



## **Centrico 5**

# **Status Report on Decision Support Models**



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## Centrico 5 – Status Report on Decision Support Models

A Euro-Regional Deployment Plan for Road ITS between Belgium, France, Germany, Luxembourg, The Netherlands and the United Kingdom.

### Partners involved:



#### **Belgium:**

- Brussels
- Flanders
- Wallonia



#### **France:**

- METL/DSCR
- SANEF
- SAPN



#### **Germany:**

- NRW
- Hessen
- RP
- SL
- Federal Ministry



#### **Luxembourg**



#### **The Netherlands**



#### **United Kingdom**



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## Status Report on Decision Support Models

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## 1. Introduction

### 1.1. Background

**CENTRICO** co-ordinates the implementation plans for traffic management and user information services for centrally located countries in Europe: Belgium and Luxembourg, and parts of France, Germany and The Netherlands. Since 1995, a common action programme has been prepared focusing on monitoring, cross-border traffic management and re-routing, traffic information exchange, co-ordination of traffic centres, the implementation of ITS in conurbations, on-trip information through RDS-TMC and interoperability of electronic fee collection. Implementation projects have begun.

The CENTRICO project and the suite of national and regional projects which it coordinates is extremely important and influential in determining the study and implementation agenda for the network of the major European motorways, the Trans-European Road Network (TERN) in north west Europe. This paper provides an update on the background, philosophy, results, organisation and technical achievements of the project, and focuses on the future plans and developments to be implemented during the next six years of CENTRICO. The paper describes how CENTRICO is contributing to improved traffic and travel in the European Union.

The Central European Region Transport Telematics Implementation Coordination (CENTRICO) project started in 1996 and is a major regional European traffic management project funded by the European Commission Directorate-General for Energy and Transport, since 2001 under the Multi-annual Indicative Programme for ITS (MIP-ITS). The MIP-ITS programme started in 2001 and will run for six years providing continuing support for the implementation of ITS to ensure maximum comfort and efficiency for the users of the TERN.

CENTRICO is a co-operation of 14 (semi) governmental partners from Belgium, England, France, Germany, Luxembourg and the Netherlands working to improve international and cross-border traffic and transport through implementing harmonised ITS (Intelligent Transport Systems) on the TERN.

The project objectives are to reduce congestion and the environmental impacts caused by transport delays and to increase efficiency and improve network safety on the TERN in the CENTRICO regions.

The CENTRICO area covers Belgium, Luxembourg and parts of England, France, the Netherlands and Germany (as illustrated in Figure 1).



Figure 1: The CENTRICO area

## 1.2. Investment

Each of the participating countries is making significant investment in studies and implementation of state-of-the-art ITS as a means to improve transport within the regions, countries and between countries. The combined investment by the CENTRICO partners within the CENTRICO project is circa 377 MEURO during the 6-year period. This sum represents just a proportion of the overall investment being made within the CENTRICO area by the partners. Each member country manages and controls individual projects within their own areas of responsibility. However, each of the individual country level projects has agreed to contribute to the CENTRICO strategy and must comply with stringent eligibility requirements.

CENTRICO provides the overall European coordination of the individual sub-projects studied and implemented in each of the member countries. This is a vital element to achieve and maintain a coordinated and consistent pan-European strategy for ITS on the TERN. CENTRICO provides the mechanism for cooperation, exchange of information and experiences and stimulates cross-border understanding.

## 1.3. Objectives and responsibilities

The CENTRICO partners are responsible for operating and managing most of the busiest transport links in Europe with heavily used motorways with volumes well over 200.000 vehicles per day (see Figure 2). Major European cities and huge seaports like Rotterdam and Antwerp characterise the area. Partners are developing ITS systems and services to respond actively to this traffic challenge. ITS implementation is being used to improve safety, reduce delay and improve customer satisfaction throughout the CENTRICO area. However, in order to gain best value for travellers and authorities it is essential that these developments are harmonised and synchronised. CENTRICO therefore has the vision of connected ITS services that support efficient travel over the long corridors within the project area. This enhanced efficiency will improve the service not just for the traveller but also for the network manager and operator. It will also provide the foundation for service providers to add extra value through the tailoring and packaging of services.

In developing these services, the CENTRICO partners have adopted a balanced top-down and bottom-up approach. A top-down approach is maintained for strategic and policy issues, while a bottom-up approach is used for the local project implementations. This includes managing the demand for the network, optimising the use of the whole network and optimising the capacities of individual transport links within the network.

In short the main objective of CENTRICO is the realisation of a safe European network of road infrastructure without hindrances, utilising ITS applications to alleviate travel delays, provide services and upgrade environmental quality by the reduction of congestion. A reduction of congestion of 15% is strived for.

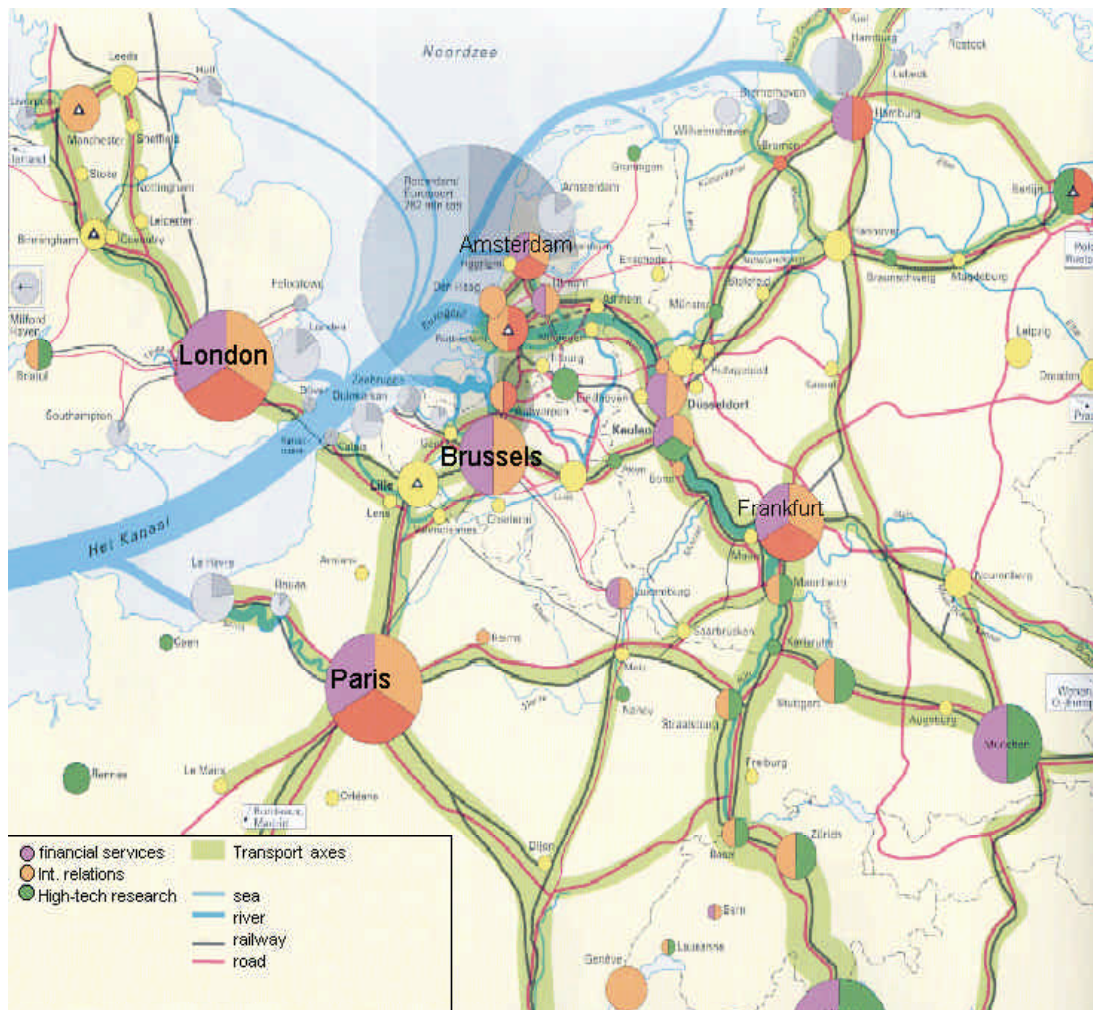


Figure 2: Economic and transportation structure

## 2. Progress and results

The CENTRICO project has already provided significant and tangible results. These include improved and increasingly linked traffic management centres throughout the area, studies, pilots and implementation of a number of successfully operating systems and increased understanding, cooperation and support for working together across international borders.

