Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA/TX-95/1235-10		

4. Title and Subtitle	5. Report Date
EVALUATION OF URBAN TRAVEL SURVEY METHODOLOGIES	October 1994
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
David F. Pearson and George B. Dresser	Research Report 1235-10

9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Texas Transportation Institute The Texas A&M University System College Station, Texas 77843-3135	11. Contract or Grant No. Study No. 0-1235

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
Texas Department of Transportation Research and Technology Transfer Office P. O. Box 5080 Austin, Texas 78763-5080	Interim: September 1989 - August 1994
	14. Sponsoring Agency Code

15. Supplementary Notes

Research performed in cooperation with the Texas Department of Transportation and the U.S. Department of Transportation, Federal Highway Administration
Research Study Title: Improving Transportation Planning Techniques

16. Abstract

This report documents the evaluation of the methodologies used in the travel surveys done in five urban areas in Texas in 1990 and 1991. Based on those evaluations, specific recommendations are made in the areas of sample size estimation, survey methodologies, data specifications, survey instruments, etc. Surveys evaluated include household surveys, workplace surveys, special generator surveys, external station surveys, and truck surveys. Several travel data gaps are also identified where current survey efforts are not sufficient in terms of providing data for their estimation or modeling.

17. Key Words	18. Distribution Statement
Travel Surveys, Household Surveys, Workplace Surveys, External Surveys, Special Generator Surveys, Truck Surveys	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)	20. Security Classif.(of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	166	

EVALUATION OF URBAN TRAVEL SURVEY METHODOLOGIES

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Research Report 1235-10
Research Study Number 0-1235
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Sponsored by the
Texas Department of Transportation
In Cooperation with
U.S. Department of Transportation
Federal Highway Administration

October 1994

TEXAS TRANSPORTATION INSTITUTE
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IMPLEMENTATION STATEMENT

This report presents a comprehensive evaluation of the methodologies used in the travel surveys conducted in five urban areas in Texas in 1990 and 1991. Recommendations are included to improve the survey designs, methods of data collection, data specifications, and the overall validity of the results of the surveys. These recommendations may be implemented in future survey activities undertaken by the Texas Department of Transportation to improve the overall data being collected and used in travel demand modeling.

DISCLAIMER

The contents of this report reflect the views of the authors who are responsible for the opinions, findings, and conclusions presented herein. The contents do not necessarily reflect the official views or policies of the Federal Highway Administration or the Texas Department of Transportation. This report does not constitute a standard, specification, or regulation. Additionally, this report is not intended for construction, bidding, or permit purposes. George B. Dresser, Ph.D., was the Principal Investigator for the project.

TABLE OF CONTENTS

LIST OF FIGURES xi
LIST OF TABLES xiii
SUMMARY xv

INTRODUCTION 1

TRIP GENERATION 3

TRAVEL SURVEYS 7

HOUSEHOLD SURVEYS 9
- DALLAS-FORT WORTH 9
- HOUSTON-GALVESTON 16
- TEXARKANA 18
- 1990-1991 HOUSEHOLD SURVEYS 24
  - San Antonio, Amarillo, and Brownsville 31
  - Tyler and Sherman-Denison 32
- EVALUATION 32
  - Sample Size 35
  - Sample Selection 40
  - Data Collection Methodology 41
  - Data Specifications 43
- ALTERNATIVE METHODS 43
- RECOMMENDATIONS 51
  - Sample Size 51
  - Sample Selection 61
  - Data Collection Methodology 64
  - Data Specifications 65
  - Other Considerations 65

WORKPLACE SURVEYS 69
- DALLAS-FORT WORTH 70
- TEXARKANA 72
- 1990-1991 WORKPLACE SURVEYS 76
- EVALUATION 86
  - Sample Size 86
  - Sample Selection 88
  - Data Collection Methodology 88
  - Data Specifications 90
- RECOMMENDATIONS 91
  - Sample Size and Selection Procedure 93
  - Data Collection Methodology and Specification 104

Freestanding Workplaces 104
Non-Freestanding Workplaces 110
Non-Freestanding Alternative 113
General Considerations 114

SPECIAL GENERATOR SURVEYS 115
1990-1991 SPECIAL GENERATOR SURVEYS 115
San Antonio 115
Amarillo 116
Tyler 117
EVALUATION 117
RECOMMENDATIONS 117

EXTERNAL STATION SURVEYS 125
San Antonio 125
Amarillo 130
Brownsville 130
Tyler 130
Sherman-Denison 132
EVALUATION 132
RECOMMENDATIONS 133

TRUCK SURVEYS 135
San Antonio 135
Amarillo 136
Brownsville 136
Sherman-Denison 136
Tyler 138
EVALUATION 138
RECOMMENDATIONS 138
Commercial Truck Survey 138
For-Hire Passenger Carrier Survey 142

GAPS IN TRAVEL SURVEYS 145

REFERENCES 147

LIST OF FIGURES

1	1960s Origin-Destination Household Survey Instrument	10
2	North Central Texas Council of Governments 1984 Home Interview Survey	14
3	Houston-Galveston 1984 Household Survey	19
4	Texarkana 1989 Household Survey Instruments	25
5	San Antonio-Bexar County 1990 Household Information Survey Instrument	29
6	San Antonio-Bexar County 1990 Household Trip Survey Instrument	30
7	Boston 1990 Regional Household Activity Diary	45
8	Revised Household Information Survey Instrument	66
9	Revised Household Trip Survey Instrument	67
10	North Central Texas Council of Governments 1984 Employee Travel Survey	73
11	North Central Texas Council of Governments 1984 Nonemployee Travel Survey	74
12	Texarkana Urban Area Travel Surveys, 1989 Employee Travel Survey	77
13	Texarkana Urban Area Travel Surveys, 1989 Nonemployee Travel Survey	78
14	San Antonio-Bexar County 1990 Travel Survey, Workplace General Information Survey Form	82
15	San Antonio-Bexar County 1990 Travel Survey, Workplace Employee Travel Interview Form	84
16	San Antonio-Bexar County 1990 Travel Survey, Workplace Nonemployee Travel Interview Form	85
17	Workplace Employee Travel Survey, Part 1: Household Information	105
18	Workplace Employee Travel Survey, Part 2: Trip Information	106
19	Workplace Visitor Travel Interview Form, Freestanding Workplace	108
20	Workplace General Information Survey Form.	109
21	Activity Center General Information Survey Form	111
22	Workplace Visitor Travel Interview Form, Non-Freestanding Workplace	112
23	San Antonio-Bexar County 1990 Travel Survey, Special Generator General Information Survey Form	119
24	San Antonio-Bexar County 1990 Travel Survey, Special Generator Employee Questionnaire	120
25	San Antonio-Bexar County 1990 Travel Survey, Special Generator Nonemployee Questionnaire: Mall, Military Base	121
26	Special Generator Employee Travel Survey, Part 1: Household Information Survey	122
27	Special Generator General Information Survey Form	123
28	Special Generator Employee Travel Survey, Part 2: Trip Information	124
29	San Antonio-Bexar County Travel 1990 Survey, Postcard Survey Instrument	126
30	Amarillo 1990 Travel Survey, External Travel Survey Interview Form	127
31	Tyler-Smith County 1991 Travel Survey	128
32	Tyler-Smith County 1991 Travel Survey, External Travel Survey Interview Form	129

33 Brownsville 1990 Travel Survey,
Pedestrian External Travel Survey Interview Form 131
34 External Travel Survey Interview Form 134
35 San Antonio-Bexar County 1990 Truck Travel Survey 137
36 Sherman-Denison Area 1991 Commercial Truck Travel Survey 139

LIST OF TABLES

1	Production Trip Rate Cross-Classification Example	4
2	Sample Requirements, Dallas-Fort Worth Household Survey	12
3	Desired Household Responses, Houston-Galveston Survey	16
4	Household Response Matrix, Texarkana Household Survey	22
5	Household Sample Goals, San Antonio Household Survey	33
6	Amarillo Household Initial Sampling Goals	33
7	Brownsville Household Initial Sampling Goals	34
8	Household Response Matrix for Recommended Usable Surveys, Tyler Household Survey	34
9	Household Response Matrix for Recommended Usable Surveys, Sherman-Denison Household Survey	35
10	Number of Surveyed Households in the 1990 San Antonio Household Survey	37
11	Estimated Percentage Error in Trip Production Rates by Trip Purpose, 1990 San Antonio Household Survey	38
12	Expanded Trip Rates and Estimated Errors, San Antonio 1990 Household Survey	39
13	Expanded Person Trips per Household by Trip Purpose	42
14	Comparison of Zero Trip Households and Households Not Reporting Income	42
15	Stratification of Household Samples	52
16	1990 Percentage Distributions of Households by Household Size and Income, El Paso	52
17	Percentage Distribution of Households in 1980 by Household Size and Income (1980 Dollars), San Antonio-Bexar County	53
18	Percentage Distribution of Households in 1980 by Household Size and Income (1990 Dollars), San Antonio-Bexar County	54
19	1990 Percentage Distributions of Households by Household Size and Income, San Antonio-Bexar County	55
20	Estimated Percentage Distributions of Households in 1990 by Household Size and Income, El Paso	55
21	1990 Person Trips per Household, San Antonio-Bexar County	57
22	Sample Standard Deviations of 1990 Person Trips per Household, San Antonio-Bexar County	57
23	Relative Trip Rate Values, San Antonio-Bexar County	58
24	Proportional Distribution for Allocation of Overall Trip Rate Error (±10%)	58
25	Distribution of Overall Trip Rate Error (±10%)	59
26	Trip Rate Errors by Category	60
27	Initial Estimates of Sample Sizes by Category	61
28	Recommended Sample Sizes by Category, El Paso	61

29 Designation of Urban Areas for Borrowing Information in Computing Sample Sizes for Household Surveys 62
30 Workplace Survey Sample Quotas, 1984 Dallas-Fort Worth Travel Survey 71
31 Workplace Survey Sample Quotas, 1989 Dallas-Fort Worth Travel Survey 75
32 Workplace Survey Sample Quotas, 1990 San Antonio Travel Survey 79
33 Workplace Survey Sample Quotas, 1990 Amarillo Travel Survey 79
34 Workplace Survey Sample Quotas, 1990 Brownsville Travel Survey 80
35 Workplace Survey Sample Quotas, 1991 Tyler Travel Survey 80
36 Workplace Survey Sample Quotas, 1991 Sherman-Denison Travel Survey 81
37 Average and Range of Size, Establishments Surveyed, 1990-1991 Workplace Surveys 89
38 Example of Selecting Firms Using Weighted Systematic Sampling Technique 97
39 Distribution of a 5 Percent Sample of Employers/Workplaces in San Antonio-Bexar County 98
40 Total Employment for a 5 Percent Sample of Employers/ Workplaces in San Antonio-Bexar County 98
41 Average Employment per Workplace for a 5 Percent Sample of Employers/Workplaces in San Antonio-Bexar County 98
42 Estimated Percentage Distribution of Employers/Workplaces By Employment Type in San Antonio-Bexar County 99
43 Estimated Percentage Distribution of Employees By Employment Type in San Antonio-Bexar County 99
44 Recommended Percentage of Employees To Be Surveyed in Workplace Surveys 100
45 Sample Sizes Required for San Antonio (Example) 100
46 Number of Employees to Be Sampled by Area Type In San Antonio-Bexar County 101
47 Estimated Number of Workplaces to Be Sampled In San Antonio-Bexar County 102
48 Proportionate Distribution of Vehicle Miles of Travel (VMT) By Vehicle Classification Houston-Galveston Region 142

SUMMARY

The travel surveys accomplished in Texas in 1990 and 1991 represent a significant effort on the part of the urban areas and the Texas Department of Transportation. This report has evaluated the methodologies used in those surveys and, where considered appropriate, presented recommendations for improvements. The following paragraphs present brief summaries of the findings in this report.

HOUSEHOLD SURVEYS

The household surveys methodologies were considered to be reasonable in most respects. Recommendations were made in the areas of sample size determination, survey methodology, and data specifications. A need for additional research and work in the area of activity surveys in lieu of trip surveys was also identified.

WORKPLACE SURVEYS

The evaluation of the workplace surveys conducted in 1990 and 1991 indicated that the survey methodology was theoretically flawed. Recommendations were made for a procedure for the determination and computation of sample sizes for workplace surveys, a revised methodology for the conduction of those surveys, and additional data elements to be collected.

SPECIAL GENERATOR SURVEYS

The evaluation of the special generator surveys revealed no serious problems with the methodology or data being collected in the surveys. Recommendations were made for revisions to the data being collected to maintain consistency with the data from both workplace and household surveys.

EXTERNAL STATION SURVEYS

The evaluation of the external station surveys indicated several areas of potential concern. One was the time that data were actually being collected and another was the methodology being used. Recommendations were made for the methodology to be used in external station surveys

and the time that the surveys should be conducted. Revisions to the survey instruments were also recommended to obtain additional data elements for travel demand and air quality modeling.

TRUCK SURVEYS

While no significant problems were found in the evaluation of the truck survey methodologies, the issue of how the results could be applied and used was raised. Recommendations were made for the methodology and procedures to use in conducting a commercial truck survey and a for-hire passenger carrier survey. Included with those recommendations were discussions on the use and expansion of the resulting survey results for estimating total commercial truck travel and for-hire passenger carrier travel within an urban area.

DATA GAPS

Several gaps that have not been addressed in current survey procedures were identified relative to travel occurring within urban areas. Previous recommendations dealt with one of those areas, but other areas still need to be addressed. These will require new survey efforts or possible modifications to existing survey efforts to collect the necessary data for estimating and modeling these trips.

In summary, the recommendations in this report are intended to provide basic guidelines for improving travel surveys in Texas. The collection of travel data must be tailored to meet the individual needs of travel models within urban areas. The methods used for collecting that data will continue to be evaluated and improved.

INTRODUCTION

Estimating travel demand is a critical part of transportation planning. It is typically accomplished through a process which involves four major steps: trip generation, trip distribution, mode split, and trip assignment. Trip generation involves estimating the number of trips being produced and attracted by discrete subareas (zones) within the urban area. Trip distribution is the process by which the number of trips that are interchanged between zone pairs is estimated. Mode split is the process of estimating the number of those trips that will use each available transportation mode. Trip assignment is the process of predicting the route or line (e.g., transit) that the trips will take in going from one zone to another. The results of these steps are estimates of the travel demand on the facilities being analyzed. Additional refinement typically is necessary before final estimates of the travel demand are developed.

In 1989, the Texas Department of Transportation (TxDOT) contracted with the Texas Transportation Institute (TTI) to review, analyze, and make recommendations for improving the transportation planning techniques used by the Department. The overall objective of the project is to ensure that the transportation planning techniques being used in Texas are state of the art and the best currently available. This report is only one of many produced as a part of that overall project. It reviews and analyzes one important aspect of estimating and predicting urban travel demand, obtaining the data and information used in developing trip generation models. More specifically, this report deals with the design and conduct of urban travel surveys in Texas.

This report is organized into nine sections following the introduction. The first section discusses the development of trip generation models. The second section discusses the travel surveys in general. The third through seventh sections discuss each of the five surveys as typically done in Texas, the techniques and methodologies currently in use, an evaluation of the methods, and present recommendations for improvements. The eighth section discusses other surveys which may or may not be used, the methods available, and recommendations concerning their application in Texas. The final section summarizes the previous six sections and the recommendations.

TRIP GENERATION

Trip generation is the process of estimating the number of trips that are produced and attracted by discrete subareas, or zones, within an urban area. These trips are classified into two principal categories, home based and non-home based. A home based trip's origin or destination is the home. All other trips are non-home based. The zone where a home based trip is produced is the zone in which the home is located, regardless of whether the zone is the origin or destination. The zone where a non-home based trip is produced is the origin zone for the trip. The zone where a home based trip is being attracted is the non-home zone. The zone where a non-home based trip is attracted is the destination zone. These definitions are significant because they form the basis on which the trip generation models are subsequently developed. Trip productions are estimated using models based on the characteristics of the household. Trip attractions are estimated using models based on the characteristics of the land use activities attracting the trips. The development of trip generation models are therefore predicated and dependent on the data available for model development and calibration.

Trip generation models generally fall into two categories, linear regression models and cross-classification models. The type of model used is, in many cases, dependent on the data available for developing and calibrating the model. Other considerations are the trip purposes being estimated and whether specific models are being employed for each trip purpose.

Linear regression has been and continues to be used in trip generation modeling. The models used relate the number of trips (either productions or attractions) to various independent variables at the zone level. Trip productions are usually related to socioeconomic characteristics of the households at the zone level such as household size, number of autos owned, household income, age of head of household, number of licensed drivers, etc. Trip attractions are usually related to the characteristics of the land use activity or intensity measures such as employment, acres of development, amount of parking, square feet of leasable area, etc. The variables used typically depend on the trip purpose and whether productions or attractions are being estimated.

Cross-classification, also referred to as category analysis, is considered a disaggregate approach to estimating trips. Trip rates (e.g., trips per household or trips per employee) are stratified (i.e., cross-classified) by certain socioeconomic characteristics which have been found

to influence the type and number of trips produced or attracted. For example, Table 1 shows production trip rates in terms of trips per household cross-classified by household income and household size. The estimation of the trips produced by a zone would involve

Table 1
Production Trip Rate
Cross-Classification Example

Income Range	Household Size			
	1	2	3	4+
0 - $7,499	0.31	0.37	1.60	1.44
$7,500 - $9,999	0.84	0.92	1.62	2.05
$10,000 - $19,999	1.11	1.36	1.55	1.66
$20,000 - $29,999	1.23	1.94	2.22	2.76
$30,000 & Over	1.50	2.13	2.28	2.43

estimating the number of households in the zone which had the characteristics of the categories by which the trip rates were stratified. For example, the number of households with two persons in them and with an average household income between $7,500 and $9,999 would be multiplied by the trip rate of 0.92 to estimate the number of trips produced by those households. The households within each zone would be disaggregated into each cross-classification category and multiplied by the appropriate trip rate to estimate the number of trips produced. Trip rates can be developed for estimating trip attractions in a similar manner. Each trip purpose may also have separate trip rates.

The data for developing and calibrating trip generation models generally come from travel surveys. Up until the mid-1980s, the trip rates and models used in Texas were based on origin-destination travel surveys conducted in the 1960s and early 1970s. Beginning in the 1980s, TxDOT and several Metropolitan Planning Organizations (MPOs) in Texas began an effort to update the base information for their trip generation models and procedures. Travel surveys were first conducted in the Dallas-Fort Worth and Houston-Galveston urban areas in 1984. A survey was subsequently done in Texarkana in 1989. Following these efforts, TxDOT made a

commitment to expand these surveys and improve the amount and quality of data available for transportation modeling in Texas. This effort corresponded with the conduction of the 1990 census and consisted of having a number of travel surveys conducted in urban areas within the state.

TRAVEL SURVEYS

Travel surveys are the means by which the information used to develop trip generation models is obtained and, in some instances, may be used to study and/or analyze travel patterns within an urban area. In the sixties and early seventies, surveyors conducted home interviews in randomly selected homes throughout the urban area. In addition to the home interview surveys, external station and truck/taxi surveys were conducted. These methods provided the most reliable and accurate information, but they required a great deal of time, manpower, and money. These surveys gathered information on the characteristics of the household and the number, purpose, and mode of travel for each trip made by persons five years and older in the household during a 24-hour period, typically during the middle of the week, the number and type of trips entering and leaving the study area, and the number of taxicab and truck trips being made within the study area. The information gathered from the surveys and from secondary sources (e.g., employment) was used to develop trip production and trip attraction models. The models were used to predict the number of trip productions and attractions in the future by assuming that the trip making characteristics would remain stable over time with any increase/decrease in travel being caused by changes in households and/or land use activities.

