

APPLICATION OF A MICRO-SIMULATION MODEL TO ESTIMATE THE EFFECTIVENESS OF TOLL PRICING ALTERNATIVES ON THE DIVERSION OF TRAFFIC TO TOLL FACILITIES

PROBLEM STATEMENT

The Central Florida area is a growing destination center. Growth is anticipated to continue and the ability of the road network to service the growing traffic volumes will continue to decline. Improvements to the network are in progress and more significant construction is planned for the near future. The issues concerning the Turnpike Enterprise are to evaluate the effectiveness of the network with respect to the existing improvement plans as well as the proposed plans. These plans are expected to change the capacity of the roadways. As such, there is a need to investigate the impact of deployment of ITS strategies such as dynamic traveler information and alternative toll pricing. There is a need to accurately estimate traffic diverted to Turnpike facilities, such as the SR 417, as a result of alternative toll pricing plans. The effect of these strategies in alleviating congestion on I-4 should also be evaluated.

OBJECTIVES

The main goal of this project was to execute and evaluate the effectiveness of alternative toll reduction scenarios on diverting traffic to Turnpike facilities such as the SR417. Specific objectives of this project included the following:

1. Evaluation of diversion of vehicles from a non-toll road such as I-4 to toll facilities such as SR417.
2. Studying the impact of increased traffic on toll facility operations and travel times.
3. Evaluation of traffic volumes on selected non-toll road facilities after diversion and their resulting operational speed and travel time.

FINDINGS AND CONCLUSIONS

Researchers developed a micro-simulation network (UCF-PARAMICS Network) that included I-4, major toll roads, and major arterials in Central Florida. The main challenge in this research was to calibrate the network and to implement and evaluate the alternative toll pricing plans. The validated UCF-PARAMICS Network model provided a foundation for further investigative scenarios (such as change in the geometric and physical design of the roadways) as well as conclusions on the level of benefits from the defined network in this research.

The final report for this project documents the simulation effort and the steps taken towards the development and calibration of the UCF-PARAMICS Network to deploy the alternative toll

pricing plans in Central Florida. Twenty four scenarios incorporating various locations of the lane closures/incidents, and different toll reduction strategies were defined, in addition to the base scenario, which was calibrated to reflect the existing conditions. The performance of the simulated scenarios was evaluated using two measures of effectiveness: traffic volumes on selected paths and links, and travel times. The volume diversion analysis was performed at four screen lines to compare the changes in volume from the base scenario for trips originating from Lake Mary area.

The results demonstrated that diversion of traffic volumes to SR417 was insignificant under all lane closure/incident scenarios under no change in the toll structure. It was also observed that *50%-100% toll reduction on SR417 only* and *50%-100% toll reduction on both SR417 and SR528 simultaneously* had a similar effect on the hourly traffic volume diverted to SR417. As a result, there appeared to be no added benefit from toll reduction on SR528. Under all lane closure/incident scenarios, the hourly traffic volume on I-4 dropped at the location of lane closure except at locations where off ramps were closed. The volumes that diverted upstream of the lane closure/incident were observed to be less than 15% of the hourly peak volume. However, the traffic diverted back to I-4 downstream of the lane closure/incident, thereby restoring the default conditions on I-4. As such, there was no such significant change in the traffic conditions on I-4.

With respect to travel times, the overall network travel time did not change across the scenarios. Also, due to multiple alternatives available across specific OD pairs, the overall travel times for the ODs did not provide any significant insight into the benefits. Therefore, a microscopic assessment of travel times across critical routes was conducted. Moreover, I-4 had the least travel time from the northern end to the southern end of the network when travel time included the toll cost. So, usually no significant diversion happened off of I-4 to SR417 even under incident/lane closure and toll reduction scenarios. For people who value time significantly more than out of pocket toll cost, the toll roads were better alternatives when an incident/lane closure occurred on I-4.

BENEFITS

This study showed that there was no significant benefit of toll reduction to I-4 at the macroscopic network level, and that there was no benefit of reducing tolls on SR528. This was the case because diversions resulting from any toll reduction only made I-4 more attractive to the local commuters who used arterials. These arterial commuters switched to I-4, which resulted in rendering its conditions what they were before the toll reduction. In addition, there was some diversion to SR417 due to toll reduction, but not necessarily from I-4.

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