Evaluation of food transport calculation tools

Evaluation of food transport calculation tools used for calculating the environmental impact from food transports

Christoffer Krewer, Joakim Forsman

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Project Information

Start of project
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Project leader
Christoffer Krewer

Project group
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There are no scientific references in this report. Even though not mentioned in the text a lot of the background information has been obtained from MINT – Model and decision support system for evaluation of intermodal terminal networks, deliverable 1, MINT State-of-the-art.
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1 Aim
The aim of this report is to provide a reader that is inexperienced in the field of transport planning calculation tools with information about the field in general, and information about which transport planning calculation tools that are available on the market today in specific. The information about the tools is provided in a survey in the end of the report. The survey does not assess the tools based on different case studies (because of the wide variety of stakeholders), but gives answers according to questions in a form that was filled out for all tools in the survey.

The delimitations when choosing were that all tools must be able to calculate environmental impact and being able to model parameters characteristic for food transports like cooling of goods, and total transportation time. When it is uncertain if a tool meet this criteria it shall be mentioned in the evaluation.
## 2 Terminology

<table>
<thead>
<tr>
<th><strong>Table 1 Terminology</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>O-D pair</strong></td>
</tr>
<tr>
<td><strong>Transport mode</strong></td>
</tr>
<tr>
<td><strong>Transport model</strong></td>
</tr>
<tr>
<td><strong>Transport calculation tool</strong></td>
</tr>
<tr>
<td><strong>Multimodal network</strong></td>
</tr>
<tr>
<td><strong>Transport demand point</strong></td>
</tr>
<tr>
<td><strong>SAMGODS</strong></td>
</tr>
</tbody>
</table>
3 Theory

3.1 The traditional four step model
The four step model, or methodology, describes different starting points of transport modeling. Each step covers a certain problem, uses a certain type of input data and produces a certain type of output data.

1. Production and attraction
2. Trip distribution
3. Modal split
4. Assignment

A transport calculation tool does not have to support all steps, although some do.

3.1.1 Production and attraction
The production and attraction step can be seen as the step with the most overview perspective. In this step the total volume of goods going into and out from a region is determined. Where exactly the goods come from or are going to is not dealt with in this step, hence the name production and attraction (of a region).

3.1.2 Trip distribution
In this step the demand for transport is translated into origin-destination pairs, i.e. from which origin a certain goods comes from and to which destination it is going to. It is done by using data from the previous step and use weight factors such as transport cost and distance. The most common approach to this is the gravity model, where the interaction between two locations is assumed to decline with increasing distance between them due to increasing transport cost and time.

The O-D pairs can also be entered as input data into the model.

3.1.3 Modal split
The modal split concerns the choice of transport mode, e.g. when train is preferred to truck. The choice is most often based on cost. Modal split models can be divided into two groups: Aggregated models and disaggregated models. Aggregated models represent a zone where each transport mode has a share in that specific zone, whereas disaggregated models determine the modal split for each shipment.

If a multimodal network model is used, a cost minimizing algorithm can be used to determine the modal split and the route choice in the network.

The modal split can also be entered as input data into the model.

3.1.4 Assignment
This last step concerns the route choice in the network, i.e. which roads to use between A and B. This can be done by using different algorithms, e.g. shortest, fastest route algorithms. This can also be included in the modal split when a multimodal network model is used.

3.2 The transport system
While the traditional four step model describes different approaches on modeling from a methodological perspective the transport system itself can be represented in different detail levels (Figure 1).
3.2.1 Freight flows
The freight flow level is the highest system level and the least detailed. It is built of nodes and links and represents the supply chains. It includes the demand for transport, e.g. number of shipments, size, time constraints, frequency etc. Individual trucks, trains etc. are not considered on this level.

3.2.2 Transport network
The transport network is the system middle level. It is more detailed than the freight flow level and concerns the movement of trucks and trains on a transport network. Here individual trucks, trains etc. are considered although their behavior can still be generalized.

