Traffic + Mobility – measures and tools: from traffic regulation to GIS-analysis
Ralf Kober /Josef Brosthaus (TÜV Rheinland Group Cologne, Germany)

Johannesburg, Wed. 07.03.2007, 9:30, Civic Centre, Block A, 11th floor

---

Present:

City of Johannesburg (COJ):	John Kelly (JK) Justice Netshandama Margot Richardson (MR) Vumile Senene (VS)
Ekurhuleni:	Lou van Niekerk (LvN)
TÜV Rheinland:	Josef Brosthaus (JB) Ralf Kober (RK)
University of Johannesburg (UJ):	Chris Cooper (CC) Philip Goyns (PG) Melanie Kneen (MK)
Uni Midlands Zim:	Charles Paradzayi (CP)
Other:	Mtumbi Goma (MG)

I. Introduction (JB)

a) Reference to the kick-off meeting, Nov. 2005, Johannesburg (copy of the agreed activities for all participants).

During the kick-off meeting the following potential pilot projects were identified

1. Public transport: alternative technologies,
2. Air quality and emissions linking to vehicle activity and associated modelling and
3. Urban form planning influence on congestion, energy consumption and emissions.

"Air *quality and emissions linking to vehicle activity and associated modelling"* was selected as the most appropriate pilot project due to its appropriateness to a short term low capital cost pilot project. It also suited the current activities in the Environmental Management department at the City of Johannesburg, the expertise at TÜV Rheinland and the interests at the University of Johannesburg.

The aim of the project was to:
Link vehicle activity & vehicle fleet to emissions – input into *EMIT & ADMS-Urban*; Compare *TESM* (TÜV emission simulation model) and *ITM* (IKARUS Transport Model) (top-down approach) with models used by Johannesburg for validation and peer review.

b) Progress of pilot project so far (PG)

As part of the pilot project Philip Goyns made a 3 month research visit to the German partners (1 June-6 September 2006.)

The purpose of the research visit was to:

- Learn more about the models and decision support tools developed and used at IER, Research Centre Jülich and TÜV Rheinland to evaluate transport energy and emissions policies;
- Select an appropriate model, modify an existing model or develop a new model in order to simulate fuel consumption, emissions, and relevant policy options for the City of Johannesburg;
- Study the methods used to develop transport emissions inventories;
- Conduct a literature review of driving cycles and their impact on emissions and fuel consumption;
- Strengthen and develop relationships between German and South African institutions involved in the Enerkey project by providing a mechanism for the exchange of knowledge and by providing a South African perspective of conditions and issues in the Greater Johannesburg region; and
- Gain access to data and expertise in Germany in order to focus the aims of Enerkey mobility working group.

Milestones achieved

The research visit contributed by helping select an appropriate model, by providing detailed explanations of the inner workings of the models being considered and by providing data which can be used to link vehicle technologies and driving cycles in Johannesburg to emissions factors and fuel consumption.

The following *key points* were made about choosing an appropriate model:

- A model's ability is limited by the availability of relevant data; and
- When there is lack of data for the higher level models lower level models can be use to generate the required data.

The *ITM* was found to be most suitable of the models examined for this research for the following reasons:

- It allows one to consider vehicle technologies, types of infrastructure (roads), and driving conditions on fuel consumption and emissions, the focus of this research; and
- It can be used to study scenarios of different shares vehicle technologies, the impact of modal shifts, varying vehicle occupancies, and policy options which impact on these parameters.

II. Emissions Inventory: Tool for Scenario-Calculations and necessary input for Dispersion Modelling

Key words: GIS (Web-based, statistical analysis, emissions inventory), Tools, Data structure (source, traffic, emission factors),Results

a) Status

Gauteng

Continuing Work as a Result of Philip Goyns visit (**UJ;** PG)

At present the driving conditions in the ITM are calibrated for Germany. In order to use the ITM for Johannesburg an appropriate transformation is required to match South African driving conditions and driving cycles to those in Germany. This is only possible by using the data in the *Handbook of Emission Factors* (HBEFA) and the data used to generate it. The

HBEFA provides the underlying data in the ITM. Driving cycles, vehicle operating parameters and emissions data used to develop the HBEFA were obtained from TÜV Rheinland and EMPA during the visit.

Progress since research visit

A new emission simulation model has been built from the data obtained during the research visit. The model requires engine operating patterns of engine speed and engine load, the vehicle capacity and the emissions regulation it adheres to calculate fuel consumption and emissions of CO, NOx and HC. (PM is still being developed for diesel vehicles.) In addition engine operating patterns and driving patterns from 2300 trips, 550 hours, and 24000 km have been collected from of 22 vehicles driven in Johannesburg.

The data collected from the vehicles is currently being processed to characterise common patterns within the City.

