# I2V-based traffic management measures for cooperative automated vehicles

Dr. Sven Maerivoet

TRANSPORT & MOBILITY LEUVEN

www.transaid.eu
@transaid_h2020
www.linkedin.com/groups/13562830/
www.facebook.com/transaidh2020/

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# Main observations about state-of-the-art for traffic management

- General approaches
  - Coordinated network-wide traffic management
  - Using KPIs, hierarchical controls via layered architectures, TMaaS
- Cooperative systems
  - V2X / VANETs / C-ITS
- Machine learning techniques (AI)
  - Traffic light control and congestion / queue length predictions

- **Conclusion**
  - No (readily available) implementations of more advanced TM schemes
  - Focus on solving partial problems with specific measures

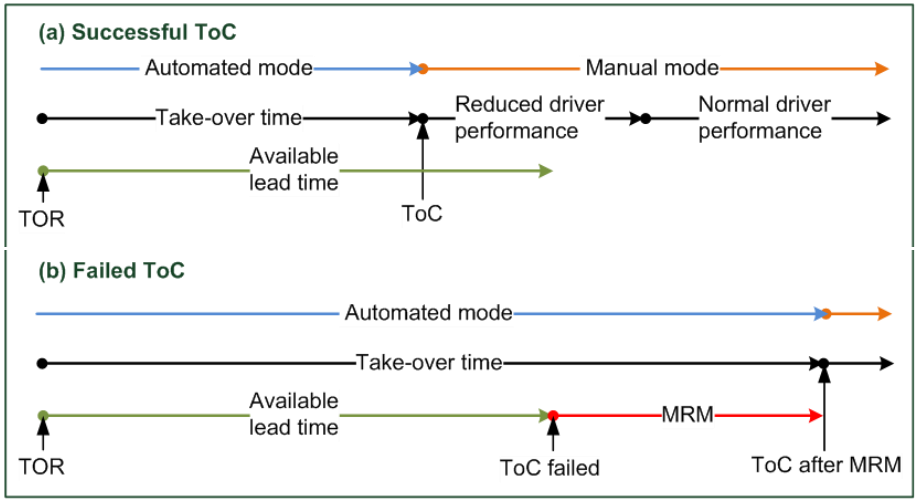
# Developing TransAID's services for traffic management in transition areas

- Solutions take the form of these actions:
  - **Prevent** ToC/MRM
  - **Manage** or support ToC/MRM
  - **Distribute** (in time and space) ToC/MRM

- Assess solutions based on impacts measured by **KPIs**:
  - **Traffic efficiency**
    - Network-wide: average speeds and throughput
    - Local: tempo-spatial diagrams
  - **Traffic safety**
    - Number of events with time-to-collision < 3 sec
  - **Environmental impact**
    - $CO_2$ emissions

