1. Report No. FHWA/TX-10/0-5711-P1	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle GUIDELINES AND RECOMMENDATIONS FOR HOUSEHOLD AND EXTERNAL TRAVEL SURVEYS		5. Report Date September 2009 Published: March 2010
		6. Performing Organization Code
7. Author(s) David F. Pearson, Edwin Hard, Stephen Farnsworth, Tim Forrest, Debbie Spillane, Mark Ojah, Katie Womack, Sharon A. Boxill, and Carol A. Lewis		8. Performing Organization Report No. Product 0-5711-P1
9. Performing Organization Name and Address Texas Transportation Institute The Texas A&M University System College Station, Texas 77843-3135		10. Work Unit No. (TRAIS)
		11. Contract or Grant No. Project 0-5711
12. Sponsoring Agency Name and Address Texas Department of Transportation Research and Technology Implementation Office P. O. Box 5080 Austin, Texas 78763-5080		13. Type of Report and Period Covered Product September 2006–August 2009
		14. Sponsoring Agency Code

16. Abstract
The Texas Department of Transportation has a comprehensive ongoing travel survey program. Research under RMC 0-5711 examined areas within two select travel surveys concerning quality control issues involved in data collection and sampling error in the data caused by various assumptions, survey methods, and issues such as non-response. Quality control issues, sampling errors, and non-response in external and household travel surveys conducted in Texas were identified, examined, and evaluated. This report presents an assessment of various quality control issues for household and external surveys in Texas. Much of it is based on the research documented in RMC 0-5711-R1. This report extends those findings and includes documentation on the individual data element checks performed on the data from household and external surveys conducted in Texas. A set of guidelines and recommendations are presented to maintain and improve quality control for household and external surveys in Texas.

17. Key Words External Survey, Household Survey, Response Rates, Survey Methodology, Geocoding, Data Analysis, Vehicle Classification Counts, Sample Size, Survey Design	18. Distribution Statement No restrictions. This document is available to the public through NTIS: National Technical Information Service 5285 Port Royal Road Springfield, Virginia 22161		
19. Security Classif.(of this report) Unclassified	20. Security Classif.(of this page) Unclassified	21. No. of Pages 56	22. Price

Form DOT F 1700.7 (8-72)　　　**Reproduction of completed page authorized**

GUIDELINES AND RECOMMENDATIONS FOR HOUSEHOLD AND EXTERNAL TRAVEL SURVEYS

by

David F. Pearson, Ph.D., P.E.; Research Engineer; Edwin Hard, Research Scientist; Stephen Farnsworth, Associate Research Scientist; Tim Forrest, Assistant Transportation Researcher; Debbie Spillane, Assistant Transportation Researcher; Mark Ojah, Assistant Research Specialist; and Katie Womack, Senior Research Scientist, of the Texas Transportation Institute

and

Sharon A. Boxill, Ph.D., Research Associate; and Carol A. Lewis, Ph.D., Director, of Texas Southern University

DISCLAIMER

The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the Federal Highway Administration (FHWA) or the Texas Department of Transportation (TxDOT). This report does not constitute a standard, specification, or regulation. The engineer in charge was David F. Pearson, P.E., (Texas, # 45457).

ACKNOWLEDGMENTS

TABLE OF CONTENTS

LIST OF TABLES

Page

INTRODUCTION

The Texas Department of Transportation (TxDOT), Transportation Planning and Programming Division (TPP) funds and manages an ongoing statewide travel survey program (TSP). Data are collected on different components of travel in all major urban areas in the state of Texas. Specific travel surveys are conducted to obtain data on each component of travel. Typically, four surveys are done; household, external, work place, and commercial vehicle. The household survey is designed to capture data on the internal travel generated by persons that live in an urban area. The external survey is designed to capture data on the movements of people and vehicles in and out of an urban area and through an urban area. The work place survey is designed to obtain data at the destination end of travel, and the commercial vehicle survey captures data on the movement of commercial vehicles in an urban area.

The purpose of this document is to establish some guidelines for quality control in the conduct of household and external surveys. The term "quality" has a number of definitions and is widely used with little or no explanation of what it means. For purposes of this document, quality is defined as an assessment of survey data in terms of the accuracy of the data. Accuracy of the data is measured or assessed by errors in the data, bias in the data, and consistency in the data. The research conducted under RMC Project 0-5711 specifically addressed some of the issues impacting the accuracy of the survey data for household and external surveys. These are addressed in this document as well as a number of other items being recommended to maintain the high standards for survey data that have been established in the ongoing travel survey program. This report is organized in three sections following this introduction. The first section discusses the household survey and is followed by a section discussing the external survey. The last section summarizes the research findings and recommendations.

HOUSEHOLD TRAVEL SURVEYS

Household travel surveys are contracted through a competitive bidding process conducted by the General Services Division (GSD) of TxDOT. The bid specifications outline the procedural requirements each vendor must meet if awarded the contract. Included in the bid specifications are specific technical requirements the vendor is expected to meet in conducting the survey. A copy of the current household survey bid specification may be obtained by contacting the General Services Division of TxDOT. The household survey is performed under a deliverables agreement whereby the vendor is not paid for data until the data have been received and checked to ensure it is acceptable.

Household surveys are generally conducted as follows:

- A list of phone numbers is obtained for the area being surveyed. This list may be purchased or developed by the vendor. It will typically exclude, to the extent possible, phone numbers for businesses and non-operating phone numbers. It will include unlisted as well as listed numbers and cell phone numbers. Some vendors elect to use random digit dialing (RDD) to contact households.
- A letter or postcard is mailed to the households notifying them that they have been randomly selected for the survey and will be contacted soon by phone.
- Households are contacted by phone with the phone number randomly selected. The household is asked if they would agree to participate in the survey. During this recruitment call, select data on characteristics of the household are obtained from households that agree to participate. A travel day is set up for the household during this time.
- Approximately a week before the household's travel day, an activity/travel survey package is sent to the household with the following materials:
  o general information letter explaining the survey;
  o an activity/travel survey diary for each member of the household;
  o a travel day reminder sheet;
  o a postage paid return envelope;
  o the contact name and toll free number for the household if they have questions or concerns; and
  o a letter thanking the household for participating in the survey.
- The day before the household's travel day, they are called and reminded to record their activities and travel information the next day. They are also asked if they have any questions or concerns about the survey.
- The day after the household's travel day, the household is contacted by phone to retrieve the activity and travel information. Each adult member of the household is supposed to be interviewed to retrieve each member's activities and travel information for the previous day. An adult is allowed to act as a proxy for minors in the household in providing the activity and travel information for each minor.

Contact must be made with the household within four days after the household's travel day, and all data must be retrieved within seven days after the travel day.

Prior to households being recruited for the survey, a public information campaign is initiated through press releases and local contacts with law enforcement agencies and elected public officials.

The following sections discuss the monitoring of household surveys and survey accuracy. Survey accuracy is addressed relative to eight areas. Guidelines in the form of recommended changes to existing procedures are presented.

Household Survey Monitoring

Household surveys are conducted by vendors selected through the competitive bidding process administered by TxDOT. That selection procedure contains specific criteria the vendor must meet in order to be awarded the contract. This discussion deals with the monitoring of the conduct of the survey. The vendor is required to conduct an orientation session for all vendor employees that are expected to work on the survey. This session is to explain the survey goals, objectives, guidelines, and safety procedures. Since this session establishes the context of the survey, a TxDOT representative should either be present at the session or listen in to the session by teleconference.

Vendors are required under the survey contract to conduct a pilot survey prior to the initiation of the full household survey. The pilot is intended to be a full dress rehearsal of the household survey including the sample selection, recruitment procedure, data retrieval, data checking, and data submittal. The pilot also includes the recruitment, installation, retrieval, and downloading of global positioning data (GPS). Since the pilot represents a full dress rehearsal of the entire survey, a TxDOT representative should listen to a number of recruitment and data retrieval calls. A representative should also be present at the installation and retrieval of the GPS data. The pilot data is to be submitted and reviewed following the same procedures as the normal household survey data. The vendor should be required to submit a memorandum to TxDOT with the pilot data that discusses each of the steps performed and an assessment of any problems or recommended changes. This memorandum should also include the computation of the response rate for the pilot survey.

During the conduct of the full household survey, a TxDOT representative should listen to recruitment and retrieval calls on a random basis every week. The purpose is to ensure the vendor maintains consistent procedures in both recruitment and retrieval. A TxDOT representative should also be present at the installation and retrieval of GPS equipment during the full household survey. This presence should be done randomly with no prior notification given to the vendor. Again, the purpose is to ensure the vendor consistently follows the same procedures for collecting the GPS data.

Survey Accuracy

Survey accuracy is the primary criteria for assessing the quality of the survey. There are eight areas discussed in the following sections; sample selection, survey response rate, sample frame, non-response, proxy reporting, complete household, zero trip households and persons, and pilot survey.

Sample Selection

Households are supposed to be selected randomly from the sample frame of households in the survey area with a working telephone number. The method for selecting these households historically has been where the vendor has purchased a list of telephone numbers that have been pre-screened to remove non-working and commercial numbers or the vendor has implemented a random digit dialing process. Since the survey methodology includes the mailing of a letter or postcard notifying the household they have been selected and will be contacted by phone, the purchase of a pre-screened list of phone numbers is typically the method used. Vendors should be required to specify the method they will use in their bid response, and document the method used in the survey in their final report. Most importantly, vendors should document the method and how they maintain the randomness of the selection process even when they are targeting hard to fill cells in the sampling plan.

Response Rate

The response rate for the survey is typically the measure of survey quality since it is used as an indication of non-response bias in the survey. This measure has not been a requirement in the household surveys conducted in Texas but some vendors have provided a computed response rate. Since this measure is generally accepted across the nation as a standard of good practice in

household surveys, it is recommended that the computation of the survey response rate be required in household surveys in Texas. There are two organizations that have published recommendations for computing response rates, the Council of American Survey Research Organizations (CASRO) and the American Association of Public Opinion Research (AAPOR) *(1)*.

Essentially, the response rate is the ratio of completed household surveys to the number of eligible households. The difference in computations between CASRO and AAPOR is in the definition of eligible households. The determination of the number of eligible households depends on how the unknown households are determined. In any household survey, there are those households where attempts are made to contact and no contact is ever made. These households fall into the category of unknown in terms of eligibility. The recently completed National Cooperative Research Project titled *Standardized Procedures for Personal Travel Surveys (1)* has recommended the following AAPOR formula (note formula has been adapted slightly in an effort to simplify) for computing response rates in household surveys:

$$RR = \frac{SR}{(SR + PI) + (R + O) + e_A(U + NC)}$$

Where:

SR	=	number of complete household surveys
PI	=	number of partial household surveys
R	=	number of refusals and terminations
O	=	other
U	=	unknown households
NC	=	number of non-contacts
e_A	=	estimated proportion of cases of unknown eligibility that are eligible

Since this formulation is likely to have widespread acceptance as the method for computing response rates in household surveys, it is recommended for use in Texas household surveys. To ensure consistency, Table 1 presents a breakdown and description of the possible dispositions for use by vendors in classifying households during the survey. Essentially, when households are being recruited, they fall into two groups; those whose eligibility is known and those whose eligibility is unknown. Those whose eligibility is known fall into two groups as well; eligible and not eligible. During the survey, the eligible households then become either

respondents (those that participate in the survey) or non-respondents (those that do not participate in the survey). The value for e_A is the ratio of the eligible households to the sum of eligible and ineligible households. This ratio is applied to the total number of households whose eligibility is unknown to estimate the number of them that are eligible.

Table 1. Household Survey Disposition Classifications.

Survey Eligibility	Item	Disposition Description
Eligible Interview	1	Complete household survey.
	2	Partial household survey.
Eligible Non-interview	3	Household refusal.
	4	Household terminates survey prior to completion.
	5	Respondent never available after call back request.
	6	Telephone answering device (message confirms it is a household).
	7	Other reasons interview never completed.
Unknown Non-interview	8	Unknown if housing unit.
	9	Phone always busy.
	10	No answer.
	11	Telephone answering device (unknown if it is a household).
	12	Telecommunication technological barriers, e.g., call blocking.
	13	Technical phone problems.
	14	Housing unit but unknown if eligible respondent.
	15	Other.
Not Eligible	16	Out of sample.
	17	Fax/data line.
	18	Non-working number.
	19	Disconnected number.
	20	Temporarily out of service.
	21	Special technological circumstances.
	22	Number changed.
	23	Business, government office, other organization.
	24	Institution.
	25	Group quarters.
	26	No eligible respondent.
	27	Quota filled.

