National Cooperative Highway Research Program

NCHRP Synthesis 236

Methods for Household Travel Surveys

A Synthesis of Highway Practice

Transportation Research Board
National Research Council

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Synthesis of Highway Practice 236

Methods for Household Travel Surveys

PETER R. STOPHER, Ph.D.

and

HELEN M. A. METCALF
PlanTrans

Topic Panel

PATRICK DeCORLA-SOUZA, *Federal Highway Administration*
ROBERT GRIFFITHS, *Metropolitan Washington Council of Governments*
R. LESLIE JONES, *California Department of Transportation*
ELAINE MURAKAMI, *Federal Highway Administration*
CHARLES L. PURVIS, *Metropolitan Transportation Commission, Oakland, California*
PHILLIP A. SALOPEK, *Bureau of the Census*
JAMES A. SCOTT, *Transportation Research Board*
RONALD W. TWEEDIE, *New York State Department of Transportation*

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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

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The program is developed on the basis of research needs identified by chief administrators of the highway and transportation departments and by committees of AASHTO. Each year, specific areas of research needs to be included in the program are proposed to the National Research Council and the Board by the American Association of State Highway and Transportation Officials. Research projects to fulfill these needs are defined by the Board, and qualified research agencies are selected from those that have submitted proposals. Administration and surveillance of research contracts are the responsibilities of the National Research Council and the Transportation Research Board.

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PREFACE

A vast storehouse of information exists on nearly every subject of concern to highway administrators and engineers. Much of this information has resulted from both research and the successful application of solutions to the problems faced by practitioners in their daily work. Because previously there has been no systematic means for compiling such useful information and making it available to the entire community, the American Association of State Highway and Transportation Officials has, through the mechanism of the National Cooperative Highway Research Program, authorized the Transportation Research Board to undertake a continuing project to search out and synthesize useful knowledge from all available sources and to prepare documented reports on current practices in the subject areas of concern.

This synthesis series reports on various practices, making specific recommendations where appropriate but without the detailed directions usually found in handbooks or design manuals. Nonetheless, these documents can serve similar purposes, for each is a compendium of the best knowledge available on those measures found to be the most successful in resolving specific problems. The extent to which these reports are useful will be tempered by the user's knowledge and experience in the particular problem area.

FOREWORD

By Staff
Transportation
Research Board

This synthesis will be of interest to planning, administrative, and traffic officials in state transportation agencies and in metropolitan planning organizations (MPOs); to consultants concerned with the design and conduct of surveys; and to those engaged in developing and applying travel forecasting models. It describes the various facets of planning, designing, conducting, and evaluating household travel surveys.

Administrators, engineers, and researchers are continually faced with highway problems on which much information exists, either in the form of reports or in terms of undocumented experience and practice. Unfortunately, this information often is scattered and unevaluated and, as a consequence, in seeking solutions, full information on what has been learned about a problem frequently is not assembled. Costly research findings may go unused, valuable experience may be overlooked, and full consideration may not be given to available practices for solving or alleviating the problem. In an effort to correct this situation, a continuing NCHRP project, carried out by the Transportation Research Board as the research agency, has the objective of reporting on common highway problems and synthesizing available information. The synthesis reports from this endeavor constitute an NCHRP publication series in which various forms of relevant information are assembled into single, concise documents pertaining to specific highway problems or sets of closely related problems.

This report of the Transportation Research Board provides information on the manner in which many household surveys are currently carried out and provides comment on the likely changes in the process, in the survey instrument, and in the application of more cost-effective methods of data collected in household travel surveys. This synthesis describes the methods for collection, including survey instrument design, as well as testing and administering the surveys. Information on time and cost requirements is also included, as are descriptions of evaluation and data analysis methods.

To develop this synthesis in a comprehensive manner and to ensure inclusion of significant knowledge, the Board analyzed available information assembled from numerous sources, including a large number of state highway and transportation departments. A topic panel of experts in the subject area was established to guide the research in organizing and evaluating the collected data, and to review the final synthesis report.

This synthesis is an immediately useful document that records the practices that were acceptable within the limitations of the knowledge available at the time of its preparation. As the processes of advancement continue, new knowledge can be expected to be added to that now at hand.

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The Principal Investigators responsible for the conduct of this synthesis were Sally D. Liff, Manager, Synthesis Studies, and Stephen F. Maher, Senior Program Officer. This synthesis was edited by Linda S. Mason.

Scott A. Sabol, Senior Program Officer, National Cooperative Highway Research Program, assisted the NCHRP 20-05 staff and the Topic Panel.

Information on current practice was provided by many highway and transportation agencies. Their cooperation and assistance are appreciated.

METHODS FOR HOUSEHOLD TRAVEL SURVEYS

SUMMARY

This synthesis focuses on the household travel survey, which has been a major component of transportation planning for the past 40 years.

Based on a survey of 55 recently conducted household travel surveys from urban areas across the United States and one or two from overseas, the "typical" survey had the characteristics described below.

The typical survey was conducted at the specific time because of aging data and because funds were available within the Metropolitan Planning Organization's (MPO's) and the state's budget. It was conducted in either the spring or the fall and collected data about travel on weekdays only. It was conducted by a consultant retained for this purpose by the MPO. The planned sample size was about 2,500 households, and it was estimated that about 9,000 households would need to be contacted to produce this desired sample size. The survey was conducted using a telephone recruitment, followed by mailing out survey materials, and then retrieving the completed data by telephone. The primary survey instrument was a trip diary sheet.

Sampling of households was done using random-digit dialing (RDD) and non-telephone households were not included in the survey effort. Sampling was most often a stratified random sample. Group quarters were excluded from the sample, and responses were sought from household members of the ages of 5 years and over.

A pretest of the survey instrument was conducted, together with a pretest of some aspects of the management of the survey. The pretest sample was about 75 households, of which about 50 responded. Changes were made to the survey instruments as a result of the pretest.

Progress reports were provided to the MPO/Department of Transportation (DOT), on both a weekly and monthly basis, and task-completion reports were also required. A peer review panel was not used by the typical survey. The MPO/DOT staff monitored recruitment and retrieval calls during the survey.

A toll-free telephone number was provided for respondents to call to confirm the legitimacy of the survey and to ask questions on how to complete the survey forms, and publicity, primarily in the form of newspaper articles and public-service announcements, was undertaken by MPO staff. The typical survey did not offer any incentives to households to respond, but one reminder to respond was provided.

Data were reviewed on a daily basis, and corrections were made to both missing and invalid entries, using some recontacting and some imputation from other survey responses. The MPO/DOT defined certain questions as key and used these to determine retention of household data and to determine what constituted a completed household survey. Data were manually coded and keypunched, and geocoding was done through a mix of manual and computer address matching. Geocoding was checked independently for accuracy. Most commonly, TIGER (Topologically Integrated Geo Encoding and Referencing) files or GBF/DIME (GeoBase File/Dual Independent Map Encoding) files were used as the source of geocoding, and coding was done to the traffic analysis zone.

The median household travel survey cost just over $240,000 for consultant services (agency staff costs and other costs not included in the consultant contract were not included)

and the median cost of a completed household was about $92. (The average total cost was over $400,000 and the average cost per household was $106, with an average sample of 4,200 households.) The survey typically took considerably longer than was estimated by the MPO/DOT when the Request for Proposals (RFP) was issued, averaging between one-and-one-half and two times the original time estimate. On the average, the telephone retrieval took 15 minutes per person and 33 minutes per household. The average recruitment rate was about 50 percent of households, while the average completion rate for recruited households was about 70 percent. This gave an overall average response rate from contacted households of 36 percent. Completion was defined as obtaining complete data from all members of the household and having no data missing for any of the critical or key questions.

The typical survey reported linked trips, where linking was through both change of travel mode and pick-up and drop-off activities. Some nonmotorized trips were included in the definition of trips. The average trip rates for linked person trips were 3.5 per person and 8.9 per household. A variety of other trip rates were often reported, including trip rates by purpose.

The typical survey recorded the data in ASCII format, using trip, household, and person files. Typically, the survey data were made available to some other agencies, but were not released for public use. However, reports that were available to the public were produced from the survey.

This description of a "typical" survey masks a great deal of variation in almost all of the descriptors provided in this summary. Also, this profile is based on surveys conducted within the past 5 years, a time period that has seen a dramatic evolution in survey design. As a result, looking ahead to what household travel surveys may be like in the next decade, there are many expectations for changes in the characteristics described here, particularly based on the trends evident in the most recent surveys. Surveys in the next 10 years are likely to use more targeted sampling of rare populations and rare travel behaviors, will likely make greater use of longitudinal panels, will be conducted over multiple seasons of the year, all days of the week, seek data from all household members, and include surveys of non-telephone households and of the use of nonmotorized modes of travel.

Reliance on random-digit dialing (RDD) is likely to decline as the method for sampling, although it is unclear what will emerge as the most probable alternative. Computer-aided telephone interviewing (CATI) and computer-aided personal interviewing (CAPI) are likely to become the dominant ways of retrieving completed data from respondents. New technologies, such as global positioning systems (GPS), geographic-information systems (GIS), videotapes, and other mechanisms are likely to find increasing use in assisting in the conduct of household travel surveys.

Surveys are likely to continue to increase in content demands, with increasing detail being sought on the trade-off between in-home and out-of-home activities, and more detail desired on the work situation and characteristics of people in the household. It is anticipated that the activity diary, which has been replacing the travel diary, will itself be replaced by a time-use diary and that diaries will be collected for multiday periods, including weekend days. There is likely to be more attention paid to performing nonresponse follow-up surveys and non-telephone surveys, while retrieval of data is likely to involve CATI or CAPI. Incorporation of new technology is also likely to have a role in future surveys.

It is anticipated that future surveys will need to rely more and more on incentives, and that more attention will need to be paid to publicity and survey "hot lines." Surveys are not likely to get any cheaper to perform, and time requirements, which are routinely underestimated by agencies in seeking consultant help, are not likely to get any shorter. There is a significant need for the profession to establish performance standards for surveys and to use this both in commissioning and evaluating surveys. Finally, a trend toward wider dissemination of data, findings, and reports is seen, with data being made available both on CD-ROM and the Internet.

CHAPTER ONE

INTRODUCTION AND BACKGROUND

This synthesis explores a number of facets of the design of household travel surveys. In particular, the synthesis:

- Examines the reasons for conducting household travel surveys and examines briefly other surveys that may be associated with household travel surveys;
- Reviews the evolution of household travel surveys;
- Reviews and synthesizes current methods of planning and designing a household travel survey;
- Reviews and synthesizes current methods of executing surveys;
- Reviews and synthesizes the results obtained in recent and current surveys; and
- Describes possible future developments in the design and conduct of household travel surveys, based on current trends and recent developments.

REASONS FOR CONDUCTING HOUSEHOLD TRAVEL SURVEYS

Survey Purposes

Household travel surveys are usually done for two primary purposes. First, they are done to provide information about the ways in which the transportation system is currently being used and to provide some clues as to the performance of the system from the viewpoint of individual travelers. This could be categorized as being a purpose of current or present measurement. Second, they are done to provide data that will be used to forecast the future demands for transportation within the region where they are conducted. This could be categorized as being a purpose of future prediction.

There may be secondary purposes for which household travel surveys are done, such as to measure certain attitudes or preferences of household members concerning possible policies or investments in transportation facilities. Also, household travel surveys are sometimes performed with a primary aim of replacing a prior survey, and providing inputs for reassessing and recalibrating existing travel-forecasting models or building new travel-forecasting models. Nevertheless, the primary purposes remain measurement and description of the present and the future demands for transportation services.

Types of Data to be Collected

Given such purposes, the predominant types of data collected can be classified as follows:

- Descriptions of the household, such as household size, vehicle availability, housing type, and income;
- Descriptions of the persons in the household, such as age, gender, education, working status, and driving license status;
- Descriptions of the vehicles available to the household, such as make, model, and year;
- Descriptions of the travel undertaken by members of the household and the activities performed following the travel; and
- Vehicle operating characteristics such age, mileage accrual, fuel used, and hot-start/cold-start data.

Methods of Collection

To obtain such data, it has generally been considered necessary to question members of the households that are sampled from the region to represent the region. Thus, some form of interview process is normally employed. However, the interview may take a number of different forms, and may take place in different locations. Interviews may take place while a household member is engaged in travel, such as in a roadside interview or an on-board transit survey. Such interviews are, however, usually restricted to obtaining data about the travel then in progress, and have not been seen as effective means to obtain data about other travel, such as that engaged in within the most recent 24-hour period. Other surveys collect data at the workplace about travel made by a person to and from the workplace. However, because these various surveys do not provide a means to collect data on travel by all members of the household, they are not considered household travel surveys and are not discussed in detail in this synthesis.

When data are to be collected on all of the travel of the members of a household for a prescribed period of time, typically a 24-hour period, then the interview process is usually conducted with household members while they are at home. The interviewer may or may not be physically present in the household. There are different mechanisms that may be used to collect data from household members while they are at home. These include a personal face-to-face interview, in which an interviewer visits the home and collects the data by questioning one or more members of the household; a telephone interview, in which the interviewer speaks with one or more household members by telephone and obtains the data from the household members; and a mailed survey, in which survey questionnaires are sent to households to be filled out by one or more household members, and returned by mail after completion. Some variants on these basic three forms of household-based interview are used, most commonly one in

which questionnaires are mailed to the household, but the data are collected by telephone rather than by having the household mail back the completed surveys.

Related Data-Collection Efforts

As noted above, household travel surveys are conducted on a sample of households from the study region, largely because the costs of measuring all households in the region would be prohibitive, and it is unnecessary to incur such costs, given the science of statistical sampling. Nevertheless, it is necessary to know characteristics of the entire population from which the sample is drawn, particularly if the sample is to be expanded to represent the entire population of the study region, or if any form of variable sampling rate is used, or if incomplete responses are obtained. For these reasons, certain other data-collection efforts have particular relevance to the conduct of household travel surveys.

The Decennial Census

Probably the single most important related data-collection effort is the decennial census conducted by the U.S. Bureau of the Census. The primary importance of the census data is in the information it provides about the entire population of the United States. Particularly because of the nature of sample surveys, it is important that there is some knowledge of the distribution of demographic characteristics of the population of the study region, both for the purposes of sampling and for expansion of the sample data. In addition, the census data provide means to assess biases in the collected sample data relating to specific subgroups of the population. The decennial census also provides data on some limited aspects of travel. However, because the data are collected differently from the typical household travel survey, as has been discussed elsewhere, (*1*) care must be taken in using these data in conjunction with household travel-survey data for a region. In particular, the data relate only to work trips (but do not distinguish home-based work trips from nonhome-based work trips), estimate weekly not daily work trips, do not include travel to second jobs, lead to overestimates of total work trips compared to household travel surveys, underestimate use of those modes of travel most likely to be used on an occasional or less-frequent basis, and provide unreliable information on trip lengths.

Compatibility Issues Between Census Journey-to-Work and Household Travel Survey Data—Under current procedures, the reporting of "usual" mode of travel, as is done under the journey-to-work section of the census, creates numerous problems for transportation planners, who are interested in behavior on a specific day, and wish to have the average of usual and unusual behaviors included in this representation of a day.

For some time, the transportation planning profession has attempted to influence the actual content collected in the journey-to-work portion of the census, but with only moderate success. The principal issue is the use of the notion of "usual" in the census data collection, compared to the transportation planning use of a specific instance. The census journey-to-work section asks for data on travel to work during the preceding week, or the most recent week that the person was at work. The questioning then requests the usual mode of travel to work, and stipulates that only a main mode is to be reported if multiple modes are used. This main mode is defined as the one used for the longest time or longest distance. Information on length of the journey to work (in time) is also requested as usual travel time to work, and the usual time of leaving is also requested. These data items are incompatible with standard transportation planning data, which would ask how the person traveled to and from work, and where they went on a specific day (e.g., the last working day prior to the day on which the household fills out the instrument), and would find out the sequence of modes used by an individual.

Knowing the time when the travel takes place is important, and probably of more value than a report on how long the travel took, which is notoriously unreliable. Knowing if stops were made on the way to work on that day is also important information that the census does not collect.

It is probably important to point out, in this connection, that transportation planners are interested in determining what travel looks like on an "average" day. On an average day, some workers are on vacation, some are traveling out of town, some are sick, and some are doing unusual activities in relation to workplace, or other aspects of their normal occupation. All of these occur on any given day and are assumed to be measured well by asking respondents to report about a specific day, without regard to whether it was a usual or unusual day. More importantly, however, the newer thinking about travel behavior regards a "trip" not as an isolated event, but part of a pattern of activities controlling the set of trips and trip chains that take place in a day. This means that the census journey-to-work data may need serious rethinking to capture more than information on a person's travel to and from work.

Data from the decennial census were produced through the state departments of transportation (DOTs) in cooperation with the U.S. Department of Transportation (U.S. DOT) and the American Association of State Highway and Transportation Officials (AASHTO) in the form of a Census Transportation Planning Package (CTPP) for most urban areas in the United States. This package contains many of the demographic variables describing both people and households published in the Standard Tape Files (STF) 1 and 3 of the U.S. Bureau of the Census, together with the journey-to-work data from the long form. For those areas of the United States that provided the geography of their traffic analysis zones (TAZ), the CTPP data have been provided at the level of the TAZ, or the tract, or the block group. For areas that did not provide TAZ geography, data are available at the tract level only. The data are available on CD-ROM and on diskettes.

Public Use Microdata Sample—One other important resource provided by the U.S. Bureau of the Census, through its state data centers, is the Public-Use Microdata Sample (PUMS). This sample provides housing and person records from a one percent or five percent sample of households and is

provided at the geographic level of a Public-Use Microdata Area (PUMA). A PUMA contains at least 100,000 population and PUMS data are provided for the entire United States. No geographic breakdown below the PUMA is provided. However, because the data are provided in the form of individual household and person records, within a PUMA, any type of multi-way cross-tabulation of data, and statistical analyses on multiple variables can be performed. The five percent samples, which are used most often, provide data sets of 6,000 to 12,000 persons for each PUMA, depending on its actual size. The one percent sample provides about 1,200 to 2,000 persons for each PUMA and may be used in instances where larger samples are not needed for statistical purposes or because of limited computing capability. PUMS data are usually available on CD-ROM, diskette, or by direct or Internet access to mainframe computer files at state data centers.

The American Housing Survey

The second major survey that relates to household travel surveys is the American Housing Survey, although relatively little use has been made of this survey by transportation planners. The American Housing Survey (AHS) is conducted by the Bureau of the Census for the Department of Housing and Urban Development (HUD). The AHS, which surveys occupied and unoccupied housing units (not households), is conducted as a panel survey, in that the same housing units are surveyed every year. A housing unit is defined as a house, apartment, flat, mobile home, or a group of rooms or a single room in group quarters. Housing units are contacted by telephone or in person; information about unoccupied units is collected from landlords, rental agents or neighbors. The AHS is conducted in two parts, a national survey and a survey of selected metropolitan areas.

The national survey is conducted every 2 years in odd-numbered years, with a sample of just under 50,000 housing units. Before 1982, the survey was conducted every year and was called the Annual Housing Survey.

The metropolitan survey is conducted every 4 years in 44 metropolitan areas. Each year data are gathered from 11 metropolitan areas, the next year from another 11 areas, and so on. A sample of at least 3,300 housing units is included in each metropolitan area. The sample is divided into units within the central city and units in the rest of the metropolitan area.

The AHS survey collects detailed information about housing in the nation, including information about structures, building conditions, mortgages, neighborhood quality, and other factors. It also collects household income, journey-to-work information, and personal characteristics such as age, sex, race/cultural origin, education and wages from all persons (adults and children). The journey-to-work data are now collected only from the national sample and not from the metropolitan samples. There has also been some inconsistency in who is asked this information and on the specific measures requested. This may account for the relatively limited use made of the data by the transportation planning profession. AHS data for the nation and for metropolitan areas are available in the form of published reports, computer tapes, diskettes, and on CD-ROM through the Bureau of the Census. Microdata, similar to PUMS data, are also available.

The Nationwide Personal Transportation Survey

The third survey of relevance is the Nationwide Personal Transportation Survey (NPTS) that is collected by the U.S. Department of Transportation approximately every 5 years. This survey is being redesigned to be compatible with standard regional household travel surveys and is increasing in relevance as a supplemental data source for household travel surveys. The 1995 NPTS was conducted from May 1995 through July 1996. The survey collected data on about 25,000 households across the country, representing a random sample of about 0.025 percent of the population. Thus, in an urban region with 100,000 population, data will be collected on the average from about 25 people or about 10 households. For a population of one million persons, the sample would be expected to be 250 people, or about 100 households. Metropolitan areas and states were provided with the option to purchase additional household samples in blocks of 1,000 households. About five regions have taken advantage of this. In the add-on samples, full geocoding of the data will be provided. Data are collected on all travel by sampled households that takes place within a 24-hour period. Data similar to those collected in a household travel survey are collected but long-distance travel, often omitted from regional household travel surveys, is included. More details can be found on this survey by contacting the Federal Highway Administration of U.S. DOT.

In the past, the data have been provided on diskette, together with appropriate documentation, and also in a series of summary reports that are available both as printed documents from the Federal Highway Administration and in extracts on CD-ROM from the Bureau of Transportation Statistics of the U.S. DOT. The Bureau of Transportation Statistics has also released the 1983 and 1990 NPTS data on CD-ROM. Plans for the distribution of the 1995 NPTS will include CD-ROM, Internet access and a condensed version on diskette.

The American Travel Survey

As a result of the lack of recent data on intercity person travel, the Bureau of Transportation Statistics (BTS) of the U.S. DOT has initiated the American Travel Survey (ATS), following the mandates of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) for developing, maintaining, and disseminating a data base on intermodal transportation movement patterns. The ATS is being conducted for the BTS by the Bureau of the Census as a component of the Census of Transportation, and covers a sample of approximately 80,000 households for 1995. The sample includes persons in households and persons in group quarters, but not those in military barracks, prisons, nursing homes, etc. Persons who are included in the sample at the time of the initial interview are interviewed for as long as they live at the sample address.

However, upon moving, a person was not followed to a new address, but the persons who move into the sample address were added to the sample.

Interviews are conducted using both Computer-Assisted Telephone Interviewing (CATI) and Computer-Assisted Personal Interviewing (CAPI). Households were interviewed every three months on a staggered basis (i.e., throughout the three months) and persons in the sample were provided with a diary in which to record relevant travel. All travel made by members of the household that entailed a distance of at least 75 miles in one direction was covered by the survey, but tabulations will be based only on trips of 100 miles or more. In the initial interviews, data were collected on household and person characteristics, including household relationship, sex, age, education, marital status, Hispanic origin, race, employment status, number and type of vehicles in the household, and individual or family income. Trips did not have to originate at the sample address. Trips made by members of the Armed Forces on active duty, trips by aircraft, train, bus, or ship crews, and trips by long-distance truck drivers were not included. Information requested about the travel included the origin and destination, purpose, modes of travel used, including intermodal connections, number of nights at the destination and type of lodging, and information on stops along the way and side trips taken after reaching the destination. Travel distances were appended to trip records by the Oak Ridge National Laboratory based on network-derived data.

Data are expected to be released by BTS on CD-ROM, in printed form, and on the Internet. The current schedule calls for release beginning in the spring of 1997. The CD-ROM releases will include software for extraction and tabulation of the data.

OTHER ASSOCIATED SURVEYS

When a household travel survey is conducted, it provides only part of the information required for most of the purposes for which the data will be used. There are two aspects to travel data and modeling that need to be the subject of data collection. These two aspects are identified using terms borrowed from microeconomics (*2*), namely, demand and supply. Demand has to do with the needs and desires of persons to travel, while supply has to do with the transportation system infrastructure and the levels of service and prices offered to users. The household travel survey collects data on the demand for travel, and does so only incompletely. Additional surveys are required to complete the demand data. The household travel survey does not provide data on the supply aspects and these must be collected in other separate surveys. The following are among the surveys that should also be considered to complete the data collection. A more complete discussion is provided in the *Travel Survey Manual* (*3*).

Demand-Side Surveys

The household travel survey is excellent at collecting data on the household demands for travel. However, the survey does not collect good information about the demands at the nonhome ends of trips. In addition, the household travel survey may not collect sufficient information about less-used travel modes and options. Therefore, the demand-side data may need to be supplemented with other types of surveys.

