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## FOCAL AREAS OF NEEDED LAND USE RESEARCH

### The Problem Areas, the Objectives, and Some Selected References

#### Contents

	<u>Page</u>
<u>Introduction</u> . . . . .	2
<u>The Research Problem</u> . . . . .	3
<u>Problem Area 1 - Land Development Process.</u> . . . . .	3
Objectives . . . . .	3
References . . . . .	4
<u>Problem Area 2 - Land Development Variables</u> . . . . .	5
Objectives . . . . .	5
References . . . . .	5
<u>Problem Area 3 - Forecast Techniques.</u> . . . . .	10
Objectives . . . . .	10
References . . . . .	11
<u>Problem Area 4 - Goals, Design and the Evaluation of     Alternative Land Use Plans</u> . . . . .	13
Objectives . . . . .	13
References . . . . .	14
<u>Problem Area 5 - Policy Development and Its Execution</u> . . . . .	16
Objectives . . . . .	16
References . . . . .	17

## INTRODUCTION

Over the past two years, the Land Use Evaluation Committee of the Department of Urban Transportation Planning has been endeavoring to determine "the state of the arts" in research on land use. A year ago in connection with the Highway Research Board's effort at identifying research gaps across the boards in all department research areas, a draft was compiled and submitted by this Committee to the Deputy Executive Director. With the recently announced plans for establishment of a project to carry this research inventory forward under the National Cooperative Highway Research Program, the draft of this Committee's report has been updated, and this issue of the HRB Circular is devoted to reproducing the updated report.

### THE RESEARCH PROBLEM

Until recently approaches to the analysis of land use have been largely descriptive and limited to methods of study manageable "by hand." Research on the origin and development of land use patterns utilizing modern research methods and data handling system has been uneven and somewhat narrow in scope. Much of the effort based on descriptive studies has led to trend-based projections, often only intuitively related to a comprehensive planning framework. Such descriptive-intuitive land use planning studies generally suffer from an inability to effectively relate the dynamic interaction of planning controls and the land market mechanism.

In addition to these problems of a methodological nature, the conceptual basis for developing these models is in need of attention. The few recent attempts to develop comprehensive planning models of metropolitan growth have been handicapped by a lack of adequate theoretical constructs to guide model formulation. Advances in theory have been spotty and often unrelated, coming from a variety of disciplines: land economics, urban sociology, communications theory, market research, regional science, geography, transportation engineering, and urban planning.

Perhaps the most critical need is in the prescriptive area -- criteria for evaluating alternatives, the definition of goals and translating these into specific programs, and the effectiveness of implementation programs in achieving objectives -- these have received very little attention from researchers.

There is an urgent need in land use planning as well as transportation planning for a systematic effort to extend and broaden research on land use. Needed research can be broken down into five areas encompassing (1) the land development process, (2) land development variables, (3) forecast techniques, (4) goals, design, and evaluation of alternatives, and (5) policy development and implementation.

#### Problem Area 1--Land Development Process

##### Objectives

Research on the land development process encompasses both theoretical and empirical investigations of a behavioral nature.

At the conceptual level there is a need to review, synthesize, and build upon the body of theory that has developed with the various disciplines concerned with the structure and evolution of urban areas. It is probable and desirable for differing theoretical approaches to be advanced from time to time. These conceptual systems will need testing. Required for this testing are hypotheses rigorously fitted to each particular conceptual system. These hypotheses will be concerned with the processes by which raw land is converted into urban uses, as well as the shifts in use of existing urban land. They should be theoretically capable of accounting for the land development pattern at any point in time; specifically the type of activity, the location, the intensity of activity, and the timing of the location of activity.

Advances in theory will depend to a large extent upon empirical study of the land development process as an evolutionary phenomenon. Such a dynamic view

of land use involves investigations in a least four linked focal areas:

- (1) Research centering on daily activity patterns of households, firms, and institutional entities as these activity systems and related attitudes and policies serve to precondition location behavior.
- (2) Research focusing on location behavior of such land-using entities as they take up the land and develop it in accommodation to key spatial considerations in the performance of their daily activities.
- (3) Research dealing with the sequence of location actions in the urban scene and the progression of change represented in aggregates of location actions.
- (4) Research concentrating on the feedback effect of this changing total environment as it plays back to activity patterns and location behavior.