While trip generation models have changed somewhat over time (i.e., since the sixties), the information necessary to develop and calibrate those models has remained basically the same. What has changed has been the amount of information and the techniques for obtaining the information. It became apparent in the seventies that funding was not sufficient to update the earlier travel surveys in the same manner as they were originally accomplished. Consequently, new techniques (or, in some cases, modified old techniques) were developed in the late seventies and eighties and applied to obtain the travel information necessary for updating or validating trip models being used in major urban areas.

The surveys begun in Texas in the mid-eighties began a process of updating information originally obtained (in many instances) more than 20 years earlier. While the original origin-destination surveys had included home interviews, external station surveys and truck/taxi surveys, the new survey efforts were designed to obtain similar and additional information on travel within urban areas operating under the constraint of limited funding. These surveys have included up

to five independent surveys within an urban area, household, workplace, special generator, external, and trucks. These are discussed individually in the subsequent chapters of this report.

HOUSEHOLD SURVEYS

Household surveys are designed to obtain information about the socioeconomic characteristics of households and the amount, type, and mode of travel made by the members of the household. In the 1960s and early 1970s, household surveys were done through home interviews. Households were selected using a systematic sampling process. For example, if a 10 percent sample was desired, every 10th household would be surveyed. An example of the survey instrument used is shown in Figure 1.

The Dallas-Fort Worth and Houston-Galveston areas were the first urban areas in Texas to conduct comprehensive regional household travel surveys in the mid-1980s. In 1989, a household travel survey was also conducted in Texarkana, Texas. These surveys and the experience gained in their implementation subsequently led to a standard survey instrument for use in similar travel surveys in Texas. During 1990 and 1991, household surveys were conducted in San Antonio, Amarillo, Brownsville, Tyler, and Sherman-Denison using these standard household survey instruments. The following sections present brief descriptions of the Dallas-Fort Worth, Houston, and Texarkana household travel surveys followed by a discussion of the five surveys done in 1990 and 1991.

DALLAS-FORT WORTH (1)

A regional travel survey was initiated by the North Central Texas Council of Governments in the Dallas-Fort Worth area in 1984. That survey consisted of a household survey with two other independent surveys designed to provide information by which the urban travel demand models in use at the time could be updated. The travel demand models in use had been originally developed based on an origin-destination travel survey conducted in 1964 and updated in 1973.

In the household travel survey, households were selected using a quota sampling technique. Using data from the 1964 survey, an analysis was performed to determine the number of households to be sampled. Households were stratified by size and auto ownership. The number of households in each cell (i.e., to be sampled) was based on the

URBAN FALLS URBAN TRANSPORTATION STUDY

DWELLING UNIT SUMMARY

FORM I8 (REVISED 11-16-67)

CARD 1

COUNTY OR CITY

CENSUS TRACT

CENSUS BLOCK

SAMPLE NUMBER

SURVEY ZONE

INTERVIEW ADDRESS

STRUCTURE TYPE

1 SINGLE DWELLING
2 DUPLEX
3 3 TO 4 APARTMENTS
4 5 TO 19 APARTMENTS
5 20 OR MORE
6 ROOMING HOUSE
7 HOTEL
8 MOTEL
9 REST HOME, INSTITUTION
0 MOBILE HOME
OTHER (SPECIFY)

DATE OF TRAVEL (MONTH AND DAY)

A - HOW MANY PERSONS LIVE HERE

B - HOW MANY ARE 5 YEARS OF AGE OR OLDER

C - HOUSEHOLD INFORMATION:

HOW LONG HAS HEAD OF HOUSEHOLD LIVED AT THIS ADDRESS

D - HOW MANY AUTOS OWNED AT THIS ADDRESS

E - HOW MANY COMPANY OWNED OR BORROWED AUTOS AT THIS ADDRESS

F - HOW MANY TRUCKS USED FOR PERSONAL (NON COMMERCIAL) TRIPS

TOTAL VEHICLES USED AT THIS ADDRESS

G - HOW MANY LICENSED DRIVERS LIVE AT THIS ADDRESS

H - HOW MANY PERSONS LIVING AT THIS ADDRESS ARE PRIMARILY STUDENTS (TOTAL)

ELEMENTARY OR KINDERGARTEN

JUNIOR HIGH SCHOOL

HIGH SCHOOL

COLLEGE OR UNIVERSITY

I - HOW MANY PERSONS LIVING AT THIS ADDRESS ARE EMPLOYED (EXCLUSIVE OF STUDENTS)

J - HOW MANY PERSONS LIVING AT THIS ADDRESS WENT TO WORK TODAY

K - WHAT IS THE TOTAL INCOME EARNED BY MEMBERS OF THE HOUSEHOLD ANNUALLY

CIRCLE ONE GROUP
1-UNDER $3000 4-5000-5999 7-8000-8999 10-12,500-14,999
2-3000-3999 5-6000-6999 8-9000-9999 11-15,000-24,999
3-4000-4999 6-7000-7999 9-10,000-12,499 12-OVER-25,000

L - TOTAL NUMBER OF AUTO DRIVER (VEHICLE) TRIPS REPORTED AT THIS ADDRESS

M - TOTAL NUMBER OF TRIPS REPORTED AT THIS ADDRESS (EXCEPT WALKING)

1-NUMBER OF PERSONS 5 YEARS OF AGE OR OLDER MAKING TRIPS

2-NUMBER OF PERSONS 5 YEARS OF AGE OR OLDER MAKING NO TRIPS

3-NUMBER OF PERSONS 5 YEARS OF AGE OR OLDER WITH TRIPS UNKNOWN

N - FACTOR

DOMESTIC HELP

PERSON NUMBER	IF INTERVIEWED	SEX	PERSON IDENTIFICATION	CODE	OCCUPATION AND INDUSTRY	TRIPS YES	TRIPS NO
01							
02							
03							
04							
05							
06							
07							
08							
09							
91-99			VISITORS WITH TRIPS				

ADMINISTRATIVE RECORD

INTERVIEWER

CALLS

	DATE	TIME
(1)		
(2)		
(3)		
(4)		

REPORT SUBMITTED

DATE

COMPLETE INCOMPLETE

REASONS INCOMPLETE

TELEPHONE NUMBER

INTERVIEWS CHECKED (INITIAL)

CODED BY (INITIAL)

CHECKED BY (INITIAL)

Figure 1. 1960s Origin-Destination Household Survey Instrument

URBAN FALLS URBAN TRANSPORTATION STUDY

Form I-8A
REVISED 11-15-67

Sheet ____ of ____ Sheets

INTERNAL TRIP REPORT

CARD 2 | COUNTY or CITY | CENSUS TRACT | CENSUS BLOCK | SAMPLE NUMBER | SURVEY ZONE | MONTH and DAY of TRAVEL

1*	2	3	4	ORIGIN 5	6	DESTINATION 7	8	9	10	11	12*	13
Occupation & Industry	Person No.	Trip No.	Sex	WHERE DID THIS TRIP BEGIN?	Kind of Place (Origin — Dest.)	WHERE DID THIS TRIP END?	Mode of Travel	No. in Car Including Driver	Time of Starting	Purpose of Trip (From ——→ To)	Purpose of Vehicle Trip (From / To)	Kind of Parking
			1 2	City	0-RESIDENTIAL 1-INDUST-MFG 2-UTIL-TRANS-WSLE 3-COM-RETAIL 4-SERVICES 5-CULT-ENTERN 6-PARKS-OPEN 7-AGRI-UNDEV 8-MILTI-BLDG 9-PUBLIC BLDG	City	0 WALK(TO WORK) 1 AUTO DRIVER 2 AUTO PASSENGER 3 BUS PASSENGER 4 TAXI PASSENGER 5 TRUCK PASSENGER 6 SCHOOL BUS		AM / PM	1-WORK 2-PERSONAL BUSINESS 3-MEDICAL-DENTAL 4-SCHOOL 5-SOCIAL-RECREATION 6-CHANGE TRAVEL MODE 7-EAT MEAL 8-SHOP 9-SERVE PASSENGER 0-HOME	FROM / TO	1-STREET 2-STREET METER 3-LOT FREE 4-LOT PAID 5-GARAGE FREE 6-GARAGE PAID 7-SERVICE OR REPAIRS 8-RES PROPERTY 9-CRUISED 0-NOT PARKED
			1 2	City	0-RESIDENTIAL 1-INDUST-MFG 2-UTIL-TRANS-WSL 3-COM-RETAIL 4-SERVICES 5-CULT-ENTERN 6-PARKS-OPEN 7-AGRI-UNDEV 8-MILTI-BLDG 9-PUBLIC BLDG	City	0 WALK(TO WORK) 1 AUTO DRIVER 2 AUTO PASSENGER 3 BUS PASSENGER 4 TAXI PASSENGER 5 TRUCK PASSENGER 6 SCHOOL BUS		AM / PM	1-WORK 2-PERSONAL BUSINESS 3-MEDICAL-DENTAL 4-SCHOOL 5-SOCIAL-RECREATION 6-CHANGE TRAVEL MODE 7-EAT MEAL 8-SHOP 9-SERVE PASSENGER 0-HOME	FROM / TO	1-STREET 2-STREET METER 3-LOT FREE 4-LOT PAID 5-GARAGE FREE 6-GARAGE PAID 7-SERVICE OR REPAIRS 8-RES PROPERTY 9-CRUISED 0-NOT PARKED
			1 2	City	0-RESIDENTIAL 1-INDUST-MFG 2-UTIL-TRANS-WSL 3-COM-RETAIL 4-SERVICES 5-CULT-ENTERN 6-PARKS-OPEN 7-AGRI-UNDEV 8-MILTI-BLDG 9-PUBLIC BLDG	City	0 WALK(TO WORK) 1 AUTO DRIVER 2 AUTO PASSENGER 3 BUS PASSENGER 4 TAXI PASSENGER 5 TRUCK PASSENGER 6 SCHOOL BUS		AM / PM	1-WORK 2-PERSONAL BUSINESS 3-MEDICAL-DENTAL 4-SCHOOL 5-SOCIAL-RECREATION 6-CHANGE TRAVEL MODE 7-EAT MEAL 8-SHOP 9-SERVE PASSENGER 0-HOME	FROM / TO	1-STREET 2-STREET METER 3-LOT FREE 4-LOT PAID 5-GARAGE FREE 6-GARAGE PAID 7-SERVICE OR REPAIRS 8-RES PROPERTY 9-CRUISED 0-NOT PARKED
			1 2	City	0-RESIDENTIAL 1-INDUST-MFG 2-UTIL-TRANS-WSL 3-COM-RETAIL 4-SERVICES 5-CULT-ENTERN 6-PARKS-OPEN 7-AGRI-UNDEV 8-MILTI-BLDG 9-PUBLIC BLDG	City	0 WALK(TO WORK) 1 AUTO DRIVER 2 AUTO PASSENGER 3 BUS PASSENGER 4 TAXI PASSENGER 5 TRUCK PASSENGER 6 SCHOOL BUS		AM / PM	1-WORK 2-PERSONAL BUSINESS 3-MEDICAL-DENTAL 4-SCHOOL 5-SOCIAL-RECREATION 6-CHANGE TRAVEL MODE 7-EAT MEAL 8-SHOP 9-SERVE PASSENGER 0-HOME	FROM / TO	1-STREET 2-STREET METER 3-LOT FREE 4-LOT PAID 5-GARAGE FREE 6-GARAGE PAID 7-SERVICE OR REPAIRS 8-RES PROPERTY 9-CRUISED 0-NOT PARKED
			1 2	City	0-RESIDENTIAL 1-INDUST-MFG 2-UTIL-TRANS-WSL 3-COM-RETAIL 4-SERVICES 5-CULT-ENTERN 6-PARKS-OPEN 7-AGRI-UNDEV 8-MILTI-BLDG 9-PUBLIC BLDG	City	0 WALK(TO WORK) 1 AUTO DRIVER 2 AUTO PASSENGER 3 BUS PASSENGER 4 TAXI PASSENGER 5 TRUCK PASSENGER 6 SCHOOL BUS		AM / PM	1-WORK 2-PERSONAL BUSINESS 3-MEDICAL-DENTAL 4-SCHOOL 5-SOCIAL-RECREATION 6-CHANGE TRAVEL MODE 7-EAT MEAL 8-SHOP 9-SERVE PASSENGER 0-HOME	FROM / TO	1-STREET 2-STREET METER 3-LOT FREE 4-LOT PAID 5-GARAGE FREE 6-GARAGE PAID 7-SERVICE OR REPAIRS 8-RES PROPERTY 9-CRUISED 0-NOT PARKED

*Column 12 To Be Used Only if "Serve Passenger" Is A Purpose Used In Column 11.

FACTOR

Figure 1. 1960s Origin-Destination Household Survey Instrument (con't.).

variance of trip rates for each cell (from the 1964 survey). Table 2 presents the final stratified sample quotas.

Table 2
Sample Requirements
Dallas-Fort Worth Household Survey

Autos Owned	Persons per Household				Total
	One	Two	Three	Four+	
Zero[1]	101	66	40	43	250
One	501	363	228	292	1384
Two	-	226	179	179	584
Three or More	-	-	155	377	532
Total	602	655	602	891	2750

[1]Quotas for zero auto households were desired numbers, but variations would be accepted.
Source: Reference 1

Households were selected via a systematic random sampling technique using area telephone directories and were contacted and asked to participate. For those agreeing to participate, household characteristics were obtained to determine in which stratification cell the household belonged. As quotas for each cell were reached, households would be excluded if they fell in a cell already filled. Additional effort was required to fill the necessary quotas for the zero-car households. Each household that agreed to participate was subsequently sent a letter and a set of travel diaries for recording their travel on a specified day. An interviewer then went to the household and interviewed each person over 16 years of age about the travel they did on the survey day.

The household survey consisted of two parts. The first was to obtain basic information concerning the characteristics of the household:

1. Household address and structure type.

2. Number of persons age five and older living at that address.
3. Number of out-of-town visitors staying at that address.
4. Number of vehicles available for use.
5. Household income.
6. Data on persons age five and older:
    a. Relation to head of household
    b. Age and sex
    c. Licensed to drive
    d. Occupation
    e. Industry
    f. Whether they worked on the survey day, made trips while at work, and whether they made other trips that day

The second part of the household survey dealt with the information on the number and type of trips made during the survey day by each person 16 years of age and older:

1. Address where trip began (i.e., origin) and address where trip ended (i.e., destination).
2. Purpose of trip.
3. The land use activity at the origin and destination ends of the trip.
4. The time the trip was started and the time the person arrived at the destination.
5. The mode of travel used for the trip.
6. If the person (i.e., making the trip) was the driver, the number of passengers in the car, and the number of passengers in the vehicle if the trip was a carpool or vanpool.
7. If the mode of travel was transit, the mode used to access the transit system.
8. The cost for transit if the mode of travel was transit and the cost for parking if the mode of travel was by car

In addition, the travel diaries were obtained from the survey respondents. The travel diary also included the person's age and sex along with the information listed above. Copies of the household survey forms are shown in Figure 2. Additional details and specific information on the Dallas-Fort Worth household survey may be found in Reference 1.

Travel Day _____ and Date ☐☐☐

Sample Number ☐☐☐☐

NORTH CENTRAL TEXAS COUNCIL OF GOVERNMENTS HOME INTERVIEW SURVEY

Section I: Household Data

A. Sample Address _____ _____ _____ _____ ☐☐☐☐☐
House Number, Street Name, Apt. No. | City/Town | County | Zip Code

B. Structure Type _____ ☐

C. Number of People Living at this Address _____ ☐☐

D. Number of People Age 5 and Over Living at this Address _____ ☐☐

E. Number of Out-of-Area Visitors Staying at this Address _____ ☐

F. Number of Passenger Cars, Vans, and Pickups Available for Use _____ ☐

G. Household Income: (Do Not Ask Until Interview is Complete) _____ ☐

Section II: Data on Persons Age 5 and Over

A Person Number	B ✓ If Interviewed	C Relation to Head	D Age	E Sex	F Licensed to Drive?	G Occupation	H Industry	I Worked on Travel Day?	J Made Trips While at Work?	K Made Other Trips on Travel Day?
01		Head ☐	☐☐	1 M 2 F	1 YES 2 NO	☐☐	☐☐	1 YES 2 NO 3 Worked at Home	1 YES 2 NO	1 YES 2 NO
02		☐	☐☐	1 M 2 F	1 YES 2 NO	☐☐	☐☐	1 YES 2 NO 3 Worked at Home	1 YES 2 NO	1 YES 2 NO
03		☐	☐☐	1 M 2 F	1 YES 2 NO	☐☐	☐☐	1 YES 2 NO 3 Worked at Home	1 YES 2 NO	1 YES 2 NO
04		☐	☐☐	1 M 2 F	1 YES 2 NO	☐☐	☐☐	1 YES 2 NO 3 Worked at Home	1 YES 2 NO	1 YES 2 NO
05		☐	☐☐	1 M 2 F	1 YES 2 NO	☐☐	☐☐	1 YES 2 NO 3 Worked at Home	1 YES 2 NO	1 YES 2 NO
06		☐	☐☐	1 M 2 F	1 YES 2 NO	☐☐	☐☐	1 YES 2 NO 3 Worked at Home	1 YES 2 NO	1 YES 2 NO
07		☐	☐☐	1 M 2 F	1 YES 2 NO	☐☐	☐☐	1 YES 2 NO 3 Worked at Home	1 YES 2 NO	1 YES 2 NO
08		☐	☐☐	1 M 2 F	1 YES 2 NO	☐☐	☐☐	1 YES 2 NO 3 Worked at Home	1 YES 2 NO	1 YES 2 NO
09		☐	☐☐	1 M 2 F	1 YES 2 NO	☐☐	☐☐	1 YES 2 NO 3 Worked at Home	1 YES 2 NO	1 YES 2 NO
10		☐	☐☐	1 M 2 F	1 YES 2 NO	☐☐	☐☐	1 YES 2 NO 3 Worked at Home	1 YES 2 NO	1 YES 2 NO

Age Codes

1 5 - 10	6 36 - 45
2 11 - 15	7 46 - 55
3 16 - 20	8 56 - 65
4 21 - 25	9 65 - OVER
5 26 - 35	0 UNKNOWN

Relation Codes

1 HEAD	6 GRANDCHILD
2 SPOUSE	7 OTHER RELATIVE
3 SON	8 UNRELATED
4 DAUGHTER	9 OUT-OF-AREA VISITORS
5 GRANDPARENT	0 UNKNOWN

Section III: Trip Summary

A. Total Vehicular Trips Reported _____ ☐☐☐
B. Persons Age 5 and Over Making Trips _____ ☐☐
C. Persons Age 5 and Over Not Making Trips _____ ☐☐
D. Complete or Incomplete Interview Code _____ ☐

Section IV: Administrative

A. Household Telephone Number: _____

B. Interviewer: _____

C. Telephone Contacts (If Any):

Date	Time	Purpose/Outcome

D. Personal Contacts in Household:

Date	Time	Talked to/Comments

E. Completed Interview Submitted:

Date: _____ By: _____

I Certify That All Information On this Form Is Correct and True.

_____
Signature of Interviewer

F. If Interview Submitted Incomplete

Interviewer's Reason: _____

Date _____ Initials _____

Supervisor's Comments: _____

Date _____ Initials _____

G. First Edit: Fail Pass

Date _____ Initials _____

H. Final Edit: Fail Pass

Date _____ Initials _____

I. Coding Complete

Date _____ Initials _____

Figure 2. North Central Texas Council of Governments 1984 Home Interview Survey.

NORTH CENTRAL TEXAS COUNCIL OF GOVERNMENTS

Trip Report

CONFIDENTIAL
The information obtained in this survey will be accorded confidential treatment, and will be used for statistical purposes only.