Workplace Surveys

Conducted among the staff employed at a given organization or company, workplace surveys are useful for providing improved data on the levels of work trips attracted to specific types of employment locations and on nonhome-based travel that may be based at the workplace. Many people make trips from their workplace during the day, such as trips on employer business, trips to and from lunch, and so forth. These trips are often reported much less completely in household travel surveys. Workplace surveys provide an alternative means to capture these trips by focusing the respondent on the workplace and travel undertaken during the working day. Such surveys are usually administered as self-completed forms that are distributed to employees through the internal mail system of some employers, or through direct distribution in the workplace. Data collected are usually very similar to the data requested in the household travel survey and may be in the form of a diary. These surveys are usually most effective if the employers can be persuaded to allow employees to complete them during the workday, in which case response is often high.

Transit On-Board Surveys

Typically, transit on-board surveys are conducted to enrich the data set with transit riders. In many urban areas of the United States, transit ridership is less than 5 percent of all daily trips and transit riders are found in less than 5 percent of all households. For surveys with samples even as large as 8,000 households, transit riders may constitute fewer than 400 households and may provide less than 400 trips for any given purpose from a random sample of households. Therefore, enrichment is often desirable, particularly when modeling is one of the major purposes of the survey. These surveys are usually conducted as self-completed surveys, with distribution to boarding transit riders by the driver or a survey person, and collection by an on-board box, a second survey person, or mail back to the survey organization. Data collected usually include origin and destination of the trip, purpose, boarding and alighting stop, mode used before getting on the transit vehicle and mode to be used on leaving, some demographic data on the rider and the rider's household, and some data on time of day and fares paid. Response rates are usually rather modest, running at anywhere from 15 to 40 percent.

Intercept Surveys at Attraction Sites

The third type of survey that may be undertaken is an intercept survey at nonresidential land uses, aimed at determining

numbers of trips made to the location as a trip attractor. Such surveys are usually conducted as face-to-face interviews with persons entering the site, and are usually designed to last no more than 2 to 3 minutes. Data collected usually pertain to the purpose of the trip, the location of the origin of the trip, the mode of travel used to access the site, the frequency that such visits are made to the site, and the size of the party traveling to the site. Response rates are usually high, but there is difficulty in determining an actual response rate because reliable counts of the numbers of persons entering the site are often difficult to determine.

External Cordon Surveys

The study region is bounded by an external cordon, which is an imaginary line that encircles the urbanized area and the area that is expected to be urbanized within the planning horizon. The survey has traditionally been conducted as a sample roadside interview, in which drivers are stopped near the locations where the cordon crosses a highway leading into and out of the study region. A few questions are asked, usually comprising purpose, origin and destination, and number of vehicle occupants. In addition, the time of the interview is noted, along with the type of vehicle. Automated counters are usually placed at the survey site to provide an estimate of the total number of vehicles passing the survey site and to provide a means to expand the sample data. The surveys are used to estimate the volume of traffic that enters and leaves the study region within a typical day, and the volume that passes through, without an origin or destination within the study region.

The roadside method is used very little in large metropolitan areas today, largely because of survey crew safety and the potential for traffic bottlenecks at the interviewing locations. Other, less intrusive, methods are used such as postcard surveys and license-plate surveys with a follow-up postcard survey, and similar procedures. In cases where only external traffic is to be determined, license plate matching records the time and location for both entry and exit of the same vehicle. A useful summary of some of the methods and their strengths and weaknesses is reported by Stokes and Chira-Chavala (*4*).

Screenline Surveys

A screenline is an imaginary line that cuts across the study region, usually located along a feature that has only a limited number of crossing points, such as a river or an at-grade rail line. Screenline surveys may be identical to the external-cordon survey, involving a roadside interview for identical data, or may involve only a count of vehicle volumes by time period at each screenline crossing point. The results of such surveys are used for model validation purposes.

Supply-Side Surveys

Many different types of supply-side surveys may be undertaken to complete the travel picture for a region. The surveys listed here are not exhaustive but include those used most frequently. Details of these and other associated surveys are to be found in the new U.S. DOT *Travel Survey Manual (3)*, which also provides details on what each survey is to measure, how it should be designed and conducted, and the uses generally made of the resulting data. The reader interested in a detailed description is referred to that document.

Land-Use Survey

Current land uses within the study area are usually examined by either a windshield survey or an establishment survey, and may be supplemented with local jurisdiction permit records, aerial photography, and other sources of information on land uses.

Highway Inventory

The highway inventory represents the compilation of data needed to construct a computer-based network representing the highway system, and usually includes functional class of roadway, locations of major intersections, numbers of lanes, posted speed limits, restrictions on turning movements, and other related data. Data are collected on permanent traffic counts and short counts within the study region that will be used for subsequent model validation activities. State and local jurisdiction records also yield data and may require some amount of field inspection of a sample of segments of the highway system.

Transit Inventory

The transit inventory is a parallel effort to the highway inventory and is used to construct the transit network for computer-based modeling. It will usually include details of the routes operated and specific route variations, frequencies of service by time period, round-trip running times for each route variation, and type of vehicle (including vehicle capacity) used on each route or route variation. Data also include current information on boarding and alighting volumes by stop or group of stops, and information on the loads by line segment and location of the maximum load point.

Speed Checks

As an input for calibration and validation of models, it is highly desirable to run speed checks on a sample of highway links that represent each combination of area type and facility type, and for each of peak and off-peak traffic conditions (although peak is generally the most important). Alternatively, aerial surveys can be done to obtain traffic density, and hence compute the average speeds on segments of the network.

Spot Counts

Because permanent counting locations in most urban regions are relatively few and cover only the more major

highways, it is usually necessary to supplement the permanent counts with a substantial number of spot counts of 1-day minimum, in order to provide information on volumes on a much larger sample of the highway system, covering all facility types in all area types.

STUDY APPROACH

This synthesis has been prepared by using a combination of recent experiences of various metropolitan planning organizations (MPOs) in designing and performing household travel surveys, together with an inventory of states and MPOs to gather information on household travel surveys that have been designed and conducted within the past 5 years. In this section, the methods used to gather data are described, and the analyses performed on the resulting data are discussed. The section concludes with an overview of the remainder of the synthesis.

Survey of States and MPOs

For this synthesis, a survey was designed and conducted to identify most of the household travel surveys conducted within the past 5 years either by a state department of transportation or by another agency within the state. To do this, the survey was designed in two parts. The first part was a telephone contact that was designed to determine if the state or any of its MPOs or other agencies had conducted a household travel survey within the past 5 years. In the event that the response to this question was affirmative, the telephone survey continued with questions about where the surveys were done and who would be the most knowledgeable person to talk to about each survey. The telephone conversation was concluded with a request for certain documentation about the survey, including, if available, any Requests for Proposals (RFPs) issued for services to design or conduct the survey, copies of survey instruments, copies of any instructions for interviewers, and copies of any reports on the results of the survey.

In the event that the person contacted was also the most knowledgeable about the survey(s), a request was then made that the individual complete a rather lengthy questionnaire on each survey. The questionnaire was sent by fax, and respondents were encouraged to return the completed questionnaire by fax. In the event that another person was indicated as being most knowledgeable about the survey, contact information (telephone number or address) was requested, and contact was then made by telephone with that person. In that contact, the purposes of the contact were explained again, and it was indicated that this person had been identified as being the appropriate person with whom to talk about the specific survey. After confirming that this person was knowledgeable, and gaining a small amount of additional information, the request was made for completion of the fax questionnaire.

In no case did the eventual contact person at the state indicate that he or she was unaware of whether or not any household travel surveys had been conducted within the past 5 years. It is possible, of course, that some relevant surveys were not known to state officials and that they have been missed from this synthesis. However, it has not been the intention of this synthesis to be based on an exhaustive identification and collection of data about all recent household travel surveys. Rather, the intent was to collect sufficient data to provide a good indication of the methods and procedures in common use. Copies of the two survey instruments—the telephone script and the fax questionnaire—are provided in Appendix A.

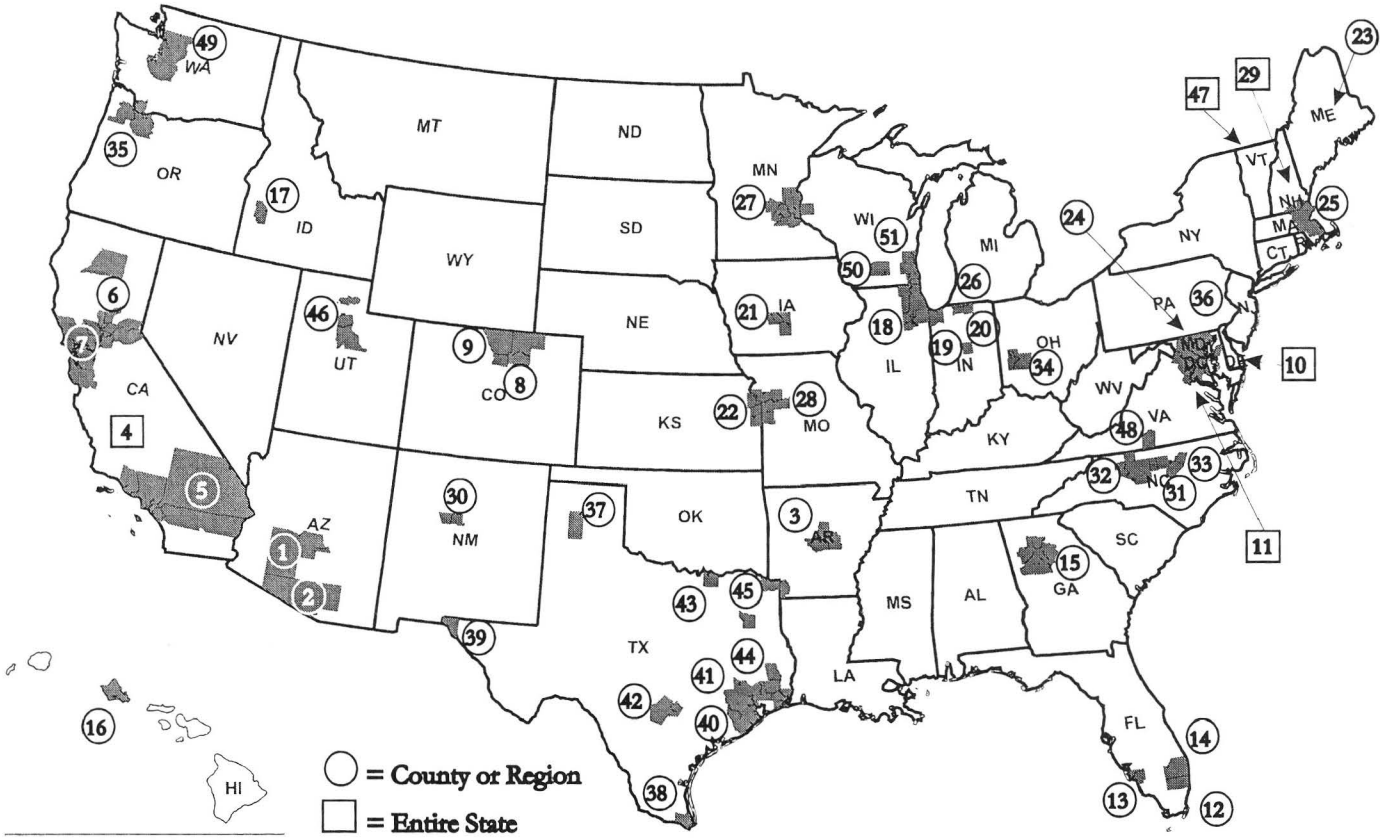
The survey succeeded in identifying 55 recent surveys, most of which had been conducted by or on behalf of an MPO. As noted above, these were all surveys conducted within the past 5 years, with the exception of the inclusion of one survey begun in 1987 and completed in 1988, and one begun in 1988 and completed in 1989. All other surveys were conducted between 1989 and 1994. In the subsequent sections of this synthesis, the information gained from these 55 recent surveys is used to provide statistical backing to the various descriptions of steps in the survey process and the prevailing current methods. The locations included are shown in Figure 1. Surveys of the entire states of Vermont, New Hampshire, and California were included, and the remaining surveys were of an MPO planning area or of entire counties.

Data Analysis

The questionnaire was designed to provide relatively simple analysis of the results for this synthesis. Therefore, the majority of the analyses have been of simple frequencies of certain responses, selected cross-tabulations, and an analysis of open-ended responses that could not be readily coded into one of the provided categories. In the case of questions in which multiple responses were permitted and given, an analysis was performed of the frequency of the various combinations of the responses. The resulting information is provided in a series of substantive areas of design, execution, analysis, and evaluation of the surveys, as is discussed in chapters 2 through 5.

Structure of the Synthesis

The remainder of the synthesis is organized around the major aspects of the household travel surveys. It is organized to follow the approximate chronology of the process from inception of the survey to the final analyses of the data resulting from the survey. Chapter 2 deals with an overall look at the process of planning, designing, conducting, and analyzing household travel surveys. The process is illustrated with a flow diagram of the steps. This chapter also discusses the evolution of household travel surveys. Chapter 3 deals with the planning and design of a household travel survey. It examines how and why agencies have initiated household travel surveys and discusses the goals and objectives of surveys, the means to pay for the survey, and the reasons for choosing the timing and method of survey. This chapter also examines sampling methods and sample size, and looks at a number of



LEGEND

Arizona
1 Maricopa County
2 Pima County

Arkansas
3 Little Rock

4 California (Statewide)
5 Los Angeles/Orange/
Riverside/
San Bernardino/
Ventura Counties
6 Sacramento (6 counties)
7 San Francisco Bay Area

Colorado
8 Boulder County
9 Greeley/Fort Collins/
Loveland

10 Delaware (Statewide)

11 District of Columbia (Statewide)

Florida
12 Broward County
13 Lee County
14 Palm Beach County

Georgia
15 Atlanta

Hawaii
16 Oahu

Idaho
17 Ada County

Illinois
18 Northeast Illinois
(7 counties)

Indiana
19 Kokomo
20 South Bend-Elkhart

Iowa
21 Des Moines

Kansas
22 Kansas City (8 counties)

Maine
23 Portland

Maryland
24 Baltimore

Massachusetts
25 Boston

Michigan
26 Southwest Michigan
(8 counties)

Minnesota
27 Minneapolis-St. Paul

Missouri
28 Kansas City (8 counties)

29 New Hampshire

New Mexico
30 Albuquerque

North Carolina
31 Alamance County
32 Greensboro-Winston
Salem-High Point
33 Raleigh-Durham

Ohio
34 Dayton

Oregon
35 Portland and Southwest
Washington State

Pennsylvania
36 Reading

Texas
37 Amarillo
38 Brownsville
39 El Paso
40 Houston (8 counties)
41 Jefferson/Orange/ Hardin
42 San Antonio/ Bexr
43 Sherman- Dennison
44 Tyler-Smith County
45 Texarkana

Utah
46 Salt Lake/Utah/
Weber Counties

47 Vermont (Statewide)

Virginia
48 Danville

Washington
49 Seattle

Wisconsin
50 Madison
51 Southeast Wisconsin

FIGURE 1 Locations of household travel surveys included in the synthesis.

issues of survey content. The chapter concludes with a discussion of the design of instruments and data-collection procedures.

Chapter 4 deals with survey execution, beginning with pilot surveys and pretest surveys, then examining survey administration, including overall project management responsibilities, use of peer-review panels, etc. Chapter 4 also examines the issue of obtaining responses to surveys and looks at the whole issue of response rates and follow-up contacts of various types. The chapter concludes with a discussion of the issues of processing the data and preparing the data for use in various types of analyses and modeling. Chapter 5 reviews time and cost requirements for surveys and compares both the expectations prior to surveying and the reality after the survey was completed. The chapter also looks at certain statistics that may be used to evaluate surveys, and reviews methods by which survey results have been disseminated.

Chapter 6 provides a look at what may be ahead in the evolution of household travel surveys, extrapolating from the information in this synthesis and looking particularly at some of the most recent innovative surveys. This chapter is also partly based on the Transportation Research Board Conference on Household Travel Surveys: New Concepts and Research Directions that was held in Irvine, California in March 1995. Appendix A contains copies of the survey forms used for this synthesis; and Appendix B contains names and addresses of agencies that provided data for the synthesis.

CHAPTER TWO

CONDUCTING A HOUSEHOLD SURVEY

OVERVIEW

Many steps are involved in conducting a household travel survey. The process of planning, designing, conducting, and analyzing household surveys is represented in Figure 2 (*5*). The process of conducting a household travel survey begins with preliminary planning; issues such as funding, the geographical areas to include in the data collection, the time period for data collection, and the level of effort that can be contributed by the DOT/MPO staff are among those that should be discussed during the planning process. Answers to these questions lead to the selection of the survey method to be used (telephone recruitment, mail-out/mail-back, CATI, etc.), which leads to development of a survey instrument and the sampling design. An often neglected, but important step in the survey process is a pilot survey, which should be used to test the survey instrument, sampling design, and all the procedures that are to be used during the conduct of the survey. After analyzing the results of the pilot survey, revisions may be made to the survey method, survey instrument, or sample design. Once the details of the survey have been refined, implementation of the survey can begin. Data coding then follows (this may be done simultaneously with data collection if CATI is utilized). If necessary, the process may then include data editing and correction, expansion of the data, and data analysis. The survey process usually ends with the presentation of the survey results, often in the form of a report and data files.

The backward linkages (the dashed arrow lines) represent items where information must be transferred from later in the process. For example, the survey instrument design will affect the data coding procedures that are used later in the process and the data coding will depend on the type of data analysis to be performed. These backwardly linked items are dictated by the decisions made early in the survey process. The feedback linkages indicate that two activities must be performed in a closed loop. For example, the design of the survey instrument is tested in the pilot survey, which may indicate that the instrument should be revised and then re-tested. In Figure 2, the items outside the dotted box are the planning procedures that dictate the specific actions taken with the items that are inside the dotted box.

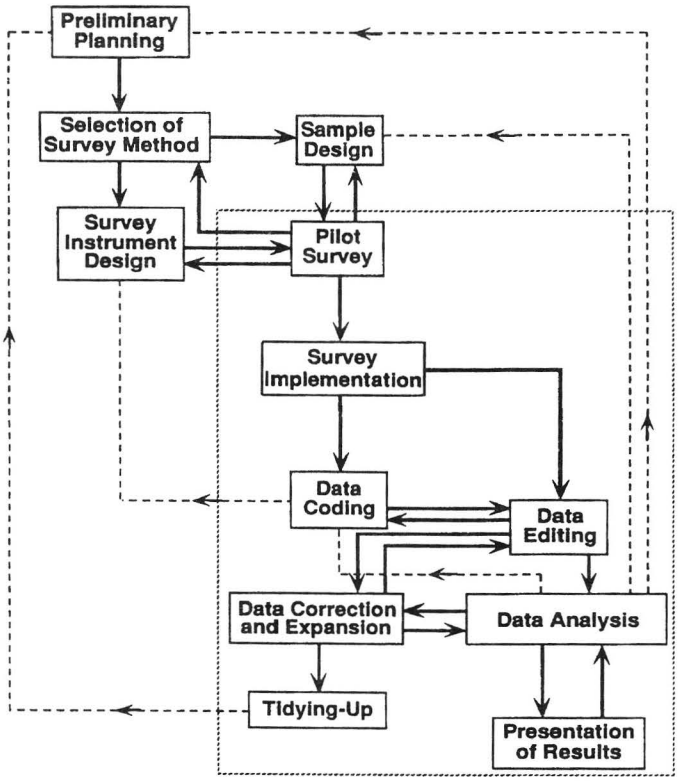


FIGURE 2 Flow diagram of the survey process.

EVOLUTION OF HOUSEHOLD TRAVEL SURVEYS

Brief Historical Review

Household travel surveys, which are defined here as some form of survey that involves an interview with members of households, are a relatively recent phenomenon, appearing in the United States for the first time in the 1940s. Prior to that time, transportation planning (which itself was in rapid evolution to the regional type of planning performed today) relied principally on some form of roadside intercept survey that collected origin and destination information from travelers on specific roads, at river crossings, and at locations on highways where they entered urban areas (*6*). Such surveys were first collected in the 1930s. Beginning with the Federal Highway Act of 1944, funds were made available at the federal level for conducting travel surveys. The Bureau of Public Roads (BPR), now the Federal Highway Administration (FHWA), together with a number of states, developed some initial procedures for a home-interview survey. Using these procedures, home-interview surveys were conducted with a sample of the urban-area population in 1944 in Kansas City (both Missouri and Kansas), Lincoln (Nebraska), Little Rock, Memphis, New Orleans, Oklahoma City, Savannah, and Tulsa. Revised editions of these initial procedures were issued in 1946 and 1954. In 1956, the Eno Foundation book, *Highway Traffic Estimation* (*7*), tabulated data derived from origin-destination surveys (mainly home-interview surveys) from 45 cities that had con-

ducted such surveys since 1945. Similarly, Wilbur Smith and Associates (*8*) used data from 12 urban areas across the U.S. that had conducted home-interview surveys in the 7 years from 1954 to 1961 under sponsorship of the BPR, state highway departments, and county, city, and local governments. In 1973, a new document was issued: the so-called "Yellow Book," or *Urban Origin-Destination Surveys* publication of the FHWA (*6*). At the time of this publication, the primary method for conducting such surveys was an in-home interview, conducted by a trained interviewer. Data were collected retrospectively by the interviewer, who asked household members about the travel they had undertaken on the previous day. These interviews were normally conducted without notifying households in advance of the day for which travel would be recorded.

Data about trip-making patterns has been a mainstay of transportation planning from the beginning of such planning earlier this century. Surveys of trip making have traditionally provided the basis for formulating transportation policy, developing transportation plans, and developing improvements to transportation operations. The primary roles served by surveys are discussed at the beginning of chapter 1.

Changes in Household Travel Surveys

Over the almost half-century of household-based travel surveys, this type of survey has undergone substantial growth and change. Originally, the household travel survey was conducted almost exclusively by face-to-face interviews taking place in the homes of respondent households, using recall of the previous day's travel by household members, and often involving extensive proxy reporting by one family member for most of the rest of the household. Generally, the interview was conducted as a "cold-contact" process, because the only prior contact made was usually a letter informing the household that they had been selected for the survey and that they should expect a visit by an interviewer within the next several days (or weeks). No prior contact was made to arrange the time for the interview or to forewarn household members of the day for which travel would be recorded. Probably the last U.S. home-interview survey was the one to collect what was known as the Baltimore Disaggregate Data Set, which was collected in 1976 in an effort to provide a data set that could be used for a wide range of research and development activities. The face-to-face interviews for this survey cost about $300 per household in 1976 dollars. Possibly, this cost alone sounded the death-knell of face-to-face interviews in the United States. At about that time, Caltrans performed what may be the first telephone surveys. This began the transition from face-to-face to other methods. In 1981, the Southeast Michigan Transportation Agency conducted a household survey that used an initial visit by an interviewer, during which a diary was left at the household for each qualifying household member. Subsequently, the interviewer returned to collect completed diaries from each household. Thus, this survey used self-completion but still used a two-visit system for distributing and collecting survey instruments. In 1982, the Oahu Metropolitan Planning Organization used telephone contact, followed by mail-out and mail-back of diary instruments, together with household and person data sheets. More recent household travel surveys have involved telephone contact to recruit the household, followed by mailing some form of diary, that may be for either one or two days, with a set day in the future on which travel (or activities) are to be recorded. This is followed frequently by retrieval of the data from the diary by a telephone interview, conducted using Computer-Aided Telephone Interviewing (CATI), involving real-time error checking and data entry.

Reliance on the telephone has been the subject of some concern within the profession, particularly with respect to the potential for biases to arise from the exclusion of non-telephone households. There has been speculation, although little factual analysis to date, that significant proportions of non-telephone households are transit riders, and are therefore quite different from their counterparts in telephone households. Some anecdotal evidence to this effect was accumulated in Dallas in 1995, where an attempt was made to enrich the pilot test sample by intercepting transit riders. In this process, the rate of non-telephone households for transit riders was found to be about twice as high as in the population of the Dallas-Fort Worth region. In a recent study for the FHWA (*9*), non-telephone bias with respect to a variety of measures was investigated, using the Public Use Microdata Samples (PUMS) from the 1990 Decennial Census. This study found considerable differences in non-telephone proportions by region of the country, varying from a low of two percent in Massachusetts to 12 percent in New Mexico. There are also significant variations from region to region, within metropolitan areas, and between urban and rural areas. There were also significant correlations found between certain demographic characteristics of households and people, and the presence or absence of a telephone. Importantly, there was also a significant difference in vehicle ownership between households with telephones and households without. Given these findings, this should remain an area of concern to those designing household travel surveys, because it is likely that the travel characteristics of households without telephones are significantly different from those with telephones, and normal methods of weighting and expansion will not deal with these issues.

