated transport flows.



Figure 10: Short ferry routes via North Jutland

The regulatory framework for services on the short ferry routes (currently mainly served by RoPax vessels) will need to ensure that:

- Future service levels are stable and time tables are adequate through competitive market conditions, or through concessions in peripheral areas in cases where volumes are too low to offer viable commercial conditions to more than one operator.
- Ferry terminals are functioning as an intermodal interface between overland and sea transport, and allowing access by competing operators in cases where volumes are sufficient.

Public subsidies to port terminals and ferry services could be considered to balance the low level (or lack of) road pricing for lorry transport.

It should be identified whether the future role of the ferry ports in question will be a modal shift function mainly (such as it is the case for most of the present ferry ports), or the port should also function as a node and terminal, which will offer consolidation of freight and multimodal services e.g. in combination with a ferry route serving both road and rail traffic.

Case Description:

Container Traffic through the Port of Rotterdam

The Rotterdam – Rhine Delta

Rotterdam is the largest port in Europe, and - together with Antwerp and Hamburg - it is one of the three main container ports. The port functions as a hub in the international container-line network and has an important role in the import and export of North-West Europe.

Figure 1:
Geographical position of North Sea related container ports in Germany, Benelux, UK and France

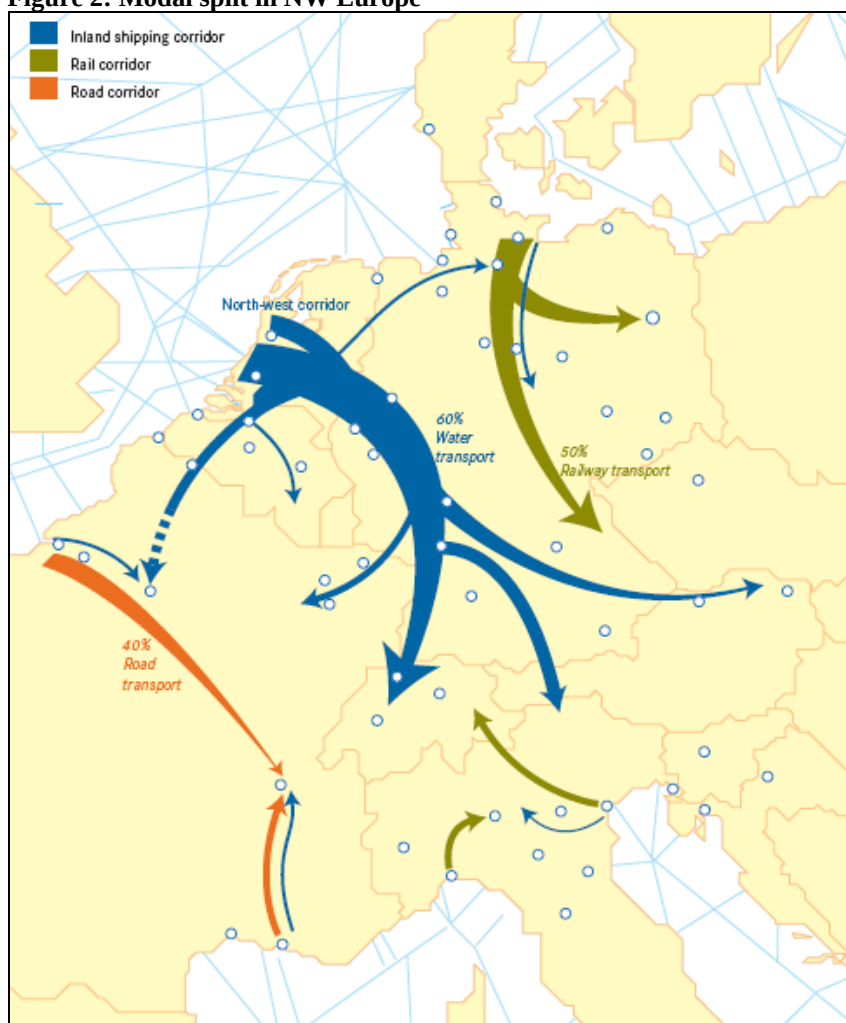


<i>Turnover in Million TEU⁷, 2005</i>	
ROTTERDAM	9.2
HAMBURG	8.1
ANTWERP	6.5
BREMEN	3.7
FELIXSTOWE	2.7
LE HAVRE	2.1
ZEEBRUEGGE	1.4

Rotterdam is well connected with all types of transport modes but the most notable feature is the connection through inland waterways. The following Figure 2 shows that Rotterdam is at the origin of the largest transport corridor in Europe, which is dominated by barge transport.