### References

Research on the development process so far has been mainly theoretical and comes under the rubric of urban spatial structure. From the vantage point of economic theory, the following are relevant:

Wingo, Lowdon, Jr., Transportation and Urban Land, Washington: Resources for the Future, Inc., 1961.

Alonso, William, Location and Land Use: Toward a General Theory of Land Rent, Cambridge: Harvard University Press, 1964.

From the viewpoint of communications theory, the following are relevant:

Meier, Richard L., A Communications Theory of Urban Growth, Cambridge: M.I.T. Press, 1962; see also Meier's "Human Time Allocation: A Basis for Social Accounts," Journal of AIP, May 1959.

Hagerstrand, Torsten, "On Monte Carlo Simulation of Diffusion," in William Garrison, ed., Quantitative Geography, forthcoming.

Other references based broadly on concepts of human interaction as it relates to spatial environment include:

Mitchell, Robert B., and Rapkin, Chester, Urban Traffic: A Function of Land Use, New York: Columbia University Press, 1964.

Webber, Melvin M., ed., Explorations into Urban Structure, Philadelphia: University of Pennsylvania Press, 1964.

Chapin, F. Stuart, Jr., Chapters 2 and 6, Urban Land Use Planning, Urbana: The University of Illinois Press, 2nd edition, 1965.

Twin Cities Metropolitan Planning Commission, "Selected Determinants of Residential Development," and "Selected Determinants of Industrial Development," St. Paul, 1962.

There are very few references on activity analysis of an empirical nature. Among them are the following:

Human interaction applications of activity analysis are illustrated in the Household Activities System Project of the Center for Urban and Regional Studies, University of North Carolina, Chapel Hill. See F. Stuart Chapin, Jr., and Henry C. Hightower, "Household Activity Patterns and Land Use," Journal of AIP, August 1965.

Economic applications of activity analysis are illustrated in Walter Isard and Robert E. Kuenne, "The Impact of Steel upon the Greater New York-Philadelphia Region: A Study in Agglomeration Projection," The Review of Economics and Statistics, November 1953; Charles L. Leven, Theory and Method of Income and Product Accounts for Metropolitan Areas, Including the Elgin-Dundee Area as a Case Study, University of Pittsburg Press, 1963; and Robert G. Spiegelman, et al., Application of Activity Analysis to Regional Development Planning, Resource Development Economics Division, U. S. Department of Agriculture, March 1965.

By contrast, there is a wide range of empirical investigations of location behavior of various land uses. Standard sources on industrial location, wholesale activity, retail shopping centers, housing market analysis, and so on should be consulted.

Virtually no research has been devoted to sequential aspects of land development and to feedback effects of the whole environment. No basic references can be cited at this time.

### Problem Area 2--Land Development Variables

#### Objectives

In addition to the investigations at the behavioral level under Area 1, the development of theoretical explanations of the urban growth process is also dependent upon, and subject to verification by empirical study focusing on the key variables affecting the location, intensity, and mobility of the various types of urban activities. A fine line separates Problem Areas 1 and 2, and many studies will overlap this line. The primary difference is one of emphasis either on the explanation of behavior (Area 1), or on the manner in which aggregate behavior is shaped or modified by particular factors or groups of factors (Area 2).

#### References

Research on land development variables involves both area-specific and activity-specific studies of the relationships between aggregate change and various development variables. Specific items of investigation include:

- (1) Accessibility between various activities within the metropolitan area and accessibility from outside the region. As an underlying concept involved in all location models of land use, accessibility is a research area also covered in references appearing in Problem Area 3 below. Background references come from two major sources as follows:

For economic explanations of accessibility, see historical materials on "friction of space" by Robert M. Haig in Haig and McCrae, "Major Economic Factors in Metropolitan Growth and Arrangement," Regional Survey of New York and Its Environs, Vol. I, New York, 1927. For more current handling of Haig concept, see Albert Z. Guttenberg, "Urban Structure and Urban Growth," Journal of AIP, May 1960. Relevant economic models concerned with accessibility include William Alonso, Location and Land Use: Toward a General Theory of Land Rent, Harvard University Press, 1964, and Lowdon Wingo, Jr., Transportation and Urban Land, Resources for the Future, Inc., 1961.

