Experience with the 1980 Census Urban Transportation Planning Package in the Washington Metropolitan Area

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ABSTRACT

The planned uses of the Urban Transportation Planning Package by the Metropolitan Washington Council of Governments and its experiences to date are summarized. Some recommendations for the 1990 census are made.

The 1980 census journey-to-work data were obtained by the Metropolitan Washington Council of Governments (COG) from the Bureau of the Census in 1982. The data formed a major part of a multiyear regional transportation planning work program that was designed to develop a new, updated data base and to serve as a basis to verify or revise existing travel models (such as those for trip generation, distribution, and mode choice). In addition, comparisons with prior surveys could permit the development of trend data showing areas of growth and change. The relationship between census data and the validation process for a model of traffic estimation procedures is shown in Figure 1. (The roman numerals relate to COG work program tasks.)

Because census data only provide information on work travel, the Transportation Planning Board (TPB) of COG in cooperation with its member agencies

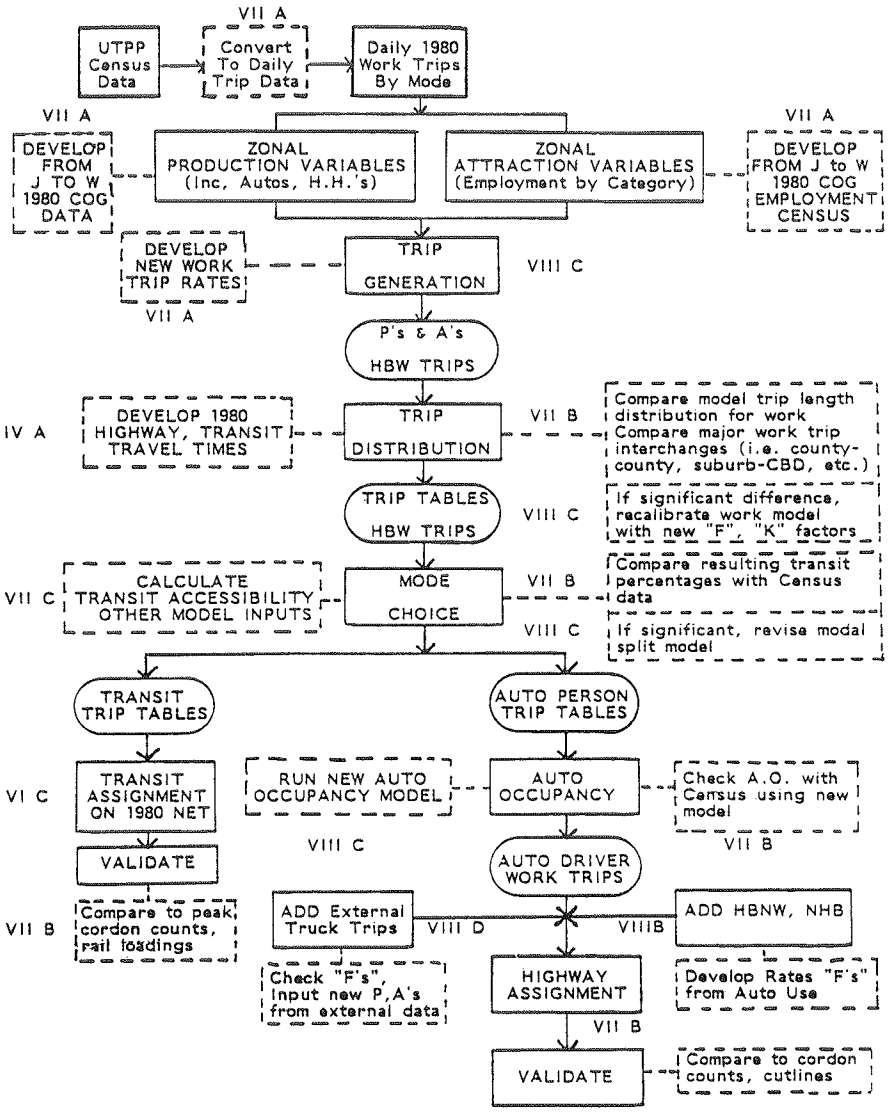

FIGURE 1 Flow chart of 1980 model validation.

undertook several small-scale supplemental surveys to add information on nonwork travel. These included analysis of an automobile use study conducted in 1980 and a roadside travel survey of traffic crossing the outer boundaries of the study area. The automobile use survey obtained information through a mail questionnaire on the use of vehicles in selected sample households.

