Impacts of Connected and Autonomous Vehicles on the Performance of Signalized Networks: A network fundamental diagram approach

Evaluate the impacts of connected and autonomous vehicles (CAVs) on the performance of signalized networks at the aggregate level.

WHAT IS THE NEED?

Connected and autonomous vehicles (CAV) are expected to improve or alleviate traffic congestion, but their impacts are usually evaluated at the microscopic level (e.g., through the design of optimal vehicle trajectories or optimal operation of individual intersections).

There is a need to develop a new performance evaluation framework through Network Fundamental Diagrams (NFD), which capture the relationship between the average flowrate and density at the network level. More specifically, there is a need to study and evaluate how individual advisory speed limits of connected vehicles can increase the network capacity (maximum flow-rate for the whole network). Researchers will also evaluate how different start-up (acceleration) and clearance (aggressiveness) behaviors of autonomous vehicles can increase the network capacity.

WHAT ARE WE DOING?

The research team at the University of Southern California (USC) will perform research with simulation algorithms to evaluate the impacts of start-up and clearance behaviors of autonomous vehicles. The research team will use different combinations of CAV technologies to determine whether their impacts are additive or alternative. Researchers will evaluate the performance of mixed traffic flows with autonomous and human-driven vehicles. They will use different market penetration rates of autonomous vehicles in the mixed traffic flow evaluations.
WHAT IS OUR GOAL?

Our goal is to study and evaluate how individual advisory speed limits of connected vehicles can increase the network capacity (maximum flow-rate for the whole network). Also, to have researchers evaluate how different start-up (acceleration) and clearance (aggressiveness) behaviors of autonomous vehicles can increase the network capacity in mixed traffic flows with autonomous and human-driven vehicles. Also, to determine whether their impacts are additive or alternative.

WHAT IS THE BENEFIT?

This research will analyze and evaluate, through simulations how individual advisory speed limits of connected vehicles and different start-up and clearance behaviors of autonomous vehicles can increase the network capacity and reduce the start-up and clearance lost times.

The results of this research have the potential to help improve the traffic network capacity and reduce traffic delays due to start-up and clearance lost times.

WHAT IS THE PROGRESS TO DATE?

The task started on March 15, 2020 and Caltrans is working with the researchers to schedule the kickoff meeting.