Source: Adapted from Table 9, page 40 *(1)*.

To be able to compute the response rate consistently in household surveys in Texas, it will be necessary for the bid specifications to clearly state the vendor must track the number of contact attempts and record the disposition of those attempts. It is recommended that TxDOT establish the categories to be used in defining the dispositions and specify the formulation for use by the vendor in calculating the response rate.

Sampling Frame

The sampling frame used for household surveys in Texas consists of all households in an urban area with a working phone. By definition, this excludes households without a phone, temporarily or permanent. The issue examined in this research was whether this impacted the overall accuracy of the estimate of person trips by biasing the sample drawn for the survey. This research did not examine the additional question of travel behavior and characteristics since the primary data used from these surveys are the trip rates. The analyses performed in this research demonstrated that the exclusion of households without a phone from the sampling frame was not likely to impact the accuracy of the estimate of total person trips for the area. This analysis dealt with households that did not have a phone, it did not include those households with only a cell phone(s). It has since been learned that the sampling frame for household surveys includes cell phone numbers so this is not considered to be a problem for household surveys in Texas.

It is recommended that the sampling frame for household surveys in Texas continue to be households with a working phone including cell phones. Vendors submitting bids to perform household surveys in Texas should be required to verify that the sampling frame that will be used will be all households with a working phone including cell phones.

Non-Response

Non-response has been promulgated to have a potential negative impact on the quality of household surveys. The measure of quality of household surveys of interest in this research was the number of trips estimated from a household survey. It is important to define what is meant by non-response since this reference may be applied to several categories of households. As previously discussed, household surveys in Texas use a sample frame that consists of all households in an urban area with a working phone. Households are contacted by phone, recruited, and the subsequent data on travel and activities retrieved by phone (except in some cases). Non-response as defined in this research deals with three categories of households as follow:

- households that were phoned to be recruited but no contact made despite repeated call backs. These are referred to as no contact households;
- households that were contacted but refused to participate in the survey; and
- households that were contacted and agreed to participate in the survey but during the course of the survey dropped out and did not complete the survey.

For purposes of this research, the first category of households was assumed to be similar to the households that participated in the survey and fell into the same category as all the households that were not contacted in the survey.

The question that was evaluated in this research was whether the non-response households could impact the accuracy of the estimate of total person trips developed from the survey. Based on the analysis done, it was concluded that under worst case scenarios, non-response households could have impacted the accuracy and consequently the quality of the survey results. Since the time this analysis was done, research under the National Cooperative Research Program (NCHRP) titled *Standardized Procedures for Personal Travel Surveys* was completed and published *(1)*. The issue of non-response in household travel surveys was extensively researched and documented in NCHRP Web –Only Document 93 *(2)*. That research included a discussion of a non-response survey conducted in Sydney, 2001, by the Transport Data Centre, NSW Department of Transport. That study investigated non-response and its effects on data quality relative to the Sydney Household Travel Survey. One of the findings in that study was that total household trip rates for non-responding households did not differ significantly from total household trip rates for responding households. It was noted, however, that travel by walk and train modes was higher for non-responding households than responding households. The implication is that inclusion of non-responding households in the regular household survey would not have impacted the accuracy of the estimate of trips. With respect to the issue of non-response, the NCHRP study *(1)* recommended the following standardized procedures:

1. Use pre-survey incentives.
2. Use a pre-notification letter and reminders.
3. Specially train interviewers.
4. Increase efforts to contact households that are difficult to contact.
5. Undertake non-response surveys.

Relative to household surveys in Texas, only two of the items are not currently being done. Use of incentives is an option left to the vendor but it is not required. The use of non-response surveys is recommended for a future household survey in Texas to test and determine the potential for non-responding households to have significantly different travel and activity characteristics compared to those households that participate in the surveys. Non-response surveys are not recommended as a standard at this time.

Proxy Reporting

Proxy reporting is defined as that situation where the travel and activity information for an individual is reported by a person other than the individual that did the travel and activities. For household surveys in Texas, the vendor is expected to interview every person in the household except for minors. Travel and activity data for minors is reported by an adult in the household. This practice is standard around the nation. It is recognized, however, that in many instances, individuals are unavailable at the time the travel and activity data are being retrieved, and in those cases vendors have been prone to accept the travel and activity data from a proxy. This research evaluated the impact of this practice on the estimates of travel and found that the number of trips for individuals represented by proxy is consistently lower than those for individuals interviewed directly and for individuals that returned completed travel activity diaries. This research is consistent with other research reported in the NCHRP study *(1)*. Recommended standards from that study for acceptable proxy reporting were:

- for persons aged 14 and under, require parental or other adult proxy reporting;
- for persons aged 15 to 17, permit proxy reporting unless the individual is available to report their activities directly with parental permission; and
- all persons aged 18 and older should be asked directly for their activities or travel *(1)*.

The Texas surveys evaluated under this research had 45 to 50 percent of the adults over the age of 14 represented by proxy. Researchers feel these percentages have a negative impact on the quality of the survey, especially from the perspective of the primary data of interest, the amount of travel, and resulting estimates of travel in the urban area. It is recommended that Texas adopt the recommended standards above with the understanding that there will be unavoidable instances where individuals will not be available to report their activities and travel. To allow for those cases, a maximum limit of 20 percent of persons over the age of 14 to be represented by proxy should be established. Vendors may be encouraged to expand the number of options for obtaining the activity and travel information to include completed diaries, web-based data retrieval, and face-to-face data retrieval. Incentives may also be used to increase the response. It is expected that these recommendations will result in higher costs for household surveys.

Survey Data Checks

Household travel and activity surveys in Texas collect a large amount of information. The information is reported in four data files, a household information file, a person information file, a vehicle information file, and a travel/activity file. Table 2 lists the specific data elements that are collected and reported in each file. Specific edit programs have been designed to input these data files and perform checks on the data elements. These checks are designed to identify errors and inconsistencies in the data. Household surveys in Texas are somewhat unique because they are conducted under deliverable contracts whereby the vendor must perform the survey, collect the data, and submit the data in prescribed formats. The data are checked and if acceptable, the vendor is paid based on the amount of data submitted. If not acceptable, the data are returned to the vendor with a listing of errors or problems identified for correction. The objective of this section is to detail the data checks that are performed, and identify any additional checks that should be added to improve the quality of the data.

Table 2 presents the list of data items currently provided by vendors that perform household travel surveys in Texas. Most, but not all, of these items are collected directly from households that participate in the survey. For example, addresses provided by the households are geocoded by the vendor to longitude, latitude, and the appropriate transportation analysis zone for the urban area that is surveyed. The geocoding is done in a post processing step by the vendor. The data are submitted by the vendor to TxDOT in pre-specified ASCII formatted files. There are four record types; record type 1 contains household information, record type 2 contains person information with individual entries for each person in the household, record type 3 contains vehicle information with individual entries for each vehicle available to the household, and record type 4 contains the activity and travel information for each person in each household.

Table 2. Household Survey Data Elements.

Household Information		
No.	Data Item	Description
1	Record Type	Code indicating type of record. It should be 1.
2	Sample Number	Unique non-zero number assigned to each household participating in survey.
3	Phone	Phone number of household.
4	Month	Month of travel day.
5	Day	Day of the month of travel.
6	Day of Week	Day of the week travel was recorded; 1-Monday, 2-Tuesday, 3-Wednesday, 4-Thursday, 5-Friday.
7	Advance Letter	Code indicating if household received advance letter; 1-Yes, 2-No, 98-Don't Know, 99-Refused.
8	Address	Street address or nearest cross streets of household.
9	City	City where household is located.
10	Zip Code	Zip code of household address.
11	HH County	Code indicating county in which household is located: Codes vary depending on area being surveyed.
12	HH Study Area	Code indicating study area in which household address/TAZ zone is located. Codes vary depending on area being surveyed. Typically consist of 1 character.
13	HH Zone	TAZ number where household is located. The HH address must be coded to a zone in the MPO modeling area. Unknown zones should be coded 88888.
14	Longitude	Longitude of household address. If unknown, it is coded 888.8888.
15	Latitude	Latitude of household address. If unknown, it is coded 888.8888.
16	Number Persons	Number of persons living in residence.
17	Number Employed	Number of persons in household that are employed either full or part time.
18	Vehicles Available	Number of cars, vans, light trucks, motorcycles available for use by the HH; 98-Don't Know, 99-Refused.
19	Vehicles Owned/Leased	Combined number of cars, vans, light trucks, motorcycles owned or leased by members of the household, 98-Don't know, 99-Refused.
20	Bikes	Number of working bicycles available for use by members of household; 98-Don't know, 99-Refused.
21	Residence	Code indicating the type of residence.
22	Other Residence	If residence is coded as "other", this field contains a description of the type of residence.
23	Tenure	Code indicating number of years at residence; 0-<1yr, 1-one year, 2-two years, 3-three years, 4-four years, 5-five or more years, 98-Don't Know, 99-Refused.
24	Previous Residence	If tenure was less than five years, this code indicates if previous residence was in modeling area; 1-Yes, 2-No, 8-Don't Know, 9-Refused.
25	Previous Zip Code	If tenure was less than five years, this is the zip code of the previous residence.
26	HH Factors	Code indicating factors that influenced their decision to locate in their current household. If more than one, separate code numbers by comma.
27	Other Factors	Other factors influencing their decision to locate in their current household.
28	Income	Code indicating combined annual income of all household members.
29	Sample HH Income	Code indicating household income stratification for sampling quota. Codes vary depending on area surveyed and sampling plan.
30	Day Visitors	Number of non-family persons that stopped at this residence for any reason on the travel day; 98-Don't Know, 99-Refused.
31	Overnight Visitors	Number of overnight visitors at this residence during their travel day. 98-Don't Know, 99-Refused.
32	Delivery Vehicle	Code indicating if someone in household drives a form of delivery vehicle; 1-Yes, 2-No, 8-Don't Know, 9-Refused.
33	Number Delivery Driver	Number of persons in household that are delivery drivers or travel within study area as part of their work.
34	Phone Service	Number of times within past 12 months household was without telephone service.

Table 2. Household Survey Data Elements (continued).

	Household Information	
No.	Data Item	Description
35	Time Without	Code indicating the average length of time household was without phone service.
36	HH Vehicle Use by Non HH Member	Code indicating if one or more of the household vehicles was used by a non-household member on the travel day. 1-Yes, 2-No, 3-Zero vehicle household, 98-Don't Know, 99-Refused.
37	Share Phone	Number of households that share a phone line with this household.
38	GPS House	Code indicating if household vehicles had GPS equipment installed for GPS survey. 1-Yes, 2-No.
39	Total HH Trips	The total combined number of trips made by all persons in the household on the assigned travel day.

	Person Information	
No.	Data Item	Description
40	Record Type	Code indicating type of record. It should be 2.
41	Sample Number	Unique non-zero number assigned to each household participating in survey. This number should match the sample number in the household information file.
42	Person Number	Number assigned to each person in the household with 0 assumed to be the head of household.
43	Relationship	Code indicating relationship of person to the head of household.
44	Head of household	Code indicating the person number in the household considered to be the head of household.
45	Sex	Sex of person; 1-Male, 2-Female, 98-Don't Know, 99-Refused.
46	Ethnicity	Code indicating race or ethnicity of person.
47	Ethnicity Other	Description of ethnicity if it is coded as "other".
48	Age	Age of person. 998-Don't Know, 999-Refused.
49	Licensed Driver	Code indicating if person is a licensed driver; 1-Yes, 2-No, 98-Don't Know, 99-Refused.
50	Employment	Code indicating if person is employed in a paying or volunteer job; 1-Yes, 2-No, 98-Don't Know, 99-Refused.
51	Employment Status	If person is employed, this is a code number indicating the person's employment status, i.e., employed full or part time and if self-employed.
52	Hours	On average, the number of hours worked per week. 998-Don't Know, 999-varies from week to week.
53	Not Employed	Code indicating current status if person is not employed.
54	Not Employed Other	Description of status if none of the options in the not employed status code is applicable.
55	Delivery	Code indicating if person is a delivery driver or not; 1-Yes, 2-No, 98-Don't Know, 99-Refused.
56	Transporting Cargo	Code indicating if person drives vehicle used to transport cargo; 1-Yes, 2-No, 98-Don't Know, 99-Refused.
57	Comm. Service	Code indicating if person drives vehicle used for commercial service; 1-Yes, 2-No, 98-Don't Know, 99-Refused.
58	Flex Time	Code indicating if person's employer allows them to work flexible hours or the hours are fixed; 1-Flexible/Variable, 2-Fixed/Unchanging, 98-Don't Know, 99-Refused.
59	Job	Code indicating if person has more than one paying job; 1-Yes, 2-No, 98-Don't Know, 99-Refused.
60	Employer Name	Name of person's primary employer.
61	Work Place Type	Code indicating type of work place where person is employed.
62	Other Work Place	Description of workplace type if "other" is coded.
63	Home Office	Code indicating if workplace is a home office or business operated out of the home; 1-Yes, 2-No, 98-Don't Know, 99-Refused.
64	Telecommute	If employed 30 or more hours per week, code indicating if person works from home or telecommutes on a regular basis; 1-Yes, 2-No, 98-Don't Know, 99-Refused.
65	Work Place Address	Street address of work place or nearest intersecting street names.
66	Work Place City	City where work place is located.
67	Work Place County	Code indicating county in which work place is located: Codes vary depending on area being surveyed.
68	Zip Code	Zip code or work place address.