Section V: Trip Report

Travel Day _____ and Date _____ Sheet ____ of ____

A	B	C	D	E		F		G		H	I	J	K	L
PERSON NUMBER	TRIP NUMBER	WHERE DID THIS TRIP BEGIN? (ORIGIN)	WHERE DID THIS TRIP END? (DESTINATION)	TRIP PURPOSE		LAND-USE (Type of Activity)		TIME OF TRIP		Mode of Travel	If Auto Driver, Number of Passengers in Car Including Driver	If Car/Van Pool, Number of Passengers Including Driver	If Transit, Mode of Access	Transit Fare/ Parking Cost
				From	To	ORIGIN	DESTINATION	START	ARRIVAL					
		Address/Intersection Place (City) Zip Code	Address/Intersection Place (City) Zip Code			Type of Activity	Type of Activity	Circle AM PM N M : Time	Circle AM PM N M : Time					$.
		Address/Intersection Place (City) Zip Code	Address/Intersection Place (City) Zip Code			Type of Activity	Type of Activity	Circle AM PM N M : Time	Circle AM PM N M : Time					$.
		Address/Intersection Place (City) Zip Code	Address/Intersection Place (City) Zip Code			Type of Activity	Type of Activity	Circle AM PM N M : Time	Circle AM PM N M : Time					$.
		Address/Intersection Place (City) Zip Code	Address/Intersection Place (City) Zip Code			Type of Activity	Type of Activity	Circle AM PM N M : Time	Circle AM PM N M : Time					$.
		Address/Intersection Place (City) Zip Code	Address/Intersection Place (City) Zip Code			Type of Activity	Type of Activity	Circle AM PM N M : Time	Circle AM PM N M : Time					$.
		Address/Intersection Place (City) Zip Code	Address/Intersection Place (City) Zip Code			Type of Activity	Type of Activity	Circle AM PM N M : Time	Circle AM PM N M : Time					$.
		Address/Intersection Place (City) Zip Code	Address/Intersection Place (City) Zip Code			Type of Activity	Type of Activity	Circle AM PM N M : Time	Circle AM PM N M : Time					$.
		Address/Intersection Place (City) Zip Code	Address/Intersection Place (City) Zip Code			Type of Activity	Type of Activity	Circle AM PM N M : Time	Circle AM PM N M : Time					$.

PURPOSE CODES:

1. HOME
2. WORK
3. SHOP
4. SCHOOL
5. SOCIAL/REC.
6. PERSONAL BUS
7. EAT MEAL
8. SERVE PASSENGER
9. CHANGE MODE
0. RIDE

MODE OF TRAVEL CODES:

1. AUTO DRIVER
2. AUTO PASSENGER
3. BUS:TROLLEY
4. SCHOOL BUS
5. TAXI
6. MOTORCYCLE
7. CAR/VAN POOL
8. WALK/BICYCLE
9. OTHER

TRANSIT ACCESS CODES:

1. WALK
2. DROVE AUTO & PARKED
3. AUTO, BUT NOT PARKED
4. CAR POOL
5. OTHER

Figure 2. North Central Texas Council of Governments 1984 Home Interview Survey (con't).

HOUSTON-GALVESTON (2)

A regional travel survey was initiated by the Houston-Galveston Area Council (HGAC) in 1984. This household travel survey was designed to provide information for updating the Houston-Galveston area travel demand models. Previous travel models had been based on information from an origin-destination travel survey conducted in the 1960s.

The total number of households to be surveyed was estimated using modified coefficients of variation weighted by the proportion of households in each stratification by size and vehicle ownership. The needed number for the survey was estimated to be 1,200. A goal was set at 1,500, however, to ensure that the minimum of 1,200 would be obtained.

Table 3
Desired Household Responses
Houston-Galveston Household Survey

Autos Available	Household Size				Totals
	1 person	2 persons	3 persons	4+ persons	
0	10	6	1	2	19
1	238	103	42	41	424
2	22	330	146	222	720
3+	6	72	107	148	333
Totals	276	511	296	413	1,496

Source: Reference 2

Based on data from Dallas on the variability of the number of trips per household, three categories of households were identified; and census tracts in the Houston-Galveston area were grouped according to those categories (based on the number of households in the census tract that fell in each category; i.e., the category with the largest number was the one to which that census tract was assigned). Using data from the 1980 census, the number of households by household size and vehicle availability were computed for each category. An estimate of the trip variability

per household for each of the three categories was developed by weighting the estimated trip variances per household by the estimated number of households in each household size and vehicle availability strata. The number of households to be sampled from each of the three categories was estimated based on the variability of trips per household and number of households in each category.

Households were selected randomly for ten replicates of 1,200 households. It was anticipated that up to 12,000 households would have to be contacted in order to obtain 1,500 that would participate in the survey. The procedures used to implement the survey consisted of two primary stages. Households were first contacted by phone and asked to participate in the travel survey. The telephone survey was used to screen the households to ensure that the number within each size and auto availability stratification was obtained in terms of those agreeing to participate. The information obtained during the telephone interview verified the names and address of the household occupants, the number of automobiles available, the number of household members, and whether or not the household would participate in the second stage of the survey.

The second stage of the survey consisted of mailing survey forms and instructions to each household that agreed to participate. The survey mailed to each household consisted of two parts. The first part requested information about the household and its members, while the second part requested information on the trips made by each member of the household. Each household member five years of age and older was requested to complete the trip survey forms for a selected day.

The household survey questionnaire asked that each household member be assigned a number and requested the following information:

1. The age and sex of each member of the household.
2. The relationship of each member to the first person in the household.
3. Whether that person was employed full time, part time, or not employed.
4. Whether that person did or did not travel on the designated travel day for that household.
5. The combined annual income of all members of the household (five income ranges were on the survey form and they were requested to indicate where their combined household income fell within those categories).

Each household member was given a different colored trip survey form to complete concerning the trips that member made on the designated travel day. The trip survey form requested the following information:

1. The travel day.
2. The location where the person's first trip began.
3. The address, building, or nearest intersection of the destination of each trip.
4. The time each trip began.
5. The purpose of each trip.
6. The mode of travel for each trip including whether the person was the driver or a passenger (if a driver or a passenger, the person was asked the number of other persons in the vehicle).

The households were asked to return the completed survey forms to H-GAC by mail. The forms were processed and, if necessary, the households were contacted by phone again to clarify any questions and/or missing information. It should also be noted that the households were contacted prior to their travel day to ensure they had received the survey forms, determine if they had any questions, and remind them to complete the survey form on their travel day and return it. The household survey forms are shown in Figure 3.

TEXARKANA (3)

A regional household travel study was initiated in the Texarkana, Texas, area in 1989 by TxDOT and the Arkansas Highway Department in cooperation with the Ark-Tex Council of Governments. The purpose of the study was to collect information by which the urban travel demand models for the Texarkana area could be updated. The travel survey consisted of three independent travel surveys, a household travel survey, a workplace travel survey (which included a survey of special generators as a component), and a roadside travel survey.

PART 1: HOUSEHOLD INFORMATION

1. Address Label _____

_____

Remember, your travel day is ____/____ (MONTH / DAY)

The label above includes your home address, and the number of persons and the number of vehicles reported in our initial telephone conversation. If any of these are incorrect, please write the correct information directly on the label.

We would now like some information on each household member.

2. Please assign a "Person Number" to each person residing in your household who is five years or older, starting with yourself as "Person Number 1." (Fill in appropriate box for each question for each person.)

Person Number	Age	Sex	RELATIONSHIP TO PERSON NUMBER 1 (Check one)				Is he/she employed? If yes, full or part-time?			Did he/she travel on the "Travel Day"?		Form to be used for Trip Record
		M / F	Spouse	Child	Relative	Not Related	Full Time	Part Time only	No	Yes	No	
1	____	____	PERSON NUMBER 1				☐	☐	☐	☐	☐	Continue on Attached Page
2	____	____	☐	☐	☐	☐	☐	☐	☐	☐	☐	Blue
3	____	____	☐	☐	☐	☐	☐	☐	☐	☐	☐	Yellow
4	____	____	☐	☐	☐	☐	☐	☐	☐	☐	☐	Green
5	____	____	☐	☐	☐	☐	☐	☐	☐	☐	☐	Tan
6	____	____	☐	☐	☐	☐	☐	☐	☐	☐	☐	Pink
7	____	____	☐	☐	☐	☐	☐	☐	☐	☐	☐	Gray
8	____	____	☐	☐	☐	☐	☐	☐	☐	☐	☐	Orange

3. If you add up the annual incomes of all household members, into what range does it fall? (Check one)

Under $10,000 ☐ $10,000 - $20,000 ☐ $20,000 - $30,000 ☐ $30,000 - $40,000 ☐ Over $40,000 ☐

This completes the household information needed. Please fill out the attached travel questionnaire for **yourself** and ask every other household member over 5 to complete the enclosed trip record of the color indicated in question 2 above. For example, person number 2 use blue form, person number 3 use yellow form, etc.

Figure 3. Houston-Galveston 1984 Household Survey.

PART 2: TRIP RECORD

FOR PERSON NUMBER _1_ (write number from question 2)

Please fill out this form for one person only.
Do NOT report walking or bicycle trips.
Please enter your travel day ____/____ (MONTH / DAY)

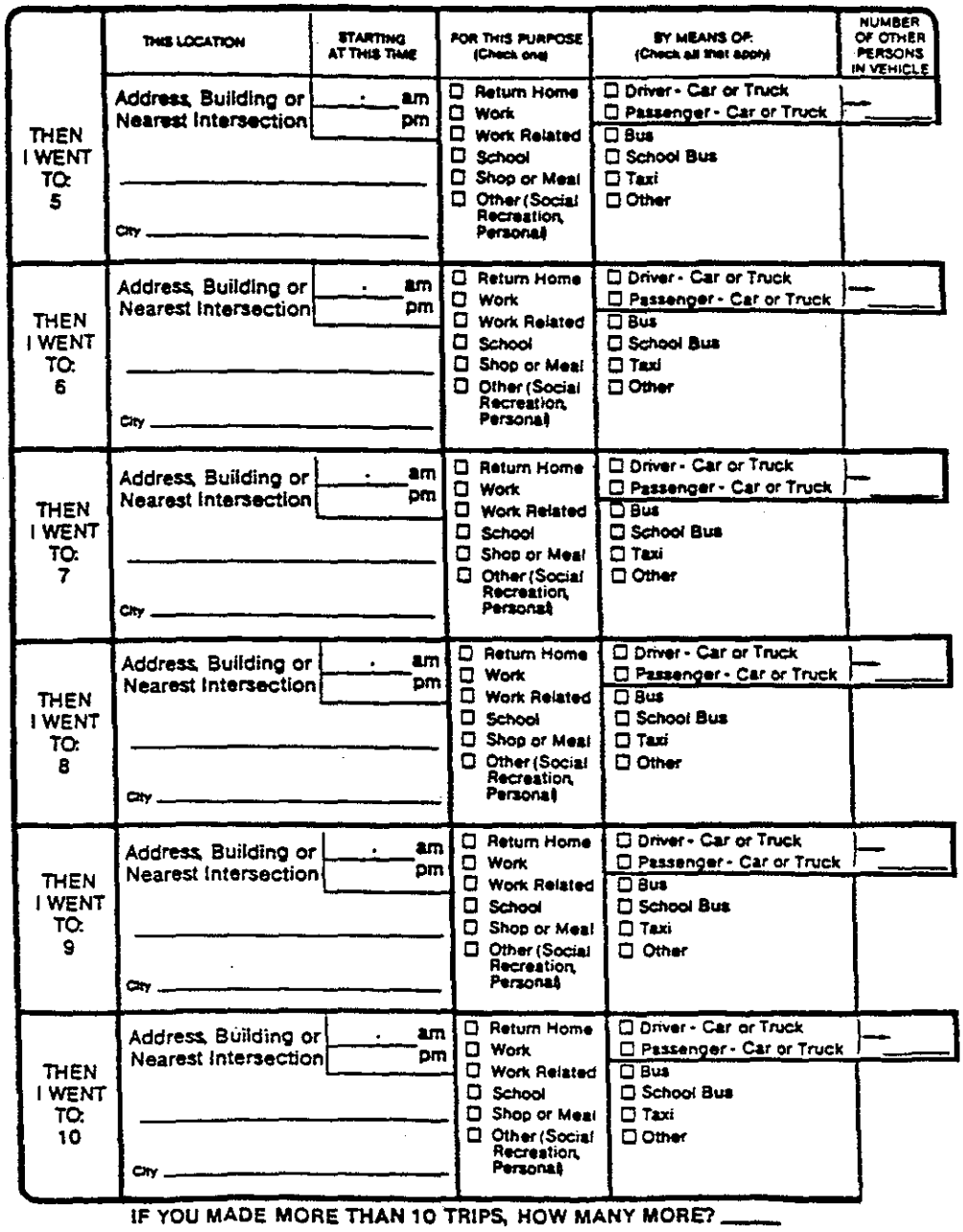
On this day, did you travel outside the home? (check one)
☐ NO — Return questionnaire
☐ YES — Continue below

MY FIRST TRIP TODAY BEGAN AT
☐ Home ☐ Other Location (fill in) _____

	THIS LOCATION	STARTING AT THIS TIME	FOR THIS PURPOSE (Check one)	BY MEANS OF: (Check all that apply)	NUMBER OF OTHER PERSONS IN VEHICLE
BEGIN ⇩ FIRST I WENT TO: 1	Address, Building or Nearest Intersection _____ City _____	___:___ am / pm	☐ Return Home ☐ Work ☐ Work Related ☐ School ☐ Shop or Meal ☐ Other (Social Recreation, Personal)	☐ Driver - Car or Truck ☐ Passenger - Car or Truck ☐ Bus ☐ School Bus ☐ Taxi ☐ Other	— ____
THEN I WENT TO: 2	Address, Building or Nearest Intersection _____ City _____	___:___ am / pm	☐ Return Home ☐ Work ☐ Work Related ☐ School ☐ Shop or Meal ☐ Other (Social Recreation, Personal)	☐ Driver - Car or Truck ☐ Passenger - Car or Truck ☐ Bus ☐ School Bus ☐ Taxi ☐ Other	— ____
THEN I WENT TO: 3	Address, Building or Nearest Intersection _____ City _____	___:___ am / pm	☐ Return Home ☐ Work ☐ Work Related ☐ School ☐ Shop or Meal ☐ Other (Social Recreation, Personal)	☐ Driver - Car or Truck ☐ Passenger - Car or Truck ☐ Bus ☐ School Bus ☐ Taxi ☐ Other	— ____
THEN I WENT TO: 4	Address, Building or Nearest Intersection _____ City _____	___:___ am / pm	☐ Return Home ☐ Work ☐ Work Related ☐ School ☐ Shop or Meal ☐ Other (Social Recreation, Personal)	☐ Driver - Car or Truck ☐ Passenger - Car or Truck ☐ Bus ☐ School Bus ☐ Taxi ☐ Other	— ____

CONTINUE TRIPS 5 THROUGH 10 ON REVERSE SIDE. THANK YOU.

Figure 3. Houston-Galveston 1984 Household Survey (con't).



	THIS LOCATION	STARTING AT THIS TIME	FOR THIS PURPOSE (Check one)	BY MEANS OF: (Check all that apply)	NUMBER OF OTHER PERSONS IN VEHICLE
THEN I WENT TO: 5	Address, Building or Nearest Intersection City	: am pm	☐ Return Home ☐ Work ☐ Work Related ☐ School ☐ Shop or Meal ☐ Other (Social Recreation, Personal)	☐ Driver - Car or Truck ☐ Passenger - Car or Truck ☐ Bus ☐ School Bus ☐ Taxi ☐ Other	
THEN I WENT TO: 6	Address, Building or Nearest Intersection City	: am pm	☐ Return Home ☐ Work ☐ Work Related ☐ School ☐ Shop or Meal ☐ Other (Social Recreation, Personal)	☐ Driver - Car or Truck ☐ Passenger - Car or Truck ☐ Bus ☐ School Bus ☐ Taxi ☐ Other	
THEN I WENT TO: 7	Address, Building or Nearest Intersection City	: am pm	☐ Return Home ☐ Work ☐ Work Related ☐ School ☐ Shop or Meal ☐ Other (Social Recreation, Personal)	☐ Driver - Car or Truck ☐ Passenger - Car or Truck ☐ Bus ☐ School Bus ☐ Taxi ☐ Other	
THEN I WENT TO: 8	Address, Building or Nearest Intersection City	: am pm	☐ Return Home ☐ Work ☐ Work Related ☐ School ☐ Shop or Meal ☐ Other (Social Recreation, Personal)	☐ Driver - Car or Truck ☐ Passenger - Car or Truck ☐ Bus ☐ School Bus ☐ Taxi ☐ Other	
THEN I WENT TO: 9	Address, Building or Nearest Intersection City	: am pm	☐ Return Home ☐ Work ☐ Work Related ☐ School ☐ Shop or Meal ☐ Other (Social Recreation, Personal)	☐ Driver - Car or Truck ☐ Passenger - Car or Truck ☐ Bus ☐ School Bus ☐ Taxi ☐ Other	
THEN I WENT TO: 10	Address, Building or Nearest Intersection City	: am pm	☐ Return Home ☐ Work ☐ Work Related ☐ School ☐ Shop or Meal ☐ Other (Social Recreation, Personal)	☐ Driver - Car or Truck ☐ Passenger - Car or Truck ☐ Bus ☐ School Bus ☐ Taxi ☐ Other	

IF YOU MADE MORE THAN 10 TRIPS, HOW MANY MORE? _____

Figure 3. Houston-Galveston 1984 Household Survey (con't).

In the household travel survey, households were selected randomly from the 1989 Cole Cross Listing Directory for the Texarkana Urban Area and Vicinity in accordance with a stratified sampling plan developed by TxDOT. A total of 626 useable household surveys were desired with the household stratified by vehicle availability (four classifications) and household income (four classifications). The number of households to be surveyed within each stratification category was estimated using the modified coefficient variation method (4) with nationally averaged modified coefficients of variation with cell frequencies for the income and vehicle categories for the Texarkana area.

Table 4
Household Response Matrix
Texarkana Household Survey

Income Quartile	Vehicle Availability				Totals
	0	1	2	3+	
$0 - $10,000	20	72	27	6	125
$10,000 - $20,000	3	63	59	23	148
$20,000 - $30,000	1	39	101	51	192
$30,000+	0	13	74	74	161
Totals	24	187	261	154	626

Source: Reference 3

Households were randomly contacted based on the wealth rating of the census tract within which they were located. In an attempt to survey an even cross section of the community, an effort was made to survey a proportionate number of households in each census tract based on the number of known households within the tract. The method used to conduct the household travel survey was a telephone/mail/telephone/mail technique. Households were contacted initially by telephone and asked to participate. Those agreeing to participate were asked basic information to determine the category the household was in. A survey packet was then mailed to the

household with appropriate instructions and later contacted twice by phone, once to remind them of their survey day (i.e., the day they were to record their trips and complete the survey forms) and answer any questions concerning the survey and again after their survey day to determine if they had completed the survey and later to remind them to return the survey. As surveys were returned and checked, some households were contacted again by phone to clarify or obtain missing information.

The household survey consisted of two parts. The first part was to obtain basic information concerning the characteristics of the household:

1. Household address.
2. Number of persons living in that household.
3. Number of persons in that household that were employed for more than 20 hours per week.
4. The number of cars, vans, and/or light trucks available for use by members of the household.
5. For each person in the household, the following information was requested: age, sex, relationship to first person listed (usually the head of the household), if they were employed full time, part time, or not at all, and if that person traveled or not on the survey day.
6. The total annual income range earned by all members of the household (four ranges were listed on the survey).

The second part of the household survey dealt with the travel information on the number and type of trips made during the survey day by each person five years of age and older:

1. The location where the first trip began and whether it was at home or the person's place of work.
2. The address of the destination of each trip and the time of arrival at that destination.
3. The purpose of the trip. (i.e., return home, work, work related, school, shop or meal, and other, e.g., social, recreation, personal, etc.).

4. The means of transportation for the trip, i.e., car, pickup, van, or motorcycle and whether the person was the driver or a passenger; bus/school bus; commercial truck; taxi; or other (blank included for mode to be specified).
5. Total number of persons in vehicle.

The survey forms are shown in Figure 4.

