ST. LOUIS REGION

SMALL SAMPLE TRAVEL SURVEY

Prepared for

East-West Gateway Coordinating Council
St. Louis (Missouri-Illinois) Metropoitan Area
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This report summarizes results of the St. Louis Region Small Sample Travel Survey. A total of 1,446 households participated in the survey, which was designed to collect travel characteristics data from residents of the St. Louis metropolitan region. The survey updates the 1965-66 Origin-Destination home-interview data.

The primary use of the data will be to calibrate the East-West Gateway Coordinating Council's travel demand model, with applications in trip generation and trip distribution. This travel survey data will ultimately aid the Council in their preparation of transportation planning studies.

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1. Introduction

This report documents the design and conduct of a telephone home interview travel survey of 1,446 households performed in the Fall of 1990 for the St. Louis Region. The area surveyed (see Figure 1) included the City of St. Louis, St. Louis County, and parts of Jefferson County, Madison County, St. Clair County, Monroe County, and St. Charles County. The survey was performed for the East-West Gateway Coordinating Council (EWG) by Barton-Aschman Associates, Inc. (BA) with assistance from NSI Research Group (NSI). This report contains a narrative summary of the survey and a preliminary summary of the survey results. Specific details of the survey can be found in technical memoranda referenced in the report and included as an Appendix to this report.

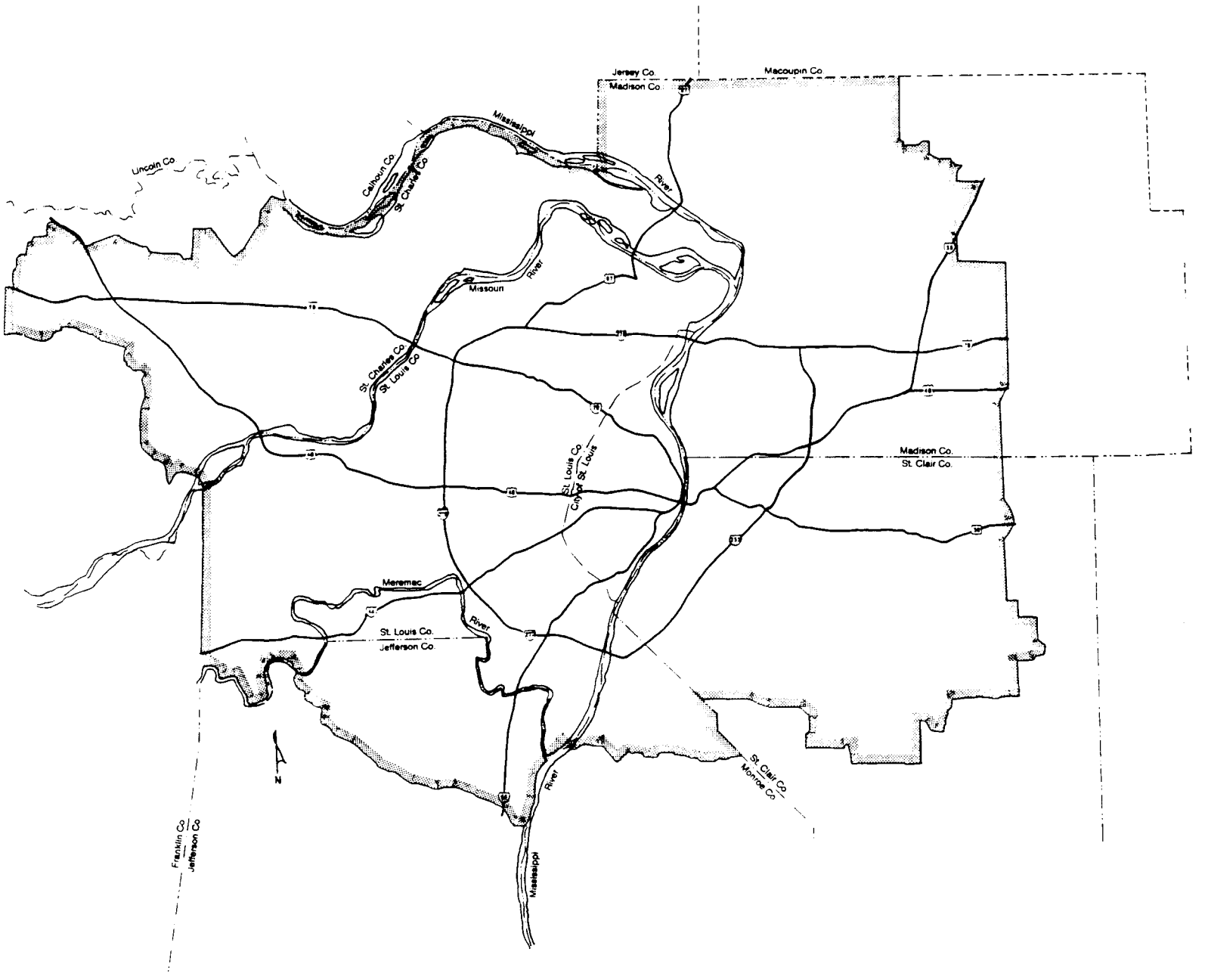

Figure-1

TRAVEL SURVEY AREA
St. Louis Region
Small Sample Travel Survey

2.
Survey Design

Sample Design

A minimum sample size of 1,400 households was recommended for the survey. This number was chosen based on three main criteria:

- The models to be calibrated using the survey.
- The statistical significance of the survey results.
- The available budget for the survey.

The survey will be used primarily for the calibration of trip production models. Other uses will include the calibration of trip attraction models and trip distribution models. The information from this survey could also be used in conjunction with data from an on-board bus survey to calibrate mode choice models. Experience with previous model calibrations has shown that samples of about 1,300 to 1,600 households provides sufficient data to calibrate reasonable trip production, trip attraction, and trip distribution models.

The statistical significance of data generated by the survey data was also a concern in the design of the survey size. Statistical significance is a qualification of the degree of certainty that the experimental or survey results did not occur by chance. A result is said to be significant when the likelihood of its being random falls below a certain agreed-upon level of probability, called the "accuracy level." This probability of errors decreases as the size of the sample is increased, but can never be completely eliminated unless the entire universe is enumerated.

If, for instance, the statistic of interest is the mean, one may express precision in terms of the probability that the sample mean could differ from the universe mean by a specific amount by chance alone. The probability is termed the confidence level and is usually expressed as a percent. Values of 90 percent or 95 percent are most

commonly used as levels of confidence. The error of the estimate of the mean may be expressed as an absolute or relative error. Assume, for example, that a sample mean of 80 trips per household was obtained from a survey. One can describe the desired accuracy as an error of no more than 0.8 trips per household in estimating the mean at the 90 percent confidence level. This states that if 10 samples of the same size were randomly selected, nine out of 10 of these samples would have means that were bounded by 7.2 and 8.8. Note that the analyst can not be certain since the sample mean would fall outside the confidence interval one time out of the 10 times.

The ability to specify accuracy levels and confidence levels for the survey allows the results to conform to desired overall accuracy and enhances usefulness of the survey data. Expected accuracy levels and confidence levels for the survey were estimated based on results obtained from the 1965-66 regional travel survey for the St. Louis Region. Table 1 shows the expected accuracy levels at the 95 percent confidence level that were estimated from the 1965-66 travel survey prior to the 1990 Regional Travel Survey along with the accuracy levels actually obtained.

Table 1
Expected and Observed Overall Household Trip Rate Accuracy Levels (95 Percent Confidence Level)

Trip Purpose	Expected [1]	Observed [2]
Home-Based Work	±3.9%	±4.8%
Home-Based Non-Work	±6.1%	±5.0%
Non-Home-Based	±11.8%	±6.6%
Total Trips	±4.6%	±3.9%

[1] Expected accuracy levels are based on 1965-1966 travel survey results and the assumption of the survey size of 1,400 households.

[2] Observed accuracy levels are based on the preliminary results of the 1990 travel survey for 1,446 households.

The funds available for the survey dictated an upper limit on the size of the survey. Budget constraints limited the sample size to 1,400 households. This sample size was exceeded slightly due to surveying techniques, better response rates than expected, and the need to complete areawide "replicates" once a single household from replicate was surveyed. Areawide replicates and sample selection are explained more fully in Chapter 3, Sample Selection.

The total number of completed, useable households sampled for the survey area totaled 1,446. Based on 1990 estimates prepared by EWG staff, the area sampled

encompassed 862,500 households. Thus, the sample rate was about 0.17 percent or, in other words, each sampled household represented about 600 households.

Additional details regarding the sample design can be found in the technical memorandum entitled, "Task B.1--Determination of Sample Sizes", dated May 21, 1990.

Sample Stratification

For the St. Louis region, one of the main uses of the survey will be the recalibration of the trip production models. Since the trip production models are stratified by income group and household size, the allocation of sample households to those strata was a prime concern. Three basic methods were considered for the allocation of samples to the socioeconomic strata:

- Allocation to ensure equal accuracy in each stratum.
- Optimum allocation.
- Allocation proportional to the distribution of households in the region.

The first method specified a level of accuracy and confidence level for each stratum; for example, 10 percent at the 90 percent confidence level. Two difficulties emerged from such an approach. First of all, the accuracy requirement for a stratum was not related to the size of the stratum in the universe. Information for households in a stratum which contributed only two percent of the trips in the region would have had the same precision as a stratum that contributed fifteen percent of the trips. Second, if the precision level was set such that, for example, only one-half of the expected number of households in a stratum would be required to satisfy the precision requirement, then the required number of samples for the stratum would have been obtained about one-half way through the survey. Additional households in that stratum would had to have been discarded for the remainder of the survey. Even worse, if the quota for a particular stratum was twice the expected share of the stratum, the number of contacts required in the pre-qualification interviews would be doubled. This would have caused an increase in the cost of the survey.

An alternative to the first method was optimal allocation. This method would have set the sample size per stratum proportional to the product of the standard deviation of the variable to be measured in the stratum and the number of households in the universe in the stratum. In this way, strata that had a large number of households would have been represented in proportion to their occurrence in the universe of all households in the region. That is, a stratum that represented 90 percent of the households in the universe would receive 90 percent of the samples, provided all strata had equal standard deviations. At the same time, if the standard deviation of a variable for one stratum was larger than the standard deviation for another stratum, the stratum with the higher standard deviation would have been given proportionately more samples.

There were three difficulties with the second approach. First, the optimal allocation could vary based on the variable being considered. The optimal allocation based on home-based work trip rates could have been different than the optimal allocation based on home-based non-work trip rates. Second, as with the first allocation method, the optimal allocation would have cost more since households would have been rejected once the optimal number of samples was obtained for a cell. Finally in order to minimize the overall sample size, certain strata might have small numbers of samples allocated. The number of samples allocated to some strata might be sufficiently small to compromise the use of trip rates from those strata.

The third allocation process was the selected process. Samples were allocated to a stratum in proportion to the number of households in the stratum in the universe. This process was straightforward to apply and cost effective. Although the precision levels varied for each stratum using the third method, they tended to reflect the stratum's importance to trip making in the region.

The third sample allocation procedure could have been applied as a quota sample--when the expected number of household for stratum was obtained, additional sample household for the stratum would have been discarded. This procedure would have reduced the cost effectiveness of the third sample allocation technique and was not used. Rather, households were allocated to cells based simply on their frequency in the random sample (and their participation in the survey). It was expected that some biases in the sample would occur using this procedure, but that the biases could be easily corrected using weighting techniques. Sampling biases did, in fact, occur (e.g., undersampling of low income households). However, the biases were not extreme enough to compromise the validity of the data. Techniques for correcting for the biases are discussed in Chapter 8, The Next Steps.

The expected distribution of households by household size and income group that was projected prior to the survey is shown in Table 2. It was estimated from draft projections of households in the region by size and income group for 1990 (prepared by the EWG personnel). Table 3 shows the actual distribution of households obtained from the survey. The distribution percents shown in Table 3 are based only on those households reporting their incomes and can be compared directly to the distribution percents shown in Table 2.

Three income groups were used in Tables 2 and 3: low income, medium income, and high income. The groups were based on the current groupings used in the St. Louis region for travel modeling purposes. These groupings corresponded roughly to income tertiles. In 1990 dollars, the annual household income tertile breakpoints based on EWG estimates were:

Low Income:	less than $20,000
Medium Income:	$20,000 to $40,000
High Income:	more than $40,000.

Table 2
Expected Distribution of Surveyed Households[1]

Income Group	Household Size 1	2	3	4	5+	Total
Low	234	113	50	32	30	459
(Percent)	(16.7%)	(8.1%)	(3.6%)	(2.3%)	(2.1%)	(32.8%)
Medium	105	154	70	53	41	423
(Percent)	(7.5%)	(11.0%)	(5.0%)	(3.8%)	(2.9%)	(30.2%)
High	31	161	117	119	90	518
(Percent)	(2.2%)	(11.5%)	(8.4%)	(8.5%)	(6.4%)	(37.0%)
Total	370	428	237	204	161	1,400
(Percent)	(26.4%)	(30.6%)	(16.8%)	(14.6%)	(11.5%)	(100%)

[1] The distribution shown in this table was developed by Barton-Aschman Associates, Inc. based on draft projections of households by income group and household size for 1990 prepared by EWG.

Table 3
Distribution of Surveyed Households

Income Group	Household Size 1	2	3	4	5+	Total
Low	126	97	52	18	25	318
(Percent)	(9.5%)	(7.3%)	(3.9%)	(1.4%)	(1.9%)	(24.1%)
Medium	101	163	75	63	54	456
(Percent)	(7.7%)	(12.3%)	(5.7%)	(4.8%)	(4.1%)	(33.9%)
High	35	203	116	124	68	546
(Percent)	(2.7%)	(15.4%)	(8.8%)	(9.4%)	(5.2%)	(39.5%)
Total	262	463	243	205	147	1,320
(Percent)	(19.8%)	(35.1%)	(18.4%)	(15.5%)	(11.1%)	(100%)
Income Unreported	24	50	25	22	5	126

As can be seen by comparing Tables 2 and 3, there are some substantial differences in the number of expected and surveyed households for some of the cells. Specifically, there was a substantial undersampling of the low income, one person households. This undersampling was offset by oversampling of other groups such as medium and high income, two person households, and medium income five or more person households. These differences can probably be attributed to two sources: sampling errors and errors in the estimated distribution. Also note that only 126 households, about 8.7 percent of the total households sampled, refused to report their incomes. Often, 15 percent or more of the households in a sample refuse to report their income. Thus, the low refusal rate was quite good. The difference in expected samples and samples actually obtained by income group and household size, and the number of households refusing to report their incomes are not expected to adversely affect the value and results of the survey. The survey results should be weighted to match the 1990 distribution of households by income group and household size when the 1990 Census data become available (see Chapter 8, The Next Steps, for more information). This distribution might vary from the expected distribution shown in Table 2. In addition, all household size-income group cells (with the possible exception of low income four person households) have sufficient numbers of sampled households to calculate reasonable cell statistics (e.g., average trip rates, variation of trip rates, etc.).

Additional details regarding the sample stratification can be found in the technical memorandum entitled, "Task B.1--Determination of Sample Sizes", dated May 21, 1990.

Survey Methodology

A mail out-telephone collection survey methodology was used for the St. Louis Region Travel Survey. The methodology included the following steps and characteristics:

- A random sample of listed and unlisted telephone numbers was drawn as a proxy for the households in the region (see Chapter 3, Sample Selection).

- The telephone numbers were called and households were recruited for the survey. Several informational questions were asked and a travel day was assigned.

- A "travel packet" of travel diaries, a household and person questionnaire, and instructions were mailed to the households agreeing to participate in the survey.

- Households were called one or two days after their travel day and the household, person, and travel data was collected over the telephone.

- The data were edited, coded, and keyed to computer data base files.

The mail out-telephone collection survey methodology was selected for several reasons. First, the methodology was cost effective. The cost for each completed household survey was about $100. Second, it was possible to collect high quality data using the methodology. Interviewers had personal contact with each surveyed household and could clarify unclear responses. Finally, the methodology was effective for reducing underreporting of trips since interviewers could probe for easily forgotten trips.

Two other home-interview survey methodologies used in the past were not considered for the St. Louis survey. The first widely used methodology was the in-home interview where surveyors would actually gather trip information based on a personal interview completed in the respondent's home. This methodology resulted in very high quality data. However, the method was very costly. In addition, based on recent experience in the Dallas-Fort Worth area, the in-home interview methodology has resulted in lowered participation rates due to the reluctance of interviewees to allow interviewers into their homes.

The second travel survey methodology that has been used is the self administered, "mail out/mail back" survey. This methodology can be similar to the mail out-telephone collection survey with the exception that no travel information is collected over the telephone. Travel diaries and household questionnaires are completed by respondents and mailed back to the surveyors. This survey methodology is very cost effective. However, the surveys instruments require very careful design to ensure that they are clear, concise, and unbiased. The methodology suffers from the lack of personal contact between the interviewer and the surveyed household members and the non-response rate is very high even with telephone reminders. This makes it subject to the problem of underreporting of trips.

Questionnaire Design

The survey instrument consisted of two parts: a household data questionnaire that obtained data on characteristics of the household and the members of the household, and a travel diary that collected travel data for each trip made by a household member (aged five and older) on the travel day. Figure 2 shows the household data form and Figure 3 shows the travel diary. Note that both of the forms are designed to be as user friendly as possible through the use of "check-off" boxes for many of the questions. The household data form was printed on white 8-1/2 inch by 11 inch paper. The travel diary was printed on blue 8-1/2 inch by 11 inch card stock.

The survey data were collected by interviewers on similar, but slightly different questionnaires (see Figures 4 and 5). The check-off boxes were replaced by numbers that made the collection forms largely self-coding. In addition, in the person data section of the household questionnaire, two questions regarding whether or not the person was interviewed and whether or not the person used the travel diary were

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HOUSEHOLD DATA

Travel Day_____

Please answer the following questions about your household:

1. Is the address label at the right correct?

2. How many people live in this household? _____

3. How many people are 5 years old or older? _____

4. How many visitors from outside the area are staying with you on your travel day? _____

5. How many cars, pickups and vans are generally available for use by this household? _____

6. What was the combined income from all sources for all members of your household in 1989 (please circle the appropriate letter)?

A. Under $10,000
B. $10,000 - $14,999
C. $15,000 - $19,999
D. $20,000 - $24,999
E. $25,000 - $29,999
F. $30,000 - $34,999
G. $35,000 - $39,999
H. $40,000 - $49,999
I. $50,000 - $59,999
J. $60,000 or more

Please fill out the following table. **Complete one line for each member of your household.** Each line of the table begins with a person number. Please be sure that the person number on this form corresponds to the person number on each persons travel diary.

PERSON NUMBER	RELATION TO HEAD OF HOUSEHOLD					AGE	SEX	LICENSED TO DRIVE?	EMPLOYMENT STATUS (check as many boxes as apply)						
	Head of Household	Spouse/ Partner	Child	Other Member of Household	Out-of- Area Visitor				Employed Full Time	Employed Part Time	Employed 2 or More Jobs	Homemaker	Retired	Student	Other
01	☒						☐ M ☐ F	☐ YES ☐ NO	☐	☐	☐	☐	☐	☐	☐
02		☐	☐	☐	☐		☐ M ☐ F	☐ YES ☐ NO	☐	☐	☐	☐	☐	☐	☐
03		☐	☐	☐	☐		☐ M ☐ F	☐ YES ☐ NO	☐	☐	☐	☐	☐	☐	☐
04		☐	☐	☐	☐		☐ M ☐ F	☐ YES ☐ NO	☐	☐	☐	☐	☐	☐	☐
05		☐	☐	☐	☐		☐ M ☐ F	☐ YES ☐ NO	☐	☐	☐	☐	☐	☐	☐
06		☐	☐	☐	☐		☐ M ☐ F	☐ YES ☐ NO	☐	☐	☐	☐	☐	☐	☐
07		☐	☐	☐	☐		☐ M ☐ F	☐ YES ☐ NO	☐	☐	☐	☐	☐	☐	☐
08		☐	☐	☐	☐		☐ M ☐ F	☐ YES ☐ NO	☐	☐	☐	☐	☐	☐	☐
09		☐	☐	☐	☐		☐ M ☐ F	☐ YES ☐ NO	☐	☐	☐	☐	☐	☐	☐
10		☐	☐	☐	☐		☐ M ☐ F	☐ YES ☐ NO	☐	☐	☐	☐	☐	☐	☐

Figure-2

HOUSEHOLD DATA QUESTIONNAIRE (Mail Out Version)

East-West Gateway
Coordinating Council

TRAVEL DIARY

TRIPS FOR PERSON NUMBER:_____
(use person number from household data form)

NAME:_____

TRAVEL DAY:_____

My first trip today began at:

☐ Home

☐ Other location as shown below (if not home)

Name of Place

Address or Intersecting Streets

City State Zip Code

INSTRUCTIONS:

- Record trips in the order you make them.
- Include the specific information requested for each trip.
- Record your trip even if it is made with another household member.
- **Do not** record walking or bicycle trips except if you walked or rode your bicycle all the way to work.
- At the end of your travel day, leave all completed diaries in a convenient place at home so they will be available when the interviewer calls.
- Use the back of this card and an extra card, if necessary.
- If you have any questions about completing this travel diary, please call our toll-free number: **1-800-447-8287**

	WHERE did this trip end?	**KIND OF PLACE** (Restaurant, doctor's office, grocery store)	**PURPOSE** of trip (Check one)	**TIME** of trip (Circle AM or PM)	**MODE** of travel (Check one)	**IF DRIVER,** number in vehicle (include self)
(1) First I Went To:	Name of Place Address or Intersecting Streets City State Zip Code		☐ Return Home ☐ Job Related ☐ Go to Work ☐ Change Mode (e.g. Auto to bus) ☐ Shopping ☐ Pick up/drop off Passenger ☐ School ☐ Personal ☐ Social/ Recreational ☐ Eat Meal	BEGIN : AM PM END : AM PM	☐ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:_____	
(2) Then I Went To:	Name of Place Address or Intersecting Streets City State Zip Code		☐ Return Home ☐ Job Related ☐ Go to Work ☐ Change Mode (e.g. Auto to bus) ☐ Shopping ☐ Pick up/drop off Passenger ☐ School ☐ Personal ☐ Social/ Recreational ☐ Eat Meal	BEGIN : AM PM END : AM PM	☐ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:_____	
(3) Then I Went To:	Name of Place Address or Intersecting Streets City State Zip Code		☐ Return Home ☐ Job Related ☐ Go to Work ☐ Change Mode (e.g. Auto to bus) ☐ Shopping ☐ Pick up/drop off Passenger ☐ School ☐ Personal ☐ Social/ Recreational ☐ Eat Meal	BEGIN : AM PM END : AM PM	☐ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:_____	

(Front)

OVER

Figure-3

TRAVEL DIARY (Mail Out Version)

	WHERE did this trip end?	KIND OF PLACE (Restaurant, doctor's office, grocery store)	PURPOSE of trip (Check one)	TIME of trip (Circle AM or PM)	MODE of travel (Check one)	IF DRIVER, number in vehicle (include self)
(4) Then I Went To:	Name of Place Address or Intersecting Streets City State Zip Code		☐ Return Home ☐ Job Related ☐ Go to Work ☐ Change Mode (e.g. Auto to bus) ☐ Shopping ☐ Pick up/drop off Passenger ☐ School ☐ Personal ☐ Social/ Recreational ☐ Eat Meal	BEGIN AM PM : END AM PM :	☐ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:	
(5) Then I Went To:	Name of Place Address or Intersecting Streets City State Zip Code		☐ Return Home ☐ Job Related ☐ Go to Work ☐ Change Mode (e.g. Auto to bus) ☐ Shopping ☐ Pick up/drop off Passenger ☐ School ☐ Personal ☐ Social/ Recreational ☐ Eat Meal	BEGIN AM PM : END AM PM :	☐ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:	
(6) Then I Went To:	Name of Place Address or Intersecting Streets City State Zip Code		☐ Return Home ☐ Job Related ☐ Go to Work ☐ Change Mode (e.g. Auto to bus) ☐ Shopping ☐ Pick up/drop off Passenger ☐ School ☐ Personal ☐ Social/ Recreational ☐ Eat Meal	BEGIN AM PM : END AM PM :	☐ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:	
(7) Then I Went To:	Name of Place Address or Intersecting Streets City State Zip Code		☐ Return Home ☐ Job Related ☐ Go to Work ☐ Change Mode (e.g. Auto to bus) ☐ Shopping ☐ Pick up/drop off Passenger ☐ School ☐ Personal ☐ Social/ Recreational ☐ Eat Meal	BEGIN AM PM : END AM PM :	☐ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:	
(8) Then I Went To:	Name of Place Address or Intersecting Streets City State Zip Code		☐ Return Home ☐ Job Related ☐ Go to Work ☐ Change Mode (e.g. Auto to bus) ☐ Shopping ☐ Pick up/drop off Passenger ☐ School ☐ Personal ☐ Social/ Recreational ☐ Eat Meal	BEGIN AM PM : END AM PM :	☐ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:	
(9) Then I Went To:	Name of Place Address or Intersecting Streets City State Zip Code		☐ Return Home ☐ Job Related ☐ Go to Work ☐ Change Mode (e.g. Auto to bus) ☐ Shopping ☐ Pick up/drop off Passenger ☐ School ☐ Personal ☐ Social/ Recreational ☐ Eat Meal	BEGIN AM PM : END AM PM :	☐ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:	

(Back)

Figure-3 (Continued)

HOUSEHOLD DATA

Sample No._____

Section I. Household Data

Please answer the following questions about your household:

1. Is the address label at the right correct? ☐ Yes ☐ No

2. How many people live in this household? _____

3. How many people are 5 years old or older? _____

4. How many visitors from outside the area are staying with you on your travel day? _____

5. How many cars, pickups and vans are generally available for use by this household? _____

6. What letter did you circle for the combined income from all sources for all members of your household in 1989?

_____

A. Under $10,000	F. $30,000 - $34,999
B. $10,000 - $14,999	G. $35,000 - $39,999
C. $15,000 - $19,999	H. $40,000 - $49,999
D. $20,000 - $24,999	I. $50,000 - $59,999
E. $25,000 - $29,999	J. $60,000 or more

Section II. Person Data

Please fill out the following table. **Complete one line for each member of your household.** Each line of the table begins with a person number. Please be sure that the person number on this form corresponds to the person number on each persons' travel diary.

PERSON NUMBER	RELATION TO HEAD OF HOUSEHOLD				AGE	SEX	LICENSED TO DRIVE?	EMPLOYMENT STATUS (circle as many as apply)							INTER-VIEWED ?	USED DIARY?
	Spouse/ Partner	Child	Other Member of Household	Out-of- Area Visitor				Employed Full Time	Employed Part Time	Employed 2 or More Jobs	Homemaker	Retired	Student	Other		
01	(1)	HEAD OF HOUSEHOLD				1 M 2 F	1 YES 2 NO	1	2	3	4	5	6	7	1 YES 2 NO	1 YES 2 NO
02	2	3	4	5		1 M 2 F	1 YES 2 NO	1	2	3	4	5	6	7	1 YES 2 NO	1 YES 2 NO
03	2	3	4	5		1 M 2 F	1 YES 2 NO	1	2	3	4	5	6	7	1 YES 2 NO	1 YES 2 NO
04	2	3	4	5		1 M 2 F	1 YES 2 NO	1	2	3	4	5	6	7	1 YES 2 NO	1 YES 2 NO
05	2	3	4	5		1 M 2 F	1 YES 2 NO	1	2	3	4	5	6	7	1 YES 2 NO	1 YES 2 NO
06	2	3	4	5		1 M 2 F	1 YES 2 NO	1	2	3	4	5	6	7	1 YES 2 NO	1 YES 2 NO
07	2	3	4	5		1 M 2 F	1 YES 2 NO	1	2	3	4	5	6	7	1 YES 2 NO	1 YES 2 NO
08	2	3	4	5		1 M 2 F	1 YES 2 NO	1	2	3	4	5	6	7	1 YES 2 NO	1 YES 2 NO
09	2	3	4	5		1 M 2 F	1 YES 2 NO	1	2	3	4	5	6	7	1 YES 2 NO	1 YES 2 NO
10	2	3	4	5		1 M 2 F	1 YES 2 NO	1	2	3	4	5	6	7	1 YES 2 NO	1 YES 2 NO

Section III. Trip Summary

A. Total vehicular trips _____
B. Persons age 5 and older making trips _____
C. Persons 5 and older not making trips _____
D. Complete or incomplete interview code _____

Section IV. Administrative

A. Telephone contacts:

Date	Time	Outcome	Initials

B. Completed interview submitted:

Date:_____ By:_____
I certify that all the information on this form is correct and true

_____
Signature of Interviewer

C. If interview submitted incomplete, give reasons:

_____
_____
_____

D. First edit: FAIL PASS

Date:_____ Initials:_____

E. Final edit: FAIL PASS

Date:_____ Initials:_____

Figure-4

HOUSEHOLD DATA QUESTIONNAIRE
(Data Collection Version)

TRAVEL DIARY

Sample Number_____

Section V. Trip Data

TRIPS FOR PERSON NUMBER:_____
(use person number from household data form)
NAME:_____

TRAVEL DAY:_____

NOTES:

_____
_____
_____
_____
_____
_____
_____
_____

(0) My first trip today began at:
☐ Home
☐ Other location as shown below (if not home)

_____
Name of Place

_____
Address or Intersecting Streets

_____
City State Zip Code

Trip Purpose (if not home)
_____

WHERE did this trip end?	KIND OF PLACE (Restaurant, doctor's office, grocery store)	PURPOSE of trip (Circle one)	TIME of trip (Circle AM or PM)	MODE of travel (Circle one)	IF DRIVER, number in vehicle (include self)
(1) First I Went To: _____ Name of Place _____ Address _____ City State Zip Code		0 Return Home 7 Job Related 1 Go to Work 8 Change Mode (e.g. Auto to bus) 2 Shopping 9 Pick up/drop off Passenger 3 School 4 Personal 5 Social/ Recreational 6 Eat Meal	BEGIN : AM PM _____ END : AM PM	1 Driver (auto/van/pickup/motorcycle) 2 Passenger (auto/van/pickup/motorcycle) 3 Public Bus 4 Taxi 5 School Bus 6 Heavy Truck 7 Walk or Bike (to work) 8 Other:_____	
(2) Then I Went To: _____ Name of Place _____ Address _____ City State Zip Code		0 Return Home 7 Job Related 1 Go to Work 8 Change Mode (e.g. Auto to bus) 2 Shopping 9 Pick up/drop off Passenger 3 School 4 Personal 5 Social/ Recreational 6 Eat Meal	BEGIN : AM PM _____ END : AM PM	1 Driver (auto/van/pickup/motorcycle) 2 Passenger (auto/van/pickup/motorcycle) 3 Public Bus 4 Taxi 5 School Bus 6 Heavy Truck 7 Walk or Bike (to work) 8 Other:_____	
(3) Then I Went To: _____ Name of Place _____ Address _____ City State Zip Code		0 Return Home 7 Job Related 1 Go to Work 8 Change Mode (e.g. Auto to bus) 2 Shopping 9 Pick up/drop off Passenger 3 School 4 Personal 5 Social/ Recreational 6 Eat Meal	BEGIN : AM PM _____ END : AM PM	1 Driver (auto/van/pickup/motorcycle) 2 Passenger (auto/van/pickup/motorcycle) 3 Public Bus 4 Taxi 5 School Bus 6 Heavy Truck 7 Walk or Bike (to work) 8 Other:_____	

(Front) **OVER**

Figure-5

TRAVEL DIARY (Data Collection Version)

	WHERE did this trip end?	KIND OF PLACE (Restaurant, doctor's office, grocery store)	PURPOSE of trip (Circle one)	TIME of trip (Circle AM or PM)	MODE of travel (Circle one)	IF DRIVER, number in vehicle (include self)
(4) Then I Went To:	Name of Place Address City State Zip Code		0 Return Home 7 Job Related 1 Go to Work 8 Change Mode (e.g. Auto to bus) 2 Shopping 9 Pick up/drop off Passenger 3 School 4 Personal 5 Social/ Recreational 6 Eat Meal	BEGIN : AM PM END : AM PM	1 Driver (auto/van/pickup/motorcycle) 2 Passenger (auto/van/pickup/motorcycle) 3 Public Bus 4 Taxi 5 School Bus 6 Heavy Truck 7 Walk or Bike (to work) 8 Other:_____	
(5) Then I Went To:	Name of Place Address City State Zip Code		0 Return Home 7 Job Related 1 Go to Work 8 Change Mode (e.g. Auto to bus) 2 Shopping 9 Pick up/drop off Passenger 3 School 4 Personal 5 Social/ Recreational 6 Eat Meal	BEGIN : AM PM END : AM PM	1 Driver (auto/van/pickup/motorcycle) 2 Passenger (auto/van/pickup/motorcycle) 3 Public Bus 4 Taxi 5 School Bus 6 Heavy Truck 7 Walk or Bike (to work) 8 Other:_____	
(6) Then I Went To:	Name of Place Address City State Zip Code		0 Return Home 7 Job Related 1 Go to Work 8 Change Mode (e.g. Auto to bus) 2 Shopping 9 Pick up/drop off Passenger 3 School 4 Personal 5 Social/ Recreational 6 Eat Meal	BEGIN : AM PM END : AM PM	1 Driver (auto/van/pickup/motorcycle) 2 Passenger (auto/van/pickup/motorcycle) 3 Public Bus 4 Taxi 5 School Bus 6 Heavy Truck 7 Walk or Bike (to work) 8 Other:_____	
(7) Then I Went To:	Name of Place Address City State Zip Code		0 Return Home 7 Job Related 1 Go to Work 8 Change Mode (e.g. Auto to bus) 2 Shopping 9 Pick up/drop off Passenger 3 School 4 Personal 5 Social/ Recreational 6 Eat Meal	BEGIN : AM PM END : AM PM	1 Driver (auto/van/pickup/motorcycle) 2 Passenger (auto/van/pickup/motorcycle) 3 Public Bus 4 Taxi 5 School Bus 6 Heavy Truck 7 Walk or Bike (to work) 8 Other:_____	
(8) Then I Went To:	Name of Place Address City State Zip Code		0 Return Home 7 Job Related 1 Go to Work 8 Change Mode (e.g. Auto to bus) 2 Shopping 9 Pick up/drop off Passenger 3 School 4 Personal 5 Social/ Recreational 6 Eat Meal	BEGIN : AM PM END : AM PM	1 Driver (auto/van/pickup/motorcycle) 2 Passenger (auto/van/pickup/motorcycle) 3 Public Bus 4 Taxi 5 School Bus 6 Heavy Truck 7 Walk or Bike (to work) 8 Other:_____	
(9) Then I Went To:	Name of Place Address City State Zip Code		0 Return Home 7 Job Related 1 Go to Work 8 Change Mode (e.g. Auto to bus) 2 Shopping 9 Pick up/drop off Passenger 3 School 4 Personal 5 Social/ Recreational 6 Eat Meal	BEGIN : AM PM END : AM PM	1 Driver (auto/van/pickup/motorcycle) 2 Passenger (auto/van/pickup/motorcycle) 3 Public Bus 4 Taxi 5 School Bus 6 Heavy Truck 7 Walk or Bike (to work) 8 Other:_____	

(Back)

Figure-5 (Continued)

added. These questions were completed by the interviewer. The household data collection form also included a trip summary section that was completed by the interviewer at the end of a survey and an administrative section used to record the progress of the interview. The survey data collection forms were printed on white 11 inch by 17 inch card stock.