For gravity model and opportunity model handling of accessibility, see early references such as George K. Zipf, Human Behavior and Principle of Least Effort, Addison-Wesley Press, 1949; John Q. Stewart, "Demographic Gravitation: Evidence and Applications," Sociometry, February and May, 1948; and Samuel A. Stouffer, "Intervening Opportunities: A Theory Relating Mobility and Distance," American Sociological Review, December 1940, and "Intervening Opportunities," Chapter 4 in Stouffer, Social Research to Test Ideas, The Free Press, 1962. For review of concepts, see Gunnar Olsson, Distance and Human Interaction, Regional Science Research Institute, 1965; and Gerald A. P. Carrothers, "An Historical Review of the Gravity and Potential Concepts of Human Interaction," Journal of AIP, May 1956. Examples of applications include Walter G. Hansen, "How Accessibility Shapes Land Use," Journal of AIP, May 1959, and George T. Lathrop and John R. Hamburg, "An opportunity Accessibility Model for Allocating Regional Growth," Journal of AIP, May 1965.

- (2) Studies of intensity of use -- investigations of factors influencing residential densities, employee densities, and recreation densities. Research relating in part to this subject area includes:

Regional Plan Association, Inc., Spread City, New York, September 1962.

Hamburg, John R., "Land Use Projections for Predicting Future Traffic," Highway Research Board Bulletin 224, 1959.

- (3) Studies of tax policy and how it affects development sequences. Available references include:

Walker, Mabel, "Impact of Taxing Practices on Land Use Problems," Institute on Planning and Zoning, Vol. 3, Southwestern Legal Foundation, Matthew Bender & Co., 1963.

Rawson, Mary, Property Taxation and Urban Development, Research Monograph 4, Urban Land Institute, 1961.

Pickard, Jerome P., Changing Land Uses as Affected by Taxation: A Conference Summary Report, Urban Land Institute, 1962.

Beck, Morris, Property Taxation and Urban Land Use in Northeastern New Jersey, Research Monograph 7, Urban Land Institute, 1963.

- (4) Studies of ownership patterns and the propensity of development to

scatter. Investigation of the speculative withholding of land and the timing of its release for development. Studies relating to this subject area include:

Twin Cities Metropolitan Planning Commission, "Selected Determinants of Residential Development," and "Selected Determinants of Industrial Development," St. Paul, 1962.

Lower Mainland Regional Planning Commission, Dynamics of Residential Land Settlement, New Westminster, B. C., June 1963.

Meyerson, Martin, et al., Housing, People and Cities, McGraw-Hill Book Co., Inc., 1962.

Wheaton, William L. C., "Public and Private Agents of Change in Urban Expansion," in Webber, Explorations into Urban Structure, University of Pennsylvania Press, 1964.

Weiss, Shirley F., et al., "Developer Behavior, A New Dimension in Urban Growth Research," Research Previews, Vol. 12, No. 2, Institute for Research in Social Science at University of North Carolina, March 1965.

Cornick, Philip, Premature Subdivision and Its Consequences, Columbia University Institute of Public Administration, 1938.

See special issue of House and Home, August 1960, and Architectural Forum, September 1956.

(5) Demographic, social, and economic composition of the metropolitan area. Relationships to development patterns, and to data requirements from economic and population projections. Reference material relevant to this subject area includes:

Duncan, Otis D., and Reiss, Albert J., Social Characteristics of Urban and Rural Communities, John Wiley & Sons, Inc., 1956.

Hauser, Philip M., and Schmore, Leo F., eds., The Study of Urbanization, John Wiley & Sons, Inc., 1965.

Advisory Commission on Intergovernmental Relations, "Social and Economic Population Characteristics in Metropolitan Areas," Chapter II, Metropolitan Social and Economic Disparities: Implications for Intergovernmental Relations in Central Cities and Suburbs, Washington, 1965.

Rossi, Peter H., Why Families Move, The Free Press, 1955.

Artle, Roland, The Structure of the Stockholm Economy: Toward a Framework for Projecting Metropolitan Community Development, Cornell University Press, 1965.