Table 2. Household Survey Data Elements (continued).

No.	Data Item	Description
	Person Information – Continued	
69	Work Study Area	Code indicating study area in which work address and TAZ zone is located. One character code used to identify area. Field is left blank if location is not within MPO study area.
70	Work Zone	Zone where work place is located. If unknown but in the modeling area, it is coded 8888. Locations outside the modeling area but within Texas are coded using the Statewide Zone System. Unknown locations outside of the modeling area but within Texas should be coded 6666. Addresses in Mexico are coded 7777. Addresses outside of Texas and Mexico are coded using 9999.
71	Longitude	Longitude of work place location. If within the modeling area but unknown, it is coded 888.8888. If outside the modeling area but within Texas and unknown, it is coded 6666. Locations in Mexico are coded 777.7777, and addresses outside of Texas and Mexico are coded 999.9999.
72	Latitude	Latitude of work place location. If within the modeling area but unknown, it is coded 888.8888. If outside the modeling area but within Texas and unknown, it is coded 6666. Locations in Mexico are coded 777.7777, and addresses outside of Texas and Mexico are coded 999.9999.
73	Days Worked	Number of days per week person typically works. 98-Don't Know, 99-Refused.
74	Work at Home	Out of the last seven days, the number of days worked at home instead of going to work. Valid responses 0-7, 98-Don't Know, 99-Refused.
75	Second Job Type	Code indicating type of work place where person works at second job.
76	Second Job Other	Description of work place type for second job if "other" is coded.
77	Second Job Employment Status	If person is employed in a second job, this is a code number indicating the person's employment status related to the second job.
78	Total Hours	Total hours on average person works per week at all jobs. 888-Don't know, 999-Refused.
79	Primary Occupation	Code indicating the type of occupation for primary job.
80	Primary Industry	Code indicating the type of industry worked in for primary job.
81	Second Occupation	Code indicating the type of occupation for second job.
82	Second Industry	Code indicating the type of industry worked in for second job.
83	Student Status	Code indicating if person is enrolled in any type of school; 1-Yes, 2-No, 98-Don't Know, 99-Refused.
84	School Type	Code indicating type of school attended.
85	School Type Other	Description of 'other' if other is coded as school type.
86	Hours Enrolled	If person is enrolled in a college, trade school, etc., code indicates if person is enrolled for 12 or more hours; 1-Yes, 2-No, 98-Don't Know, 99-Refused.
87	Bike Use	Number of days person rode bike in last seven days. 98-Don't Know, 99-Refused.
88	Bike Purpose	Code indicating the most common trip purpose for person's bike trips.
89	Disability	Code indicating if person has transportation disability; 1-Yes, 2-No, 98-Don't Know, 99-Refused.
90	Travel	Code indicating if person traveled on the designated travel day; 1-Yes, 2-No, 96-Indication person was out of town or away from the residence for the entire day and night of their travel day.
91	Person trips	The total number of trips the person made on his/her travel day.
92	Why No Travel	Description of why the person did not make any trips on the travel day.
93	Diary Use	Code indicating if person used diary or if information is based on memory or provided by a proxy. 1-yes, used diary; 2-no, did not use diary; 3-Did not receive diary; 98-Don't Know; 99-Refused.
94	Data Retrieval Method	Code indicating how data was retrieved: 01-respondent, 02-proxy, 03-mailed diary, 04-Internet, 98-Don't Know; 99-Refused.
95	Proxy ID	This item identifies the person by person number who provided the information by proxy. 98-Don't Know; 99-Refused.
96	Date Data was Retrieved	The month and day the data was retrieved. Record all months as 2 digits and all days as 2 digits with the month preceding the day. Example: April 1st should be coded as 0401.

Table 2. Household Survey Data Elements (continued).

Household Vehicle Information		
No.	Data Item	Description
97	Record Type	Code indicating type of record. It should be 3.
98	Sample Number	Unique non-zero number assigned to each household participating in survey. Number should match number in household information file.
99	Vehicle Number	Unique non-zero number assigned to vehicle.
100	Type of Vehicle	Code indicating type of vehicle.
101	Other Vehicle Type	If vehicle type is coded as "other", field contains description of vehicle type.
102	Year	Year vehicle was manufactured; 9998-Don't Know, 9999-Refused.
103	Make	Make of vehicle.
104	Other Make	If make of vehicle coded as "other", field contains description of vehicle make.
105	Model	Model of vehicle.
106	Type of Fuel	Type of fuel used by vehicle; 1-Gasoline, 2-Diesel, 3-Propane, 4-Natural Gas, 5-Electricity, 6-Other, 7-Gas/Electric, 8-Don't Know, 9-Refused.
107	Other Fuel Type	If fuel is coded as "other", this field contains a description of the type of fuel.
108	Commercial Use	Code indicating if vehicle is used for commercial purposes; 1-Yes, 2-No, 98-Don't Know, 99-Refused.
109	Odometer Reading	Odometer reading on vehicle at beginning of travel day. Don't Know, 99999998. Refused, 99999999.
110	Ownership	Code indicating ownership of this vehicle. 1-Owned or leased by member of household, 2-Owned or leased by another person, 98-Don't Know, 99-Refused.
111	Non HH Vehicle Number	If one or more household vehicles used by non-household member, this is the number of the vehicle that was used.
112	Non HH Use	Code indicating if vehicle was used by a non-household member on the travel day. 1-Yes, 2-No, 8-Don't Know, 9-Refused.
113	Lighter Working	Code Indicating if the lighter in the vehicle is working; 1-Yes, 2-No, 8-Don't Know, 9-Refused.

Travel and Activity Information		
No.	Data Item	Description
114	Record Type	Code indicating type of record. It should be 4.
115	Sample Number	Unique non-zero number assigned to each household participating in survey. This number must match the number used for the same household and recorded in the household information file.
116	Month	Month of survey day.
117	Day	Day of the month of the survey.
118	Person Number	Number assigned to the person doing this activity.
119	Activity/Trip Number	The first trip/activity for each person is recorded as 0 for where their day began. Each subsequent trip/activity should be numbered sequentially as 1, 2, 3, etc.
120	Activity Type Code	Code indicating the type of activity. For activity 0 (where day began), this should be coded as a 1 if it began at home, 4 if day began at work, or as 20 if it began at another location. If this is coded as 20, the activity description should be included in the next field.
121	Activity Description	Description of activity.
122	Location	Name of location where activity took place.
123	Location Address	Street address of location or name of nearest intersecting streets.
124	Location City	Name of city where location is.
125	Location County	Code indicating county where location is.
126	Zip Code	Zip code of location address.
127	Exit Route Name	If location is outside of the MPO modeling area, this is the name of the highway/route/road used to exit the applicable study area.
128	Study Area	Code indicating study area in which activity address/TAZ zone is located. Codes vary between study areas. Field should be blank if location is not within the MPO study area.
129	Zone Number	Zone number of location address. If in the modeling area but location unknown, it is coded 8888. Locations in Mexico are coded 7777, and addresses outside modeling area but within Texas are coded using the Statewide Zone System. Unknown locations outside of modeling area but within the state of Texas are coded 6666. Addresses outside of Texas and Mexico are coded 9999.

Table 2. Household Survey Data Elements (continued).

No.	Data Item	Description
	Travel and Activity Information – Continued	
130	Longitude	Longitude of location. If within modeling area but unknown, it is coded 888.8888. If outside modeling area but within Texas and unknown, it is coded as 666.6666. Locations in Mexico are coded 777.7777, and addresses outside of Texas and Mexico are coded 999.9999.
131	Latitude	Latitude of location. If within modeling area but unknown, it is coded 888.8888. If outside modeling area but within Texas and unknown, it is coded as 666.6666. Locations in Mexico are coded 777.7777, and addresses outside of Texas and Mexico are coded 999.9999.
132	Type of Place	Code indicating the type of place at this location.
133	Other Place	If type of place is coded as "other", this field contains description of the type of place where activity occurred.
134	Purpose	Purpose of trip, coded based on the activity.
135	Mode of Travel	Code indicating mode of travel used in traveling to this location.
136	Other Mode	If mode of travel is coded as "other", this field contains a description of the "other" mode.
137	Number of People	If travel was by private vehicle, this is the number of persons in the vehicle, including the person driving. Non-private vehicle modes are coded 96.
138	Household Members	Of those in the vehicle, how many were household members.
139	Persons on Trip	Who was/were the household members traveling with you? Code person numbers separated by commas.
140	Non Household Members	Number of non household members in vehicle.
141	Household Vehicle	Code indicating if a household vehicle was used to make this trip? 1-Yes, 2-No, 8-Don't Know, 9-Refused.
142	Vehicle Used	If household vehicle was used for travel, this is the vehicle number. If other vehicle is used, this should be coded as 99.
143	Body Type	Code indicating body type of vehicle used for trip.
144	Other Body Type	If body type is coded as "other", this field contains a description of the body type.
145	Other Vehicle Year	Year of "other" vehicle used for trip. 9998-Don't Know, 9999-Refused.
146	Other Vehicle Make	Make of "other" vehicle used for trip. See code set.
147	Other Vehicle Make Description	If make of other vehicle is coded as "other", this field contains a description of the vehicle make.
148	Other Vehicle Model	Model of "other" vehicle used for trip.
149	Other Vehicle Fuel	Code indicating type of fuel used by "other" vehicle; 1-Gasoline, 2-Diesel, 3- Propane, 4-Natural Gas, 5-Electricity, 6-Other, 7-Electric/gasoline, 98-Don't Know, 99-Refused.
150	Other Fuel	If fuel is coded as "other", this field contains a description of the fuel.
151	Other Vehicle Commercial Use	Code indicating if "other" vehicle used for commercial purposes; 1-Yes, 2-No, 98-Don't Know, 99-Refused.
152	To Bus Stop	Code indicating if they walked more than one block to get to bus stop; 1-Yes, 2-No, 98-Don't Know, 99-Refused.
153	To Activity	Code indicating if they parked or got off bus more than one block from this activity; 1-Yes, 2-No, 98-Don't Know, 99-Refused.
154	Off Bus Location	Street address or nearest intersecting streets where person got off of bus.
155	Parking Location	Street address of nearest intersecting streets where vehicle was parked.
156	Parking Cost	Amount paid for parking.
157	Payment Method	Time period for parking cost payment; 1-Hourly, 2-Daily, 3-Weekly, 4-Monthly, 5-Annually, 98-Other, 99-Don't Know/Refused.
158	Arrival Hour	Hour that person arrived at this location. This hour should be in terms of military time. If this is activity 0, this is blank since this is where they began their day.
159	Arrival Minute	Minute that person arrived at this location. If this is activity 0, this is blank since this is where they began their day.
160	Departure Hour	Hour that person departed this location. This hour should be in terms of military time. If this is the last activity, this is blank.
161	Departure Minute	Minute that person departed this location. If this is the last activity for this person, this is blank.

