

# Uses of Census Data for Travel Research

---

Gordon A. Shunk, *Texas Transportation Institute*

Among the many possible uses often cited for data from the decennial census are those related to travel research. This is appropriate, because the social, economic, and locational data provided by the census are rich in information about factors that affect travel. This value has been enhanced by the journey-to-work data collected as part of several recent censuses. The availability of such information is often greeted enthusiastically by researchers unfamiliar with idiosyncrasies of journey-to-work data. This paper reports that a sample of researchers, having experienced those conditions, are apparently less enthusiastic about using these data for travel research. The value of census data appears to be greater for analyses associated with transportation planning.

The findings reported here are from a brief survey of a broad spectrum of individuals and organizations that appear most likely to use census data for travel research.

In this paper, the term "research" is intended to mean exploratory analysis to identify or determine relationships and includes model *development*. Model estimation, calibration, application, and related activities constitute the largest portion of responses to the survey and are reported here as *planning* activities.

## SUMMARY OF FINDINGS

### Travel Research

Surprisingly little research on travel using journey-to-work data was reported. Only 11 respondents of 56 contacted indicated such activity. The travel research reported consists primarily of analyses of trends and comparisons of travel patterns among cities. Commuting patterns, including mode choice, were examined by seven respondents, and in two cases these were related to location trends. Travel by minorities and the elderly was studied by one respondent, and changes in travel time were examined by another. The travel research also included analyses of funding distributions and the effects of policy actions.

## Data Bases

The journey-to-work data are being used to develop and validate data bases for research and planning. These activities include designing surveys, checking survey results, and verifying data from other sources.

## Demographic Research

Census demographic data are used for several analyses related to transportation. These include population characteristics, income distribution, household structure, and vehicle ownership. Of particular importance are growth analyses of residential location and density trends. Demographic data were also used for Title VI studies.

## Land Use and Development Research

Only one respondent indicated using census data for land use and development research related to travel. That work examined time series of data on transit effects. Analyses of transportation's effect on urban form, housing location, and residential density were also conducted. Research on the effects of development patterns on emissions strategies was reported as well.

## Planning

Since many of the survey responses are more accurately characterized as planning applications of research results rather than as research, those responses are reported here. Those applications include uses of both travel and demographic data from the decennial census. Population, housing, income, and employment data are used by trip generation models for small-area analysis of factors influencing travel and for other aspects of travel forecasting. The other uses include estimating and calibrating travel models and comparing trip length frequencies and origin-destination patterns of trip distribution models.

Traffic peaking studies have also been conducted. The census data are also used for statewide and local transit planning, rural transit planning, transit accessibility analyses, and development of route-level transit models. The census TIGER files are used to develop transportation networks and identify critical facilities.

## DESCRIPTION OF CENSUS DATA USES

This section provides more specific descriptions of the census data uses identified in the survey conducted for this paper.

## Travel Research

Trend analyses and comparisons of patterns are the principal uses of census data for travel research. The Center for Urban Transportation Research (1) has conducted several analyses of census data along with data from the Nationwide Personal Transportation Study. (Numbers refer to the agencies and names of survey respondents listed at the end of this paper.) The conditions and trends of journey-to-work and demographic data for Florida were analyzed and compared with those of the rest of the United States. Trends of use and user profiles for commuting alternatives have been examined, and policy implications for changes in commuting behavior have been considered. Travel behavior of the elderly and minorities has been

examined to identify characteristics and special needs of these groups. Information on minority location and transit use has been used to prepare Title VI analyses for the LYNX transit system in Florida.

The Texas Transportation Institute is analyzing changes in trip times reported between censuses. The Southeast Michigan Council of Governments (SEMCOG) has analyzed 1980 and 1990 census data to identify changes and trends in commuting patterns (16). METRO in Portland, Oregon, has used census data to track mode choice trends for the journey-to-work (4). Another researcher in Portland has analyzed commuting patterns in connection with IVHS studies (23). The University of Toronto has used data from the Canadian census to relate patterns and trends in residential location to commuting patterns (5). The university is continuing this analysis by attempting to develop an integrated land use/transportation model.

The metropolitan planning organization (MPO) for Charlotte, North Carolina, intends to analyze trends of work travel by households between 1980 and 1990 (6). Trends in mode choice and travel times were studied by Caltrans in cooperation with the MPO for the San Diego region (14). The San Francisco Bay Area Metropolitan Transportation Commission (MTC) has analyzed commuting trends and commuter characteristics (15). Researchers at Florida State University have studied trends in residence and job location and travel behavior, specifically mode choice (17). They have also used Public Use Microdata Sample (PUMS) data for disaggregate analysis of mode choice.

Twelve of the 23 survey respondents did not report activities that could be considered travel research according to the definition used in this paper. Several described analyses involving demographic research that are related to transportation and will be reported later in this paper.