Both surveys obtained information that could supplement work-trip relationships developed from the census. Nonwork vehicle trip generation rates and trip distribution factors were checked and revised as necessary using these survey data.

INITIAL TABULATIONS

Because TPB's basic data were all derived from the regional home interview and from external and truck-taxi surveys conducted in 1968, many participating agency representatives were anxious to obtain and use the census data base for their own analysis and planning purposes. TPB staff designed a three-part data summary that could be released at no charge to participating agencies. This data set would contain tabulated information (zone level) at the home end and the work end. In addition, county-to-county information was also provided. TPB had agreed to obtain travel data between the Baltimore and Washington regions, and this information was also included in the summaries made. Data on a detailed trip interchange basis could be made available on request as needed.

PROBLEMS

Tabulations and dissemination of the residence-zone data from Part I of the Urban Transportation Planning Package (UTPP) and of the county-to-county data from Part VI were quickly accomplished. Comparisons with TPB simulated travel data were dependent on reconciling the definitional difference between a trip made yesterday (or not made) and the census question on usual mode of travel. An analysis of rates of daily work trips indicated that census data should be adjusted by a factor of 0.85 to produce data comparable with home interview trip information.

Data by submode of travel did not seem consistent or reliable. In the census the primary mode of travel used is requested, not all modes, and the choice of the primary mode is left to the respondent. It was found desirable to combine bus and subway responses into a public transit subtotal rather than report these modes separately.

Although these problems could be overcome with minimal effort, other checks with independent sources revealed that more extensive adjustments were required before the information could be used at detailed levels of analysis.

CODING DISCREPANCIES

COG had conducted a Regional Employment Census (REC) in 1980. This REC was based on state bureau of employment security records; firms that had more than one location were called to determine the distribution of jobs by location. This file had been address coded by establishment to the block and zone level. Total REC employment was 1,665,000 jobs (this included some part-time workers and second-job holders not accounted for by the census) compared with the UTPP Part IV (zone-to-zone) total of 1,607,000. Of these, 2,000 records representing 67,000 workers were coded to other than traffic zones. Adding the 44,000 workers who commute into the Washington area as determined from UTPP Part VI brought the total to 1,651,000 jobs, 111,000 of which are not coded or allocated to zone. These trips are missing at this level of destination geography.

A comparison of the adjusted census zone-level data with the 1980 REC indicated large discrepancies in many areas, however. Some comparisons are shown in Table 1.

TABLE 1 Comparisons of 1980 Census Journey-to-Work Data at Major Employment Sites with COG 1980 REC

Area	No. of Trips	
	Census	REC
Washington, D.C., central business district	146,426	138,966
Virginia		
Springfield	23,950	20,909
Crystal City[a]	17,140	24,817
Tysons Corner[a]	12,961	27,136
Rosslyn	12,532	15,534
Merrifield[a]	11,666	17,548
Langley	10,613	6,700
Vienna	9,814	7,544
Ballston	8,742	6,900
Reston	7,423	4,836
Alexandria central business district	6,540	8,500
Bailey's Crossroads	4,649	7,152
Cameron Run	2,481	6,000
Total	128,511	153,396
Maryland		
Silver Spring[a]	27,451	17,500
Bethesda[a]	26,298	18,212
National Institutes of Health[a,b]	14,325	18,600
Andrews Air Force Base[a]	10,922	15,500
Friendship Heights	10,096	11,700
Prince George's Plaza	9,504	6,900
Wheaton	7,585	6,300
New Carrollton	7,930	8,451
Suitland	6,613	5,400
North Bethesda[a]	6,589	13,013
Largo	1,464	4,739
Total	128,777	126,311

[a]Greater than 4,000 difference.

[b]Institute of General Medical Sciences.