Another aspect of the evolution of the household travel survey has to do with the sampling. The first major change has been the sample sizes. In the early days of home-interview surveys, samples of from one to five percent were normally recommended and undertaken. The "Yellow Book" was probably the first official guidance that provided information on collecting smaller samples. It refers to both "small samples," defined as from 600 to 3,000 households (*6*) and to "traditional samples," defined as ranging from 3,000 to 30,000 sampled households and consisting of from two to 20 percent of the population, depending on size of urban area. Even though the guidance introduced the notion of small samples, the majority of household surveys conducted through the 1970s were still within the definition of a traditional sample.

A second aspect of sampling is the sampling method. Almost exclusively, early household travel surveys used either simple random sampling of households in the metropolitan region, or a form of cluster sampling, as a means to reduce

interviewer travel. Current household travel surveys usually use a form of random stratified sampling, with variable sampling fractions, with the strata typically based on household characteristics determined in the initial recruitment call.

It is appropriate to ask what has been driving the evolution of the household travel survey over the past 40 years. One element is clearly the desire to improve the accuracy of the household travel survey. From early on, it was recognized that the conventional home-interview survey, based on recall, provided a significant level of undercounting of certain trips, particularly those trips associated with minor errands and those representing short, nonhome-based trips. The shift from recall reporting to use of a diary designed to be completed at a subsequent date is clearly one of the steps that was taken primarily in an attempt to address the problem of underreporting of certain trip types. The hope was that, by reducing proxy reporting (all family members would have a diary in which to record the trips they made) and by shifting from recall to real-time recording of the person's travel, the number of these short trips reported would increase. Conversely, one could state this as the hope that the number of such trips that would be forgotten would decrease. There is at least some anecdotal information to suggest that this may have happened, but no clear analysis has actually established that a significant improvement in reporting nonhome-based travel actually occurred through this mechanism.

A second driving force has been a concern with the complexity and difficulty of the task presented to a respondent to complete the travel survey instrument. Although early diary surveys still relied on face-to-face contact, the design necessitated having the respondent complete the instrument. This requirement initially was not recognized as a difficulty, and early designs still used a survey form that was little different from the type of form that had previously been used only by a trained interviewer. Not very surprisingly, these survey forms were not found to perform well, with two primary problems arising. First, response rates dropped, because many people were unable to understand how to fill out the survey, or were intimidated by the amount of information packed into a rather small space in the survey form. Second, those responses that were obtained often showed considerable confusion about how to answer correctly, with the result that surveys had to be discarded, or inference was required to correct the returned surveys.

A third driving force has been changes in the requirements of the models and other procedures to be developed from the data collected. Interestingly, much of the early work in household travel surveys tended to ignore the survey purist's notion that a survey should be designed carefully with the eventual uses of the data always in mind. Data on specific measures might be collected either because it always had been collected, or because it was thought to be interesting, while there was no specific plan to use such measures. The corollary to this type of survey design was that surveys may be conducted only to find that an essential piece of information was never obtained, thus seriously limiting the usefulness of the resulting data. Another cause of problems with survey design has been the tendency of many agencies to design the survey by "committee," in the sense that a number of different individuals may be asked to assist from a number of different agency perspectives. The result of this process is often the growth of more and more questions in the survey, with each individual or agency attempting to get its set of questions included. More recently, there has been significant attention given to the concept of measuring only what will be used in either descriptive or modeling work with the data. There are also some data items that are included for "strategic" reasons, relating to such issues as the need to be able to show the types of households that have been included in the sample. For example, some transportation surveys collect data on ethnic origin, even though there are no existing models of travel behavior that include ethnic origin, and investigations of variability of travel by ethnic origin has not been reported. Such measures are clearly also essential items, particularly when political jurisdictions are funding the survey.

With an increasing amount of attention being paid to justifying each item of data to be included, and with a slow evolution of some parts of the travel-forecasting model system, changes have been made in the survey instruments to reflect these contextual changes. The general acceptance of disaggregate models (*2*) for mode-choice modeling had a significant effect on the design of data-collection instruments during the 1980s, in particular, and is reflected in renewed attention to the sequence of use of different travel modes on a single trip, attention to vehicle occupancy and availability, parking costs, and collection of data on the modes of access to and egress from public transportation. The widespread acceptance of disaggregate models also brought with it an interest in collecting data about subjective evaluations of travel options, in addition to the standard reporting of "objective" data. In the 1970s and 1980s, significant interest in collecting data on attitudes, preferences, and opinions about transportation alternatives was evident (*10*). However, so little of this information was found to be helpful in travel forecasting, and sufficient doubts raised as to its validity or usefulness even for descriptive purposes, that the late 1980s showed a significant decline again in the collection of such data.

Notwithstanding this decline in the collection of a variety of attitudinal data of varying rigor, the past decade has seen a resurgence of interest in collecting conjoint data, or, more correctly, Interactive Stated-Response (ISR) data. In the Stated Preference subset of ISR data, responses are obtained by offering to respondents a series of trade-offs between different levels of attributes of various alternatives for travel or other decisions. The context is set as an existing choice (e.g., travel to the respondent's workplace), and the changed levels of various attributes or the introduction of a new alternative with various different attributes, is keyed to the existing levels of attributes that the person experiences. An excellent discussion of the technique, of the other types of data included within ISR, and of the various forms it takes is to be found in a paper by Lee-Gosselin (*11*). This specific evolutionary change can be explained largely as resulting from two coincident issues. First, in the late 1980s, the United States became increasingly interested in the concept of high-speed rail systems. Because there was no existing intercity service similar to high-speed rail in

current operation in the United States, the idea of determining stated preferences for a service profile similar to that of high-speed rail seemed to be the best method to determine potential patronage. The general success of this approach gave rise to an initial credibility for ISR measurement as a means to deal with an alternative for which the marketplace had no current equivalent. Second, with current urban policies focusing increasingly on new options for handling transportation problems, such as transportation demand management (TDM) strategies, pricing strategies, etc., interest in using ISR as a means to estimate how the traveling public will respond to such programs is increasing rapidly.

Another significant issue in the past 10 to 20 years has been a decreasing response rate from surveys. Almost universally, recent surveys demonstrate an increasing reluctance to respond. This has been most noteworthy in the U.S. Decennial Census in 1990, which reported the highest ever nonresponse rates to the census, and also involved the largest proportionate spending ever by the U.S. Bureau of the Census in trying to contact nonrespondents to the initial mailing of census forms. All of this should be seen in the context that federal law requires everyone to complete a census survey form. The census also showed the slowest rate of returns ever experienced. Consistent with this, almost every transportation survey of the past few years has reported significantly lower response rates than surveys conducted a decade or more ago, often in cases where the exact same instrument has been used. Without a law requiring persons to complete household travel surveys, it is not surprising that the household travel survey has suffered a greater loss in response rates than has the decennial census.

No hard facts are available to explain the reasons for the decline that has been seen, but several surveys bear out that the decline is both substantial and continuing. One can speculate that there are a number of contributors to this decline, some of which are of specific relevance to transportation surveys, while others affect almost all surveys. These contributors include:

- The increasing use of telephone surveys by various marketing agencies that tend to contribute to "burn-out" of the U.S. public with respect to surveys;
- The increased use of marketing surveys as a "foot-in-the-door" to sell some product (as evidenced by the frequent response that "I'm not buying anything" when a transportation-survey interviewer calls a household);
- The increasing pace of life in late 20th-century United States that makes people more and more reluctant to spend time in activities not directly connected to their own busy schedules;
- The increasing concern over personal privacy and the potential for various outside agencies to know personal details that represent an invasion of privacy, resulting in a decreasing willingness to answer any questions relating to demographics, activities, etc.;
- The perception of vulnerability to crime through the types of information typically requested in a household transportation survey;
- The increasing number of immigrant households in which English may not be spoken, or is not spoken fluently; and
- The increasing use of telephone screening devices, such as answering machines and caller identification devices.

These and other factors are almost certainly significant contributors to difficulties encountered in obtaining adequate responses to household travel surveys. At the same time, in the United States, there has been a marked decline in the effectiveness of face-to-face interviewing, primarily for three reasons:

- Interviewer reluctance resulting from perceived risk. The crime problem in American cities has made it increasingly difficult to be able to send interviewers into certain parts of many cities and to guarantee their personal safety.
- Respondent reluctance resulting from perception of crime risks. The perception of vulnerability to crime makes it less and less likely that a household will allow a stranger to enter their home and spend time to interview them.
- Respondent absence from home. With the rapid increase of two-worker households and the increase in the amount of time spent by household members in out-of-home activities, there is an increasing problem to find a responsible adult at home who could be interviewed. As a result, the costs of performing face-to-face interviews have sky-rocketed, while the effectiveness of such interviews and the ability of the interviews to cover a random sample of households has declined dramatically.

CHAPTER THREE

PLANNING AND DESIGN

INTRODUCTION

In this chapter, the initiation of the survey is discussed, covering the reasons that a survey is undertaken at a particular time. Sampling methods are also discussed, along with indications of the sample sizes selected in recent surveys. Finally, the chapter reviews survey content and instrument design and collection procedures.

INITIATION OF THE SURVEY

To initiate a household travel survey, the need to undertake a survey must be identified, goals and objectives must be set, and the necessary resources must be put together to implement the survey. Frequently, the costs of a household travel survey represent a large proportion of the unified planning budget of an MPO for a year, so that timing of the initiation is particularly critical in relation to the availability of funds. The primary reasons for deciding to undertake a household travel survey at a specific time are:

1. The age, or the nonexistence of prior data;
2. The availability of funds to collect data; and
3. The proximity to the timing of the decennial census (for the purposes of validation and expansion of the travel survey sample data).

Table 1 shows the various reasons given by the respondents to the survey. Those mentioning the age of the existing data totaled 72 percent, and a further 11 percent mentioned no prior data as one of the reasons. In addition, 74 percent indicated that the availability of sufficient funds was a reason for the decision on when to initiate the survey, and 46 percent mentioned proximity to the decennial census as one of the reasons. (Multiple responses were permitted on this question.)

With respect to timing, the importance of the census is borne out in the proportions of surveys conducted in different years, from the survey of MPOs and states having collected data since 1989. Eleven percent collected their data in 1990 (the year of the census), and 26 percent collected it in 1991. Nine percent were collected in 1992 and 11 percent in 1993. However, a significant upswing is seen with 24 percent collected in 1994, possibly as a result of the planning mandates of the Clean Air Act Amendments of 1990 and ISTEA, and the greater availability of funds from ISTEA to support such efforts. Therefore, a fourth reason should probably be added to the previous three of the passage of federal legislation that is changing the focus on transportation planning and increasing the impetus for transportation surveys.

TABLE 1

REASONS GIVEN FOR TIMING OF THE SURVEY
(Multiple Answers Allowed)

Reasons for Timing of the Survey	Percentage Reporting
Single Reason	
Age of data	5.56
Proximity to census	3.70
No prior data	3.70
Funds available	7.41
Other	3.70
Multiple Reasons	
Age of data and proximity to census	5.56
Age of data and funds available	20.37
Age of data and other	1.85
Proximity to census and funds available	1.85
No prior data and funds available	5.56
Funds available and other	1.85
Age of data, proximity to census, and funds available	29.63
Age of data, proximity to census, and other	1.85
Age of data, funds available, and other	1.85
No prior data, funds available, and other	1.85
Age of data, proximity to census, funds available, and other	3.70

Most surveys were collected within a single year, although 20 percent reported that their surveys spanned two years, and 4 percent spanned more than two years. A survey could span two years if it was initiated in the fall of one year and completed in the following spring. This is not an uncommon schedule. Collection of data from one single period of the year is, however, still the most usual design. It is noteworthy, however, that there was no evidence of any metropolitan areas conducting panels, other than the ongoing panel in the Puget Sound region of Washington state.

The timing of the survey also involves a decision on the time of the year in which to survey. Traditionally, the demands of the travel-forecasting profession have been for surveys to collect data that represents some notion of "typical" travel. This has often been defined as covering travel in the spring (from about March through May/June, although as early as January in the deep South) or in the fall (from September until Thanksgiving). This remains the predominant timing, as shown by the survey: 40 percent reported surveying in the spring only, 22 percent in the fall only, and almost 10 percent in the spring and fall together, totaling almost 72 percent of MPOs conducting surveys only in one or more of the spring and fall. Of these, 80 percent reported that considerations of weather primarily determined this choice. What is interesting to note among the MPOs that did not restrict their surveys to

spring and fall is that 11 percent included the summer, 8 percent included the winter, and 1.5 percent included all four seasons. This may be a reflection of the increasing pressures from air-quality rules and regulations for surveys that include the peak pollution periods of the summer (for ozone) and the winter (for carbon monoxide).

In addition to the season of the year, the other timing issue in design is that of the days of the week to be included in the survey. Traditionally, household travel surveys have been concerned solely with weekday travel, and attempt to define what is measured as the typical travel undertaken on an average weekday. Consistent with this, 87 percent of the recent surveys have measured weekday travel only. The remaining 13 percent included weekend days as well as weekdays, primarily because of issues relating to mobile-source emissions. As a historical note, it should be pointed out that the State of California collected data on weekend travel as early as the 1960s and 1970s, although most states and metropolitan areas still collect weekday data only.

Surveys are most frequently conducted by retaining a consultant firm or team to perform various parts of the survey work. Relatively infrequently does an MPO or a state DOT actually undertake a survey with only their own staff. The use of consultants was selected by over 81 percent of the MPOs and states surveyed. Only 10 percent were undertaken by MPO staff, and a little over 8 percent by some combination of either MPO or state DOT staff and possibly a consultant.

SAMPLING METHODS

The second major aspect of planning and design usually concerns the sampling methods and designs. As noted in the discussion of the evolution of travel surveys, the predominant method of sampling has traditionally been the simple random sample. However, this has now been replaced by stratified sampling as the preferred method, with 56 percent of recent surveys having used this method, compared to 24 percent that used simple random sampling. Simple random sampling does remain, however, the second choice. Nine percent of recent surveys used quota sampling, and 4 percent used cluster sampling, while the remainder used some other type of sampling, often a combination of two methods.

The method by which the sample is drawn is dependent on the method chosen for conducting the survey. Here, the most popular method for data collection is the telephone recruitment or contact, followed by mail-out of surveys and telephone retrieval of the data. This method was reported as the one selected by about 54 percent of the recent surveys. Telephone contact followed by mail-out and mail-back of materials was used in 22 percent of cases, and one survey (2 percent) used a telephone contact followed by a face-to-face interview. Just over 7 percent used a straight mail-out/mail-back format, with no prior telephone contact, and the remainder used some other combination of mail and intercept, or other methods to recruit and survey households. Of those using telephone contact to recruit the sample, 83 percent used random-digit dialing to draw the sample of households, with stratification or quotas being implemented through the telephone contact, while 17 percent used published telephone directories. Given the increasingly high proportions of unlisted residential telephone numbers and the tendency for telephone directories to be out of date almost as soon as they are published, this relatively high use of telephone directories is surprising. It suggests that a significant number of household surveys are undertaken with a potential for serious bias in the sampling, resulting from the sampling frame selected. For those using mail as the initial contact, one survey used utility listings, and two used some other source of address listings.

With 78 percent of recent surveys using the telephone as the means to recruit the sample, another potential source of sample bias is the exclusion of households without telephones. In response to a question about any efforts made to contact households without telephones, 95 percent reported that no such attempts were made, while only 5 percent indicated that any form of non-telephone household survey was undertaken. Because contacting non-telephone households often seems likely to require a face-to-face in-home interview, and because many of the households without telephones are located in areas of the city that are more risky to visit, most regions have shied away from attempting to do this type of survey.

Choosing the sample size is another important aspect of the planning and design of the sampling. Samples may be chosen on the basis of the maximum acceptable levels of error in certain information to be collected, or on the basis of the samples required for building models of travel demand. Smith (*12*) and Stopher (*13*) have proposed methods to estimate the required sample size for given levels of accuracy required from a cross-classification model of trip generation. It is relatively simple to specify the sample-size requirements for a given accuracy of trip rate. However, sample sizes tend to be more difficult to determine for calibration of trip-distribution models, and there have been some significant differences of opinion on the sample-size requirements for calibrating logit models of mode choice (*14*). The result is that no set method has been adopted by the profession for determining the required sample size for a household travel survey. Instead, sample sizes are determined sometimes on the basis of statistical assessments of accuracy, sometimes on political requirements (such as minimum sample sizes for certain jurisdictions within the survey region), and sometimes by simply determining how many samples can be obtained for the available budget.

In surveying recent household travel surveys for this synthesis, it was not practical to inquire what the reasons were for choosing a particular sample size. Actual sample sizes chosen for the survey show a very wide range of variation, with 45 percent choosing a sample size of less than 2,000 households, 40 percent choosing between 2,000 and 9,999, and 15 percent choosing a sample size greater than 10,000 households. The average sample size was 4,167, with a median of 2,460, showing the preponderance of smaller samples. Statistically, sampling error for any form of random sample is a function of the variability of the measure of concern (which is estimated from the sample) and of the size of the sample (*15*). In the case of small populations (e.g., less than 500), there is a correction factor that is related to the size of the total population.

However, this correction factor is negligible when the population is more than about 500, irrespective of the sample size. It is important to note that, because the population of an MPO is statistically indistinguishable from infinite, the population size has no bearing on the statistical estimation of sample size, although it may have much bearing on the political and financial determination of sample size.

Choosing a sample size allows computation of the number of households that must be contacted to achieve the desired completed sample. Prior estimates of what this number should be are based on expectations of the success of the recruiting activity and the success of the retrieval. In terms of the numbers of contacts anticipated at the outset, over 55 percent of the recent surveys expected to obtain the desired sample with fewer than 10,000 contacts, a further 40 percent expected to need between 10,000 and 40,000 contacts, and just over 4 percent expected to need more than 40,000 contacts for the sample. The average number of expected contacts was 13,490, and the median was 7,166. Examining the ratios between the desired sample size and the expected number of contacts shows an extraordinary range of anticipated response rates, ranging from a low of 3 percent to a high of 75 percent. The average expected response rate was 33.6 percent, with a median of 31.9 percent. As is discussed later, there are problems in these figures of the interpretations of compilations, contacts, and expected response rates that may be reflected in this extraordinary range. However, it is obvious that there is not a clear expectation of response rates for use in designing this element of the survey.

Two other issues that relate to sampling concern decisions about the minimum age of persons whose travel is to be reported and whether or not to include group quarters within the sample. Traditionally, household travel surveys restricted data collection to those members of the household who were over the age of 4 years. This was based on the assumption that children under 5 years would normally accompany their mother throughout the travel day, so that having a complete reporting of the mother's travel would automatically provide the child's travel. This assumption was probably reasonable and appropriate in the 1950s and 1960s, when the nuclear family tended to consist of two adults, only one of whom worked, and one or more children. In these families, more often than not, the mother did not work outside the home but remained at home with the child or children, at least until all children were of school age. However, it has been recognized that this is no longer true in the 1990s. As a result, there is the beginning of a trend to extend data collection to all members of the household, irrespective of age. This is shown by 15 percent of recent surveys that set no age limit on the collection of travel data, and an additional 1.5 percent that set an age of 2 years as the minimum age. On the other hand, the use of a cutoff at age 5 is still prevalent, with 70 percent of recent surveys using this cut off. A small number of surveys used other ages, including one each that specified 6 years, 14 years, 15 years, and two surveys that used 16 years.

It has also been fairly traditional for household travel surveys to exclude group quarters from the sample. This was true of 79 percent of recent surveys that continued to exclude group quarters by design. In addition, 14 percent had intended to exclude group quarters but had not actually succeeded in doing so. Presumably, the random-digit dialing procedure included telephones in group quarters and the screening questions used to determine eligibility did not permit identification of the dwelling as being group quarters. Therefore, in these cases, interviews were completed with persons living in what were determined subsequently to be group quarters. This can happen quite easily in the case of nursing homes, where each occupant has a private telephone line. Unless there is a specific question that identifies this as a nursing home or other institutional type of dwelling, it is unlikely that this information can be deduced until the entire response is obtained. Only 7 percent had intentionally included group quarters in the sampling frame.

SURVEY CONTENT

Reviewing a sampling of survey instruments from recent surveys reveals that there are changes in what is measured in recent surveys. Axhausen (*16*) has noted that surveys in the United States in the 1980s tended to collect data on four primary categories, shown in Table 2.

Recent changes primarily have added parking cost to the data on a trip or "movement;" educational level and ethnicity

TABLE 2

UPDATED LIST OF MEASURES INCLUDED IN RECENT SURVEYS (adapted from *(19)*)

Category	Variable
Movement	Order of stages in a trip
	Trip purpose
	Main mode/modes of stages
	Start and end times of trip
	Number of passengers in the vehicle
	Location of trip ends
	Parking costs/transit fare
	Household vehicle used for trip
Person	Sex
	Age
	Participation in the labor market
	Profession
	Amount of work
	Driving license status
	Relationship of each person in the household
	Educational level
	Ethnic origin (race and Hispanic status)
Household	Number of persons
	Income
	Number of vehicles
	Dwelling-unit type
	Length of tenure of household
	Prior residence
	Number of workers in the household
Vehicles	Existence
	Make
	Model
	Year
	Odometer readings at beginning and end of diary period

are appearing in the person data; dwelling-unit type, length of tenure, prior residence, and number of workers in the household have been added to the household data; and odometer readings, make, model, and year are all added to vehicle information. Finally, several recent surveys have asked for the household vehicle used in each trip made by the household to be identified, thereby linking the vehicle information to the travel information and allowing determination of the allocation of household vehicles to different household members and household needs. These additions are shown in italics in Table 2. Some specific examples are also of interest from a recently completed survey (Portland, Oregon) and a survey now underway (Dallas, Texas). In the Dallas survey, there are no additions to the household data. A number of additions have been made on vehicle data, primarily to collect the year of acquisition of the vehicle; whether the vehicle was a replacement, addition of another vehicle, or the first vehicle owned; the fuel type; who owns or leases the vehicle; and whether the vehicle was used on the diary day. These are all added to the items listed in Table 2. Similarly, there are a number of additions to the person data, namely:

- Disabilities affecting travel
- Personal income
- For those in school or working:
  - Number of days attended in the past seven days
  - Number of days of use of each mode of travel in the past seven days
  - Parking cost at work or school, or amount expected to be paid if not driving and parking
  - Name and address of school or workplace

- For those working:
  - Number of hours worked on the weekend
  - Length of time working at present location
  - Reason for not working on the diary day
  - Need for a vehicle at work
  - Whether the employer subsidizes parking
  - Whether the employer subsidizes transit use
  - Number of days worked at home in the past seven days
  - Type of hours worked

- Abbreviated information on a second job.

Although the time of the start and end of a trip (or an activity) are usually asked, it is important to note that these are not collected for purposes of calculating travel time and entering the values into models. It is well known that people do not estimate times very accurately, either in terms of clock time or elapsed time (*2,17,18*). Typically, the times entered in a survey will be rounded to the nearest 5 or 15 minutes. Estimating a travel time from such times will usually result in errors of ± 5 to ± 30 minutes in the travel time. The times are collected for two other reasons. First, they identify the time of day at which the travel took place, allowing categorization into peak or off-peak times, and even to hour of the day. Second, the times can be used for a reasonableness check, particularly when the data are collected in an interview. The reasonableness check can be undertaken against both travel times and duration's of activities, e.g., checking if the travel time really equaled the elapsed time computed from the start and end times. These recorded times can also be used as a means to check times derived from the network to ensure that they are within a reasonable range of the reported times.

For the same reasons that actual travel time is not asked for modeling purposes, neither are the perceived or expected times requested for possible, but not used, modes for each trip. In addition, even though it can be argued that people may base their choices of how to travel on their perceptions of the travel times and other aspects of travel, no matter how much those perceptions differ from reality, it is not possible for transportation planners to forecast perceptions into the future. Therefore, models of travel choices are built using computer-network-derived values of travel times and costs both for the chosen alternatives and the rejected alternatives, hence, the omission of questions to collect such data. It should also be noted that information on travel costs is often even less reliable and usable, and certainly not able to be forecast into the future, with the exception of bus fares and parking costs. Typically, the parking cost actually paid by the individual, and the bus fare paid, or the type of bus pass used are the only cost information collected from people in household travel surveys.

An emerging area of importance in the collection of household travel data has to do with the workplace of each worker in the household. There is an increasing use of a battery of questions relating to travel and parking subsidies, work-schedule flexibility, and potential to telecommute. These questions are driven by air-quality planning needs and have appeared in a number of the surveys collected in the past 2 or 3 years.

It is also fairly usual that each household travel survey will add some questions that are unique to that particular survey. Such questions arise either because the local agency wishes to try to find out a piece of information through this mechanism that has not been tried before, or because of some local situation that demands a unique data item.

