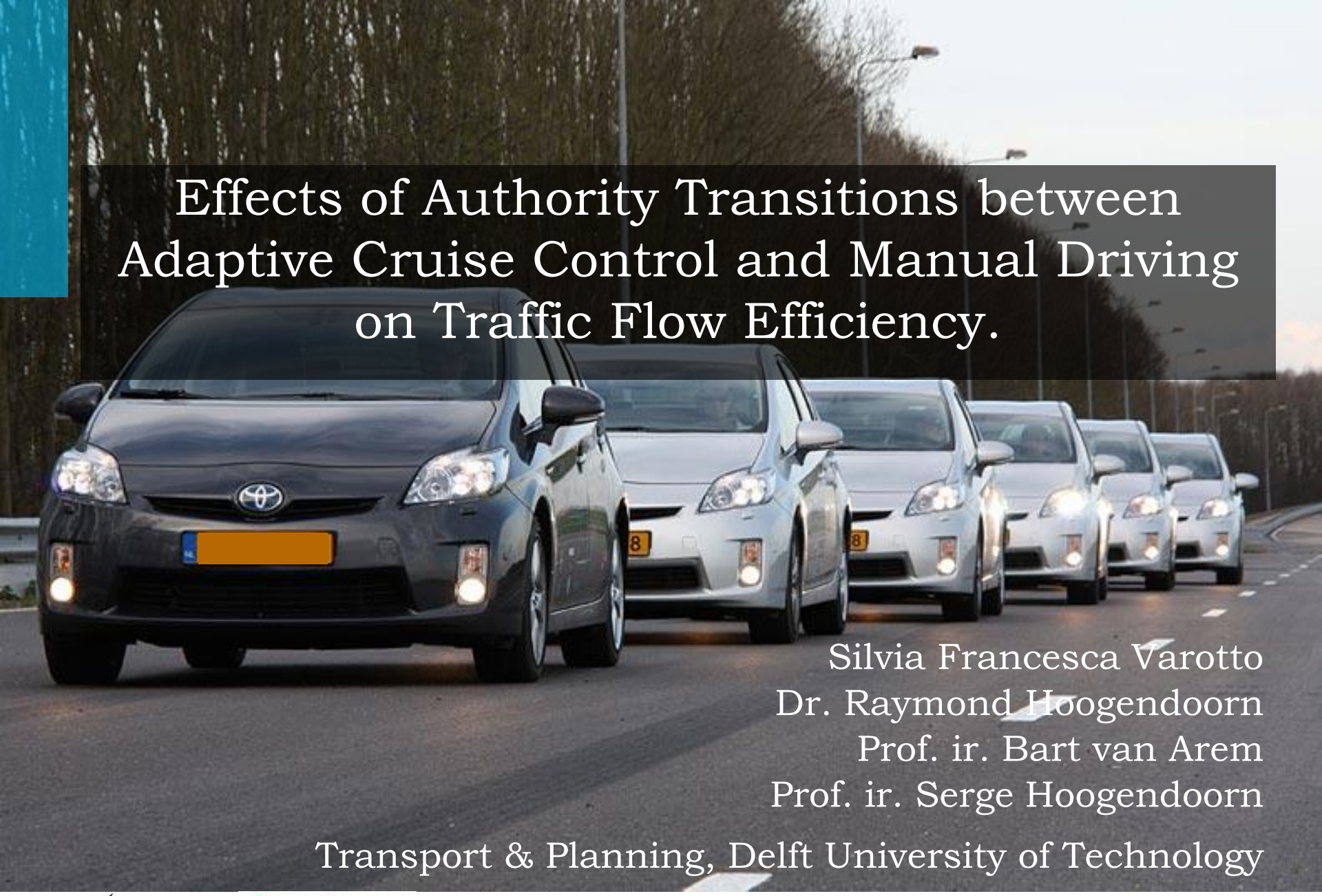

Effects of Authority Transitions between Adaptive Cruise Control and Manual Driving on Traffic Flow Efficiency.

Silvia Francesca Varotto
Dr. Raymond Hoogendoorn
Prof. ir. Bart van Arem
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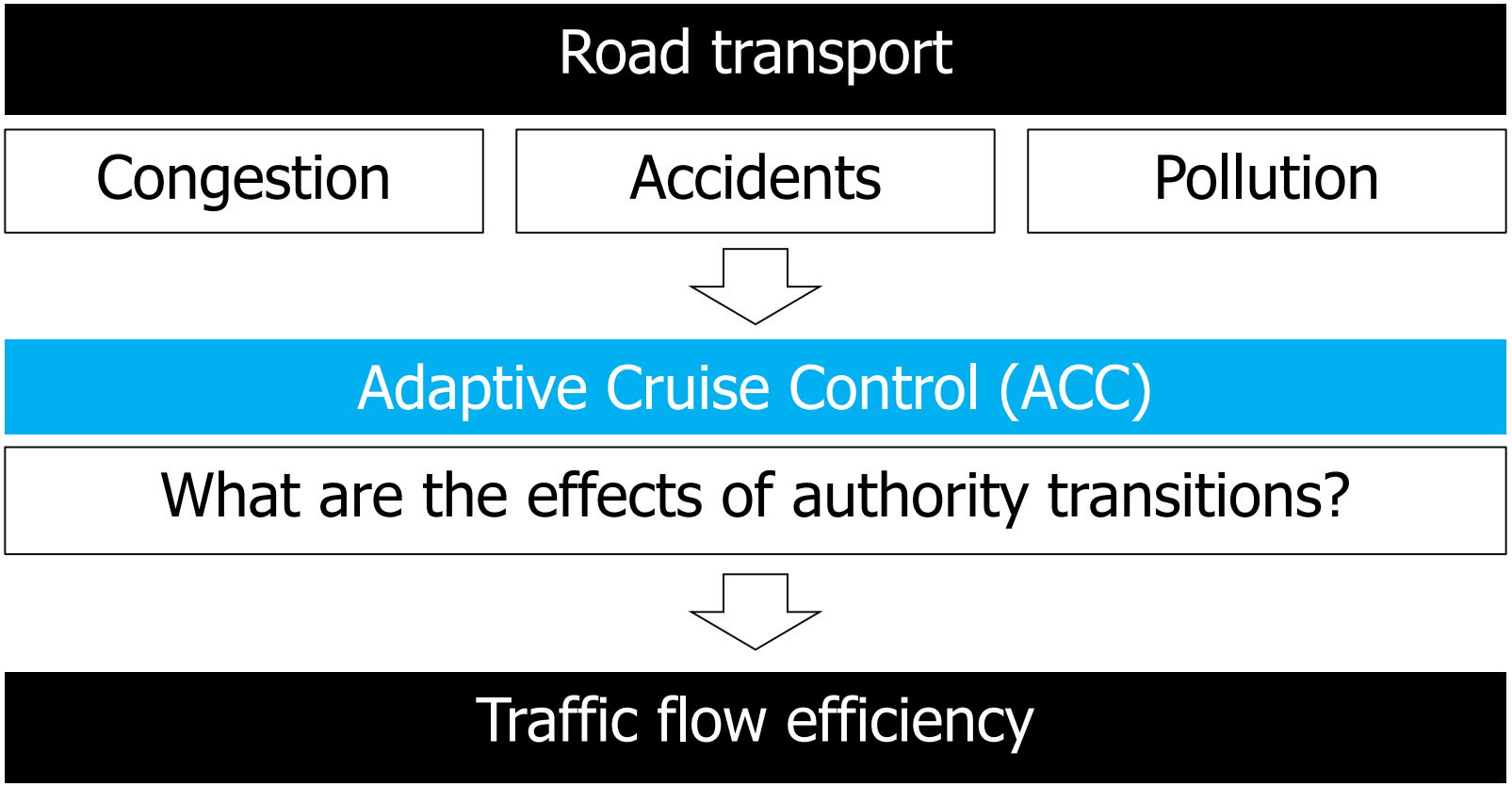
Introduction



