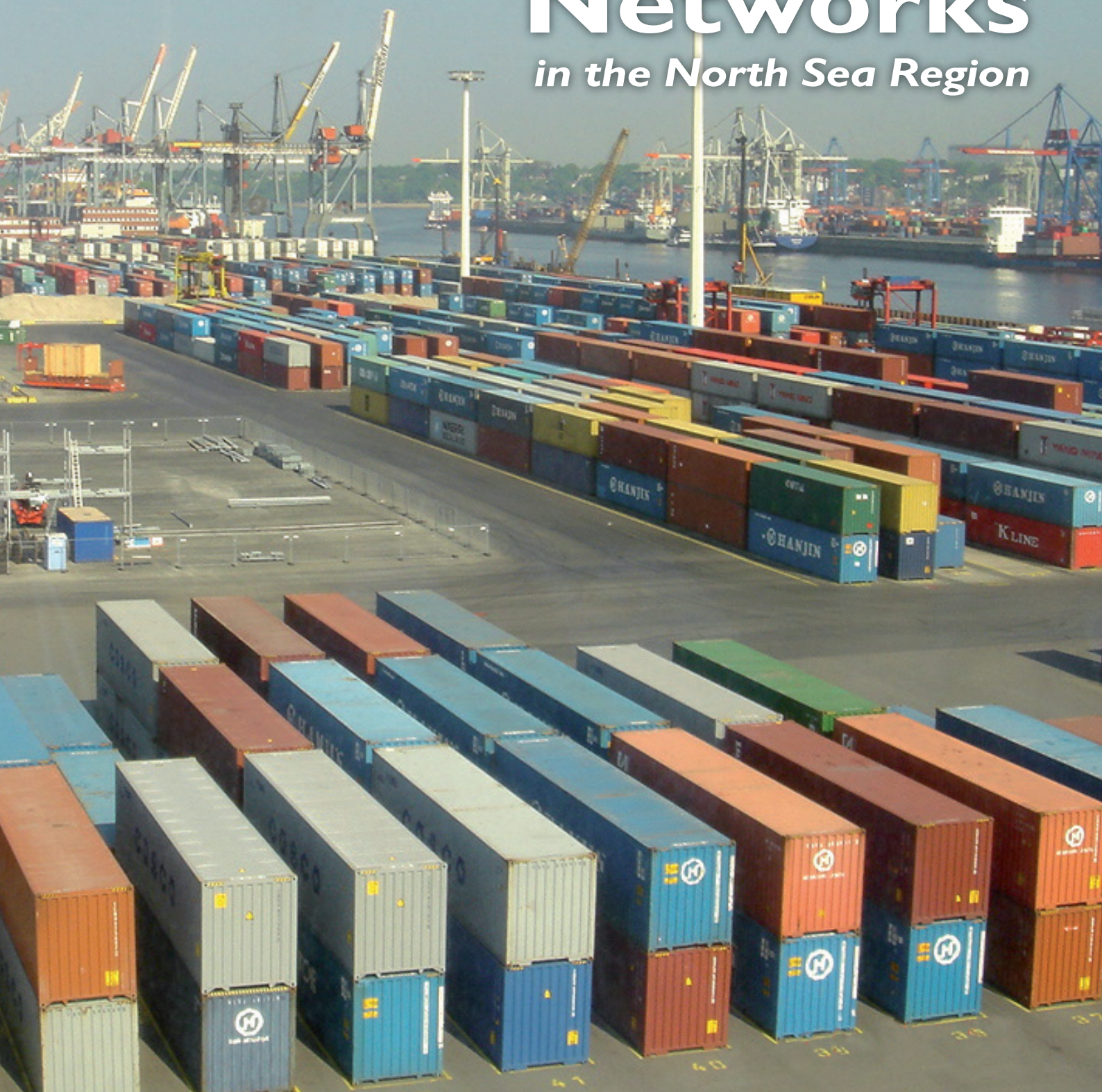




Intermodal Transport Networks

in the North Sea Region





Introduction to SUTRANET

SUTRANET (Sustainable Transport Research & Development Network in the North Sea Region) is a project carried out under the European Commission's (EC's) Interreg IIIB North Sea Programme. The project commenced end-2004 and was completed mid-2007.

