travel "budgets" for car travel in U.S. cities are, on the average, about 0.8 hours on the road network, or 1.1 hours door-to-door, and 11 percent of income). A disequilibrium condition is the case where the daily travel distance is less than the minimum and/or when time or money spent on travel is abnormally high.

2. If travel speeds change, as a result of changes in the number of vehicles, road network, travel costs, or city size, a disequilibrium condition may arise, which can generate forces that change urban structure.

3. It is possible to distinguish between two kinds of disequilibrium: a stabilizing disequilibrium which tends to dampen the oscillations in the urban system to reach, or at least approach, a new equilibrium condition. Such conditions are usually found in cities of developed countries, where most of the generated forces are endogenous, within the city. The other is a destabilizing disequilibrium, which tends to increase the oscillations in the urban system. Such conditions are usually found in cities of developing countries, where most of the generated forces are exogenous, from outside the city, as in cities that double their population every decade by the in migration of poor people. These cities expand at a higher rate than the rate at which the population and jobs can adjust to the new conditions, resulting in ever-increasing travel distances and costs to job opportunities coupled with ever-decreasing speeds, with no equilibrium conditions for the poor in sight.

4. Disequilibrium forces introduced into a city of a developed country by policy decisions, such as by a continuous increase in travel costs, in both money and time, may change urban structure. While the relative travel costs in such cities results in population dispersion, the increase in relative travel costs does not result in the same population gravitating back towards the city center, and although some households do it, the net result is more likely to be a dispersion of jobs towards the population (the ratchet effect, when a reversal of cause does not reverse the effect). Hence, the belief that increase in travel costs will encourage dispersed cities in the U.S. to coalesce into compact cities may be contradicted by an accelerated dispersion of jobs outwards.

5. Practically all urban models have been conceived and developed in developed countries, mostly under equilibrium conditions and, therefore, they tend to reflect the understanding and beliefs upon which they were based. For instance, such models always reach, or at least approach, equilibrium conditions at the conclusion of the iterations. A truly policy-sensitive model, on the other hand, should rather seek and measure the amount of possible disequilibrium conditions that policy alternatives could generate, with special attention focused on the population segments affected most.

Conclusion

In order to study the relevant relationships between travel and urban structure, it is necessary to observe a wide range of variables. Therefore, it seems that we should first observe in more depth the travel behavior and needs of people in cities, large and small, of different structures, compact and dispersed, poor and rich, before reaching final decisions about the future of our cities.

The examples in this paper are few, but they appear to be disturbing enough to suggest that there may be other interpretations than the conventional ones to explain the observaations in different cities. International organizations, such as the World Bank, could greatly assist the study of urban development by encouraging the collection of key data in a form that would enable inter-city comparisons to be made readily. This paper suggests that the results of such comparisons could be of great value to planners and policy makers in developed and developing countries alike.

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AN OPERATIONAL LAND USE TRANSPORT MODEL FOR THE TEHRAN REGION, IRAN

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Introduction

Land use and transportation modeling, while conceptually sound, generally has failed to meet the needs of the real world of professional and political planning, because the millions of dollars and the two or three years usually required to develop a reliable model are beyond the credibility and patience of public officials.

The land use transportation model developed for the Tehran Development Council (TDC) overcame these two major obstacles by dividing the program into two parts: phase one for the development and calibration of the model to be done within seven months and at a maximum cost of $150,000, and phase two for the testing of existing and proposed policies and programs. The model was developed for the Tehran Development Council, a council of ministers supervising the growth and development of Tehran's region. The TDC's staff collected economic and population data and inventoried existing policies affecting the growth and development of the city and region. Following data collection and analysis, a series of 10 technical reports were published prior to the development of the model and used as input for population, economic growth, migration, land use and spatial requirements, transportation, housing, public investment priorities and jurisdictional problems.

The purpose of the model was (1) refinement of recommended policies and actions for implementation, (2) preparation of short-range improvement programs and impact analysis, and (3) preparation of medium long-range land use transportation plans.

Design of the model.

The Tehran model is a system model -- that is to say that everything within the model affects everything else. The model contains three interdependent components: (1) the regional growth submodel, (2) the land use submodel and (3) the transport submodel. The regional growth submodel predicts the growth of economic and residential activities for the region as a whole. The land use submodel predicts the location of these activities within zones and regions. The transport submodel predicts the travel between zones and activities.

The dynamic component of the model is the regional growth submodel and drives the rest of the system, increasing or decreasing the level and characteristics of the activities within a time period for the entire region.

The land use submodel takes information given by the regional growth submodel and distributes the activity among the zones of the region. Of course, additional inputs can be introduced such as land control, zoning, taxation and subphysical housing or employment, etc.

The transport submodel receives information from the previous submodel in terms of the locational characteristics of land use. It also requires inputs in terms of the characteristics of the transport network and operating costs and fares. As outputs, it produces the traffic generated by each zone, with the distribution of this traffic and characteristics in terms of type of vehicle and the congestion and costs which will result.

The Evaluation of Policy Practices for Tehran

After all the preliminary work and calibration of the model were completed, an evaluation of the various policy packages was prepared by the TDC staff. Examples of typical policy packages are shown below.

	Policies	Ranges
i	Parking	N (no change) L (low Parking) H (high parking)
ii	Fares	U (unintegrated) F (integrated flat fares) G (integrated graduated fares)
iii	Metro	N (no metro) S (small metro) L (large metro)
iv	Roads	S (small network) L (large network)
v	Employmt.	N (no tax) Y (tax on employment location)
vi	Housing	N (no subsidies) Y (housing subsidies)
vii	Land	R (restrictive) E (extensive controls) M (market)
viii	New towns	M (market) P (planned new towns)

A combination of these policies constitute a package. The following packages were specified:

	Policies	Packages												
		1	2	3	4	5	6	7	8	9	10	11	12	13
i	Parking	N	L	L	L	H	H	H	H	L	L	L	L	H
ii	Fares	U	U	F	F	F	G	G	G	F	F	F	F	F
iii	Metro	N	N	S	S	S	S	S	L	S	S	S	S	L
iv	Roads	S	S	S	S	S	S	S	S	L	L	L	L	L
v	Employmt.	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y
vi	Housing	N	N	N	N	N	N	N	N	N	N	Y	N	Y
vii	Land Supply	R	R	R	M	M	M	E	E	M	M	M	M	E
viii	New Towns	M	M	M	M	M	M	M	M	M	M	M	P	P

Each package was run through time and evaluated against other specific packages. In total, 45 runs of the model were undertaken, including the basic calibration runs of 1971 and 1976.

Conclusion

Preliminary results show that the model was effective in examining and testing alternative policies and their interaction. It became clear, for example, that a restrictive land development policy would greatly increase the land rents throughout the city and intensify inflation, congestion and transportation costs. On the other hand, an unrestricted free market land policy would encourage sprawl and inefficient land development, greatly increasing the cost of public infrastructure such as in highways and transit, while a controlled land release program based on an approved plan would appear to offer the best solution. However, this is an oversimplification since many other questions remained to be explored such as the cost and benefit of public subsidies housing, rapid transit, etc.

The authors are, however, convinced that the land use transportation model developed in Tehran is a useful and important tool to aid in the planning process and to develop and test various policies affecting growth and development. Furthermore, the Tehran model was achieved during the shortest period of time possible and at the lowest cost, far better than any previous model used internationally.

TRANSPORTATION, LAND POLICY AND THE URBAN POOR IN THE DEVELOPING COUNTRIES, John Courtney Urban Projects Department, The World Bank

Introduction

In the developing countries, the urban poor lack the income to pay even the most basic