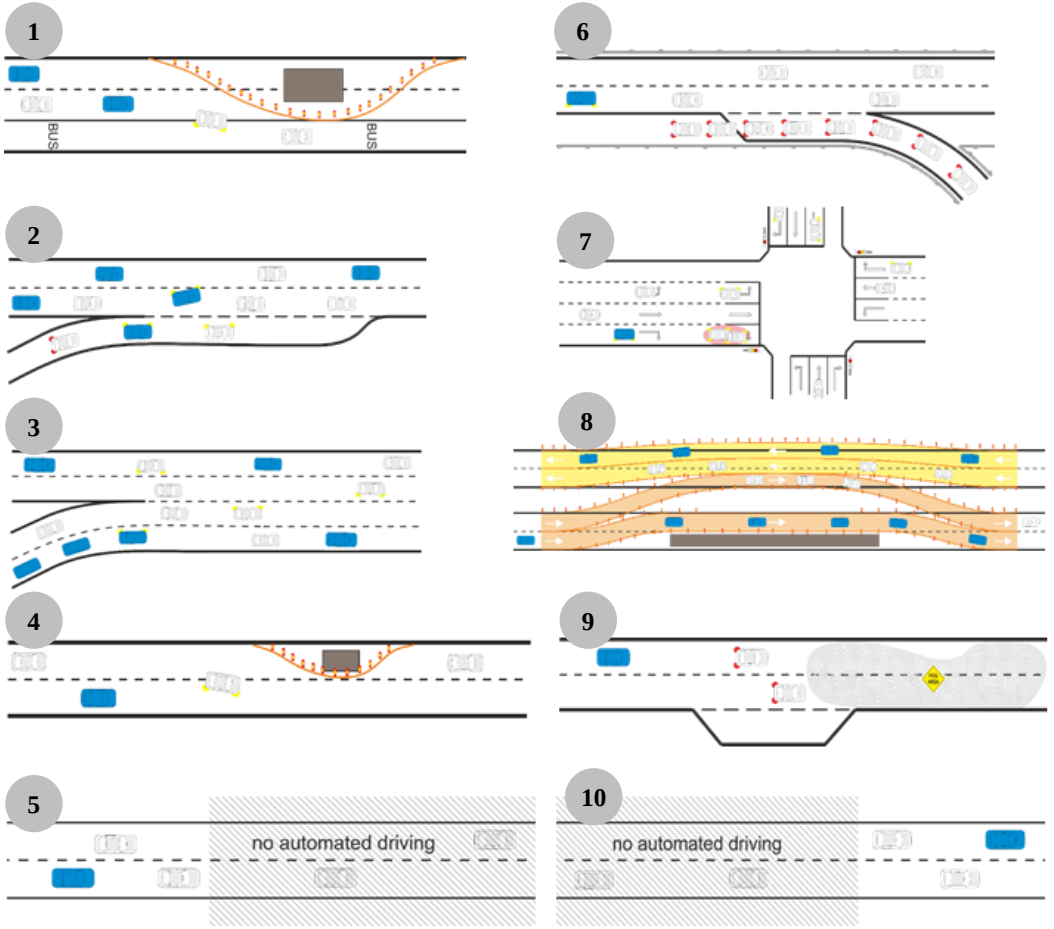
# Sequence of events when AD disengages

- Take-over request (**TOR**) issued by the car
- Transition of Control (**ToC**) from car to driver
- Minimum-Risk Maneuver (**MRM**) by the car

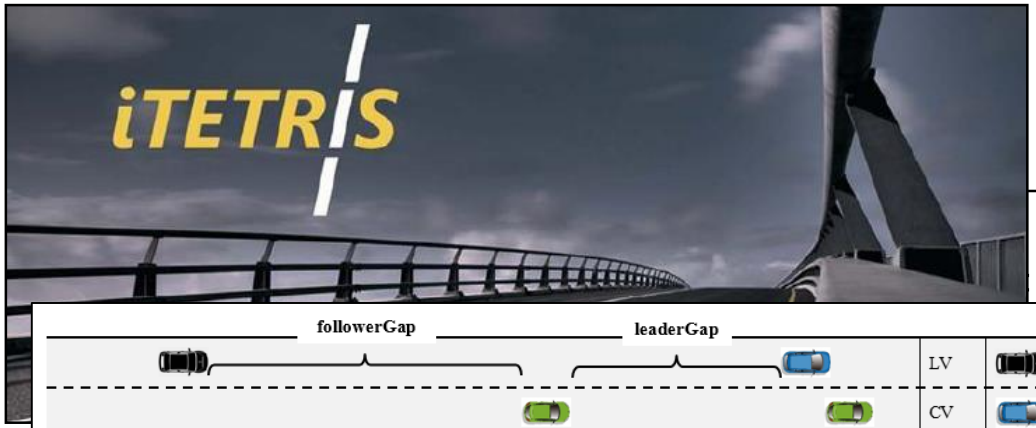


# Services and use cases

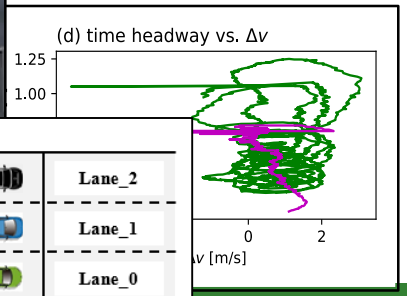
- **Service 1**: Prevent ToC/MRM by providing vehicle path information
- **Service 2**: Prevent ToC/MRM by providing speed, headway and/or lane advice
- **Service 3**: Prevent ToC/MRM by traffic separation
- **Service 4**: Manage MRM by guidance to safe spot
- **Service 5**: Distribute ToC/MRM by scheduling ToCs

