

6. The UTPP format often uses the column heading "Totals," but what is being totaled is not always clear. A more appropriate heading should be devised that is consistent with the individual tables.

7. A user's handbook should be included with the Urban Transportation Planning Package for each SMSA. It should include pertinent information from this report plus recommendations from FHWA and the Bureau of the Census on using the data. A summary of the accuracy, data collection techniques, and data definitions would be helpful.

8. The organization of the tape file should be restructured so that selected pieces of data can be easily read off the tape by using FORTRAN IV.

9. The time of work-trip origins is a key parameter that is needed in the development of a peak-period model. This information should be obtained in the census; otherwise, it must be collected by an independent survey.

10. So that the external work trips originating outside the SMSA and terminating inside can be determined, the census should record a person's work address in all cases. At the present no specific address is asked for the workplace outside of the worker's home county.

11. A significant weakness in the UTPP data is that employment at major employment centers is often underestimated. This may result from persons' not knowing the specific addresses of their places of work and using references such as "GE Plant" or "Coronado Center." If the local agency prepared a correspondence table between major employment centers and census blocks for use in coding the sample data, the Bureau of the Census might be able to retrieve much of the lost employment information.

The really difficult problem is how to improve the collection of data so that the work trips can be assigned to a specific work subzone. It is certainly not clear from the evaluation of the UTPP where the difficulty is. A comprehensive study of the whole data collection and processing techniques may be required to identify what is required to reduce the number of unassigned trip ends to an acceptable level. This effort would certainly be worthwhile in view of the tremendous potential of the package.

Effort should also be continued on developing and evaluating techniques for assigning the missing trips. The main need is to do a quantitative check of the various alternatives so as to determine the accuracy of each technique. This would probably require that an origin-destination survey be taken at the same time the census data are collected.

To develop the necessary attraction generation equation requires that the zone-of-work table be completed. Considerable effort is still required to develop an acceptable technique and to evaluate its accuracy. It appears that a considerable amount of local data will be required to complete the table. Hence, an investigation should be initiated on how to accomplish the needed completion with a minimum of local data.

If the full potential of the UTPP concept is to be realized, effort should be continued on the development of the peak-traffic model concept. This approach looks favorable if all the information of a complete origin-destination study is available. However, it is certainly not clear how this problem can best be handled with a minimum of data.

## The Wilmington Project

Maurice M. Carter, Delaware Department of Highways and Transportation

The Wilmington SMSA is located in the northern part of Delaware and includes New Castle County, Delaware; Cecil County, Maryland; and Salem County, New Jersey. The SMSA had a 1970 population of 500,000 (according to the Bureau of the Census); 386,000

of those persons lived in New Castle County, Delaware—our transportation planning study area. New Castle County represents 77 percent of the SMSAs population and 38 percent of its land area.

We are involved in an Urban Mass Transportation Administration technical study that incorporates a level 3 plan reevaluation. The joint work program uses FHWA and UMTA resources. Our goal is to produce a multimodal transportation plan for the Wilmington region.

Like most early transportation studies, the Wilmington study developed its models to predict only impacts that were highway related. Because of a reevaluation, national as well as local, we are now more interested in predicting the action of people rather than of vehicles. To accomplish that, we are developing new person-trip generation equations from the original 1964 origin-destination study, updating our 1964 base-year data to 1970, evaluating our models by comparing 1970 predictions with 1970 observations, and developing modal-split models by using 1970 socioeconomic data.

This is only the initial portion of our program, i.e., that portion that involves the 1970 census data. To say that in another way, the 1970 census data were intended to provide actual data to satisfy generation equations and to provide data for developing the modal-split model.

The Urban Transportation Planning Package (UTPP) is composed of 4 parts: (a) cross tabulations of data (Part II), data by zone of residence (Part I), data by zone of work (Part III), and work-trip data by zone of residence to zone of work (Part IV). I will give some general comments on Parts I, III, and IV and specific comments on our manipulation of those parts to conform to our needs.

The user's first contact with the package is when he is asked to complete an equivalency listing whereby he assigns his zone numbers to the census data in the blocked area and fictitious zone numbers to areas outside the blocked area and to areas designated by nongeographic entities such as zip codes.

We decided to simply "rename" the census data area for most areas outside our blocked area (the blocked area comprises 93 percent of the population and 36 percent of the land area) in New Castle County. Knowing there was a conflict of geographic boundaries, we felt it was better to keep the identity of the data and reaggregate them rather than to initially allocate them to our already existing traffic zones. I would recommend that procedure to others who intend to use the UTPP, providing data are not lost because of rules of disclosure.

The UTPP provides only residential data because the census bureau inventories people and their living characteristics according to each individual household location. In the Wilmington region 20,000 employees reside outside the SMSA. My original understanding was that we could select 20 locations outside the SMSA and obtain the number of employees coming into the SMSA from each, but, as it turns out, only residential data are provided.

Very little manipulation was necessary for Part I data because the data were by zone of residence. The only areas requiring adjustments were those located outside the blocked area. Generally these were enumeration districts, most of which were larger than our traffic zones and had to be disaggregated to varying degrees. I suggested simply renaming those areas based on data from other sources or, in homogeneous areas, on proportion of residential land area. (For those who feel that control totals must be met exactly, I will make a statistical observation. All data in the UTPP, including population and housing, are sample data. Expansion factors were applied by the Bureau of the Census to sample data according to control totals established by third count summaries. By aggregating these factored data according to a geographic shape other than a census tract, one is almost guaranteed a total having some variance with the control total.) The adjustments having been made, Part I was in working order.

