

Uses of Census Transportation Data by COMSIS Corporation

William R. Loudon, *COMSIS Corporation*

Over the years COMSIS has developed a number of products related to the census as well as other census-related applications. Working with information from 1970, 1980, and 1990, COMSIS has developed many products that are of direct use to both transportation practitioners and policy makers, including technical reports, training materials, trend and factoring information, and topological geographic information. Through technical committee representation and conference presentations, COMSIS has provided extensive insight into the use of the census data. More specifically, COMSIS has provided guidance in the use of census data as related to transportation planning and travel forecasting. This information is integral to the development of travel models and the understanding of work trip making in a specific region.

Census journey-to-work information continues to be a valuable tool for transportation planning. The use of census data provides information that can be used directly and very cost-effectively to generate travel demand models for home-based-work trip making, which is at the core of peak-hour demand. Information related to trips by mode, trip origin-destination patterns, and trip length can be extracted from census data in support of travel demand model calibration and validation.

Over the years COMSIS has developed a number of products related to the census as well as other census-

related applications. Working with information from 1970, 1980, and 1990, COMSIS has developed many products that are of direct use to both transportation practitioners and policy makers, including technical reports, training materials, trend and factoring information, and topological geographic information data. Through technical committee representation and conference presentations, COMSIS has provided extensive insight into the use of the census data. More specifically, COMSIS has provided guidance in the use of census data as related to transportation planning and travel forecasting. This information is integral to the development of travel models and the understanding of work trip making in a specific region.

CENSUS CONVERSION FACTORS HANDBOOK

In order for the 1990 census data to be useful for transportation planners, it must reflect information collected in transportation surveys such as home interviews and on-board studies. COMSIS developed the handbook *Transportation Planning Conversion Factors for Using the 1990 Census*. Inherent to the 1990 census are problems related to biases created by the way in which the journey-to-work questions are asked. Issues related to questions that ask for "typical" or "usual" activity in the previous work week tend to overestimate certain trip making while underestimating others. For example, an

individual might generally use an automobile to go to work but might occasionally use transit. The census data would not reflect any transit use for this case. An analysis compared the 1990 census and the 1990 Nationwide Personal Transportation Survey (NPTS) and developed factors by urban area size. Factors developed include

- **Absenteeism:** related to sick time, vacation, personal business, part-time employment, and business-related travel.
- **Day of the week:** to adjust to any given weekday since certain days represent atypical travel.
- **Mode of travel:** shifts between highway and transit modes.
- **Multiple jobs:** for individuals who hold multiple jobs or make multiple trips to the same place of work from home.
- **Trip chaining:** to distinguish between direct home-to-work trips, as defined in travel model home-based work, from trips that make intermediate stops.

A final analysis included the review of one urban area case study and the use of locally collected survey data as a comparison with the factors developed using the 1990 census and NPTS. This comparison proved to be an important factor in the use of census data for a specific area. Definitions related to trip making and geographic coverage can make the direct comparison of census data with local data difficult. COMSIS was able to provide FHWA with guidance that will foster further investigation of these types of problems.

CENSUS MAPBOOK

The *Census Mapbook for Transportation Planning* was designed to provide many examples of how U.S. census-related data can be utilized to assist with transportation planning and policy decisions. The mapbook includes 49 examples of how census data can be used in travel demand model development and model validation, population forecasting, corridor analysis, and transit route planning.

TOPOLOGICAL GEOGRAPHIC INFORMATION

The Census Bureau issues the Topologically Integrated Geographic Encoding and Referencing (TIGER) File periodically as well as specifically for each decennial census. These files provide the geographic units at which census data are collected. The units or "zones" are integral to the development of transportation planning travel models. Through the use of commercially available geographic information system (GIS) software,

COMSIS has used the TIGER File for numerous planning applications. The development of these zone systems is integral to COMSIS project work and the interpretation of census and locally derived data and forecasts. COMSIS also uses the TIGER File and the National Transportation Planning Atlas Data Bases to develop the computerized highway and transit networks needed for planning studies. These data sets can provide the initial step in the definition of a spatially accurate set of transportation networks and can save a local planning agency months of work in setting up a new transportation model or in expanding an existing planning model.

Through project work related to the conduct of major investment studies (MIS) and the predecessor alternatives analyses (DEIS/AA and FEIS/PE), COMSIS has used the TIGER File for

- Geocoding of addresses using TIGER street networks;
- Worker, employment, population, and other data at the block group or block level that can be analyzed for trip generation;
- Common identifier numbers that can reference any collected demographic information and display it graphically;
- Point data for transportation terminals, churches, schools, cemeteries, parks, and other landmarks;
- Reference coverages for use with other topological information such as wetlands, hazardous waste sites, and floodplains;
- Census feature class codes to extract line segments from the TIGER File and build line coverages for numerous classes of roads, railways, and water features;
- Polygon Geographic Entity Codes to create polygon coverages ranging from county to traffic analysis zone level and the accompanying equivalency tables; and
- Definition of transit walk and drive accessibility markets and densities for transit modes that penetrate specific zones.

The ability of planners to tap the wealth of information in the census is somewhat limited by the lack of computer programs that can access the data. Both the Statewide Element and the Urban Element of the Census Transportation Planning Package (CTPP) have limited the ability of transportation professionals to gain quick and direct access to the data. COMSIS has developed generic, platform-independent Statistical Analysis Software (SAS) programs to access and produce tabular summaries of all tables including both the CTPP Statewide Element, Parts A, B, and C, and the CTPP Urban Element, Parts 1, 2, and 3. The programs are designed to allow the user to specify any geographic summary level included in the CTPP. Summary tables are produced by integrating the CTPP and Geographic Reference

Files (GRFs) to provide accurate naming of each geographic summary level available in the CTPP.

