IV－8 An Investigation of the Recent Land-Use and Transportation Modeling Practices

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1. INTRODUCTION

Travel demand forecasting is one of the most essential steps both in the comprehensive transportation planning and the individual transportation infrastructure projects. However, the forecast has not been always so satisfactory when it is compared with the observed travel volumes after the implementation of the plan/project. Also due to the emerging concerns on the urban environment, travel demand forecasting procedures are requested to have a higher ability to respond to changing lifestyles and social concerns as well as a wide range of policies and policy measures.

To respond, the Department of Transportation, in cooperation with the Environmental Protection Agency, has embarked on Travel Model Improvement Program (TMIP 1997) in USA with a variety fields in travel demand forecasting methods including land-use issues. In Japan, with a similar motivation, the Ministry of Construction, which is in charge of road transportation plan and the implementation, has initiated a research and development project to improve the forecasting system. It covers all the processes in transportation planning and the plan implementation. One of its topics is to improve the application of land-use models to travel forecasting procedures.

The present paper is the first report of this ongoing study. It describes the first results of a review of the existing applications of land-use models in the travel demand forecasting procedure. Before the comparison of existing applications of the models, a scheme is introduced to classify the type of model structure with respect to land use and transportation interactions.

2. INTERACTION STRUCTURE OF LAND USE AND TRANSPORTATION IN SIMULATION MODELS

A number of land-use models have been developed since Lowry Model in 1964, and some modern 17 models are so far counted up in the world (Wegener 1999). However, most of them are developed in the course of academic research and a few of them have been actually applied to practical transportation planning. In Japan, CALUTAS has been applied to some real big transportation development projects but few other applications have been identified. In Europe, only few applications other than those of MEPLAN and DELTA are found in this investigation. In the US, many Metropolitan Planning Organizations have been introducing land-use models in their transportation planning process.

From those in-use operational land-use transportation models, land use framework may be of the land-use model, of the land-use module, or of the unified framework of land-use and transportation. This results in three configurations the urban model, Figure 1.

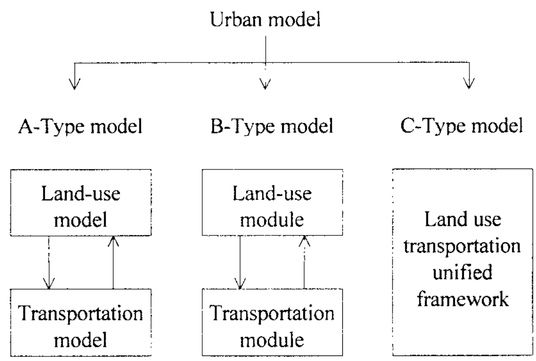

Figure 1. Overall land-use transportation model structure

- A-type model is the sequential system of independent land-use model and transportation model. Land-use model represents land-use only, and transportation model deals transportation only. The land use transportation interactions are modeled by external interfaces of the two models. Land-use model output is the input to transportation model, and vice versa. Examples includes the DRAM/EMPAL in the US's MPOs, etc.
- B-type model is the interaction/composite system comprising of land-use module and transportation module interconnected to each other. Land-use module determines land use and sometimes also implies transportation, and output to the transportation module. Examples include MEPLAN, TRANUS, etc.
- C-type model is the unified/integrated system of land-use and transportation. It determines land use and transportation simultaneously, rather than a sequential determination of land-use and transportation as of A-type or B-type model. Examples include RURBAN, MUSSA.

In the past, there were some attempts to classify urban models by structure resulting into two categories that conforms to B-type and C-type models of this paper. These two types are sometimes called the integrated land-use transportation models despite of the different extent of land-use transportation modeling integration, Wegener & Frurst (1997) and Miyamoto & Sathyaprasad (1995).

3. EXTENT OF LAND USE AND TRANSPORTATION INTERACTIONS IN MODELING

Based on the modeling structure, a land-use transportation model system may be classified into two general kinds: the interaction/composite (A-type and B-type) model and the truly integrated/unified (C-type) model. Anyway, some B-type model may be considered as an integrated models to some extent because the output from land-use are both activity distribution and travel demand distribution, following the behavioral theory. Likewise, some A-type model may be considered more or less the same as B-type model because the transportation and land use effect are represented in very similar way, despite of separate modeling framework. To classify the model into two discrete types of model either by modeling framework or land-use transportation interaction alone may, therefore, not be sufficient.

This study proposes a rather continuous range of modeling essences, Figure 2. Two extreme cases are of the left and the right end of the axis respectively. Two points of view are discussed. From modeling structure point of view, the left end represents the model that comprises of the interacting independent land-use and transportation subsystems and determines land use and transportation separately. The right end represents the model that determines land use and transportation into one unique framework. Next, from the consistency point of view, the left end represents the model having large inconsistencies between land use and transportation, whereas the right end represents the model having very consistent land use and transportation. Any models may stand on this axis at different location depending on the extent of land-use transportation integration and the extent of consistencies.

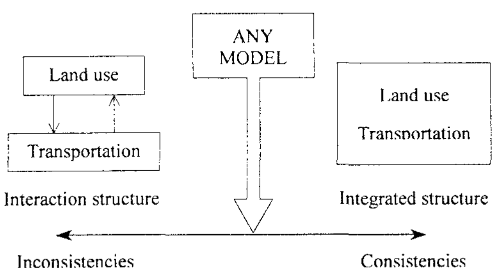

Figure 2. An axis representing land use and transportation integration extent

4. EXAMPLE OF MODELS

The four models, being in-use to practical travel forecasting, are selected based on information availability to illustrate the previous propose. Two are of US practices (Oregon statewide model & San Diego metropolitan model) and another two are of UK (Trans-Pennine Corridor model in the North England & London LASER model). On the axis of integration level just introduced in the previous section, the four models stand in different positions as shown in Figure 3.

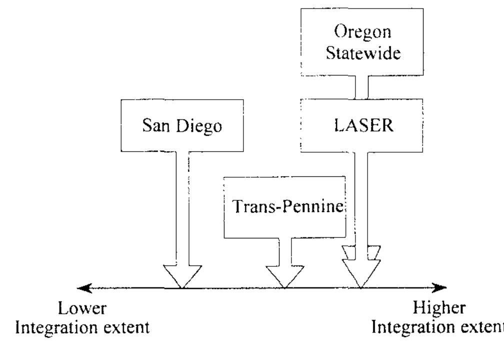

Figure 3. Four example models on the axis defined above

5. CONCLUDING REMARKS

Due to less implementation effort required, the effort to integrate land use analysis to transportation modeling by linking land-use model with existing transportation model (falling in the A-type model) appears increasingly popular in practice. The ongoing attempts include the UrbanSim land-use model linked with Emme/2 transportation model, the MENTOR land-use model (based on MEPLAN) linked with SATURN transportation model, etc. However, this results in different extent of integration: probable land use and transportation inconsistencies. In the practical transportation planning, still there are not many truly integrated land-use transportation models (rightmost model) being widely and efficiently adopted. This study seeks the approach to the truly integrated system and also operationally feasible. A larger numbers of models in addition to the four models presented are being reviewed from more points of consideration and will be presented in subsequent reports.

6. REFERENCES

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