When the data files are submitted to TxDOT, they are processed through two edit programs that perform checks on the data items. The first edit program checks the household, person, and vehicle information files and outputs a file with selected information for input to the

second edit program. The second edit program checks the activity and travel data and cross checks the data with information from the household, person, and vehicle data files. Both programs begin checking the data by verifying that all fields expected to have integer values do not have any character values. These checks ensure the data are formatted correctly. Table 3 lists the checks that are completed on the individual data items in the programs. The program's output detailed lists of questionable items in the data and identified the data element and record where the problem was encountered.

Table 3. Household Survey Data Checks.

No.	Data Item	Data Checks
Household Information		
1	Record Type	Sequence checked, i.e., Record 1 must be followed by correct number of Record 2 entries (number of persons), and correct number of Record 3 entries (number of available vehicles).
2	Sample Number	Non-zero and no duplicate numbers for Record 1 entries.
3	Phone	None.
4	Month	Range of value between 1 and 12.
5	Day	Range of value for month coded.
6	Day of Week	For month and day, day of week is calculated and compared to value.
7	Advance Letter	Non-blank.
8	Address	Non-Blank.
9	City	Non-Blank.
10	Zip Code	Non-Blank.
11	HH County	Non-blank and falls within correct range of values for area being surveyed.
12	HH Study Area	Non-blank and is an acceptable character for area being surveyed.
13	HH Zone	Non-blank and falls within correct range of values for area being surveyed.
14	Longitude	Non-blank and falls within correct range of values for area being surveyed.
15	Latitude	Non-blank and falls within correct range of values for area being surveyed.
16	Number Persons	Non-blank and matches number of Record 2 entries for this sample number.
17	Number Employed	Less than or equal to number of persons and matches number of Record 2 entries that reported being employed.
18	Vehicles Available	Matches number of Record 3 entries.
19	Vehicles Owned/Leased	None.
20	Bikes	None.
21	Residence	Non-zero and falls within correct range of values.
22	Other Residence	If residence coded as "other", field checked to see if non-blank.
23	Tenure	Non-blank and falls within correct range of values.
24	Previous Residence	If tenure less than 5 years, checked to see if non-blank and falls within correct range of values.
25	Previous Zip Code	If tenure less than 5 years, checked to see if non-blank.
26	Household Factors	Non-blank and values are within acceptable ranges.
27	Other Factors	If "other coded for household factors, field checked to see if non-blank.
28	Income	Non-blank and falls within correct range of values.
29	Sample HH Income	Non-blank and checked for consistency with income range.
30	Day Visitors	None.
31	Overnight Visitors	None.
32	Delivery Vehicle	Values fall within acceptable range.
33	Number Delivery Driver	If delivery vehicle coded as yes, value checked against Record 2 entries that reported driving delivery vehicle.
34	Phone Service	If non-zero, time without field is checked.

Table 3. Household Survey Data Checks (continued).

No.	Data Item	Data Checks
Household Information		
No.	Data Item	Data Checks
35	Time Without	If phone service non-zero, value check against acceptable range of values.
36	HH Vehicle Use by Non HH Member	None.
37	Share Phone	None.
38	GPS House	None.
39	Total HH Trips	Checked against number of trips reported for household sample in Activity Trip file.
Person Information		
No.	Data Item	Data Checks
40	Record Type	None.
41	Sample Number	Matches value in household information record.
42	Person Number	Non-blank and sequence of values checked (all Record 2s for household).
43	Relationship	Non-zero and falls within acceptable range of values.
44	Head of household	None.
45	Sex	Non-blank and falls within acceptable range of values.
46	Ethnicity	Non-blank and falls within acceptable range of values.
47	Ethnicity Other	Non-blank if ethnicity coded as "other".
48	Age	Non-blank.
49	Licensed Driver	If age is greater than 14, checked to see if falls within acceptable range of values.
50	Employment	If age is greater than 14, checked to see if falls within acceptable range of values.
51	Employment Status	If coded as employed, checked to see if falls within acceptable range of values.
52	Hours	If coded as employed, checked to see if falls within reasonable range of values.
53	Not Employed	If coded as not employed, checked to see if falls within acceptable range of values.
54	Not Employed Other	If not employed coded as "other", checked to see if non-blank.
55	Delivery	Non-blank and falls within acceptable range of values.
56	Transporting Cargo	If delivery is coded yes, value falls within acceptable range of values.
57	Comm. Service	If delivery is coded yes, value falls within acceptable range of values.
58	Flex Time	If employed full time, non-blank and values falls within acceptable range of values. If not employed, checked to see if not blank.
59	Job	If employed, value falls within acceptable range of values.
60	Employer Name	If employed, non-blank.
61	Work Place Type	If employed, non-blank and falls within acceptable range of values.
62	Other Work Place	If employed and type coded as "other", non-blank.
63	Home Office	If employed, non-blank and falls within acceptable range of values.
64	Telecommute	If employed, non-blank and falls within acceptable range of values. If not employed, checked to see if not blank.
65	Work Place Address	If employed, non-blank.
66	Work Place City	If employed, non-blank.
67	Work Place County	If employed, non-blank and falls within acceptable range of values.
68	Zip Code	If employed, non-blank.

Table 3. Household Survey Data Checks (continued).

No.	Data Item	Data Checks
Person Information – Continued		
69	Work Study Area	If employed, character checked against valid values.
70	Work Zone	If employed, non-blank and falls within acceptable range of values.
71	Longitude	If employed, non-blank and falls within acceptable range of values.
72	Latitude	If employed, non-blank and falls within acceptable range of values.
73	Days Worked	If employed, non-blank and falls within acceptable range of values.
74	Work at Home	If employed, non-blank and falls within acceptable range of values.
75	Second Job Type	If employed and more than one job, non-blank and falls within acceptable range of values.
76	Second Job Other	If employed and more than one job and type coded as "other", non-blank.
77	Second Job Employment Status	If employed and more than one job, non-blank and falls within acceptable range of values.
78	Total Hours	If employed, checked for non-zero value.
79	Primary Occupation	If employed, non-blank and value falls within acceptable range of values.
80	Primary Industry	If employed, non-blank and value falls within acceptable range of values.
81	Second Occupation	If employed and more than one job, non-blank and value falls within acceptable range of values.
82	Second Industry	If employed and more than one job, non-blank and value falls within acceptable range of values.
83	Student Status	Non-blank and falls within acceptable range of values.
84	School Type	If student, non-blank and falls within acceptable range of values.
85	School Type Other	If student and school type coded as "other", non-blank.
86	Hours Enrolled	If school type is college or trade, non-blank and falls within acceptable range of values.
87	Bike Use	Falls within acceptable range of values.
88	Bike Purpose	If bike use not zero, falls within acceptable range of values.
89	Disability	Non-blank and falls within acceptable range of values.
90	Travel	Non-blank and falls within acceptable range of values.
91	Person trips	Value checked against number of trips recorded in activity travel information.
92	Why No Travel	If travel coded as none, non-blank.
93	Diary Use	Non-blank and falls within acceptable range of values.
94	Data Retrieval Method	Non-blank and falls within acceptable range of values.
95	Proxy ID	If retrieval method proxy, non-blank.
96	Date Data was Retrieved	Within five days of travel day.

Table 3. Household Survey Data Checks (continued).

Household Vehicle Information		
No.	Data Item	Data Checks
97	Record Type	None.
98	Sample Number	Same as household sample in household information record.
99	Vehicle Number	Sequential numbering of Record Type 3 entries.
100	Type of Vehicle	Non-blank and falls within acceptable range of values.
101	Other Vehicle Type	If vehicle type coded as "other", non-blank.
102	Year	Non-blank and falls within reasonable range of values.
103	Make	Non-blank and falls within acceptable range of values.
104	Other Make	If make coded as "other", non-blank.
105	Model	Non-blank.
106	Type of Fuel	Non-blank and falls within acceptable range of values.
107	Other Fuel Type	If fuel coded as "other", non-blank.
108	Commercial Use	Non-blank and falls within acceptable range of values.
109	Odometer Reading	Non-blank and falls within reasonable range of values.
110	Ownership	Non-blank and falls within reasonable range of values.
111	Non HH Vehicle Number	None.
112	Non HH Use	None.
113	Lighter Working	None.

Travel and Activity Information		
No.	Data Item	Data Checks
114	Record Type	Value is 4.
115	Sample Number	Matches one in household information record.
116	Month	Range of value between 1 and 12 and same as coded in household information file.
117	Day	Range of value for month coded and same as coded in household information file.
118	Person Number	Consistent with person number in household person information record.
119	Activity/Trip Number	Begins with zero and numbered sequentially for each person number.
120	Activity Type Code	Non-blank and falls within acceptable range of values.
121	Activity Description	If activity coded as "other", non-blank.
122	Location	Non-blank.
123	Location Address	Non-blank.
124	Location City	Non-blank.
125	Location County	Non-blank and falls within acceptable range of values for area surveyed.
126	Zip Code	Non-blank.
127	Exit Route Name	None.
128	Study Area	Non-blank and matches acceptable code for area surveyed.
129	Zone Number	Non-blank and falls within acceptable range of values for area surveyed.

Table 3. Household Survey Data Checks (continued).

No.	Data Item	Data Checks
Travel and Activity Information – Continued		
130	Longitude	Non-blank and falls within acceptable range of values for area surveyed.
131	Latitude	Non-blank and falls within acceptable range of values for area surveyed.
132	Type of Place	Non-blank and falls within acceptable range of values and is consistent with activity code.
133	Other Place	If type of place coded as "other", non-blank.
134	Purpose	Non-blank and falls within acceptable range of values and is consistent with activity code.
135	Mode of Travel	Non-blank and fall within acceptable range of values.
136	Other Mode	If mode coded as "other", non-blank.
137	Number of People	If mode coded as driver of private or commercial vehicle, non-blank.
138	Household Members	None.
139	Persons on Trip	None.
140	Non Household Members	None.
141	Household Vehicle	Non-blank and falls within acceptable range of values.
142	Vehicle Used	If household vehicle coded as yes, non-blank and matches a vehicle number coded in vehicle information file for household.
143	Body Type	If vehicle coded as other (non-household), non-blank and falls within range of acceptable values.
144	Other Body Type	If vehicle coded as other (non-household) and body type coded as "other", non-blank.
145	Other Vehicle Year	If vehicle coded as other (non-household), non-blank and falls within reasonable value.
146	Other Vehicle Make	If vehicle coded as other (non-household), non-blank and falls within acceptable range of values.
147	Other Vehicle Make Description	If vehicle coded as other (non-household) and vehicle make coded as "other", non-blank.
148	Other Vehicle Model	If vehicle coded as other (non-household), non-blank.
149	Other Vehicle Fuel	If vehicle coded as other (non-household), non-blank and falls within acceptable range of values.
150	Other Fuel	If vehicle coded as other (non-household) and fuel coded as "other", non-blank.
151	Other Vehicle Commercial Use	If vehicle coded as other (non-household), non-blank and falls within acceptable range of values.
152	To Bus Stop	If mode coded as public transit, non-blank and falls within acceptable range of values.
153	To Activity	None.
154	Off Bus Location	If mode was public transit and to activity was coded yes, non-blank.
155	Parking Location	If mode was private vehicle and to activity was coded yes, non-blank.
156	Parking Cost	None.
157	Payment Method	If parking cost was non-zero, non-blank and falls within acceptable range of values.
158	Arrival Hour	If activity is 0, should be blank. If activity is not 0, non-blank and falls within acceptable range of values. Less than or equal to departure hour. Greater than or equal to departure hour for previous activity.
159	Arrival Minute	If activity is 0, should be blank. If activity is not 0, non-blank and falls within acceptable range of values.
160	Departure Hour	If activity is 0, non-blank and falls within acceptable range of values. If last activity for person, should be blank. Greater than or equal to arrival hour for activity. Less than or equal to arrival time for next activity.
161	Departure Minute	If activity is 0, non-blank and falls within acceptable range of values.

Additional checks not listed in Table 3 include the following:

- the last trip for each person is checked to determine if they returned home. If not, a warning is printed identifying the sample household, person number, and trip number; and
- the time of arrival and departure for each trip are checked to ensure they are consistent and logical. For example, a trip cannot arrive after the time it departs.

