

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	Package	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

of transport costs. Therefore, any land development policy should stress the location of housing close to jobs and services, especially for the poor. Such locations tend to be within the existing urban areas and justify a policy of squatter settlement upgrading complemented by a sites and service strategy.

Rarely do the transport studies address the needs of the urban poor who comprise from 34% or 2.0 million people in Manila to 55% or 2.8 million in Jakarta. The studies tend very much to address the needs of the upper 50% of the population in income terms and in many cases the top 25%. This is because the planning is done for a level of affluence and affordability that is found mainly in the developed countries and not the developing ones. It is focused on providing facilities and not accessibility, for all, and systematic tools and the process for addressing the transport needs of the urban poor are relatively undeveloped and virtually lacking in most of the expertise which less developed countries (LDC's) receive from the west.

While an increasing amount of attention is being given to the world population increase, and its implications for food production, relatively little attention has been focused on what may ultimately become another severe problem for development, rapid urbanization. What is meant here by rapid urbanization is simply growth of urban areas which outpaces the means to accommodate that growth. Of the 4 billion plus people at present in the world, 2.8 billion or 70% are in the developing countries with 720 million in their urban areas. It is expected that in the next 25 years the urban areas of the developing countries will have to absorb approximately 1.3 billion people with a resulting expansion of the present 90 cities with populations of over 1 million to roughly 300 cities with populations over 1 million.

While we do not know what the ultimate city size will be, we do know quite a lot about the locations of some of the cities which will be most severely impacted by the population growth phenomenon, and many of their characteristics. Two significant characteristics of these cities for urban transport policy are city size in terms of land area, and size and location of the urban poverty group most commonly known as squatters. Several city/regions of 25 million such as Mexico City and Manila are anticipated within 25 years and a large part of the population growth is anticipated to be in the urban poverty group¹/in many of these giant world cities. What are the implications of this for transportation and land development policy? What are some of the specific transport and land development problems that are being dealt with now?

First of all, the sheer size of the urban poverty group in the major centers of the developing countries is leading to some inevitable conclusions on the part of policy makers: attention must be focused on this large and rapidly growing group, which is estimated to number 250 million people at present and to increase by 450 million more people in the next 25 years.

The poor are often without public transport and walk to work, travelling as

long as two hours each way. Such distances are a penalty both to their energy and to their earnings. In city after city of the developing world, the streets are growing congested with private automobiles, while the city governments are focusing on plans for elaborate subways or expressways which will produce little if any benefit for the urban poor. Rather, they will drain away resources that might be used to help them become more productive and improve the quality of their living environment.

If present patterns of development continue, longer journeys to work will be inevitable. The cost of these journeys will be prohibitive to the very poor who cannot afford to locate near the center because of high land prices; thus, placing them at a locational disadvantage for job opportunities. The growing cities of the poorer developing countries cannot afford to follow the spatial patterns of cities in richer countries which will increase distances from home to work. Job and residential locations will have to be more contiguous spatially to reduce transport costs so that low income groups can have better access to employment opportunities and essential services.

Finally, the urban problem in the developing countries is a poverty problem. It will be a poverty problem for the foreseeable future. An urban transport strategy must therefore be, or include, an urban poverty strategy. Manila clearly illustrates some of the points just made.

Metro Manila: A Case Study

The Metropolitan Manila Area²/had an estimated population in 1977 of 5.8 million, or 13% of the national total. With an average annual growth rate of 5% since 1960, Manila's population is increasing faster than those of other urban areas in the Philippines. If the present trends continue, 25 million persons could be living in the Manila region by the end of the century, fully 65% of the urban and 30% of the total population of the Philippines. In 1972, approximately 50% of physically inadequate dwelling units in the Philippines and 80% in all urban areas were in Manila. About 2.0 million persons now live in substandard structures on unserviced lots with a very low level of environmental sanitation on 15% of the land at densities of over 1000 persons/hectare on 50m² lots with up to 10 persons/dwelling unit.