3.2.3 Transport infrastructure
Transport infrastructure is the lowest system level and the most detailed. It concerns detailed routing, driving time restrictions, speed variations, tolls, timetables etc.
4 Method
First the fill out form which was to be used for evaluating the tools was designed. Thereafter various stakeholders and personal network contacts were invited to a workshop to discuss the selected approach. After that the form was redesigned and sent out to a group of software developers that had been chosen based on literature research, stakeholder information and contacts with the workshop participants. The answers were then interpreted, and in some cases follow-up questions were sent or phone calls were made. The software developers were also asked if demo software was available. If possible, demos were tested and the tests were used as a basis for completing the forms. If a demo was tested it is mentioned, otherwise the information comes from the developers.
5 Evaluation
The tools in Table 12 were chosen for the initial assessment.

Table 2 The table shows the initial selection of tools for the evaluation

<table>
<thead>
<tr>
<th>Tool</th>
<th>To be further evaluated?</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIT-model</td>
<td>Yes</td>
</tr>
<tr>
<td>NTM calc 3.0</td>
<td>Yes. The software will be released in May 2012.</td>
</tr>
<tr>
<td>DISMOD</td>
<td>Yes</td>
</tr>
<tr>
<td>KombiSim</td>
<td>No. The tool was not found.</td>
</tr>
<tr>
<td>NODUS</td>
<td>No. Neither software nor contact person was not found.</td>
</tr>
<tr>
<td>The platform project</td>
<td>No. Neither software nor contact person was not found.</td>
</tr>
<tr>
<td>SimNet</td>
<td>No. The software was not yet released.</td>
</tr>
<tr>
<td>STAN</td>
<td>Yes</td>
</tr>
<tr>
<td>VISUM</td>
<td>Yes</td>
</tr>
<tr>
<td>CUBE</td>
<td>Yes</td>
</tr>
<tr>
<td>TransCAD</td>
<td>Yes</td>
</tr>
<tr>
<td>EcoTransit</td>
<td>Yes</td>
</tr>
<tr>
<td>Transtool</td>
<td>No. The software itself is free but requires other costly software in order to work.</td>
</tr>
<tr>
<td>TREMOVE</td>
<td>No. The installation time of the software was estimated to be too long in order to meet project time requirements.</td>
</tr>
<tr>
<td>Containerised Cargo Carbon Calculator</td>
<td>Yes</td>
</tr>
</tbody>
</table>
5.1 Information points
This chapter describes the information generic form that was used for the software in the survey.

General information
- Based on well-known standards, methodologies or best practice?
- System boundaries and allocations
- Templates for dataset production of the most common transport types?
- Integration possibilities? (e.g. Input/output to Excel)
- What kind of output data is available?
- Model detail level, e.g. separate vehicles, flows?
- Type of tool, main purpose, divide in classes (relate to “intended for”)
- Scenario support

Databases included?
Is input data included, or does all information need to be gathered and everything needed to be built from scratch? What kind of input data is included/needed (too old data?)? What about transport distances between demand points? Can input data be altered, e.g. fuel type?

Organization
What is the name of the organization that has developed the tool?

Contact information
How does one get in contact with the developer?

Restrictions
Are there any limitations in the use of the tool, e.g. geographic limitations?

Intended for
What can be done with the software and who is the intended user?

Stability, updates and support
Is the software updated and how often is this done? Is support offered? How many uses the software today? Is it commercial?

Application type
Is it web-based or stand-alone?

Cost
What does it cost?
5.2 Evaluation criteria
This chapter describes the evaluation criteria generic form that was used for software in the survey.
Base criteria: All tools can calculate environmental impact.

Accessibility
Is the software easy to get hold of? Did we get hold of it?

User friendliness
Given that the user has good knowledge within the field of transports and logistics, is the tool easy to understand and use? Are there tutorials, example models? Can the user have made and/or started working with a model in less than a day? Is training required?

User prerequisites
Is the tool instructive within the field of transports and logistics, or does the user need good knowledge within the field?

Transparency
Is it easy to understand how calculations have been performed which data that have been used and how data have been used? Are input data well documented?

Chilled transports
Is it possible to model chilled transports?

Load factor
Is it possible to model load factors of specific transports?

Intermodal transports
Is it possible to model different types of transports?
5.3 Tools

5.3.1 Cube

Information points

No demo was used for the evaluation.
The evaluation has been done by the developer.

