Date: September 24, 1998

To: William J. Upton

From: Paul Waddell
Doug Hunt

Cc: Bill Davidson
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Re: Technical Memorandum 7, Task 3E:
Dynamic Model Application Strategy

1 Overview

This memorandum describes the application strategy for the longitudinal operation of the UrbanSim model and its interaction with the LCOG transport model system. This description focuses heavily on the interaction between the land use and transport models, and the requirements for operating the models and passing information between them. The coordination and interaction of these models is key to the objective of integrating land use and transport modeling. This description addresses the specific application of the model system as it will be conducted for the longitudinal calibration of the metropolitan model in Eugene-Springfield. It will not address longer-term recommendations for travel model refinements or further integration of the land use and transport models as envisioned in the second generation models.

2 Information Flows and Processing

2.1 Flowchart

2.2 Transport Model Feedback

The design of UrbanSim accommodates interaction on a periodic basis, up to an annual interaction. The land use model predictions can be used as the demographic inputs to the travel models for any year that the travel model is run. The predictions of the travel model based on this set of demographic inputs are then used in UrbanSim in the following simulation year to estimate accessibility indices and influence location choices of households and businesses.

For various reasons, it may be impractical to run the travel model for each simulation year from 1980 to 1994, but rather to only run the travel model for selected years that punctuate the time frame of this analysis. The selection of these years could be based on a desire to spread the travel model runs somewhat evenly across the 15-year period, or alternatively, the years could be selected based on the timing of improvements in the transport network or levels of service. Based on a review by LCOG of the major transportation system improvements, and on the availability of observed travel data for use as calibration targets, the years selected for running the travel model are 1980, 1983, 1988, 1990, and 1994.

Part of the sensitivity testing of the model may involve running the travel models for additional years, to determine the sensitivity of the land use-transport model system to the frequency of interaction between the land use and transport systems.

2.3 Data Translation Programs

In order to operate the UrbanSim and travel models interactively from 1980 to 1994, and in order to prepare for comparison of model results to observed calibration targets, several data preparation and translation procedures will need to be developed, as discussed below.

2.3.1 Land Use to Transport Model

The outputs of UrbanSim are the predicted demographics and land use for a given year. These are written into a series of ASCII, tab-delimited files:

- Hholds.tab (summary household data)

The trip generation program in the LCOG transport model is implemented in a series of linked Excel spreadsheets and macros. The trip generation procedure uses households by household size and by number of workers, as well as the housing unit count by type, in each zone. It does not use household income due to concerns about the income data from the 1994 household survey. The trip attraction procedure uses the employment by various aggregations of 15 underlying sectors.

The data used in the trip generation procedures do not precisely match the data output from UrbanSim in the files listed above. A procedure will need to be developed to transform the UrbanSim outputs, in particular the zonal distributions of population, households by size, housing units by type, and employment by sector, into the form needed for trip generation. It appears that the most effective strategy would be to incorporate a simple distribution mechanism to distribute employment from the more aggregate sectors predicted by UrbanSim to the 15 detailed sectors used as the basis of the LCOG trip generation procedure. Analogous transformations would be required for the households and housing data. We recommend that this be developed at LCOG as an extension to the current Excel spreadsheet and macros, in order to make the translation as efficient and integrated into the trip generation program as possible. This procedure would need to be developed by October 1, in order to be available for use in the longitudinal calibration. Sample outputs from UrbanSim could be provided to facilitate the development of these macros.

2.3.2 Land Use to Calibration Target Comparison

In order to make comparisons to the calibration targets for land use-related variables, the output from UrbanSim will need to be manipulated to match the format and level of aggregation of the available calibration targets. Until the calibration targets, specified in technical memorandum 3e-3, are fully identified and documented, the specific manipulation that will be needed cannot be described in greater detail. Once this data collection phase is complete, and documented in memorandum 3e-6, further description of the data conversion will be prepared.

2.3.3 Transport Model to Calibration Target Comparison

3 Transport Model Runs at LCOG

The travel model runs necessary for this longitudinal calibration process will be run by LCOG. The following is a very brief summary of the current software implementation of the LCOG travel models, which has implications for the interaction between the travel and land use models.

The trip distribution and assignment components are implemented in emme/2, and mode choice is an external program called from an emme/2 macro. The trip production and attraction model components are implemented as a set of linked Excel spreadsheets. The trip production model uses independent variables that include household size, some housing type descriptors, but not household income. The exclusion of household income was based on concerns with the income data in the household survey. Absence of household income may influence the interaction of the land use and transport models.

In the trip attraction model, the employment sectors are derived from 18 more detailed sectors depending on the trip purpose. These sectoral definitions, as noted earlier, will not directly match the employment sectors from UrbanSim, which at the current time are fairly aggregate. UrbanSim also does not currently model the location of employment in government and education, which will need to be addressed for the interaction with the travel models.

4 Suggestions for Interaction

There are several possible arrangements for actually running the travel and land use models, and managing their interaction, including the following:

1. UrbanSim could be run by the consultants, and the travel model by LCOG, with data exchange via ftp or email.

2. Both UrbanSim and the travel models could be run by the consultants, with no need for remote file transfers.

3. Both UrbanSim and the travel models could be run by LCOG, again with no need for remote file transfers.

To facilitate the longitudinal calibration, UrbanSim will also be installed on the computer of Douglas Hunt, as well as at the University of Washington for Paul Waddell and assistants.

5 Conclusions

The preferred method for managing the interaction between UrbanSim and the transport models would be full automation. Due to the data translations necessary, to the software implementation of the LCOG travel models, and to the need to review travel model results at various stages, the degree of automation may be substantially less than ideal. To the extent that the interaction could be made more efficient and automated, the ability to undertake additional runs with the integrated model system would increase significantly.

There are some concerns relating to the absence of income in the LCOG travel model, and the sectoral definition differences between the LCOG travel model and UrbanSim, that may affect the overall performance of the integrated model system. Moreover, it will be difficult to assess the degree to which these factors affect the calibration results. In the longer run, availability of income and closer matching of sectoral definitions would be desirable.