INTERIM CORRECTIONS

A two-part process was agreed on to reconcile the foregoing differences. First, a listing of areas where a comparison of census UTPP and REC data exceeded an absolute total job difference of 4,000 was sent to the Census Bureau for investigation and possible correction. A listing of major employers in those zones was sent to the bureau as well. As of this writing, the bureau has corrected the data from some of the sites. As shown in Table 2, the revised UTPP file is within ±10 percent of the REC for the data from three of the four corrected sites. Because these corrections took time, it was also decided to

TABLE 2 Comparison of Adjusted UTPP with Original Totals

Area	UTPP		
	Original	Adjusted	REC
Bethesda	26,298	20,016	18,212
National Institutes of Health	14,325	17,413	18,600
Andrews Air Force Base	10,922	12,096	15,500
North Bethesda	6,589	12,263	13,013
Total	58,134	61,788	65,325

go ahead and adjust the uncorrected UTPP file to match the REC totals. This was done by computing factors relating the REC and UTPP job totals at the work end by district (groups of zones). All origin districts were given a factor of 1 and a Fratar factoring process was applied. This process has the effect of readjusting the trips between districts so that the REC totals would be hit at the destination district level and so that the same number of trips would originate in each zone of origin as reported by the UTPP.

This latter file is now being used as the corrected journey-to-work data set for the Washington metropolitan area. It is adjusted at the district level to match 1980 REC employment. [It should also be noted that all downtown and central business district (CBD) zones with large numbers of employees were treated as districts in the factoring process.]

This file is an interim file and will be used until the revised census journey-to-work file is received from the bureau. That file may contain different numbers of trips by mode than the interim file, depending on whether address coding changes affected each mode equally in the recoding process.

USES OF THE CENSUS DATA

Checks of Model Output

Considerable use of the census UTPP data has already been made and more is planned. An early task was to compare the UTPP census data with the results of regional travel simulation models developed from 1968 data and run for 1980. This was done at a jurisdiction-to-jurisdiction level by mode of travel. This comparison was of considerable interest to the TPB Technical Committee because it indicated the degree to which existing travel simulation models were accurately predicting travel by mode between major geographic areas.

Conclusions from this analysis were as follows:

1. Work person trips were understated by the current model process by approximately 10 percent. This could be explained by recognizing that the common tendency to form a triangular trip to home from work (i.e., work to shop to home) was reflected in the home interview data and the model but not in census data.
2. There was a consistent bias toward understating suburban and exurban work trips and overstating closer-in origins. This indicated the need to improve the work-trip generation relationship by geographic area. A new person work-trip model has already been developed by using the UTPP data. This model shows marked improvement over the prior relationship developed with 1968 data.
3. It was noted that some model-derived county-to-county work interchanges were being systematically under- or overstated compared with the census data. Work trips to the central area were consistently understated, whereas reverse commuting was consistently overstated. This indicated a need to revise the trip distribution model. This work is under way.
4. Estimated transit use was higher than that reported by the census. This was due almost entirely to differences in two in-close jurisdictions, indicating that revisions to the mode-choice model needed to be made. This work will be undertaken by a consultant using the UTPP data.
5. A prior study using the 1977 Annual Housing Survey journey-to-work data had confirmed that carpool formation was higher from outlying areas than COG's automobile occupancy model had been forecasting. A revised automobile occupancy model was developed using the 1977 data. That revised model will be checked with the 1980 UTPP data.

Trend Analysis

Considerable use of the UTPP census data has been made in comparing 1968 (and in some cases 1970) data with the 1980 results. Major travel demand increases have been noted within and between suburban and exurban areas, with little growth in the CBD. Travel to the CBD has also increased, though by a smaller amount. This kind of information lends itself to political and public presentation and was presented to citizens and professional groups. A nationwide study of work travel trends between 1970 and 1980 was recommended and federal funding support has been approved.

Service Projects

Several service (technical assistance) projects are under way for state and local governments using the UTPP data, and several more have been approved. They are discussed in the following.

Maryland Department of Transportation

A new interregional study of the area between the Baltimore and Washington beltways is being made. Because the UTPP file covers travel movements between the two regions, a single new modeling process can provide for better peak-hour travel estimates (based on commuter patterns) than two independent processes with artificial high-volume cordon (external) stations dividing the joint study area.

This program is being carried out with the participation of the Baltimore Regional Planning Commission and is expected to produce improved traffic forecasts in this area, where current techniques are inadequate.

Montgomery County, Maryland

A study is being made of the patronage expected on the Metrorail extension expected to open late in 1983. This study uses the 1980 census data as a base along with existing mode choice and travel in the corridor to determine potential use of stations along the new line. Mode of access is also considered in the analysis by using the experience on other existing rail lines in the region.