The vision of SUTRANET is to improve the knowledge base for freight transport systems in the North Sea Region and for transport related policy decisions. The focus has been on transport networks and solutions serving unitised goods transport flows in the region. The assumption is that decisions based on a better understanding and awareness of this field could lead to improved efficiency and sustainability of the transport networks. The rationale behind SUTRANET is that this in turn will enhance regional development and interactions in the North Sea Region,

in the form of a strengthened regional competitiveness within the EU and in the global economy, and resulting in more local income generation and employment.

Apart from this brochure about general aspects of intermodal freight transport networks in the North Sea Region, SUTRANET dissemination brochures have been issued for the following topics:

- **Motorways of the North Sea**
- **Transport and Logistics Centres**
- **Training Programme Development.**

Knowledge of Intermodal Transport Networks

This dissemination brochure presents findings related to the framework conditions and strategies for policies, planning and investment decisions concerning transport infrastructure and commercial freight transport operations in the North Sea Region. This part of the SUTRANET project was led by Aalborg University Department of Development and Planning, and the following outputs have been presented:

1. Proposal for a common terminology (concepts, maritime transport system definitions, and sustainability criteria and indicators).
2. A first step of a common information system for goods transport flows and traffic, with a particular focus on unitised goods handling via North Sea ports and maritime routes.
3. Environmental impact assessment tool for maritime traffic and port development.

4. Presentation of the scenario building methodology through selected case descriptions, notably related to transport corridors and container port development.
5. Framework guidelines for freight transport flow modelling aimed at policy decision support.
6. Stakeholders' views on the development of intermodal transport solutions in the North Sea Region.

Among these outputs to improve the knowledge base for decision-making and to provide planning tools, there are particular interrelations between the availability of relevant data, modelling of transport flows, impact assessment of policies and infrastructure investments, and scenario building.

1. Definitions and Concepts

Some of the terminology applied in the SUTRANET project is summarised below.

The eligible area of the **North Sea Region** was defined in the EC Interreg IIIB North Sea Programme as indicated on the map.



(Source: Interreg IIIB North Sea Programme)

In the EC Interreg IVB North Sea Programme this eligible area has been expanded to include Kent in southern England and the whole of Norway. The maritime area in the North Sea Region of particular SUTRANET focus is delimited by the English Channel to the south and the Norwegian Sea to the north. It includes the seas of Skagerrak and Kattegat in the 'triangle' between southern Norway, western Sweden and northern Jutland. The Baltic Sea is linked with the North Sea through the Kiel Canal, and via Kattegat through the Great Belt and Öresund ('the Sound'). Among the examples of policy options to achieve a **sustainable development in the North Sea Region**, the European Spatial Development Perspective (ESDP) document (EC, 1999) mentions: better accessibility of peripheral regions; development of European corridors; and strengthening of the regions at the borders of EU - with a particular view to multimodal infrastructure and intercontinental accessibility. A challenge to the SUTRANET project was to identify the realistic potentials for increased regional interactions in the North Sea Region,

and how these interactions can be stimulated by improved and sustainable transport networks.

Intermodal transport or 'intermodality' indicates that the transport system allows at least two different modes (e.g. road and rail, road and ferry transport/short sea shipping, or rail and ferry transport/short sea shipping) to be used in a door-to-door transport chain for individual freight shipments or passenger services.

Multimodality implies that for each particular shipment of goods there is a choice between at least two different modes of transport (e.g. between road and rail, or between road/rail and ferry transport/short sea shipping) on a particular route or in a particular transport corridor.

In Europe **short sea shipping (SSS)** is defined as the movement of cargo and passengers by sea between ports situated in geographical Europe or between those ports and ports situated in non-European countries which are bordering the EU territory. Short sea shipping constitutes an alternative to road transport because it offers intermodal transport of Intra-European cargo on a port-to-port basis, usually in containers or trailers.

Ferry services include both passengers and freight. The services are scheduled i.e. they take place according to a regular time table and are often relatively frequent. The ferry route is one link only in a passenger trip or freight transport chain, as it must connect with overland road and/or railway infrastructure at both ends of the route.

There is no commonly agreed definition of a **transport corridor**. In the SUTRANET project the focus in relation to transport corridors has been on unitised freight transport. It may be considered to include mobility aspects as well. A distinction is often made between an 'economic' corridor and a 'transport' corridor. A transport corridor is conceivably to be linked with socio-economic activities and to be broadly defined as a geographical sequence of strongly interconnected sub-regions, and the corridor could provide important interconnections and communication between two or more separate geographical areas. EC research has advised that it is crucial also to identify the economic corridors that constitute the sources (origins and destinations) of the traffic that flows through the





particular corridor. The SUTRANET project has analysed some elements of specific corridors such as the transport networks linking Norway with UK and the Continent, and the development trends for container transport via the deep-sea ports of Rotterdam, Hamburg and Bremerhaven have been described.