⁷ TEU is the unit for the equivalent number of twenty-foot containers (TEU = “Twenty-foot Equivalent Unit”).

Figure 2: Modal split in NW Europe



Source: Dutch inland shipping information Agency

The area serviced by inland waterways from the Port of Rotterdam can be considered very large, as can be seen in the following Figure 3. There is a substantial network of short sea connections, and most major industrial areas in North-West Europe can be reached over inland waterways. As shown in Figure 2 above, approximately 60% of all goods in the Rhine delta are transported by barge.

For the current study the modal split for containers is more interesting, because most dry bulk products needed in Germany industry are shipped through the Port of Rotterdam, and the only way to do this on a large scale is by barge. The modal split of container transport is given in Table 1.

Table 1: Modal split for containers 2005

Barge	31.1 %
Rail	9.3 %
Road	59.6 %
Total	100 %

For cargo that has a destination or origin within a 200 km radius from Rotterdam the main transport mode is the truck. For somewhat longer distances, barge is often used, especially to inland terminals in Germany lying on the shore of the river Rhine.

Figure 3: Inland and short sea connection of Rotterdam



Source: Dutch inland shipping information Agency

Rail transport is relatively underdeveloped in the Rhine corridor. The main reason for this is of course the presence of the river Rhine. This makes large scale transport possible and thus does not create the need for a substantial railway link with mid-Europe. Rail is used for cargo that has long-distance destinations which cannot be reached by barge or when transport needs to be faster than by barge.

Scenario A

Scenario A implies that no additional investment is made with regard to transport infrastructure or a modal shift. For the case of Rotterdam this means that current capacity on the road will not be sufficient with a growing flow of goods; that the river Rhine might experience capacity problems due to low water levels in the summer; and that railway links will expand because of the recent opening of the Betuwe rail link⁸. Investments in large-scale port expansions will not take place, because of a lack of hinterland connections.

The picture by year 2020 would roughly look like this:

- Structural congestion on the main highways connecting the port, leading to a 50% reduction of the average speed for truck transport.
- Increase in the use of rail transport, because this is the only modality with spare capacity.
- Maut taxes through Germany have been increased by 100%.
- Fuel prices have increased by 50%.
- More use of barge transport for short distances because truck is less competitive.
- Total container throughput will stabilise; growth in international container transport is mainly accommodated by the ports of Antwerp and Hamburg.

Scenario B

Scenario B assumes investments in the hinterland transport network and management of the good flows to and from the Port of Rotterdam. Rail links to and in the German hinterland will increase in capacity. Water management schemes will increase the capacity of the river Rhine in low water periods. The highway network in the Netherlands will have an upgrade by expansion of the highway A15 and highway A4 (north and southbound), reducing the congestion for trucking.

As per year 2020 the picture would look like the following:

- Strong increase in total number of containers shipped through Rotterdam, with same growth figures as competitors.
- Increased transport by all hinterland modalities.
- Congestion on road network remains stable.
- Maut taxes through Germany increased by 200%.
- Slight modal shift from road towards rail transport.
- Strong growth in barge transport as a result of efficiency measures in the terminal barge interface.
- Introduction of road charges in the Netherlands, making trucking more costly.

⁸ The Betuwe line is a rail link project (TEN-T Priority axis No 5) that connects Emmerich in Germany with Rotterdam and Europoort in Belgium.

Quantitative Forecasting in the Two Scenarios

In **Scenario A** there is no extra development of port infrastructure, and only the presently available infrastructure will be used to the maximum. Meanwhile the assumption is that the competition in other ports does develop new infrastructure to accommodate growing transport flows. A modal shift will take place because of congestion and growing costs for road transport.

Scenario B assumes that Rotterdam builds new physical infrastructure in the same quantities as the competing ports, resulting in a stable market share for the large ports in the Hamburg-Le Havre (HLH) range. Hinterland transport will show a modal shift towards rail and barge, due to efficiency gains in these modalities combined with growing costs for road transport in Germany.

The quantitative forecast is based on current container volumes and the GDP development, assuming that GDP is the dominant driver of container transport. Historical figures show the following development of GDP in the Netherlands and the growth of container transport.

