Connected and automated vehicle (CAV) technologies have recently drawn an increasing attention from governments, vehicle manufacturers, and researchers. Connected vehicles (CV) technologies provide real-time information about the surrounding traffic condition (i.e., position, speed, acceleration) and the traffic management center's decisions. The CV technologies improve the safety by increasing driver situational awareness and reducing crashes through vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I). However, the market penetration rate (MPR) of CAVs and the higher level of automation might not be available in the near future. Examining the lower level of automation is more realistic in the foreseeable future. Finally, the study investigates the integrated safety and operational benefits of CAV application on 22 miles expressway (SR408) segments in the state of Florida. The optimal market penetration rates of CAV application for both peak and off-peak periods are recommended. In this study, the simulation model was developed in PTV VISSIM. The baseline scenarios of different roadway, traffic, and weather conditions were calibrated and validated using the real-time detectors from multiple sources in Florida. The car following and the lane changing behavior of the CAV technologies were modeled in the C++ programming language with considering realistic car following models and lane changing models in VISSIM. Surrogate safety assessment techniques were considered to evaluate the safety effectiveness of these CAV technologies, while the average travel time, average speed, and average delay were considered as traffic operational measures. Afterwards, the managed lane CV platooning technologies outperformed all lanes CV platoons in terms of surrogate safety measures. Moreover, connected vehicle lower level automation improved the arterial traffic in terms of both segment and intersection crash risks. In addition, from the safety and operation perspective, at least 30% and 20% MPR were needed to achieve both the safety and operational benefits of peak and off-peak hour, respectively.

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The public is welcome to attend.