World Academy of Science, Engineering and Technology
International Journal of Transport and Vehicle Engineering
Vol:13, No:02, 2019

Pricing Techniques to Mitigate Recurring Congestion on Interstate Facilities Using Dynamic Feedback Assignment

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Abstract : Interstate 4 (I-4) is a primary east-west transportation corridor between Tampa and Daytona cities, serving commuters, commercial and recreational traffic. I-4 is known to have severe recurring congestion during peak hours. The congestion spans about 11 miles in the evening peak period in the central corridor area as it is considered the only non-tolled limited access facility connecting the Orlando Central Business District (CBD) and the tourist attractions area (Walt Disney World). Florida officials had been skeptical of tolling I-4 prior to the recent legislation, and the public through the media had been complaining about the excessive toll facilities in Central Florida. So, in search for plausible mitigation to the congestion on the I-4 corridor, this research is implemented to evaluate the effectiveness of different toll pricing alternatives that might divert traffic from I-4 to the toll facilities during the peak period. The network is composed of two main diverging limited access highways, freeway (I-4) and toll road (SR 417) in addition to two east-west parallel toll roads SR 408 and SR 528, intersecting the above-mentioned highways from both ends. I-4 and toll road SR 408 are the most frequently used route by commuters. SR-417 is a relatively uncongested toll road with 15 miles longer than I-4 and $5 tolls compared to no monetary cost on 1-4 for the same trip. The results of the calibrated Orlando PARAMICS network showed that percentages of route diversion vary from one route to another and depends primarily on the travel cost between specific origin-destination (O-D) pairs. Most drivers going from Disney (O1) or Lake Buena Vista (O2) to Lake Mary (D1) were found to have a high propensity towards using I-4, even when eliminating tolls and/or providing real-time information. However, a diversion from I-4 to SR 417 for these OD pairs occurred only in the cases of the incident and lane closure on I-4, due to the increase in delay and travel costs, and when information is provided to travelers. Furthermore, drivers that diverted from I-4 to SR 417 and SR 528 did not gain significant travel-time savings. This was attributed to the limited extra capacity of the alternative routes in the peak period and the longer traveling distance. When the remaining origin-destination pairs were analyzed, average travel time savings on I-4 ranged between 10 and 16% amounting to 10 minutes at the most with a 10% increase in the network average speed. High propensity of diversion on the network increased significantly when eliminating tolls on SR 417 and SR 528 while doubling the tolls on SR 408 along with the incident and lane closure scenarios on I-4 and with real-time information provided. The toll roads were found to be a viable alternative to I-4 for these specific OD pairs depending on the user perception of the toll cost which was reflected in their specific travel times. However, on the macroscopic level, it was concluded that route diversion through toll reduction or elimination on surrounding toll roads would only have a minimum impact on reducing I-4 congestion during the peak period.

Keywords : congestion pricing, dynamic feedback assignment, microsimulation, paramics, route diversion
Conference Title : ICDTASP 2019 : International Conference on Dynamic Traffic Assignment and Simulation Procedures
Conference Location : Rome, Italy
Conference Dates : February 18-19, 2019