CATS 1990 Household Travel Survey
A Methodological Overview

Working Paper 94-05
by
Ed J. Christopher
Alan R. Fijal
Anne C. Ghislandi

Information Services Division
Chicago Area Transportation Study
300 W Adams
Chicago, Illinois   60606

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Abstract

This report contains a methodological discussion of the CATS 1990
Household Travel Survey.   It was prepared to assist those who are
working with the Household Travel Survey data base.   This report

concentrates on the survey procedures and is intended to be a supplement to the materials that document the data base and its structure. It should be noted that a great deal has been written about the Household Travel Survey. This has been done both in terms of documenting the conduct of the survey and in the preparation of research papers covering several methodological aspects of the survey. Shown in the References at the end of this report is a listing of the published articles discussing various aspects of the survey. Copies of these articles are available by contacting CATS Public Information Officer.

Table of Contents

List of Exhibits

Exhibit

1.0 Background and Overview

The collection and use of travel behavior data in the northeastern
Illinois region by the Chicago Area Transportation Study (CATS) has
had a rich and illustrative history. The data itself has been culled
largely from two sources: Data collected locally and data collected by
the Census Bureau.

In 1956, CATS conducted a region-wide survey of household travel.
This survey provided detailed origin-destination (O-D) data on trip
purposes, modes of travel, trip lengths and travel patterns. In 1960,
the U.S. Census Bureau initiated its first effort to collect journey-
to-work (JTW) travel data in urbanized areas. For the next decennial
census in 1970, the Census Bureau greatly improved the JTW data
source. In conjunction with the Census Bureau's effort, CATS
conducted its 1970 Home Interview Survey. This CATS effort had three
main purposes: to provide a check on the census JTW data; to develop
factors for areas where the census data was incomplete; and to provide
O-D travel information on non-work related travel. There were, of
course, many other secondary uses of the CATS home interview survey
data. For 1980, the Census Bureau made further improvements to its
JTW survey and CATS performed an update of its 1970 database in 1979.

For the 1990 census, the JTW supplement was further fine tuned and

improved. Having worked with three prior census JTW databases (1960, 1970 and 1980), CATS understood the need to augment the census information with data on non-work related travel. To meet this need, CATS once again embarked upon a household travel survey, formally called the CATS 1990 Household Travel Survey (HHTS).

The HHTS encompassed a seven-year effort that produced a body of information on both work and non-work trips. Under the scope of the project, CATS surveyed the region on a county-by-county basis with the Chicago Central Business District (CBD) and the remainder of Chicago being surveyed separately. Starting in 1988, nine separate surveys were planned and conducted over a period of four years. The remaining years of the effort were spent on preparing and packaging the final data base for public distribution. Exhibit 1 following the text of this report contains the timeline for the areas surveyed.

The survey featured a self-administered mail-back questionnaire. The questionnaire was designed in a manner to allow the results to be adjusted and factored with the 1990 census. Specifically, the questionnaire collected two types of data: census variables such as the number of persons per household, age, vehicle availability, sex, employment status, occupation and income; and transportation related variables including trip origin and destination, trip purpose, travel time, mode of travel used, vehicle occupancy, and walking distance if transit modes were involved. Exhibit 2 presents an outline of the survey design and its features.

Once all the data was collected and put into a digital format researchers from the University of Illinois at Chicago undertook the task of bias reduction and factoring. Armed with the 1990 census journey-to-work package, the researchers factored, adjusted and, when completed, will certify the data base. A great deal of work has been undertaken on this aspect including a survey of travel survey factoring methods used by other metropolitan areas, research into the end uses of the data and an analysis of survey returns and bias reduction methods. Several published research papers on the conduct of the survey, its method and the factoring technique have also been published.

2.0 Survey Technique

All survey techniques are the result of compromises among the objectives of the survey, the resources available and the amount of data to be collected. For the HHTS three different techniques were reviewed: a self-administered mail-back questionnaire or travel diary, a face-to-face home interview and a telephone interview. During the methodology review process many items were evaluated including the survey objectives, anticipated costs and effectiveness of each technique, and the experiences of other regions. Resulting from this evaluation the self-administered mail-back technique emerged as the most attractive for CATS' purposes.