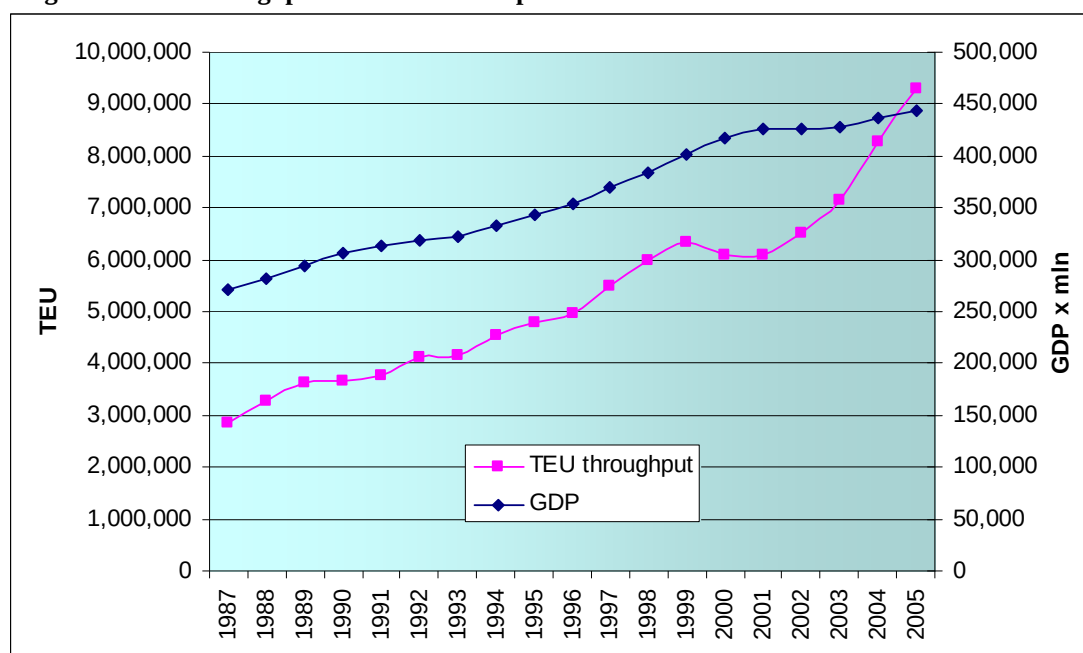
Table 2: Development of GDP and container throughput in Rotterdam, prices 2000, million euro

Year	GDP	% growth	TEU	% TEU growth	Tonnes
1987	271,953		2,868,000		24,854,354
1988	281,312	3.4%	3,289,000	14.7%	27,745,005
1989	293,746	4.4%	3,617,293	10.0%	31,072,936
1990	306,034	4.2%	3,666,273	1.4%	31,193,120
1991	313,499	2.4%	3,782,661	3.2%	31,756,000
1992	318,847	1.7%	4,125,279	9.1%	35,111,086
1993	322,857	1.3%	4,166,629	1.0%	35,710,775
1994	332,417	3.0%	4,540,472	9.0%	38,980,049
1995	342,776	3.1%	4,786,563	5.4%	38,869,898
1996	354,452	3.4%	4,972,872	3.9%	41,017,581
1997	369,617	4.3%	5,494,628	10.5%	46,336,487
1998	384,119	3.9%	5,995,352	9.1%	47,518,949
1999	402,113	4.7%	6,340,497	5.8%	51,255,867
2000	417,960	3.9%	6,093,570	-3.9%	51,335,966
2001	426,009	1.9%	6,096,142	0.0%	48,662,884
2002	426,334	0.1%	6,506,311	6.7%	50,723,572
2003	427,765	0.3%	7,143,918	9.8%	55,498,095
2004	436,119	2.0%	8,291,994	16.1%	62,208,764
2005	442,790	1.5%	9,288,399	12.0%	70,998,184

Source: Central Bureau of Statistics (the Netherlands) and Port of Rotterdam

In the figure below the development is shown graphically. This clearly indicates an upward trend for both the GDP and the container throughput in the Port of Rotterdam.

Figure 4: TEU throughput and GDP development



Source: Based on Central Bureau of Statistics (the Netherlands) and Port of Rotterdam

The graph shows that national GDP and container throughput follow roughly the same development. Between 1999 and 2001 there has been some decline as regards the annual container throughput, mainly due to expansion of ports abroad and a temporary underperformance of Rotterdam container terminals. The table below shows the correlation between TEU and GDP.

