Bilaga 1

Summary: The Swedish national model system for goods transport

(ur SAMPLAN-rapport 2001:1)

On the needs for national goods transport models in Sweden

Goods transport is a vital component of the production and distribution processes of modern societies. The separation of production and consumption as well as a more or less global division of labour, act as driving forces for a seemingly ever increasing demand of goods transport. From time to time the development of the production and distribution processes as well as the logistical systems have been such as to incur a growth rate of goods transport demand higher than the growth rate of the transported quantities of goods and also at a rate higher than the general GDP growth rate.

Transport demand plays a crucial role in the development of the transport sector. Total demand development and changes of the demand structure initiate capacity changes (investment as well as divestment), and is also one of the major factors influencing transport policy decisions e.g. policies aiming at influencing the modal structure emerging from market decisions, the level of demand, the spatial distribution of transport activities, transport technology and the emissions of transport operations.

Both transport policy implementation and capacity alterations of the transport systems take time, which is sometimes very considerable. A process of rational decision making therefore requires some foresight of future demand changes, and also some understanding of the underlying driving forces. The needs for forecasting demand changes is by no means confined to policy makers, and decision makers involved in the development of public infrastructure. Many market actors involved in strategic decisions which have long implementation lead times should have similar requirements.

Demand information is therefore an essential component in the processes of planning and decision making about transport policy and infrastructural measures. An assessment of future demand changes is a key component of evaluation methods such as Cost Benefit Analysis (CBA), Strategic Environmental Assessment (SEA) , Environmental Impact Assessment (EIA), analyses of the incidence of policy measures, and other types of policy analysis. Some kind of structured approach is necessary to meet the demand information requirements of these planning and decision processes. A quantitative modelling approach is needed. The purpose of this paper is to outline the contents and structure of the model system which was developed to provide demand analysis capabilities for the Swedish national infrastructure planning process, and for national transport policy analysis.

The model system

The problem of modelling the entire goods transport system of a whole nation is very complex. It is necessary to balance many needs against each other, and many compromises and simplifications will be inevitable. One has to recognize also, that alterations and amendments of the model will be necessary over time due to changes of the driving forces of demand as well as changing requirements on the model output due to shift of focus of the policy making processes.

The Swedish national model system for goods transport could most correctly be described as a set of separate models, sometimes developed for entirely different purposes than the analysis of national goods transport demand, which have been tied together to enable them to interact in a reasonably effective and consistent way in the process of modelling Swedish goods transport demand.

The system comprises two major subsystems namely the transport demand models, and the transport network/transport market model. A third model package, the evaluation models and tools, are associated with these models. The demand models generate spatially disaggregated demand matrixes which are also disaggregated into separate commodities. The spatial structure covers not only Swedish territory but also the European union as well as all other areas involved in Swedish foreign trade. The demand matrices are used as input to the transport network/market model, which allocates the flow matrices to the transport modes and networks according to a system cost minimizing algorithm. The model system allows projections to be made of transport flows on transport modes and networks, analyses of transport chains, modelling of transport system effects of certain transport policy measures as well as the effects of changes to the infrastructures.

The institutional context for the Swedish national goods transport model

The national goods transport model is used within a few rather complex institutional frameworks. Perhaps the most important one is the system for 10-year strategic planning of transport infrastructures, which includes all transport modes. Despite focusing on long term infrastructure issues, in the planning process attention also has to be paid to many transport policy matters such as transport related taxation, charges, traffic subsidies etc. The ambition is that the model system should be applicable for all modes, all planning levels (national, regional, international connections), and for as many stages of the process as possible. Additionally, the system should also provide a truly intermodal demand analysis and be able to deliver consistent results for different levels of detail. Undoubtedly therefore, the complex institutional setting also causes complex and sometimes conflicting demands to be put on the model system.

Other complex institutional frameworks where the model is used are the transport policy process and the process to support Swedish contributions to EU level policy analyses.

Since there are many participating actors in the processes where the national goods models system is used, it is mandatory that the system is as transparent as possible.

The Swedish national model system is continuously developed in co-operation between the members of a consortium of Swedish state agencies involved in infrastructure planning and development as well as transport research. Members of the consortium are the Swedish Institute for Transport and Communications Analysis (SIKA), the Swedish National Rail Administration, the Swedish National Road Administration, the Swedish Maritime Administration, the Swedish Civil Aviation Administration and the Swedish Communication Research Board.

Major application areas

The national model system for goods transport has multiple purposes. The focus is on the strategic long term (10 year) infrastructure planning which encompasses all modes and regions. The planning exercise therefore also has a process aspect, since many state agencies at the national and regional level interact in the process. The role of the system in this planning process is to provide demand forecasts, policy and project evaluation information, analyses of effects and consequences of alternative strategies.

Other important application areas are analyses of strategic corridors and investment projects as well as structural analyses of the terminal systems of transport modes. Such analyses are either an integral part of the 10 year strategic planning process or carried out as entirely separate analyses for policy evaluation purposes.

A third application area is analyses of general transport policy measures as well as policy measures related to specific infrastructures e.g. road, rail etc. The advent during the last decade of some substantial transport policy initiatives at the EU level, has created still another application area for the national model system.

The transport demand models

The goods transport demand models (”generation of origin/destination matrices”) comprises five separate model modules:

- Multi-sectoral models of the Swedish economy (ISMOD)
- A model for regional disaggregation of sectoral employment (EARLY) linked to ISMOD
- A model for modelling inter - regional transport demand within Sweden (VTI/TPR)
- Model for regional forecasting and regionalising Swedish foreign trade
- Models for forecasting of implicit commodity value for aggregates of commodities

The multi-sectoral model ISMOD is an input-output model. A characteristic feature of the model is the endogenous generation of the capital stock, where productivity varies with capital vintage. The model is driven exogenously by world market commodity price forecasts as well as domestic public sector demand forecasts. Additionally two exogenous balancing restrictions are given namely total employment and the balance of current account. The model provides as output production, investment, intermediate commodity demand, employment as well as wage and profit levels for all sectors of the Swedish economy. Also, private consumption, export and import are solved for commodities and services specified in the model. The model is designed to produce projections of Swedish economic development for a medium term perspective (5–10 years). Within the goods transport demand system the output of the ISMOD model for production, export, import and consumption for each sector is used as input to the Early model, to the system for modelling interregional transport demand, and to the foreign trade model.

The EARLY model is linked to the ISMOD model. Based on the ISMOD demand projections per sector total national employment changes are calculated per sector. These changes are further disaggregated per region in the Early model. The disaggregation is carried out in a number of steps. One important tool is the separation of sectors into “engines” and “wagons”, with the idea that some sectors (engines) could be viewed as primary employment generators, while employment in other sectors (wagons) could be looked upon as induced by employment changes in “engine” sectors. By the combination of historical data, “engine” sector growth and decline probabilities and the model of engine/wagons, employment changes per sector and region are calculated.

The model for inter-regional transport demand within Sweden (VTI/TPR-model) uses as input data the output from the ISMOD multisectoral model, output on regional employment changes from the EARLY model, output from the foreign trade model system, and output from the model for forecasting implicit prices for the commodity aggregates used in the model system. The VTI/TPR models utilises an entropy algorithm to estimate forecast demand matrixes for the relevant commodity groups. Estimates of the present domestic inter-regional transport flow matrices based on available empirical information as well as the corresponding foreign trade matrices are used as à priori matrices in the entropy algorithm. The marginal conditions for each commodity are derived from the ISMOD-model output.

