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"HAVE WE LEARNED ANYTHING FROM TRANSPORTATION STUDIES?"

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PREFACE

In 1960 the Ford Foundation made a grant to The RAND Corporation to undertake an exploratory study of urban transportation. The study has focused on the problem generally, rather than on any particular city. A selected bibliography of external publications to date from the RAND study is appended to this paper.

"HAVE WE LEARNED ANYTHING FROM TRANSPORTATION STUDIES?"

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Over \$50,000,000 has been authorized or expended for major urban transportation studies in the United States during the past decade.**

What have we received for our money? In a word -- information. Very few physical transportation facilities have been constructed to date as a direct result of these studies. The question, therefore, is whether the information we have acquired is worth the money spent to acquire it. I believe the answer to be affirmative.

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The author wishes to acknowledge the ideas and comments of his RAND colleagues, Richard H. Haase, Ira S. Lowry, John H. Niedercorn, Anthony J. Pascal, and Charles J. Zwick.

** "Major urban transportation studies" are here defined to include those studies having the following characteristics:

a) Geographic comprehensiveness -- designed to encompass a region with economic and social identity rather than a single political jurisdiction.

b) Analytical comprehensiveness -- designed to include consideration of all major modes of transportation, and to be based on careful analysis of population, economics, and land use development as well as traffic flows.

c) Breadth of support -- established and guided jointly by various local, state, and Federal Government agencies.

These criteria serve to distinguish these urban transportation studies from purely local, one-city, traffic studies and other less comprehensive enterprises.

In reaching this conclusion, I have considered the following questions:

1. What specific questions have these studies tried to answer?
2. Has the methodology for seeking answers been appropriate?
3. Are the right questions being asked?
4. What can be learned from the collective experience of these studies, and how should we proceed from here in urban transportation analysis?

WHAT QUESTIONS HAVE TRANSPORTATION STUDIES TRIED TO ANSWER?

Two broad categories of questions have been asked: (1) What will be the form of future urban development? (2) What transportation systems can best serve this future development?

Within the first topic fall the efforts to understand and then predict the growth or decline of population, the changing nature and location of different kinds of economic activity, and the patterns of land use within the area. The second topic focused in the early days around rather narrowly defined considerations of highway network location or improvements in existing mass transit facilities. More recently, and especially in the Penn-Jersey study, it has emphasized comprehensive consideration of all appropriate modes and facilities within a system intended to serve the over-all urban transportation requirements of the region.

The interrelationships between these two categories of questions are becoming recognized more and more, particularly as it becomes increasingly clear that causality runs between them in both directions.

HAS THE METHODOLOGY FOR SEEKING ANSWERS BEEN APPROPRIATE?

Considering that studies of the type discussed here have been under way for barely a decade, I think the pioneers can take pride in their work. To be sure, such transportation analysis is in its infancy, but measured against our knowledge at mid-century -- just thirteen years ago -- achievement can clearly be seen.

My purpose is not to describe in detail how the various studies have gone about their analysis. Zettel and Carll have already published an excellent treatment of this topic.* Instead, let me stress three methodological points common to nearly all such studies, the first being the use of computers and mathematical models. Without these tools, recent studies would have been substantially different, and they promise even greater impact on studies in the future. About computers, let me say again what you all know already -- that they handle information you give them according to rules that you specify. They perform no magic, and while they operate at very rapid internal speeds, they can run up quite a bill in solving problems. For example, running a relatively straightforward urban analysis problem at RAND recently took 128 minutes on an IBM 7090 computer. This amount of computer time rents for about \$1,000, and the analysis, programming, and debugging typically cost several times more. So while the computer is a valuable tool, it is not a cheap one, and therefore should be expected to produce at least as much value as it costs.

* Richard M. Zettel and Richard R. Carll, Summary Review of Major Metropolitan Area Transportation Studies in the United States, Institute of Transportation and Traffic Engineering, University of California, Berkeley, November, 1962, especially pp. 44-59.

