TRANSPORTATION PLANNING FOR SAIGON

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In the winter of 1973-74, the author provided advisory services to the South Vietnam Ministry of Public Works on transportation planning techniques. He installed the program packages of the Federal Highway Administration on urban transportation planning and the Urban Mass Transportation Administration on transportation planning system on computers in Saigon and instructed South Vietnamese personnel in the use of the packages for a long-range planning study they wished to conduct. Transportation in Saigon in 1973 and 1974 and major differences of Saigon and Western traffic composition are discussed. Some of the long-range planning alternatives considered in Saigon are presented. Some of the problems associated with applying the U.S. Department of Transportation planning packages in a remote location also are presented.

•IN mid 1973, Daniel, Mann, Johnson, and Mendenhall (DMJM) was requested by the Vietnam Ministry of Public Works and the U.S. Agency for International Development (AID) to provide advisory assistance to the South Vietnamese in urban transportation planning. DMJM sent me to Saigon to determine the objectives of a possible study, evaluate the personnel and data resources available, and prepare a scope of work for advisory services. This trip also served as an introduction to Saigon and to the characteristics of its transportation.

TRANSPORTATION IN SAIGON

Saigon in 1973 and 1974 was a city of nearly 3 million people living and moving in a community that was planned by the French for less than a half million. The primary street system consists of broad, straight avenues that originally were lined with trees but now have few trees remaining. These boulevards are interrupted frequently by traffic circles, and the traffic-bearing capacity of the roadway often is reduced by marketplaces and vendors overflowing the sidewalks into the curb lanes (Figures 1 and 2).

The vehicle mix in Saigon was heavily weighted toward motorcycles and other motorized 2- or 3-wheeled vehicles, and increases in gasoline prices resulted in an upsurge of bicycles and pedicabs as replacement for motorscooters and motorcycles. Approximately 80 percent of the private vehicles were small motorcycles and scooters, and many of the private automobiles were obsolete and poorly maintained French and Japanese imports (Figure 3).

Until late 1973, the principal form of public transportation was an extensive route system of 3-wheeled, 10-passenger Lambros powered by motorcycle engines. More than 4,000 of these vehicles operated over many fixed routes, stopped anwhere on demand, and charged low fares (Figure 4).

In late 1973 and early 1974, bus service was reintroduced to Saigon after an absence of more than 5 years; some of the buses were owned by unions of former Lambro drivers and operated over former Lambro routes, and others were privately owned. The bus routes were subject to government control, and the bus lines were heavily patronized; however, accurate counts of patronage for the system as a whole or for individual lines were not available (Figure 5).

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Figure 1. Nguyen Hue Boulevard in downtown Saigon.

Figure 2. Curbside market.

Figure 3. Traffic on major arterial.

Other forms of public transportation included taxicabs (most of which were Renaults and Simcas of the 1950s), motorcycles, and pedicabs. Because of the energy shortage, the pedicabs made a tremendous resurgence in late 1973 and 1974. All of these vehicles operated by cruising for passengers or by waiting at busy locations such as markets, government offices, and schools. The passenger always had to bargain with the driver to establish a fare.

The vehicle occupancies observed in Saigon were substantially higher than those in the United States; even the motorcycles and scooters carried up to 5 persons regularly (Figure 6), and a family of 11 on a single Honda was sighted by one observer. The traffic mix and occupancy rates were so different from those experienced elsewhere that capacity and volume relationships had to be redefined. Observed speeds also were much lower than those elsewhere. Even driver expectations were different from those familiar to U.S. traffic engineers because intersection traffic control was frequently nonexistent or not operating and those signals that were present were too far from the intersection to be visible to drivers at the heads of queues. Entering the intersection thus became a game of chicken, with opposing drivers attempting to bluff each other and with the bigger vehicle usually winning. There was little driver lane discipline even though the traffic department had attempted to delineate frontage roads or right lanes for exclusive use of 2- and 3-wheeled vehicles (Figure 7). In spite of these problems, traffic in Saigon improved significantly in 1974, but the improvement mainly was due to the great decrease in American military traffic and to increased gasoline costs (more than 200 percent in the last year), which reduced the number of vehicles on the road.