The purpose of the foreign trade model system is to forecast trade (export and import) between Swedish municipal areas and numerous foreign trade regions disaggregated into commodity aggregates. The model system has two main subsystems namely the bilateral trade model subsystem and the subsystem modelling lower level regional trade flows. The model system comprises some 50 bilateral trade models for suitable trade areas (countries or groups of countries) and commodity aggregates. These models are of the gravitation type using inter alia GNP, population, and distance as independent variables. In principle the model system is intended to provide forecasts of inter-area trade patterns on the most disaggregated area level used in the transport market model (demand matrix level) as well as a suitable commodity disaggregation.

The transport market model (transport network model implemented in the STAN software)

The purpose of the network model is to represent the transport markets´ allocation of transport demand to combinations of transport modes and also to transport routes (paths). Transport demand matrices, which are output from the model for interregional transport demand, are input to the transport network model (disaggregated per product). The allocation to modes and routes is controlled by the cost conditions of the transport services production system, which are represented as functions and parameters of the network model. The network model is implemented within the framework of the STAN-model package, which uses a system cost minimising algorithm to solve the allocation problem.

It is essential in the policy context where it is used, that the national model systems produces demand projections and also allows for policy analyses related to the transport network. Only the capability of dealing with the network level makes it useful for analyses of a range of issues related to transport infrastructure development (investment, divestment, system level changes of the general properties of subsystems of the infrastructure, corridors, missing strategic links etc) as well as for the analysis of transport policy issues such as pricing/taxation).

Evaluation models and tools

The purpose of the evaluation models and tools is to make use of information already available in the national model system as well as utilising the system’s analytical capabilities for evaluation and effect analyses. The evaluation tools will support CBA, EIA and SEA analysis of major projects and programmes as well as CBA and SEA analysis of a wide range of policy measures and general changes of subsystems of the infrastructure. The effects of infrastructure measures and certain policy measures on transport cost, transport time etc. could be calculated and presented with the appropriate regional distribution. Major transport corridors could be studied with regard to time/cost characteristics.

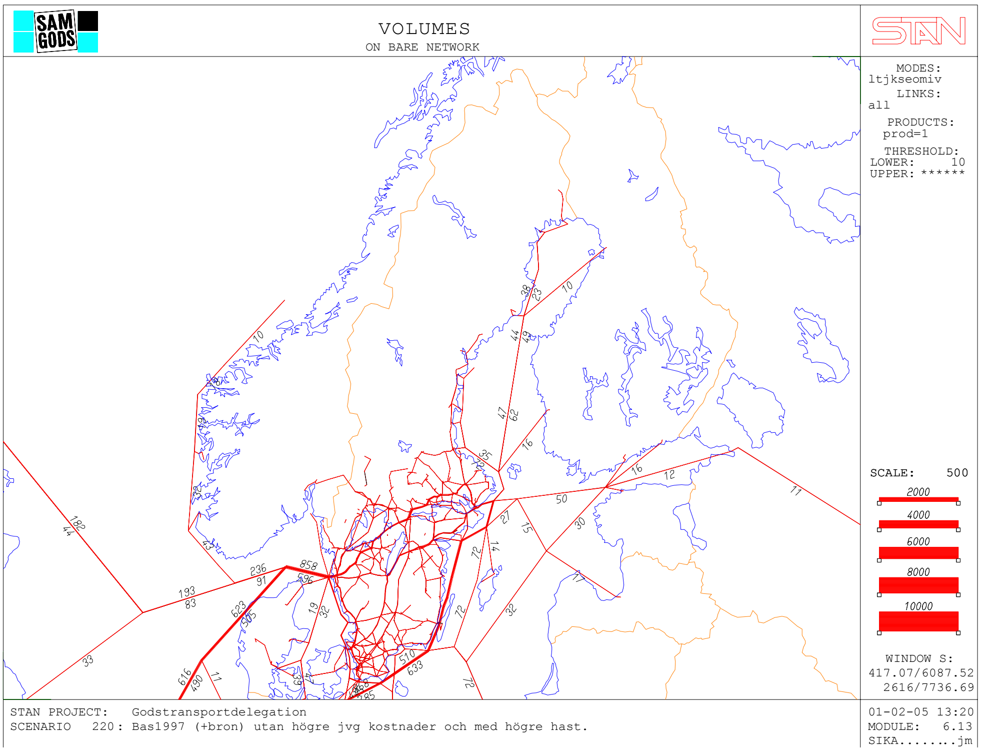
The evaluation models comprise tools for getting access to model system data. The evaluation modules are planned to interact with other components of the national model system in order to make the best use also of already available built-in tools of various software components.

Calibration and validation

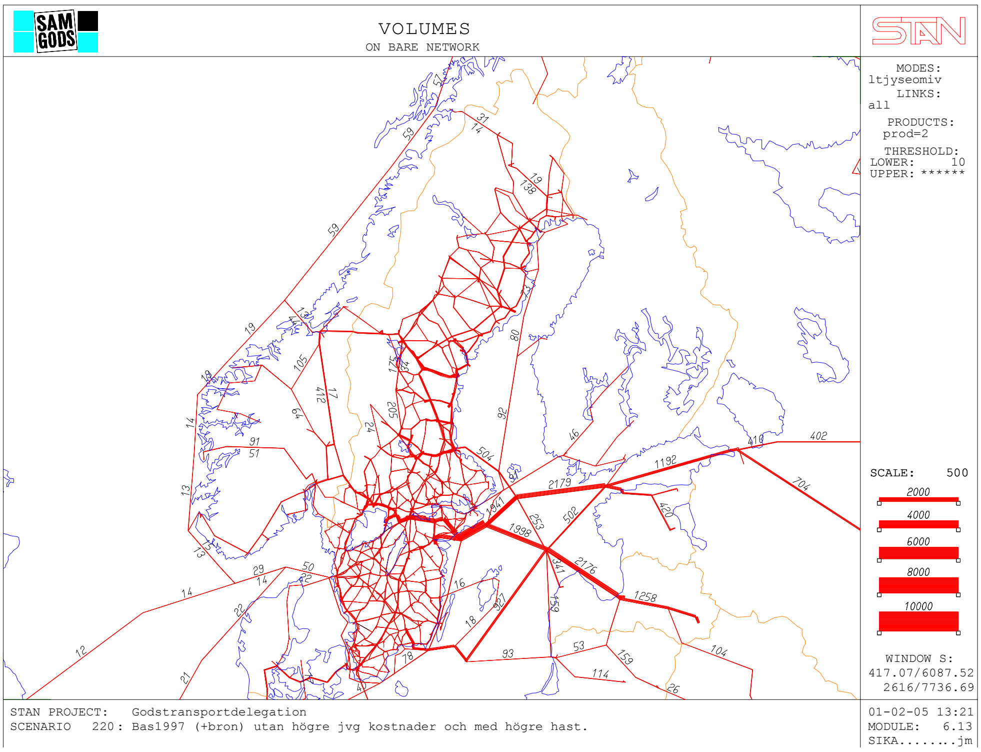
Generally, more efforts should be made to calibrate as well as to validate the model system as a whole and the separate modules. Considering that early versions of the system have been used for quite a few years now, there is also scope for evaluation of the model system performance against the actual development. For the VTI/TPR model an evaluation/validation report has been produced in the early 90s. For the entire model version of 95/96 an evaluation was initiated by RRV. The report was written by Anders Karlström. There are to our knowledge no more recent efforts within this field.