General information
Cube is a software package for travel demand forecasting of person and freight travel and includes functions for handling all modes of transport and any level of detail. Cube includes a wide set of tools for developing models, running them and analyzing their result by scenario. Cube’s graphical interface embeds ESRI’s ArcGIS features for handling transport networks and other geographic data. Cube models can run on desktop PCs, servers and in the Cloud.

Author comment: It is unclear if additional software is needed to perform the modeling.

SAMGODS
The Samgods model uses Cube as an interface for setting up scenario tests, running the model and reports its results. Cube is also providing the assignment tools which calculate routes for the various modes of transport and the flow on links. Cube also provides conversion tools for moving data from and to the specially built module in Samgods for freight demand (external to Cube but handled by the Cube interfaces).

Four stage steps
1-4

Level modeled
Transport network, transport infrastructure

Databases included?
Cube supports ESRI’s geodatabase technology and can handle various formats such as private databases (MS Access MDB format), file based geodatabases (ESRI’s GDB format) and enterprise database systems such as SQL Server and Oracle (through ESRI’s ArcSDE). Cube also supports ESRI’s shape format, CAD formats such as Autocad and Microstation, raster formats (picture formats) and online mapping such as Google maps and Bing maps.

Author comment: Most likely Data has to be purchased separately from e.g. ESRI.

Organization
Citilabs develops, markets and supports the Cube software which is used across the world in more than 75 countries. The Citilabs headquarters are situated in California and the development team is located in Florida. Citilabs has sales and support offices in Europe and Asia.

Contact information
Tor Vorraa
Citilabs - Regional Director
The Oriel, Sydenham Road, Guildford, Surrey, GU1 3SR, UK
Tel: +44 (0)1483 814204
www.citilabs.com
Restrictions
Cube can handle any type of transport planning model and there are no practical limits for model sizes and complexity.

Intended for
Cube is foremost intended for transportation planning and customers today are governmental organizations or consultants working for governmental organizations.

Stability, updates and support
The software is updated.
Support is available under a current maintenance contract.
It is commercial and is marketed via reference customers.

Application type
Stand-alone, server based, cloud based.

Cost
Core system (Cube Base/Voyager) : Euro 13,300 + 15% annually for maintenance contract
Most model types can be developed with the core system.

Evaluation criteria

Accessibility
Cube is sold with various license options. This includes full licenses (with maintenance options for updates to new versions), lease versions and contracts related to running models in the Cloud. Cube can be purchased by contacting the regional director (see Contact Information below).
Author comment: No demo is available.

User friendliness
Cube includes intuitive tools for developing models (through a flow chart based macro language), scenario based management of runs and a familiar graphical interface for handling data. Cube includes GIS based on ESRI’s ArcGIS.
It is easy to run models and display their results. The interface is similar to MS Office programs with intuitive buttons on toolbars and ribbons.
Citilabs’ homepage includes a learning centre where tutorials can be downloaded and run. Training is available in different locations and is also offered on site.

User prerequisites
Cube is a tool for transport planners with the necessary skills for such studies.
Development of models requires expert skills but running existing models can be learnt quickly. A three day course is recommended for this.

Transparency
Cube is an open system and all macros and scripts can be studied in detail.

Chilled transports
Cube includes an advanced set of development tools for supporting any type of model.
This includes parameters such as trip rates, vehicle occupancy, load factors and a wide range of others for handling the transport of people and goods to the degree of detail required for the project.
Load factor
See answer above.

Intermodal transports
Cube is fully multi modal for handling any modes related to goods transport.
5.3.2 TransCAD

Information points

No demo was used for the evaluation.

General information

TransCAD is mainly used in America and has most of its customers in the passenger transport modeling area, but it can also be used for freight modeling. The main approach of the software developer is to make it as general as possible (like an Excel spreadsheet) and provide as many functions as possible so that it can be used for almost any transport planning activity. For instance, it has no specific function for intermodal freight transports, but has generic functions that may well be used for that purpose. The developer claims that “TransCAD is the first and only package to provide complete integration of GIS and transportation analysis functions”, which means that no additional GIS software needs to be purchased. The GIS system has added functionality for transport applications.