1. Overview of work

Authority transitions

Driving Behaviour

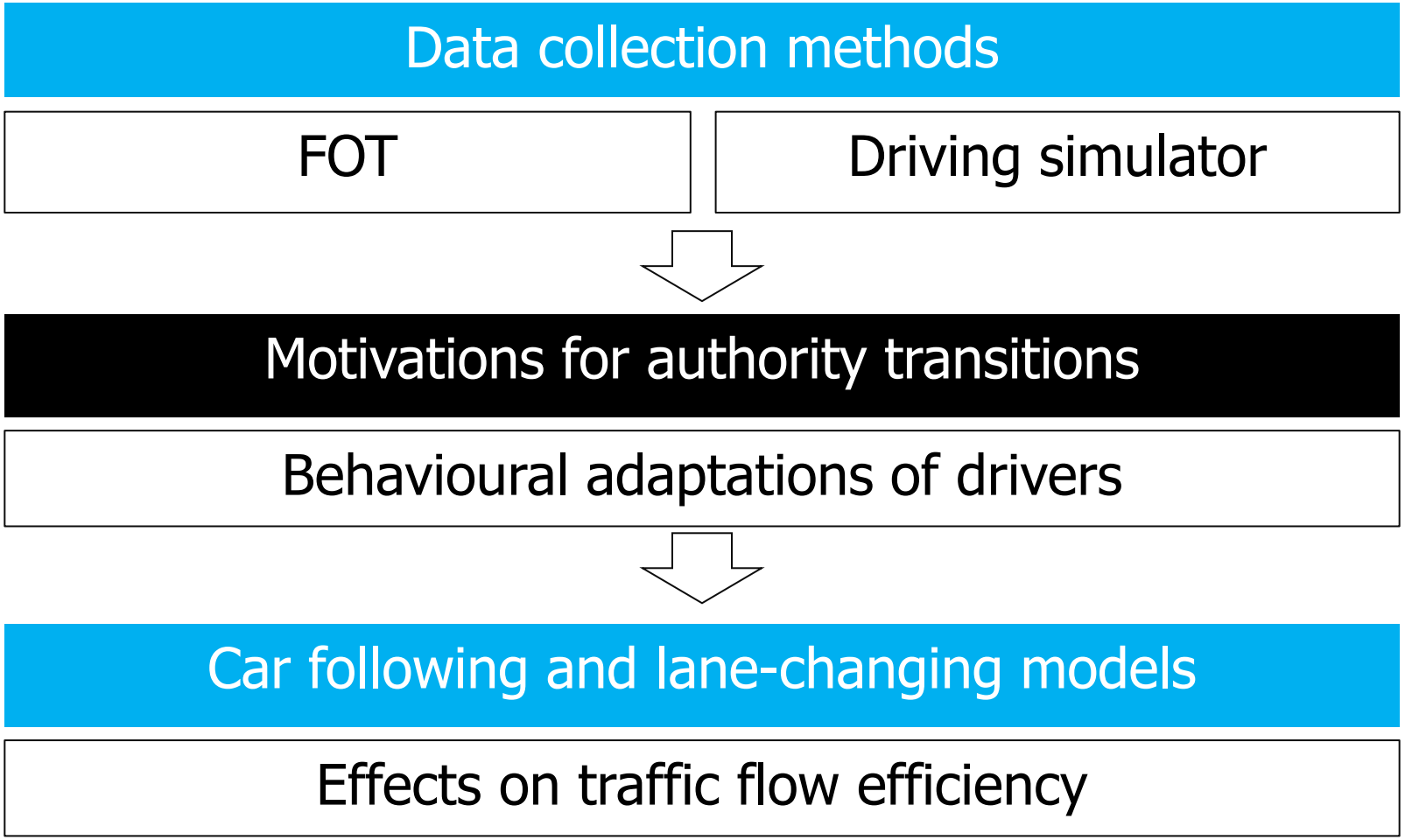
Microscopic traffic flow simulation

Analysis of empirical driving behaviour

Analysis of traffic flow characteristics

Conclusion and future research

2. Literature review



2.1. Motivations for authority transitions

Authority transitions between ACC and manual driving
(Pauwelussen & Minderhoud 2008; Klunder, et al. 2009)

Discretionary	Mandatory
⇩	⇩
Drivers switches off	**System switches off**
Lane change	Sensor failure
Create a gap	Constraints reached
Left-lane speed adaptation	