1990-1991 HOUSEHOLD SURVEYS

As a result of the surveys conducted in the Dallas-Fort Worth, Houston, and Texarkana areas and the recognition that the basis for the travel demand models was questionable due to the age of much of the data, an effort was successfully initiated by TxDOT to fund and supervise travel surveys in several different size urban areas throughout the state. The intent was to compile a comprehensive data base on travel by which travel demand models used for transportation planning could be updated using the latest techniques and data available. The San Antonio urban area was selected for the first of these surveys. Surveys were subsequently conducted in Tyler, Amarillo, Brownsville, and Sherman-Denison.

As the first of several areas where travel surveys would be done, the travel survey in San Antonio became the preliminary design for the travel surveys that would follow. The surveys conducted in Dallas-Fort Worth, Houston-Galveston, and Texarkana all provided a base of information relative to the techniques to be used, information to be gathered, and methodologies, but each survey was different in one way or another. Using the information and knowledge gained in the previous three travel surveys, the household travel survey was structured in two parts, one to obtain household information and one to obtain trip information.

The household information was requested in three sections. The first requested general information on the household, the second requested specific information on each member in the household, and the third requested information on household income. The following information was requested in the first section of the household survey:

1. Household address confirmation and type of structure (i.e., single family detached or multi-unit).

Texarkana Urban Area Travel Survey
PART 1: HOUSEHOLD INFORMATION

Address _____

_____

_____

Remember, your travel day is _____
DAY MONTH YEAR

1. Thank You for agreeing to participate in this important travel survey. Please provide or confirm the requested information on all appropriate survey forms.

   A. Including yourself, how many people live in your household? _____

   B. How many people in your household are employed for more than 20 hours per week? _____

   C. How many cars, vans and light trucks are available for use by members of your household? _____

The information above includes your home address, and the number of persons and the number of vehicles reported in our initial conversation. If any of this information is incorrect, please make the necessary corrections above.

We would now like some information on each household member.

2. Please assign a "Person Number" to each person residing in your household who is five years or older, starting with yourself as "Person Number 1". (Fill in appropriate box for each question for each person.)

Person Number	Age	Sex M/F	RELATIONSHIP TO PERSON NUMBER 1 (Check one) Spouse	Child	Relative	Not Related	Is he/she employed? If yes, full or part-time? Full Time	Part Time	No	Did he/she travel on the "Travel Day"? Yes	No	Form to be used for Trip Record.
1	___	___	PERSON NUMBER 1				☐	☐	☐	☐	☐	White
2	___	___	☐	☐	☐	☐	☐	☐	☐	☐	☐	Blue
3	___	___	☐	☐	☐	☐	☐	☐	☐	☐	☐	Yellow
4	___	___	☐	☐	☐	☐	☐	☐	☐	☐	☐	Green
5	___	___	☐	☐	☐	☐	☐	☐	☐	☐	☐	Tan
6	___	___	☐	☐	☐	☐	☐	☐	☐	☐	☐	Pink
7	___	___	☐	☐	☐	☐	☐	☐	☐	☐	☐	Gray
8	___	___	☐	☐	☐	☐	☐	☐	☐	☐	☐	Orange

3. If you add up the annual incomes of all household members, into what range does it fall? (Check one)

   ☐ 0–$10,000 ☐ $20,000–$30,000

   ☐ $10,000–$20,000 ☐ $30,000 +

This completes the household information needed. Please fill out the attached travel questionnaire for yourself and ask every other household member over five years old to complete the enclosed trip record of the color indicated in question 2 above. For example, person number 2 use blue form, person number 3 use the yellow form, etc. Please mail all completed forms using the postage paid envelope enclosed in this package to:

Texarkana Urban Transportation Study
P.O. Box 5826
Texarkana, Texas 75505

Thank You for your cooperation!

Figure 4. Texarkana 1989 Household Survey Instruments.

Texarkana Urban Area Travel Survey

PART 2: TRIP RECORD

FOR PERSON NUMBER 1

Please fill out this form for one person only.

Please enter your travel day ____ / ____
MONTH DAY

On this day, did you travel outside the home? (check one)

☐ NO – Return questionnaire

☐ YES – Continue below

MY FIRST TRIP BEGAN AT ☐ Home ☐ Other Location (fill in) NAME OF LOCATION

ADDRESS

IS THIS YOUR PLACE OF WORK? ☐ YES ☐ NO

	LOCATION	TIME	FOR THIS PURPOSE (Check one)	BY MEANS OF (Check all that apply)	TOTAL NUMBER OF PERSONS IN VEHICLE
BEGIN ⇩ FIRST I WENT TO: 1	Please be specific Name of Place Address/Nearest Intersection City	___:___ am pm	☐ Return Home ☐ Work ☐ Work Related ☐ School ☐ Shop or Meal ☐ Other (Social, Recreation, Personal)	☐ Passenger–Car, Pickup, Van, Motorcycle ☐ Driver ☐ Passenger ☐ Bus/School Bus ☐ Commercial Truck ☐ Taxi ☐ Other(specify)	____
OFFICE USE					
THEN I WENT TO: 2	Please be specific Name of Place Address/Nearest Intersection City	___:___ am pm	☐ Return Home ☐ Work ☐ Work Related ☐ School ☐ Shop or Meal ☐ Other (Social, Recreation, Personal)	☐ Passenger–Car, Pickup, Van, Motorcycle ☐ Driver ☐ Passenger ☐ Bus/School Bus ☐ Commercial Truck ☐ Taxi ☐ Other(specify)	____
OFFICE USE					
THEN I WENT TO: 3	Please be specific Name of Place Address/Nearest Intersection City	___:___ am pm	☐ Return Home ☐ Work ☐ Work Related ☐ School ☐ Shop or Meal ☐ Other (Social, Recreation, Personal)	☐ Passenger–Car, Pickup, Van, Motorcycle ☐ Driver ☐ Passenger ☐ Bus/School Bus ☐ Commercial Truck ☐ Taxi ☐ Other(specify)	____
OFFICE USE					
THEN I WENT TO: 4	Please be specific Name of Place Address/Nearest Intersection City	___:___ am pm	☐ Return Home ☐ Work ☐ Work Related ☐ School ☐ Shop or Meal ☐ Other (Social, Recreation, Personal)	☐ Passenger–Car, Pickup, Van, Motorcycle ☐ Driver ☐ Passenger ☐ Bus/School Bus ☐ Commercial Truck ☐ Taxi ☐ Other(specify)	____
OFFICE USE					

Figure 4. Texarkana 1989 Household Survey Instruments (con't).

Texarkana Urban Area Travel Survey
PART 2: TRIP RECORD
FOR PERSON NUMBER **2**

Please fill out this form for one person only.
Please enter your travel day_____/_____
MONTH DAY

On this day, did you travel outside the home? (check one)
☐ NO – Return questionnaire
☐ YES – Continue below

MY FIRST TRIP BEGAN AT ☐ Home ☐ Other Location (fill in) _____ NAME OF LOCATION

ADDRESS

IS THIS YOUR PLACE OF WORK? ☐ YES ☐ NO

	LOCATION	TIME	FOR THIS PURPOSE (Check one)	BY MEANS OF (Check all that apply)	TOTAL NUMBER OF PERSONS IN VEHICLE
BEGIN ⇩ FIRST I WENT TO: 1	Please be specific Name of Place Address/Nearest Intersection City	__:__ am pm	☐ Return Home ☐ Work ☐ Work Related ☐ School ☐ Shop or Meal ☐ Other (Social, Recreation, Personal)	☐ Passenger–Car, Pickup, Van, Motorcycle ☐ Driver ☐ Passenger ☐ Bus/School Bus ☐ Commercial Truck ☐ Taxi ☐ Other(specify) _____	_____
OFFICE USE					
THEN I WENT TO: 2	Please be specific Name of Place Address/Nearest Intersection City	__:__ am pm	☐ Return Home ☐ Work ☐ Work Related ☐ School ☐ Shop or Meal ☐ Other (Social, Recreation, Personal)	☐ Passenger–Car, Pickup, Van, Motorcycle ☐ Driver ☐ Passenger ☐ Bus/School Bus ☐ Commercial Truck ☐ Taxi ☐ Other(specify) _____	_____
OFFICE USE					
THEN I WENT TO: 3	Please be specific Name of Place Address/Nearest Intersection City	__:__ am pm	☐ Return Home ☐ Work ☐ Work Related ☐ School ☐ Shop or Meal ☐ Other (Social, Recreation, Personal)	☐ Passenger–Car, Pickup, Van, Motorcycle ☐ Driver ☐ Passenger ☐ Bus/School Bus ☐ Commercial Truck ☐ Taxi ☐ Other(specify) _____	_____
OFFICE USE					
THEN I WENT TO: 4	Please be specific Name of Place Address/Nearest Intersection City	__:__ am pm	☐ Return Home ☐ Work ☐ Work Related ☐ School ☐ Shop or Meal ☐ Other (Social, Recreation, Personal)	☐ Passenger–Car, Pickup, Van, Motorcycle ☐ Driver ☐ Passenger ☐ Bus/School Bus ☐ Commercial Truck ☐ Taxi ☐ Other(specify) _____	_____
OFFICE USE					

Figure 4. Texarkana 1989 Household Survey Instruments (con't).

2. Number of persons living at that address and the number that were five years of age and older.
3. Number of persons in the household that were employed.
4. Number of vehicles available for use by members of the household.

The second section of the household information survey assigned each member of the household a number and requested the following information:

1. Sex.
2. Age.
3. Indicator whether they were or were not a licensed driver.
4. Relationship of person to the head of the household (i.e., spouse, child, etc.).
5. Indicator whether the person was or was not employed.
6. Indicator whether the person did or did not travel on the household's travel day.

The third section of the household information survey requested the household to report the range within which the total combined annual income of all members in the household fell. Ten ranges were provided on the form. The first eight were in $5,000 increments from zero to $40,000. The ninth range was from $40,000 to $49,999 and the last range was $50,000 or more. Figure 5 presents Part 1 of the Household Survey form as used in San Antonio.

Part 2 of the household survey instrument was designed to collect information on each trip made by persons within the household during the specified travel day. That form is shown in Figure 6. The information requested was as follows:

1. The location where that person's first trip of the day began, i.e., home or other.
2. Name and address of location of each trip destination.
3. The time of the person's arrival at each location and the time of departure at each location.
4. Purpose of the trip (seven purposes including other were provided).
5. Mode of travel for the trip (these included vehicle driver, vehicle passenger, walk, bicycle, bus, school bus, taxi, commercial vehicle and other).

SAN ANTONIO - BEXAR COUNTY TRAVEL SURVEY

PART 1: HOUSEHOLD INFORMATION

1 Thank You for agreeing to participate in this important travel survey. Please provide or confirm the following information:

A. Is this your correct mailing address? ☐ Check box if correct
B. Is your residence ☐ Single family detached ☐ Multi-unit (apartment/condo/townhouse)
C. How many people live at this address? _____
D. How many people are five years or older? _____
E. How many people in your household are employed? _____
F. How many cars, vans, and light trucks are available for use by members of your household? _____

Address: _____

_____

_____

Telephone: _____

Remember, your travel day is: _____

The information above includes your home address, the number of persons, and the number of vehicles reported in our initial conversation. If any of this information is incorrect, please make the necessary corrections above. We would now like some information on each household member.

2 Please assign a "Person Number" to each person residing in your household who is five years or older, starting with "Person Number 1" as the designated head of the household. (Fill in appropriate question boxes for each person.) This Section 2 is continued on the reverse side.

Person Number	Sex M/F	Age	Licensed Driver ? (circle one)	Relation to Person No. 1 (check box) 2 Spouse	3 Child	4 Relative	5 Not Related	Employed ? (circle one)	Did He/She Travel on the "Travel Day" ? (circle one)	Color of Form to be Used for Trip Record
Head of Household			1) Yes 2) No	☐	☐	☐	☐	1) Yes 2) No	1) Yes 2) No	White
2			1) Yes 2) No	☐	☐	☐	☐	1) Yes 2) No	1) Yes 2) No	Blue
3			1) Yes 2) No	☐	☐	☐	☐	1) Yes 2) No	1) Yes 2) No	Yellow
4			1) Yes 2) No	☐	☐	☐	☐	1) Yes 2) No	1) Yes 2) No	Green
5			1) Yes 2) No	☐	☐	☐	☐	1) Yes 2) No	1) Yes 2) No	Gold
6			1) Yes 2) No	☐	☐	☐	☐	1) Yes 2) No	1) Yes 2) No	Pink
7			1) Yes 2) No	☐	☐	☐	☐	1) Yes 2) No	1) Yes 2) No	Tan
8			1) Yes 2) No	☐	☐	☐	☐	1) Yes 2) No	1) Yes 2) No	Cream
9			1) Yes 2) No	☐	☐	☐	☐	1) Yes 2) No	1) Yes 2) No	Grey
10			1) Yes 2) No	☐	☐	☐	☐	1) Yes 2) No	1) Yes 2) No	Ivory

Figure 5. San Antonio-Bexar County 1990 Household Information Survey Instrument.

PART 2: TRIP RECORD

FOR PERSON NUMBER 1 (Refer to question 2 of the Household Questionnaire)

Please fill out this form for one person only.
Please enter your travel day _____ / _____
Month Day

On this day, did you travel outside the home? (check one) ☐ Yes ☐ No
If Yes, continue below. If No, return the questionnaire to the designated head of household.

MY FIRST TRIP TODAY BEGAN AT ☐ Home ☐ Other Location
(Fill in address)

(Place/address or nearest intersection/city/state/zip code)

Departure time: _____ a.m. p.m.

	Location Address	When did you get here/leave here?	Purpose of Trip (check one)	Mode of Transportation (check one)	Total No. People in Car/Truck/Van (including self)	If You Paid Parking, What Was the Parking Cost?	If Bus, What Was the Fare? How Did You Get to the Bus Stop?
BEGIN (1) FIRST I WENT TO:	Name of Place Address or nearest intersection City State Zip	Arrive a.m. p.m. Depart a.m. p.m.	☐ Return Home ☐ Go to Work or Work Related ☐ School ☐ Social / Recreational ☐ Pick up/Drop off Passenger ☐ Change Travel Mode ☐ Other _____	☐ Driver (car/truck/van/motorcycle) ☐ Passenger (car/truck/van/motorcycle) ☐ Walk ☐ Taxi ☐ Bicycle ☐ Commercial Vehicle ☐ Bus (over 1 ton) ☐ School Bus ☐ Other _____		P $____.____ per day	Fare $____.____ /trip ☐ Drove Auto & Parked ☐ Dropped Off ☐ Walked ☐ Carpooled with bus riders ☐ Other _____
(2) THEN I WENT TO:	Name of Place Address or nearest intersection City State Zip	Arrival a.m. p.m. Departure a.m. p.m.	☐ Return Home ☐ Go to Work or Work Related ☐ School ☐ Social / Recreational ☐ Pick up/Drop off Passenger ☐ Change Travel Mode ☐ Other _____	☐ Driver (car/truck/van/motorcycle) ☐ Passenger (car/truck/van/motorcycle) ☐ Walk ☐ Taxi ☐ Bicycle ☐ Commercial Vehicle ☐ Bus (over 1 ton) ☐ School Bus ☐ Other _____		P $____.____ per day	Fare $____.____ /trip ☐ Drove Auto & Parked ☐ Dropped Off ☐ Walked ☐ Carpooled with bus riders ☐ Other _____
(3) THEN I WENT TO:	Name of Place Address or nearest intersection City State Zip	Arrival a.m. p.m. Departure a.m. p.m.	☐ Return Home ☐ Go to Work or Work Related ☐ School ☐ Social / Recreational ☐ Pick up/Drop off Passenger ☐ Change Travel Mode ☐ Other _____	☐ Driver (car/truck/van/motorcycle) ☐ Passenger (car/truck/van/motorcycle) ☐ Walk ☐ Taxi ☐ Bicycle ☐ Commercial Vehicle ☐ Bus (over 1 ton) ☐ School Bus ☐ Other _____		P $____.____ per day	Fare $____.____ /trip ☐ Drove Auto & Parked ☐ Dropped Off ☐ Walked ☐ Carpooled with bus riders ☐ Other _____
(4) THEN I WENT TO:	Name of Place Address or nearest intersection City State Zip	Arrival a.m. p.m. Departure a.m. p.m.	☐ Return Home ☐ Go to Work or Work Related ☐ School ☐ Social / Recreational ☐ Pick up/Drop off Passenger ☐ Change Travel Mode ☐ Other _____	☐ Driver (car/truck/van/motorcycle) ☐ Passenger (car/truck/van/motorcycle) ☐ Walk ☐ Taxi ☐ Bicycle ☐ Commercial Vehicle ☐ Bus (over 1 ton) ☐ School Bus ☐ Other _____		P $____.____ per day	Fare $____.____ /trip ☐ Drove Auto & Parked ☐ Dropped Off ☐ Walked ☐ Carpooled with bus riders ☐ Other _____

Figure 6. San Antonio-Bexar County 1990 Household Trip Survey Instrument.

6. Total number of persons in vehicle.
7. Parking cost if the person paid parking.
8. If bus was the mode of travel, the mode of travel to the bus stop and the bus fare paid.

Figure 6 presents the Part 2 form used in the household survey to record the trip information for each person in the household.

While the survey instruments were consistent for each of the five urban areas surveyed, there were some differences in the sample sizes and the methodologies employed in implementing the surveys. These are discussed in the following sections. Where procedures and/or methodologies were identical between urban areas, the areas are discussed together.

San Antonio, Amarillo, and Brownsville

The household surveys in San Antonio, Amarillo, and Brownsville were accomplished using the same methodology as well as the same survey instruments. The only differences between the three urban areas were the sample sizes established for each. Tables 5 through 7 present the stratified sample sizes for each of the three urban areas. The actual number of households surveyed varied. For example, in San Antonio 2,643 households were surveyed. In Amarillo, 2,590 were surveyed, and in Brownsville, 1,411 were surveyed.

The methodology used in the household survey was the same in all three urban areas. Households were randomly selected, contacted by phone, and asked to participate in the survey. Those agreeing to participate were assigned a travel day and mailed a packet containing travel diaries for every person in the household over 5 years of age. They were asked to record all of their trips on the survey day assigned. The household was contacted after their travel day, and the survey data were retrieved by phone interviewers. Each household was then asked to mail the travel diaries back for documentation purposes. Detailed descriptions of the survey methodologies are contained in References 5, 6, and 7.

Tyler and Sherman-Denison

The household surveys in Tyler and Sherman-Denison were accomplished using the same methodology and survey instruments. The methodology differed from that used in San Antonio. Tables 8 and 9 present the stratified sample quotas established for the two surveys. The actual number of households surveyed varied with 2,646 surveys being done in Tyler and 2,289 surveys done in Sherman-Denison.

The methodology used in the household survey was the same for both urban areas. Households were randomly selected, contacted by phone, and asked to participate in the survey. Those agreeing to participate were assigned a travel day and mailed a packet containing travel diaries for every person in the household over 5 years of age. Each person was asked to record all of their trips on the survey day assigned. Each household was asked to return the travel diaries and household information by mail. This was the principal difference between the survey methodology used in these two urban areas versus that used in the other three. Here the data were obtained by the survey instruments being mailed back in lieu of an interviewer retrieving the information by phone. Detailed descriptions of the survey methodologies may be found in References 8 and 9.

EVALUATION

The subsequent evaluations of the household survey methodologies were accomplished, in part, with the analysis of the data that were collected. Because the primary objective of the household survey is to obtain information for use in travel demand modeling, the evaluation of the methodology is keyed to how well this objective was met. Four key issues were identified, sample size, sample selection, data collection methodology, and the data actually collected.