The SAS programs can be easily executed either interactively or in a batch mode. They are available for application on any hardware platform (personal computer, work station, mainframe) by adding the appropriate program control commands and are to be available on the Census Bureau computer Bulletin Board System (BBS) by spring 1996. Each program will produce a formatted set of tabular results.

COMSIS has also provided these and other utilities for using census data that are also available on the Census Bureau BBS. These utilities included routines that make access to the Statewide and Urban elements of the CTPP easier with formatted reports that clarify the expansive detail in the CTPP.

MORE ADVANCED GIS APPLICATIONS

In another more advanced project, COMSIS, working with GIS/Trans Ltd., assisted FHWA in integrating GIS with informational data bases and designing a spatial data base. The product of the study improved the accessibility of the Highway Performance Monitoring System (HPMS) and the National Highway Planning Network (NHPN) to state departments of transportation, FHWA field offices, and other public agencies. It provides organizations that wish to use this information the opportunity to enhance their own planning programs. COMSIS also assisted in improving the National Transportation Planning System through the addition of supplementary data bases and analytical tools in support of the transportation management goals outlined by the Intermodal Surface Transportation Efficiency Act (ISTEA). COMSIS developed import utilities for transferring information between the GIS and the National Transportation Planning System.

A final product of the work was the delivery of transportation-related applications in GIS with the use of video imagery (GIS/video imagery) for use in an FHWA demonstration project (No. 85).

COMMUTER RAIL STUDIES

As an example of direct integration of off-the-shelf census products, COMSIS has developed a set of simplified models for estimation of commuter rail ridership that are independent of the availability of a traditional set of highway and transit networks. Working on projects for the Georgia and Delaware departments of transportation, COMSIS combined the use of the TIGER File and census journey-to-work files to develop a model that estimates ridership based on employment densities at the

destination end of the trip, the in-vehicle trip distance, and automobile access distance, all estimated with readily available census files. This approach has been used directly to estimate ridership (Delaware Department of Transportation) and as a means to provide distance-sensitive validation of a more traditional mode choice logit model (Georgia Department of Transportation). Such applications are good examples of the cost and time savings that are available to state and local governments through the creative application of readily available census materials.

TECHNICAL REPORTS

Under contract to FHWA and FTA to develop Urban Transportation Planning Software (UTPS) planners' aids, COMSIS developed the *Transportation Planner's Guide to the 1980 Census*, which describes available data from the 1980 decennial census of value to transportation planners. The material includes

1. Using census data for analytical and model purposes, information available and reporting mechanisms that the Census Bureau uses in their normal decennial data distribution;
2. A special Urban Transportation Planning Package that brings together in one release for each metropolitan area those data items most useful to transportation planners—the most important features of this package are the data available on a tract or zone basis and the trip information available for the journey to work;
3. Data collection methods to supplement census data; and
4. Uses of census data for analysis and model-related purposes—including current situation assessment, trend evaluation, transit planning, accessibility analysis, park-and-ride lot location, land use and arterial spacing consideration, input to planning models, and model calibration and development.

For FHWA, COMSIS has produced technical reports for the 1969, 1977, 1983, and 1990 NPTS and is part of the technical assistance team for the 1995 NPTS (quarterly sample). This survey gathers a national sample of transportation data, which is then used to develop national trends and figures used by transportation planners. This information complements census journey-to-work data, which are derived from the percentage of the census population requested to provide additional detailed information related to traveling to work. NPTS is a true "survey" sample of individuals, with questions related to a specific survey day.

Before the 1990 NPTS, COMSIS was placed under contract to reassess the survey, which had been conducted

three times (1969, 1977, and 1983). This assessment was a result of a serious threat to eliminate the 1990 NPTS. Major incompatibility was suggested between the growing cost of home interview survey methods (as applied by the Census Bureau) and the available resources to conduct the survey. A thorough reassessment of what the survey was intended to be and what alternative methods might exist to carry out and fund the survey was conducted. COMSIS led a study effort in which the firm

1. Contacted and interviewed past and potential users regarding their needs and problems with the existing data,
2. Performed analysis and assisted discussions to establish priorities for data,
3. Developed alternative survey designs and cost estimates, and
4. Developed recommendations to FHWA regarding survey options and follow-up procedures.

As a result of the reassessment, a major new direction was taken for the survey. It is now telephone based and is being conducted by a private market research firm, providing significant cost advantage and time efficiency. The reassessment allowed the survey to continue on schedule,

enjoy a much larger sample size than the previous survey, and offer the users much greater flexibility in its use.

COMSIS developed the 1980 *Census Training Course Student's Notebook*, which includes comprehensive problems and other materials related to a workshop course on using 1980 census data. The beginner's manual was developed to help the first-time census user on the options related to transportation. The course covered the material in the general census releases as well as in the Urban Transportation Planning Package, uses of the data, and lectures and workshops on data use in trip generation, trip distribution, transit use estimation, vehicle occupancy estimation, and pivot point procedure for estimating travel.

COMSIS summarized information from the 1970 and 1980 census data sets and from the 1960 census publications to a geographic base compatible for the three decennial years to develop the report *Journey-to-Work Trends Based on 1960, 1970 and 1980 Decennial Censuses*, in which the changes that have occurred in population, journey-to-work patterns, mode of travel to work, and vehicle availability at the household level were identified. The report focused on those metropolitan areas of the United States with 1980 populations of 1 million or more. Evaluations were made of the differences in the data over the three time periods.