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Godstransportmodeller

Seminarium

Trondheim, Norge 5 – 6 november 1998

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Godstransportmodeller

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Trondheim, Norge 5 – 6 november 1998

Konferensrapport 1998:3

Innehåll

Nordisk Transportforskning
Nordic Transport Research

Program NTF-seminar: Freigth transport models 5th and 6th November 1998 at Gildevangen Hotel in Trondheim, Norway

Thursday 5th November

12.00	**Checking-in and registration**	
12.30	**Lunch**	
	Introduction	
13.30	**Welcome**	
13.40	**Logistics**	Antti Permala
	Theoretical presentation of the scientific area	*VTT, Finland*
14.00	**The need for freigth transport models, how are these models utilised?**	Tor Nicolaisen
	Application of models in connection with strategic planning	*SCC Trafikon,Norway*
14.20	**An outline of the area of freight transport models**	Tore Knudsen
	Different kinds of models, problems with implementation of logistics in models, etc.	*SINTEF, Norway*
14.40	**Discussion**	
15.00	**Coffee break**	
	Strategic freight transport models – examples of models applied today	
15.20	**Network models**	Solveig Meland
	STAN, applied in the STEMM project	*SINTEF, Norway*
15.45	**Disaggregated models and input/output-models**	Sean Newton
	The MDST-model	*MDS Transmodal, Great Britain*
16.10	**Discussion**	
16.20	**Coffee break**	
	Specific issues related to freight transport modelling	
16.30	**Efficient use of disaggregated data in model estimation**	Goran Jovicic *Tetraplan, Denmark*
16.55	**Cost functions in aggregated models**	Matts Lundin
	Examples from the STEMM project	*Temaplan, Sweden*
17.20	**Assignment procedures**	Otto Anker Nielsen *Scanrail Consult, Denmark*
17.45	**Discussion**	
18.00	**End of the day's programme**	
19.00	**Conference dinner**	

Friday 6th November

9.00	**Workshops**	
1	**Criteria for definition of commodity groups – data need and availability**	Matts Lundin *Temaplan, Sweden*
2	**Measuring and implementation of quality factors in models**	Erik Bergkvist *Umeå Universitet, Sweden*
3	**Assignment and transport chains**	Jørgen Rødseth, *SINTEF, Norway*
10.45	**Presentation and summing up the workshops**	
11.15	**Lunch**	
	Nordic and European co-operation	
12.15	**Environmental effects of transport chains in a Nordic perspective**	Anders Sjöbris *MariTerm, Sweden*
12.45	**The European Commission's 5th frame work programme** Outlines of the content known at present	Knut Østmoe *Transportøkonomisk institutt, Norway*
	Discussion	
14.30	**End of conference**	

NTF-seminar om godstransportmodeller - deltakere

Navn	Organisasjon	Land
Anders Godal Holt	Asplan Viak Trondheim	Norge
Anders Sjöbris	Mariterm AB	Sverige
Anne Madslien	Transportøkonomisk Institutt (TØI)	Norge
Antti Permala	VTT Samällsbyggnad och Infrastruktur	Finland
Arne Hvamstad	Oslo Kommune, Samferdselsetaten	Norge
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Goran Jovicic	Tetraplan	Danmark
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Kári Sigurðsson	University of Iceland, Instute of Economic Studies	Island
Knud Erik Andersen	Vejdirektoratet	Danmark
Knut Østmoe	Transportøkonomisk Institutt (TØI)	Norge
Krister Sandberg	CERUM, Umeå Universitet	Sverige
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Lennart Hallbeck	Banverket	Sverige
Marielle Christiansen	NTNU Industriell økonomi og teknologiledelse	Norge
Martina Nilsson	Statens Institut för Kommunikations Analys (SIKA)	Sverige
Matts Lundin	Temaplan	Sverige
Morten Steen Petersen	Tetraplan	Danmark
Oskar Andreas Kleven	Oslo Kommune, Samferdselsetaten	Norge
Otto Anker Nielsen	Scanrail Consult	Danmark
Peter Värbrand	Linköbings Universitet	Sverige
Petri Blomquist	Viatek	Finland

Navn	Organisasjon	Land
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Randi Jule	Transportøkonomisk Institutt (TØI)	Norge
Riitta Viren	Trafikministeriet	Finland
Robert Sörensson	CERUM, Umeå Universitet	Sverige
Sean Newton	MDS-Transmodal	Storbritannia
Siamak Baradaran	Tekniska Högkolan i Stockholm (KTH)	Sverige
Siv Schéele	Inregia AB	Sverige
Solveig Meland	SINTEF Bygg og miljøteknikk	Norge
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Thomas Ljungström	Sjöfartsverket	Sverige
Thorkel C. Askildsen	Agderforskning	Norge
Tor Nicolaisen	SCC Trafikon	Norge
Tore Knudsen	SINTEF Bygg og miljøteknikk	Norge
Torfinn Larsen	Vejdirektoratet	Danmark
Øyvind Sunde	Høgskolen i Molde	Norge

Antti Permala, VTT, Finland

Logistikk

Logistics

Tech. Lic. Antti Permala
VTT Communities and Infrastructure
Finland

LOGISTICS
Short introduction for freight model builders

1. Logistics system

The term "logistics" has suffered inflation over the last decade and is used in virtually every human connection. Still, professionals like managers and educators agree to a large extent on the contents of this term. The Council of Logistics Management defines logistics as follows (CLM 3.11.1998, see http://www.clm1.org/):

“Logistics is that part of the supply chain process that plans, implements, and controls the efficient, effective flow and storage of goods, services, and related information from the point of origin to the point of consumption in order to meet customers' requirements”.

There are many different viewpoints in logistics (see e.g. Pfohl 1995):
- Business logistics
    - Industry
    - Trade
    - Services
- Macro logistics

Business logistics is dealing with the business of one company. This can be administrated and controlled by the company concerned. On macro level a single company can not control all the aspects of logistics. An example of macro level is a port where all the users must operate according to the common working methods. Other example is transport barcode, which may be accepted by a group of enterprises. On macro level there are also factors which are linked to surroundings, such as infrastructure, legislation, public control, and environmental questions.

Innovative approaches to business logistics strategy can give competitive advantage. Logistics strategy may have the objectives of cost reduction, capital reduction and service improvement. In business logistics each link in the logistics system is planned and balanced with each other in an integrated logistics planning process (Figure 1).

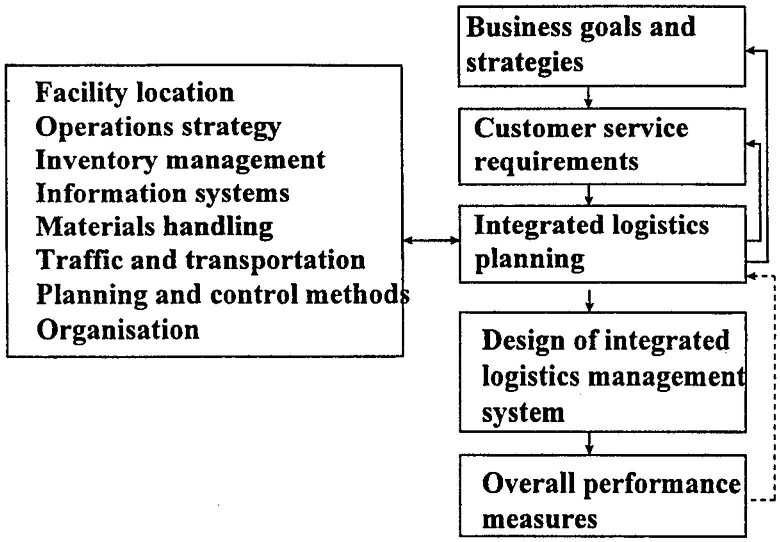

Figure 1. Flow of logistics planning by Capacino and Rosenfiel in Ballou 1992.

A good service level in physical distribution means that one has the right goods in the right place at the right time or at the right cost (Figure 2). The importance of these elements—time, place and cost—has long been known by companies. However, in multi-organisational distribution chains or processes it has been very difficult, if not impossible, to be sure what is really happening in the logistics processes of a company. The reason is that information systems do not support the decision making in logistics.

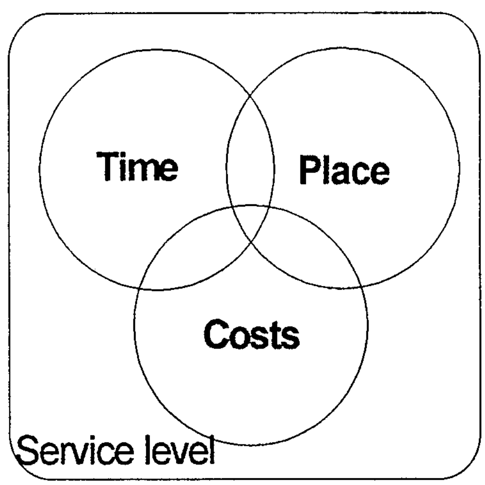

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Figure 2. Key components of decision support in logistics.

2. Freight transport

Key actors in logistics process are the customer and the shipper. Key activities are on the critical loop (Figure 3). The physical distribution loop starts with customer order, followed by processing of the order, and transmission in the information systems. Physical distribution is the outcome. The goods ordered are either produced before delivery or delivered from the stock. Physical delivery is a process which consists of two basic activities:

- Transportation of goods and
- Handling of goods; loading, unloading and storing.

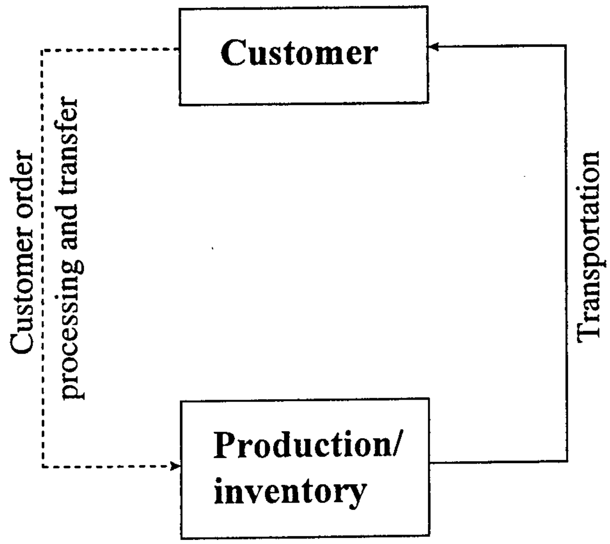


Figure 3. The critical physical distribution loop (Ballou 1992).

Enterprises in manufacturing and trade are working in a network. Moving of goods forms the material flow and information flow (information flow starts material flow as showed in figure 3). Material flow needs transport services, information flow data processing and data transfer. These both operations need physical infrastructure. Besides these flows there is money flow (Figure 4). Flows are based to logistics strategies of enterprises, e.g. where the business is located geographically.

Components of the freight transport system are traffic networks, freight transport on the networks and handling of goods. Transport generates demand for networks and a network supply for traffic. The demand for freight transport is generated outside this system, in the logistics of enterprises and public administration.

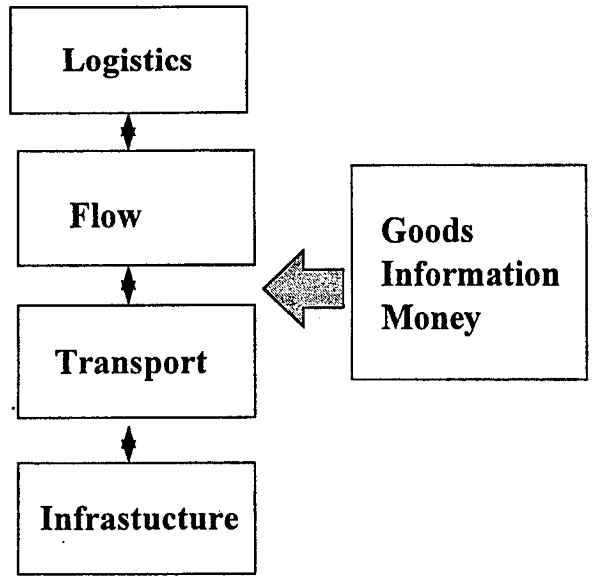


Figure 4. Four layer model of transport (modified from OECD 1992).

Starting points of material flow in a country are raw materials and import in foreign trade. Materials flow via production and trade into consumption and investments. All these activities produce wastes (Figure 5). Transport of wastes and recycling are a fast growing sector in transport business. In wholesale one half of the outbound goods flow may return back as empty packages and wastes.

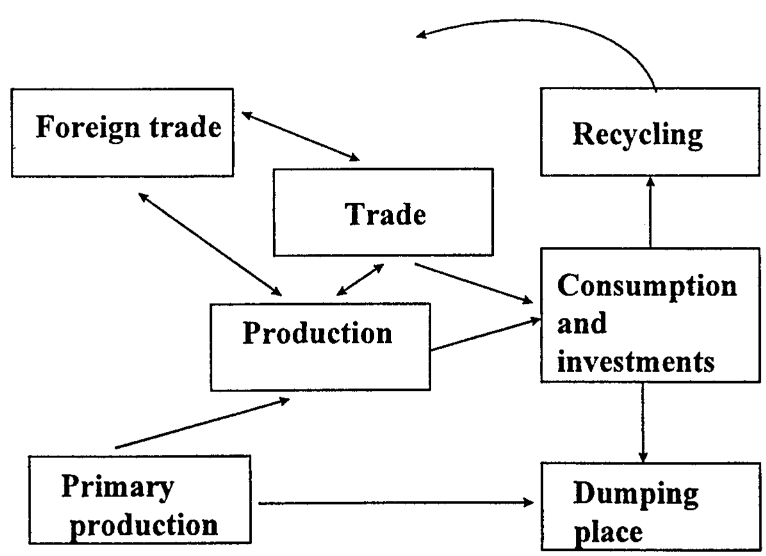


Figure 5. Material flows in national system, case Finland.

3. Trends

A recent survey by the European Logistics Assocation (ELA 1997) identifies six main ongoing trends and strategies for European logistics:

1. *Globalisation.* Design and realisation of global, fast and reliable logistics networks for manufacturing and distribution
2. *Customer Orientation.* Supply chain management ensures customer-oriented order and production processes.
3. *Global purchasing* for cost reduction and fast innovation
4. *Outsourcing.* Value added partnership with suppliers and service providers
5. *Information and communication systems*; High-speed logistics through information and communication systems (incl. internet and multimedia) and
6. *Logistics leaders.* Logistics leaders apply success strategies to secure their top position

Sources:

Ballou, Ronald H, Business Logistics Management. Third edition. Prentice-Hall International Editions. USA 1992

European Logistics Association, ELA, Towards the 21st Century. Trends and Strategies in European Logistics. Results of the ELA survey 1997.

OECD: Advanced logistics and road freight transport. Paris 1992.

Pfohl, H.-Ch., Logistiksysteme. Betriebswirtschaftliche Grundlagen. 5. Auflage. Springer 1995 Berlin.

Tor Nicolaisen, SCC Trafikon, Norge

The demand for strategic freight transport models

National Strategic Transport Plan 2002-2011

- A coordinated plan for road-, railroad-, air- and sea-transport.

- The intention is that this process and plan is to be a fundament for:

  - Coordinated political priorites

  - Efficient use of measures within the transport sector

  - Strengthening of the cooperation between modes

  to contribute to effecient, safe and environmental acceptable transportsolutions.

- It is of vital interest that the plan contributes to:

  - vigorous living- and employment-areas

  - trades and industry that are able to compet

  - development of national transport corridors and connections to Denmark, Finland, Sweden and the rest of Europe.

- Planning process:

December 1998:	Problem description and challenges
June 1999:	Measures and action plan

Challenge parameters and issues important for the use of measures:

- Better accessebility through the transport system:
  - bottlenecks and capacity problems
  - connections between modes
  - transport needs of industry and trade

- The properties of the different modes, level of competition and possibilities to transfer transport between modes.

- The transport sectors role in regional development

- Reduced outlet of green house gases from modes (cf. Kyoto-protocol)

- A substansial reduction in the risk of accidents

- Reduction of noise and local pollution

- Reduce the use of car and strengthen the use of transit in cities

- Better coordination of the planning for built environment and transport

- Development of new technology and use information-technology

The need for Strategic Freight Models. How are such models used today?

Aspects of need and use within the National Strategic Transport Plan (NSTP)

- Problemdescription. What level of detail is needed?
  Personal transport (trips), **freight**, accidents, noise, pollution and resources.

- National Freight Transport Model:
  - Level of detail
  - Reliability (on the level needed)

- Our need in the work with NSTP:
  - cf. the corridor-problems and -challenges
  - the need for sufficient detailed data to deal with the challenges.
  - cf. the need to answer the question:
    How and when should there be:
      Cooperation between modes
      Coordination of modes
      Competition between modes
  - this meens questions about freight data such as:
      Data/knowledge about freight in the corridors
      Classification of Products by Acivity.

Tore Knudsen, SINTEF, Norge

En oversikt over godsmodellområdet

An outline of the area of freight transport models

Freight Transport Models (1)

Model types:

1. General equilibrium, input / output models
2. International freight transport models
3. National freight models

- - -

4. Freight models for cities

* * *

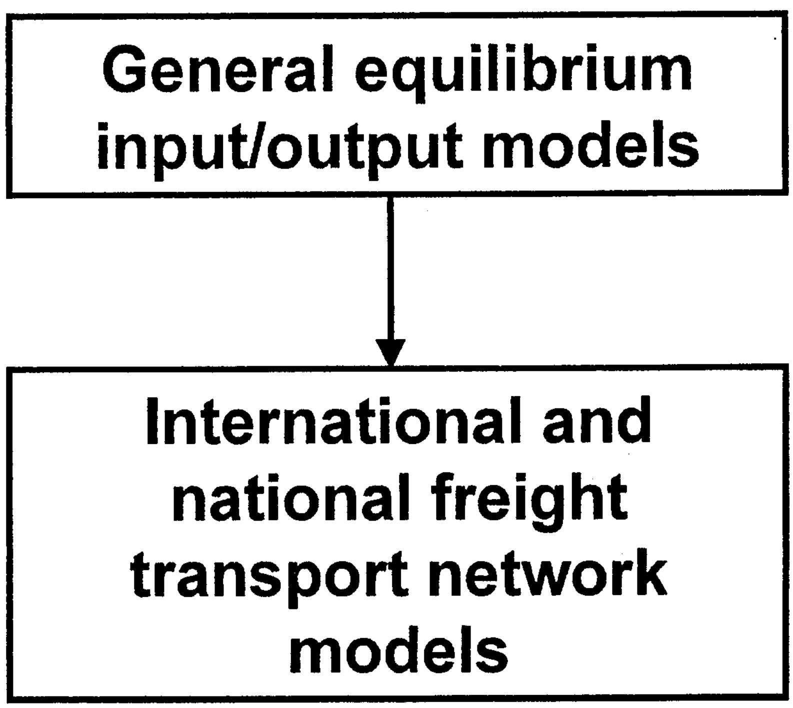
5. Logistic planning models

Freight Transport Models (2)

General equilibrium, input / output models

- based on macro-economic theory
- does not have a geographical network dimension
- main purpose of the model is to analyze the effect of economic measures
- models are also used for forecasting
- Typical results (output) from these models are:
  - freight (commodity) volumes on modes
  - domestic freight "transport work" (tonkm)
- models give input to the national freight network model

Freight Transport Models (3)



Freight Transport Models (4)

International Freight Transport Models

- network models (includes transport networks for different modes and transfer points)
- designed to allocate commodity flows on mode networks minimizing transport costs
- in later lectures three models/parts of models from the STEMM-project will be presented:
  - The STAN-model developed for the North Sea Case Study (Solveig Meland, SINTEF,N)
  - Cost functions in freight models (Matts Lundin, Temaplan,S)
  - The MDST Freight Model developed mainly for the Cross Channel Case Study (Sean Newton, MDST,UK)
- in the STEMM-project the objective was to analyze different policy measures in order to increase intermodality in international freight transport

Freight Transport Models (5)

National Freight Transport Models

- Finland, Sweden and Norway have developed national freight models based on the STAN model framework, Denmark ? Iceland ?
- These are network models, assigning freight volumes (commodities) to modes and links minimizing transport costs
- Model results: Freight volumes (commodities) on network links, transfer points and modes

Freight Transport Models (6)

Freight Modelling in Cities

- not covered in depth in this conference
- often modelled as a separate trip purpose in the city transport models
- many failures, few successes if any ?
- large ongoing project in Stockholm

Freight Transport Models (7)

Challenges in Freight Modelling - I

Knowledge of transport modelling is mainly developed within "person trip modelling" - freight transport modelling is different:

The decision process: For person trips each person makes his own choice. For freight transport one or a few persons can make decisions of mode and route choice for large freight volumes. The decision criteria are often not quite obvious. In addition: different commodities have different transport requirements, thus different decision criteria.