2.2. Behavioural adaptations of drivers

Behavioural aspects that are influenced by ACC

- Higher speeds
- Shorter time headways

⇩

Changed role of the driver

- Reduction of vigilance
- Reduction of situation awareness

⇩

Ability to respond to emergency situations

2.3. Microscopic traffic flow models

Car following models

Lane-changing models

ACC are a different type of vehicle

Authority transitions are not possible

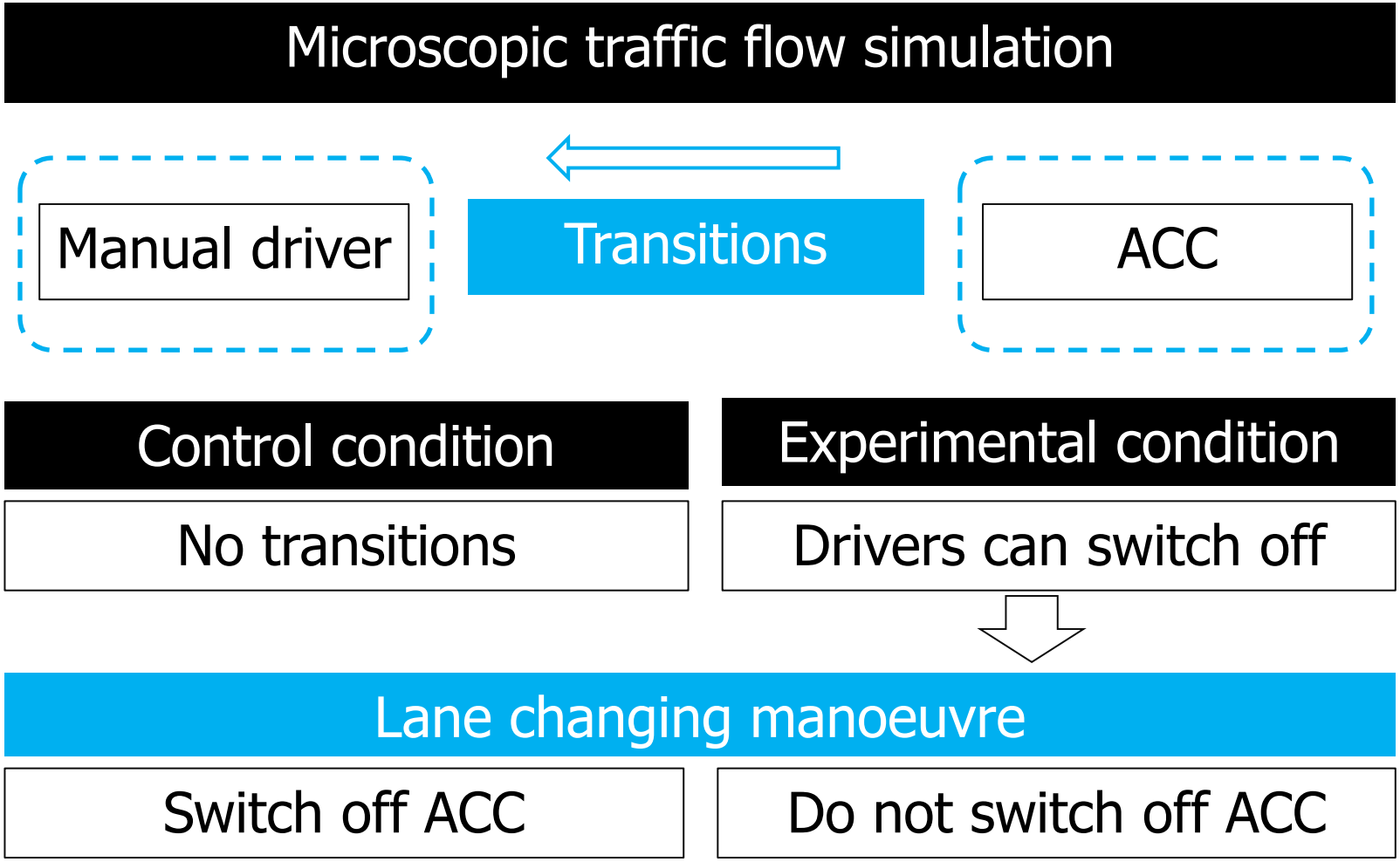
ACC vehicles have an effect of traffic flow (Kesting 2008; Klunder, et al. 2009)