The systems really work and are delivering benefits to the people who use the TERN and those depending on the effective operation of the TERN.

These include:

- Extending the monitoring of the motorways in all CENTRICO Member States based on agreed quality levels.
- Installing and upgrading 12 Traffic Information Centres (TIC) and interconnection of those centres to exchange traffic and traffic management information within and between different countries. An example being the communications link established between the Dutch TIC in Utrecht with the TIC Köln in Nord-Rhein Westfalen officially established on the 18th June 2001 by the 2 ministers of transport, following a successful pilot phase.
- Implementation of 10 cross-border Traffic Management Plans for rerouting (international) traffic on major international corridor motorways in case of congestion. Timely information to drivers is given on VMS and radio and alternative routes are advised. For example, on the Eindhoven – Köln corridor, part of the Randstad (NL) – Rhein-Ruhr (D) corridor, the cross-border re-routeing is activated about forty times a year. The Rotterdam (NL) – Antwerp (BE) corridor re-routeing system (as part of the greater Amsterdam – Antwerp corridor, see Figure 3) is activated about twice a week. These systems are saving motorists thousands of hours, reducing frustration and pollution. Evaluation studies are nearly completed. The savings demonstrated indicate that a return on the ITS investment is achieved within three – five years.
- In-vehicle information systems are also included. In the Netherlands, the so-called RIC2 pilot project equipped 1,000 cars with access to improved travel information through low-cost RDS-TMC (Radio Data System – Traffic Message Channel) receivers.
- Progress in harmonisation in topics, including use of DATEX protocols, ramp metering systems, and the signs for re-routeing of traffic.
- A continuous and fruitful cooperation between the road managers of the different Member States. This is producing both increased mutual cooperation and more emphasis on European-wide ITS developments.
- In addition a wealth of information and experiences has been exchanged between CENTRICO partners and with other projects that significantly contributed to speeding up the implementations and further developments of the TERN.



*Figure 3: Amsterdam-Antwerp re-routeing corridor.*

### 3. 2001 Focus

In 2001, the first year of the MIP, CENTRICO participation has extended to include the South East of England. This provides a significant expansion to the area covered by the project.

The link between South East England and mainland Europe carries some 10 million vehicle trips per year. In the last four years, this cross channel traffic has increased by 255%. With this increase in traffic comes a great demand from travellers for timely and accurate travel information about the crossing services and the travel conditions in the country they are about to enter. This information is especially important during times of travel disruption.

Work during 2001 and onwards is coordinated through distinct but inter-related technical domains:

- Road Monitoring Infrastructure
- European Network of Traffic Centres
- Traffic Management and Control
- Traveller Information Services
- Freight and Fleet Management
- Electronic Fee Collection
- Incident and Emergency Handling

A number of activities are on the priority list for 2001. For a large part these follow projects started earlier.

Work on Traffic Management Plans continues on many of Europe's major international and interregional corridors including:

- Brussels (B) – Nancy (F)
- Amsterdam (NL) – Antwerp (B)
- Randstad (NL) – Rhein-Ruhr (D)
- Paris (F) – Brussels (B)
- London (UK) – Paris (F)
- Rhein corridor (D)
- Ruhr (D) – Channel (B) – South-east and central England (UK)
- Mosel – Saar Network (F, L, D)

The MIP also includes scope for the development of long distance corridors as a means of further extending the scale and cooperation between the Euro-Regional projects. By this truck drivers and motorists will receive relevant traffic and route information and the overall performance of the TERN will be improved.

The ultimate objective is to deliver or co-ordinate relevant services on a closed net of European corridors to the users of the network.

Communications network architecture of the Traffic Information Centres is being further developed. This is a key element of CENTRICO activities. CENTRICO is also working with the other Euro-Regional projects and developing links to contribute to a total Euro-wide architecture.

CENTRICO is focussing more on information and guiding services for the individual traveller. CENTRICO aims to develop information dissemination and collection services that will provide seamless travel information to the traveller, ultimately providing route planning and on-trip support



USING ITS TO MANAGE  
EUROPE'S BUSIEST ROADS

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## **STATUS REPORT ON DECISION SUPPORT MODELS**

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and encouraging other commercial services. For instance travel time information systems, which will become an increasingly important component of information provision in Europe.

More emphasis is being put on evaluation of the measures introduced, visualizing the benefits and making the results more widely available.



#### **4. Introduction to the status report on decision support models**

During the elaboration of the CENTRICO 5 workplan, several regions introduced the development and use of decision support models as projects to be followed in CENTRICO. The CENTRICO co-ordination team recognized the interest of the regions on this topic and decided to elaborate a short report giving an overview on the status of decision support models within CENTRICO.

Furthermore, during a CENTRICO workshop the interest in exchanging information and experiences between the CENTRICO partners was recognized and lead to an expert meeting dedicated particularly to decision support models. This meeting was held on 22<sup>nd</sup> January 2001 in Antwerp with participation of experts from several CENTRICO regions, such as the Netherlands, Belgium (Flanders), Germany (Hessen), France and the United Kingdom.

The scope of this report is to give an overview on the national / regional experiences regarding the development and use of decision support models within the CENTRICO regions. The report is based on the outcome of the expert meeting and on additional national/regional information. For further, more technical information, the national / regional representatives in CENTRICO can provide more information respectively contacts to experts in this domain.

## 5. Status of decision support models in the Netherlands

The information given on the Dutch experience regarding decision support models is based on a presentation given on the above-mentioned workshop held on 22<sup>nd</sup> January 2001 in Antwerp [4].

### 5.1. Model used

In the project introduced by the Netherlands, the model used is METANET [5], being a macroscopic decision support model.