### **Transportation-Related Demographic Research**

Historical demographic and economic data have been compiled by The University of Texas and related to census transportation data to analyze and compare historical patterns of growth for 15 U.S. metropolitan areas (7). The Portland MPO is using PUMS to develop models of household structure and vehicle ownership to produce data for use by transportation models (4). This MPO has also used census data to compare demographic characteristics among metropolitan areas and as a source of employment location. SEMCOG has analyzed trends in demographics that are used by its trip generation models to better understand the effects of such changes on travel (3). The University of Toronto is using workplace location data to develop a microsimulation model of residential location (5). Portland State University is assessing a procedure based on housing value and rent to allocate income to blocks within census tracts (8). The Charlotte MPO has also used census data for income and population allocation within census tracts (6). It is using historical census data to develop a vehicle ownership model.

### **Land Use Research Related to Transportation**

Most of the reported research in this area is being conducted at the University of California at Berkeley (9). That work includes an assessment of the effects of BART on the Bay Area, a study of housing location choices and density patterns, and an examination of the effects of urban development patterns on the success of emissions reduction strategies. Other research is being conducted on the relationships between transportation and urban form. The University of Texas is studying land activity data to characterize spatial density patterns in Austin (7).

### **Data Bases and Surveys**

The University of California at Berkeley has prepared a data base on international transportation (9). The University of California at Irvine has used census data to check other surveys (10). The Charlotte, North Carolina, MPO has also used census data for data verification as well as

for survey design (6). The Center for Urban Transportation Research at the University of South Florida has analyzed data from the census and the Nationwide Personal Transportation Study to prepare data bases of demographics and the journey-to-work and to compare results within Florida and with those of other states (1).

MTC used census data to weight and expand the data from a recent household interview travel survey (15). It also used census data to correct for nonresponse bias in that survey. The Association of (San Francisco) Bay Area Governments used census data as the basis for its demographic and land use forecasting techniques (15).

### Transportation Planning Uses

Census data, particularly the journey-to-work information, are used for various aspects of transportation planning but especially travel model estimation, calibration, and validation. Researchers at Louisiana State University have used census data as input for travel forecasting models (11). The Center for Transportation Research has used census data for both statewide and local transit planning (1). Census data have been used for rural transit planning in Massachusetts, Florida, and Utah (18,19,21). Portland, Oregon, METRO uses trip length information from the census to check work trip patterns and frequency distributions (4). MTC has used census data to validate trip distribution and mode choice models (15). The Charlotte MPO also uses census data for trip generation model development (6). This use was widespread according to findings of research at the University of Oklahoma (12).

SEMCOG uses census data to analyze changes in the spreading of peak period traffic (3). Census data are also used by the Michigan Department of Transportation for analyses of transit accessibility (3). MTC has used census data to estimate vehicle ownership and other demographic models (15). The census was the source of information on intercounty commuting patterns and times in Broward County, Florida (19).

Network applications of census data include use of TIGER files for developing rural transportation networks (2). The Michigan Department of Transportation uses data from economic censuses to help define priorities for commercial traffic networks (3). It uses census population data in the formula that distributes state transportation funding to units of local government.

The use of census data is apparently much greater for transportation planning and related analyses than for what is described here as travel research. This is especially true for journey-to-work data.

## PROBLEMS AND RECOMMENDATIONS

The problems encountered in the use of census data can be classified into several categories. The problems include concerns about how questions were stated, the manner in which data are presented in products, and delays in availability. Unfortunately, the list of problems is nearly as lengthy as the number of uses, but survey respondents offered suggestions for overcoming many of the problems.

### Problems with Questions

Concerns were indicated about the questions that ask where persons "worked most last week" and how they "usually get to work." It was recommended that information on workplace be requested for a specific day and that provision be made for persons reporting more than one job. Travel mode should be requested for the day worked, since the current question underestimates little-used modes. It was also recommended that the "worked at home" response be differentiated from telecommuting. Another concern is the incompatibility of census data with data obtained from transportation surveys, specifically the inconsistency in questions about

travel characteristics but also demographic and other socioeconomic data. The limited number and nature of these comments on questions indicate that they have probably been fine-tuned to the satisfaction of most of the user community over the last three censuses.

### **Problems with Coding Detail**

More detail is desired in various tabulations and computer media. The principal recommendations are for more detailed geocoding of workplaces and coding to blocks for entire metropolitan regions. Other requests were for additional disaggregation of socioeconomic data and more detailed cross-classification of household characteristics.

### **Problems with Coding Accuracy**

Geocoding of census data according to local zone systems continues to be a problem. This occurs despite concerted efforts of all parties to alleviate past difficulties. There apparently needs to be better coordination, explanation, and agreement for traffic zone/census tract correspondence and in coding samples that cannot be accurately allocated to locally supplied zones. The allocation process for workplaces not codable was mentioned as a continuing problem from the 1980 census, and accuracy of workplace coding continues to be questionable. In metropolitan areas with more than one MPO, correspondence tables must be coordinated to avoid duplication of zone numbers and the resulting coding confusion. There were also concerns about the accuracy or consistency of place names. Data on inner-city residents, particularly immigrants, were questioned by one researcher.