Table 5
Household Sample Goals
San Antonio Household Survey

Persons per Household	Cars per Household				Total
	0	1	2	3+	
One Person	199	264	100	--	563
Two Persons	78	357	244	100	779
Three Persons	43	284	146	159	632
Four or More Persons	70	250	151	157	628
Total	390[1]	1156	641	415	2602

[1]Column total was only requirement in terms of sample size.
Note: Shaded cells had no minimum number of samples.
Source: Reference 5

Table 6
Amarillo Household Initial Sampling Goals

Persons per Household	Cars per Household				Total
	0	1	2	3+	
One Person	-	144	99	--	243
Two Persons	-	173	99	99	371
Three Persons	-	133	102	99	334
Four or More Persons	-	155	99	102	356
Total	163[1]	605	399	300	1467

[1]Column total was only requirement in terms of sample size.
Note: Shaded cells had no minimum number of samples.
Source: Reference 6

Table 7
Brownsville Household Initial Sampling Goals

Persons Per Household	Cars Per Household				Total
	0	1	2	3+	
One Person	-	144	99	--	243
Two Persons	-	173	99	99	371
Three Persons	-	133	102	99	334
Four or More Persons	-	155	99	102	356
Total	163[1]	605	399	300	1467

[1]Column total was only requirement in terms of sample size.
Note: Shaded cells had no minimum number of samples.
Source: Reference 7

Table 8
Household Response Matrix for Recommended Usable Surveys
Tyler Household Survey

No. of Vehicles Available	Persons in Households				Total
	1	2	3	4+	
0	218	120			120
1		264	204	415	883
2		259	239	188	686
3+		218	209	191	618
Total	218	741	652	794	2525

Source: Reference 8

Table 9
Household Response Matrix for Recommended Usable Surveys
Sherman-Denison Household Survey

No. of Vehicles Available	Persons in Households				Total
	1	2	3	4+	
0	299	110			110
1		249	168	228	645
2		260	235	184	419
3+			198	183	641
Total	299	509	601	595	2114

Source: Reference 9

Sample Size

Sample size has always been a critical issue. In the past two decades, it has become even more an issue because of limited funding. This creates a paradox relative to how much is affordable versus how much is needed in order to get reasonably good results.

For the surveys conducted in 1990 and 1991, the sample size for the household travel survey posed one of the most difficult areas of consideration. The sample size for obtaining certain levels of accuracy could be estimated using standard statistical methods based on an estimate of the coefficient of variation for each trip rate (i.e., trips per household) within each cell of the stratification being used in the survey. The coefficient of variation estimates were not, however, readily available; and data from the survey in the Dallas-Fort Worth area were used in most cases to develop desired sample sizes. As discussed previously, the stratifications selected for use in those household travel surveys were household size (four categories: 1, 2, 3, and 4 plus) and auto ownership (four categories: 0, 1, 2, and 3 or more). The overall level of accuracy desired for estimating the mean trip rates for each of three trip purposes (i.e., home based work, home based non-work, and non-home based) was set at $\pm$5 percent with a level of confidence of 90 percent. The desired level of accuracy for the average trip rates (for each trip purpose) within

each cell of the primary cross-classification stratification was set at ±10 percent with a level of confidence of 90 percent without exceeding a sample size of 2,500 households. It was acknowledged that to maintain the desired level of accuracy within the cells considered the most significant, the criteria would have to be relaxed in the least significant cells to stay within the specified overall sample size of 2,500 households. The least significant cells were identified as those with zero auto ownership and those where the number of autos exceeded the persons in the household. The sample size of 2,500 households was based primarily on limiting the overall cost of the survey and ensuring that the resulting data would be sufficient to provide reasonable results. Subsequent analysis of the data from the surveys indicated that the sample sizes were adequate in most cases. The problem identified was the stratification used for the samples. Data analysis resulted in a recommendation that trip rates be stratified by household size and household income for use in travel demand models (10). Since the survey samples were stratified by household size and vehicle availability, the resulting sample sizes were found to be insufficient in some cells when the samples were stratified by household size and income. During the survey, the location of households with no vehicles available was difficult and required additional effort on the part of the consultants. This additional effort may have introduced some bias into the survey due to its non-random nature.

The desired accuracy of the survey was ±5 percent with a level of confidence of 90 percent for each of the three trip purposes. In addition, the level of accuracy within each stratification cell was set at ±10 percent with a level of confidence of 90 percent. These were desired given the constraint that the total sample size would not exceed 2,500 households. Evaluation of the results from the survey indicated that these levels of accuracy were not met except in a few stratification cells. For example, Table 10 presents the number of surveyed households and the percentage they represented of the desired number in the San Antonio survey stratified by size and vehicles available. Several cells were under

Table 10
Number of Surveyed Households
In the 1990 San Antonio Household Survey

Persons per Household	Item	Cars per Household				Totals
		0	1	2	3+	
One Person	Number	173	343	38	8	562
	Percent[1]	86.9	129.9	38.0	N.A.	99.8
Two Persons	Number	72	245	375	79	771
	Percent	92.3	68.6	153.7	79.0	99.0
Three Persons	Number	44	147	180	121	492
	Percent	102.3	51.8	123.3	76.1	77.8
Four or More Persons	Number	61	248	336	183	828
	Percent	87.1	99.2	222.5	116.6	131.8
Totals	Number	350	983	929	391	2653
	Percent	89.7	85.0	144.9	94.2	102.0

[1]"Percent" is the percentage of the desired number of households (see Table 5) that were actually surveyed.

Table 11
Estimated Percentage Error in Trip Production Rates by Trip Purpose
1990 San Antonio Household Survey
(90% Confidence Level)

Home Based Work

Persons per Household	Person Trips per Household				Auto Driver Trips per Household			
	Vehicles Available				Vehicles Available			
	0	1	2	3+	0	1	2	3+
One Person	27.6	9.8	34.6	26.6	164.0	10.4	36.6	26.6
Two Persons	32.6	12.4	7.3	14.7	164.0	13.4	7.7	15.5
Three Persons	26.0	12.0	7.8	9.6	164.0	13.2	7.9	10.4
Four or More Persons	25.9	9.1	5.6	8.4	164.0	10.7	6.1	8.3

Home Based Non-Work

Persons per Household	Person Trips per Household				Auto Driver Trips per Household			
	Vehicles Available				Vehicles Available			
	0	1	2	3+	0	1	2	3+
One Person	17.9	8.6	21.1	110.2	100.3	9.1	24.8	98.1
Two Persons	26.3	10.4	8.4	17.0	164.0	11.5	8.5	16.7
Three Persons	25.8	11.7	10.3	13.3	164.0	14.4	11.9	13.2
Four or More Persons	27.9	8.6	6.3	8.8	79.0	10.9	7.7	9.9

Non-Home Based

Persons per Household	Person Trips per Household				Auto Driver Trips per Household			
	Vehicles Available				Vehicles Available			
	0	1	2	3+	0	1	2	3+
One Person	30.9	12.5	35.0	92.7	85.8	12.8	35.0	92.7
Two Persons	52.7	16.2	10.2	19.6	164.0	16.7	10.5	20.2
Three Persons	49.0	22.6	16.4	18.3	164.0	25.67	16.5	18.8
Four or More Persons	38.5	16.4	10.9	14.3	100.9	16.5	11.2	13.9

Total Trips

Persons per Household	Person Trips per Household				Auto Driver Trips per Household			
	Vehicles Available				Vehicles Available			
	0	1	2	3+	0	1	2	3+
One Person	14.4	6.5	18.4	42.3	78.5	6.9	20.5	37.3
Two Persons	20.5	8.8	5.5	11.1	117.5	9.2	5.6	11.3
Three Persons	19.4	9.6	7.3	9.5	164.0	10.2	7.7	9.3
Four or More Persons	20.8	7.8	5.4	6.9	78.0	8.2	5.5	6.8

sampled and several were over-sampled relative to the desired number of households to be surveyed. Table 11 presents the estimated percentage error (plus or minus) for the trip rates developed from the survey data stratified as the sample was drawn. Table 12 presents the estimated error in the expanded average trips per household by trip purpose from the San Antonio survey. It presents a more representative picture of the accuracy in the sample data because it represents expanded data which incorporate the estimated distribution of households within the study area. A particular cell might have a large error in its estimate, but its relative contribution to the overall trip rate for the area may be small. Thus the expansion of the data would not be as impacted by the high error in that trip rate.

Table 12
Expanded Trip Rates and Estimated Errors
1990 Household Survey
San Antonio

Trip Purpose	Expanded Person Trips		Expanded Auto Driver Trips	
	Average per Household	Percentage Error[1] (±)	Average per Household	Percentage Error (±)
Home Based Work	1.839	9.46	1.482	9.26
Home Based Non-Work	4.274	9.70	2.441	11.08
Non-Home Based	2.379	15.15	1.775	15.26
Total (All)	8.492	7.59	5.757	7.79

[1]Confidence level is 90 percent.

The data for the other four urban areas surveyed yielded similar results as that shown for San Antonio. The desired levels of accuracy were not met in any of the five urban areas surveyed. The reasons vary, but it appears a different approach is needed for establishing a reasonable sample size for household surveys which consider both the expected accuracy of the trip rate estimates and the contribution each stratification cell makes to the overall travel in the urban area. The stratifications used for obtaining the sample households should also be the same as that used for developing the trip rates used in travel demand modeling.

Sample Selection

Sample selection is the process by which households are identified and solicited for participation in the household survey. The key concern here is that the process be random and that each household has the same probability of being selected. One of the issues is how to actually select the households. Several methods have been used (as described previously), but they have all, in one way or another involved, the use of telephones. This raises the question of bias due to households that do not have telephones not having an equal probability of being selected for participation in the survey. In terms of sample selection, there is a bias due to these households not having an opportunity to participate. In terms of the survey results, there is no reason to believe that the travel patterns of these households (i.e., households without phones) would be any different than that of households with telephones. If this premise is correct, the trip rates developed from households with telephones would still be applicable to households that did not have telephones. The number of households without telephones usually represents a very small proportion of the total population in most urban areas. The amount of bias that may or may not be entered into the survey is not considered to be significant, and the cost which would be associated with attempts to reach this portion of the population is felt to greatly exceed the benefit gained.

Selecting the telephone numbers for use in soliciting participation in the survey may be accomplished in a number of ways. One of the most cost-effective ways is to hire an agency or organization that provides telephone numbers for survey purposes. These agencies typically have developed techniques that address problems such as unlisted numbers, business numbers, disconnections, etc. They can reduce the amount of effort required in the solicitation and, in some cases, can ensure a more comprehensive coverage of the study area.

The number of telephone numbers necessary for the sample selection may be estimated from previous experience. Typically, 20 to 30 percent of the households contacted will agree to participate in a one-day travel survey. If the desired sample size is 2,500 households, the number of randomly selected telephone numbers will be approximately 8,000 to 13,000 (these numbers are rounded). To ensure randomness, the numbers should be provided in a pre-specified number of replicates. For example, if ten replicates were desired with a total of 8,000 telephone numbers, ten sets of 800 phone numbers would be selected with each set being selected randomly from the

entire population. This ensures that every household has an equal chance of being selected in the process.

Data Collection Methodology

In the household surveys done in 1990 and 1991, two methodologies were used for collecting the survey data. After a household was contacted and had agreed to participate, a package containing travel diaries was mailed to them with a request that each person over 5 years of age in the household record information on every trip made during a specified 24-hour period. This was the same for all five surveys. The method used in retrieving the data from the households differed. In three of the urban areas surveyed, the data were retrieved by telephone through an interview process. In the other two urban areas, the households mailed the travel diaries and survey instruments back; and the data were taken directly from them.

The analysis of the data from the surveys indicated some differences in the results between those areas where the data were retrieved by phone versus those areas where the data were taken from the survey instruments returned in the mail. The data were analyzed by comparing several results between the surveys. Table 13 presents the expanded average person trip rates by trip purpose for the five urban areas surveyed. It appears the overall trip rates in Sherman-Denison and Tyler tend to be slightly less than the trip rates for the other three urban areas. These differences however, are not large enough to draw any valid statistical conclusion. Table 14 presents two other comparisons, the percentage of households recorded as making zero trips during their survey day and the percentage of households which reported their annual household income. Two observations were made. One was that the percentage of zero trip households were significantly higher in the two

Table 13
Expanded Person Trips per Household
By Trip Purpose

Data Collection Method	Urban Area Surveyed	Year	Person Trips per Household			
			HBW	HBNW	NHB	Total
Telephone	San Antonio	1990	1.94	4.46	2.55	8.95
Telephone	Amarillo	1990	1.77	4.81	3.16	9.74
Telephone	Brownsville	1990	1.69	6.27	3.04	11.01
Mail	Sherman-Denison	1991	1.43	4.18	3.01	8.62
Mail	Tyler	1991	1.60	4.08	2.81	8.49

Table 14
Comparison of Zero Trip Households
And Households Not Reporting Income

Data Collection Method	Urban Area Surveyed	Year Surveyed	Percentage of Households With Zero Trips	Percentage of Households Not Reporting Income
Telephone	San Antonio	1990	8.25	7.54
Telephone	Amarillo	1990	6.24	3.00
Telephone	Brownsville	1990	7.44	3.12
Mail	Sherman-Denison	1991	11.95	0.55
Mail	Tyler	1991	11.01	23.54

surveys where the data were retrieved by mail. The second was that the telephone retrieval seemed to produce more consistent results in households reporting their annual income. These data indicate that the telephone retrieval method appears to produce more consistent and reliable results.

Data Specifications

The data that were collected in each of the household surveys were complete in its purpose to identify and compile travel data for households by which trip rates could be developed and used for travel demand modeling purposes. It was determined, however, that there were some data elements missing that were needed for both travel demand modeling and air quality analysis. More specifically, information was needed for the type of activity at the destination end of the trips being recorded. This was felt to provide additional information for the development of trip attraction models. For air quality analysis, more information was needed on the vehicles available to the household for travel and the specific vehicle being used for travel. These data would be applicable to the development of input data for modeling mobile source emissions. An additional data element was also desired which would indicate the number of trips being made to a household by non-household members. This was necessary to develop residential trip attraction rates. Modifications were subsequently developed and are discussed in the recommendations section of this chapter.

ALTERNATIVE METHODS

The surveys conducted in 1990 and 1991 were designed along the concept of each member of a household completing a travel diary in which information would be provided on each trip made during a specified travel day. It is generally felt that in many instances, household members do not remember (or complete their diary as they travel during the day) and the resulting trip information is incomplete. An alternative method to the travel diary is the use of an instrument referred to as an activity diary. The use of the term "activity" is felt to be more understandable to people and, therefore, easier to remember and record. It is also argued that the reason that people travel is to participate in different activities and that it is more logical to think and remember in this manner (11).

With an activity diary, people are asked to record each activity they do during a specified day and the means (i.e., mode) of travel from one activity to another. It is designed to obtain the same basic information as the typical travel diary, but the format and structure of the questions is slightly different. An example of an activity diary is shown in Figure 7. The activity diary shown in Figure 7 was used in the 1990 Boston household survey. While similar

to the typical travel diaries, activity diaries offer some advantage in their orientation to activities instead of trips. In both cases, there is some confusion relative to what constitutes a trip or what is an activity. This could introduce some inconsistency in surveys that are self-enumerated; but where the data are collected by phone using trained interviewers, the amount of inconsistency should be minimized.

The use of activity diaries may also be advantageous for developing new types of travel demand models that lend themselves to being sensitive to issues such as telecommuting or policy changes. The use of these diaries should be designed to obtain the same information as that from the typical travel diary as a minimum. The similarities between the two are such that the accuracy when using trained interviewers to obtain the data should be similar. The advantage offered by the activity diary is one of potential ease of understanding, growing acceptance in the professional community, and additional information for use in developing new models.

Another alternative survey method which has not been used is that of passive data collection. This is a new research area that needs extensive development work to demonstrate feasibility and use in travel data collection. It is discussed here because it may become a viable alternative in the future. The concept is to monitor travel within vehicles through the use of on-board equipment that would compile information on the number of trips made, the speed and direction of travel, trip length, and, possibly, vehicle emissions. It could also incorporate global positioning and track vehicle paths through the urban area. This alternative offers the advantage of not relying on human memory or cooperation for gathering travel information and, thus, is non-intrusive by its nature. The disadvantages are that limited information is obtained in terms of trip purpose, and there is a fear that people may consider the use of such devices as an infringement of their privacy. These issues, while difficult, are not insurmountable; and the development of such tracking devices will most likely occur as a natural evolution in technology. This is an area where more research is needed.

1991 Boston Region Household Survey

Your One-Day Diary

For Wednesday

Today's Date: ____ (Month) ____ (Date)

Year of Birth: 19____

Are you: *Male* ☐ *Female* ☐

Address or nearest intersection of workplace:

City:	*State:*

Address or nearest intersection of school:

City:	*State:*

Figure 7. Boston 1990 Regional Household Activity Diary.

How To Use Your Diary

All you have to do is tell us what activities you do and how you get from each activity to the next on your diary day.

An ACTIVITY is something that you do at a particular place. The trips to and from the places you go do not count as activities.

If you leave the house on your diary day, fill out the diary and tell us about what you did. Every time you stop to do things at a different place, that's an activity. For example, all of the following are separate activities:

- ☆ dropping someone off or picking someone up
- ☆ work or school
- ☆ eating at a restaurant
- ☆ visiting friends or going bowling
- ☆ dentist or doctor appointments
- ☆ shopping or running errands (bank,cleaners)
- ☆ stopping to buy gas or shop on the way home
- ☆ being at home after work, school, shopping, etc.

For the times that you are at home on your diary day, just tell us that you were AT HOME – we don't have to know what you do while you're home. Things like walking the dog or jogging in your neighborhood are included in the things you do at home, and are not separate activities.

It's EASY! You only have to check a few boxes and fill in some blanks on each page.

Figure 7. Boston 1990 Regional Household Activity Diary (con't).

What To Fill In

First, fill in the questions on the cover.

Next, use the blank MEMORY JOGGER to fill in your activities throughout your diary day. This is provided to help you remember what you do. Page 4 is an example of the Memory Jogger. The blank Memory Jogger for you to fill in is on Page 5.

Then, during the day, or at the end of your diary day, turn to the pages after the Memory Jogger and fill in

☆ one ACTIVITY page and
☆ one HOW I GOT HERE page

for EACH ACTIVITY listed in the MEMORY JOGGER. After you have filled in the ACTIVITY and HOW I GOT HERE pages for one day, return the diary to us.

If you do not leave home on your diary day, fill in the information on the cover, fill in AT HOME ACTIVITIES for the first activity, and return the diary.

Your diary day starts at 3:00 AM. If you were at home sleeping at 3:00 AM, fill in AT HOME on the Memory Jogger, and check the box that says AT HOME ACTIVITIES on the activity page.

Your Information Counts!

No matter how much or how little you travel, YOU ARE IMPORTANT. You are one of the few people picked to help us understand the travel patterns in the Boston Region. Please fill in and return this diary.

It's a lot simpler than you might expect, and it makes a difference!