SCOPE OF WORK

The South Vietnam Directorate General of Reconstruction and Urban Planning (DGRUP) with assistance from AID urban planning personnel had developed 5 alternative land use plans for metropolitan Saigon in the year 2000. For every square kilometer in the region, they had projected land use, population, employment, activity centers, communications, water and sewer lines, power distribution, and even the spacing of the local street system. They had prepared capital and operating cost estimates for all 5 alternatives, but the tables of costs that they showed included 1 blank row for the costs of a transportation network for interzone trips. The South Vietnamese objective for the project was to fill in the blank row. The AID objective was more limited, perhaps, but more realistic. AID wanted the South Vietnamese to develop some transportation planning capabilities of their own so that they could continue their efforts after American support was reduced. To this end, AID wanted the consultant advisor to concentrate efforts on teaching the South Vietnamese personnel-planning techniques and models by using the evaluation of the 5 alternative plans as a framework for instruction. The Vietnamese personnel assigned to the study by DGRUP consisted of a Saigon University engineering professor, an instructor in computer sciences, and a graduate assistant in engineering, all of whom acted as consultants to DGRUP. The Director General took an active interest in the project as did the Deputy Minister of Public Works; therefore, cooperation from the staff of the ministry was ensured. The facilities of the Office of the Prime Minister Computer Center, including an IBM 360/50 with 512-K memory capacity, were made available for the study even though the computer had been turned over only recently to the South Vietnamese and operating personnel were inexperienced in its use.

The South Vietnamese had done some preliminary work, including a travel survey. Because their experience with both employee and home-interview surveys was unfavorable, they decided to survey school children about the trip-making behavior in households. By making the survey a homework assignment, they were able to collect information from some 80,000 households; they coded and processed the information on a computer. Unfortunately, the sample selection and quality control of the survey were not well designed, and factoring the survey results to represent the entire metropolitan area was not possible. However, the DGRUP consultants were able to derive some trip-length distributions from the survey data, and the distributions were of use in calibrating

Figure 4. Saigon Lambro.

Figure 5. Saigon public bus.

Figure 6. Motor scooter with 5 passengers.

Figure 7. Typical intersection traffic.

traffic-assignment models. The DGRUP consultants also had developed a trip-distribution model that combined aspects of gravity models and opportunity models. Some of the South Vietnamese managers were somewhat skeptical about the DGRUP trip-distribution model. Therefore, they asked DMJM to evaluate the model and attempt to validate the results. This became one of its major tasks. Another major task was to demonstrate the development and coding of transportation networks. DMJM chose 3 kinds of networks as examples: simple spiderwebs, highways, and Lambro routes (as an example of a transit network).

DMJM planned to carry out a traffic assignment of the DGRUP trip tables to the various types of networks and carried out all of the necessary preliminary steps. However, when it came time to run the programs to load the networks, DMJM discovered several program problems that could not be corrected in Saigon; after returning to the United States, DMJM personnel prepared some data-conversion routines to overcome the problems and forwarded the programs and instructions for their use to South Vietnam.

DMJM prepared detailed capital cost estimates for various types of highway construction in South Vietnam and collected public transit system capital cost estimates. DMJM also instructed the South Vietnamese personnel in the analysis of traffic assignment outputs and in the design of transportation-corridor plans to serve demand projections. DMJM also showed the South Vietnamese how to prepare cost estimates from the network outputs. The final task of DMJM was to document all of its program packages, procedures, test results, and an instruction manual on the procedures required for the South Vietnamese to complete their study.