The term RoRo is an abbreviation of Roll on/Roll off. A **RoRo vessel/ferry** typically carries a mix of rolling cargo dominated by road trailers (lorries and unaccompanied semi-trailers), but also containers loaded on special equipment. The term 'RoPax' indicates that a **RoPax vessel/ferry** is able to serve both passengers and freight. It is combining the cargo capacity of a RoRo vessel with the passenger amenities of a modern ferry. The term LoLo is an abbreviation of Lift on/Lift off. **LoLo vessels** are either short sea vessels or deep sea container ships serving intercontinental routes. The short sea vessels are shipping containers between the origin and destination port, or they act as feeder vessels to and from the few large deep sea container ports for transshipment.

In 2004, EC introduced the concept '**motorways of the sea**' as part of a second revision of the Community guidelines for development of the Trans-European Transport Network (TEN-T). The guidelines say that: *"The trans-European*

network of motorways of the sea shall aim to concentrate flows of freight on a few sea routes in order to establish new viable, regular and frequent maritime links for the transport of goods between Member States in order to reduce road congestion and improve access to peripheral and island States".



Potential Motorways of the North Sea?

However, there is no direct indication and inclusion of 'the Motorways of the North Sea' in the TEN-T. The SUTRANET findings and recommendations concerning Motorways of the North Sea are presented in a separate brochure.

2. Statistics for Unitised Goods Flows

The aim has been to elaborate a first step of a common information system for goods transport in the North Sea Region, with a particular focus on unitised goods handling via North Sea ports and maritime routes. The 'NorVision - A Spatial Perspective for the North Sea Region' document (EC, 2000/01) points out *"a general deficiency as regards harmonised information to identify and to evaluate existing spatial structures, past and even future trends.... This applies particularly to the non-EU area of Norway which is frequently not included in analytical documents or data bases of the EU."*

The SUTRANET databases cover all North Sea ports that serve unitised goods flows in international traffic. They have been established for each of the following countries or areas:

- UK east coast ports;
- Norway;
- Denmark;
- Sweden west coast ports (Kattegat and Scania);

- Germany;
- Benelux (the Netherlands and Belgium).

Elaboration of the SUTRANET databases is based on available national statistics. The databases include particular information about two groups of cargo handling:

- Goods in RoRo units, i.e. mainly freight in trailers hauled overland by trucks. This group of goods is shipped to and from the ports in accompanied trailers and unaccompanied semi-trailers on either RoPax ferries or RoRo vessels.
- Goods in containers that are shipped mainly on LoLo vessels. These are short sea or feeder vessels and container ships serving intercontinental routes via deep sea ports.

The photos illustrate various types of vessels applied to serve unitised goods transport on maritime routes, and an example of container terminal handling.



RoRo vessel serving the Esbjerg-Immingham route



RoPax vessels serving routes between Norway and Frederikshavn



RoPax vessel serving the Norway-Hirtshals routes



LoLo feeder vessel passing through the Kiel Canal



Deep-sea container vessel at the Eurogate terminal, Hamburg



Container handling at a feeder terminal, Kristiansand

The databases present the following statistical tables:

- ▶ comparative tables covering the years 2003-05 (for Benelux only year 2004) including the annual throughput (in tonnes and units) for all ports in each country/area, and for RoRo goods and container goods separately;
- ▶ for year 2004 a breakdown of the RoRo goods flows on routes to the extent possible based on available statistics;
- ▶ development of traffic through the Kiel Canal since 1996;
- ▶ for some countries a breakdown of container traffic between each port and selected countries or country groups.

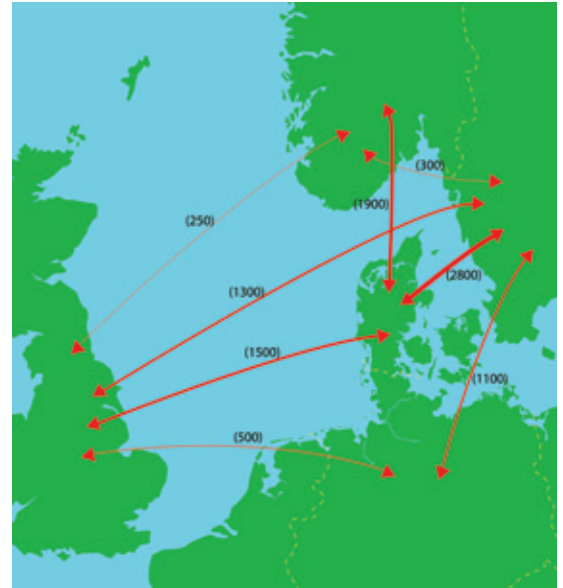
The structure of the databases enables a comparison between different North Sea countries. As examples, the figures showing the location and annual throughput of major container ports and the RoRo flows between some of the countries have been elaborated by combining country specific databases for year 2005.