- The model structure, functions and the variables to be included in the model are different.
- Trip chains are more frequent and more important, especially in freight distribution
- The connection between freight trips / volumes and land use is very complicated

Freight Transport Models (8)

Challenges in Freight Modelling - II

Freight models can hardly reflect the knowledge and the work within the field of logistic and the logistic trends which we can observe.

Some important decision-related variables are difficult to quantify and to get data for in a modelling situation.

Examples: mode frequency, reliability (risk for delays), risk for damaging goods, etc

Freight Transport Models (9)

Challenges in Freight Modelling - III

- Cost functions: important part of the model, difficult to acquire data for (confidential "competitive" information).

- Freight volumes by mode and geographical relation are difficult to acquire data for (confidential, "competitive" information in the transport firms). Important data in order to calibrate or verify the freight model.

Freight Transport Models (10)

Challenges in Freight Modelling - IV

- Seasonal and directional unbalance in freight flow matrixes may cause changes in transport services to be offered in the marked and different pricing - difficult to bring into model

- Sea networks often cause problems: no visible road, no tracks, no nodes, just ports and vessels

Solveig Meland, SINTEF, Norge

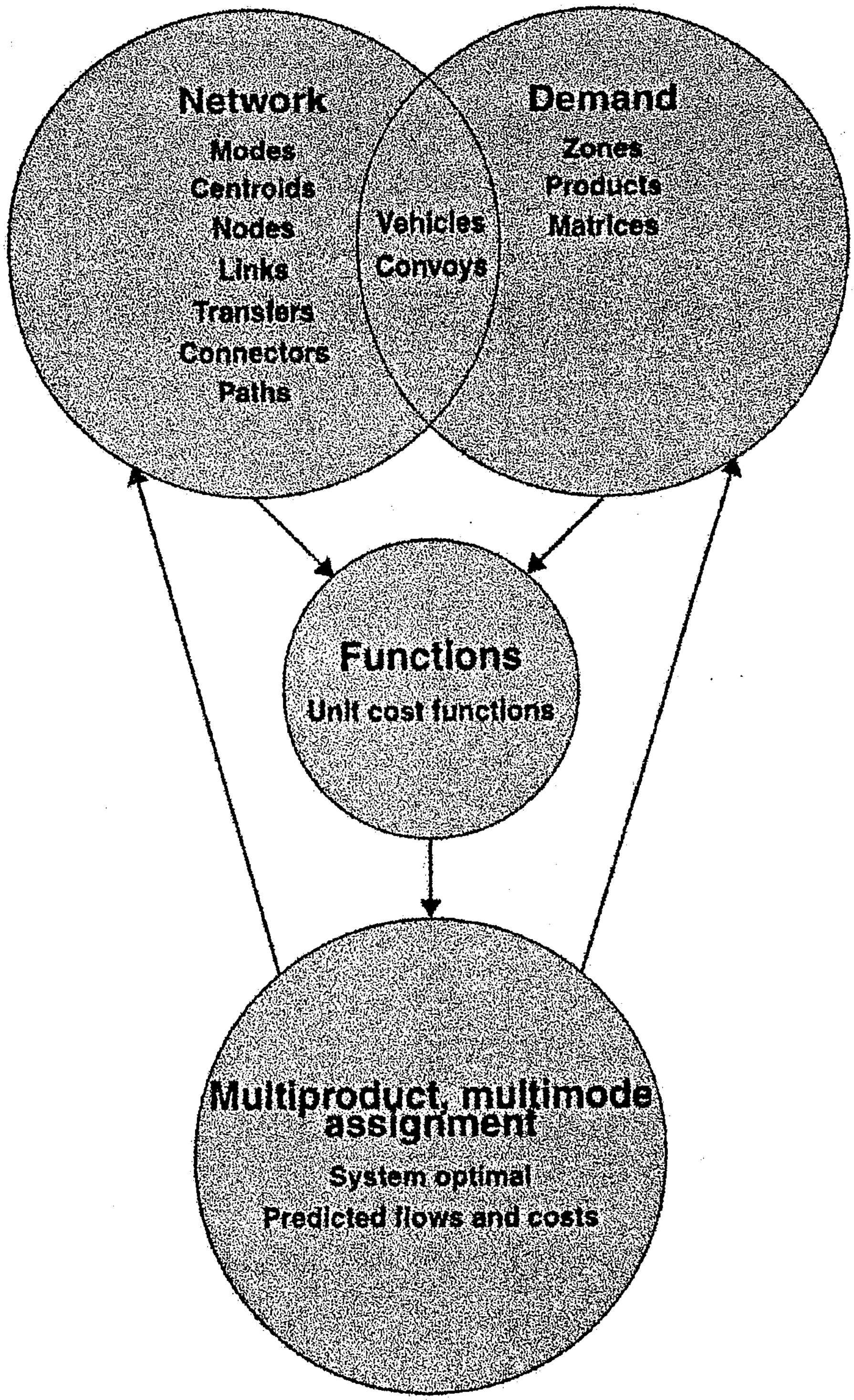
Nettverksmodeller

Network models

STAN

- Interactive graphic multimode multiproduct freight modelling tool
- Strategic planning
- Optimising transport system

STAN MODEL STRUCTURE

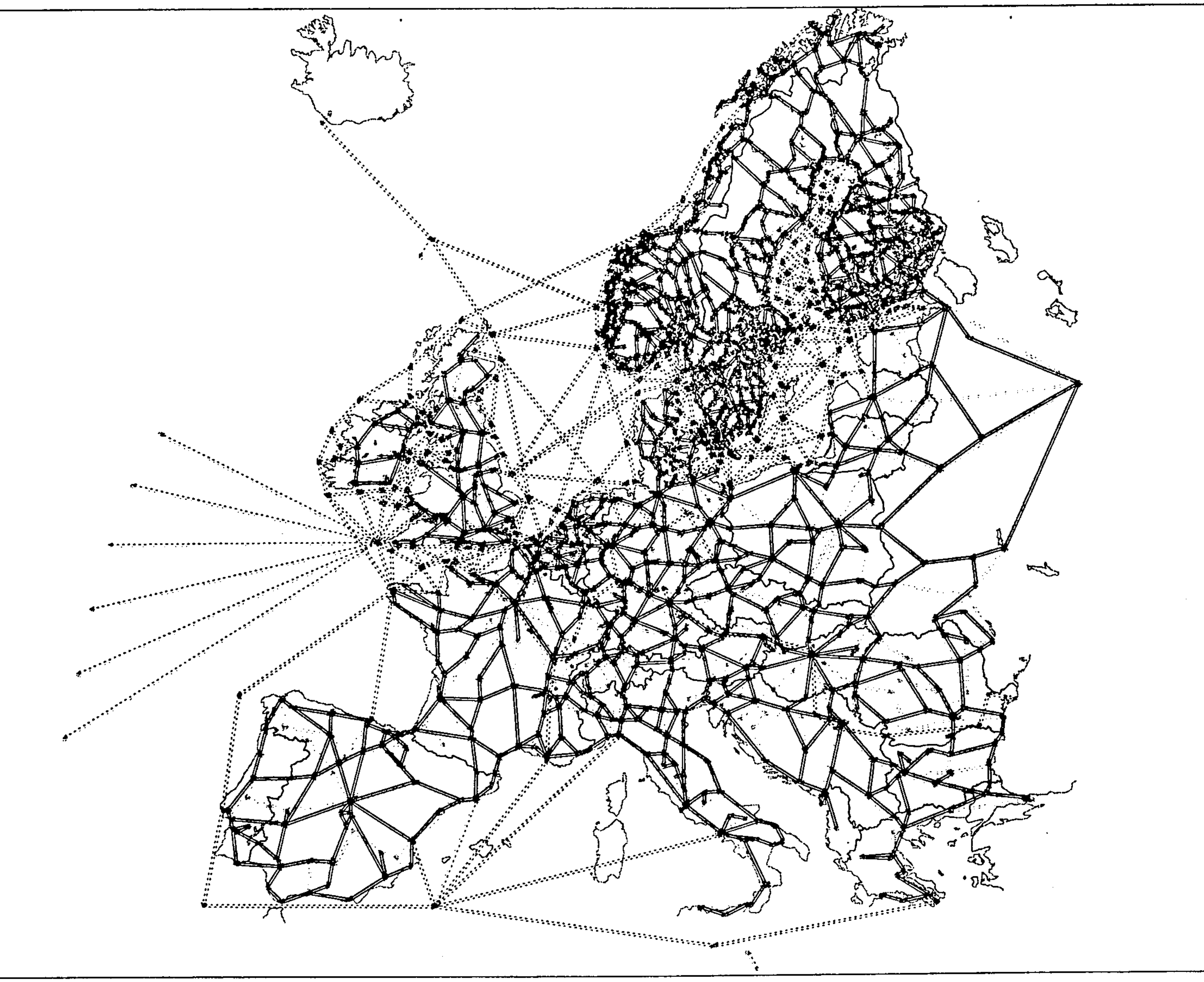


BASE NETWORK

TRANSFERS BETWEEN MODES

STAN

MODES:
l ——— r
i ······· b ·······
LINKS:
all



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STAN PROJECT: STEMM
SCENARIO 1000: STEMM network BASIS

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MODULE: 2.23
SINTEF......sm

Cost functions

- Defined for each combination of
  - Products/commodity groups
  - Modes
  - Links
  - Terminals and transfer points

- Cost items
  - Socio-economic
  - Commercial economic
  - Environmental costs
  - Other costs
  - Total costs

STEMM WP4D Cost Functions

Generalised Cost = Operating Cost + Time cost + User Defined Cost

On Links:

Operating cost (Distance-related)

= distance related cost for each mode and product (ECU/ton/dist.unit) * link length
+ CO_2 emissions per ton per distance unit * CO_2-tax (ECU/ton CO_2) * link length
+ link specific fees (road tolls, etc.) (ECU)

Connector cost (ECU/ton) = ½ * constant of regression of distance related cost

Time cost (Transport time and reliability)

= inventory cost for each cargo group (ECU/ton/hour) * time on link * (1+ quality factor)

Quality factor = reliability, flexibility, etc. for each mode. Default =0.

Connectors = inventory cost for each cargo group (ECU/ton/hour)* time on connector

User defined cost (Frequency-related) for the port to port sea modes

= inventory cost for each cargo group (ECU/ton/hour)* (0.5*24*(7/ no.departures per week)

On Transfers:

Operating cost (Handling-related)

= handling cost for each transfer type and product (ECU/ton)
+ terminal specific fees (ECU/ton).

Terminal specific fees: Default=0.

Time cost (transfer time and reliability)

= inventory cost for each cargo group (ECU/ton/hour)
* transfer time or delay at borders (hours)
* (1 + quality factor)

Quality factor for each transfer type: Reliability, flexibility, etc. Default = 0.

User defined cost (Frequency-related) for the ‘network’ sea modes.

= inventory cost for each cargo group (ECU/ton/hour) * (0.5*24*(7/0.5))

STEMM WP4D Scenarios

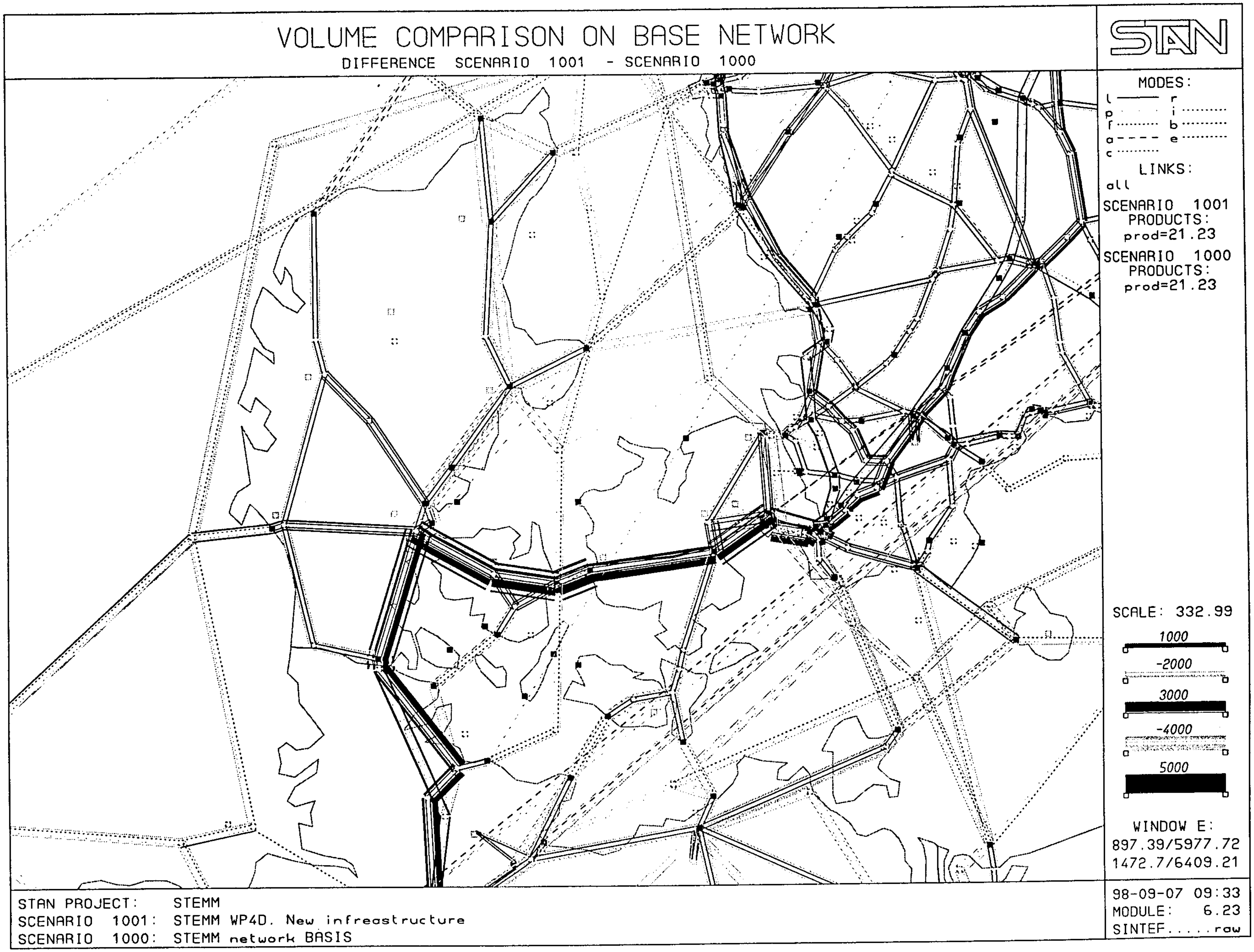
Infrastructure:
Completion of the Storebælt and Øresund connections
Representation is STAN:
S1001: Ferry links removed and replaced with new road and rail links

Subsidies of intermodal transport:
Subsidisation of rail terminals
Representation is STAN:
S1002: Reduced handling cost for transfers involving rail

Environmental pricing:
CO2 – taxes on transport
Representation is STAN:
S1003: High CO2-tax on road transport
S1004: Low CO2-tax on road transport
S1005: Low CO2-tax on all transport modes
S1006: High CO2-tax on all transport modes

Operational changes:
Increased quality of rail transport
Representation is STAN:
S1008: Rail "quality factor" reduced
Reduced quality of road transport
Representation is STAN:
S1009: Reduced speed on road network

Combinations of policy measures:
Subsidisation of rail terminals and CO2 – taxes
Representation is STAN:
S1007: Reduced handling cost for transfers involving rail (S1002)
and Low CO_2-tax on all transport modes (S1005)


VOLUME COMPARISON ON BASE NETWORK
DIFFERENCE SCENARIO 1001 - SCENARIO 1000
STAN
MODES:
l r
p i
f b
a e
c
LINKS:
all
SCENARIO 1001
PRODUCTS:
prod=21.23
SCENARIO 1000
PRODUCTS:
prod=21.23
SCALE: 332.99
1000
-2000
3000
-4000
5000
WINDOW E:
897.39/5977.72
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MODULE: 6.23
SINTEF.....raw
STAN PROJECT: STEMM
SCENARIO 1001: STEMM WP4D. New infreastructure
SCENARIO 1000: STEMM network BASIS

Sean Newton,
MDS Transmodal, Storbritannien

Disaggregerte modeller og input/output-modeller

Disaggregated models and input/output-models

Nordisk Transportforskning Seminar
MDST Disaggregated Freight Model

by

Sean Newton

MDS-Transmodal

STEMM Project: DG VII

Trondheim

Contents of Presentation

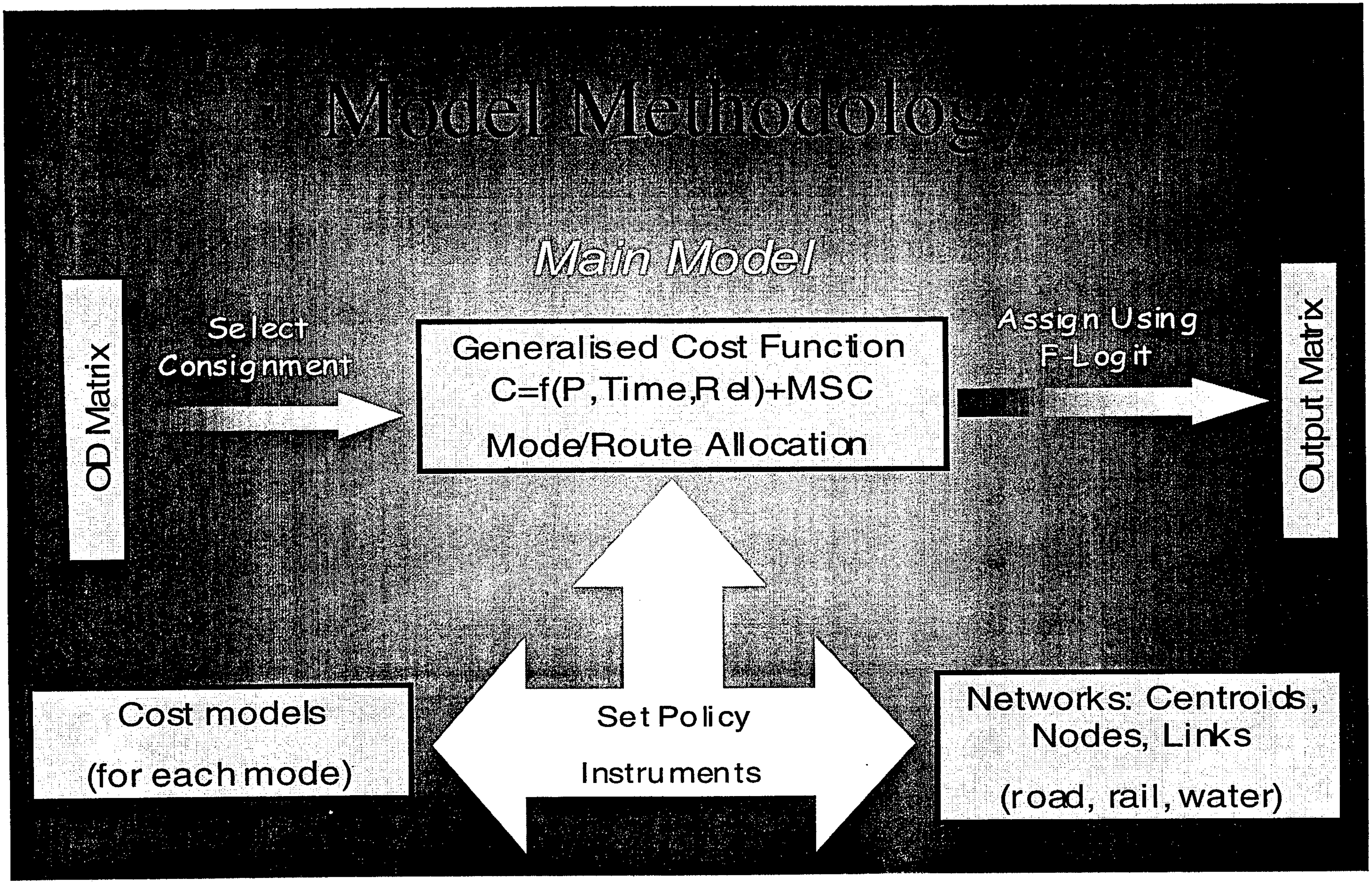
1. Project Back[illegible]
2. M[illegible]ethodology
3. Data
4. Model Operation
5. Results
6. Development

STEMM Project Objectives

- Purpose of STEMM
  - To develop modelling methodology
  - To collect transport data
  - To build passenger and freight models
  - To test policy instruments
  - To apply models to case studies,
    - MDST: Cross Channel and Trans Alpine Corridors.
    - STAN: Scan-Link, Nordic/North Sea

STEMM: MDST Freight Model

- Purpose of MDST Freight Model:
  - To estimate changes in the transport network as a result of hypothetical policy changes.
- Design Concept:
  - To base the model upon the available data.
  - To be consistent with commercial reality.
  - To reflect the relevant policy instruments.