3.
Sample Selection

Development of Telephone List

A random sample of 10,000 residential telephone numbers was obtained for the St. Louis region. The telephone numbers were purchased from a commercial vendor, Survey Sampling, Incorporated (SSI), of Fairfield, Connecticut. This firm provides sample households which are drawn from the telephone listing of households in a region. Two kinds of lists of residential telephone numbers are available from the firm:

- Telephone numbers based on a file of listed residential telephone numbers in a geographically defined region (listed telephone numbers).

- Telephone numbers possible in working blocks of exchanges located within the geographically defined region (unlisted telephone numbers).

The split between listed and unlisted telephone numbers was based on assumptions regarding the breakdown of households with listed and unlisted telephone numbers along with assumptions regarding the likelihood of a listed or unlisted telephone number resulting in completed survey. The sample list was broken down as follows:

- 4,400 listed telephone numbers.

- 5,600 unlisted telephone numbers.

The area covered by the survey for the sample selection was defined by Census tract. All Census tracts in the City of St. Louis, St. Louis County, and St. Charles County were included. In the remaining four counties, Jefferson, Madison, Monroe, and St.

Clair, only the Census tracts fully or partially covered by the survey region were included. Thus, the survey area was slightly overstated. However, the likelihood of including a household in the survey from the area outside of the survey region was small, and the adverse effect of inadvertently including such a household in the survey was negligible.

Possible Biases from Using Only Households with Listed and Unlisted Telephones for Sample Frame

Households with listed and unlisted telephones were selected as the sample frame for the St. Louis Region Travel Survey. Thus, households that did not own a telephone were not included in the survey. The omission of households without telephones from the sample frame might have introduced bias into the travel survey. Table 4 summarizes information provided by SSI regarding the number of households in the region that had telephones at the time of the sample selection along with the percent of the telephones that were listed. As can be seen in Table 4, about 96 percent of the total households in the region had telephones. Approximately 31,000 households in the survey area did not have telephones. Based on the sampling rate for the survey, about 50 samples should have been collected from households without telephones in an unbiased sample.

Table 4
Households With and Without Telephones by County

County	Total Households	Percent With Telephone	Households With Phones		Households Without Telephones
			Number	Percent Listed	
Madison, IL	88,620	95.4%	84,541	70.6%	4,709
Monroe, IL	2,647	96.2%	2,546	76.7%	101
St. Clair, IL	93,978	93.8%	88,157	66.2%	5,821
Jefferson, MO	27,679	95.4%	26,407	75.7%	1,272
St. Charles, MO	72,057	97.0%	69,895	79.7%	2,162
St. Louis, MO	370,327	98.2%	363,710	75.6%	6,617
St. Louis City	167,765	93.4%	156,690	65.3%	11,075
Total	823,073	96.2%	791,946	72.3%	31,127

Source: Barton-Aschman Associates, Inc. based on 1990 telephone listing information compiled by Survey Sampling, Incorporated.

There are two main ways in which the omission of households without telephones from the survey frame can bias the survey. The first is if the households are disproportionately allocated to certain socioeconomic groups. The second type of bias is if the households without telephones have travel characteristics different from similar households with telephones.

For the first case, it is likely that households without telephones are more likely to be low income households and, quite likely, one or two person households. If no adjustment is made for the disproportionate allocation, regional averages (e.g., average trips per household for the region) will be biased. The effects of this possible bias can be mitigated through the weighting of the survey data before the calculation of regional averages, rates, and totals. This weighting process was anticipated for the survey even before the effect of omitting households without telephones from the survey frame was considered. Chapter 8, The Next Steps, provides additional information regarding the weighting of the survey data.

The second type of bias introduced by omitting households without telephones from the sample frame is more difficult to quantify. This second type of bias is the bias that would occur if households without telephones had significantly different travel patterns from similar households with telephones. For example, it might be hypothesized that households without telephones would make more trips than similar households with telephones since they could not use the telephone as a substitute for trip-making. It might also be argued that their trip making could be lower than trip making for households with telephone service even after standardizing for family size and income. This argument would be based on being at the low end of the low income group and the high end of unemployment rate. The only way to determine the effect of this bias would be to survey the households without telephones and compare them to households with telephones controlling for the effects of household size and income (or household size and auto availability). Based on preliminary results of this survey and results from other surveys, it is likely that it would not be possible to measure statistically significant differences in trip rates between the two groups (if the socioeconomic differences are taken into account). In any case, the impact would be small on the overall trip rates. Assuming a difference of as much as one quarter in the trip rate, the overall change in regional rates would be on the order of only ±1%. Thus, the only correction suggested to account for biases introduced into the survey by omitting households without telephones from the sample frame is to ensure that the survey is weighted to match the regional distribution of households by income group and household size whenever "regional" rates or totals are estimated from the survey data.

Use of Areawide Replicates to Avoid Geographic Biases

In order to insure representative results for the survey, a replicate system was used. The St. Louis sample was stratified into twenty-four replicates. To do this, the 1st, 25th, 49th, etc. telephone numbers were assigned to replicate one; the 2nd, 26th, 50th, etc. telephone numbers were assigned to replicate two; the 3rd, 27th, 51st, etc. telephone numbers were assigned to replicate three, and so on. This procedure was

used for the original random samples of 4,400 listed telephone numbers and 5,600 unlisted telephone numbers. The listed and unlisted samples were then combined to form the entire sample file with twenty-four replicates. Eight of the replicates had 416 telephone numbers and the remaining sixteen replicates had 417 telephone numbers.

Since each replicate was, in effect, a mini-random sample of the survey area, each replicate was representative of the survey area (as long as the replicate was completely used). Telephone assignments were distributed to survey "recruiters" one replicate at a time. Each replicate was completely exhausted before samples from a new replicate was used. In other words, all required call-backs for each telephone number in the replicate were made in the recruiting stage before telephone numbers from a new replicate were used. Note that replicate number twenty-four was used for the pretest. In order to complete the travel survey, it was necessary to use sixteen of the remaining twenty-three replicates.

Additional details regarding the sample selection can be found in the technical memorandum entitled, "Task B.3--Develop Telephone List", dated December 4, 1990.

4.
Training Procedures

NSI is a market research firm that had performed travel surveys in Austin, Texas, and New Jersey with BA prior to the St. Louis survey. NSI had just completed a travel survey for the San Antonio, Texas area just prior to the St. Louis survey and, thus, had experienced surveyors and survey management staff available for the St. Louis survey. Nevertheless, training of the surveyors for the St. Louis Regional Travel Survey was not taken lightly.

A key element of the training program was the preparation of a detailed training manual. The following chapters comprised the training manual:

- The *Introduction* provided general background information on the St. Louis region being surveyed as well as general background regarding the survey.
- *Instructions to Interviewers* provided information on specific interviewer responsibilities.
- *Conducting the Interview* provided detailed instructions regarding the conduct of the actual data collection interview.
- *How to Fill Out the Survey Forms* provided detailed instructions on how to record the survey information on the two survey forms as well as detailed information for each question including allowable responses and codes.
- The *Appendices* described the initial telephone contact procedures for survey respondent recruiters, defined terms used in the travel survey, defined land-use codes, provided an example travel survey packet that

would be mailed to participating households, and provided an example work packet of materials for a surveyor.

The final document was entitled, *Interviewer Manual*, prepared for the East-West Gateway Coordinating Council by Barton-Aschman Associates, Inc., and dated August, 1990.

A training session for interviewers was held at the NSI offices in Austin, Texas prior to the survey pretest. The training session included a practice session with role playing of recruiting calls and the data collection telephone survey.

5.
Conduct of the Survey

TSMIS Overview

The Travel Survey Management Information System (TSMIS) is a microcomputer software package designed to assist in the implementation and management of a regional travel survey. The use of TSMIS was central to managing the St. Louis travel survey and, thus, is described briefly here.

TSMIS was originally developed by BA for use in a home interview travel survey in the Charlotte, North Carolina metropolitan area. The software package has been modified for use in telephone interview travel surveys in the Denver, Colorado and the Austin, Texas metropolitan areas, the State of New Jersey, and for the San Juan, Puerto Rico metropolitan area. The software was modified for use in the St. Louis Region Travel Survey.

TSMIS is composed of a series of interconnected program modules constructed using both existing database management (dBaseIII+) and word processing (WORDSTAR) software packages. Figure 6 illustrates the role of TSMIS in the survey management process and the relationships of the program modules. The program modules are divided into three general functional areas based on the type of product they generate:

- Survey implementation materials.
- Survey progress reports.
- Survey check lists.

Each program module required interaction with a central database file. This database file contained the random sample of households for the survey area acquired from SSI (see Chapter 3). The required interaction with the database file was interactive and, thus, provided a user-friendly operating environment.

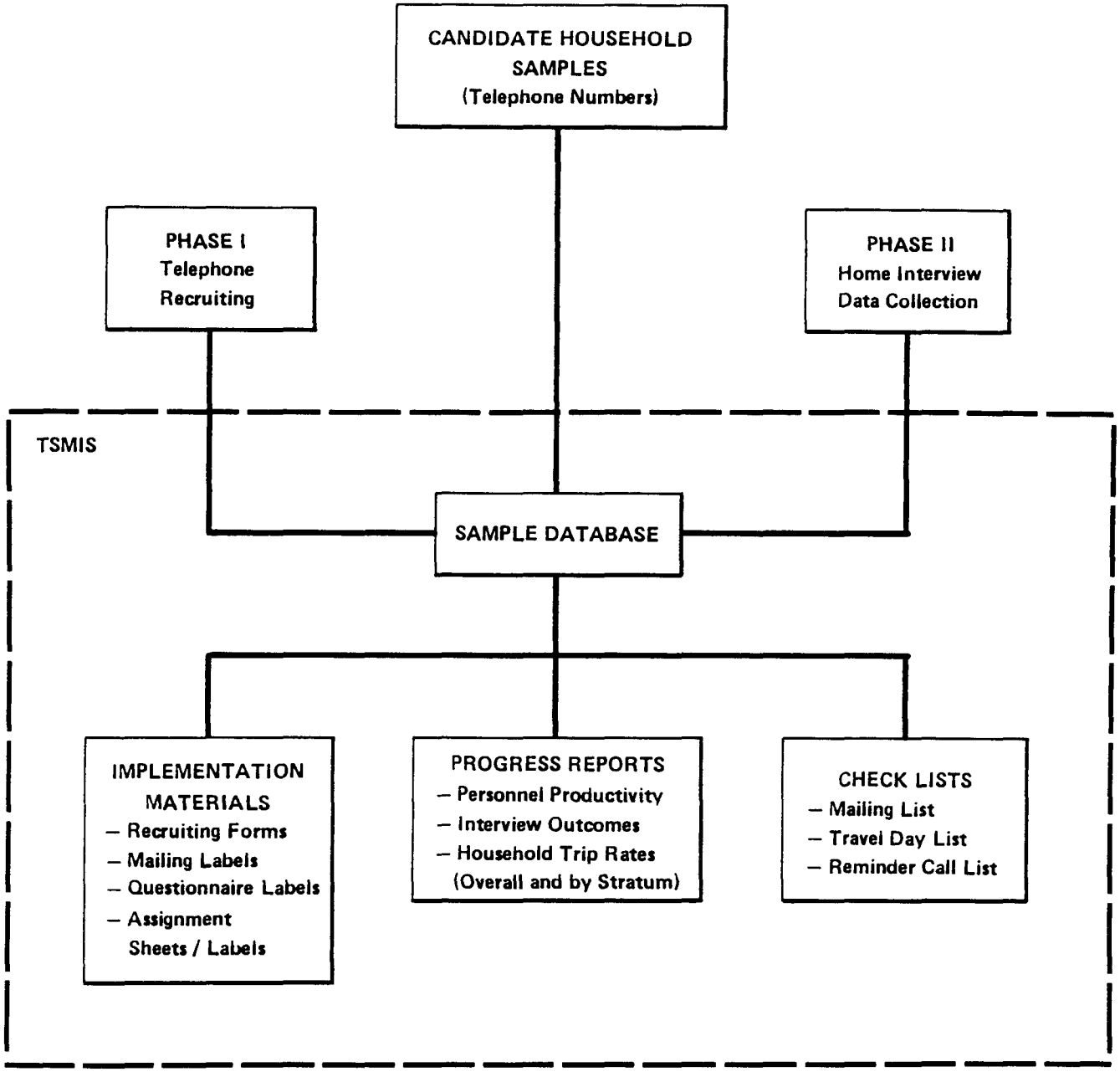

Figure-6

TRAVEL SURVEY MANAGEMENT INFORMATION SYSTEM (TSMIS) OPERATION FLOW CHART

TSMIS also includes a survey editing / checking program (SURVCHK) that was adapted for use in the St. Louis Region Travel Survey. SURVCHK performed checks on the travel data that were collected and keyed into dBase III+ database files. The following types of checks were performed:

- Range checks on household data.
- Range checks on person data.
- Range checks on trip data.
- Interrecord checks comparing trip information to household data.

Recruiting Calls

Recruiting calls were made to households included in the random sample of listed and unlisted telephone numbers purchased for this survey. The objectives of the recruiting calls were as follows:

- Introduce the household to the purpose of the travel survey and the fact that the survey was being taken in behalf of the East-West Gateway Coordinating Council.

- Enlist the cooperation and agreement of the members of the sample household to take part in the travel survey including the recording of travel on the travel diaries.

- Set the travel date for the household members to record their travel.

- Determine the number of people in the household, the number of household members five years old and older, and the number of vehicles available to the household.

- Verify that the name and address of the party answering the telephone corresponded to the information included in the sample database for listed telephone numbers. For unlisted numbers, the name, address, and zip code of the party answering the telephone was obtained.

The telephone interview forms were produced using TSMIS. They were used to record the results of the recruiting calls. An example form is shown in Figure 7. The form accommodated multiple callbacks to households if the initial calls resulted in no answer or a busy signal. If a household was willing to participate in the survey, the interviewer selected the travel day for the household using the master survey schedule shown in Figure 8.

At the end of the each day's recruiting session, the telephone interview coding forms were collected and separated into three groups:

- An acceptance group for households agreeing to participate.

St. Louis Regional Travel Survey

Telephone Interviewer Coding Form - Pre-Survey Qualification

1. Sample #: 1
2. Name: Joan A. Doe _____
3. Address: 2802 Vineyard Dr. _____
   _____
   Arnold, MO 63010 _____
4. Telephone: (314) 282-9999 Listed: T
5. Telephone Interviewer ID #: _____
6. Telephone Interview Date: _____
7. Number of Autos: _____
8. Number of Persons: _____
9. Number of Persons 5+: _____
10. Travel Day: _____ Callback Day: _____
    day date (Only if requested) day date
11. Language: English Spanish Other_____
    (describe)
12. Result:

1.	completed; accepted	6.	busy (quit) 1 2 3 4 5
2.	refusal; not acceptable	7.	no answer (quit) 1 2 3 4 5
3.	disconnected	8.	out of survey area
4.	wrong number/household moved	9.	other_____
5.	commercial number		(describe)

Pre-Survey Qualification Complete - Assignment #: _____

Comments: _____

_____

Figure-7

EXAMPLE TELEPHONE INTERVIEW RECRUITING FORM

Recruiting		Travel Day			Mailing Date	Interview Calls	
Soonest	Latest	No.	Date	Day		Soonest	Latest
8/27	8/28	1	9/5	Wed	8/29	9/6	9/8
8/27	8/29	2	9/6	Thu	8/30	9/7	9/9
8/28	8/31	3	9/11	Tue	9/4	9/12	9/14
8/29	9/4	4	9/12	Wed	9/5	9/13	9/15
8/30	9/5	5	9/13	Thu	9/6	9/14	9/16
9/5	9/10	6	9/18	Tue	9/11	9/19	9/21
9/6	9/11	7	9/19	Wed	9/12	9/20	9/22
9/7	9/12	8	9/20	Thu	9/13	9/21	9/23
9/12	9/17	9	9/25	Tue	9/18	9/26	9/28
9/13	9/18	10	9/26	Wed	9/19	9/27	9/29
9/14	9/19	11	9/27	Thu	9/20	9/28	9/30
9/19	9/24	12	10/2	Tue	9/25	10/3	10/5
9/20	9/25	13	10/3	Wed	9/26	10/4	10/6
9/21	9/26	14	10/4	Thu	9/27	10/5	10/7
9/26	10/1	15	10/9	Tue	10/2	10/10	10/12
9/27	10/2	16	10/10	Wed	10/3	10/11	10/13
9/28	10/3	17	10/11	Thu	10/4	10/12	10/14
10/3	10/8	18	10/16	Tue	10/9	10/17	10/19
10/4	10/9	19	10/17	Wed	10/10	10/18	10/20
10/5	10/10	20	10/18	Thu	10/11	10/19	10/21
10/10	10/15	21	10/23	Tue	10/16	10/24	10/26
10/11	10/16	22	10/24	Wed	10/17	10/25	10/27
10/12	10/17	23	10/25	Thu	10/18	10/26	10/28
10/17	10/22	24	10/30	Tue	10/23	10/31	11/2
10/18	10/23	25	10/31	Wed	10/24	11/1	11/3
10/19	10/24	26	11/1	Thu	10/25	11/2	11/4
10/24	10/29	27	11/7	Wed	10/30	11/8	11/10
10/25	10/30	28	11/8	Thu	10/31	11/9	11/10
10/26	10/31	29	11/13	Tue	11/1	11/14	11/16
10/31	11/6	30	11/14	Wed	11/7	11/15	11/17
11/1	11/7	31	11/15	Thu	11/8	11/16	11/18

Figure-8

MASTER SURVEY SCHEDULE

- A dead group for refusals, disconnected numbers, wrong numbers or moved, commercial numbers, busy or no answer for five continuous days, out-of-area residential location, or other (e.g., language) problems.

- A call-back group for those telephone numbers that were busy or there was no answer for less than five continuous days.

The acceptance and dead groups were turned over to the data entry staff for input into the central database file for TSMIS. After input, the forms were placed into a file for storage. The call-back group was used in the following recruiting session.

A telephone patter or script was used in conjunction with the recruiting calls. The script standardized the information given to the household respondent and explained the purpose of the survey. However, telephone recruiters were allowed to modify the script slightly so that they were more comfortable with the wording. This made the script flow more smoothly and sound more natural to the respondent. An example of the basic script is shown in Figure 9.

There were nine possible outcomes each time a candidate telephone number was dialed. The possible outcomes were as follows:

- Complete, household agreed to participate.

- Refused, household declined to participate.

- Disconnected telephone.

- Wrong number or household moved.

- Commercial number (from unlisted telephone numbers).

- Busy (a total of five attempts were made; no answer also counts as an attempt).

- No answer (a total of five attempts were made; busy also counts as an attempt).

- Household outside of survey area.

- Other.

Mail Information Packets

When a household agreed to participate in the survey, it was sent a packet of forms including a cover letter signed by the chairman and vice chairman of EWG, an instruction sheet for the survey, an example travel diary, a travel day reminder card, a household data questionnaire, and travel diaries. The households travel day and

"Hello, my name is _____, and I'm calling on behalf of the East-West Gateway Coordinating Council. Am I speaking to (--or 'Are You...'--), the head of the household?"

"We are conducting a scientific survey of travel in the St. Louis region as a basis for improving transportation in the 1990s and beyond. Your residence is one of the very few households we've selected to participate in this effort. We need information regarding weekday travel by households such as yours, and we would like your cooperation in this study." (*Brief* pause.)

"I'd like to get your name and address and ask you three questions."

"First, how many cars, vans, or pick-up trucks do you or your household members own or use regularly?"

"Second, how many people live in your household?"

"Third, how many of these people, including yourself, are five years old or older?"

"As part of the survey, I am going to mail you a packet that will contain a Travel Diary for each of your household members five years old or older, and will tell you when and how to record your travel. Your Travel Day will be __(day of week and actual date)__. One or two days after __(actual travel date previously specified)__, we will call you again and collect the information you have recorded."

"What is your name and address?" (Verify number, street, city, state, and zip code.)

"If you have any questions regarding this survey, please call Martin Altman at the East-West Gateway Coordinating Council at (314) 421-4220, or in Illinois at (618) 274-2750, or you can call us at our toll-free number, (1-800) 447-8287. It has been pleasant talking to you. We look forward to calling you again on __(repeat date you specified above)__."

Close your telephone call with a personal note, such as: **"Have a good evening and thank you very much for your assistance."**

Figure-9

EXAMPLE TELEPHONE RECRUITING CALL PATTER

date were stamped on the travel diaries and the reminder card prior to the compilation of a packet to be mailed to a household. The number of travel diaries required by the household was estimated based on the number of persons five years old and older living in the household. Examples of the household data questionnaire and the travel diary are shown in Figures 2 and 3. Figures 10 to 13 show examples of the other forms sent in the mail out packet.

This task used mailing labels and the interview form labels prepared using TSMIS. In addition, mailing check lists and travel day check lists prepared using TSMIS were used in this task. All households for a specific travel day were listed on the mailing check list. As the travel packets were prepared, they were checked-off on the mailing check list. When a packet was mailed, the household was checked-off on the travel day check list. This procedure ensured that each household received their packet of information for the survey in a timely manner. Packets were mailed to participants six to eight days before their travel day.

Reminder Calls

During the evening before each travel day, households were called and reminded that their travel day was the next day. A reminder call check list prepared using TSMIS was used by people making the reminder calls.

Data Collection Calls

The actual telephone interviews were conducted one to three days after the households travel day. For each interview session, all telephone interviewers were given the necessary material to complete the interviews including:

- Blank telephone interviewer assignment form(s).
- Two sets of preprinted labels to affix to the telephone interviewer assignment forms and the survey household data collection forms.
- Survey forms (household data collection forms and trip data collection forms).

An example of the telephone interviewer assignment form is shown in Figure 14. This document was used by the interviewer to record his or her daily progress for an assigned "bundle" of households to interview. The households that the interviewer actually called were based on the preprinted labels given to the interviewer. The interviewers affixed the preprinted label to the assignment sheet only when the survey was completed, was terminated as unsuccessful (e.g., the participant dropped out of the survey), or if the survey day had to be reassigned. If a survey required a callback in a following session to complete the collection of the information, the preprinted

EAST-WEST GATEWAY COORDINATING COUNCIL

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ST. LOUIS, MISSOURI 63101
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David M. Witter

EXECUTIVE DIRECTOR
Les Sterman

An Equal
Opportunity Employer

Dear Fellow Citizen:

Thank you for agreeing to take part in the East-West Gateway Coordinating Council's regional travel survey. Your participation in this study is important because the information which you provide will help plan for new and improved roads and transportation services for the St. Louis area.

As stated in the telephone call you received from a survey team member several days ago, your household is one of a small number of households chosen at random. All information collected for this survey is *strictly confidential*, and will be combined with responses from other households to give us a "snapshot" of regional travel patterns. Instructions to provide the information are included in the packet accompanying this letter.

If you have any questions about the purpose of the survey or about the travel diary, please call Mr. Martin Altman of East-West Gateway at one of the numbers listed above or Mr. Mark Douglas of NSI toll-free at 1-800-447-8287.

Thank you again for your time and cooperation.

Sincerely,

Thomas A. Villa
Chairman

Nelson Hagnauer
Vice Chairman

Figure-10

EXAMPLE COVER LETTER

East-West Gateway
Coordinating Council

REGIONAL TRAVEL SURVEY

INSTRUCTIONS

This survey has two parts.

Part 1 - Household Data (white) contains information about you and your household. Some of the information has already been filled in based on our telephone conversation with a member of your household.

Part 2 - Travel Diaries (blue) on which to record travel for each member of your household or out-of-area visitor to your household on the travel day. This travel diary can help a busy person keep track of his/her trips throughout the day. It will also speed up the telephone interview when we call to collect the travel data for your household.

- Please ask each member of your household and out-of-area visitor to your household to carry a travel diary with him/her on the travel date and to record each trip after it is made (even if the trip is made with another member of the household).

- Please keep a travel diary for household members and visitors five or older who are unable to fill out the diary themselves.

- Be sure to record the person's name and person number (from Part 1) on the travel diary.

- A person should use extra diaries if one is not enough.

- A sample trip diary for the trips in the following example has been included in this packet:

EXAMPLE:
YOU LEAVE HOME AND DRIVE YOUR CHILD TO THE DAYCARE CENTER (1)
THEN YOU DRIVE TO WORK (2)
THEN YOU RIDE TO LUNCH WITH YOUR BOSS (3)
THEN YOU TAKE A BUS BACK TO WORK (4)
THEN YOU DRIVE TO THE DAYCARE CENTER TO PICK UP YOUR CHILD (5)
THEN YOU AND YOUR CHILD RETURN HOME (6)

If you have any questions, call the Travel Survey Office toll-free at **1-800-447-8287.**

For your convenience, we will call you within three days of the travel day to collect your information. All of your answers are strictly **confidential.**

THANK YOU

Figure-11

EXAMPLE TRAVEL SURVEY INSTRUCTIONS

East-West Gateway Coordinating Council

TRAVEL DIARY

TRIPS FOR PERSON NUMBER: 01
(use person number from household data form)

NAME: JOHN DOE

TRAVEL DAY: WEDNESDAY, OCTOBER 10

My first trip today began at:

☑ Home

☐ Other location as shown below (if not home)

Name of Place

Address or Intersecting Streets

City State Zip Code

INSTRUCTIONS:

- Record trips in the order you make them.
- Include the specific information requested for each trip.
- Record your trip even if it is made with another household member.
- **Do not** record walking or bicycle trips except if you walked or rode your bicycle all the way to work.
- At the end of your travel day, leave all completed diaries in a convenient place at home so they will be available when the interviewer calls.
- Use the back of this card and an extra card, if necessary.
- If you have any questions about completing this travel diary, please call our toll-free number: **1-800-447-8287**

	WHERE did this trip end?	KIND OF PLACE (Restaurant, doctor's office, grocery store)	PURPOSE of trip (Check one)	TIME of trip (Circle AM or PM)	MODE of travel (Check one)	IF DRIVER, number in vehicle (include self)
1 First I Went To:	CHILDGARDEN SCHOOL Name of Place LINDELL & VANDEVENTER Address or Intersecting Streets ST. LOUIS MO 63108 City State Zip Code	DAYCARE CENTER	☐ Return Home ☐ Job Related ☐ Go to Work ☐ Change Mode (e.g. Auto to bus) ☐ Shopping ☑ Pick up/drop off Passenger ☐ School ☐ Personal ☐ Social/ Recreational ☐ Eat Meal	BEGIN 7:50 (AM) PM END 8:05 (AM) PM	☑ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:	2
2 Then I Went To:	EAST-WEST GATEWAY CC Name of Place 911 WASHINGTON AVE. Address or Intersecting Streets ST. LOUIS MO 63101 City State Zip Code	OFFICE BUILDING	☐ Return Home ☐ Job Related ☑ Go to Work ☐ Change Mode (e.g. Auto to bus) ☐ Shopping ☐ Pick up/drop off Passenger ☐ School ☐ Personal ☐ Social/ Recreational ☐ Eat Meal	BEGIN 8:10 (AM) PM END 8:25 (AM) PM	☑ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:	1
3 Then I Went To:	UNION STATION Name of Place MARKET AND 18TH Address or Intersecting Streets ST. LOUIS MO 63103 City State Zip Code	RESTAURANT	☐ Return Home ☐ Job Related ☐ Go to Work ☐ Change Mode (e.g. Auto to bus) ☐ Shopping ☐ Pick up/drop off Passenger ☐ School ☐ Personal ☐ Social/ Recreational ☑ Eat Meal	BEGIN 11:55 (AM) PM END 12:05 AM (PM)	☐ Driver (auto/van/pickup/motorcycle) ☑ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:	

(Front)

OVER

Figure-12

EXAMPLE COMPLETED TRAVEL DIARY INCLUDED IN SURVEY PACKET

	WHERE did this trip end?	KIND OF PLACE (Restaurant, doctor's office, grocery store)	PURPOSE of trip (Check one)	TIME of trip (Circle AM or PM)	MODE of travel (Check one)	IF DRIVER, number in vehicle (include self)
(4) Then I Went To:	EAST - WEST GATEWAY CC Name of Place 911 WASHINGTON AVE. Address or Intersecting Streets ST. LOUIS MO 63101 City State Zip Code	OFFICE BUILDING	☐ Return Home ☐ Job Related ☑ Go to Work ☐ Change Mode (e.g. Auto to bus) ☐ Shopping ☐ Pick up/drop off Passenger ☐ School ☐ Personal ☐ Social/ Recreational ☐ Eat Meal	BEGIN 12 45 AM (PM) END 1 00 AM (PM)	☐ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☑ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:	
(5) Then I Went To:	CHILDGARDEN SCHOOL Name of Place LINDELL & VANDEVENTER Address or Intersecting Streets ST. LOUIS MO 63108 City State Zip Code	DAYCARE CENTER	☐ Return Home ☐ Job Related ☐ Go to Work ☐ Change Mode (e.g. Auto to bus) ☐ Shopping ☑ Pick up/drop off Passenger ☐ School ☐ Personal ☐ Social/ Recreational ☐ Eat Meal	BEGIN 5 15 AM (PM) END 5 35 AM (PM)	☑ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:	1
(6) Then I Went To:	HOME Name of Place Address or Intersecting Streets City State Zip Code	HOME	☑ Return Home ☐ Job Related ☐ Go to Work ☐ Change Mode (e.g. Auto to bus) ☐ Shopping ☐ Pick up/drop off Passenger ☐ School ☐ Personal ☐ Social/ Recreational ☐ Eat Meal	BEGIN 5 40 AM (PM) END 5 55 AM (PM)	☑ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:	2
(7) Then I Went To:	Name of Place Address or Intersecting Streets City State Zip Code		☐ Return Home ☐ Job Related ☐ Go to Work ☐ Change Mode (e.g. Auto to bus) ☐ Shopping ☐ Pick up/drop off Passenger ☐ School ☐ Personal ☐ Social/ Recreational ☐ Eat Meal	BEGIN AM PM END AM PM	☐ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:	
(8) Then I Went To:	Name of Place Address or Intersecting Streets City State Zip Code		☐ Return Home ☐ Job Related ☐ Go to Work ☐ Change Mode (e.g. Auto to bus) ☐ Shopping ☐ Pick up/drop off Passenger ☐ School ☐ Personal ☐ Social/ Recreational ☐ Eat Meal	BEGIN AM PM END AM PM	☐ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:	
(9) Then I Went To:	Name of Place Address or Intersecting Streets City State Zip Code		☐ Return Home ☐ Job Related ☐ Go to Work ☐ Change Mode (e.g. Auto to bus) ☐ Shopping ☐ Pick up/drop off Passenger ☐ School ☐ Personal ☐ Social/ Recreational ☐ Eat Meal	BEGIN AM PM END AM PM	☐ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:	

(Back)

Figure-12 (Continued)

—Remember—

Your Travel Day Is

(4:00 a.m. to 4:00 a.m.)