SUTRANET research has revealed differences in practice between the various countries around the North Sea, although the statistical reporting of unitised goods flows and related maritime traffic information is based on





Container ports (more than 0.4 million tonnes annual throughput)



the common Council Directive 95/64/EC. Some of the SUTRANET recommendations with the aim to harmonise the statistical reporting procedures in between countries in the North Sea Region are summarised as follows:

- ▶ A separate presentation of the share of unaccompanied trailers (semi-trailers) at route level should be included in the standard reporting procedures involving all ferry operators. Such harmonised reporting would enable an analysis of the development trends for this important indicator of intermodal transport.
- ▶ A clear distinction could be made between RoPax and RoRo vessels in the standard reporting procedures of ferry operators, so that unitised goods flows could be specified not only on RoPax routes but also on RoRo routes.
- ▶ Periodic origin-destination surveys of RoRo traffic between North Sea countries is required as a basis for reliable estimates at route level, e.g. for the application in modelling and forecasts.
- ▶ It would be useful if the national statistical services publish the reported geographical distribution of international container traffic via major ports. There is also a need to report on the share of feeder and transshipment traffic.
- ▶ In order to assess whether containers handled by RoRo equipment is a growing market, this category should be reported separately.
- ▶ Modification and harmonisation of the ports' reporting of commodity groups is needed - because the standardised EU commodity classification does not fit a realistic grouping of unitised goods carried in containers and trailers.

3. Environmental Impact Assessment of Maritime Traffic in the North Sea Region

The SUTRANET project has suggested the application of the following gross list of environmental criteria and indicators related to sea transport as well as to intermodal transport activities via ports in the North Sea Region:

CRITERIA	INDICATORS
Energy consumption and resource use/depletion	MJ, tonnes of oil, proportion of renewable fuels
Greenhouse effect	CO ₂ -emissions
Eutrophication, acidification and human health	Air emissions: SO _x , NO _x , particles, VOC's, etc.
Water pollution	Oil spill, ballast water spill, paints & antifoiling, garbage, cargo loss or leakage
Wildlife	Barrier effects, underwater noise
Other criteria	(Air) noise, intrusion effects, land use, safety

Note: Eutrophication refers to an increase in the primary productivity of any ecosystem. It may occur on land or in water, and is caused by the increase of chemical nutrients.

These criteria and indicators aim to contribute to an on-going process of integrating environmentally argued policy measures into the transport sector. It is important that they are easily applicable and that sufficient data can be found. Furthermore, transport system indicators (e.g. modal split and transport volumes) must be associated with the environmental indicators in order to be able to assess overall effects and changes.

The environmental impact assessment outputs of the SUTRANET project include a tool in MS Excel for the calculation of air emissions from ships on a route-to-route basis, and the collection of environmental impact data. The tool has been developed to meet the needs for a simple and user-friendly, yet complete and up-to-date calculation of fuel consumption and air emissions from maritime transport in the North Sea Region. It has been found that existing models and tools do not comply with today's basic requirements on accuracy and versatility of maritime emission models.

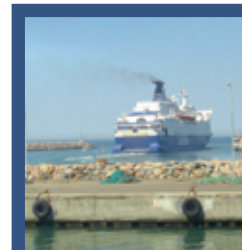
In short, the SUTRANET maritime emission calculation tool's main features are:

- differentiates into 14 types of ships, 9 types of engines (for the most common engine types further differentiation into engine power ranges), 3 types of fuels, and 6 types of air emission abatement equipment;
- operates on both default data and on more detailed optional data, once these are provided by the user;
- relies on results from the most recent research and development work conducted in the European Union within the maritime emission area.

The primary goal of the tool is to quantify emissions to air from a single ship or a fleet of ships on specified transport routes. Emissions in ports are also modelled. The input data sheets define the ships and routes to be modelled, the vessel traffic on each route, and the port time per ship and port. The output data include the modelled emissions and fuel consumption per route and per port, and the ship database with all input, intermediate and output data.

