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# Announcement of Ph.D. Dissertation/M.S. Thesis Oral Defense

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**Student:** EHSAN BEHESHTITABAR **Advisor**: PROF. MECIT CETIN

**Building: ___Online_____ Room: _____**

**Day: Friday, April 3rd, 2020_____ Time: 11:00 AM**

**Dissertation/Thesis Title:**

## A RULE BASED CONTROL ALGORITHM FOR ON-RAMP MERGE WITH CONNECTED AND AUTOMATED VEHICLES


**Abstract:**

It is envisioned that future highways with Connected Automated Vehicles (CAVs) will have a dedicated lane for the CAVs to form platoons and travel with higher speeds and lower headways. The connectivity will enable the formation of platoons of CAVs which will travel beside non-platoon lanes. The advent of connectivity between vehicles and the infrastructure will enable control strategies to be incorporated in the traffic system. These control strategies can improve the efficiency and safety of the traffic.

The merge area in a multilane highway with CAVs is one of the sections which can be enhanced by the operation of a control system. Every connected vehicle joining a connected highway from an onramp will have the challenge of when and where – while traveling on the acceleration lane – to join the adjacent mainline of the highway.

In this research, the aim is to develop a model for investigating the effects of a rule-based control strategy yielding a more efficient and systematic method for the vehicles joining the highway mainlines comprised of platoon and non-platoon lanes. The actions tested for assisting the merge process included deceleration in the mainlines and lane change to join a platoon in the platoon lanes. The model targets to direct every CAV entering a multi-lane highway segment from an on-ramp, to the rightmost lane of the highway based on the operation of different actions to determine the effectiveness of each action on the merge area performance. The merging model is compared with the current day traffic performance of the merge area. To account for car following behavior, the platoon lanes are assumed to have a simplified CACC (cooperative adaptive cruise control) and the non-platoon lanes the IDM+ car-following model. The IDM+ car following model is modified with additional controls to incorporate the current technologies of Advanced Driver Assistant Systems (ADAS) such as Collision Avoidance and Adaptive Cruise Control.

Numerous simulation experiments are conducted to understand the significance of the model parameters on the traffic performance of the merge area. The results of this study showed that the proposed car following model can increase the throughput of lane 1 from approximately 2000 vehicle per hour (vph) to 3400 vph while the platoon lanes each had an average throughput of 3500 vph. The merge model enabled higher merging throughput for the merge area compared to current day conditions. The model displayed the potentials for improved traffic performance in a connected environment comprised of platoon and non-platoon lanes and can be applied for future research on connected highways. The results of this research will help in the design and development of advanced systems for controlling on-ramp merge sections in the future with CAVs.