Capacity

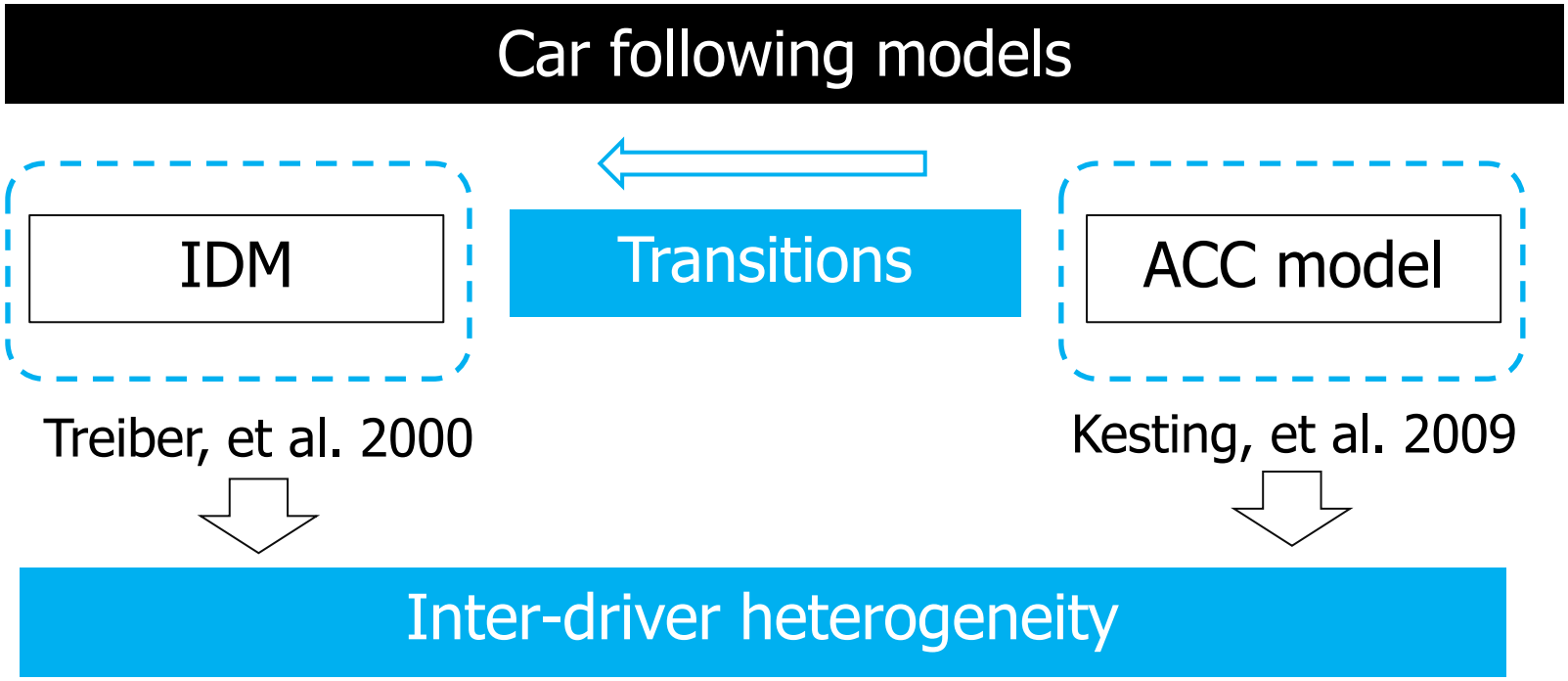
Capacity drop

Stability

3. Methodology



3.1. Model specification



$a\_max_n \sim truncN(1.4, 0.3)$

$b\_max_n \sim truncN(2, 0.3)$

$T_n \sim truncN(1.5, 0.3)$

$T_n \sim truncN(1.5, 0.3)$

3.1. Model specification

Lane changing model

Safe gap criterion

$$ds\_ego_n > gap\_ego_n$$

$$gap\_ego_n = s_0 + \theta_n \cdot T_n \cdot v_n$$

$$ds\_hp\_f_n > gap\_hp\_f_n$$

$$gap\_hp\_f_n = s_0 + \theta_n \cdot T_f \cdot v_f$$

$$\theta_n \sim truncN(1, 0.1)$$
$$T_n \sim truncN(1.5, 0.3)$$

Incentive criterion right to left

$$V_{hp\_l} > V_l + \varepsilon_n$$

$$\varepsilon_n \sim truncN(1, 0.5)$$

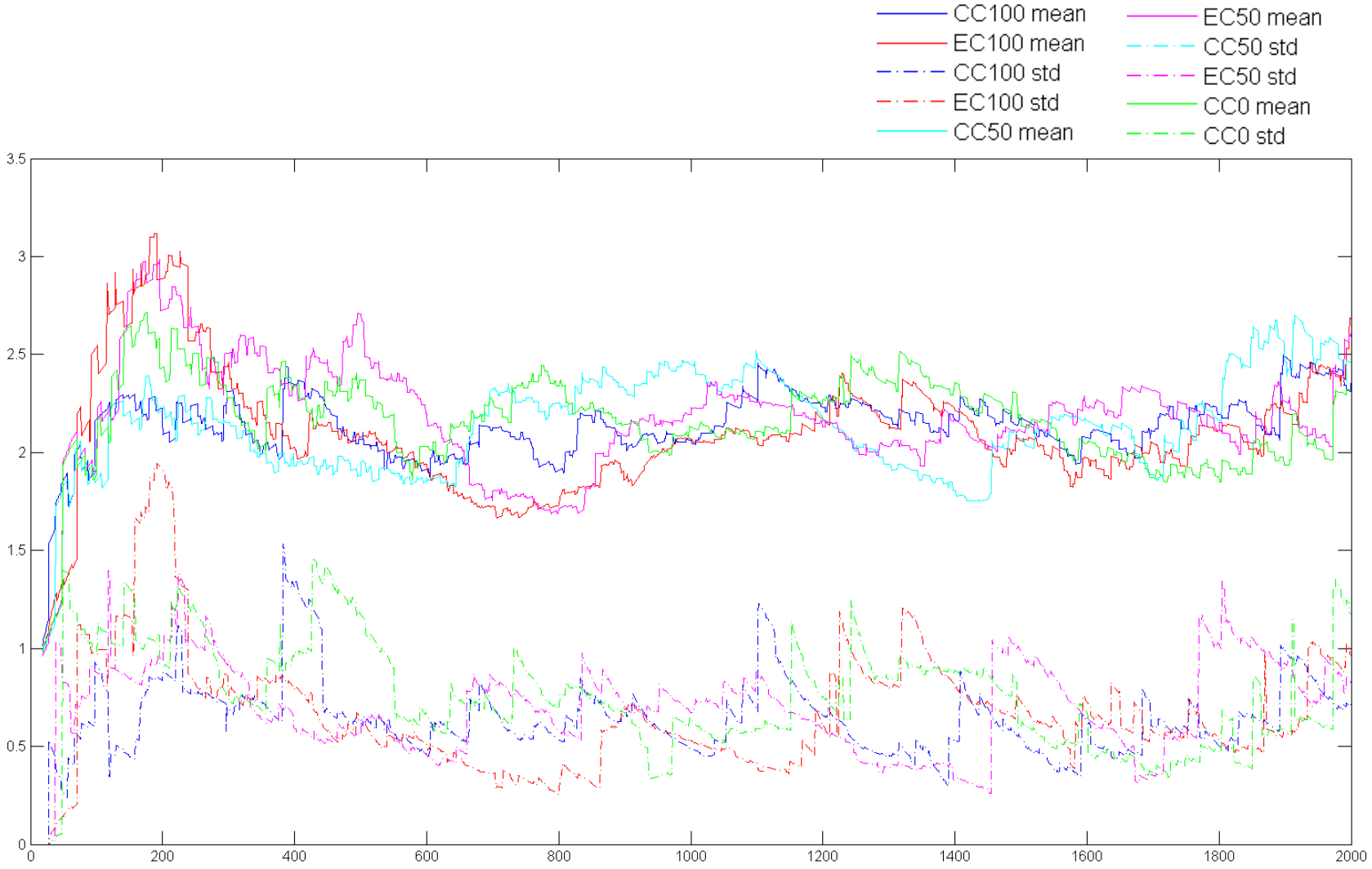
4. Simulation results

Design	Two lane highway		
Demand levels	1500 - 4000 veh/h		
Mixture	0% ACC	50% ACC	100% ACC