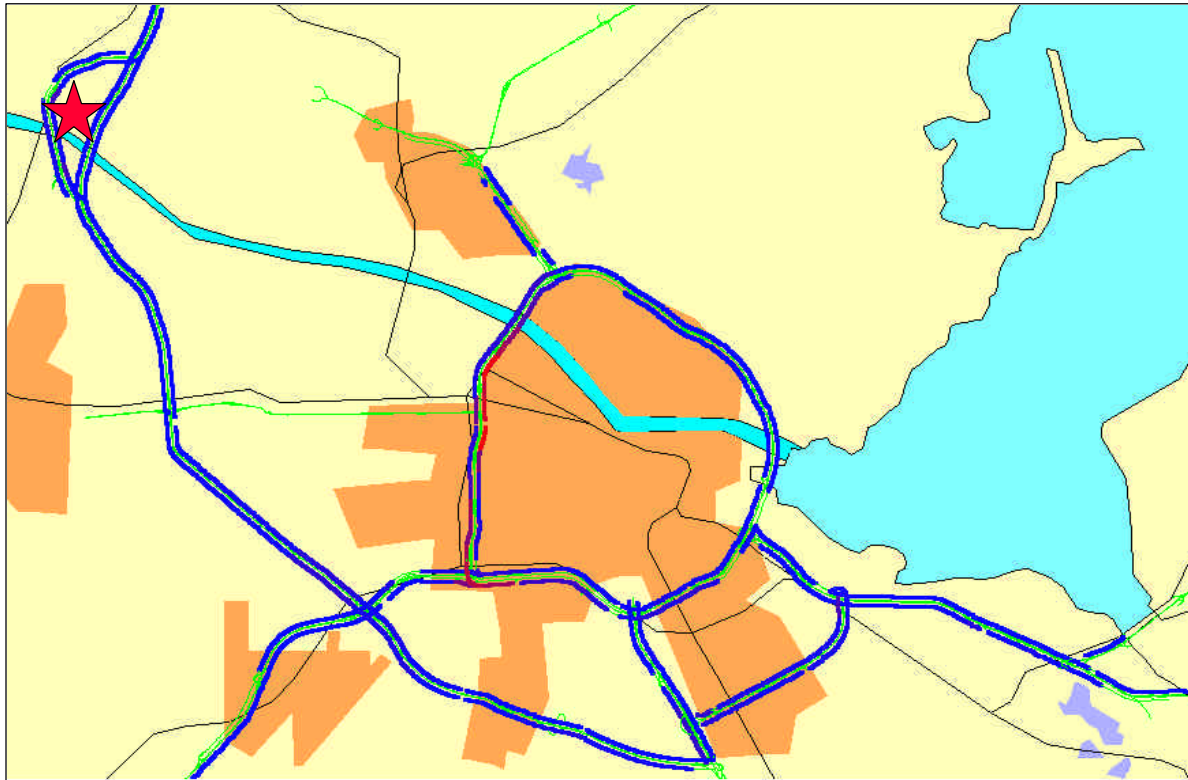
METANET is a deterministic macroscopic modelling tool for simulating traffic flow phenomena in motorway networks of arbitrary topology and characteristics, including motorway stretches, bifurcations, on-ramps and off-ramps. This modelling approach allows for simulation of all kinds of traffic conditions (free, dense and congested) and of capacity-reducing events (incidents with prescribed characteristics (location, intensity and duration). Furthermore METANET allows for taking into account control actions such as ramp metering, route guidance, and motorway-to-motorway control.

METANET has two distinct modes of operation. When traffic assignment (i.e. the drivers' route choice behaviour) aspects are not considered, then it operates in the non-destination-oriented mode. When traffic assignment is an issue, it operates in the destination-oriented mode.

The motorway network is represented as a directed graph whereby the links of the graph represent homogeneous motorway stretches. Each such motorway stretch has uniform characteristics, i.e. no on-/off-ramps and no major changes in geometry. The nodes of the graph are placed at locations where a major change in road geometry occurs, as well as at junctions, on-ramps and off-ramps.

### 5.2. Network characteristics

The current project area in the Netherlands is the area around Amsterdam. In the model, only national motorways are included. The motorways in this area are equipped with about 1000 detectors and various traffic control systems, such as ramp metering, variable message signs, variable direction signs, traffic (near off-ramps). The motorway network in the area around Amsterdam is characterized by congestion in regular intervals.



*Figure 4: Project area in the Netherlands (around Amsterdam)*

In the presentation during the workshop the results have been reported on a sub-area of this network, which is denoted by the asterisks in the upper left corner.

### **5.3. System components**

The decision support system under development consists of several components, which are pictured, in the figure below.

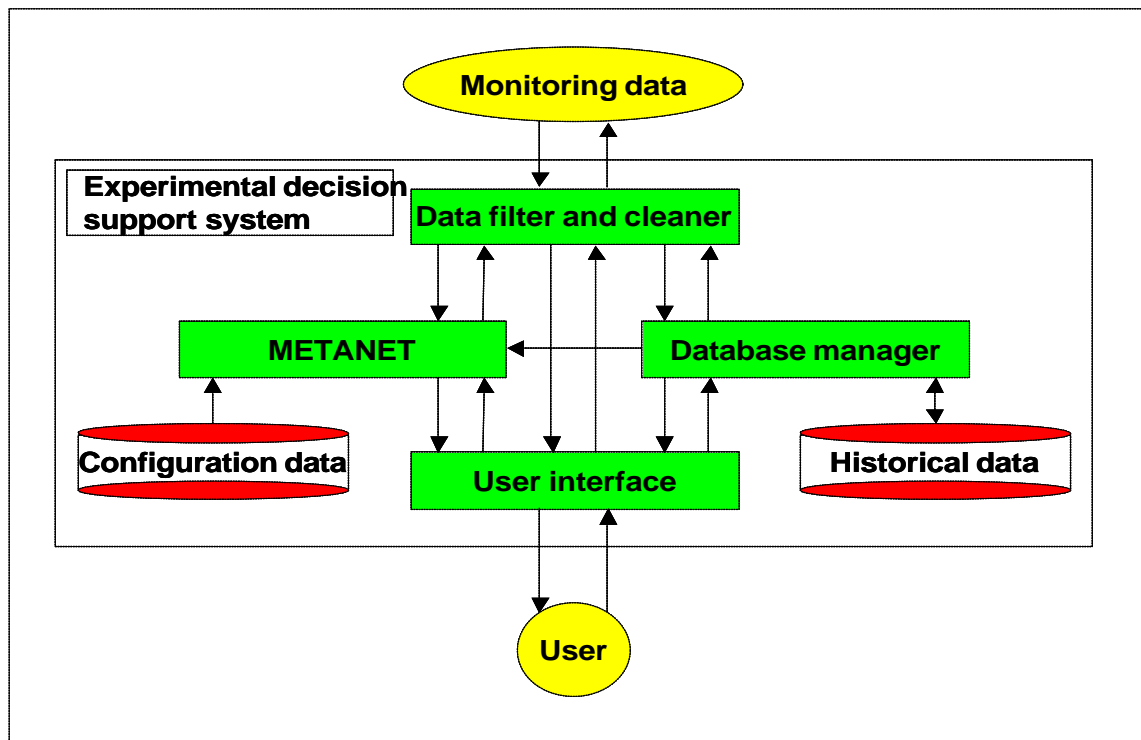


Figure 5: System components of the model under development

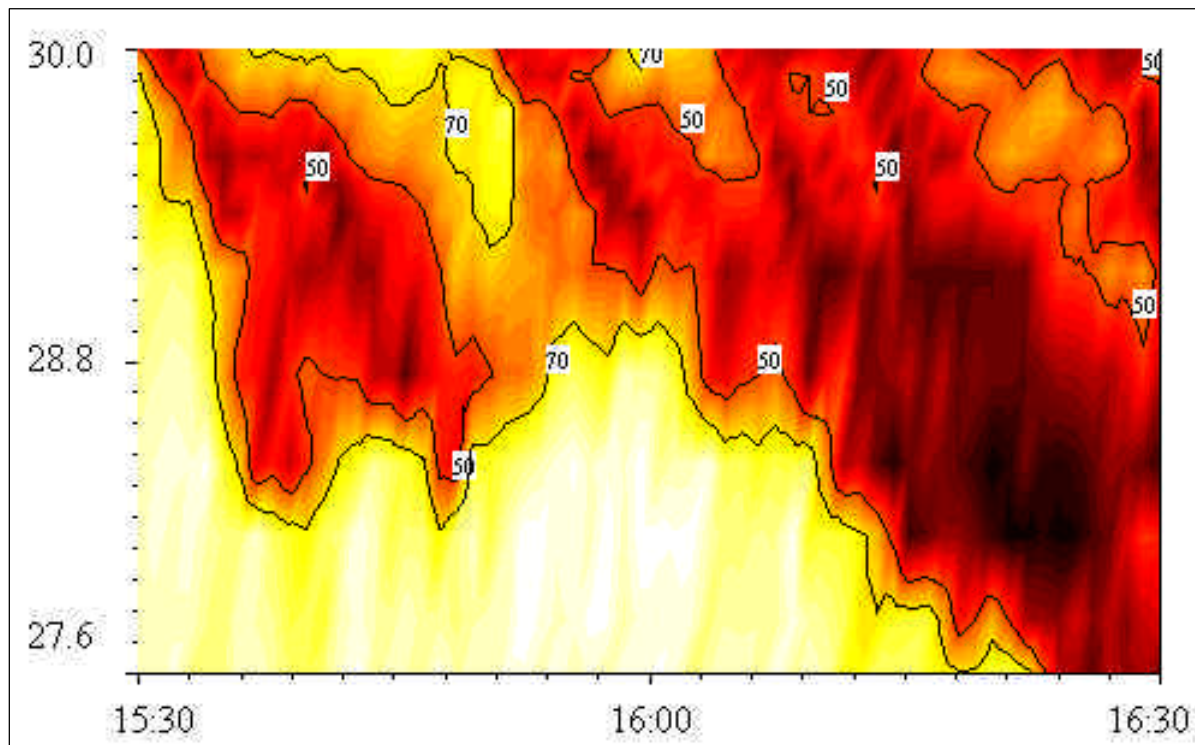
The different components in this system do the following:

1. Monitoring data: in The Netherlands a large monitoring network (MONICA) exists. This network is built upon speed detection loops buried in the road surface approximately every 500 meters. Many of these loops perform a function in the Motorway Traffic Management system (MTM), including automatic queue and incident detection. The information of all the loops is aggregated every minute and is sent to the Traffic Information Centre (TIC) in Utrecht. This centre releases every minute a dataset, which is available for information service providers and system like the Dynamic Route Information Panels (DRIPS) and the DSS. The dataset contains information like average speed, flow and occupancy per lane or cross section.
2. Data filter and cleaner: the data received every minute is filtered and cleaned for the network of the DSS and for neat and reliable information. I.e. some of the data elements may be erroneous as MONICA is not able to detect all possible problems in the information;
3. Database manager: all information in the DSS is controlled by a database in manager. It sends data from and to the other components and retrieves the data from the historical database;
4. Historical data: this is an important part of the DSS. In order to be able to predict for a certain horizon what will happen, one should know the typical characteristics of the current day and time period to come.
5. Configuration data: the size of the network, the links and nodes, the capacity of different cross sections, the number of lanes, the different control measures, etc. are part of this database;
6. METANET: the simulation model as described in the previous chapter. The model is fed by the filtered data, for the calculation of the current state of the network. The model is fed by the historical data by means of the database manager, for the calculation of the future state of the network. The prediction horizon is fixed and set in steps from NOW + 5 minutes, NOW + 10 minutes, NOW + 15 minutes, NOW + 30 minutes and NOW + 60 minutes;

7. User interface: the user plays an important role in the DSS. Communication with the user is of vital importance, as the user controls the simulation and has to deal with the results;
8. User: in a traffic management centre (in an international context abbreviated as TMS, in The Netherlands sometimes called RVMC) people with different functions and responsibilities are in charge of the real time surveillance of the network. To date most of the operators are still only what is called 'object operators'. It is however foreseen that in the near future a more 'pro-active' network management is necessary in order to fight incidents and severe congestion. Such a new responsibility will be performed by an operator function called 'network traffic manager' or 'regional traffic manager'. Actually, in The Netherlands the Ministry of Transport is heading for a Countrywide Traffic Management Centre (called LVMC) located in Utrecht.

#### 5.4. Experiences / Conclusions

As a first result, the experiment around the Velsler- and Wijkertunnel near Velsen and Beverwijk (see the asterisks in the map) was explained at the workshop in Antwerp. The first aim of the experiment was to link the real time data to the model and to make the model operate in real time as well, as, until then, METANET was typically an off-line model. The second aim was to see how traffic measures, like ramp metering and route information, could be implemented and how the model behaved in predicting the current and future situation.



A major task in this respect was the coding of the network and the calibration. It showed that there was a lack of data for the very precise needs the model demands. For the calibration, time space diagrams of the speed (as measured on line), were used, like in the picture above.

The project was successful, in such a way, that we have been able to transform METANET into a real-time model. For non-incident situations it was possible to calibrate the model against the real life data. However, sometimes congestion does not originate in the network being modelled. In such situations, the model is not aware of any incident as long as the queues have not reached the network



boundary. This is particular true for motorway congestion, but also for congestion originating urban areas. The major conclusion in this project was, that the concept of decision support should be based upon standards and interfaces along the network boundaries. Only when these standards and interfaces exist, it will be possible to link the results of DSS facilities from different authorities.

It was also concluded that with respect to decision support, a distinction should be made between on-line and off-line decision support. During incidents the time for operators to look for alternatives is very limited. They should have facilities from which they can choose a scenario for the situation currently existing or deploying in the network. Also for foreseeable situations scenarios should be available. This requires, apart from on line decision support tools, the availability of off line decision support tools, to be used by traffic managers, rather than by traffic operators.

As a follow up of the reported project, the METANET model has been extended for the whole Amsterdam area. In the calibration it again became clear that some model improvements are necessary, like controlling the outflow at the network boundaries. As a follow up it also was decided to develop an on-line and an off-line version of decision support tools, based upon the METANET model.

## 6. Status of decision support models in Flanders (Belgium)

### 6.1. Model(s) used

The model used in Antwerp (Belgium) is called VISUM/DYNEMO-ONLINE. **VISUM** is more like a static part of the model while **DYNEMO** is a mesoscopic item. The software has been developed by PTV (Germany) and has been implemented in Hannover.

The aim of the model in Antwerp is to give the current traffic status based on real time traffic data, fill in missing data, calculate travel times and doing a 30 min forecast. Maybe acting on traffic by changing cycles of traffic lights is possible in the future

The system must make it possible to calculate different traffic management scenario's (rerouting, lane closure, signal control...), which can be undertaken in specific circumstances.

The movement (speed) of individual vehicles is governed by the average traffic density on the link they traverse. Each link is divided in sections (100-200m) for which the density is calculated. Besides the speed density curves there are also the desired speed functions. This function models the preferred speed of individual drivers.

The roads are reproduced by links, which are divided in sections. Also lane turning relations, priority rules and traffic lights are inserted. Speed-density curves as well as desired speed functions are linked with different link types.

### 6.2. Network characteristics

The model area involves the most important arteries of the city of Antwerp, the ringroad and all in- and outcoming highways (7). There are about 60 zones. Major weaving sections are the most important reason of regular congestion and severe accidents on the ringroad.

High percentages of trucks (20-30%) has an influence on the traffic. Long distance traffic (North - South and West - East) causes high traffic densities on the ringroad of Antwerp.

Two tunnels on the ringroad are the only way to pass the river Schelde. One of them is a Toll tunnel which is located in the port. This is a reason why people don't like to take this tunnel.

Traffic counts are available on highways and the ringroad and some in the city of Antwerp.

### 6.3. System components

The model contains two major parts. One is VISUM which we use for building the network, entering capacities, turning relations, allowed vehicle types,... In this part assignment based on traffic data and OD matrices is done (Path Flow Estimator and Propagation).

DYNEMO is a second part which allows us to enter lanes, lane turning relations, traffic lights, blokkages... A dynamic DYNEMO assignment follows the VISUM simulation when you like to do a forecast.

The calibrated OD matrix will be delivered by another module.

Speed - density functions can be generated out of a historical data

An overview of the model architecture is presented in the figure below.

