CENTER FOR TRANSPORTATION RESEARCH

PROJECT SUMMARY

Texas Department of Transportation

0-6900: Coordinating Consistency between Statewide and Regional Models

Background

Transportation planning models are commonly used by US planning agencies to aid decision- making processes. In Texas, a statewide analysis model (SAM) is used for planning projects that will have implications on transportation across the entire state, often pertaining to major freight corridors. At the same time, metropolitan planning organizations (MPOs) throughout Texas use planning models for individual urban regions. Currently, these models are maintained and updated independently, creating inconsistency between the two planning models in the region of overlap.

This project sought to improve the synchronization of these models by defining measures of inconsistency between the SAM and MPO planning models and proposing methods for improving the consistency between the two. The research contribution includes quantifying the measures of inconsistency and demonstrating their use on a case study of SAM and the Capital Area Metropolitan Planning Organization (CAMPO) model. Seven methods for improving the inconsistency are proposed, categorized in three groups varying in complexity and performance.

What the Researchers Did

The researchers conducted an extensive literature review and a detailed analysis of current aggregation approaches to constructing statewide models from the MPO models.

The researchers proposed several ways to measure inconsistency between the statewide and MPO models, divided into three categories: network, input, and output inconsistencies. Inconsistency within the SAM model introduced by making changes to some model inputs or parameters was also quantified.

The researchers then proposed seven methods to reduce inconsistency, with distinct data requirements and implementation complexities. These methods were divided into three groups of ascending complexity. The first group's three methods—simple override, correction factors, and correction regressions—require making changes to the interpretation of the inputs and outputs of SAM without running the SAM model again. The second group's two methods—inputting MPO demand in the statewide model and changing high-level parameters—require running SAM after making changes to the model. The third group's two methods require making significant changes to the structure of SAM: efficient aggregation techniques and decentralized implementation. The researchers tested the performance of all proposed improvement methods on the same case study.

What They Found

The primary literature findings suggested that the statewide and MPO models should be coordinated by both state and MPO agencies. The researchers found that the current practices for ensuring consistency are the "stitch" approach where the MPO models are concatenated to form the statewide model, and the aggregation approach where the network and demand of the MPO model is aggregately represented

Research Performed by:
Center for Transportation Research (CTR)

Research Supervisor:
Stephen Boyles, CTR

Researchers:

Chandra Bhat
Felipe Dias
Nan Jiang
Abhilash Singh
Jennifer Duthie
Ehsan Jafari
Venktesh Pandey
Cesar Yahia

Project Completed:
08-31-2017

in the statewide model. Most states currently follow the aggregation approach; a few use a multi-resolution approach to developing a statewide model. The current interactions between the two models include the statewide model providing the internal-external or external-external traffic volumes to the MPO models and the statewide models using the aggregation of the networks in MPO models to construct the statewide network.

The consistency measure values for the case study of SAM and CAMPO model revealed that the models are highly inconsistent in terms of inputs, outputs, and network structure. (See the full report 0-6900-1 for specific findings.)

The methods for improving consistency showed varying performance for the case study. The methods in the first group were effective in reducing the demand and travel time inconsistency; however, they increased the inconsistency within the SAM model. For example, the correction factor method reduced the demand and travel time inconsistencies by 4.69% and 66.78% respectively, but increased the inconsistency within the SAM model by 21.76% and 69.53% respectively. The methods in the second group caused no within-model inconsistency and reduced the inconsistencies between SAM and CAMPO model. The "inputting MPO demand into SAM" method reduced demand and travel time errors by 100% and 17.7% respectively. The method of altering the high-level parameters of both models produced minor improvements in the demand inconsistency (approximately 2%) while considerably reducing the travel-time inconsistency (approximately 25%). The methods in the third group involved substantial efforts in changing the SAM model to improve the consistency with the MPO model. Tests conducted on a representation of the SAM network in the CAMPO region showed significant improvement in consistency across the two models (for example, reduction in error values to zero for the decentralized implementation case).

What This Means

The most salient conclusion is that there is no one-size-fits-all solution for improving the inconsistencies. The relationship between SAM and the MPO models should be evaluated on a case-by-case basis. The computational effort and resource requirements to make changes using the proposed methods suggest that planning agencies should carefully invest their time in identifying which MPO models are most inconsistent with the statewide model, and direct resources towards reducing inconsistencies in those identified areas. The choice of a particular method should be based on the geographical scope of the project being evaluated and the resources available to make changes in the statewide model. Furthermore, it would be advantageous to both MPOs and TxDOT if network modeling efforts are combined and performed in a collaborative fashion. For instance, where there is overlap with an MPO, SAM could focus on external-to-external and external-to-internal trips, while the MPO model focuses on the internal-to-internal and internal-to-external trips. Information about these trips can then be exchanged between the MPO and the TxDOT. In this way, each model would focus on different types of trips, mitigating some of the sources of inconsistency.

For More Information

Project Manager:
Chris Glancy, RTI (512) 416-4747

Research Supervisor:
Stephen Boyles, CTR (512) 471-3548

Technical reports when published are available at **http://library.ctr.utexas.edu.**

Research and Technology Implementation Office
Texas Department of Transportation
125 E. 11th Street
Austin, TX 78701-2483

www.txdot.gov
Keyword: Research