CATS staff believed that the strengths of the mail-back travel diary were the ability to collect the desired data, lower costs and the ability to conduct it with existing staff and agency resources. Its

weakness was the possibility of unknown biases. At the time of this
investigation CATS only found limited evidence of the use of this
technique so little was known about the type of bias to expect. This
was a major concern of CATS and it is discussed in several subsequent
sections.

As it turned out only minimal biases were detected and minor
adjustments were made. The self administered mail-back technique seems
to have its roots in work done in Germany, and in Albany and Ithaca,
New York. The upstate New York work was done in the early 1980's and
the results of which were reported at the Transportation Research
Board Annual Meeting in 1984. Researchers Werner Brog of Germany and
Arnim Meyburg, who has ties to Cornell University in Ithica, New York,
have done much of the premier work with this technique.

The self-administered mail-out mail-back survey technique, as
administered by CATS had four main elements: distribution of an
introduction letter to selected households; distribution of the
questionnaire and instructions; mailing out reminder letters; and
telephoning selected individuals to verify their information. A
sample copy of the materials distributed in the households in the
Chicago portion of the survey is shown in Appendix A.

3.0 Sampling Frame

The target population for the HHTS was the residents of northeastern
Illinois who were 14 years old or older. To reach the target
population, the sampling unit was the household rather than
individuals. The main reason for using households rather than
individuals rests with the level at which transportation planning
takes place. Through CATS' experience with travel forecasting, it has
been found that the household is currently the best predictor of
travel behavior and thus, the basic unit of travel. Although changes
to this paradigm are under investigation, it will literally be decades
before alternative approaches become fully operational. Within the
research community three approaches to travel forecasting and modeling
are emerging. They include activity based, dynamic and individualized
simulation approaches.

The universe that was used to draw the survey sample, or the sampling
frame, was residential electric meters (addresses) supplied by
Commonwealth Edison. This listing was successfully used for the 1970
Home Interview Survey and is frequently used by the Northeastern
Illinois Planning Commission for its work. For areas where
Commonwealth Edison addresses were not available, specifically the
cities of Naperville, St. Charles, Batavia, Geneva and Winnetka,
Illinois and sections of unincorporated Kane county, residential
addresses were obtained from other sources. These include reverse
telephone directories and municipal government files. For a detailed
explanation of the source used to identify survey residents, please
consult the area reports cited in the Reference section of this
report.

4.0 The Sample, Size and Selection

During the development of the HHTS the question of sample size was one of the most difficult questions to resolve. To help resolve the issue two approaches were pursued. First staff developed sample size estimates. The sample size estimates were based on the assumption of a standard deviation of the sample mean. In addition, it was further assumed that a little over half this basic variation could be explained by suitable stratification where the corresponding explanatory variables are known (e.g. persons per household, vehicle availability, workers per household, etc.) resulting in a smaller residual standard deviation of 0.75. The sample size calculations were based on this number, and the results are presented in Exhibit 3. These assumptions held for several items, including household trip rates, average trip length and mode.

The second tack was to assume the sample size and discuss it with the research community.   A matrix was developed of various examples trading off sample size, several expected response rates, postage and processing costs along with staff resources. Through these two approaches it was determined that a database of 400 completed household questionnaires should be sufficient to represent any geographic area that one would want to speak about. This value was then discussed with the researchers responsible for the factoring and adjusting. They confirmed it as being a sufficient number to produce results that they could work with. It was also initially assumed that a 20% response rate could be expected. Based upon a cumulation of experience this rate was surpassed in several suburban areas.

From that point on 400 households became the established number of completed household questionnaires needed to produce acceptable results. This meant that statistical reliability could be achieved for any geographical area by collecting data from 400 households. This then became the basis for the survey. Although 400 was the sample target in any given area, staff processed all the questionnaires that were returned. Since targets were exceeded in 98 percent of the areas surveyed this yielded a higher level of reliability than the original targets. Exhibit 4 shows the households surveyed, the sample targets and the number of usable surveys.