Four stage steps

1-4

Level modeled

Transport network, transport infrastructure

Databases included?

Data included covers the U.S. in depth and includes for instance government and Navtech GIS data. Additional data can be bought but does not cover Europe yet.

Organization

Caliper Corporation

Contact information

www.caliper.com

Restrictions

Available data only seems to cover the US. However the import feature of maps from other formats is extensive. No explicit function for intermodal freight transport exists.

Intended for

It can be used for a lot of applications, e.g. or regional transport planning, for transport operators to decide on warehouse locations, for transport operator vehicle routing etc.

Stability, updates and support

The software is commercial and support is available. However there does not seem to exist any sales and support agents situated in other countries.

Application type

TransCAD exists as stand-alone software. It comes as either TransCAD Base or TransCAD Standard. The developer also offers a wide range of other softwares related to Transportation planning and maps.

Cost

TransCAD Base: 4000$  
TransCAD Standard: 12000$
Evaluation criteria

Accessibility
No demo available (The demo could not be obtained in time).

User friendliness
No information

User prerequisites
No information

Transparency
No information

Chilled transports
No information

Load factor
No information

Intermodal transports
No information
5.3.3 VISUM

Information points

No demo was used for the evaluation.

General information
VISUM is used in all continents, and is designed for multimodal analysis. It integrates all relevant modes of transportation. GIS-data can be merged together with transportation data into a common database with several layers. Links to other GIS databases can also be made. A COM interface makes it possible to integrate VISUM with other software like MS Office and ArcGIS. No information on scenario analysis setups has been found.

The complexity of calculating the environmental impact depends on the starting point. Importing a network with link volumes and speeds, and computing emissions is straightforward in VISUM, although training is recommended for novice users. An add-on module called HBEFA to be purchased for that reason. The module comes with a large database of vehicle types, so disaggregated link volumes for different (truck) vehicle types can be used. Alternatively, ready-made fleet compositions for Swedish fleets and different base years are available. They can be used as is or modified by the user, to model policy assumptions.

If only OD matrices are available, then a network needs to be built in VISUM and the traffic assigned. Network data can be purchased together with VISUM. The user would still need to add the zoning system from the original model and OD matrices for car traffic would be needed as well, to obtain realistic volume/capacity ratios for links. These determine emission factors. This task is more extensive, but still manageable after some training, especially if building on bought network data.

If the freight modeling is to be performed from scratch, and because there is no standard approach to freight modeling and the model structure is always purpose-built around the available data, this is one of the most challenging modeling tasks that exist. Quite independent of the software used, building a good freight model will always require a lot of bespoke scripting / coding and only some part is covered by built-in functionality of a standard software package like VISUM. Attempting to build such a model is completely out of reach for novice users. Some models of this type have been built with VISUM, but by experienced consultants.

Four stage steps
3-4

Level modeled
Freight flow

Databases included?
No information. Data can be purchased from the developer.

Organization
Developer: PTV AG, Germany
Sales Agent: Viscotia AB, Sweden

Contact information
Developer: www.ptvag.com
Sales agent: www.viscotia.se
Restrictions
No information

Intended for
VISUM is intended for metropolitan, regional, state wide and national planning applications for traffic engineers and transportation planners.

Stability, updates and support
VISUM is commercial and new versions seem to be released frequently. VISUM 11.5 release notes are dated to 2010 and the release notes of the most recent software, VISUM 12, are dated to 2011. The release notes about “what’s new” are very detailed. The homepage contains all relevant information, is well structured and easy to navigate. Concerning support, technical support is available via a fill out form on the web page. PTV also offers consultancy services that can be carried out in VISUM. The Swedish sales agent does not use or are trained in the software but can be asked to relay questions to the developer.