Complete Household Definition

The term "complete household" referred to what is accepted in the household survey relative to the data from the members of household. The importance of this definition is that it impacts the effort required to meet the sample size in the survey. Of the 161 data items listed in Table 2, 121 are collected directly from members of the household. The most rigorous definition of a "complete household" that could be defined would be the collection of all data elements from all members of a household. For some households, this requirement would be met easily while for others, this requirement would be difficult to meet. In Texas, the practice has been established that the vendor must collect personal and travel information from every person in the household. Judgment has been used in deciding if a vendor has met this requirement in the review of the data. In practice, the data may not include every data element for every person. For example, a person may refuse to report the name of their employer or their address and furnish all of the other information. The data would be coded to reflect this and still be accepted for payment because the lack of this information would not impact the estimates of travel from the survey.

The NCHRP study, *Standardized Procedures for Personal Travel Surveys (1),* recommended the following relative to what should be considered a complete household.

- At least key household, person, and vehicle information must be obtained. In other words, a minimum set of questions should be answered for a household response to be considered acceptable or valid. Other information would be dependent on the objectives of the survey.
- At least an adult from every age group represented in the household, as well as younger household members if eligible, should complete the trip/activity data items. The groups were defined as: 15-17 (if household members under the age of 18 were eligible); 18-64 years of age; 65-74 years of age; and over 74 years of age.
- For the last three age groups, proxy reports should not count toward determining completeness of the household.
- Partial responses should not be eliminated from the data set.

Current practice in Texas meets and exceeds these standards with the exception of the use of proxies.

Pilot Surveys

Current practice in Texas household surveys is to require the vendor to conduct a pilot survey. The number of households to be surveyed in the pilot is specified in the bid specifications with the stipulation that the pilot survey is a full test of the entire survey procedures from sample selection, recruitment, retrieval, geocoding, and data submittal. It also includes the testing of procedures to install and retrieve GPS equipment and submittal of GPS data. The pilot survey is a full dress rehearsal for the household survey. The NCHRP study, *Standardized Procedures for Personal Travel Surveys (1)*, has recommended a minimum number of 30 households be surveyed in the pilot. Texas practice has required 25 households be surveyed in the pilot. Given the pilot is to serve as a dress rehearsal and the standardization of household survey design in Texas, there does not appear to be a sound reason to increase the number of households in the pilot survey at this time. The recommended guideline for household pilot surveys is that 25 households be surveyed in the pilot.

EXTERNAL SURVEYS

External travel surveys are contracted through a competitive bidding process conducted by the General Services Division of TxDOT. The bid specifications outline the procedural requirements each vendor must meet if awarded the contract. Included in the bid specifications are specific technical requirements the vendor is expected to meet in conducting the survey. A copy of the current external survey bid specification may be obtained from the General Services Division of TxDOT. The external survey is performed under a deliverables agreement whereby the vendor is not paid for data until the data have been received and checked to ensure it is acceptable.

External surveys are generally conducted as follows:

- The study area boundary is identified with the locations of all transportation facilities crossing the boundary.
- The latest average daily traffic (ADT) volume for each location is determined and used as a basis for defining the sites to be surveyed and counted as part of the external survey. Sites identified as non-surveyed sites are also listed as sites to be counted. All traffic counts are vehicle classification counts stipulated to be conducted for 24 hours in 15 minute increments directionally. Counts at surveyed sites are to be done for the same day as the survey. Generally all sites with an ADT of 5,000 and above are selected. The exceptions are sites that are only two lanes. Sites with less than 5,000 vehicles per day may also be selected provided the facility is not a two-lane facility. Generally, the number of sites selected to be surveyed have 90 percent or more of the total ADT at the external stations for the study area.
- Meetings are held with the TxDOT district office for the area being surveyed. These meetings establish the points of contact for the survey to include the TxDOT district personnel responsible for meeting with the vendor and selecting the site at each location the survey will be conducted and the personnel responsible for selecting the traffic control plan to be used at each location.
- On the day of the survey, a TxDOT district representative is responsible to review the traffic control plan setup at the site and sign off on its setup prior to the survey start-up. The vendor is required to have law enforcement personnel at the site during setup of the traffic control plan, during the conduct of the surveys, and during the take down of the traffic control plan.
- Vehicles in the outbound direction (out of the study area) are slowed by a flagger and directed into a survey area where the driver is interviewed. The number surveyed varies depending on the site but normally ranges from 3 to 5. While the surveys are being conducted, traffic is allowed to continue to flow past the site. When all the surveys are complete, the vehicles are released and allowed to return to the traffic stream, and another group of vehicles are directed into the survey area.

Non-commercial and commercial vehicles are surveyed using specific survey instruments for each vehicle type.

- Surveys are conducted during daylight hours, typically a 10 to 12 hour period. Surveys are not conducted during bad weather or unsafe conditions.

Prior to the external surveys being implemented in the field, a public information campaign is initiated through press releases and local contacts with law enforcement agencies and elected public officials.

The following sections discuss the monitoring of external surveys and survey accuracy. Survey accuracy is addressed relative to survey methodology, technology, survey design, survey sample size, survey conduct times, vehicle classification counts, survey geocoding, survey data checks, and survey data expansion and weighting.

External Survey Monitoring

External surveys are conducted by vendors selected through the competitive bidding process administered by TxDOT. That selection procedure contains specific criteria the vendor must meet in order to be awarded the contract. This discussion deals with the monitoring of the conduct of the survey. The vendor is required to conduct an orientation session for all vendor employees that are expected to work on the survey. This session is to explain the survey goals, objectives, guidelines, and safety procedures. Since this session establishes the context of the survey, a TxDOT representative should either be present or listen in to the session by teleconference.

Vendors are required under the survey contract to conduct a pilot survey at one site prior to beginning the full survey. The pilot is intended to be a full dress rehearsal of the external survey including set up of AVC counters, traffic control plan setup and take down, flagging vehicles into the survey area, surveying drivers, recording data, geocoding survey data, and submittal of data in the proper data file formats. As a dress rehearsal, it is recommended a representative of TxDOT be present at the external survey to observe the traffic control plan set up, data collection process, interactions between the surveyors and the public, and the overall general conduct of the survey.

During the conduct of the full external survey, it is recommended a representative of TxDOT be present at a minimum of three external surveys randomly picked to observe the setup

of the traffic control plan, survey setup, survey operating protocol, and general survey procedures. It is important that no prior notice be given to the vendor that the survey will be monitored at a particular site.

External Survey Accuracy

Survey accuracy is the primary criteria for assessing the quality of the survey. The accuracy of the data may be impacted a number of ways. The following sections discuss the external survey relative to survey methodology, technology, survey design, survey sample size, survey conduct times, vehicle classification counts, survey geocoding, survey data checks, and survey data expansion and weighting.

Survey Methodology

External surveys in Texas have historically been roadside intercept. In some situations, such as high-volume locations, the methodologies have been to videotape license plates and mail out a survey or videotape license plates and use a license plate matching procedure. The current external survey methodology is being reviewed and may undergo major modifications. It is uncertain the impact the revisions being considered may have on the accuracy of the data and these revisions are not discussed in this research.

Roadside intercept surveys are considered to be the most accurate and reliable survey method for external surveys. While mail out/mail back surveys have been used in certain situations, the response rate to these surveys is low and bias is introduced to the survey by the self selection nature of the survey. The use of license plate matching is considered accurate for estimating the movement of through vehicles but no information is obtained on the external local movements. Thus these movements must be estimated using data from other locations where intercept surveys were conducted. It is recommended where feasible, roadside intercept surveys continue to be used in external surveys.

Technology

The technology question relates to the choice of using a paper survey instrument that is completed by a surveyor or the use of tablet personal computers to record survey responses. Both methods collect the same information and have been found to produce reasonable results.

The tablet personal computers have the advantage of directing building data into a computer file structure as it is collected and performing checks on the data to minimize the data entry errors. The paper survey instrument has the potential for errors in the collection of the data and when the data is entered into a computer file format. These errors will not be discovered until sometime after the interview has taken place. The use of tablet personal computers is considered more accurate and is recommended for all external surveys done by intercept interview.

Survey Design

External surveys are designed to capture information on travel into, out of, and through urban areas. Different survey instruments are used for non-commercial and commercial vehicles in the intercept surveys. When license plates are recorded, non-commercial and commercial vehicles are segregated into separate files prior to processing to match the license numbers. When mail out/mail back surveys are used in external surveys, only non-commercial vehicles registered in Texas are mailed surveys. Commercial vehicles are surveyed using the intercept method at roadside truck stops and rest areas.

The survey design question raised in this discussion is primarily one that deals with the questions asked in these surveys. Tables 4, 5, 6, and 7 present the data elements vendors are expected to provide in external surveys under the latest survey design. Primary data of interest for use in the travel demand model are the origin and destination for non-commercial vehicles and commercial vehicles. Address information is critical for geocoding purposes since it is the basis for measuring average trip length, and development of the trip length frequency distribution for use in the travel demand models. Other data, while not necessary for current travel demand models, are important from developing an understanding of the type of travel, reasons for the travel, types of cargo being transported, and determining the number of non-residents traveling into and out of the area. These data have other uses not readily apparent in current travel demand models. Current survey design does not appear to impact the quality and accuracy of the survey. For that reason, no recommendations are made to revise the current survey design.

Survey Sample Size

The sample size for external surveys has the potential to have the greatest impact on the accuracy of the estimates of travel into, out of, and through urban areas. The research under RMC 0-5711 explicitly examined the question of sample size at external stations for non-

commercial and commercial vehicles. Researchers found the current minimum of 300 usable non-commercial surveys to be more than adequate for external surveys. The minimum of 50 usable commercial vehicle surveys was recommended to be changed to 70 or 25 percent of the commercial vehicles traversing the survey site during the time period the surveys are completed. These are the recommended guidelines for external station surveys at sites with 1,000 or more daily vehicles in the direction of travel. For sites with less than 1,000 vehicles, the recommended guideline is the maximum number possible. Monitoring of the vendor performance is necessary to ensure these data are collected throughout the day.

Survey Conduct Times

Current surveys are expected to be conducted during daylight hours as long as weather conditions are such that surveyors can safely conduct the surveys. Since no surveys are conducted at night, it is important the surveys are completed throughout the day to maximize the data collected. It is recommended that this practice be continued.

Vehicle Classification Counts

Vehicle classification counts are conducted at all external stations by direction and reported by time of day and vehicle class. These data are the basis for expanding the survey data, and their accuracy are paramount to the accuracy of the information that is used in travel demand models. The research under RMC 0-5711 found significant variations in the data obtained from the use of automatic vehicle classifier (AVC) counters and the data obtained by manual classification with video tape. These variations may explain some discrepancies noted in analysis of external surveys in different areas. The recommended guidelines for vehicle classification counts at external station surveys are that the vendor be required to calibrate the AVC counters by manually classifying vehicles for one hour and either adjusting the counter or providing adjustment factors for correcting the counter data. Documentation of this procedure should be submitted by the vendor with the count data for each site. In addition, the vendor should be required to videotape vehicles in both directions for the time period the surveys are conducted and manually classify the vehicles in each direction by hour based on the videotapes. Included in this data, the vendor should provide the percent split in non-commercial and commercial vehicles for vehicles in category 3 (pickup trucks and vans).

Survey Geocoding

Current guidelines for geocoding of origins and destinations in the external survey data required 90 percent of the locations be geocoded to longitude and latitude, and 95 percent of the locations be geocoded to the urban area traffic analysis zone (TAZ). This guideline is still recommended for external station surveys. Research under RMC 0-5711 did find in the review of vendor practices that certain vendors were using interactive GIS in tablet personal computers to geocode locations during the surveyor interview. This is not recommended as a guideline, and it is specifically recommended that vendors be prohibited from this practice until they can demonstrate the technical skills and capabilities for all surveyors to accomplish this within the time frame specified for the survey.

Survey Quality Control and Training

While vendors are expected to have adequately trained surveyors and flaggers at all external station surveys, there has been no means of knowing how well these requirements are met. The recommended guideline is for TxDOT to initiate a random system of monitoring vendor surveyors and flaggers in the field during the survey conduct. The number of sites recommended for on-site monitoring is a minimum of three for each urban area, and if problems are encountered, this number may need to be increased.

Survey Data Checks

To ensure that the external survey data are as accurate as possible, the current practice has been to check the data as it is received using both computer programs designed for that purpose and manual means. Tables 4 through 7 present a list of the data currently collected in the external survey intercept and postcard surveys. Tables 8 through 11 present the checks that are performed on each data element. The recommended guideline is for these checks to continue to be performed prior to data acceptance. This recommendation is in addition to the manual checks performed on the data such as spot checking geocoding accuracy.