Bilaga 2

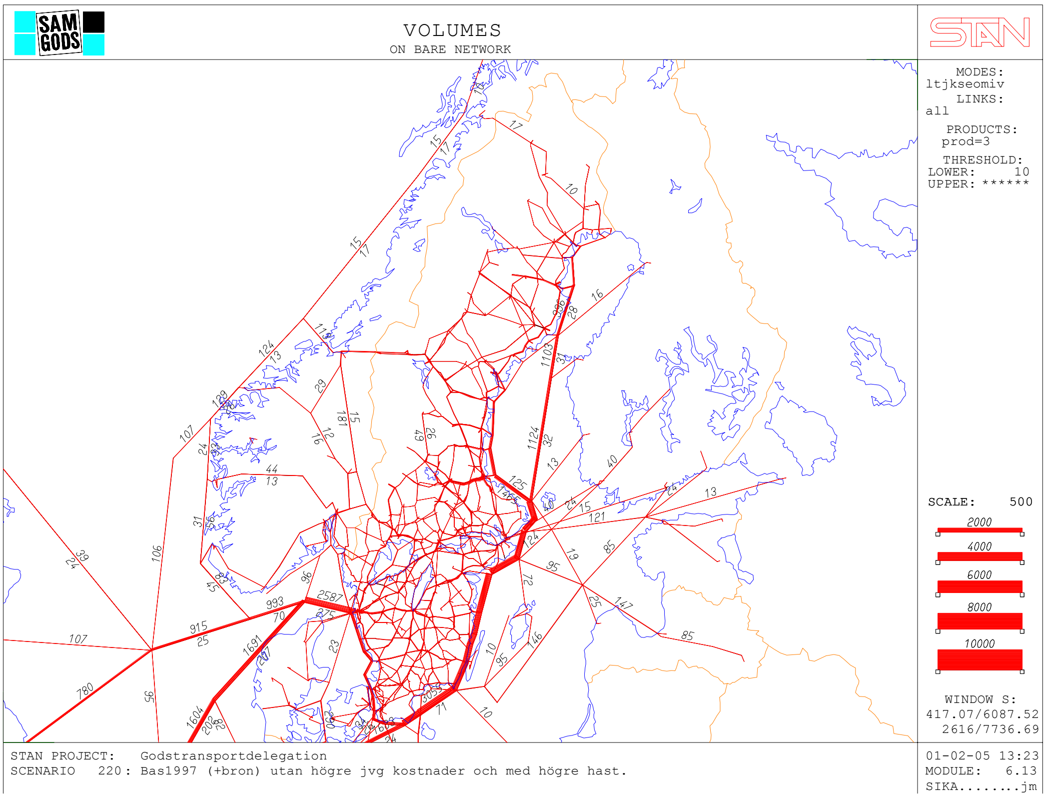
Flödesdiagram för 12 varugrupper



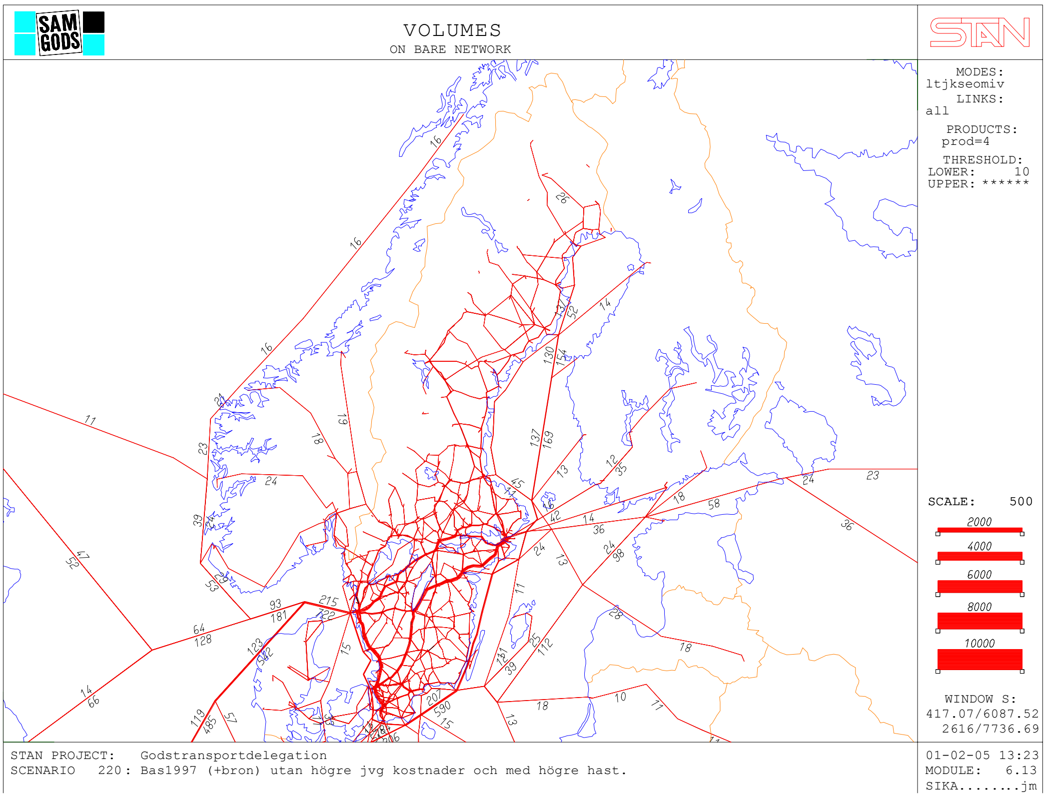
Jordbruk



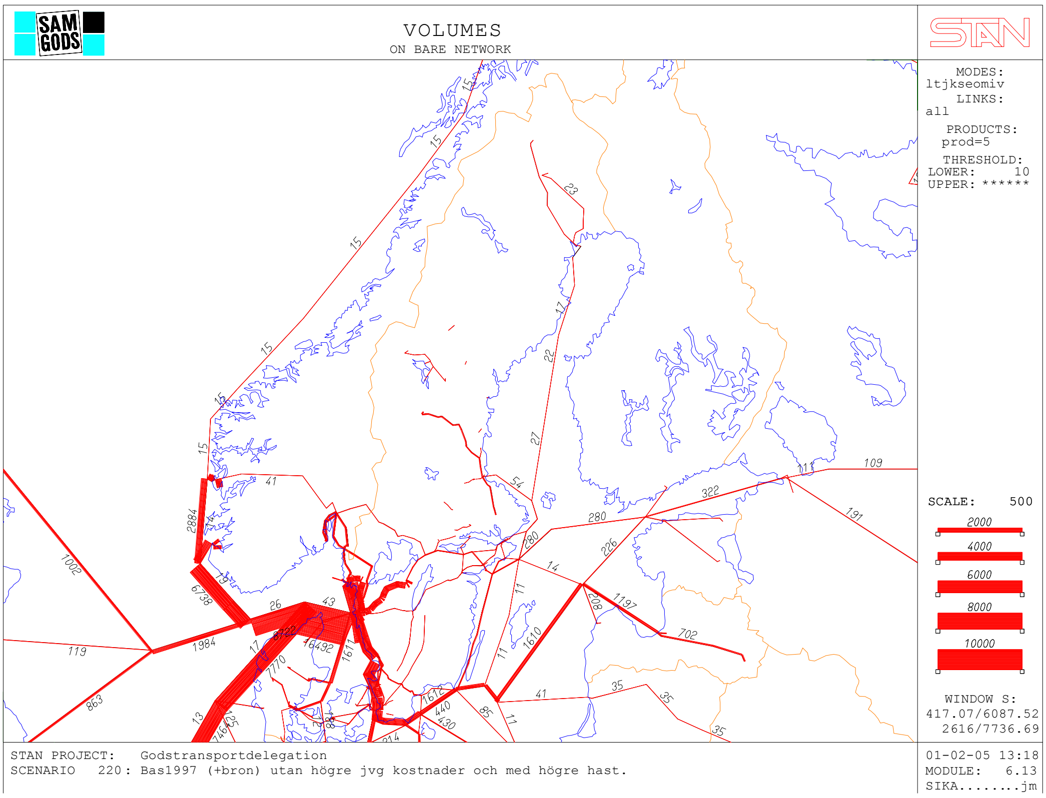
Rundvirke



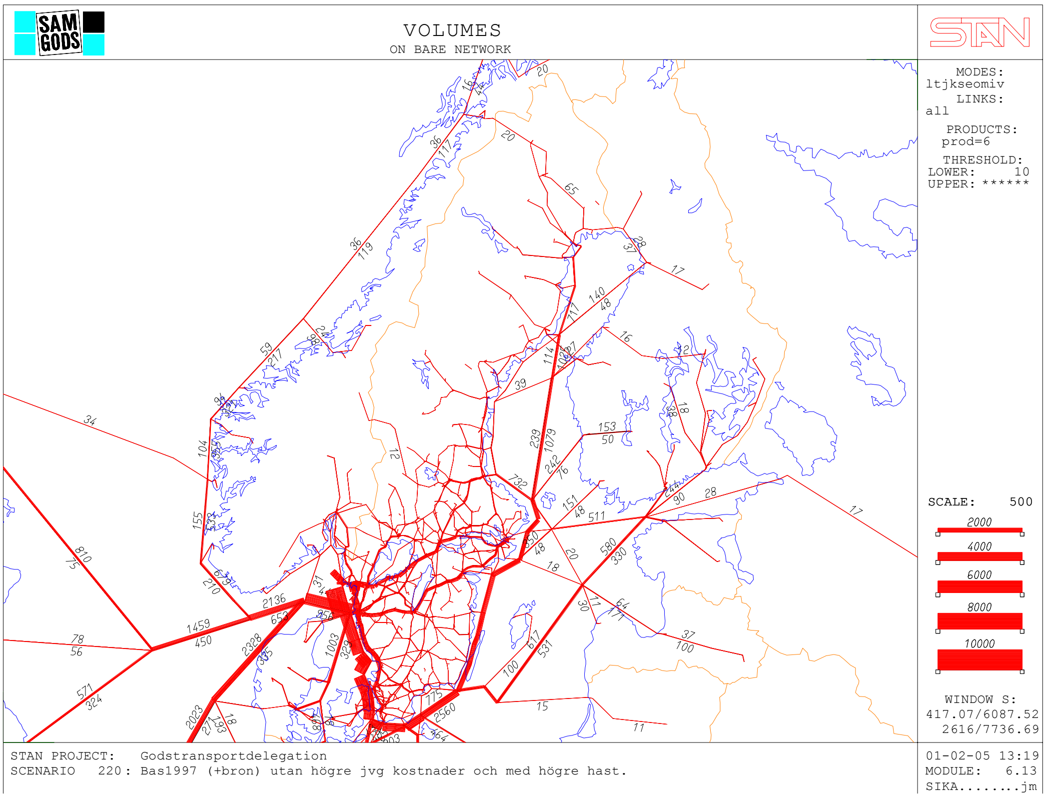
Trävaror



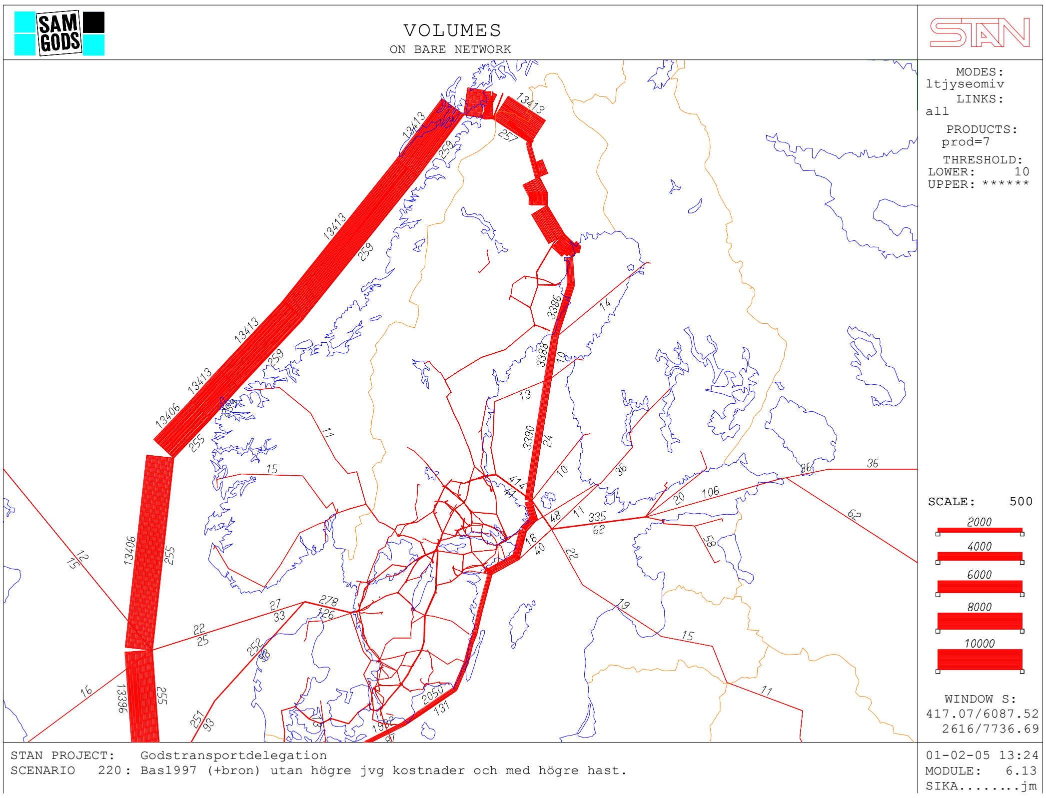
Livsmedel