Application type
Stand-alone

Cost
The cost is based on the intended size of the model (or the area):

<table>
<thead>
<tr>
<th>VISUM size</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of zones</td>
<td>100</td>
<td>200</td>
<td>400</td>
<td>600</td>
<td>1,000</td>
<td>3,000</td>
<td>5,000</td>
</tr>
<tr>
<td>Number of nodes</td>
<td>500</td>
<td>1,000</td>
<td>2,000</td>
<td>4,000</td>
<td>8,000</td>
<td>25,000</td>
<td>50,000</td>
</tr>
<tr>
<td>Number of links</td>
<td>1,200</td>
<td>2,500</td>
<td>5,000</td>
<td>12,000</td>
<td>20,000</td>
<td>50,000</td>
<td>100,000</td>
</tr>
<tr>
<td>Number of nodes navigation size</td>
<td>2,500</td>
<td>5,000</td>
<td>10,000</td>
<td>30,000</td>
<td>60,000</td>
<td>175,000</td>
<td>250,000</td>
</tr>
<tr>
<td>Number of links navigation size</td>
<td>6,000</td>
<td>12,500</td>
<td>25,000</td>
<td>75,000</td>
<td>150,000</td>
<td>375,000</td>
<td>500,000</td>
</tr>
</tbody>
</table>

Evaluation criteria

Accessibility
A demo is available that can be downloaded and tried out for two hours.

User friendliness
The demo was downloaded, but due to the complexity of the software there was not enough time to test the software.

User prerequisites
No information

Transparency
No information

Chilled transports
No information
Load factor
No information

Intermodal transports
No information
5.3.4 STAN

Information points

No demo was used for the evaluation.

General information
The STAN model works on an aggregated freight flow level. It assigns transport flows to different modes and routes with an aim to minimize the total system cost. Each link or O-D pair is assigned to an average cost function, i.e. the first and the tenth load carrier in a link are assigned to the same cost. Concerning flows, they are also handled on an aggregated level, e.g. the input flow in tons on a train route is converted to a typical rail car for that commodity on each train route and not necessarily conserved when transferred to the next train route. Using this conversion, the number of trains in the link is calculated. Train timetables etc. are not used. Time is only included as a part of the delay cost functions. It permits analysis of several planning alternatives. Results from input/output models may be imported. The emissions are calculated from the resulting speeds and flows by using standards, e.g. the EMEP/EEA air pollutant emission inventory guidebook. The different types of pollutants are quantified and their spatial distribution displayed on a grid. However, it is unclear if additional software is needed to perform the calculations.

Four stage steps
3-4

Level modeled
Freight flow

Databases included?
No information

Organization
Developer: INRO, Canada
Sales agent: WSP, Sweden

Contact information
Developer: www.inro.ca
Sales agent: WSP

Restrictions
No information

Intended for
It is intended for national and regional freight transportation planning. STAN users include cities, metropolitan areas, consulting firms and universities and it responds to the need of shippers and carriers to efficiently evaluate the impact of major changes in the transport infrastructure, regulatory environment and demand patterns on their cost, time, reliability and other performance measures. In Sweden the STAN software is included in the SAMGODS model (used for calculating the effects of infra-structure investments and for making fore-casts of the future transport demand). It is suitable for strategic freight transport planning using aggregated data on regional, national and international level.

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Stability, updates and support
STAN is used in 18 countries by more than 60 organizations. Software support costs 12% of the total license price per year. Support is available on phone and e-mail. There is also a help request form that can be filled out and submitted.

Application type
Stand-alone

Cost
30000 CHF (1st user)

Evaluation criteria

Accessibility
No demo available.

User friendliness
No information

User prerequisites
No information

Transparency
No information. However, STAN has a feature that allows for programming own scripts, which can be made transparent by own means.

Chilled transports
No information

Load factor
No information

Intermodal transports
No information
5.3.5 Containerized Cargo Carbon Calculator

Information points
The tool has been used for the evaluation.

General information
The tool offers logistics companies a website where you can compare and contrast different modes of containerised transport and their associated carbon emissions, as you plan a transport to and from the Haven Ports.

Four stage steps
N/A

Level modeled
Freight flow

Databases included?
Data is included in the tool. However, it is not given any information about where the data is from.

Organization
Developed by AECOM on behalf of the Haven Gateway Partnership and Babergh District Council

Contact information
www.ccccalculator.com

Restrictions
Limited to containerized shipments within Great Britain.

Intended for
It is intended for comparing different modes of containerized transport and their associated carbon emissions within Great Britain.

Stability, updates and support
Not commercial.
No software plan, limited support

Application type
Web-based, Google Maps in the background.

