Greener roads by talking traffic lights - Knowledge about queue length and next traffic light signalling

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25th February 2010

Introduction

Queue length estimation

Tailback information in urban traffic state estimation

Signal change prediction

Conclusion

Introduction

- TRAVOLUTION - TRAVOLUTION extended
- Pilot region: Ingolstadt
- Vehicle to infrastructure communication
- Two main applications
  1. Urban traffic state estimation
  2. Green light optimal speed advisory
- Two aspects improving speed advisory
  1. Queue length estimation
  2. Signal change prediction

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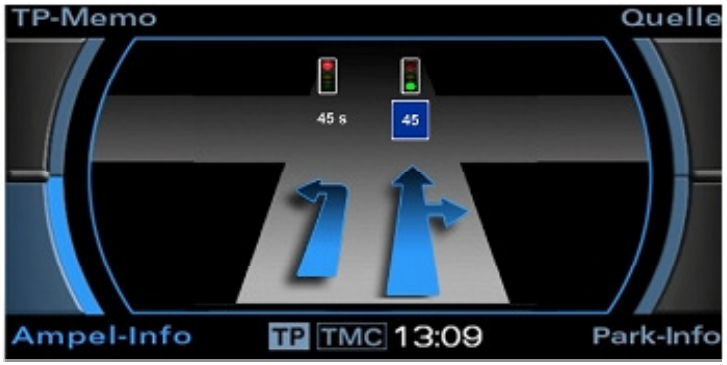
Green Light Optimal Speed Advisory



- Developed by Audi within *TRAVOLUTION*
- Integrated in the dashboard of Audi prototypes
- Goal: Speed advisory to reach the next intersection during green.
- Countdown until the next green time
- Delay resulting from vehicles queued is not considered until now.

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Queue length estimation: State of the art

- Methods based on inductive loop and/or vehicle data
- Estimate maximum queue length
- Application: Signal light control
  1. Mück's patented method is based on the filling time of the inductive loop.
  2. Comert and Cetin's statistical method is based on number and positions of communicating vehicles in the queue.
  3. Priemer and Friedrich's method is based on positioning data of communicating vehicles in the queue.

