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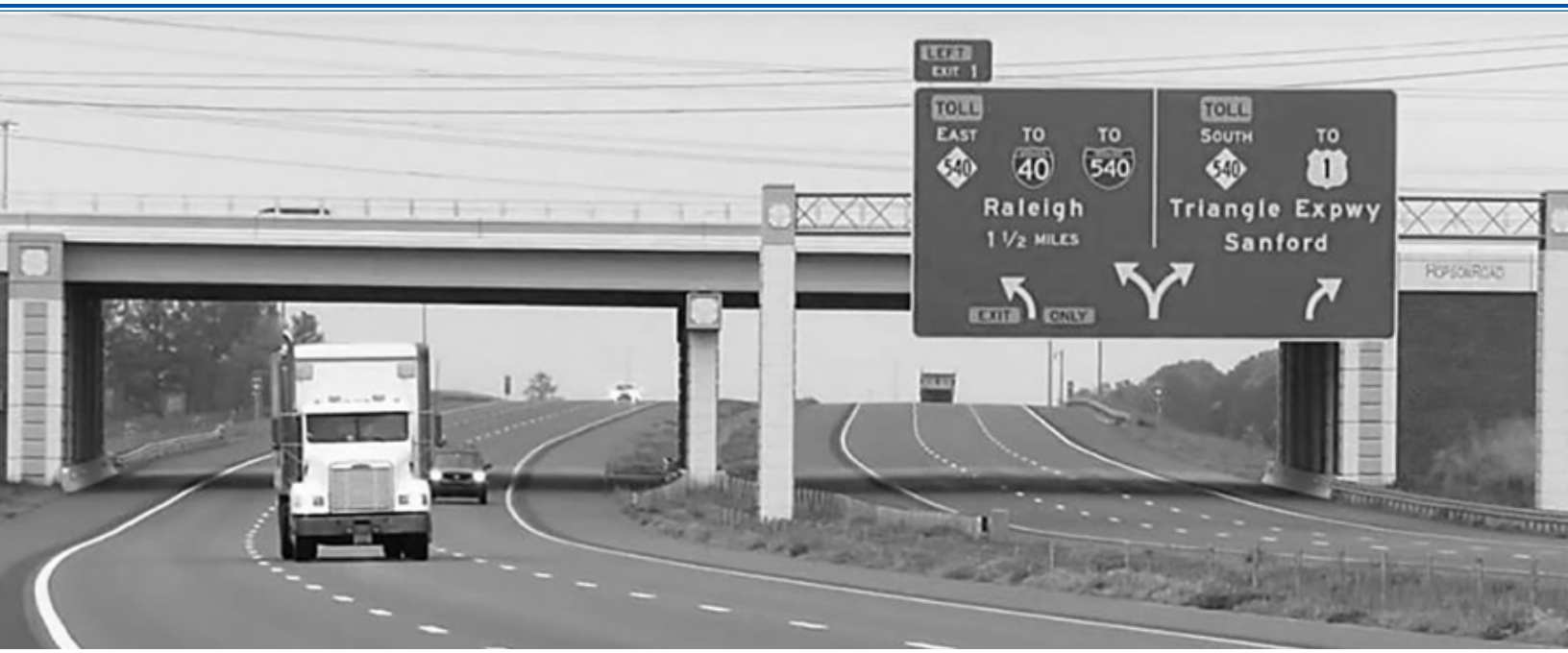
How Effective are Toll Roads in Improving Operational Performance?

Project 1804
September 2019

Sonu Mathew and Srinivas S. Pulugurtha, PhD



Source: https://www.ncdot.gov

The rapid increase in vehicle population and subsequent traffic congestion call for better utilization of road infrastructure to manage the traffic more efficiently and economically. Investing in sustainable traffic management policies like priced lanes and managed lanes not only reduce congestion but aid in optimal operation and maintenance of infrastructure on a long-term basis. Traditionally, decisions to implement toll roads and express toll lanes are made through the use of regional travel demand forecasting models and long-term transportation planning process. However, there is no guarantee that real-world results will conform to the projections from regional travel demand forecasting models. There is a need to monitor, evaluate, and assess the effectiveness of such large-scale projects after the implementation. Therefore, the main goal of this research is to develop a systematic analytical framework to evaluate the effect of toll roads on the region's traffic using travel time and travel time reliability measures.

Study Methods

The Triangle Expressway in Raleigh, NC and roads within its vicinity of 2-miles were considered as the study area for this research. The methodological framework adopted for this research comprised of two parts. In the first part, travel time-based analysis was carried out separately for the toll road, parallel alternate route, and other major cross-streets in toll road vicinity for different phases of construction and after opening the toll road for providing service. This part of the analysis assists in assessing the effectiveness of the toll road in improving operational performance within its vicinity, over time through the construction phases and after the completion of the whole

project. In the second part, travel time and travel time reliability measures were computed for different years of toll road operation for road links along the toll road, parallel alternate route, and other near cross-streets. This part of the study assists in quantifying the change in the effectiveness of the toll road over time. In each part, the spatial and temporal effect of toll roads were quantified at link level (disaggregate level) and the corridor level (aggregate level).
The statistical significance of the change in travel time performance measures was evaluated using a one-tailed paired t-test.

Findings

Some of the key findings are listed as follows.

1. The increase in traffic volume along the toll road can be considered as a positive result, as the majority of new traffic is attracted to the more reliable toll road, keeping the alternate free route from becoming as congested, as it might otherwise.
2. The toll road showed a positive trend in travel time reliability over the years of its operation. The increase in traffic volume does not worsen the travel time and travel time reliability on the toll road. The distinguishing capability of expressways in managing higher traffic volume is evident from the analysis.
3. The effects of large-scale transportation projects vary spatially and temporally. The near vicinity corridors analyzed in this research substantiated the geospatial and temporal variation of travel times and travel time reliability during different phases of toll road operation.
4. The average travel time, planning time, buffer time, and buffer time index were used for the link–level assessment. The cumulative distribution of travel times is better for before-after comparisons at corridor level.

Policy Recommendations

Link-level travel time reliability analysis is suitable in identifying the segments on a road which are unreliable during different hours of the day. The corridor-level assessment can be used to assess the overall effect of long-term transportation projects on regions' traffic. Overall, the findings from this research help with transportation system management, assessing the influence of travel demand patterns, and evaluating the effectiveness of the planned implementation of similar projects.

About the Authors

Mr. Sonu Mathew is pursuing his Ph.D. in Infrastructure and Environmental Systems at the University of North Carolina at Charlotte. He earned his master's degree from Sardar Vallabhbhai National Institute of Technology, Surat, India. His areas of interest are transportation planning, traffic flow modeling and simulation, and traffic safety.

Dr. Srinivas S. Pulugurtha, P.E., F.ASCE is currently working as Professor & Research Director of the Department of Civil & Environmental Engineering at The University of North Carolina at Charlotte (UNC Charlotte). He is also currently directing the Infrastructure, Design, Environment, and Sustainability (IDEAS) Center on UNC Charlotte campus.

To Learn More

For more details about the study, download the full report at transweb.sjsu.edu/project/1804.html

MTI is a University Transportation Center sponsored by the U.S. Department of Transportation's Office of the Assistant Secretary for Research and Technology and by Caltrans. The Institute is located within San José State University's Lucas Graduate School of Business.