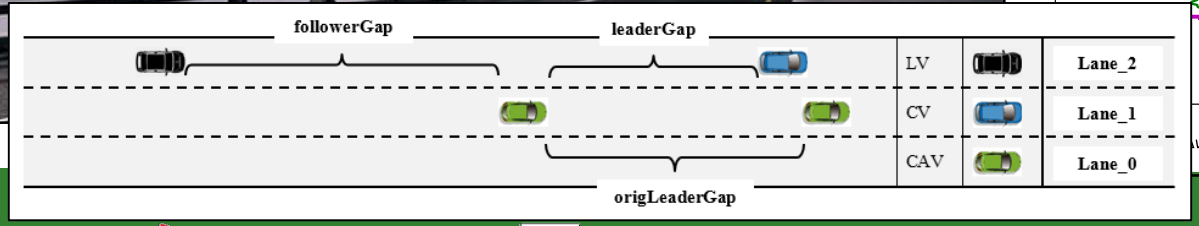


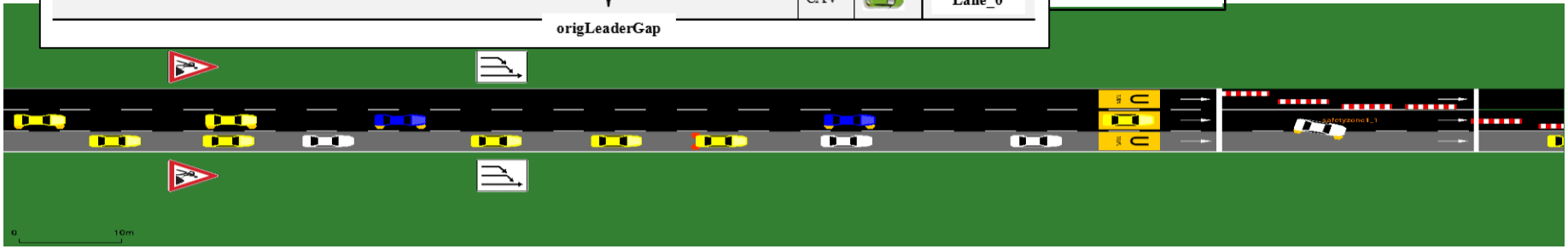
# Simulating the impact of traffic management