Overall, this battery of questions leads to three elements in the survey instruments: a household element, a person element, and a travel or activity element. These elements may then be split in certain ways between the different steps in the survey implementation, or may be combined in certain ways within an instrument. As is noted in the next section, many household travel surveys now use a telephone recruitment, followed by mailing a package of survey materials, and retrieval of the completed materials by telephone or return mail. In these structures of surveys, it is customary that some household questions are asked in the initial telephone recruitment call, partly as a means to classify the household into a sampling stratum, and partly as a check on the eligibility of the household to be included in the survey. The mailed-out package will often include a household survey form, usually including questions about vehicles available to members of the household, and a form or booklet (diary) asking for the travel or activity data. The questions about persons are sometimes asked on a separate person form and are sometimes combined

into the travel diary. It is also fairly common that some of the questions asked in the telephone recruitment are asked again on the household form. This is done both for reasons of confirmation, and also because some of the data may be different on the travel-recording day than on the day of recruitment. Such repetitions of questions do require a form of reconciliation in the final survey data processing, in which either households are called back and the discrepancies are explored, or a decision is made to accept only those values collected at one of the two times, whenever the values are found to differ.

INSTRUMENT DESIGN AND COLLECTION PROCEDURES

The decision on how the data are to be collected is closely interlinked with the decisions on how to design the instruments for data collection. At the simplest level, the decision on whether to recruit by telephone or by mail determines the nature of the initial contact instrument, which is either an introductory letter and set of survey instruments for mail recruitment, or a telephone script for telephone contact. Similarly, if a survey is to be self-administered, this requires that the instruments that will be self-completed are designed with the respondent in mind. A survey form to be used by a trained interviewer should be, and usually is, a very different instrument from the one that would be offered to a respondent to complete.

A survey using telephone recruitment, followed by mail-out of a set of survey instruments, and telephone retrieval of the data in the completed instruments requires a minimum of three survey instruments: a recruitment script, a self-administered survey instrument, and a retrieval script.

Additional scripts may be required for reminder and confirmation calls. Essentially, this is the structure used in a number of recent surveys, such as those in Southern California; Salt Lake City; southeast Michigan; Portland, Oregon; Oahu; and Dallas-Fort Worth. In most of these instances, two additional scripts have been added. One of these is a script for a call-back to confirm the mailing address, usually made within an hour of the initial recruitment. The second is a script for a reminder call made on the evening prior to the diary day (or first diary day).

An interesting development has been observed in the Dallas-Fort Worth survey. While it has long been agreed by survey designers that survey instruments need to be made more user friendly, a significant effort has been made in the Dallas survey to simplify language, to remove unnecessary wording, and to rearrange scripts and instruments to be much more oriented to the user rather than the analyst. At a number of points, the survey instrument or the script has intentionally been changed to make it easier for the respondent, with the explicit recognition that the change will require additional processing and manipulation of the recorded data. While, at the time of writing, it is yet to be seen what effect this will have on response and survey quality, these changes seem to be ones that should occur in all future designs.

When telephone recruitment is used with a mail-out/mail-back procedure, the first two instruments above are required, together with reminder postcards and reminder telephone scripts, depending on whether either or both of mail and telephone reminders are used to help obtain sufficient mail-back responses. This is the format that was used in the Boston survey in 1990. When a survey uses mail for recruitment, with a mail-out/mail-back instrument, then the primary instrument required is the self-administered survey instrument, together with a letter that is intended to gain the cooperation of the household to which the survey package is sent. Reminder postcards and telephone scripts may be used for follow-up. In a telephone recruitment that is followed by a face-to-face interview, (the procedure used in only one of the recent surveys), the instruments required will be the recruitment script and an interviewer-completed survey form.

Generally, the two principal options available for collecting travel data are retrospective collection and prospective collection. In retrospective collection of data, respondents are asked to recall the travel of a previous day, usually the day prior to the contact day. This is the method that was used almost without exception in early surveys of the 1950s and 1960s. The prospective method calls for providing an instrument to respondents and setting a day in the future on which travel is to be recorded. This was probably first used in the United States in southeast Michigan in 1981 and in Oahu in 1982. Usually, the hope is that the respondents will carry the instrument around on that day, keeping track of all of their activities and travel as they do it, so that little is forgotten. This is intended to be assisted by the inclusion of a memory jogger in the diary, which is discussed below. In reality, it is probable that most respondents do not carry the instrument with them, but complete the instrument at the end of the travel day. Nevertheless, the prospective method appears to provide more complete information than retrospective methods and has become the preferred method in the 1990s. This is shown by the fact that 95 percent of the recent surveys used some form of diary for collecting data, with a day set in the future for completion of the diary data.

With respect to the diary, several options exist for the design. It is not possible to undertake an exhaustive review of the methods used in recent surveys, but rather an attempt is made to summarize some of the options that are to be found in current designs, and to indicate in some instances the recent comparative levels of use.

First, diaries can be one of three basic types: trip diaries, activity diaries, or time-use diaries. A trip diary focuses on the travel performed during the survey period. It requests information about the travel, such as the origin and the destination locations, the time at which the travel took place, the purpose at the destination, and other potential data items about the travel. These may include mode or modes used, distance or time taken, out-of-pocket expenditures associated with the travel, number of occupants in the vehicle, how and where a private vehicle was parked, etc. A page from a travel diary is shown in Figure 3. The activity diary consists of an instrument that focuses on what the respondent did during the day, and defines that travel is not an activity, but is recorded in the context of how a person got to an activity that was performed at a different place from the previous activity. Essentially, the

same data are collected in the activity diary as in the travel diary, but in a different order and with a different focus (*19*). A page from a recent activity-diary design is shown in Figure 4. The time-use diary treats travel as another activity, rather than trying to exclude travel from among the set of activities. This

9. WHERE DID YOU GO TO NEXT?

A) WHAT TIME OF DAY DID YOU BEGIN THIS TRIP? (Be exact, such as 4:32, a.m.)

_____ a.m./p.m.

B) WHERE DID YOU GO?

( ) home
( ) work
( ) school
( ) shopping
( ) other (specify) _____

C) ADDRESS OR CROSS STREETS: _____

_____

CITY/TOWN: _____

NAME OF THAT PLACE: _____

D) HOW DID YOU GET THERE: _____
(Car, bus, train, airplane, walk, etc.)

E) WHAT TIME DID YOU GET THERE?

_____ a.m./p.m.

10. WHERE DID YOU GO TO NEXT?

A) WHAT TIME OF DAY DID YOU BEGIN THIS TRIP? (Be exact, such as 4:32, a.m.)

_____ a.m./p.m.

B) WHERE DID YOU GO?

( ) home
( ) work
( ) school
( ) shopping
( ) other (specify) _____

C) ADDRESS OR CROSS STREETS: _____

_____

CITY/TOWN: _____

NAME OF THAT PLACE: _____

D) HOW DID YOU GET THERE: _____
(Car, bus, train, airplane, walk, etc.)

E) WHAT TIME DID YOU GET THERE?

_____ a.m./p.m.

FIGURE 3 Page from a travel diary.

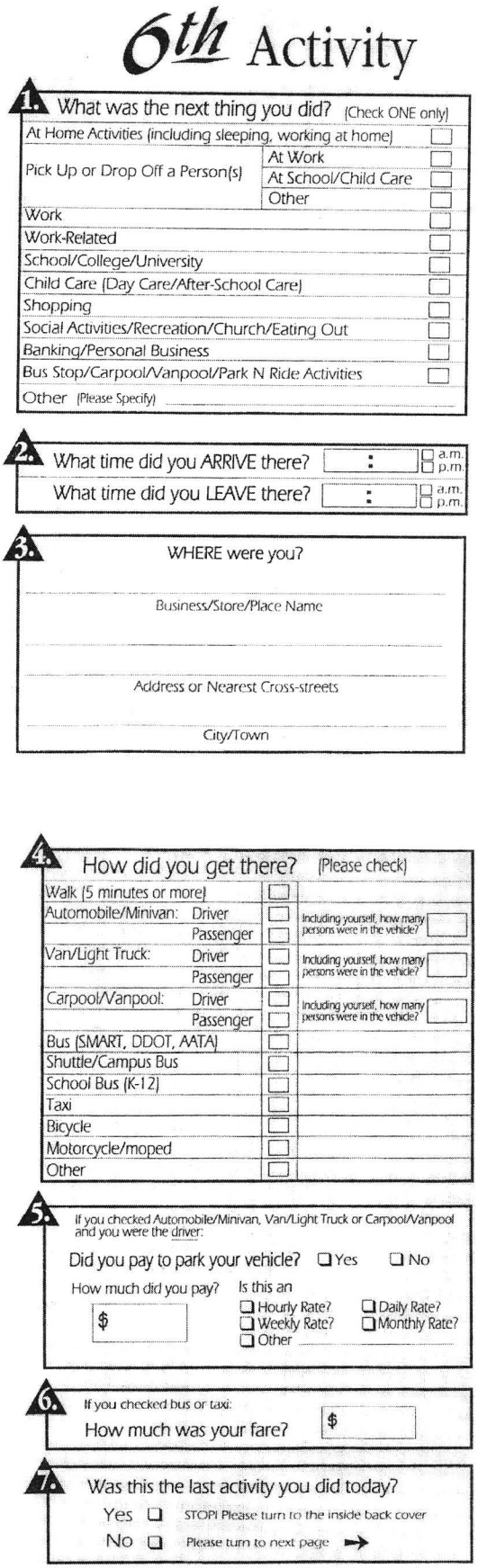


FIGURE 4 Page from an activity diary.

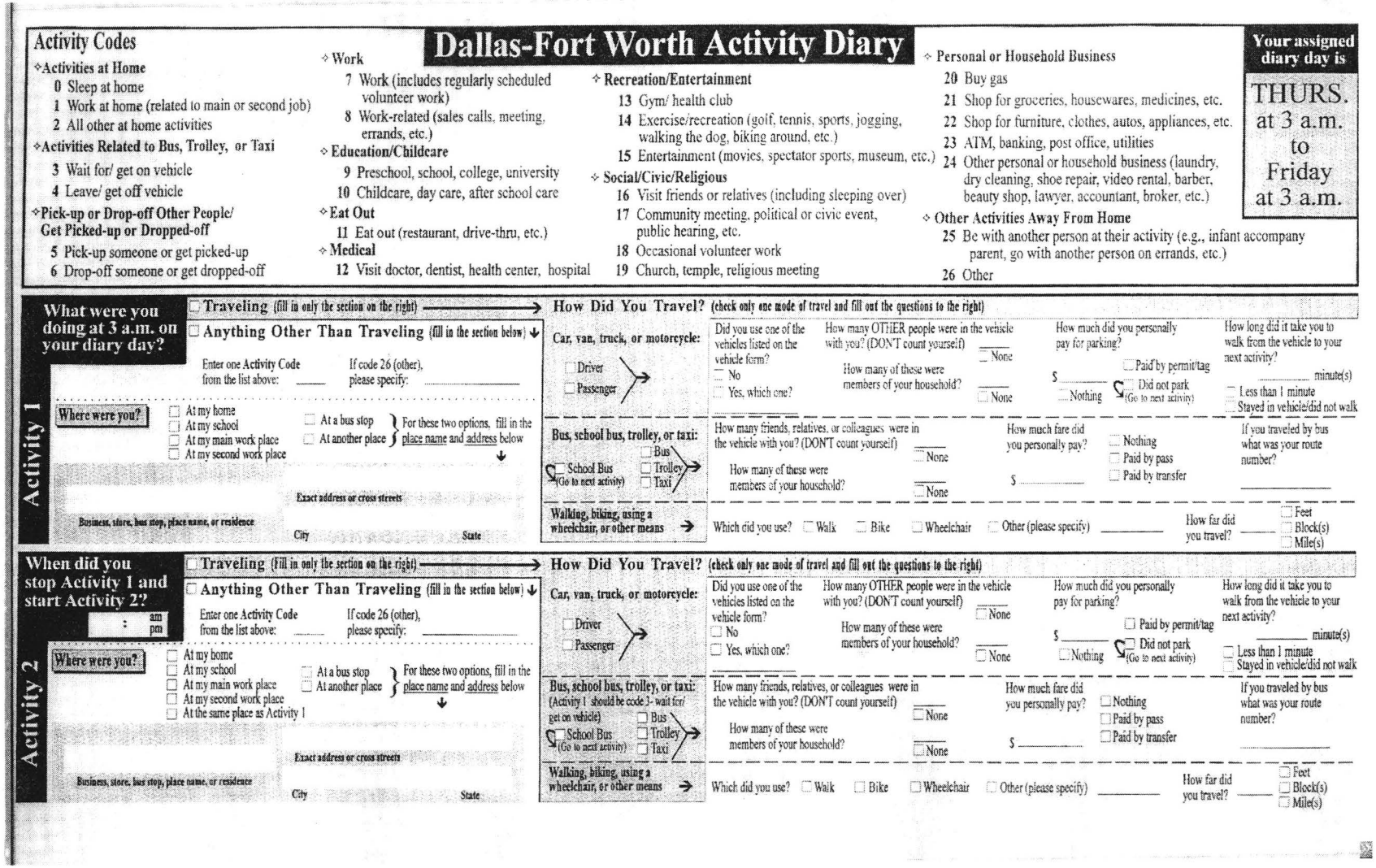


FIGURE 5 Page from a time-use diary.

results in a bifurcated set of questions, where activities at a single location trigger questions about the location (e.g., address), while activities of travel trigger questions about the travel (e.g., number of people traveling together). All activities, whether travel or not, are described in sufficient detail to determine mode of travel or type of fixed-location activity, and the times of beginning and ending the activity are also recorded. An example of such an instrument is shown in Figure 5. In sum, the data collected in each instrument are the same, while the order of questions and the concept change between each type of diary. Among recent surveys, 76 percent used a trip diary and 19 percent used an activity diary. Six percent used a retrospective collection of data, without specifying if this was trip or activity based. The first time-use diary is being used in an ongoing survey in Dallas-Fort Worth, which is the source for Figure 5. Two things are noteworthy about the change in design. First, the number of questions to be answered on each activity are very few. If the activity is at a fixed location, only the time start (which is defined as the time that the preceding activity ended), the activity, and the location are requested. If the activity is travel, then a range from two to five questions are asked, in addition to identification of the travel mode. It should also be noted that the Dallas time-use survey collects each stage of a trip as a separate activity, using the waiting time between stages as additional fixed-location activities, from which it is hoped to be able to define the location and duration of each transfer wait. To date, there are no completed instances of the use of the time-use diary for household travel surveys from among the MPOs and states surveyed, the ongoing Dallas survey being the first such survey to be done in the United States.

A diary consists of either a sheet or a booklet. In a sheet, there will usually be a row or column that represents each trip or activity, while the booklet will allocate either a single page or a pair of facing pages to each trip or activity. (A time-use diary can also be designed as either a booklet or a sheet, and will follow a similar pattern.) For trip diaries, the sheet appears to be the most popular with 86 percent of those surveys that used a trip diary using a sheet, and 14 percent using a booklet. For activity diaries, the reverse is the case, with almost 90 percent of those surveys that used an activity diary using a booklet, and only 10 percent using a sheet. There is one known instance of a comparison between the sheet and the booklet in a recent pilot test. The results of that test were inconclusive with respect to whether either the sheet or the booklet was preferable. Overall, it was not possible to detect significant differences between the two, in terms of such measures as response rate and trip rates.

Diaries may include a memory jogger, which provides space for recording an abbreviated set of information about each trip or activity. The idea of the memory jogger is to permit people an easy and rapid way to record their travel or activities as they carry out their diary day, with the details to be completed later. Usually, a memory jogger is used with a diary booklet and not with a diary sheet, because the sheet is closer to the concept of the memory jogger in the first place. Memory joggers may be included as pages inside the diary or may be provided as a separate document. Details were not collected in the survey about the use of memory joggers, although instruments were obtained from a number of surveys. Generally, it appears to be most common that the memory jogger is included within the diary. To the extent that mailback surveys have been examined where a memory jogger is provided, evidence appears to indicate that it is used by a significant proportion of respondents. However, it is also notable that the contents of the memory jogger often do not match the detailed diary pages, apparently because respondents see the need to correct their recording when the more detailed questions are considered. An example of a memory jogger is shown in Figure 6.

Summary of Activities

Please fill out during your Diary Day

#	Start Time	Activity (Please do not record travel)	End Time
1	3:00am		
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

FIGURE 6 Example of a memory jogger.

It is interesting to note that, in the mail-back surveys, such as Boston, the memory jogger was usually filled out fairly completely and often provided clues as to how to "mend" the main body of the diary survey, where that had been filled out incorrectly. In Portland, an experiment was tried in which the memory jogger was provided as a separate item from the diary, where prior memory joggers were always included within the diary. In follow-up analysis of the use of the jogger, it was found that people chose either to fill in the jogger or the diary, but not both. Therefore, the jogger was omitted in the latter

stages of that survey. In the Dallas survey, the diary has been redesigned into more of a memory-jogger style, and so the memory jogger has been omitted from the design. In the NPTS pilot tests for the 1995 survey, a memory jogger was tested as a stand-alone instrument against a leaflet-style diary and the prior design of a retrospective telephone collection. The stand-alone memory jogger was found to perform better on almost all counts than the retrospective call, but performed slightly less well on several key aspects than the leaflet diary.

Another option in the design of the instrument and scripts relates to whether all questions that are included in the retrieval are asked in the self-administered instrument. There appears to be some difference of opinion in the profession on the appropriate design in this respect. Some hold that there should be no "surprises" for the respondent in the form of questions asked in the retrieval interview compared to questions asked on the survey forms. This position is based on the idea that a respondent is likely to be disconcerted by being asked for information that was not included in the written instrument. This does not include the use of probe questions, which may be required to obtain more complete diary records or to fill in specific data items requested by the written instrument but omitted by the respondent at first. The alternative opinion is that it is sufficient to provide the respondent with a reduced version of the questions in the written instrument and to seek additional information during the retrieval. This position is based on the notion of minimizing respondent burden in the task of completing the survey instrument and effectively uses the instrument as though it were a memory jogger. It has not been possible to determine from the recent surveys the extent to which either of these positions has been taken, nor to comment on the comparative success of each. In one recent pilot test, both the memory-jogger style of survey form and a more complete diary sheet were used. The results of that pilot test tended to show that there were some improvements in overall data quality and completeness from the diary sheet where all questions were asked, over the use of the abbreviated version as a memory jogger.

CHAPTER FOUR

SURVEY EXECUTION

PRETESTS AND PILOT TESTS

The terms "pretest" and "pilot test" tend to be used interchangeably in the transportation arena. Correctly speaking, a pretest is simply a test before the main survey and will often represent a test of a single element of the survey, such as a specific question wording or instrument layout. The test is usually performed by using that element of the survey and determining how it works. Also correctly speaking, a pilot test should be termed a pilot survey and represents a complete run through of the entire survey process, often with variants of instrument, procedure, sampling, and so forth. Pilot surveys should be able to perform four functions: (*20*)

- A means of testing survey forms and sampling techniques, and to train interviewers/surveyors;
- A first approximation of data on variability in the population for the study area;
- A basis to estimate the costs of the full survey and the time that the full survey is likely to take; and
- Determination of the most effective type and size of sampling unit (not usually applicable to household travel surveys).

However, for the balance of this section, the term "pretest" is used to imply either a true pretest or a pilot survey, in keeping with customary use in the transportation profession.

Pretests should always be performed prior to commencing a survey, at least to test the survey instrument. Even when an instrument is being used from a prior survey or a survey in another location, there are likely to be changes needed resulting from either geographic or temporal change. Any change in an instrument from a previous use or a use in another location should be tested. Nevertheless, pretests are still not carried out in all household travel surveys. In fact, 74 percent of the recent surveys included a pretest. Among these 74 percent, Table 3 shows the proportions that tested different elements of the survey.

TABLE 3

PROPORTIONS PRETESTING ELEMENTS OF THE SURVEY AMONG THOSE CONDUCTING A PRETEST

Element Pretested	Percentage Pretesting
Instrument	100
Management	58
Training of survey personnel	48
Sampling	40
Keypunching	28
Geocoding	25
Analysis	23
Incentive	10

As can be seen, the most common testing done was of the instrument, followed by the management of the survey. Almost half of those using some form of pretest used it also as a means to train survey personnel, consistent with the goals of a pilot survey, as noted above. It is notable also that few surveys tested data entry, geocoding, and analysis, meaning that few of the pretests met the definition of a full pilot survey. Further, the potential must exist in many cases that, after completion of the survey, data will be found to be lacking in some way for the desired analysis.

Sampling for the pretest must address both the size of the sample needed and the population from which the sample is drawn. An important concern with the population from which the sample is drawn is one of bias to the final sample. This arises where those selected for the pretest are excluded from being a part of the final sample for the survey. This is an issue that is often ignored in household travel surveys. Correctly, the main sample should be drawn first from the population. Then, the pretest sample should be drawn from those households that are not part of the main survey sample (including all spares drawn for the main sample). This procedure avoids the potential for the pretest sample to bias the main survey sample. In some instances, the pretest is conducted on staff of the agency that is conducting the survey. This will not bias the survey if these individuals and their households are not excluded from being drawn for the main survey, which usually is the case. However, except in the case of relatively minor changes to a survey element, this form of pretesting is quite limited in its ability to detect serious problems in an instrument or procedure. The reason for this is that agency staff are usually more literate and educated than the average population, and are less likely to find certain question wordings or instructions difficult to perform. In addition, agency staffs are usually more attuned to the reasons for the survey and will tend to work harder at trying to respond than will the general public, therefore often not providing good feedback on potential problems in the survey design. The reasons that pretests are often not done are that too little time is allowed for the survey to permit a pretest to be done, with the result that this is sacrificed in order to achieve the turnaround that has been determined as necessary. In addition, a number of agencies have not considered including a sufficient budget for a pretest, and including one may result in having to forego a significant portion of the final survey sample, because of funding limitations.

Two points are worth noting with respect to the value of pretests. First, failing to undertake a pretest can result in the data collected being quite unsuitable for the purposes of the survey. In this case, a modest expenditure of time and money could have avoided a significantly larger waste of time and

money, when the survey is found to be of questionable value. Second, any significant change from prior surveys should be seen as an absolute requirement for a pretest. Even changes that seem to make perfect sense to the designers can turn out to be unworkable with the public.

The numbers of households recruited and completed in pretests are shown in Table 4. Final numbers of completed surveys in pretests ranged from 0 to 1,800 for the recent surveys, with 82 percent having completed samples of 75 or less, and 94 percent having completed samples of less than 200. The average sample size for the pretest was 336 households, but the median was at 67, again showing a preponderance of small samples. To obtain these completed surveys, the range of contacted households was from 10 to 5,300, with a mean of 121 and a median of 40. Completion rates ranged from 0 percent to 100 percent. (100 percent was obtained in those instances where the pretest was performed on agency staff.) The mean pretest response rate was 57.5 percent and the median was 61.7 percent, showing some upward skewing due to the use of agency staffs as pretest samples, where response rates will tend to be near 100 percent. Response rates are shown in Table 5.

TABLE 4

RECRUITED AND COMPLETED HOUSEHOLDS IN PRETEST

Number of Households	Recruited	Completed
0–25	4	6
26–50	9	17
51–75	7	4
76–100	5	2
101–200	6	4
201–500	2	1
>500	1	1
TOTAL Pretesting	34	35

TABLE 5

RESPONSE RATES REPORTED IN PRETESTS

Response Rate Range	Number Reporting
0–0.25	3
0.26–0.50	4
0.51–0.75	16
0.76–1.00	8

The reason for the imbalance in the total is that one region indicated the number recruited but not the number completed, and two regions indicated the number completed but not the number recruited.

The final issue to note on pretests is whether or not the pretest had any effect on the survey. Of those agencies that reported undertaking a pretest, 92 percent reported that some change was made as a result of the pretest. This bears out the importance of undertaking a pretest. Table 6 shows which elements were changed as a result of the pretest and also shows what percentage this is of those that pretested the element.

From the table, it can be seen that, if tested, the most likely items to be changed were the incentives, the instrument, survey management, and geocoding. This suggests that these are the most important elements of the survey that should be tested. However, it is the testing of analysis and data entry that may lead to some of the changes in instruments and geocoding. Therefore, a pretest should also include these elements.