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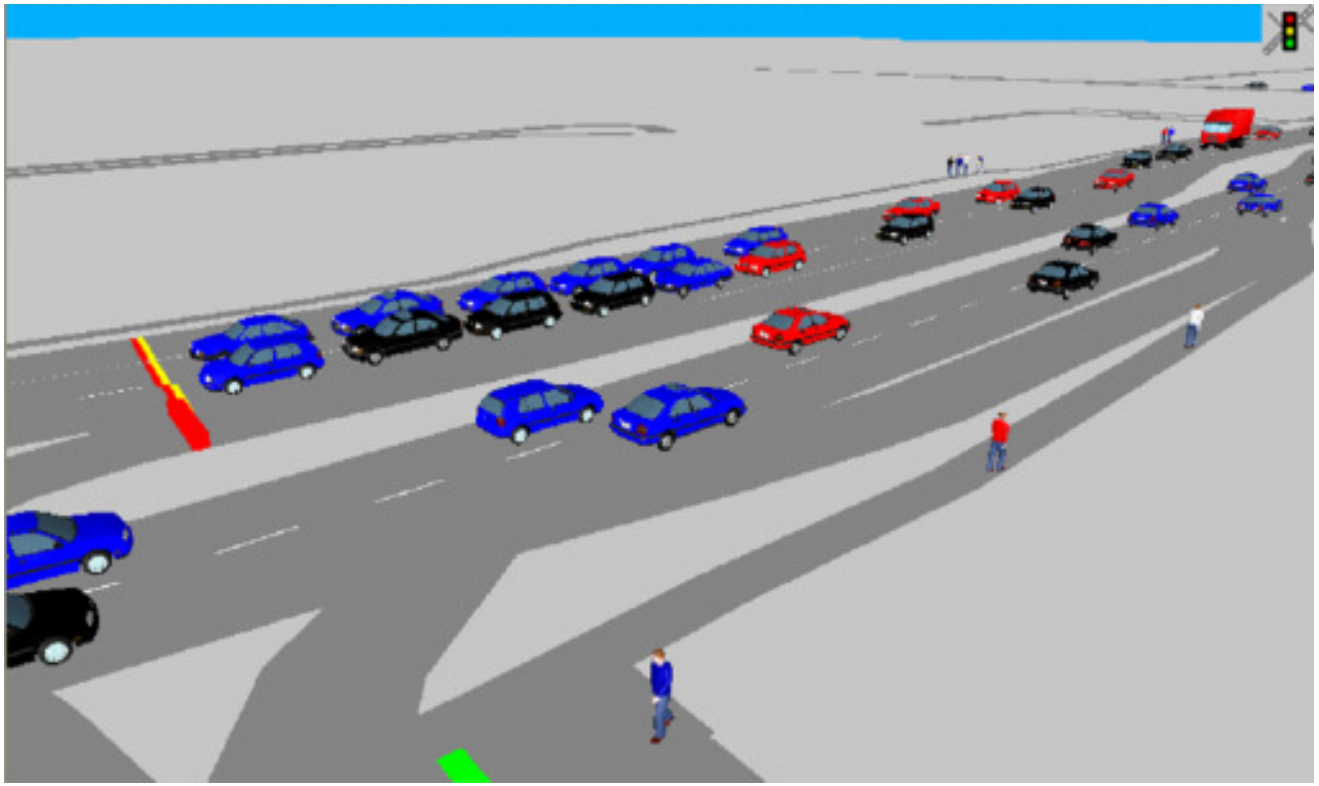
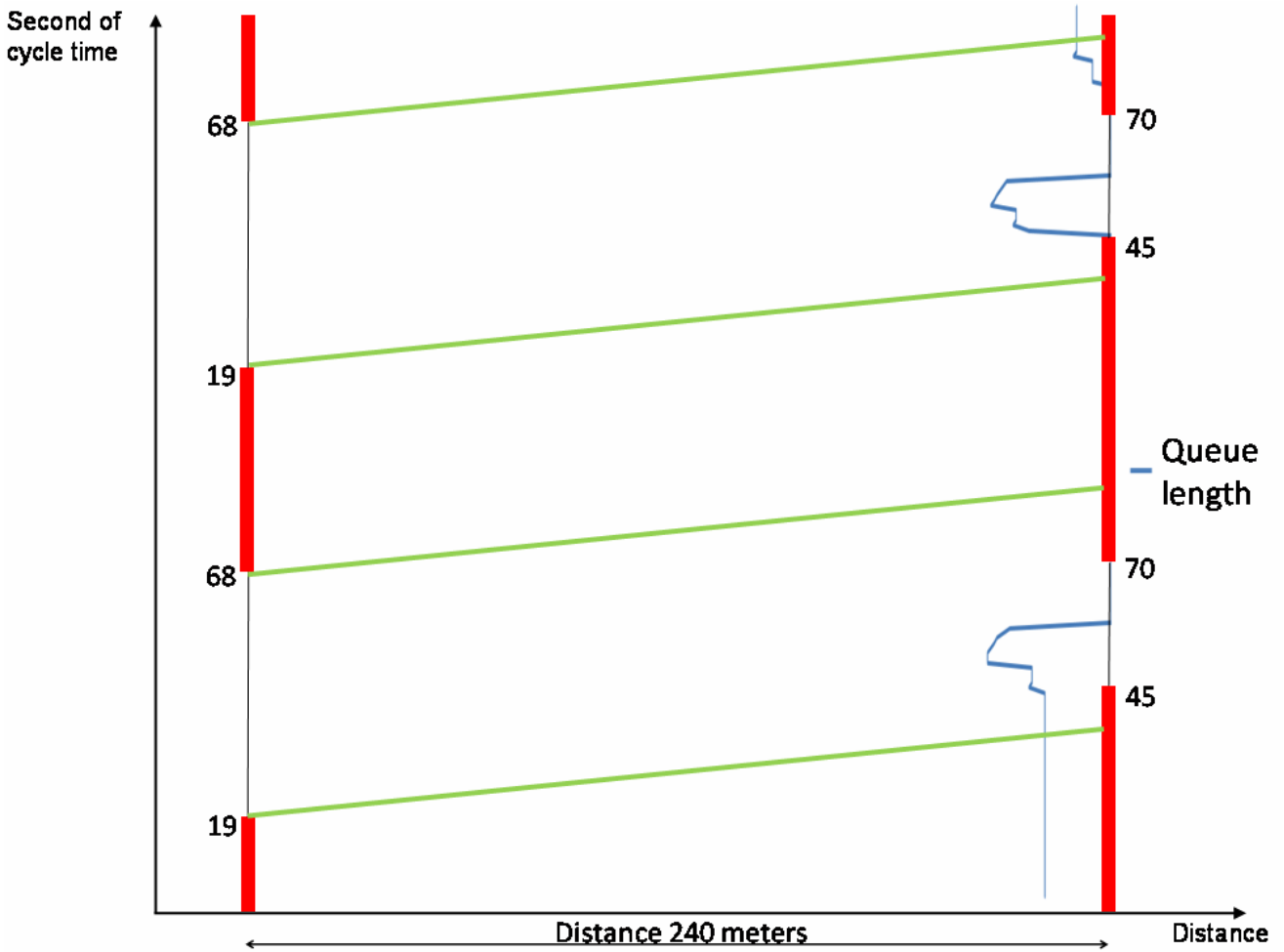
Intersection under consideration