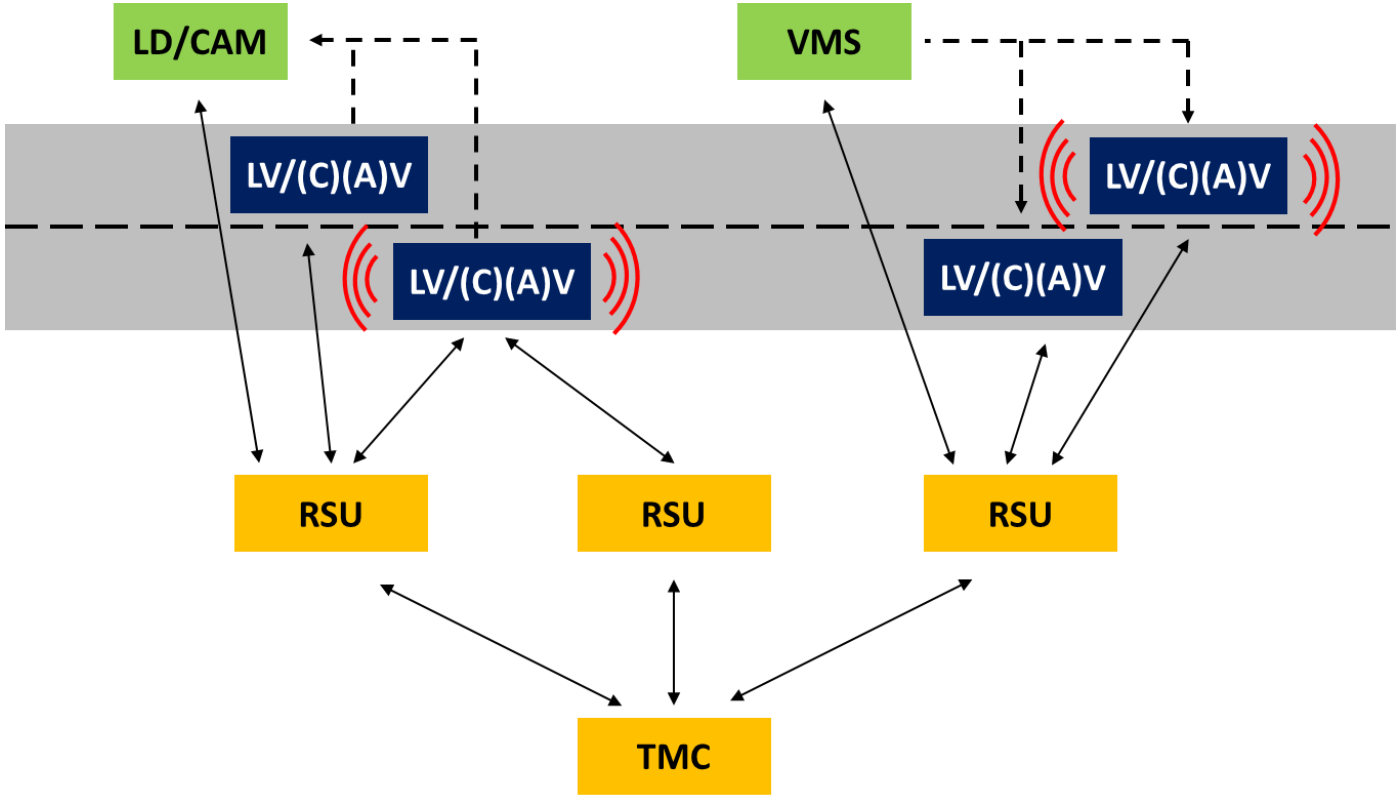

SUMO
SIMULATION OF URBAN MOBILITY



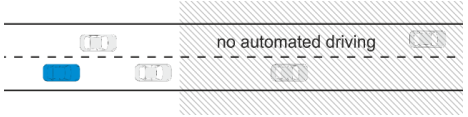



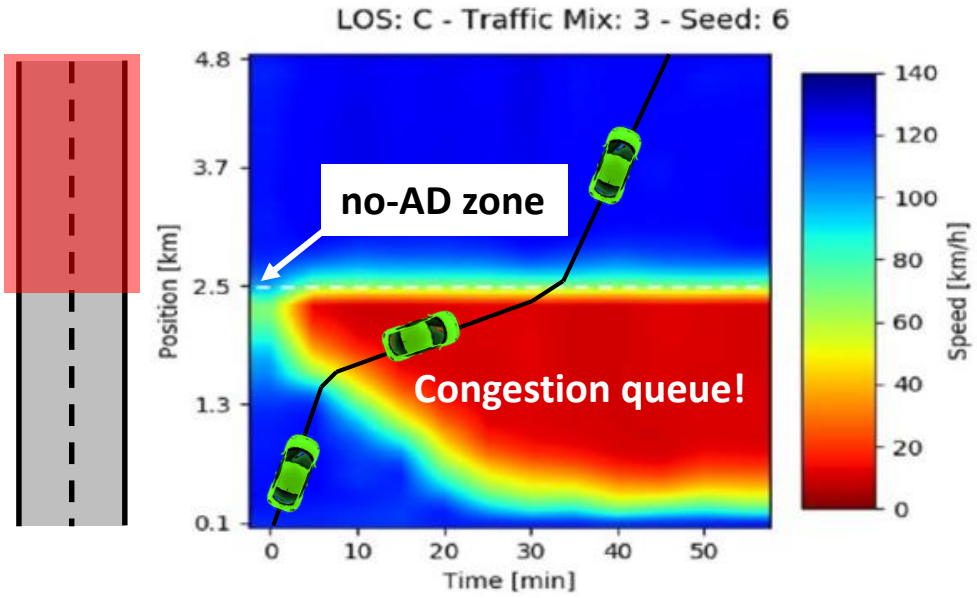
# High-level overview: V2V and V2X communication