TABLE 6

CHANGES MADE TO SURVEY ELEMENTS AS A RESULT OF THE PRETEST

Survey Element	Percent of Those Changing an Element that Changed this Element	Percent of Those that Tested the Item Reporting Changes
Instrument	97	85
Management	43	65
Geocoding	17	60
Sampling	14	31
Other	14	N/A
Incentives	11	100
Keypunching	6	18
Analysis	3	11

SURVEY ADMINISTRATION

The area of survey administration includes determining who is responsible for the overall administration of the survey, what reporting is required from consultants involved in the survey, whether or not a peer review panel is used in the design of the survey, what monitoring is done of consultant work, and what interaction with the public is included. As noted earlier in this document, most MPOs and states opt to use consultants in some role in carrying out household travel surveys. Of those using consultants, about one-third turned over the entire responsibility for administration to the consultant and half gave major responsibility to the consultant, with the MPO or state taking only a minimal role. In only 4 percent of cases did the MPO or state take the primary role, while 14 percent took a joint role with the consultant. Clearly, the most common procedure is to use a consultant and to provide that consultant with the primary responsibility for survey administration.

In the case of those using consultants, progress reporting of some form was required by almost all MPOs and states. In just under 10 percent of cases, progress reports were not required. The form and frequency of reports was quite varied, ranging from weekly written reports to monthly verbal reports. While a number of those surveyed did not receive reports on a daily, weekly, or monthly schedule, from those that did indicate such reports, the most common reporting was a written monthly progress report. In nearly half of these cases, a verbal weekly report was also required. The next most common reporting requirement was a weekly written report, which was occasionally supplemented by a weekly informal or verbal report. In eight cases (25 percent of those responding to the question), the most frequent reporting required was daily. In 72 percent of cases, the most frequent reporting required was weekly. Thus, in 97 percent of cases, reporting was daily or

weekly. In almost all cases where consultants were used, task completion reports were required. In approximately 40 percent of those cases where consultants were used, only task completion reports were required.

The use of peer review panels, which has become increasingly popular in travel-demand modeling work, has not yet become customary for household travel surveys. Only 15 percent of the recent surveys used a peer review panel at any stage of the household travel survey. Monitoring of the survey during conduct, in contrast, was quite common, with only 20 percent not monitoring the survey. The most common monitoring to be done was of both the recruitment and retrieval calls, which was reported as done by 50 percent of the MPOs and states responding to the survey. Ten percent monitored only the recruitment call, and seven percent monitored only the retrieval call. All of those that performed face-to-face interviews also monitored those interviews.

An increasingly common procedure in household travel surveys is to provide a toll-free 800 telephone number for contacted households to call, either for verification of the bona fides of the survey, or for questions about the survey. Less than 10 percent of recent surveys did not provide either a toll-free number or a local number for respondents to call. About three-quarters of the recent surveys used some form of publicity to inform the public in the study area that the survey was either being done or about to be done. Newspaper articles were used by 92 percent of those undertaking publicity, followed by 28 percent using radio stories. Public service announcements in newspapers, on radio, or on television were used by the majority of those that undertook any form of publicity. It may be worth noting that the medium used most for publicity is the one that is probably used least by the American public (the newspaper), while television, the medium with the largest audience, was used by only 23 percent as a means of publicity. This is almost certainly a reflection of the cost and difficulty of undertaking publicity.

It is also interesting to note that the MPO or DOT staff were most likely to undertake the publicity effort. In more than half of all cases, the public agency staff took sole responsibility for the publicity. In only 3 percent of cases was this done by the consultant doing the survey, while about 17 percent used a specialist consultant on publicity.

OBTAINING RESPONSES

As was noted earlier in this document, one of the problems that plagues all forms of surveys in the late twentieth century is the problem of increasing nonresponse. One of the issues to examine is what steps are being taken to increase response rates. There are really two primary methods that can be used to boost response rates, once the design of the instrument and the basic procedure for doing the survey have been determined: incentives and reminders. However, this section also includes some discussion of what was done to gain additional information from households or to correct apparent errors and anomalies in the data, since these are actions that can convert what is otherwise an unusable response to a usable one, thereby improving the overall response rate.

Incentives

The use of incentives is a somewhat controversial issue among survey designers. The major concern that arises with offering incentives is that the type of person or household to which an incentive appeals is not typical of households in the general population. Therefore, the argument is made that offering an incentive introduces bias into the survey. On the other hand, when response rates drop to a sufficiently low point, nonresponse biases may be so large that the bias introduced by incentives is comparatively negligible. In the field of household travel surveys, no investigation has been reported in the literature of the biasing effects of incentives. This would require a comparative study of households drawn at random from the same population with different levels and types of incentives offered, including a control group to whom no incentive is offered.

While it appears that the idea of offering incentives is growing in the field of household travel surveys, it is still not done widely. However, as the information demands on people grow and response rates continue to fall, it can be expected that this trend will change. In the recent surveys, 80 percent still used no incentive of any type. Of those using an incentive, almost half favored a straight cash incentive, and one case used cash and pens, while a drawing was used by another third of those using incentives. Lottery tickets were used in one case, in Boston in 1990. The amount of the cash incentives was not requested. However, anecdotal information indicates that incentives have generally been on the order of $1 per person. The Puget Sound Regional Council tested several incentives in the late 1980s and concluded that $1 per diary was the most effective of those incentives tested. More recently, in Dallas-Fort Worth, tests were made of a pen, $2 per diary, and the combination of the pen and $2. It was found that the $2 incentive seemed to work best. A more detailed analysis of incentives is provided by Tooley (*21*).

In addition to determining the amount of the incentive, the second issue relates to whether the incentive is sent in advance (i.e., as an "inducement" to the household to respond), or whether it is sent to those households returning complete information (i.e., as a "reward" for completion). There are again conflicting opinions within the transportation profession about what is best in this matter, although survey experts generally seem agreed that the enclosed incentives are far superior to promised incentives (*22,23*). Sending an incentive in the mailing of materials to all households is administratively easier and is argued to create an obligation in people to respond. However, it also results in a number of households receiving money for doing nothing, if they choose to keep the incentive and still do not complete the survey. Sending out the incentive as a reward for completion is clearly effective only if this reward is announced in advance. In that case, some households may provide spurious or fictitious information simply in order to receive the reward. Also, this procedure requires a greater administrative effort and opens the door to conflict over whether the response provided was complete (in the eyes of the agency for whom the survey is being done, in contrast to the eyes of the respondent). On the other hand, this procedure

ensures that only those who provide information actually receive the incentive. In the case of a drawing, the incentive is offered only to those who complete the survey (the identification number on the survey form is usually used for the drawing, and only those returning surveys are entered into the drawing), without the administrative burden of an additional mailing after the surveys are returned. Among those using cash or lottery tickets as an incentive, about half provided the incentive in advance of the response, and half provided it as a reward to those completing the survey.

Reminders

Another method to increase response rates is to provide reminders to households to complete their surveys and to send the completed surveys back, or be available for the retrieval call. Several forms of reminder can be used. These include telephone reminders, postcard reminders, and letter reminders (often accompanied by another copy of the survey materials). Two aspects of reminders are of specific interest: the type and the number. Some recent work on nonresponse in Australia (*5*) shows clearly that the use of reminders is highly cost-effective and is preferable to increasing sample size to counter initial nonresponse. This paper also shows that multiple reminders are normally necessary and still cost-effective.

Reminders are used in most recent surveys. Approximately 80 percent of MPOs and states used reminders. Most of the reminders were performed by telephone, this being used in 93 percent of the cases where a reminder was used. However, the use of multiple reminders is much less common. Of those that used reminders, 60 percent used only a single reminder, while almost 20 percent used four or more reminders. Seventeen percent used two reminders. Of those using reminders, 75 percent used only a telephone reminder, while 10 percent used a combination of telephone and postcard, and 8 percent used a combination of telephone and a letter. Eight percent used a combination of telephone, postcard, and letter. No one reported using a postcard reminder alone, although 5 percent reported using only a letter reminder.

Most of the surveys planned on making three contacts with households (usually a recruitment contact, one reminder contact, and a retrieval contact). About 20 percent planned only two contacts (generally no reminders) and 20 percent planned four or more contacts. Over 10 percent planned only a single contact, which was true of the face-to-face interviews and one or two of the mail-out/mail-back surveys that used no reminders.

Data Correction

Nearly 20 percent of recent surveys have taken the position that data retrieved from households is noncorrectable. This means that any errors found are used as a basis for final acceptance or nonacceptance, and no effort is made to make corrections. More common is to make corrections to the data, in order to retain as many households as possible in the final sample. Corrections can be made in a number of ways. First, corrections can be restricted only to invalid data (such as a child of 5 who is reported to have driven to school). Corrections may also be restricted only to missing data. When data corrections are made, these can be done either by recontacting the household or by inference from other data in the household and person records. There are also issues of timing in making corrections. Timing relates to issues of the speed with which data are reviewed for completeness and correctness, and the rapidity with which recontact is made with households. Clearly, with travel data, the sooner the errors are found and the sooner the household is recontacted, the more likely it is that the data can be repaired. Generally, demographic data on the household are less sensitive to time issues and can be checked later and households recontacted later to correct or complete the information.

The need for immediacy in correcting travel-related data has been recognized in the profession, in that 70 percent of recent surveys reported that at least some of the data were reviewed for correctness and completeness on a daily basis. Eight percent reported reviewing data on a weekly basis, 2 percent on a monthly basis, and 10 percent at the end of the study. The remainder either did not check the data at all, or did not know how the consultant handled data corrections. Even among those surveys that checked the data, a number did not make corrections. In total, almost 20 percent of recent surveys made no corrections to the data, once collected. On the other hand, two-thirds made corrections to both missing and invalid data, while 14 percent restricted corrections to invalid data only.

Of those that made corrections, 57 percent waited until the respondent could be recontacted, while 16 percent made immediate corrections to the data. The remainder made some corrections immediately and some only after recontacting the respondent. Most surveys relied on some form of recontact to make corrections. Only 7 percent reported making all corrections by inference from other data, with no recontact. Sixty-two percent made corrections partly by inference and partly by recontacting respondents. In cases where no recontact was possible, 38 percent left the data as invalid or missing, while the remainder made some type of repair to the data or discarded the data entirely.

An issue that arises for determining completeness of a response and repair of data is the notion of "critical" questions, i.e., questions that must be answered with valid responses for the record to be considered usable. It is usual to define such critical questions, in order to be able to define when a household response is complete, and to guide on what level of effort is to be expended on correction and repair. About 80 percent of recent surveys defined critical questions, of which 81 percent discarded households that had missing critical data. The remainder generally separated the households with missing data from the rest of the sample, but kept them available for those analyses that did not use the missing data items. A related issue is what happens to households that terminate part way through the retrieval process. In most cases (60 percent), such households were simply dropped from the data set. In 30 percent of cases, the data were retained but kept in a separate file,

again so that such data could be used for some analyses. In six percent of cases, it was reported that terminated households were kept in the main body of the data.

Processing the Data

In the 1950s and 1960s, the convention was to record data by paper and pencil, often with literal written out entries for various responses. Subsequently, the survey forms would go through a coding step in which numeric codes were entered manually into a coding form or coding block within the interview form. These coding forms or coded interview forms were then turned over to a keypunch operator who keyed in each data item, typically with a double-entry keypunch that permitted a fairly high level of error checking. As the travel survey has evolved and technology has changed, this method of data processing has changed. Nevertheless, among recent surveys, 43 percent still use keypunching and manual coding as the data-entry method. The next most popular method and the one that seems likely to become the most popular in the next few years is direct data entry through Computer-Aided Telephone Interviewing (CATI), used by 39 percent of recent surveys. In one instance, both direct entry and manual coding and keypunching were reported as being used. and several surveys reported a combination of CATI and direct data entry or CATI and manual coding and data entry. These combination methods generally apply to entry of geocodes or other data that cannot be coded directly in the CATI process. In only two instances (3 percent), was scanning (mark-sensing) used as the method of data entry.

Geocoding

Geocoding deserves special treatment in this discussion because it is probably the single most challenging element of the data coding. Geocoding is a problem partly because of incomplete and inaccurate reporting of addresses by respondents, and partly because accurate geocodes are essential for many of the uses of household travel-survey data. In the early days of household travel surveys, geocoding was entirely manual, involving staff looking up each address in a gazetteer (a listing of street addresses by map location, often with the addition of a traffic analysis zone number) or locating it on a map and determining the geographic unit into which the location fell. Generally, the coding was done to the traffic analysis zone (TAZ) only. Modern technological advances in geographic information systems (GIS) and related areas have produced substantial changes in this, as is shown by the changes reported in geocoding of recent surveys. Typically, geocoding can now be done increasingly by computer through various versions of address-matching capabilities, although some level of manual geocoding remains necessary because of incomplete addresses and addresses that are too broad to allow correct allocation to a single geographic unit.

Over the past 5 years, 30 percent of the household travel surveys reported still using manual geocoding. However, 55 percent reported using a combination of manual and computerized geocoding, while 9 percent used computerized geocoding alone. Six percent reported some other method of geocoding, generally relying on the respondent to provide the geocoding to a zip code or a large geographic area. Sources for geocodes are also very important. A number of different sources were reported as being used for recent surveys. Many surveys reported using multiple sources to geocode the data. Sometimes, multiple sources are used to provide different geographic specificity, such as using TIGER (Topologically Integrated Geo Encoding and Referencing) or GBF/DIME (GeoBase File/Dual Independent Map Encoding) files for census tracts and telephone directories for zip codes.

The single most frequently used source for geocoding was the TIGER or GBF/DIME files, with 48 percent of recent surveys using these files as the source or one of the sources for geocodes. The second most frequently used source was telephone directories, used by 37 percent of recent surveys. Maps were used by 34 percent of recent surveys and a community database, such as 911 data bases, were used by 28 percent of recent surveys. (Many regions are now in the process of setting up a GIS of address locations for the purposes of 911 emergency service. These GIS data bases provide a telephone number and precise street location for every building or unit in the region and make it easier for 911 operators to determine the location from which a call is made.) Several other sources were also mentioned, such as the use of zip codes reported on the survey forms.

As noted, early household travel surveys geocoded almost exclusively to the TAZ system of the study region. With the increasing variety of sources for geocoding and the use of computerized address matching, it is no longer necessary to limit geocoding to a single scheme, and much finer levels of detail are possible, provided that addresses are reported with sufficient accuracy in the survey. Many recent surveys have taken advantage of recent technological developments to geocode to multiple geographic schemes, although the TAZ represents the single most common geocoding level still, with 36 percent of recent surveys using the TAZ as the only geocoding scheme, and 33 percent using TAZs as one of the schemes of geocodes. Coding to latitude and longitude was the second most frequently used scheme, reported in 31 percent of recent surveys, followed by census tract (17 percent), zip code (15 percent), and census block or block group (8 percent). A few surveys used a much more aggregate level of geocoding, with variation from U.S. Public Land Survey quarter-sections to counties.

Finally, although no questions were addressed to this issue, checking of geocodes is of utmost importance. Several recent surveys have encountered serious problems in this regard, which can arise from such things as faulty source records for the geocodes, incorrect manual geocoding, and unfamiliarity with the geography of a region. For example, in one recent instance in Southern California, the initial geocoding was done in ignorance of the fact that some census tract numbers occurred in more than one county. Erroneous geocoding created, in one instance, a 42-mile walk to work that was performed in 5 minutes! This resulted from using a census tract from the wrong county. Not all errors created in geocoding are as obvious as this, but they can have serious repercussions on subsequent use of the data for modeling purposes. This type of problem can also occur when large urban areas contain communities with identical street names (e.g., Main Street).

CHAPTER FIVE

SURVEY RESULTS

TIME AND COST REQUIREMENTS

Household travel surveys have traditionally been conducted during a single season of the year. Not uncommonly, the survey effort would be initiated in the early winter or early summer, with the expectation that preliminary design, pretesting, and refinement would be conducted in two or three months, so that the full survey would go in the field by early spring or early fall, respectively. It is probably appropriate to note that agencies typically provide too little time for the survey design and testing process, with the result that surveys intended to be fielded within two to three months of the initiation of design and testing either fail to meet the planned timetable, or are fielded with inadequate testing and little or no redesign. The consequence of the lack of testing and redesign is seen frequently in data that contain a variety of problems or are found to be less than ideally suited to the intended uses. Judging by a review of the requests for consultant proposals for household travel surveys, most agencies seem to believe that a competent household travel survey can be undertaken in a time frame that allows two months of preparation, three months of fielding, and three months of data coding, data entry, analysis and reporting, for a total duration of about eight to nine months.

The reality is somewhat different. The time taken to prepare for, execute, analyze, and report results is more frequently in the range of 15 to 18 months, with some surveys taking considerably longer. While the front end of the survey task is often undertaken on a schedule close to that desired by the agency, this often leads to a protracted period of data editing, data correction, and related activities as attempts are made to patch data that were collected with too little testing and too little attention to refinement of the processes of the survey. The majority of recent surveys (62 percent) were still implemented as one-season surveys. However, a substantial proportion (38 percent) covered multiple seasons, often with this not being the original intent of the agency commissioning the survey, but ending up as the accommodation to the realities of the survey process.

In the same way, household travel surveys often are seriously underbudgeted. Allocating insufficient funds to household travel surveys appears to be firmly embedded in the profession. Whether it results from the difficulties of convincing nontechnical boards of the need to spend money on collecting data, or arises from some notion that if less funding is allocated, the job will actually be executed for less money, is not clear. However, underestimating the costs of surveys and underestimating the time required both have identical effects. If the task is forced to fit the money allocated, then more often than not the quality of the resulting data suffers, or the agency finds itself injecting additional funds to achieve the quality demanded and the scope originally planned. Alternatively, compromises are reached, such as reducing the sample size, or reducing the scope of the survey, or shifting what were intended to be consultant tasks back to the agency.

In conducting the survey of agencies concerning recent household travel surveys, copies of various documents were requested, including final reports and original requests for proposals. These documents were examined to determine something of the relationship between anticipated costs and schedule and actual costs and schedule. In many cases, one or more of the necessary documents was missing, making an analysis of these aspects of the survey somewhat difficult. In most cases, information on the requests for proposals was not provided, although requested, so that this analysis is limited to four case studies. The studies are not identified to locality in Table 7, which summarizes information on the comparison of what was requested and what was done. Several observations are in order about this table. First, the table indicates that costs were generally not exceeded. This is largely a result of the fact that consultants were used in all cases with either a lump-sum contract or a cost-plus-fixed-fee contract with a ceiling. If no contract amendments were offered, the agency would have paid no more than the contract amount. Any losses incurred by the consultant are not shown. In addition, the costs do not include the agency's own staff costs.

Second, in all cases, the survey took significantly longer than the time requested in the RFP. In general, it appears that the duration of the survey was between 150 and 200 percent of the time originally requested. This is also reflected in the timing

TABLE 7

COMPARISONS OF RFP AND ACTUAL SURVEY STATISTICS FOR A SAMPLE OF SURVEYS

Survey	Cost ($000s)		Duration (months)		Time of Survey		Sample	
	RFP	Survey	RFP	Survey	RFP	Survey	RFP	Survey
1	170	164	8	14	Fall	Oct.–March	2,824	2,992
2	400	275	8	19	Fall	Spring	N/A	1,913
3	750	1,000	10	15	Spring	Spring and Fall	9,900	9,400
4	N/A	800	22	40	Spring–Fall	Summer–Fall	10,000	9,600

of the fieldwork. In all cases, the fieldwork started from one to three months later than was requested, even though the contracts for the surveys generally started when scheduled. Also, in two cases, the survey fieldwork was originally targeted to be completed within a single season, but actually required two seasons to complete.

Finally, the sample sizes requested were generally achieved, within a margin of about 5 percent. Therefore, it appears that emphasis is focused on achieving the desired sample, as well as a requirement for more time to prepare to field the survey. Coding, geocoding, and analysis of the data appear to be the other major contributors to the extended time requirements of the survey. Taking the 8-month requests as an example, these requests generally anticipated 2 months to be spent in preparation, including pretests, 3 months for fieldwork, and 3 months for data coding, data entry, clean-up, analysis, and reporting. Based on the cases examined here, the actual times appear to be 4 months for preparation, 5 months for fieldwork, and 5 to 10 months for coding, data entry, clean-up, analysis, and reporting.

One impetus to changing the methods used to collect data from the in-home interview to either telephone and mail or solely mail surveying has been the cost of conducting each household survey. In the mid 1970s, the U.S. Department of Transportation collected a major home-interview survey in Baltimore that involved a fairly lengthy collection of travel behavior data. That survey was estimated to have cost over $300 per home interview in 1975 dollars. Today, the equivalent cost would probably be in excess of $600 per household. Even with less expensive methods, it is to be expected that surveys will cost on the order of $100 per completed household by almost any of the current methods. This results in the fact that household travel surveys are, by planning standards, high-cost activities. With a median desired sample of around 2,500 households, the median cost of a survey would be expected to be around $250,000. From the recent surveys, it was found that the median was actually $242,500 and the mean was $406,250. The mean cost of a completed household was $106 and the median was $92. It must be kept in mind that these costs are averaged over all methods, and included one face-to-face interview with a small sample and several mail-out and mail-back surveys. Also, the costs reported were, in almost all cases, the costs of the consultant contract only, which ranged in scope from collecting the data with a predesigned survey instrument, and delivering the data to the local agency for coding, data entry, cleaning, and analysis, to carrying out all of the steps shown earlier in Figure 1, i.e., from design through analysis. About 70 percent of the reported costs did not include publicity of the survey, and about one-quarter did not include at least one of three significant elements of the survey, namely the pretest, geocoding, and analysis.

With respect to the cost figures, some information on the variability is important. Actual reported costs ranged from $8,500 to $1,530,000. The low cost of $8,500 was achieved with a very small sample and was the case in which only data collection costs were included. However, 28 percent of the surveys cost less than $100,000, while 72 percent cost less than $500,000. Fourteen percent of the surveys cost in excess of $1 million. While breakdowns of costs for different steps were requested, these were generally not available. The only specific cost that was reported was for geocoding. This ranged from a cost of $35,000 to $300,000 in those cases that reported a cost. The range of costs per completed household were from $19.54 to $534.38, which cover the gamut from administering a previously designed survey form to the complete design, pretesting, execution, and analysis of the survey. About 30 percent of the surveys were completed for less than $65 per household, while 20 percent cost over $140 per completed household. In considering these figures, it is also relevant to note that the number of households that were recruited averaged 6,000 (median of 3,000), of which an average of 3,840 (median of 2,150) completed the survey.

From the cost figures provided, there appears to be relatively little relationship between the method of the survey and the cost. The median cost of the telephone recruitment with mail-out and mail-back is $60, with a mean of $128; the median cost for the telephone recruitment with mail-out and telephone retrieval is $100, with a mean of $104. These are the only methods for which there are sufficient cases to determine a mean or median cost. Again, however, these costs are not consistent across surveys, because of differences in what has been included in the costs and what has been omitted with respect to specific tasks.

Duration of the Interview

The length of time that it takes to conduct an interview is important, both from the perspective of costs and from the perspective of response rates. Clearly, the longer the interview takes, the greater will be the data-collection costs. Relationships of survey length to response rates is less clear. Experiences have shown that the length of a survey form may have little effect on the response rate, particularly when the survey questions are interesting to the respondent (*24*). In the pretests in Dallas-Fort Worth in 1995, there was found to be relatively little difference in response rates between surveys of two different lengths and the longer survey was not necessarily the one with the lower response. There is anecdotal evidence that longer surveys may result in a lower level of completion of data, for example, in fewer activities or trips being reported. This issue has not been researched within the transportation arena and is clearly of importance to survey design. Data collected on the recent surveys about the time spent in the different elements of the interviewing suggested that careful measurement may not always have been done. In a number of cases, the responses bore strong resemblance to the responses of household travel survey respondents when asked about the duration of a trip, i.e., a number of times appeared to have been rounded to the nearest 5 or 10 minutes.

There were only three cases of a face-to-face interview. One of these was very short and took 30 minutes, while the others took 112 and 180 minutes respectively on average for each household. Eight surveys reported telephone retrieval times per person and 22 reported telephone retrieval times per household. From those reporting on the per person times, the

range was from 4 to 20 minutes, with an average of 14.5 minutes and a median of 15 minutes. For those reporting per household times, the range was 9 to 72 minutes, with a mean of 33 minutes and a median of 30 minutes. These times will tend to lengthen as surveys become more detailed in their requests. This makes it very important that methods are developed to shorten the time required, particularly in the interests of containing costs, but also potentially to reduce loss of data from fatigue. It should also be noted that one survey included in the telephone retrieval statistics was a 2-day diary, while the remainder were all 1-day diaries. The 2-day diary will necessarily involve a longer retrieval call.

