Telephone Interviews: Cost-Effective Method for Accurate Travel Surveys

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A residential travel survey of a seven-county regional area was designed and conducted by Anderson, Niebuhr & Associates, Inc. for the Metropolitan Council of the Twin Cities Area, Saint Paul, Minnesota, between September 1982 and March 1983. A random sample of households was selected from directories of listed telephone numbers using computer generated random digits. Preliminary telephone interviews were conducted. If the household member agreed to have the household participate in the survey, general household data were collected and a day for logging travel information was selected. A cover letter, travel cards, and instruction cards were mailed to the households participating in the travel survey. Reminder calls were made to these households on the evening preceding the selected travel day to remind them to complete the travel diaries and to answer any questions. On the day after the travel day, households were again called to collect the travel data. The survey data were edited and coded by the staff of the Metropolitan Council. The primary purpose of the survey was to update, not repeat, a previous 1970 survey. Questions were limited to key data needed to verify findings of the earlier survey. Both the brief survey content and the method of data collection resulted in substantial cost savings while retaining acceptable representation and accuracy.

The Twin Cities Regional Transportation Planning participants include the Minnesota Department of Transportation, the cities and counties in a seven-county 3,500 sq mi region, and the Metropolitan Council of the Twin Cities Area, Saint Paul, Minnesota. The Metropolitan Council is an areawide regional planning body that serves as the metropolitan planning organization (MPO) as provided for in the federal UMTA/FHWA guidelines. A key role of the council is long-range travel forecasting for the region. The council also prepares a plan for land use known as the Regional Development Framework.

The region's planned 595 mi of metropolitan freeways and expressways, along with its transit system, have been shaped to the Regional Development Framework provided by the Metropolitan Council. During the 1970s this combined transportation system was expected to provide extremely good mobility to the year 2000 and beyond; however, planners are no longer certain of this. A phenomenon more commonly remarked in the faster growing sunbelt states is beginning to occur in the Twin Cities as well. This is what Orski (*1*) has identified as the coming crisis in suburban mobility. The problem is highway congestion in the suburbs which is partly due to the general growth in development adjacent to freeways and partly due to the emergence of specific suburban megacenters. Such suburban development attracts many more automobile trips than development counterparts in the older center city. In the Twin Cities this relationship was not fully reflected in the travel data collected in previous surveys (1958, 1970) and has heightened awareness of the need for better information on which to base transportation planning for the late 1990s and beginning decades of the 21st century.

The Twin Cities' regional planners approach to one aspect of this data need was to conduct a low cost microsample origin-destination (O–D) survey. The travel behavior inventory (TBI) update was designed and executed in a tight-budget environment. Sample selection and interview technique for representative accuracy were primary concerns because few dollars meant few interviews—far fewer than had been attempted before.

DESIGNING AND SELECTING THE TBI PROCESS

Planning for the 1982 TBI update (*2*) began in the mid–1970s. It was determined that a travel update should be conducted to coincide with the 1980 census. Early consideration of information needs was comprehensive and addressed a number of issues beyond ordinary travel behavior data. The Twin Cities' Transportation Policy Plan outlined goals, policies, and standards for regional highway and transit systems. In order to track the implementation of the plan, the Metropolitan Council commissioned a study of policy and goal measures called the Performance Measures and Travel Behavior Inventory Study.

The study developed a methodology for determining performance measures and developed a list of approximately 150 such performance measures, plus 20 summary performance measures (*3*). The study also outlined the data requirements for obtaining performance measures (*4*). Measures included such items as percent of population with access to transit. Data sources included O–D matrices, land records, automobile occupancy surveys, and many other types of inventories.

Many of the performance measures were derivative of common travel data sets so information needs were not so staggering as suggested by 150 measures; however, the total time and effort for putting the performance measures system into operation was still judged to be considerable. The consultants that prepared the study were asked to develop strategies for data collection, including estimates of time and cost. These were prepared for several alternative data collection strategies and for three budget levels. Expressed as multiyear continuing data inventory programs for the 1981 to 1990 period, the cost totals ranged from $205,000 to $680,000. That much money or more had been previously spent in the Twin Cities, and in less time. Nonetheless, consultations with state and federal officials indicated less than $100,000 would be available for actual data collection in 1981–1983.