Cost
Free

Evaluation criteria

Accessibility
The user just needs to register an account in order to access the tool.

User friendliness
Easy to use, step by step guidance. Possible to use default numbers or put in specific information about the transports.
**User prerequisites**
The user just needs to know the origin and destination of the transport to be able to make a calculation.

**Transparency**
No information about how the fuel consumption is calculated into carbon amounts. It can be assumed that data from DEFRA is used, but there is no documentation to support it.

**Chilled transports**
No.

**Load factor**
Possible to adjust the weight of each container.

**Intermodal transports**
Yes. Road, rail and ship.
5.3.6 EcoTransIT

Information points

The tool has been used for the evaluation.

General information
The Ecological Transport Information Tool (EcoTransIT) calculates environmental impacts of any freight transport. Thereby it is possible to determine the energy consumption, CO₂ and exhaust emissions transported by rail, road, ship and aircraft in any combination. EcoTransIT is free of charge for any non-commercial use.

Four stage steps
N/A

Level modeled
Freight flow

Databases included?
No information

Organization
The Institute for Energy and Environmental Research (ifeu), Heidelberg, and the Rail Management Consultants GmbH (RMCon), have developed EcoTransIT as an objective tool to quantify emissions from freight transport. This Project was initiated by a number of European railway companies in 2000, and more railway companies have subsequently joined.

Contact information
www.ecotransit.org

Restrictions
No information

Intended for
EcoTransIT's target audience is company managers, logistics operators, progressive transport planners, political decision makers, customers, NGOs and all stakeholders who are interested in calculating the environmental impact of freight transport on specific routes. EcoTransIT enables anyone to compare the environmental impact of differing transport solutions for specific traffic flows.

Stability, updates and support
The software is updated. It is possible to contact via e-mail. It is also available for commercial use.

Application type
Web-based.

Cost
Free of charge for any non-commercial use.
Evaluation criteria

Accessibility
Instantly available to use from the web page.

User friendliness
Easy to use, step by step guidance. Possible to choose between standard and extended mode.

User prerequisites
The user need to know how the transport is performed, what type of transport that is used and what route that is used.

Transparency
Thorough documentation of how the calculations are performed and which data that is used.

Chilled transports
No.

Load factor
Possible to set unique load factor for all of the transports in extended mode. In standard mode it is possible to choose between three different load factors.

Intermodal transports
Yes. Road, rail, ship and air.
5.3.7 NTMCalc 3.0

Information points
A demonstration of the tool given by NTM has been used for the evaluation. NTMCalc 3.0 will be released in May 2012.

General information
NTMCalc 3.0 calculates environmental impacts of any freight transport. It has evolved over the years and present version is the third generation, available as professional and basic. The development has been carried out by NTM, IVL, WSP and FOI.

Compared to the previous versions, NTMCalc 3.0 is much more detailed. It is possible to adjust each transport in many different ways and adding activities such as loading and cold start.

Four stage steps
N/A

Level modeled
Freight flow

Databases included?
Yes, NTM’s database is included. Default values are given for all entries but can be adjusted by the user.

Organization
The Network for Transport and Environment, NTM

Contact information
www.ntmcalc.se

Restrictions
No information

Intended for
NTMCalc 3.0 is used for calculating the environmental impact from a known transport or travel route. It can be used by private individuals who want to know more about the impacts from their traveling as well as companies that want to learn more about their freight transports.

Stability, updates and support
It is possible to contact via e-mail.

Application type
Web-based

Cost
Available in two versions, Basic and Professional. The Basic version can be used by anyone and is free of charge. The Professional version is open to all NTM members, meaning that the cost is the membership fee. The coming modules, web service and database service will be offered as separate services. The price is not yet determined.
Evaluation criteria

Accessibility
Instantly available to use from the web page.

User friendliness
Easy to use, step by step guidance.

User prerequisites
Easy to use due to the step by step guidance. The user need to know how the transport is performed, what type of transport that is used and what route that is used. Recommended default values are given for all entries, helping an inexperienced user to perform calculations.

Transparency
A report can be created after the calculation, giving the user information about how the calculations were performed and what values that was used. References to documentation are also given.