Remember,
Have Every Household Member and
Out-of-Town Visitor Take A Travel Diary
And Keep A Record of His or Her Trips!

Thank You!

East-West Gateway
Coordinating Council

For further information call toll free:
1-800-447-8287

Figure-13

EXAMPLE REMINDER SHEET

Daily Interview Assignment Sheet

Telephone date: _____ Telephone Interviewer I.D.:_____

(Affix ALABEL Here)

Results Code (*):_____
Number of Trips:_____
Income Group:_____

(Affix ALABEL Here)

Results Code (*):_____
Number of Trips:_____
Income Group:_____

(Affix ALABEL Here)

Results Code (*):_____
Number of Trips:_____
Income Group:_____

(Affix ALABEL Here)

Results Code (*):_____
Number of Trips:_____
Income Group:_____

(Affix ALABEL Here)

Results Code (*):_____
Number of Trips:_____
Income Group:_____

---

* Result Codes:

1. Complete
2. Refusal
3. No one home, repeated calls
4. Language Problem
5. Not in Area on Travel Day
6. Sick on Travel Day
7. Household Demolished or Converted to Commercial
8. Household Moved
9. Other

Figure-14

EXAMPLE
INTERVIEWER ASSIGNMENT FORM

label was paperclipped to the survey forms. Thus, the preprinted label was affixed to the assignment sheet in the session in which the survey is completed. The interviewer filled out the summary information for each completed interview (number of trips, completion code, and income group) on the assignment sheets at the end of every interviewing session. The information on the assignment sheets was entered into the TSMIS central database file after every interview session to keep track of the progress of the survey.

At the end of every interviewing session, the interview materials were collected and separated manually into three groups:

- Completed interview group.
- An incomplete survey group.
- A survey reassignment group.

The completed interview group consisted of successful interviews and interviews that were unsuccessful due to household refusal or other reasons. This group was turned over to the editing and coding staff. Any interviews that required a call-back were placed in the incomplete group and were used in the following interview session. The reassignment group consisted of households that forgot their travel day and could not reconstruct their travel from memory or had a "result code" five (out-of-area on travel day) or six (sick on travel day). Note that if only some of the members of the household were out of the area or sick, result codes five and six were not used. This file was reviewed by a supervisor and a new travel date was selected for the household and entered into the central database file.

There were nine possible outcomes from each survey:

- *Complete*--a completed survey.
- *Refused*--the household refused to participate in the survey (after initial agreement in the recruiting call).
- *No one home, repeated calls*--no contact could be made with the household after at least five callbacks.
- *Language problem*--data could not be collected from all members of the household due to language problems.
- *Not in area on travel day*--all members of the household were outside of the survey area on the travel day. The travel day was reassigned, if possible. Only those households refusing to accept a new travel day received this completion code.

- *Sick on travel day*--all members of the household were sick on the travel day. The travel day was reassigned, if possible. Only those households refusing to accept a new travel day received this completion code.

- *Household demolished or converted to commercial*--the household was demolished or converted to commercial use between the initial recruiting call and the data collection call.

- *Household moved*--the household moved between the initial recruiting call and the data collection call.

- *Other*--this category included any other problem that prevented the successful completion of a survey such as the telephone being disconnected between the initial recruiting call and the data collection call.

Note that data collection calls could have taken several days to complete. Attempts were made to personally interview all members of the household over 15 years of age (information from younger children was collected from an adult member of the household based on the child's travel diary). This required callbacks to households when not all family members were present during an interviewing session. If an absent member of the family (on the survey data collection day) had completed a travel diary, the information on the travel diary was collected in lieu of a personal interview.

Interviewers were trained to ask questions and probe for additional information and trips without suggesting possible answers to the respondents. Some general phrases that were used to get the additional information without leading the respondent were:

- Please explain that a little more.

- Could you be more specific?

- I'm not sure I understand. Would you explain that again?

- On the last trip you said you made yesterday from your office to your house, did you make a stop for any reason along the way?

Interviewers were also trained to look at the reasonability of a pattern of trips to ensure that trips were not missed. For example, if a trip was made to work, the interview made sure that a trip was made from work (unless there were mitigating circumstances such as a very long work day to meet a deadline or the person walked home).

Data Editing, Coding, and Keying

Completed surveys were edited, coded, and keyed to computer data files during this task. Initial editing and coding of the survey data were performed manually. The surveyor made an initial check to ensure that all information was obtained for the survey, that the information was logical, and that the information was clearly written on the household and trip collection forms. The survey forms were then given to editing staff for a double check of the information recorded on the survey forms. The editing of a survey could have required a follow-up phone call to the household by an editor and/or supervisor to resolve any problems detected with the collected information.

The data collection forms were, to a large extent, self-coding. Surveyors circled numbers or letters of responses or recorded a letter or number as a response. However, two items required coding by the editing staff. Specifically, the income code was a letter designation on the household data collection form. This information was converted to a numeric designation by the editors. On the travel data collection form, surveyors recorded a description of the land use at the destination of the trip. Editors converted this information to a one digit land use code.

After a sample passed the initial editing and coding procedure, it was passed to data entry personnel for keying into dBase files. Three different record types were keyed: household data (record type 1), person data (record type 2), and trip data (record type 3). The data structures for these three files are shown in Chapter 7, Survey Results. There was one household data record for each sample number, one person record for each member in the household age five years and older, and at least one trip record (the zero trip record) for each member of the household age five years and older.

After key entry, the data were input to the TSMIS editing program, SURVCHK. The program performed range edits on individual fields, intrarecord checks (e.g., to ensure that the starting time of a trip was not after the ending time for the trip), and interrecord checks (e.g., to ensure that there are the correct number of person records for the number of people listed in the household). The edit checks performed by SURVCHK are shown below:

Household Data Range Checks

- Family size must be in the range 1 - 20.
- Family size age five and older must be in the range 1 - 20.
- Family size age five and older must be less than or equal to family size.
- Visitors must be in the range 0 - 9.
- Income code must be in the range 0 - 9 or R.
- Travel day must be a valid travel date.
- The sum of trip makers and non-trip makers must equal the sum of the family size age five and older plus the number of visitors.
- Listed phone must be 1 or 2 (yes or no).
- Completion code must be 1 (complete).

Person Data Range Checks

- Person numbers are not skipped or repeated.
- Relationship code is in the range 1 - 5.
- Age is in the range 1 - 99.
- Gender is 1 or 2 (male or female).
- Drivers license is 1 or 2 (yes or no).
- Each employment status code must be in the range 1 - 7 and codes must not be repeated.
- Interviewed code is 1 or 2 (yes or no).
- Used diary code is 1 or 2 (yes or no).

Trip Data Range Checks

- Trip numbers are not skipped or repeated for any person.
- A 0 trip record exists for each person.
- Kind of place is in the range 0 - 9.
- Trip purpose is in the range 0 - 9.
- Beginning time of trip is legal (000 - 059, 100 - 159, ...).
- Beginning AM or PM code is A or P.
- Ending time of trip is legal (000 - 059, 100 - 159, ...).
- Ending AM or PM code is A or P.
- Beginning time is before the ending time.
- Mode is in the range 1 - 8.
- Auto occupancy is in the range 1 - 9 if mode is auto driver.
- Auto occupancy is 0 if mode is not auto driver.
- In addition, the program cross-tabulated the trip purpose by the kind of place codes to allow checking for illogical combinations.

Interrecord Checks

- Person number is less than or equal to the sum of the family size age five and older plus the number of visitors.
- At least one trip record (the 0 record) exists for each person.
- Persons without a drivers license are not listed as auto drivers.
- If purpose is to work, an employment status of 1, 2, or 3 is listed.
- The sum of motorized trips from the trip records is equal to the total trips coded on the household record.
- The sum of persons making trips in motorized vehicles on the trip records is equal to the number of trip makers listed on the household record.

Samples that completely passed the editing were copied into the final data files. Samples that failed the editing were copied to a "reject" file for correction. Rejections

could have been caused by keying errors or problems missed in the initial editing and coding step.

The final step in the process is the "merging" process. This step can be accomplished using a dBase program to merge the home address information from the sample file onto the household record and the trip records (whenever a destination has been recorded as "Home"). This step has not yet been performed since it will be more efficient to perform this step after geocoding. That way, only the zone number information needs to be transferred.

Several documents more fully explain the conduct of the survey and the survey editing:

- *Interviewer Manual*, prepared for the East-West Gateway Coordinating Council by Barton-Aschman Associates, Inc., August, 1990.
- *Home Interview Survey Editing and Coding Manual--St. Louis Region Travel Survey*, prepared for the East-West Gateway Coordinating Council by Barton-Aschman Associates, Inc., August, 1990.
- A memorandum entitled, "Task C.5--Verify and Process Survey Responses--Computerized Survey Data Edit Checks", dated December 4, 1990.

Survey Monitoring Process

NSI used quality control staff, completely separate from the data collection staff, to monitor the survey and assure the maintenance of high quality data. The quality control staff monitored selected interviewer telephone calls, performed the editing described above, and validated the interviewers' work by calling selected surveyed households to verify responses.

For the recruiting calls, the quality control staff monitored recruiter calls for thoroughness and clarity. Quality control staff monitored selected telephone calls for each recruiter to determine whether or not the recruiter followed the script as written (see Figure 8), how well they explained the purpose of the study, how well they listened to the respondent, the thoroughness of their probing for names and addresses, the level of interest of the recruiter, and the tonal quality of the recruiter. Monitoring of recruiters was "blind"-- recruiters did not know when quality control staff were monitoring their calls. Any deviations or problems were noted on a validation form and verbally related to the recruiter either by the quality control staff or by the recruitment supervisor.

NSI also monitored recruiter productivity. Specifically, they monitored the number of households recruited per dialing hour by each recruiter as well as the recruiter's number of dialings per hour. Recruiters were retrained or reassigned if they did not meet a minimum level of productivity.

Finally, NSI also produced weekly productivity reports on recruiters using TSMIS. Copies of the weekly reports were sent to BA and EWG for review. The reports summarized agreement rates, recruiter hours worked, and overall recruiter productivity.

NSI also monitored interviewers collecting the travel survey data. Several types of checks were performed. First, completed interviews were checked in NSI's field data collection section (the group actually making the telephone calls). Problems noted were returned to interviewers for immediate clarification or correction. The field unit supervisor monitored whether specific interviewers had an inordinate number of surveys returned for clarification.

After surveys were edited in the field unit, they were passed to quality control staff for the editing described in the Data Editing, Coding, and Keying section above. As with the field unit checks, if an interviewer had an inordinate number of surveys that required problem correction, the field supervisor was notified so the interviewer could be retrained or reassigned.

As with the survey recruiters, quality control staff monitored selected interviews for each interviewer throughout the survey. Particular attention was paid to probing for address information (for trip destinations), the tone of voice used by the interviewer, and the overall flow and pace of the interview. Approximately 10 percent of each interviewers' surveys were validated by quality control staff. The validation was accomplished by recalling surveyed household and verifying responses to questions.

NSI monitored the productivity of the interviewers using TSMIS. Reports were generated that showed the number of surveys completed, the productivity of each interviewer (in completed surveys per hour worked), and the average number of trips per household collected by the interviewer. The reports were generated by interviewer and for all interviewers, combined. NSI used the individual reports to determine underproductive interviewers and interviewers that seemed to be missing trips due to lack of probing. These interviewers were retrained or reassigned.

The summary reports were sent to BA and EWG for review. BA monitored the average overall trip rates and the distribution of households by income group and household size for reasonability. The status of the survey was discussed with the NSI survey manager weekly.

Two memoranda more fully explain the survey monitoring process:

- "Recruitment Quality Control Procedures", dated November 29, 1990.
- "Data Collection Quality Control Procedures", dated November 29, 1990.

The above memoranda were prepared as requirements under Task C1 - Select Sample and Conduct Prequalifying Interviews, and Task C4 - Collect Travel Diary Information, respectively.

6.
Pretest Results

A pretest of the St. Louis Region travel survey was performed during the last two weeks of June 1990. The pretest covered all stages of the surveying process including selection of households, recruiting calls, travel day assignment, survey packet mail-out, reminder telephone calls, collection of the travel data, and coding, editing, and keying of survey results. Survey recruiting calls were made during the week of June 18. Travel days were Tuesday, June 26 through Thursday, June 28. Collection of the travel data was initiated on Wednesday, June 27 and fully completed on Thursday, July 5. The data collected in the pretest were analyzed for reasonability and to determine any potential problems with the survey. In addition, EWG personnel volunteering to participate in the pretest were debriefed regarding their experience participating in the survey.

A total of 41 surveys were completed in the pretest. The telephone numbers for the pretest were obtained from one of the twenty-four replicates of telephone numbers purchased from Survey Sampling, Inc. (SSI). The replicate used had 416 telephone numbers, 183 which were listed and 233 which were unlisted. The telephone list was modified to include five volunteers from the East-West Gateway Coordinating Council (EWG). To obtain the completed surveys, 411 telephone numbers out of the 416 total numbers were called.

The most important result from the pretest was the identification of problems with survey instruments and survey procedures so that the problems could be corrected. A number of problems were identified and corrected. In addition, several changes not related to problems with the forms or procedures were suggested. The problems and corrections are summarized below:

- Recruiters did not have a brief, simple definition for EWG and EWG's duties. A two-sentence explanation was drafted and inserted into the training manual.

- Scheduling of data collection callbacks was difficult to administer. The original telephone patter requested a time to call the respondent to collect the survey data. Since the length of each individual data collection call could not be estimated, it was impossible to accurately schedule the data collection calls. This question was dropped from the recruiters' telephone patter.

- The original recruiters' telephone patter did not request the respondent's cooperation in the survey. This made the recruiters, as well as one EWG staff member participating in the pretest, uncomfortable. The telephone patter was modified to ask for cooperation with the study, followed by a brief pause.

- The format for printing the travel data collection forms was changed so that the forms were turned around horizontally, rather than vertically, to record information on the second side of the form.

- It was determined that travel packets could safely be mailed six to eight days prior to the respondent's travel day. Originally, it was thought that the packets would need to be mailed ten days in advance.

- Several statements in the instructions and on the travel diaries were modified to clarify which trips needed to be recorded.

- Reluctance to respond to the income question was noted. The response categories on the household information form were changed to include identification letters to try to improve the response, especially for low income families (e.g., respondents reported that they were in income group "B" which designated the $10,000 to $14,999 income group).

- Rules for responding to answering machines were established. Messages requesting that the respondent call NSI's 800 number were left on answering machines as a last resort to establish contact with the surveyed household.

- The date was removed from the survey packet cover letter since the survey would extend over three months.

- Decision criteria were established to help interviewers consistently identify incidental trips that would not be included as actual trips. The criteria related to the amount of diversion from the normal route for the main trip, the purpose of the stop, and the duration of the stop (see definition of a trip in Chapter 7, Survey Results, for additional information).

- The trip data collection form was modified to provide a starting point trip purpose for the first trip of the day if the starting location was not "home".

- The travel day and two of the trip purposes on the example travel diary included in the survey packet were modified.

- Several other minor format and wording changes were made to the household data form mailed to respondents and the household data collection form.

Details regarding the pretest can be found in the technical memorandum entitled, "Task B.5--Pretest Summary," dated August 7, 1990.

7.
Survey Results

Survey Problems / Resolutions

The corrections made to the survey process and survey forms based on the pretest resulted in a survey with very few problems. Several problems were, however, encountered in the conduct of the actual travel survey. These problems and their solutions are summarized below:

- Recruiters were initially recruiting households in which members had expressed doubts about everyone participating. This was reflected by incomplete interviews in the data collection stage. Recruiters were reminded that the entire household had to participate in the survey; if one household member refused to participate, that meant that the household refused to participate.

- One interviewer was overly aggressive with a respondent. A letter of apology was sent to the respondent by NSI, the interviewer was removed from the project, and the remaining interviewers were rebriefed regarding proper telephone conduct.

- Incorrect forms (from a survey for a different city being performed at the same time by NSI) were mailed to about 130 households. The data collected from about 50 of the households was suspect and had to be deleted from the survey results. The travel day for the remaining 80 households was rescheduled and correct forms were remailed to the households.

Disposition of Telephone Calls

In total, 6,373 different telephone numbers were called during the travel survey. The 6,373 calls results in 1,446 completed, usable surveys. In other words, 22.7 percent of the initial telephone calls results in usable surveys. Table 5 shows the final disposition of all telephone number called during the course of the survey.

Table 5
Disposition of Surveyed Telephone Numbers

		Number	Percent
Recruiting Calls			
	Agreements	1,893	29.7%
	Refusals	1,772	27.8%
	Disconnected Phones	1,350	21.2%
	Wrong Number/Household Moved	164	2.6%
	Commercial	411	6.4%
	Busy/No Answer (for Five Calls)	773	12.1%
	Out-of-Survey Area	2	--
	Other (Language Problems)	8	.1%
	Total	6,373	99.9%
Interview Calls			
	Completions	1,482[1]	78.3%
	Refusals	308	16.3%
	Quit Survey	40	2.1%
	Language Problems	0	0.0%
	Out-of-Area on Travel Day	5	0.3%
	Sick on Travel Day	6	0.3%
	Household Demolished	0	0.0%
	Moved	50	2.6%
	Disconnected	2	0.1%
	Total	1,893	100.0%

(1) A total of 1,482 interviews were completed. However, 36 of the interviews were later rejected due to editing or coding problems. This resulted in 1,446 completed, usable surveys.

Preliminary Results

Preliminary results from the travel survey are summarized in the following sections. The results are preliminary from the standpoint that the data had not been "linked" (see Chapter 8, The Next Steps) at the time of the summary. In addition, the survey data had not been weighted to reflect the estimated distribution of all households in the region. Specific comments regarding the effect of not linking and weighting the data will be made in the sections below if the results summarized could be affected by the linking or weighting of the data.

Before the survey results can be interpreted, the definition of several basic terms used in the travel survey must be understood. These terms are as follows:

Household. Generally, a household was considered to be the entire group of persons living in one dwelling unit. A household could have been just one person living alone or several persons living together. The household usually consisted of a family with a head (e.g., a father or mother) and all of his or her relatives living in the dwelling unit. The household also may have included members such as roommates, lodgers, visitors, and maids. In order to determine whether a person was a member of the household or not, two general rules were applied:

1. Was the person's usual place of residence, at the time of the interview, in the household?

   The usual place of residence was where a person normally slept and where there were living quarters for that person to return to any time he or she wanted to. It was not just a mailing address. It could have been a temporary place of residence where a person was staying while looking for permanent living quarters.

2. Was the person from outside the St. Louis area and visiting the household at the time of the interview?

   A visitor from outside the area was considered a member of the household for the survey and his or her trips were recorded. A visitor who lived within the St. Louis area was not considered a member of the household and his or her trips were not included.

Travel Mode. The means used to travel including auto, pick-up, van, bus, school bus, taxi, motorcycle.

Trip. A trip was considered to be one-way travel from one point to another which took the person outside the block he or she started the trip in. Travel must have been made by one of the designated modes of travel which did not include boats, horses, wagons, or bicycles, unless a bicycle was used for a work trip. Walking trips were not included as trips, unless the walking trip was a

work trip. Note, however, that bicycle and walk trips to and from work were not considered in the summaries included in this report.

Trips made by truck drivers (dump truck, delivery truck, or semitrailer) during their working day were not counted; information on truck trips should be collected in a separate survey. Also, trips made during the working day by persons whose regular job was making deliveries in any type of vehicle were not counted.

A continuous round trip was considered as two separate trips. The destination of the first trip and the origin of the second were the farthest point that was reached on the round trip. For example, if a person traveled to a park, drove around the park without getting out of the car, and returned home, it was counted as two trips. The destination of the first trip was the park, and the origin of the second trip was the park.

There were some stops that were not considered as ending and beginning points of a trip. These included:

- Stops for traffic delays or detours.
- Stops to transfer from one bus to another on a trip from home to work.
- Stops made en route for an incidental purchase such as gasoline, cigarettes, newspaper, etc.

The latter category of incidental stops were not included as separate trips under the following circumstances:

- The stop was made along the normal route taken for another trip (or within two blocks).
- The stop involved a short amount of time (under two minutes).

Other indications of incidental stops were stops made on a home-to-work or work-to-home trip, and stops for a purchase of one item at a convenience store.

Travel had to begin or end in the survey area to be included as a trip. For example, travel from St. Louis to Springfield within the travel day was included as a trip. However, if the traveler continued his or her journey with a trip from Springfield to Chicago, the second trip was not included as a trip.

The travel day, for the purpose of this survey, was the designated day of travel for the household, which began at 4:00 A.M. that morning and ended at 4:00 A.M. the next day. The trip had to begin and end during that period to be counted.

Trip Purpose. The primary reason for making any given trip was considered to be the trip purpose. Trips were categorized into the following trips purposes:

Go to Work

A work trip was travel to a person's place of employment or business, such as an office, factory, or store. Some people had more than one job, and travel to each place of employment was considered a work trip. Also, some persons visited different locations during the day in performing their work, such as doctors and salespeople. The purpose of each of these work-related stops was job-related (see below).

Shop

Travel to shop or to purchase things was classified as a shopping trip.

Return Home

A trip to a person's usual place of residence was a home purpose trip.

School

Travel by a student to school or college was a school trip. Travel by a teacher or school employee to a school was a work trip.

Social/Recreation

Travel made for social or recreation purposes during which no business was transacted, either work-related or personal business, were social/recreational trips. These trips included trips made for:

Parties	Golfing
Social meetings	Fishing
Lectures	Movies
Cultural events	Athletic events
Visits to friends	Tennis
Church activities (social in nature)	

Trips made to regularly scheduled church services were recorded as Personal.

Eat Meal

These were trips made to eat a regular meal. Stops for snacks or refreshments were better classified as social/recreational. A trip home to eat a meal (e.g., a person came home from work to eat lunch and returned to work) was classified as an "eat a meal" trip.

Personal

This category included trips made for transactions that were not considered to be a part of a person's primary or secondary employment, and were made to obtain services--not purchase goods. Trips to a bank, to the post office, to a doctor or dentist, and to a barber were personal trips. Trips made to have an item repaired, such as a car or radio, or to have clothes cleaned, were also personal trips.

Change of Travel Mode

Travel by one mode of transportation to get to another mode of transportation was considered a change of travel mode purpose. The modes of transportation used in this survey when considering change of travel mode trips were: auto, bus, airplane, and rail. For example, if a person drove a car to a bus stop to take a bus to the office, the trip from home to the bus stop by car was for the change of travel mode purpose. However, if it was necessary for the person to transfer to another bus to get to his or her office, the second trip was not a change of travel mode trip. Even though the person traveled on two buses, the buses were the same mode.

Trips to a railroad station, bus station, or airport, at which point a train, airplane, or bus was taken out of the survey area, were recorded as change of travel mode. The air, rail, or bus travel was considered part of the trip and was recorded on the trip report.

Pickup/Drop-Off Passenger

This category included trips or stops to pick up or deliver someone at a specific location.

Job Related

Some people, such as salespeople and repair persons, traveled to different locations during the day in performing their work. The purpose of the work-related stops they made was job-related.

Distribution of Households by Income Group and Household Size

The distribution of households by income group and household size was discussed in Chapter 2, Survey Design, under the section on sample stratification. Tables 2 and 3 show the expected and the surveyed distributions of households by income group and household size. The surveyed distribution is different from the expected distribution, but the differences should not cause problems in the calibration of trip production models. Note, however, that if regional average trip rates are calculated, the survey data should be weighted to reflect the regional distribution of households by income

group and household size. Procedures for weighting are discussed in Chapter 8, The Next Steps.

A chi-square test of statistical significance comparing the expected distribution of households (using the 1,320 households with reported incomes) to the surveyed distribution of households was performed. The chi square statistic was calculated using the following formula:

$$\chi^2 = \Sigma \frac{f_o^2}{f_e} - N$$

where:

f_o is the observed number of households in the cell
f_e is the expected number of households in the cell
N is the total number of households.

The chi-square value was 84 with 14 degrees of freedom. This implied that the surveyed distribution was statistically significantly different from the expected distribution at the 0.01 significance level.

The total number of people living in the surveyed households (including children under 5 but excluding visitors) was 3,841. Thus, the overall average household size was 2.66 and the average household size for five or more person households was 5.38. If only the 1,320 households reporting their incomes were considered, the average households size was 2.38 and the average households size for five or more person households were 5.37.

Distribution of Households by Auto Availability and Household Size

Table 6 shows the expected distribution of households by auto availability and household size (assuming 1,446 households) and Table 7 shows the surveyed distribution. As can be seen in the two tables, there was a substantial undersampling of households with zero or one automobiles available. The undersampling of those two groups was counterbalanced by an oversampling of households with two or more automobiles available. It should be noted, however, that the expected distribution of households by auto availability and household size was based on EWG estimates developed from 1980 Census data. It is possible that the expected distribution will be modified when the 1990 Census data become available.

Table 6
Expected Distribution of Surveyed Households by Auto Availability and Household Size

	Household Size					
Auto Availability	1	2	3	4	5+	Total
0 Autos	87	48	19	14	13	182
(Percent)	(6.0%)	(3.3%)	(1.3%)	(1.0%)	(0.9%)	(12.6%)
1 Auto	195	194	100	81	65	635
(Percent)	(13.5%)	(13.4%)	(6.9%)	(5.6%)	(4.5%)	(43.9%)
2+ Autos	100	201	124	116	88	629
(Percent)	(6.9%)	(13.9%)	(8.6%)	(8.0%)	(6.1%)	(43.5%)
Total	382	443	243	211	166	1,446
(Percent)	(26.4%)	(30.6%)	(16.8%)	(14.6%)	(11.5%)	(100%)

Table 7
Observed Distribution of Surveyed Households by Auto Availability and Household Size

	Household Size					
Auto Availability	1	2	3	4	5+	Total
0 Autos	43	36	23	18	10	130
(Percent)	(3.0%)	(2.5%)	(1.6%)	(1.2%)	(0.7%)	(9.0%)
1 Auto	213	102	35	19	21	390
(Percent)	(14.7%)	(7.1%)	(2.4%)	(1.3%)	(1.5%)	(27.0%)
2+ Autos	30	375	210	190	121	923
(Percent)	(2.1%)	(25.9%)	(14.5%)	(13.1%)	(8.4%)	(63.8%)
Total	286	513	268	227	152	1,446
(Percent)	(19.8%)	(35.5%)	(18.5%)	(15.7%)	(10.5%)	(100%)

Distribution of Households by Travel Day

The travel survey was designed to collect an equal number of surveys for Tuesdays, Wednesdays, and Thursdays over the survey period. Mondays and Fridays were not included as travel days. As can be seen in Table 8 the surveyed number of households was almost equally split between the three travel days.

Table 8
Distribution of Households by Travel Day

Travel Day	Number of Households	Percent of Households
Tuesday	463	32.0%
Wednesday	505	34.9%
Thursday	478	33.1%

Geographic Distribution of Households

Table 9 shows the expected and surveyed distribution of households by county and for the City of St. Louis. As can be seen in the table, there was a difference between the expected number of samples by county and the surveyed samples. The major problem was that the City of St. Louis was undersampled. This resulted in an oversampling of St. Louis County, St. Charles County, Jefferson County, and Madison County. The calculated chi-squared value comparing the expected and surveyed distributions was 76.49 with six degrees of freedom. This implied that the surveyed distribution was statistically significantly different from the expected distribution at the 0.01 significance level. Based on these results, it might be worthwhile to consider geographically based expansion factors for the survey data as well as socioeconomic based factors.

Respondents Interviewed and Using Diary

Table 10 shows a crosstabulation of the number of people who were interviewed and who said they used their travel diary. As can be seen, over one-half of the household members were not personally interviewed. This number is somewhat misleading, however, since a large portion of the household members who were not interviewed were under 16 years old.

Almost 85 percent of the respondents reported using their travel diary. This was a very high percentage. However, there might be several reasons for the high reported use. First, the surveyors asked whether or not the diary was used. It was possible that many respondents responded yes to appear to be in compliance with the survey instructions.

Table 9
Geographic Distribution of Households

County	Expected		Surveyed	
	Number	Percent	Number	Percent
City of St. Louis	285	20.4	233	16.6
St. Louis County	630	45.0	632	45.1
St. Charles County	123	8.8	134	9.6
Jefferson County	47	3.4	55	3.9
Madison County	151	10.8	190	13.6
Monroe County	5	0.4	9	0.6
St. Clair County	159	11.4	147	10.5

Table 10
Respondents Interviewed and Using Diary

Interviewed	Used Diary		Total
	Yes	No	
Yes	1,333	297	1,630
No	1,670	266	1,936
Total	3,003	563	3,566

Second, even if the diary was used, it was possible that it was completed at the end of the travel day rather than during the trip making, as requested. Nevertheless, as will be reported later, the preliminary trip rates obtained from the survey appear to be reasonable. The use of the travel diary, coupled with surveyor probing, probably contributed to the good results.

Households by Listed and Unlisted Telephones

Table 11 summarizes the number of households with listed and unlisted telephones along with the average trip rates for those households. As reported in Chapter 3 (see Table 4), it has been estimated that 72.3 percent of the households in the St. Louis region had listed telephones. Thus, based on Table 11, it appears as if the households with listed telephones were undersampled. Based on the raw trip rates, this might cause some bias in the survey results since the average trip rate for households with listed telephones is higher than the rate for households with unlisted telephones.

However, the difference in trip rates might be explained by differences in the socioeconomic characteristics of the households with listed and unlisted phones. In addition, the trip rates for households with listed and unlisted telephone numbers shown in Table 11 are not statistically significantly different from each other at the 0.95 significance level. It should be noted that the trip rates shown in Table 11 are based on unlinked trips. This should not impact any conclusions drawn from the data summarized in Table 11.

Table 11
Households by Listed and Unlisted Telephones

Listed Phone	Number of Households	Percent	Average Trip Rate[1]
Yes	886	61.3%	9.30
No	560	38.7%	8.66
	1,446	100.0%	

[1] The average trip rates reported here are based on unlinked, unweighted trips made in motorized vehicles by residents of the region. Final average trip rates might be different.

Households by Trip Frequency

Table 12 summarizes the number of households by the number of trips made. As can be seen in Table 12, 4.9 percent of the households surveyed did not make any trips during the travel day. The percentage of households making no trips during the travel day was low. It was typical of low density, southwestern cities. In comparison, the percent of zero trip making households might be in the 10 percent to 15 percent range for established, high density cities like Chicago or New York. Note that the percent of zero trip making households will be affected by the weighting of the survey data.

The percent of households making only one trip per day was very low, as should be expected. The few households making only one trip during the day either left (or returned to) the region, or they traveled in a motorized vehicle to their initial destination and walked home (or vice versa).

About three percent of the surveyed households made more than 25 trips per day. The highest number of trips made on the travel day was 69 by one five or more person household. Further analysis of the data showed that the households with the highest trips rates (i.e., more than 25 trips per day) were generally four or more person households. Thus, the households with high numbers of trips do not indicate a problem with collecting "traveling salesman" trips.

