Evaluation and Use of the 1980 Urban Transportation Planning Package in the Delaware Valley Region

Thabet Zakaria

In 1983, the board of the Delaware Valley Regional Planning Commission (DVRPC) authorized $50,000 for the purchase of the 1980 Urban Transportation Planning Package (UTPP) for the Delaware Valley region, which includes portions of Pennsylvania and New Jersey. Specifically, the region includes four suburban counties in Pennsylvania (Bucks, Chester, Delaware, and Montgomery), four suburban counties in New Jersey (Burlington, Camden, Gloucester, and Mercer), and the city of Philadelphia. The Delaware Valley includes an area of 3,833 mile^2 and a population of more than 5 million. There are 352 municipalities, including such major cities as Trenton and Camden in New Jersey and Chester in Pennsylvania.

DVRPC received the UTPP data tapes in 1984, almost 4 years after Census Day in 1980. Work has been initiated to process and print data for various levels of geographic units for purposes of transportation planning analysis and evaluation and for project studies. Because the contents of the UTPP are extensive, work on the processing and evaluation of data is still under way and will continue into 1985.

The purpose of this brief paper is to discuss the experience of DVRPC with the UTPP data with special emphasis on the journey-to-work information and other socioeconomic information useful to transportation planning. Some specific problems with the 1980 UTPP are defined, the uses of data in several DVRPC planning projects are described, and some recommendations for improving the quality of the 1990 census data are offered.

CONTENTS OF THE 1980 UTPP AND AREAL SYSTEM

The UTPP information was collected from the 1980 long-form census questionnaire distributed to about 17 percent (1 in 6) of all households. However, because of census budgetary constraints, only one-half (1 in 12) of this sample was processed for work-trip information at the place of work (1). The UTPP consists of six parts containing 82 tabulations of data items, including basic socioeconomic characteristics of the population and workers such as income, sex, age, race, households, housing units, car ownership, and employed persons. The UTPP also includes information on work trips, travel time, car occupancy, carpools and vanpools, and vehicle types used in the journey to work. Nonwork trips, however, were not collected in either the 1970 or 1980 census (2).

The data were collected using census areal units consisting of blocks, block groups, tracts, Minor Civil Divisions (MCDs) (townships, boroughs, cities, and villages), counties, and Standard Metropolitan Statistical Areas (SMSAs). In 1975, the DVRPC grid system was converted to the census areal system to avoid the time-consuming preparation of a correspondence (equivalency) table between the two systems, which was necessary for the 1970 UTPP.

DVRPC requested the Census Bureau to produce all six parts of the 1980 UTPP

for the three Delaware Valley region, including information for 20 external counties and cities, which were specified for Part VI of the UTPP. Based on DVRPC experience with the 1970 data, it was felt tht the 1980 UTPP would satisfy the majority of data requests for transportation planning studies that would be conducted by DVRPC staff, its member governments, or transportation consultants.

EVALUATION OF THE 1980 UTPP DATA

A review of the 1980 UTPP data for the Delaware Valley region indicated some programming, definitional, and statistical problems. Unlike the 1970 UTPP, however, the 1980 data on work-trip destinations do not contain trips not identified by block, tract, or MCD (1). Generally, the data on population, household, car ownership, employed persons, and other socioeconomic characteristics obtained from Part I are quite accurate and do not require any adjustment due to sampling errors or other errors. Part I data compare favorably with the 100 percent census counts. The magnitude of differences between the population produced from Part I and from the 100 percent counts for tracts, MCDs, and counties is small (less than 1 percent) and as such is acceptable for planning purposes.

Parts III, IV, V, and VI contain trip data to the place of work for various geographic units such as tracts, MCDs, and counties. If trip destinations by resident and nonresident workers living in commutershed areas are added together, the sum will be approximately equal to the number of jobs, or employment. A certain percentage of these work-trip destinations (employment) should be added to account for workers who were absent during the census week due to illness, vacation, or other personal reasons and for workers who had more than one job (3). Based on the Bureau of Economic Analysis (BEA) and DVRPC employment data, the UTPP employment, or number of trips to the place of work, was increased by 9.27 percent, 1.54 percent for absenteeism and 7.73 percent for multiple-job workers (4). A comparison of UTPP employment before and after adjustments for selected municipalities, counties, and the total region showed that the percent difference between the adjusted UTPP employment estimates and those estimated by BEA or DVRPC is small. The differences between the two sets of regional and county employment data range from 0.2 to 2.6 percent.

