7. Model should be relatively simple.

8. Model should be able to accept data from redevelopment, urban renewal, or new-town plans.

9. Model should have a capability of permitting easy abstractions. It should be designed to facilitate research.

10. Should have graphic and tabular outputs as well as magnetic tape outputs for subsequent assignments and evaluation work.

11. Sensitivity analysis should be included in the design of the model.

V.   Development Policies - Twin Cities Area Joint Program

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The Minnesota Highway Department, the Twin Cities Metropolitan Planning Commission, the Cities of St. Paul and Minneapolis and the seven counties comprising the Metropolitan area are jointly involved in producing a comprehensive plan for the Metropolitan Area. This program, which like the earlier work undertaken by the Minnesota Highway Departments, Twins, Cities, Areas, Transportation Study, focuses on the inter-relationships between transportation and land use. The TCATS Program forecasted vehicle travel needs for 1980, based on the general assumption that current land development policies and travel trends would continue through the forecast period.

The Joint Program supplants and extends TCATS in three basic ways. One, the use of a year 2000 forecast horizon. Two, the extension of the quality of comprehensiveness, that is, the contemplation of as many aspects of urban development as possible. Three, its focus on policy. Specifically, its analysis of the predicted effects of alternative land development and transportation policies.

Ideas About Alternatives

Why look at alternatives? The answer is to be found in the Joint Program's participants attitude about change, namely that is inevitable, predictable, and manageable. A mere effort to "intelligently predict and cooperate with the inevitable" is not considered to be adequate. In the Twin Cities, the extension of current development trends and policies point to certain conflicts and problems which seem to necessitate the introduction of different policies at some point in the future.

For example, the trend of continuing centrality in the downtown area on the one hand accompanied by the trend of substantial new growth at low density in the outlying areas produces travel demands which will necessitate by 1980 new facilities substantially in excess programmed resources.

Thus it is assumed that a plan based on the forecast continuation of past and current trends, to the measure that it is not able to accomodate these

conflicts, will probably be deflected in major ways by future events. By looking at the effects of alternative land development and transportation policies, optimal courses of action can be selected which, if intelligently pursued over time, may help achieve stated goals for urban development in more positive and satisfactory ways.

Key Goals and Policies Of The Alternatives

Four schemes for land development and transportation through the year 2000 have been developed. Their predicted effects will be "tested" through extensive analysis of the results of model runs. This testing will include a major dialogue with selected elements of the Metropolitan Community who will be asked to participate in the selection of the set of policies that will undergird the plan.

To select the proper course of action in developing the urban environment we must know the range of actual choice available. By "bracketing" this range with alternative test schemes, the dimensions of this range of choice can be more clearly measured and understood. Thus, a formal identification and evaluation of alternatives is seen as the key to optimal policy in plan formulation.

The schemes selected for testing are the result of an amalgamation of three distinct yet inter-related research efforts. One approach focuses on goals. An attempt has been made to assess the personal and societal values which underlie them and the alternative policies that must be pursued to attain these goals.

The second approach analyzes the implications of pursuing pragmatic responses to observe problems and opportunities in such functional areas as parks and open space, water resource management, renewal, transportation, etc.

The third can be characterized as the "intuitive" response to the previous two approaches, synthesized and expressed through the processes of urban design.

The alternative development patterns being tested are described in summary fashion as follows. All four are constructed to represent the Twin Cities Area in the year 2000 with a population of four million persons. All respond in varying degrees to basic physical environmental considerations. All embody the basic elements of the TCATS "System Five" highway scheme for 1980. Each responds to certain common and fundamental values such as freedom, choice, flexibility, economy, historic continuity, etc. All are assumed to be resultants of a marketoriented economy with different sets of constraints in operation for each. Any of them may offer an acceptable reflection of our underlying value systems. In a sense, each alternative maximizes and rationalizes a major development trend observed to be operating in the Twin Cities area today. The dominant goals and key policies for each alternative are summarized as follows:*

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*Design Section Paper No. 15 - March 1964

A. Present Trends
    Goal: Create an environment possessing a mixture of centrality,
            dispersal and subcentralization in which the present con-
            straints on our free market economy will continue to force
            a resolution of conflicting forces.

Key Policy: Identify, make explicit, and continue in force all policies
            promulgrated by all levels of government which currently af-
            fect the process and form of urban growth and change.

This means a continued effort to design and provide public services,
particularly transportation, in response to development decisions.

B. Spread City
    Goal: Create a loose knit, flexible, and open ended low intensity
            environment which optimizes the role of the automobile and
            reduces localized congestion.

Key Policy: Construct an extensive grid system of freeways and expressways
            in outlying areas to create large areas offering uniform access-
            ibility in all directions and many points of equal attraction
            throughout the region.

C. Multiple Centers
    Goal: Achieve a degree of centralization in suburban areas while re-
            lying heavily on automobile usage by creating a series of
            multipurpose activity centers of substantial size providing
            a broad range of goods and services, a high proportion of
            local employment and a strong visual focus for each subregion.