Niedercorn, John H., An Econometric Model of Metropolitan Employment and Population Growth, Memorandum RM-3758, The RAND Corporation, October 1963.

Berman, Barbara R., Chinitz, Benjamin, and Hoover, Edgar M., Projection of a Metropolis, Harvard University Press, 1961.

Chapin, F. Stuart, Jr., and Weiss, Shirley F., "Land Development Patterns and Growth Alternatives," Chapter 13, Urban Growth Dynamics, John Wiley & Sons, Inc., 1962; see also their Factors Influencing Land Development, Center for Urban and Regional Studies, University of North Carolina at Chapel Hill, August 1962. See Chapin's Urban Land Use Planning, Second Edition, University of Illinois Press, 1965.

Hansen, Walter G., "How Accessibility Shapes Land Use," Journal of AIP, May 1959. See also his "Land Use Forecasting for Land Use Planning," Highway Research Board Bulletin 253, 1960.

Kain, John F., A Multiple Equation Model of Household Locational and Tripmaking Behavior, The RAND Corporation, April 1962.

(6) Soil Conditions: slope, drainage, vegetation, etc. Some background reference include:

Olson, Gerald W., Using Soil Surveys for Problems of the Expanding Population in New York State, Cornell Extension Bulletin 1123, Ithaca, March 1964.

Division of Planning, Massachusetts Department of Commerce, "Soils and Their Interpretation for Various Uses, Hanover, Mass.," Vols. I and II, Boston, 1964.

Bauer, Kurt W., "Determination of Runoff for Urban Storm Water Drainage System Design," Technical Record, Southeastern Wisconsin Regional Planning Commission, April-May 1965.

Southeastern Wisconsin Regional Planning Commission, The Soils of Southeastern Wisconsin, Soil Survey Planning Report No. 8, 1965.

(7) Water resources, waste disposal, other utilities. Some background references include:

U. S. Public Health Service, Future Requirements for Municipal Use of Water, Committee Print No. 7, U. S. Senate Select Committee on National Water Resources, 86th Congress, 2nd Session, 1960.

Graham, J. B., and Burrill, M. F., Water for Industry, Publication No. 45, American Association for Advancement of Science, 1956.

Twin Cities Metropolitan Planning Commission, "Policy Statement No. 7, 25 October, 1962, The Metropolitan Sewage Problem and Its Solution," St. Paul, October 1962.

Research Triangle Regional Planning Commission, "General Plan for the Development of the Research Triangle Region as Affected by Waste Disposal and Water Resources," Raleigh, June 1962.



Rhyne, Charles S., et al., Cities and Atomic Energy, National Institute of Municipal Law Officers, 1959.

Economic Consultants Organization, In., Control of Automobile Scrap, A report to Subcommittee on Automobile Scrap on the New York Joint Legislative Committee on State's Economy, Albany, February 1965.

(8) Land development costs. Background material on this subject area includes:

Crerar, A. D., "Land for our Future, The High Cost of Sprawl," Community Planning Review, a Canadian journal, June 1959. See also Lower Mainland Regional Planning Commission, "Urban Sprawl," 1956 and "Land for Living," June 1963.

Harvey, Robert O., and Clark, William A. V., "The Nature and Economics of Urban Sprawl," Land Economics, February 1965. See also Lessinger, Jack, "The Case for Scatteration," Journal AIP, August 1962.

Stone, P. A., "The Economics of Housing and Urban Development," Journal of the Royal Statistical Society, Series A (General), Vol. 122, Part 4, 1959. See also "The Impact of Urban Development on the Use of Land and Other Resources," British Journal of the TPI, May 1961.

Ludlow, William H., "Urban Densities and Their Costs," in Woodbury, Urban Redevelopment: Problems and Practices, University of Chicago Press, 1953.

Colean, Miles L., and Davis, Arthur P., Cost Measurement in Urban Development, National Committee on Housing, 1945.

(9) Market value of land. Background references on this subject area include:

Wendt, Paul F., "Theory of Urban Land Values," Land Economics, August 1957. See also Ratcliff, Richard U., "A Commentary: On Wendt's Theory of Land Values," Land Economics, November 1957.

