Driver behavior and advanced driver assistance systems: an exploratory driving simulator study

B. B. Martin    L. Elefteriadou

University of Florida, 365 Weil Hall, Gainesville, FL 32611
email: barbaramartin@ufl.edu, elefter@ce.ufl.edu

Abstract
This paper explores potential driver behavior changes due to the interactions with advanced vehicle technologies emerging on the market. These technologies, called Advanced Driver Assistance Systems (ADAS) can take control over specific functions of the vehicle, and provide warnings to assist drivers in a variety of driving tasks. These technologies were designed mainly to improve roadway safety and provide comfort to drivers. There is evidence that these systems may change the way drivers behave on the road, resulting in traffic operational improvements and congestion mitigation, but a limited amount of research has been conducted to assess these potential impacts. This study evaluated performance measures of a vehicle equipped with two types of ADAS in a driving simulator (STISIM Drive) environment. Two systems, which are more likely to affect traffic operations, were evaluated: Adaptive Cruise Control (ACC) and Lane Change Assist (LCA). A specific route was created in the driving simulator, which consisted of an arterial section followed by a freeway. This route was driven twice by drivers: first without the systems and secondly using the two ADAS. There were a total of 25 participants with varying characteristics and backgrounds. Performance measures such as speed, lane change maneuvers, and headway with the front vehicle were collected. The analysis compared driver performance for different driver groups as well as for the entire sample. Performance without the systems was compared to that obtained while the systems were used. Results showed changes in driving behavior due to the systems and specific driver’s characteristics that are more likely to be affected by these technologies.

Keywords – ADAS, car following, lane changing, driving simulator

1. Introduction
Advanced Driver Assistance Systems (ADAS) are electronic devices installed in vehicles to assist drivers in tasks such as lane changing, merging and speed control by providing warnings or even taking control of the vehicle. These systems have shown promise in the improvement of road safety, as proven in several tests [1, 2]. An important question is whether the use of these systems would also result in traffic improvements and congestion mitigation. Some papers already show positive effects of one particular system (Adaptive Cruise Control), but the integration of these systems’ impact and the use of such systems by different drivers have not been evaluated yet.

With the constant increase of these technologies on the market it is very important to consider the acceptance and use of such systems by different drivers. This paper explores differences in driving behavior due to the interactions with 2 ADAS as a function of different driver’s characteristics, such as age, gender, and aggressiveness.