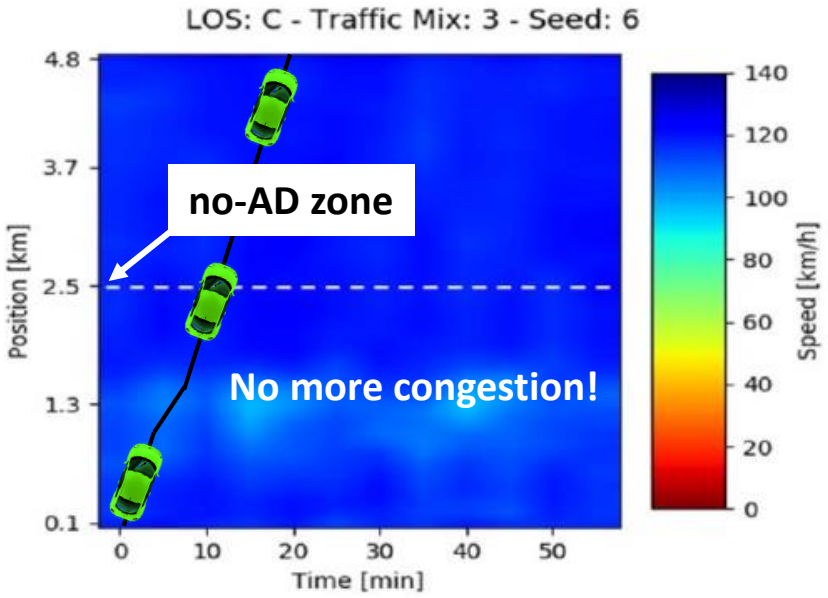
# Example use case 5.1 (Distribute the TORs within a dedicated TOR area )



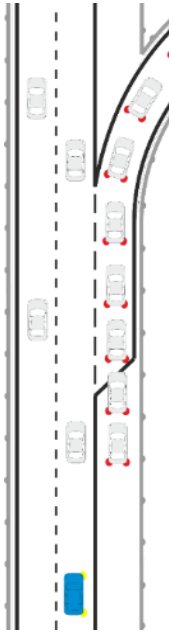

**Without traffic management**



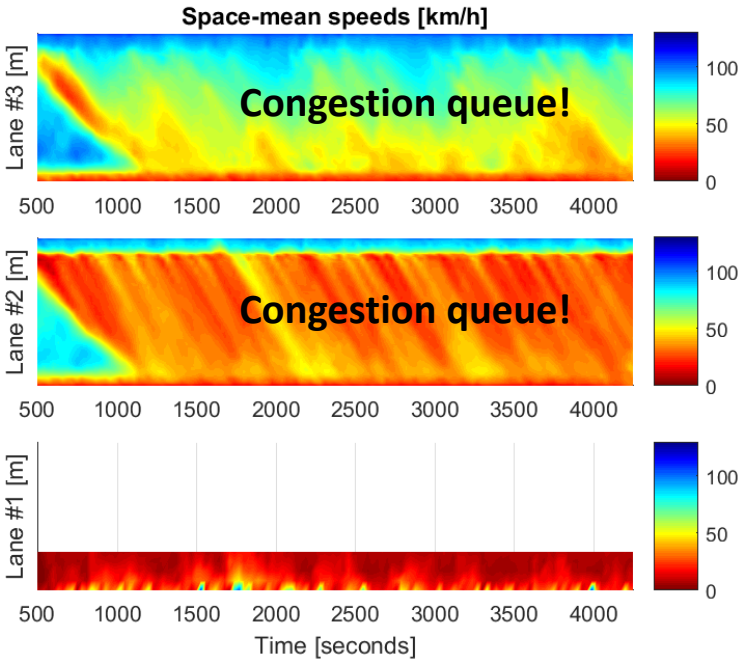

**With traffic management**



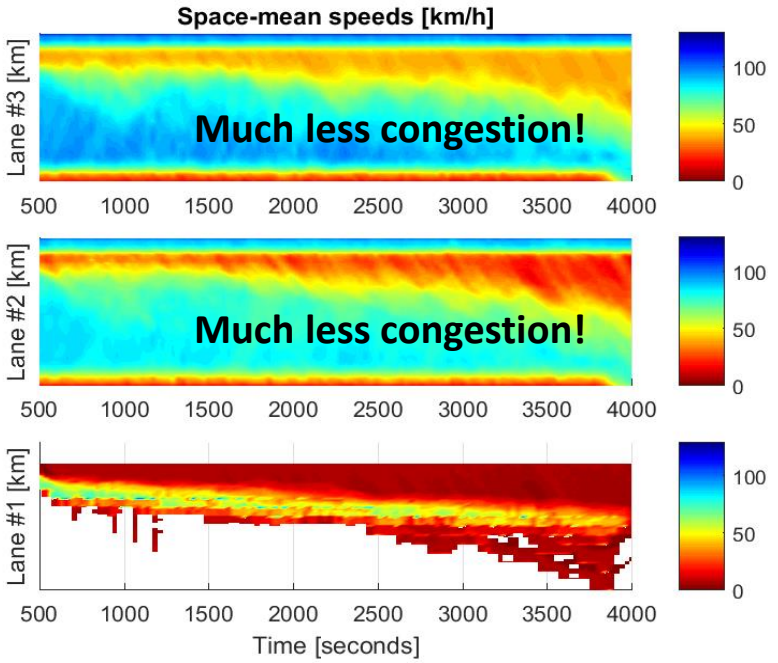
# Example use case 1.3 (queue spillback at motorway exit ramp)