Expansion of Survey Data

Current practice in external surveys is to expand the survey data based on the 24-hour vehicle classification counts performed at each site. The research performed under RMC 0-5711 found this practice to be sufficient and acceptable. The recommended guideline is external

surveys continue to be expanded using the current procedures. Researchers feel that the

improved accuracy of the vehicle classification counts will result in more accurate data for the

external surveys.

Table 4. External Non-Commercial Data Elements.

No.	Data Item	Description
1	Record Type	Code which indicates the type of record. It should be A.
2	Month	Month station is surveyed.
3	Day	Day of the month survey is conducted.
4	Station Number	Site number of the station being surveyed.
5	Station	Name of station/facility being surveyed.
6	Longitude	Longitude of location being surveyed.
7	Latitude	Latitude of location being surveyed.
8	Name of Interviewer	Name of surveyor conducting interview.
9	Vehicle Number	Vehicle number surveyed (column number on survey form).
10	Survey Begin Time	Hour and minute when survey began. Must be in military time.
11	Survey End Time	Hour and minute when survey ended. Must be in military time.
12	Occupancy	Number of people in vehicle.
13	Vehicle Class	Code indicating the classification of the vehicle.
14	Vehicle Class Other	If vehicle type is coded as "other", this field contains a description of the vehicle.
15	Residence Status	Code indicating county in which person lives: Codes vary depending on area being surveyed.
16	Resident Home Location	This field contains the city and state of their home.
17	Home Location (Non-Resident)	For persons not living in the study area, this field contains the city and state where they reside. This field is blank if item 21 is coded as the study area being surveyed.
18	Enter Texas (Non-Resident)	For persons not living in the study area, this field contains the code indicating if person entered Texas on the survey date. 1-Yes; 2-No; 99-Unknown/Refused. This field is blank if item 21 is coded as the study area of the survey.
19	Travel Origin (Non-Resident)	For persons not living in the study area, this field contains the travel origin for persons who entered Texas on the survey day. This field is blank if item 21 is coded as the study area for the survey or if item 27 is coded as 2.
20	Texas Entry Point (Non-Resident)	For persons not living in the study area who entered Texas on the travel day, this field should state the name of the road or highway they used to enter Texas. This field is blank if item 21 is coded as the study area for the survey or if item 27 is coded as 2.
21	Texas Entry Zone (Non-Resident)	This field contains the external station zone number of the entry or exit point listed in item 29. This field is blank if item 21 is coded as the study area for the survey or if item 27 is coded as 2.
22	Origin Field 1	This is the address of the last place person got into their vehicle or the name of the nearest intersecting streets to that place.
23	Origin Field 2	This is the second street name of the nearest intersecting streets to the last place person got into their vehicle or a continuation of the address in item 31.
24	Origin Longitude	This is the longitude of the origin address. Unknown/Refused origins within the study area should be coded as 888.8888. Unknown external origins outside of the study but within Texas are coded as 666.6666. Unknown Mexico origins are coded as 777.7777. Unknown out-of-state external origins (non-Mexico) are coded as 999.9999.
25	Origin Latitude	This is the latitude of the origin address. Unknown/Refused origins within the study area should be coded as 888.8888. Unknown external origins outside of the study but within Texas are coded as 666.6666. Unknown Mexico origins are coded as 777.7777. Unknown out-of-state external origins (non-Mexico) are coded as 999.9999.
26	Origin Study Area	Code indicating study area origin is located. Codes vary depending on area being surveyed. Typically consist of 1 character. Field is blank if location is not within study area.
27	Origin Zone	If the trip origin is within the study area, this is the zone number where the origin is located. Unknown/refused internal locations within the study area are coded as 8888. If the trip began outside of the study area but within Texas, it is coded using the statewide zone system (SAM) and preceded by the number 1. Unknown/refused external locations within Texas are coded as 16666. If the origin is in Mexico, this is the zone number for the international border crossing used to enter Texas. Unknown/refused border crossings from Mexico are coded as 7777. If the origin is outside of Texas (non-Mexico), this is coded to the SAM zone number for the highway used to enter the state. Unknown/refused external locations outside of Texas (non-Mexico) are coded as 9999.
28	Departure Hour	This is the hour the vehicle departed from the origin location. This should be in military time.
29	Departure Minute	This is the minute the vehicle departed from the origin location.
30	Origin Type	Code indicating the type of place from which the trip originated.
31	Origin Type Other	If the origin type is coded as "other", this field contains a description of the type of place. Otherwise it is blank.

Table 4: External Non-Commercial Data Elements (continued).

No.	Data Item	Description
32	Origin Purpose	Code indicating the driver's purpose for being at the origin location.
33	Origin Purpose Other	If the origin purpose is coded as "other", this field contains a description of the purpose. Otherwise it is blank.
34	Trip Indicator	Code indicating if the origin address is within the study area. 1-Yes, 2-No, 99-Unknown/Refused.
35	Entry Point	If the trip origin is outside the study area, this field should state the name of the external highway/bridge at which the vehicle entered the study area.
36	Entry Zone	If the trip origin is outside the study area, this field contains the external station number of the entry point. Unknown is coded as 99999. This field is blank if origin is in the study area.
37	Destination Field 1	This is the address of the destination for the person or the name of the nearest intersecting streets to that destination.
38	Destination Field 2	This is the second street name of the nearest intersecting streets to the destination of the person or a continuation of the address.
39	Destination Longitude	This is the longitude of the destination address. Unknown/Refused internal destinations are coded as 888.8888. Unknown external destinations within Texas are coded as 666.6666. Unknown Mexico external destinations are coded as 777.7777. Unknown out-of-state external destinations (non-Mexico) are coded as 999.9999.
40	Destination Latitude	This is the latitude of the destination address. Unknown/Refused internal destinations are coded as 888.8888. Unknown external destinations within Texas are coded as 666.6666. Unknown Mexico external destinations are coded as 777.7777. Unknown out-of-state external destinations (non-Mexico) are coded as 999.9999.
41	Destination Study Area	Code indicating study area in which destination is located. Codes vary depending on area being surveyed. Typically consist of 1 character. Field is blank if destination is not within study area.
42	Destination Zone	If the trip destination is within the study area, this is the zone number where the destination is located. Unknown/refused internal locations within the study area are coded as 8888. If the trip ends outside of the study area but within Texas, it is coded using the statewide zone system (SAM) and preceded by the number 1. Unknown/refused external locations within Texas are coded as 16666. If the destination is in Mexico, this is the zone number for the international border crossing used to exit Texas. Unknown/refused border crossings to Mexico are coded as 7777. If the destination is outside of Texas (non-Mexico), this is the SAM zone number for the highway used to exit the state. Unknown/refused external locations outside of Texas (non-Mexico) are coded as 9999.
43	Trip Purpose	Code indicating purpose of trip to destination.
44	Trip Purpose Other	If trip purpose is coded as "other", this field contains the description of that trip purpose.
45	Destination Indicator	Code indicating if the destination location is outside of Texas. 1-Yes, 2-No, 99-Unknown/Refused.
46	Destination Location	If person is traveling to a location outside of Texas, this field contains the city/state to which the person is traveling.
47	Destination Texas	If person is traveling to a location within Texas, this field contains the city/county to which the person is traveling.
48	Additional Trips	Number of additional trips/stops person made on day of survey up to the time they were surveyed.
49	Form	Number of survey form data was recorded.

Table 5. External Commercial Vehicle Data Elements.

No.	Data Item	Description
1	Record Type	Code which indicates the type of record. It should be B.
2	Month	Month station is being surveyed.
3	Day	Day of the month station is surveyed.
4	Station Number	Site number of the station being surveyed.
5	Station	Name of station/facility being surveyed.
6	Longitude	Longitude of location being surveyed.
7	Latitude	Latitude of location being surveyed.
8	Name of Interviewer	Name of surveyor conducting interview.
9	Truck Number	Truck number surveyed (column number on survey form).
10	Survey Begin Time	Hour and minute when survey began. Must be in military time.
11	Survey End Time	Hour and minute when survey ended. Must be in military time.
12	Occupancy	Number of people in vehicle.
13	Vehicle Class	Code indicating the classification of the vehicle.
14	Vehicle Class Other	If vehicle classification is coded as "other", this field contains a description of the vehicle. Otherwise it is blank.
15	Vehicle Type/Use	Code indicating if the vehicle is primarily used for cargo/freight transport or for service. 1-Cargo Transport 2-Service.
16	Vehicle Cargo	This is a code number indicating the type of cargo being carried by the vehicle.
17	Vehicle Cargo Other	If the cargo is coded as "Unclassified Cargo", this field contains a description of the cargo. Otherwise it is blank.
18	Cargo Weight	Weight in pounds (lb) of the cargo being transported.
19	Hazmat Placard	If cargo code is hazardous materials, this is the hazmat placard number affixed to the sides/rear of the vehicle or trailer.
20	Mexico Cargo	Code indicating if cargo came from or is going to Mexico. 1-Yes; 2-No; 99-Unknown/Refused. This field is blank if cargo is coded as empty.
21	Pick up Address	Address of location where cargo was picked up. This field is blank if cargo is coded as empty.
22	Pick up Intermodal	Code indicating if location where cargo was picked up was an interposal transfer or custom brokerage facility. 1-Yes; 2-No; 99-Unknown/Refused. This field is blank if cargo is coded as empty.
23	Cargo Transfer Type	Code indicating how cargo was transferred. This field is blank if cargo is coded as empty.
24	Drop off Address	Address of location where cargo will be dropped off. This field is blank if cargo is coded as empty.
25	Drop off Intermodal	Code indicating if location where cargo will be dropped off is an interposal transfer or custom brokerage facility. 1-Yes; 2-No; 99-Unknown/Refused. This field is blank if cargo is coded as empty.
26	Cargo Transfer Type	Code indicating how cargo will be transferred at drop off site. This field is blank if cargo is coded as empty.
27	General Origin	This is the city/state where the vehicle is coming from. City/State information is required for locations in Mexico.
28	Texas Origin	Code indicating if the General Origin is located in Texas. 1-Yes; 2-No; 99-Unknown/Refused.
29	Entry Point	If General Origin was not in Texas, this field contains the name of the road or highway at which the person entered Texas. This field is blank if General Origin is coded as in Texas.
30	Entry State Zone	This field contains the external station zone number of the entry or exit point listed as the entry point. This field is blank if general origin is coded as in Texas.
31	Origin Field 1	This is the address of the last place person got into the vehicle or the first street name of the nearest intersecting streets to that location.
32	Origin Field 2	This is the second street name of the nearest intersecting streets to the originating point or a continuation of the origin address.
33	Origin Longitude	This is the longitude of the origin address. Unknown/Refused origins within the study area are coded as 888.8888. Unknown external origins outside of the study area but within Texas are coded as 666.6666. Unknown Mexico origins are coded as 777.7777. Unknown out-of-state origins (non-Mexico) are coded as 999.9999.
34	Origin Latitude	This is the latitude of the origin address. Unknown/Refused origins within the study area are coded as 888.8888. Unknown external origins outside of the study area but within Texas are coded as 666.6666. Unknown Mexico origins are coded as 777.7777. Unknown out-of-state origins (non-Mexico) are coded as 999.9999.

Table 5. External Commercial Vehicle Data Elements (continued).