TRANSPORTATION PLANNING ANALYSIS

Validation of Trip-Distribution Model

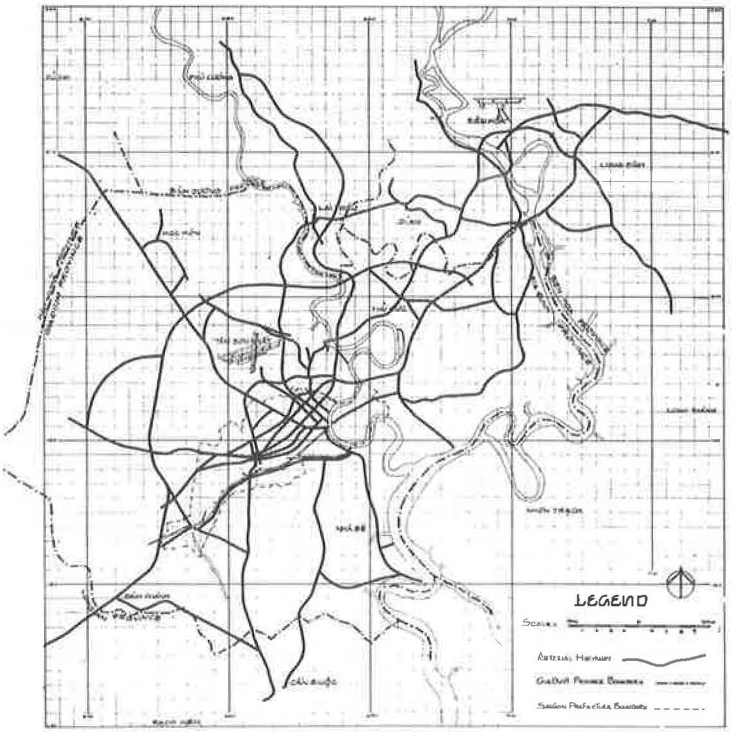
One of the tasks DMJM hoped to accomplish early in the study was a validation of the trip-distribution methodology that had been devised by DGRUP. DMJM eventually accomplished the task, but only after at least 1 false start and only near the end of its participation in the project. The approach of DMJM was to attempt to run a conventional gravity-distribution model on the production and attraction data developed by DGRUP, calibrate the gravity model to the trip-length distribution obtained from the travel survey, and compare the gravity-model outputs with the DGRUP model outputs. The DGRUP trip interchanges had been developed by using the airline distances between zone centroids as impedances; DMJM hoped to use the link distances of spiderweb networks as a better approximation. DMJM therefore prepared spiderweb networks for all 5 land use plans and spent several days coding and editing the spiderwebs. At the same time, DMJM proceeded with its attempts to reformat the DGRUP trip interchanges so that the trips could be loaded onto the spiderweb networks. However, both of these efforts were frustrated when it was discovered that the program that was supposed to be used to load spiderwebs still contained errors and that it was not possible to overcome the program problems.

The next DMJM task was to attempt to run the gravity model on the highway networks that it had coded. After overcoming some minor problems caused by the lack of observed trips of lengths between 0 and 1 km (because the only trips in the DMJM table were interzone trips and minimum zone separation was 1 km), DMJM finally was able to obtain a reasonable match with the observed trip-length distribution. DMJM also was unable to reformat the DGRUP trip tables for successful network loading, and eventually determined that an assembly-language program would have to be written to complete the reformatting.

Preparation of Networks

The highway network DMJM finally used in the model validation and as the basis for all further analysis was an extension of the existing network shown in Figure 8. DMJM

Figure 8. Saigon metropolitan area, existing arterial-highway system.



located centroids for all of the traffic zones and essentially extended existing streets to serve each zone. Networks were completed for plans 2 and 4, including all coding, editing, and computation of shortest zone-to-zone paths. All of the maps and printouts of these networks were turned over to DGRUP together with the instructions on how they were built; DGRUP had to complete the same process for the other 3 alternative plans or any additional combinations.

A second type of network that was prepared and tested to a limited extent was the Lambro network. Although this network could not be used for the analysis, DMJM felt that building it would be a useful exercise to demonstrate the application of the Urban Mass Transportation Administration Transportation Planning System (UTPS) programs to a transit network. Further analysis of transit networks would be desirable, and these programs also might be used to study short-term improvements in the existing bus system.