Table 3: Correlation between GDP and container throughput⁹

		GDP	TEU
GDP	Pearson Correlation	1	.944(**)
	Sig. (2-tailed)		.000
	N	20	19
TEU	Pearson Correlation	.944(**)	1
	Sig. (2-tailed)	.000	
	N	19	19

** Correlation is significant at the 0.01 level (2-tailed).

Although GDP is the most important indicator of economic activity and therefore an important indicator for transport, the relation also is influenced by the containerisation rate of the cargo. Over the years more cargo is shipped in containers instead of in break-bulk, pallets etc. We assume that this effect has no significant distortion on the relation. The relation between GDP and TEU throughput is then described by the following empirical formula:

⁹ Correlation is measured on a scale from -1 to 1. A correlation of 1 means that a change in GDP in a specific year is exactly the same as the change in TEU throughput. Significance shows how certain this relation is; a score below 0.01 means that there is less than 1% chance that the found relation is a coincidence.

$$TEU = 28.453 * GDP - 4969792.$$

The forecast for the future development based on extrapolation of past growth is then as presented in Table 4. It should be noted that the developments in 2004 and 2005 (ref. Table2) are extreme in relation to the historical growth path. Year 2005 already showed the TEU throughput predicted for 2010.

Table 4: Trend extrapolation of GDP and TEU

Year	GDP	TEU
2007	467,518	8,332,456
2008	480,395	8,698,849
2009	493,627	9,075,335
2010	507,224	9,462,191
2011	521,194	9,859,701
2012	535,550	10,268,161
2013	550,301	10,687,872
2014	565,458	11,119,142
2015	581,033	11,562,292
2016	597,037	12,017,648
2017	613,482	12,485,545
2018	630,379	12,966,331
2019	647,742	13,460,359
2020	665,584	13,967,994
2021	683,916	14,489,612
2022	702,754	15,025,597
2023	722,110	15,576,345
2024	742,000	16,142,263
2025	762,438	16,723,768

Scenario A

In scenario A there will be some deviations from the extrapolated growth. Most factors in this scenario limit the growth. Rotterdam currently has a market share of 30% in the HLH range. Therefore, under normal circumstances, Rotterdam is expected to receive 30% of the growth in container flows. In Scenario A, however, we expect that extra congestion and lagging port expansion halves this figure. The estimation is that 85% of the increase in container traffic is accommodated by other ports, resulting in a 15% share of the growth for Rotterdam. Compared to the 30% market share that Rotterdam currently has in the HLH Range, this is a shift-share of 50%.

Thus Scenario A will lead to the following TEU throughput in Rotterdam:

Table 5: Expected annual throughput development in Scenario A

<i>Year</i>	<i>TEU throughput</i>
2007	8,154,169
2008	8,337,366
2009	8,525,609
2010	8,719,037
2011	8,917,792
2012	9,122,022
2013	9,331,877
2014	9,547,513
2015	9,769,088
2016	9,996,765
2017	10,230,714
2018	10,471,107
2019	10,718,121
2020	10,971,939
2021	11,232,748
2022	11,500,740
2023	11,776,114
2024	12,059,073
2025	12,349,826

The growth of container throughput is still expected to be substantial due to growing world trade. However, Scenario A will lead to 4 million containers less in 2025 than can be expected based on the current trend.

Scenario B

Scenario B is an optimistic scenario. Growth in transport volumes will be accommodated by the Port of Rotterdam. The improvement in hinterland transport and effective deployment of port expansion plans are likely to lead to a higher than proportional growth in Rotterdam. Based on the characteristics of Scenario B we expect the container throughput to grow 10% faster than projected in the trend-extrapolation. This results in the expected annual TEU throughputs given in the table below.

Table 6: Expected annual throughput development in Scenario B

<i>Year</i>	<i>TEU throughput</i>
2007	8,368,113
2008	8,771,146
2009	9,185,280
2010	9,610,821
2011	10,048,083
2012	10,497,389
2013	10,959,071
2014	11,433,468
2015	11,920,933

