Conventional roundabouts have been prevalent worldwide since the emergence of modern roundabouts’ concept. An innovative design of multilane roundabouts known as turbo roundabouts, however, has been recently introduced as an alternative to conventional multilane roundabouts. Due to several reasons, there has been no general consensus on the operational performance of turbo roundabouts throughout the world. Nationwide, turbo roundabouts have yet to be part of roadways system, but there is an ongoing project expected to be finished in 2020. Therefore, this dissertation aims to evaluate the operational performance of a widespread variant of turbo roundabouts, namely basic turbo roundabouts, as compared with conventional roundabouts in the State of Florida. Field data from existing double-lane roundabouts has been recently collected. A microsimulation analytical tool has been employed to develop base and alternative models. Operational performance measures of effectiveness include throughput volume, average delay, and maximum queue lengths. In addition, vehicular traffic conflicts have been considered using Surrogate Safety Assessment Model. The results indicate that basic turbo roundabouts with an entry speed of 25 mph, i.e., Scenario 2, can provide slightly more throughput volume and can significantly reduce the overall average delay when traffic flow is considered low, i.e., nearly 1500 vehicles/hour. At higher traffic flow, even though not being able to process more vehicles in comparison with conventional models, basic turbo models with the Dutch’s entry speed, i.e., Scenario 2, can experience lower average delay in certain ranges of traffic flow levels, mainly depending on origin-destination patterns. Furthermore, the aforementioned turbo models predominantly cut maximum queue lengths on major approaches regardless of traffic flow intensity, while minor approaches can be negatively affected. Finally, except for crossing conflicts at moderate and high flow, read-end, lane change, and total traffic conflicts have been consistently reduced on basic turbo roundabouts at all traffic flow levels.

Keywords: Conventional Roundabouts, Basic Turbo Roundabouts, Microsimulation Analysis, Operational Performance, VISSIM, Double-lane Roundabouts.

Major: Civil Engineering

Educational Career:
Bachelor's of Civil Engineering, BS, 2003, University of Benghazi
Master's of Civil Engineering, MS, 2014, University of Central Florida

Committee in Charge:
Essam Radwan, Chair, Civil, Environmental and Construction Engineering
Mohamed A. Abdel-Aty, Professor; Chair of Civil, Environmental and Construction Engineering Department
Nizam Uddin, Professor; Department of Statistics and Data Science
Hatem Abou-Senna, Department of Civil, Environmental and Construction Engineering

Approved for distribution by Essam Radwan, Committee Chair, on October 27, 2019.

The public is welcome to attend.