Once the desired sample size was known a sample had to be drawn. Although many different methods exist, a simple clustered random sample technique was used. This will be explained below. As noted, an early decision was made to conduct the survey and the sampling on a county by county basis.   The decision was also made to develop subzones within each county sampled. These subzones acted in essence as containment areas in case something went wrong during the survey process. These subzones were drawn up to respect survey township boundaries and a map of them is shown as Exhibit 5. As it turned out these zones proved most useful in the city of Chicago where early low response rate indications in two subzones led to a selection of additional households.

Maintaining 400 as the target number of responses needed and using the assumed 20 percent response rate, a two stage sampling process was employed. The first stage consisted of developing the sampling frame, or universe of households, for each containment area or sub zone. This

was accomplished by sorting the household addresses provided by Commonwealth Edison with a geographic code, which corresponds to the quarter-section where the electrical transformer of the residence is located. In the cases where alternate sampling frames had to be used, the sampling frame was sorted by the street address.

The file for each zone was then divided into approximately equal groups. The size of the group was derived by dividing the total number of units in the sampling frame for each zone by the number of survey questionnaires that were to be mailed (approximately 2,000 per zone if one assumes a 20 percent response). Before dividing the universe into groups, the number of households in each group was rounded to the nearest whole number. Once the geographically sorted groups were developed, one record was randomly selected from each group. The calculations for this step are shown in Appendix B for DuPage County. In the case of the telephone directory listings, the same process was employed except that the street address was used for sorting purposes.

Since the Commonwealth Edison files contained some vacant and nonresidential units an edit of selected records took place whereby these units were removed. This edit, coupled with the rounding of the number of groups, accounted for the slightly different number of surveys being distributed in each sampling zone. However it must be noted that according to the sample design, it was acceptable to have a different number of households surveyed for each zone as long as at least 400 samples per zone were returned and usable. Therefore, the mailing to each sampling zone was more or less than the targeted 2,000 questionnaires needed to achieve a 20 percent response. In addition to deleting obvious "bad" records, the selected records were edited to correct misspellings and other anomalies. Unique identification numbers were then assigned to the questionnaires and mailing labels were produced. Exhibit 4 presents a summary of the households selected.

5.0 Survey Instrument, Household Form and Trip Form

This section is intended to provide insight into the survey instrument, specifically the questionnaire, the logic behind its design, and the use of the data. Appendix B contains a copy of the materials mailed to the selected households including the questionnaire. The questionnaire is divided into two sections: a household form that identifies the characteristics of the household and its members; and a trip form that identifies the characteristics of each trip. Those working with the HHTS data files also need to review the Data Base Documentation presented in CATS Working Paper 94-05.

5.1 Survey Instrument

The households selected to participate in the survey received three mailings. The first contact was to mail two introduction letters. These were sent two weeks prior to the mailing of the survey package.

The first letter was written by a local government official, usually the county board chairman. It explained the goals of the survey and the importance of cooperation and introduced CATS. The second letter was from CATS' Executive Director and focused on the mechanics of the survey. Although the net effect of the dual letters is unknown, staff felt that showing local support added credibility to the effort.

Two weeks after the introduction letters were mailed, the survey packet arrived. The mailings of the survey packets were timed to arrive on a Tuesday or Wednesday, approximately one day before the travel day. Referring to Appendix B, one can see that the packet was loaded with instructions. It was accompanied by a postage-paid return envelope. The questionnaire format drew heavily from one used in Ithaca, New York. Although the questionnaire was self-administered it asked for the respondent's name and telephone number to allow for follow-up telephone calls. The ability to make follow-up telephone calls was most important and proved very valuable during the editing stage. Many times an entire household's worth of data could be salvaged with a simple telephone call to resolve a questionable response. Depending on the area surveyed between 5 percent and 7 percent of the respondent households were called back. In general it was the opinion of the staff that conducted the edit of the returned questionnaires that most respondent household's had limited difficulty completing the survey forms.

