



TRAFFIC AND POLLUTION MANAGEMENT

NEW MARKET FOR DEVELOPING
AND
DEVELOPED COUNTRIES

ITS World Congress, 24.09.2009

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Introduction

Our transport networks have to carry increasing load day by day. Looking into the future, the growth rates will remain on a high level or even increase further.

But the road traffic we discuss here (*carbon based engines*) also emits gases and particles into the environment.

How may advanced and innovative traffic and pollution management systems support jobs creation, economic growth and ecological needs at the same time ?



Content

- Emission and Immission
- Why and Wherefore?
- Traffic management policies
- Emission Modelling as part of integrated traffic management
- System architecture
- Conclusions

Emission and Immission (I)

Emission

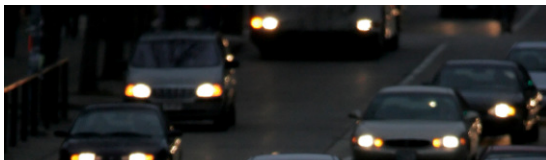
- Emission is the disposal of substances or energy by an artificial or natural entity.
- Relevant examples: CO₂, NO_x, CO, SO₂, PCH, Pb, particulate matter, light, noise.
- Legal emission limits placed on products (vehicles).

Immission

- Concentration of pollutants at a certain location – irrespective of the place of emission or process of formation (e.g. O₃).
- Legal immission limits placed on locations.
- Alternative definition widely found (but possibly wrong) : Immission is the introduction of substances or energy to the environment.
- Synonym for **Pollution**.

Emission and Immission (II)

Emission (per/by vehicle)



- CO₂, NO_x, CO, SO₂, PCH, Pb
- Particulate Matter
- Light, Noise, Vibrations

- Emission density:
 - Fleet structure
 - Traffic distributions
 - Fuel mix
- Dispersion Mechanisms
- Production and Reduction Mechanisms

Immission (concentration of pollutants)



- Modes of Action
- Location of Action
- Derived Pollutants (e.g. O₃, acid rain)

Why and wherefore?

Emission Modelling is a ...

- ... global/regional tool for **public authorities** to reach their goals:
 - Keep the immission limits
 - Contribute to cutting / mitigating emissions
 - Motivation/Reasoning of political measures
 - Traffic control, traffic management
 - Environmental zones, city tolling schemes
- ... individual tool for **drivers**:
 - Make emission profile transparent (econometers exist since 20 years!)
 - Feedback on individual driving behaviour
 - Possible basis for incentives

CO₂ is a highly emotionalised buzzword...

- ... synonymous for negative climate effects (warming, destabilisation),
- ... synonymous for energy efficiency (resources are political drivers),
- ... mostly of global interest (no local toxicity or climate effects), but:
 - ➔ “Where much CO₂ is produced (by traffic), also other (locally active) pollutants are produced.”

