AGENCY EXPECTATIONS FROM PREDICTIVE MODELS

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I am told that the mood of this Conference is to be introspective. We are to air disagreements, document agreements, and in general, to stop and assess where we are after an initial flurry. My intention is to be optimistic, but I will also be frank and blunt.

When I first agreed to this address, I wrote down on a piece of paper—one piece—some things which went through my mind. They were the following:

- What models are we talking about?
- Models for what purpose?
- Models are useful in making what kinds of decisions?
- Models are amoral.

By the last point, I mean that models are neither right nor wrong, except in a specific context. I believe we have to focus on what we are trying to do and what decisions we are trying to make. Only against some criterion, some decision, do models become correct or incorrect. These ideas will be woven into my discussion today.

Enough time has passed since the big flurry of urban development models in the early 1960's for introspection to be appropriate for this Conference. We have had a number of successes as well as a significant number of failures and disappointments from both the research side and from the decision-makers' side. On the other hand, this work is expanding and growing. Undoubtedly, there will be more money available for urban development models. Clearly, this is a growth industry. Despite the failures and disappointments, we will continue to expand these efforts.

Progress also can be measured by the technical competence of the people attending this conference. Without trying to be Pollyannaish about it, I think this is a fairly impressive collection of people. We could not have gotten together a group with this technical competence four or five years ago. In this sense progress has been made.

Still another index of progress to me, looking at some of the papers distributed at this Conference, is the fact that both Britton Harris [1] and Jack Lowry

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[1] Britton Harris, "Quantitative Models of Urban Development," a paper prepared for a Conference of the Committee on Urban Economics, January 1967, Washington, D.C.

have tried to classify urban development models. A first step in any scientific inquiry is that of taxonomy. I happen not to like either one of the classification schemes they propose, but that is irrelevant to the desirability of trying to classify the various models.

In his classification, Britton Harris talks about model attributes; micro versus macro models, static versus dynamic models, and deterministic versus probabilistic models. Jack Lowry's categorization is more a process approach to the problem; land use models, migration models, and land use succession models. I think that a classification focused on end-use—on what kinds of decisions models aid us in making — would be more useful, as I hope will become clear as the Conference proceeds.

To sum up these introductory remarks, we do have some work behind us; good people are working in the area; it is a growth industry; and people are beginning to try to classify various models. So introspection *is* in order. It is important to step back now and assess our status before we take the next leap forward. To aid in this process, I would like to ask several questions.

The first question is, *what models are we talking about*? This is a conference on urban development models. However, in fact, we are interested at this meeting only in a subset of all urban development models. These are — to use Jack Lowry's phrase — quantitative models of spatial aspects of urban development. There are obviously other models of urban development, including, for example, models of changes in political institutions and social attitudes. The key terms with which we are concerned are quantitative and spatial aspects of urban development.

We are also talking about large models with land use, transportation, and other submodels within these large models. Ted Holmes made the point that we need to build some feedback loops into the larger model so as to reflect clearly how one of these subsystems affects the other subsystems. I believe it is important to define clearly the models we are talking about as we go forward.

The next question is, *models for what purposes*? In his paper, Britton Harris says the purpose of models is to aid decision-making. I would argue that this only clouds the issue — what decisions, what time frame? There has been a lack of clarity on the purpose of models. I once wrote a paper setting forth at least three purposes for models which I still think are valid. I would like to restate them for your consideration.

First, models can be used as an *aid in forecasting*; that is, to make conditional statements. If *a* changes under certain conditions, *b* will result. This is a typical predicting or forecasting objective.

A second related, but really quite different, purpose for models is their use as research tools or techniques for *studying the process of urban change*. The objective here is understanding the underlying system in order to identify and measure relationships. We can come out of a study of the process of urban change with forecasts, but if we are interested only in predicting or forecasting

we might use a much different model than if we are interested in studying the underlying components of a system. This relates to the whole business of structural versus nonstructural models, with which we are all familiar. Any predictions resulting from a large, complicated model are subject to large uncertainty and error. Partial equations usually allow us to forecast a narrower range. Thus, I think that the distinction between a forecasting tool and a research device to get at the underlying relationships in a very complicated system is an important one to keep clearly in mind.

A third purpose for models, obviously, is their use as *an educational device,* a teaching aid, to instruct people about an underlying structure. This, of course, assumes we understand the underlying structure and that we are using the model or the simulation to display the various interactions and relationships. The model in this case is clearly a teaching aid. I would argue that this is a very different purpose than the other two I have identified.

Our thinking should be clear as to which of these three purposes we have in mind when we undertake to build a model. Bill Ross came close to making this point when he said he wanted a clear distinction between operational models and research models. These distinctions have been clouded up in work statements by both government agencies and research organizations. A model is not going to do all things for all people. Life is not quite that simple.