Input data sheet

The maritime emissions tool has been developed by **IVL Swedish Environmental Research Institute Ltd** within the SUTRANET project. The tool is free to use for all interested persons and organisations, after signing the required agreement with IVL. The model is not a freeware tool and may not be distributed to any third party without the approval of IVL.





4. Cases of Scenario Description

The SUTRANET project has illustrated the future development trends regarding goods flows and intermodal freight transport by two case descriptions for 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 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.

The Norway-Jutland-Continent Corridor:

The corridor involves direct ferry or RoRo routes between Norway and the continental North Sea coast, transit traffic between Norway and Germany through Jutland, and short ferry routes between Norway and North Jutland:



Direct RoRo routes



Ferry + road + rail transit routes



Ferry + road routes

The key scenario figures in tonnes indicated in the table are based on time series presented in the SUTRANET report on modelling guidelines. Regional traffic is defined as RoRo traffic between Norway and western Denmark.

Transit traffic is RoRo traffic between Norway and the western part of the Continent (some of it passing through Jutland).

ANNUAL NORWEGIAN RORO 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	2.0	4,400	2.3	5,100

Scenario A assumes the same overall growth factor from year 2005 to 2020 concerning RoRo 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.

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 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.

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 inadequate and outdated railway infrastructure, a mismatch concerning the institutional and organisational setup of infrastructure and operations, and a distorted market for rail freight services.

Scenario B suggest an integrated package of measures to address these issues, including 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 realistic and sustainable option.

Several international ferry links in the corridor could 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.

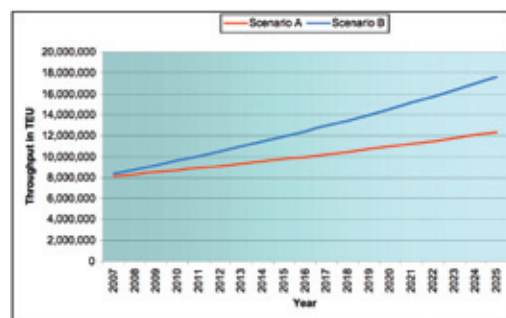
Rotterdam Container Port Development:

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

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 Belgium). Investments in large-scale port expansions will not take place, because of a lack of hinterland connections.

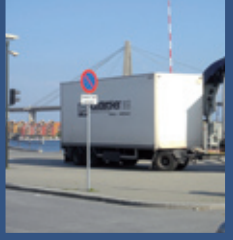


Forecasts of container traffic in scenario A and scenario B

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. The improvement 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.

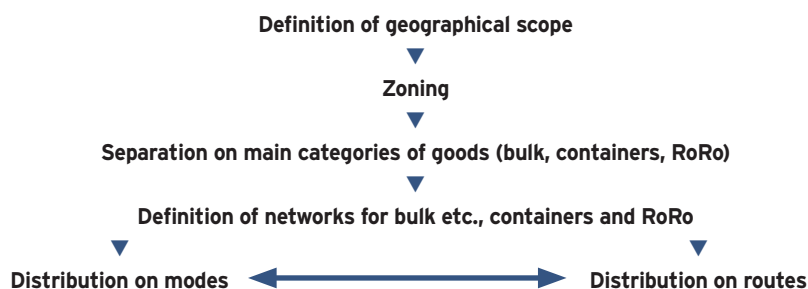
A separate SUTRANET paper outlines the development trends related with the **deep sea container ports in Germany**, notably the ports in Hamburg, Bremerhaven and Wilhelmshaven.





5. Modelling Framework Guidelines

The SUTRANET report on modelling guidelines suggests that the assumptions and definition of scope etc. have to be considered in the following modelling steps:



The modelling framework guidelines have been illustrated through a case description of the development in the Norway-Jutland-Continent transport corridor. This case study considers the competitiveness and complementarities between direct maritime routes between Norway and the Continent, and ferry routes between Norway and Jutland. The case description illustrates how these flows could be modelled, and - in combination with forecasts and scenarios - provide an overall picture to policy decision-makers and infrastructure providers.



Network modelling principle (source: J. Kronbak, SDU 2006)

The existing network in the corridor is characterised by a range of ferry routes and no or low road pricing fees. The future network has to consider new RoRo routes, a renewed railway infrastructure, restructuring of container flows, and a new cost structure for the use of infrastructure such as increased road pricing of heavy goods traffic.