QUESTIONS? Call us TOLL-FREE at
(508)371-4255

Each Time You Go Out of the House TODAY

AND Each Time you RETURN HOME:

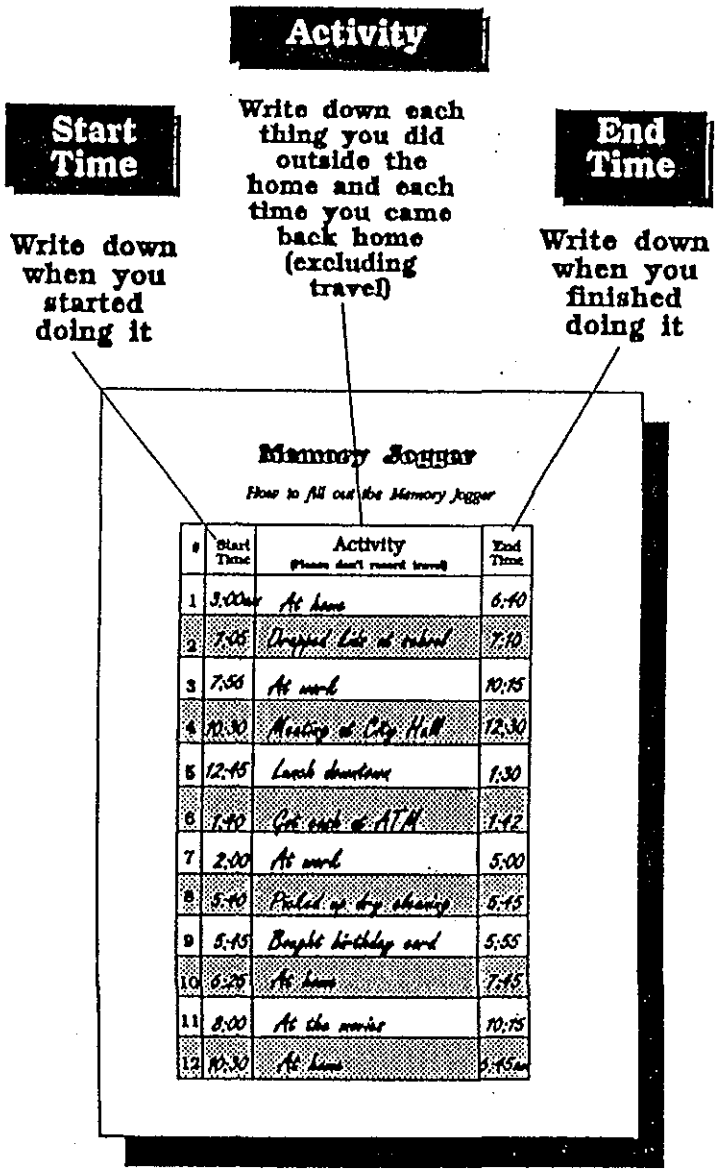


Figure 7. Boston 1990 Regional Household Activity Diary (con't).

Memory Jogger

Please fill out during YOUR Diary Day

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

Please turn to the next pages for more help and fill in each Activity Page and "How I Got Here" page for each line you filled in on this page.

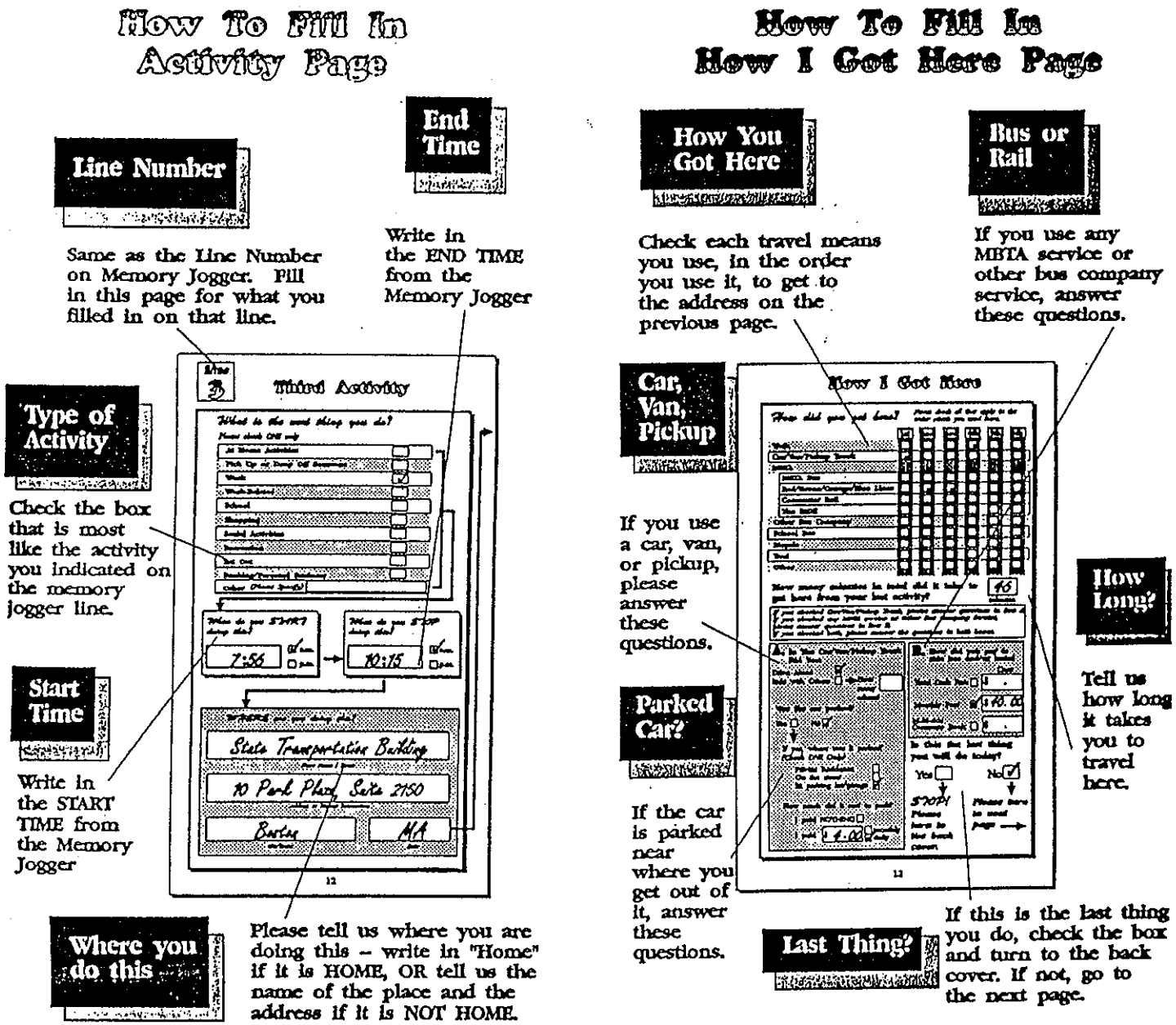


Figure 7. Boston 1990 Regional Household Activity Diary (con't).

Figure 7. Boston 1990 Regional Household Activity Diary (con't).

Figure 7. Boston 1990 Regional Household Activity Diary (con't).

RECOMMENDATIONS

As a result of evaluating the household survey methodology used in the 1990 and 1991 travel surveys, a number of recommendations have been developed. These are presented in terms of the same areas discussed in the evaluation, sample size, sample selection, data collection methodology, data specifications, and other considerations.

Sample Size

The question of sample size has raised a number of problems mostly due to funding availability and how much accuracy can be afforded. Because most household surveys (particularly during the last 10 to 15 years) have been small samples (i.e., 1,200 to 2,600 households), the question of accuracy is sensitive and has been additionally complicated by the sample stratification by different variables. The following discussion presents the recommended procedure for determining the sample size for household surveys in Texas.

Extensive analysis of the 1990-91 surveys resulted in the recommendation that household size and household income be used as the variables to stratify household trip production rates. For consistency and statistical reasons, these variables will also be used to stratify the households to be surveyed in subsequent household travel surveys. Table 15 presents the household stratification categories for the survey. The number of surveyed households in each category (i.e., cell) will be determined as a function of each category's expected trip rate variability and the amount each contributes to the area's overall travel estimate as indicated by the trip rate size and the category's expected number of households. The sample size computation for each category is accomplished as follows:

1. Develop an estimate of the urban areas household distribution by household size and income. Since these data are not currently available, a reasonable estimate is computed using the 1990 census distribution of households by household income and the distribution of households by household size. For example, Table 16 shows these distributions for El Paso, Texas.

Table 15
Stratification of Household Samples

1990 Income Range	Household Size				
	1	2	3	4	5+
$0 to $4,999					
$5,000 to $9,999					
$10,000 to $19,999					
$20,000 to $34,999					
$35,000 Plus					

To compute the cell values for Table 16, a seed distribution from another area must be used. If available, an earlier distribution (e.g., 1980) for the area being surveyed may be used. An iterative proportional weighting routine is used to estimate the cell values which are forced to sum to the correct row and column totals. For the example shown, the 1980 distribution from San Antonio shown in Table 17 will be modified and used.

Table 16
1990 Percentage Distributions of Households by Household Size and Income
El Paso

1990 Income Range	Household Size					Totals
	1	2	3	4	5+	
$0 to $4,999						9.12
$5,000 to $9,999						11.19
$10,000 to $19,999						23.78
$20,000 to $34,999						26.46
$35,000 Plus						29.45
Totals	16.68	23.78	18.29	18.50	22.75	100.00

Source: 1990 Census

Table 17
Percentage Distribution of Households in 1980
by Household Size and Income (in 1980 Dollars)
San Antonio-Bexar County

1980 Household Income Range	Household Size					Totals
	1	2	3	4	5+	
$0 to $4,999	7.02	3.23	1.75	1.30	1.66	14.96
$5,000 to $7,999	3.37	3.10	1.48	1.04	1.32	10.31
$8,000 to $9,999	2.04	1.92	1.25	0.95	1.16	7.32
$10,000 to $14,999	3.70	4.86	2.97	2.54	2.89	16.96
$15,000 to $19,999	2.08	4.36	2.99	2.57	2.87	14.87
$20,000 to $24,999	1.06	3.29	2.46	2.42	2.50	11.73
$25,000 to $34,999	0.70	3.86	2.93	3.00	3.10	13.59
$35,000 to $49,999	0.28	2.09	1.39	1.57	1.51	6.84
$50,000 or More	0.18	1.17	0.68	0.72	0.67	3.42
Totals	20.43	27.88	17.90	16.11	17.68	100.00

Source: 1980 Census

The first step is to convert the 1980 San Antonio-Bexar County distribution to reflect the same distribution, except in terms of 1990 dollars. The method used for this is described in Household Trip Rate Comparison, Technical Note, published by the Texas Transportation Institute in August 1992. The resulting distribution in terms of 1990 dollars is shown in Table 18. Using the distribution of households by income and size from the 1990 census (the same as shown in Table 16 for El Paso), an iterative proportional weighting procedure was used to estimate household distribution by household income and by size for 1990. The results are shown in Table 19. Using the values in Table 19 as seed values, the iterative proportional weighting procedure was applied using the distributions for El Paso shown in Table 17. The results are shown in Table 20.

Table 18
Percentage Distribution of Households in 1980
by Household Size and Income (1990 Dollars)
San Antonio-Bexar County

1990 Household Income Range	Household Size					Totals
	1	2	3	4	5+	
$0 to $4,999	4.12	1.89	1.03	0.77	0.98	8.79
$5,000 to $9,999	3.88	2.22	1.15	0.84	1.07	9.16
$10,000 to $14,999	3.21	2.97	1.55	1.13	1.41	10.27
$15,000 to $19,999	2.52	2.83	1.78	1.46	1.70	10.29
$20,000 to $24,999	2.18	2.84	1.73	1.50	1.70	9.95
$25,000 to $29,999	1.35	2.58	1.74	1.50	1.68	8.85
$30,000 to $34,999	1.13	2.44	1.70	1.48	1.64	8.39
$35,000 to $39,999	0.63	1.92	1.43	1.39	1.45	6.8
$40,000 to $49,999	0.64	2.68	2.02	2.03	2.11	9.48
$50,000 or More	0.87	5.46	3.73	3.99	3.95	18.00
Totals	20.53	27.83	17.86	16.09	17.69	100.00

2. Because no statistical data are available for El Paso in terms of previous household surveys and resultant trip rate variances, these data are borrowed from the 1990 San Antonio household travel survey. San Antonio data are used because they most closely approximate the size and composition of the El Paso urban area. Data from the other travel surveys would be used in other urban areas of the state and would be selected on the basis of similarity and on professional judgment. The information borrowed from the San Antonio survey consists of the person trip rates and the standard deviation of those rates as observed from the survey. These values are shown in Tables 21 and 22.

Table 19
1990 Percentage Distributions of Households
by Household Size and Income
San Antonio-Bexar County

1990 Income Range	Household Size					Totals
	1	2	3	4	5+	
$0 to $4,999	4.76	1.66	0.88	0.64	0.72	8.66
$5,000 to $9,999	4.20	2.18	1.06	0.75	0.83	9.02
$10,000 to $19,999	6.67	5.57	3.25	2.57	2.65	20.71
$20,000 to $34,999	4.77	7.59	5.15	4.49	4.29	26.29
$35,000 Plus	2.57	10.88	7.47	7.67	6.73	35.32
Totals	22.97	27.88	17.81	16.12	15.22	100.00

Source: Household Trip Rate Comparison, Technical Note, August 1992

Table 20
Estimated Percentage Distributions of Households in 1990
By Household Size and Income
El Paso

1990 Income Range	Household Size					Totals
	1	2	3	4	5+	
$0 to $4,999	3.76	1.80	1.17	0.98	1.41	9.12
$5,000 to $9,999	3.75	2.68	1.61	1.30	1.85	11.19
$10,000 to $19,999	5.04	5.80	4.17	3.78	4.99	23.78
$20,000 to $34,999	2.91	6.37	5.32	5.34	6.52	26.46
$35,000 Plus	1.22	7.13	6.02	7.10	7.98	29.45
Totals	16.68	23.78	18.29	18.50	22.75	100.00

The methodology for computing sample sizes for the household survey is based on establishing an overall acceptable error in terms of the weighted average person trip rate. The error is distributed to the categories (i.e., cells)

in a proportional relationship based on the percentage of population in the category and a relative value for the categories trip rate as compared to the trip rates for all of the other categories.

The minimum acceptable error is $\pm$10 percent. The weighted average person trip rate for San Antonio was 9.7032. Applying the household distribution for El Paso to the San Antonio trip rates yielded an average person trip rate of 9.643. This means that the overall error in the total trip rate should not exceed $\pm$0.9643. Table 23 shows the relative values for each category's trip rate as compared to the other trip rates shown in Table 21. These values were computed by summing all the trip rates in Table 21 and dividing each by the total. Summing the values in Table 23 with the values in Table 20 and dividing by 2 gives the proportional distribution values for distributing the minimum acceptable error of $\pm$0.9643. The proportional distribution values are shown in Table 24, and the resulting distribution of the acceptable error is shown in Table 25.

Conceptually, the acceptable error in the overall trip rate has been distributed to the individual categories in relation to the amount each category contributes to the overall travel. The values shown in Table 25 are next divided by the percentage of households in each category to compute the acceptable error in that category's trip rate. These values are shown in Table 26. Dividing the values in Table 26 by the trip rates in Table 21 will compute the percentage error for each category's trip rate.

Table 21
1990 Person Trips per Household
San Antonio-Bexar County

1990 Income Range	Household Size				
	1	2	3	4	5+
$0 to $4,999	1.47	2.83	6.18	6.07	7.97
$5,000 to $9,999	3.13	4.47	5.30	7.31	10.55
$10,000 to $19,999	4.26	6.77	8.66	12.25	13.82
$20,000 to $34,999	4.59	7.52	9.22	11.83	15.91
$35,000 Plus	4.63	8.24	10.56	14.36	18.64

Table 22
Sample Standard Deviations
of 1990 Person Trips per Household
San Antonio-Bexar County

1990 Income Range	Household Size				
	1	2	3	4	5+
$0 to $4,999	1.72	3.17	4.80	5.22	6.73
$5,000 to $9,999	3.34	4.37	3.42	6.45	8.03
$10,000 to $19,999	3.17	5.49	5.67	8.74	8.91
$20,000 to $34,999	3.10	4.78	5.92	6.52	9.40
$35,000 Plus	2.53	4.98	6.48	7.65	10.87

Table 23
Relative Trip Rate Values
San Antonio-Bexar County

1990 Income Range	Household Size				
	1	2	3	4	5+
$0 to $4,999	0.007	0.014	0.030	0.029	0.039
$5,000 to $9,999	0.015	0.022	0.026	0.035	0.051
$10,000 to $19,999	0.021	0.033	0.042	0.059	0.067
$20,000 to $34,999	0.022	0.036	0.045	0.057	0.077
$35,000 Plus	0.022	0.040	0.051	0.070	0.090

Table 24
Proportional Distribution for Allocation
Of Overall Trip Rate Error (±10%)

1990 Income Range	Household Size					Totals
	1	2	3	4	5+	
$0 to $4,999	0.022	0.016	0.021	0.020	0.026	0.105
$5,000 to $9,999	0.026	0.024	0.021	0.024	0.035	0.130
$10,000 to $19,999	0.036	0.045	0.042	0.049	0.058	0.230
$20,000 to $34,999	0.026	0.050	0.049	0.055	0.071	0.251
$35,000 Plus	0.017	0.056	0.056	0.070	0.085	0.284
Totals	0.127	0.191	0.189	0.218	0.275	1.000

Table 25
Distribution of Overall Trip Rate Error (±10%)

1990 Income Range	Household Size					Totals
	1	2	3	4	5+	
$0 to $4,999	0.022	0.015	0.020	0.019	0.025	0.101
$5,000 to $9,999	0.025	0.023	0.020	0.023	0.034	0.125
$10,000 to $19,999	0.034	0.044	0.040	0.047	0.056	0.221
$20,000 to $34,999	0.025	0.048	0.047	0.053	0.069	0.242
$35,000 Plus	0.017	0.054	0.054	0.068	0.082	0.275
Totals	0.123	0.184	0.181	0.210	0.266	0.964

The error in the trip rates shown in Table 26 and the standard deviations shown in Table 22 are the inputs to the following formula for computing the required sample size to estimate the trip rate for each category (i.e., cell) within ± the errors in Table 26 at a confidence level of 95 percent.

$$N = \left[\frac{1.96 * \sigma}{E} \right]^2$$

N = *Number of Households*

σ = *Standard Deviation*

E = *Trip Rate Error*

The resulting sample sizes computed using the above equation are shown in Table 27. These sample sizes should result in an overall error of no greater than ±10 percent in the estimate of total person trips in the El Paso urban area. It is felt, however, that a minimum number of households should be surveyed to assure statistically reliable results. In addition, the methodology may tend to over-sample certain categories; and a maximum

sample size is also established to reduce that probability. The minimum sample size is 50 households, and the maximum is 250. Replacing all sample sizes less than 50 with 50 and those greater than 250 with 250 results in the final sample size recommendations for El Paso shown in Table 28. The sample sizes recommended in Table 28 are estimated to produce an overall error in the total household person trip rate of $\pm$10 percent.

Table 26
Trip Rate Errors by Category

1990 Income Range	Household Size				
	1	2	3	4	5+
$0 to $4,999	0.573	0.849	1.715	1.928	1.802
$5,000 to $9,999	0.677	0.872	1.251	1.795	1.813
$10,000 to $19,999	0.679	0.755	0.967	1.239	1.129
$20,000 to $34,999	0.850	0.758	0.887	0.999	1.052
$35,000 Plus	1.368	0.752	0.892	0.954	1.027

Required sample sizes for household surveys must be computed for each area. The methodology presented in this section uses the distribution of households by household size and of household income for determining sample size. This distribution will be different for each urban area being surveyed. In addition, borrowing seed distributions, trip rates, and trip rate standard deviations will be different depending on the size and type of the urban area being surveyed. Pending the release of the detailed census data, Table 29 presents a listing of the potential urban areas to be surveyed in Texas and the areas previously surveyed that are best suited to borrow the necessary information for use in computing sample sizes required for household surveys.

Table 27
Initial Estimates of Sample Sizes by Category

1990 Income Range	Household Size					Totals
	1	2	3	4	5 +	
$0 to $4,999	35	54	31	29	54	203
$5,000 to $9,999	94	97	29	50	76	346
$10,000 to $19,999	84	204	133	192	240	853
$20,000 to $34,999	51	153	172	164	307	847
$35,000 Plus	14	169	203	247	431	1064
Totals	278	677	568	682	1108	3313

Table 28
Recommended Sample Sizes by Category
El Paso

1990 Income Range	Household Size					Totals
	1	2	3	4	5 +	
$0 to $4,999	50	54	50	50	54	258
$5,000 to $9,999	94	97	50	50	76	367
$10,000 to $19,999	84	204	133	192	240	853
$20,000 to $34,999	51	153	172	164	250	790
$35,000 Plus	50	169	203	247	250	919
Totals	329	677	608	703	870	3187

Sample Selection

The components of the household survey design presented in this report deal primarily with those areas which differ substantially from the design of the surveys conducted in 1990-91. Where necessary, reference will be made to the procedures developed and used in those surveys rather than presenting the information in this text. For

example, no discussion is provided on survey personnel training. This is assumed to be the responsibility of the consultant and a part of the contractual agreement between TxDOT (or the Metropolitan Planning Organization) and the consultant. The only discussion presented in this paper relative to items such as training will deal with recommendations of significant difference.

