The National Danish Transport Model

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Background / The case for a national model

• Recommendation from Government Committee

The foundation for decisions must be strengthened by developing a national transport model system, which encompass all the different modes and their interrelations

The model must support socioeconomic evaluations and strengthen the basis for prioritizations in the transport sector
Vision

• Open and easy to use model
• Cover whole country, all modes, passenger & freight
• Different types of users;
  – Users at (large) public authorities
  – Consulting firms typically supporting customers (mostly public authorities)
  – Transit operators and other transport companies
  – Other universities
  – Others (NGO’s, think tanks,...)
• Modular system to ease maintenance
• ArcGIS-based
The national transport model – Decided in 2009, started may 2010

Organization:

• Project coordinated by DTU Transport
  – A number of tasks outsourced
  – Public authorities deliver data and work

• Lead by the Ministry of Transportation

• Steering committee and user group
  – Ministry of Transport, Road Directorate, National Transport Authority, Railnet Denmark

• Released versions open for third parties on a lease basis

• Budget of about 10 million $
Examples of projects

• (semi) high speed rail forecasts for national transport
• New urban railway timetable
• Consequences of opening more stations on existing lines
• Buss Rapid Transit in Copenhagen
• New freeways in Jutland
• New fixed link (bridge) between each and west Denmark
• Toll scenarios
Methodology

- State-of-the-art structure
  - Used in many other large-scale transport models
    - Danish National Model
    - Dutch national Model
    - Sampers (although not using pivoting)
Methodology

- Parallel passenger and freight demand models
Methodology

- Parallel passenger and freight demand models
- Pivoting
  - Calibration to base-line matrices (invariance to absolute deviation in the model)
Methodology

• Parallel passenger and freight demand models

• Pivoting
  – Calibration to base-line matrices (invariance to absolute deviation in the model)

• Assignment
  – SUE based utilising matrix thinning
Methodology

- Parallel passenger and freight model
- Pivoting
  - Calibration to base-line matrices (invariance to absolute deviation in the model)
- Assignment
- Improved convergence methodology (WMSA)
Smart data processing

- Road transport
  - Commercial road network
  - Traffic counts from many sources
- Transit (Public transport)
  - Travel planner import
  - Counts
  - Link of busses to road network
Features / specific tools

- Intelligent Scenario Management
  - Forecast years
  - Comparing projects
Features / specific tools

• Intersection delay modelling
Features / specific tools

- Intersection delay modelling
Features / specific tools

- Easy sketching of public transport line and time table scenarios
Model results

• Flows
  – Road traffic
  – Transit flows on rail and roads
  – Change patterns at transit terminals
• Filtered results
• Key figures / aggregated numerical results
• Comparative maps showing differences between model results
Model results

– Road flows
Model results

- Transit flows on rail and roads
Model results

- Accurate modelling of transit lines and stops allows precise maps and difference maps.
Model results

- Comparative maps showing differences between model results
Model results

- Transit embarkation
Model results

- Key figures / aggregated numerical results

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Transportation Activity (1000 Person Kiloneter) pr working day
Traffic Impacts Cost Benefit analyses

- Key numbers for impact analyses
  - Time savings
  - Costs
  - Energy use
  - Emissions
  - Safety
- Link to "Teresa" (official Danish model for CBA)
Technical architecture

- **Master-DB / CalcDB:** Resilient against IT glitches
- **Roles**

![Diagram of technical architecture]
Technical architecture

• Changes to model workflow and datasets do not require changes to User Interface
Platform benefits

• GIS is central
  – Data integrity, DBMS support, multi-user, editing, map production, industry standard
• Data management is vital for building and using transport models
  – 40% of entire modelling budgets are used on data and data management
  – Data quality is essential for the validity and reliability of transport models
  – ArcGIS with SQL Server supports this requirement very well
• Openness is important
  – Model results are frequently used in many different “downstream” analyses
  – Every single data set in the model is simply a database table. Everything lives in SQL Server.
• Geoprocessing is simply ideal for encoding very complex modelling workflows with a mix of drag-and-drop programming and very accessible Python scripting
  – And has very smooth integration with database programs (Stored Procedures)
• Network analyst lets us easily integrate commercial street networks
  – Navteq / Here is used. Intersection data added on top
• Traffic Analyst
  – Rapidis deliver software-changes on-demand
• Model builder works as documentation
Conclusions

• A multi-user national model system
  – ArcGIS Enterprise
  – SQL Server
• Modular calculation core
  – Traffic Analyst software
  – Network Analyst
  – Tailor made code
  – Other
• Able to be used of a wide user group