Project Summary

Texas Department of Transportation

0-6632: Positive Feedback: An Examination of Current Approaches in Iterative Travel Demand Model Implementation

Background

Travel demand models (TDMs) are critical quantitative analysis tools that support development of long-range transportation plans and air quality analysis. The Texas Department of Transportation's Transportation Planning and Programming Division (TxDOT-TPP) provides TDM development support to 23 Metropolitan Planning Organizations (MPOs) in the state. Currently, the models developed by TxDOT-TPP are traditional three-step models (i.e., trip generation, trip distribution, and traffic assignment) that are sequentially applied with minimal adjustments between each step. A recognized limitation of this sequential approach is an inconsistency between the speed/time data used in trip distribution (i.e., the decision people make on where to go), which is based upon a preliminary set of estimated network link speeds and travel times, versus the resulting speeds and travel times from the final traffic assignment step, which reflect some level of congestion. This inconsistency between the speed/time data used in different stages of the traditional sequential process may result in travel models that do not accurately reflect current system or corridor-level travel patterns. As a result, the speeds and travel times that result from alternative analyses used to support long-range transportation planning decisions may not entirely reflect accurate results.

This project researched a fundamental advancement to the traditional TDM development approach currently utilized by TxDOT-TPP. By implementing feedback TxDOT-TPP could better represent current and forecasted travel patterns and substantially improve the quality of this critical decision-making tool for TxDOT and local decision-makers statewide.

What the Researchers Did

This project researched current trends, practices, and tools in implementing a feedback approach for potential implementation in the TxDOT travel models for study areas where this may be considered a viable option (e.g., larger, congested study areas). A field test and sensitivity analysis of applying feedback within the TxDOT TDM process using a previously validated Texas MPO model was also conducted as part of the research effort. Researchers emphasized what is practical - based upon the current state of practice - with feedback, as well as logical for incorporation into the TxDOT urban models as they stand today. Researchers primarily focused on existing approaches for feedback implementation in the context of the TxDOT TDM process.

Research Performed by:

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What They Found

Researchers found:

- In general, past research and practice underscores the importance of incorporating feedback loops in the travel demand process, especially in regions with moderate to high levels of traffic congestion during certain times of the day.
- Since the current TxDOT TDM model does not include any impedance or accessibility measures in the trip generation step, the best current approach is to apply the output from the traffic assignment step as input to the trip distribution step.
- MPOs nationwide use a variety of approaches with respect to the feedback method and convergence criteria; the Method of Successive Averages and constant weight approaches have demonstrated advantages over direct feedback methods and limiting the number of feedback loops to a predetermined number.

An optimal prerequisite for feedback looping is time of day in some form in the modeling process. Nevertheless, the research suggests that there are alternate approaches TxDOT-TPP may wish to examine with respect to implementing a feedback mechanism.

What This Means

Time of day considerations may be undertaken in the TxDOT TDM. A time of day split factoring process could be introduced just before traffic assignment, running assignment for multiple time periods, and feeding back a weighted travel impedance to trip distribution for the next iteration of the feedback process.

The Texas Package does not have an approach to address the influence of travel time on location decision-making within the trip generation models. This may require long-term consideration but for the immediate future, recycling congested times back to the trip generation step is simply not feasible.

In the context of implementing a feedback mechanism within the current 24-hour framework, a number of considerations may be examined as a part of the traffic assignment step prior to implementation of feedback. Overall, critical consideration should be given to the relative impact that implementing feedback might have on existing TxDOT-TPP practices. A feedback mechanism would include additional training and increased calibration time associated with delivering base year travel models; and possibly could include additional data processing (and collection) related to time of day implementation.

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