Chilled transports
Yes, either by choosing a chilled vehicle or changing the fuel consumption of a regular vehicle.

Load factor
Possible to set unique load factor for all of the transports.

Intermodal transports
Yes
5.3.8 The HIT model

Information points

General information
The HIT-model takes it starting point in a competitive situation between traditional all-road transport and intermodal transport, where the modal split and the potential of the intermodal transport is determined on how well it performs in comparison with all-road transport. The model can also be used for calculating the costs and the environmental impact of a given transport system. The HIT-model is a heuristic model, which means that the modal split is performed by a series of statements that are evaluated in a certain order.

Four stage steps
3

Level modeled
Transport network

Databases included?
No input data is included. All transport demand points has to be added as well as the distance between them.

Organization
Jonas Flodén, School of business, Economics and law at University of Gothenburg

Contact information
http://www.fek.handels.gu.se/sekctioner/ife_och_log/medaretare/jonas__floden%C3%A9n/hit-model/

Restrictions
It is not possible to model transport infrastructure and do scenario analyses based on choice of routes.

Intended for
Decision-making for intermodal operators and politicians

Stability, updates and support
Not commercial.
No software plan, limited support

Application type
Remote desktop connection, C++ model together with Microsoft Access as graphical user interface

Cost
Free

Evaluation criteria

Accessibility
The software is easily accessed via a remote desktop connection
User friendliness
Low (when MS Access is used as graphical user interface)
It takes a lot of reading to understand all numbers, units etc.

User prerequisites
Everything is well documented and explained.

Transparency
Calculations are explained and heuristics are described in detail.

Chilled transports
No. A new transport type has to be created that includes cooling.

Load factor

Intermodal transports
Yes.
5.3.9 DISMOD

Information points

General information
DISMOD is developed by Fraunhofer IML and is available in different versions, depending on the needs from the user. All versions are based on the open source DISMOD Core.

Four stage steps
4

Level modeled
Transport network, transport infrastructure

Databases included?
Additional Road(or other)-digital Map Data has to be included

Organization
Fraunhofer IML

Contact information

Restrictions
Does only depend on the digital road-map data (see Point above)

Intended for
DISMOD is a strategic planning tool for (re-)designing transport chains over multimodal transport modes. Subjects such as location optimization, structure planning, utilization optimization, and division of territories are being covered by DISMOD.

Stability, updates and support
The software is permanently updated. Updates and support are regulated in a support contract in case of buying a DISMOD License.

Application type
Stand-alone, additional clients can be web-based.

Cost
The DISMOD-core is free but the other software cost.

Evaluation criteria

Accessibility
A demo with limited function is available and can be downloaded.

User friendliness
Training is required.

User prerequisites
Good logistics knowledge is helpful
Transparency
The process of defining the user-specific input data format is part of the process of a DISMOD usage.

Chilled transports
Yes.

Load factor
Yes.

Intermodal transports
Any type that is handled by the road-data, so that e.g. distances or travelling times can be calculated.
6 Discussion
Performing this study without pre-defined case studies has been difficult mainly because broad questions without a starting point or intended result specified are difficult to get answered. For instance the question ‘Can emissions from transports be quantified and calculated into environmental impact, e.g. climate change?’, does not describe the required accuracy of the intended result or what the result is to be used for. The following aspects can be taken into consideration when calculating environmental impact:

- Weather conditions, e.g. temperature, humidity and barometric pressure, cloud coverage etc.
- Type of traffic, e.g. city traffic or highway traffic
- Time dependent driving conditions, e.g. rush hour
- Starts and stops, e.g. cold and warm crank
- Total volume of emissions from a population of vehicles within a certain geographic region
- Fuel type
- Euro class
- …

For all parameters average data can be used, but specific data and thus advanced models may also have to be used in order to obtain the required result.

The second implication was that almost no demo software was available. Thus, the evaluation had to be based on literature and information from the supplier, but since software develops rapidly there was little literature to be found that was up to date. The third implication was that terminology within this field is not strictly defined, which made it hard to understand what the software actually could be used for based on the developer information.

6.1 Future steps
The next natural step should be to define case studies, and based on this survey use the established contacts to get the additional information needed to choose the software most suited for the case studies.
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