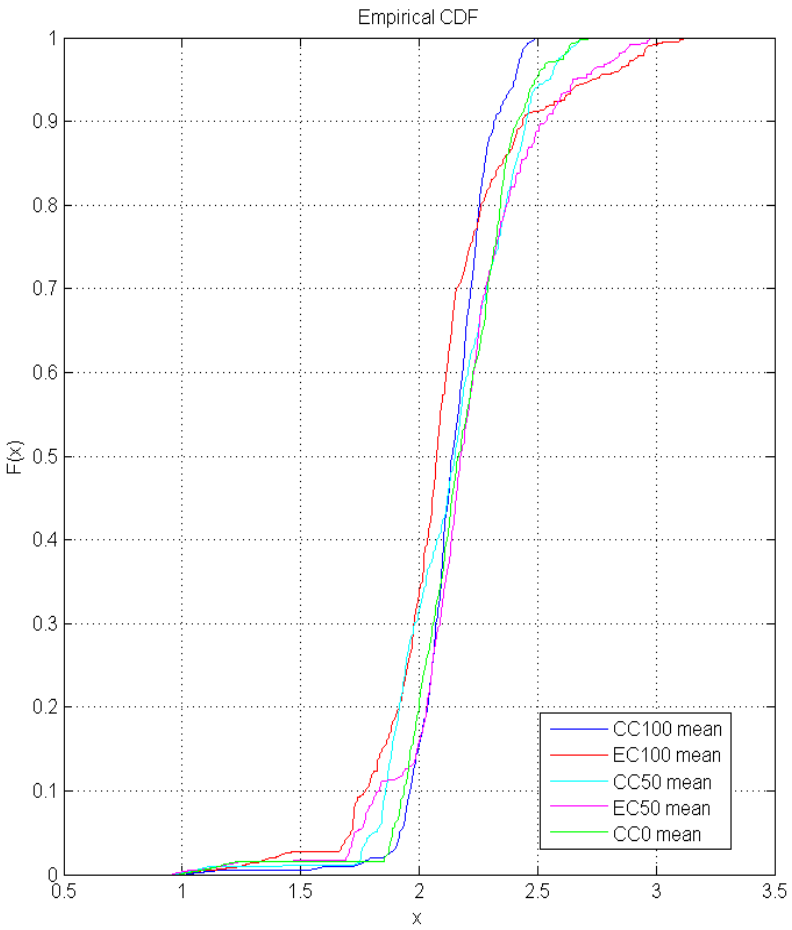
Analysis of traffic flow characteristics