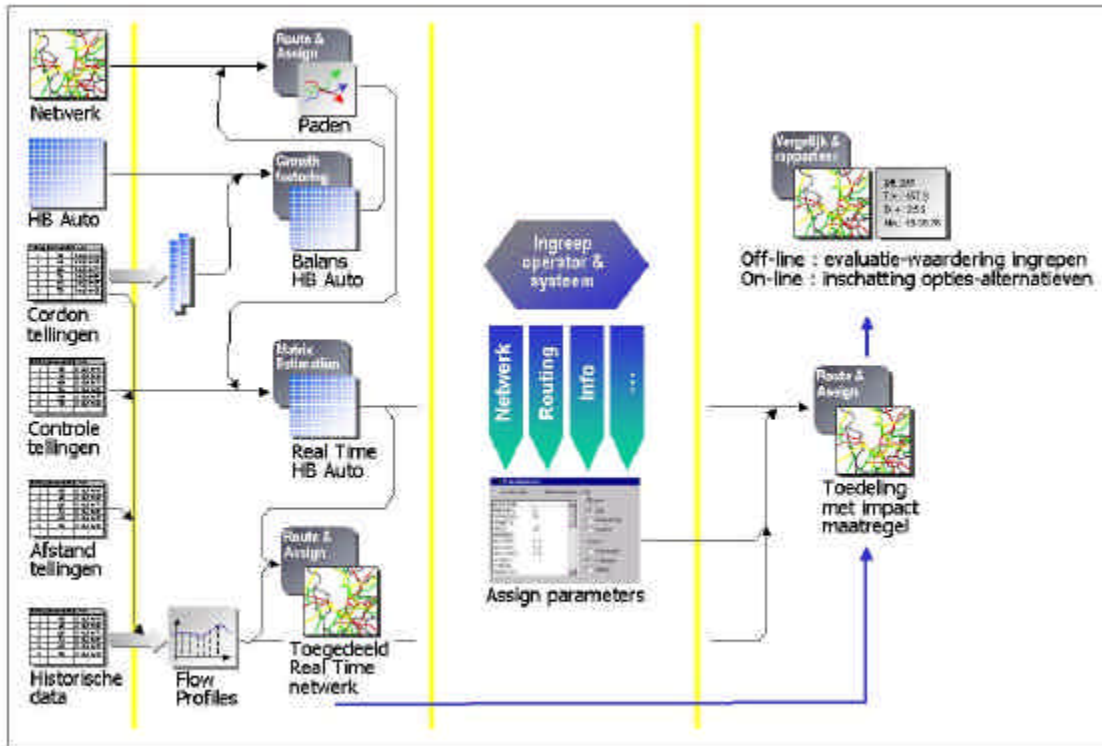


Figure 6: Overview over the model architecture

#### 6.4. Experiences / Conclusions

At the moment the model is in full development. The network is finished and validation for the evening peak is taking place (off-line). OD-matrices, speed density and desired speed functions must be produced for several days and periods of the day (peak hours, night, rain, snow,...).

There are also specific ringroad characteristics which must to be defined.

Later on the model will be implemented as a real time/on line model in the Antwerp traffic control centre. The model will then deliver the traffic status monitoring for the operator of the TCC and moreover some traffic control systems (rerouting, traffic light control) will run using the real time output of the model as input for the control algorithms.

## 7. Status of decision support models in Germany

### 7.1. North Rhine-Westphalia

#### 7.1.1 Model(s) used

In NRW a model is being developed by the University of Duisburg to complete traffic data and to forecast the future traffic situation [7]. Based on raw data (local data) a simulation can be run, which reproduces the current traffic status and allows to forecast the future traffic status.

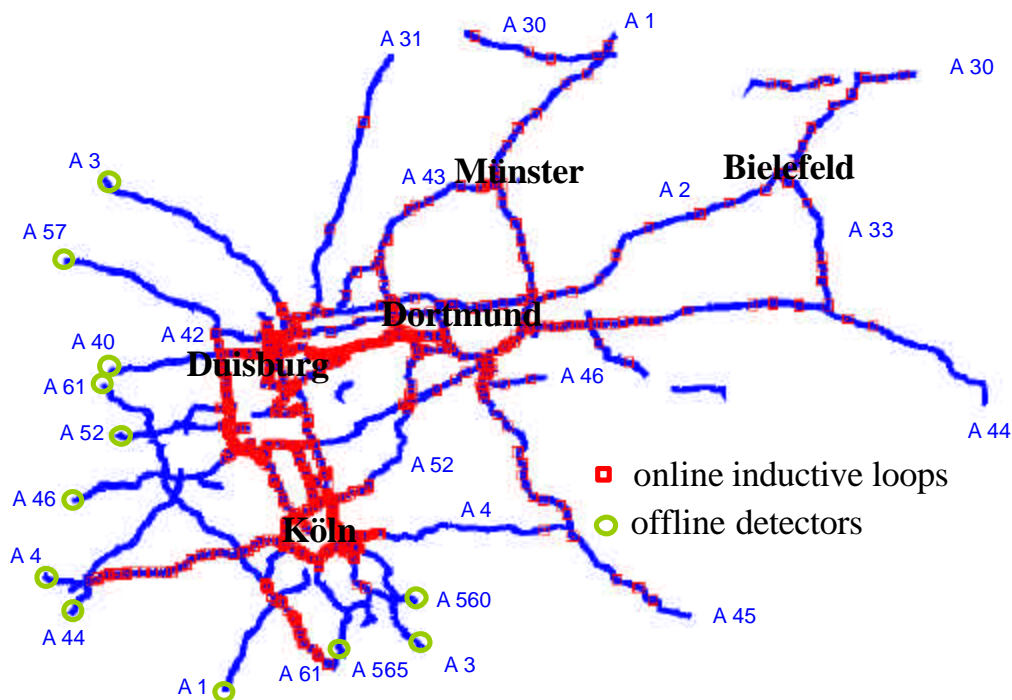
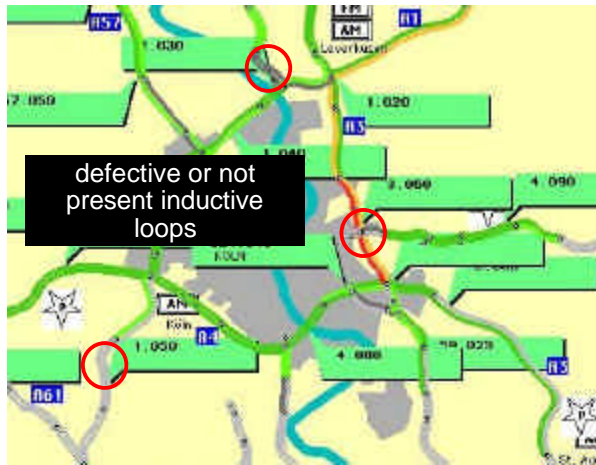


Figure 7: Inductive Loops in the BAB-network of NRW [7]

The simulation is based on a microscopic model using discrete algorithms to describe individually the dynamics of all vehicles. For the simulation of motorway traffic additional lane changing rules have to be considered taking into account legal requirements. The goals for the traffic authority in NRW with respect to the simulation model are amongst others to reproduce the current traffic status, to complete traffic data for motorway sections without detectors, to determine travel times, to do a short term traffic status forecast (up to 1h) and to enable construction site management.

*Measurement Results*



*Simulation Results*

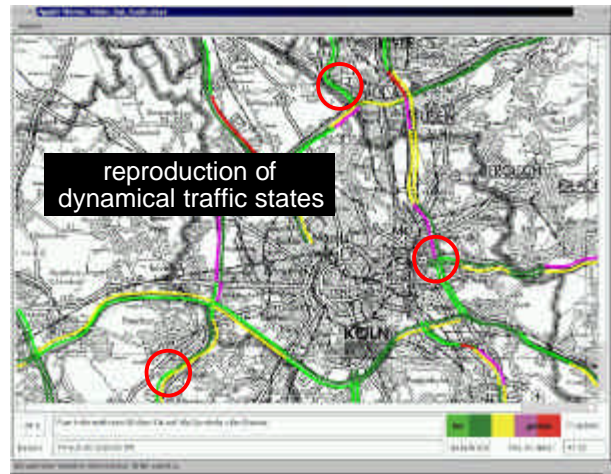


Figure 8: NRW-Simulation Model: Measurement Results vs. Simulation Results on the Kölner Ring [7]

7.1.2 Network characteristics

The motorway network is reproduced by single cells with a length of 7,5 m each. One vehicle is placed within a cell, the gap (number of cells between the succeeding vehicles) depends on the speed. The update of one vehicle is 60 times faster than in reality (i.e., one minute in the system corresponds to one hour in reality.)

