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Title	INTEGRATION OF DYNAMIC TRAFFIC ASSIGNMENT WITH A TRAVEL DEMAND MODEL BASED ON SYNTHETIC POPULATION FOR STOCKHOLM REGION
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Abstract

Integrated four-stage travel demand models and static equilibrium assignment procedures with LOS feedback have been used for urban and regional forecasts for many years. The drawbacks of this approach –in particular misspecification of congestion phenomena and coarse aggregation of travel demand– have been long recognized as hindrances in the investigation and evaluation of congestion mitigating measures such as road charges and capacity expansions. The need to more accurately represent the complex demand/supply interactions in real transport systems calls for replacement of the four-stage model by activity based travel demand model and the static equilibrium assignment by dynamic traffic assignment (DTA). Despite of the availability of detailed activity-based and DTA models and despite of the conceptual clarity of how such integration should take place, only few operational model systems have been developed for large-scale applications. One reason is the high complexity of the model system and the resulting difficulty in parameter estimation, calibration, implementation, maintenance, and result interpretation. Another one is the crucial requirement for the integration, which is the existence of an application programmer interface (API) that allows to automatically iterate between DTA and demand model and to automatically create manipulate the data structures (in particular demand matrices and dynamic travel time matrices) being passed back and forth. There are currently only few commercial DTA programs that have such capabilities. The development of DTA appears to have been oriented to operational studies of limited size road networks that ignored impact of capacity improvements on mode and destination choice. However, the emergence of fast computers and multithread processors now makes it possible to merge the two branches of transport models for better decision support.

Of particular practical relevance is an incremental model development approach that builds on the existing legacy model system and replaces its components one by one. Several cities in the USA and in Europe have replaced the four-stage model by an activity-based model, resulting in operational activity-based model systems with fairly simple network flow representations, given that a static traffic assignment fails to represent the spatiotemporal dynamics of congestion. An important second step in this incremental approach is therefore to replace the static model by DTA. Another approach is to first replace the static traffic assignment by DTA in the four stage demand model. The integration with the mode and destination choice model can still be implemented based on origin/destination and travel time matrices, only that these matrices now become time-dependent. Replacement of the mode and destination choice

model by an activity based model in this approach would be implemented as a second step. The advantage of this approach is that congestion can be represented at an appropriate time resolution and accurate travel times from the model can be used to estimate coefficients in utility functions of the activity based demand model.

We report on the implementation of the second approach for the Greater Stockholm region. This effort has been commissioned by the Swedish Transport Administration in order to investigate the feasibility of integrating of the existing travel demand model Regent with a commercial DTA package instead of the currently used static assignment package EMME. A comprehensive screening of commercially available DTA software packages has been conducted, including an extensive questionnaire survey filled out by the vendors. The two commercial DTA packages Visum (macroscopic) and Transmodeler (meso-/microscopic) were then selected for prototype testing through integration with the existing activity-based demand model for Stockholm County.

The demand model Regent computes for each individual in the synthetic population and for each trip purpose ("Work" and "Other") the probabilities of making a home-based tour using different modes to different destinations. These computations are based on travel costs by origin/destination-pair and mode, which are provided by the assignment package. Individual tours are then sampled from these probabilities and inserted into an origin/destination matrix. Currently, there is no departure time choice model in Regent; the first legs of the tours are therefore assigned to 15-minutes time intervals from 6:30 to 9:00 AM using a fixed departure time profile obtained from a recent travel survey. These trips are assigned on the network to produce traffic flows, queues and travel times for each road link and time interval. The matrices containing travel times, travel distances and tolls for each origin/destination pair in a representative time interval are then fed back to Regent for the next iteration of demand calculation.

First results show that even without systematic calibration the DTA is in reasonable agreement with observed traffic counts and travel times. Major issues in the assignment that required manual corrections(both in Visum and Transmodeler) were due to miss-specifications of capacities/vehicle interactions at intersections. A macroscopic assignment of the Stockholm network took 2 hours, an assignment with the disagreggate DTA system took 5 hours, both with currently only limited performance tuning efforts. (It should be acknowledged that this comparison is biased towards the macroscopic model system because only a few commodities were assigned.) As an indicator of the convergence of the complete model system (mode and destination choice model + DTA), the evolution of logsums (expected maximum utilities in the deployed random utility models) was tracked over the iterations. It turned out that the iterations stabilized after just a few iterations of the demand-supply loop. Current investigations focus on plausibility tests (evaluation of congestion charges and traffic flow forecasts based on future land use scenarios) and will be presented at the symposium.