Time & Distance headways	Speed	Acceleration
Density	Traffic flow	

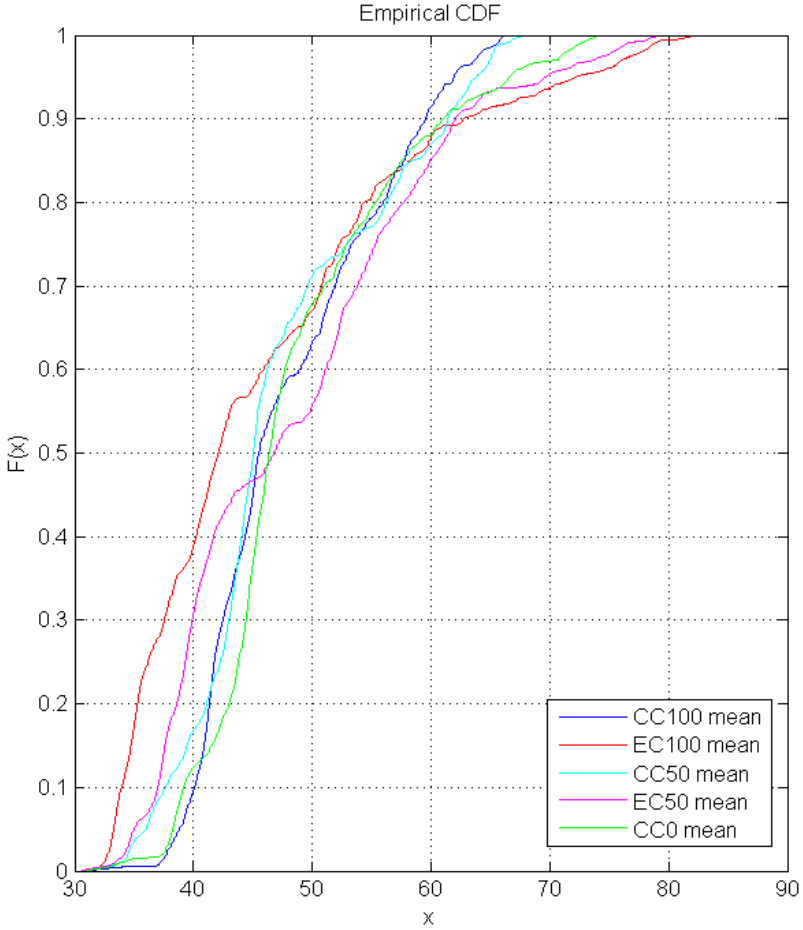
4.1. Time headway



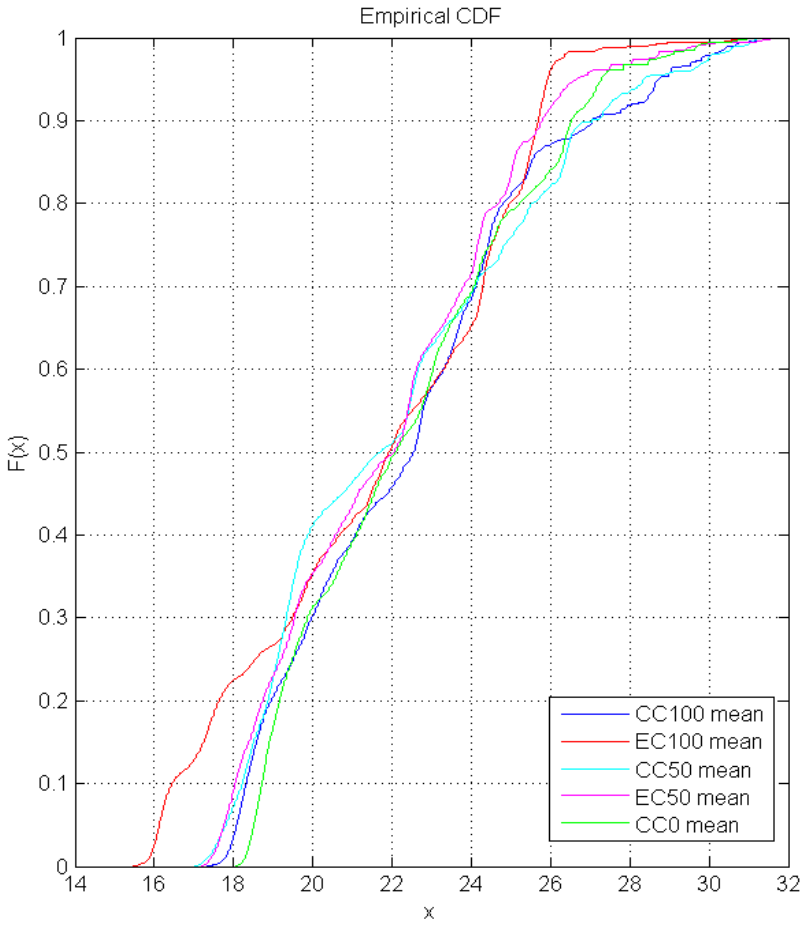
4.1. Time headway



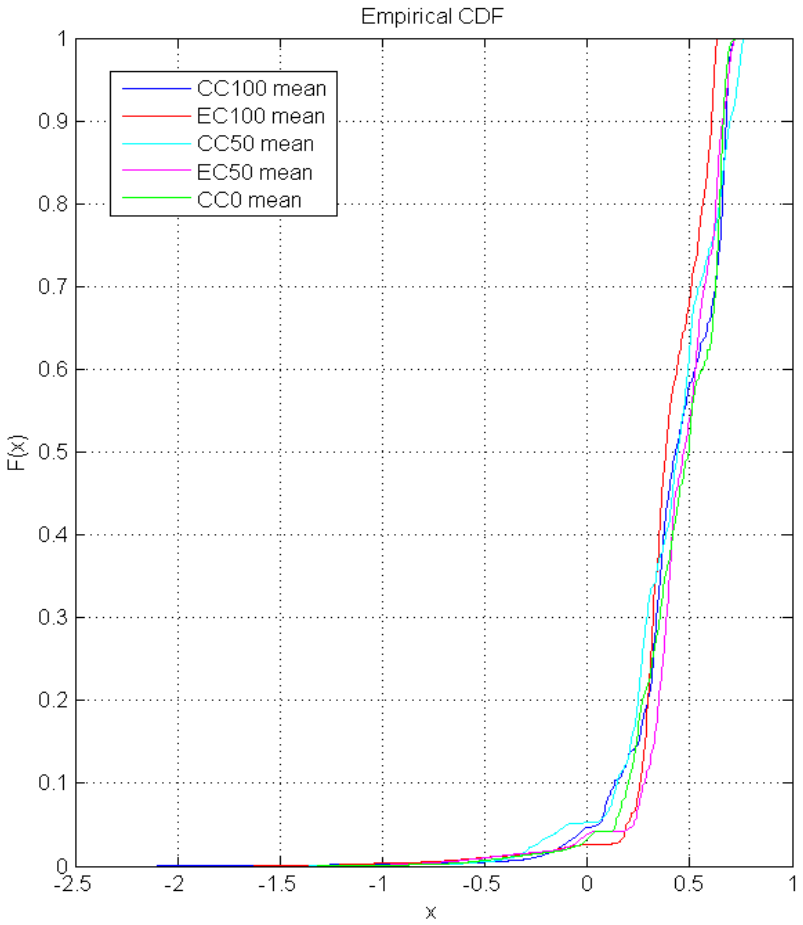
4.2. Distance headway



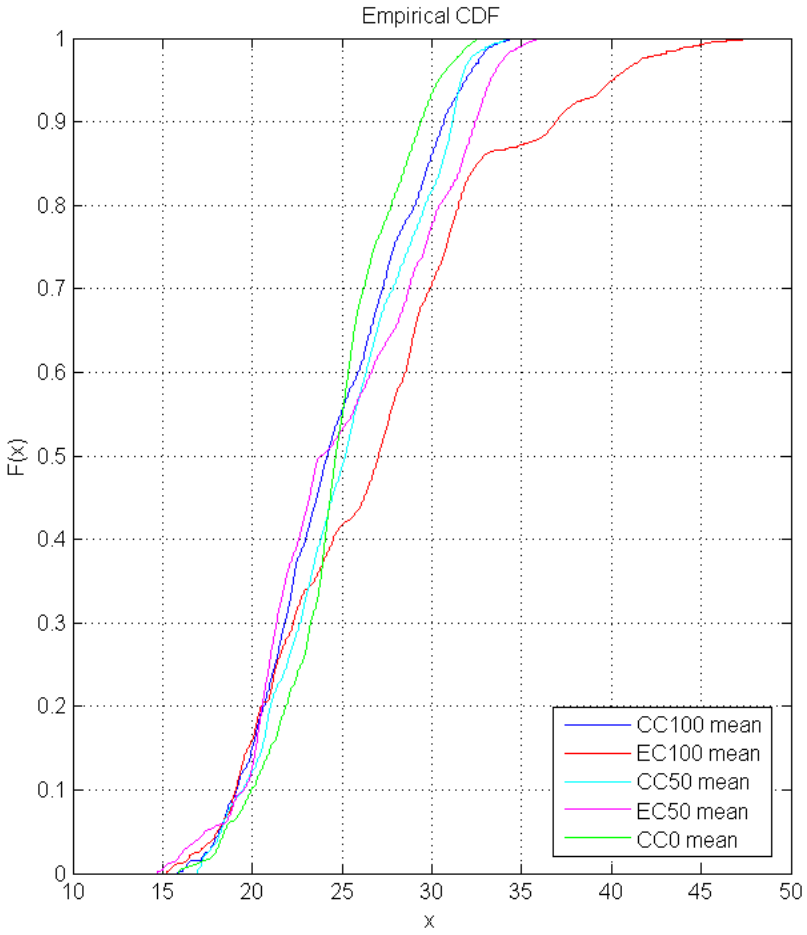