The questionnaire was designed to obtain information regarding household size, composition, employment status, vehicle availability and household income before asking the respondent to complete the travel/trip records. Prior to completing the trip records the respondents were asked to assign a "person number" to each household member (14 years and older) based on age with the oldest person listed as Person 1, the next oldest as Person 2, etc. They also provided their sex, age, relationship to the oldest person in the household, employment status and current occupation. Using the assigned person number, the respondents were then asked to note whether or not each person traveled on the reference (travel) day. If the person traveled, s/he was asked to provide the details for each trip in sequential order. This included the origin and destination, travel time, purpose and mode. In addition, there were several questions regarding walk links to and from all transit trips.

As suggested earlier, this data was collected and represents a reference day as opposed to a typical day. It was decided early on by CATS staff that collecting the travel data for a reference day would be adequate. By taking a "snapshot" of people's travel for one day the data can then be adjusted according to the type of analysis being pursued. Since two of the stated goals were to capture non-work and linked trips, which usually involve a work trip end it was decided that Thursday would be the optimal business day. It is a well established fact that midweek is the best time to study work trips but Thursday is also a shopping day in the northeastern Illinois region. On Thursday night most establishments that are not typically opened at night are open.

Once the questionnaires were mailed and five days after the travel day, a reminder letter was sent to the non-responding households. Since the original travel day had passed, the reminder letter

instructed the respondent to use either of the following two Thursdays
as an alternate travel day. The reminder letters proved very helpful
and netted an added response ranging from 12 percent to 22 percent. A
summary of the responses by travel day and area can be found in
Exhibit 6.

Early on in the surveys an unanticipated trend in the use of the
travel date had developed. Upon receiving the first wave of completed
forms from residents of the CBD it was found that several respondents
reported their travel for the Thursday a week before the "official"
travel day. After reviewing these forms and comparing them with the
trip forms received for the subsequent Thursdays, it was decided that
the data was usable. Thus, Exhibit 6 shows four travel days per
area.

The next two sections present a detailed summary of many of the issues
asked of the respondents. This discussion follows the structure of
the questionnaire to make it easier to follow with the forms. As
noted there were two basic forms, the household and trip forms.

5.2 Household Form

The first group of questions on the form asked the respondent to
identify how many people live in the household and how many are 14
years old or older. The choice to collect trip information from those
14 and older was a policy decision made by CATS planning staff. With
a minor adjustment, this data can be comparable with the Census
Bureau's data which uses 16 years and older for reporting travel. For
historical reference, the 1970 CATS home interview survey collected
travel data from each household member 16 years of age or older.

The next item solicited was the number of vehicles owned or kept at
home for use by household members. Finally, a telephone number and a
household member's first name was requested so that follow-up
telephone calls would be possible. Although this information was
solicited on the household form, it does not appear on any of the
files related to the survey. It has been edited out to assure the
confidentiality of the respondents.

There are several issues to understand regarding the question on
vehicle inventory. The 1970 CATS survey sought to collect the number
of vehicles kept at the housing unit and used by household members by
asking specifically, "What is the number of vehicles owned or garaged
at this location?" If clarification was needed, the interviewer added
the concept of "cars kept and used". The face-to-face interview
technique used in 1970 made clarification possible. In 1980, the
Census Bureau asked for a vehicle inventory through the use of two
separate questions.

The 1990 census asked the question "How many automobiles, vans and
trucks of one-ton capacity or less are kept at home for use by members
of your household?" For the household travel survey, CATS broadened
the concept of vehicle inventory to include motorcycles, bicycles and
any other vehicle types kept at home for use. By broadening the
response criteria, the HHTS collected the exact information that the

census collected plus additional information on modes of travel that tended to be associated with non-work related travel.

The next several items on the questionnaire made up the "individual profile" and include age, relationship to the oldest person in the household, sex, school enrollment, employment status, and occupation information. These items are consistent not only with the census data, but also with the CATS 1970 data as well.