Fairfax County, Virginia

A study of the current use of transit by Fairfax County residents and the development of a simplified mode-choice technique for use at the project and subarea planning levels are being undertaken.

Virginia Department of Highways and Transportation

A study is being made of potential patronage on two proposed new commuter rail facilities. This study looks at high-occupancy vehicle and express bus competition. Data on travel demand and carpool use were obtained from the UTPP Part VI, where outlying county commutation movements were reported.

District of Columbia

A study is being made of the current pattern of commuting into and out of (reverse flow) the Dis-

trict to determine the degree to which scarce street space can be reallocated or transit improved to serve current flow patterns. Another aspect of this study is to determine the accessibility of specific types of employment to workers in the D.C. region.

PROS AND CONS

As may be seen from the previous discussion, the 1980 census UTPP journey-to-work data have been extensively reviewed and utilized in the transportation planning process in the Washington area. There are more than 75,000 individual records representing 1,650,000 workers in 1980. It should be recognized that census data bring some inherent problems as well as provide a new data source for transportation analysts and planners.

Cons

The following problems appear inherent in these data:

1. There are certain basic definitional differences between the way the census views the journey to work and an actual trip. The difference between "usual" and "yesterday" and the triangular nature of many work trips (serving some other intermediate trip purpose) need to be dealt with.
2. Comparisons of census employment location coding with an independent data source indicates that more effort is needed to code accurately to the traffic zone or district level. Although trips to downtown and to urban areas were compatible, trips to outlying suburban centers were underrepresented in most cases.
3. Not all trips were coded to the zone level of geography. Adjusting the trips that were may not accurately represent those that were not.
4. Certain key data items useful for transportation planning were not collected. This includes information on the cost of parking, departure and arrival times for the work trip (peak hour, peak period, and nonpeak), and a listing of all modes of travel used.
5. Considerable additional staff effort was needed to produce a file considered suitable for use in recalibrating models or for use at the individual planning project level.

Pros

The following positive statements may be made:

1. The census data have been used extensively. It is unlikely that any other comprehensive data source could have been developed and used within the time and cost associated with the census data.
2. Parts I, III, and VI of the UTPP have been used most extensively so far. The county-to-county totals are extremely useful.
3. Because the Baltimore and Washington areas could be treated as a unit, there was an opportunity to obtain data in an area that was not handled adequately by two separate data collection and study processes.
4. Although not a file of individual workers, the data seem entirely capable of being used for model verification and development. The data have verified the need for revisions to current travel forecasting procedures.
5. Acceptance of the data by participants in the planning process, even in their current form, is high. As continued experience is gained with the file, other uses and improvements may be uncovered.

CHANGING PLANNING NEEDS AND USE OF 1980 CENSUS DATA

It is trite but true to say that data should respond to needs and not vice versa. A review of transportation issues over the last 30 years leads to the following conclusion: As the urban area expands, more, not less, detail is needed within the urban area. The 1970s saw the birth of subarea and corridor planning, just as the 1960s dealt comprehensively with the urban area. Planning methods used at the subregional scale differ from those at broader levels of analysis. Large-scale, comprehensive inventories of total travel movements were needed in the 1950s and 1960s because forecasts were heavily dependent on trend analysis or factoring up an existing travel pattern. As mathematical models calibrated on these existing data bases replaced actual data in the late 1960s and early 1970s, smaller trip samples could be used to develop acceptable trip data. By mid-decade, disaggregate, targeted sample data tied to behavior could substitute for uniform sample data. A major need emerged to provide updated inputs to the models as well as to verify the stability of the parameters used in the models themselves.

New planning issues have emerged at these finer levels of analysis, including traffic management of peak-hour congestion, parking, access to transit, and the provision of ridesharing and exclusive travel ways for high-occupancy vehicles. The scale of planning has shifted from designing a system of facilities to improving existing routes and services. In many areas, it has become a question of which transit routes within the urban area should be terminated, not one of expanding service.

Comparison of the 1980 journey-to-work data with those of the prior decades has established clearly that travel patterns are more diffuse than ever before. Suburban development is outpacing growth in older central areas many times over, an exurban and intrasuburban travel now dominate the urban areas. By 1990 this growth will blur urban area boundaries as regions merge together. Multinucleated areas such as the Baltimore-Washington region will create new patterns of commuting and strain the capacity of existing suburban and rural transportation facilities.

