# IDEA League Summer School at Chalmers University of Technology

Analysis and modelling road user behavior for road crash prevention

Exercise 1 - Quantitative analysis of driving simulator data

The file Data_DSS.mat contains data from a driving simulator study conducted in October 2017. In the study, the participant sitting on the ego vehicle was asked to drive on a multi-lane road and follow the lead vehicle. At some point during the study, the lead vehicle suddenly braked and the ego vehicle was confronted with a critical situation (Figure 1).
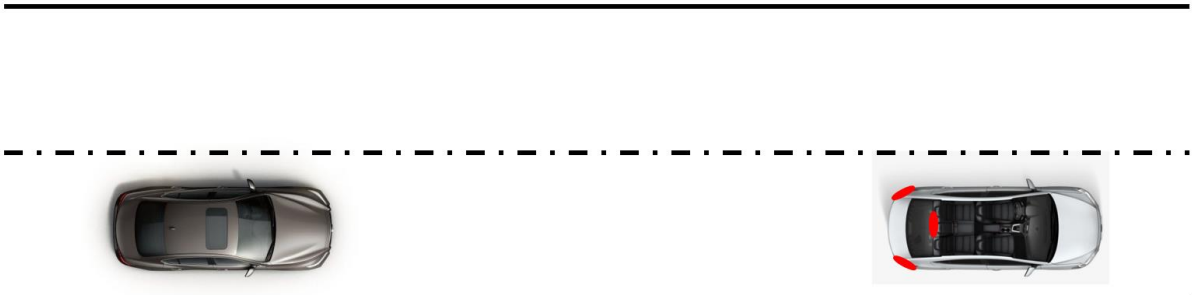
Figure 1: lead vehicle braking during the driving simulated scenario, originating a critical situation

The file Data_DSS.mat includes the following variables:
- *Time*: continuous time from the start of the scenario [s]
- *Ego_vehicle_longitudinal_speed*: longitudinal speed of ego vehicle [m/s]
- *Ego_vehicle_pedal_brake_depression*: depression of the brake pedal (0 when the brake pedal is released and 1 when the brake pedal is depressed) [-]
- *Lead_vehicle_critical_situation_index*: index indicating that the lead vehicle is starting to brake (the start of event can be approximated, when the index assumes the value 4) [-]
- *Lead_vehicle_longitudinal_speed*: longitudinal speed of lead vehicle [m/s]
- *Distance_headway_ego_lead_vehicle*: distance headway measured between the centers of gravity of ego and lead vehicle [m]

You have also information about the measurements of vehicles:

- Length of ego vehicle: 4.5 [m]
- Length of lead vehicle: 4.1 [m]
- Longitudinal distance between center of gravity and leading surface of ego vehicle: 1.9 [m]
- Longitudinal distance between center of gravity and leading surface of lead vehicle: 1.7 [m]

Given this information, how do you calculate the driving performance measures below?

- Perception Response Time (assuming the start of the event as the first appearance of the *Lead_vehicle_critical_situation_index* equal to 4)
- Distance gap
- Time gap (assuming that the speed of the ego vehicle is constant)
- Distance headway between front of lead vehicle and front of ego vehicle
- Time headway between front of lead vehicle and front of ego vehicle (assuming that the speed of the ego vehicle is constant)
- Time To Collision (for this calculation, don't forget to take into account the difference in speed between the vehicles)

You should also plot all the variables, apart from the Perception Response Time.