As for mathematical models,* planners should approach them as they approach computers, realizing that what comes out of them depends on what goes in. Studying problems in the analytical framework of a mathematical model is often extremely valuable, largely because it forces one's thinking to be more explicit and vigorous than it might be otherwise. But the answers the model produces are no better than the data on which they are based, and no amount of exotic mathematical symbology should be allowed to obscure this fact.

The second methodological point I should like to present concerns the collection of data for urban transportation studies. We all recognize that cities are dynamic, living systems; yet typically, transportation studies have collected land-use and other data for only one point in time. I appreciate the practical problems of waiting for four or five years to pass during the study just to enable another set of data to be collected, and I shall say something further about this later on. Here I want to stress the importance of studying a dynamic system by the analysis of trends and changes. Conclusions based on single-point-in-time data may simply be dead wrong. Another related point is to endeavor to collect land-use, origin-destination, and related home-interview data in years coinciding with relevant U. S.

*Some valuable works are Britton Harris, "Some Problems in the Theory of Intra-Urban Location," Operations Research, September-October, 1961, pp. 695-721; Melvin M. Webber, "Transportation Planning Models," Traffic Quarterly, July, 1961, pp. 373-390; and various articles in the Journal of the American Institute of Planners, issues of May, 1959, and November, 1960. For a brief introduction to such tools, see Edward F. Hearle, "How Useful Are Scientific Tools of Management?" Public Administration Review, Vol. XXI, No. 4, Autumn, 1961, pp. 206-209.

Censuses.* Many useful correlations will otherwise be difficult at best.

My third methodological point deals with the need for a better framework for comparison among different transportation systems. It is presently possible to compare, reasonably well, characteristics within systems of the same type; for example, station-spacing/train-speed trade-offs for surface rail vehicles. But reliable comparisons between systems -- e.g. automobile freeway versus subway transit -- are very difficult because we have no framework and few criteria. I realize this is not a problem each study can solve for itself, but it is going to become more critical as the mode-choice question looms ever larger.**

ARE THE RIGHT QUESTIONS BEING ASKED?

I believe that urban transportation studies are generally addressing themselves to the right questions. What follows are suggestions for some change in emphasis.

First, I think studies have tended to assume the status quo too rigidly with respect to transportation technology. True, work at RAND and elsewhere generally suggests we should not expect any Sunday-supplement technological breakthroughs that will make the urban

* Censuses of the following types are scheduled to be taken in years ending in the numbers indicated: Population and Housing: "0"; Manufactures: "3" and "8"; Business: "3" and "8"; Governments: "2" and "7"; Agriculture: "4" and "9."

** Dr. Richard Haase is examining this problem for the RAND study in terms of the characteristics of different systems in the following five categories: vehicles, propulsion systems, rights of way and allied structures, storage and maintenance facilities, and control systems (affecting both vehicles and people).

transportation problem go away forever. But several substantial improvements seem possible, including increasing the attractiveness of the electric car.* Particularly important are improvements in mass transport technology, and there is some promise in this area. Tunneling may become economically feasible, and automation offers hope for lower operating costs. Since, at present, mass transport appears economically attractive only along and between areas with high residential and employment densities, work aimed specifically at lowering its cost in less dense areas should be encouraged.

Second, I feel that we should move on from the discussion of whether transportation systems should shape as well as serve metropolitan regions. Clearly they do shape development, and the real question is -- toward what form? I am happy to leave the discussion of this question to city planners, with this comment: Other forces shaping our cities appear just as strong or stronger than transportation systems. Specifically, I would single out three: increasing personal incomes, leading to a willingness to pay for service and convenience, with all that these preferences mean for the mode-choice problem; changing industrial processes, leading to manufacturing sites in areas of large land parcels, with implications for decentralization of employment; and persistent racial segregation, leading to employment, residential, and trip-making behavior that appears to be substantially different among white and non-white people.** I believe these

*See George Hoffman, Electric Motor Cars, The RAND Corporation, RM-3298-FF, March 1963.