Hoyt, Homer, Dynamic Factors in Land Values, Technical Bulletin 37, Urban Land Institute, May 1960.

Knox, Duane S., Distribution of Land Values in Topeka, Kansas, Center for Research in Business, The University of Kansas, Lawrence, May 1962.

Brigham, E. F., A Model of Residential Land Values, Memorandum RM-4043-RC, The RAND Corporation, August 1964.

(10) Public Works and governmental services. Cost benefit references appropriate to this subject area are listed under Topic (1) of Problem Area 4 below. Other reference material relating to this subject area includes:

Coughlin, Robert E., "The Capital Programming Problem," Journal of AIP, February 1960.

Coughlin, Robert E., and Stevens, Benjamin H., "Public Facility Programming and the Achievement of Development Goals," Regional Science Research Institute, University of Pennsylvania, 1964.

Planning Advisory Service, "Capital Improvement Programming," Information Report No. 151, American Society of Planning Officials, October 1961.

(11) Zoning and subdivision regulations. Background references relevant to such regulatory measures include:

Reps, John W., and Smith, Jerry L., "Control of Land Subdivision," Syracuse Law Review, Spring 1963. See also Reps' "Requiem for zoning," Planning 1964, American Society of Planning Officials, 1964.

Lovelace, Eldridge, and Weismantel, William L., Density Zoning: Organic Zoning for Planned Residential Developments, Technical Bulletin 42, Urban Land Institute, 1962.

### Problem Area 3--Forecast Techniques

#### Objectives

A forecast capability is desired for urban land uses. Knowledge of the future spatial arrangement of the resident population and activities is necessary to, and interrelated with the intelligent planning and budgeting of capital expenditures for transportation facilities and other public improvements.

A conceptual and definitional problem exists in differentiating between the roles of planning and forecasting, and a statement of this issue serves to define the objective of forecasting techniques. Forecasts of the future spatial distribution of activities might be made in situations where there is little or no public policy formulation and implementation through the mechanism termed planning, and forecasts may be made in situations where there is much planning. As a practical matter, most situations fall somewhere between these extremes.

In terms of the capability required, since forecast models must deal with alternative policies and variable implementing controls, they must be quite flexible with respect to inputs. That is, models must be sensitive to a wide variety of policy variables which may potentially be manipulated to guide patterns of development. Levels of transportation service, zoning constraints, open space programs, mortgage insurance and tax policies, redevelopment, and the reservation of land for new towns are important examples of such policy variables which might significantly modify expected land use patterns.

Other requirements of a model include: (1) It should have a solid theoretical foundation (as contrasted to purely descriptive models) so that it conforms with what is known about behavior in the market place; (2) it should be dynamic, that is, it must reflect the feedback influences between various land uses as their pattern changes over time, and it must be sensitive to the timing of exogenous inputs; (3) it must be capable of empirical verification through calibration with historical data, or by testing its output against existing land use patterns (the critical need for employment data by small areas should be noted here); (4) the output of a forecast should provide information sufficient for traffic simulation models and for evaluation of land use-transporta-

tion alternatives; and (5) it should be designed to provide feedbacks from observed trends and refined policies to adjusted forecasts and model parameters.

One of the more urgent needs is a critical review of the state of the art of land use model building, closely linked to the review of theory (Area 1). This review, however, should go beyond an evaluation of the logic of model formulations to include comparative accuracy checks of more promising models, using the same inputs and exploring reasons for differences.

A general question on which forecasting research should focus (again tied to Area 1) is the definition of the kinds of processes whose outcomes are being forecast. It is quite clear that most of the processes of interest in land use development cannot be taken to be stationary and purely random. But there is also some evidence that these processes can be effectively defined in fairly simple terms. The familiar Markoff process, for instance, would seem to be of much use in the forecasting problem.

A particular process which needs attention is that of the residential housing market. What is required is a model which would unit traditional housing market analysis with location theory as spelled out by Alonso and Wingo, and would utilize transportation models in lieu of simple spatial parameters.