Most parts of the UTPP include information on the worker's mode of transportation to work. The travel-mode proportions appear to be reasonable because they compare favorably with DVRPC highway traffic counts and transit surveys for individual counties and the region. Table 1 shows that the

TABLE 1 Comparison of 1980 UTPP and DVRPC Work-Trip Estimates for Highway and Public Transportation

		1980 Highway and Public Transportation Work Trips			
		UTPP			
Areal Unit	Mode	Unadjusted	Adjusted	DVRPC Estimates	Percent Difference
Philadelphia CBD	Public transportation				
	Railroad	41,493	45,642	40,945	11.5
	Subway-elevated	40,442	44,486	57,649	-32.8
	Surface	55,903	61,493	46,223	33.0
	Total	137,838	151,621	144,817	4.7
	Highway	80,758	88,834	87,274	1.8
DVRPC region	Public transportation	285,366	313,902	315,700	-0.6
	Highway	1,577,760	1,722,914	1,648,810	4.5

difference between the UTPP data and actual counts for total public transportation work trips is less than 1 percent. However, such a difference becomes large for travel submodes within smaller areas. In the Philadelphia central business district (CBD), the difference in the category of subway-elevated trips is about 33 percent. These large differences are mainly due to incorrect responses to the questionnaire. It appears that many respondents confused the access mode to the subway station with the subway mode, which is supposed to be the principal mode of travel to work according to the census definition. Bus or trolley rather than subway was reported as the principal means of transportation of workers in some areas. As shown in Table 1, the surface trips (bus and trolley) are overestimated as much as the subway-elevated trips are underestimated.

These problems are similar to those experienced with the 1970 UTPP (5). However, the magnitude of 1980 errors is smaller. For these reasons, the UTPP trip information should be adjusted before it is used for transportation planning.

USES OF THE 1980 UTPP AT DVRPC

Since the early 1970s, DVRPC has been forced to rely on census data for transportation planning and travel forecasting because of rising costs of large-scale data collection such as regional home interviews and employment and land use surveys. DVRPC used the 1970 census data to check and validate traffic simulation models for producing traffic analyses based on up-to-date information. Census work trips, housing statistics, car ownership, employed persons, and employment data were used to estimate trip generation and distribution patterns between transportation simulation zones. In addition, information about the journey to work and other characteristics of workers has been used by DVRPC, local and state governments, transit operating agencies, and private corporations to make a variety of decisions on transportation and locational matters.

The uses of the 1980 UTPP in the Delaware Valley region are somewhat similar to those applications outlined in the Transportation Planners' Guide to Using the 1980 Census (3). These include the study of bus circulation patterns, location of park-and-ride lots and express bus service, study of accessibility and special population segments, analysis of highway and transit trips, planning of highway and public transportation systems, planning and analysis of projects, update of traffic simulation models, analysis of work-trip trends, location of shopping centers and service industries, analysis of parking requirements, and studies of employment.

DVRPC has already used census data in various studies and will continue to use such data in transportation planning and nontransportation planning activities because it is the only comprehensive information at the regional and local levels. There are at least six major uses of the 1980 UTPP in the Delaware Valley region. Some of these have been completed and some will continue into the future.

Establishment of a Data Base for Transportation Planning

DVRPC has prepared a data bank for transportation planning at the block-group and tract levels. This information includes population, employment, work trips, car ownership, and other socioeconomic variables required for traffic simulation and transportation analysis and planning. Such data have been extracted from Parts I, III, IV, and V of the UTPP. All data items have been edited for reasonableness based on other census data and DVRPC surveys, traffic counts, and employment files. These data will be used in most transportation system and project planning studies.

Preparation of Data Summaries and Evaluation of Trends

DVRPC completed a report on the journey-to-work trends in the Delaware Valley region (4). This report compares the 1970 and 1980 journey-to-work information, means of transportation for commuting to work, employed persons, and employment at the county and regional levels. It also analyzes the commuting flow between the counties of the Delaware Valley region and surrounding counties and cities. The report was well received by planners and decision makers because it provides factual information about trends in development and travel patterns in the region. For example, Table 2, taken from the report, shows the 1970-1980 trend in the distribution of Montgomery County workers by place of work. Other tables show the trends in employment and mode of travel for all DVRPC counties.

Six short data bulletins were also published. Each includes one or two information items obtained from Parts I or VI of the UTPP. For example, a bulletin was prepared on car ownership growth between 1970 and 1980 for the counties in the Delaware Valley region. It also includes households stratified by the number of cars owned (zero, one, two, or three or more cars).