Selecting households to be solicited for participation in the household survey may be done a number of ways. The first recommendation is that the solicitation and ultimate data collection be done by a professional telemarketing firm. The firm should have experience in soliciting and gathering survey data by telephone including the training and support operations with experienced personnel committed to the project.

Table 29
Designation of Urban Areas
For Borrowing Information in
Computing Sample Sizes for Household Surveys

Urban Area To Be Surveyed	Urban Area From Which To Borrow Information
Abilene	Amarillo
Austin	Dallas-Fort Worth
Belton-Killeen	San Antonio
Bryan-College Station	Tyler
Corpus Christi	Houston
El Paso	San Antonio
Harlingen-San Benito	Brownsville
Laredo	Brownsville
Longview	Tyler
Lubbock	Amarillo
Midland-Odessa	Amarillo
McAllen/Pharr/Edinburg	Brownsville
Beaumont-Port Arthur	Houston
San Angelo	San Antonio
Victoria	Tyler
Waco	San Antonio
Wichita Falls	San Antonio

It is recommended that households be randomly selected and contacted by telephone. "Random" as used here implies that each household with a phone has an equal opportunity

of being contacted. The total number of randomly selected telephone numbers is estimated to equal the number of households desired or expected to participate in the survey divided by 0.2. Approximately 20 to 30 percent will agree to participate in the survey. In the case of El Paso, this would be approximately 16,000 telephone numbers. Since households will be selected by stratification cell until a pre-determined quota is reached, the selection procedure must be done in replicates to maintain the randomness of the process.

A set of 10 replicates of telephone numbers randomly selected from the population for the urban area under study is recommended. For example, if 16,000 randomly selected telephone numbers are desired, 10 sets of 1,600 numbers will be required; each set will be randomly selected from the population of all telephone numbers in the urban area including unpublished numbers. These lists are available from firms which specialize in drawing random samples, and the lists may be purchased for a fee. Unless a consultant proposes another method with appropriate justification, it is recommended that the telephone numbers be purchased from a firm specializing in random telephone number selection.

Households should be contacted by phone and a prepared script used to solicit their participation in the travel survey. As part of the prepared script (to be developed by the consultant during the Request for Proposal process), it is recommended that information on the characteristics of the household be obtained, e.g., number of persons in the household, number of vehicles available, annual household income, etc. It is recommended that this information be obtained (or at least attempted) even if the household does not agree to participate in the survey. A running account, based on the stratification cell each household falls into, should be kept of the households which agree to participate. As the quota for each cell is reached, households falling within those categories will not be requested to participate, but their household characteristics data should be collected and retained for use later. The consultant should include as a part of the response to the Request for Proposals a detailed plan of action for filling cells which are found to be difficult to fill. Those cells should be identified jointly by TxDOT staff and the consultant after either 70 percent of the cells have been filled or 70 percent of the contacts have been completed.

Data Collection Methodology

The recommended procedure for conducting the household survey is similar to that used in the San Antonio, Amarillo, and Brownsville surveys. A travel day should be designated for each participating household. A travel diary with instructions should be mailed to them within two days after they agree to participate. The household should be contacted the day before their travel day and reminded to complete the diary. At that time, any questions can also be answered. If contact with the household is not made prior to the travel day, attempts should continue until two days past the travel day. After that, it should be assumed that the household did not complete the diary, and the household should be replaced. On the day after the household's travel day, they should be contacted by phone and the travel information obtained via an interview with each member of the participating household that completed a diary. It is expected that a travel diary will be completed for each person in the household 5 years of age or more. The information should be coded and an edit check made to determine if any information is missing or is not clearly coded. If necessary, the household should be called back to clarify any missing or unclear information. If the household reports that no trips were made during their travel day, the interviewer should request additional clarification to determine if there were adequate reasons for no trips and record that information on the survey form. The survey information for households reporting no trips on their travel day should be reviewed by a supervisor or TxDOT staff person to determine if the response was reasonable. If it is determined that the response is not reasonable, the household should be considered as a non-respondent and replaced.

If the household has not been contacted (for whatever reason) within four days after their travel day, the household should be replaced. After the travel information has been obtained over the phone, the household should be requested to mail back the travel diaries; and a stamped, self-addressed envelope should be sent to them for that purpose.

The survey data obtained should be coded and entered in a pre-specified format (i.e., a computer file) and forwarded to TxDOT or the contracting agency every two weeks. The data files should be processed using programs designed to identify missing or inconsistent information. Those records identified as incomplete, illogical, etc., should be returned to

the consultant for correction or further editing. The consultant should be responsible for correcting errors found in the data during the survey and within three months following the completion of the survey.

Data Specifications

The recommended survey instruments for the household survey are similar to those used previously. Minor modifications are recommended to clarify certain information being obtained and to collect additional information. Figures 8 and 9 present the revised household survey instruments. The major revisions being recommended are the expansion of the data on the vehicles available to the household, additional data on the land use activity at the end of each trip, and data on the vehicle being used for each trip. The format presented in Figures 8 and 9 may be modified if desired and the questions reworded if necessary. The data shown in those figures are considered to meet the minimum requirements for purposes of travel demand modeling. Modifications such as expanding the number of household income ranges may be made to meet the needs of individual areas. In addition, the instruments may also be expanded in terms of the questions and detail necessary to meet an individual area's needs. The data being collected in a household survey are more a function of the modeling needs of a specific urban area and the survey instrument may be modified as necessary.

Other Considerations

A major consideration that may be addressed in the design of a household survey is whether to design an activity diary survey or a travel diary survey. The survey instrument in both cases collects very similar information; and as long as the data meet the modeling needs of the area, either survey will suffice. The activity diary survey offers some opportunities in terms of additional information on household activities, but care must be exercised that the data collected will still furnish the trip information necessary for modeling purposes. It is recommended that additional research be accomplished in current survey instruments to incorporate activity data in addition to the travel data being collected.

Record Types 1, 2, and 3

TRAVEL SURVEY
PART 1: HOUSEHOLD INFORMATION

10/01/93

Sample # _____

Thank you for agreeing to participate in this important travel survey. If you have any questions, please call _____.

(1) A. Is this your correct mailing address? ☐ Yes ☐ No If not, please enter the correct information.

_____

_____

_____

B. Is your residence: ☐ Single family detached
☐ Multi-unit (apartment/condo/townhouse)

C. How many people live at this address?_____

D. How many people who live at this address are five years or older?_____

E. How many people visited your residence on this day who do not live there? _____

F. How many people in your household are employed?_____

G. How many vehicles (cars, vans, light trucks, and motorcycles) are available for use by members of your household?_____

(2) Please assign a "Person Number" to each person residing in your household who is five years or older, starting with "Person Number 1" as the designated head of the household. (Fill in appropriate question boxes for each person.)

Person Number	Sex M/F	Age	Licensed Driver? (circle one)	Relation to Person No. 1 (check box) 2 Spouse	3 Child	4 Relative	5 Not Related	Employed? (circle one)	Did He/She Travel on the "Travel Day"? (circle one)
Head of House			1) Yes 2) No	☐	☐	☐	☐	1) Yes 2) No	1) Yes 2) No
2			1) Yes 2) No	☐	☐	☐	☐	1) Yes 2) No	1) Yes 2) No
3			1) Yes 2) No	☐	☐	☐	☐	1) Yes 2) No	1) Yes 2) No
4			1) Yes 2) No	☐	☐	☐	☐	1) Yes 2) No	1) Yes 2) No
5			1) Yes 2) No	☐	☐	☐	☐	1) Yes 2) No	1) Yes 2) No
6			1) Yes 2) No	☐	☐	☐	☐	1) Yes 2) No	1) Yes 2) No
7			1) Yes 2) No	☐	☐	☐	☐	1) Yes 2) No	1) Yes 2) No
8			1) Yes 2) No	☐	☐	☐	☐	1) Yes 2) No	1) Yes 2) No
9			1) Yes 2) No	☐	☐	☐	☐	1) Yes 2) No	1) Yes 2) No
10			1) Yes 2) No	☐	☐	☐	☐	1) Yes 2) No	1) Yes 2) No

(3) Please list all vehicles available to your household (including company cars, rental cars, motorcycles, etc.) and complete the following:

Vehicle Number	Year	Make	Model	Circle One	Odometer Readings On Travel Day Beginning	Ending
1				Diesel Gas		
2				Diesel Gas		
3				Diesel Gas		
4				Diesel Gas		
5				Diesel Gas		

(4) If you add up the annual income of all household members, into what range does it fall? (check one)

1) ☐ Less than $5,000
2) ☐ $5,000 to $9,999
3) ☐ $10,000 to $14,999
4) ☐ $15,000 to $19,999
5) ☐ $20,000 to $24,999
6) ☐ $25,000 to $29,999
7) ☐ $30,000 to $34,999
8) ☐ $35,000 to $39,999
9) ☐ $40,000 to $49,999
10) ☐ $50,000 or more

This completes the household information needed. Please proceed to Section 2 of this survey.

Thank you for your cooperation!

Figure 8. Revised Household Information Survey Instrument.

Record Type 4

PART 2: TRIP RECORD

Sample # _____ 10/01/93

FOR PERSON NUMBER 1 (Refer to Question 4 of the Household Questionnaire)

Please fill out this form for one person only.
Please enter your travel day _____ / _____ (Month / Day)

On this day, did you travel outside the home? (check one) ☐ Yes ☐ No
If yes, continue below. If no, return the form to the head of the household.

BEGIN:

MY FIRST TRIP TODAY BEGAN AT: ☐ (1) Home ☐ (9) Other Location

_____
(Fill in address)

_____
(Place/address or nearest intersection/city/state/zip code)

Departure time: _____ a.m. / p.m.

	Location Address	When did you get here/leave here?	Type of activity at this location (check one)	Purpose of Trip (check one)	Mode of Transportation (check one)	Total number of people in car/truck/van (including self)	If Driver, what vehicle was used? (make/model)	If Bus, what was the fare? How did you get to the bus stop?
① FIRST I WENT TO:	Name of Place Address or nearest intersection City/State/Zip	Arrive a.m. p.m. Depart a.m. p.m.	☐ (0) Residential ☐ (1) Basic: Manufacturing/Wholesale, Utility/Transportation/Communications, Construction ☐ (2) Retail: Commercial/Retail/Food ☐ (3) Services: Finance/Insurance/Real Estate, Governmental, Educational, Services, Park/Open Space ☐ Other _____	☐ (1) Return Home ☐ (2) Go to Work ☐ (3) Work Related ☐ (4) School ☐ (5) Social/Recreation/Eat ☐ (6) Shop/Buy Gas, etc. ☐ (7) Pick up/Drop off Passenger ☐ (8) Change Travel Mode ☐ (9) Other _____	☐ (1) Driver (car/truck/van/motorcycle) ☐ (2) Passenger (car/truck/van/motorcycle) ☐ (3) Walk ☐ (4) Bicycle ☐ (5) Bus ☐ (6) School Bus ☐ (7) Taxi ☐ (8) Commercial Vehicle (over 1 ton) ☐ (9) Other _____	_____ number of people If you paid parking, what was parking cost? $_____.___	Year Make Model	Fare: $_____.___ ☐ (1) Drove and Parked ☐ (2) Dropped off ☐ (3) Walked ☐ (4) Carpooled ☐ (5) Other _____
② THEN I WENT TO:	Name of Place Address or nearest intersection	Arrive a.m. p.m. Depart a.m. p.m.	☐ (0) Residential ☐ (1) Basic: Manufacturing/Wholesale, Utility/Transportation/Communications, Construction ☐ (2) Retail: Commercial/Retail/Food ☐ (3) Services: Finance/Insurance/Real Estate, Governmental, Educational, Services, Park/Open Space ☐ Other _____	☐ (1) Return Home ☐ (2) Go to Work ☐ (3) Work Related ☐ (4) School ☐ (5) Social/Recreation/Eat ☐ (6) Shop/Buy Gas, etc. ☐ (7) Pick up/Drop off Passenger ☐ (8) Change Travel Mode ☐ (9) Other _____	☐ (1) Driver (car/truck/van/motorcycle) ☐ (2) Passenger (car/truck/van/motorcycle) ☐ (3) Walk ☐ (4) Bicycle ☐ (5) Bus ☐ (6) School Bus ☐ (7) Taxi ☐ (8) Commercial Vehicle (over 1 ton) ☐ (9) Other _____	_____ number of people If you paid parking, what was parking cost? $_____.___	Year Make Model	Fare: $_____.___ ☐ (1) Drove and Parked ☐ (2) Dropped off ☐ (3) Walked ☐ (4) Carpooled ☐ (5) Other _____
③ THEN I WENT TO:	Name of Place Address or nearest intersection _____ _____	Arrive a.m. p.m. Depart a.m. p.m.	☐ (0) Residential ☐ (1) Basic: Manufacturing/Wholesale, Utility/Transportation/Communications, Construction ☐ (2) Retail: Commercial/Retail/Food ☐ (3) Services: Finance/Insurance/Real Estate, Governmental, Educational, Services, Park/Open Space ☐ Other _____	☐ (1) Return Home ☐ (2) Go to Work ☐ (3) Work Related ☐ (4) School ☐ (5) Social/Recreation/Eat ☐ (6) Shop/Buy Gas, etc. ☐ (7) Pick up/Drop off Passenger ☐ (8) Change Travel Mode ☐ (9) Other _____	☐ (1) Driver (car/truck/van/motorcycle) ☐ (2) Passenger (car/truck/van/motorcycle) ☐ (3) Walk ☐ (4) Bicycle ☐ (5) Bus ☐ (6) School Bus ☐ (7) Taxi ☐ (8) Commercial Vehicle (over 1 ton) ☐ (9) Other _____	_____ number of people If you paid parking, what was parking cost? $_____.___	Year Make Model	Fare: $_____.___ ☐ (1) Drove and Parked ☐ (2) Dropped off ☐ (3) Walked ☐ (4) Carpooled ☐ (5) Other _____

Figure 9. Revised Household Trip Survey Instrument.

WORKPLACE SURVEYS

Workplace surveys were initiated in Texas in 1984 during a region-wide travel survey in the Dallas-Fort Worth area. The purpose of the surveys was to obtain information at the non-home end of the trip in order to better estimate attraction rates for use in travel demand modeling.

The trip generation phase of the travel demand modeling process generates trip production and attraction estimates for different trip purposes. Trip productions are estimated based on the characteristics of households within a zone. There are two types of trip productions: the first are those productions which begin or end at the home and are referred to as home based trip productions; the second are those which begin and end at locations other than the home and are referred to as non-home based trip productions. Trip attractions are estimated based on the type and intensity of non-home activities within a zone. Each trip consists of one production and one attraction. It naturally follows that the final estimates of total productions and total attractions will be equal. Since these two estimates are generated using different models, the final totals are typically not equal, and one must be adjusted to equal the other. Since productions are historically felt to be more accurate estimates, the attractions are generally balanced to equal the productions.

While balancing the final estimates ensures that the condition of having equal productions and attractions is met, problems arising when the two estimates (i.e., productions and attractions) are severely out of balance should be resolved. Examples of such problems might be inconsistencies in forecasts, improper/illogical allocations of forecasts, etc. Since the attraction estimates were considered to be less accurate than productions, a need was identified to develop a means by which better estimates of attractions could be obtained. The proposed solution was to conduct workplace surveys to obtain information for developing more accurate models for estimating attractions. The current models in Texas use rates (attractions per employee) to estimate attractions.

The following sections present brief descriptions of the Dallas-Fort Worth and Texarkana workplace surveys followed by a discussion of the five workplace surveys done in 1990 and 1991.

DALLAS-FORT WORTH (12)

A regional travel survey was initiated by the North Central Texas Council of Governments in the Dallas-Fort Worth area in 1984. That project consisted of three independent surveys (a household survey, a workplace survey, and a special generator survey) designed to provide information by which the urban travel demand models in use at the time could be updated. The travel demand models in use had been originally developed based on an origin-destination travel survey conducted in 1964 and updated in 1973.

The workplace survey was unique in that it included a survey of the persons arriving at a selected establishment as well as a survey of the employees of the establishment. The arriving persons (i.e., nonemployees/visitors) were interviewed to obtain the characteristics of their trips to the establishment. The employees were surveyed to obtain the characteristics of the trips they made to and from the establishment during the day. The surveys were self-enumerated. The employee surveys were distributed through the employer; the nonemployee surveys were distributed to all persons arriving at the establishment.

The establishments in the area were stratified by three industry types, basic (SIC codes 0000 to 5099), service (SIC Codes 6000 or higher), and retail (SIC Codes 5100 to 5999) and by three area type categories, central business district and other business districts, urban residential, and suburban residential/rural. Quotas were established for the number of establishments in each stratification cell to be surveyed. Table 30 shows the initial sample quotas established for the workplace survey in the Dallas-Fort Worth area. The establishments surveyed were selected by use of a systematic random sampling technique.

Table 30
Workplace Survey Sample Quotas
1984 Dallas-Fort Worth Travel Survey

Area Type	Business Type			Total
	Retail	Service	Basic	
Central Business District or Other Business District	50	50	34	134
Urban Residential	50	50	33	133
Suburban/Rural	50	50	33	133
Total	150	150	100	400

Source: Reference 12

The employee survey obtained the following information:

1. The time the employee normally arrived at work.
2. Mode of transportation to work; if by auto, truck, or van, the number of persons in the vehicle.
3. If the employee was the driver of the vehicle, how much was paid for parking (if any) and how many blocks from work the employee parked.
4. If the employee traveled by bus to get to work, mode of transportation to the first bus stop.
5. The number and purpose of each stop made on the way to work and on the way home from work.
6. The number, mode, and purpose of any trips made during working hours.
7. The number of autos, pickups, and/or vans available to the employee for his/her use.
8. The employee's occupation, home address, and the annual household income.

After determining that a person was not an employee, the nonemployee travel survey obtained the following information:

1. The time of arrival at the establishment.
2. Where the trip began that brought the person to the establishment.

3. How the person traveled to the establishment, e.g., drove alone, drove car with other passengers, etc.
4. If travel was by auto, truck, or van, the number of persons in the vehicle and the number of blocks from the establishment the person parked.
5. If the person traveled by bus, how they traveled to the first bus stop.
6. The reason for the person's trip to the establishment.

Copies of the survey forms used in the workplace survey are shown in Figures 10 and 11. For each establishment surveyed, the survey attempted to gather information on the total arrivals (either vehicles and/or persons) at the establishment during the day of the survey. In addition, for a sub-sample of establishments, truck counts were also obtained by type of truck.

TEXARKANA (3)

As part of a regional travel survey done in 1989 for the purpose of updating the urban travel demand models being used in the Texarkana area, surveys were conducted at workplaces in the region. The workplace travel survey consisted of two independent components, a survey of the employees at the workplace and a survey of the persons (i.e., nonemployees) traveling to the workplace. A total of 45 business establishments (not including those classified as special generators) were surveyed. These establishments were stratified by three employment types, (basic, retail, and service) and by three area types (central business district (CBD), urban, and suburban). Table 31 shows the sample quotas established for the workplace survey. In addition to the surveys at each site, traffic counts and person counts were obtained by TxDOT.

00001

North Central Texas Council of Governments

1984 EMPLOYEE TRAVEL SURVEY

The North Central Texas Council of Governments is sponsoring a survey of travel in the Dallas-Fort Worth area. We ask your cooperation by answering each of the questions below. If possible, please return this questionnaire to the person who gave it to you.

YOUR ANSWERS WILL BE KEPT CONFIDENTIAL AND WILL ONLY BE USED TO PRODUCE STATISTICAL DATA NEEDED TO IMPROVE TRANSPORTATION SERVICES IN THE AREA.