The section of the "individual profile" entitled employment status requires some clarification. When designing the questionnaire there was a great deal of discussion regarding employment status. It was decided that for trip generation purposes there needed to be a means to identify individuals who are employed and those who are not employed. However, after asking for this information from CBD household members, it became clear that an individual could be both employed and retired at the same time. Also, it was acknowledged that knowing the individuals' complete employment status provides useful information for editing the trip forms and ensures the attainment of the most detailed information while providing a means to identify workers and non-workers.

So, to obtain more detailed information, while providing a means to identify workers and nonworkers, an editing step was added to the coding process. Presented below is an outline of the steps and logic used to perform this edit. With this edit, it became possible to identify those individuals who were employed full and/or part time) as well as those who were not. Being able to break down the information this way made it possible to summarize the number of work trips made by each employed individual.

A.   Employed Full-Time. It was totally acceptable for an individual to check this box and not have reported any work trips. However if a "work" or "work related" destination activity (trip purpose) was given, either the "employed full-time" or "employed part-time" box had to be checked. This box could be checked in combination with any of the other boxes.

B.   Employed Part-Time. Same logic as employed full-time.

C.   Homemaker. This is the first category that required close examination. If this box alone is checked, the editor was instructed to make sure that no "work" or "travel related to work" trips were made. If a work trip was reported, a determination was made (using the length of time at the work location) as to whether the individual was also a full or part-time worker. If this could not be determined, a telephone call was made to the respondent.

D.   Student. Same logic as homemaker.

E.   Unemployed. Under no circumstances could someone check this box in conjunction with either of the two boxes indicating employment. However, this box could be checked in combination with Homemaker, Student, Retired and/or Other. Additionally, if this box was checked, there could not be any trips with a destination activity of "work" or "travel related to work".

F.   Retired. Same logic as homemaker.

    G.   Other. Same logic as homemaker.

The last item to the "individual profile" was the respondent's current
occupation. A concern in designing the survey was whether to obtain
the respondent's current occupation, or the industry in which the
respondent worked. The question arose as to whether industry
information was needed for transportation planning purposes. In this
light, there were two issues that must be clarified. First,
occupation was not intended to be a travel forecasting variable but
instead was asked as a controlling variable capable of being linked
back to the census. Second, the forecasting process does not look at
the home-end (trip productions) for the variable "Industry". This
variable comes into play during the trip distribution phase and is
associated with the trip attraction side of the distribution equation.
In short, the worker's industry is not a home-based variable, but
instead is an employer based variable. Consequently, it was beyond
the focus of the household travel survey, and the survey only requests
occupation information.

The last item on the household form asked for household income before
taxes. One of the most difficult data items to collect, household
income typically receives the most incomplete responses.
Consequently, income information was asked for at the end of the form
as a means of minimizing the impact of asking for it. In other words,
its placement was meant to allow respondents to decide whether or not
to report income while still having completed the majority of
questions. As the questionnaire evolved it was decided that household
income would not be a factoring variable. Thus, in all but the CBD
and McHenry forms it was asked as an optional item. Although it was
optional, only 19 percent of the responding households did not answer
this question. This yielded a highly acceptable completion rate
overall.

Another goal when designing the survey as it related to the income
issue was to develop specific income brackets that would be compatible
with the 1990 census. However, because the Bureau of the Census did
not develop its brackets until after the census was completed,
compatibility on this item could not be ensured. Thus, the brackets
used do not exactly mirror the census and further aggregation of
Census data is necessary for comparability. Another income adjustment
to consider would be to correct for the spread of years in which the
survey was administered. Although travel behavior changes little on a
yearly basis, some feel that this is not the case for income issues.

5.3 Trip Form

The trip form was designed with the goal of minimizing confusion on
the part of the respondent while collecting the needed information. A
copy of the trip form can be found in Appendix B. Check-off answers
were provided wherever possible.