Evidence on the travel characteristics of the urban poor is limited. However, one survey of 250 household heads in the Vitas community in Manila provides some feel for life in such a community. In this area it was found that (1) poor people work close to their homes, over 40% walking to work and 70% of the journeys taking under 30 minutes; (2) less than 5% use private transport of any kind for the journey to work; this includes bicycles and motorcycles and (3) the 50% of the people who travel to work by public transport have frequent changes of vehicles with consequent high cost. Only 20% get to work in one ride and 40% take three or four rides paying the five kilometer minimum fare each time of U.S. 4 cents or a daily transport cost of U.S. 24-32 cents for the head of the

household or 10-13% of the average daily income of approximately U.S. 2.50^{3/}. Allowing for journeys to and from work, schools and market, accessibility for a family of six is clearly limited to its immediate neighborhood. An estimated daily family transportation cost could be U.S. 50 cents or 20% of the family budget for the most absolutely essential travel even in a reasonably central location.

There is another related problem which travel costs have on the urban poor when they are incorrectly located in respect to their work source. The new resettlement areas for Manila such as Carmona, Dasmarias and San Pan Palay are at least 20 to 30 kilometers outside Metro Manila, and do not have adequate jobs nearby; many heads of the households, unable to afford the daily traveling costs back into Manila, have been forced to set up second households in the city which they occupy during the week. This has raised important questions about the location of these new settlements and what alternatives should be considered to reduce the social and economic costs to the urban poor.

In the case of the people who would daily commute in from the outlying areas, the head of household could be expending 25%, or greater of his income on transportation.^{4/} When one realizes that their urban poor spend up to 60% of their income on food for the family, it does not leave very much flexibility for items such as shelter, clothing, and other essentials. A question which arises here is the extent to which public transportation is subsidized in order to provide transport at a cost people can afford or the extent and effort on the other hand which is made to create appropriate locations for settlement with jobs and housing in reasonable proximity so that transportation costs are placed at an absolute minimum.

A closer examination of these alternatives would show that it is more beneficial socially and economically to develop or upgrade existing in-city sites for the urban poor, thereby save in transportation, and secondary accommodation costs, and permit these resources to be invested in a permanent shelter in an area with reasonable access to employment and other services. The World Bank is assisting with the funding of such a strategy at present in Metro Manila under its first urban project in the Tondo area. These projects fully recover costs that are paid for by the residents through taxes and rental fees at prices which are affordable and within their incomes. The location also provides good access to jobs.

Five years ago this type of housing policy would have been unacceptable and efforts would have been made by the authorities to relocate these people outside the city,^{5/} at distances of 30 kms thereby compounding already existing problems and inequities. Building on the Tondo Strategy the National Housing Authority has embarked upon a Metro Manila wide program to up-grade on-site in the next 5 years the residences of approximately 1.0 million of the urban poor who are either squatters or living in major blighted areas. This group is at present located in approximately 415 blighted pockets^{6/} scattered through the metro area.

This land development policy minimizes costs and maximizes the locational advantage for the urban poor. A level of equity is being established for people who have traditionally been socially and economically neglected. Furthermore most of these sites are located in areas where there is extensive coverage by the informal public transport -- the Jeepney (an enlarged jeep), which provides a higher level of service at less cost than the public bus service.

In effect, what is emerging in Metro Manila is a highly responsive land development policy, specifically tailored to the needs of the urban poverty group. This group in 1977 constitutes 2 million of the 5.8 million population in Metro Manila. Through this program over the next five years, 1.3 million or 68% of the urban poor will benefit through the provision of new or improved housing conditions in locations in which the transportation costs are minimized.

Development Policy Issues

Based on the previous discussion a series of development policies emerge in respect to planning for the urban poor. These include:

1. Traditional transport planning processes are not appropriate as the urban poverty group for the most part do not operate within the conventional markets for their transport services.
2. Even the most basic of transport services except for a few essential trips tend to overextend the urban poor's family budget.
3. Because of the need to reduce transport costs, the planning for this group requires that settlements with jobs and basic services be provided within reasonable walking distance.
4. Remote locations even if the land is cheap will not usually serve their needs as lack of jobs and basic services will require heavy transport costs.
5. This leads to a policy of upgrading on-site, in which housing costs are minimized and already existing transport routes are utilized, particularly the informal transport sector such as the jeepneys in Manila.
6. Any land development policy should require a reasonable distribution of the sites within the metro area for low income settlements.
7. The type of transport appropriate to the urban poor should be low cost, replicable, affordable and wherever possible should support small scale industry involving low capital to job investments. Transport such as Jeepneys, Bemos (motorized vehicles carrying about 2 people), Bedchucks (non-motorized bicycle-rickshaw vehicles carrying about 2 people), tricycles, small vans, fall into this category.
8. Finally, the goal is to improve mobility and increase opportunity by reducing the need for transport.