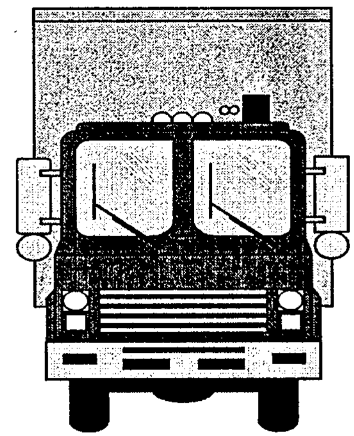
MDS-Transmodal, 3rd Nov 1998

Data

- Detailed Origin-Destination Data
  - NUTS2/NUTS3, SITC, Tonnes
- Flows on Key Links
  - e.g. Total Freight Units by Ferry/Alpine Pass
- Service/Infrastructure Data
  - Rail Services, Shipping Schedules
- Data for Cost Models
  - Transport Costs, Rates, Tolls etc.

Model Operation

- Run Cross Channel Model



- Run Visual Representation

Model Outputs

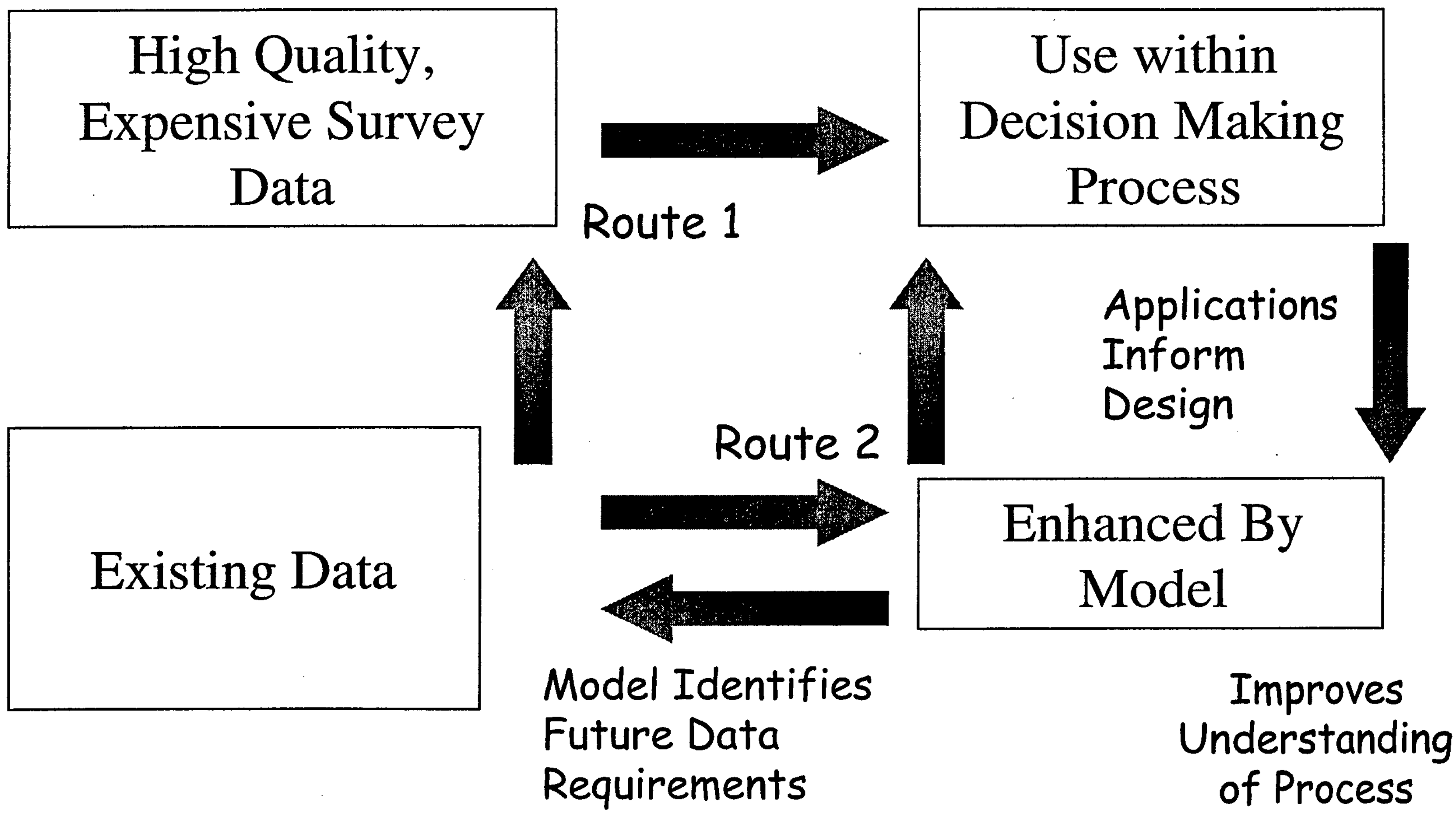
- Enhanced OD Matrix
  - Origin
  - Destination
  - Commodity
  - Main Mode
  - Transfer Points
  - Barrier Crossing Point
  - Tonnes
  - Units

- Flow Network
  - Node 1
  - Node 2
  - Link Type
  - Direction
  - Tonnes
  - Units

Development - Progress

- STEMM has..
  - Identified technique for analyzing policy decisions relating to freight transport on particular corridors.
  - Identified certain fundamental data requirements.
  - Developed technique for adding transport chain details to basic OD data.

Data - Models - Decisions



Development - Potential

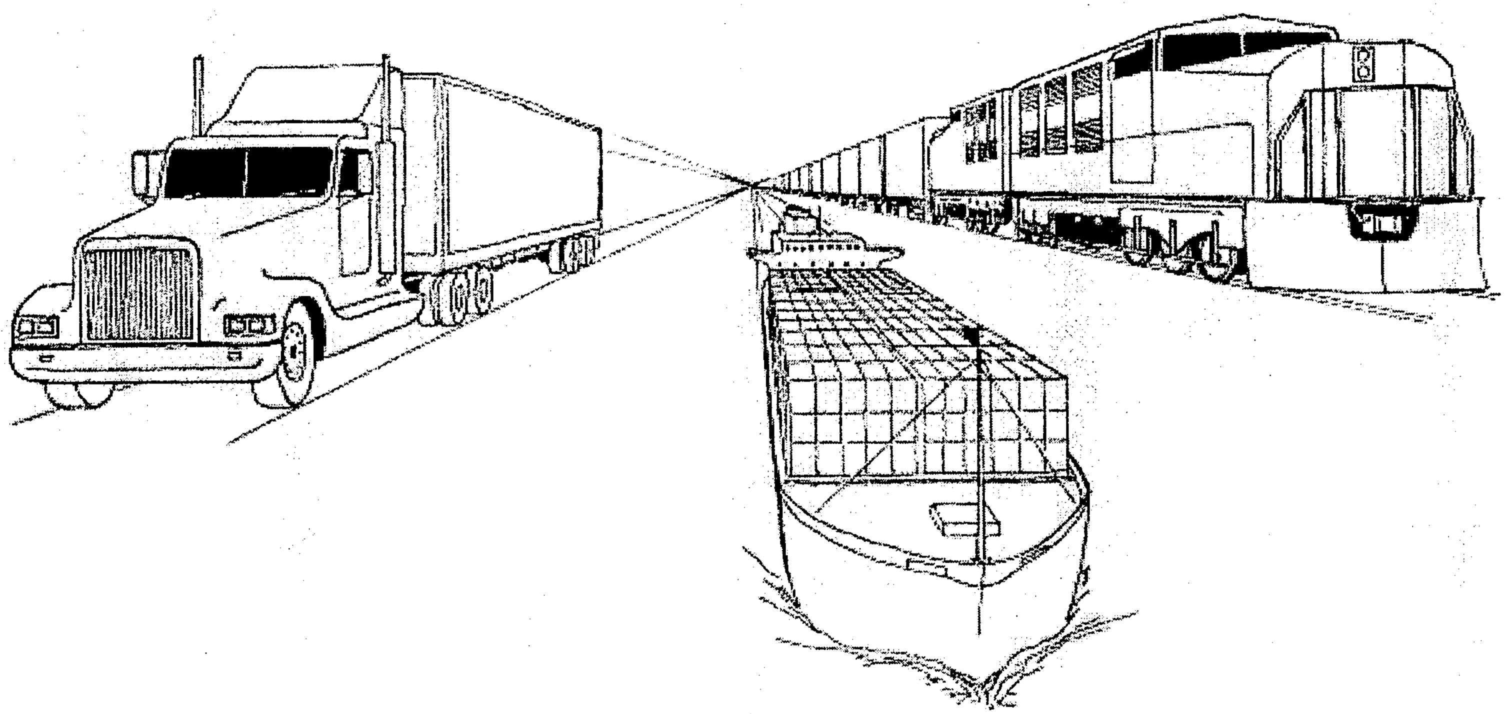
- Extended European Coverage
  - What are the limits beyond corridor studies?
- Integration with Data Collection Projects
  - Which data structures are essential?
  - Which aspects can be estimated by modelling?
- Feedback
  - Are model predictions valid?
  - Which new data sources can improve model performance?
  - How can methodology be improved?

Goran Jovicic, Tetraplan, Danmark

Effektiv bruk av disaggregerte data i modell-estimering

Efficient use of disaggregated data in model estimation

Efficient use of disaggregated data in model estimation



Goran Jovicic, TetraPlan A/S

Context of the presentation

- Aim of the project
- Modelling approach
  - *new ideas*
  - *applied data*
  - *model structure*
  - *model estimation (methodology and results)*
  - *model calibration (methodology and results)*
  - *forecasting results*
- Conclusions

Aim of the project

- To forecast the future demands for rail and sea transport relative to lorry transport, when supply variables change.

- Assumptions:
  - *to apply data from the existing projects*
  - *to limit amount of new data to be collected*
  - *to segment the model according to commodity groups*

Modelling approach

- A hierarchical logit model has been built

- The model combines in its structure:
  - *revealed and stated preference data*
  - *3 transport modes: lorry, rail and sea transport (the last 2 are in the nested structure)*
  - *data originating from 3 independent projects*

Modelling approach - new ideas

- To include some extra SP-specific variables in the model estimation *(i.e., flexibility and information system)*

- To find a method how these variables and their estimates can be applied in the forecasts

- To combine data from different sources in the model estimation

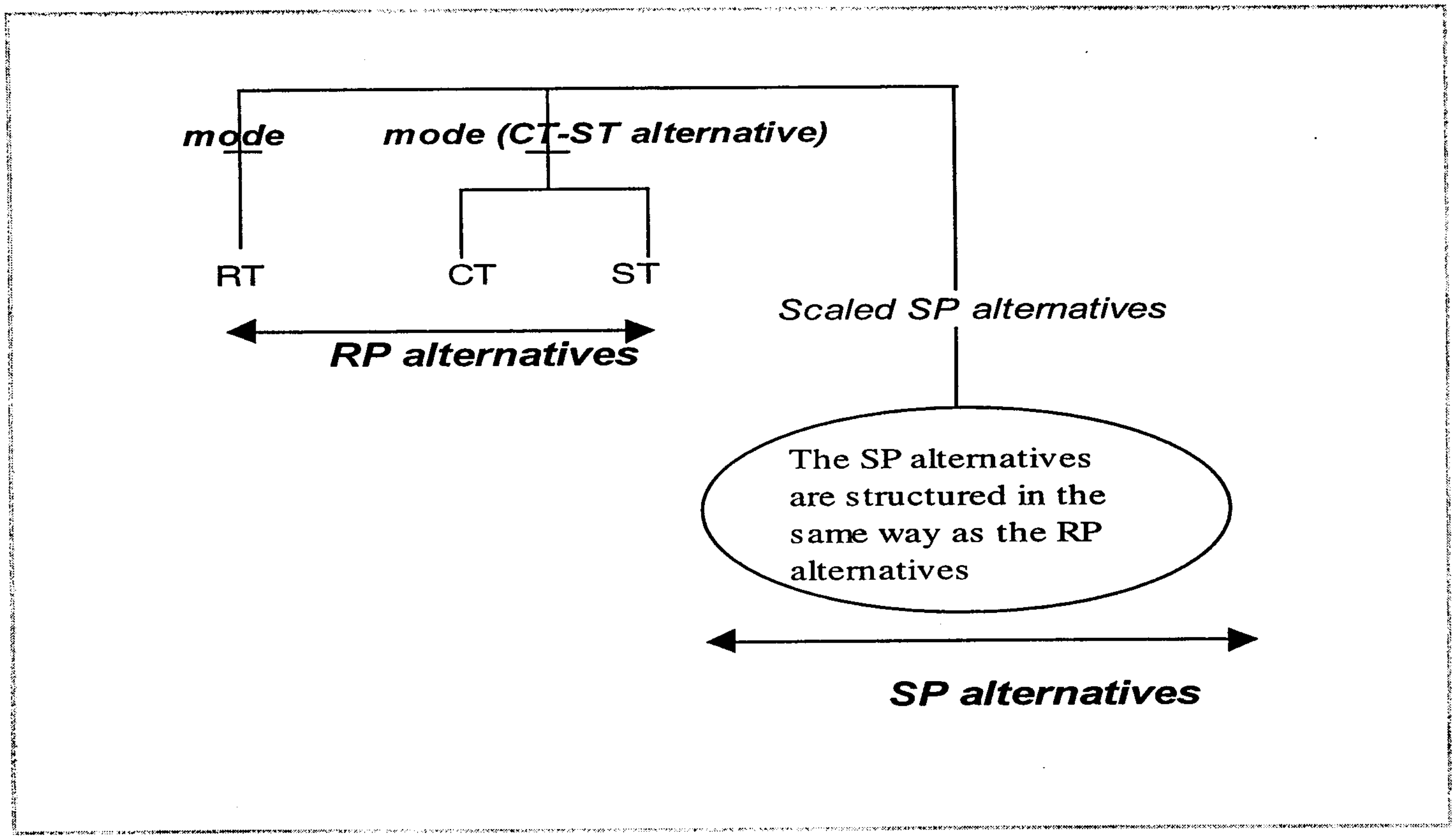
Modelling approach - applied data

Project	Year	RP data	SP data
The Nordic-Link Project	1996	1 set	1 within mode SP data 2 across mode SP data
Parameters of Quality of Goods Transport Project	1997	1 set	3 within mode SP data 1 across mode SP data
Potential of Sea Transport Project	1993	0	3 within mode SP data

Total of 11337 observations: 1012 RP + 10325 SP observations

- 847 RP respondents are road-transport users
- 90 RP respondents are rail-transport users
- 75 RP respondents are sea-transport users

Modelling approach - the model structure



- 7 SP scaling parameters are estimated
- 1 mode parameter (for both RP and SP data) is estimated

Modelling approach - the model structure

Variables	*Variables' units*	*Variables source*
Transport cost	*Door-to-door transport cost in DKK*	*RP and SP data*
Transport time	*Door-to-door transport time in hours*	*RP and SP data*
Risk of damage	*Per mille of the risk of the shipment being damaged at destination*	*RP and SP data*
Risk of delay	*Percent of the risk of the shipment being delayed at destination*	*RP and SP data*
Trans. frequency	*Number of weekly departures for rail and sea transports*	*RP and SP data*
Information system	*A descriptive variable in 2 levels:* *1. Low level of information* *2. High level of information*	*SP data*
Flexibility	*A descriptive variable in 2 levels:* *1. Low level of flexibility* *2. High level of flexibility*	*SP data*

Modelling approach - the model structure

Linear Logit Model

$U_i = V_i + e_i$; in the logit model 'e_i' is a random error with double-exponential (or Gumbel) distribution

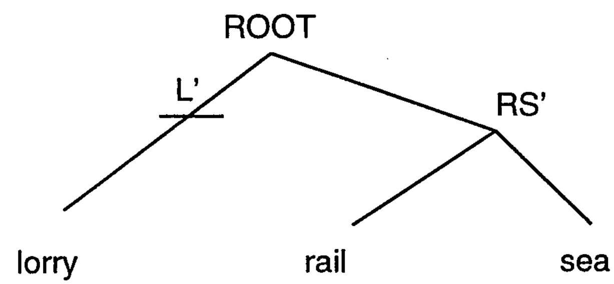
$$V_i = \beta_{time} * \text{Time Variable}_{(i)} + \beta_{cost} * \text{Cost Variable}_{(i)}$$
$$+ \beta_{damage} * \text{Damage Variable}_{(i)} + \beta_{delay} * \text{Delay Variable}_{(i)}$$
$$+ \beta_{frequency} * \text{Frequency Variable}_{(i)}$$
$$+ \beta_{flexibility\ (SP\ only)} * \text{Flexibility Variable}_{(i)}$$
$$+ \beta_{information\ (SP\ only)} * \text{Information-System Variable}_{(i)}$$

β parameters are estimated by the maximum-likelihood method

$p_{(i)} = \exp(V_i)/\Sigma_j [\exp(V_j)]$; 'j' is a number of alternatives

Modelling approach - the model structure

Nested Logit Model



deterministic parts of the utilities for lorry, rail and sea are:

$V_{l,r,s} = \Sigma_n \beta_n * X_{n\,(l,r.s)}$; 'n' is a number of variables

deterministic parts of the utility for L':

$V_{L'} = \Theta * \ln(\exp(V_l)) = \Theta * V_l$; Θ is a mode parameter to be estimated ($0 < \Theta < 1$)

deterministic parts of the utility for RS' alternative is:

$V_{RS'} = \Theta * \ln(\exp(V_r) + \exp(V_s))$

$p_{(RS')} = \exp(V_{RS'})/[\exp(V_{RS'}) + \exp(V_{L'})]$
$p_{(r|RS')} = \exp(V_r)/[\exp(V_r) + \exp(V_s)]$
$p_{(r)} = p_{(r|RS')} * p_{(RS')}$

Modelling approach - estimation method

Step 1: Estimation of trade-off coefficients (β parameters)

- both RP and SP data used, simultaneously
- scaling factor applied to SP utilities to take account of different error variance between RP and SP data
- cost variable is common for all data sets, both RP and SP data
- separate ASCs estimated for each data set
- estimation carried out using disaggregate, unweighted data records

Step 2: Re-estimation of observed mode constants (RP data only)

- trade-off coefficients are constrained to values estimated in Step 1
- resulting alternative-specific constants reflect observed mode shares

Modelling approach - estimation results

Parameters	Model for Low Value Commodities		Model for High Value Commodities	
	Estimates	t-values	Estimates	t-values
Travel Cost	-0.0003790	-3.50	-0.00050950	-3.90
Travel Time	-0.0053360	-3.30	-0.02344000	-4.70
Risk of Damage	-0.0260900	-2.70	-0.06400000	-4.00
Risk of Delay	-0.0359400	-3.00	-0.07083000	-3.50
Travel Frequency	0.0590800	3.10	0.13560000	2.70
Flexibility	0.1447000	2.40	0.11560000	1.50
Information System	0.2092000	2.40	0.06900000	0.70

$\Theta \sim 1$ for low value commodities

$\Theta \sim 0.5$ for high value commodities

Modelling approach - estimation results

Value of	Unit	LV comm.	HV Comm.
Travel Time	DKK/hr	14.08	46.01
Risk of Damage	DKK/per mille of damage	68.84	125.61
Risk of Delay	DKK/per cent of delay	94.83	139.02
Travel Frequency	DKK/no. of weekly departures	155.88	266.14
Flexibility	DKK/per level of service	381.79	226.89
Information System	DKK/per level of service	551.98	135.43

LV Comm. = Low Value Commodities
HV Comm. = High Value Commodities

Modelling approach - calibration

- The models are calibrated for the Danish Export/Import per transport mode and commodity type in 1995, in millions of tons.