Key Policies: Concentrate in one location for each subregion, much of the
                nonresidential activity presently decentralizing within sub-
                urban areas in a random fashion. Construct a subradial trans-
                portation system to focus on these centers.
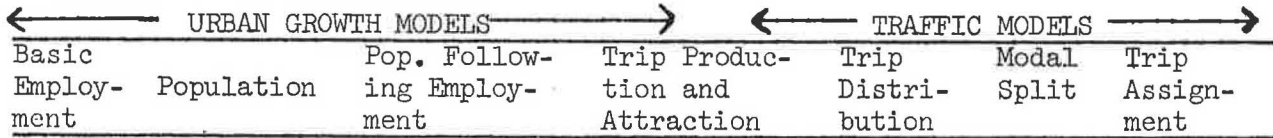
D. Radial Corridor
    Goal: Create an intensively centralized metropolis with central
            place activities highly accessible to the whole region. Optim-
            ize investiment in existing public service system and encour-
            age natural reconstruction of older areas.

Key Policy: Construct an extensive radial commuter rail system of advanced
            technology fully coordinated with freeways construction, to
            encourage development to occur in a few broad corridors.

How The Alternative Policies Are Tested

The system of models used to develop and test the alternatives emphasize
the inter-action between land use and transportation. From the chart it will
be seen that its two major components are urban growth models which deal with
the underlying dynamics of urban change and the traffic models which actually
deal with traffic demand and distribution and assignment to facilities.

Note under the traffic models that the middle item, the trip production and attraction model acts as a link between urban growth and traffic movements.

Basic Employ-ment	Population	Pop. Follow-ing Employ-ment	Trip Produc-tion and Attraction	Trip Distri-bution	Modal Split	Trip Assign-ment

←——— URBAN GROWTH MODELS ———→   ←——— TRAFFIC MODELS ———→

Most of the urban growth models involve the use of multiple regression techniques which in this analysis are used to determine the relative strength of association of a number of factors with a dependent factor. They are also used to predict the value of the dependent variable -- given the values for the factors associated with it. Acutally, many of these models are "distributive" -- i.e., they really "predict' the distribution of a previously determined total value -- of population or employment for example.

As noted by Lakshmanan* the construction and analysis of the model takes into account the distinction between "policy variables" and "status variables".

Policy variables are those that directly reflect public policy decisions. For example, in the manufacturing and wholesale submodel, it is hypothesized that increase in manufacturing and wholesale employment depends on the amount of land within 1500 feet of 4-lane highway and also the amount of land sewered.

Both of these variables can be changed by governmental policies concerning location and extension of facilities. In addition, governmental policies could determine, through zoning, what sites along 4-lane highways would be available for development. Status variables are those that do not respond to policy decisions -- except perhaps in a very round about way.

They actually describe the "status" of the situation. An example of this type of variable would be "base year employment" in the Fire Insurance, Real Estate employment sub model.

In making projections, it is necessary to decide what the policies would be for each policy variable under each alternative so that we can develop figures for the independent variables. For example a policy in the "trends" alternative would be postulated as allowing any and all undeveloped land within 1,500 feet of a highway to receive growth if it "wanted" to go there. In manufacturing and wholesale employment it might be along corridors; in the Multiple Center scheme it would be near the centers; and in the Spread City schemes, scattered sites would be encouraged.

Also, for each alternative, policies would state how much and where sewer service would be provided. Population growth is distributed on the basis of relative accessibility to employment, relative cost of residential development, and per cent of the area saturated at the beginning of the period. The new total population then becomes the input for the models which distribute what we

*Lakshmanan, T. R., An Approach to the Analysis of Intra Urban Location Applied to the Baltimore Region   Economic Geography, October, 1964

have called "population tied" employment, i.e., that employment which locates to serve population within a district. It is made up of retail employment, education, local government, and service employment (business, personal and professional services).

The policies used in the urban growth analysis directly relate to travel demand in a number of ways. For example, the trip production equation projects the number of people in a zone who will make different kinds of trips for work, shopping, social-recreation, school and miscellaneous trips, based on factors such as family size, density, and income.

The trip attraction equation deals with factors indicating the relative "attractiveness" between zones for various types of trips. For example, work trips are related to total employment within the zone, shopping trips are relative to the amount of retail employment within a zone, social recreation trips are related to the amount of non-basic employment, the amount of population, and the number of acres of open space in a zone. Note the relationship of the above to land development policies.

Land development policies also have an impact on the input used for the modal split model which deals with such things as population density and income at the zone of origin, parking cost and employment densities at the zone of destination.

From the above it can be seen that the Joint Program is attempting to produce a set of analytical tools that can be used over a period of time to refine and expand knowledge of how the urban area actually works and to enable us to see the results of adjusting one or many policy decisions affecting Land Development and Transportation.