To provide a link between trips, the last question asked the respondent "Did you go anywhere else after this trip?" If the "Yes" box was checked, an arrow was provided to steer the respondent to the next trip . This way the trips were linked in such a way as to eliminate the need to duplicate the destination of one trip as the origin of the next trip. Consequently, just the destination of the next trip was requested, eliminating the confusing "from and to" issue for the respondent. To begin the trip chain, the respondent was asked "Where did you start your first trip?": "Home" or "Elsewhere... Specify". Since the forms were serialized, staff already knew the home location.

Each trip form contained enough space to report on 7 trips. As noted, a separate form was to be completed for each household member 14 years of age or older. Respondents were asked to indicate the "person number" of the household member for whom the trip form applied. Four household members were identified (pre-coded). Additional unnumbered trip forms were included to allow for either additional trips by persons 1, 2, 3 or 4 or trips by additional household members.

A standard CATS convention was used for coding the trip origins and destinations. Trips within the six-county region were coded down to the quarter-section level of detail. For trips outside the region, a code was used which represents a state/city coding scheme (FIPS state and census place codes were used). This code begins with two '9's followed by a 2-digit FIPS state code and the 4-digit census place code. The city and state codes can be found in many Census Bureau products most notably 1980 Census of Population and Housing Geographic Identification Codes, PHC 80-R5 U.S. Department of Commerce, April 1983. Once city codes were assigned, latitude and longitude were derived from several files which CATS maintains. Trip distances and speeds were then calculated from the coordinates.

Looking closely at the form, one can see that what is commonly referred to as the trip purpose is listed on the trip form under the heading of "Destination Activity." The question reads "Why did you go to this destination?" When designing the trip form, an attempt was made to improve on past efforts while assuring some compatibility with them. Specifically, the trip purpose category (now destination activity) identified in CATS' 1970 survey as "personal business" was eliminated. Experience has shown that personal business trip purposes tend to be confused by those who are self-employed. Further, because of the "catchall" nature of the variable, trips that should more precisely be reported as shopping or recreation tend to be reported as personal business. As a result, a category entitled "Other" was added in place of personal business. Several tests and past survey work have demonstrated that this is an acceptable way of dealing with overreported personal business travel. The new categories can be collapsed reasonably into the 1970 Home Interview "personal business" category to facilitate direct comparisons.

Another destination activity to note is "change type of transportation". This activity was included to make the respondents report each segment of a multi-modal trip separately. When using this data for transportation modeling and forecasting, the analyst must combine trip segments to conform to the traditional trip circuits used by the models.

Other items on the trip form include the date for which travel was reported, the time and location of each trip, the number of blocks walked if transit modes were used and the number of persons in the auto, van or truck if the trip was made by any of those modes. Another point to note is that for all trips that were made on a school bus, a check was performed to assure that the destination activity was valid.

One other item that should be noted relates to the type of transportation used for a particular trip. For transportation planning purposes, pickups and vans can be considered synonymous with automobiles. This classification is consistent with the way the Census Bureau counts vehicles.

6.0 Sampling Error and Bias

A discussion of the sampling procedures and concepts would not be complete without an acknowledgment of error and bias and how it was handled. Even with the best methodology and design, sampling error and bias must be recognized, understood and dealt with. Throughout the conduct of the HHTS this was a major concern of CATS. Presented below is a discussion of the various types of error and bias and the steps taken to combat them.

Sample Error is the error that occurs because the survey is dealing with a sample and not the total population. No matter how well a sample is designed, error can always occur. As a result, the largest feasible sample size was drawn. (Refer to the sample size discussion elsewhere in this report.) Although sample error can be assumed to be minimal the data user should always be aware that it may exist. To check for obvious errors when choosing the sample, maps were produced and examined identifying the locations of the households that were selected.

Sampling Bias, on the other hand, arises because of mistakes in choosing the sampling frame or the survey method. Data falsification, and nonresponse effects can also cause sampling bias. Early in the design of the HHTS it was assumed that the sampling frame and survey method would be adequate. The use of Commonwealth Edison residential electric meter addresses had been used in the past with good results. As for the survey method, a review of the literature and consultation with several national experts in the survey field who had experience with this technique helped support staffs' confidence. In terms of data falsification a structured manual edit was performed. With this done the focus of the bias investigation shifted to nonresponse effects.