Table 12
Households by Trip Frequency

Trip Frequency[1]	Number of Households	Percent of Total Households[2]
0	71	4.9%
1	5	0.3%
2	152	10.5%
3	44	3.0%
4	144	10.0%
5	65	4.5%
6	141	9.8%
7	63	4.4%
8	123	8.5%
9	72	5.0%
10	108	7.5%
11-15	246	17.0%
16-20	119	8.2%
21-25	49	3.4%
25 or more	44	3.0%
Total	1,446	100.0%

[1] The trips summarized in this table include only those trips made in motorized vehicles. Walk and other non-motorized trips are not included. In addition, trips have not been linked.

[2] The distribution of households by number of trips will be affected by the weighting of the survey data.

Trips by Purpose

The number of trips by trip purpose are summarized in Table 13. Traditional transportation planning definitions of trip types have been used (home-based work, home-based shop, etc). Only trips made in motorized vehicles have been summarized in Table 12; walk and other mode trips have been removed.

Table 13
Trips by Purpose

Trip Purpose	Trips in Vehicles[1]	Percent[2]
Home-Based Work	2,459	18.8%
Home-Based Shop	1,236	9.4%
Home-Based School	1,304	9.9%
Home-Based Personal	1,174	8.9%
Home-Based Social/Recreation	982	7.5%
Home-Based Eat Meal	336	2.6%
Home-Based Job Related	211	1.6%
Home-Based Change Mode	55	0.4%
Home-Based Pick-up/Drop-off Passenger	1,340	10.2%
Non-Home-Based	3,992	30.6%
Total	13,089	99.9%

[1] The trips summarized in this table include only those trips made in motorized vehicles. Walk and other non-motorized trips are not included. In addition, the trips have not been linked. Trips made by residents into or out of the region have not been removed.

[2] The distribution of trips by trip purpose will be affected by the weighting of the survey data.

If all of the home-based non-work purposes are aggregated, they comprise about 50.6 percent of the total trips in the region. Home-based work trips comprise 18.8 percent and non-home-based trips comprise 30.6 percent of the total trips. These percentage breakdowns are not what would typically be expected in a metropolitan region. However, they will be affected by trip linking. The trip linking will have a tendency to increase the number (and share) of home-based work trips while reducing the numbers of home-based non-work trips and non-home-based trips. It is likely that almost all of the home-based change mode trips will be linked with their subsequent trips. Most of the resulting linked trips will probably be work trips. It's possible that one-third to one-half of the home-based pick-up/drop off passenger trips might also be removed by the linking. These actions should bring the proportions of trips by purpose closer to what might be expected for the region (i.e., more home-based work trips and fewer home-based and non-work and non-home-based trips). In addition, weighting the data to more closely match the socioeconomic distribution of household in the region could affect the results.

Trips by Mode

Table 14 summarizes the number of trips by travel mode. The data show a large percent of the total trips, 93.9 percent, being made by automobile either as a driver or passenger. Only 1.2 percent of the total trips were made by public transit in the survey. Thus, according to the survey, school bus ridership is almost four times greater than public transit ridership. Note, however, that the number and percent of trips by travel mode will be affected by the trip linking and survey weighting processes.

The effect of school bus trips should be considered before the recalibration of travel models. Schools bus trips are not normally modeled as a mode choice phenomenon since the riders are typically captive riders. It is possible that these trips will be "linked" out. Note that this would affect mode shares and shares by trip purpose summarized in this report. Alternatively, these trips could be modeled in trip generation and then removed later in the modeling process. This procedure would provide for flexibility in the future modeling of school trips.

As with the previous tables, only trips made in vehicles were summarized in Table 14. A total of 34 trips made by walking and 23 trips made in other modes were excluded from the data summarized in Table 14.

Table 14
Trips by Mode

Mode	Trips in Vehicles[1]	Percent[2]
Auto Driver	9,634	73.6%
Auto Passenger	2,657	20.3%
Public Bus	151	1.2%
Taxi	25	0.2%
School Bus	605	4.6%
Heavy Truck	17	0.1%
Total	13,089	100.0%

[1] The trips summarized in this table include only those trips made in motorized vehicles. Walk and other non-motorized trips are not included. In addition, the trips have not been linked. Trips made by residents into or out of the region have not been removed.

[2] The distribution of trips by mode will be affected by the weighting of the survey data.

Trips by Purpose, Income Group, and Household Size

Table 15 summarizes preliminary trip rates by trip purpose, income group, and household size. Table 15 is, in effect, a trip generation model. However, the rates shown in Table 15 will be affected by trip linking, decisions regarding the treatment of school bus trips, and adjustments to remove trips by residents into or out of the region.

Table 15
Preliminary Household Trip Rates by Purpose, Income Group, and Household Size[1]

Home-Based Work

	Household Size				
Income Group	1	2	3	4	5+
Low	0.68	0.93	1.15	1.22	1.28
Middle	1.03	1.04	2.12	2.38	2.07
High	0.89	2.10	2.40	2.35	2.25

Home-Based Non-Work

	Household Size				
Income Group	1	2	3	4	5+
Low	1.61	3.46	4.50	5.83	8.72
Middle	1.67	3.57	5.13	6.97	10.98
High	1.60	2.85	4.60	7.90	11.00

Non-Home-Based

	Household Size				
Income Group	1	2	3	4	5+
Low	0.91	1.64	1.96	2.44	2.04
Middle	1.82	2.37	3.07	3.92	4.04
High	1.77	2.59	4.35	4.36	5.16

[1] The trips summarized in this table include only those trips made in motorized vehicles. Walk and other non-motorized trips are not included. In addition, the trips have not been linked. Trips made by residents into or out of the region have not been removed.

The results summarized in Table 15 are, for the most part, reasonable. Trip rates increase as household sizes increase and, generally, as incomes increase. The home-

based non-work trip rates behave somewhat peculiarly, however, over the income group strata. This could be due to a lack of statistical significance in the differences of the trip rates by income group (controlled for household size variations) or it could signal a problem with the income group definitions used. It is possible that income tertiles do not properly reflect homogeneous socioeconomic groups.

Table 16 shows overall household and person trip rates by trip purpose. The overall, unweighted, unlinked trip rate per person is about 3.4 trips per person per day. It is likely that this rate will decrease to about the 3.1 to 3.3 trips per day range after all adjustments have been made to the survey data.

Table 16
Preliminary Trip Rates by Purpose[1,2]

Trip Purpose	Household Rate	Person Rate
Home-Based Work	1.70	0.64
Home-Based Non-Work	4.58	1.73
Non-Home-Based	2.77	1.04
Total	9.05	3.41

[1] The trips summarized in this table include only those trips made in motorized vehicles. Walk and other non-motorized trips are not included. In addition, the trips have not been linked. Trips made by residents into or out of the region have not been removed.

[2] The average overall trip rates will be affected by the weighting of the survey data.

Persons by Employment Status

Table 17 summarizes the people included in the survey by employment status. The numbers summarized in the table will be affected by the weighting of the data to adjust for socioeconomic biases.

The results shown in Table 17 appear to be logical. Based on the survey, males were more likely to hold full-time jobs than females. However, females were more likely to hold part-time jobs. Females were more likely to list homemaker as one of their employment status codes. Relatively equal shares of males and females were retired. Likewise, relatively equal shares were students. However, the results should be compared to the expected distribution of population by gender and employment status to test the reasonability of the results.

Table 17
Persons by Employment Status

Employment Category	Male		Female	
	Number	Percent[1, 2]	Number	Percent[1, 2]
Employed Full-Time	951	55.9%	717	38.4%
Employed Part-Time	99	5.8%	275	14.7%
Employed Multiple Jobs	40	2.4%	30	1.6%
Homemaker	3	0.2%	356	19.1%
Retired	172	10.1%	173	9.3%
Student	488	28.7%	495	26.5%
Other	58	3.4%	33	1.8%

[1] Percents do not sum to 100 percent since some respondents indicated multiple employment categories. Percents based on 1,700 male respondents and 1,866 female respondents.

[2] The distribution of the number of persons by employment category will be affected by the weighting of the survey data.

Single Heads of Households

Table 18 summarizes the number of households that have a single head of household. The information summarized in Table 18 will be affected by the weighting process to remove socioeconomic biases. It is interesting to note the large number of single head households. Overall, about 36 percent of the households had a single head. If the single person households were not considered in the single head group, this percentage dropped to about 16 percent.

Final Data Formats

The final data files are coded as dBase files. The following sections describe the file formats and explain codes used for various data items.

Final Household Data File

Table 19 shows the final household data file structure. The final household data file is named HHOLD90.DBF. This file contains 1,446 household records.

Table 18
Single Heads of Households

Single Head of Household

	Household Size				
Income Group	1	2	3	4	5+
Less than $10,000	48	13	14	4	4
$10,000 - $14,999	33	16	3	5	3
$15,000 - $19,999	45	24	13	2	1
$20,000 - $24,999	37	18	6	1	0
$25,000 - $29,999	23	8	4	0	2
$30,000 - $34,999	26	11	6	2	1
$35,000 - $39,999	15	11	2	0	1
$40,000 - $49,999	16	14	3	3	1
$50,000 - $59,999	10	3	2	1	1
$60,000 or more	9	5	7	2	0
Refused	24	6	8	3	2
Total	286	129	68	23	16

Non-Single Head of Household

	Household Size				
Income Group	1	2	3	4	5+
Less than $10,000	-	11	4	0	3
$10,000 - $14,999	-	11	10	4	6
$15,000 - $19,999	-	22	8	3	8
$20,000 - $24,999	-	24	7	14	8
$25,000 - $29,999	-	31	15	12	13
$30,000 - $34,999	-	27	16	12	12
$35,000 - $39,999	-	33	19	22	17
$40,000 - $49,999	-	58	34	37	22
$50,000 - $59,999	-	46	32	29	14
$60,000 or more	-	77	38	52	30
Refused	-	44	14	19	3
Total	-	384	200	204	136

Table 19
DBase File Data Structure
Final Household Data File (HHOLD90.DBF)

Field	Field Name	Type	Width	Description
1	RECTYPE1	Numeric	1	Record Type
2	SAMPNO	Numeric	4	Sample Number
3	FAMSIZ	Numeric	2	Family Size
4	FAMSIZ5P	Numeric	2	Family Size (5 Years and Older)
5	VISITORS	Numeric	1	Number of Visitors on Travel Day
6	AUTOS	Numeric	1	Auto Available
7	INCOME	Character	1	Income Code
8	TRAVELD	Numeric	4	Travel Day
9	LSTPHONE	Numeric	1	Listed Telephone?
10	TRIPS	Numeric	2	Number of Trip Makers
11	TRPMKRS	Numeric	2	Number of Non-Trip Makers (Trips in Vehicles)
12	NTRPMKRS	Numeric	2	Number of Non-Trip Makers
13	COMPLTNC	Numeric	1	Completion Code

Field 7–Income Code

Income code is a character field as follows:

0	Less than $10,000
1	$10,000 - $14,999
2	$15,000 - $19,999
3	$20,000 - $24,999
4	$25,000 - $29,999
5	$30,000 - $34,999
6	$35,000 - $39,999
7	$40,000 - $49,999
8	$50,000 - $59,999
9	$60,000 or more
R	Refused

Field 8–Travel Day

Travel day is a four-digit number designating the month of the survey in the first two digits and the day of the survey in the last two digits. For example, if the travel day is September 5, this field is coded as 0905; November 14 is coded as 1114.

Field 9–Listed Phone

Listed phone is a numeric code as follows:

1 Yes, the phone number is listed (i.e., listed)
2 No, the phone number is not listed (i.e., unlisted)

Field 13--Completion Code

Completion codes are as follows:

1 Completed Survey
2 Refused
3 No one home, repeated calls
4 Language Problems
5 Not in the area on the travel date
6 Sick on the travel date
7 Household was demolished or converted to commercial use
8 Household moved
9 Other

Final Person Data File

Table 20 shows the final person data file structure. The final person data file is named PERSON90.DBF. This file contains 3,566 person records (these are for household members five years old and older and visitors).

Field 4–Relationship to Head

This field is a numeric code as follows:

1 Head of Household
2 Spouse / Partner
3 Child
4 Other Member of Household
5 Out-of-Area Visitor

Field 5--Age

The actual age of the respondent is coded. If age was refused, 99 has been coded.

Table 20
DBase File Data Structure
Final Person Data File (PERSON90.DBF)

Field	Field Name	Type	Width	Description
1	RECTYPE2	Numeric	1	Record Type
2	SAMPNO	Numeric	4	Sample Number
3	PERSNO	Numeric	2	Person Number
4	RELATION	Numeric	1	Relation Code
5	AGE	Numeric	2	Age
6	GENDER	Numeric	1	Gender
7	LICENSE	Numeric	1	Licensed Driver?
8	EMPSTAT	Character	5	Employment Status
9	INTERVIEW	Numeric	1	Interviewed?
10	DIARY	Numeric	1	Diary Used?

Field 6–Sex

The codes for this field are as follows:

1 Male
2 Female

Field 7–Driver's License

The codes for this field are as follows:

1 Yes (respondent has a valid driver's license)
2 No (respondent does not have a valid driver's license)

Field 8–Employment Status

At least one and up to five numbers have been coded in this field. The numbers are left justified, and each digit is different (e.g., a code of 112 is not valid). Employment status codes are as follows:

1 Employed Full Time
2 Employed Part Time
3 Employed Multiple Jobs

4 Homemaker
5 Retired
6 Student
7 Other

Final Trip Data File

Table 21 shows the final trip data file structure. The final trip data file is named TRIPS90.DBF. This file contains 16,712 trip records.

Field 4–Trip Number

For the starting location for the day, the trip number is recorded as "00". For subsequent trip records, trip numbers will be 01, 02, 03, ... Note that each person for each household will have at least one trip record for the day (the 00 record), even if that person made no trips on the travel day.

Fields 5 through 8--Address Information

The data coded in these four fields will depend on how the address has been specified. If an actual street address has been given, the following format will be used:

Field 5--Address 1: The street number will be coded here, left justified.

Field 6--Direction: A one-character abbreviation for North, South, East, or West will be coded if given. Otherwise, this field will be blank.

Field 7--Address 2: The street name will be entered here, left justified.

Field 8--Street Type/Corner: A two-character code will be entered here to designate the type of street, as appropriate. Codes are as follows:

Street	ST	Boulevard	BV
Avenue	AV	Parkway	PK
Drive	DR	Way	WY
Road	RD	Place	PL
Lane	LN		

Table 21
DBase File Data Structure
Final Trip Data File (TRIP90.DBF)

Field	Field Name	Type	Width	Description
1	RECTYPE3	Numeric	1	Record Type
2	SAMPNO	Numeric	4	Sample Number
3	PERSNO	Numeric	2	Person Number
4	TRIPNO	Numeric	2	Trip Number
5	ADDRESS1	Character	29	Address 1 Information
6	DIRECTION	Character	1	Street Direction
7	ADDRESS2	Character	28	Address 2 Information
8	STRTYP	Character	2	Street Type
9	CITY	Character	23	City
10	STATE	Character	2	State
11	ZIPCODE	Numeric	5	Zip Code
12	PLACE	Numeric	1	Kind of Place
13	PURPOSE	Numeric	1	Trip Purpose
14	BEGIN_TIME	Numeric	4	Beginning Time
15	BEGIN_AMPM	Character	1	Beginning Time (AM or PM)
16	END_TIME	Numeric	4	Ending Time
17	END_AMPM	Character	1	Ending Time (AM or PM)
18	MODE	Numeric	1	Travel Model
19	AUTO_OCC	Numeric	1	Auto Occupancy

If the address is given as intersecting streets, the following format is used:

Field 5--Address 1:	The first street name is coded here, left justified.
Field 6--Direction:	An ampersand (&) is coded here.
Field 7--Address 2:	The second street name is coded here, left justified.

Field 8--Street Type/Corner: If a corner of the intersection has been given, a one- or two-digit directional code is coded here (left justified). Possible codes are:

North--N	Northeast--NE
South--S	Northwest--NW
East--E	Southeast--SE
West--W	Southwest--SW

If the address is given as a place name, all four fields were used as necessary to code the location (always left justified).

Finally, if the address was home, "HOME" is coded in Field 5--Address 1, left justified. In this special case, Fields 6 through 11 (Direction, Address 2, Street Type/Corner, City, State, and Zip Code) are left blank. The information can be obtained from the sample file (SAMPLE.DBF).

Field 9--City

This information is the city of the starting location for the day or the city for the subsequent destinations (if HOME is not recorded in Field 5).

Field 10--State

This information is the state of the starting location for the day or the state for subsequent destinations (if HOME is not recorded in Field 5). The information is entered in capital letters using the two character state abbreviations (e.g., IL for Illinois or MO for Missouri).

Field 11--Zip Code

This information is the zip code of the starting location for the day or the zip code for subsequent destinations, if reported (if HOME is not recorded in Field 5).

Field 12--Kind of Place

This information is the one-digit land-use code. Land-use codes are as follows:

0 Residential
1 Agriculture, forestry, and fishing
2 Manufacturing--durable items
3 Manufacturing--nondurable items
4 Transportation, communications, and other industrial nonmanufacturing
5 Commercial retail
6 Commercial services

7 Wholesale trade and contracting
8 Public and quasi-public buildings
9 Public and quasi-public open spaces

Field 13--Trip Purpose

Trip purposes are as follows:

0 Return Home
1 Go to Work
2 Shopping
3 School
4 Personal
5 Social / Recreational
6 Eat Meal
7 Job Related
8 Change Mode (e.g., auto to bus)
9 Pick Up / Drop Off Passenger

Field 14--Dummy (for 00 Trip Record)

On the trip record for the starting location for the day, the remaining information is blank. This information is actually Fields 14 through 19 for normal trip records.

Field 14--Beginning Time of Trip

The hours and minutes for the start of the trip are recorded (e.g., 7:35 is coded as 0735).

Field 15--AM or PM

An "A" is recorded for AM and a "P" for PM.

Field 16--Ending Time of Trip

See Field 12.

Field 17--AM or PM

See Field 13.

Field 18--Mode of Travel

Travel modes are as follows:

1 Driver (Auto, Van, Pick-up, Motorcycle)

2 Passenger (Auto, Van, Pick-up, Motorcycle)
3 Public Bus
4 Taxi
5 School Bus
6 Heavy Truck
7 Walk or Bicycle (to Work)
8 Other

Field 19--Number in Vehicle

Codes for the number of persons in the vehicle are as follows:

1 One Person (i.e., the Driver)
2 Two Persons
3 Three Persons
4 Four Persons
5 Five Persons
6 Six Persons
7 Seven Persons
8 Eight Persons
9 Nine or More Persons
0 Not Applicable (i.e., Mode of Travel Was Not Driver)

Sample Data File

Table 22 shows the final sample data file used for the survey. The file is named SAMPLE.DBF and contains 9,584 records. Note that not all of the samples were used in the survey.

Field 6--Phone

This is the phone number for the sample household.

Field 7--Listed

This logical field tells whether or not the phone number in field is a listed phone:

T Phone is listed
F Phone is unlisted

Field 8--Telephone ID Number

This is the employee number of the survey recruiter who made the initial contact with the household.

Table 22
DBase File Data Structure
Sample Data File (SAMPLE.DBF)

Field	Field Name	Type	Width	Description
1	SAMPNO	Numeric	4	Sample Number
2	NAME	Character	30	Name
3	ADDR1	Character	30	Street Address
4	ADDR2	Character	30	Apartment Number
5	ADDR3	Character	37	City, State, Zip
6	PHONE	Character	13	Phone
7	LISTED	Logical	1	Listed Phone
8	TELID	Numeric	3	Telephone ID Number
9	DATE	Date	8	Date
10	OUTCOME	Numeric	1	Outcome Code
11	CARS	Numeric	1	Number of Cars
12	FSIZE	Numeric	2	Number of People
13	FIVE	Numeric	2	Number of People 5+
14	AGREE	Logical	1	Agree Code
15	TRAVELD	Date	8	Travel Date
16	DAY	Numeric	1	Day Code
17	LANG	Character	1	Language Code
18	ASSIGNNO	Numeric	3	Assignment Number
19	COMP	Numeric	1	Completion Code
20	FIELDID	Numeric	3	Field I.D. Number
21	TRIPS	Numeric	2	Number of Trips
22	COUNTY	Numeric	5	State/County Code
23	INCGRP	Character	1	Income Group
24	REPLICATE	Numeric	2	Replicate Number

Field 9–Date

This is the date of the initial telephone contact. The dates are recorded in the following format: mm/dd/yy.

Field 10--Outcome Code

This is the outcome of the initial telephone contact. The codes are as follows:

0	not called
1	complete; accepted
2	refusal; not accepted
3	disconnected phone
4	wrong number / household moved
5	commercial number
6	busy quit (busy for 5 continuous days)
7	no answer quit (no answer for 5 continuous days)
8	out-of-area residential location
9	other (e.g., language problem)

Field 14--Agree Code

This variable is set to "t" for households agreeing to participate in the survey; otherwise, the code is "f."

Field 15--Travel Date

This is the date of the travel day. The date is recorded in the following format: mm/dd/yy.

Field 16--Day

This is the weekday numeric value for the travel day. The range for this code is "1" to "7" for Sunday to Saturday. The code is set based on the travel date. Only codes 3, 4, and 5 were used since surveying took place only on Tuesdays, Wednesdays, and Thursdays.

Field 17--Language Code

If the household is English-speaking, the code is "e." If the household is Spanish-speaking, the code is "s."

Field 18--Assignment Number

This was a special code used for tracking the survey.

Field 19--Completion Code

This is the completion status for the actual interview. The codes are as follows:

0	not interviewed yet

1	completed
2	refused
3	no one home, repeated call
4	language problem
5	out-of-area on travel day
6	sick on travel day
7	household demolished/converted to commercial property
8	household moved
9	other (e.g., disconnected phone number)

Field 20--Field ID Number

This is the employee number of the surveyor who made the final contact with the household to collect travel data.

Field 22--County

This is the state and county in which the household resides (using U.S. Census Bureau "FIPS" codes). The first two digits of the code indicate the state, and the last three digits indicate the county. The codes are as follows:

FIPS	State	County
29099	Missouri	Jefferson
29183	Missouri	St. Charles
29189	Missouri	St. Louis
29510	Missouri	St. Louis City
17119	Illinois	Madison
17133	Illinois	Monroe
17163	Illinois	St. Clair

Field 23--Income Group

Income group was obtained from the household data form. Income groups and ranges are:

A	Under $10,0000	F	$30,000 - $34,999
B	$10,000 - $14,999	G	$35,000 - $39,999
C	$15,000 - $19,999	H	$40,000 - $49,999
D	$20,000 - $24,999	I	$50,000 - $59,999
E	$25,000 - $29,999	J	$60,000 or more

If the household declined to answer this question, the income group is coded as "R," for refused.

Field 24--Replicate Number

This is the replicate number for the sample. Replicates are numbered 1-23.

8.
The Next Steps

The following sections describe tasks that need to be performed by EWG to prepare the survey data for use in recalibrating travel models.

Geocoding Procedures

Three dBase data files, a household data file, a person data file, and a trip data file, were delivered to EWG as a result of the project. In addition, the original sample data file was also delivered. The formats of the data files are described in Chapter 7. Home address information exists for households on the sample data file and trip destination address information exists on trip data files. Geocoding is the process of converting the address information to the geographic areas comprising the St. Louis transportation zones.

EWG will convert the address information to zone information using a combination of automated and manual procedures. There are several procedures that can be used to simplify this process that are discussed, briefly, below.

As noted in Chapter 7, several different methods were used to code address information:

- Coding of the actual street address information.
- Coding of intersecting streets.
- Coding of place names.
- The special address code, "Home".

All home addresses on the sample file were coded as actual street addresses. Destination addresses on the trip file were coded using one of the four alternatives. Thus, the initial step in geocoding should be to separate the address data into five groups:

- Sample file home addresses (only the 1,446 households included in the final survey).
- Trip records with addresses coded as full addresses.
- Trip records with addresses coded as intersections.
- Trip records with addresses coded as place names.
- Trip records with addresses coded as "home".

Each of the geocoding data files needs up to four items of information:

- Sample number.
- Person number (on trip records only).
- Trip number (on trip records only).
- Addresses (including 90 characters of data for address, city, state, and zip code).

The sample number, person number, and trip number provide the survey identification information necessary to merge the geocoded data with the original data files.

The trip data file can be split into the four geocoding files using the following rules and procedures:

- Create a temporary full geocoding file with the four data items (sample number, person number, trip number, and address).

- If the address for a record is "HOME", "Home", or "home", write the record to the "home" geocoding file and delete the record from the temporary full geocoding file.

- If the 30th character ("street direction") of the address is an ampersand (&), write the record to the intersection geocoding file and delete the record from the temporary full geocoding file.

- Sort the remaining records in the temporary full geocoding file by ascending address. All actual addresses should be at the beginning of the file and records with place names recorded as addresses should be at the end of the file. "Manual" techniques can be used to split the remaining records of the full geocoding file into an address geocoding file and a place name geocoding file.

The "home" geocoding file should be sorted by ascending sample number, person number, and trip number.

The address geocoding file should be sorted in ascending order by the following fields:

- Street name (the 31st through 58th characters).
- Direction (the 30th character).
- Street number (the 1st through 29th characters).
- State.
- City.

The intersection geocoding file should be sorted in ascending order by the following fields:

- First street name (the 1st through 29th characters).
- Second street name (the 31st through 58th characters).
- State.
- City.

The place name geocoding file should be sorted in ascending order by the following fields:

- Place name (all 60 characters).
- State.
- City.

Sorting the files as suggested above has two main benefits. First, it allows an analyst to quickly scan the file to find variations in spellings of the same address, street, city, etc. This will allow for standardization of those spellings. Second, it will simplify and speed the manual geocoding of addresses that could not be geocoded using the automated process. This will happen since addresses will be grouped by street name or place name. Whenever multiple records with the same destination location are found, the zone number for the address will need to be found only once.

Once all the sample file addresses have been geocoded, they should be sorted by sample number. The zone information than can be merged with the trip information for destinations coded as "home". The key to matching the correct zone number with the correct home information will be the sample number.

Once all addresses have been geocoded, the zone information can be remerged with the original trip data. The keys to matching the correct zonal information with the correct trip information will be the sample number, the person number, and the trip number.

Procedures to Link Trips

Trips obtained in a home interview survey are often linked. Linking means the combining of two or more trip records into a single record. The reasoning behind linking has to do with trip generation and the simulation of trips. For example, if a

person is driven from home to a bus stop from whence he or she catches a bus to work, the home interview survey technique will pick-up four person trips as follows:

- Trip from home to change mode for person 1.
- Trip from change mode to work for person 1.
- Trip from home to pick-up/drop-off passenger for person 2.
- Trip from home to pick-up/drop-off passenger to some other purpose for person 2.

All four of these trips might be candidates for linking. The linking of the first two trips would produce a combined trip from home to work.

The linking of the second two trips would require some analysis. If person 2 continued on to another non-home location, his or her trip should be linked. If, however, person 2 returned home, his or her trips should not be linked--the resulting home-to-home trips would be illogical. There might be other cases where the pick-up/drop-off passenger trip should not be linked. If the person stayed at the location where the passenger was picked-up/drop-off for more than, say, five minutes, the trip should not be linked.

Because of the methodology used to store the trip data for the St. Louis Survey, six trip records would be used to store the four trips in the example above. As documented in Chapter 7, only destination addresses and destination trip purposes are coded on trip records, with the exception of the "zero" trip record, which has the origin of the day's trip making for each traveler. Origins and destinations zones and origin and destination trip purposes for specific trips are obtained in a cascading manner, the destination information shown on a specific trip record for a specific person is the origin information for the subsequent trip record. Thus, the first two trips shown in the example could be represented by the following trip record information:

Trip Number	"Destination" Zone	Trip Purpose	Start Time	End Time	Mode
0	256	1	---	---	--
1	256	8	7:16 AM	7:20 AM	2
2	298	2	7:25 AM	7:55 AM	3

In the linking process, trip number 1 would be "linked" out. However, the record cannot simply be thrown away; some of the information on trip number 1 is essential for properly describing the trip. The information that might be taken from the "linked-out" trip record is start time of the trip, mode, and auto occupancy. Start time should always be obtained from the linked out record. Mode should be taken from the linked out record based on a hierarchy of modes. If the mode on the linked out record is higher in the hierarchy than the mode recorded for the ending record in the trip

sequence, the mode should be taken from the linked out record. A suggested hierarchy, in decreasing order, is as follows:

- Public bus (mode 3).
- Auto passenger (mode 2).
- School bus (mode 5).
- Auto driver (mode 1).
- Taxi (mode 4).
- Heavy truck (mode 6).
- Other (mode 8).
- Walk or bike to work (mode 7).

In the example shown above, the mode would be taken from the last record in the sequence since mode 3, public bus, is higher in the hierarchy than the mode 2, auto passenger, mode listed for the linked record. Note, however, that if the example had been a trip from work to home following the reverse pattern (i.e., bus changing mode to auto passenger), the mode would have been taken from the "linked-out" record.

For auto occupancy, the value used to describe the auto occupancy for the trip should be the highest auto occupancy recorded in the trip record sequence. For example, if a carpooler drives alone from home to pick-up the passenger, (thus making a serve passenger trip), and the driver and passenger then proceed to work, the highest auto occupancy coded on the trip sequence would be 2. The auto driver's trips would be linked to form one home to work trip (two trip records in the St. Louis trip data file).

Survey Weighing

As was noted in Chapter 7, Survey Results, there were differences in the surveyed distribution of households and the estimated distribution of the universe of households by socioeconomic and geographic strata. The differences in the sample distribution of households should be corrected before any aggregate results of the data are reported. For example, if an average home-based work trip rate for the region is calculated and reported, ideally, the reported rate should be adjusted to account for the undersampling of the low income households and subsequent oversampling of the middle and high income households. If the aggregate rates were developed from unfactored data, they would have a tendency to overstate the average trip rate since the low trip making, low income households would not be fully represented in the region.

Note that the above problem occurs only when the aggregate rates reported were calculated for a stratification across which there is a bias. If, for example, the only bias in the sample data set was by income group and household size, average trip rates calculated for each income group and household size will be unaffected by the bias. In this case, it would be possible to calibrate a cross-classification trip production model since the average trip rates calculated for each strata would be unaffected by the biases in the sample.

In addition, if the trip rates do not vary across the strata for which there is a bias, there will be no effect of the bias. In other words, there would be no adverse effect on average trip rates of a survey biased by geographic area, if the trip rates did not vary across the different geographic areas (after accounting for variations in the number of households by income group and household size).

The conventional technique for calculating expansion factors, or weights, is to use the ratio of the number of elements in the universe to the number of sample elements for each stratum:

$$W_h = \frac{M_h}{N_h}$$

where:

W_h is the expansion factor for stratum h.
M_h is the number of element in the universe for stratum h; e.g., the number of households in an income group / household size stratum.
N_h is the number of sampled households in stratum h.

In applying this procedure, care should be used to ensure that a reasonable number of sampled households are in each stratum being factored. Typically, 30 (households) has been used as a minimum number of sampled households to have in a stratum although it might be reasonable to relax this criterion in certain cases (e.g., if only one or two of the strata have 25 observations). In cases where the chosen minimum number of households do not exist in a stratum, the stratum can be combined with an adjacent stratum with similar characteristics. If the strata are defined by household size and income group, it would probably be better to aggregate across household size (for large household sizes such as four and five or more) and across income group for low household sizes (one person households).

The above criterion limits the number of strata that can reasonably be used in calculating the expansion factors. Disaggregation of the strata to a level below income group and household size might be difficult. If an adjustment for geographic biases is desired, it might be best to use only two geographic strata such as St. Louis City and the rest of the region. The addition of this stratification would double the number of cells. However, it might be important for the calibration of trip attraction and trip distribution models.

To calculate expansion factors, a current estimate of the number of households by the strata chosen is needed. The 1990 estimates of the number of households by income group and household size is a good starting point. However, when they become available, the 1990 Census data should be used to calculate the expansion factors. Table 23 shows survey expansion factors calculated using an estimate of 862,500 households in the survey area, the estimated distribution of households shown in Table 2, and the observed distribution of households shown in Table 3. Note that the

Table 23
Preliminary Survey Expansion Factors

	Household Size				
Income Group	1	2	3	4	5+
Low	1,143	720	597	1,102	725
Medium	640	582	575	520	463
High	542	489	625	591	812
Income Unreported	0	0	0	0	0

expansion factors for those households that refused to report their incomes are zero for this method of calculating the expansion factors. In effect, those households are "lost" from the survey when information based on expanded data is summarized.