Can the planning needs of these regions be met by relying on a one-time small sample survey of commuting habits? Are the data provided useful in analyzing building tools to address these issues? The answer appears to be a qualified yes based on a review of the assets and a comparison of them with the options available.

The foremost asset of the census journey-to-work data is their comprehensiveness. The entire area is covered, even a biregional area like the Baltimore-Washington region. Data are provided on commuting from exurban areas. The data have proven useful in a variety of ways, as described previously. They provide control totals and socioeconomic and modal data and they are generally regarded as an independent, unbiased source of information at the local, state, and national levels. The initial cost of $38,000 for the 75,000 records representing 1,600,000 work trips figures out to slightly more than $0.50 per record.

RECOMMENDATIONS FOR 1990

The decennial census in the United States is a marvelous data collection device. Collecting the data is three-quarters of the battle. Relatively minor additions to content can provide the additional data needed. This is not to say that data on work travel are all that is needed. Metropolitan planning organizations (MPOs) and others will have to supplement

census data to cover nonwork travel and to keep travel patterns up to date.

A major change can be made in the coding of work addresses. One option is to allow MPOs and local governments to perform this function in the future. This will permit more rapid processing, because coding can proceed simultaneously with data collection, not sequentially as it does now with the Census Bureau doing it all. MPOs and localities can selectively process by sampling the file and code to levels of geography according to their needs.

To avoid the problem of confidentiality, all that is needed is for the Census Bureau to supply a list of addresses to the MPO, local government, or state identified only with a serial number that the Census Bureau can relate back to the interview. After local coding of these anonymous addresses, the Census Bureau can rematch them to the proper interview and provide summary data according to the rules now in effect.

Certain additional data are needed in order to make the data base more relevant to current planning issues. These include information on

1. Departure and arrival time for the work trip,
2. Parking cost, and
3. All modes of travel used.

Data are also needed, most importantly, on whether a work trip was made yesterday and what mode was used (as opposed to the usual mode).

SUMMARY

Despite its shortcomings, the census journey-to-work data are a valuable asset for transportation planning. The experience with and use of the 1980 data in one urban area have been reviewed. Although changes need to be made in 1990 to improve turnaround time and reliability, planning in the 1990s will require the kind of comprehensive information provided by this type of survey. Certain relevant additions can also greatly enhance the utility of the data base at little additional cost. User-based geography (i.e., traffic zones) is essential.

Transit agencies would also be well served by a question relevant to whether any household member used transit yesterday for a nonwork transit trip. This question would complete the picture of transit use in a region and enable the MPO and transit authority to develop relationships that would be extremely useful to forecast total transit demand. Above all, user-based geography is essential if the data are to be relevant to needs.

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

THABET ZAKARIA

ABSTRACT

The 1980 Urban Transportation Planning Package (UTPP) for the Delaware Valley region is analyzed with special emphasis on journey-to-work trips, employment, mode of transportation to work, car ownership, employed persons, and other socioeconomic data essential to transportation planning and travel forecasting. A review of the UTPP computer tapes and data showed some programming, sampling, and bias problems, which were resolved before the data were used as a base for trend analysis, traffic simulation, highway and transit project studies, strategic planning, and economic development. The trip information should be adjusted before it can be used for transportation planning. The errors in the 1980 UTPP data are generally small and the package shows a significant improvement over the 1970 UTPP. Most of the 1980 UTPP problems can be avoided in the future if the recommendations made in this paper and by other interested planning agencies are considered in the 1990 census.

Information on 1980 census work trips, employed persons, employment, and many other socioeconomic variables is available in the 1980 Urban Transportation Planning Package (UTPP). The UTPP is a special tabulation of census data used in transportation planning by individual Standard Metropolitan Statistical Areas (SMSAs) and tailored to a geographic area. The tabulations and data items were specified by an ad hoc committee of transportation planners representing TRB's Committee on Transportation Information Systems and Data Requirements. Funding for the development of the UTPP program was provided by the U.S. Department of Transportation.

In June 1983 the board of the Delaware Valley Regional Planning Commission (DVRPC) authorized $50,000 for the purchase of the 1980 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 miles^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.