Data sources

Ekurhuleni (LN): Transportation and traffic engineering. Use *Saturn transport model*

The major routes in Ekurhuleni are provincial and national managed by *SANRAL* and *Gautrans*. Localised improvements have little impact on national and provincial traffic
The Gauteng freeway improvement program is currently underway (contact *Alex van Niekerk*)
Ekurhuleni *Integrated Transport Plan* – is the main source of data and is primarily about public transport

City of Johannesburg (JK): Network data – major links

Johannesburg including provincial and national roads – also include data from Ekurhuleni. Includes data about:

- Link capacity – speed flow
- Traffic counting program (sparse) 5% links observed
- Full flows modelled (*EMME/2*) – linked (calibrated) model to counts
- *Natis* (national transport information system)
- Summaries of data from household surveys
- Measured flows and growth models
- Johannesburg Integrated Transport Plan

b) Clustered data structure Europe (RK)

On the basis of he **attached sheet** the data structure was discussed and agreed as necessary input for future *Emissions Inventory Mobile Sources* (EIMS).

c) Interfaces, supplementations (all)

Possibilities discussed

d) Link between top-down and bottom – up models, example: ITM (PG)

see I: *Progress of pilot project so far*

III. Generate Scenarios (W*hat would happen if*...) (all discussed)

a) Reference to the soccer world cup 2010:

Effectiveness of traffic signals, bicycle systems, more and better public transport: rapid bus system, Metro, Gautrain…..

b) Long term:

Better fuel quality, alternative fuels, IM-effects etc.

IV. Further work, co-operations, follow-up projects (e.g. CDM)

Problems that need to be considered on the basis of the **attached sheeet** *Clustered Input Data:*

- The traffic counts are not detailed enough to differentiate between the age of vehicles, engine capacities and fuel types.
- Integration between different systems
  - Transport models and Dispersion models
  - Different models used by different cities
  - Different models used at local, provincial and national level
- Impacts of fuel shortages

Other comments:

COJ: *What does COJ hope to get from Enerkey?*

- Further research ideas
- Model impact of potential new technologies
- Trial projects testing potential new technologies

COJ:*Transport plans for the next 5 years:*

- Rationalise and expand public transport system
- Bus rapid transport system
- Infrastructure for BRT busses
- Feeder collector system – other busses taxis
- Route planning – SPTS (strategic public transport system), IPTN (Integrated Public Transport System)
- Vehicle technologies

COJ Environment Management Plan:

Presentation *Air Quality Modelling*
EMIT, ADMS- Urban & Transportation (MR)

- Transport and domestic fuel emissions
- Problems spatial data
- Interface EMME/2 and emit
- Plan to ground truth boilers

Sum it up: *A very good basis for further co operation.*

Gautrain (discussed all)

- Impact on the environment?
- Influence on local transport?

Further work:

1. Continue current project and extend monitoring of vehicles (PG)
2. Detailed traffic counts (vehicle types) initially at 6?? joint monitoring stations (co-ordinates from Cities, TÜV)
3. Create a base case (data benchmark) for Johannesburg
4. Create a base case (data benchmark) for Gauteng
5. Data portability between cities, province and state (MK+gov)
6. Socio-economic study of alternative transport systems (cost benefit analysis) (TÜV) (Integration with other working groups)

Key points for possible Follow - up Projects

- Pilot area emissions inventory
- What are the impacts of vehicle emissions regulations?
- Collection of important data on the basis of the **sheet attached**
- What are the strategic needs?
- Assess transport technologies and methods
- Alternatives to road transport
- ITS – intelligent transport systems
- Regulations of cars
- Regulate maintenance of vehicles – administration
- Local transport systems
- Town house complexes
- Suitability of current data
- Transport technology options – economic and environment impacts
- Integrated transport systems

March 2007 (PG, JB, RK)

Attachment: Emissions Inventory Mobile Sources,
Clustered Input data

EnerKey Phase 2: ***Energy use in transport***

WS 05. bis 08.03.2007 in Johannesburg

Task: **Emissions Inventory *Mobile Sources* (EIMS)**

Clustered Input data

source

line				**area**		
highway	rural	urban		dwellings	industrial	mixed

characteristcs

number of traces paved or unpaved		population and building density distance from city center
speed limits		

traffic data

for the different types of vehicles (e.g. passanger cars, busses, trucks, vans etc.):
- number of vhicles
- average vehicle speed
- speed and acceleration distributions
- diurnal traffic flow on an hourly base (working day, saturday, sunday, week average)
- driving behaviour, average speed as function of diurnal traffic flow

emission factors

for various reference years as function of:
- type of vehicle (s. traffic data)
- age distribution of vehicles
- maintenance level
- speed/acceleration
- vehicle load
- ambient temperature
- road gradient
- etc.

Cologne, 23. Febr. 2007

Josef Brosthaus