- Proof of benefit of tailback information on the green light optimal speed advisory

Coordinated signal plans and queue length characteristic



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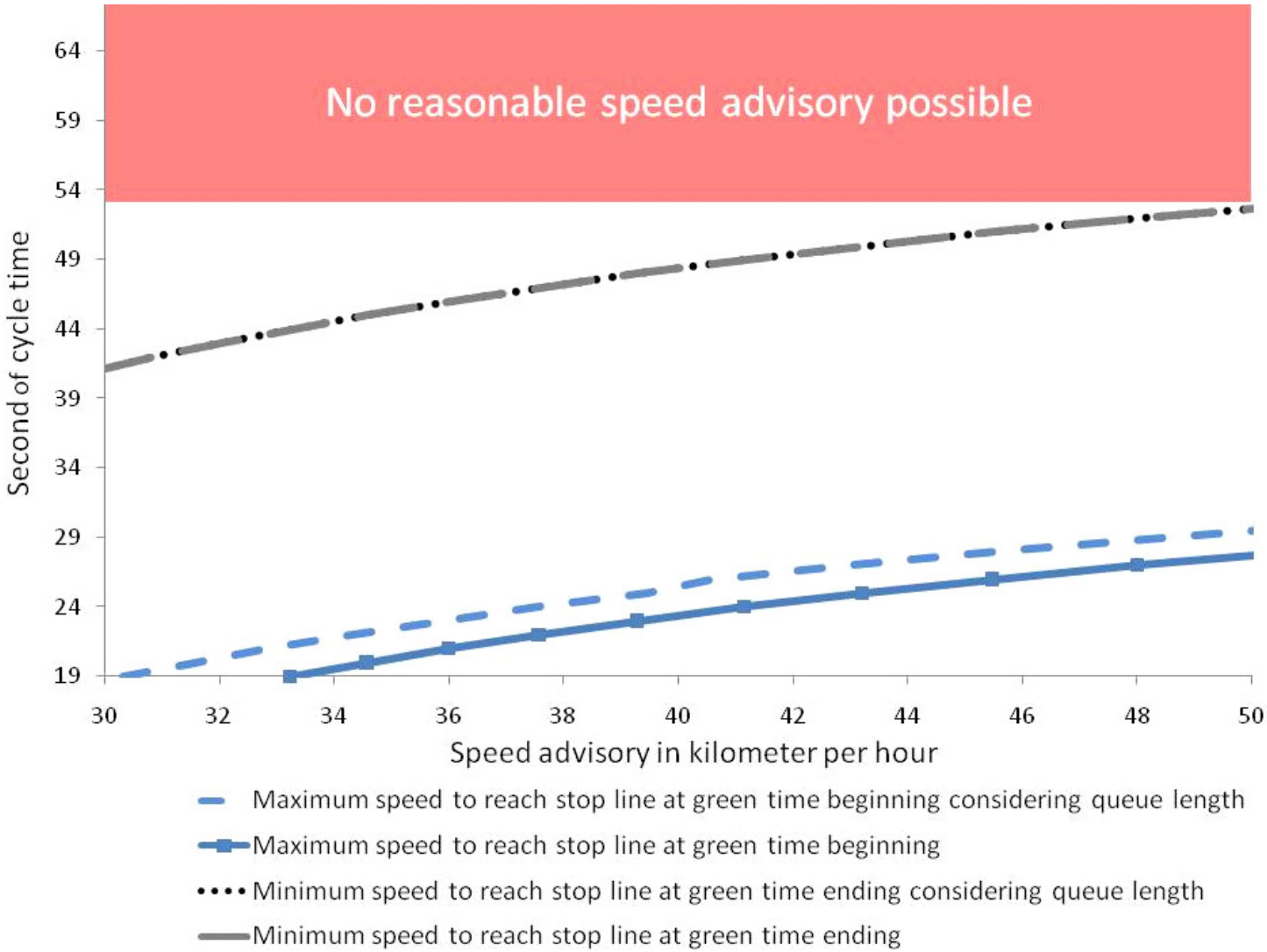
Range of speed advisories



