I. DESIDERATA FOR LAND USE MODELS

William L. Garrison, Northwestern University

The theme of this session is land use evaluation, and my assigned topic was "What Constitutes an Adequate Theory for Land Use Models?" While this topic poses an interesting question, it does not pose a question that we know how to answer. We will have an adequate theory for land use models when we can produce land use models that are good enough -- how good do our land use models need to be? Our ability to model and plan our urban environment affects the quality of that environment, so improving our models could improve the quality of the urban environment. This poses a question of values where everyone's values differ. How safe should aircraft be? How much health care should be provided for the American family? How clean should our air and water be? I can answer questions of this type for myself, but I cannot answer them for society.

While it is not possible to say how good our theory should be, it may be possible to set down some desirable properties of land use models and these are the content of these notes. The theory ought to improve properties of the models, so by stating some desired properties of models, we may provide some guides for the development of theory.

Models should be manipulatable. This suggests that the theory should permit developing models for which we have necessary mathematics and numbers. It is of no use to couch theory in terms for which we have no calculus, and for which no calculus is likely to become available. This is almost the same as saying that theory must be logical, but it is adding the condition that the logic be well-developed from mathematical points of view.

Models should be testable. In asking for testability, we are asking for a way to tell if a model is right or correct in some sense. Traditional Fisherian tests refer the parameters of a model to one or more sampling distributions. With respect to one of the coefficients of an equation, for example, one might use a statistical test to inquire whether or not a particular coefficient was drawn from a sampling distribution of coefficients centered at some hypothetical value, say zero. Scientific convention is to inquire either at the five percent or at the one percent level of confidence with reference to sampling distributions. There may be some instances within land use models where this testing is appropriate, but by and large it certainly is not. What we need is a decision theory which will tell us something about expected rewards and punishments from taking actions based upon models. In other words, we need ways to test our models in terms of payoffs. It is easy to exhibit simple cases to illustrate this point. For instance, if it were felt that the payoff from cloud seeding was very large, then seeding might be undertaken even though the probability was low that cloud seeding would under the circumstances increase rainfall.

To test in these terms is to determine whether or not a model assists in making the kinds of decisions that are to be made using the model. The desire that our models be testable under a decision theory concept is not unique to our field -- the problem arises in business, in medicine, and in other instances where we are bullish or bearish, depending upon the stakes.

This is not completely uncharted territory; it is time to begin to explore it with land use models.

The recommendation that models be complete requires more extended discussion for the term complete covers a variety of desirable properties. Perhaps it would be desirable to use the longer phrase, "complete and relevant." In a general way, the notion is simply that land use models should embrace all of the relevant entities and interrelationships appropriate to the land use problem. The nature of the phenomena generating patterns of land use is such that one would generally expect land use models to be rather broad, systems models which tie together a number of different entities. Relevant entities would include households, manufacturing establishments, elements of the transportation system, governmental decision making units, areas of land, and political units, among others. Some of the entities would be collections of other entities, and relationships among entities would be defined in several different ways. A political entity, for instance, might be a collection of households and other entities that may be within the political unit, and the relationship between the political unit and the household is in some sense at a different level than the relationships between households.

The system that is identified should extend far enough to include all the relevant behavior to the problem under study. In most of our land use studies, we are well aware that policy making in the government sector must be reflected in the system for study, and that public and private decisions with respect to investment and transportation may have impacts upon the pattern of land development.

It might be useful to make a stab at a set of requirements that models be asked to meet if they are to be complete, manipulatable, and testable. The list below is a start, and I am much less than certain that either the list is anywhere near complete or that the points on the list are unarguable. The requirements are listed with only minimal comments.

1. The model should incorporate those processes that are relevant to the land use development. The model should have reference to the structure of rents in the urban area and to those market processes that generate rents, and it should also recognize the diffusion processes that are present in urban growth and development, intra-and inter-urban migrantion, renewal, and decay.

2. The model should recognize possibilities of shifts in cohort behavior. We continue to learn to live in our urban environment, and perceptions of the urban envirnoment are constantly changing as are the behavioral responses to that urban environment. Models must recognize the evolutionary nature of life in urban areas.

3. The model should identify decision-making units. Relevant entities in land use work include the household, the firm, urban political agencies, etc. Our models now pay too much attention to inanimate objects, such as buildings and units of land, and we fail to model those entities that are valuing alternates and making choices.

4. The model should be able to use cross-section data, in spite of the fact that our studies also extend to time dimensions. The fact of the matter is that longitudinal data are in short supply and are going to be in short supply for years to come. If we are to manipulate a model, we must deal squarely with the fact that they are going to be forced to use cross-section data.

5. The model should be strongest in dealing with critical aspects of the problems that which we desire to study. In transportation, the congestion phenomena is mainly a journey-to-work phenomena and there should be appropriate reference to the network during a rather small percent of the time. Land use problems also arise because of the relocation by certain classes of locating entities. Models ought to have the right kinds of spectacles in the sense that they look closely at the critical issues while treating others somewhat more generally.

6. There are many policy choices which can greatly affect patterns of land use development and the model should allow for explicit statements of policy. These statements should extend beyond policy about the transportation system to policies about zoning, density controls, and mortgage money, for instance, for these policies are important to land use development.

7. The model should be reversible. Our present structure of decision making is to examine a proposed transportation and land use policy in light of the projected demand, and then to identify the consequences of these policies. There is the alternate of stating that certain consequences are desired and asking what policies with respect to transportation and land use could yield those desirable outcomes. Much of present planning is laissez faire in the sense that transportation and zoning is provided to fit evolving land use patterns, but a more goal oriented planning is evolving.

8. The model ought to be self-adaptive. The land use and transportation planning process is conceived to be a continuing process, yet we often construct models of land use simply to project patterns to a target date some years away. We need models which can be adapted every year to changes in behavior, policy, resource availability, technology, and so on, so that the model provides a planning capability, rather than one shot, far away but soon to be out-of-date, projection.

II. Some Notes on Conceptual Approaches: Residential Area

Kenneth J. Schlager, Chairman

Residential models used in land use planning may be classified in two general categories. The first class includes models used to directly aid in the design of the plan itself. These models are usually designated as normative or design models. The function of a design model is to aid the planner in the selection of a land use plan alternative that satisfies the objectives of the plan within specified constraints with some consideration of resource economy.