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UTC Spotlight

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Evaluating and Enhancing Advanced Traffic Management Techniques for Florida Freeways

The Center for Congestion Mitigation Strategies (CMS) at the University of Florida (UF) recently completed two projects related to advanced freeway management strategies along I-95 in Miami and I-4 in Orlando. Both projects were conducted for the Florida Department of Transportation (FDOT).

Congestion Pricing–I-95 Express

FDOT implemented high occupancy/toll (HOT) lanes, known as 95 Express, in the Miami / Fort Lauderdale area along I-95. The system is currently approximately 13 miles and is expected to be extended to 22 miles. The primary goal of 95 Express is to maximize the throughput of the facility while providing travel speeds greater than or equal to 45 mph on the HOT lanes. Dynamic tolling (i.e., tolling as a function of prevailing conditions) is implemented.

UF researchers examined several questions regarding the operations of HOT lanes. Simulation experiments showed that at the current demand, the system achieves a certain degree of equilibrium with respect to traveler departure choice as a function of toll levels. However, if the demand increases and there is severe congestion, the system may exhibit hysteresis-like behavior where travelers are constantly shifting their departure times on a day-to-day basis. In that case, the system performance would be unstable. The experiments also confirmed that dynamic tolling is able to manage the traffic demand and maintain a superior performance on the HOT lanes. When the demand is predictable, time-of-day or even static tolling could perform equally well, provided that the tolls are optimized against the demand pattern. However, since dynamic tolling is adaptive to demand fluctuations, its performance is more robust.

Vipul Modi

A section of the I-4, Orlando, Florida

Researchers next examined the capacity and operations of 95 Express. HOT lanes are separated from the general purpose (GP) lanes with plastic poles and have reduced lane widths (11 feet). Examination of capacity before and after implementation of HOT lanes showed no substantial impact on capacity due to lane widths. The proximity of the plastic delineators reduced utilization of the adjacent GP lane.

Researchers also explored the interactions between dynamic tolling and ramp metering. An increase in the toll rate results in lower utilization of the HOT lanes, shifting traffic to the GP lanes. This results in more restrictive metering rates. It was concluded that the system could be optimized by maximizing the utilization of the HOT lanes. This could be accomplished if one of the objectives of the pricing algorithm was to maximize HOT lane utilization

Finally, researchers used the Corridor Simulation (CORSIM) to replicate variable speed limit (VSL) operations along 95 Express and evaluate its effectiveness in mitigating congestion. It was concluded that VSLs have the potential to improve traffic operations along the I-95 corridor, if enforced properly.

Variable Speed Limits–I-4

The I-4 VSL system was implemented by FDOT in 2008. Since its deployment the majority of traffic exceeds the speed limit by more miles per hour when the speed limit is reduced versus when it is at the baseline level. The researchers explored the effectiveness of the existing VSL system, evaluated traffic operations and bottlenecks along the facility, and analyzed a variety of VSL configurations and algorithms.

Focus group studies as well as in-vehicle observation studies were conducted to evaluate driver perceptions. Participants indicated they would typically not reduce their speeds unless drivers in their surroundings reduce theirs, and they suggested installing the VSL sign boards on both sides of the roadway and if possible, on over-head sign boards at each lane. Through a combination of sensor data analysis and aerial reconnaissance, the research team identified bottleneck locations and congestion times. Based on these, a CORSIM simulation of the I-4 VSL zone was built to evaluate various potential VSL algorithms and their respective settings.

It was concluded that changing the detector configuration, and using the data from the worst performing detector (rather than an average), does have the potential to reduce travel times and improve operations for some of the VSL scenarios tested. There is no clear pattern regarding the type of algorithm that would be most beneficial at a particular bottleneck, nor any clear patterns regarding the VSL sign configuration. The researchers observed that VSL may work at specific types of bottlenecks, and be less effective at others. VSLs were shown to be effective at diverge bottlenecks such as the one along I-95, but not as effective at merge and weaving locations.

About This Project

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