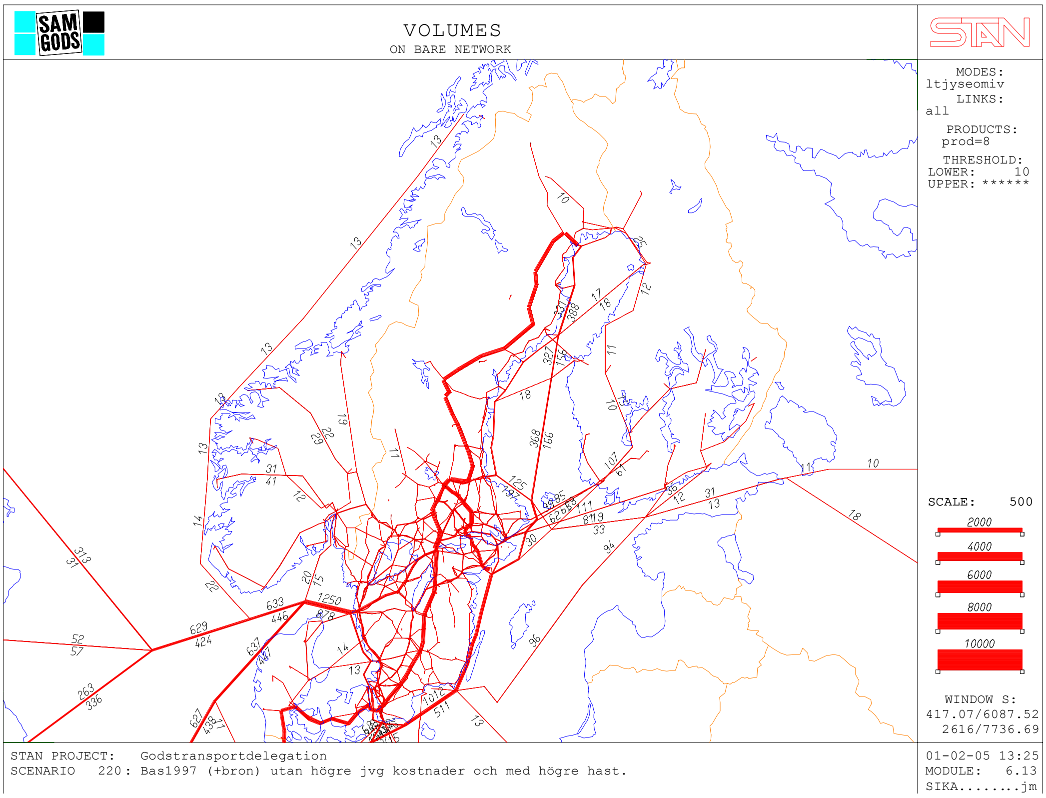
Råolja och kol



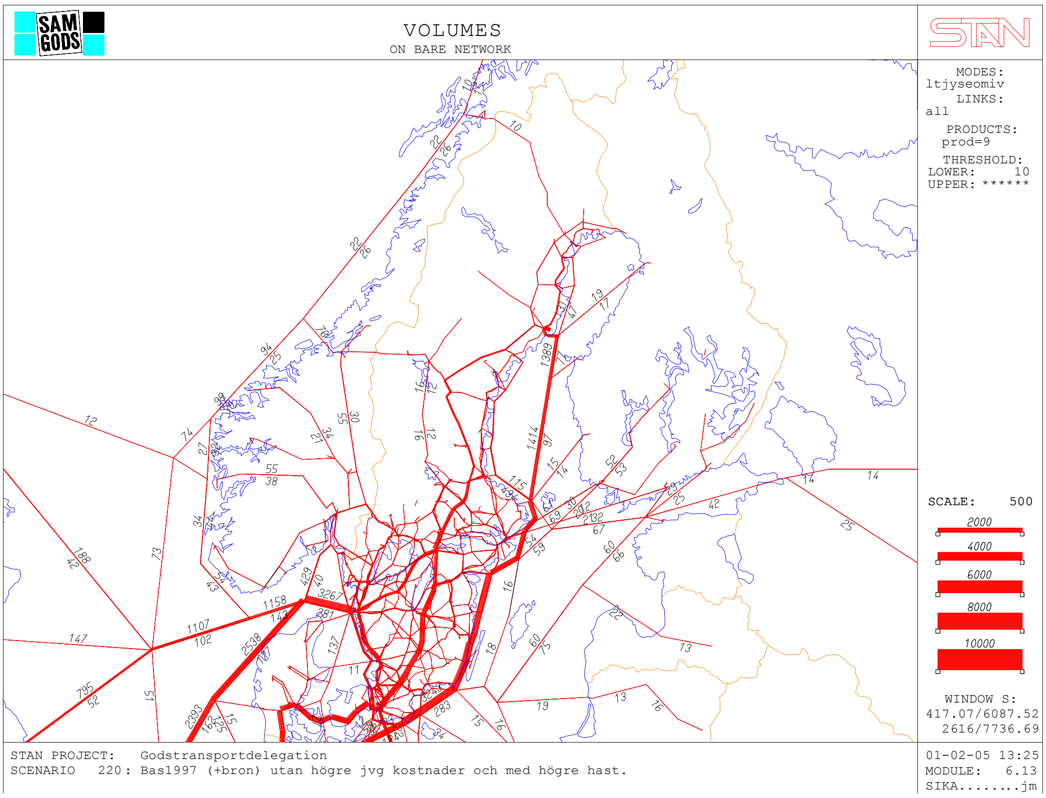
Oljeprodukter och tjära



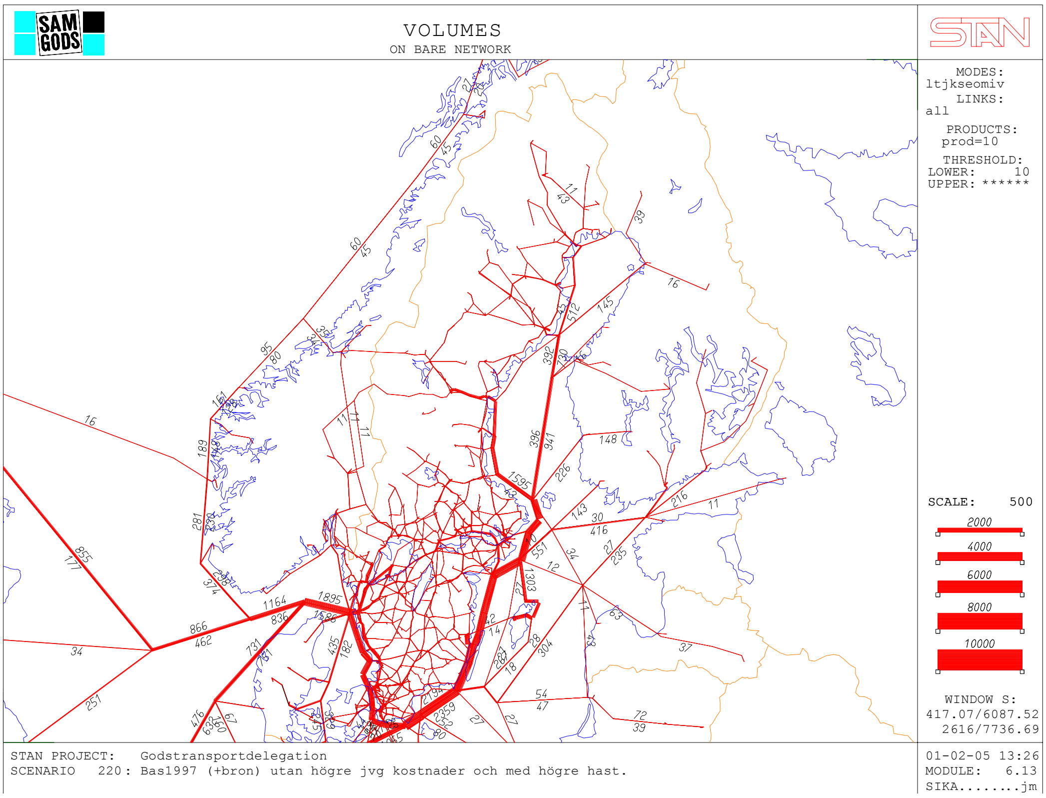
Järnmalm och skrot



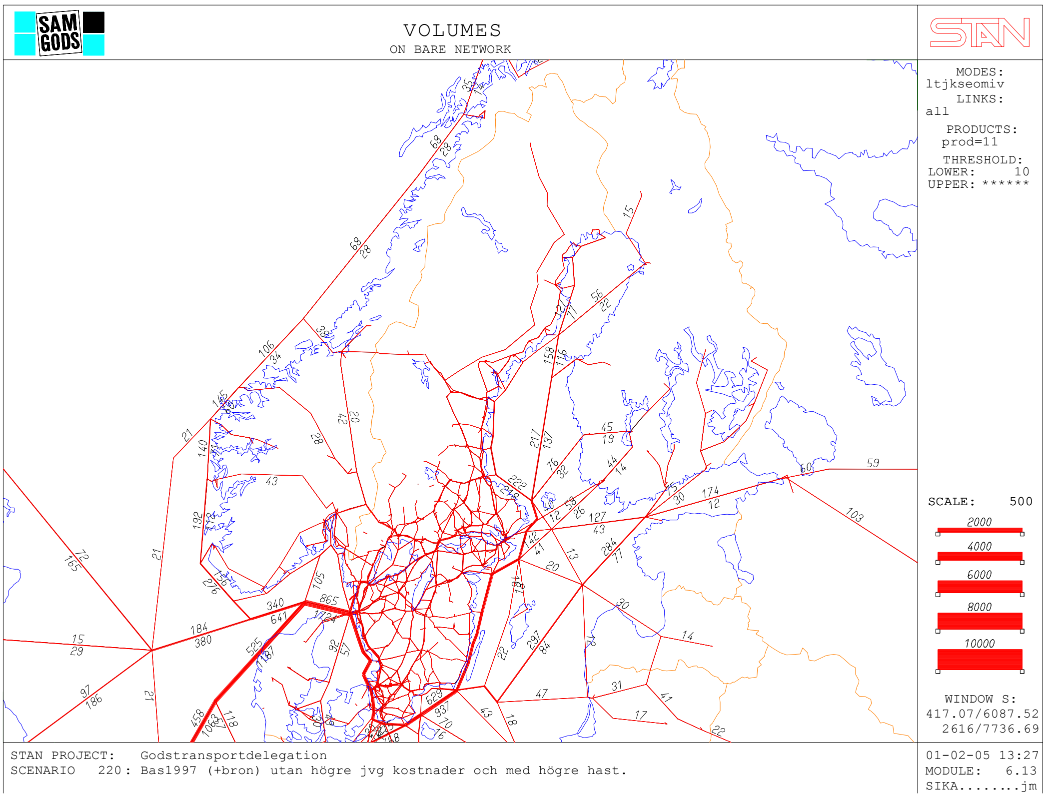
Stålprodukter



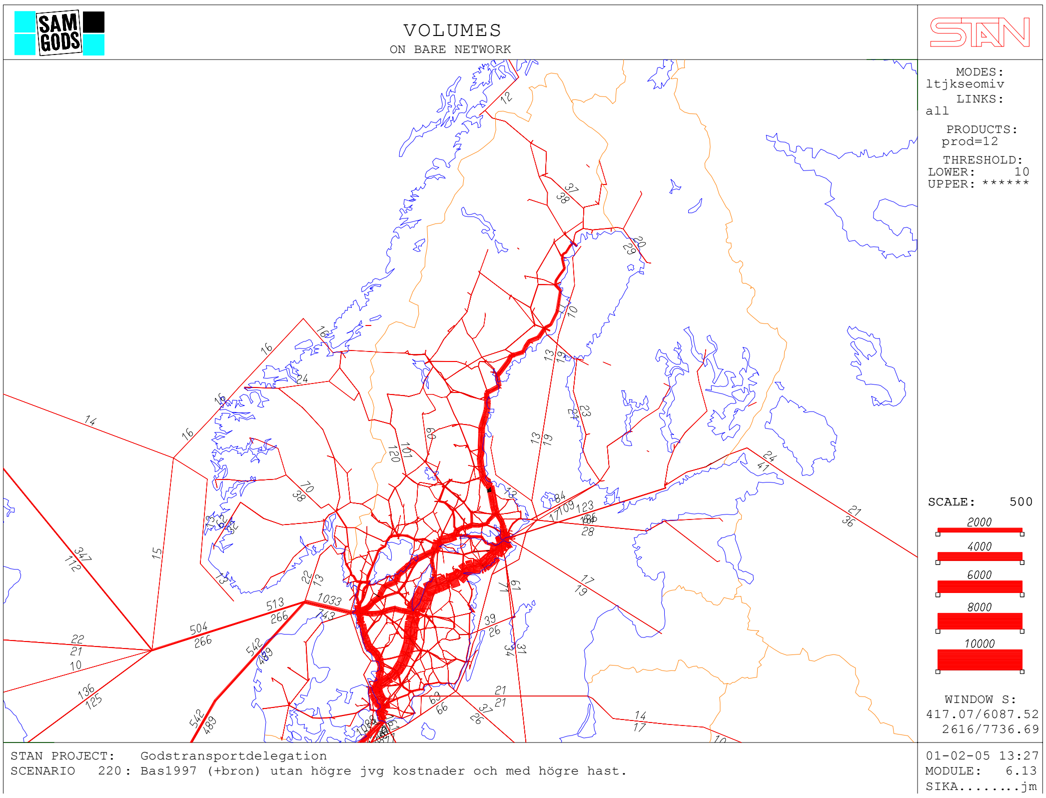
Papper och massa



Jord, sten och byggnadsmaterial