The microscopic model can cope with complete networks (e.g., the motorway network of NRW consists of about 1,2 Mio cells) to reproduce the current and to forecast future traffic status and give network wide information. It allows the inclusion of heterogeneous traffic data and enables the evaluation and optimization of control measures.



nodes	1.200
links	3.560
on-ramps	830
inductive loops (IL)	3.500
off-line detection	200
intersections	67
length	2.500 km
cells	1.400.000

Figure 9: Network characteristics of the motorway network in NRW (based on the regional road information data base [NW-SIB]) [7]



### 7.1.3 Experiences / Conclusions

The simulation model for NRW is under development. Currently, it is already able to simulate the current traffic status by completing the detected traffic data.

## 7.2. Hessen

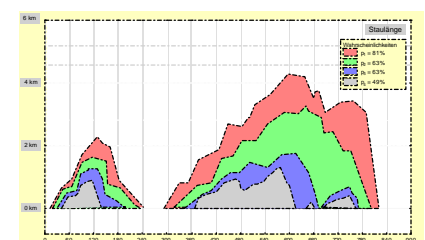
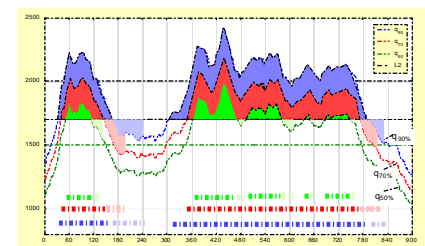
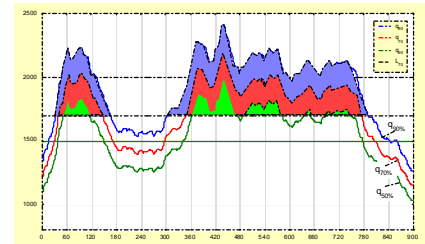
### 7.2.1 Model(s) used

In Hessen three decision support systems are being developed for different traffic management tasks. The description of the three systems are based on a presentation given on the above mentioned workshop held on 22<sup>nd</sup> January 2001 in Antwerp [1] and on the Traffic Centres Workshop held on 29<sup>th</sup> March 2001 in Utrecht [8].

The **Intermodal Strategy Manager (ISM)** is a prototype decision support system for intermodal strategy management in the Rhine-Main area. Currently the specifications and the prototype are being elaborated to be demonstrated within the national research and development project WAYflow in the Rhine-Main area. The **ISM** is being developed by a consortium lead by momatec GmbH (Aachen) and the partners TSS (Barcelona), GEWI (Berburg), Softeco Sismat (Genoa) and AS&P (Frankfurt). The Hessian Road and Traffic Authority, the City of Frankfurt and the regional public transport association RMV have agreed on intermodal strategies to be applied in predefined situations. These traffic management strategies are the basis of the ISM-project. The model of the offline-ISM is based on AIMSUN2 and GETRAM.

The second decision support system, which will be operated in Hessen, is dedicated to **road work management** and is based on a pattern-based risk analysis. The tool is called ALMO\_BAU and will be integrated in the road works management system in Hessen. Based on statistical distribution of capacities and transport demand patterns, the following output can be determined [1]:

- the **probabilities of congestion caused by road works**,
- the **expected congestion duration**, and
- the **probability of congestion length**.



With a given maximum congestion length caused by road works, which can be accepted from the traffic management point of view, and the determined congestion length decision support is provided by indicating the optimum start and end dates of the road works on motorway sections.

Further models, **ASDA** (Automatische Stauanalyse) and **FOTO** (*forecasting of traffic objects*), are being developed to trace and predict moving traffic jams and to detect and to trace synchronized traffic on motorway sections. These models are based on on-line traffic data, a validation of parameters is not necessary.

**ASDA:** ASDA is a model which allows tracing and prediction of moving traffic jams. Moving traffic jams are characterized, a.o., by a congestion front moving with an almost constant speed. The speed of the congestion front can be measured both by stationary detector systems (e.g., loops) or mobile systems (e.g. FCD) and used for the prediction of the moving traffic jam. This is the basic idea which has been used for the model ASDA. The model has the following main output data:

1. movement of the traffic jam can be predicted and traced, even if the traffic jam is located on a section between two detectors,
2. travel time (resp. time loss) can be predicted based on length and position of the moving traffic jam,
3. efficiency of traffic control measures can be validated based on the congestion dynamic.

**FOTO** (Forecasting of traffic objects):

FOTO is able to recognize the transition from one to another of the three traffic phases (free traffic, synchronized traffic and moving traffic jams). At first, the transition from free traffic to synchronized traffic is determined. Then the further development of synchronized traffic can be predicted.

Both models have been integrated in the application FOTOWin, which has been developed for the Hessian state road and traffic authority. They are installed for the section of the traffic line control system A5 interchange Frankfurt-West and intersection Friedberg in both directions.

### 7.2.2 Network characteristics

The prototype-**ISM** is covering a part of the Hessian motorway network (sector Frankfurt-Wiesbaden) including the relevant strategic secondary network as well as the strategic urban road network of the city of Frankfurt and the relevant network of the regional public transport association in the Rhine-Main area (RMV).

The **decision support system for road work management ALMO\_BAU** is covering the complete motorway network of Hessen.

The models **ASDA** and **FOTO** have been installed for an online test on the motorway section A5 between Westkreuz Frankfurt and intersection Friedberg in both directions of travel.

### 7.2.3 System components

#### **ISM**

The **ISM** consists of an offline and online ISM. The offline-ISM simulates and evaluates the impacts of intermodal strategies. The scenario-optimized network relations are estimated with the aid of traffic models. The optimized strategies are downloaded into the online-ISM, which activates automatically the intermodal strategies.

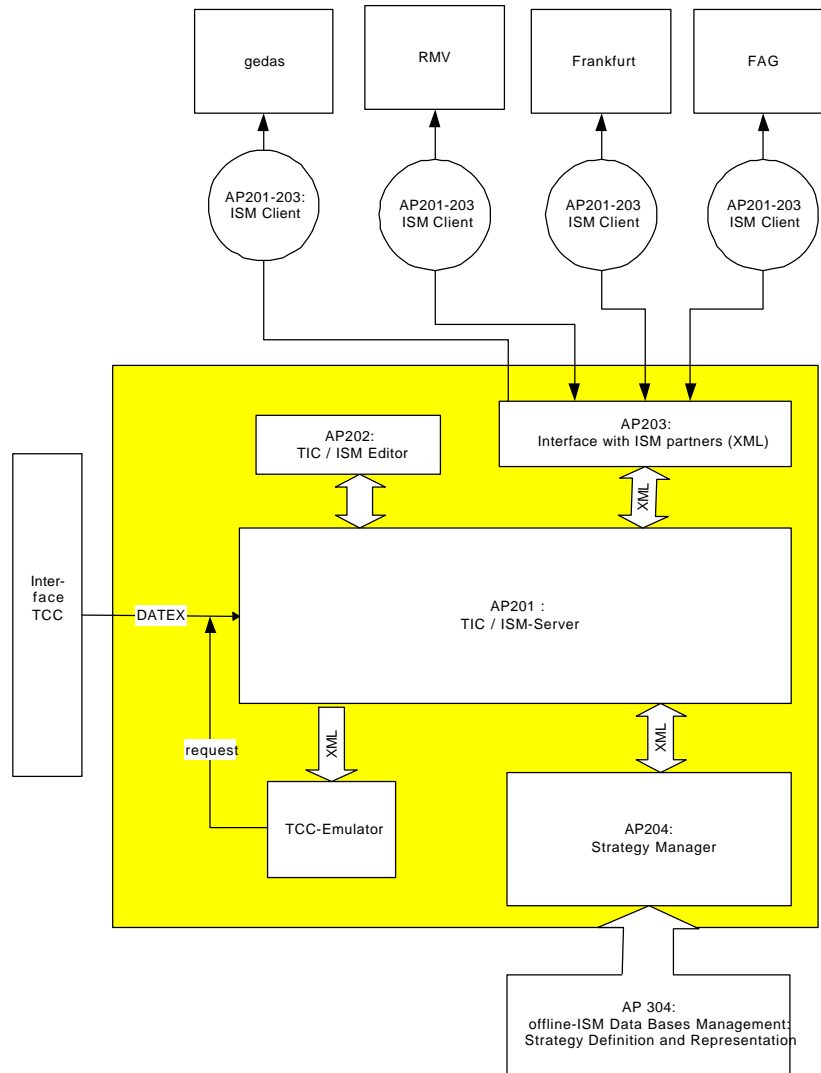


Figure 10: The online ISM: Intermodal Strategic Traffic Management [1]