**On this last point, see J. F. Kain, Commuting and the Residential Decisions of Chicago and Detroit Central Business District Workers, The RAND Corporation, P-2735, April 1963.

three forces deserve at least the same amount of attention in urban transportation studies as that given to trip generation and traffic assignment.

Third, it might be a good idea for long-range planners to take more account of the constraints affecting the plans they propose. Fuller recognition of economic forces and political/institutional arrangements would often make such plans both more "realistic" and more realizable. The impact of these factors on urban development and transportation is substantial, and the influence of comprehensive general plans, including their circulation component, might be greater were they more firmly rooted in politics and economics.

WHAT CAN BE LEARNED AND WHERE DO WE GO FROM HERE?

From the collective experience of the dozen or so major urban transportation studies to date, I believe a few points stand out.

First, these studies have generated and brought together, at large cost, tremendous volumes of data concerning the regions involved. Typically, transportation studies have a specified objective to produce a plan, and the implication is that when this objective is achieved, the study project will end. In practice it seems these studies are finding reasons to continue in existence, largely to preserve the data files they have assembled. Earlier I stressed the importance of looking at time-series data; here I want to suggest strongly that more formal mechanisms for continuing urban data-handling be established. We all know that the same basic data are needed for a wide range of planning and other governmental activities. Transportation studies have striven mightily to bring many of these data together.

The need is to develop systems to maintain these and other data and to make them widely available.

Several cities are already embarked on various programs for "databanks." Noteworthy among these are the cities of Denver, Little Rock, Fort Worth, Tulsa, and Wichita, which are jointly engaged in a "Metropolitan Data Center" project with support from the Housing and Home Finance Agency. Los Angeles and Pittsburgh are also in the vanguard of cities moving on such programs, which I believe to be of the highest importance in providing the foundation for better transportation as well as other kinds of planning.*

Second, there is a need for better tools for taking into account the reciprocal relationships between land uses and the forces shaping them, including transportation especially. I realize planning officials are primarily concerned with utilizing rather than developing techniques, but I believe you can be a great force for good in promoting intellectual cross-pollination with such "technique" groups as the Operations Research Society of America, the Regional Science Association, the Econometric Society, and The Institute for Management Sciences. You have the problems; persons in these groups often have ideas for techniques and are looking for problems to try them out on. Let's get together around the urban problems that affect us all.

Third, I believe these studies, and especially the Penn-Jersey

* For relevant writings, see Edward F. R. Hearle and Raymond J. Mason, "Data Processing for Cities," Management Information Service Report 219, International City Managers Association, April 1962; and idem., A Data Processing System for State and Local Governments, Prentice-Hall, Englewood Cliffs, New Jersey, 1963 (in press).

study, teach us the value of trying to develop alternatives -- alternative transportation systems, land-use plans, and cost-benefit packages. Surely the emphasis on presenting alternatives with supporting policies should be strengthened.

Finally, there is a need for urban transportation research that looks beyond the specifics of a single region. Frameworks for comparison, techniques for analysis, potentials of technologies are all common to many studies and need not be duplicated by each. Support for such enterprises should come side by side with support for research on the pressing problems of each city.

CONCLUSION

When I first outlined this talk, I had a fifth major question to discuss after "What specific questions have been asked?" This additional question was, "How good are the answers?" I dropped this question because I couldn't figure out how to answer it. You and your bosses -- the elected officials -- have that tough job.

The answers, of course, are going to depend on the criteria. True, not many physical transportation facilities have yet been constructed as a direct result of these studies; some are in the planning stage, almost ready to go. But mostly the studies have had, and will have, I believe, an indirect, hard-to-trace impact on the thinking of responsible officials. People are beginning to think in regional perspectives and in terms of transportation systems, rather than in village perspectives and in highway or monorail terms. If this trend continues, and I believe it will, our investment in these studies will have paid big dividends.

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