Update of DVRPC Traffic Simulation Models

A project has been initiated to update the DVRPC travel forecasting models using the 1980 UTPP. As mentioned before, the 1970 UTPP was used to check and update the DVRPC traffic simulation models. These models will be updated again using 1980 census data. The DVRPC travel simulation models follow the traditional steps of trip generation, trip distribution, modal split, and travel assignment and utilize the computer programs included in the federally sponsored Urban Transportation Planning System (UTPS). A careful review and evaluation of the results of each model will be conducted and necessary adjustments will be made

TABLE 2 Montgomery County Resident Workers: Distribution by Place of Work *(3)*

Place of Work	No. of Workers 1970	No. of Workers 1980	Percent Difference
DVRPC region			
Bucks County	8,488	14,325	68.8
Chester County	5,900	10,525	78.4
Delaware County	5,897	7,773	31.8
Montgomery County	158,986	204,673	28.7
Philadelphia	54,489	55,598	2.0
Burlington County	1,632	532	-67.4
Camden	3,089	1,643	-46.8
Gloucester County	883	225	-74.5
Mercer County	1,877	354	-81.1
Total	241,241	295,648	22.6
Outside DVRPC region			
Berks County	2,499	3,070	22.8
Lancaster County	82	172	109.8
Lehigh County	633	773	22.1
New Castle County	513	282	-45.0
Northampton County	665	196	-70.5
Other	5,504	4,185	-24.0
Total	9,896	8,678	-12.3
Total workers	251,137	304,326	21.2

to achieve the most accurate calibration. The simulated traffic volumes will be compared with actual highway traffic counts and public transportation ridership to assure that acceptable accuracy of the simulated results is obtained from these models.

Use in Highway and Transit Corridor Studies

The 1980 UTPP data, especially the journey-to-work information contained in Part IV, have been used in three transit corridor studies to check the travel demand or ridership for each transit submode, including high-speed rail line, express bus and park-and-ride service, and local bus service. The 1980 data will also be used in many future highway and transit studies because it is the only information available for transportation planning. The use of these data minimizes any large-scale data collection and decreases the rising costs of surveys required for transportation planning.

Application in Strategic Planning and Economic Development

DVRPC has used the 1980 UTPP information on employment, particularly Part V, to evaluate the significant changes in the type and location of industries and commercial establishments. This evaluation will result in recommendations and strategies aimed at attracting new industries and high-technology firms to the Delaware Valley, Also, employment information is useful to the redevelopment of declining areas of old urban centers and provision of the required physical improvements for their rehabilitation.

Provision of 1980 UTPP Data to Public Agencies and Private Corporations

Finally, DVRPC intends to sell the 1980 UTPP data to any public or private agency involved in planning or urban studies. This may include studies for housing, finance, real estate, health facilities, social services, economic base, and economic development. It appears that some planning agencies and private companies in the Delaware Valley region are interested in obtaining the UTPP information for their various studies.

FINDINGS AND CONCLUSIONS

Generally, the 1980 UTPP for the Delaware Valley region contains data of good quality for transportation planning, economic base and employment location studies, urban development analysis, and planning and evaluation of public services. However, the evaluation of UTPP data indicates a few programming, statistical, and bias problems. Most of these problems were resolved before DVRPC used the UTPP for trend analyses, information purposes, traffic simulation, highway and transit project studies, and strategic planning. The errors in the 1980 data are generally smaller than those found in the 1970 UTPP. Trip and employment information should be adjusted before it is used in transportation planning studies because it does not include all workers or jobs.

Most of the 1980 UTPP problems and errors can be avoided in the 1990 census by quality control edits and a careful review of the census questionnaire, sample size, and the computer programs required for processing the information. Specifically, the journey-to-work questions should be simplified to prevent any confusion on the part of respondents on such questions as mode of travel and industry classification. The questionnaire should be redesigned to capture

multimodal trip information from the place of residence to the place of work. The employment categories should be simplified to avoid any error or misunderstanding in the employment sectors. The sample size (8.3 percent) for coding work-trip destinations should be increased 100 percent, as originally planned, to improve the quality of the trip matrix used to calibrate trip distribution models for travel forecasting. The format of the UTPP tapes should be simplified, and the print program should be made operational for any urban region. Concurrent with the 1990 census, samples of nonwork trips should be collected by density of development for several urban regions around the country. Finally, a more timely release of the 1990 data is obviously important to all census users.

ACKNOWLEDGMENT

This paper was financed in part by the Federal Highway Administration and Urban Mass Transportation Administration of the U.S. Department of Transportation and by the Pennsylvania and New Jersey Departments of Transportation.

REFERENCES

1. P.N. Fulton. Allocating Incomplete Place-of-Work Responses in the 1980 Census Urban Transportation Planning Package. In Transportation Research Record 981, TRB, National Research Council, Washington, D.C., 1984.
2. 1980 Urban Transportation Planning Package: Detailed Specifications. Bureau of the Census, revised June 1982.
3. A.B. Sosslau. Transportation Planners' Guide to Using the 1980 Census. FHWA, U.S. Department of Transportation, Jan. 1983.
4. The Journey-to-Work Trends in the Delaware Valley Region 1970-1980. Delaware Valley Regional Planning Commission, Philadelphia, Pa., April 1984.
5. R.C. Stuart and M.R. Hauck. The Census and Urban Transportation Planning. Final Report. U.S. Department of Transportation, March 1976.