No.	Data Item	Description
35	Origin Study Area	Code indicating study area in which origin is located. Codes vary depending on area being surveyed. Typically consist of 1 character. Field is blank if origin is not within study area.
36	Origin Zone	If the trip origin is within the study area, this is the TAZ number where the origin is located. Unknown/refused locations within the study area are coded as 8888. If the trip began outside of the study area but within Texas, it is coded using the statewide zone system (SAM) preceded by the number 1. Unknown/refused locations within Texas are coded as 16666. If the origin is in Mexico, this is coded to the zone number for the international border crossing used to enter Texas. Unknown/refused border crossings from Mexico are coded as 7777. If the origin is outside of Texas (non-Mexico), this is coded to the SAM zone number for the highway used to enter the state. Unknown/refused external locations outside of Texas (non-Mexico) are coded as 9999.
37	Departure Hour	This is the hour the vehicle departed from the origin location. This is in military time.
38	Departure Minute	This is the minute the vehicle departed from the origin location.
39*	Origin Type	Code indicating the type of place from which the trip originated.
40	Origin Type Other	If the origin type is coded as "other", this field contains a description of the type of place. Otherwise it is blank.
41	Origin Purpose	This is the driver's purpose for being at the origin location.
42	Origin Purpose Other	If trip purpose is coded as 'other', this field contains the description of the trip purpose.
43	Trip Indicator	Code indicating if trip origin is inside the study area. 1-Yes; 2-No; 99-Unknown/Refused.
44	Origin Entry Point	If the trip origin is outside the study area, this field contains the name of the road or highway on which the vehicle entered the study area.
45	Origin Entry Zone	If the trip origin is outside the study area, this field contains the external station number of the entry point. Unknown is coded as 99999.
46	Destination Field 1	This is the address of the destination of the person or the first street name of the nearest intersecting streets to that location. (place/address or nearest intersection/city).
47	Destination Field 2	This is the second street name of the nearest intersecting streets to the destination of the person or a continuation of the address.
48	Destination Longitude	This is the longitude of the destination address. Unknown/Refused internal destinations are coded as 888.8888. Unknown external destinations within Texas are as 666.6666. Unknown Mexico external destinations are coded as 777.7777. Unknown out-of-state destinations (non-Mexico) are coded as 999.9999.
49	Destination Latitude	This is the latitude of the destination address. Unknown/Refused internal destinations are coded as 888.8888. Unknown external destinations within Texas are as 666.6666. Unknown Mexico external destinations are coded as 777.7777. Unknown out-of-state destinations (non-Mexico) are coded as 999.9999.
50	Destination Study Area	Code indicating study area in which destination is located. Codes vary depending on area being surveyed. Typically consist of 1 character. Field is blank if origin is not within study area.
51	Destination Zone	If the trip destination is within the study area, this is the TAZ number where the destination is located. Unknown/refused locations within the study area are coded as 8888. If the trip ends outside of the study area but within Texas, it is coded to the statewide zone system (SAM) and preceded by the number 1. Unknown/refused external locations within Texas are coded as 16666. If the destination is in Mexico, this is coded to the zone number for the international border crossing used to exit Texas. Unknown/refused border crossings to Mexico are coded as 7777. If the destination is outside of Texas (non-Mexico), this is coded to the SAM zone number for the highway used to exit the state. Unknown/refused external locations outside of Texas (non-Mexico) are coded as 9999.
52	Trip Purpose	Code indicating purpose of trip to destination.
53	Trip Purpose Other	If trip purpose in item 65 is coded as "other", this field contains a description of that trip purpose.

Table 5. External Commercial Vehicle Data Elements (continued).

No.	Data Item	Description
54	Destination Indicator	Code indicating if the destination location is outside of Texas. 1 - Yes, 2 – No, 99 – Unknown/Refused.
55	Destination Location	If person is traveling to a location outside of Texas, this field contains the city/state to which the person is traveling.
56	Exit Location	If person is traveling to a location outside of Texas, this field contains the name of the road or highway where the vehicle will exit Texas.
57	Exit Zone	This field contains the external station zone number of the exit point from Texas. Unknown is coded as 99999.
58	Destination Texas	If person is traveling to a location inside Texas, this field contains the city/county in Texas to which the person is traveling.
59	Additional Trips	Number of additional trips/stops person made on day of survey up to the time they were surveyed.
60	Form	Number of survey form the data were recorded.

Table 6. External Non-Commercial Data Elements – Postcard Survey.

No.	Data Item	Description
1	Record Type	Code which indicates the type of record, here it is C.
2	Month	Month station was surveyed.
3	Day	Day of the month station was surveyed.
4	Site Number	Unique non-zero number assigned to the station being surveyed.
5	Station	Name of station/facility.
6	Longitude	Longitude of station location.
7	Latitude	Latitude of station location.
8	Residence	Code indicating county where person lives. Value depends on area being surveyed.
9	Other County	If residence county is coded as "other", this field contains the name of the county the residence is located.
10	Origin Activity	Code indicating the type of activity person was engaged at the origin of trip.
11	Other Activity	If the origin activity is coded as 'Other', this field contains a description of the activity. Otherwise it is blank.
12	Destination Activity	Code indicating the type of activity person was engaged at the destination end of the trip.
13	Other Activity	If the destination activity is coded as 'Other', this field contains a description of the activity. Otherwise it is blank.
14	Origin Field 1	This is the address of the last place the person got into their vehicle, or the name of the nearest intersecting streets to that place.
15	Origin Field 2	This is the second street name of the nearest intersecting streets to the last place the person got into their vehicle or a continuation of the address in the previous field.
16	Origin Study Area	Code indicating study area in which origin is located. Codes vary depending on area being surveyed. Typically consist of 1 character. Field is blank if location is not within study area.
17	Origin Zone	If the trip origin is within the study area, this is the zone number where the origin is located. Unknown/refused internal locations within the study area are coded as 8888. If the trip began outside of the study area but within Texas, it is coded using the statewide zone system (SAM) and preceded by the number 1. Unknown/refused external locations within Texas are coded as 16666. If the origin is in Mexico, this is the zone number for the international border crossing used to enter Texas. Unknown/refused border crossings from Mexico are coded as 7777. If the origin is outside of Texas (non-Mexico), this is coded as 9999.
18	Origin Longitude	This is the longitude of the origin location. Unknown/refused should be coded as 888.888888
19	Origin Latitude	This is the latitude of the origin location. Unknown/refused should be coded as 888.888888.
20	Destination Field 1	This is the address of the destination for the person or the name of the nearest intersecting streets to that destination.
21	Destination Field 2	This is the second street name of the nearest intersecting streets to the destination of the person or a continuation of the address in destination field 1.
22	Destination Study Area	Code indicating study area in which destination is located. Codes vary depending on area being surveyed. Typically consist of 1 character. Field is blank if location is not within study area.
23	Destination Zone	If the trip destination is within the study area, this is the zone number where the origin is located. Unknown/refused internal locations within the study area are coded as 8888. If the trip began outside of the study area but within Texas, it is coded using the statewide zone system (SAM) and preceded by the number 1. Unknown/refused external locations within Texas are coded as 16666. If the origin is in Mexico, this is the zone number for the international border crossing used to enter Texas. Unknown/refused border crossings from Mexico are coded as 7777. If the origin is outside of Texas (non-Mexico), this is coded as 9999.
24	Destination Longitude	This is the longitude of the destination location. Unknown/refused should be coded as 888.888888.
25	Destination Latitude	This is the latitude of the destination location. Unknown/refused should be coded as 888.888888.
26	Comments	This field should contain the comments and suggestions entered on the postcard.

Table 7. External Commercial Data Elements – Postcard Survey.

No.	Data Item	Description
1	Record Type	Code which indicates the type of record, here it is D
2	Month	Month station was surveyed.
3	Day	Day of the month station was surveyed.
4	Site Number	Unique non-zero number assigned to the station being surveyed
5	Station	Name of station/facility
6	Longitude	Longitude of location being surveyed.
7	Latitude	Latitude of location being surveyed.
8	Origin Activity	Code indicating the type of activity person was engaged at the origin of trip.
9	Other Activity	If the origin activity is coded as "other", this field contains a description of the activity. Otherwise it is blank.
10	Destination Activity	Code indicating the type of activity person was engaged at the destination end of the trip.
11	Other Activity	If the destination activity is coded as "other", this field contains a description of the activity. Otherwise it is blank.
12	Origin Field 1	This is the address of the last place the person got into their vehicle, or the name of the nearest intersecting streets to that place.
13	Origin Field 2	This is the second street name of the nearest intersecting streets to the last place the person got into their vehicle or a continuation of the address in the previous field.
14	Origin Study Area	Code indicating study area in which origin is located. Use 'C' if zone is in the Corpus study area and 'V' if the zone is in the Victoria study area. Field should be blank if zone is not within one of these two study areas.
15	Origin Zone	If the trip origin is within the study area, this is the zone number where the origin is located. Unknown/refused internal locations within the study area should be coded as 8888. If the trip began outside of the study area but within Texas, it should be coded using the statewide zone system (SAM) and preceded by the number 1 in column 266. Unknown/refused external locations within Texas should be coded as 16666. If the origin is in Mexico, this should be the zone number for the international border crossing used to enter Texas. Unknown/refused border crossings from Mexico should be coded as 7777. If the origin is outside of Texas (non-Mexico), this should be coded as 9999.
16	Origin Longitude	This is the longitude of the origin location. Unknown/refused should be coded as 888.888888
17	Origin Latitude	This is the latitude of the origin location. Unknown/refused should be coded as 888.888888.
18	Destination Field 1	This is the address of the destination for the person or the name of the nearest intersecting streets to that destination. If unknown, type unknown.
19	Destination Field 2	This is the second street name of the nearest intersecting streets to the destination of the person or a continuation of the address in destination field 1. If unknown, type unknown.
20	Destination Study Area	Code indicating study area in which destination is located. Codes vary depending on area being surveyed. Typically consist of 1 character. Field is blank if location is not within study area.
21	Destination Zone	If the trip destination is within the study area, this is the zone number where the destination is located. Unknown/refused internal locations within the study area are coded as 8888. If the trip began outside of the study area but within Texas, it is coded using the statewide zone system (SAM) and preceded by the number 1. Unknown/refused external locations within Texas are coded as 16666. If the origin is in Mexico, this should be the zone number for the international border crossing used to enter Texas. Unknown/refused border crossings from Mexico are coded as 7777. If the origin is outside of Texas (non-Mexico), this is coded as 9999.
22	Destination Longitude	This is the longitude of the destination location. Unknown/refused should be coded as 888.888888.
23	Destination Latitude	This is the latitude of the destination location. Unknown/refused should be coded as 888.888888.
24	Cargo	Code indicating type of cargo being transported.
25	Cargo Weight	Weight in pounds of cargo being transported.
26	Hazardous Code	Placard number for hazardous material being transported.
27	Comments	This field should contain the comments and suggestions entered on the postcard.

Table 8. External Non-Commercial Data Elements – Data Checks.

No.	Data Item	Data Checks
1	Record Type	None.
2	Month	Range of value between 1 and 12.
3	Day	For month and day, day of week is calculated and compared to value.
4	Station Number	Non-blank.
5	Station	Non-blank.
6	Longitude	Non-blank and falls within correct range of values for area being surveyed.
7	Latitude	Non-blank and falls within correct range of values for area being surveyed.
8	Name of Interviewer	Non-blank.
9	Vehicle Number	None.
10	Survey Begin Time	Non-blank. Hour falls within range of 0 and 23. Minute falls within range of 0 and 59.
11	Survey End Time	Non-blank. Hour falls within range of 0 and 23. Minute falls within range of 0 and 59. Time also checked that it falls after survey begin time.
12	Occupancy	Non-zero for all but buses.
13	Vehicle Class	Non-zero and value falls within certain range.
14	Vehicle Class Other	If vehicle class is coded as "other", non-blank.
15	Residence Status	Non-blank and falls within certain range.
16	Resident Home Location	Non-blank if residence status is coded as in study area.
17	Home Location (Non-Resident)	Non-blank is residence status is coded as "other".
18	Enter Texas (Non-Resident)	If residence status coded as "other", value falls within certain range.
19	Travel Origin (Non-Resident)	If "enter Texas" is coded yes or residence status coded as "other", non-blank.
20	Texas Entry Point (Non-Resident)	If "enter Texas" is coded yes or residence status coded as "other", non-blank.
21	Texas Entry Zone (Non-Resident)	If "enter Texas" is coded yes or residence status coded as "other", non-blank and falls within range of values for Texas SAM zone numbers
22	Origin Field 1	Non-blank.
23	Origin Field 2	None.
24	Origin Longitude	Non-blank and falls within correct range of values for area being surveyed.
25	Origin Latitude	Non-blank and falls within correct range of values for area being surveyed.
26	Origin Study Area	Non-blank and matches expected value for area.
27	Origin Zone	Non-blank and falls within range of values for area.
28	Departure Hour	Non-blank and falls within correct range of values.
29	Departure Minute	Non-blank and falls within range 0–59.
30	Origin Type	Non-blank and value falls within expected range.
31	Origin Type Other	If origin type coded "other", non-blank.
32	Origin Purpose	Non-blank and falls within expected range of values.
33	Origin Purpose Other	If origin purpose coded as "other", non-blank
34	Trip Indicator	Non-blank and falls within expected range of values.
35	Entry Point	If trip indicator coded as outside study area, non-blank.
36	Entry Zone	If trip indicator coded as outside study area, non-blank and value falls within expected range.
37	Destination Field 1	Non-blank.
38	Destination Field 2	None.
39	Destination Longitude	Non-blank.
40	Destination Latitude	Non-blank.
41	Destination Study Area	None.
42	Destination Zone	Non-blank and falls within range of values depending on code for destination study area.
43	Trip Purpose	Non-blank and falls within expected range of values.
44	Trip Purpose Other	If trip purpose coded as "other", non-blank.
45	Destination Indicator	Non-blank and falls within expected range of values
46	Destination Location	If destination indicator coded as outside Texas, non-blank.
47	Destination Texas	If destination indicator coded as outside Texas, non-blank.
48	Additional Trips	None.
49	Form	None.