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This budget constraint was one of two major constraints that had to be dealt with; the other was time. The research on performance measures carried beyond the time of the 1980 census and was deemed necessary to begin the travel inventory. As it was, the inventory was finally conducted in 1982–1983. The low potential funding forced planners involved to look closely at their priority data needs.

From other evidence gathered during the 1970s it was known that certain key travel factors were probably changing. Chief among those were the overall rate of travel in trips per person, and the vehicle occupancy. Traffic assignments using estimated current socioeconomic data and models based on 1970s trip rates and mode shares were not successfully replicating ground counts. It was determined therefore to conduct as large a sample as possible with only those priority questions needed to update the trip generation and mode choice models. It was known that the data would possibly not be adequate to revise trip distribution models.

CONDUCTING THE TBI SURVEY

The sampling approach used to update the travel behavior inventory of 1970 differed from typical travel survey methods in four ways: (a) the type of sample drawn, (b) the source from which the sample was drawn, (c) the size of the sample, and (d) the manner in which representativeness of response was achieved. These differences are detailed as follows:

1. Type of sample—Cluster sampling is sometimes used to survey households in a region because of its efficiency. However, an equal probability simple random sample was used for the travel survey. The simple random sample was chosen because the precision of data collected from simple random samples is easily and accurately determined. This served the objective of obtaining a selected number of data items needed to update the travel forecasting models with as much representative validity as possible. Also the simple random sample was chosen instead of a cluster sample because some of the assumptions for using cluster sampling appropriately could not be met in such a study.

2. Source of the sample—Equal probability random samples for telephone surveys can be drawn from listings of households with telephones or by using random digit dialing. For the travel survey, directory listing of households with telephones were used. Research has shown that a large percentage of the numbers dialed using random digit dialing are not working telephone numbers of households. The use of directories reduces the cost of calling these nonworking numbers. In addition, it is impossible to assess the extent to which nonresponse is a problem in random digit dialing because it is not certain if an unanswered call is to the number of a household, a business, or a nonworking number. The use of directories reduced this problem in assessing nonresponse. In using telephone directories, the exclusion of unlisted numbers was recognized. However, research has shown that data using listed numbers yield substantially the same results as data from unlisted numbers because unlisted numbers represent such a small proportion of the total numbers. Research has shown that the Midwest is an area of the country that contains the smallest proportion of unlisted numbers. One additional benefit of selecting a sample from current telephone directories was that family names were listed. Addressing the respondent by using the family name encouraged cooperation in the survey. Attention to such details of the population being interviewed can improve response rates (*5*).

3. Size of the sample—A common misconception in survey research is that surveying a large percentage of a population will yield more accurate data than surveying a smaller percentage. In travel studies used to establish baseline data, it is customary to draw samples that are 1 percent of the population. The purpose of this travel survey was to update baseline data; therefore, the need for such a large sample was not necessary and possibly would not have yielded data as accurate as that obtained. Another common problem in determing sample size is the manner in which sampling error is expressed. The relationship between sample size and sampling error is frequently expressed as a percentage. However, in this study the relationship was expressed in trips because trips were the units being measured in the study. Considering the need to update baseline data and report sampling erro in terms of trips, a minimum sample size of 2,000 households was selected from approximately 721,000 households in the area. A total of 2,581 surveys were actually completed. This size ensured that all work-trip data were accurate within ±0.14 trips. The random sample accurately represented all geographic segments of the area within ±2 percent at a 90 percent confidence level.

4. Representativeness of response—Because of time and cost considerations, the following approach is frequently used in survey research: (a) a limited number of contacts is made to reach the original sample, (b) those unable to be reached with minimal effort are replaced, and (c) the response rate is either not reported or does not take into consideration the replacement of the original sample. In this travel study, numerous follow-up procedures were used. Extensive callbacks were made to each household in the original sample before replacements to the sample were made. Calls were made at varying times of the day and night, and on different days of the week to increase the likelihood that the original sample was contacted. Replacements were made by randomly selecting a replacement household from a second listing of households generated in the same manner as the first listing. Of the 2,581 households for which surveys were completed, 151 provided household information, and 2,430 provided information on all aspects of the survey. This resulted in an overall response rate of 91 percent. Response rates of 90 percent or more of the original sample are routinely achieved by Anderson, Niebuhr & Associates, Inc. in similar studies by using these follow-up procedures.