Part III, data by zone of work, was the most exciting challenge. Our immediate needs from Part III were employment by type by zone. Of the data we received, 55 percent of the employment was in traffic zone and needed no manipulation, 39 percent was assigned to zip codes (ZC), and 6 percent was assigned to Universal Area Code (UAC). Remember that 20,000 additional jobs held by nonresidents were not supplied at all. Let me describe the most severe case of allocation.

1. We are given X number of jobs of a specific type in a zone.
2. To that we might add jobs that were assigned UACs. Each zone within that particular UAC area might be entitled to a portion of the UAC area's jobs.
3. If the zone happened to fall in a ZC area that contained jobs (this is true for most of the Wilmington cases), it might have some of those jobs assigned to it.
4. The zone might be entitled to a portion of the nonresidential employment that is not in the package.

Let me interject something about zip codes. First, the U. S. Postal Service has never mapped zip codes. Second, some zip codes, such as 19899 in Wilmington, are designated for boxholders at post offices; in our case, there are 2,500 possibilities of employers, some of whom are not even located in the state of Delaware. Third, the zip code that the job was coded to may represent the location of the home or central office of an employer and not the location of the job. The zip code allocation was difficult; the allocation philosophy varied for each zip code.

Fortunately, we had 2 items that assisted us greatly in making the allocation: an employment inventory for the city of Wilmington completed in 1971 and a survey of land use by acre for New Castle County outside the city of Wilmington completed in 1970. Large employers such as Chrysler, du Pont, and General Motors provided us with exact counts of employees by facility and by SIC code, and those allowed us to arrive at precise employment totals.

Nonresidential employment was a gap that had to be filled before we could consider our task complete. We went to Maryland, New Jersey, and Pennsylvania (Pennsylvania is not part of our SMSA but contributes 45 percent of the nonresidential employment) and requested a count of residents in those states who worked in Delaware. Of course, we had some of our own nonresidential or non-SMSA employees to add. The distribution of this employment group was the last to be made to our multilayered creation.

At last, we had data that satisfied the input requirements for our person trip generation equations, except for one item: automobiles. The UTPP reports the number of cases in a zone having 1, 2, and 3+ automobiles. We were concerned about the 3+ automobiles. With a little investigation, we discovered that automobile control totals for December are used by the census bureau and also by our State Planning Office to represent the year. With the aid of regression analysis, we found relations between population, income, and automobiles and have been able to create a zonal automobile table that balances with the desired region control total. So, even though the UTPP did not provide automobiles directly, the data could be obtained with the information given.

Our conclusions with regard to Part IV of the UTPP should be obvious by now. Because of the extensive reworking that was necessary in Part III, matching the productions and attractions was impossible. Our conclusion is that the trip table is virtually useless for transportation planning because, in approximately 45 percent of the cases for residential data, the attraction end of the trip is in a location other than the actual location, and matching the specific attraction to its related production is impossible. That does not mean that there is not some good information in the table. The modal relations on an areawide basis have proved to be accurate.

To summarize, I consider the following to be the major shortcomings of the package:

1. Nonresidential employment data are not provided;
2. For population and dwelling units, the data are sample data and, therefore, are subject to expansion error;
3. Automobile tables do not contain precise counts for cases having more than 2 automobiles;
4. The small area geographic accuracy for employment coding is inadequate, i.e., too much emphasis is given to coding by zip code; and
5. Given the above, part IV should be deleted from the package for economic reasons.

Some of my comments may sound pessimistic. The fact is, however, that the package works for the Wilmington region. Granted we had to tack on 6 man-months of work to make it operational, but it works. Those who are considering the purchase of the UTPP

will have to evaluate their specific cases, and the Bureau of the Census provides preliminary data that are helpful in that evaluation. We think the package is good; it just needs refining.

## The Tri-State Region

Haden Boswell, Tri-State Regional Planning Commission

In order to show how the Tri-State Regional Planning Commission has used data from the 1970 census, I want first to define our region briefly and describe our role as a census processing center. I shall also describe in more detail our experience so far with the journey-to-work and the Urban Transportation Planning Package (UTPP) because I believe it is unique and will be of interest to you.

### THE REGION

The Tri-State region comprises 8,456 square miles, including parts of 3 states, 27 counties and planning regions, and more than 600 communities. It contains 11 (1970) SMSAs, about 140 Universal Areas, and 4,521 census tracts.

According to the 1970 census, the population of the region was 18.7 million, a gain of 11 percent since 1960. More than 15 percent of this population is nonwhite. The population total includes 75 percent of the population of New Jersey, 67 percent of New York, and 52 percent of Connecticut. On a typical workday in 1970 there were 7.4 million journeys to work; 25 percent of those ended in the Manhattan central business district. Sixty percent of all the work trips were by automobile, an increase of 39 percent since 1960. Transit trips dropped from 48 percent in 1960 to 37 percent in 1970. There are 7.5 million registered vehicles in the region, and 85 percent of all their travel is on highways.

### DATA BASE

To establish its planning data base, Tri-State in 1963 conducted field surveys in the intensively developed urbanized area of the region. A home interview survey of 1 percent of the households (57,000 interviews) gathered detailed demographic and travel data. A land use survey field-listed all blocks in the urbanized area portion (except those in New York City, which were compiled from tax assessor records). Truck, goods movement, taxi, and external (cordon crossing) surveys were also accomplished at that time.

To cope with the processing and analysis of data for a region this size, Tri-State developed the square-mile data cell, defined by X-Y coordinates. Data from the surveys, originally coded to the block, were aggregated to these square miles, which are represented visually in many forms in our planning process. The origins of these are the data map, computer produced in strips and photographically reduced. Another form in which square-mile data are represented is the "stick model," a 3-dimensional approach that also begins with the data map.

The square-mile data cell is an example of our regional approach to this large land area, an approach that is often at variance with census geography.