EVALUATION AND DATA ANALYSIS

There are several ways in which the success of a survey may be judged. In household travel surveys, two groups of statistics are often used to measure success, namely response rates and trip rates. Both are complex measures and both incorporate a range of ambiguities and alternative ways to calculate. It is not clear that either is a good measure of success; however, the profession has not developed a standard metric of success in the evaluation of household travel surveys. An effective measure of success should probably include measures of response and accuracy, but should also include some measures that relate more directly to the quality of the data. The measures used here are those most often used by the profession.

Achieved Response Rates

Response rates vary with the methodology used. As noted in chapter 3, response rates have generally been considered to be highest for face-to-face interviews, and lowest for mail-out and mail-back surveys. The general expectations of the profession have been for response rates for face-to-face interviews to run as high as in the 90 percents, while mail-back surveys have often been as low as in the 20 percents, and generally no higher than about 30 percent. The telephone retrieval interview is sufficiently new that there is no general expectation, but rather expectations based on recent anecdotes.

From the recent surveys, the mail-back response rate was found to have been lower than is generally expected, with a range from 5 to 24 percent and a mean of 14 percent. There were too few face-to-face interviews to obtain a statistic on response rates. The telephone retrieval was found to be the most common method applied, and this method has two separate response rates. The first is the fraction of contacted households that agree to complete the mail package, i.e., that agree to be recruited for the survey. The second is the fraction of recruited households that provide complete data on the survey (however completeness is defined). Correctly, the first of these rates should not include telephone numbers that are answered and found to be other than household voice lines. Thus, contacts that turn out to be dedicated fax and data lines, businesses, and various nonresidential lines should all be excluded from the calculation. Also, numbers that are called repeatedly and that never result in obtaining any response (either no answer or busy) to determine if there is a household at the other end should also be excluded from the count. On the other hand, numbers that are answered by an answering machine and are clearly in a residence should be included in the count. It is not clear if these rules were obeyed consistently in the statistics collected from recent surveys. For the second response rate, there is less ambiguity, since this should be derived from all households that were successfully recruited in the first step and the number from which a usable response was obtained. The actual response rate for this type of a survey is then the product of these two response rates.

In the recent surveys, telephone recruitment was reported as ranging from 12 to 100 percent of the numbers called. (Keeping in mind that some surveys used published telephone directories as the source of numbers, the high recruitment rates are not entirely surprising. However, in some cases, the figure may be a result of misunderstanding as to the meaning of household contacts required, which may have been confused with number of recruited households required.) The mean recruitment rate was 49.9 percent and the median was 50 percent. There is significant variation by method. For telephone recruitment followed by face-to-face interviews, the recruitment rate was not reported. For telephone with mail-out and mail-back, the recruitment rate was 58.3 percent, while for telephone recruitment with mail-out and telephone retrieval, the recruitment rate averaged 45.7 percent.

The rate of completion of recruited households was reported as ranging from 36 to 97 percent of the households recruited. The mean completion rate was 69.5 percent and the median was 72.5 percent. Completion rates were again quite different by method. Completion of the face-to-face interviews (for which responses were reported under completions) averaged 72.5 percent. However, completion by recruited households for mail-back averaged 61 percent, while the average for telephone retrieval was 72.5 percent. For all methods using telephone contact, the rate of completion of recruited households was 68.6 percent. As a percentage of contacted households, the completed households ranged from 10 to 75 percent, with a mean of 36.4 percent and a median of 35.5 percent. This is the percentage obtained by multiplying the recruitment percentage by the completion percentage. Again, differences are apparent by method. For telephone contact with mail-back, the overall completion rate averaged 35.4 percent, while for telephone recruitment with telephone retrieval, it averaged 32 percent. For all telephone contact methods, it averaged 33.2 percent.

Different surveys stipulate different conditions for what is considered to be a complete record, which leads to potential ambiguity in the meaning of response rates. To be considered complete, options include the requirement that no information and no persons be missing from any household response or that no information classified as key is missing, implying that nonkey data items may be missing from a complete household. (The definition of key variables was discussed earlier in chapter 5.) A third definition of completeness, which is not exclusive from the key-data requirement, is to permit households to be counted as complete provided that data are

obtained from most eligible persons in the household. Here, it is quite common to stipulate different numbers of persons that may be missing, according to household size. For example, none may be stipulated for households of one or two persons, while one may be missing from three- or four-person households, and two may be permitted to be missing from households of five or more persons.

Of agencies reporting response rates, 56 percent required complete information from all members of a household to count as a complete record. Thirty-three percent allowed incomplete records from household members, provided that no key data were missing. In some of these cases, households were also considered complete even if one or more individuals were missing from the retrieved data. In 19 percent of cases, the number that could be missing from the household depended on the household size, while 2 percent stipulated that no more than one eligible person could be missing.

Probably the most important lesson to be derived from the response rates here is the need for standardization in the treatment of response rates throughout the transportation profession. It is clear that the response rates reported are derived from different methods and that many are not comparable to one another. It is not plausible that some surveys achieve 100 percent recruitment rates, while others achieve 28 percent recruitment rates from application of the same procedures.

Trip Rates

The second measure that is frequently used within the profession to judge the effectiveness and quality of the household travel survey is trip rates. Indeed, many agencies compare trip rates with one another to determine if the survey has produced plausible results. The estimation of trip rate, however, is even more fraught with difficulties than the response rate. First, care must be taken to determine if the trip rates to be estimated and compared are nonmotorized person trip rates, motorized and nonmotorized person trip rates, or vehicle trip rates, because all are reported. Second, trip rates, whether person or vehicle, may be reported as either per person rates or per household rates. Third, trip rates may relate to "linked" or "unlinked" trips. Unlinked trips represent trips undertaken on a specific mode or vehicle between a single origin and a single destination. However, there are two primary instances in which trips are linked so that two or more unlinked trips become one linked trip, one being through changes in travel mode (generally impacting transit trips rather than any others), and linking through pick-up and drop-off activities (which used to be called "serve-passenger" trips). An illustration of this is provided in Figure 7 in which a series of unlinked trips are shown that, following linking, become a single trip. In most recent surveys, linking was done by both methods. Trip linking was performed in 50 percent of recent surveys. For those undertaking linking, 82 percent reported linking through the change travel mode, 75 percent reported linking through pick-up and drop-off activities, and 36 percent reported some other type of linking, most frequently being to link only home-based work trips. Twenty-nine percent linked by both change travel mode and pick-up/drop-off activities for all trips, and 32 percent did both types of linking only for work trips. Twenty-one percent linked only through change travel mode and did so for all trip purposes, and 14 percent linked only through pick-up and drop-off activities for all trip purposes.

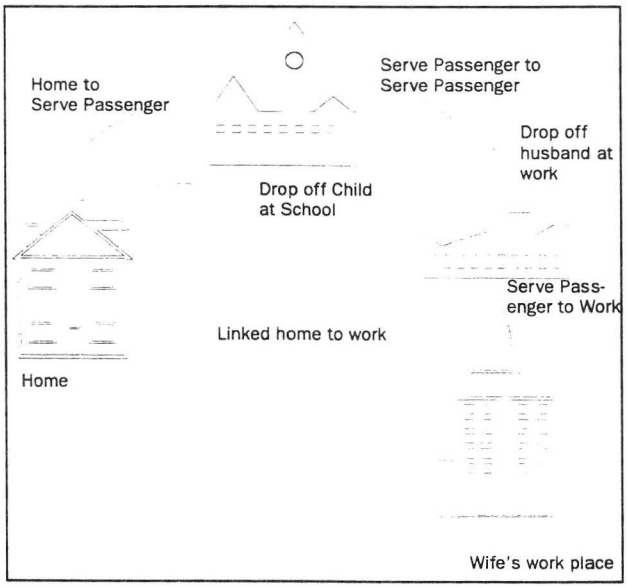


FIGURE 7 Illustration of the effects of trip linking.

As a result of these variations in trip-linking procedures, comparisons of trip rates become significantly more difficult. In addition, many other factors contribute to variations in trip rates, including levels of transit use, urban density, extent of urbanization, etc. In general, recent studies show that linked trip rates per person per day should average somewhere in the range of 3.5 to 4.5, while linked trip rates per household should average in the range of 8 to 11. These are figures that have been used as "conventional wisdom" for comparison purposes. It is interesting to note the difficulties of comparing such rates for the reasons discussed above, and also interesting to see what the recent surveys show. Table 8 provides summary results of trip rate data obtained from the recent surveys for all trip purposes combined.

Table 8 shows the diversity of trip-rate reporting, and indicates that linked trip rates are more common than unlinked, and that person-trip rates are slightly more common than vehicle-trip rates. However, no trip rate is used by a majority of the agencies reporting on recent surveys. Table 9 shows a similar breakdown of trip rates by the three major trip purposes. The three purposes shown in this table are home-based work (HBW), home-based nonwork (HBNW), and nonhome-based (NHB) trips. Table 9 shows, as one would expect, that unlinked trip rates are generally higher than linked trip rates, because linking involves reducing the overall number of trips. It is instructive to examine some of the rates in this table, however, in order to obtain some further insights on the use of trip rates and what they indicate. The first row of the table shows that a little more than one quarter of the surveys reported

TABLE 8

LINKED AND UNLINKED PERSON AND HOUSEHOLD TRIP RATES FROM RECENT STUDIES

Trip Type	Base	Percent Reporting	Statistic		
			Range	Median	Mean
Linked Person	Person	32.73	1.82 to 4.20	3.60	3.50
Unlinked Person	Person	20.00	3.64 to 5.53	4.15	4.20
Linked Person	Household	40.00	6.67 to 11.04	9.07	8.91
Unlinked Person	Household	27.27	7.20 to 13.61	9.81	10.20
Linked Vehicle	Person	25.45	2.05 to 3.61	2.50	2.63
Unlinked Vehicle	Person	12.73	2.37 to 4.89	2.91	3.32
Linked Vehicle	Household	38.18	4.30 to 11.05	6.62	6.79
Unlinked Vehicle	Household	20.00	5.34 to 12.02	7.41	8.00

TABLE 9

LINKED AND UNLINKED TRIP RATES BY PURPOSE FROM RECENT STUDIES

Trip Type	Purpose	Percent Reporting	Statistic		
			Range	Mean	Median
Linked Person	HBW	27.27	1.34 to 1.99	1.71	1.76
Linked Vehicle	HBW	23.64	1.29 to 1.78	1.52	1.55
Unlinked Person	HBW	12.73	0.90 to 4.77	2.14	1.86
Unlinked Vehicle	HBW	5.45	1.22 to 1.77	1.52	1.64
Linked Person	HBNW	27.27	3.00 to 6.32	4.58	4.76
Linked Vehicle	HBNW	23.64	0.46 to 4.39	2.70	2.84
Unlinked Person	HBNW	12.73	1.90 to 5.80	4.11	4.36
Unlinked Vehicle	HBNW	5.45	3.27 to 3.60	3.42	3.40
Linked Person	NHB	25.45	1.74 to 3.33	2.63	2.73
Linked Vehicle	NHB	21.82	1.13 to 2.60	2.02	2.14
Unlinked Person	NHB	12.73	1.50 to 4.53	3.02	3.24
Unlinked Vehicle	NHB	5.45	2.50 to 7.00	4.07	2.70

linked person trips for the HBW purpose. These studies showed a range of 1.34 to 1.99 trips per person, with a mean of 1.71 and a median of 1.76, these two showing that the distribution of trip rates is fairly symmetrical.

The second line shows that nearly one quarter of the studies reported linked vehicle trip rates, and that these trip rates are lower than the linked person trip rates, as would be expected if average vehicle occupancy is greater than 1. In fact, the ratio of the mean trip rates for persons and vehicles shows an average vehicle occupancy for work trips of 1.125. (This will include the effects of transit ridership, which, where significant, will tend to increase the average occupancy.) Even though most of the rates were from distinctly different surveys, this figure is close to the national average. The third row shows that almost 13 percent of surveys reported unlinked person trips for the HBW purpose. The unlinked person trips have a much wider range than the linked person trips, reflecting such things as multi-stop trips to work, including trips by transit and trips with pick-up and drop-off activities within them. Oddly, the lowest rate for unlinked person trips is below that for linked person trips, which is unexpected. This appears to be an inconsistent result, as is further shown by the fact that the mean and median are both higher than the linked trip values, as would be expected. Finally, a little over 5 percent of the surveys reported unlinked vehicle trips. The range, mean, and median for these trips are almost identical to those for the linked vehicle trips. This is not a surprising result, because most of the linking is through changes in travel mode and pick-up and drop-off activities, and the former will have relatively little impact on vehicle trip rates.

Similar comments can be made and similar patterns are apparent for the other trip purposes. Mean trip rates are consistently higher for person trips than for vehicle trips, and are generally higher for unlinked than for linked. Implied vehicle occupancy can also be determined from the ratio of the person to vehicle trip rates, and these are 1.70 for HBNW trips and 1.30 for NHB (both derived from the linked trip rates). An odd result occurs for nonhome-based, where the mean trip rate for unlinked vehicle trips is higher than the mean trip rate for unlinked person trips. This suggests either some problems with trip measurement or incomparability between those studies that developed the person trip rates and those that developed the vehicle trip rates.

In both tables, it is apparent that there are significant ranges in trip rates, although means and medians are generally fairly close, and the values are generally not far from those of conventional wisdom. An investigation of the effects of trip-linking procedures on the trip rates reveals very little apparent effect on the rates. The biggest variations appear to occur for unlinked trip rates, rather than linked trip rates, as shown

particularly for the unlinked vehicle-trip rates for NHB trips, which show a range from 2.5 to 7. There are also two odd rates provided in the data for HBW trip rates for unlinked person trips, where one survey reported an average rate of 2.07 and one reported 4.77. Work-trip rates are generally expected to be in the range of 1.3 to 1.7, depending on the extent to which people work at home, or perform other activities on the way to and from work, with the analysis treating the resulting trips as an NHB trip plus an HBNW trip. Therefore, these rates of 2.07 and 4.77 seem too high, unless travel for employer's business is included, or unless a large proportion of people work two jobs or return home for lunch. Neither of the regions are ones in which large numbers of complex transit trips might be expected to occur, which might also result in higher trip rates being estimated. Serve passenger trips and trip chaining cannot account for these high trip rates, because such trips will generally decrease home-based work trips in the unlinked trip file. Therefore, they call into question the methods by which the rates are computed. In general, the expectation is for a linked HBW trip rate to be on the order of 1.6 to 1.7. Unlinked trips would include pick-ups and drop-offs, as well as change travel mode, and could increase these average rates above 2.00, in cases where these activities occur very frequently, or in cases where most people work two jobs each day.

Two other variations appeared in the methods used to compute trip rates that are hidden within the rates in Tables 8 and 9. Seventy-one percent of surveys reported including motorized trips only in the trip computations. Thus, 29 percent apparently included some number of nonmotorized trips, which would generally lead to higher trip rates. Second, among those including nonmotorized trips, 31 percent specified a minimum distance before the trip was counted. These variations make it more difficult to use the trip rates comparatively across different surveys.

Trip rates appear to be potentially useful methods to assess the success of surveys, but suffer from too many methods for computation. As a result, for trip rates to be used as a general method of assessing survey success, standards are needed for how to compute the rates, as well as provision of good measures against which to assess the resulting rates. Tables 4 and 5 demonstrate that there is little commonality in the trip rates reported, and that a wide variety of different rates may be computed. This also raises two further issues: first, why comparative measures are of interest, and second, what other comparative measures might be of use. To answer the first question, it is often a matter of a client wishing to have some way to be sure that the survey just completed has met some reasonable standard of effectiveness and completeness. It is also often a matter of making historical comparisons to determine how the population and its trip making have changed since the last survey. Controlling standards for the latter is easier, because a specific agency can determine its own methods for computing trip rates and use these identical methods on each occasion that it wishes to assess historical change. It is more difficult when trip rates are being used as a means to assess whether the survey was executed reasonably well. Response rates are not a sufficient measure of this, particularly given that the profession has been changing survey methods largely because of an assumption of inadequate reporting of trips.

Other criteria that could be examined as measures of survey quality are rates of no travel (which measures the ease with which respondents can avoid the task of reporting travel, while still being counted as complete); and trip rates by age group, which might indicate biases in collection of data on trips based on age (under-reporting from the young and the old, most probably). These and other measures may be more valuable than simple trip rates in measuring quality of the survey.

PRODUCTS AND DISSEMINATION

Generally, the final result of a survey is the production of a data set of some type. Data may be assembled in different formats that make the data more or less readily used by others. Data may or may not be provided for other agencies or public use. In the early years of data collection, the availability of computer capabilities to work with the data were so limited that most data sets stayed in the agency that collected the data. Even now, there is often reluctance to make data sets generally available because of the potential for those who might misuse the data and produce results that are annoying to, or embarrassing or awkward for the agency concerned. On the other hand, reports on the surveys generally are readily available and provide useful summary information about the region in which the data were collected. As a final element of the assessment of recent surveys, information was collected on the form in which data were stored, the availability of the data, and the availability of reports on the survey.

Databases

Most agencies store their data in either one or two formats. The most common format, reported by 81 percent of agencies, was to store data in ASCII files. The second most common format was as a database, using one of the standard database formats. In the days of mainframe computers, the majority of data sets would have been stored in binary format. Among the recent surveys, no agency reported using this format. Other formats included those of proprietary statistical software (SAS—15 percent, SPSS—12 percent). Sixty-two percent of recent surveys used only a single format, with most using ASCII and the remainder using a database format. The remaining 38 percent used multiple formats, with most using only two formats.

Organizing the data for analysis is a second issue in the area of the format of the database. Generally, the tradition has been to set up trip, household, and person files with common identification numbers that allow the files to be linked for analysis purposes. Also, some household data are usually included on the person file, and some household and person data are usually included in the trip file. Approximately 50 percent of recent surveys reported using the three basic files or a

combination into a single file. A household file was the most common file to be included, with about 90 percent reporting using a household file. Trip files were reported as being used by 80 percent of agencies, and 65 percent used a person file. Two other file types that appeared from recent surveys are activity files (16 percent) and vehicle files (18 percent).

With respect to availability, 38 percent indicated that they do not make the data available to anyone outside the agency. At the other end of the scale, 26 percent make the data available to any interested party, and another 14 percent reported that it is made available on request through the state DOT. Between these two extremes are those that make the data available to other local agencies, state agencies, transit agencies, consultants, researchers, and U.S. DOT, or some combination of these various entities.

Reports

Most agencies provide the findings of the survey in a report, usually available to the public. Eighty-five percent indicated that reports were available from the survey. Two other mechanisms used to distribute results were public forums and newsletters, both of which were reported as being used by 13 percent of recent surveys. A number of surveys were still incomplete at the time we collected information about them, so that the form of any reports and their availability was not known at the time. In all cases where public forums or newsletters were involved, one or more reports were also available.

Of the agencies responding, 70 percent had completed their survey, 24 percent were still analyzing the data, and 6 percent were still in progress.

CHAPTER SIX

CONCLUSIONS

In this final chapter, an attempt is made to extend the trends observed in research for this synthesis as observed in recent surveys. There is also comment on some of the areas in which advances may be made in travel surveys and some new concepts that may be developed. Much of this is based on the TRB Conference on Household Travel Surveys: New Concepts and Research Directions, that was held in 1995. This chapter follows a similar order of survey elements as the prior parts of this synthesis.

PLANNING AND DESIGN

Sampling Methods

In the area of sampling, it seems likely that the household travel survey will move increasingly toward more specialized sampling techniques and sample-enrichment procedures. Sample sizes seem unlikely to increase, because of the cost of household travel surveys and the limited budgets available to support surveys. Therefore, it is likely to become increasingly important that surveys yield a richer information base that will allow better description of the variety of travel patterns in the population and that will also permit richer models to be built. Sampling that targets rare populations seems likely to emerge as an increasing concern in survey design. Rare populations may include, among others, households with transit riders, households with people who regularly ride bicycles, low-income households, and households where no person is fluent in English.

Panels

Possibly one of the most underused survey devices in household-travel surveys is the longitudinal panel. Only one panel of significant duration has been undertaken in the United States to date (*25*), and few such surveys have been undertaken elsewhere in the world. The benefits offered by panels have been discussed in numerous other places (*26,27*) and are not elaborated further in this synthesis. Because of response problems and the size and complexity of the measurement task that transportation planners need to undertake, it is probable that panel participants should be paid and selected to represent a cross-section of the population, which may eliminate some of the biases perceived to exist in current cross-sectional, telephone-based surveys.

The establishment of panels offers a number of advantages, including measuring the dynamics of change, measuring seasonal variations in travel behavior, and providing opportunities for more extensive measurement over time, by combining different subsets of stated-preference questions at different waves of the panel. The potential to rely heavily on an ongoing small, paid panel is a concept that may emerge in the near future. Such panels would eliminate the need for periodic expensive household travel surveys, and replace them with a much lower but continuing cost for annual or twice-yearly questioning of the panel. The panel can be bench-marked from time to time by conducting a modest cross-sectional survey, so as to determine the extent to which the panel remains representative of the target population, and to determine how future panel attrition should be made up. The potential to gain a greater wealth of data from an ongoing panel than from conducting large cross-sectional surveys at long time intervals needs to be explored and defined, so that the potential of this concept may be assessed appropriately. With the possibility that the U.S. Bureau of the Census may opt for a continuous measurement design (*28*), the use of panels in transportation would be both consistent with this change in census measurement and also well-served by the availability of continuous data from the census.

Finally, because it is not necessary to collect as much data from panel members in the second and subsequent waves of questioning as it is from a cross-sectional survey, the development of panel-based household travel surveys could well be the answer to the dilemma posed in the next section of the need to collect more information, yet reduce respondent burden. In panel surveys, a fairly large amount of data needs to be collected initially, but subsequent waves are often conducted by asking only for changes since the last wave, and then asking a small set of new questions. With the ability of modern technology to feed back to respondents the information provided in a previous wave, it becomes very easy for respondents to identify what has changed and provide that new information. It is also potentially feasible to pay panel members at a significantly higher rate than the incentives that have been used in recent travel surveys, which may help overcome respondent burden problems, and also may help reduce panel attrition.

Development of a National Sample of Households

It may be time to consider the notion of undertaking a national sampling for household travel surveys, designed to provide a means for any region to use the data to develop models and undertake planning analyses at the local level. Such a sample would probably again be best treated as a panel, but drawn this time from the entire geographic area of the United States, and with stratification into a range of

household and person characteristics. Distribution of the data on such media as CD-ROM or over the Internet would provide broad accessibility of the data to most MPOs and state agencies.

This concept is significantly different from that of the current Nationwide Personal Transportation Survey (NPTS). It would involve creating a national longitudinal panel designed to provide data for regional modeling, based on differential expansion factors for different regions of the country. The panel would be much smaller than the current sample for NPTS, probably numbering closer to 2,500 than 25,000 households. Also, rather than being distributed randomly across the country, it would be concentrated in a number of urban and rural areas. These areas would be selected so that they would provide data representative of the range of different urban and rural areas, and would provide information on trends in household structure and its relationship to travel. There would still be a need for occasional bench-marking surveys at the local level, to determine how the panel relates to each region of the country. Targeted sampling may also need to be a feature of the national sample, in order to provide reliable data on rare behaviors, such as transit use in areas that have small transit systems, or low levels of transit use. For such a concept to be embraced, considerable effort would need to be expended to show how the data collected would be transferrable from the national sample to local jurisdictions.

Expanded Sample Coverage

It seems clear that the profession is becoming ready to abandon older concepts that the data collected are to be for weekdays only in the spring or fall, collected from households with telephones, and concentrating on data for a 24-hour period. Future data collection is more likely to target both weekend days and weekdays, for reasons already discussed in this synthesis and shown as emerging in recent surveys. Future household travel surveys will also cover different seasons of the year, including summer (particularly in ozone nonattainment areas) and winter (particularly in carbon-monoxide nonattainment areas), and are likely to be conducted over multiple days for each household included in the sample. They are likely to include surveys of non-telephone households, and responses are likely to be sought from everyone in the household, irrespective of age.

Survey Content

Revealed Preference

The trend of the 1990s has been an increasing level of detail in what people are asked to report. It is questionable as to how much more people can be asked to report in a household travel survey, or even whether we have already passed the point of asking for too much information. However, the current planning mandates and what one might anticipate will be the planning mandates in the opening years of the 21st century seem to require that more and more information be collected. It is likely that the area of information and the way in which it is to be collected will require increasing sophistication and improvement. In particular, there is likely to be a growing need to consider much more carefully what respondent burden is created by a specific design of survey and survey content, and to develop methods to reduce respondent burden while yet increasing the amount of information obtained.

The primary areas of content change seem most likely to be in the level of detail on activities, including collecting information on activities performed at home that could also be performed out of the home (including more information on telecommuting); and in the data about vehicle usage. A problem area of content continues to be the collection of parking costs, particularly because many people do not pay the posted parking price, but may also not know the value of any subsidy received. Probably, better methods of asking for parking costs will be developed, and also anticipated parking costs for those who did not drive will also be asked.