4.3. Speed



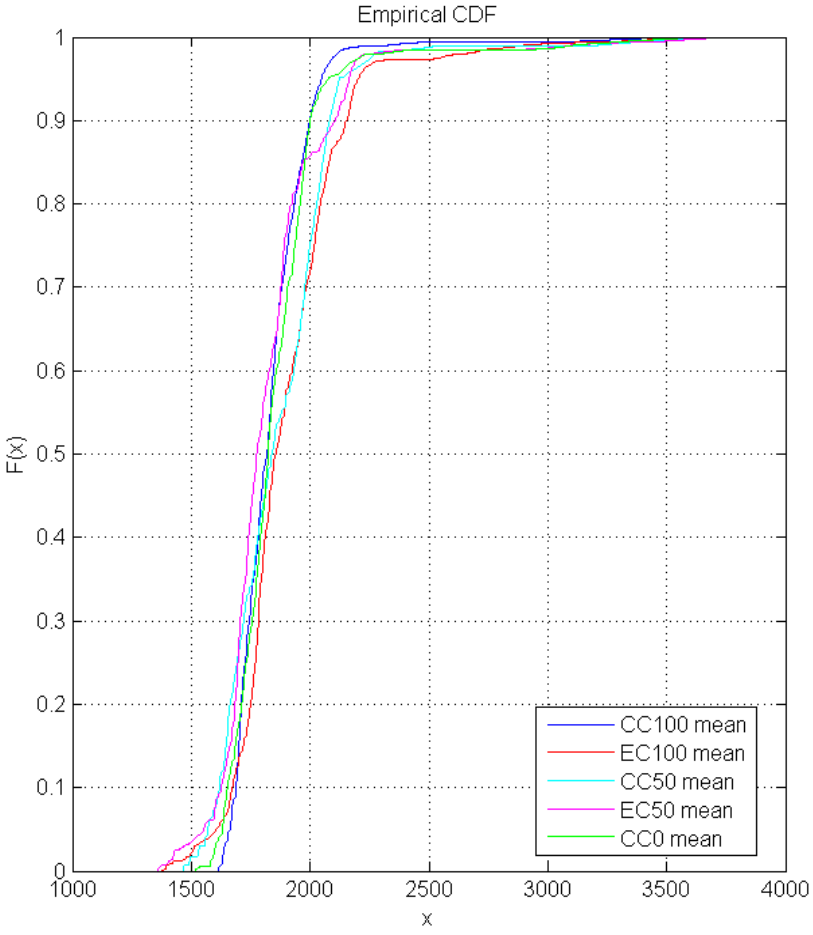
4.4. Acceleration



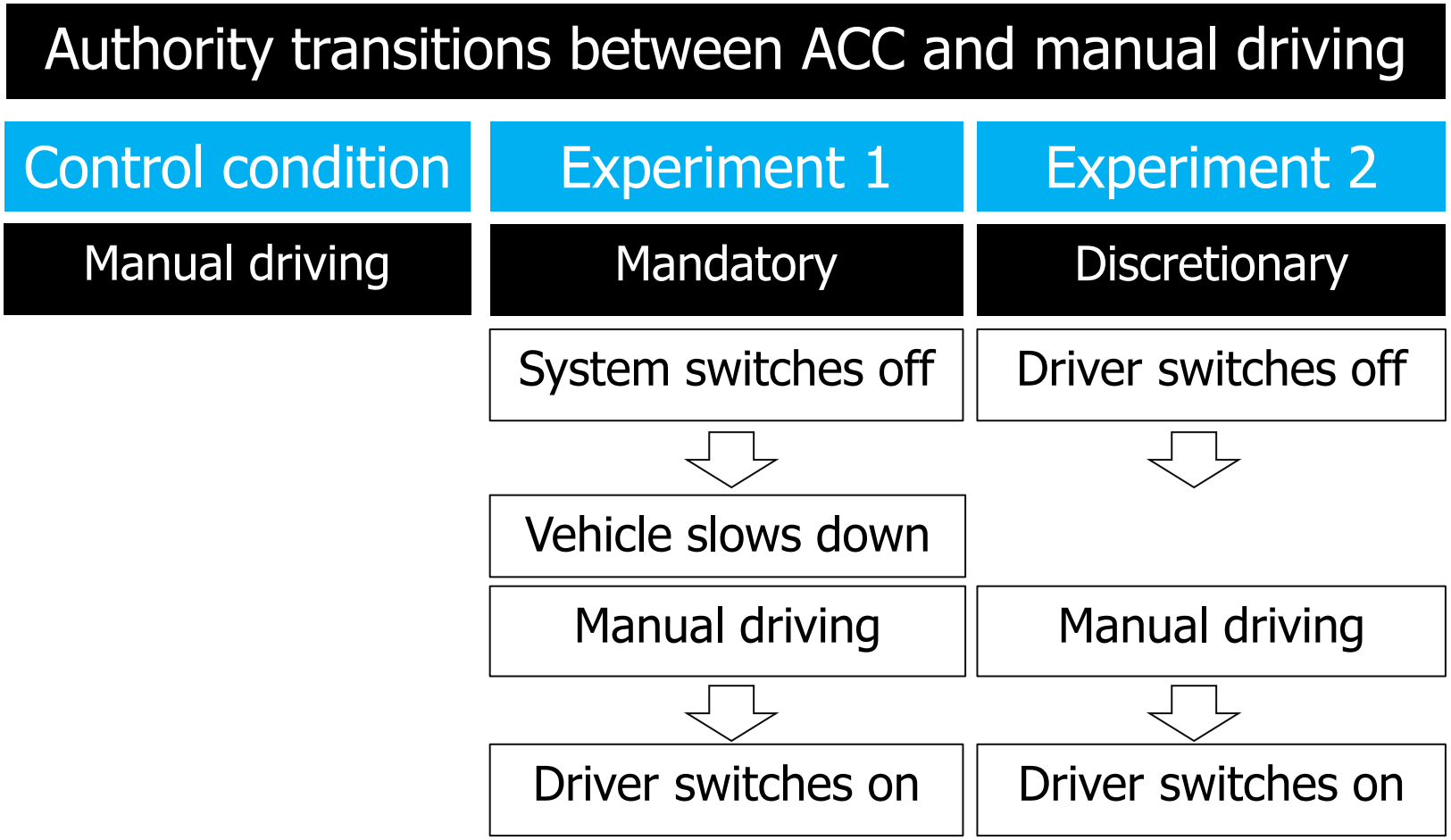
4.5. Density



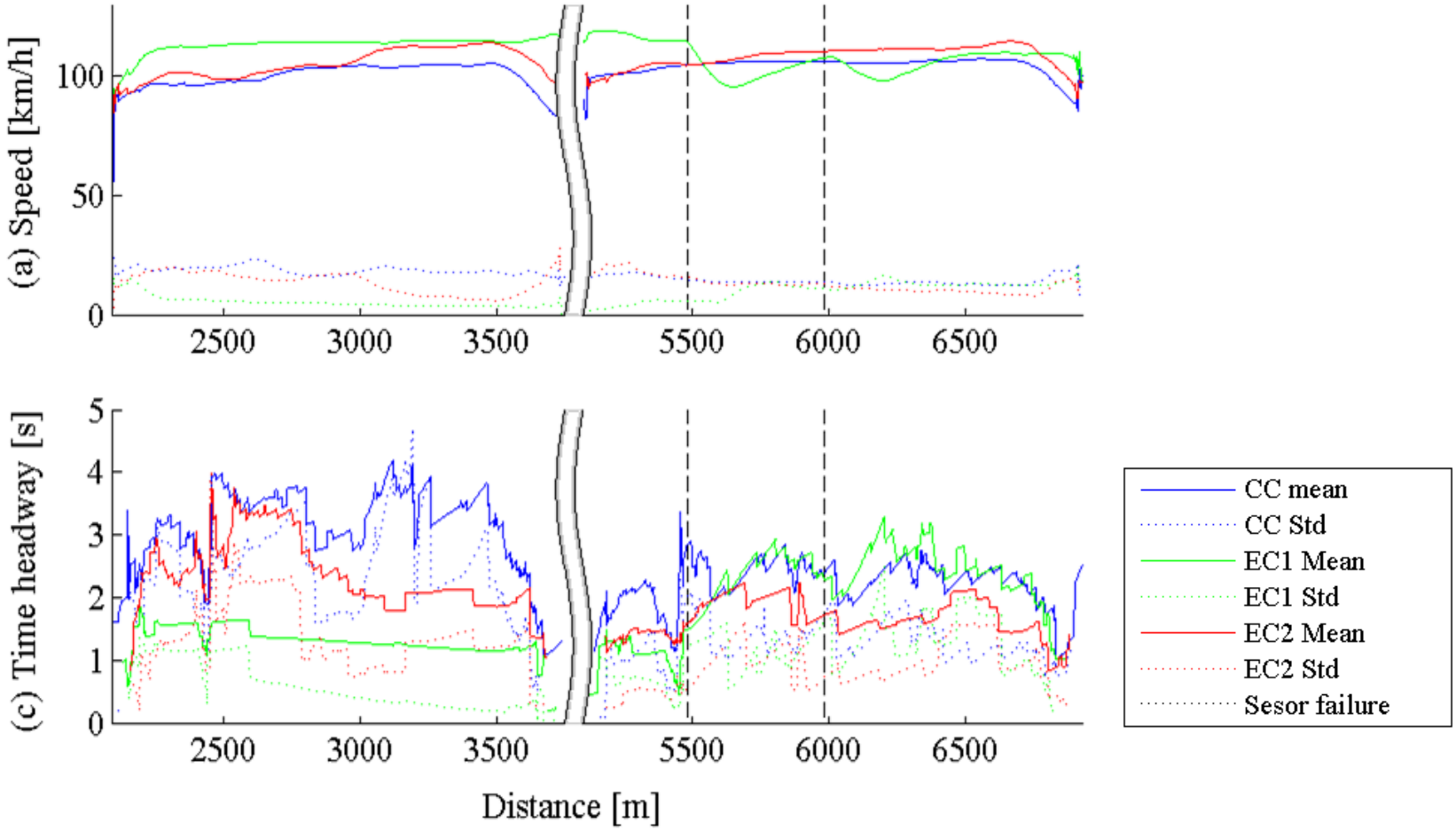
4.6. Flow



5. Driving simulator experiment



5.1. Experimental results



6. Conclusion and future research