DMJM chose to use the Lambro system rather than the bus system because, when the project was started in late 1973, accurate information on bus routes was not available. DMJM plotted the Lambro routes on a large-scale map, assigned node numbers, and coded all of the street links as well as the line sequences. DMJM completed editing of the network, computed shortest paths, and even loaded the network with some artificial trip tables derived from gravity-model outputs. The UTPS Network Development Manual presents very complete instructions on preparing transit system networks, and DMJM recommended that such networks be prepared for the existing bus system. The Lambro system did serve to indicate some of the limitations of the planning models. In particular, Lambros in Saigon frequently operated at very close headways (10 to 15 seconds), and they traveled very slowly so that they could stop at the demand of a rider or a prospective passenger. DMJM, for its model, felt that arbitrarily assigning Lambro stops to street intersections was satisfactory, but program limitations would not allow DMJM to simulate the close headways actually experienced in the Lambro system.

Traffic Assignment and Network Analysis

The remaining steps in the planning process were to be carried out by DGRUP by using the procedures and program models provided to them. The procedures and programs were detailed in manuals.

The next step to be completed was traffic assignment. The DGRUP trip interchanges first had to be reformatted by using the conversion program that DMJM forwarded. Then the interchanges could be loaded on the highway network by using a Federal Highway Administration program that automatically accumulated the link usage over shortest interzone paths for all trips in the tables. Other programs could be used to print summaries of the link loads; the planners then should record the loads on the network map.

To analyze the results of traffic assignment, the DGRUP planners would have to work with traffic engineers from the Directorate General of Highways. Information about the design capacities of the links of the highway network, in terms of the vehicle mix and occupancy factors that were experienced in Saigon, would be required. The link volumes from the traffic assignment have to be compared with the capacities, and those links with insufficient capacity have to be identified and flagged. The planners and highway engineers then must determine how to increase capacities to meet excess demands. In some cases, alternate routes might be available, or widening the existing roads to add lanes might be possible. Another means of increasing capacity would be to provide frequent bus service, thereby increasing the vehicle-occupancy factors. When these measures are insufficient, new highways or expressways must be designed, or, when the demand is high enough, a fixed-guideway rapid-transit route must be designed. These new links must be added to the test network, the network must be rebuilt and edited, and the trips must be reassigned. The process continues until a balance is obtained between demand and capacity throughout a network.

The primary objective of the study was to determine the comparative capital costs of transportation system alternatives. The program packages provided a means of doing this. The network building and formatting routines allowed the planner to output the total length of the street and transit systems. The lengths of any additions to the basic system could be computed, and unit construction costs could be applied to develop comparative capital cost estmates. Development of operating cost estimates, however, would have required more data, more detailed analysis, and more resources.

SUGGESTED RESEARCH

Throughout its involvement in this study, DMJM identified areas where additional research was required. The research was needed both for the preliminary analysis and for the comprehensive transportation planning study that would have to be conducted before a new transportation system could be implemented.

Before this study can be completed, information on traffic volumes, capacities, and vehicle occupancies must be compiled. The best way to collect such data is to assign observers to make counts at key points throughout the city including counts of number of vehicles (by type) passing a point during time intervals and counts of the number of passengers in each vehicle. These counts should be taken during peak hours at high-volume locations to obtain a reasonable estimate of street cpacities. A comprehensive travel survey is needed, conducted through home interviews, work interviews, or the schools. The survey should attempt to collect information on both travel behavior of a large sample of Saigon residents and attitudes toward time valuation, mode preferences, and transportation costs. Preferably, the survey and traffic-count operations should be conducted during the same time period so that the traffic observations can be used to calibrate the travel behavior data when they have been processed through trip-generation, trip-distribution, and trip-assignment models.

The new bus system should be carefully studied by observing passenger volumes and boarding and alighting points, determining operating and stop times and speeds, and surveying passengers about their travel patterns. The bus system should be simulated by using some of the programs supplied, and the effects of changes in the operations should be analyzed.

Further socioeconomic analysis on population, employment, income, household size, and travel behavior should be conducted to support more extensive trip-generation analysis. Supporting transportation studies of parking, pedestrian movements, freight traffic, and railroad activity also are needed. South Vietnamese personnel need more training in transportation planning and design; the advisory service provided by foreign consultants and the formal courses of study have some use, but it would be even more useful if selected South Vietnamese personnel could spend time working with public and private transportation agencies in advanced countries.