Stated Response

An emerging area of interest is that of stated response, often also referred to as stated preference (*11*). In a handful of recent surveys, as noted in chapter 2, stated-response surveys have been conducted as a component of the overall household travel survey, usually targeting a subsample of the households that responded to the revealed-preference portion of the survey, and focusing on a few specific issues. Portland, Oregon focused on issues of household location, car purchasing, and some mode-choice issues. Other areas, such as Washington, D.C. and Dallas have selected several similar issue areas for their efforts on stated response. It seems likely that this type of survey will increase in popularity, especially if its promise to provide information on as yet untried policies and strategies is realized, and if policy makers continue to examine new options.

Instrument Design and Collection Procedures

Instrument Design

The trip diary is already largely being replaced by an activity diary, and it seems probable that the activity diary may be replaced in the future by a form of time-use diary, that is a diary in which travel is treated as an activity, just like any other activity. It is unclear whether the diary will be a booklet or a sheet, although the indications seem to be more in the direction of a sheet than a booklet. It also appears that the diary may become a multi-day rather than a single-day diary.

Nonresponse and Non-Telephone Surveys

Serious consideration must be given to the method of surveying, because of the increase in resistance to the use of the telephone in both recruitment and retrieval of data. The mail-

out and mail-back survey may receive some increased attention, if methods can be developed to provide satisfactory sampling frames of addresses, and if better response levels can be achieved from the surveys (this is addressed also in the issue of obtaining responses). It is also possible that increased consideration will be given to returning to face-to-face interviews. Given some of the issues of nonresponse to telephone-based surveys and given also the potential biases of not including households without telephones, a return to face-to-face interviews may be the only way in which improved response can be obtained and in which biases can be reduced.

However, new technology has a role to play in such a return to face-to-face interviews. The notebook computer provides a potential for conducting face-to-face interviews with a Computer-Aided Personal Interview (CAPI) process. There are also potentials for interviews to be conducted by allowing respondents to enter data directly on a computer, or to use touch screens for data entry. As notebook computers increase in power and decrease in weight and cost, the potentials for this type of face-to-face interview are considerable. Applying this concept to the notion of a paid panel, panel members could even be provided with their own notebook computers, with modem hook-up to survey administration, so that they can enter their data directly on the computer and have it transferred to those conducting the survey, without need of a telephone interview or face-to-face contact.

Remote Sensing

Various forms of remote-sensing devices have potential application for household travel surveys. One is the type of device that can be fitted to the automobile to record various attributes of automobile operation, such as starts and stops, acceleration, deceleration, time, distance, etc. (*29*) Coupled with a diary (activity or time use), the potentials for improved data collection about use of vehicles is enormous. In the United States, there has been no report of such a coupling of remote-sensing vehicle devices with multi-day diaries to date, although some work has been done in Canada (*30*). Clearly, this marriage of technology and state-of-the-art surveys could have major potential to reduce respondent burden while increasing the richness of the available information.

The second type of technological advance is global positioning systems (GPS) that could be combined in a variety of ways with collection of diary data. At one extreme, GPS could be connected into the type of automobile-sensing device just discussed, to provide continuous position information that would provide vehicle routing, as well as all of the vehicle function, time, and distance data. At the other extreme, if GPS equipment can be sufficiently miniaturized, and if issues of privacy invasion can be resolved, then such equipment could be issued to individuals who are also completing diaries. This would provide fully geocodable data on exactly where people go during a reporting period.

Other Technological Advances

While it is too early to tell yet in what directions changes could occur that might assist household travel surveys, the technological advances that are moving us into an era of two-way television, television shopping, and other such communication devices may have enormous potential to change the way in which household travel surveys are conducted. A potential that could already be realized is the use of videotapes to conduct the survey, or to provide instruction on how to complete a written survey. For example, many companies are now providing instructional videotapes in place of or as a complement to instruction manuals for building and using equipment in the home. This same procedure could be adapted to the household travel survey, in which a videotape is made that shows a household going through the completion of the survey forms, providing hints and directions as they go that instruct the recipient on how to complete the survey form. Videotapes could even be used to conduct a survey by using them in conjunction with a device for recording responses, such as a personal digital assistant (PDA). In this case, the videotape would record an interviewer asking questions, with the respondent touching various keys on the PDA to record information. Of course, this system does not provide a means to skip questions or customize the survey to specific situations. However, future developments may permit a link between the videotape and the PDA that would allow the videotape to be fast-forwarded to certain locations based on the response to specific questions. Future developments could alternatively use the videotape, together with communication from the household to the survey administration to allow real-time entry of data from the respondent in response to a videotaped interview, such as through a live telephone hook-up, in which the respondent records all information by pressing the various keys on the telephone dial pad.

Similarly, there may be some potential, as yet undefined, to use computer networks to assist in the conduct of household-travel surveys. This is an area in which it is more difficult to determine how use might be made of the technology, both as a result of issues relating to appropriate uses of networks, and also because of the undesirability of self-selection. Nevertheless, it seems to be an area worth considering for the potential of changes and enhancements to the conduct of future household-travel surveys.

SURVEY EXECUTION

Pretests and Pilot Tests

Already, such testing is becoming much more prevalent than in the early days of household travel surveys, when it was often the case that no pretest of any type was done. As late as the early 1980s, arguments had to be put forward in the professional literature to persuade agencies and professionals to conduct pilot tests (*31*). Judging by recent surveys, this is no longer the case, but it is still not widespread practice to conduct a complete test of all phases of a survey. In the next few years, this seems likely to change as complete tests, and comparative tests among a number of elements of the survey will become increasingly common. The 1996 TRB conference on household travel surveys recommended that a number of national pretests and comparative surveys should be carried out to inform the

profession about various possible designs and to provide information about the range of impacts of different designs on the quality, quantity and nature of the data collected.

Survey Administration

The household travel survey is becoming increasingly complex to design and administer. It seems likely that local authority staffs will be less and less able to design and field a future household travel survey without assistance from a consultant specialist of some type. The use of peer review panels has become virtually a fixture for travel-forecasting work by MPOs and other state and local agencies. As noted in this synthesis, it is making an appearance in the travel-survey arena. This appears to be a growing trend, as agencies recognize the value of subjecting the survey designs to the critical review of a small group of experts, and reap the gains in terms of much higher quality data.

It is also probable that future household travel surveys will need to pay increasing attention to publicity and public relations. This will include, particularly, the availability of help from a toll-free telephone number, and the ability to check on the authenticity of a survey through a telephone contact. It will also include publicity of the survey through information provided to the media. In an age in which the television has become the medium of the masses, it is quite surprising to see how little use is made of television as a means to publicize surveys, and this would seem to be a feature that will change in the near future.

Obtaining Responses

In discussing the panel survey, the idea of increased incentives has already been raised. It seems likely that incentives will become increasingly necessary to achieve reasonable response rates, although research is needed to establish the potential biasing effects of different incentives and also the impact of different types and values of incentives. It also seems that the trend will be toward more reminders and more effort to obtain responses from recruited households. Certainly, this is a highly desirable direction for future household travel surveys. Methods to reduce the length of time required to collect data from respondents are likely to become more prevalent, possibly with the development of improved computer capabilities for either CATI or CAPI retrieval.

Processing the Data

As CATI and CAPI are adopted more widely, the need for any form of manual coding and subsequent key entry of data will decrease, while the direct entry of data in real time, during the interview, will become more and more common. The most troublesome area of data entry has always been geocoding of address information. As travel-forecasting models become increasingly disaggregate, which seems to be the most probable direction of development of these models, the importance of precise location of addresses will increase, because these models are likely to need to work with point-to-point travel coding rather than zone-to-zone coding. The issue of how to obtain sufficiently precise data from people who do not know the street address of places they visit will become an increasing challenge to survey designers. Again, this is likely to accelerate the potential development of methods to adapt GPS technology to use in household travel surveys.

With the development of improved address systems in GIS, a trend of the future will be the use of computer-based gazetteers that will permit real-time coding of addresses, as well as identification of addresses that seem impossible to code. Already, there have been uses reported of interactive GIS coding that permits the interviewer to determine which of several addresses of a chain restaurant or store were visited, by having the computer display a list of all those in the region (*32*). The respondent is then able to select the correct one, in response to questions from the interviewer. Conceivably, a future GIS could even determine the locus of a trip end, based on information given by the respondent on the time taken to travel to a location whose address is not known to the respondent, so that the approximate whereabouts of the destination can be located through a similar interactive process. Of course, these methods work only when interviewing is done to retrieve data, and a shift in the future to a mail-back survey would not permit the full capabilities of GIS to be used in this interactive mode.

SURVEY RESULTS

Judging by recent trends, it is not likely that future surveys will take any less time, and it must be anticipated that costs will continue to increase, at least in pace with inflation. If incentives must become more valuable, the possibility is that costs per completed survey will increase, although this may be offset by the realization that it is actually cheaper to pursue responses from recruited households than to continue to add new recruits to make up for nonresponding households. Overall, there seems nothing on the horizon to suggest that any significant downward trend would appear in the costs or time requirements of household travel surveys. It should be noted, however, that the adoption of panels would result in a substantial decrease in the total expenditures on surveys, although the unit costs may rise substantially. Time requirements, and the ability to produce data more rapidly from a survey would also improve with the use of panels.

The profession is much in need of standards and performance measures with which to evaluate surveys and determine what are good-quality surveys. The problems in response-rate comparisons and trip-rate comparisons noted in this synthesis need to be resolved. However, better measures of the data quality are needed than these simple rates can provide.

Finally, in the area of dissemination, an emerging trend that seems likely to gain considerable momentum is the use of modern electronic communication devices to provide information about the results of surveys and to share the data. Distribution of reports and data on CD-ROMs and over the Internet

are already beginning and seem likely to increase in the future. However, information sharing will require circumspection to guard against misapplication of the shared data, and incorrect inferences drawn. Simply placing raw data on the Internet or distributing on CD-ROM is a very dangerous procedure. Again, there is a need for standards of data cleaning to be established and procedures incorporated for flagging data that have been imputed or calculated to substitute for nonresponse items. Standards of coding conventions need to be established, as does the computation of weights and expansion factors that correct for biases in the sampling and that provide a means to expand the data to the full population. Almost certainly, erroneous conclusions will be drawn from data that do not include weights and expansion factors. In addition, standards are also needed for constructing data dictionaries that inform users of the content of each field in the data and that provide any information about source, imputation of data, etc. Finally, data require documentation so that the purposes of the survey are clearly spelled out, the nature of the sample is described, and capabilities and limitations in the data are clear to potential users. Standards of what should be included in documentation seem necessary, particularly based on the range of information provided in survey documentation obtained for this synthesis.

It is important not to lose sight of the purposes of data collection. As noted early in this synthesis, data are collected for two primary purposes: to permit an understanding of what the present looks like and how the system that is the subject of the planning effort is functioning; and to provide the basis for updating models or constructing new ones. The uses to which the data will be put should be the primary consideration that guides what data are collected and the quality demanded of those data. It must also be noted that the uses to which the data are put may change over time, so that data collected infrequently, such as every 10 or 20 years, may have to be able to answer questions and policy issues of tomorrow. This demands that much more thought be given to what data to collect than merely satisfying immediate policy issues. There must be some anticipation of future issues and problems, as well as future developments in the modeling area.

Second, data quality is extremely important. It is all too easy to collect poor-quality data or to collect data that contain large biases and errors without being aware of it. Many practices in household-travel survey data collection have tended to generate such problems, and a number of those have been noted in this synthesis. Recruiting more and more households from the total population (to make up for nonresponding households) and households that provide only partial data is one of the ways in which data quality and accuracy can be compromised in the pursuit of reaching total sample requirements. The two purposes of data collection, noted above, are susceptible to the phenomenon of "garbage in, garbage out." Therefore, it is important to improve the quality of the data collected, so that the result of using the data is not compromised.

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APPENDIX A

Survey Forms

INTERVIEW GUIDE - STATE DOTs - SCREENING SCRIPT

Hello, I would like to speak to _____
(NAME OF DIRECTOR OF PLANNING, OR EQUIVALENT FROM AASHTO DIRECTORY).

WHEN CONNECTED:

Hello, my name is _____ and I am working for the Transportation Research Board (TRB). TRB is preparing a Synthesis Report on Household Travel Surveys. This is part of a National Cooperative Highway Research Program (NCHRP) project which is sponsored by the American Association of State Highway and Transportation Officials (AASHTO) in cooperation with the Federal Highway Administration (FHWA). I would like to speak to someone who is knowledgeable about household travel surveys that have been conducted in the state of _____. Would that be you or is there someone else I should talk to.

- ❑ Right person *(GO TO QUESTION 1)*
- ❑ Someone else

Can you please give me the person's name and telephone number?

Name: _____ Phone: _____

ASK TO BE TRANSFERRED TO THE CORRECT PERSON OR CALL THAT PERSON AND BEGIN AT A.

A. Hello, I would like to speak to _____
(NAME OF PERSON NAMED BY PLANNING DIRECTOR/EQUIVALENT).

WHEN CONNECTED:

Hello, my name is _____ and I am working for the Transportation Research Board (TRB). TRB is preparing a Synthesis Report on Household Travel Surveys. This is part of a National Cooperative Highway Research Program (NCHRP) project which is sponsored by the American Association of State Highway and Transportation Officials (AASHTO) in cooperation with the Federal Highway Administration (FHWA). I understand from _____ that you are the most
(NAME OF PLANNING DIRECTOR/EQUIVALENT)
knowledgeable person at _____ on recent household travel surveys. Is that right?

- ❑ Yes *(GO TO QUESTION 1)*
- ❑ No

Can you please give me the name and phone number of the person I should talk to?

Name: _____ Phone: _____

ASK TO BE TRANSFERRED TO THE CORRECT PERSON OR CALL THAT PERSON AND BEGIN AT A.

☞ START HERE WHEN CALLING SOMEONE AT AN MPO, OR ANYONE ABOUT A SPECIFIC STUDY.

B. Hello, I would like to speak to _____
(NAME OF PERSON NAMED BY PLANNING DIRECTOR/EQUIVALENT).

WHEN CONNECTED:

Hello, my name is _____ and I am working for the Transportation Research Board (TRB). TRB is preparing a Synthesis Report on Household Travel Surveys. This is part of a National Cooperative Highway Research Program (NCHRP) project which is sponsored by the American Association of State Highway and Transportation Officials (AASHTO) in cooperation with the Federal Highway Administration (FHWA). I understand from _____ that you are the most
(NAME OF PLANNING DIRECTOR/EQUIVALENT)
knowledgeable person at _____ on the _____ household travel survey. Is that right?

- ❑ Yes *(GO TO QUESTION 13)*
- ❑ No

Can you please give me the name and phone number of the person I should talk to?

Name: _____ Phone: _____

ASK TO BE TRANSFERRED TO THE CORRECT PERSON OR CALL THAT PERSON AND BEGIN AT B.

1. **Has this state conducted any household travel surveys either statewide or within individual metropolitan areas since 1989?**

   - ❑ Yes *(GO TO QUESTION 4)*
   - ❑ No
   - ❑ Don't Know

2. a. **Are you aware of any Metropolitan Planning Organizations within your state having conducted a household travel survey since 1989?**

   - ❑ Yes *(GO TO QUESTION 3)*
   - ❑ No
   - ❑ Don't Know

   b. **Do you know of anyone who might be aware of any household travel surveys completed in your state since 1989?**

   - ❑ Yes ☞ If yes, ask for: Name: _____
   - ❑ No Phone: _____
   - ❑ Don't Know

   THANK RESPONDENT AND HANG UP.

3. **Can you tell me which MPOs have collected household travel surveys since 1989, and give me a name and a phone number of a contact person who would know about the survey at the MPO?**

MPO Name:	_____	MPO Name:	_____
Contact:	_____	Contact:	_____
Phone:	_____	Phone:	_____

MPO Name: _____ MPO Name: _____
Contact: _____ Contact: _____
Phone: _____ Phone: _____

Thank you very much for your help. These are all the questions I have for you. I will follow up with the MPO(s) you have told me about. The information you have provided has been most helpful. If I should have any problems in getting the information from the MPO(s), would you mind if I called you again to request any additional help that I may need?

❑ Call back is OK ❑ Prefer not to be called again
THANK RESPONDENT AND HANG UP.

4. **How many household travel surveys have been conducted in this state since 1989?**

❑ None RECHECK RESPONSE TO QUESTION 1. IF RESPONSE SHOULD HAVE BEEN NO, GO TO ENDING. IF RESPONSE WAS CORRECTLY YES, RECHECK RESPONSE TO QUESTION 4 AND CONTINUE.
❑ One
❑ Two ***(SKIP TO QUESTION 9)***
❑ Three ***(SKIP TO QUESTION 9)***
❑ Four ***(SKIP TO QUESTION 9)***
❑ Five ***(SKIP TO QUESTION 9)***
❑ Six or more ***(SKIP TO QUESTION 9)***

5. a. Can you tell me for what area the survey was done?

❑ An MPO
❑ The entire State ***(GO TO QUESTION 6)***
❑ Other ***(please specify)*** _____ ***(GO TO QUESTION 6)***

b. What is the name of the MPO? _____

6. in would like to collect some specific information about the survey. Are you the person most knowledgeable about the survey, or should I speak to someone else?

❑ This person ***(GO TO QUESTION 13)***
❑ Speak with someone else at DOT ***(GO TO QUESTION 7)***
❑ Speak with someone else at the MPO ***(GO TO QUESTION 7)***
❑ Speak with Consultant ***(GO TO QUESTION 8)***

7. Can you please tell me that person's name and telephone number?

Name: _____
Phone: _____
THANK RESPONDENT, CALL THE CORRECT PERSON AND BEGIN AT B.

8. a. Can you please tell me the name of the consulting firm, the person's name, and their telephone number?

Consultant: _____
Name: _____
Phone: _____

b. Since we are trying to collect detailed information, we will need to obtain a copy of the RFP issued for this survey, along with copies of the survey instruments, instruction manuals, and any reports that have been written about this survey. Are any of these available?

(Check all that apply)
❑ Nothing available ***(GO TO QUESTION 8d.)***
❑ Consultant can provide any available documents ***(GO TO QUESTION 8d.)***
❑ RFP available
❑ Survey instruments available
❑ Instruction manual(s) available
❑ Report(s) available

c. Could you please send a copies of these documents to:

Dr. Peter R. Stopher, PlanTrans, 3533 Granada Drive, Baton Rouge, LA 70810-1142

d. **Is there any protocol that we will need to follow when contacting your consultant about the survey; for example, will they need to request permission from you or someone else to release information to us?**

_____

THANK RESPONDENT, CALL THE CORRECT PERSON, AND BEGIN AT B.

MULTIPLE SURVEYS **(REPEAT QUESTIONS 9-12 FOR ALL SURVEYS)**

			Area 1:	Area 2:	Area 3:	Area 4:	Area 5:	Area 6:
9.	For each of the surveys, can you tell me what areas the surveys were conducted in?							
READ ONCE ONLY:	I need to collect some specific information about each of the surveys.							
10.	Are you the person who is most knowledgeable about ____ survey, or should I speak to someone else?	This person ***(Repeat Q10. or Go to Q13.)***	❑	❑	❑	❑	❑	❑
		Someone else at DOT ***(Go to Q11.)***	❑	❑	❑	❑	❑	❑
		Someone else at MPO ***(Go to Q11.)***	❑	❑	❑	❑	❑	❑
		Speak with Consultant ***(Go to Q12.)***	❑	❑	❑	❑	❑	❑
11.	Can you please tell me that person's name and telephone number?	***Name:***						
		(Repeat Q10. or END) ***Phone:***						
12a.	Can you please tell me the name of the consulting firm, the person's name, and their telephone number?	***Consultant:***						
		Name:						
		Phone:						
12b.	Since we are trying to collect detailed information, we will need to obtain a copy of the RFP issued for this survey, along with copies of the survey instruments, instruction manuals, and any reports that have been written about this survey. Are any of these available?	***(Go to Q12d.)*** Nothing available	❑	❑	❑	❑	❑	❑
		(Go to Q12d.) Consultant can provide documents	❑	❑	❑	❑	❑	❑
		RFP available	❑	❑	❑	❑	❑	❑
		Survey instruments available	❑	❑	❑	❑	❑	❑
		Instruction manual(s) available	❑	❑	❑	❑	❑	❑
		Report(s) available	❑	❑	❑	❑	❑	❑
12c.	**Could you please send copies to:** Dr. Peter R. Stopher, PlanTrans, 3533 Granada Drive, Baton Rouge, LA 70810-1142							
12d.	**Is there any protocol that we will need to follow when contacting your consultant(s) about the survey; for example, will they need to request permission from you or someone else to release information to us?** ____ ***(GO TO END)***							

IF NONE OF THE RESPONSES WERE "THIS PERSON":

END: Thank you very much for your help. These are all the questions I have for you. I will follow up with the people you have told me about. The information you have provided has been most helpful. If I should have any problems in getting the information from these individuals, would you mind if I called you again to request any additional help that I may need?

❑ Yes ❑ No Thank respondent and hang up.

13. In order to collect all the information we need for this synthesis report, I would like to have you complete a written questionnaire about this study (these studies). I would like to send it to you via fax machine, have you fill it out over the next several days, and return it to us by fax. So that I can send the questionnaire to you, can I please have your fax machine number?

- ❑ Refused to complete survey
- ❑ No fax machine available ***(Go to Question 14.)***
- ❑ Yes - FAX MACHINE NUMBER (___) _____
- ❑ Other ***(Please specify)*** _____

The questionnaire will provide instructions about how to return the survey and how to contact me if you have any questions. I will call you again later today or tomorrow to confirm that you received the fax and to answer any questions you may have at that time. Thank you very much for your cooperation, and I look forward to receiving your completed survey.

THANK RESPONDENT, AND HANG UP.

14. Alternatively, I can mail the questionnaire to you. Can I please have your mailing address?

- ❑ Refused to complete survey

Name: _____

Address: _____

_____

The questionnaire will provide instructions about how to return the survey and how to contact me if you have any questions. I will call you again in several days to confirm that you received the fax and to answer any questions you may have at that time. Thank you very much for your cooperation, and I look forward to receiving your completed survey.

THANK RESPONDENT, AND HANG UP.

TO: State or MPO Contact
FROM: Peter Stopher
DATE: September 28, 1996
RE: Household Surveys

PLEASE RESPOND BY: Response Date

This fax transmittal contains 13 pages total. If you did not receive all 13 pages, please call (504) 767-7843 for re-transmission.

Transportation Research Board
NCHRP Project 20-5; Synthesis Topic 26-03
Synthesis of Household Travel Surveys

The Transportation Research Board (TRB) is preparing a Synthesis Report on Household Travel Surveys. This is part of a National Cooperative Highway Research Program (NCHRP) project which is sponsored by the American Association of State Highway and Transportation Officials (AASHTO) in cooperation with the Federal Highway Administration (FHWA). The objective of the synthesis is to summarize the state of the practice as found in existing criteria, guidelines, and methods. It will also include information on quality control practices, and will include information on methods used to plan, design, conduct, and evaluate household survey data.

Your assistance with completing the following questionnaire will be greatly appreciated. Please return the completed questionnaire by fax to (310)767-1386. If you have any questions or if you need additional information, please contact Helen Metcalf (310)767-1335 or Peter Stopher at (504) 767-7843.

Thank you for your assistance.

Please answer the following questions with regard to the Household Travel Survey(s) we discussed with you over the telephone (if there was more than one, you will need to copy this set of forms for each survey). If the survey is currently being conducted, please answer as many questions as are currently answerable.

HOW AND WHEN THE SURVEY WAS CONDUCTED

1. How was the survey carried out? *(Check all that apply)*

- ❑ By the state using its own staff
- ❑ By the MPO using its own staff
- ❑ By a consultant/contractor to the state
- ❑ By a consultant/contractor to the MPO
- ❑ Other ***(please specify)*** _____

2. a. Please indicate the year or years and period or periods of the year when the data were collected. *(Check all that apply)*

Year: 19_____through 19 _____

Period:
- ❑ Spring ⇒ ***(Go to Question 2b.)***
- ❑ Summer ⇒ ***(Go to Question 2c.)***
- ❑ Fall ⇒ ***(Go to Question 2b.)***
- ❑ Winter ⇒ ***(Go to Question 2c.)***

Other: ***(please specify)*** _____

_____

b. Was the survey conducted in the Spring and/or Fall for the purposes of avoiding inclement weather and/or to collect data while schools were in session (i.e., to collect data that represent "normal" travel conditions in the area)?