The offline-ISM enables the generation, simulation and analysis of scenarios to support strategic traffic and mobility management, including

- analysis of recurrent congestion problems in the network,
- planning strategies to face expected anomalies in
  - transport supply (e.g. network capacity problems, bad weather, road works, etc.) or
  - transport demand (e.g. special events like fairs, etc.)
- definition and evaluation of new strategies to adapt transport supply (network capacity, parking capacity, multimodal offers, etc.),
- analysis of intermodal traffic control strategies (e.g. VMSs or RDS/TMC messages, etc.),
- the use of historic patterns as basis for simulation and predictions.

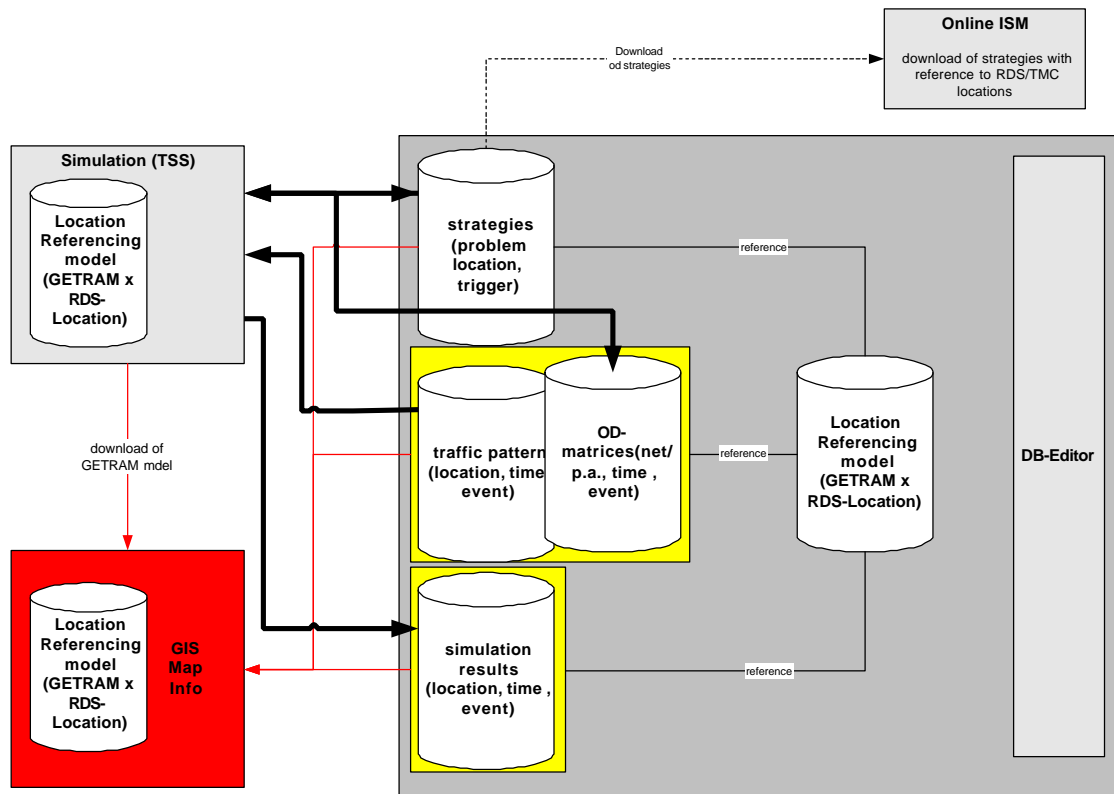


Figure 11: Offline-ISM: Integration of simulator with Data Warehouse [1]

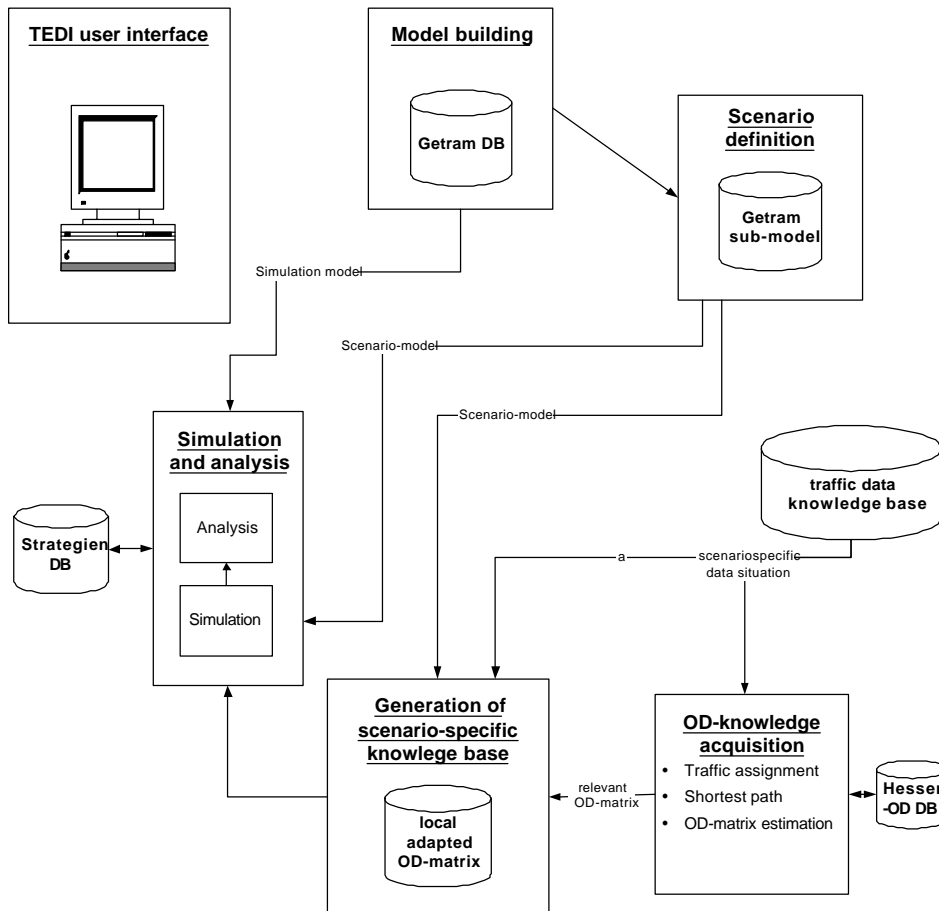


Figure 12: Offline ISM: Traffic & Mobility Management Strategy Planning [1]

#### 7.2.4 Experiences / Conclusions

The **ISM** is still in the phase of development. Implementation of the online-ISM prototype is planned for autumn 2001 and for the offline-ISM for beginning 2002.

The comparison of the traffic situation detected and the traffic situation simulated by the model shows that the analysis of the traffic situation and the tracing and prediction of traffic objects performed by the models **ASDA** and **FOTO** is very similar to the real conditions. It can be concluded that the results of the on-line test of the models **ASDA/FOTO** show various possibilities to improve the detection and tracing of disturbances to reproduce a realistic data basis in TCCs as basis for traffic management measures. The application of these models to the complete Hessian motorway network will be one of the major projects in the MIP-TEMPO.