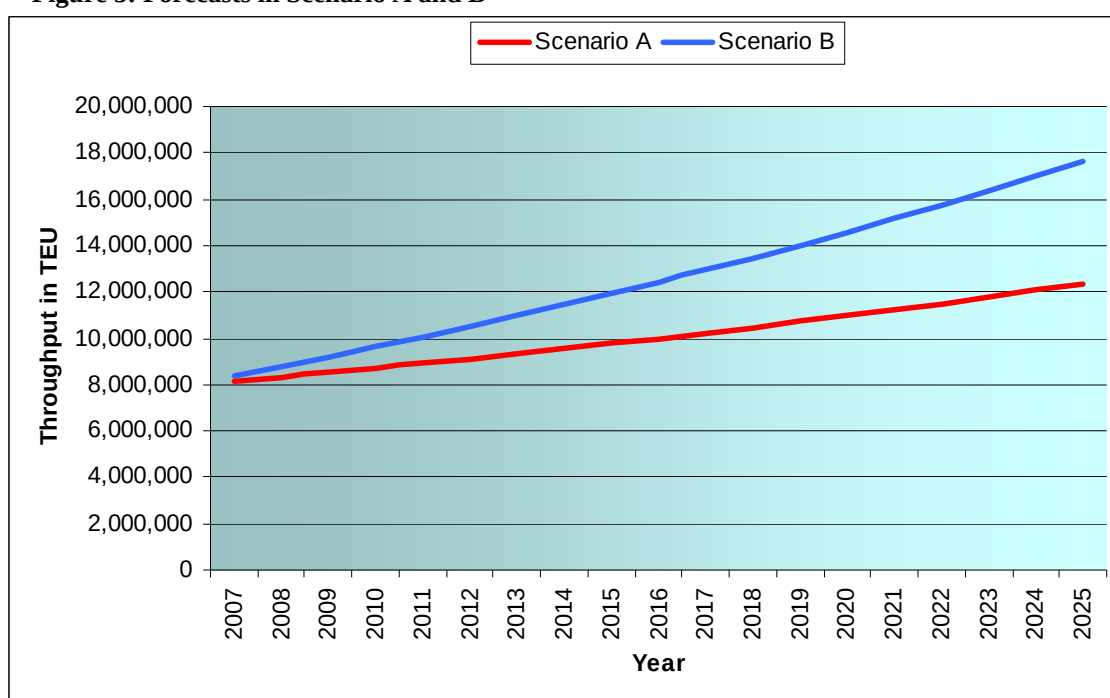
2016	12,421,824
2017	12,936,512
2018	13,465,376
2019	14,008,807
2020	14,567,206
2021	15,140,985
2022	15,730,568
2023	16,336,391
2024	16,958,901
2025	17,598,556

Growth of throughput is expected to be strong, resulting in 900.000 containers annually more than in the extrapolated trend. Roughly Scenario B foresees a doubling of the container throughput in 20 years. In the same time the market share of Rotterdam in the Hamburg-Le Havre range will increase slightly.

Comparison between Scenario A and Scenario B

The forecasts in Scenario A and B are given in the following graph, showing the difference in TEU throughput growth as a result of different policies and developments.

Figure 5: Forecasts in Scenario A and B



The difference between Scenario A and B in 2025 is expected to be 5.2 million containers or 30%.

Modal Split

In both scenarios the modal split is expected to change. In Scenario A this change is mainly due to congestion on the road network. In Scenario B it is due to positive developments in transport by rail and barge, which make these modalities more attractive. Based on projections by the Rotterdam Port Authority¹⁰ one can expect the modal split to be as follows in 2025:

<i>Barge</i>	40 %
<i>Rail</i>	18 %
<i>Road</i>	42 %

In Scenario B the barge share might be a bit more positive, whilst the rail share will be the same in Scenario A and B. The main difference between the two scenarios is the total volume that is shipped with these modalities. Scenario B will take a huge effort to make efficient use of the transport infrastructure. Not only the expansion of the physical infrastructure is needed but also the management of the capacity is an important success factor.

The main bottleneck will be the connection of the terminals with the rail and barge operations. Nowadays the coordination between hinterland transport and deep-sea terminals is not optimal. In Scenario B the total load to be transported is almost doubled. Doubling of the hinterland capacity is not feasible, and as a consequence efficient handling and use of capacity will be essential to accommodate the transport flows.

¹⁰ Projections 2020, Port of Rotterdam, 2004.

REFERENCES

Cesars Marchetti, 1987: On Transport in Europe: The Last 50 Years and the Next 20.

European Commission (EC), 2001: European transport policy for 2010: time to decide (White Paper. Office for Official Publications of the European Communities, 2001).

EC, 2003: Revitalising Europe's Railways – Towards an integrated European railway area (Office for Official Publications of the European Communities, 2003).

EC Directorate-General for Energy and Transport, 2005: Trans-European Transport Network – TEN-T priority axes and projects 2005 (Office for Official Publications of the European Communities, 2005).

Case Description: The Southern Norway – Jutland Corridor:

SUTRANET, 2007: Transport Flow Modelling Framework Guidelines (draft technical report, August 2007).

SUTRANET, 2007 Statistics Report Norway: Annex 2 (January 2007)

SUTRANET, 2007 Statistics Report Denmark: Annex 2 (March 2007)

Case Description: Container Traffic through the Port of Rotterdam:

CBS (Central Bureau of Statistics), National Accounts, found at: www.statline.nl.

Dutch inland shipping information Agency, 2005, *The power of inland navigation*, Dekkers printing, Dordrecht.

Port of Rotterdam, 2006, statistics: Container and TEU time series.