The case description also presents a modelling example of intermodal and multimodal trip chains which illustrates the cost competition between land-based routes and sea routes. The focus of this example, which is visualised in GIS (Geographical Information System), is on the supply side and confined to RoRo traffic but the geographical scope extends to the western part of the European Continent.

There is a general need to establish a harmonised set of modelling data for all countries within the geographical scope of the corridor. This should include socio-economic zone data involving relevant parts of Norway, Sweden, Denmark, Germany and Benelux, and specific maritime infrastructure and traffic data - thus enabling estimates based on border-crossing flow modelling in the corridor. The modelling tools to be elaborated must be simple to apply and aimed at supporting the policy-decision and planning levels. The use of such tools should be free of cost and not restricted by any commercial property rights. Thus the tools should have the status of 'freeware', and be considered complementary to the existing national and commercial modelling software. However, a lot of modelling development remains to be done, and a particular challenge is to establish co-operation and consistency between statistics and research of the various countries involved in the corridor.

Ropax/RoRo traffic development between Jutland and Norway:

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1000 tonnes	965	1304	1145	1164	1331	1283	1233	1322	1356	1492	1274	1117	1191	1232	1661	1784
Index (1990 = 100)	100	135	119	121	138	133	128	137	141	155	132	116	123	128	172	185

6. Stakeholders' Involvement

User group activities have been carried out through workshops held in Scotland and western Norway with the focus on establishing new RoRo services across the North Sea. Among other options they have looked into the potentials of a new RoPax route between Kristiansund, Lerwick and Rosyth. Findings of these activities are presented in separate workshop reports, and the activities and contacts established have led to a growing policy awareness in Scotland and Norway on this issue.



(Source: Napier University, 2006)

The dialogue with potential users of the SUTRANET project results has also been carried out through a range of detailed interviews and meetings with ports, commercial ferry and freight operators, and local governments in Jutland and Southern Norway. The findings of these activities have been published in a report in Danish and a synthesis report in English, and in separate reports (in English) for some Norwegian ports located in the Oslo Fiord area.

The SUTRANET study indicates that development of intermodal transport solutions in the Jutland corridor is facing a number of challenges related to physical

structures and the lack of organisational coordination. Different stakeholders are primarily committed to promote their own type of transport modality, and the current setup of freight transport in the corridor is organised according to the requirements of the road based transport systems. The only prevailing intermodal transport solutions is the necessary combination of road-ferry transport between Norway/Sweden and Denmark/Continent. In the largest ferry ports the operation of the ferries has been tuned to fit the unbroken transport chain of road based transport by high frequencies and relatively fast RoPax ferries. In this context the railways only play an insignificant role, which partly is due to lack of local customer contact, dominance of one major operator concentrating its services on specific routes and also the continued orientation towards road based logistics. This has further led to under-investment in terminals and supporting railway infrastructure at the ports.

The different stakeholders' transport systems in many occasions run parallel to each other and therefore also represent a potential for more and better coordination or even integration. This raises the need for new types of stakeholders or redefinition of the roles of the existing ones in terms of a role as neutral coordinators of intermodal transport solutions. These could potentially create a better coherence between each stakeholder's own transport services and enhance national and European transport policies concerning more efficient and sustainable transport solutions.





The SUTRANET Website and Partners

For further information concerning the SUTRANET project results please consult the website:

www.sutranet.org

All SUTRANET written outputs and publications are available on this website for download - such as articles, reports and papers, PowerPoint presentations etc. at workshops and seminars, statistics and databases covering all North Sea ports handling unitised goods flow, the maritime emissions calculation tool and documentation, and a training programme on intermodal transport in the form of an e-learning module etc.

The following ten partners have contributed to the SUTRANET project: Aalborg University, Department of Development and Planning (Lead Partner); Napier University Transport Research Institute, Edinburgh Scotland; University of Applied Sciences (Fachhochschule Kiel, FHK), Germany; Swedish Environmental Research Institute (IVL), Gothenburg; the Association of Danish Transport Centres (FDT); Erasmus University, Rotterdam the Netherlands; Institute of Transport Economics (TØI), Oslo Norway; Molde Research Institute, Norway; SINTEF Technology and Society, Trondheim Norway; and Institute of Shipping Economics and Logistics (ISL), Bremen Germany.



Cultural event during the SUTRANET Seminar held in Aalborg March 2007

June 2007



SUTRANET