9.
Evaluation of the Soundness of the Data

In general, the St. Louis travel survey seems to have produced high quality data. Preliminary summaries of trip rates, distributions of trips by trip purpose, and distributions of trips by mode appear to be quite reasonable. The trip rates and distributions by trip purpose and mode should be resummarized after trip linking and survey weighting and compared to results for other parts of the country. Table 24 shows results from New Jersey, Denver, Dallas-Fort Worth, and Seattle that can be used for comparison purposes.

The survey does have some socioeconomic biases that should be corrected. Similar biases have occurred in other surveys and are common in sample surveys. A process to correct for the socioeconomic biases exists and has been described in this report. After the weighting is performed, final results can be summarized for the region. Even without the weighting, the travel survey can safely be used to recalibrate the trip production model. Calibration of the trip attraction model and trip distribution model should be delayed until after the 1990 Census data are acquired and final survey expansion factors calculated.

Table 24
Trip Making Characteristics from Selected U.S. Cities

	St. Louis	New Jersey	Denver	Dallas/ Fort-Worth	Seattle
Year for Data Collection	1990 (Preliminary)	1986	1985	1984	1985-88
Trips/Person/Day	3.4	2.7	3.0	3.4	4.25
Percent of Trip by Purpose					
HBW	19%	27%	26%	27%	18%
HBNW	50%	50%	47%	48%	52%
NHB	31%	23%	27%	25%	30%
Percent of Trips by Mode					
Auto Driver	73.6%	NA	75.9%	78.3%	68.5%
Auto Passenger	20.3%	NA	19.0%	20.1%	19.7%
Public Transit	1.2%	NA	2.5%	1.6%	3.3%
School Bus	4.6%	NA	2.6%	NA	5.5%
Other	0.3%	NA	NA	NA	5.5%

APPENDIX

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MEMORANDUM TO: Mark Myavec
East-West Gateway Coordinating Council

FROM: David L. Kurth
Barton-Aschman Associates, Inc.

DATE: May 21, 1990

SUBJECT: Task B.1--Determination of Sample Sizes

Introduction

This technical memorandum summarizes the results of Task B.1, Sample Size, of the St. Louis Region Small Sample Travel Survey. It describes determination of the recommended sample size, the expected breakdown of samples into socioeconomic and geographic strata, and the calculation of statistical significance levels associated with the survey.

Sample Size Determination

A sample size of 1,400 households has been recommended for the survey. This number was chosen based on three main criteria:

- The models to be calibrated using the survey.
- The statistical significance of the survey results.
- The available budget for the survey.

The survey will be used primarily for the calibration of trip production models. Other uses will include the calibration of trip attraction models and trip distribution models. Experience with previous model calibrations has shown that a sample of about 1,300 to 1,600 households provides sufficient data to calibrate reasonable trip production, trip attraction, and trip distribution models.

The statistical significance of data generated by the survey is also a concern in the design of the survey size. The ability to specify accuracy levels and confidence levels for the survey allows the results to conform to desired overall accuracy and enhances usefulness of the survey data. It is important to be assured of a minimum and explicit level of error as the result of sampling.

Specific statistical accuracy and confidence levels associated with the St. Louis Region Small Sample Travel Survey will be covered in more detail in following sections.

The funds available dictated an upper limit on the size of the survey. Budget constraints limited the sample size to 1,400 households. This sample size should be sufficient for the calibration of trip production models, as demonstrated in the section on calculation of significance. In addition, it should provide sufficient data to calibrate trip attraction and trip distribution models for the St. Louis region.

Allocation of Samples to Socioeconomic Strata

For the St. Louis region, one of the main uses of the survey, as described above, will be the recalibration of the trip production models. Since the trip production models are stratified by income group and household size, the allocation of sample households to the various strata is a prime concern. Three basic methods can be considered for the allocation of samples to the socioeconomic strata:

- Allocation to ensure equal accuracy in each stratum.
- Optimum allocation.
- Allocation proportional to the distribution of households in the region.

The first method specifies a level of accuracy and confidence level for each stratum; for example, ± 10 percent at the 90 percent confidence level. Two difficulties emerge from such an approach. First of all, the accuracy requirement for a stratum should be related to the size of the stratum in the universe. Why should information for households in a stratum which contributes only two percent of the trips in the region have the same precision as a stratum that contributes 15 percent of the trips. Second, if the precision level is set such that, for example, only one-half of the expected number of households in a stratum are required to satisfy the precision requirement, then the required number of samples for the stratum will be obtained about one-half way through the survey. Households in that stratum will be discarded for the remainder of the survey with an attendant increase in the cost of the survey.

An alternative to the first method is optimal allocation. This method sets the sample size per stratum proportional to the product of the standard deviation of the variable to be measured in the stratum and the proportion of the households in the stratum. In this way, strata that have a large number of households are represented in proportion to their occurrence in the universe of all households in the region. At the same time, if the standard deviation of a variable for one stratum is larger than the standard deviation for another stratum, the stratum with the high standard deviation will be given proportionately more samples.

There are also two difficulties with the second approach. First, the optimal allocation can vary based on the variable being considered. The optimal allocation based on home-based work trip rates might be different from the optimal allocation based on home-based non-work trip rates. Second, as with the first allocation method, the optimal allocation costs more since households will be rejected once the optimal number of samples is obtained for a cell.

We recommend the third allocation process--allocation to strata proportional to households in the region. The third allocation process is straightforward to apply and is cost-effective. Although the precision levels for each stratum will vary using the third method, the precision levels will tend to follow the cell's importance in trip-making in the region.

The third sample allocation procedure could be applied as a quota sample--when the expected number of household for a stratum have been obtained, additional sample households for the stratum are discarded. This procedure would reduce the cost-effectiveness of the third sample allocation technique and is not recommended at this extreme. However, as is discussed in the next section, it is recommended that the sample be monitored for biases (e.g., undersampling of low income households).

Expected Sample Households by Socioeconomic and Geographic Strata

Using the latest available demographic figures, we estimated the expected breakdown of a representative 1,400-household sample into subsample cells representing socioeconomic and geographic stratifications in the region. The socioeconomic profile of the region is reflected in two breakdowns: by household size and income, and by household size and auto availability. The geographic profile is reflected in a breakdown by county. The distributions will be used to monitor for potential biases in the sample.

The distribution of households by household size and income, shown in Table 1, was estimated from draft projections of households in the region by size and income group for 1990, prepared by the East-West Gateway Coordinating Council. The projections are being reviewed by the council and might be revised.

Three income groups were used: low income, medium income, and high income. The groups are based on the current groupings used in the St. Louis region for travel modeling purposes and correspond roughly to income tertiles. In 1990 dollars, the annual household income tertile breakpoints are estimated as:

Low Income:	less than $20,000
Medium Income:	$20,000 to $40,000
High Income:	more than $40,000

Table 1
EXPECTED DISTRIBUTION OF SAMPLE HOUSEHOLDS
BY INCOME GROUP AND HOUSEHOLD SIZE

Income Group	Household Size 1	2	3	4	5+	Total
Low	234	113	50	32	30	459
Medium	105	154	70	53	41	423
High	31	161	117	119	90	518
Total	370	428	237	204	161	1,400

Table 2
EXPECTED DISTRIBUTION OF SAMPLE HOUSEHOLDS
BY AUTO AVAILABILITY AND HOUSEHOLD SIZE

Autos Available	Household Size 1	2	3	4	5+	Total
0	84	46	21	14	12	177
1	189	188	96	78	63	614
2+	97	194	120	112	86	609
Total	370	428	237	204	161	1,400

The distribution of households by household size and automobile availability, shown in Table 2, was estimated based on the 1980 Census journey-to-work data on the number of autos available to households in the region by income group.

This information will be used only for rough estimates of the number of households by auto availability and household size. It will be useful for summarizing the results of the pre-survey qualification calls. Information regarding household size and auto availability will be asked in during the qualification calls. This information will be summarized and compared to Table 2 throughout the survey to monitor the survey for socioeconomic biases. If a bias in the number of surveyed households by auto availability and household size becomes apparent from the summary of the pre-survey qualification calls, it is likely that there will also be a bias in the number of households by income group and household size. Tracking the pre-survey qualification calls will provide about two to three weeks lead time to determine whether sample biases are occurring in the survey. If severe sample biases do seem to be occurring, options and costs for correcting those biases will be discussed with the council. Options might include oversampling in an area, revising the survey to a quota survey, or simply accepting the bias and adjusting regional estimates through weighting of the survey results.

The distribution of households by county, shown in Table 3, was based on 1990 projections of households for the St. Louis region, made by East-West Gateway. The county estimates were derived by aggregating results for regional analysis areas. In addition, the table shows the expected number of households for the City of St. Louis. These estimates show that 1,085 of the households, or 77.5 percent, will be drawn from Missouri, and 315, or 22.5 percent, will be from Illinois.

Statistical Significance of the Survey

Statistical significance is a quantification of the degree of certainty that the experimental or survey results did not occur by chance. A result is said to be significant when the likelihood of its being random falls below a certain agreed-upon level of probability, called the "accuracy level." This probability of error decreases as the size of the sample is increased, but can never be completely eliminated.

An accuracy level is therefore the percentage of sampling error that is acceptable to the analyst. For example, sufficient samples might be collected to estimate the average household trip rate within ± 10 percent with 90 percent confidence. That is, if the trip rate is estimated at 8.0 trips per household, the analyst can be reasonably sure that the actual rate is between 7.2 and 8.8 trips per household. Note that the analyst is only reasonably sure, not certain. The confidence

Table 3
EXPECTED DISTRIBUTION OF SAMPLE HOUSEHOLDS BY COUNTY

Geographic Location	Analysis Area	Expected Number of Samples: Analysis Area	Expected Number of Samples: County
St. Louis City	1	28	
	2	41	
	3	106	
	4	51	
	5	59	
	City Total		285
St. Louis County	6	83	
	7	38	
	8	54	
	9	38	
	10	148	
	11	76	
	12	76	
	13	72	
	14	45	
	County Total		630
St. Charles County	15 (Part)	30	
	16 (Part)	74	
	17 (Part)	13	
	18 (Part)	6	
	County Total		123
Jefferson County	24	47	
	25	0	
	26	0	
	27	0	
	28	0	
	County Total		47

Table 3 (cont'd)
EXPECTED DISTRIBUTION OF SAMPLE HOUSEHOLDS BY COUNTY

Geographic Location	Analysis Area	Expected Number of Samples: Analysis Area	Expected Number of Samples: County
Madison County	29	71	
	30	40	
	31	40	
	32	0	
	County Total		151
St. Clair County	33	54	
	34	11	
	35	94	
	36	0	
	37	0	
	County Total		159
Monroe County	38	5	
	39	0	
	40	0	
	County Total		5
Regional Total			1,400

limit of 90 percent means that, if 10 independent random samples of the same size were taken, nine of the 10 resulting trip-rate estimates would fall between 7.2 and 8.8 trips per household.

Calculation of Statistical Significance

Three elements determine the accuracy level of estimates of a variable in a random sample:

- The amount of variation in the variable being examined.
- The number of samples in the survey.
- The confidence limits considered desirable.

The variation of the variable in the sample is measured by the coefficient of variation which cannot actually be empirically estimated until the survey data have been collected. Reasonable estimates of the coefficient of variation can be made, however, based on past surveys and reports. For of the St. Louis regional travel survey, the 1965 travel survey can be used to provide good estimates of the coefficients of variation.

The formula for computing the accuracy level of a variable where the sample universe is all households is:

$$E = (C^2 * Z^2 / n)^{.5} \qquad (1)$$

where:

E is the accuracy level relative to the mean expressed as a decimal fraction,
C is the coefficient of variation,
Z is the value of Student's t-distribution for the desired confidence limits (1.96 for 95 percent confidence and 1.645 for 90 percent confidence), and
n is the number of samples.

Note that the above formula is appropriate in calculating rates for household-based variables, such as average household trips or average home-based work trips per household.

Calculations of accuracy and confidence levels for rates where the basis of the rate is not households (e.g., trips per person or percentages of trips by purpose) might be impacted by clustering effects. See the Appendix for a discussion of the effects of clustering on sample statistics.

Statistical Significance of Trip Rates

Estimates of the coefficients of variation for the regional average household trip rate by trip purpose, based on the 1965 St. Louis travel survey, were used to calculate the accuracy levels expected for the 1,400-household St. Louis Region Small Sample Travel Survey. Table 4 shows the average trip rates, standard deviations, and resulting coefficients of variation. It also summarizes the expected accuracy levels at the 90 and 95 percent confidence intervals for the 1,400-household survey.

These accuracy levels should be used mainly as a barometer of the accuracy associated with the survey, since the average overall household trip rates and regional trip rates by trip purpose are not generally used in trip production models.

These results suggest that, with a 1,400-household sample, it should be possible to estimate the regional average household trip rate for home-based work trips and for total trips within ± 5 percent accuracy at the 95 percent confidence level. It will not, however, be possible to estimate the average trip rates for home-based shop, home-based other, home-based non-work (i.e., combined home-based shop and home-based other), and non-home-based with as much accuracy. The accuracy level for the estimate of the average non-home-based trip rate will be somewhat lower than for the other trip purposes: ± 11.8 percent at the 95 percent confidence level.

The calibration of the trip generation production model will be affected by the accuracy level of trip rates for each household size-income group combination. The accuracy level for each stratum can be calculated using Equation 1, shown previously. It will also be important to determine the number of household size-income group strata to use in the model. One method for determining the number of strata is to estimate the average trip rates on a cell-by-cell basis for each combination of household size and income group. Average trip rates for adjacent cells are then compared to determine whether or not they are statistically significantly different, using the formulae:

$$s^2 = \frac{(n_1 - 1) * s_1^2 + (n_2 - 1) * s_2^2}{(n_1 - 1) + (n_2 - 1)} \qquad (2)$$

$$s_d^2 = (s^2 / n_1 + s^2 / n_2) \qquad (3)$$

and

Table 4
EXPECTED OVERALL SURVEY ACCURACY LEVELS

	1965 Travel Survey Summary Statistics[1]			1,400-Household Survey Accuracy Level	
Trip Purpose	Mean	SD	CV	90% Conf.	95% Conf.
Home-Based Work	2.1	1.6	0.8	±3.4%	±3.9%
Home-Based Shop	1.2	2.0	1.7	±7.5%	±8.8%
Home-Based Other	2.7	3.8	1.4	±6.4%	±7.4%
Home-Based Non-Work[2]	3.9	4.5	1.2	±5.2%	±6.1%
Non-Home-Based	1.1	2.5	2.3	±10.1%	±11.8%
Total Trips	7.1	6.2	0.9	±3.9%	±4.6%

[1] The summary statistics are from unweighted survey data. The mean trip rates might be different from mean trip rates developed based on weighted survey data. SD is Standard Deviation. CV is Coefficient of Variation.

[2] The home-based non-work trip is a composite of home-based shop and home-based other trips.

$$t_d = \frac{(m_1 - m_2)}{s_d} \qquad (4)$$

where:

s^2 is the "pooled" variance
s_1^2 and s_2^2 are the variances for cells 1 and 2
n_1 and n_2 are the number of households in cells 1 and 2
s_d^2 is the sample variance for the difference of the means for cells 1 and 2
s_d is the sample standard deviation for the difference of the means for cells 1 and 2
m_1 and m_2 are the average trip rates in cells 1 and 2
t_d is the t-score corresponding to the difference in the means for cells 1 and 2

This group of formulae should be used in the calibration of the trip production models for the region. It is not reasonable to use the 1965 cell-by-cell average trip rates and variances together with expected sample breakdowns based on the 1990 data shown in Table 1. The trip production model should be calculated using the cell means, variances, and number of samples from the 1990 St. Louis Region Small Sample Travel Survey.

The discussion of statistical significance is mainly intended to provide information regarding the different types of statistics that can be calculated for the survey and the importance of those statistics.

→ FYI - O.KURTH

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM REPORT **120**

DATA REQUIREMENTS FOR METROPOLITAN TRANSPORTATION PLANNING

CREIGHTON, HAMBURG
PLANNING CONSULTANTS
DELMAR, NEW YORK

RESEARCH SPONSORED BY THE AMERICAN ASSOCIATION
OF STATE HIGHWAY OFFICIALS IN COOPERATION
WITH THE FEDERAL HIGHWAY ADMINISTRATION

AREAS OF INTEREST:

- TRAFFIC MEASUREMENTS
- URBAN TRANSPORTATION ADMINISTRATION
- URBAN LAND USE
- URBAN TRANSPORTATION SYSTEMS

HIGHWAY RESEARCH BOARD
DIVISION OF ENGINEERING NATIONAL RESEARCH COUNCIL
NATIONAL ACADEMY OF SCIENCES—NATIONAL ACADEMY OF ENGINEERING 1971

types of control mechanisms. One of the proposed automatic control mechanisms would use the characteristic sound of cars colliding to activate the permanent recording system.

Performing Transit Traffic Surveys Electronically.—Research is presently being completed at the University of West Virginia on a system that could be used to conduct transit-passenger-volume surveys automatically.* The research is divided into two main parts. The first is concerned with the development of a data collection device that could be mounted on a bus. The software necessary to process these data is being developed as the second part of the research.

The counting device on the bus operates electronically. It keeps a records of the number of passengers entering and leaving the bus at each stop. Using these data, it is possible to determine the loading characteristics at each stop as well as the total use along any route.

Software, developed to process the data collected, is designed to assist in decision-making regarding scheduling, headways, and number of transit vehicles needed. The software appears to be designed for detailed transit planning.

This type of system has many advantages over the traditional method of transit surveys, in which manual counts have been necessary to determine transit use. Once the initial investment in equipment has been made, surveys can be taken at any time to allow for a more detailed analysis. Whereas previously counts were generally taken on one survey day, it will now be possible to conduct transit surveys at different times.

RELIABILITY

The original work program for this research project contained an item "reliability studies." The intention of these studies was to measure the reliability of existing data by a system of check measurements in order to determine whether the data's reliability matched the need for accuracy of the data as determined by the sensitivity tests.

As research work progressed, however, it became clear that the original concept was not adequate. Whereas it would have been possible to have measured the reliability of a few data collection operations, it would not have been possible to generalize from the results. The conclusions could only have been applicable to the city and operation reviewed. Hence, the idea of actual checking of survey data had to be discarded.

This forced a re-thinking of the whole subject of data reliability. In this re-thinking, it became apparent that data reliability is only a real problem in the sample surveys. The surveys of transportation facilities and of land use measure entire universes—in one case, all arterial streets and expressways (and all buses and rapid transit service), and, in the other case, all land use. Measurement of the whole, with the accounting checks that are possible in such surveys, is rarely going to permit results that are wrong in any substantial way. Even errors at the zone level can be caught when land use data are displayed in map form by computer, or when the network is calibrated in the first traffic assignments.

In the sample surveys, however, data reliability is a problem. If one assumes that basic survey workmanship is high-level, there still remains the problem of sampling variability. Accordingly, it was decided to conduct an investigation of the sampling variability of home interview data as the main part of the reliability studies, and particularly of the variability resulting from cluster sampling, which has not previously been studied adequately.

Sampling Variability of Home Interview Data

From the standpoint of trip information, the standard home interview survey is a cluster sample. That is, one does not have a random sample of trips or even a systematic sample of trips. When a household falls into the sample, all of the trips made by occupants of the household are enumerated. If the average number of trips per household is seven, this means the average cluster size is seven.

To the extent that the travel performed by an individual member of a household tends to be more like the travel performed by other members of the household than that by non-household members, the reliability or precision of the sample results is lower than would be the precision of a random sample of the same size. This report examines the impact that the similarity of household members (intra-class correlation) has on sample reliability.

Variance of a Proportion for a Random Sample

The variance of a proportion for a random sample is given by

$$\sigma^2 = \frac{pq}{n} \qquad (1)$$

in which

σ^2 = variance proportion p;
p = proportion of elements possessing a given attribute;
q = proportion of elements not possessing that attribute; and
n = number of sampled elements.

If, for example, 10 of the apples in a random sample of 100 apples were spoiled, it would be possible to calculate the limits within which the actual proportion of rotten apples in the apple population would fall at a given level of confidence:

$$\sigma_p = \sqrt{pq/N} = \sqrt{0.1 \times 0.9/100} = 0.03$$

This would be interpreted to mean that about 68 times out of 100 the actual percentage of rotten apples would lie between 7 percent and 13 percent. At the 95-percent confidence level, one would estimate the actual percentage of rotten apples at between 4.1 percent and 15.9 percent.

In this kind of sampling, it is assumed that the sampled apples were randomly selected.

Variance of a Clustered Sample

When a sample of clusters is taken, all elements in the cluster are enumerated. When the clusters are of different sizes,

* Report due in February 1970. For further information contact: Dr. Seg Elias, Chairman, Industrial Engineering Dept., University of West Virginia, Morgantown, West Virginia, 26506.

$$\sigma_c^2 = \frac{1}{m^2}\sum\left(\frac{N_i}{\overline{N'}}\right)^2 (p_i - p')^2 \qquad (2)$$

in which

σ_c^2 = the variance of the proportion p;
N_i = number of elements in cluster i;
$\overline{N'}$ = average number of elements in cluster;
p_i = proportion of elements in cluster i possessing given attribute;
p' = proportion of elements possessing that attribute; and
m = number of clusters.

Returning to the discussion of spoiled apples, assume that the apples were in plastic packages, with a varying number per bag. A sample of 20 bags was selected and every apple in each bag was examined. The results of this hypothetical case are as follows:

BAG	NO. OF APPLES IN BAG	SPOILED APPLES
1	3	0
2	4	0
3	5	0
4	5	0
5	4	0
6	6	5
7	7	0
8	6	0
9	5	0
10	5	0
11	4	3
12	5	0
13	6	0
14	8	0
15	4	0
16	3	2
17	5	0
18	6	0
19	5	0
20	4	0
Total	100	10

Substituting in the equation for variance of a clustered sample results in:

$$\sigma_c^2 = \frac{1}{20^2}\left[\frac{1\times 3^2}{25}(0.1)^2 + \frac{4\times 4^2}{25}(0.1)^2 + \frac{7\times 5^2}{25}(0.1)^2 + \frac{3\times 6^2}{25}(0.1)^2 + \frac{1\times 7^2}{25}(0.1)^2 + \frac{1\times 8^2}{25}(0.1)^2 + \frac{1\times 3^3}{25}\left(\frac{2}{3}-\frac{1}{10}\right)^2 + \frac{1\times 6^2}{25}\left(\frac{5}{6}-\frac{1}{10}\right)^2 + \frac{1\times 4^2}{25}\left(\frac{3}{4}-\frac{1}{10}\right)^2 = 0.00337$$

$\sigma_c = 0.058$

As in the first case, the proportion of rotten apples was 10 out of 100, or 0.1. However, because the apples were selected in clusters and because the condition of the apples in the cluster tended to be homogeneous, the reliability of the sample is not as high. In fact, the standard error of the cluster sample proportion is almost twice as large as that found in the random sample proportion (0.058 as compared to 0.030).

Intra-Class Correlation

The tendency for elements in a cluster to be more similar to each other than to elements outside the cluster can be measured in terms of intra-class correlation. The formula is:

$$[(\sigma_c^2/\sigma^2) - 1]/[(n/m - 1] = \rho = \text{intra-class correlation} \qquad (3)$$

In the example,

$$\rho = [(0.00337/0.009) - 1]/[(100/20) - 1]$$
$$= (3.74 - 1)/(5 - 1) = 0.685$$

As the intra-class correlation approaches 1.0, the ratio of the variance of a cluster sample to the variance of a random sample approaches the value of the average cluster size. Even for small values of intra-class correlation, the effect or reliability is significant; for example, with an intra-class correlation of 0.1, the variance of a cluster sample with five elements to the cluster would be 1.4 times larger than that of a random sample.

Negative intra-class correlations are possible. If an element in a cluster is less like other elements in the cluster than elements not in the cluster, the intra-class correlation is negative. In the foregoing case, if each of the clusters had exactly one rotten apple, this would result in a negative intra-class correlation of −0.22. Notice that the limit of the intra-class correlation is the reciprocal of the cluster size minus 1, at which point the variance is zero.

The impact of intra-class correlation on sample size for a specified level of accuracy can be significant. The expression for the number of cluster samples needed to give the same reliability as a random sample is given by

$$n_c/n_r = \rho(\overline{N'} - 1) + 1 \qquad (4)$$

in which

n_c = number of samples in a cluster sample; and
n_r = number of samples in a random sample.

The multipliers of ratios for different values of the intra-class correlation, ρ, and selected values of the average cluster size, $\overline{N'}$, are given in Table 24. The ratio of trips per household in most origin-and-destination studies ranges from 6 to 10. Table 24 indicates that relatively low values of intra-class correlation, 0.2 and 0.3, result in very significant increases in sample size when household clusters were used. As the intra-class correlation approaches 1.0, the multiplier approaches the average cluster size. Thus a 5-percent sample of households given a trips/household ratio of 6 and an intra-class correlation of 0.3 is equivalent to a 2-percent random sample of trips.

Sampling Variability of Home Interview Survey Data

To evaluate the impact that cluster sampling has on the sampling variability of home interview data, a computer program was written. This program performs the calcula-

tions required by Eqs. 1, 2, and 3. The home interview survey selected for this analysis was the Buffalo origin-and-destination survey that was conducted in 1962.

Trip Purpose.—The trip information from the Buffalo survey was classified into six trip purpose classes:

1. Home to work and work to home.
2. Home to social recreation and social recreation to home.
3. Home to personal business and personal business to home.
4. Home to shop and shop to home.
5. Other home-based trips.
6. Non-home-based trips.

The results of this analysis are given in Table 25.

For the six purpose groupings analyzed, the assumption of a random sample would seriously understate the estimates of sampling variability. For work travel, the ratio of actual sampling variance to the variance of a random sample is 2.45. For social recreation travel, the ratio is 3.40 and for non-home-based trips the ratio is 3.69. These ratios are, incidentally, the multipliers by which the sample size of a random sample would need to be multiplied to achieve the same sampling error as the random sample. Taken together, the average ratio of actual to random sample variances is 3.0.

If one wished to estimate the proportion of all trips that are from home to work or work to home within ±5 percent, 95 times out of 100, the sample size would be $0.0004 = 2.45(0.16/n)$, or $n = 400 \times 2.45 = 980$ samples required.

Land Use.—Land use classifications are often used in the calculation of trip origins and destinations. The Buffalo trip file was stratified into the following land use categories by trip destination:

1. Residential land use.
2. Commercial land use.
3. Manufacturing land use.
4. Public building land use.
5. Public open space.
6. All other land uses.

These trip data were then analyzed in terms of their sampling variability. The results are given in Table 26.

The variability of trip proportions by land use at trip destination is less affected by cluster sampling than are trip purpose proportions. The proportion of residential trip destinations has a variability that is only 27 percent greater than that which would be expected for a random sample. Over-all, the ratio of the variability of the cluster sample to the variability of a random sample is 1.77, suggesting a cluster sample size of just under twice a random sample to achieve comparable reliability (based on a weighted average of the variance ratios in Table 26).

Mode of Travel.—Mode of travel information is necessary in order to estimate vehicular and transit utilization. Buffalo trip data were classified by the following modes of travel:

1. Auto driver.
2. Auto passenger.
3. Bus transit passenger.
4. School bus passenger.
5. All other modes of travel.

The results of this analysis are given in Table 27.

The mode of travel information is subject to greater impact from clustering than is land use information. In

TABLE 24

RATIO OF CLUSTERED SAMPLE SIZE TO RANDOM SAMPLE SIZE TO ACHIEVE EQUAL RELIABILITY FOR DIFFERENT VALUES OF INTRA-CLASS CORRELATION

INTRA-CLASS CORRELATION	RATIO, BY CLUSTER SIZE			
	4	6	8	10
0	1.0	1.0	1.0	1.0
0.1	1.3	1.5	1.7	1.9
0.2	1.6	2.0	2.4	2.8
0.3	1.9	2.5	3.1	3.7
0.4	2.2	3.0	3.8	4.6
0.5	2.5	3.5	4.5	5.5
0.6	2.8	4.0	5.2	6.4
0.7	3.1	4.5	5.9	7.3
0.8	3.4	5.0	6.6	8.2
0.9	3.7	5.5	7.4	9.1
1.0	4.0	6.0	8.0	10.0

TABLE 25

ANALYSIS OF SAMPLING VARIABILITY OF BUFFALO TRIP PURPOSE DATA

TRIP PURPOSE	PROPORTION OF TRIPS	VARIANCE OF A RANDOM SAMPLE [a]	ACTUAL VARIANCE	RATIO	INTRA-CLASS CORRELATION
Home to work and work to home	0.200	1.517×10^{-6}	3.718×10^{-6}	2.45	0.18
Home to social recreation and social recreation to home	0.144	1.173×10	3.922×10	3.40	0.30
Home to personal business and personal business to home	0.076	0.665×10	1.783×10	2.68	0.21
Home to shop and shop to home	0.131	1.182×10	2.875×10	2.65	0.21
Other home-based trips	0.192	1.472×10	4.314×10	2.93	0.24
Non-home-based trips	0.257	1.812×10	6.684×10	3.69	0.34

[a] $\sigma^2 = pq/n$; $n = 105{,}371$.

TABLE 26

SAMPLING VARIABILITY OF BUFFALO TRIPS BY LAND USE AT DESTINATION

LAND USE AT DESTINATION	PROPORTION OF TRIPS	VARIANCE OF A RANDOM SAMLE	ACTUAL VARIANCE	VARIANCE RATIO: ACTUAL/RANDOM	INTRA-CLASS CORRELATION
Residential	0.505	2.372×10^{-6}	3.003×10^{-6}	1.27	0.03
Commercial	0.277	1.901×10^{-6}	4.265×10^{-6}	2.24	0.16
Manufacturing	0.061	0.547×10^{-6}	0.942×10^{-6}	1.72	0.09
Public building	0.091	0.783×10^{-6}	1.779×10^{-6}	2.27	0.16
Public open space	0.027	0.250×10^{-6}	0.659×10^{-6}	2.64	0.20
All other land use	0.039	0.354×10^{-6}	1.169×10^{-6}	3.30	0.29

TABLE 27

SAMPLING VARIABILITY OF BUFFALO TRIPS BY MODE OF TRAVEL

MODE OF TRAVEL	PROPORTION OF TRIPS	VARIANCE OF A RANDOM SAMPLE	ACTUAL VARIANCE	VARIANCE RATIO: ACTUAL/RANDOM	INTRA-CLASS CORRELATION
Auto driver	0.576	2.317×10^{-6}	7.445×10^{-6}	3.21	0.28
Auto passenger	0.317	2.056×10^{-6}	7.070×10^{-6}	3.44	0.31
Bus transit passenger	0.073	0.643×10^{-6}	2.443×10^{-6}	3.80	0.35
School bus passenger	0.028	0.258×10^{-6}	1.015×10^{-6}	3.93	0.37
All other modes	0.005	0.049×10^{-6}	0.136×10^{-6}	2.78	0.22

general, mode of travel data requires a cluster sample over three times the size of a random sample in order to achieve comparable reliability. School bus use would require a cluster sample of almost four times the size of a random sample for the same accuracy. To estimate the proportion of trips on school buses within ±10 percent, 95 times out of 100, would require 54,571 samples; i.e., $n_c = 400Rq/p$, in which $R = \sigma_c^2/\sigma^2$, or $(400 \times 3.93 \times 0.972)/0.028 = n = 54{,}571$.

Screen Line Crossings.—Origin-and-destination studies are conducted mainly to collect data on travel. The accuracy of these data are often evaluated in terms of how well estimates of travel crossing a line compare with actual observations at the line. This screen line check, as it is called, is used not only as a measure of the accuracy of the survey, but also sometimes as a basis for survey adjustment.

Because of the important role that the screen line check plays in survey evaluation, it was felt that the impact of cluster sampling on the reliability of the proportion of trips crossing a screen line should be investigated. Six screen lines were constructed as follows:

1. A north-south line centered in the Buffalo CBD.
2. A north-south line 5 miles to the east of the CBD.
3. A north-south line 10 miles to the east of the CBD.
4. An east-west screen line centered in the CBD.
5. An east-west screen line 5 miles to the south of the CBD.
6. An east-west screen line 5 miles to the north of the CBD.

The results of analyzing these six screen lines are given in Table 28.