Table 9. External Commercial Vehicle Data Elements Data Checks.

No.	Data Item	Data Checks
1	Record Type	None.
2	Month	Range of value between 1 and 12.
3	Day	For month and day, day of week is calculated and compared to value.
4	Station Number	Non-blank.
5	Station	Non-blank.
6	Longitude	Non-blank and falls within correct range of values for area being surveyed.
7	Latitude	Non-blank and falls within correct range of values for area being surveyed.
8	Name of Interviewer	Non-blank.
9	Truck Number	None.
10	Survey Begin Time	Non-blank. Hour falls within range of 0 and 23. Minute falls within range of 0 and 59.
11	Survey End Time	Non-blank. Hour falls within range of 0 and 23. Minute falls within range of 0 and 59. Time also checked that it falls after survey begin time.
12	Occupancy	Non-blank and non-zero.
13	Vehicle Class	Non-blank and value falls within expected range.
14	Vehicle Class Other	If vehicle class is coded as "other", non-blank.
15	Vehicle Type/Use	Non-blank and value falls within expected range.
16	Vehicle Cargo	If vehicle type coded as "cargo transport", non-blank and falls within expected range.
17	Vehicle Cargo Other	If vehicle type coded as "cargo transport" and cargo coded as "unclassified", non-blank.
18	Cargo Weight	If vehicle type coded as "cargo transport" and cargo coded as "non-empty", non-blank.
19	Hazmat Placard	If vehicle type coded as "cargo transport" and cargo coded as "hazardous materials", non-blank.
20	Mexico Cargo	If vehicle type coded as "cargo transport" cargo is not coded as "empty", non-blank and value falls within expected range.
21	Pick up Address	If vehicle type coded as "cargo transport" and cargo is not coded as "empty", non-blank.
22	Pick up Intermodal	If vehicle type coded as "cargo transport" and cargo is not coded as "empty", non-blank and values falls within expected range.
23	Cargo Transfer Type	If vehicle type coded as "cargo transport" and cargo is not coded as "empty", non-blank and value falls within expected ranges.
24	Drop off Address	If vehicle type coded as "cargo transport" and cargo is not coded as "empty", non-blank.
25	Drop off Intermodal	If vehicle type coded as "cargo transport" and cargo is not coded as "empty", non-blank and value falls within expected ranges.
26	Cargo Transfer Type	If vehicle type coded as "cargo transport" and cargo is not coded as "empty", non-blank and value falls within expected ranges.
27	General Origin	Non-blank.
28	Texas Origin	Non-blank and value falls within expected ranges.
29	Entry Point	If general origin is not in Texas, non-blank.
30	Entry State Zone	If general origin is not in Texas, non-blank and values falls within expected ranges for Texas SAM zones.
31	Origin Field 1	Non-Blank.
32	Origin Field 2	None.
33	Origin Longitude	Non-blank and if trip indicator coded as in study area, value falls within expected range for study area.
34	Origin Latitude	Non-blank and if trip indicator coded as in study area, value falls within expected range for study area.

Table 9. External Commercial Vehicle Data Elements – Data Checks (continued).

No.	Data Item	Data Checks
35	Origin Study Area	If trip indicator coded as in study area, value is expected for study area.
36	Origin Zone	Non-blank and if trip indicator coded as in study area, value falls within expected range for study area internal zones.
37	Departure Hour	Non-blank and value falls within expected range.
38	Departure Minute	Non-blank and value falls within 0–59.
39*	Origin Type	Non-blank and value falls within expected range.
40	Origin Type Other	If origin type coded as "other", non-blank.
41	Origin Purpose	Non-blank and value falls within expected range.
42	Origin Purpose Other	If origin purpose coded as "other", non-blank.
43	Trip Indicator	Non-blank and value falls within expected range.
44	Origin Entry Point	If trip indicator coded as origin outside study area, non-blank.
45	Origin Entry Zone	If trip indicator coded as origin outside study area, non-blank and value falls within expected range for study area.
46	Destination Field 1	Non-blank.
47	Destination Field 2	None.
48	Destination Longitude	Non-blank.
49	Destination Latitude	Non-blank.
50	Destination Study Area	None.
51	Destination Zone	Non-blank and value falls within expected range depending on whether destination study area is coded as the study area or destination indicator is coded as in Texas.
52	Trip Purpose	Non-blank and value falls within expected range.
53	Trip Purpose Other	If trip purpose is coded as "other", non-blank.
54	Destination Indicator	Non-blank and value falls within expected range.
55	Destination Location	If destination indicator is coded as outside Texas, non-blank.
56	Exit Location	If destination indicator is coded as outside Texas, non-blank.
57	Exit Zone	If destination indicator is coded as outside Texas, non-blank and value falls within expected range.
58	Destination Texas	If destination indicator is coded as inside Texas, non-blank.
59	Additional Trips	None.
60	Form	None.

Table 10. External Non-Commercial Data Elements – Postcard Survey Data Checks.

No.	Data Item	Data Checks
1	Record Type	None.
2	Month	Range of value between 1 and 12.
3	Day	For month and day, day of week is calculated and compared to value.
4	Site Number	Non-blank.
5	Station	Non-blank.
6	Longitude	Non-blank and falls within correct range of values for area being surveyed.
7	Latitude	Non-blank and falls within correct range of values for area being surveyed.
8	Residence	Non-blank and falls within certain range.
9	Other County	If residence county is coded as "other", non-blank.
10	Origin Activity	Non-blank and value falls within expected range.
11	Other Activity	If origin activity is coded as "other", non-blank.
12	Destination Activity	Non-blank and value falls within expected range.
13	Other Activity	If destination activity is coded as "other", non-blank.
14	Origin Field 1	Non-blank.
15	Origin Field 2	None.
16	Origin Study Area	None.
17	Origin Zone	Non-blank and value falls within expected range depending on coding of origin study area.
18	Origin Longitude	Non-blank and value falls within expected range depending on coding of origin study area.
19	Origin Latitude	Non-blank and value falls within expected range depending on coding of origin study area.
20	Destination Field 1	Non-blank.
21	Destination Field 2	None.
22	Destination Study Area	None.
23	Destination Zone	Non-blank and value falls within expected range depending on coding of destination study area.
24	Destination Longitude	Non-blank and value falls within expected range depending on coding of destination study area.
25	Destination Latitude	Non-blank and value falls within expected range depending on coding of destination study area.
26	Comments	None.

Table 11. External Commercial Data Elements – Postcard Survey Data Checks.

No.	Data Item	Data Checks
1	Record Type	None.
2	Month	Range of value between 1 and 12.
3	Day	For month and day, day of week is calculated and compared to value.
4	Site Number	Non-blank.
5	Station	Non-blank.
6	Longitude	Non-blank and falls within correct range of values for area being surveyed.
7	Latitude	Non-blank and falls within correct range of values for area being surveyed.
8	Origin Activity	Non-blank and value falls within expected range.
9	Other Activity	If origin activity is coded as "other", non-blank.
10	Destination Activity	Non-blank and value falls within expected range.
11	Other Activity	If destination activity is coded as "other", non-blank.
12	Origin Field 1	Non-blank.
13	Origin Field 2	None.
14	Origin Study Area	None.
15	Origin Zone	Non-blank and value falls within expected range depending on coding of origin study area.
16	Origin Longitude	Non-blank and value falls within expected range depending on coding of origin study area.
17	Origin Latitude	Non-blank and value falls within expected range depending on coding of origin study area.
18	Destination Field 1	Non-blank.
19	Destination Field 2	None.
20	Destination Study Area	None.
21	Destination Zone	Non-blank and value falls within expected range depending on coding of destination study area.
22	Destination Longitude	Non-blank and value falls within expected range depending on coding of destination study area.
23	Destination Latitude	Non-blank and value falls within expected range depending on coding of destination study area.
24	Cargo	Non-blank and value falls within expected range.
25	Cargo Weight	If cargo is not coded as "empty", non-blank.
26	Hazardous Code	If cargo is coded as hazardous materials, non-blank.
27	Comments	None.

RECOMMENDED GUIDELINES

This section presents a composite set of recommended guidelines for household and external station travel surveys. Many of the areas included were not a part of the research effort under RMC 0-5711. For completeness, it was considered appropriate to include all these areas.

Table 12. Recommended Household Survey Guidelines.

Household Surveys	
Area	Recommended Guidelines
Survey Monitoring	1. Attend and/or listen to survey orientation session conducted by vendor. 2. Listen to recruitment and data retrieval during the pilot and normal survey on a random basis. 3. Attend and observe installation and retrieval of GPS equipment during pilot and normal survey on a random basis.
Survey Data Elements	4. Continue current practice.
Survey Sample Size	5. Continue current practice.
Sampling Frame and Sample Selection	6. Have vendor document method of selecting households, e.g., random digit dialing, purchased phone list, etc. 7. Use sampling frame of all households with working phone. Phone can be either land line or cell.
Sample Recruitment	8. Continue current practice of recruitment by phone. 9. For households unable to be contacted, use a mail out/mail back survey method.
Response Rate	10. Establish call disposition categories for use by vendor. 11. Use the AAPOR formula for computing survey response rate.
Non-Response	12. Use a mail out/mail back survey method to obtain participation of non-response households. 13. Use incentives to obtain participation of non-response households.
Proxy Reporting	14. Accept proxy reporting for all individuals 15 years of age and younger. 15. Establish the maximum number of individuals over the age of 15 that can be represented by proxy as 20 percent.
Survey Data Checks	16. Continue current practice.
Complete Household	17. Continue current practice.
Pilot Survey	18. Conduct full household survey on 25 households for the pilot survey. 19. Conduct GPS data collection on 5 of the 25 households in the pilot survey. 20. Meet with vendor to review and discuss pilot survey results.

Table 13. Recommended External Survey Guidelines.

Area	Recommended Guidelines
External Surveys	
Area	Recommended Guidelines
Survey Monitoring	1. Attend and/or listen to survey orientation session conducted by vendor. 2. Observe the traffic control plan set up and data collection at the pilot external. 3. Observe a minimum of three external station surveys randomly selected during the full survey. Observation should include survey setup, survey operating protocol, and general surveys procedures during the day.
Survey Data Elements	4. Continue current practice.
Survey Sample Size	5. Continue current practice for non-commercial vehicles. Increase minimum usable surveys for commercial vehicle to 70 or 25 percent of the commercial vehicles traversing the site during survey.
Survey Methodology	6. Require vendor to use tablet personal computers to collect survey data. 7. Prohibit vendors from using interactive GIS software to geocode survey locations while collecting survey data. 8. Require vendors to log by hour the number of surveyors actively conducting surveys and the name of the site supervisor. Information should be provided with the survey data for the site. 9. Prohibit project manager from serving as full time site supervisor. Allow project manager to serve as site supervisor in a temporary relief capacity only.
Vehicle Classification Counts	10. Have vendor calibrate AVC counters at site when counters are set up. Documentation of calibration should be submitted with data for site. 11. Require vendor to video tape vehicles in both directions and manually classify vehicles by hour for time period surveys are conducted. 12. Require vendor to break down the classification of pickup trucks and vans into non-commercial and commercial counts based on the video data. 13. Require vendor to classify vehicles using FHWA Scheme F in 15 minute increments.
Survey Data Checks	14. Continue current practice.
Survey Data Expansion	15. Continue current practice.

REFERENCES

1. *Standardized Procedures for Personal Travel Surveys*. National Cooperative Highway Research Program, Report 571, NCHRP Project 8-37, Transportation Research Board, Washington, D.C., 2008.

2. *Technical Appendix to NCHRP Report 571: Standardized Procedures for Personal Travel Surveys*. National Cooperative Highway Research Program, Report 93, NCHRP Project 8-37, Washington, D.C., 2007.