The performance of ALMO\_BAU will be tested when the road works management system for Hessen has been developed and the system properly integrated. The development of the road works management system is one major project in the MIP-TEMPO.

## 8. Status of decision support models in France

### 8.1. Background

The information given on the French situation regarding decision support models is based on a presentation given on the above mentioned workshop held on 22<sup>nd</sup> January 2001 in Antwerp [2].

In France the CERTU (Centre d' Etudes sur les Réseaux, les Transports, l'Urbanisme et les constructions publiques) has conducted a study on the dynamic road simulation tools describing the theoretic principles, providing an overview of available tools in USA and Europe, giving a detailed description of tools distributed in France and focusing on user needs. The results of this study were published in January 2001.

The simulation tools often are used for different purposes, such as ex-ante/ex-post evaluation of traffic management schemes, real time decision support tools (short term prediction) and real time control (tools adapting / fine-tuning parameters automatically). Furthermore, traffic models are used for different problems, such as localised difficulties (e.g. bottlenecks, geometrical problems, etc.), for section or network wide optimisation, for different types of networks (urban, peri-urban, interurban), for a special time frame (e.g. peak hours). This often leads to the use of different tools (microscopic, macroscopic, hybrid, etc.).

### 8.2. Main models used in France

The main tools distributed in France are:

Dynalogic	}	<b>Microscopic</b>
Vissim		
SitraB+		
Paramics (recent)		
Integration	}	<b>Macroscopic</b>
PX-Metacor		
Polyflots		
SIMRES		

#### ***Dynalogic***

***Dynalogic*** is a microscopic tool and operational since 1994. The networks to be introduced to the model can be motorways and urban sections. ***Dynalogic*** can be used to test infrastructure design of traffic control schemes. The background is a stochastic approach with multiple parameters. It provides a user-friendly graphical interface. The platform necessary to run the model is LINUX.

#### ***Sitra***

***Sitra*** has been developed since the 1970's. It is a microscopic tool used especially on urban networks. The enhanced model to be used on motorways is under development. It can be used to test infrastructure design or traffic control schemes. It has a fairly user-friendly graphical interface, which could be subject to some improvement. The platform to be used is a UNIX PC.

#### ***Vissim***

***Vissim*** has been developed since the 70's in Germany. It is an microscopic tool to be used for urban networks. It can be used to test infrastructure design (bus stations, toll stations), traffic control

strategies (algorithms embedded). It has a user-friendly graphical interface, including 3D-developments. The platform to be used is a PC.

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**Integration**

**Integration** was developed in the USA. It provides the possibility of a uniform treatment of urban freeways and urban networks. It is able to test infrastructure design and traffic control strategies (freeway/UTC). It can be situated between macroscopic and microscopic tools. The user interface is old fashioned and not very comfortable. It can be run on a PC.

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**Px-Metacor**

**PX-metacor** was developed by INRETS and Phoenix. It is a macroscopic tool targeted at simulating strategies on corridors (ramp metering, speed management, impact user information etc.). It has good user interface and is extensively validated.

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**Simres**

**Simres** has been developed by INRETS and Isis. It has been designed to reproduce flow on motorways (on- and offline). **Simres** reconstitutes and predicts traffic situations (1h, 2h) in case of incidents, simulates traffic control / information strategies. It is used in Scotland and by some motorway companies in France.

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**Polyflots**

**Polyflots** has been developed in 1994-1996 by ATN-SA in France. It is based on intelligent agents modelling and interaction vehicle-traffic flow. It is able to simulate large interurban networks. It had been especially developed for a study in the Alps, which explains several limitations.

### 8.3. Experiences / Conclusions

A user survey was part of the above mentioned study. The results were:

- Simulation is useful, but not widely used.
- It remains a complex and specialised field.
- The graphical user interface is of major importance.
- On-line / real-time simulation is needed by "high-profile" clients (e.g. road managers, motorway companies).
- There is no single tool for all needs.

## 9. Status of decision support models in England (HA network)

The information given on the experience of the Highways Agency regarding decision support models is based on a presentation given on the above mentioned workshop held on 22<sup>nd</sup> January 2001 in Antwerp [3].

### 9.1. Model(s) used

In the Highways Agency (HA) projects were executed on macroscopic, mesoscopic, and nanoscopic level. The HA started working on microscopic modelling in 1978 on the M5 with a model called **Autowarn**. In 1989 the HA reviewed the existing microscopic models and developed the **SISTM** model. On mesoscopic level they choose **MCONTRM**, which is based on **CONTRAM**.

#### **SISTM**

The **SISTM** (Simulation of Strategies for Traffic on Motorways) is a microscopic model, which is applied on 20-99km of 2-6 lane motorway. The model is based on individual vehicles with single driver's characteristics. The model responds to traffic management systems, road configuration. The latest release is version 5.2. The users now have 10 years of development and experience. It is applied in the area of the HA on 12 major projects, in particular on ramp metering, on the M25 controlled motorway pilot, on the MIDAS project, and on other applications such as speed flow on D5/D6 motorways, tolling sites, HGV speed limiters, bus lane restrictions, hardshoulder running, etc. The weakness on the model is its user interface and the modelling of shockwaves.

#### **MCONTRM / MOLA**

**MCONTRM** is designed for simulating traffic on motorway networks. The model is based on the proven **CONTRAM** urban models. In the HA it is used on the Kent corridor, on national diversion plans and on the MDIS (Midlands Driver Information System).

The **MOLA** (MCONTRM On-Line Assistant) is a real-time network model. It predicts network conditions one hour ahead and gives recommendations such as model diversions during incidents and recommends best strategy.

### 9.2. Network characteristics

The modelling expert group within the HA mainly runs the models on the motorway network, such as on the M25 signal trials and the controlled motorways pilot, for the MIDAS development, for motorway/urban control system integration, for ramp metering / access control etc. and to investigate the impact of enhancements proposals to increase lane provision at specific sites.

Real-time traffic demands are input to Kent Mola by MIDAS type loops detectors at major nodes on the network. Also coupled with Kent Mola is a database of roadworks or other events which effect road capacity. The database is modified weekly to reflect changes in roadworks. The MOLA system is not linked to the diversion setting system and the implementation of diversion strategies has to be undertaken manually by the operator.

Coupled with the MOLA system in Kent, the Police are provide with advanced information of HGV demand which needs to be store during disruption to the channel crossing facilities at the port or the channel tunnel. Known as "Operation Stack" it involves the storing of HGVs on part of the adjacent motorway network that is commandeered to store the vehicles.

### 9.3. System components

Models such as SISTM are integrated applications that run on stand-alone PCs and are used for off-line decision making.



Mola uses MIDAS loops, outstation equipment and transmission to gather the real-time data. This data is processed by a dual/quad processor based PC to provide the operator guidance on route diversion strategies to adopt. A monitor provides a county based display giving real-time traffic flows at each collection node; it also provides bar chart of HGV demand at each junction approaching the cross channel terminals.

#### **9.4. Experiences / Conclusions**

Though MOLA has been used regularly the need for the implementation of a diversion strategy has not proved necessary. The "Operation Stack" display has proved a great benefit to the Police and though changes in responsibility will in time see Kent Police loose responsibility for the Kent Motorway network the Kent Police wish to retain the display.



## 10. Conclusions

The various projects conducted in the CENTRICO regions show, that traffic modelling is an important issue.

A user survey conducted in France showed, that simulation is useful but not widely used [2]. The graphical user interface is of major importance of the model. Simulation is complex and there is no tool for all needs.

In England, the MOLA project revealed that operators were a bit reluctant to use it in the beginning, but after now 4 years of experience they indicated that it was one of the most important tools.

The participants of the expert meeting held on 22<sup>nd</sup> January 2001 at Antwerp concluded that exchange of experience would be needed. The CENTRICO Steering Committee decided to keep this subject as issue within the regular CENTRICO workshops.

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