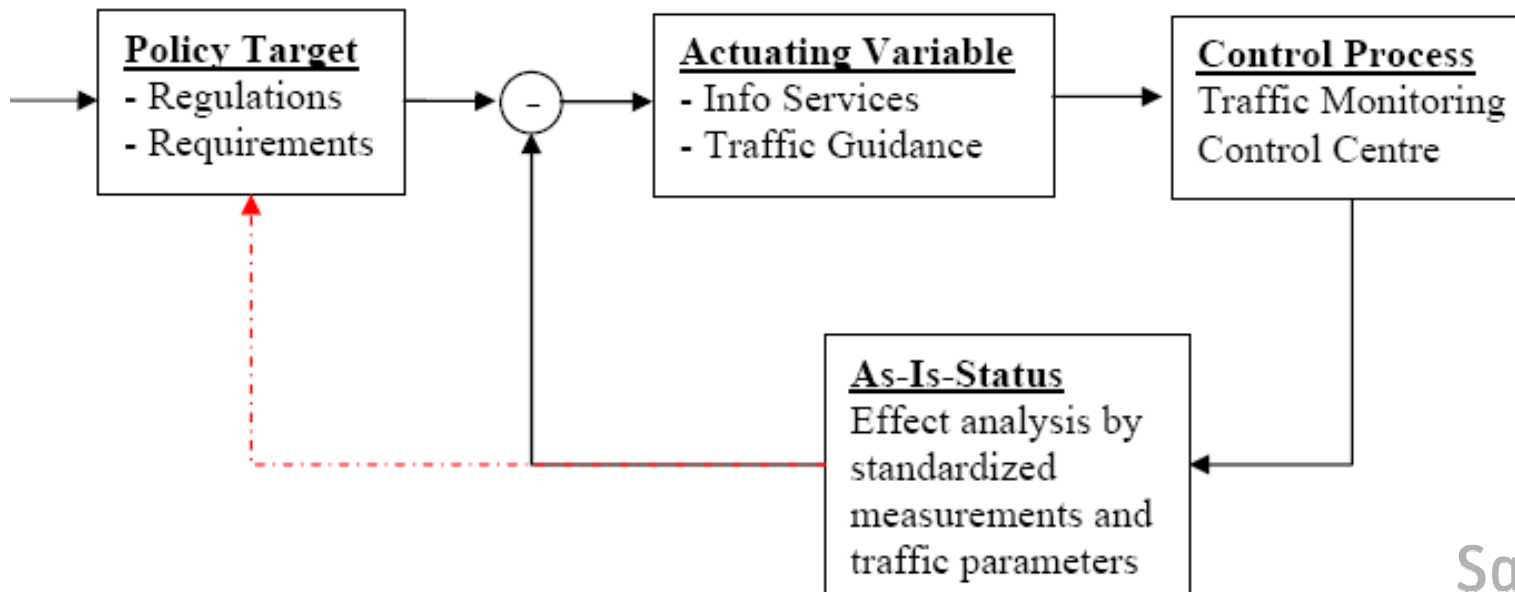


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Traffic management policies

Control loop of policy targets for traffic management:

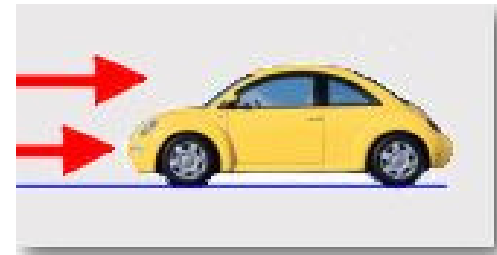
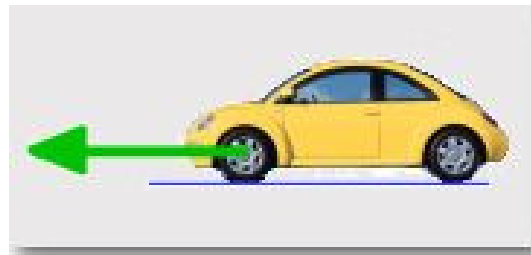
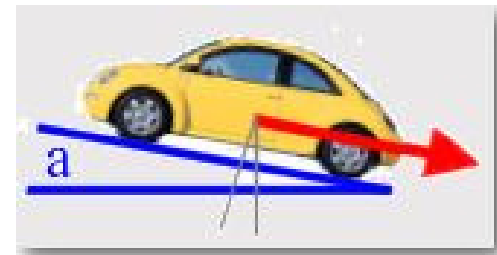
- The relation between traffic and emissions is used to build up a control loop
- Better insight may lead to different / more suitable regulations



CO₂ Model

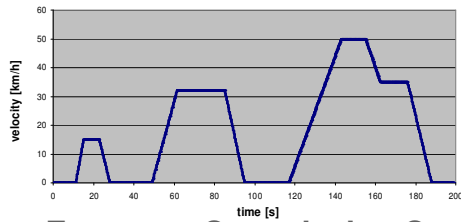
Fuel consumption, physical model

- Fuel consumption rate is driven by:
 - Motor and transmission efficiency
 - Forces effecting the vehicle:
 - Acceleration (positive)
 - Rolling Friction
 - Grade
 - Air drag (aerodynamics)

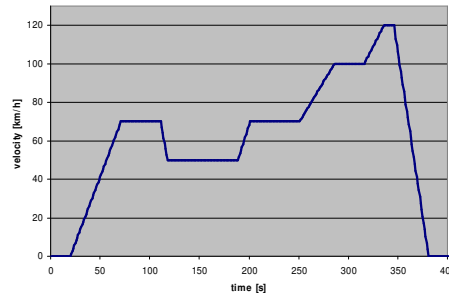


Emissions-Modelling

„Make energy visible and comparable“



European Commission Cycle (ECE15)



Extra Urban Driving Cycle (EUDC)

Property	ECE15	EUDC
Distance [km]	1.013 (x4)	6.955
Duration [s]	195 (x4)	400
Speed. Ø [km/h]	18.7	62.6
Max. Speed [km/h]	50	120