Kemikalier



Högvärdiga produkter

Bilaga 3

Terminaler i Sverige

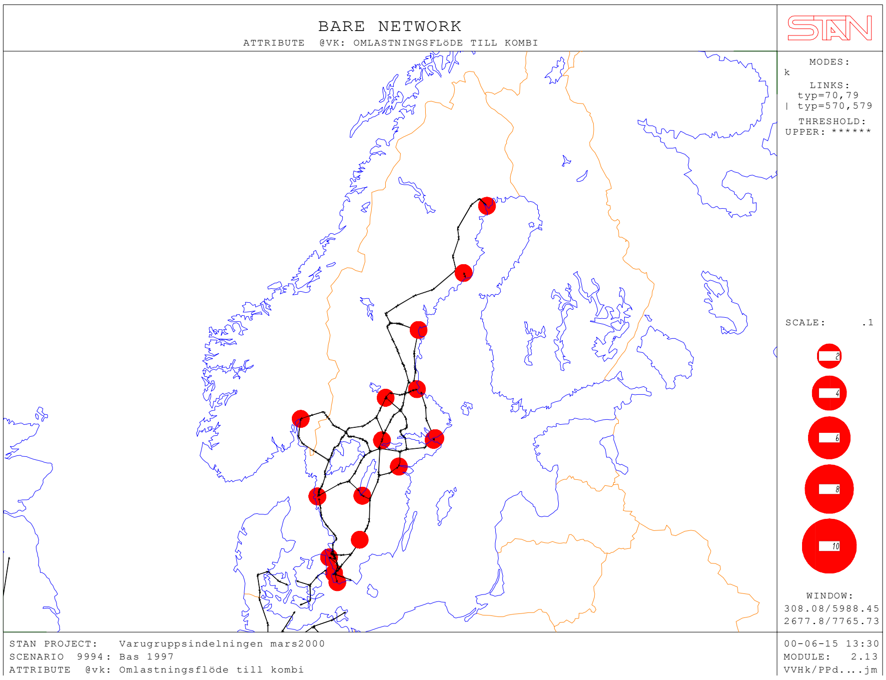
Hamnar

Tabell: De största hamnarna i Sverige, mätt i miljoner ton lossade och lastade 1997

Hamn	*Miljoner ton på fartyg 1997*	*Miljoner ton på färja 1997*
1 Göteborg	30,3	2,8
2 Brofjorden	19,7	
3 Trelleborg	8,7	8,6
4 Luleå	7,5	
5 Stockholm	5,7	4,0
6 Malmö	5,5	3,1
7 Oxelösund	4,3	
8 Karlshamn	3,9	
9 Norrköping	3,7	
10 Stenungsund	3,2	
11 Husum	2,4	
12 Sundsvall	2,4	
13 Slite	2,3	
14 Gävle	2,2	
15 Halmstad	2,1	0,4
16 Västerås	2,1	
17 Helsingborg	1,9	6,7
18 Umeå	1,7	0,2
19 Nynäshamn	1,7	
20 Köping	1,6	

