

# Participatory Design of an Integrated Land Use — Transportation Modeling System: First Steps

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## **ABSTRACT**

Land use and transportation models play an important role in guiding decisions about such matters as transportation infrastructure construction and land use policy. Previous land use and transportation modeling systems have largely been black boxes, understandable only by experts in the field. For the last several years we have been developing and deploying a land use modeling system, UrbanSim, which is integrated with a transportation model. We will be redesigning and generalizing this system, and in the process will attempt to open the black box. We plan to use a participatory design process, bringing in a variety of stakeholders, to determine what are the important attributes to model, how users should interact with the model, and how the results can be most usefully presented.

## **Keywords**

Land use modeling, transportation modeling

## **INTRODUCTION**

The patterns of land use and the available transportation systems in urban areas play a critical role in determining the livability and sustainability of those urban areas. Land use interacts strongly with transportation. For example, sprawl development induces a strong demand for freeways, parking structures, and other features of an automobile-oriented environment, while compact, pedestrian-friendly urban forms can induce demand for transit, walking, and bicycling. In the other direction, major transportation investments can in turn induce different patterns of land development.

Land use and transportation models play an important role in guiding future decisions about transportation infrastructure construction and land use policy. Given the interaction between land use and transportation, it is important to model them in an integrated way.

## **THE URBANSIM MODEL**

For the last several years, the first author has been developing a new land use modeling system, UrbanSim [4], which is integrated with a transportation model. The system has been applied in metropolitan areas in Hawaii, Oregon, and Utah.

The model simulates the key decision makers and choices impacting urban development, in particular, the mobility and location choices of households and businesses, and the development choices of developers. It simulates the land market as the interaction of demand (location preferences of businesses and households) and supply (existing vacant space, new construction, and redevelopment), with prices adjusting to clear market. The model also incorporates governmental policy assumptions explicitly, for example, the provision of an urban growth boundary or restrictions on development in environmentally sensitive areas, allowing users to evaluate the impacts of these policies and possible alternatives. It is integrated with existing travel modeling software, outputting travel demands for selected years to the travel model, and feeding travel behavior from the travel model back into UrbanSim.

## **OPENING THE BLACK BOX**

Land use and transportation models have historically been black boxes [1], understandable and usable only by a small number of experts. Given the widespread importance of the decisions made about land use and transportation modeling, we would like to open up the model and the process of its design as much as possible. Important points for participation and decision making include what aspects are modeled, how users should interact with the model, and how the results can be most usefully presented. In addition, the model itself should be believable – citizens should have some confidence in its results.

Regarding what is modeled, early transportation models concerned themselves purely with capacity (either automobile alone, or automobile and transit). Other modes, such as walking and bicycling, have generally not been modeled. It is thus problematic to use such a model to investigate the effect of some policy on pedestrian access. In addition, many other properties of the urban environment, such as air quality, and the quality of public spaces and their encouragement or discouragement of interactions among citizens, are influenced by transportation. It is thus important for stakeholders to help specify the aspects to be modeled.

The manner in which users interact with the model is also important – for example, we would like it to be as easy as possible to experiment with important parameters, such as changing an urban growth boundary, to see its effect on the model. Also, we want the results of the modeling activity to be accessible. We plan to experiment with making the results of the model available via the web; and in the longer term we want to make it possible to interact with the model via the internet.

Finally, it is important for at least some of the stakeholders to participate in the design of the model itself, to help foster confidence in the model and to provide greater understanding of the strengths and limitations of the modeling process. (Some aspects of the environment may be quite difficult to model with much accuracy.) We believe that UrbanSim is a promising basis for such an understandable model, because it is behaviorally-based simulation, using terms such as “rent,” “average household income,” and so forth, rather than being a more abstract and mathematical model.

The LUTRAQ (Land Use Transportation Air Quality) project [2] is a strong example both of considering a wider range of important objectives in planning a transportation project, and of citizen involvement; but a difficulty in that project was the limited capabilities of the technical tools available. One way of viewing our current project is to provide better technical tools for future LUTRAQ-style projects.

#### **PLAN FOR THE PARTICIPATORY DESIGN PROCESS**

Our plans for the participatory design process are still evolving. Our current plan is first to identify the principal stakeholders, including staff in government agencies, business representatives, and representatives of neighborhood and environmental groups, and particular individuals from the different groups and organizations who are interested in working on the project. We will discuss the project with individual stakeholders, gathering ideas and concerns. We then propose to employ a “concentric circle” process for user involvement, as described by Rector [3]. One or more “inner groups” would meet fairly regularly, perhaps once a week during the design phase, to work with us on the detailed design. Tentatively, one of these inner groups would concern itself with the technical aspects of the modeling, such as the operation of the market, land development and redevelopment, aggregate demographic and economic changes, and how households and businesses make location choices and travel decisions. A second inner group would focus on policy and planning requirements, the users’ view of the system, and the understandability of the model and its interface. An “outer group” would meet less frequently, and would serve as a check on our work and that of the inner groups (as well as providing a vehicle for participation that requires less time

commitment). As the work progresses, the groups will also be evaluating data availability, and considering limitations of time, budget, and technology. Our initial UrbanSim model will provide a concrete artifact that can serve as a starting point for this participatory design process.

We would very much welcome feedback on this plan from other Participatory Design Conference participants.

#### **PUGET SOUND REGIONAL COUNCIL INVOLVEMENT**

The Puget Sound Regional Council (PSRC) is the Metropolitan Planning Organization for the Seattle-Tacoma metropolitan area. PSRC is responsible for coordinating transportation planning within the region, and currently operates land use and transportation models in support of coordinated land use, transportation, and air quality planning. PSRC is eager to collaborate with us in this project. Key staff will participate in the review of the design and development of the modeling environment, and provide feedback on the policy and planning requirements for potential use of the modeling system in the region. PSRC will also make data available for analysis and use in the modeling environment.

#### **FURTHER INFORMATION**

While the UrbanSim model itself has been in existence for several years, our participatory design work is just beginning. For updated information, please consult our web site: [www.urbansim.org](http://www.urbansim.org)

#### **REFERENCES**

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