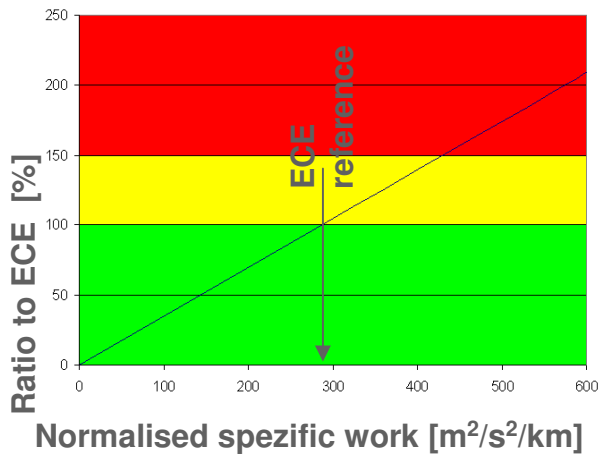
Model- car:

$$m = 1200\text{kg}$$

$$\mu = 0.015$$

$$c_d = 0.325$$

$$A = 2\text{m}^2$$

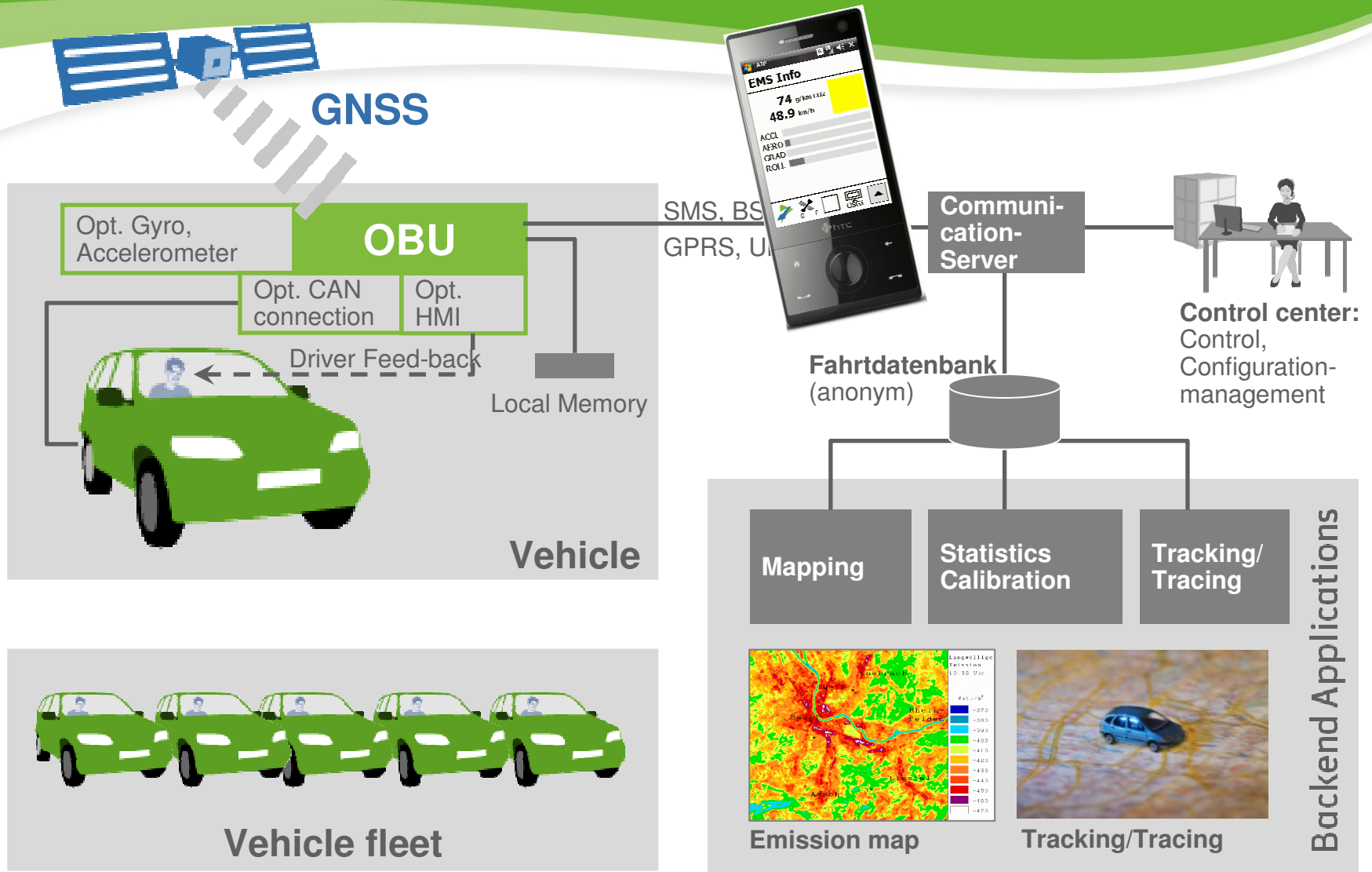


„Low speed regime“: Aero-dynamic effects not considered

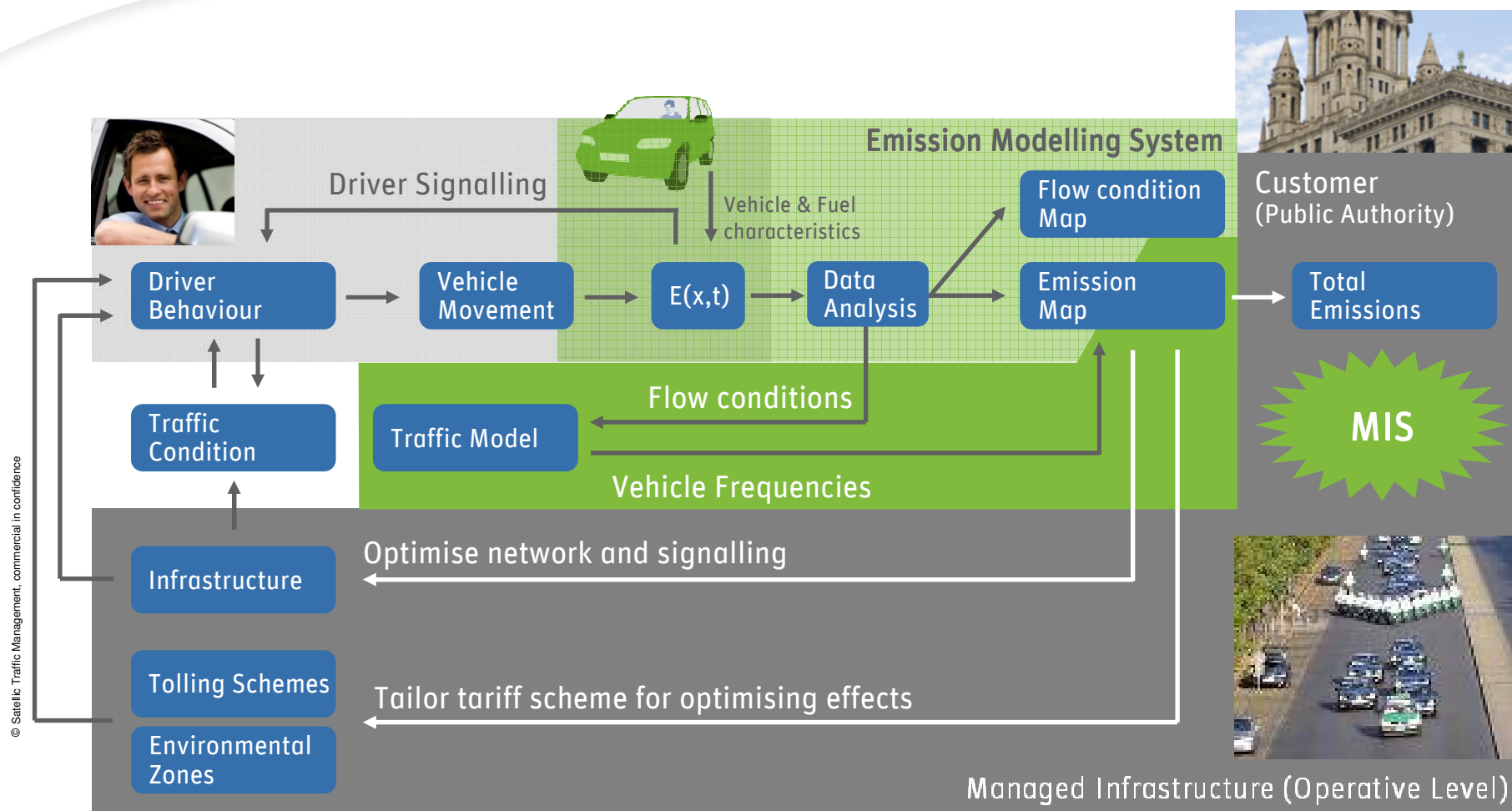
Cycle	Acceleration work	Friction	Aerodyn. work	Climb work	Total
ECE15	175 kJ (45%)	174 kJ (45%)	38 kJ (10%)	0 kJ	387 kJ (100%)
EUDC	786 kJ (24%)	1189 kJ (36%)	1340 kJ (40%)	0 kJ	3315 kJ (100%)

Method and derived values © Satellic Traffic Management

Emission - Modelling System architecture



EMS as part of an integrated Traffic Management System



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Conclusions

- The future is becoming **green and mobile**.
- Satellic introduced a vehicle based Emission Modelling System that is based on **GNSS data only** (no vehicle sensors).
- **EMS** is a valuable and efficient method to validate and support **environmentally oriented traffic management**
- **Direct in-vehicle driver feedback** allows to influence the driver's behaviour positively.
- In FCD-mode Emission Modelling as a valuable component for Integrated Traffic Management:
 - Optimise Traffic by visualising Urban Pollution caused by vehicle traffic.
 - Provides public decision makers with additional relevant information
 - Helps to achieve the (local and global) Pollutions Limits.
 - It is a visualisation tool for reasoning Urban Tolling schemes or Environmental Zones.
- Modern architectures allow the integration of **multiple services** on one platform using commodity hardware.



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Thank you for your attention !

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