- The ASCs are adjusted by correction-terms in the calibration phase. The correction terms for each transport mode was calculated iteratively by the following formula:

Correction term = Old correction term + ln(95 observed value / model result)

- *Flexibility* and *Information S*. variables are attached to the RP records with values of 1.6, for lorry, and 1.0 for rail and sea transports. The ranges of these variables are from 1 to 2.

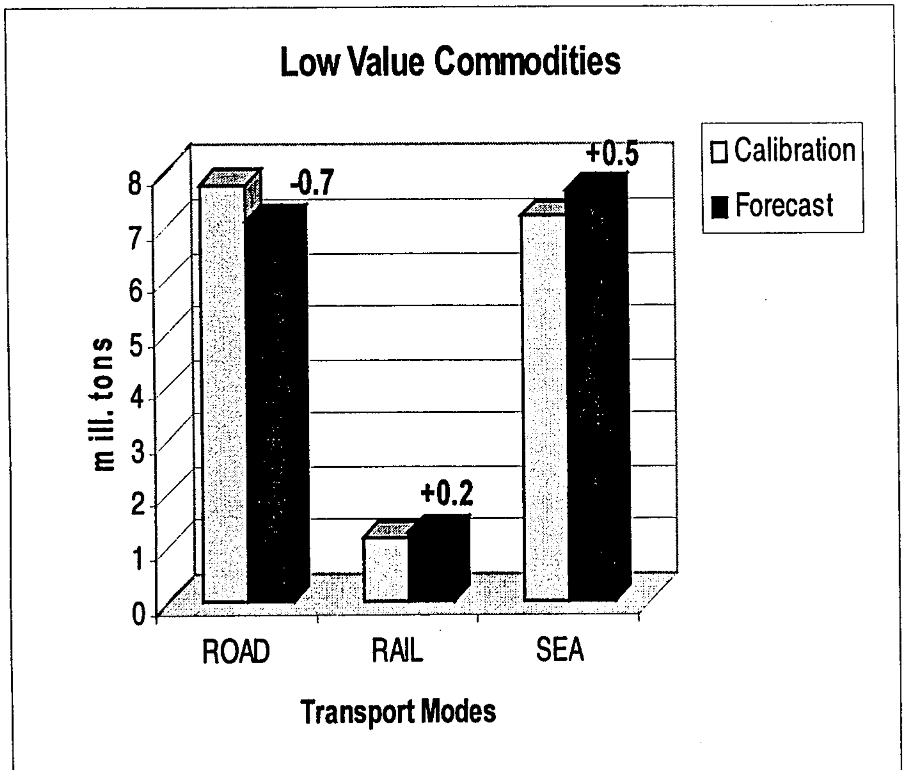
Modelling approach - calibration

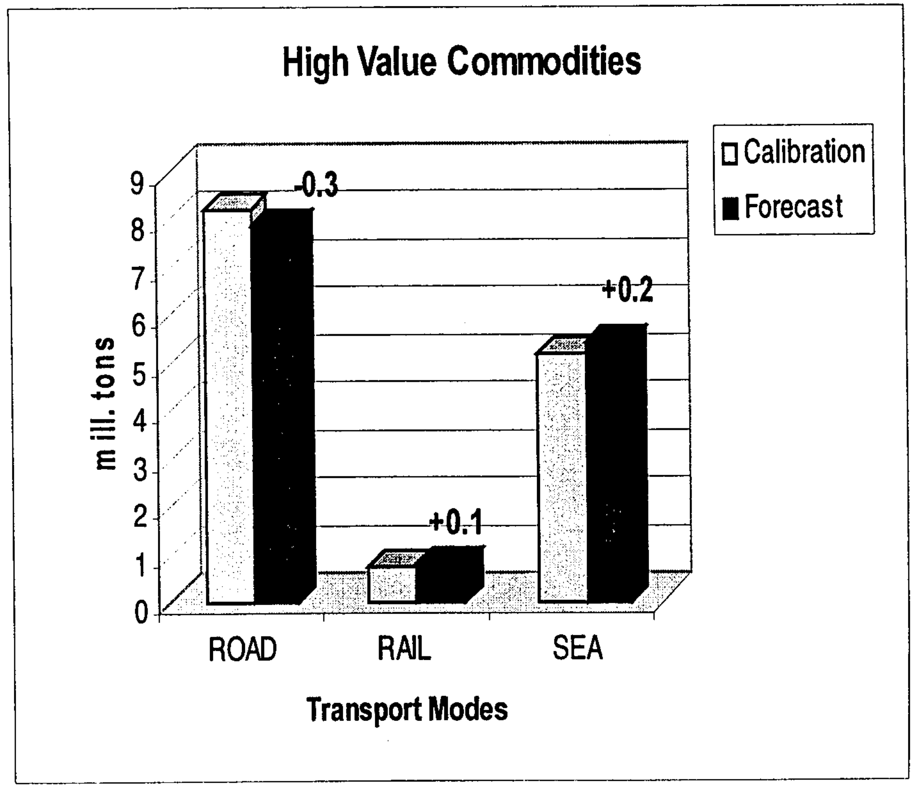
Values of the ASCs before and after model calibration, in both segments

Transport Modes	Low Value Commodities		High Value Commodities	
	Before calibration	After calibration	Before calibration	After calibration
Road Transport	0.000	-0.100	0.000	-0.480
Rail Transport	-0.240	-1.110	-1.180	-1.970
Sea Transport	0.003	0.410	-0.920	0.300

Modelling approach - forecasts

Forecasting results for a scenario where lorry costs have increased for 10%





Modelling approach - forecasts

- *Transport cost* and *time* are far most important variables in both segments in the mode choice. *Risk of damage* and *delay* are of the secondary importance. Finally, *flexibility* and *information system* are of the least importance in the mode choice.

- The biggest share of the road-transport tons shifts to sea transport and the smallest share shifts to rail transport.

Conclusions

- Modelling approach:
  - It is possible to combine RP and SP data in a single model structure. If properly scaled, the SP data will help the estimations in such models
  - It is possible to combine data from different sources in a single model structure. One must take care of differences of the explanatory variables in different data sets. It is theoretically important that at least one variable (say cost) exist in each of the data sets
  - SP specific variables can be applied in both calibration and forecasts

Conclusions

- Forecasting results:
  - Sea transport is more competitive to lorry transport than rail transport, in the Danish international goods transport
  - *Transport cost* and *time* are the most important variables to decide the mode choice, in the Danish international goods transport

Conclusions

- Problems:
  - 1. Data:
    - A lot of care must be taken when collecting data, especially in the planning phase. The quality of data is essential for good model results
    - Disaggregated data in the project refer to shipments while we calibrated the models to number of tons
    - Weight factors are not available in the RP data
  - 2. Methodology:
    - Estimates for *transport cost* and *time* are constants which leads to a constant VOT. But VOT in its nature is not constant - it is somehow distributed (normally or log-normally).

Matts Lundin, Temaplan, Sverige

Kostnadsfunksjoner i aggregerte modeller

Cost functions in aggregated models

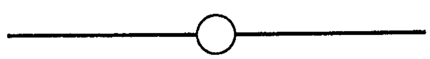
$$C_{Tot}^{Link+Transfer} = \alpha_1 C_1 + \alpha_2 C_2 + \alpha_3 C_3$$

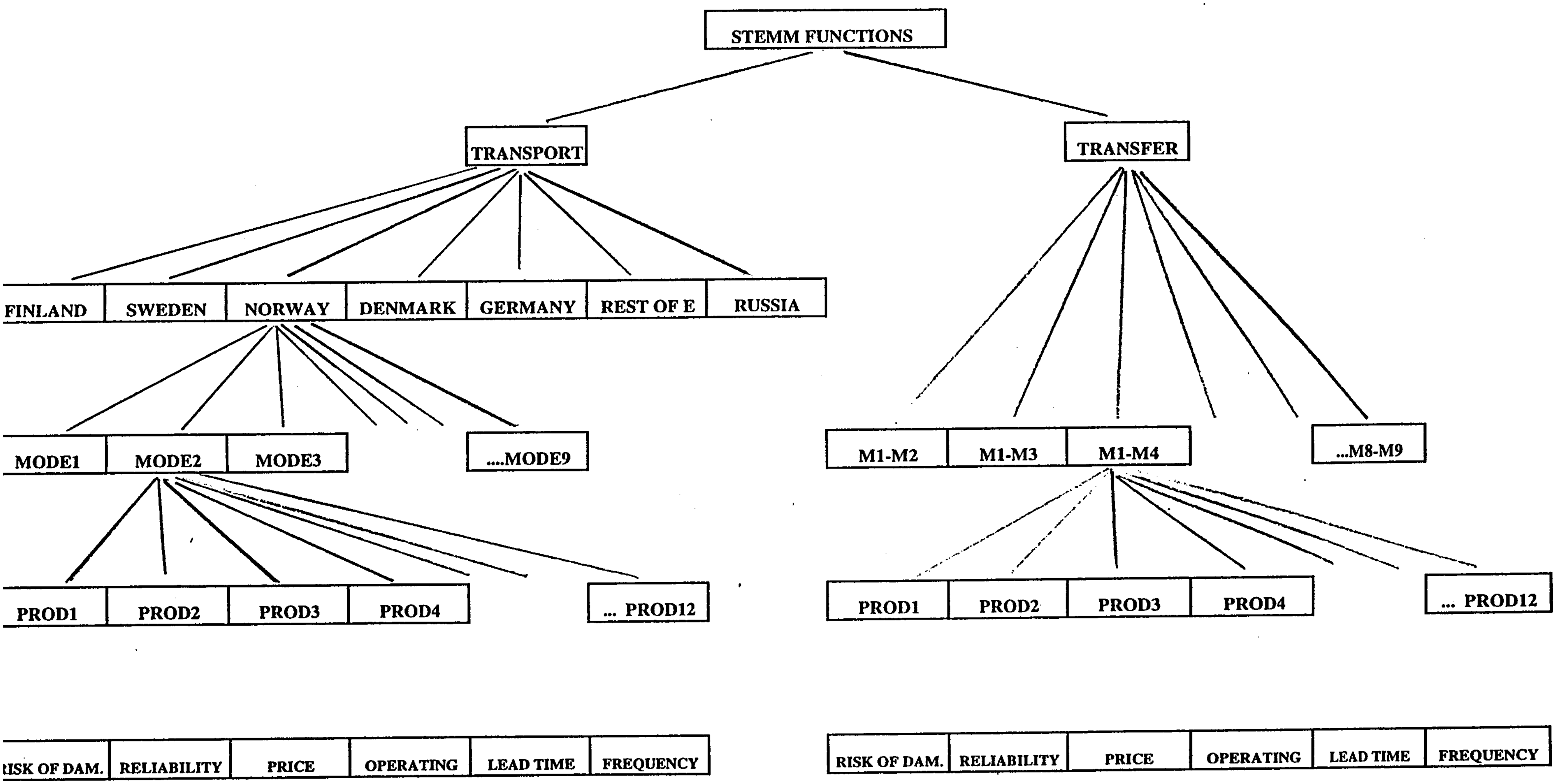
mode 1

Link:

mode 1 mode 2

Transfer:





STEMM FUNCTIONS
TRANSPORT
TRANSFER
FINLAND
SWEDEN
NORWAY
DENMARK
GERMANY
REST OF E
RUSSIA
MODE1
MODE2
MODE3
....MODE9
PROD1
PROD2
PROD3
PROD4
... PROD12
RISK OF DAM.
RELIABILITY
PRICE
OPERATING
LEAD TIME
FREQUENCY
M1-M2
M1-M3
M1-M4
...M8-M9
PROD1
PROD2
PROD3
PROD4
... PROD12
RISK OF DAM.
RELIABILITY
PRICE
OPERATING
LEAD TIME
FREQUENCY

Components in STAN cost functions in the STEMM project

Mode and route choice:
A: Risk of damage
B: Reliability
C: Price inventory
D: Operations cost
E: Lead time
F: Frequency

	Factor	Include	Link	Transfer
A	Risk of damage	Losses and damage. Risk in temperature contr.		
B	Reliability	Door-to-door, JIT		
C	Price	Costs for inventory on wheels		
D	Operating costs	Transport and handling costs		
E	Lead time	Total transport time		
F	Frequency	Only sea links		

- Each product has a **weight** for **each cost factor** that describes how much it differs from the average value.
- **Metal products** is an **average product** in the model.
- The **average cost** can be quite well described with this product.

Components in STAN cost functions in the STEMM project.

Estimation of the weights for each product:

	Factor	Source
A	Risk of damage	Finnish customs Statistics of insurance
B	Reliability	ITS Leeds studies
C	Price	Value data from Finnish Customs Statistics
D	Operating costs	Finnish Customs Statistics of freight costs for Finnish import
E	Lead time	ITS Leeds studies
F	Frequency	ITS Leeds studies

OMMODITY	RISK OF DAMAGE A	RELIABILITY B	PRICE (inventory) C	OPERATING COSTS D	LEAD TIME E	FREQUENCY (sea transport) F
FOOD AND LIVE ANIMALS						
BEVERAGES AND TOBACCO						
CRUDE MATERIALS, INEDIBLE, EXCEPT FUELS						
MINERAL FUELS, INEDIPLE, EXPECT FUELS						
ANIMAL AND VEGETABLE OILS, FATS AND WAXES						
CHEMICALS AND RELATED PRODUCTS						
PAPER, PAPERBOARD AND ARTICLES OF PAPER PULP, PAPER OR PAPER B						
METAL PRODUCTS						
MANUFACTURED GOODS						
) MACHINERY						
l MISCELLANEOUS MUFACTURED ARTICLES						
2 VALUABLE MACHINERY AND MANUFACTURED ARTICLES						

Estimation of up-data in STAN cost functions in the STEMM project

Commodity	Risk	Reliability	Price	Operating	Lead time	Frequency
1	0.69	1.82	0.28	0.55	1.19	1.19
2	1.05					
.						
.						
8 Metal products	0.63		~~0.35~~	0.35		
.						
.						
.						
12						1.47
Mean value	1.00	1.00	1.00	1.00	1.00	1.00

	0.46	0.62	0.51	1.00	0.46	0.34

Commodity	Risk	Reliability	Price	Operating	Lead time	Frequency
1	0.50 1)	2.05	0.49	1.58	0.88	0.65
2	0.77					
.						
.						
8 Metal products	0.46			1.00		
.						
.						
.						
12						0.81

1) Example: (Normative value vertical) * (Normative value horizontal) based on metal products = 0.69/0.63 * 0.46 = 0.50

These data will be stored as product user data (up1, up2, up3) and used as parameters in the cost function. For each commodity six parameter values will be defined in three up-parameters.

Example: Commodity 1: up1 = 050205 Risk + Rel.

up2 = 049158 Price + Op.

up3 = 088065 Lead + Fr.

Otto Anker Nielsen,
Scanrail Consult, Danmark

Assignment prosedyrer

Assignment procedures

ASSIGNMENT PROCEDURER

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1 INTRODUKTION

2. 'Traditionelle' assignmentmodeller

3. Udvidede rejsemodstandsfunktioner

4. Håndtering af forskellige præferencer

5. Modeller for flere trafikantklasser

6. Praktiske erfaringer, Ørestadsmodellen

7. Praktiske erfaringer, Havnetunnelprojektet

8. Konklusioner

PRAKTISKE ERFARINGER

- Lastbiltrafik til og fra Københavns Havn
- Transportrådets GIS-T projekt
- Gamle Havnetunnelprojekt
- Ørestadsmodellen
- Betalingsring og bompenge
- Nye Havnetunnelprojekt

1. Introduktion

SAMARBEJDSPARTER

IFP/ScanRail:

- Nikolaj Simonsen (data, implementering & test)
- Erik Rude Nielsen (data & test)

TetraPlan:

- Rasmus Dyhr Frederiksen (data, implementering & test)
- Christian Overgaard Hansen (faglige diskussioner)
- Jan Holm (test)

Hague Consult:

- Andrew Daly (estimering)
- Charlene Rohr (estimering)
- Tom van Vuren (faglige diskussioner)

2. 'TRADITIONELLE' ASSIGNMENTMODELLER

ALT ELLER INTET:

- Trafikken afvikles frit uden nogen form for forsinkelser
- Trafikanterne har fuldt kendskab til trafiknettet
- Alle trafikanter er ens og har samme præferencer

MODELLER FOR BRUGER LIGEVÆGT:

Rejsetiden – eller mere generelt rejse-modstanden - afhænger af trafik-mængden (Sheffi, 1985):

En ligevægt opnås hvor ingen trafi-kants rejsetid kan formindskes ved, at den pågældende alene skifter rute

Den enkelte trafikant minimerer sin rejsetid

2. 'Traditionelle' assignmentmodeller

Formalistisk beskrivelse:

$$T_{ijar} = \min_R \left[U = \sum_{a \in R} t_a \right]$$

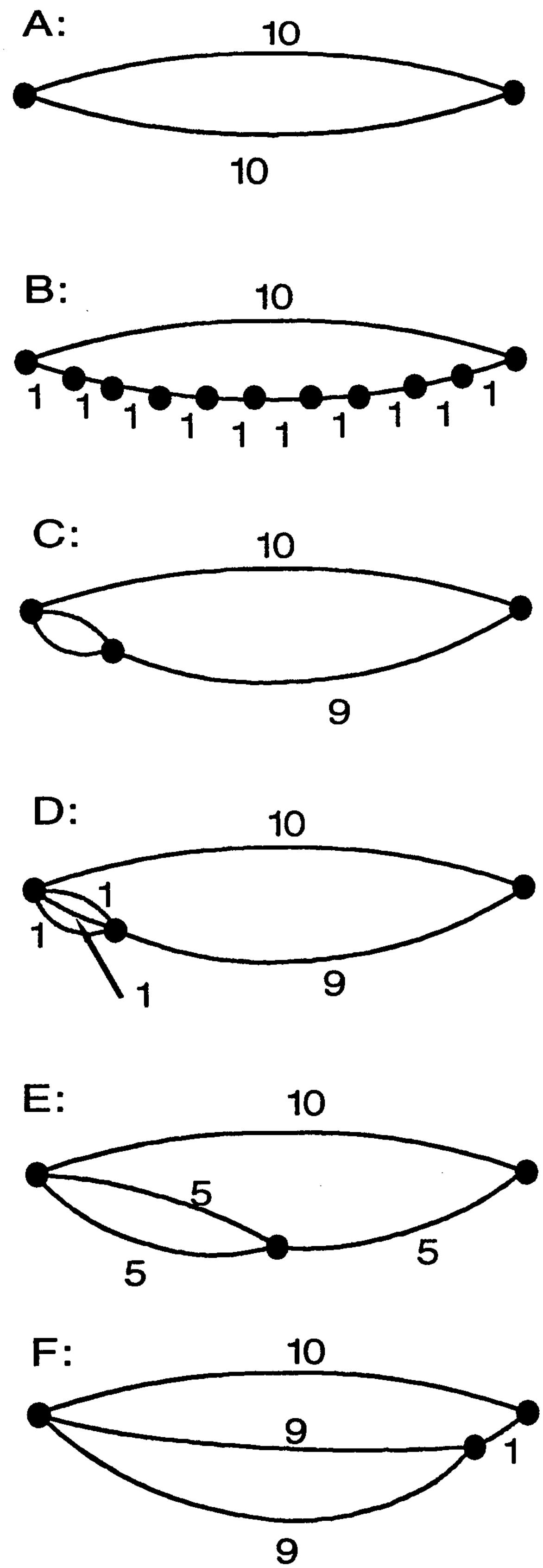
$$hvor \quad t_a = f\left(T_a, t_{a(0)}\right)$$