The screen line proportions appear to be highly affected by the clustering of trips by households. For the six screen lines analyzed, the variance of the screen line proportion was about five times greater than the variance of a random

TABLE 28

SAMPLING VARIABILITY OF SCREEN LINE PROPORTIONS

SCREEN LINE	PROPORTION OF TRIPS	VARIANCE OF A RANDOM SAMPLE	ACTUAL VARIANCE	VARIANCE RATIO: ACTUAL/RANDOM	INTRA-CLASS CORRELATION
North-south CBD	0.151	1.216×10^{-6}	6.283×10^{-6}	5.17	0.52
North-south 5 miles east of CBD	0.122	1.015×10^{-6}	5.350×10^{-6}	5.27	0.54
North-south 10 miles east of CBD	0.048	0.437×10^{-6}	2.654×10^{-6}	6.07	0.64
East-west of CBD	0.046	0.419×10^{-6}	2.202×10^{-6}	5.26	0.53
East-west 5 miles south of CBD	0.118	0.988×10^{-6}	4.166×10^{-6}	4.22	0.41
East-west 5 miles north of CBD	0.135	1.111×10^{-6}	5.310×10^{-6}	4.78	0.47

sample of the same size. This is not surprising, because the probability of crossing any given screen line most likely declines exponentially with increasing distance from the trip origin. Because all members of a household have the same distance between home and the screen line, the intra-class correlation should be high. Table 28 gives a range of from 0.41 to 0.64 and an average of about 0.50 for the intra-class correlation, and a variance ratio of about 5.0. Translated to the sample size required to estimate screen line crossings within ±10 percent, 95 times out of 100, it is found that $n = (400 \times 5 \times 0.9)/0.1 = 18{,}000$.

To obtain accuracy of ±5 percent, 95 times out of 100, would require 72,000 samples.

Required Sample Sizes

Based on the preceding analysis of the variability of cluster samples, it became possible to define the number of samples of home interview data required to provide reliable data for transportation planning purposes.

As usual in such cases, there is no simple answer. Planning uses home interview travel data for a variety of purposes—for checking purposes (as in screen line comparisons), for mode split estimation, and for trip generation studies of one kind or another. In each of these different groupings, a different level of reliability obtains.

Table 29 gives the minimum number of trip samples (to obtain households, divide by 6.6) for different proportions of trips having selected attributes. For example, if one is dealing with trips to a type of land use that has 5 percent of all trips made to it (see line 1 of Table 29) then 13,450 trip samples (2,190 sample households) are needed to make certain, at the 95-percent confidence limits, that the correct proportion is, in fact, within ±10 percent of the 5-percent figure; or, in other words, that the proportion lies between 0.045 and 0.055.

If the proportion of a particular type of trip is required to be studied in a particular area (as in a district), the number of samples indicated in Table 29 must be obtained *for that geographic area.*

TABLE 29

MINIMUM NUMBER OF TRIP SAMPLES REQUIRED TO ENSURE ±10 PERCENT ACCURACY AT THE 95-PERCENT CONFIDENCE LIMITS LEVEL FOR SELECTED ATTRIBUTES AND PROPORTIONS

SIZE OF PROPORTION	MINIMUM NO. OF TRIP SAMPLES REQUIRED			
	LAND USE	MODE OF TRAVEL	SCREEN LINE CROSSING	TRIP PURPOSE
0.05	13,450	25,384	38,000	23,104
0.10	6,372	12,024	18,000	10,944
0.25	2,124	4,008	6,000	3,648
0.50	708	1,336	2,000	1,216

Note: Trip samples above are based on an analysis of Niagara Frontier Study data. To obtain home interview samples, the figures above should be divided by a factor of 6.6, the average number of trips per household.

For estimates of trip length, it is recommended that 1,000 trip records (approximately 150 sample households) be obtained for any area for which trip length is desired to be known within ±10 percent at the 95-percent confidence limits level.

For estimates of trip production by household, approximately 400 *households* would have to be interviewed to obtain trips/household data within ±10 percent, 95 percent of the time. This is too large a number to obtain in each district, unless districts are very large. For purposes of estimating trip production it is recommended that districts be grouped and that trip production rates be calculated in relationship to population and car ownership. These rates can then be applied back against district population and car ownership rates to give reliable measures of district and zone trip production.

CHAPTER THREE

CONCLUSIONS, APPLICATIONS, AND SUGGESTED RESEARCH

The purpose of this project is to determine what data should be collected in the future by transportation studies both for the preparation of new transportation plans and for the continuing review and improvement of existing long-range transportation plans. What policy on data can be assembled out of the investigations that are reported herein? In what direction or directions should a transportation study go regarding data collection?

BASIC DATA POLICY

Before listing the basic data policies that have been synthesized from the work reported herein, the key assumptions have to be spelled out:

1. It is assumed that it is desirable to review present strategic transportation plans periodically to determine whether investment levels, mode-split of investment, and

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MEMORANDUM TO: Martin Altman
East-West Gateway Coordinating Council

FROM: David L. Kurth
Barton-Aschman Associates, Inc.

DATE: December 4, 1990

SUBJECT: Task B.3--Develop Telephone List

OVERVIEW

Task B.3 of the St. Louis Regional Travel Survey was the development of the telephone list for the survey. This work was performed in May, 1990 with the purchase of 10,000 residential telephone numbers for the St. Louis region. The telephone numbers were purchased from a commercial vendor, Survey Sampling, Incorporated (SSI), of Fairfield, Connecticut. The sample list was broken down as follows:

- 4,400 listed telephone numbers
- 5,600 unlisted telephone numbers.

The split between listed and unlisted telephone numbers was based on assumptions regarding the breakdown of households with listed and unlisted telephones along with assumptions regarding the likelihood of a listed or unlisted telephone number resulting in completed survey.

Part of Task B.3 is the assessment of the biases that will be introduced into the survey by selecting households with telephones as the sample frame. This memorandum discusses the possible biases and corrections for the biases. In addition, this memorandum discusses the use of areawide replicates in the sampling process to avoid biases from not using the entire sample.

POSSIBLE BIASES FROM USING LISTED AND UNLISTED TELEPHONES FOR SAMPLE FRAME

Effect of Omission of Households Without Telephones

Households with listed and unlisted telephones have been selected as the sample frame for the St. Louis Region Travel Survey. Thus, households that do not own a telephone have not been included in the survey. The omission of households without telephones from the sample frame might introduce bias into the travel survey. Table 1 summarizes information provided by SSI regarding the number of households in the region that have telephones along with the percent of the telephones that are listed. As can be seen

TABLE 1
HOUSEHOLDS WITH TELEPHONES

County	Total Households	Percent With Telephones	Households With Phones		Households Without Telephones
			Number	Percent Listed	
Madison, IL	88,620	95.4%	84,541	70.6%	4,079
Monroe, IL	2,647	96.2%	2,546	76.7%	101
St. Clair, IL	93,978	93.8%	88,157	66.2%	5,821
Jefferson, MO	27,679	95.4%	26,407	75.7%	1,272
St. Charles, MO	72,057	97.0%	69,895	79.7%	2,162
St. Louis, MO	370,327	98.2%	363,710	75.6%	6,617
St. Louis City	167,765	93.4%	156,690	65.3%	11,075
Total	823,073	96.2%	791,946	72.3%	31,127

in Table 1, about 96 percent of the total households in the region have telephones. Approximately 31,000 households in the survey area do not have telephones. Based on the implied sampling rate for the survey (1400 samples out of 823,073 households), about 50 samples should have been collected from households without telephones for an unbiased sample.

There are two main ways in which the omission of households without telephones from the survey frame can bias the survey. The first is if the households are disproportionately allocated to certain socioeconomic groups. The second type of bias is if the households without telephones have different travel characteristics than similar households with telephones.

For the first case, it is likely that households without telephones are more likely to be low income households and, quite likely, one or two person households. If no adjustment is made for the disproportionate allocation, regional averages (e.g., average trips per household for the region) will be biased. The effects of this possible bias can be mitigated through the weighing of the survey data before the calculation of regional averages, rates, and totals. This weighing process was anticipated for the survey notwithstanding the effect of omitting households without telephones in the survey frame. Specifically, it is anticipated that sample weights will be calculated for surveyed households so that the weighted surveyed households match the distribution of households by income group and household size for the region. Table 2 shows the number of surveyed households for the region (as of November 21, 1990) by income group and household size and Table 3 shows the expected number of households for the corresponding strata based on estimates produced by the East-West Gateway Coordinating Council.

TABLE 2
SURVEYED HOUSEHOLDS BY INCOME GROUP AND HOUSEHOLD SIZE (AS OF 11/21/90)

	Household Size					
Income Group	1	2	3	4	5+	Total
Low	103	90	47	22	27	289
Middle	88	158	70	55	56	427
High	25	194	107	105	67	498
Total	216	442	224	182	150	1,214

TABLE 3
EXPECTED TOTAL HOUSEHOLDS BY INCOME GROUP AND HOUSEHOLD SIZE

	Household Size					
Income Group	1	2	3	4	5+	Total
Low	137,453	66,669	29,631	18,931	17,285	269,969
Middle	61,730	90,538	41,154	31,277	23,869	248,568
High	18,108	94,653	69,138	69,961	52,677	304,537
Total	217,291	251,860	139,923	120,169	93,831	823,074

Table 4 shows example survey expansion factors that account for the income group and household size bias introduced into the survey by the sampling process. Part of this bias is the omission of households without telephones from the sample frame. As can be seen in Table 4, the average regional expansion factor (i.e., total households in the region divided by surveyed households in the region) is 678. In other words, each surveyed household represents 678 households. However, when the income group and household size of the households are considered, the expansion factors range from a low of 426 to a high of 1,334. The expansion factors shown in Table 4 are an example only. The actual expansion factors should be based upon the final survey data and, if possible, the regional distribution of households by income group and household size from the 1990 Census. In addition, it might be worthwhile to include a geographic stratification in the calculation of the final expansion factors.

The second type of bias introduced by omitting households without telephones from the sample frame is more difficult to quantify. This second type of bias is the bias that would occur if households without telephones had significantly different travel patterns than households with telephones. For example, it might be hypothesized that households without telephones would make more trips than similar households with telephones since they could not use the telephone as a substitute for trip-making. The only way to determine the effect of this bias would be to survey the households without telephones and compare them

TABLE 4
EXAMPLE HOUSEHOLD EXPANSION FACTORS BY INCOME GROUP AND HOUSEHOLD SIZE

	Household Size					
Income Group	1	2	3	4	5+	Total
Low	1,334	741	630	861	640	934
Middle	701	573	588	569	426	582
High	724	488	646	666	786	612
Average	1,006	570	625	660	626	678

to households with telephones controlling for the effects of household size and income (or household size and auto availability). Based on preliminary results of this survey and results from other surveys, it is likely that it would not be possible to measure statistically significant differences in trip rates between the two groups (if the socioeconomic differences are taken into account). Thus, the only corrections suggested to account for biases introduced into the survey by omitting households without telephones from the sample frame are to ensure that the survey is weighted to match the regional distribution of households by income group and household size whenever "regional" rates or totals are estimated from the survey data.

Effect of Households With Multiple Telephones

Since the actual sample frame is the "population" of residential telephone numbers in the St. Louis region, there is some possible bias that will be introduced into the survey due to the fact that some households have more than one telephone. Based on a sample of 594 random telephone interviews in the St. Louis region, SSI estimated the following breakdown of households by number of telephone lines:

- Households with one telephone line -- 93.6%
- Households with two telephone lines -- 5.7%
- Households with three or more lines -- 0.7%

Since some households have multiple telephone lines, they have a higher probability of being included in the survey. It is possible that a single household could be included multiple times in the sample frame if the household has multiple telephone lines. The likelihood of this happening is very small. In addition, as of November 21, no households indicated that they had been asked to participate in the survey "on their other line".

The possible biases that could be introduced into the survey by the multiple line households is similar to the biases introduced by the omission of the households without telephones. The corrections for the biases are also similar. The socioeconomic bias will be corrected through the weighing of the data to match the estimated distribution of households by income group and household size for the region. The biases caused by differences in travel characteristics between similar households with and without multiple lines will not be corrected. However, as with the households without telephones, the differences in trip rates between households with one telephone line and households with multiple lines are probably not statistically significant when the rates are stratified by income group and household size.

USE OF AREAWIDE REPLICATES TO AVOID BIASES

As mentioned above, a sample of 10,000 telephone numbers was purchased for the survey. The requirement of 10,000 numbers to obtain a survey of 1,400 households was based on assumptions regarding the likelihood of each telephone number resulting in the actual contact of a household and the response rate after a household has actually been contacted. In addition, a safety factor was used in the determination of the required number of telephone numbers to reduce the likelihood of having to acquire additional telephone numbers to complete the survey.

In order to insure representative results for the survey, a replicate system was used. The St. Louis sample was stratified into twenty-four replicates. To do this, the 1st, 25th, 49th, etc. telephone numbers were assigned to replicate one; the 2nd, 26th, 50th, etc. telephone numbers were assigned to replicate two; the 3rd, 27th, 51st, etc. telephone numbers were assigned to replicate three, and so on. This procedure was used for the original random samples of 4,400 listed telephone numbers and 5,600 unlisted telephone numbers. The listed and unlisted samples were then combined to form the entire sample file with twenty-four replicates. Eight of the replicates had 416 telephone numbers and the remaining sixteen replicates had 417 telephone numbers.

Since each replicate was, in effect, a mini-random sample of the survey area, each replicate was representative of the survey area (as long as the replicate was completely used). Telephone assignments were distributed to survey "recruiters" one replicate at a time. Each replicate was completely exhausted before samples from a new replicate was used. In other words, all required call-backs for each telephone number in the replicate were made in the recruiting stage before telephone numbers from a new replicate were used. Note that replicate number twenty-four was used for the pretest. In order to complete the travel survey, it was necessary to use seventeen of the remaining twenty-three replicates.

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May 16, 1990

Ms. Gwen Kaplan
Survey Sampling
One Post Road
Fairfield, CT 06430

Re: St. Louis Region Travel Survey

Dear Ms. Kaplan:

As we discussed on the telephone Monday, May 14, 1990, I would like to order a sample of 10,000 telephone numbers (residential listings) for the St. Louis Region. The sample should be broken down as follows:

- 4,400 listed telephone numbers with names, addresses, zip codes, and census tract numbers.
- 5,600 unlisted telephone numbers.

The sample should cover the City of St. Louis and the six county St. Louis metropolitan area as shown below.

City/County	County/City FIPS Code	State	State FIPS Code	All or Part
City of St. Louis	510	MO	29	All
St. Louis County	189	MO	29	All
St. Charles County	183	MO	29	All
Jefferson County	099	MO	29	Part
Madison County	119	IL	17	Part
Monroe County	133	IL	17	Part
St. Clair County	163	IL	17	Part

Census tracts have been determined for the counties that will be only partly included in the coverage area. A list of these tracts is attached. They are also included in an ASCII file, CENSUSTR.DAT, on the enclosed floppy diskette.

I would like the data to be transmitted on floppy diskette.

I have received the file formats you faxed on Monday. I would like the sample of telephone numbers to be broken into 12 replicates.

In addition to the above data, I would appreciate any summary information that you can provide on:

- The percent of listed and unlisted telephone numbers in the St. Louis region.
- The percent of two or more telephone line households (e.g., "parents'" telephone and "childrens'" telephone).
- The effect of car phones on the list of telephone numbers.
- The percent of households without a telephone.

Please send the data and information to me at:

2925 South Raleigh Street
Denver, CO 80236

It is my understanding that the total cost for this information will not exceed $2,000.

Please call me if you have any questions. I will be in our Evanston office (708-491-1000) through May 18, 1990, and in Denver (303-936-5983) the following week.

Sincerely,

David L. Kurth

David L. Kurth
Senior Associate

DLK:cah

Enclosures

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MEMORANDUM TO: Martin Altman
East-West Gateway Coordinating Council

FROM: David L. Kurth
Barton-Aschman Associates, Inc.

DATE: August 7, 1990

SUBJECT: St. Louis Region Travel Survey
Task B.5--Pretest Summary

Background

The pretest of the St. Louis Region travel survey was performed during the last two weeks of June 1990. Pre-survey qualification calls were made during the week of June 18. Travel days were Tuesday, June 26 through Thursday, June 28. Collection of the travel data was initiated on Wednesday, June 27 and fully completed on Thursday, July 5.

A total of 41 surveys were completed in the pretest. The telephone numbers for the pretest were obtained from one of the twenty-four replicates of telephone numbers purchased from Survey Sampling, Inc. (SSI). The replicate used had 416 telephone numbers, 183 which were listed and 233 which were unlisted. The telephone list was modified to include five volunteers from the East-West Gateway Coordinating Council (EWG). To obtain the completed surveys, 411 telephone numbers out of the 416 total numbers were called.

Pretest Results

Productivity of Telephone List

Table 1 summarizes the disposition of all calls made during the pretest. As can be seen in the table, 10 percent of the telephone numbers called resulted in completed surveys. This percentage is lower than the percentage assumed in the estimation of the required telephone numbers for the survey. Different success rates were assumed for the listed and unlisted telephone numbers based on previous surveys. The composite success rate was 14 percent.

The main cause of the low success rate was probably the short time frame for the pretest (three days of pre-survey telephone calls) and the fact that only 40 samples were desired for the pretest. In the actual travel survey, callbacks of continually busy or no answer phone numbers would be performed over a longer time period, thus improving the chance of finding someone at home. In addition, the pre-survey callbacks were discontinued in the pretest when sufficient samples for the pretest were obtained.

Table 1
DISPOSITION OF PRETEST TELEPHONE CALLS

Status	Number of Calls	Percent	
Pre-Survey Qualification Calls			
Agreed to survey	52	13	%
Refusals	119	29	
Disconnected telephone	74	18	
Wrong number or moved	2	0	
Commercial number	19	5	
Quit during screening[1]	0	0	
Busy or no answer (5 Calls)	136	33	
Out-of-area household	0	0	
Language problems	9	2	
Total	411	100	%
Survey Telephone Calls			
Completed survey	41	10	%
Refused (after pre-survey agreement)	5	1	
Quit (during survey)[2]	3	1	
Out-of-area on travel day	0	0	
Sick on travel day	0	0	
Household demolished/Converted to commercial use	0	0	
Household moved	0	0	
Language problems	0	0	
Phone disconnected	1	0	
Forgot survey day[3]	2	0	
Total	52	12	%

[1] This category is reserved for use if a quota sample is used and a specific quota has been filled.

[2] These three households were actually households that could not be contacted after their travel day to collect the travel information.

[3] The two households that forgot their travel day were willing to reschedule, if necessary.

The ratio of the number of households agreeing to the survey to the sum of the households agreeing and refusing the survey is 30 percent (52 / [52 + 119]). If it is assumed that one-half of the continually busy/no answer percentage from the pretest will be converted to actual contacted households in the actual survey (i.e., through additional callbacks over a longer period of time), the percent agreeing will increase to about 18 percent and the percent of refusals will be about 41 percent.

It should also be noted that NSI expects that the percent of households agreeing to the survey (based on the total households actually contacted) should be over 40 percent. In the actual survey, surveyors obtaining a lower than average percentage of households agreeing to the survey will be reassigned or retrained. These actions should increase the agreement rate.

However, if the low success rate persists during the actual survey, it will not be possible to obtain the required number of surveys from the purchased sample. Several options exist. First, it might be possible to perform additional follow-up of refusals or make additional callbacks (more than five) to continually busy/no answer "quits". Second, additional telephone numbers could be purchased. However funds were not budgeted within the contract for such a purchase, so a source for the additional funds required would need to be found (EWG considers this to be a responsibility of the Consultant). Third, it might be possible to supplement the list with random digit dialing using numbers generated by NSI. It should be reiterated that the need for these measures is not expected in the actual survey.

Disposition of All Calls

As mentioned above, Table 1 shows the disposition of all telephone calls. Table 2 compares the disposition of the St. Louis pretest telephone calls to the Denver and New Jersey travel surveys (performed in 1985 and 1986, respectively). The Denver and New Jersey surveys were very similar to the St. Louis survey in procedure, form, and source of telephone numbers. SSI provided the telephone list for all three surveys. The New Jersey survey was performed by the Barton-Aschman/NSI Research Group team.

As can be seen in Table 2, there are some similarities and dissimilarities in the disposition of telephone calls. The percentage of households agreeing to the survey and the percentage of households where the number was continually busy or there was no answer are the most dissimilar items between the three surveys. The probable reasons for the low agreement rate and the high busy or no answer rate for the St. Louis region are discussed in the previous section.

Table 2
COMPARISON OF ST. LOUIS PRETEST TELEPHONE CALL DISPOSITION TO NEW JERSEY AND DENVER TRAVEL SURVEYS

Status	Percent of Initial Calls		
	St.Louis	New Jersey	Denver
Agreed to survey	13 %	29 %	41 %
Refusals	29	24	27
Disconnected telephone	18	14	13
Wrong number or moved	0	3	3
Commercial number	5	8	5
Quit during screening	4	9	na
Busy or no answer (5 calls)	29	14	8
Out-of-area household	0	0	4
Language problems	2	1	0
Completed survey	10	23	34
Refused (after pre-survey agreement) or quit	2	4	6

The percentage of completed surveys is also dissimilar. However, the completed surveys as a percent of the number of households initially agreeing to the survey are close for the three surveys: 77 percent for St. Louis, 79 percent for New Jersey, and 83 percent for Denver.

The above results suggest that some of the main concerns with the St. Louis survey should be obtaining the initial agreement to participate in the travel survey and reducing the number of households dropped from the survey due to continued busy signals or no answer to telephone calls. Again, the percent of households agreeing to the survey should increase and the percent of continually busy or no answer households should decrease in the actual survey.

Nine households were dropped from the survey due to language problems. Most of the language problems seemed to be with people who spoke only an Asian language (Vietnamese, Chinese, Cambodian, etc.). Although it is possible to schedule a recruiter who speaks an Asian language, the cost to produce an Asian language (or multiple Asian language) survey instruments would be prohibitive. As an alternative, when an Asian language (or other foreign language) speaking household is encountered in the recruiting stage of the survey, a second callback will be made on another day to try to determine if there is an English speaking member in the household. If

one is found, an attempt will be made to recruit the household for the survey. Otherwise, the household will be dropped due to "language problems."

Loss of Respondents

As is shown in Tables 1 and 2, the loss of respondents is not critical. Although slightly higher, it is comparable to losses reported in the New Jersey and Denver travel surveys. Note that the two households that forgot their travel day would have been willing to reschedule or participate on another travel day had there been ample time for another travel day. The inclusion of these two households as successful surveys would have increased the percent of completed surveys (to households agreeing to the survey) to 83 percent.

Problems Encountered in the Administration of the Pretest

One of the earliest problems encountered in the pretest was the lack of a simple definition of the East-West Gateway Coordinating Council in the training manual. Although EWG is referenced several times in the training manual, no explanation suitable for respondents was available. This prompted the halting of the first night's recruiting efforts when a recruiter was unable to adequately define EWG for a potential respondent. A brief, two-sentence explanation was drafted and distributed prior to the resumption of recruiting calls. The following definition will be used in the survey:

> The East-West Gateway Coordinating Council is a voluntary association of local governments in the St. Louis metropolitan area. The council prepares plans to improve highways and transit service in the region.

A logistics problem encountered in the data collection phase centered around scheduling appointments for callbacks. This causes a problem since it is impossible to estimate how long any particular interview will take to administer. This problem makes it difficult to prepare an interviewer assignment schedule for night telephone calls. For example, one interviewer began an interview around 6:00 P.M. The interview lasted about 40 minutes and, as a result, a request from another household to be interviewed before 6:30 P.M. was missed since the interviewer lost track of time and did not pass the second assignment to another interviewer.

As a result of this pretest experience, coupled with experience gained by NSI in other travel survey efforts, we recommend that recruited households be informed only that they will be called one or two days after their travel day to collect the information. Scheduled appointments for callbacks will be made on a case-by-case basis, if requested by the recruited household. We anticipate that only three or four appointments per day will be requested; this lower number of scheduled appointments will be manageable. A secondary benefit to this procedure is that callbacks will be made the day immediately following the respondent's travel day rather than at the respondents' "convenience". This should insure that the travel day information is "fresh" in the respondents' memories and produce better survey results, especially if the travel diaries have not been used.

The recruiting surveyors noted that they found it discourteous to not ask respondents if they would participate in the survey and were uncomfortable not asking for the respondents' cooperation. This feeling was supported by an EWG staff member who participated in the pretest. As a result, a line will be added to the survey recruiting banter asking for the respondents' cooperation in the survey. An example of such a request is:

> We need information regarding weekday travel by households such as yours, and we would like your cooperation in this study.

A brief pause after this statement will be indicated in the banter dialogue. This statement will be at an appropriate point in the middle of the banter, not at the end of the dialogue.

The travel diary collection forms used by the surveyors were printed so that they needed to be turned over vertically rather than turned around horizontally to record the travel diary information on the second side of the form. This was inconvenient for the surveyors and made it difficult to read the second side of the forms when they were stapled together with the rest of the household's forms. Thus, when the travel diary collection forms are printed for the survey, they should be oriented so that the top of the form is at the same edge of the paper for both the front and the back of the form.

Finally, although not a problem, per se, it was noted that households agreeing to the survey received their survey packets in plenty of time for their travel day even though it was not possible to mail the packets for the pretest ten days prior to the travel day as specified in the scope of work for the project. Thus, it is recommended that the survey packet mailing time be six to eight days prior to the travel day. This will have the added benefit of insuring that the day one week prior to the assigned travel day is not mistaken by the respondent as the travel day.

Problems Noted by EWG Volunteers for the Pretest

The spouse of one of the EWG volunteers for the pretest was confused about whether his trip should be recorded even when he traveled with another family member (e.g., as a passenger in an automobile). Because of the possible confusion, clarifying statements will be added to the survey instructions and to the travel diaries.

One of the volunteers and the spouse of one of the volunteers were confused by the beginning time of the trip requested in the travel diary. They recorded the ending time of the previous trip by mistake. No simple, clear methods to clarify the time question are obvious. NSI surveyors are well trained to note discrepancies in travel times and abnormal travel times (e.g., they questioned one volunteer about a ten-minute difference between the travel time to a baseball game and the travel time from the game). As a result, no modifications to the survey instruments are recommended. Rather, the surveyors will be called upon to note major problems with respondents' understanding of this question and to probe for the correct travel times.

One of the EWG volunteers noted respondents' reluctance to answer the income question on the survey. As will be noted later in this memo, 5 of the 41 households responding to the pretest refused to answer the income question. This refusal rate, 12.5 percent, is consistent with what has been noted with many different types of surveys of different types administered throughout the nation. It would be possible to re-ask the question with broader ranges (i.e., corresponding to the low, middle, and high income ranges for the St. Louis region) at the end of the survey. However, NSI's experience is that a "No" to a request for income information means "No!", and that further probing will only antagonize the respondent. As a result, it is recommended that the income question not be re-asked if it is initially refused.

Finally, a message requesting that a volunteer call NSI's 800 number was left on one volunteer's answering machine. While this will continue to be used as a "last resort" in contacting a respondent to collect travel diary information, messages on answering machines will be used to inform respondents that attempts are being made to contact them. Specifically, for respondents with automatic answering machines, a message will be left on the machine on the final attempt of the evening to contact the respondent. The message will state that "...we are sorry we missed you and we will attempt to contact you again tomorrow...".

Other Problems With the Pretest

Since the actual travel survey will take place over three months, a date should not be shown on the survey packet cover letter. Consequently, the date on the example travel diary should be updated to reflect a travel day approximately one-half way through the travel survey (e.g., Wednesday, October 10, 1990).

There was a problem consistently identifying incidental trips or stops. Several decision criteria have been established relating incidental trips to the amount of diversion from the normal route for the main trip, the purpose of the stop, and the duration of the stop. Specifically, incidental stops are indicated by:

- Stops made en route for incidental purchases of gasoline, cigarettes, newspaper, etc.

- The stop was made along the normal route taken for another trip (or within two blocks).

- The stop involved a small amount of time (under two minutes).

Traditionally, serve passenger trips for, say, carpooling, have been included as incidental trips. These trips were normally collected as part of the survey and later "linked" out of the travel data. However, many present serve passenger trips are made for purposes like taking a child to daycare. These serve passenger trips should be considered actual trips for modeling purposes since they are often made for reasons other than convenience. Establishing additional decision

criteria to distinguish the "non-incidental" serve passenger trips from the incidental serve passenger trips would be cumbersome and place a large burden on the surveyors. As a result, it is recommended that the three decision criteria listed above for determining incidental trips be retained and that all serve passenger trips be collected as normal trips. Any linking out of serve passenger trips should be done on a case-by-case basis by EWG personnel trained in travel modeling (rather than automatically using a computer program).

It was discovered that the trip purpose for the first trip made by each traveler could not be determined if the starting point for travel was not "Home". To solve this problem, a question and recording box will be added to the travel diary collection form used by surveyors requesting the starting trip purpose if the starting location is not home. The trip purpose codes used for the destination of trips will be used.

Several additional modifications to travel survey forms are recommended. The pretest travel survey forms showing all suggested corrections are included in Appendix A.

Finally, NSI has requested that the surveyor training manual be updated to include land-use codes.

Proportion of Respondents Interviewed and Using Diary

The travel survey person data were summarized by diary use and by whether or not the person was interviewed. The results of the summary are shown in Table 3.

Table 3
SUMMARY OF RESPONDENTS INTERVIEWED AND USING DIARY

		Persons Making Trips	
	All Persons	Number	Average Trip Rate
Diary used?			
Yes	67	64	4.4
No	36	11	1.5
Interviewed?			
Yes	43	35	4.5
No	58	40	3.5
Interviewed and Age 16 or Older			
Yes	--	35	4.5
No	--	28	3.8

The data summarized in Table 3 regarding diary use shows that about 85 percent of the people making trips in the pretest used the travel diaries. This is a very high "compliance" rate that shows that people participating in the travel survey followed the directions. Thus, no changes to the directions regarding diary use are suggested.

Those people who did not use travel diaries, but made at least one trip during the day, made substantially fewer trips as shown by their low average trip rate. There could be two reasons for this fact. First, the people who did not use the travel diary might have known that they were making very few trips and did not bother with the diaries. This case should not negatively affect the travel survey. On the other hand, if the trip rate is lower because people who did not use the travel diary forgot trips, a systematic bias would be introduced into the survey. It is likely that trip rates for non-diary users will be lower than for diary users for both reasons.

Table 3 also shows that 47 percent of the people participating in the travel survey were interviewed. When only those people 16 years of age and older are considered, 56 percent were interviewed. The average trip rate for respondents 16 years old and older who were interviewed was about .7 trips per day higher than the rate for those who were not interviewed. This suggests that every effort should be made to interview all respondents age 16 and older in order to reduce the amount of bias introduced into the survey because of "missed trips".

Cost and Time for Pretest

Two surveyor productivity measures are summarized by the Travel Survey Management Information System (TSMIS) used in the survey. A total of 23.5 hours of surveyor time was required for the pre-survey qualification calls, and 59.5 hours was required to collect the survey data. The number of agreements to the survey averaged 2.2 per hour of pre-survey qualification calls and the number of completed surveys averaged .7 per hour of surveyor time. We anticipate that the completed surveys per hour will increase to 1.0 to 1.2 once the full survey begins and the number of scheduled collection times is reduced.

The total cost incurred by NSI for the pretest was about $4,400, or $107 per completed survey. The total cost includes surveyor training time, all surveyor time, supervisory time, sample data base management (using TSMIS), preparation and mailing of travel survey packets, editing and coding of surveys, data entry of survey data, and senior management time.

Surveyor Monitoring and Supervision

Surveyors were closely monitored during the pretest. This is perhaps best evidenced by the immediate halting of the recruiting process when one of the surveyors could not provide a clear and concise explanation of the East-West Gateway Coordinating Council.

In addition to the direct monitoring and supervision of the surveyors during the pretest, the productivity of the surveyors was monitored through the TSMIS. The standard reports produced by TSMIS regarding surveyor productivity are included in Appendix B. The TSMIS

productivity information regarding the interviewers used for recruiting is summarized in Table 4. Five surveyors were used for recruiting. Of the three surveyors performing most of the recruiting (surveyors 2, 3, and 4), surveyor number 3 appears to have a substantially lower productivity rate than the other two. In the actual survey, such results would be a cause for retraining or reassignment of the surveyor. However, it should be noted that in the pretest, surveyor number 3 was assigned the bulk of the callbacks when there was no answer on the initial call. Thus, the low productivity rate for surveyor number 3 was probably more related to the candidate households called rather than poor recruiting skills.

It should be noted that the total for the Telephone Interviewer Productivity report included in Appendix B does not seem to match the sum of the results of the individual surveyor reports. This is for two reasons. First, the telephone recruiter identification was not coded or miscoded for three households. Second, although the report line titles in the total summary section are identical to the report line titles in the individual report sections, they are actually summarizing different information. Some corrections and modifications are being made to the TSMIS.