This session is labeled "Agency Expectations from Predictive Models." Predictive models, I assume, means the first of these purposes, namely models as an aid in forecasting. From my vantage point this is probably the least important of the three purposes for models. The models to date have been more important as research vehicles and as educational devices than as aids in forecasting specific land use patterns or transportation requirements. This raises the question of whether this will continue to be the case over the next decade. I suspect it will. Over the next decade, I predict that if we are interested in forecasting specific land use patterns or specific transportation requirements, we will be able to do this more accurately and efficiently by undertaking partial analyses. I will develop this idea further as I go along.

I would now like to turn to *what kinds of decisions must be made* in the area of urban development. There is obviously a whole spectrum of decisions, ranging from fairly detailed questions of the alignment of streets to very broad questions such as the desirable spatial distribution of the population. Ted Holmes and Bill Ross have indicated how some of these decisions are viewed from their respective agencies. I assume that others will focus on decisions they face in their presentations in succeeding sessions of this Conference. I will limit my discussion of decisions to those we face in the Bureau of the Budget—an agency perspective, if you will.

Of necessity, decisions at the Bureau of the Budget level tend to be gross, global, "big" decisions. Bureau decisions influence the amount of money available for research in broad areas or for specific major capital investments of the Federal Government.

The best way to get at this decision question, I am sure, is to illustrate it with a few examples. I will do it in the transportation area. These are decisions which I believe will be of critical importance, and I would like to point out the relevance of specific land use, transportation models to these decisions. I will argue that specific models are not very relevant as forecasting vehicles, but they are useful in helping us understand the process of urban development. Therefore, to repeat a point I have already made, models will be very useful for educating people. They will be less useful in providing specific answers to questions that need answering.

The first point I would make is that most urban development models tend to be global and consider all modes of transportation in an attempt to define either a preferred transportation system, or several alternative transportation systems. A typical approach is to take as given an existing transportation complex and talk about a process of evolution towards a "desirable transportation system" sometime in the future. It is a matter of fact that now and for the foreseeable future, most important transportation decisions are made partially, involving usually only one mode of transportation. Let me give some examples.

The first one that comes to mind is the question of airport facilities. There is a need for a major expansion of airport facilities in the United States over the next decade. Billions of dollars will be spent over the next five years on airport facilities — the terminals, the runways, the whole process of getting people on and off airplanes. It is asserted that the financial requirements are so large that state and local governments cannot afford to undertake the expansion by themselves and that Federal financial assistance is needed. There is a potential conflict between "the national airport plan," which views this problem as a national air transportation system, and the land use desires of local communities. We are going to make decisions which will involve billions of dollars, and which will have major impacts on other modes of transportation, as well as major impacts on land use within our metropolitan areas.

What planning requirements should the Government impose if Federal money is going to support this expansion of airport facilities? How do we force an integration of these plans and these expenditures with other plans of the Federal, state and local highway departments, local mass transit plans, and so forth? Do we build big terminal facilities at the airports, or, as some people have proposed, should we expand on the "Dulles" solution and have a number of mobile terminals that can pick up people around the metropolitan areas and move them directly to the planes? Is a fourth airport needed in New York City? Or, in the New York case, can the nonscheduled portion of the traffic be moved to Floyd Bennett Field and thereby relieve LaGuardia and Kennedy airports so that they can serve the scheduled airline needs for the foreseeable future?

These are really quite basic decisions. Important issues of land use and intermodal transport problems are involved. We need people who understand

this process much better than we now have to help us develop realistic options. I know of no particular model that I can take off the shelf to help me with this. Individual models do, however, give insights into particular aspects of the bigger issue.

A second example that comes to mind is referred to as the post-1972 highway system — what do we do after the Interstate System is complete? This is probably the most important of all the transportation decisions that are going to be made in the next couple of years. The Interstate System, which is a specific system in terms of highway miles, is supposed to be completed in October 1972. Undoubtedly, there is going to be a follow-on system. The implications of this follow-on system for urban planning and land use are obviously of utmost importance. It is quite clear without any deep analysis that in contrast with the present Interstate System most of the new system is going to be in either urban areas or in high-density corridors that serve the urban areas. What is it going to look like? Is it going to be more of the same? What procedures are going to determine its characteristics? The same old ones, or will there be new rules of the game? If so, how do we evolve new procedures? These decisions must be made fairly soon.