Authority transitions influence traffic flow efficiency

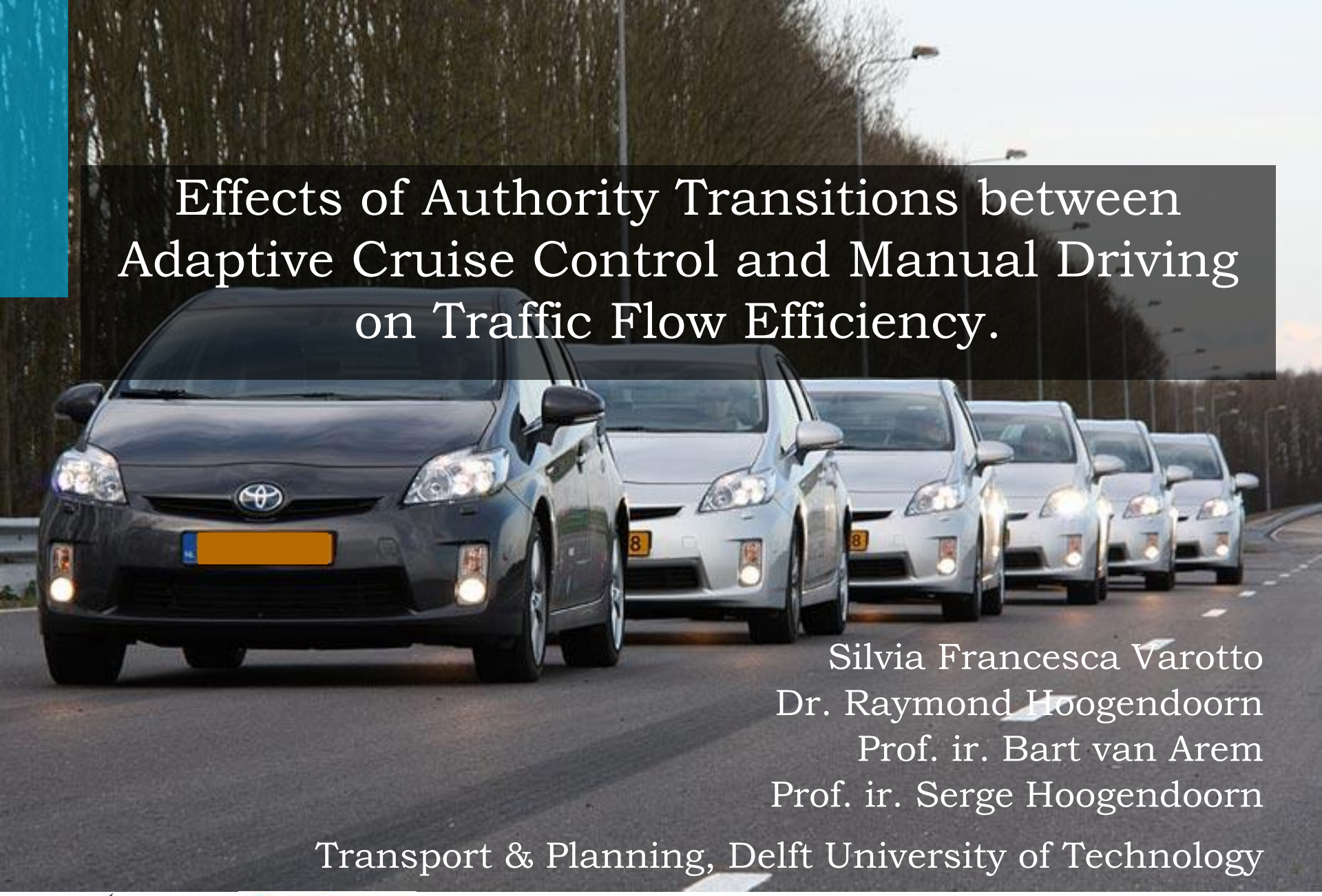
Current models are not adequate

Validity of decision rule introduced

Parameter calibration

When do drivers disengage ACC?

Human factors



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