Table 4
SURVEYOR PRODUCTIVITY SUMMARY (RECRUITING CALLS)

Interviewer	Households Called	Percent Agreeing	Percent Refusing/ Other	Hours Worked	Productivity Rate[1]
1	30	20.0 %	80.0 %	4.0	1.500
2	127	14.2	85.8	6.5	2.769
3	107	7.5	92.5	6.0	1.333
4	136	13.2	86.8	6.0	3.000
5	8	25.0	75.0	1.0	2.000
Other	3	0.0	100.0	--	--
Total	411	12.7 %	87.3 %	23.5	2.213

[1] Productivity rate is the number of households agreeing to participate per hour of surveyor time worked.

Table 5 summarizes the TSMIS Field Interviewer Productivity report included in Appendix B. As can be seen in Table 5, two interviewers performed most of the data collection. Although too few households were called to draw solid conclusions about whether or not an interviewer was systematically obtaining fewer trips per household (e.g., through insufficient probing) or

whether an interviewer's productivity was substandard, the report will be valuable in the actual survey for making these determinations.

Table 5
SURVEYOR PRODUCTIVITY SUMMARY (DATA COLLECTION CALLS)

Interviewer	Households Called	Average Trips/Household	Hours Worked	Productivity Rate[1]
1	23	6.87	29.0	0.793
2	2	2.00	2.5	0.800
4	5	5.60	9.0	0.556
6	10	8.40	19.0	0.526
10	1	10.00	--	--
Total	41	6.93	59.5	0.689

[1] Productivity rate is the number of completed surveys (households called) per hour of surveyor time worked.

Editing and Coding

Survey editors reviewed the draft editing and coding manual developed by Barton-Aschman. Editing and coding were performed simultaneously in order to minimize the handling of survey forms. The primary coding activity was the assignment of land-use codes based on the "kind of place" response on the travel diary. Most remaining responses on the travel survey are "self-coding."

Editors noted several inconsistencies in responses on the travel survey forms. Those forms were returned to surveyors for clarification and/or correction. In addition, several walking trips that should not have been recorded (i.e., walking trips to locations other than work) were "lined out" by editors to prevent their inclusion in the keyed travel survey data.

Survey Results

Table 6 summarizes the distribution of surveys by day of week. As can be seen, the number of households agreeing to the survey was almost equally split among the three travel days. On the other hand, the number of completed surveys was slightly biased toward Wednesday.

Table 6
TRAVEL DAY DISTRIBUTION

Day of Week	Agreed	Percent	Completed	Percent
Tuesday	17	33 %	12	29 %
Wednesday	17	33	16	39
Thursday	18	33	13	32

In the pretest analysis meeting, it was decided that Tuesday, September 4 (the day after Labor Day) should not be used as a travel day and that the households for that day should be distributed to other Tuesdays. Since Tuesday, November 6 (Election Day) will not be used as a travel day, there will be nine Tuesdays, eleven Wednesdays, and eleven Thursdays included as travel days. In order to maximize the likelihood of obtaining a survey with an even distribution of samples across travel days, Tuesdays will have to be over-sampled. Thus, the recommended number of households to be recruited by day of week is as follows:

Days of Week	Number of Travel Days	Minimum Number of Recruits Required
Tuesday	9	52
Wednesday	11	43
Thursday	11	43

Table 7 summarizes the number of households resulting in completed surveys by automobile availability and household size. The table is too sparse to make a reasonable comparison to the expected number of households by automobile availability and household size for the region (as summarized in the technical memorandum for Task B1). However, Table 8 compares the percent of households by automobile availability and the percent of households by household size from the pretest to the expected regional distributions.

As can be seen in Table 8, the pretest distribution of households by automobile availability does not match the regional distribution. There is an undersampling of zero automobile households and an oversampling of two or more automobile households. The difference in the distributions could be caused by several reasons. The most crucial would be an inherent bias in the sampling procedure that would cause an underreporting of the zero automobile households. However, the undersampling could also be caused by other factors that are not as crucial and might disappear when the actual survey is taken. These factors include a bias due simply to the small sample size (41 households) or by the high percentage of continually busy/no answer outcomes discussed previously. Specifically, since zero automobile households are more likely with smaller household sizes, it is possible that all members of the household would be more likely to be

away from the home in the summer when it is more pleasant outdoors. This is supported by the undersampling of one-person households. During the actual survey, it is likely that the percentage of zero automobile households and one-person households will increase as the percentage of continually busy/no answer outcomes to pre-survey recruiting calls is decreased. Finally, the undersampling could be caused by a bias in the "observed" regional data. The regional data are based on 1980 Census data and, as a result, could overstate the percent of zero automobile households. It is quite likely that the percent of zero automobile households has decreased since 1980. Nevertheless, the results of the pretest suggest that the survey be closely monitored for biases in the distribution of households by automobile availability.

Table 7
DISTRIBUTION OF PRETEST HOUSEHOLDS
BY AUTOMOBILE AVAILABILITY AND HOUSEHOLD SIZE

	Household Size					
Automobile Available	1	2	3	4	5 +	Total
0	0	1	0	0	0	1
1	7	6	2	0	0	15
2 +	0	8	6	7	4	25
Total	7	15	8	7	4	41

Table 8
COMPARISON OF PRETEST AND REGIONAL DISTRIBUTIONS OF HOUSEHOLDS BY AUTOMOBILE AVAILABILITY AND BY HOUSEHOLD SIZE

Automobiles Available	Pretest Percent	Regional Percent
0	2 %	13 %
1	37	44
2+	61	43
Household Size	**Pretest Percent**	**Regional Percent**
1	17 %	26 %
2	37	31
3	20	17
4	17	15
5	10	11

The distribution of households by household size from the pretest is reasonably close to the expected regional distribution, especially considering the size of the pretest sample. The results show that there might be a slight undersampling of one-person households. Again, this undersampling might be directly related to the high percentage of the busy/no answer outcome to the pre-survey qualification calls.

Table summarizes basic results from the coded and edited household records. Some of the rates that can be determined from the data presented in Table 9 provide preliminary insights into the representativeness of the travel survey data. However, all of the conclusions drawn from the rates presented below must be tempered by the fact that they are based on data from only 41 household samples. No statistical significance is placed on or claimed for the rates summarized below.

Table 9
PRETEST SUMMARY RESULTS

Item	Summary
Number of households	41
Number of people	111
Number of people aged 5 or older	103
Number of visitors	0
Number of listed	33
Number of unlisted	8
Total trips[1]	290

[1] Based on trips summarized on household forms by interviewers.

The average household size calculated from the data summarized in Table 9 is 2.7 persons per household. This is higher than the estimated survey area average household size: 2.64 persons per household. The high average household size is due to the undersampling of one person households. Again, this undersampling is probably due to the high percentage of continually busy/no answer outcomes to the pre-survey recruiting calls caused by the short pretest time frame.

The average trip rate is 7.07 trips per household. This corresponds to an average trip rate of 2.61 trips per person per day. In comparison, the average trip rate based on the 1964-65 St. Louis survey was 2.36 trips per person. Thus, the per person trip rate based on the small pretest sample is about 10 percent higher than the 1964-65 trip rate. Note, however, that the

pretest trip rate is based on "unlinked" trips. The trip rate will decrease as the change mode trips are "linked out" of the data.

Although the pretest trip rate is higher than the 1964-65 trip rate, it seems to be low. The 1985 trip rate for Denver was 3.0 trips per person and the 1986 trip rate for the north New Jersey region was 3.1 trips per person. Preliminary results from the 1990 Bexar County (San Antonio), Texas travel survey show an average rate of 3.3 trips per person per day.

Several factors probably contributed to the low trip rate. Since the pretest was performed in the summer, school and school related trips were low. The addition of these trips would increase the rate. In addition, the underreporting of one-person households would tend to decrease the average trip rate since, on a per person basis, one-person households make more trips than two-person households. Finally, one of the EWG volunteers mentioned that the weather was hot on their travel day. Hot weather decreases travel for many people.

Nevertheless, the seemingly low trip rate reemphasizes the need to probe for easily missed trips and to collect the survey data as soon as possible after the travel day to minimize forgotten trips by respondents who do not use their travel diaries.

Table 9 shows that there were 33 households with listed telephone numbers included in the survey and 8 households with unlisted numbers. In other words, 80 percent of the completed surveys were obtained from households with listed telephone numbers and 20 percent from households with unlisted numbers. In comparison, data from SSI show that about 72 percent of the households with telephones in the region have listed telephone numbers. Thus, the survey seems to be oversampling households with listed telephone numbers.

It is interesting to note that this oversampling of households with listed telephone numbers should decrease as the undersampling of low income households (documented below) decreases. The geographic area with the lowest percentage of households with listed telephone numbers is St. Louis City. Average incomes within St. Louis City are generally lower than incomes in other parts of the region.

Table 10 summarizes the number of households by income group. Income groups 0 through 2 can be aggregated to the low income tertile, income groups 3 through 6 form the middle income tertile, and income groups 7 through 9 form the high income tertile. The surveyed distribution of households by income group (normalized for households refusing to report their incomes) and the expected regional distribution are shown below:

Tertile	Pretest Percent	Expected Percent
Low income	25 %	33 %
Middle income	36	30
High income	39	37

As shown above, the low income group was undersampled in the pretest. This finding is consistent with the undersampling of zero automobile and one-person households reported above. It is expected that the representativeness of the sample will improve in the actual survey as the percent of continually busy/no answer telephone call outcomes is decreased.

Table 10
HOUSEHOLDS BY INCOME GROUP

Income Group	Income Range	Number of Households
0	Less than $10,000	2
1	$10,000 - $14,999	2
2	$15,000 - $19,999	5
3	$20,000 - $24,999	3
4	$25,000 - $29,999	2
5	$30,000 - $34,999	3
6	$35,000 - $39,999	5
7	$40,000 - $49,999	6
8	$50,000 - $59,999	3
9	$60,000 or more	5
R		5

About 12.5 percent of the households refused to report their incomes. If this rate continues into the actual survey, there will be about 175 households that do not report incomes. As a result, only about 1225 households will be available for the trip production model calibration. This "loss" of households in travel surveys due to nonreporting of income is normal. For example, in the New Jersey survey, only 1325 of 1505 households surveyed (88 percent) reported their incomes.

The nonreporting of incomes will slightly reduce the statistical significance of the trip production model or any model stratified by income group. However, it should still be possible to calibrate a reasonable trip production model. When the sample size for the survey was originally designed, 1500 households were suggested. This number was based on being able to estimate the average regional trip production rate with an overall statistical significance level of ± 5 percent at the 95 percent confidence level along with experience in calibrating trip production models using samples of this size. Trip production models previously calibrated by BA (e.g., in Denver and New Jersey) were based on survey data that included the loss of households due to the nonreporting of incomes. Because of budget constraints, data from only 1400 households can be collected in the St. Louis survey. This will reduce the expected overall statistical significance level to ± 5.2 percent at the 95 percent confidence level. Although the combined effect of the reduction of samples and loss of households due to nonreporting of incomes on the

statistical significance of some income group-household size cells might be exacerbated, the overall effect on the trip production model should be slight.

The loss of households due to nonreporting of income will also affect the trip attraction model. Data from surveyed households will need to be expanded to the region to calibrate the trip attraction model. Expansion factors will probably be calculated based on the distribution of households by income group and household size. Thus, any households not reporting incomes will be lost for the calibration. However, the effect of this loss of households was "accounted" for in the specification of the survey size based on experience in other areas.

Table 11 summarizes the percent of trips by trip purpose for both the pretest and the 1964-65 travel survey. The pretest trip data were processed using dBase and summarized by typical trip purposes for Table 11. These preliminary results suggest that the proportion of non-home-based travel is growing in the region at the expense of home-based travel. The high percentage of home-based work travel for 1964-65 is unusual. In contrast, the percentage of home-based work travel from the pretest seems to be low. In general, we have found the percentage of home-base work travel to be in the low 20 percent range for the 1960s and increasing over time. This is in concert with the increase in two-worker households over the last 20 to 30 years.

Table 11
PERCENT OF TRIPS BY TRIP PURPOSE

	Percent of Trips	
Trip Purpose	Pretest	1964-65
Home-based work	20 %	30 %
Home-based other	51	54
Non-home-based	29	16

Table 12 shows a breakdown of the travel survey data by mode of travel. Although no data are readily available for a comparison, the breakdown of trips by mode seems to be reasonable.

Table 12
PERCENT OF TRIPS BY MODE

Mode	Percent of Trips
Auto driver	69%
Auto passenger	27
Transit	2
Taxi	0
School bus	1
Heavy truck	0
Walk to work	1

Modifications to Survey Methodology and Forms

Based on the information outlined in this memorandum, some modifications will be made to the survey administration and the survey forms. Modifications will be made to the Interviewer Manual and the Coding and Editing Manual to implement the changes in the survey administration. Changes to survey forms will be implemented by EWG staff. Copies of the survey forms used in the pretest with modifications marked are included in Appendix A. Finally, some changes will be made to the TSMIS.

Appendix A
CHANGES TO TRAVEL SURVEY FORMS

East-West Gateway
Coordinating Council

REGIONAL TRAVEL SURVEY

INSTRUCTIONS

This survey has two parts.

Part 1 - Household Data (white) contains information about you and your household. Some of the information has already been filled in based on our telephone conversation with a member of your household.

Part 2 - Travel Diaries (blue) on which to record travel for each member of your household or out-of-area visitor to your household on the travel day. This travel diary can help a busy person keep track of his/her trips throughout the day. It will also speed up the telephone interview when we call to collect the travel data for your household.

CHANGE

- Please ask each member of your household and out-of-area visitor to your household to carry a travel diary with him/her on the travel date and to record each trip after it is made (even if the trip is made with another member of the household).
- Please keep a travel diary for household members and visitors five or older who are unable to fill out the diary themselves.
- Be sure to record the person's name and person number (from Part 1) on the travel diary.
- A person should use extra diaries if one is not enough.
- A sample trip diary for the trips in the following example has been included in this packet:

EXAMPLE:
YOU LEAVE HOME AND DRIVE YOUR CHILD TO THE DAYCARE CENTER (1)
THEN YOU DRIVE TO WORK (2)
THEN YOU RIDE TO LUNCH WITH YOUR BOSS (3)
THEN YOU TAKE A BUS BACK TO WORK (4)
THEN YOU DRIVE TO THE DAYCARE CENTER TO PICK UP YOUR CHILD (5)
THEN YOU AND YOUR CHILD RETURN HOME (6)

If you have any questions, call the Travel Survey Office toll-free at **1-800-447-8287.**

For your convenience, we will call you within three days of the travel day to collect your information. All of your answers are strictly **confidential.**

THANK YOU

East-West Gateway Coordinating Council

TRAVEL DIARY

[4 CHANGES]

TRIPS FOR PERSON NUMBER: 01
(use person number from household data form)

NAME: JOHN DOE

TRAVEL DAY: TUESDAY, JUNE 12 [CHANGE DATE TO: WEDNESDAY, OCTOBER 10]

My first trip today began at:

☑ Home

☐ Other location as shown below (If not home)

Name of Place

Address or Intersecting Streets

City State Zip Code

INSTRUCTIONS:

- Record trips in the order you make them.
- Include the specific information requested for each trip.
- Do not record walking or bicycle trips except if you walked or rode your bicycle all the way to work.
- At the end of your travel day, leave all completed diaries in a convenient place at home so they will be available when the interviewer calls.
- Use the back of this card and an extra card, if necessary.
- If you have any questions about completing this travel diary, please call our toll-free number: 1-800-447-8287

[ADD NOTE: • Record your trip even if it is made with another household member]

	WHERE did this trip end?	KIND OF PLACE (Restaurant, doctor's office, grocery store)	PURPOSE of trip (Check one)	TIME of trip (Circle AM or PM)	MODE of travel (Check one)	IF DRIVER number in vehicle (Include self)
(1) First I Went To:	CHILDGARDEN SCHOOL Name of Place LINDELL AND VANDEVENTER Address or Intersecting Streets ST. LOUIS MO 63108 City State Zip Code	DAY CARE CENTER	☐ Return Home ☐ Job Related ☐ Go to Work ☐ Change Mode (e.g. Auto to bus) ☐ Shopping ☑ Pick up/drop off Passenger ☐ School ☑ Personal ☐ Social/ Recreational ☐ Eat Meal [CHANGE PURPOSE TO PICKUP/DROP OFF PASSENGER]	BEGIN 7:50 AM PM END 8:05 AM PM	☑ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:	2
(2) Then I Went To:	EAST-WEST GATEWAY CC Name of Place 911 WASHINGTON AVE. Address or Intersecting Streets ST. LOUIS MO 63101 City State Zip Code	OFFICE BUILDING	☐ Return Home ☐ Job Related ☑ Go to Work ☐ Change Mode (e.g. Auto to bus) ☐ Shopping ☐ Pick up/drop off Passenger ☐ School ☐ Personal ☐ Social/ Recreational ☐ Eat Meal	BEGIN 8:10 AM PM END 8:25 AM PM	☑ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:	1
(3) Then I Went To:	UNION STATION Name of Place MARKET AND 18th Address or Intersecting Streets ST. LOUIS MO 63103 City State Zip Code	RESTAURANT	☐ Return Home ☐ Job Related ☐ Go to Work ☐ Change Mode (e.g. Auto to bus) ☐ Shopping ☐ Pick up/drop off Passenger ☐ School ☐ Personal ☐ Social/ Recreational ☑ Eat Meal	BEGIN 11:55 AM PM END 12:05 AM PM	☐ Driver (auto/van/pickup/motorcycle) ☑ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:	

OVER

East-West Gateway
Coordinating Council

HOUSEHOLD DATA

Move Down 1 Line & ½ inch to LEFT

Travel Day _____

Please answer the following questions about your household:

1. Is the address label at the right correct?

2. How many people live in this household? _____

3. How many people are 5 years old or older? _____

4. How many visitors from outside the area are staying with you on your travel day? _____

5. How many cars, pickups and vans are generally available for use by this household? _____

6. What was the combined income from all sources for all members of your household in 1989 (please check the appropriate box below)? circle letter

a. ☑ Under $10,000
b. ☑ $10,000 - $14,999
c. ☐ $15,000 - $19,999
d. ☑ $20,000 - $24,999
e. ☑ $25,000 - $29,999
f. ☑ $30,000 - $34,999
g. ☑ $35,000 - $39,999
h. ☑ $40,000 - $49,999
i. ☑ $50,000 - $59,999
j. ☑ $60,000 or more

Please fill out the following table. **Complete one line for each member of your household.** Each line of the table begins with a person number. Please be sure that the person number on this form corresponds to the person number on each persons travel diary.

PERSON NUMBER	RELATION TO HEAD OF HOUSEHOLD: Head of Household	Spouse/ Partner	Child	Other Member of Household	Out-of-Area Visitor	AGE	SEX	LICENSED TO DRIVE?	EMPLOYMENT STATUS (check as many boxes as apply): Employed Full Time	Employed Part Time	Employed 2 or More Jobs	Homemaker	Retired	Student	Other
01	☒						☐ M ☐ F	☐ YES ☐ NO	☐	☐	☐	☐	☐	☐	☐
02		☐	☐	☐	☐		☐ M ☐ F	☐ YES ☐ NO	☐	☐	☐	☐	☐	☐	☐
03		☐	☐	☐	☐		☐ M ☐ F	☐ YES ☐ NO	☐	☐	☐	☐	☐	☐	☐
04		☐	☐	☐	☐		☐ M ☐ F	☐ YES ☐ NO	☐	☐	☐	☐	☐	☐	☐
05		☐	☐	☐	☐		☐ M ☐ F	☐ YES ☐ NO	☐	☐	☐	☐	☐	☐	☐
06		☐	☐	☐	☐		☐ M ☐ F	☐ YES ☐ NO	☐	☐	☐	☐	☐	☐	☐
07		☐	☐	☐	☐		☐ M ☐ F	☐ YES ☐ NO	☐	☐	☐	☐	☐	☐	☐
08		☐	☐	☐	☐		☐ M ☐ F	☐ YES ☐ NO	☐	☐	☐	☐	☐	☐	☐
09		☐	☐	☐	☐		☐ M ☐ F	☐ YES ☐ NO	☐	☐	☐	☐	☐	☐	☐
10		☐	☐	☐	☐		☐ M ☐ F	☐ YES ☐ NO	☐	☐	☐	☐	☐	☐	☐

East-West Gateway
Coordinating Council

TRAVEL DIARY

TRIPS FOR PERSON NUMBER: _____
(use person number from household data form)

NAME: _____

TRAVEL DAY: _____

My first trip today began at:

☐ Home

☐ Other location as shown below (if not home)

Name of Place

Address or Intersecting Streets

City State Zip Code

INSTRUCTIONS:

- Record trips in the order you make them.
- Include the specific information requested for each trip.
- Record your trip even if it is made with another member of your household.
- Do not record walking or bicycle trips except if you walked or rode your bicycle all the way to work.
- At the end of your travel day, leave all completed diaries in a convenient place at home so they will be available when the interviewer calls.
- Use the back of this card and an extra card, if necessary.
- If you have any questions about completing this travel diary, please call our toll-free number: **1-800-447-8287**

	WHERE did this trip end?	KIND OF PLACE (Restaurant, doctor's office, grocery store)	PURPOSE of trip (Check one)	TIME of trip (Circle AM or PM)	MODE of travel (Check one)	IF DRIVER, number in vehicle (Include self)
1	First I Went To: Name of Place; Address or Intersecting Streets; City State Zip Code		☐ Return Home ☐ Go to Work ☐ Shopping ☐ School ☐ Personal ☐ Social/ Recreational ☐ Eat Meal ☐ Job Related ☐ Change Mode (e.g. Auto to bus) ☐ Pick up/drop off Passenger	BEGIN ___:___ AM PM; END ___:___ AM PM	☐ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:	
2	Then I Went To: Name of Place; Address or Intersecting Streets; City State Zip Code		☐ Return Home ☐ Go to Work ☐ Shopping ☐ School ☐ Personal ☐ Social/ Recreational ☐ Eat Meal ☐ Job Related ☐ Change Mode (e.g. Auto to bus) ☐ Pick up/drop off Passenger	BEGIN ___:___ AM PM; END ___:___ AM PM	☐ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:	
3	Then I Went To: Name of Place; Address or Intersecting Streets; City State Zip Code		☐ Return Home ☐ Go to Work ☐ Shopping ☐ School ☐ Personal ☐ Social/ Recreational ☐ Eat Meal ☐ Job Related ☐ Change Mode (e.g. Auto to bus) ☐ Pick up/drop off Passenger	BEGIN ___:___ AM PM; END ___:___ AM PM	☐ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:	

	WHERE did this trip end?	KIND OF PLACE (Restaurant, doctor's office, grocery store)	PURPOSE of trip (Check one)	TIME of trip (Circle AM or PM)	MODE of travel (Check one)	number in vehicle (include self)
(4) Then I Went To:	Name of Place Address or Intersecting Streets City State Zip Code		☐ Return Home ☐ Job Related ☐ Go to Work ☐ Change Mode (e.g. Auto to bus) ☐ Shopping ☐ Pick up/drop off Passenger ☐ School ☐ Personal ☐ Social/ Recreational ☐ Eat Meal	BEGIN : AM PM END : AM PM	☐ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:_____	
(5) Then I Went To:	Name of Place Address or Intersecting Streets City State Zip Code		☐ Return Home ☐ Job Related ☐ Go to Work ☐ Change Mode (e.g. Auto to bus) ☐ Shopping ☐ Pick up/drop off Passenger ☐ School ☐ Personal ☐ Social/ Recreational ☐ Eat Meal	BEGIN : AM PM END : AM PM	☐ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:_____	
(6) Then I Went To:	Name of Place Address or Intersecting Streets City State Zip Code		☐ Return Home ☐ Job Related ☐ Go to Work ☐ Change Mode (e.g. Auto to bus) ☐ Shopping ☐ Pick up/drop off Passenger ☐ School ☐ Personal ☐ Social/ Recreational ☐ Eat Meal	BEGIN : AM PM END : AM PM	☐ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:_____	
(7) Then I Went To:	Name of Place Address or Intersecting Streets City State Zip Code		☐ Return Home ☐ Job Related ☐ Go to Work ☐ Change Mode (e.g. Auto to bus) ☐ Shopping ☐ Pick up/drop off Passenger ☐ School ☐ Personal ☐ Social/ Recreational ☐ Eat Meal	BEGIN : AM PM END : AM PM	☐ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:_____	
(8) Then I Went To:	Name of Place Address or Intersecting Streets City State Zip Code		☐ Return Home ☐ Job Related ☐ Go to Work ☐ Change Mode (e.g. Auto to bus) ☐ Shopping ☐ Pick up/drop off Passenger ☐ School ☐ Personal ☐ Social/ Recreational ☐ Eat Meal	BEGIN : AM PM END : AM PM	☐ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:_____	
(9) Then I Went To:	Name of Place Address or Intersecting Streets City State Zip Code		☐ Return Home ☐ Job Related ☐ Go to Work ☐ Change Mode (e.g. Auto to bus) ☐ Shopping ☐ Pick up/drop off Passenger ☐ School ☐ Personal ☐ Social/ Recreational ☐ Eat Meal	BEGIN : AM PM END : AM PM	☐ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:_____	

	WHERE did this trip end?	KIND OF PLACE (Restaurant, doctor's office, grocery store)	PURPOSE of trip (Check one)	TIME of trip (Circle AM or PM)	MODE of travel (Check one)	IF DRIVER, number in vehicle (include self)
(4) Then I Went To:	Name of Place: EAST-WEST GATEWAY CC Address or Intersecting Streets: 911 WASHINGTON AVE. City: ST. LOUIS State: MO Zip Code: 63101	OFFICE BUILDING	☐ Return Home ☑ Go to Work ☐ Shopping ☐ School ☐ Personal ☐ Social/ Recreational ☐ Eat Meal ☐ Job Related ☐ Change Mode (e.g. Auto to bus) ☐ Pick up/drop off Passenger	BEGIN 12:45 AM (PM) END 1:00 AM (PM)	☐ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☑ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:	
(5) Then I Went To:	Name of Place: CHILDGARDEN SCHOOL Address or Intersecting Streets: LINDELL AND VANDEVENTER City: ST. LOUIS State: MO Zip Code: 63108	DAY CARE CENTER	☐ Return Home ☐ Go to Work ☐ Shopping ☐ School ☑ Personal ☐ Social/ Recreational ☐ Eat Meal ☐ Job Related ☐ Change Mode (e.g. Auto to bus) ☒ Pick up/drop off Passenger [CHANGE PURPOSE TO: Pick up/Drop off Passenger]	BEGIN 5:15 AM (PM) END 5:35 AM (PM)	☑ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:	1
(6) Then I Went To:	Name of Place: HOME Address or Intersecting Streets: City: State: Zip Code:	HOME	☑ Return Home ☐ Go to Work ☐ Shopping ☐ School ☐ Personal ☐ Social/ Recreational ☐ Eat Meal ☐ Job Related ☐ Change Mode (e.g. Auto to bus) ☐ Pick up/drop off Passenger	BEGIN 5:40 AM (PM) END 5:55 AM (PM)	☑ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:	2
(7) Then I Went To:	Name of Place: Address or Intersecting Streets: City: State: Zip Code:		☐ Return Home ☐ Go to Work ☐ Shopping ☐ School ☐ Personal ☐ Social/ Recreational ☐ Eat Meal ☐ Job Related ☐ Change Mode (e.g. Auto to bus) ☐ Pick up/drop off Passenger	BEGIN : AM PM END : AM PM	☐ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:	
(8) Then I Went To:	Name of Place: Address or Intersecting Streets: City: State: Zip Code:		☐ Return Home ☐ Go to Work ☐ Shopping ☐ School ☐ Personal ☐ Social/ Recreational ☐ Eat Meal ☐ Job Related ☐ Change Mode (e.g. Auto to bus) ☐ Pick up/drop off Passenger	BEGIN : AM PM END : AM PM	☐ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:	
(9) Then I Went To:	Name of Place: Address or Intersecting Streets: City: State: Zip Code:		☐ Return Home ☐ Go to Work ☐ Shopping ☐ School ☐ Personal ☐ Social/ Recreational ☐ Eat Meal ☐ Job Related ☐ Change Mode (e.g. Auto to bus) ☐ Pick up/drop off Passenger	BEGIN : AM PM END : AM PM	☐ Driver (auto/van/pickup/motorcycle) ☐ Passenger (auto/van/pickup/motorcycle) ☐ Public Bus ☐ Taxi ☐ School Bus ☐ Heavy Truck ☐ Walk or Bike (to work) ☐ Other:	

EAST-WEST GATEWAY COORDINATING COUNCIL

911 WASHINGTON AVENUE
ST. LOUIS, MISSOURI 63101
314 421-4220 618 274-2750
FAX 314 231-6120

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President, Board of Aldermen
City of St. Louis

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EXECUTIVE DIRECTOR
Les Sterman

[June 15, 1990] ← No DATE

Dear Fellow Citizen:

Thank you for agreeing to take part in the East-West Gateway Coordinating Council's regional travel survey. Your participation in this study is important because the information which you provide will help plan for new and improved roads and transportation services for the St. Louis area.

As stated in the telephone call you received from a survey team member several days ago, your household is one of a small number of households chosen at random. All information collected for this survey is *strictly confidential*, and will be combined with responses from other households to give us a "snapshot" of regional travel patterns. Instructions to provide the information are included in the packet accompanying this letter.

If you have any questions about the purpose of the survey or about the travel diary, please call Mr. Martin Altman of East-West Gateway at one of the numbers listed above or Mr. Mark Douglas of NSI toll-free at (800) 447-8278.

Thank you again for your time and cooperation.

Sincerely,

[Les Sterman
Executive Director]

Signed by: Thomas A. Villa

Nelson Hagnauer

An Equal Opportunity Employer

TRAVEL DIARY

Sample Number_____

Section V. Trip Data

TRIPS FOR PERSON NUMBER:_____
(use person number from household data form)
NAME:_____

TRAVEL DAY:_____

NOTES:

(0) My first trip today began at:
☐ Home
☐ Other location as shown below (If not home)

Name of Place

Address or Intersecting Streets

City State Zip Code

ADD
↓
Trip Purpose (if not home) ☐

	WHERE did this trip end?	KIND OF PLACE (Restaurant, doctor's office, grocery store)	PURPOSE of trip (Circle one)	TIME of trip (Circle AM or PM)	MODE of travel (Circle one)	IF DRIVER, number in vehicle (include self)
(1) First I Went To:	Name of Place Address or Intersecting Streets City State Zip Code		0 Return Home 7 Job Related 1 Go to Work 8 Change Mode (e.g. Auto to bus) 2 Shopping 9 Pick up/drop off Passenger 3 School 4 Personal 5 Social/ Recreational 6 Eat Meal ↑ ADD MORE SPACE BETWEEN RESPONSES	BEGIN AM PM END AM PM	1 Driver (auto/van/pickup/motorcycle) 2 Passenger (auto/van/pickup/motorcycle) 3 Public Bus 4 Taxi 5 School Bus 6 Heavy Truck 7 Walk or Bike (to work) 8 Other:_____	
(2) Then I Went To:	Name of Place Address or Intersecting Streets City State Zip Code		0 Return Home 7 Job Related 1 Go to Work 8 Change Mode (e.g. Auto to bus) 2 Shopping 9 Pick up/drop off Passenger 3 School 4 Personal 5 Social/ Recreational 6 Eat Meal	BEGIN AM PM END AM PM	1 Driver (auto/van/pickup/motorcycle) 2 Passenger (auto/van/pickup/motorcycle) 3 Public Bus 4 Taxi 5 School Bus 6 Heavy Truck 7 Walk or Bike (to work) 8 Other:_____	
(3) Then I Went To:	Name of Place Address or Intersecting Streets City State Zip Code		0 Return Home 7 Job Related 1 Go to Work 8 Change Mode (e.g. Auto to bus) 2 Shopping 9 Pick up/drop off Passenger 3 School 4 Personal 5 Social/ Recreational 6 Eat Meal	BEGIN AM PM END AM PM	1 Driver (auto/van/pickup/motorcycle) 2 Passenger (auto/van/pickup/motorcycle) 3 Public Bus 4 Taxi 5 School Bus 6 Heavy Truck 7 Walk or Bike (to work) 8 Other:_____	

ORIENT BACK SIDE SO TOP EDGE IS ↑

OVER

Need Δ to editing & coding manuals.

coders convert #'s.