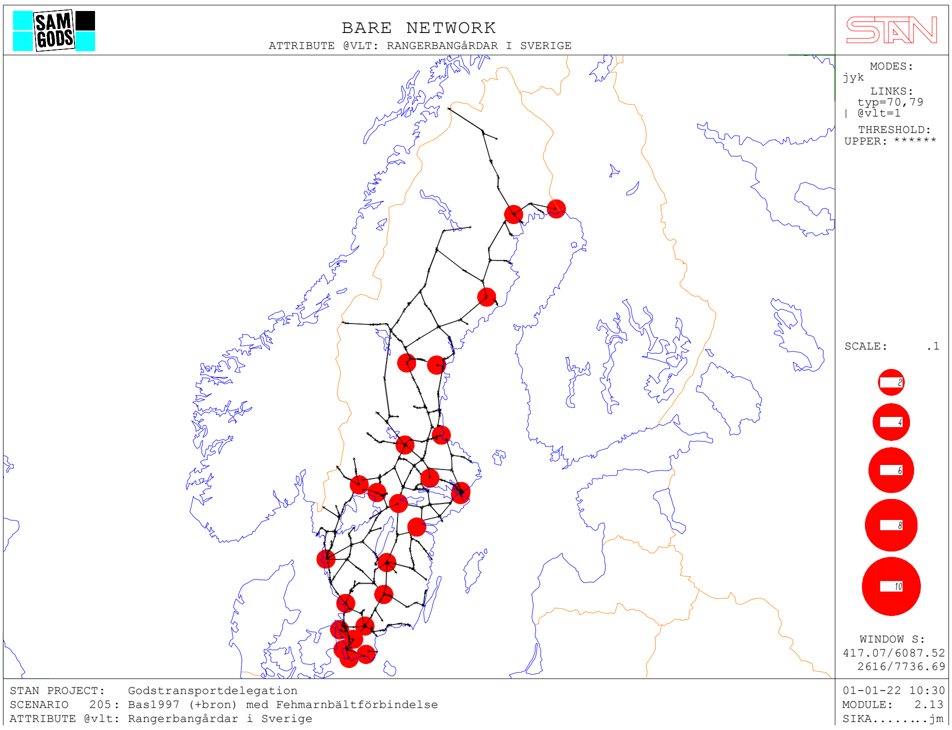
Källa: SCB/SIKA

Kombiterminaler



Källa: Banverket/SJ

Rangerbangårdar

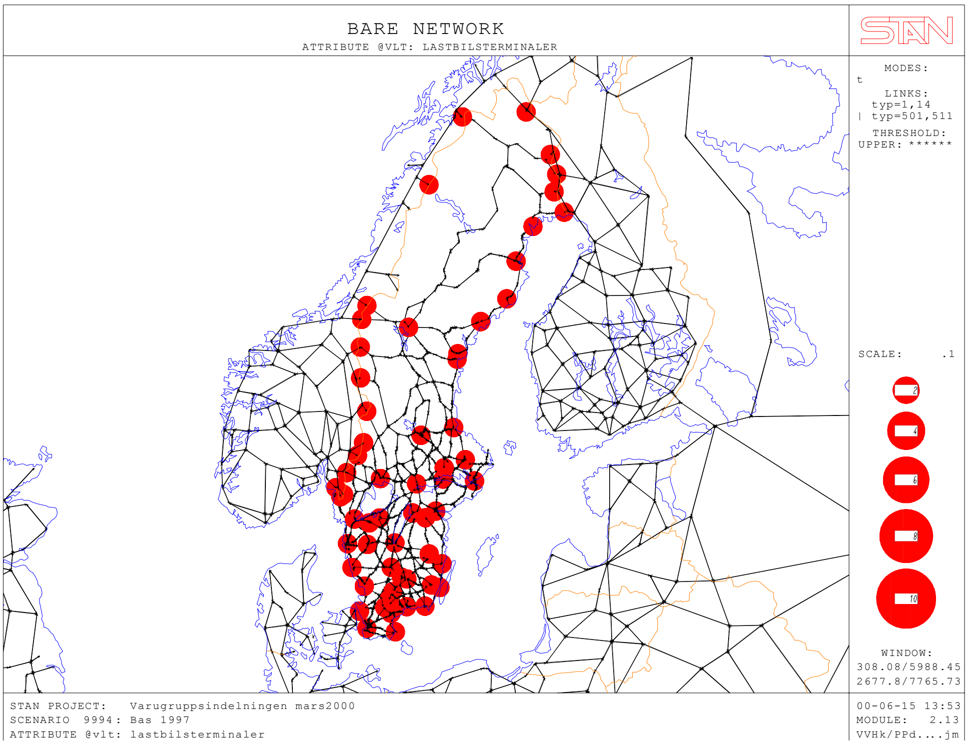


Rangerbangårdar	**Rangerbangårdar**
Borlänge	Boden
Sävenäs (Göteborg)	Halmstad
Malmö	Alvesta
Hallsberg	Kristinehamn
Gävle	Ystad
Helsingborg	Älvsjö
Trelleborg	Västerås
Nässjö	Kil
Ånge	Tomteboda
Sundsvall	Hässleholm
Norrköping	Eslöv
Vännäs	Haparanda

Enl. BV sorterade i fallande ordning (1998 års trafikering)

Källa: Banverket

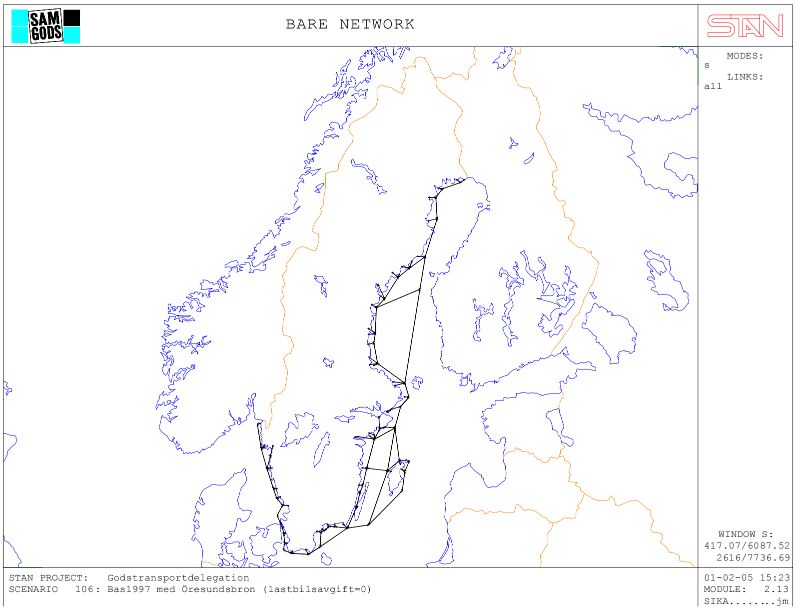
Lastbilsterminaler och punkter för gränspassage