Eller med en simplere notation:

$$U_a = t_a$$

$$hvor \quad t_a = f\left(T_a, t_{a(0)}\right)$$

2. 'Traditionelle' assignmentmodeller



<u>Stokastiske modeller</u>

Trafikanterne har ikke fuldt kendskab til nettet. Afhængigt af antagelser om stokastik fås

- En Logitmodel (Dial, 1971)
- En Probitmodel (Daganzo & Sheffi, 1977 + Sheffi & Powell, 1981)

2. 'Traditionelle' assignmentmodeller

Formalistisk beskrivelse:

$$T_{ijar} = \min_{R} \left[U = \sum_{a \in R} \left(t_{a(0)} + \varepsilon_a \right) \right]$$

Eller med en simplere notation:

$$U_a = t_a + \varepsilon_a$$

MODELLER, DER BÅDE ER STOKASTISKE OG TRAFIKAFHÆNGIGE (SUE)

Stokastisk Bruger Ligevægt tager udgangspunkt i principperne om probit-baseret vejvalg, men inddrager også trafikafhængige strækningsrejse-modstande (Daganzo & Sheffi, 1977):

> *En ligevægt opnås hvor ingen trafikants opfattede rejsemodstand kan formindskes ved, at den pågældende alene skifter rute'*

Den enkelte trafikant minimerer sin oplevede rejsemodstand

2. 'Traditionelle' assignmentmodeller

Formalistisk beskrivelse:

$$T_{ijar} = \min_{R}\left[U = \sum_{a \in R} \left(t_a + \varepsilon \right) \right]$$

$$hvor \quad t_a = f\left(T_a, t_{a(0)}\right)$$

Eller med en simplere notation

$$U_a = t_a + \varepsilon_a$$

$$hvor \quad t_a = f\left(T_a, t_{a(0)}\right)$$

PROBIT-BASERET VEJVALG (SUE):

1. Enkeltstrækningers rejsemodstande opfattes individuelt af trafikanterne
2. Strækninger med samme rejse-modstande har samme sandsynligheds-fordeling af opfattede rejsemodstande
3. De enkelte strækningers opfattede rejsemodstande, $c_{a(\varepsilon)}$, er normal fordelte efter følgende funktion:

$$c_{a(\varepsilon)} \in \Phi\left(c_a, err \cdot c_a\right)$$

Successive Gennemsnits metode er løsningsalgoritme, fordelinger Monte Carlo Simuleres (Sheffi & Powell, 1982)

SIMULERING AF OPFATTEDE REJSEMODSTANDE:

- Rejsemodstande antages som regel at være normal fordelte
- Men, opfattede rejsemodstande bør aldrig være negative
- Andre fordelinger, der med tilstrækkeligt mange simulationer tilnærmer normalfordeling, kan også benyttes (Nielsen, 1997)

Gammafordelingen har dog vist sig at give de bedste resultater

3. UDVIDEDE REJSEMODSTANDS-FUNKTIONENER

- Trafik i én retning påvirker trafik i den anden
- Forsinkelser i vejkryds, hvor sving-bevægelser påvirker hinanden (Nielsen m.fl. 1997 & 1998)

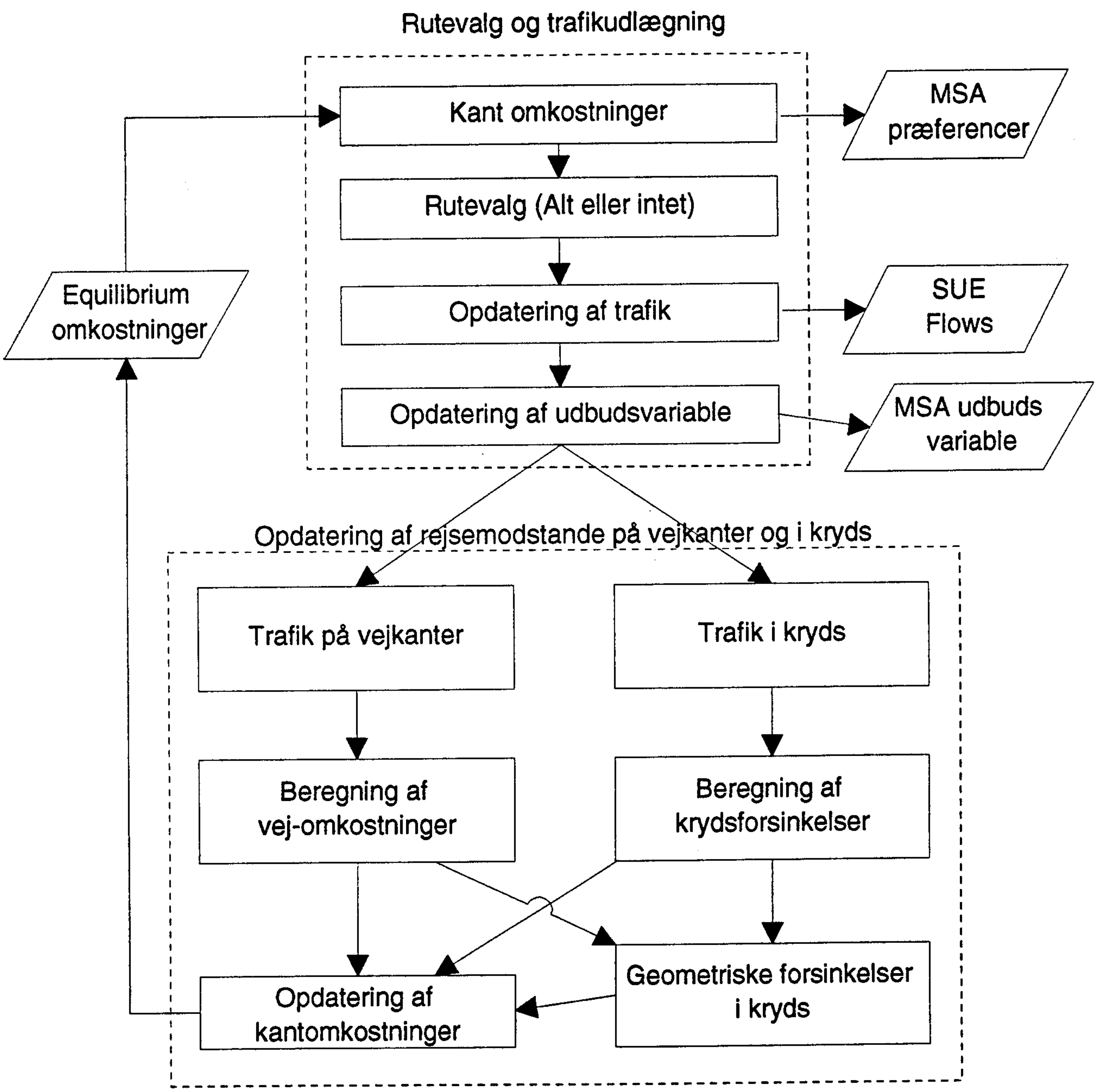
Med den simple notation

$$U_a = t_a + \varepsilon_a$$

$$hvor \quad t_a = f\left(\overline{T_a}, \overline{t_{a(0)}}\right)$$

3. Udvidede rejsemodstandsfunktioner

MODELOVERBLIK:



SPEED-FLOW KURVER FOR STRÆKNINGER:

Den generaliserede BPR-formel benyttes (Horowitz, 1997):

$$t_a = t_{(0)a} \cdot \left(1 + \alpha_a \cdot \left(\frac{T_{a(fremad)} + \gamma \cdot T_{a(tilbage)}}{T_{(kap)a}}\right)\right)$$

FORSINKELSER I VEJKRYDS:

Ikke-signalregulerede kryds (prioriterede kryds og rundkørsler):

Samlet forsinkelse = decelerations-forsinkelse + kø-forsinkelse + ventetid for plads til fremkørsel + accelerations-forsinkelse

- Svingkapaciteter følger Harders (1976) gap acceptance model
- En kø-model bruges til at estimere forsinkelse indenfor kapacitetsgrænserne
- Austroads (1993) bruges når trafik-mængden er i nærheden af kapaciteten

Signalregulerede kryds:

Samlet forsinkelse = decelerations-forsinkelse + kø-forsinkelse + ventetid for grønt lys + ventetid for plads til fremkørsel + accelerations-forsinkelse

- Akcelik's (1996) forsinkelsesmodel benyttes for trafikmængder både under og over afviklingskapaciteten
- En model for koordineret ankomst beskriver effekterne af grønne pil og koordinerede signaler (grønne bølger)

Geometriske forsinkelser:

Semmens (1985a & b) med modifikationer fra Frederiksen & Simonsen (1997):

- Den geometriske forsinkelse afhænger af reguleringsform og svingforløb
- Sving modelleres forskellige i prioriterede og signalregulerede kryds
- Den geometriske forsinkelse afhænger også af hastighederne på til- og frafartskanten

4. HÅNDTERING AF FORSKELLIGE PRÆFERENCER

Egentlig nyttefunktion (Nielsen, 1994):

$$U_a = \left(\beta \cdot c_a + \nu \cdot t_a \right) + \varepsilon_a$$

$$hvor \quad t_a = f\left(\overline{T_a}, \overline{t_{a(0)}} \right)$$

Udvidet nyttefunktion med stokastiske koefficienter (Nielsen, 1996):

$$U_a = \left(\beta + \xi_\beta\right) \cdot c_a + \left(\nu + \xi_\nu\right) \cdot t_a + \varepsilon_a$$

$$hvor \quad t_a = f\left(\overline{T_a}, \overline{t_{a(0)}}\right)$$

Tilsvarende diskrete valgmodeller er tidligere udviklet af Ben-Akiva, Bolduc & Bradley (1993)

For assignment dækker koefficienterne over præferencer, mens ε_a er en vektor for manglende kendskab til trafiknettet (uendeligt mange valgmuligheder)

SANDSYNLIGHEDSFORDELINGER FOR PRÆFERENCER

- Sandsynlighedsfordelingerne for præferencevægte behøver ikke at være reproduktive
- Trunkerede sandsynlighedsfordelinger giver bias mod bestemte ruter
- Derfor anbefales det at benytte ikke-negative sandsynlighedsfordelinger for alle præferencevægte

LogNormal og Gamma fordelinger giver sammenlignelige resultater

5. HVORFOR BRUGE STOKASTISKE VEJVALGSMODELLER FOR FLERE TRAFIKANTKLASSER?

- bolig-arbejdsstedsrejsende samt fragtkørsel kan have bedre viden om vejnettet end andre rejsende
- Erhversrejsende har generelt en højere tidsværdi end andre rejsende
- Rejsende med samme formål kan have forskellige tidsværdier
- Lastbiler accelererer, decelererer og drejer langsommere end personbiler
- Efterspørgselsmodeller har typisk en flertrafikantklasse-struktur

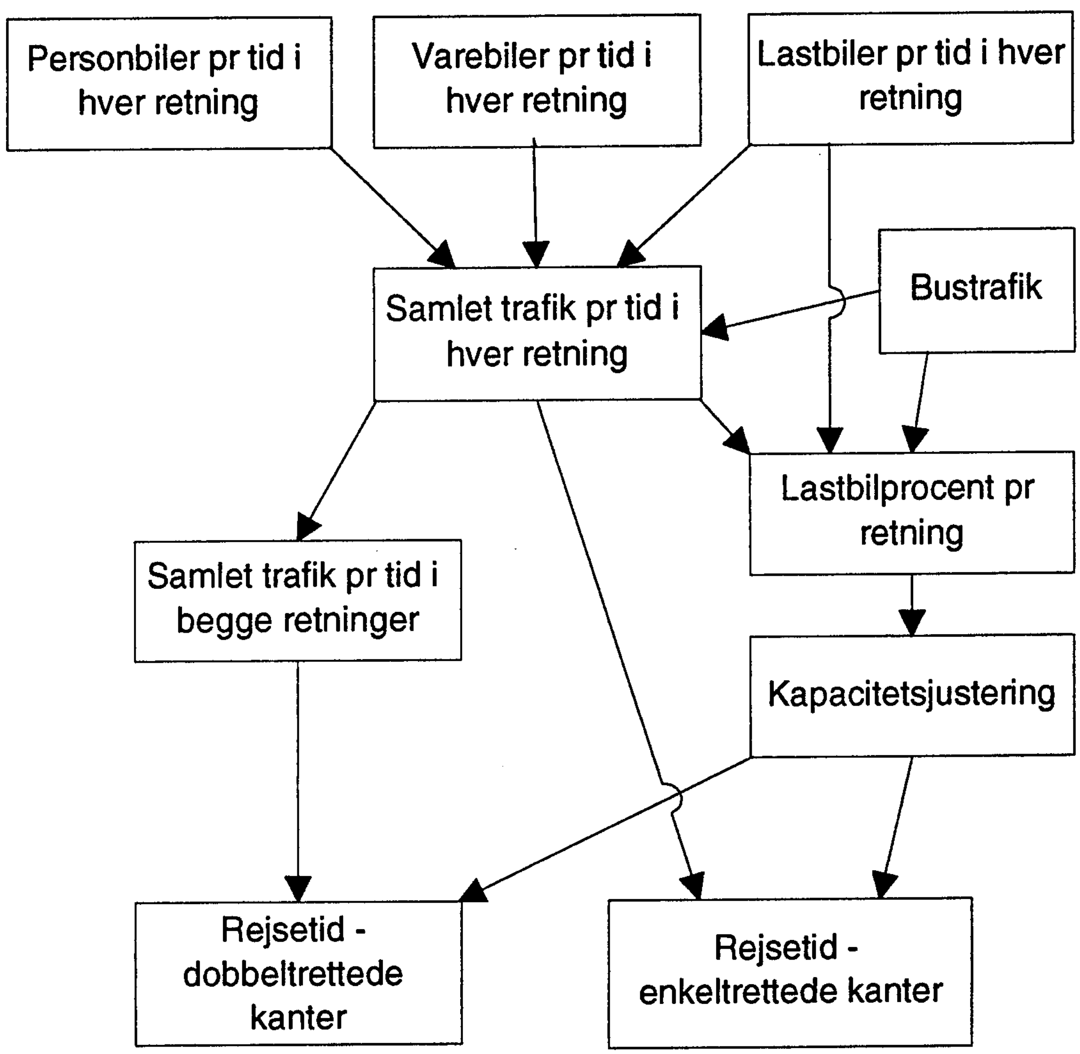
STOKASTISK VEJVALG FOR FLERE TRAFIKANTKLASSER:

En ligevægt opnås, hvor ingen trafikants opfattede rejsemodstand, bestemt af trafikantklassens nyttefunktioner og af køretøjets type, kan formindskes ved at den pågældende alene skifte rute' (Nielsen, 1998)

$$U_{ak} = \left(\beta_k + \xi_{\beta k}\right) \cdot c_{ak} + \left(\nu_k + \xi_{\nu k}\right) \cdot t_{ak} + \varepsilon_{ak}$$

$$hvor \quad t_{ak} = f\left(\overline{\overline{T_{ak}}}, \overline{\overline{t_{ak(o)}}}\right)$$

BEREGNING AF FORSINKELSER



TEORETISK GRUNDLAG:

- Probit-baseret Stokastisk Bruger Equilibrium
- Hver trafikantklasse vælger ruter efter deres nyttefunktioner
- Der er variationer i de rejsendes præferencer indenfor hver trafikant-klasse
- Der er variationer i de rejsendes nyttefunktioner indenfor hver trafikant-klasse
- Rejsende påvirker hinanden på tværs af trafikantklasser via forsinkelse på vejstræk og interaktion i kryds

6. PRAKTISKE ERFARINGER, ØRESTADSMODELLEN:

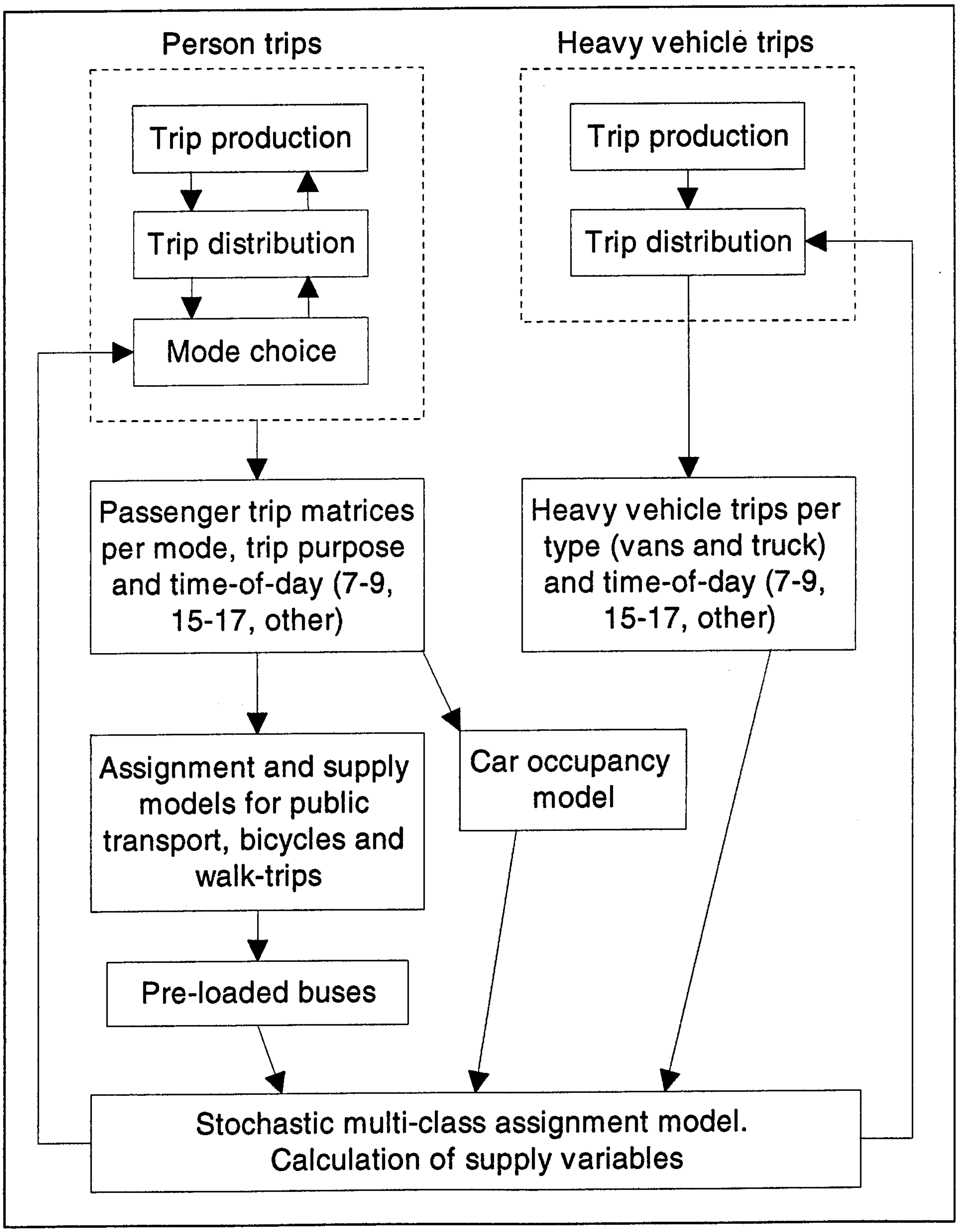
- 2,369 knuder/kryds
- 3,462 vejstræk

Dette resulterer i:

- 6,108 enkeltrettede kanter (frem- og tilbagerettede)
- 12,073 'pseudo-knuder'
- 19,111 svingbevægelser

Turmatricerne for 5 turformål, opdelt i 3 døgnperioder, har hver 297x297 = 88.209 elementer

DET SAMLEDE MODELSYSTEM:



KALIBRERING AF MODELLEN:

1. Speed-flow kurver blev estimeret ud fra køreforsøg

2. Krydsmodellerne benyttede parametre, fra tidligere studier

3. Præferencevægtene for hver trafikantklasse blev fastslået på basis af eksisterende undersøgelser og opgørelser

4. Sandsynlighedsfordelingerne for præferencevægtene og opfattede rejsemodstande blev kalibreret ud fra trafiktællinger og kendte rutebundter

5. Modellerede rejsetider og kryds-forsinkelser blev sammenlignet med målinger
6. Modelkomplekset benytter en såkald pivot-matrix justering af resultatet af den hierarkiske logit model for turfordeling og valg af transportmiddel
7. Resten af modelkomplekset blev re-estimeret

KONVERGENS AF VEJVALGSMODELLEN

To typer konvergenstest er foreslået i litteraturen (f.eks. van Vuren, 1994):

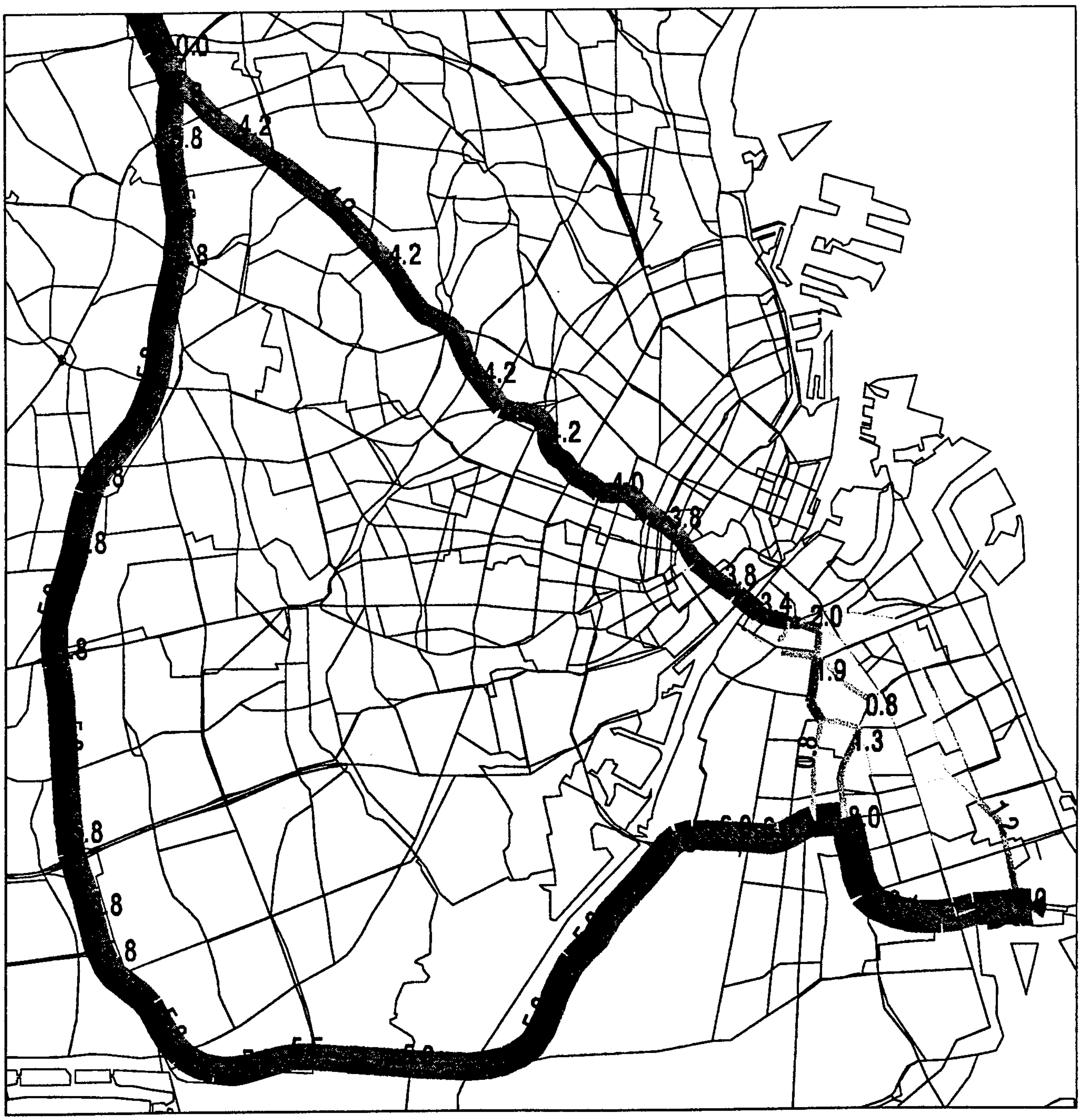
1. Sammenlign resultatet af de sidste to observationer
2. Sammenlign resultater med tællinger og målinger

Som et supplement kan modellen køres to gange, og resultaterne kan sammenlignes

Disse kriterier garanterer ikke en "god model" (Nielsen, 1996)

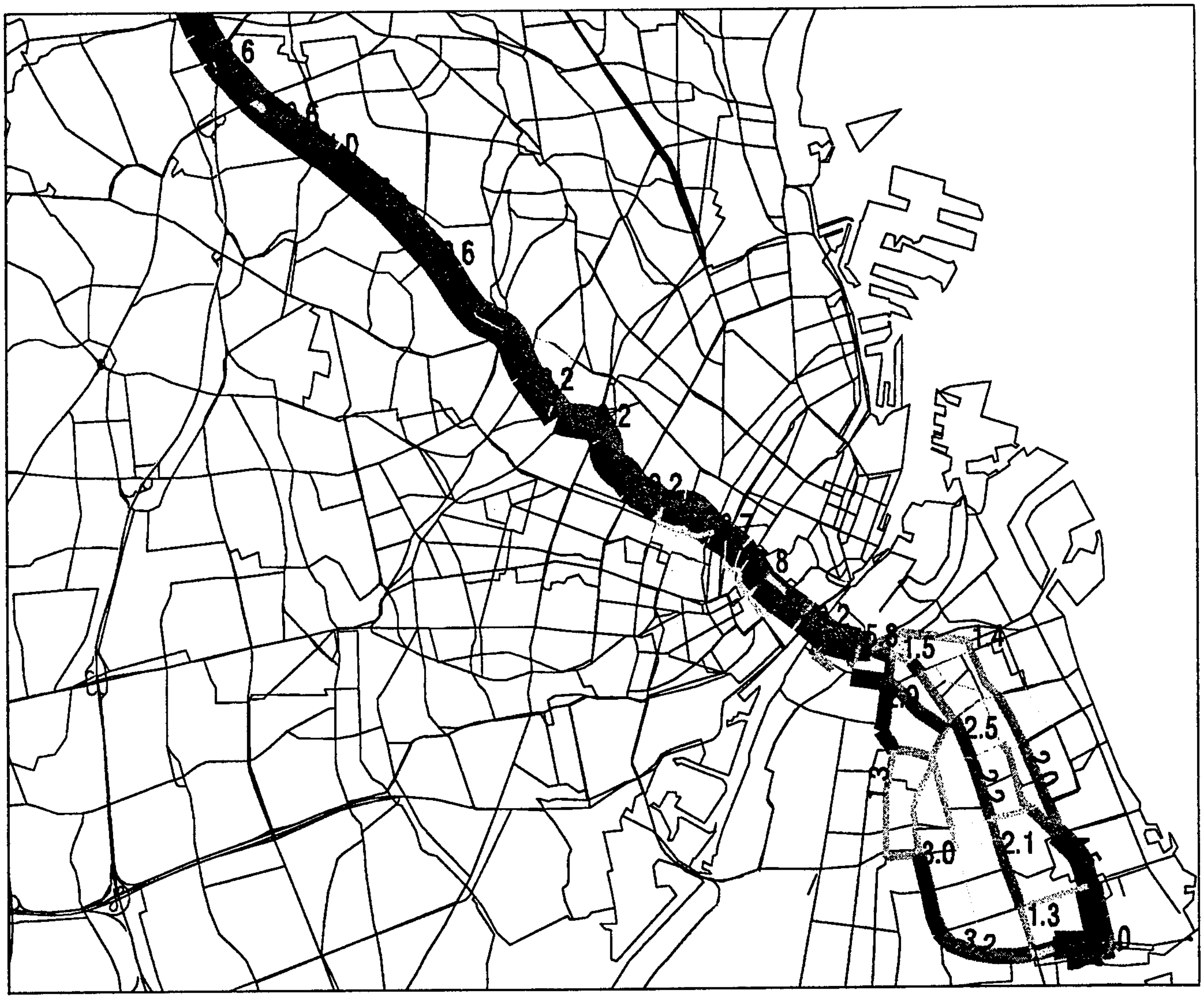
KONSEKVENSER FOR UDVALGTE RUTEBUNDTER

Bolig-Arbejdstedstrafik, morgen:



6. Praktiske erfaringer, Ørestadsmodellen

Andre personbilture:

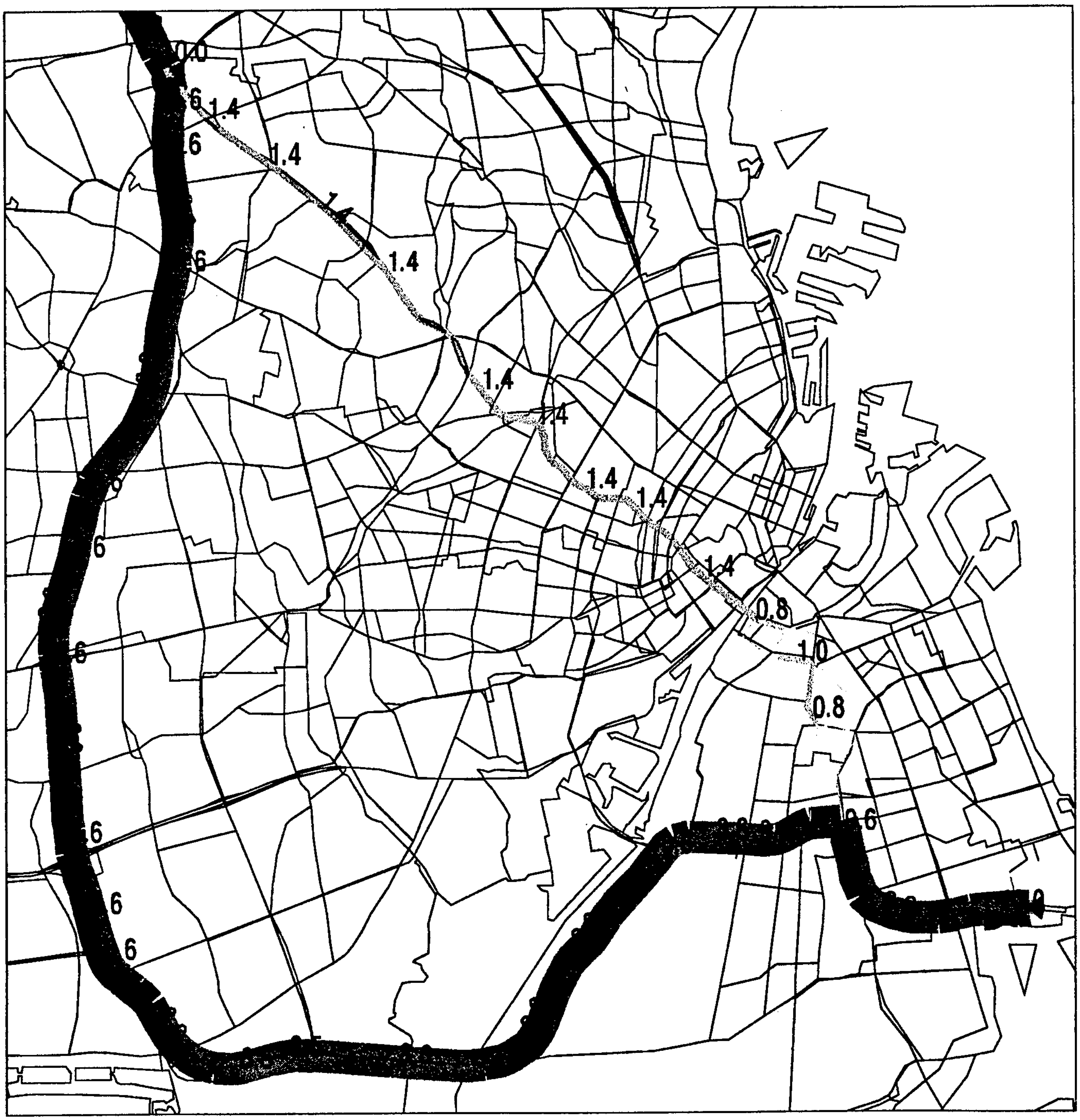


6. Praktiske erfaringer, Ørestadsmodellen

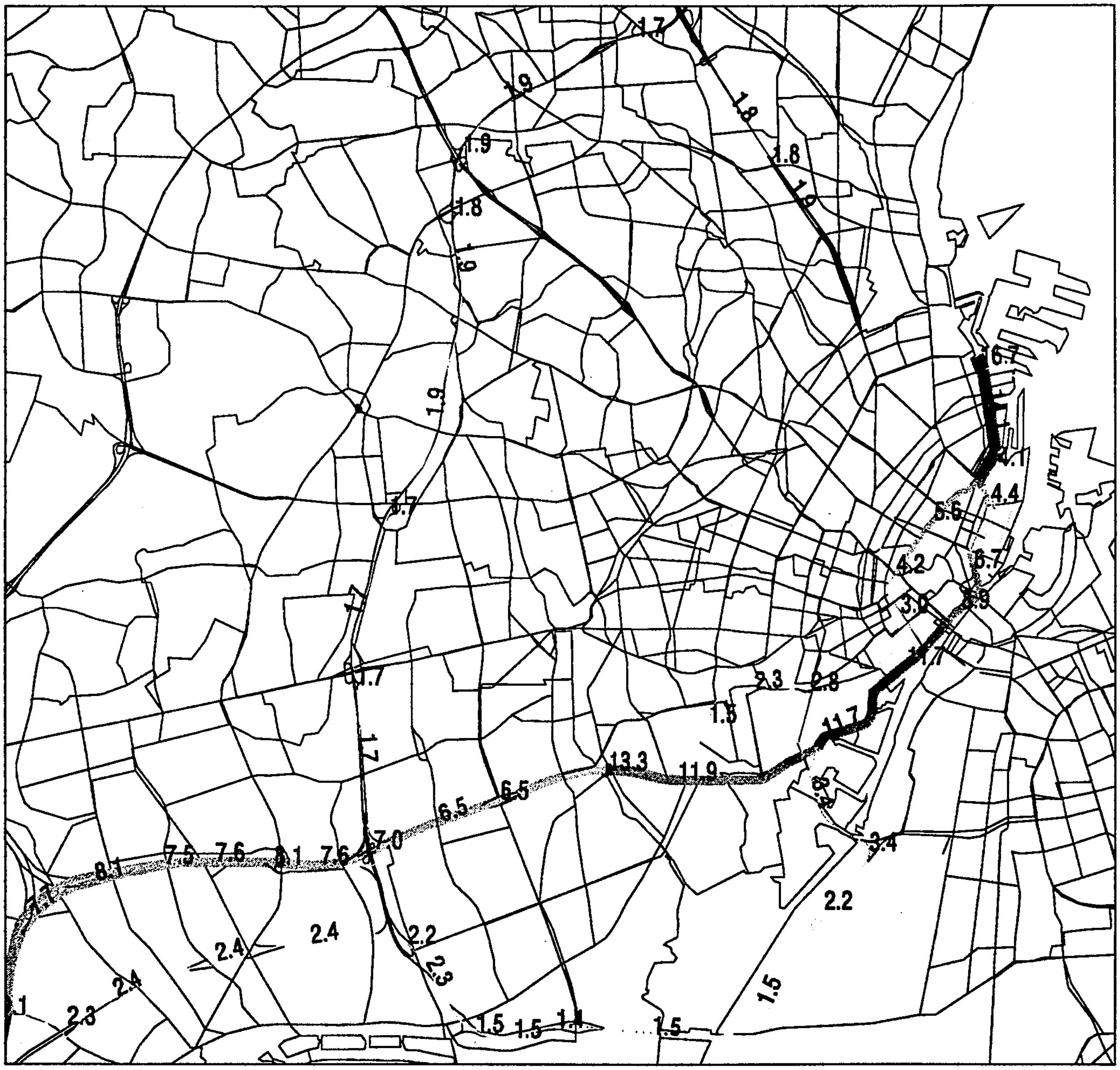
Varebilture:

6. Praktiske erfaringer, Ørestadsmodellen

Lastbilture:

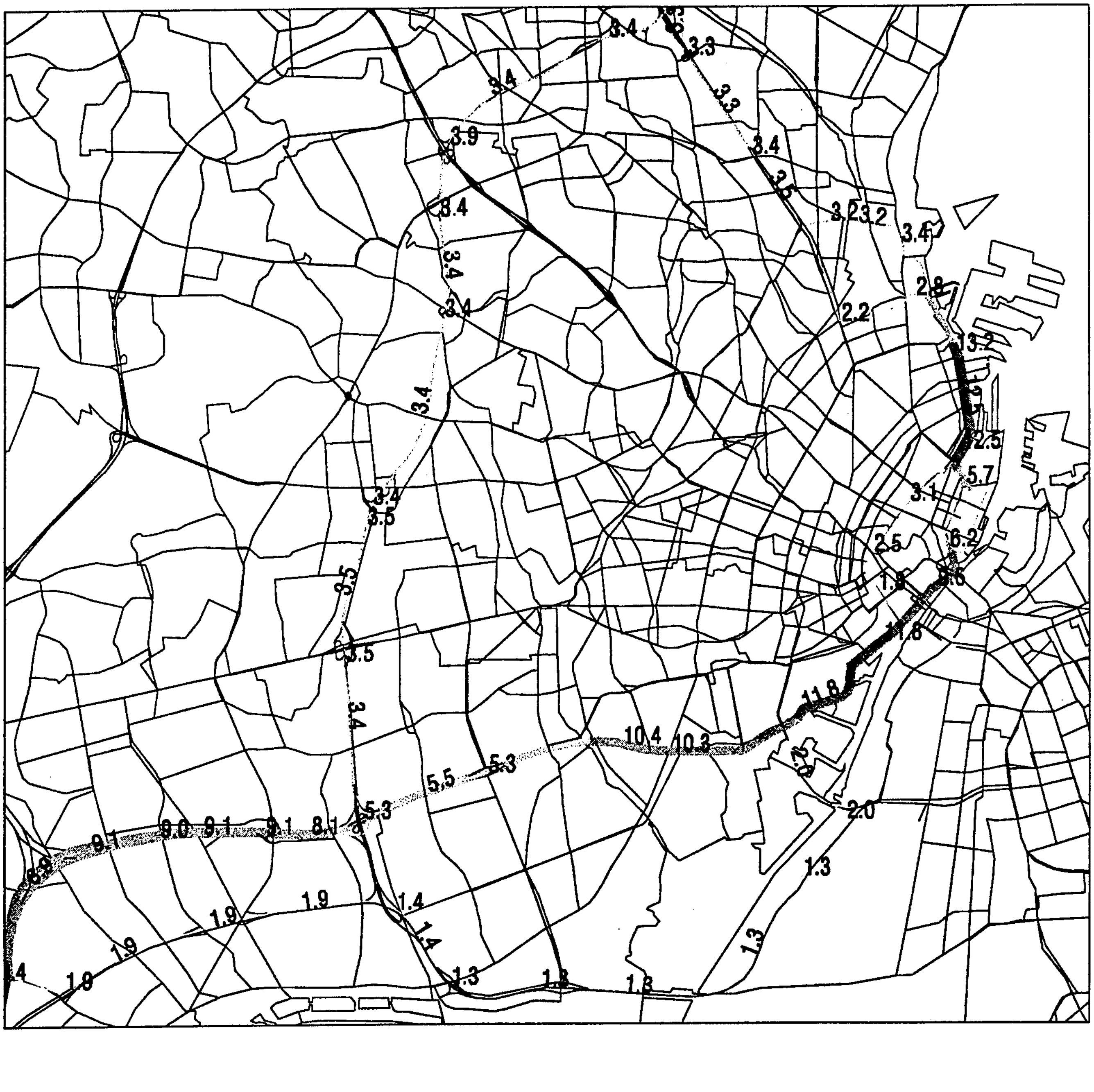


Bolig-Arbejdsstedsture:

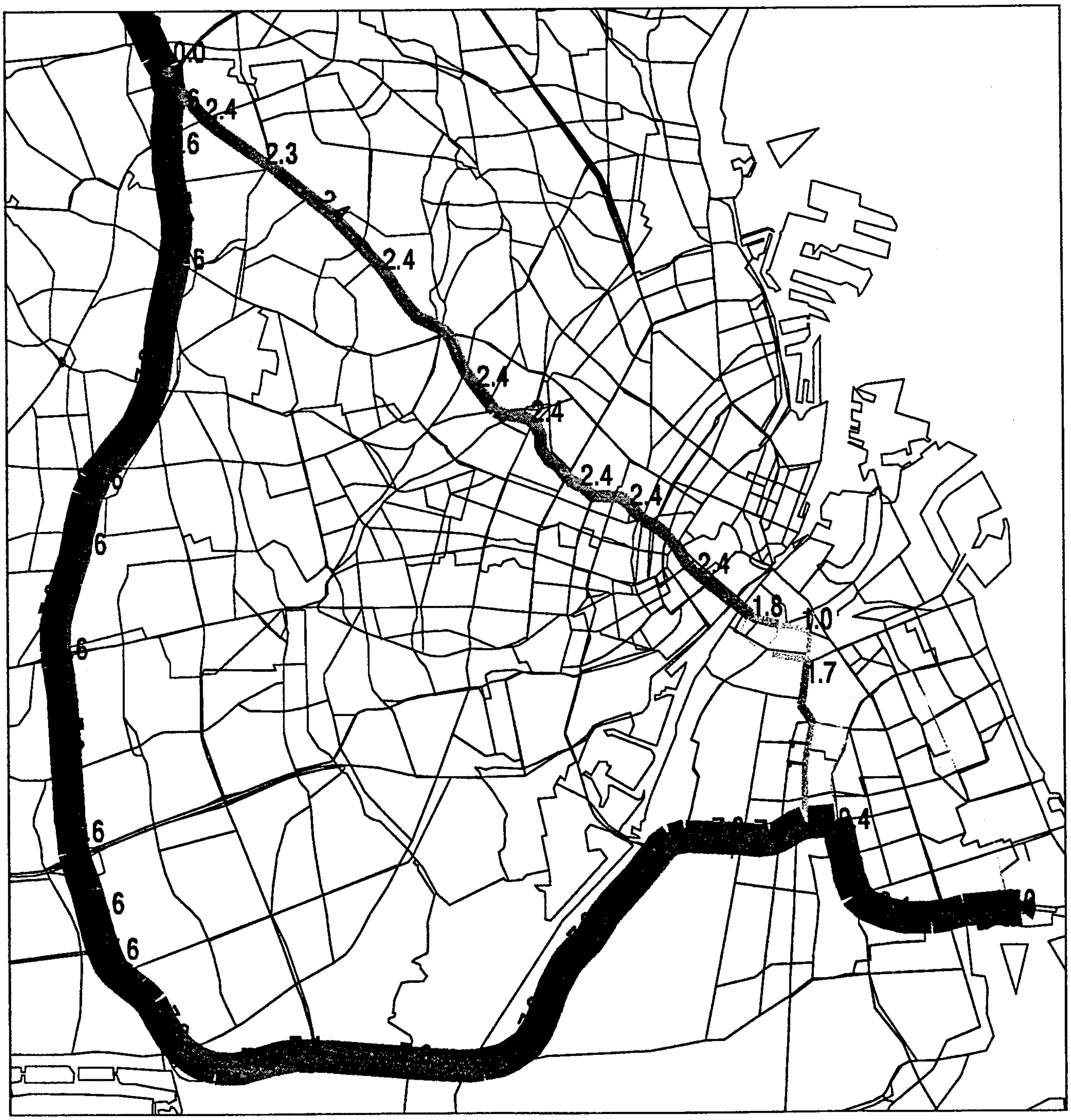


6. Praktiske erfaringer, Ørestadsmodellen

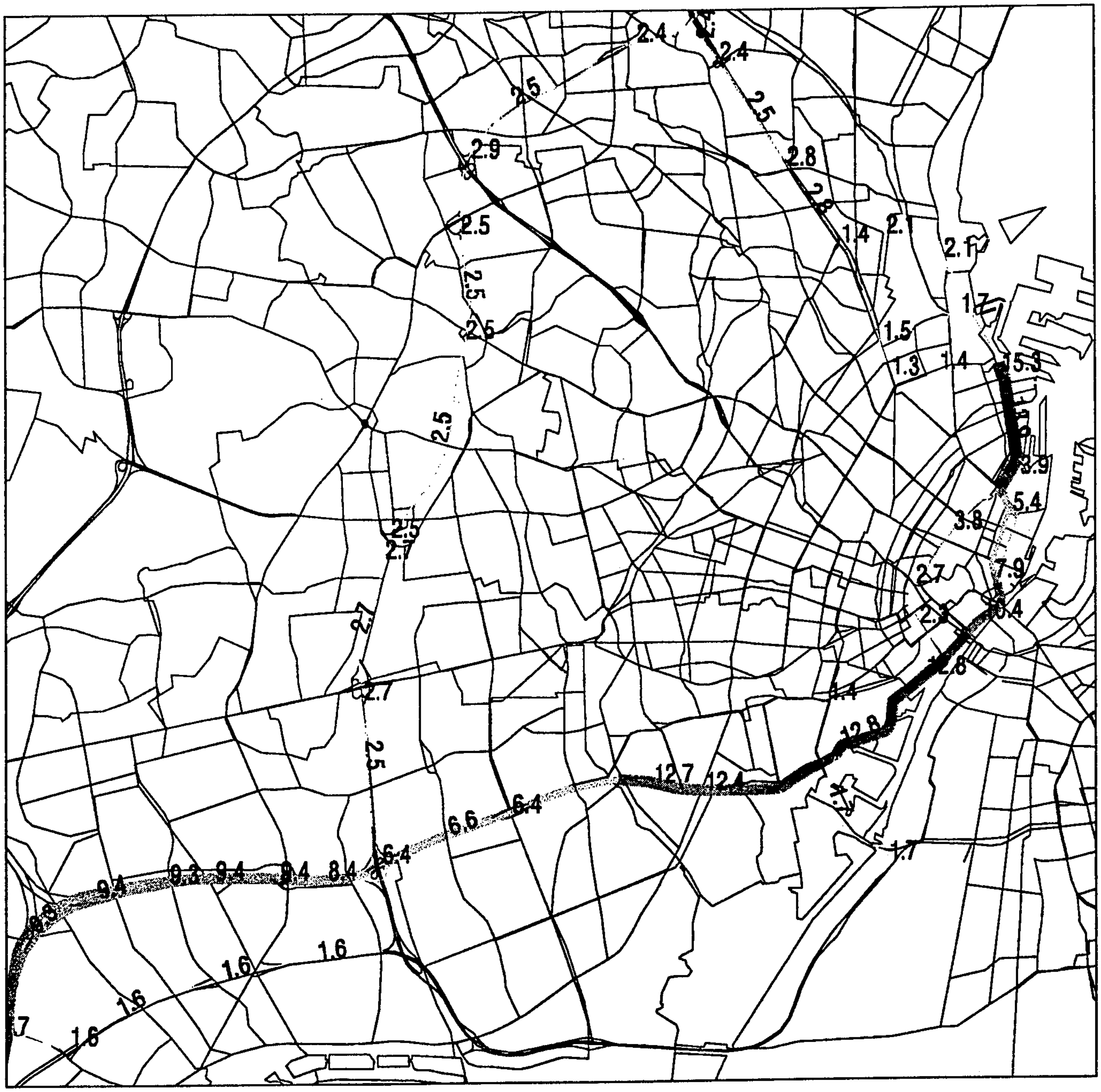
Lastbilture:



Lastbilture, beregnet uden hensyn til ringere acceleration og deceleration:



Lastbilture, beregnet uden hensyn til ringere acceleration og deceleration:



7. PRAKTISKE ERFARINGER FRA HAVNETUNNELPROJEKTET

Kombineret RP- og SP-analyse

Alogit 4.0:

- Test af variation indenfor og mellem respondenter
- Test af træstrukturer (tid på dagen, VOC versus tunnelafgift)
- Estimering af normal fordelte COV på koefficienter

GAUSS:

- Estimering af normal- of Log.Norm-fordelte COV

Grundlæggende nyttefunktion:

$$U_{ak} = \left(\beta_{lk} \cdot l_a + \beta_{ck} \cdot c_{ak}\right) + \xi_{\beta k}$$

$$+ \left(v_{kt(0)} \cdot t_{ak(0)} + v_{kt(kø)} \cdot \left(t_{ak} - t_{ak(0)}\right)\right) + \xi_{vk}$$

$$+ \varepsilon_{ak}$$

Omskrivning til assignmentmodellen:

$$U_{ak} = \left(\beta_{ck} + \xi'_{\beta k}\right)\left(\frac{\beta_{lk}}{\beta_{ck}} \cdot l_a + c_{ak}\right) +$$

$$+ \left(v_{kt(0)} + \xi'_{vk}\right)\left(t_{ak(0)} + \frac{v_{kt(kø)}}{v_{kt(0)}} \cdot \left(t_{ak} - t_{ak(0)}\right)\right) +$$

$$+ \varepsilon_{ak}$$

7. Praktiske erfaringer, Havnetunnelprojektet

Nogle meget foreløbige resultater:

Segment	Bolig-arbejde	Erhverv	Andre	Vare- og lastbiler
DKr/km (variable omkostninger)	0,35	0,35	0,35	0,38
COV COST	43%	25%	54%	
Free-flow VOT	0,48	0,74	0,31	2,86
Congested VOT	0,63	1,21	0,67	3,98
COV VOT				88%
Længde-tid forhold	0,40 0,60	0,31 0,69	0,49 0,51	0,11 0,89

Konklusioner på modelestimationen i Havnetunnelprojektet

- Der var stor forskel på de enkelte trafikantklassers nyttefunktioner
- Stokastiske koefficienter forbedrede markant likelihood funktionerne
- Der var meget stor variation på koefficienterne. Dette er konsistent med Ben-Ben-Akiva et.al. (1993)
- Variationen er størst ved log.normal fordelingen. Disse var korreleret med indkomstvariationer (Ibid.)
- De enkelte klasser påvirkede hinanden i betydeligt omfang ved modelkørsler

8 Konklusioner

- Assignment modellen for flere trafikantklasser forbedrede modelleringen af rejseadfærd
- Dette blev eksemplificeret med illustrationer fra Ørestadsmodellen
- Markant bedre likelihoodfuntioner for RP- og SP-analyser i Havnetunnel-projektet
- Vejvalgsmodellen er lige så detaljeret som turfordelingsmodellen med hensyn til turformål og køretøjstyper

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Erik Bergkvist, Umeå universitet, Sverige

Workshop 2: Hvordan måle og implementere ulike kvalitetsfaktorer i modellene?

Workshop 2: Measuring and implementation of quality factors in models

Measuring and implementation of quality factors in models.

Disposition

-What is quality in transportation and how can we try to measure and implement it?

-Studies of VOT's for road freight in Europe and the Nordic countries

-The Swedish experience

-Further research

What is quality in transportation and how can we try to measure and implement it?

General quality factors

- Transport time
- Damage
- Delay
- Availability
  - Frequencies
  - Distance to transport mode
  - Reload needs

Specific quality factors

-Volume

-Weight

-Temperature

-Security
    -For the goods
    -For the surrounding environment

-Flexibility
    -Proportion of transports with special needs

-Hygiene

-Service

Other sources to heterogeneity in estimated values

-Goods type

-Branch specific

-Transport distance

-Owner conditions

-Goods values

Problems

-Data

-Real data availability scarce due to company secrecy
-Are our hypothetical (SP) data correct?
-Do we ask the right persons?
-Do receiving companies valuation differ?
-What time perspective(s) do we capture?
-What is being transported?
-Heterogeneity in data and values
Are just-in-time transports discovered?

-Estimation

-Heteroskedacticity (non observed heterogeneity) causes biased parameter estimates in logit models.
-Methods to take care of e.g. heterogeneity
-How does "simpler" methods such as OLS perform?

-Implementation

-Easy to use values

Studies of VOT's for road freight in Europe and the Nordic countries

Some done and few in a university environment.

Average VOT estimates for road freight in some European countries.
Values per transport in SEK the year 1996.

Country	Year	Method	Value of time
Sweden	1992	Logit	52
The Netherlands 1	1986	Factor cost	182
The Netherlands 2	1991	Factor cost	195
The Netherlands 3	1992	Logit	325
The Netherlands 4	1995	Logit	299-325
Great Britain	1995	Logit	273-351
Norway	1994	Box-Cox Logit	0-520
Norway	1995	Box-Cox Logit	0-340
Denmark	1996	Logit	234-533
Sweden	1998	Logit	0-732

The Swedish experience

Heterogeneity

Descriptive statistic for four classes of transportation in the survey by Transek (1992).

	Internal transportation				External transportation			
Attribute	Mean	Std Dev.	Min	Max	Mean	Std Dev.	Min	Max
	Internal/Short (264 observations)				External/Short (640 observations)			
Cost	1 199	889	100	3 000	1 389	1 268	200	7 000
Time	1.3	0.5	1	2	1.3	0.5	1	2
Value	243	285	3	1 800	250	792	1	5 500
Weight	1 634	3 339	3	10 400	38 800	283 063	1	4 840 000
Damage	3.7	6	0	25	0.7	2.3	0	10
Freq.	187	351	10	1 500	728	2 498	3	14 000
	Internal/Long (278 observations)				External/Long (3 883 observations)			
Cost	3 039	2 211	850	8 640	4 076	11 859	1	214 000
Time	6.7	3	3	16	29	26	3	493
Value	186	269	3	1 000	443	1 765	1	15 000
Weight	601	778	1	3 500	17 610	247 652	1	4 840 000
Damage	0.5	0.7	0	2	3.7	9.9	0	100
Freq.	185	275	2	1 000	222	958	1	12 000

Swedish VOT estimates for road freight the year 1992 measured in SEK 1996. Values are given for regions and different transported distances. Lower and upper bounds are given within a 95 percent significance level.

Category		VOT	Lower bound	Upper bound
All flows		37	27	47
Short distance:	South Sweden	732	550	914
	North Sweden	185	0	269
Long distance:	South Sweden	40	26	54
	North Sweden	32	0	47

Swedish VOT for different types of road freight with regard to distances and ownership conditions. Prices are expressed in values of SEK 1992.

	Mean value	Relative value
All transports	37*	8,9
Internal	91*	4,0
External	13*	3,3
Short	225*	2,9
Long	14*	3,9
Internal short	572	7,4
Internal long	50	3,4
External short	143*	1,9
External long	15*	4,4

*significant at the 95 percent level.

Swedish VOT for road freights with regard to industry branches, distance and ownership conditions, 1992.Values in SEK.

Industry	All	Rel.	Internal	External	Short	Long
Food	26*	3,4	202*	19*	(-)	24*
Engineering	22*	6,2	(-)	22*	676	24*
Forestry	103*	3,1	(-)	96*	48	(-)
Agricultural	23	6,3	430	16	194	16
All transports	37*	8,9	91*	13*	225*	14*

* Significant at the 95 percent level. No convergence of the estimation is indicated by (-).

Further research

-New and larger studies to, among other things, enhance possibilities to better explore and handle heterogeneity

-Further comparison of estimation methods

-Compare revealed- and stated preference studies

-Explore possibilities to enhance usability by finding patterns by, for example, scaling

-Investigate how different actors in the transport market, shippers, receivers and transport companies may differ in valuation

Jørgen Rødseth, SINTEF, Norge

Workshop 3: Assignment og transportkjeder

Workshop 3: Assignment and transport chains

Workshop 3:

Assignment
og turkjeder

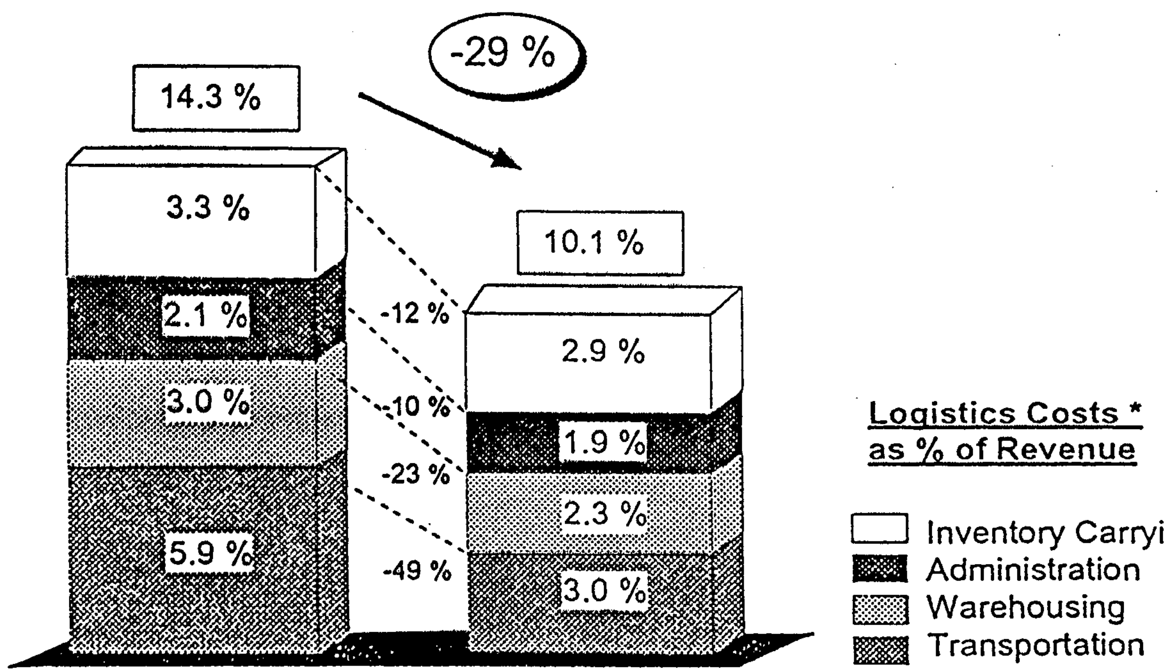
Anvendelse av transportmodeller:

Hvem er kunden ?

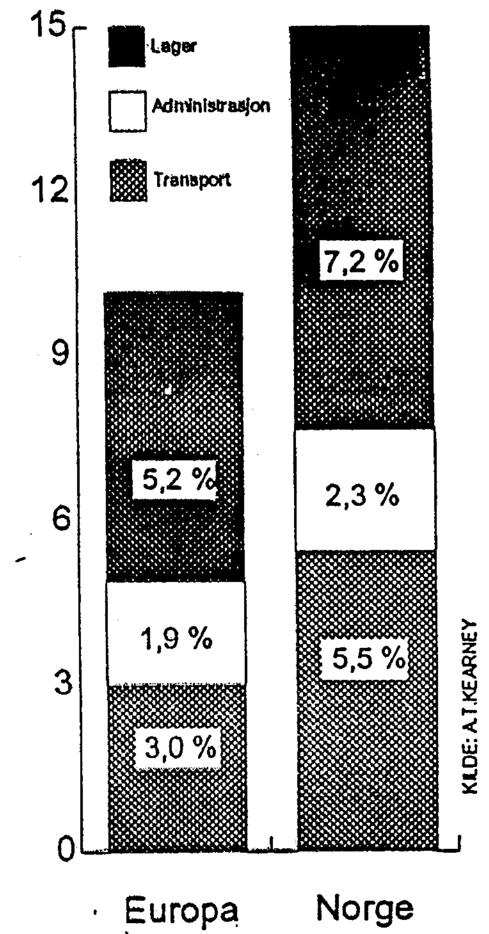
Hva er kundens behov ?

Hva får kunden ?

