PEEK traffic solutions

Cooperative technology becomes green

Energy efficiency in traffic management and control

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Environmental concerns

Problem:

- Global warming, air quality, health, livability
- Pollutants versus emission versus air quality
- Contribution of traffic +/- 20 percent

Solutions:

- Vehicle technology – cleaner vehicles
- Traffic regulation – smoother traffic
- Mindset – balance individual and system optima
  - ECT
  - Social navigation

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Strategy

- Strategic → Tactical → Operational

- Trip planning
- Modal split
- Route choice
- Vehicle movement

- Macroscopic approaches (flows) → Microscopic (vehicles)

- Approach: relatively simple solutions, significant improvements

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Some figures

- Fuel consumption waste factors
  - Inefficient deceleration, lack of anticipation 22%
  - Congestion 15%
  - Driving too fast 11%
  - Inefficient traffic light control 11%
  - Poor management of construction sites, traffic accidents 11%

➢ Focus: Driving behaviour and *Traffic management and control*

➢ Scope: less acceleration, less stops and less fuel

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Selective priority in local control

CVIS

- Prioritize heavy vehicles (in particular on main routes)
  - Shifts stops from heavy to light vehicles
  - Reduces the overall number of stops
- Advise the driver on the best approach to the stop line
  - Avoids unnecessary acceleration (deceleration)
  - Helps the driver to anticipate
  - Avoids stops resulting from excess speed
- Avoid the situation in which a heavy vehicle is the first vehicle to stop for a red light

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Simulation experiment

- Microsimulation (AIMSUN) in a network of 9 intersections
  - Two vehicle classes
    - 10-16 ton modern heavy goods vehicles (22% of total volume)
    - Modern small private cars (78% of total volume)
  - Adaptive traffic control system
  - Approximation of Cooperative Priority Application by giving the HVG's on the main routes additional weight in the optimisation

- Comparison of:
  - State-of-the art adaptive control optimised for overall delay
  - Approximation of the Cooperative Priority Application

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Main results

Volume as percentage of saturation	30%	65%	100%
Fuel consumption HGV	-5.5%	-12.7%	-20.3%
Fuel consumption overall	-7.0%	-10.8%	-16.0%
STOPS HGV	-40%	-33.3%	-51.9%
STOPS overall	-15.4%	-11.1%	-33.3%

Note: the comparison is made with state-of-the-art adaptive control

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Single intersection (Mahmod et al.)

- Traffic demand control (1:1 relation)
- Banning trucks (-7% → -25% CO2 and -50% NOx)
- Speed restriction (-20% CO2 and NOx, +20% PM10)
- Adaptive cruise control (-10% all indicators)

- Significant differences per vehicle type.
- Complexity and dynamics of intersection important.

→ Further improvements with cooperative implementation.

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Methodology for cities (Van den Elshout et al.)

Measures are site specific, therefore:

- Establish reference pattern
- Select threshold for emission parameters
- Choose time percentage a measure may be evoked
- Selected minimum consecutive hours a measure is wanted

Note:

- Less (polluting) traffic is probably the only sustainable solution
- Solutions often only avoid local and temporal peaks
- Exposure is shifted instead of reduced: not solved!

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Discussion

- Decision making and setting priorities is difficult.
- Particularly for road operators *and* travelers to do what is best.
- Media and survey results unduly influence the opinion.

- Multi-objective optimization increases complexity. Which objectives are aligned and opposite?

- Decisions makers *and* travelers need support in making choices.
- Cooperative technology provides enabling means.

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Conclusions

- With relatively *simple* measures and *today's* traffic management and control systems traffic can become greener (at low penetration rates!).

- Measure may be near Pareto efficient: One individual cannot be better off without making any other individual worse off.

- Local conditions have a high impact on the performance of applications. Generic improvement-ratio does not exist.

- Multi-objective traffic management requires a change in *mindset* by local authorities/government *and* road users.

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FREILOT – Pilot

- 1 year real-life trials in 4 cities to show a reduction of 25% of fuel consumption on equipped trucks in urban areas.
- Cities and road authorities, fleet operators and industry involved.

eCoMove - Research

- *"To develop a combination of cooperative systems and tools using vehicle-infrastructure communication to help drivers sustainably eliminate unnecessary fuel consumption, and road operators manage traffic in the most energy-efficient way."*
- Towards integral multi-objective traffic management

eCoMove
Cooperative Mobility Systems and Services for Energy Efficiency

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Smoother, safer and cleaner.
Questions?

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