Several steps were taken to assure that nonresponse bias did not jeopardize the validity of the survey. Foremost on this list was the use of reminder letters. Since the questionnaires were serialized it was possible to send out targeted reminder letters to non responding households. Although some argue that this has little affect on response rates the use of this technique for the HHTS proved successful. To support this contention review Exhibit 6 which shows how many households reported travel by travel day.

Another technique was to look at the response rates at a small geographic level to determine if any spatial bias existed. By comparing the residents' home locations with those in the total population, it was possible to determine if the nonresponse was spatially based. The results of this analysis did yield some nonresponse bias which was easily accounted for and documented in Factoring Household Travel Surveys, National Academy Press, Transportation Research Board, January 1993.

Another means for dealing with nonresponse was to check to see if any tail-end factoring was needed. According to the theory nonresponders more closely represent the late responders or those who responded as a result of prodding. In the case of the HHTS the prodding was accomplished with the reminder letters. As a means to determine if any tail-end factoring was needed staff from the University of Illinois examined the trip circuits produced by the respondents by the date in which they reported their travel. The results of this research showed that there was no significant difference between the on time and late respondents. Thus, it was decided that tail-end factoring was not needed. The results of this effort can found in Nonresponse Bias and Trip Generation Models, National Academy Press, Transportation Research Board, 1993.

The type of nonresponse examined above dealt with total nonresponse. That is the whole household did not respond. However, another type of nonresponse that concerned CATS was item nonresponse. This is much harder to detect and it can grossly affect the results. Item nonresponse is where someone in the household forgot a trip or did not respond to all the questions. CATS took two approaches to deal with this issue.

First, a great deal of effort went into the preparation of the survey instrument and its related instructions and forms. One form was included that listed over 60 potential trip purposes ranging from "airport" trips to "visit friend". This sheet was set up as a check list and can be found in Appendix A.

The second safeguard to item nonresponse, specifically missed trips, fell between the quality of the editing and the layout of the form. It was the contention of the editing crew that an experienced editor could spot a trip form with missing trips. The layout of the form also contributed to reducing item nonresponse especially when one considers that the respondent had to put both a start and end time on the form. This allowed for successive chain building since all the hours of the day had to be covered.

In terms of item nonresponse where whole individuals did not report, two issues played off each other. On the household form the respondent was asked to put down the total number of people in the household so the editor could check the trip makers against the residents. The other side of this was in the way the data was factored using the 1990 Census. One of the variables used in the factoring scheme was the number of people in the household as reported by the Census Bureau. In terms of factoring the HHTS this will be discussed in subsequent documents produced by the University of Illinois who conducted this task.

7.0 The University Role

When the HHTS was being designed it was a well recognized fact that when complete, the survey data base would have to be factored up to the population. It was further understood that it may have to be adjusted to account for any bias that crept into the study. Recognizing that this work would need to be done, CATS approached the Urban Transportation Center (UTC) of the University of Illinois to solicit their interest in the study. It was the general opinion that the final product would have a higher degree of credibility attached to if it were factored and adjusted by "the experts" The UTC assigned a senior ranking transportation statistician professor and a noted geographer to the project.

The UIC researchers laid out six tasks related to factoring and adjusting the travel data. They included a literature review, identification of end uses for the data, developing a data base and information system, conducting the bias reduction, factoring the data, and preparing the final data sets. Below is a brief discussion of their work.

A literature search relating to bias reduction, factoring and travel surveys was undertaken early in the project. In addition to the literature search, a survey of twenty-three large metropolitan planning agencies (MPOs) throughout the country was conducted to determine what methods they used in factoring their travel surveys. The results indicated that eleven had used some method of factoring and six of those used specific demographic variables from the Census to scale the survey data up to the population.

As part of the second task, UIC inventoried the end uses and users of the data. A final report has been completed and is cited in the References section of this report. Also, as part of this task, a theoretical analysis of sample size calculations was performed. The next task centered on the form and medium of the final data sets with an eye to how the data could be stored and retrieved. It was decided early on that the data base would be PC based and available 'free of charge' to the member agencies of the MPO.