HOUSEHOLD DATA

Sample No. _____

Section I. Household Data

Please answer the following questions about your household:

ADD, BUT DON'T EXTEND BEYOND LINE

1. Is the address label at the right correct? [☐ Yes ☐ No]
2. How many people live in this household? _____
3. How many people are 5 years old or older? _____
4. How many visitors from outside the area are staying with you on your travel day? _____

[NOTE: ADD LISTED/UNLISTED CODE TO TSHIP LABEL BA TASK.]

5. How many cars, pickups and vans are generally available for use by this household? _____

letter did you circle for

6. What was the combined income from all sources for all members of your household in 1989 ~~(use code)~~? _____

a ~~0~~	Under $10,000	f ~~5~~	$30,000 - $34,999
b ~~1~~	$10,000 - $14,999	g ~~6~~	$35,000 - [illegible],999
c ~~2~~	$15,000 - $19,999	h ~~7~~	$40,000 - $49,999
d ~~3~~	$20,000 - $24,999	i ~~8~~	$50,000 - $59,999
e ~~4~~	$25,000 - $29,999	j ~~9~~	$60,000 or more

Section II. Person Data

Please fill out the following table. **Complete one line for each member of your household.** Each line of the table begins with a person number. Please be sure that the person number on this form corresponds to the person number on each persons' travel diary.

PERSON NUMBER	RELATION TO HEAD OF HOUSEHOLD: Spouse/Partner	Child	Other Member of Household	Out-of-Area Visitor	AGE	SEX	LICENSED TO DRIVE?	EMPLOYMENT STATUS (circle as many as apply): Employed Full Time	Employed Part Time	Employed Multiple Jobs	Homemaker	Retired	Student	Other	INTERVIEWED?	USED DIARY?
01	1	HEAD OF HOUSEHOLD				1 M 2 F	1 YES 2 NO	1	2	3	4	5	6	7	1 YES 2 NO	1 YES 2 NO
02	2	3	4	5		1 M 2 F	1 YES 2 NO	1	2	3	4	5	6	7	1 YES 2 NO	1 YES 2 NO
03	2	3	4	5		1 M 2 F	1 YES 2 NO	1	2	3	4	5	6	7	1 YES 2 NO	1 YES 2 NO
04	2	3	4	5		1 M 2 F	1 YES 2 NO	1	2	3	4	5	6	7	1 YES 2 NO	1 YES 2 NO
05	2	3	4	5		1 M 2 F	1 YES 2 NO	1	2	3	4	5	6	7	[illegible] 2 NO	1 YES 2 NO
06	2	3	4	5		1 M 2 F	1 YES 2 NO	1	2	3	4	5	6	7	1 YES 2 NO	1 YES 2 NO
07	2	3	4	5		1 M 2 F	1 YES 2 NO	1	2	3	4	5	6	7	1 YES 2 NO	1 YES 2 NO
08	2	3	4	5		1 M 2 F	1 YES 2 NO	1	2	3	4	5	6	7	1 YES 2 NO	1 YES 2 NO
09	2	3	4	5		1 M 2 F	1 YES 2 NO	1	2	3	4	5	6	7	1 YES 2 NO	[illegible]ES [illegible] NO
10	2	3	4	5		1 M 2 F	1 YES 2 NO	1	2	3	4	5	6	7	1 YES 2 NO	1 YES 2 NO

REMOVE → Travel Day _____

Listed Telephone? 1 YES 2 NO

Section III. Trip Summary

A. Total vehicular trips _____
B. Persons age 5 and older making trips _____
C. Persons 5 and older [illegible] making trips _____
D. Complete or incomplete interview code _____

Section IV. Administrative

REMOVE & CHANGE → A. Household telephone number _____

~~B.~~ Telephone contacts:

Date	Time	Outcome	Initials

B. ~~C.~~ Completed interview submitted:

Date: _____ By: _____

I certify that all the information on this form is correct and true

_____
Signature of Interviewer

C. ~~D.~~ If interview submitted incomplete, give reason

_____

D. ~~E.~~ First edit FAIL PASS

Date: _____ Initials: _____

E. ~~F.~~ Final edit: FAIL PASS

Date: _____ Initials: _____

[No Change]

Remember

Your Travel Day Is

Thursday
June 28

(4:00 a.m. to 4:00 a.m.)

Remember,
Have Every Household Member and
Out-of-Town Visitor Take A Travel Diary
And Keep A Record of His or Her Trips!

Thank You!

East-West Gateway
Coordinating Council

For further information call toll free:
1-800-447-8287

Appendix B
TSMIS SURVEY PRODUCTIVITY REPORTS

DAILY SUMMARY REPORT#1 - TELEPHONE INTERVIEWER PRODUCTIVITY

07/06/90

TELEPHONE INTERVIEWER ID # = 1

# of households called = 30
% of households agreeing = 0.200
% of households refusing or other = 0.800

# of hours worked = 4.000
Productivity Rate = 1.500 (# of households agreeing/hour)

TELEPHONE INTERVIEWER ID # = 2

# of households called = 127
% of households agreeing = 0.142
% of households refusing or other = 0.858

# of hours worked = 6.500
Productivity Rate = 2.769 (# of households agreeing/hour)

TELEPHONE INTERVIEWER ID # = 3

# of households called = 107
% of households agreeing = 0.075
% of households refusing or other = 0.925

# of hours worked = 6.000
Productivity Rate = 1.333 (# of households agreeing/hour)

TELEPHONE INTERVIEWER ID # = 4

# of households called = 136
% of households agreeing = 0.132
% of households refusing or other = 0.868

# of hours worked = 6.000
Productivity Rate = 3.000 (# of households agreeing/hour)

TELEPHONE INTERVIEWER ID # = 5

# of households called = 8
% of households agreeing = 0.250
% of households refusing or other = 0.750

# of hours worked = 1.000
Productivity Rate = 2.000 (# of households agreeing/hour)

TOTAL

# of households called = 293
# of households unable to contact = 118
% of households agreeing = 0.177
% of households refusing or other = 0.823

# of hours worked = 23.500
Productivity Rate = 2.213 (# of households agreeing/hour)

DAILY SUMMARY REPORT #3 - FIELD INTERVIEWER PRODUCTIVITY

07/06/90

FIELD INTERVIEWER ID # = 1

HH Size	Autos	# Households Completed)	Avg # of Trips
1	0	0	0.000
1	1	4	2.500
1	2	0	0.000
2	0	0	0.000
2	1	3	8.667
2	2	6	5.333
3	0	0	0.000
3	1	0	0.000
3	2	4	7.500
4	0	0	0.000
4	1	0	0.000
4	2	2	12.500
5	0	0	0.000
5	1	0	0.000
5	2	4	8.750
TOTAL			
		23	6.870

# of hours worked = 29.000
Productivity Rate = 0.793 (# of households completed/hour)

FIELD INTERVIEWER ID # = 2

HH Size	Autos	# Households (Completed)	Avg # of Trips
1	0	0	0.000
1	1	0	0.000
1	2	0	0.000
2	0	0	0.000
2	1	0	0.000
2	2	0	0.000
3	0	0	0.000
3	1	1	4.000
3	2	0	0.000
4	0	0	0.000
4	1	0	0.000
4	2	1	0.000
5	0	0	0.000
5	1	0	0.000
5	2	0	0.000
TOTAL			
		2	2.000

# of hours worked = 2.500
Productivity Rate = 0.800 (# of households completed/hour)

FIELD INTERVIEWER ID # = 4

HH Size	Autos	# Households (Completed)	Avg # of Trips
1	0	0	0.000
1	1	1	2.000
1	2	0	0.000
2	0	1	2.000
2	1	0	0.000
2	2	0	0.000
3	0	0	0.000
3	1	1	0.000
3	2	0	0.000
4	0	0	0.000
4	1	0	0.000
4	2	2	12.000
5	0	0	0.000
5	1	0	0.000
5	2	0	0.000
TOTAL			
		5	5.600

# of hours worked = 9.000
Productivity Rate = 0.556 (# of households completed/hour)

FIELD INTERVIEWER ID # = 6

HH Size	Autos	# Households (Completed)	Avg # of Trips
1	0	0	0.000
1	1	2	2.500
1	2	0	0.000
2	0	0	0.000
2	1	3	6.000
2	2	2	10.000
3	0	0	0.000
3	1	0	0.000
3	2	1	9.000
4	0	0	0.000
4	1	0	0.000
4	2	2	16.000
5	0	0	0.000
5	1	0	0.000
5	2	0	0.000
TOTAL			
		10	8.400

# of hours worked = 19.000
Productivity Rate = 0.526 (# of households completed/hour)

GRAND TOTAL

	41	6.927

# of hours worked = 59.500

Barton-Aschman Associates, Inc.

MEMORANDUM TO: Martin Altman
East-West Gateway Coordinating Council

FROM: David L. Kurth
Barton-Aschman Associates, Inc.

DATE: December 4, 1990

SUBJECT: Task C.5--Verify and Process Survey Responses Computerized Survey Data Edit Checks

OVERVIEW

A survey editing / checking program (SURVCHK) has been written as part of the Travel Survey Management Information System (TSMIS) maintained by Barton-Aschman. The program has been adapted for use in the St. Louis Region Travel Survey.

SURVCHK performs checks on the travel data that have been collected and keyed into dBase III+ database files. The following types of checks are performed:

- range checks on household data
- range checks on person data
- range checks on trip data
- interrecord checks comparing trip information to household data

SURVCHK can be run on keyed survey data at any time. However, it is most efficient to run the program at the end of each day of data entry. The program reads the keyed data, checks for errors, and appends survey data that passes all edit checks to master database files. Error messages are written to the screen and the printer. If any part of the keyed survey data (i.e., the household data, the person data, or the trip data) fails an edit check, all of the data are written out to "rejects" files. Survey personnel have two options with the "reject" data: the data can be corrected and rerun through the SURVCHK program separately, or the data can be corrected and appended to the next day's survey data to be edited.

FILES REQUIRED

Three input files are required by the program:

- HHDATA.DBF
- PERSDATA.DBF
- TRIPDATA.DBF

The dBase file structures for the three files are shown in Tables 1, 2, and 3. Further explanations of the data in the files can be found in the Editing and Coding Manual for the survey.

TABLE 1
INPUT HOUSEHOLD DATA STRUCTURE

Field	Field Name	Type	Width	Description
1	RECTYPE1	Numeric	1	Record Type
2	SAMPNO	Numeric	4	Sample Number
3	FAMSIZ	Numeric	2	Family Size
4	FAMSIZ5P	Numeric	2	Family Size (5 Years and Older)
5	VISITORS	Numeric	1	Number of Visitors on Travel Day
6	AUTOS	Numeric	1	Autos Available
7	INCOME	Character	1	Income Code
8	TRAVELD	Numeric	4	Travel Day
9	LSTPHONE	Numeric	1	Listed Telephone?
10	TRIPS	Numeric	2	Number of Trips in Vehicles
11	TRPMKRS	Numeric	2	Number of Trip Makers (Trips in Vehicles)
12	NTRPMKRS	Numeric	2	Number of Non-Trip Makers
13	COMPLTNC	Numeric	1	Completion Code
14	SEQNO	Numeric	4	NSI Sequence Number

TABLE 2
INPUT PERSON DATA STRUCTURE

Field	Field Name	Type	Width	Description
1	RECTYPE2	Numeric	1	Record Type
2	SAMPNO	Numeric	4	Sample Number
3	PERSNO	Numeric	2	Person Number
4	RELATION	Numeric	1	Relation Code
5	AGE	Numeric	2	Age
6	GENDER	Numeric	1	Gender
7	LICENSE	Numeric	1	Licensed Driver?
8	EMPSTAT	Character	5	Employment Status
9	INTERVIEW	Numeric	1	Interviewed?
10	DIARY	Numeric	1	Diary Used?

TABLE 3
INPUT TRIP DATA STRUCTURE

Field	Field Name	Type	Width	Description
1	RECTYPE3	Numeric	1	Record Type
2	SAMPNO	Numeric	4	Sample Number
3	PERSNO	Numeric	2	Person Number
4	TRIPNO	Numeric	2	Trip Number
5	ADDRESS1	Character	29	Address 1 Information
6	DIRECTION	Character	1	Street Direction
7	ADDRESS2	Character	28	Address 2 Information
8	STRTYP	Character	2	Street Type
9	CITY	Character	23	City
10	STATE	Character	2	State
11	ZIPCODE	Numeric	5	Zip Code
12	PLACE	Numeric	1	Kind of Place
13	PURPOSE	Numeric	1	Trip Purpose
14	BEGIN_TIME	Numeric	4	Beginning Time
15	BEGIN_AMPM	Character	1	Beginning Time (AM or PM)
16	END_TIME	Numeric	4	Ending Time
17	END_AMPM	Character	1	Ending Time (AM or PM)
18	MODE	Numeric	1	Travel Mode
19	AUTO_OCC	Numeric	1	Auto Occupancy

DATA CHECKS PERFORMED

Household Data Range Checks

- Family size must be in the range 1 - 20
- Family size age 5 and older must be in the range 1 - 20
- Family size age 5 and older must be less than family size
- Visitors must be in the range 0 - 9
- Income code must be in the range 0 - 9 or R
- Travel day must be a valid travel date
- The sum of trip makers and non-trip makers must equal the sum of the family size age 5 and older plus the number of visitors
- Listed phone must be 1 or 2
- Completion code must be 1

Person Data Range Checks

- Person numbers are not skipped or repeated
- Relationship code is in the range 1 - 5
- Age is in the range 1 - 99
- Gender is 1 or 2
- Drivers license is 1 or 2
- Each employment status code is in the range 1 - 7 and codes are not repeated
- Interviewed code is 1 or 2
- Used diary code is 1 or 2

Trip Data Range Checks

- Trip numbers are not skipped or repeated for any person
- A 0 trip record exists for each person
- Kind of place is in the range 0 - 9
- Purpose is in the range 0 - 9
- Beginning time of trip is legal (000 - 059, 100 - 159, ...)
- Beginning AM or PM code is A or P
- Ending time of trip is legal (000 - 059, 100 - 159, ...)
- Ending AM or PM code is A or P
- Beginning time is before the ending time
- Mode is in the range 1 - 8
- Auto occupancy is in the range 1 - 9 if mode is auto driver
- Auto occupancy is 0 is mode is not auto driver

In addition, the program cross-tabulates the trip purpose by the kind of place codes to allow checking for illogical combinations.

Interrecord Checks

- Person number is less than or equal to the sum of the family size age 5 and older plus the number of visitors
- At least one trip record (the 0 record) exists for each person
- Persons without a drivers license are not listed as auto drivers
- If purpose is to work, an employment status of 1, 2, or 3 is listed
- The sum of motorized trips from the trip records is equal to the total trips coded on the household record
- The sum of persons making trips in motorized vehicles on the trip records is equal to the number of trip makers listed on the household record

DLK/LM1466*WP31
9171.50.32

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November 29, 1990

TO: David Kurth
Barton Aschman Associates

FROM: Karen L. Manges
NuStats, Inc.

RE: Recruitment quality control procedures.

This memo details the quality control procedures implemented and followed by NuStats during the recruitment stages of the St. Louis Travel Study.

Procedures

NuStats' Quality Control department, completely separate from our field operation, is responsible for the overall maintenance of high quality data. Specifically, this department is charged with the monitoring of interviewers, detailed editing of all surveys, as well as validation of the interviewers work. For recruitment, this meant the monitoring of recruiters for thoroughness and clarity. QC staff listened specifically for whether or not those recruiters followed the script as written, how well they explained the purpose of the study, how well they listened to the respondent, the thoroughness of their probing for names and addresses. In addition, QC monitors also listened to the level of interest and tonal quality. Any deviations were noted on a validation form and then verbally addressed to the recruiter either by the QC person or the recruitment supervisor. Additionally, copies of the validation forms were forwarded to the project manager, field director, and supervisors. Copies of the validation reports are included at the end of this section.

NSI also used several reports to measure and maintain recruiter productivity. One report, done nightly by the field supervisor measures overall recruits per dialing hour for each interviewer. Also detailed in this report are overall dialings per hour. This provides a comparative analysis by recruiter and allows adjustments to be made daily.

NSI also utilized the productivity reports generated in the Travel Survey Management Information System (TSMIS) database. Copies of these weekly reports were forwarded to both Barton-Aschman Associates and the East-West Gateway Coordinating Council for review. Detailed in these reports are cooperation rates by recruiter, hours worked, and overall productivity.

Problems Encountered and Resolutions

Overall, there were very few problems encountered in the recruitment portion of the project. A problem early on was that recruiters were recruiting households in which members had expressed doubts about everyone participating. Consequently, this was reflected in the data collection portion. Recruiters were rebriefed and reminded that the entire household had to participate . If any doubts about the entire household 's willingness to participate existed, recruiters were instructed not to recruit the household.

Results

Overall, the recruiters for this project maintained an excellent 51.3% cooperation rate. Recruiters were expected to maintain at least a 40% cooperation rate. Any falling below this were reassigned either to data collection or simply pulled from the project if not needed elsewhere. The following table reflects each recruiters cooperation rate as well as their productivity rate (# of households agreeing per hour).

Recruiter ID	Cooperation Rate	Productivity Rate
1	49.7%	2.3
2	37.3%*	2.5
3	66.6%	2.4
4	37.4%	2.7
5	60.3%	4.4
6	61.5%	3.5
7	54.8%	1.3
8	71.4%	1.7
9	22.7%*	0.78
10	12.5%**	0.33
11	74.4%	2.8
12	59.9%	2.5
13	43.9%	2.4
20	49.6%	2.7
22	60.0%	1.4
23	54.1%	6.8
25	67.5%	2.1
26	14.7%*	0.50

Recruiter ID	Cooperation Rate	Productivity Rate
28	40.4%	2.3
29	35.0%*	3.5
31	40.9%	1.6
32	65.2%	0.92
33	72.7%	3.5
34	65.6%	5.2
Overall	51.3%	2.5

* pulled from project
** reassigned to data collection

VALIDATION / MONITORING RECORD

Project Name: Saint Louis
Project Number: 90154
Date: 10-10-90
Project Supervisor: Miguel Contreras

Interviewer Name: Colleen Pierson ID Number: 12/1117 Station Number: 11
Surveys Monitored: 1 Surveys Validated:
Comments: Recruiting: On this first recruitment I came in on Q#6 and the amount of vehicles owned was asked without the breakdown. #7 and #8 were asked and the transition to Packet/Diary and Travel Date was fair. She →

Interviewer Name: Colleen Pierson ID Number: 12/1117 Station Number: 11
Surveys Monitored: 1 Surveys Validated:
Comments: Recruiting: She did not stick to introduction and expanded on the reason for the survey. On #6, she only asked for cars. #7 and #8 were satisfactory, but her Packet/Travel Diary section was lengthy with extra data →

Interviewer Name: Colleen Pierson ID Number: 12/1117 Station Number: 11
Surveys Monitored: 1 Surveys Validated:
Comments: Recruiting: Introduced survey well. After #8, respondent started to refuse. She then explained limitation of sample and the highway improvement requirements. Respondent said she worked →

Interviewer Name: Joye Barnett ID Number: 01/115 Station Number: 15
Surveys Monitored: 1 Surveys Validated:
Comments: Recruiting: Joye followed introduction well and paused to allow feedback. She asked Q#6, #7, and #8 as written. Transferred smoothly from Packet/Travel Date to address and name. →

Interviewer Name: Joye Barnett ID Number: 01/115 Station Number: 15
Surveys Monitored: 1 Surveys Validated:
Comments: Recruiting: Talked to a young man, son of the Household and followed Script for introduction and #6, #7 and #8. After Explaining Packet/Travel Date, confirmed that other family members would

Interviewer Name: Joye Barnett ID Number: 01/115 Station Number: 15
Surveys Monitored: 1 Surveys Validated:
Comments: Recruiting: She recruited a family related to our clients (Father of Head of House hold) was on board of Directors.). Followed introduction well and was very amiable. Person was willing

VALIDATION / MONITORING RECORD

Project Name: St Louis Recruiting Date: 10-18-90
Project Number: 90154 Project Supervisor: Miguel Contreras

Interviewer Name: Colleen Pierson ID Number: 12/1117 Station Number: 11
Surveys Monitored: 1 Surveys Validated: _____
Comments: Could stick closer to script but, no problems yet. Needs to cut short the explanations (unsolicited) and go ahead and get address data. Good tone and pace

Interviewer Name: Zaila Castillo ID Number: 26 Station Number: 23
Surveys Monitored: 1 Surveys Validated: _____
Comments: Good tone Cadence needs to be more natural. She sounds slightly uptight. Relaxing would put respondent at ease and make her easier to understand and in control

Interviewer Name: Sean ~~Reddick~~ Ridick ID Number: 20 Station Number: 29
Surveys Monitored: 1 Surveys Validated: _____
Comments: Good tone, Proffesional, Followed script well, Respondent was interested

Interviewer Name: Sharon Blackwell ID Number: 25 Station Number: 18
Surveys Monitored: 1 Surveys Validated: _____
Comments: Stick to #6 as written Addition to introduction was good

Interviewer Name: Curtis McDonald ID Number: 28 Station Number: 43
Surveys Monitored: 1 Surveys Validated: _____
Comments: Needs to stick to script till he gets more comfortable with it Needs to smooth it out and relax. Good tone. Polite He missed one or to details that he later probed for and would have noticed if he paid attention to Respondent. Did well for 1st Night

Interviewer Name: _____ ID Number: _____ Station Number: _____
Surveys Monitored: _____ Surveys Validated: _____
Comments: _____

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November 29, 1990

TO: David Kurth
Barton Aschman Associates

FROM: Karen L. Manges
NuStats, Inc.

RE: Data collection quality control procedures.

This memo details the quality control procedures implemented and followed by NuStats during the data collection portion of the St. Louis Travel Study.

Procedures

Prior to being sent to data processing, all completed interviews go through three edits. First, all interviewers conduct a self edit on each completed survey focusing specifically on omissions and legibility, travel time logic, vehicle occupancy counts, and total vehicular trip consistency between the trip records and the household data forms. Once this initial edithas been completed, data collectors sign a check list attesting to their reveiw and attach this to the completed form. A copy of this form is attached.

Next, the completed interview progresses through a field edit. Under the field service jurisdiction and supervised by the field supervisor, these edits are done on the same night as the data is collected which allows immediate feedback to the interviewers. This fosters a more thorough understanding of the data collection procedures as well as facilitates the correction process as it allow interviewers to immediately call back the household for corrections. Field editors specifically focus on the household's trip information logic and consistency. Any inconsistencies are immediately returned to the data collector for corrections or clarifications.

In addition to the field edits, all data collected is also routed through NSI's Quality Control department. This department, completely separate from the field operation, is responsible for the overall maintenance of high quality data. Quality control, in addition to re-editing the same information as the field editors, is also charged with all coding of the interview. QC staff must code each survey for income, listed or unlisted telephone number, and land use code. In addition, quality control is responsible for providing a "codeable" address which oftentime requires an extensive search through telephone books and criss-cross directories.

Quality Control is also responsible for all survey monitoring and validation. Every interviewer is monitored paying particular attention to probing for address information, tone of voice, and overall flow and pace of the interview. In addition

to monitoring, approximately 10% of each interviewers work is validated. Copies of both the monitoring and validation forms are attached.

As in the recruitment, NSI also utilizes the Barton-Aschman Travel Survey Management Information System (TSMIS) reports to measure field interviewer productivity. These reports generate for each data collector, the number of households completed, a productivity rate, as well as the average number of trips among the households completed by that particular interviewer. Interviewers showing a lower than average number of trips are closely monitored with corrective measures taken as needed.

Problems Encountered and Resolutions

Most of the problems encountered in the data collection portion of the travel survey revolved around inconsistent data in terms of travel times etc. which were easily corrected by calling the household back.

As was expected, some households refused to participate in the travel study after they had originally agreed to do so. Approximately 16% of households recruited refused to participate. For another 1%, we were unable to obtain complete travel information for all members of the household thus rendering the entire household useless. The table below presents the disposition of calls for data collection:

Completed survey	1415	76%
Refused (after recruitment agreement)	292	16%
Quit (during survey)	30	2%
Phone disconnected	21	1%
Reported mailing in travel diaries	13	.7
Pending	96	5%

Results

Overall, the data collectors for this project had an overall productivity rate of 1.13 completed households per hour. The overall average number of trips is 9.28. The following table reflects each interviewers number of completes along with their average trip rate as well as their productivity rate (# of completed households per hour).

Data Collector ID	HHs CM	Avg # Trips	Productivity Rate
1	77	8.45	.928
2†	9	6.89	.667
3	85	8.92	1.01
4†	27	6.93	.991
6	107	9.74	.975

Data Collector ID	HHs CM	Avg # Trips	Productivity Rate
7	270	8.75	1.34
8	29	8.52	.935
10	93	9.98	1.28
11	42	11.62	1.45
12	123	9.37	1.09
13	128	8.74	1.15
14*	1	24.0	2.00
16**	8	8.25	.405
18**	10	12.2	1.00
19***	58	8.83	.699
20	21	13.04	.913
21	18*	7.39	1.00
22	3	13.67	.75
24	86	10.05	1.21
26	20	9.25	.667
27	84	9.24	1.44
29	4	17.50	.800
30	22	13.18	1.49
32	3	16.33	.375
33	1	15.00	1.00
35	3	10.33	.375
36	9	7.89	2.40
37	3	14.33	.857
38	9	5.67	1.71
39	9	7.56	1.56
40	3	9.67	.857
41	35	8.11	1.67
42	2*	18.5	.296
Overall	1415	9.3	1.13

† pulled from project
* editor
** supervisors
*** daytime interviewer

Attachments

- Interviewer Edit Checklist
- Quality Control Edit Checklist
- Interviewer Validation Form
- Validation/Monitoring Report

- [ ] 1) Check for omissions and legibility
- [ ] 2) Check travel times. Be sure they are chronological and match with the travel times of other household members involved.
- [ ] 3) Check the # of people in the vehicle.
- [ ] 4) Check trip totals on HH Data form. Does it match the number recorded for each household member?

Signature: _____

Date: _____

- [ ] 1) Check for omissions and legibility
- [ ] 2) Check travel times. Be sure they are chronological and match with the travel times of other household members involved.
- [ ] 3) Check the # of people in the vehicle.
- [ ] 4) Check trip totals on HH Data form. Does it match the number recorded for each household member?

Signature: _____

Date: _____

- [ ] 1) Check for Omissions and Legibility

- [ ] 2) Interviewed and Diary Used?

- [ ] 3) Check Numerics for Inconsistencies
  - [ ] A.) Household and Person Data
  - [ ] B.) # of Diaries, Sample #, Person #
  - [ ] C.) # of Trips Recorded and Trip Summary
  - [ ] D.) Travel Times (especially those in conjunction and round trips)
  - [ ] E.) # of people in vehicle (if driver of vehicle)

- [ ] 3) Check for Logic
  - [ ] A.) Driver Information, # of Vehicles, Mode of Travel
  - [ ] B.) Employment Status and Trip Purpose
  - [ ] C.) Reconstruct the Travel Day for Each Person to Check Overall Logic
  - [ ] D.) Name/Kind of Place and Purpose of Trip

- [ ] 4) Make Sure Location Address is "Codable" (Address or Kind of Place)

- [ ] 5) Reconfirm Trip Summary Information

- [ ] 1) Check for Omissions and Legibility

- [ ] 2) Interviewed and Diary Used?

- [ ] 3) Check Numerics for Inconsistencies
  - [ ] A.) Household and Person Data
  - [ ] B.) # of Diaries, Sample #, Person #
  - [ ] C.) # of Trips Recorded and Trip Summary
  - [ ] D.) Travel Times (especially those in conjunction and round trips)
  - [ ] E.) # of people in vehicle (if driver of vehicle)

- [ ] 3) Check for Logic
  - [ ] A.) Driver Information, # of Vehicles, Mode of Travel
  - [ ] B.) Employment Status and Trip Purpose
  - [ ] C.) Reconstruct the Travel Day for Each Person to Check Overall Logic
  - [ ] D.) Name/Kind of Place and Purpose of Trip

- [ ] 4) Make Sure Location Address is "Codable" (Address or Kind of Place)

- [ ] 5) Reconfirm Trip Summary Information

VALIDATION SHEET

PROJECT NAME St Louis Transit # 90154

WEEK OF _____ THROUGH _____

INTERVIEWER NAME INT #	DATE:		DATE:		DATE:		DATE:		DATE:		DATE:		DATE:	
	CM'S	VLDTD	CM'S	VLDTD	CM'S	VLDTD	CM'S	VLDTD	CM'S	VLDTD	CM'S	VLDTD	CM'S	VLDTD
Natia Stewart 36	5873	Pass	6998	Pass	6476	Pass	6261	pass						
COMMENTS:														
Robert Young 29	5522	Pass	5594	Pass	4436	pass								
COMMENTS:														
Michael Brown ~~645~~ 41	6272	Pass	6567	Fail	6459	Pass	2679	Pass	6555	Pass	6288	pass	5987	pass
COMMENTS: 6567 Information on trips did not match														
Katherine Langford 38	5040	Pass	5444	pass	5324	pass	6343	pass						
COMMENTS:														
Shantae Waterson 27	3799	Pass	3914	Pass	2969	Pass	3428	pass	3049	pass	3907	pass	5339	pass
COMMENTS:														
TOTAL COMPLETED & VALIDATED:														

VALIDATION / MONITORING RECORD

Project Name: St. Louis
Project Number: _____ Project Supervisor: Miguel Contreras
Date: 6-05-90

Interviewer Name: Fred Cruz ID Number: _____ Station Number: 10
Surveys Monitored: 1 Surveys Validated: _____
Comments: DATA COLLECTION: Followed Respondent well. Read back what he wrote. He was friendly and very polite. He had to ask for a spelling out of names a few times when he didn't fully understand what was said. Explained himself and survey well.

Interviewer Name: Julia Muñoz ID Number: _____ Station Number: 13
Surveys Monitored: 1 Surveys Validated: _____
Comments: DATA COLLECTION: Very Friendly and Interested. Aware of each persons trips and of their connections. Would re ask and doublecheck any conflicts or inconsistencies. Probed Well and had a good tone

Interviewer Name: Betty Stockton ID Number: _____ Station Number: 14
Surveys Monitored: 1 Surveys Validated: _____
Comments: Followed survey well though would get slightly confused when the respondent would give extra information. Probed well and repeated data and recreated travel day to confirm what she had written.

Interviewer Name: Julia Muñoz ID Number: _____ Station Number: 13
Surveys Monitored: 1 Surveys Validated: _____
Comments: Friendly voice. Would Probe well. Kept a good pace on the survey and allowed respondent to follow format. She recreated each person's day about and asked about inconsistent departure and arrival times.

Interviewer Name: Betty Stockton ID Number: _____ Station Number: 14
Surveys Monitored: Various CALLBACKS Surveys Validated: _____
Comments: She needs to probe more for the diaries. If they are not "handy" are they filled out or could they get them. Also, she could explain the study more to those who do not know of it (Head of Household) before they refuse.

Interviewer Name: Fred Cruz ID Number: _____ Station Number: 10
Surveys Monitored: 1 Surveys Validated: _____
Comments: Polite and concise. He set a good pace and format that respondent could follow. Probed for streets and zips, and full names of places. Was patient when respondent had to look for something or ask spouse

VALIDATION / MONITORING RECORD

Project Name: St Louis DATA Collection Date: 10-17-90
Project Number: 90154 Project Supervisor: Miguel Contreras

Interviewer Name: Richard Haddad ID Number: 03/155 Station Number: 16
Surveys Monitored: 1 Surveys Validated: _____
Comments: Followed script well. Confirmed all address and Household data before starting Data Collection. Probed well for streets and intersections. Polite, Friendly with a Good Pace.

Interviewer Name: Shantae Watterson ID Number: 27/ Station Number: 29
Surveys Monitored: 1 Surveys Validated: _____
Comments: Good upbeat tone. Probed well and followed script. Sounded Friendly.

Interviewer Name: Fred Kruse ID Number: _____ Station Number: 10
Surveys Monitored: _____ Surveys Validated: _____
Comments: _____

Interviewer Name: Julia Muñoz ID Number: 07/123/ Station Number: 13
Surveys Monitored: 1 Surveys Validated: _____
Comments: Probed for street, Ave and or Roads with intersections. Once she took purpose for granted but probed anyways. Respondent's Wife still needed to fill out diary and she made an appointment for CB and gave 1-800 #. NEEDS to listen to respondent better.

Interviewer Name: _____ ID Number: _____ Station Number: _____
Surveys Monitored: _____ Surveys Validated: _____
Comments: _____

Interviewer Name: _____ ID Number: _____ Station Number: _____
Surveys Monitored: _____ Surveys Validated: _____
Comments: _____