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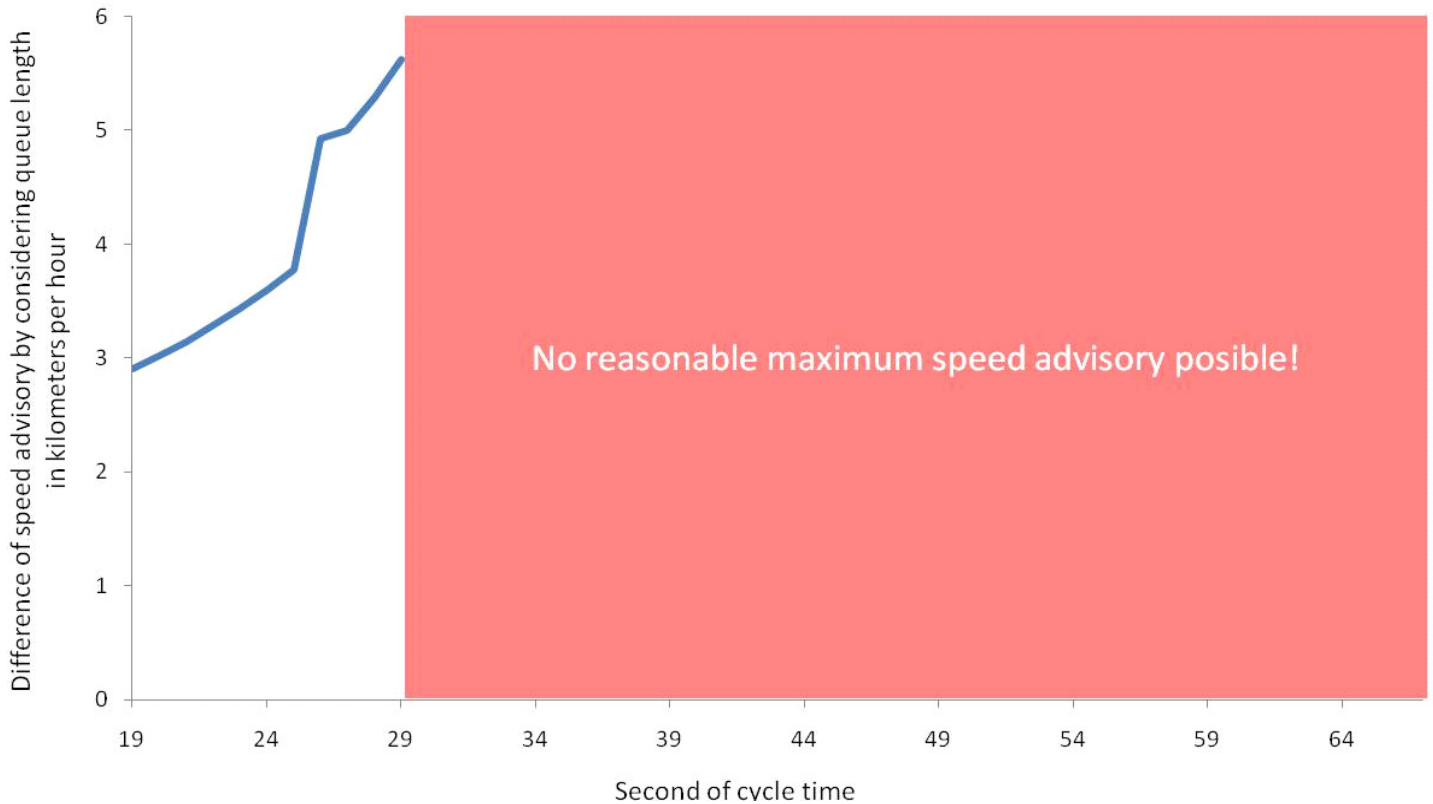
Difference of speed advisory