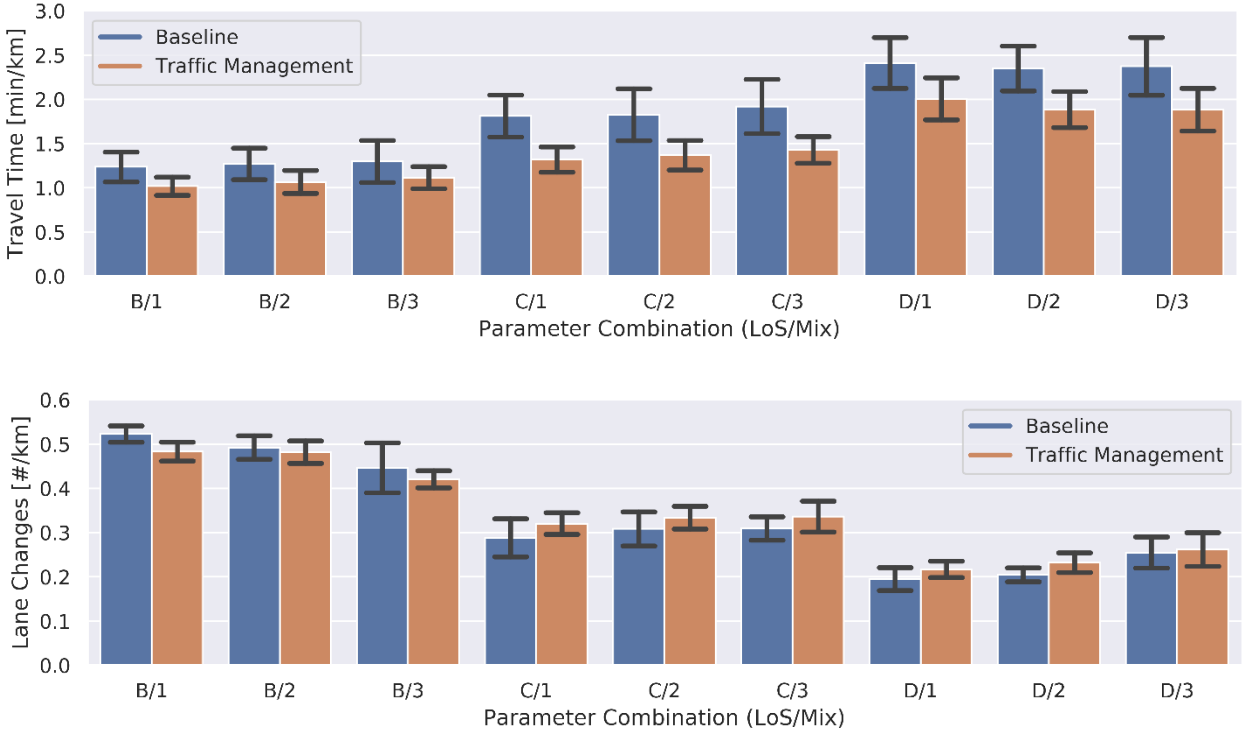
**Without traffic management**




**With traffic management**



# Measuring the impact (e.g., travel times, number of lane changes, …)



# Current work: including V2X communications

# Let’s keep in contact


- Contact:
  - sven.maerivoet@tmleuven.be (TML)
  - julian.schindler@dlr.de (DLR, project coordinator)

- Social media:
  - Website: www.transaid.eu ➡ https://www.transaid.eu/deliverables/
  - Twitter: @transaid_h2020
  - LinkedIn: https://www.linkedin.com/groups/13562830/
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# Discussion topics

- What kinds of services are essential?
- How would we interact with public authorities and OEMS?
- What would be best suited or most used: 4G/5G ⇔ ITS-G5?
- Could we give advice that will conflict with traffic regulations?
- Is adaptation of infrastructure a requirement or luxury?