The purpose of the 1982 travel behavior inventory (*2*) was to update socioeconomic and travel data gathered in a 1970 home-interview survey. To successfully complete the survey, the following criteria had to be met: (a) the survey had to be conducted within the designated time frame, (b) the survey had to be conducted within the approved budget, and (c) the study needed to produce data that were valid and useable in the Metropolitan Council's travel forecasting models.

The survey met the first two criteria related to the time frame and costs for completing the survey. To ensure the validity of the data, the results were compared to several key census and geographic indices to check for accurate representation of households.

SURVEY RESULTS AND APPLICATION

The 1970 data socioeconomic and travel base gathered from a home-interview survey was used to develop mathematical models to predict future regional travel patterns. From these, in part, the appropriate regional transportation policies, plans, and programs were developed.

From 1970 to 1982, significant changes in the Twin Cities occurred in the distribution of population and employment, energy costs, female labor participation, family size and age structure. Consequently, some 1970 data (e.g., proportion of automobile drivers, average trip length, average number of vehicles per household, and average automobile occupancy rates) became outdate. The 1982 TBI update revealed the magnitude of those changes and the extent to which 1970 travel models needed to be adjusted.

To confirm that the 1982 survey data accurately represented current socioeconomic data, key survey results were compared to analagous 1980 U.S. Census statistics *(2)*. Comparisons were made with geographic representation of the sample, selected age distribution, household size, household employment, and household income. These comparisons are summarized in Table 1.

TABLE 1 SURVEY VALIDATION SUMMARY TABLE

	1980 Census	Metropolitan Council 1982 Estimates	1982 TBI
Geographic representation of households, %			
Hennepin	50	47.0	51.0
Ramsey	23.0	22.9	22.0
Anoka	9.0	10.1	9.0
Dakota	9.0	10.1	8.0
Washington	5.0	5.8	5.0
Carver	2.0	1.9	3.0
Scott	2.0	2.3	2.0
Total	100	100	100
Selected age distribution, percentage of population 5 yr or older	92.8		91.8
Average household size	2.64	2.70	2.68
Household employment, percentage of population employed	51		52
Household income, $	24,785[a]		24,752

[a]Inflation adjusted.

Between 1970 and 1982 the most significant change in travel behavior of Twin City residents was the overall increase in mobility: more people made more and longer trips by both car and public transit. This is expected because of current (older) age structure for which the trip rate is greater.

Peak-period travel, for both morning and evening rush hours, has increased relative to off-peak tripmaking. This reflects the increase in the number of people in the labor force who have taken jobs and is indicative of these people placing priority on the trip to work.

Per capita automobile ownership continued to increase, while the vehicle occupancy rate continued to decline. This does not bode well for regional policies intended to increase ridesharing and use of public transit.

Since 1970 travel to and within suburbs has increased, while the proportion of all trips destined for central Minneapolis and St. Paul has declined. Travel to the downtown areas has remained essentially stable in absolute numbers. Since 1970 the average trip distance has increased by eight-tenths of a mile or 16 percent; however, the trip travel time still averages about 17 min.

A new trip purpose appears to be emerging—the non-home-based work trip. These are work-generated trips that are not made directly between the home and workplace (for example, stops at day care centers on the way to and from work). This explains a significant proportional decrease in home-based work trips since 1970, despite the increase in the number of workers.

The total cost of the TBI update was $180,500. This included the initial design of the survey, collection of data, editing, coding, and preparation of summary data files for analysis and evaluation. Of this amount $70,000 was spent with the consultant to prepare the final survey plan and collect the data. This figure amounts to $28.00 per household to collect the travel behavior data. The cost for processing completed interviews was $45.00 per household, which covered agency staff charges and computer costs; the total was $73.00 per household surveyed.

CONCLUSIONS

The basic approach, using a mail-out trip log and collecting data by telephone, was very workable. The cost per interview for actual data collection by the consultant was reasonable. The response rate from the selected sample was high and appeared to be due to careful design and pretesting, as well as to well-conceived and persistently applied follow-up technique.

The changes in basic understanding of travel patterns and behavior have been highly significant to the region's planners. Most of the inaccuracies in the 1970 models have been corrected. The changes between 1970 and 1982 were dramatic enough to suggest that travel data should be updated every 5 years if possible. Reduced cost per interview can help achieve that.

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