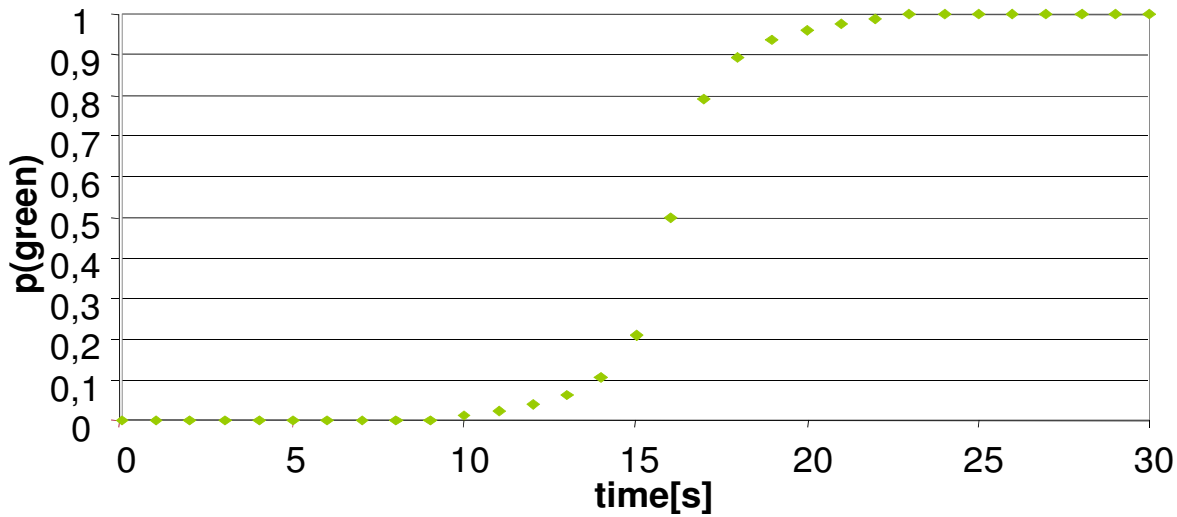
Integration of tailback information into the urban traffic state estimation

- Traffic state estimated by using taxi floating car data
- Integration method of queue length information
  1. Transformation of tailback length into velocity
  2. Data fusion of velocities
- More reliable result
- Efficient route choice possible

Signal change prediction: State of the art

- Data used so far:
  - Exported values of the traffic light controller
  - Knowledge of the chronological sequence of the signal changes
  - Controller behaviour of the last program sequence
- Disadvantage within:
  - Fast changing traffic state
  - Abrupt interactions: Prioritization of public transports

Enhanced signal change prediction



- Stochastic method
- Prediction with likelihood for green
- Use of historical information
- Traffic load curves

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Conclusion

- Benefit of tailback information on the green light optimal speed advisory demonstrated
- Integration of tailback information into the traffic state estimation
- Ideas to improve the reliability of the green time prediction
- Enhancement in the optimal speed advisory improves the reduction of environmental pollution and inner city traffic.

- Thank you!
- Any questions?