### **Additional Data Needs**

There is support for obtaining information about nonwork travel. One request was for school and shopping trips. It was requested that information be obtained about trip chaining on the journey to work. Additional information desired included the distance to work, the availability of transit for the work trip, and the distance to a transit stop. Information on level of service by mode was also requested. Other recommendations included providing data for analyzing travel characteristics of elderly and disabled persons. Information on intercity travel and job-related travel other than commuting was also requested. A longitudinal panel to provide better information on travel dynamics was recommended. For perspective, our Canadian respondent is envious of the amount of data available from the U.S. census.

### **Reporting Problems**

There appears to be a need for the census reporting media to be more "user friendly." Problems in understanding the data formats and correctly reading computer data were cited. Problems were reported in reading STF3 because of "cumbersome organization." Geographic identity should be provided on traffic zone records; apparently the space is there, but data were not coded. One suggestion was to improve the downloading software for CD-ROM data. Improvements in documentation of computer data files were requested. The opportunity to special-order tapes with limited data for specific uses was another suggestion. The ability to obtain data organized for specialized geography was requested. Changes in geography between censuses was another reported problem.

### **Data Availability**

The comments on data availability express the traditional concerns about delays from reported schedules (i.e., optimistic expectations), the amount of time to prepare products even when

schedules are met, and the errors that cause additional delays for reprocessing after products are originally released. There was a request that data from previous censuses be available on CD-ROM for ready comparison with 1990 data. The sense of these comments is that the longer the data are delayed and the less specific they are, the less useful they are. Two comments indicated that the difficulties of obtaining and using the data rendered reliance on census data not cost-effective, and the 2000 census would not be used unless there were changes from the 1990 experience.

## CENSUS USER SURVEY

The survey from which the findings reported here were taken was conducted by sending the following request for information to key informants:

- For what research have census transportation data been used?
- For what research closely related to transportation have other census data been used?
- For what transportation or closely related research do you plan or want to use 1990 or 2000 census data?
  - What problems have been encountered using census transportation and related data?
  - What recommendations do you have for improving the census transportation or related data in 2000, other than producing it faster and with more accuracy?

The survey was conducted in three stages. First, surveys were sent to 20 selected, well-known, and respected researchers, primarily at academic institutions, who were considered likely to know of any research conducted at their institution or other organizations. When the response from those people was somewhat negative, a second mailing was sent to 19 additional individuals, including practitioners as well as academic personnel. The results from the second mailing were disappointing, with few responses and little additional comment. Finally, surveys were sent to 17 chairpersons of Transportation Research Board committees requesting that they ask members of their committees at the Annual Meeting for leads to researchers using the census. That resulted in 17 additional potential sources. They were contacted, and several offered additional comments.

## RESPONDENTS TO REQUESTS FOR INFORMATION ON USES OF CENSUS DATA FOR RESEARCH

1. William Ball, Center for Urban Transportation Research, University of South Florida, Tampa
2. Thomas Williams, Texas Transportation Institute, Texas A&M University, College Station
3. Cheryl Parish, Michigan Department of Transportation, Travel Demand Analysis Section, Lansing
4. Keith Lawton, Metropolitan Services District, Planning Department, Portland, Oregon
5. Eric Miller, University of Toronto, Department of Civil Engineering, Toronto, Ontario, Canada
6. Terry Lathrop, for the Mecklenberg Union MPO, Charlotte, North Carolina
7. Shekhar Govind, The University of Texas, Austin
8. Kenneth Dueker, Portland State University, Center for Urban Studies, Portland, Oregon
9. Elizabeth Deakin, Department of City and Regional Planning, University of California, Berkeley
10. David Brownstone, Institute of Transportation Studies, University of California, Irvine
11. Peter Stopher, College of Engineering, Louisiana State University, Baton Rouge
12. Richard Marshment, Department of Regional and City Planning, The University of Oklahoma, Norman

13. Frank Koppelman, Department of Civil Engineering, Northwestern University
14. Gene Pound, California Department of Transportation, San Diego
15. Charles Purvis, Metropolitan Transportation Commission for the San Francisco Bay Area
16. George Janes and Edward Limoges, the Southeast Michigan Council of Governments
17. Greg Thompson and James Frank, Florida State University
18. George Largess, Attleboro, Massachusetts
19. Hal Maggied, Broward County, Florida Metropolitan Planning Organization
20. Kenneth Dallmeyer, Chicago Transit Authority
21. Prabhakar Attalun, Utah State University
22. Richard Stasiak, Florida Department of Transportation, Tallahassee
23. Bob Behnke, Consultant, Portland, Oregon