A specific question involved here is whether highway funds should be used for parking facilities. This is an issue that is already under debate in Washington. There is one group that argues that parking facilities are obviously part of the highway system, and therefore, it is appropriate to use highway funds to construct parking facilities. Another group agrees that parking facilities should be built with highway funds, but only in the suburbs and not downtown in the central business areas. Involved in this debate are some implicit assumptions about the relationship of parking facilities to travel and land use patterns. We simply do not have enough good information to provide a well-considered answer to this question. Here we have a major issue with strong views on all sides not backed by good analysis. We do not know yet what would happen under the various alternative parking facility locations. Yet, within a short time, the Congress will pass a law which will influence urban transportation and land use patterns for another decade or more.

Let me just make an aside at this point. I think in this area we need a little more focus on particular groups within our society and within our urban areas, rather than on "the urban transportation problem" *per se*. For the most part, the urban transportation debate today has been a middle class exercise concerned with getting relatively well-to-do people in and out of the city or to their place of employment.

If we start asking questions about how we meet the transportation requirements of particular social groups, we start changing the focus of the urban transportation discussion quite a bit. There is a great deal to be gained by working on some of these problem areas in urban transportation — the problems of the minority groups living in ghettos and their particular work-trip patterns and the concomitant cross haul and extra transport costs. At the other

extreme are the problems of the high-income commuters who are most concerned with getting to airports so that they can commute as quickly and as effectively as possible and who are willing to pay a high price for this service.

These are examples of the kinds of decisions which the Bureau of the Budget will be facing over the next several years. I believe it is clear that there is no one existing model that will generate answers to these issues. There are, however, a number of models that can provide insights into parts of these issues, and there are some analytic efforts which can be brought to bear on these problems so that we will be in a better position to make informed decisions.

This brings me to the question of *the time-frame for decision-making.* The issues that I have just described will be resolved better if analytically trained people will attempt to influence the legislation that will be required. Alternatively, as research workers, we can ignore these issues and continue our longer-term effort of accumulating general knowledge. Now, it seems to me that if we want to influence these near-term decisions, we will have to narrow our models, carry out partial analyses, work with inadequate data bases, and, in general, compromise what we would consider to be a professionally competent piece of work.

We do not have to face up to these problems, however. I know of no overriding ethic that says we are better off working on long-term problems, or alternatively, on more immediate problems. It is a choice all of us have to make, and having once made the choice we have to live with its consequences. If we get too close to the decisions, we may find we are not research workers any longer, but decision-makers. This is a fate to which a number of us have succumbed. This question of time-frame is critical and tends to be obscured in our discussions. Remember, if we want to influence some of the important issues coming along in the next few years, we are going to do different research work than if we want to accumulate general knowledge about urban development and urban change.

Let me end with a comment or two about the environment of public attitude concerning these research efforts. As I see it, public attitude is mixed. On the one hand the analytic approach is in vogue. The Bureau of the Budget is pushing for all agencies of the Government to employ a system called the Planning, Programming, and Budgeting System. The people that are coming to Government—as undersecretaries, deputy undersecretaries, assistant secretaries—have different backgrounds from those who came into Government ten years ago. More money is being spent on research, and there is every prospect that even more money will be spent. Better trained people are working on key problems. Certainly social scientists, particularly economists, have more influence than they previously had.

On the other hand, there are clearly signs of impatience and calls for action. "Let's get things done. Let's not worry about all this fancy analysis." The more sophisticated will point out that formal studies have not been con-

vincing enough to form a public consensus around particular urban development plans, and to move communities in a direction that these studies recommended. They argue that all we need to do is spend money, and spend it quickly, and get on with the job.

This impatience should influence the type of research we do. We can develop models which can be used in conjunction with action. Model City activities in HUD, mass transit and other demonstration programs, need to be conducted within a backdrop of hypotheses which can be tested and with plans which can be changed in light of new information. This ability to react often is missing from today's *ex ante* efforts which stress careful planning before a decision is made—do the analysis, think through the consequences, make your plans and then make a decision. Unfortunately, I am suggesting that the real world is not going to stand still for this. If we believe there is going to be an impatience and a drive for action, we must modify our research plans to build models which recognize this fact of life.

At a recent meeting of the National Academy of Engineering, I suggested that there are currently in vogue two methods of evaluating transportation plans One is the systematic, analytic approach in which we at this Conference have a vested interest. The other I labeled the "oracle" approach. The oracle approach is doing very well these days. Simply find a wise man or a lady as the case may be, and she or he will tell you what to do. I would hope, in this debate between the oracle and the systematic/analytic approach to problems, that our side will win. On demographic considerations alone we might get numerous enough to outvote those who prefer the oracle approach.

In any event, I would hope that this Conference will help support the systematic/analytic approach. To do so, we must focus on: What models are we talking about? Models for what purpose? What kinds of decisions must be made? And, lastly, models are amoral.