Another point of emphasis in forecasting research is of a cost effectiveness nature. Errors in forecasts may result in inefficient expenditure of public funds for capital improvements. Accuracy of forecasts may be improved in several ways. Some systematic studies of the cost of errors might well greatly increase the efficiency and effectiveness of efforts in forecasting. Sensitivity analysis of parameters could be used to gauge the value of refinements in data, etc. Also, much uncertainty can be removed from any situation, of course, by focusing growth through planning and action based on planning. It would be useful to have knowledge of those improvements in forecasts that can be obtained by increasing the planning content of the forecasting situation.

#### References

A standard reference on forecasting in general is H. Theil, Economic Forecasts and Policy, North Holland Publishing Co., 1958.

The references under Area 2 cover much of the work on statistical land-use models; references under Area 1 cover some work on conceptual models. However, the following references are those most directly related to research on land use forecasting techniques.

Harris, Britton, "Organizing the Use of Models in Metropolitan Planning," a seminar paper for Department of City and Regional Planning, University of California, Berkeley, March 1965.

Traffic Research Corporation, "Review of Existing Land Use Forecasting Techniques," prepared for the Boston Regional Planning Project, July 29, 1963.

Garrison, William L., "Toward Simulation Models of Urban Growth and Development," Proceedings of the IGU Symposium in Urban Geography, Lund, 1960, Lund Studies in Georgraphy, G.W.K. Gleerup, Lund, Sweden, 1962.

Lowry, Ira S., A Model of Metropolis, The RAND Corporation, Santa Monica, August 1964.

Stegar, Wilbur A., "The Pittsburgh Urban Renewal Simulation Model," Journal of AIP, May 1965.

Goldner, William, and Graybeal, Ronald S., "The Bay Area Simulation Study: Pilot Model of Santa Clara County and Some Applications," Center for Real Estate and Urban Economics, University of California, Berkeley, March 1965.

Schlager, Kenneth J., "Simulation Models in Urban and Regional Planning," Technical Record, Vol. 2, No.1, Southeastern Wisconsin Regional Planning Commission, Oct.-Nov. 1964, and "A Land Use Plan Design Model," Journal of AIP, May 1965.

Lathrop, George T., and Hamburg, John R., "An Opportunity-Accessibility Model for Allocating Regional Growth," Journal of AIP, May 1965.

Donnelly, Thomas G., Chapin, F. Stuart, Jr., and Weiss, Shirley F., "A Probabilistic Model for Residential Growth," May 1964, and Chapin and Weiss, "Some Input Refinements for a Residential Model," July 1965, Center for Urban and Regional Studies, University of North Carolina at Chapel Hill.

Harris, Britton, "Experiments in Projection of Transportation and Land Use," Penn-Jersey Transportation Study, Traffic Quarterly, April 1962.

Seidman, David R., "Report on the Activities Allocation Model," Penn-Jersey Transportation Study, Paper No. 22, November 17, 1964.

Herbert, John D., and Stevens, Benjamin H., "A Model for the Distribution of Residential Activity in Urban Areas," Journal of Regional Science, Volume 2, No. 2, Fall 1960.

Robinson, Ira M., Wolfe, Harry B., and Barringer, Robert L., "A Simulation Model for Renewal Programming," Journal of AIP, May 1965.

Hill, Donald M., "A Growth Allocation Model for the Boston Region," Journal of AIP, May 1965.

Silvers, Arthur R., and Sloan, Allan K., "A Model for Comprehensive Planning in New York City," Journal of AIP, August 1965.

Kain, John F., and Meyer, John R., "A First Approximation to a RAND model for Study of Urban Transportation," November 1961. See also Kain's "A Report on an Urban Transportation Model, Some Progress and Some Problems," June 1962, and "A Contribution to the Urban Transportation Debate: An

Econometric Model of Urban Residential and Travel Behavior," November 1962, the RAND Corporation, Santa Monica.

Hansen, Willard B., "An Approach to the Analysis of Metropolitan Residential Extension," Journal of Regional Science, Volume 3, 1961.

Horwood, Edgar M., "A Three-Dimensional Calculus Model of Urban Settlement," Highway Research Board Bulletin 347, 1962

Duke, Richard D., Gaming-Simulation in Urban Research, Institute for Community Development and Services, Michigan State University, 1965.