Logistikkostnader i Europa og Norge

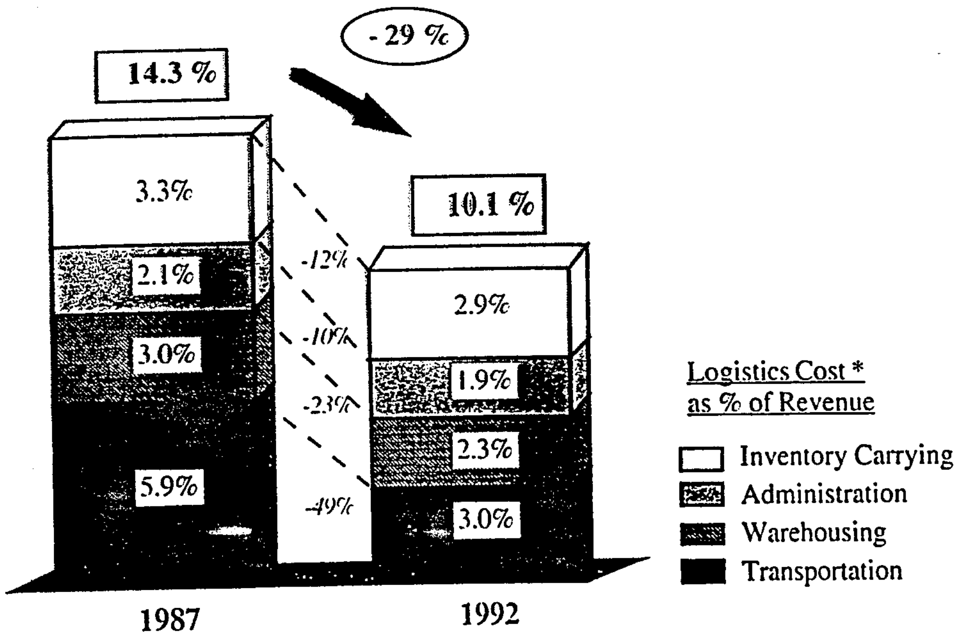


* Transport costs = inbound, intra-company, outbound
Warehousing = plant warehouses, distribution centers, transit terminals, e
Administration = logistics management, staff, EDP systems, etc.
Inventory carrying costs = raw materials, work in progress, finished goods



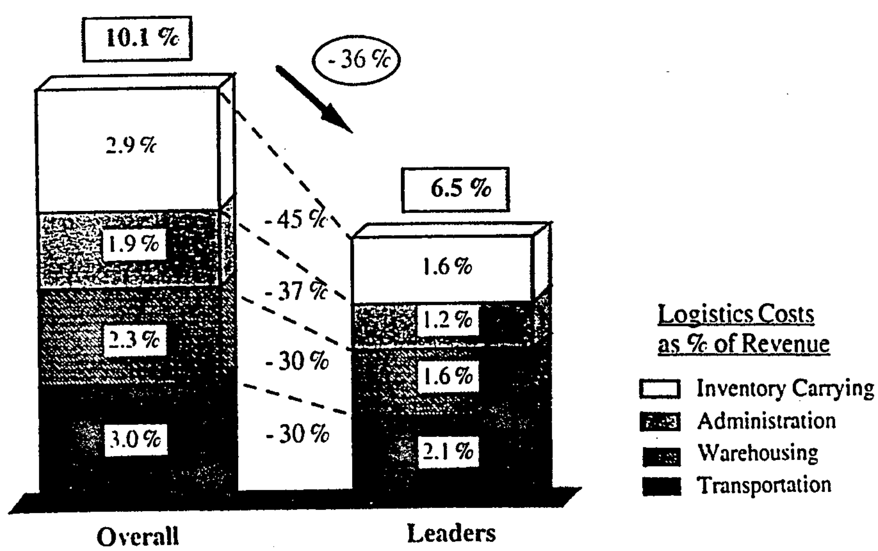
Logistics Excellence in Europe
(A.T.Kearney / ELA)

Figure 2.4: Logistics Cost Reductions (European Average)

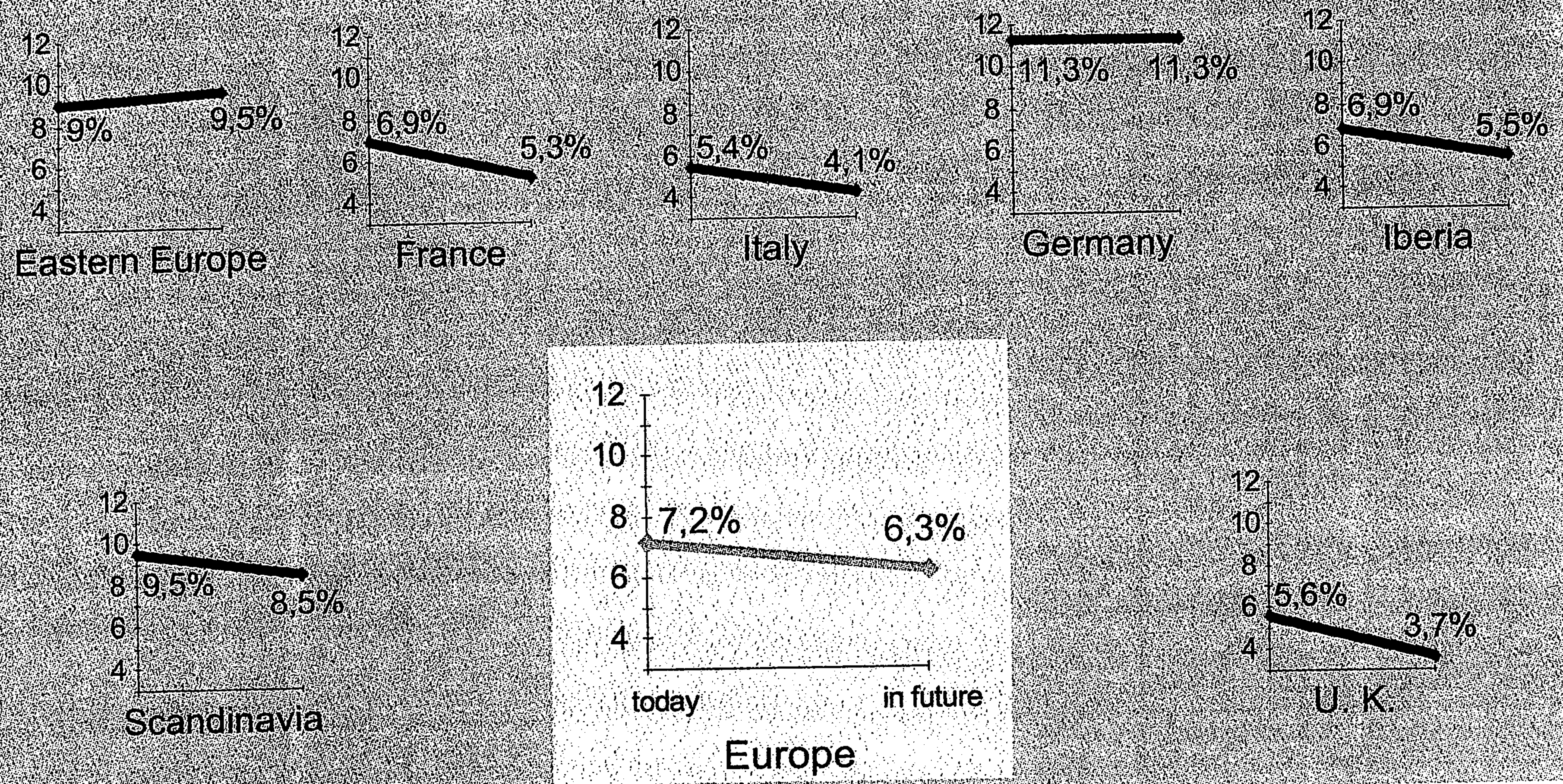


* Transport costs = inbound, intra-company, outbound
Warehousing = plant warehouses, distribution centers, transit terminals, etc.
Administration = logistics management, staff, EDP systems, etc.
Inventory carrying costs = raw materials, work in progress, finished goods

Figure 7.2: Leading Companies Have 36 Percent Lower Logistics Costs



Trend in Logistics Costs



Deltakernes erfaringer

Hvilke erfaringer har de enkelte deltakere med bruk av nettverks-modeller for godstransport ?

* Anvendelsesområde
* Modellverktøy/ assignmentkriterier
* Svakheter / mangler

Hva kan vi gjøre bedre ?
Hvor finnes potensiale ?
Kan noe gjøres enklere ?

Noen aktuelle problemer / tema / innsatsområder

- Turkjeder - intermodale transporter
- Terminaler - aktiviteter
- Bedre statistikk nye muligheter for datafangst IKT/EDI/??
- Komplekse kostnadsmodeller - fastsettelse av maksimumsverdier, - behandling av eksterne kostnader etc
- Kapasitetsproblematikk knyttet til utnyttelse av transportmiddel /last-bærer, ikke til infrastruktur (lenker)
- Kjøre og hviletidsbestemmelser

Anders Sjöbris, MariTerm, Sverige

Miljøeffekter av godstransportkjeder i et nordisk perspektiv

Environmental effects of transport chains in a Nordic perspective

Joint Nordic transport projects

The demand for joint Nordic research activities becomes obvious when looking into cross border transports and freight. The Nordic countries are linked in a unique network of ferry operations. All countries trade mostly in a North-South direction which gives a network of transit flow over the more southern located countries and infrastructure.

In 1990-1994 a project was done in Sweden which covered the freight transports from an environmental point of view. Originating from a political enquiry of how much environmental benefits a shift of cargo between transport modes would result in, a research project was set up. The project identified an over all lack of suitable statistics to be processed in an analysis. For this reason an enquiry was formed and sent out to the main manufacturing industry and in this way a database of the Swedish freight transport chains was formed.

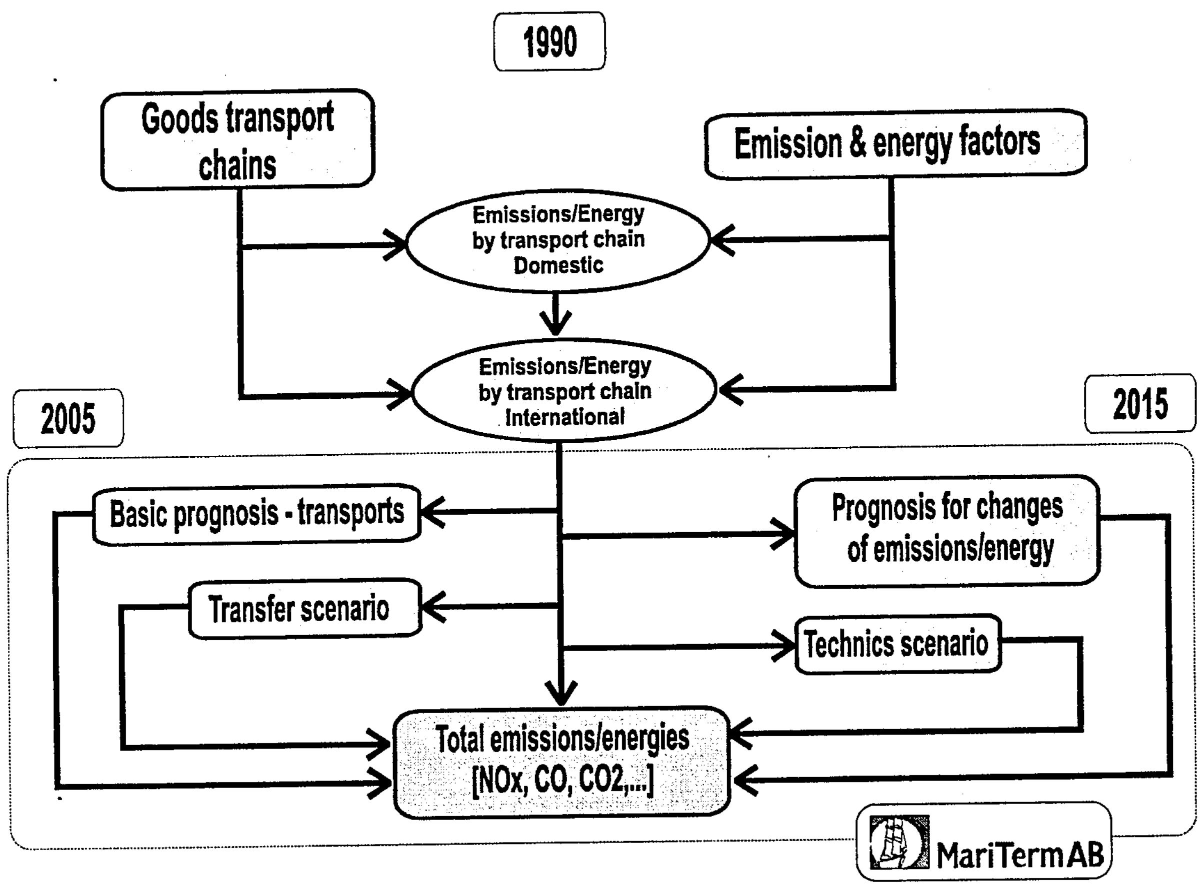


Figure 1 The principle set up of the project

Adding emission- and energy-factors to the freight flow and each component in the transport chain, the overall national emissions and energy consumption could be calculated.

Based on information of type of products and size of shipment etc. a general view of the freight flow was formed.

By adding development scenarios both as regards the freight flows as well as technical development of the individual transport equipment, a new calculation can be done presenting the result of each scenario. A number of such scenarios were calculated. One of the most interesting results was that a technical development resulting in a reduction of emissions from trucking had by far more influence on the total emissions than any possible transfer of cargo between transport modes. This is a fact that seems obvious to most researchers with knowledge of the subject, but was hard to accept by some policy-makers.

These kind of studies are important for the understanding of the freight transports and the conditions under which transports are carried out. The tool is important for the analysis of the consequences of a change of the conditions for the transports. It can give an estimation of the effect from political decisions and measures.

The Nordic perspective

It can be noted that this type of traffic assessment still is unique in an European perspective. MariTerm is participating in an environmental strategic transport research project in the 4:th framework. This project has given a view of the standard of strategic projects that has been done in Europe. Most of these project concerns public transports and very few deals with the environmental effect of the transports. Our project COMMUTE, will present a computer based tool for the assessment of emissions and energy consumption from transports in the TEN. (www.eco-tuv.de/eu/commute.htm)

Our report "Miljöeffekter av transportmedelsval för godstransporter" was also presented in KFB seminars for other Nordic countries and was in these seminars discussed with interest. It is obvious that we have common interest in these mattes in the Nordic countries. It is merely a local Nordic interest than an European interest. Especially when we consider the transit traffic.

We touched the transit problem in our first report. First of all we did a scenario of new potential rail transports in the form of transits from the Kola Peninsula based on the estimated long term growth presented by the Swedish rail roads. It is obvious that transit of this magnitude is interesting for the operators. But is it of same interest from a national and environmental point of view?

Likewise it is also of benefit to use the same methodology for the assessment of traffic that influence and concerns a whole region.

Having this background we contacted a number of research colleagues in the Nordic countries to ask their interest to participate in a common research project aimed at building and using a common methodology and do an environmental assessment of freight traffic. The response was positive but the problem was and is to finance this in order to be able to do the work parallel.

There were no joint body or program to apply for research funds as there is for a national project. It is also time consuming to keep up these contacts and form the research group.

The problem will come obvious when the project is approved in one country and rejected in the others.

Reference can be made to the common EU programs and projects, but why should, as the rules demands, the southern part of Europe be involved in a pure Nordic project. A joint development of methods would also be beneficial for the common analysis of transports in the Nordic countries. Would this type of co-operation not be more beneficial than a separate development and use of different methods and systems in the countries?

The project described should only be looked upon as an example of the situation as such. I can see a number of benefits in a joint co-operation of development and studies carried out in the field of transports.

If a more integrated research co-operation is considered interesting in a Nordic perspective I propose that this should be facilitated by the funding institutes and organisations and NTF could well host such program. It would require a common funding and a common organisation for common Nordic projects. It is not up to me to draw up this system in detail but I merely like to bring up the idea for discussion. Still it could be of interest if such Nordic committee would propose project tasks like in the EU program but not in the same detailed manner. It would be limited to and focused on areas which are of interest for all countries. NTF could just as well be open for proposals of projects from the researchers.

Hoping this will develop a deeper joint Nordic transport research co-operation I hope NTF will bring up and discuss this proposal for the coming year.

Knut Østmoe,
Transportøkonomisk Institutt, Norge

Eus 5. rammeprogram

The European Commission's 5th frame work programme

toi

NTF-seminar om godstransportmodeller

5. og 6. november 1998
Gildevangen Hotell, Trondheim

EUs 5. rammeprogram – hva med godstransportmodeller?

Instituttsjef Knut Østmoe

Transportøkonomisk institutt

EUs 5. rammeprogram

Hovedprogram:

Promoting competitive and sustainable growth

Definert 4 ”key actions” alle med målene:

- **Answering to socio-economic needs**
- **Stimulating European added value**
- **Supporting European competitiveness**

Fire ”key actions” er definert:

I. Innovative products, processes and organisation

II. Sustainable mobility and intermodality

III. Land transport and marine technologies

IV. New perspectives in aeronautics

Bruk av godstransportmodeller

- Forstå
- Styre
- Evaluere

Veksttakten over 25 år i EU

- Godstransport 75 % (Norge 113 %)
  (2,3 % p.a.)
- Persontransport 110 % (Norge 110 %)
  (3,0 % p.a.)

Konstaterer:

- Transport har nådd sine miljømessige og sosiale grenser i forhold til bærekraft
- Regner med 2 % årlig vekst framover
- Drivkrefter; Euroen, globaliering, utvidelse most øst, liberalisering etc
- Behov for nye transportgrep, som ”intermodality”-perspektiv, IT, teknologi, organisering, management mv.

Krav til transportsektoren

- Sustainability; økonomisk, miljømessig, sosialt
- "Efficiency" og "quality"
- "Safety" og "security"

Bidragsyter til den øvrige EU-politikken; som energi, industri, miljø, sysselsetting mv.

Ambisjoner

- Redusere vekstraten i CO_2-emisjonen fra transport
- Øke jernbanens markedsandel fra dagens 14 %
- Bryte koblingen transportomfang – økonomisk vekst
- Utnytte transportmidlenes relative styrke i et dør-til-dør opplegg, redusere konkurransedistansen fra 500 til 200 km for intermodale transporter
- Fokus på Trans-European Network
- EU-avgifter for godstransport på tvers i Europa

Key action:

Sustainable mobility and intermodality

Definerte tasks:

1. Socio-economic and technical scenarios for mobility of people and goods
2. Research for infrastructures and their interfaces with transport means and systems
3. Model and intermodal transport management systems

Disse er igjen inndelt i 7 subtasks som så danner grunnlag for Working Program. Det foreligger IKKE pr dato.

Strategi og faktiske måloppnåelser

- Hovedstrategi; Teknologi/standardisering/effektivisering
- Kostnadsriktige priser, gjennomføring av lønnsomme tiltak; indikativ planlegging!

Konflikt mellom NORMATIVE mål og indikativ teknologidrevet utvikling?

Vil hovedstrategien fremme veksten og ikke de "ideelle" mål. Krever i motsatt fall tiltakspakker.

Datautfordringer

- OD-matriser; effektive opplegg for innsamling og vedlikehold
- Innsamling og bruk av data av dør-til-dør godstrømmer (Markedssegmentering ut fra brukerkrav)
- Kobling av databaser til europeisk nivå (Sub-task 2.1.1 Mobility and Society)

NTF skall främja transportforskningen i Norden genom att verka för ökat samarbete mellan de nordiska länderna.

NTF skall främja informationsutbyte mellan nordiska forskare och förmedla nordiska forskningsresultat.

NTF kan ge råd och hjälpa till att etablera kontakter i samband med pågående projekt.

NTF skall tillgodose nordiska forskningsintressen inom EUs forskningsprogram genom att verka i kommittéer och expertgrupper.

NTF skall informera de nordiska forskningsmiljöerna om de möjligheter som finns till stöd för deltagande i EU:s forskningsprogram och vilka regler som därvid gäller.

NTF skall underlätta för nordiska forskare att få kontakter med andra forskningsgrupper utanför Norden genom att etablera kontakter i andra länder och genom att använda databaser.

NTF vill främja samarbete på transportforskningsområdet med Baltikum.

NTF anordnar konferenser och workshops om aktuella forskningsämnen, antingen i egen regi eller i samarbete med andra organisationer.