PROJECT SUMMARY

Texas Department of Transportation

0-6657: Investigating Regional Dynamic Traffic Assignment Modeling for Improved Bottleneck Analysis

Background

The Texas Department of Transportation (TxDOT) made geometric changes to the MoPac Expressway near the downtown Austin area in September 2010 to alleviate the existing bottleneck and improve travel conditions for downtown commuters during peak periods. The geometric changes involved ramp design modifications to allow for three mainline lanes on MoPac in the northbound direction where only two lanes existed previously. The Enfield Road exit ramp was redesigned such that there was no longer a lane drop from three to two lanes on the mainline. The Cesar Chavez/ 6th Street on-ramp approach was reduced by one lane, and this lane reduction continued on the Cesar Chavez Street approach upstream of its merging point with 6th Street. An acceleration lane about 530 feet in length was added to the Cesar Chavez /6th Street on-ramp. The research team performed a bottleneck analysis using dynamic traffic assignment (DTA) to evaluate the impact of the geometric reconfigurations on travel conditions downtown and its secondary impact on network-wide travel patterns in the area surrounding the bottleneck site.

What the Researchers Did

The researchers established that DTA modeling was a suitable approach for performing a bottleneck analysis at a regional scale since it provides an ideal balance between traffic realism and computational efficiency. In consultation with the Project Monitoring Committee the researchers developed a test bed DTA model of the MoPac Expressway, which also included the street network between MoPac to IH-35 and Cesar Chavez Street to 35th Street. The extended street network allowed for studying route-switching behavior of commuters after the geometric reconfiguration. VISTA software was chosen for this study since it met the scope of this project. The research team has extensive experience with transportation modeling using VISTA, and the availability of its source code meant that new features and updates could be added as needed. Its web-based interface provides flexibility and platform independence.

The research team compared the before and after network conditions using a suite of performance metrics, such as travel time, speed, throughput, volume-to-capacity ratio, density, and route-choice behavior. In addition to the core bottleneck analysis using DTA, additional tools were developed to help transportation planning decision makers. A decision-making

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framework using a simplified analytical hierarchy process was developed to rank potential improvement projects.

In order to take full advantage of the improved modeling capabilities of DTA, it needs to be incorporated into the traditional four-step planning process and integrated with other modeling tools currently used by transportation agencies. The research team provided guidelines to move forward in both of these directions.

What They Found

The geometric changes made by TxDOT on the MoPac Expressway near downtown resulted in a small improvement in northbound MoPac travel time during the evening peak period. The new lane configuration also drew more northbound vehicles to MoPac through the Cesar Chavez / 6th Street approach and led to a small increase in travel time on this ramp. Vehicular counts on the Enfield Road on-ramp did not change significantly. There were no major shifts in travel patterns of the commuters leaving downtown in the evening. Overall, the new geometry did not lead to major route-switching behavior in the network. A sample cost-benefit calculation demonstrated the benefit of the geometric reconfiguration.

What This Means

This research study successfully employed dynamic traffic assignment modeling for bottleneck analysis at a regional scale and proved the feasibility of such an approach. To the best knowledge of the researchers this is the first instance of DTA application for a comprehensive bottleneck analysis. DTA modeling is gaining acceptance among transportation agencies due to its superior representation of time-varying travel condition compared to static traffic assignment. The next logical step in the evolution of this trend is to incorporate DTA into the traditional four-step transportation planning process.

The research team provided a guiding framework to incorporate DTA into the planning process. The adoption of DTA by transportation agencies also presents new challenges to integrate DTA with existing traffic models currently in use. In order to take full advantage of DTA, traffic analysts will need to integrate a variety of tools with different capabilities operating at varying degrees of resolution, and establish standardized interfaces between such software packages. The research team provided guidelines for such integration by drawing a sample software from each degree of resolution (macroscopic, mesoscopic, and microscopic).

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