- ❑ Yes
- ❑ No

c. Why was the survey conducted in the Summer and/or Winter?

_____

_____

3. What were the reasons for choosing that year to conduct the survey? *(Check all that apply)*

- ❑ Age of existing data (existing data was too old)
- ❑ Wanted to collect data close to a census year
- ❑ Non-existence of data
- ❑ Funds were available to collect data during that year
- ❑ Other ***(Please specify)*** _____

SAMPLING AND DATA COLLECTION METHOD

4. What was the total desired sample size for the survey (i.e., the number of complete surveys to be obtained)?

Sample size: _____ **Is that:** ❑ Households ❑ Persons

5. How many households were contacted to reach the selected sample size? _____ Households

6. How were the survey data collected?

- ❑ Telephone recruitment, face-to-face interviews⇒
- ❑ Telephone recruitment, mail-out/mail-back survey⇒
- ❑ Telephone recruitment, mail-out survey, telephone retrieval⇒

a. If survey respondents were recruited by telephone, what was the source of the telephone numbers used?
- ❑ Telephone directories
- ❑ Random digit dial
- ❑ Other ***(Please specify)*** _____

b. Was anything done to recruit households with no telephone?
- ❑ No
- ❑ Yes ***(Please specify)*** _____

_____

- ❑ Mail-out survey, mail-back survey⇒

c. If survey respondents were recruited by mail, what was the source of the addresses used?
- ❑ Utility Listings
- ❑ Reverse directory
- ❑ Other ***(Please specify)*** _____

- ❑ Face-to-face interviews (cold contact)
- ❑ Other ***(please specify)*** _____

7. How was the sample selected?

- ❑ Simple random sample
- ❑ Stratified sample, e.g., by household size, income, auto ownership, etc.
- ❑ Quota sample
- ❑ Cluster sample
- ❑ Other ***(Please specify)*** _____

8. Were data collected for weekday travel only, or was weekend travel included?

- ❑ Weekday travel only
- ❑ Weekday and weekend travel
- ❑ Other ***(Please specify)*** _____

9. **With regard to collecting travel information from children, was a minimum age defined for the purposes of collecting responses from all household members?**

- ❑ No minimum age
- ❑ Valid respondent age defined as 5 years or older
- ❑ Valid respondent age defined as: ___ years or older ***(Please specify age)***
- ❑ Other ***(Please specify)*** _____

10. a. **Were group quarters included in this survey?**

❑ Yes ❑ No ⇒ ***(Skip to Question 11.)***

⇓

b. **If yes, how were group quarters surveyed?** _____

_____

11. **What type of survey instrument was used?**

- ❑ Trip Diary (booklet)
- ❑ Trip Diary (sheet)
- ❑ Activity Diary (booklet)
- ❑ Activity Diary (sheet)
- ❑ Other ***(Please specify)*** _____

PRE-TEST/PILOT STUDY

12. **Was a pre-test (pilot study) conducted on this survey?**

❑ Yes ❑ No ⇒ ***(Skip to Question 16.)***

⇓

13. **Please indicate which of the following were tested during the pre-test: *(Check all that apply)***

- ❑ Survey instrument wording and layout
- ❑ Incentives
- ❑ Survey management procedures
- ❑ Sampling procedures
- ❑ Keypunching of surveys
- ❑ Analysis of survey results
- ❑ Geocoding
- ❑ Pilot survey used for training purposes

14. **How many households were recruited to complete the pre-test and how many households returned a completed survey?**

Number of households recruited: _____ Number of completed surveys: _____

15. a. **As a result of the pre-test, were any changes made before the survey was conducted?**

❑ Yes ❑ No ⇒ ***(Skip to Question 16.)***

⇓

b. **Which of the following were changed as a result of the pre-test? *(Check all that apply)***

- ❑ Survey instrument wording and layout
- ❑ Incentives
- ❑ Survey management procedures
- ❑ Sampling procedures
- ❑ Keypunching of surveys
- ❑ Analysis of survey results
- ❑ Geocoding
- ❑ Other ***(please specify)*** _____

SURVEY MANAGEMENT

16. **Was a consultant used to complete this study?**

❑ Yes ❑ No ⇒ ***(Skip to Question 19.)***

⇓

17. **With regard to the day-to-day management of the survey effort, did (MPO/DOT) staff have primary, joint, minimal, or no responsibility for management?**

- ❑ Staff had no responsibility
- ❑ Staff had minimal responsibility
- ❑ Staff had joint responsibility
- ❑ Staff had primary responsibility ⇒ ***(Skip to Question 19.)***

18. a. **Did (MPO/DOT) staff receive reports on the progress of the survey?**

❑ Yes ❑ No ⇒ ***(Skip to Question 18c.)***

⇓

b. **Please indicate what type(s) of reports were received by (MPO/DOT) staff on the progress of the survey (verbal, informal, or written) and how frequently they were received (daily, weekly, or monthly basis)? *(Check all that apply)***

	Verbal	Informal	Written
Staff received daily reports on the progress of the survey	❑	❑	❑
Staff received weekly reports on the progress of the survey	❑	❑	❑
Staff received monthly reports on the progress of the survey	❑	❑	❑

Other ***(please specify)*** _____

c. **Did (MPO/DOT) staff receive reports on task completion or completion of milestones?**

❑ Yes ❑ No

19. **Was a Peer Review Panel established and consulted during the course of the survey?**

❑ Yes ❑ No

20. **Was the survey interviewing monitored during the course of the survey? *(Check all that apply)***

- ❑ No
- ❑ Yes: recruitment and retrieval telephone calls were remotely monitored
- ❑ Yes: recruitment telephone calls were remotely monitored
- ❑ Yes: retrieval telephone calls were remotely monitored
- ❑ Yes: face-to-face interviews were monitored randomly by a supervisor
- ❑ Other ***(please specify)*** _____

21. **Was a method established for respondents to contact someone during the survey if they had questions or problems?**

- ❑ No
- ❑ Yes, '1-800' or other toll-free telephone number established
- ❑ Other ***(please specify)*** _____

PUBLICITY

22. **Was there any publicity prior to or during the survey?**

❑ Yes ❑ No ⇒ ***(Skip to Question 25.)***

⇓

23. a. **Which of the following types of publicity did the survey receive? *(Check all that apply)***

- ❑ Newspaper advertisement(s)
- ❑ TV announcement(s)
- ❑ Radio announcement(s)
- ❑ Other ***(please specify)*** _____
- ❑ Newspaper article(s) ⇒ ***(Skip to Question 24.)***
- ❑ Radio story(ies) ⇒ ***(Skip to Question 24.)***
- ❑ TV news story(ies) ⇒ ***(Skip to Question 24.)***

b. **Was it a paid advertisement or a public service message?**

❑ Paid advertisement ❑ Public service message

24. **Who did the publicity?**

- ❑ The state DOT staff
- ❑ Staff of another state agency
- ❑ A consultant/contractor to the state
- ❑ Other ***(please specify)*** _____
- ❑ The MPO staff
- ❑ Staff of another local agency
- ❑ A consultant/contractor to the MPO

INCENTIVES

25. **Were any incentives used to encourage completion of the survey, and if so, what type was used?**

- ❑ No incentives used ⇒ ***(Skip to Question 27.)***
- ❑ Prize drawing (based on survey ID numbers) ⇒ ***(Skip to Question 27.)***
- ❑ Cash: **Amount** $ _____
- ❑ Gift (i.e., pen, map, etc.)
- ❑ Lottery Ticket
- ❑ Other ***(please specify)*** _____

26. **How were the incentives distributed? *(Check all that apply)***

- ❑ Mailed with survey before completion
- ❑ Mailed after receipt of completed survey
- ❑ Handed to respondent after completion of face-to-face interview
- ❑ Mailed to respondent after completion of face-to-face interview
- ❑ Other ***(please specify)*** _____

REMINDERS

27. **Were any reminders used during the survey?**

❑ Yes ❑ No ⇒ ***(Skip to Question 30.)***

⇓

28. **What types of reminders were used? *(Check all that apply)***

- ❑ Telephone
- ❑ Postcard
- ❑ Letter
- ❑ Other ***(please specify)*** _____

29. **What was the maximum number of reminders executed during the survey?**

- ❑ One
- ❑ Two
- ❑ Three
- ❑ Four or more

30. **How many contacts were *planned* to be made with *every* household during the survey (i.e., telephone recruitment, post-card reminder, and mail-back retrieval equals three contacts)?**

- ❑ One
- ❑ Two
- ❑ Three
- ❑ Four or more

EDITING AND CODING

For the purposes of answering the following questions, invalid and missing values are defined as:

invalid: includes responses which are logically incorrect (e.g., a five year old whose survey indicates that he works full-time), as well as responses which are out of range for the responses expected (e.g., a case in the data which was coded as an 8 for a question for which valid responses are 1 through 5)

missing: includes those cases where a respondent refused to answer a question or simply left the response unanswered.

31. How frequently were the data reviewed for invalid and/or missing values?

- ❑ Daily ❑ Monthly ❑ Weekly ❑ At the end of the study
- ❑ Other ***(please specify)*** _____

32. Were corrections made for invalid or missing values in the data?

- ❑ Corrections were not made to either invalid or missing values ⇒ ***(Skip to Question 35.)***
- ❑ Corrections were made to invalid values only
- ❑ Corrections were made to missing values only
- ❑ Corrections were made to both invalid and missing values

33. How soon after finding invalid or missing values were corrections made? *(Check all that apply)*

- ❑ Corrections were made immediately
- ❑ Corrections were made as soon as the respondent could be re-contacted
- ❑ Other ***(please specify)*** _____

34. a. How were invalid and/or missing values on individual data items in the survey data corrected?

- ❑ Without contacting respondent (by inferring values from other data collected) ⇒ ***(Skip to Question 35.)***
- ❑ By re-contacting the respondent
- ❑ Some by re-contacting respondent, some without re-contacting respondent
- ❑ Other ***(please specify)*** _____

b. If the respondent could not be re-contacted, what was done with invalid and/or missing values in the data?

- ❑ Missing values left missing
- ❑ Missing values were recoded with an inferred value
- ❑ Other ***(please specify)*** _____

35. a. Were certain questions in the survey defined as critical for the purposes of accepting a household survey as complete?

❑ Yes ❑ No ⇒ ***(Skip to Question 36.)***

⇓

b. What was done with households whose survey records contained invalid or missing responses to critical questions in the survey data?

- ❑ Household was discarded
- ❑ Household was separated from the rest of the data
- ❑ Household was kept intact
- ❑ Other ***(please specify)*** _____

36. What was done with households that terminated part way through the survey process?

- ❑ Household was dropped from data set
- ❑ Household was kept, but not included in final data set
- ❑ Household was kept and included in final data set
- ❑ Other ***(please specify)*** _____

37. How were the data coded? ***(Check all that apply)***

❑ Direct keypunching ⇒	**a. Were the keypunched data double-punched (a process where data are punched twice for accuracy)?** ❑ Yes ❑ No
❑ Direct keypunching and manual coding ⇒	**a. Were the keypunched data double-punched (a process where data are punched twice for accuracy)?** ❑ Yes ❑ No **b. Was the manual coding re-checked before keypunching?** ❑ Yes ❑ No
❑ Computer Aided Telephone Interviewing (CATI)	
❑ Scanning	
❑ Other ***(please specify)*** _____	

GEOCODING

38. How were the data geocoded?

- ❑ Computer generated
- ❑ Manually generated
- ❑ Combination of computer and manual
- ❑ Other ***(please specify)*** _____

39. **Were geocodes checked for accuracy?**

❑ Yes ❑ No

40. **What sources were used during the geocoding process?** ***(Check all that apply)***

❑ Census Tiger files ❑ Telephone directories
❑ Commercial database ❑ Other ***(please specify)*** _____

41. **To what geographical measurement were the data coded to?** ***(Check all that apply)***

❑ Census tract ❑ TAZ
❑ Census block ❑ Latitude/Longitude
❑ Zip Code
❑ Other ***(please specify)*** _____

COSTS

42. **How much did the survey cost?**
(please include all costs accounted for as part of the survey effort) $_____

43. **Does this figure reflect all the costs to the (DOT/MPO), including staff costs and any consultant costs?**

❑ Consultant only ⇒ ***(Skip to Question 45.)***
❑ DOT/MPO staff only
❑ Consultant and DOT/MPO staff
❑ Other ***(please specify)*** _____

44. **Are DOT/MPO staff fringe and overhead costs included?**

❑ Yes ❑ No

45. **What activities does this cost include?**

	For anything not included, please indicate cost, if known:
❑ Design	$_____
❑ Pilot survey	$_____
❑ Collection of data	$_____
❑ Coding of data	$_____
❑ Geocoding	$_____
❑ Analysis	$_____
❑ Publicity	$_____

RESPONSE RATES

46. a. **If this survey was conducted face-to-face, what was the average interview time?**

Per Person: _____hours _____minutes
Per Household: _____hours _____minutes

b. **If survey data was collected over the telephone, what was the average data retrieval time?**

Per Person: _____hours _____minutes
Per Household: _____hours _____minutes

47. **If the survey was conducted by mail without a telephone contact, how many surveys were mailed to households and how many households returned a usable (complete) survey?**

Number of surveys mailed out _____ Number of Surveys Usable _____ ⇒ ***(Skip to Question 50.)***

48. **Of those households contacted,**
how many (number, not percentage) agreed to participate in the survey? _____

49. **Of those households that agreed to participate,**
how many (number, not percentage) completed the survey? _____

50. **How was a complete household response defined?** ***(Check all that apply)***

❑ Complete data from all eligible persons in household
❑ No more than one eligible person's data missing
❑ Number of missing allowed depends on household size
❑ No missing information allowed on key variables
❑ Other ***(please specify)*** _____

TRIP RATES

51. a. **For each of the following, please indicate the average trip rates:**
(Please mark "N/A" for those trip rates which were not calculated)

	Linked Trips	Unlinked Trips
a. Person trips per person	_____	_____
b. Person trips per household	_____	_____
c. Vehicle trips per person	_____	_____
d. Vehicle trips per household	_____	_____
e. Home-based work person trips	_____	_____
f. Home-based other person trips	_____	_____
g. Non-home-based person trips.	_____	_____

	Linked Trips	Unlinked Trips
h. Home-based work vehicle trips	_____	_____
in. Home-based other vehicle trips	_____	_____
j. Non-home-based vehicle trips	_____	_____

b. If you reported linked trip rates in a. above, what linking was done? *(Check all that apply)*

- ❑ Linking through change in travel mode
- ❑ Linking through pick-up/drop-off
- ❑ Other ***(please specify)*** _____

52. a. Were non-motorized trips included in the trip rate calculations?

- ❑ Yes ❑ No

b. If yes, was there a minimum distance or time specified to define a non-motorized trip (i.e., walking less than 5 minutes may not be included)?

- ❑ Yes ***(Please specify)*** _____
- ❑ No

PRODUCTS

53. In what computer format were the final data sets generated? *(Check all that apply)*

- ❑ ASCII ❑ SPSS
- ❑ Binary ❑ SAS
- ❑ Data base ❑ Other ***(please specify)*** _____

54. What types of files were generated? *(Check all that apply)*

- ❑ Trip file ❑ Person file
- ❑ Household file ❑ Activity file
- ❑ Other ***(please specify)*** _____

55. Were the files made available to: *(Check all that apply)*

- ❑ General public ❑ State agencies
- ❑ Local agencies ❑ Transit companies
- ❑ Not made available outside (this agency/the MPO/the DOT)
- ❑ Other ***(please specify)*** _____

56. What public products were produced to report the findings of the survey? *(Check all that apply)*

- ❑ Public forum ❑ Reports
- ❑ Newsletter ❑ Other ***(please specify)*** _____

---

57. If possible, we would like to obtain copies of the following documents. Please indicate which of the following you are able to send, or indicate the name and phone of the person we should contact to obtain copies:

	Sending	Not Available	Contact
RFP for this study	❑	❑	_____
Any reports generated about this survey (pre-test report, methodology report, etc.)	❑	❑	_____
Survey instruments	❑	❑	_____
Instruction manuals/training manuals	❑	❑	_____

Please send copies to:
Dr. Peter R. Stopher, PlanTrans, 3533 Granada Drive, Baton Rouge, Louisiana 70810-1142

58. Do you have any comments or suggestions, given your experience with this household travel survey, with regard to future efforts to collect this type of information?

_____
_____
_____

59. We will be compiling the information we collect during this study in a synthesis document. We would like your permission to include your name, telephone number, and address for the potential use of readers of the document. If you are willing to provide permission to publish this information, please complete the following:

Name: _____

Agency: _____

Telephone: _____

Address: _____

_____

❑ Check here if you do not want information about yourself published in the synthesis document

Please FAX this completed questionnaire to (310)767-1386. We will call you to confirm receipt of the survey. Thank you very much for your help.

APPENDIX B

List of Study Participants

The following agencies participated in this study by furnishing information about a specific household travel survey.

Arizona	Mark L. Schlappi Maricopa Association of Governments 2901 West Durango Street Phoenix, Arizona 85009 (602) 506–4117	Survey	Maricopa County
Arizona	Richard E. Corbett Pima Association of Governments Transportation Planning Division 177 North Church #501 Tucson, Arizona 85701 (520) 628–5313	Survey	Pima County
Arkansas	John Hoffpauer Metroplan 501 West Markham, Suite B Little Rock, Arkansas 72201 (501) 372–3300	Survey	Little Rock
California	R. Leslie Jones and Don Ochoa California Department of Transportation Office of Travel Forecasting and Analysis Mail Station 38, P.O. Box 942874 Sacramento, California 94274 (912) 654–3330/654–2747	Survey	Entire state of California
California	Gail Malone Maritz Marketing Research Inc. 17100 Pioneer Boulevard, Suite 400 Artesia, California 90701 (310) 809–0500	Survey	Six counties in Sacramento
California	Cheryl Stecher and Susan Johnson Applied Management & Planning Group 12300 Wilshire Boulevard, Suite 430 Los Angeles, California 90025 (310) 820–0741	Survey	Five counties in Southern California
California	Chuck Purvis Metropolitan Transportation Commission 101 Eighth Street Oakland, California 94607–4700 (510) 464–7731	Survey	San Francisco Bay
Colorado	Jeff May Denver Regional Council of Governments 2480 West 26th Avenue, Suite 200B Denver, Colorado 80211–5580 (303) 455–1000	Survey	Boulder County

Colorado	Eric Bracke North Front Range Transportation and Air Quality Planning Council 210 East Olive Fort Collins, Colorado 80521 (970) 221–6608	Survey	Greeley/Fort Collins/Loveland
Delaware	Ralph Reeb Delaware Department of Transportation P.O. Box 774 Dover, Delaware 19903 (302) 739–2252	Survey	Delaware
District of Columbia	Robert E. Griffiths Metropolitan Washington Council of Governments 777 West Capitol Street NE Washington, D.C. 20002 (202) 962–3280	Survey	Metropolitan Washington, D.C.
Florida	Wendell Harrison Florida Department of Transportation 605 Suwannee Street, MS 19 Tallahassee, Florida 32399–0450 (904) 488–4640	Survey	Broward County, Palm Beach, Lee County
Georgia	Nancy McGuckin Barton-Aschmann 1133 15th Street NW #901 Washington, D.C. 20005–2701 (202) 775–6075	Survey	Atlanta
Hawaii	Cheryl Stecher and Susan Johnson Applied Management & Planning Group 12300 Wilshire Boulevard, Suite 430 Los Angeles, California 90025 (310) 820–0741	Survey	Oahu
Idaho	Dave Szplett Ada County Highway District 318 East 37th Street Boise, Idaho 83714–6418 (208) 345–7680	Survey	Ada County
Illinois	Ed Christopher Chicago Area Transportation Study 300 West Adams Chicago, Illinois 60606 (312) 793–3467	Survey	Seven counties in NE Illinois
Indiana	Vince Bernardin, AICP Bernardin, Lochmueller & Associates, Inc. Hulman Building, 20–24 NW 4th Street Evansville, Indiana 47708 (812)426-1737	Survey	Kokomo, South Bend-Elkhart
Iowa	Kevin Gilchrist Des Moines Area MPO 602 East First Street Des Moines, Iowa 50309–1881 (515) 237–1316	Survey	Des Moines

Kansas	Steve Noble Mid-America Regional Council 600 Broadway, Suite 300 Kansas City, Missouri 64105 (816) 474–4240	Survey	Eight counties in Kansas and Missouri
Maine	Bruce Hyman PACTS 233 Oxford Street Portland, Maine 04101 (207) 774–9891	Survey	Portland
Maryland	Gene Bandy Baltimore Metropolitan Council 601 North Howard Street Baltimore, Maryland 21201 (410) 333–1750 ext. 235	Survey	Baltimore
Massachusetts	Ian Harrington Central Transportation Planning Staff 10 Park Plaza, Room 2150 Boston, Massachusetts 02116 (617) 973–7080	Survey	Eastern Massachusetts
Michigan	Cheryl Stecher and Susan Johnson Applied Management & Planning Group 12300 Wilshire Boulevard, Suite 430 Los Angeles, California 90025 (310) 820–0741	Survey	Eight counties in SW Michigan
Minnesota	Mark Filipi Metropolitan Council 230 East 5th Street St. Paul, Minnesota, 55101–1634 (612) 229–2725	Survey	Minneapolis–St. Paul
New Hampshire	Kevin Tierney Cambridge Systematics, Inc. 150 Cambridge Park Drive, Suite 4000 Cambridge, Massachusetts 02140 (617) 354-0167	Survey	New Hampshire
New Mexico	Berry Ives Middle Rio Grande Council of Governments 317 Commercial NE. Suite 300 Albuquerque, New Mexico 87102 (505) 247–1750	Survey	Albuquerque
North Carolina	Bill Austin Alamance County 124 West Elm Street Graham, North Carolina 27253 (910)228–1312	Survey	Alamance County
North Carolina	Mike Bruff North Carolina Department of Transportation Statewide Planning Branch P.O. Box 35201 Raleigh, North Carolina 27611 (919) 733–4705	Survey	Triad Region

North Carolina	Joseph Huegy Triangle Transit Authority P.O. Box 13787, 50 Park Drive, Suite 206 Research Triangle Park, North Carolina 27709 (919) 406–1710	Survey	Raleigh–Durham
Ohio	Rich Schultze Miami Valley Regional Planning Commission 40 West 4th Street, Suite 400 Dayton, Ohio 45402 (513) 223–6323	Survey	Dayton
Oregon	T. Keith Lawton Metro 600 NE Grand Avenue Portland, Oregon 97232 (503) 797–1764	Survey	Oregon and SW Washington State
Pennsylvania	Bill Allen Consultant P.O. Box 118 Mitchells, Virginia 22729—0118 (703) 829–0124	Survey	Reading
Puerto Rico	Nancy McGuckin Barton-Aschmann 1133 15th Street NW #901 Washington, D.C. 20005–2701 (202) 775–6075	Survey	12 counties in San Juan Metro, Puerto Rico
Texas	Cynthia Adamson Houston–Galveston Area Council P.O. Box 22777 Houston, Texas 77227–2777 (713) 993–4575	Survey	Eight counties of Houston TMA
Texas	David F. Pearson Texas Transportation Institute Texas A&M University College Station, Texas 77843–3135 (409) 845–9933	Survey	Texarkana, Tyler-Smith County, Sherman/Denison, San Antonio/Brexar, Amarillo, Brownsville, Jefferson/Hardin/Orange
Thailand	Nancy McGuckin Barton-Aschmann 1133 15th Street NW #901 Washington, D.C. 20005–2701 (202) 775–6075	Survey	Bangkok, Thailand
Utah	Cheryl Stecher and Susan Johnson Applied Management & Planning Group 12300 Wilshire Boulevard, Suite 430 Los Angeles, California 90025 (310) 820–0741	Survey	Three counties in Salt Lake
U.S.	Susan Liss Federal Highway Administration HPM-40 Washington, D.C. 20590 (202) 366–5060	Survey	Entire U.S.

Vermont	David J. Scott, P.E. Vermont Agency of Transportation Planning Division, 133 State Street Montpelier, Vermont 05633 (802) 828–2391	Survey	Vermont
Virginia	Donald H. Wells Virginia Department of Transportation 1401 East Broad Street Richmond, Virginia 23219 (804) 786–2981	Survey	Danville
Washington	Steve Fitzroy Puget Sound Regional Council 1011 Western Avenue, Suite 500 Seattle, Washington 98104 (206) 464–6411	Survey	Seattle
Wisconsin	Brucer Aunet Wisconsin Department of Transportation 4802 Sheboygan Avenue Madison, Wisconsin 53707–7913 (608) 266–9990	Survey	Madison
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National Research Council
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