Although several methods were under consideration it soon became obvious that three major files consisting of a household file, a person file and a trip file would emerge. With this design, it will be possible to analyze and use each file separately or in combination. It should be pointed out that this format follows very closely the structure of the National Personal Transportation Survey (NPTS) produced by the Federal Highway Administration.

8.0 Conclusion

The preceding discussion was intended to assist the users of the HHTS with their understanding of how the survey was put together. It is CATS desire that the data files developed as part of the HHTS receive

widespread use in both planning and analytical studies. CATS invites
comments on every aspect of this data set including format, data file
structure, processing environments and the general utility of the data
itself. Further, CATS is interested in knowing how the data is being
used and what analytical results have been found. The Information
Services Division will collect analyses done by CATS staff and other
recipients as part of its data clearing house function. Please send
summaries of analyses of this data to the Director of the Information
Services Division of CATS to support data exchange in this region.

EXHIBIT 1

Timeline for the CATS 1990 Household
Travel Survey and Areas Surveyed

* Chicago's CBD--Fall 1988

* McHenry County--Spring 1989

* Lake County--Fall 1989

* DuPage County--Spring 1990

* Kane, Will and Kendall Counties--Fall 1990

* Suburban Cook County--Spring 1991

* Chicago--Fall 1991

EXHIBIT 2

CATS 1990 Household Travel Survey Features and Design

* Self Administered Mail-Out Mail-Back

* Targets Individuals at Their Homes

* Sampled from Electric Meter Addresses

* Collected Travel and Demographic Data

* Travel Data Obtained for Those 14 and Older

* Questionnaire Used Trip Diary Concept

* Sought Travel for a Reference Day (Thursday)

* Emphasized Walking To / From Transit Trips

* Focused on Non-Work Travel

* Solicited Respondent's Phone Number for Follow-up
   Interviews

* Utilized Reminder Letters for Late Respondents

* Successfully Undertaken in Other Areas Here and Abroad

* Conducted In-house with CATS Staff

EXHIBIT 3

Sample Sizes and Expected Errors

Sample Size	Standard Error of the Mean	Error at 95% Confidence Level
225	.0500	.098
400	.0375	.074
600	.0306	.060
800	.0265	.052
1000	.0237	.046
1600	.01875	.037
3200	.01326	.026

Source: Chicago Area Transportation Study, Sam Hadfield, 1988

EXHIBIT 4

Number of Households Sampled Verses the
Sampling Targets by Area

Area (Zones)	Sample	Target	Usable
CBD (1)	1,869	400	404
McHenry (3)	6,948	1,200	2,004
Lake (5)	9,143	2,000	2,480
DuPage (9)	17,586	3,600	5,098
Kane (3)	5,886	1,200	1,741
Will (2)	4,079	800	896
Kendall (1)	2,038	400	694
Sub. Cook (7)	14,037	2,800	3,675
Chicago* (6)	17,760	2,400	2,321
Total (37)	79,346	14,800	19,314

* Excludes CBD

EXHIBIT 5

EXHIBIT 6

Percent of People Reporting Travel By Travel Days and Area Surveyed

Area	Alternate 1	Assigned Day	Alternate 2	Alternate 3	Number
CBD	12.5	60.8	10.7	16.0	513

McHenry	8.3	64.8	19.1	7.8	3,938
Lake	2.7	73.6	18.4	5.3	4,727
DuPage	5.4	74.4	13.0	7.3	9,862
Kane	1.4	78.4	12.6	7.7	3,470
Will	3.1	76.8	12.9	7.2	1,704
Kendall	3.1	77.2	11.7	8.0	1,382
Sub. Cook	1.0	78.9	15.3	4.9	6,731
Chicago	6.4	66.6	16.6	10.3	3,862

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APPENDIX A

Sample of Survey Materials Mailed to Selected Households

APPENDIX B

Sample Size Calculation for DuPage County