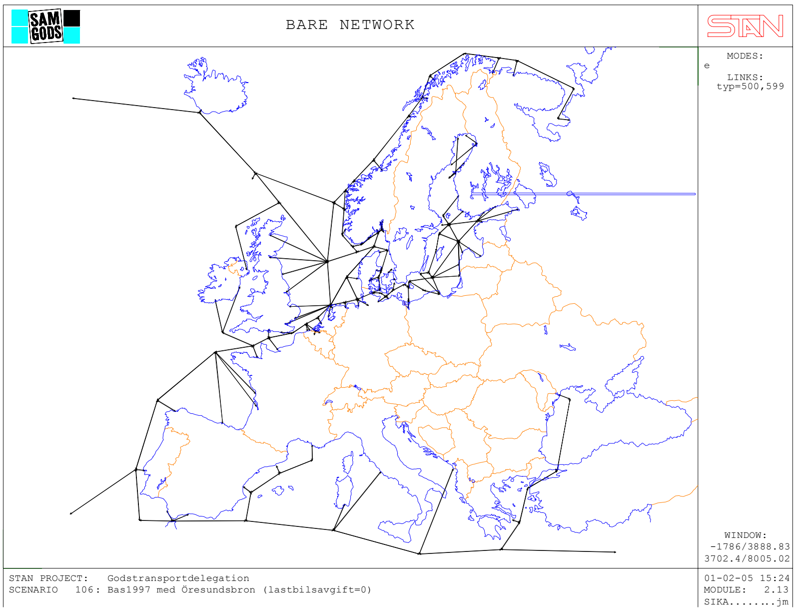
Källa: Matts Lundin, Temaplan

Bilaga 4

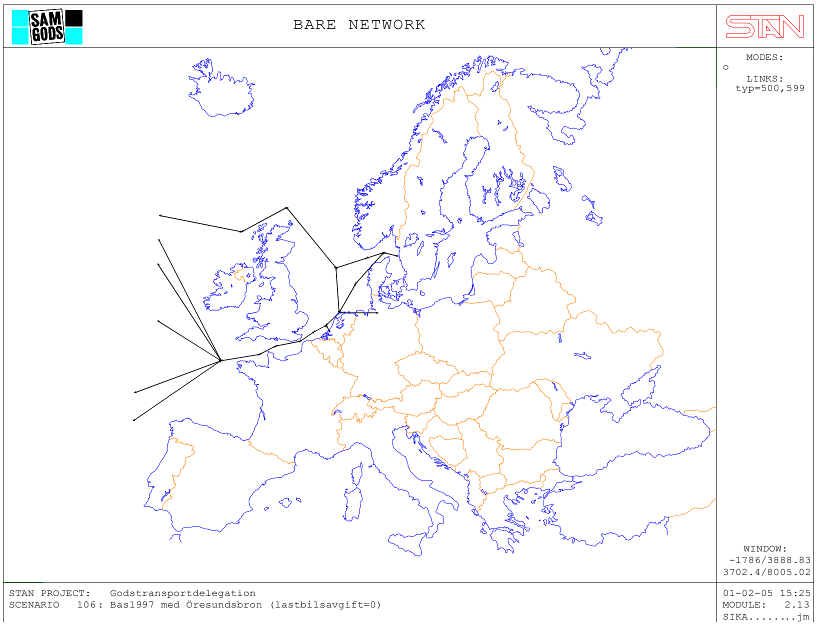
Avgränsning av sjötransportarbete i och utanför Sverige



Länkar för svensk kustfartyg



Länkar för europeiska fartyg



Länkar för overseas fartyg

Bilaga 5

Diskuterade infrastrukturprojekt i Göteborgs hamn[1]

Godstransportdelegationen ”Stråkgruppen” – Infrastruktur Göteborgs hamn

Citat:
”Infrastrukturprojekt fördelade på trafikslagen järnväg och väg omfattar endast projekt i anslutning till hamnarna och som direkt eller indirekt påverkar godskapaciteten och som skapar förutsättningar för volymer utöver prognostiserade.
Planer för ny hamnanläggning mellan Hjärtholmen och Risholmen vilket i hamnens Generalplan som sträcker sig till 2020 ej medtagen i nedanstående projekt.

För att skapa en bättre tillgänglighet till befintliga hamnanläggningar i ytterhamnarna samt till den kommande Arendalshamnen behöver följande kapacitetsförstärkningar göras.

Infrastrukturprojekt utan prioritetsordning

Järnväg

Hamnbanan elektrifieras

Idag är hamnbana inte elektrifierad vilket innebär att banan endast kan trafikeras med diesellok. För att erhålla ett logistiskt effektivare, kortare ledtider, och miljömässigt bättre transportalternativ krävs en elektrifiering av hamnbanan.

Kombibangård Ytterhamnarna
För att kunna utveckla systemtåg/ blocktåg för trailer och container en kapacitetsförstärkning genom av nuvarande kombibangård i anslutning till Ytterhamnarna (Skandia-, Älvsborg-, och Arendalshamnen)

Triangelspår mellan Norge-Vänerbanan/Marieholmsbron
För att kunna effektivt hantera blocktåg direkt till Göteborgshamn behöver ett triangelspår byggas som är ca 100 meter långt. Blocktågen är idag ca 700 meter långa och behöver tillgång till extra spår för att möta annan trafik.

Dubbelspår hamnbanan
På längre sikt, inom tio år, bör hamnbanan byggas ut till dubbelspår, vilket väsentligt skulle höja banans kapacitet.

[1] Input från Bertil Cederholm och Göteborgs Hamn AB.

Järnväg	*Kostnad*	*Ansvar*
1. Hamnbanan elektrifieras	30 Mkr	Banverket
2. Kombibangård Ytterhamnarna	200 Mkr	Banverket
3. Triangelspår mellan Norge-Vänerbanan/ Marieholmsbron	200 Mkr	Banverket
4. Dubbelspår hamnbanan	250 Mkr	Banverket

Väg

Torslandavägen - Oljevägsmotet

Kapacitetsförstärkning av lv 155 (Torslandavägen) inklusive ombyggnad av Vädermotet och Oljevägsmotet fram till den nya entrén för ytterhamnarna, via Torslandavägen nås bland annat ytterhamnarna, raffinaderierna. Det är viktigt att säkerställa god tillgänglighet till hamnarna via rationella tillfartsleder som ligger i direkt anslutning till hamnarna. Ombyggnaden berör sträckan Vädermotet till och med Oljevägsmotet.

Ny huvudentré för ytterhamnarna

Ny huvudentré mellan Torslandavägen och Oljevägen, Nordatlanten med planskildhet över järnväg och pipelines. Skapar förutsättning för rationell expedition av samtliga fordon till ytterhamnarna och oljehamnen.

Kapacitetsförstärkning Oljevägen

Oljevägens nuvarande standard behöver förstärkas för att den nya planskilda entrén till ytterhamnarna skall få avsedd effekt.

Torslandavägen – Sörredsmotet

Ny vägförbindelse från Sörredsmotet in till Arendalshamnen med planskildhet över järnvägsspår till Arendal. Ger erforderlig kapacitetsökning för att klara försörjningen av Arendalshamnen samt nytt hamnområde vid Hjärtholmen St. Risholmen

Lundbyleden

Lundbyleden är en mycket viktig del av infrastukturen i öst-västlig riktning på Hisingen. Standarden på leden är starkt varierande och behöver byggas om för planskilda korsningar för att öka kapaciteten för godstransporter till ytterhamnarna.

Ny vägförbindelse över Göta älv

Tingstadstunneln med kringliggande trafikplatser är överbelastade. Under de mest belastade timmarna är framkomligheten mycket begränsad vilket påverkar godstransporterna till hamnarna. Fyra alternativ finns i plan. Inkluderar även en ny Partihallsförbindelse.

Väg	*Kostnad*	*Ansvar*
1. Torslandavägen – Oljevägsmotet		
2. Ny huvudentré för ytterhamnarna		
3. Kapacitetsförstärkning av Oljevägen	250 – 350	VV
4. Torslandavägen – Sörredsmotet	150 – 250	VV
5. Lundbyleden	380	VV
6. Ny vägförbindelse över Göta älv	1310	VV

Den sammanlagda kostnaden för punkt 1-3 uppskattas till 250 – 350 Mkr.

Mot bakgrund av den politiska viljeinriktningen att flytta gods från väg till järnväg samt vår egen övertygelse anser vi att järnväginfrastrukturens förstärkning är mycket angelägen. Det finns också klara rationaliseringseffekter att uppnå med effektiva systemtågslösningar i stråken till upptagningsområden som Mälardalen, Mellansvenska industribältet (Karlstad-Borlänge-Falun-Avesta-Gävle), Hallsberg som knutpunkt till Östra Mellansverige samt Småland. Utöver de svenska upptagningsområdena finns det starka samordningsfördelar för Vänerbanan med stråket till Oslo och Östfold. Järnvägsstråken kring Göteborg där persontåg, lokaltåg och godståg samsas är idag hårt belastade.

I tillägg tillovanstående bör nämnas att GHAB i ”Farledsprojektet” totalt 1.500 Mkr svarar för 400 Mkr i ökad containerkapacitet i Skandiahamnen, från 750’ TEU/år till 1.500’-2.000’ TEU/år. Beräknas vara klart 2003. Det är också viktigt att notera att det råder politisk enighet om ovanstående infrastrukturprojekt inom Göteborgs Regionen.