Feldt, Allan G., The Cornell Land Use Game, Miscellaneous Papers #3, Center for Housing and Environmental Studies, Cornell University, 1965.

#### Problem Area 4--Goals, Design and The Evaluation of Alternative Land Use Plans

##### Objectives

Although in recent years there has been increased attention devoted to the development of sophisticated forecasting techniques applicable to land use planning and transportation planning there has not been a simultaneous development of means to evaluate results in terms of goals and objectives. There is a critical need for a major research effort directed toward the development of techniques for articulating planning goals and objectives, and for evaluating proposals or alternatives in terms of comprehensive, objectives criteria. Those responsible for formulating alternatives and developing recommended programs need to have available to them a **scale**, or series of scales, for relating community values to development forms, and other consequences of land use and transportation actions. Policy makers, or the public, cannot be expected to act wisely without assurance that plans are logically connected to an easily understood and generally agreed upon set of goals and objectives.

Research in this area should focus on the following three closely related topics:

(1) Criteria for Evaluating Alternatives. A comprehensive investigation is needed to identify and evaluate the many factors--fiscal, economic, social, political, and aesthetic -- which may differ among alternatives, and which therefore require consideration in the selection process. As a first step, this investigation will involve thorough library research and interviews with persons who have been working with this problem. The study should then attempt to assess the relative degree of consensus that exists concerning the importance, the definition, and methods for quantifying each of the relevant factors. The final product of this research should be a set of practical guidelines for quantifying each criterion to be used in evaluating alternatives.

(2) Techniques for Identifying Objectives. Improved methods must be developed for measuring the goals of urban residents and for relating these goals to land use planning considerations. The attitudinal survey

is one of the most promising means of ascertaining goals, but this technique needs considerable refinement to serve its potential as a planning tool. Before surveys are undertaken, considerable thought must be given to the structure of the questionnaire to develop communication between the respondent and the planner. Respondents must fully understand the questions, terms, and concepts, regardless of differing social and cultural levels.

Objectives must be linked to the various criteria discussed in (1) above in order to rank or weight each criterion, or to establish some sort of trade-off between them. Various techniques have been suggested for accomplishing this, but research is needed to determine the approach best suited to the problems of evaluating alternatives and to the methods available for identifying and measuring community planning objectives.

(3) Use of Models in the Design Process. To the extent that criteria can be quantified, and to the extent that valid weights can be attached to the various criteria, it may be feasible to apply analytical tools to the design process. It can well be argued that, since creating the most desirable community is the goal of planning, research on the use of models in the study of land use design should have a higher priority than research on forecast models.

#### References

The National Cooperative Highway Research Program's Project 8-4, "Criteria for Evaluating Alternative Transportation Plans," will shed light on Topic (1). Other research relevant to this topic includes the following:

Dorfman, Robert, ed., Measuring Benefits of Government Investment, Washington: The Brookings Institution, 1965.

Lichfield, Nathaniel, "Cost-Benefit Analysis in City Planning," Journal of AIP, November 1960; see also Lichfield's "Cost-Benefit Analysis in Urban Development," Research Report No. 20, Real Estate Research Program, University of California, 1962; and Lichfield and Margolis, Julius, "Cost-Benefit Analysis in Urban Governmental Decision Making," Real Estate Research Program, University of California, 1962.

Isard, Walter, and Coughlin, Robert E., Municipal Costs and Revenues Resulting from Community Growth, Chandler-Davis Publishing Co., West Trenton 1957.

Mace, Ruth L., Municipal Cost-Revenue Research in the United States, Institute of Government, University of North Carolina, Chapel Hill, 1961.

Carroll, Donald D., Borchert, John R., Schwinden, James, and Raup, Philip M., The Economic Impact of Highway Development Upon Land Use Values, Department of Geography, University of Minnesota, 1958.

"Highways and Economic Development," Highway Research Board Bulletin No. 227, 1959.

"Some Evaluations of Highway Improvement Impacts," Highway Research Board Bulletin No. 268, 1960.

"Impact and Implications of Highway Improvement," Highway Research Board Bulletin No. 311, 1961.

"Indirect Effects of Highway Improvement," Highway Research Board Bulletin No. 327, 1962.