Notes and References

1/ The urban poor are characterized by the lack of adequate resources to provide a basic nutritional diet and essential clothing

and shelter. The World Bank estimated the urban poverty threshold in 1975 for the Philippines at US \$180 per capita/annum, Mexico US \$484, and Indonesia US \$125.

2/ The city of Manila occupying 38.0 sq kms. has increased in density from 160 persons per hectare in 1948 to 380 persons per hectare in 1975 which has meant a doubling of population in 27 years and the metro area covers 871 sq. kms. with an estimated current population of 5.8 million. The city occupies less than 5% of the metro area, but accounts for 25% of the low income population.

3/ In 1976 the average estimated daily income for a family of six was U.S. \$2.50. At the same time, the fare for an average journey by bus (about 7.5 km) was U.S. 5.5 cents while the average journey (about 4 km) (2.5m was U.S. 3.5 cents).

4/ An estimated round trip in 1977 from Sapan Palay was U.S. \$0.70 or approximately 25% of his daily U.S. \$2.70 income.

5/ For example, in the case of one of the earliest settlements, Sapan Palay established in 1961 which is located 30 kms north of Manila, 42% of the 19,000 labor force are employed and 4,500 commute daily into Manila at least 1 hour each way at a cost of US 35 cents per trip. (25% of daily income).

6/ Approximately 215 are scheduled for upgrading in the next 3-5 years. Up-grading involves the provision of basic services on site including water sanitation, foot paths and roads and community facilities. Relocation is minimal and the people are provided with building loans to improve their houses. Incentive and assistance are provided for the creation of small scale industry within the area.

DISCUSSION by Thomas B. Deen, Chairman and Executive Vice President, Alan M. Voorhees and Associates, Inc.

The following comments refer to the original papers presented at the Annual Meeting in January 1978 but apply generally to the summaries presented here.

We are fortunate to have such a good selection of papers for this session on transportation planning in cities of developing countries. It's always much easier to be a critic than to create, so I found this to be a very satisfying experience.

Each of the papers approaches the problem from an entirely different perspective: one on basic travel demand characteristics; another with a rather comprehensive land use transportation model that almost makes an effort at embracing the entire urban system; the third paper addresses the physical planning and design of a new town; while the fourth addresses the urban issue as fundamentally one of income re-distribution and ways to carry it out.

I would recommend the paper by Byrne, Tadross and Grava, particularly the discussion of the background of the several new towns that have been built in the last two decades, including Chandigarh (India), Brasilia (Brazil), Islamabad (Pakistan) Ciudad Guayana (Venezuela), and Tenth of Ramadan (Egypt), and, of course, Sadat City (Egypt). This discussion proceeds from the basic philosophy of the designers, their concepts, configurations, planning techniques, and, particularly interesting, the development history and actual experience after development.

The transportation concept described for Sadat City makes much of the use of high densities in order to reduce total motorized mobility requirements and the focus on public transport. Explicit provisions are also made for bicycles, pedestrians, and animal carts, as well as for staging of development over time. One refreshing aspect was the rather explicit statement of the planner's objectives and the response to these objectives. Some aspects of the plans however, despite the best efforts of the designers, may come to naught. The idea, for instance, of intercepting animal carts by putting produce markets at the periphery of the city sounds very similar to the experience of San Jose, Costa Rica a few years ago. The cart owners simply by-passed the peripheral markets and went into the heart of the city where their customers were. Political officials often find it very difficult to enforce regulations against such entrepreneurs.

The designers also claim that the grid system of exclusive busways along with the dispersion of both population and employment will permit balanced loads and a minimum mileage of exclusive busway requirement. However, grid busways often have problems of multiple transfers unless a large number of routes are used, in which case low headways result. The paper unfortunately is silent on the route structure of the buses using the busways.

It should also be noted that the high density may turn out to be a real problem if, in fact, higher incomes and therefore higher motorization comes about. While the exclusive busways should allow for the transit to keep functioning, the high density does reduce the flexibility potential for the future. It's also interesting to note the focus on high density to reduce total travel puts Byrne, Tadross, and Grava on a collision course with Zahavi, as discussed below.

The paper by Zahavi represents another in the series of papers that he has been preparing as a result of his research in comparison of data from many urban transport projects, both in developing and developed countries. He has a unique and innovative way of analyzing this data and has come up with a number of interpretations which tend to confront the conventional wisdom on transportation relationships.