Research on Topic (2) is just emerging. References which appear to have relevance include the following:

"Community Values as Affected by Transportation," Highway Research Board Record No. 2, 1963.

Udy, John M., "Values and the Planning Process," The Joint Land Use-Transportation Program, St. Paul, July 1963.

Program Notes No. 3, The Joint Land Use-Transportation Program, St. Paul 1965.

Wilson, Robert L., "Livability of the City: Attitudes and Urban Development," in Chapin and Weiss, eds., Urban Growth Dynamics, New York: John Wiley & Sons, Inc., 1962.

Voorhees, Alan M., "Attitudes and Planning Goals," a paper presented at AIP Annual Meetings, 1963.

Von de Muhll, Celia, "The Use of Living Patterns and Attitude Surveys in City Planning," Voorhees & Associates, 1963.

Lynch, Kevin, The Image of the City, Cambridge: Harvard University and Technology Presses, 1960.

Appleyard, Donald, Lynch, Kevin, and Myer, John R., The View from the Road, Cambridge: M.I.T. Press, 1964.

Voorhees, Alan M., "Techniques of Measuring Community Values," a paper presented at 1965 HRB Meetings.

Work available on Topic (3) is perhaps the least advanced in this research area. Among the references which appear to be relevant are:

Alexander, Christopher, Notes on the Synthesis of Form, Cambridge: Harvard University Press, 1964

Schlager, Kenneth J., "A Land Use Plan Design Model," Journal of AIP, May 1965.

Problem Area 5--Policy Development And Its Execution

Objectives

Research on forecast models (Area 3) and techniques of plan evaluation (Area 4) applies to the predecision stage of public policy formulation. There remains one additional aspect in the decision-making sequence, namely policy development and execution. Problem Area 5 is concerned with the dynamics of policy impact, how policy positions, regulatory measures, and other plan implementation actions set in motion after adoption of a plan serve to shape the development that actually occurs. In Area 5, the focus on policy is more concerned with studying the range of feasible policy positions than with political behavior in policy formulation. The emphasis then is on defining policy positions involved in various effectuation measures and in determining how, individually and in combination, these measures influence development as it takes form on the ground. Of course, research in this area has significance for the other four problem areas above in establishing feedback influences on subsequent sequences in plan preparation, evaluation, and policy execution. There are several specialized areas of investigation within Area 5.

- (1) Public Improvement Policies. The impact that consistent policy positions with respect to highway, water, sewer, and other community facilities and services have on development patterns needs much more attention in research. Of particular interest are the differential impacts of individual policies, the timing of the impacts, and the effect that long-term consistency of position has within a mix of public improvement policies.
- (2) Public Works Programming and Capital Budgeting. A very crucial consideration in plan effectuation is the related problem of financial capability of public agencies and the extent that public expenditure powers are utilized in plan implementation. Research is needed to determine how consistent public works programming and capital budgeting practices influence the progression of the land development process.
- (3) Regulatory Measures. Zoning, subdivision control, and official map ordinances for reserving highway rights-of-way and sites for other public facilities are illustrations of police power regulations for carrying out features of a plan. Research is needed to establish the effect that vigorously enforced ordinances with varying standards have on development patterns.
- (4) Civic Education. The influence of this factor on the execution of plans is perhaps less directly measurable, but nevertheless it is a consideration of great importance. Much more needs to be known of the techniques of civic education which affect the extent of apathy, interest, and action response of urban residents, civic groups, and community leaders, and how civic education programs related to other effectuation measures influence land development.



## References

Aspects of Topic (1) are covered in a wide variety of reports on decision-making and policy formulation. Relatively little work seems to have been devoted to the dynamics of policy impacts on land development, particularly in terms of policy mixes. Again, under Topic (2) there is a considerable literature on capital budgeting techniques and public works programming generally, but virtually nothing devoted to defining and measuring the impact on land development. The same situation applies to Topic (3). There is an extensive literature on zoning, subdivision control, and other regulatory measures, but little research seems to have been done in the systematic measurement of the impacts of regulations for their utility in achieving the objectives of a plan. Finally, under Topic (4), the literature again is of a general nature, with little systematic research available which is relevant to research under Area 5.

A selection of general references for Problem Area 5 includes the following:

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