A. At what TIME do you usually arrive at work?

___:___ A.M. P.M. (write time and circle A.M. or P.M.)

B. HOW did you travel to work this morning? (Circle number)

1. I drove by myself.
2. I drove a car with others as passengers.
3. I was a passenger in a car driven by someone else.
4. I walked or bicycled.
5. I rode a motorcycle.
6. I rode in a vanpool.
7. I rode in a taxi.
8. I rode a bus.

C. If you traveled to work by auto, truck, or van, HOW MANY PERSONS were in the vehicle, including yourself? _____ (enter number of persons)

D. If you were the DRIVER today, how much did you PAY TO PARK?

☐ Free I paid $_____.____

E. If you were the DRIVER today, how many BLOCKS away from work did you park?

☐ 1 or less ☐ 2 ☐ 3 ☐ 4 ☐ more than 4

F. If you traveled BY BUS to get to work today, how did you get to your first bus stop? (Circle number)

1. I drove by myself.
2. I drove a car with others as passengers.
3. I was a passenger in a car driven by someone else.
4. I walked or bicycled.
5. I rode a motorcycle.
6. I rode in a vanpool.
7. I rode in a taxi.

G. Did you make any STOPS on your way TO work today? (Check yes or no)

☐ No, I traveled directly to work.

☐ Yes, I made the following stops:

IF YES, please check the purpose for EACH stop

PURPOSE OF STOP	STOP MADE 1st Stop	2nd Stop	3rd Stop	4th Stop
Work Related	1 ☐	1 ☐	1 ☐	1 ☐
Shopping	2 ☐	2 ☐	2 ☐	2 ☐
School	3 ☐	3 ☐	3 ☐	3 ☐
Social/Recreational	4 ☐	4 ☐	4 ☐	4 ☐
Personal Business	5 ☐	5 ☐	5 ☐	5 ☐
Eat a Meal	6 ☐	6 ☐	6 ☐	6 ☐
Pick-Up or Drop Off a Passenger	7 ☐	7 ☐	7 ☐	7 ☐

If Blocked, Please Fold Along Dashed Line

H. Did you make any STOPS on your way home FROM work yesterday (or your last weekday at work)?

☐ No, I traveled directly home.

☐ Yes, I made the following stops:

IF YES, please check the purpose for EACH stop

PURPOSE OF STOP	STOP MADE 1st Stop	2nd Stop	3rd Stop	4th Stop
Work Related	1 ☐	1 ☐	1 ☐	1 ☐
Shopping	2 ☐	2 ☐	2 ☐	2 ☐
School	3 ☐	3 ☐	3 ☐	3 ☐
Social/Recreational	4 ☐	4 ☐	4 ☐	4 ☐
Personal Business	5 ☐	5 ☐	5 ☐	5 ☐
Eat a Meal	6 ☐	6 ☐	6 ☐	6 ☐
Pick-Up or Drop Off a Passenger	7 ☐	7 ☐	7 ☐	7 ☐

I. Did you make a trip(s) during working hours yesterday (or your last weekday at work)?

☐ No ☐ Yes If yes, please check purpose for each trip.

1ST TRIP	2ND TRIP	3RD TRIP	4TH TRIP
PURPOSE	PURPOSE	PURPOSE	PURPOSE
1 ☐ Work Related	1 ☐ Work Related	1 ☐ Work Related	1 ☐ Work Related
2 ☐ Shopping	2 ☐ Shopping	2 ☐ Shopping	2 ☐ Shopping
3 ☐ School	3 ☐ School	3 ☐ School	3 ☐ School
4 ☐ Social/Recreational	4 ☐ Social/Recreational	4 ☐ Social/Recreational	4 ☐ Social/Recreational
5 ☐ Personal Business	5 ☐ Personal Business	5 ☐ Personal Business	5 ☐ Personal Business
6 ☐ Eat a Meal	6 ☐ Eat a Meal	6 ☐ Eat a Meal	6 ☐ Eat a Meal
7 ☐ Pick Up/Drop Off a Passenger	7 ☐ Pick Up/Drop Off a Passenger	7 ☐ Pick Up/Drop Off a Passenger	7 ☐ Pick-Up/Drop Off a Passenger
8 ☐ Home	8 ☐ Home	8 ☐ Home	8 ☐ Home
MEANS OF TRAVEL	MEANS OF TRAVEL	MEANS OF TRAVEL	MEANS OF TRAVEL
1 ☐ Auto	1 ☐ Auto	1 ☐ Auto	1 ☐ Auto
2 ☐ Bus	2 ☐ Bus	2 ☐ Bus	2 ☐ Bus
3 ☐ Other	3 ☐ Other	3 ☐ Other	3 ☐ Other
AND THEN:	AND THEN:	AND THEN:	AND THEN:
1 ☐ Back to Work	1 ☐ Back to Work	1 ☐ Back to Work	1 ☐ Back to Work
2 ☐ To 2nd Trip	2 ☐ To 3rd Trip	2 ☐ To 4th Trip	2 ☐ To Next Trip (point on back)

J. How many AUTOS, PICKUPS, and VANS are available for use by members of your household? _____ (enter number)

K. What is your OCCUPATION? _____ ☐

L. What is your home ADDRESS?

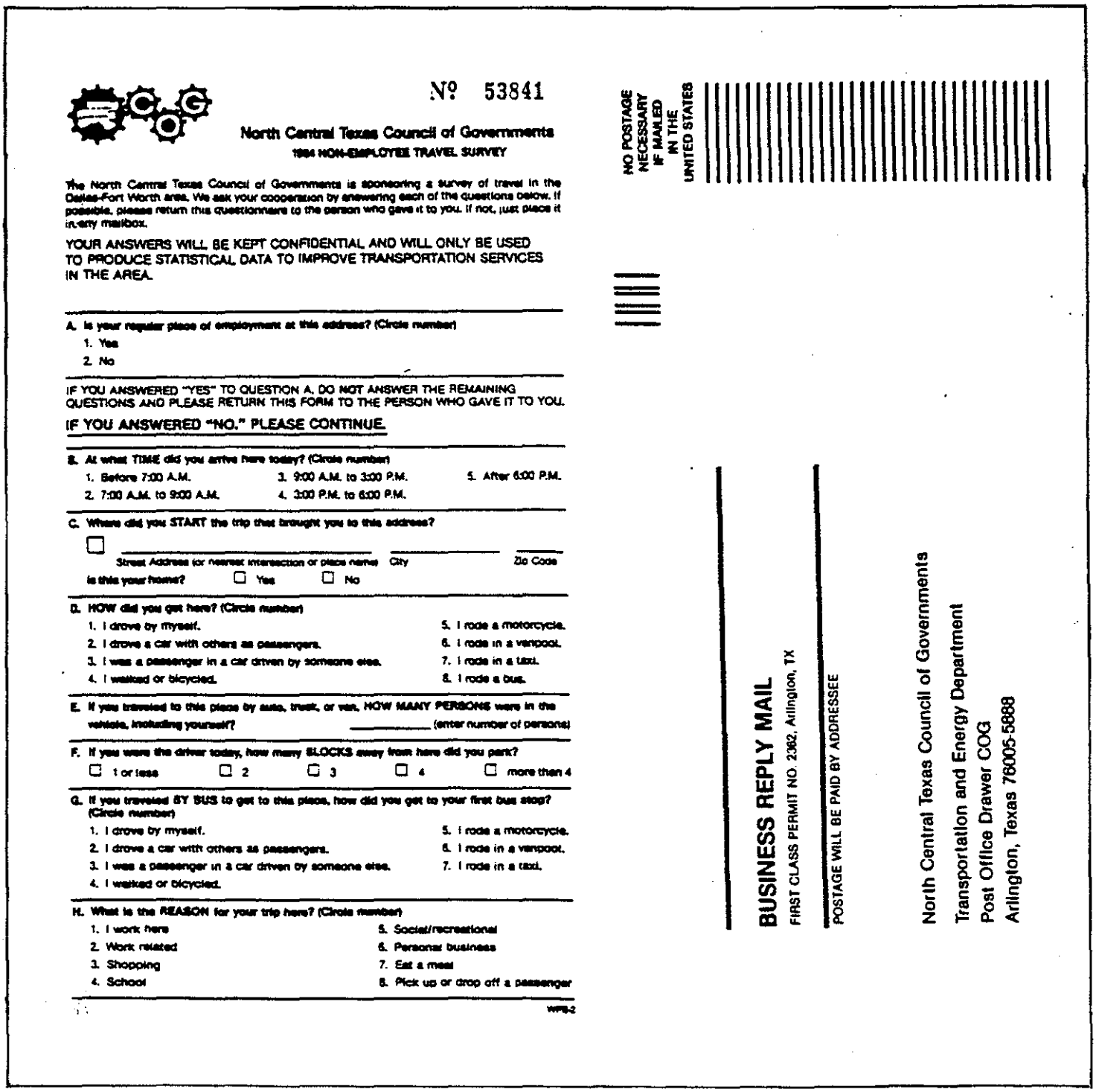
☐ _____ _____ _____

Number and Street City Zip Code

M. What is your annual HOUSEHOLD INCOME? (Circle number)

1. Less than $5,000
2. $ 5,000-$ 9,999
3. $10,000-$14,999
4. $15,000-$19,999
5. $20,000-$24,999
6. $25,000-$29,999
7. $30,000-$34,999
8. $35,000-$39,999
9. $40,000-$50,000
10. More than $50,000

Figure 10. North Central Texas Council of Governments 1984 Employee Travel Survey.



№ 53841

North Central Texas Council of Governments

1984 NON-EMPLOYEE TRAVEL SURVEY

The North Central Texas Council of Governments is sponsoring a survey of travel in the Dallas-Fort Worth area. We ask your cooperation by answering each of the questions below. If possible, please return this questionnaire to the person who gave it to you. If not, just place it in any mailbox.

YOUR ANSWERS WILL BE KEPT CONFIDENTIAL AND WILL ONLY BE USED TO PRODUCE STATISTICAL DATA TO IMPROVE TRANSPORTATION SERVICES IN THE AREA.

A. Is your regular place of employment at this address? (Circle number)
1. Yes
2. No

IF YOU ANSWERED "YES" TO QUESTION A, DO NOT ANSWER THE REMAINING QUESTIONS AND PLEASE RETURN THIS FORM TO THE PERSON WHO GAVE IT TO YOU.

IF YOU ANSWERED "NO," PLEASE CONTINUE.

B. At what TIME did you arrive here today? (Circle number)
1. Before 7:00 A.M.
2. 7:00 A.M. to 9:00 A.M.
3. 9:00 A.M. to 3:00 P.M.
4. 3:00 P.M. to 6:00 P.M.
5. After 6:00 P.M.

C. Where did you START the trip that brought you to this address?

☐ _____ _____ _____
Street Address (or nearest intersection or place name) City Zip Code

Is this your home? ☐ Yes ☐ No

D. HOW did you get here? (Circle number)
1. I drove by myself.
2. I drove a car with others as passengers.
3. I was a passenger in a car driven by someone else.
4. I walked or bicycled.
5. I rode a motorcycle.
6. I rode in a vanpool.
7. I rode in a taxi.
8. I rode a bus.

E. If you traveled to this place by auto, truck, or van, HOW MANY PERSONS were in the vehicle, including yourself? _____ (enter number of persons)

F. If you were the driver today, how many BLOCKS away from here did you park?
☐ 1 or less ☐ 2 ☐ 3 ☐ 4 ☐ more than 4

G. If you traveled BY BUS to get to this place, how did you get to your first bus stop? (Circle number)
1. I drove by myself.
2. I drove a car with others as passengers.
3. I was a passenger in a car driven by someone else.
4. I walked or bicycled.
5. I rode a motorcycle.
6. I rode in a vanpool.
7. I rode in a taxi.

H. What is the REASON for your trip here? (Circle number)
1. I work here
2. Work related
3. Shopping
4. School
5. Social/recreational
6. Personal business
7. Eat a meal
8. Pick up or drop off a passenger

WPB-2

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

BUSINESS REPLY MAIL
FIRST CLASS PERMIT NO. 2362, Arlington, TX

POSTAGE WILL BE PAID BY ADDRESSEE

North Central Texas Council of Governments
Transportation and Energy Department
Post Office Drawer COG
Arlington, Texas 76005-5888

Figure 11. North Central Texas Council of Governments 1984 Nonemployee Travel Survey.

Table 31
Workplace Survey Sample Quotas
1989 Texarkana Travel Survey

Area Type	Business Type			Total
	Basic	Retail	Service	
Central Business District	3	4	3	10
Urban	3	10	9	22
Suburban	2	6	5	13
Total	8	20	17	45

Source: Reference 3

Survey questionnaires for the employees were distributed by the employer, and the employees were to complete the survey and return it to a location at the business where it would be picked up. Nonemployees were interviewed by the consultant staff and at times by the employer's personnel. The following information was obtained in the survey of the employees:

1. Usual time the employee arrived at work.
2. Usual time the employee departed work at the end of the work day.
3. How the employee traveled to work on the survey day. Three choices were indicated; personal vehicle, commercial truck, and other (blank provided).
4. If the employee traveled to work by auto, pick-up, or van, the number of persons also in the vehicle (including employee).
5. Any stops on the way to work and the purpose of each stop. Purposes listed were work related, shopping, school, social/recreation, personal business, eat a meal, and pick-up or drop off a passenger.

There were some exceptions to the general procedure for conducting the employee surveys. At one location due to three different work shifts, the questionnaires were distributed by the consultant staff to workers on each shift as they arrived at work. The employees were asked to complete the survey and return it to their supervisor. Special generators were also allowed several days to complete their employee surveys due to the large number of

employees. The nonemployee survey was conducted by interview. Surveyors interviewed persons outside businesses and/or special generators. The following information was obtained:

1. Time the person arrived at the establishment where the survey was being conducted.
2. The address from where the person was traveling (i.e., where they began the trip).
3. Mode of travel to the establishment.
4. If traveling by auto, truck, or van, how many persons were in the vehicle (including the employee).
5. The purpose of the trip to the establishment.
6. The address or location of where the employee would be going upon leaving the establishment.

In some situations, the surveys were conducted by the businesses themselves; and for large companies with security gate entrances, the surveys were administered by the security guards at the gate. For area colleges, a selected number of students were surveyed as they arrived for or departed from classes. At high schools, campus personnel administered the survey to visitors and the seniors, and drivers education students were surveyed with a nonemployee survey. The procedures and forms used in the special generator surveys were essentially the same as the workplace surveys. Figures 12 and 13 show copies of the survey instruments used in the Texarkana Workplace Survey.

1990-1991 WORKPLACE SURVEYS

Workplace surveys were conducted in each of the five urban areas surveyed in 1990 and 1991. The survey designs were patterned after the survey done in the Dallas-Fort Worth area for each of the five urban areas, San Antonio, Amarillo, Brownsville, Tyler, and Sherman-Denison. The principal differences in the surveys between the urban areas were the number of establishments surveyed and the stratifications used. Tables 32 through 36 show the sample quotas established for each of the five urban areas. It should be noted that the actual number of establishments surveyed varied and did not meet the sample quotas

Texarkana Urban Area Travel Surveys

1989 EMPLOYEE TRAVEL SURVEY

The Texas & Arkansas Highway Departments, in cooperation with the Ark–Tex Council of Governments are sponsoring a survey of travel in the Texarkana area. We ask your cooperation by answering each of the questions below. If possible, please return this questionnaire to the person who gave it to you.

Your answers will be kept confidential and will only be used to produce statistical data needed to improve transportation services in the area.

Thank You for your cooperation!

FOR OFFICE USE ONLY

ST. MICHAEL HOSPITAL
8062
0034

A. At what time do you usually arrive at work? ____:____ A.M. P.M. (write time and circle A.M. or P.M.)

B. Upon completion of your work day at what time do you usually depart your place of work? ____:____ A.M. P.M. (write time and circle A.M. or P.M.)

C. How did you travel to work today? (Circle number)

1. Personal Vehicle 2. Commercial Truck 3. Other _____ (specify)

D. If you traveled to work by auto, pick–up, or van, HOW MANY PERSONS were in the vehicle, including yourself?

_____ (enter number of persons)

E. Did you make any STOPS on your way TO work today? (Check yes or no)

☐ NO, I traveled directly to work

☐ Yes, I made the following stops;

IF YES, please check the purpose for EACH stop

PURPOSE OF STOP	STOP MADE			
	1st Stop	2nd Stop	3rd Stop	4th Stop
Work Related	☐	☐	☐	☐
Shopping	☐	☐	☐	☐
School	☐	☐	☐	☐
Social/Recreational	☐	☐	☐	☐
Personal Business	☐	☐	☐	☐
Eat a meal	☐	☐	☐	☐
Pick–Up or Drop Off a Passenger	☐	☐	☐	☐

1ST ☐
2ND ☐
3RD ☐
4TH ☐

March, 1989

Figure 12. Texarkana Urban Area Travel Surveys, 1989 Employee Travel Survey.

Texarkana Urban Area Travel Surveys

1989 NON-EMPLOYEE TRAVEL SURVEY

The Texas & Arkansas Highway Departments, in cooperation with the Tex-Ark Council of Governments is sponsoring a survey of travel in the Texarkana area. We ask your cooperation by answering each of the questions below. Please return this questionnaire either to the drop boxes provided at survey locations or to the persons who gave it to you.

Your answers will be kept confidential and will only be used to produce statistical data needed to improve transportation services in the area.

Thank You for your cooperation!

FOR OFFICE USE ONLY

Survey Location _____

Name of Establishment: _____

Street Address (or nearest intersection or place name) _____ City _____ Zip Code _____

A. Is your regular place of employment at this address? (Circle number)

1. Yes 2. No

IF YOU ANSWERED "YES" TO QUESTION A. DO NOT ANSWER THE REMAINING QUESTIONS AND PLEASE RETURN THIS FORM TO THE PERSON WHO GAVE IT TO YOU.

IF YOU ANSWERED "NO" PLEASE CONTINUE

B. At what time did you arrive here today? (Circle Number)

_____:_____ A.M. P.M. (write time and circle A.M. or P.M.)

C. Where did you START the trip that brought you to this address?

Street Address (or nearest intersection or place name) _____ City _____ Zip Code _____

Is this your home? ☐ Yes ☐ No

D. How did you get here? (circle number)

1. I drove myself.
2. I drove a car with others as passengers.
3. I was a passenger in a car driven by someone else.
4. I walked or bicycled.
5. I rode a motorcycle
6. I rode in a vanpool
7. I rode in a taxi
8. I drove a commercial truck

E. If you traveled to this place by auto, truck or van, HOW MANY PERSONS were in the vehicle including yourself? _____ (enter number of persons)

F. What is the REASON for your trip here? (circle number)

1. I work here
2. Work related
3. Shopping
4. School
5. Social/recreational
6. Personal Business
7. Eat a Meal
8. Pick up or drop off a passenger
9. Commercial delivery or pick-up

G. What is your next destination? ☐ Home ☐ Other

Figure 13. Texarkana Urban Area Travel Surveys, 1989 Nonemployee Travel Survey.

in many cases. In some of the urban areas (e.g., Brownsville), some of the area types were combined due to the low number of establishments within the stratification cells. Additional information may be found in References 13 through 17 concerning that actual number of establishments surveyed and the results.

Table 32
Workplace Survey Sample Quotas
1990 San Antonio Travel Survey

Area Type	Industry Type			Total
	Retail	Basic	Service	
Central Business District/Urban	31	20	42	93
Urban Residential	15	5	18	38
Suburban Residential/Rural	67	31	53	151
Total	113	56	113	282

Source: Reference 13

Table 33
Workplace Survey Sample Quotas
1990 Amarillo Travel Survey

Area Type	Industry Type			Total
	Retail	Basic	Service	
Central Business District	3	5	9	17
Urban Fringe	24	7	19	50
Urban Residential	18	7	15	40
Suburban	20	12	21	53
Rural	3	3	4	10
Total	68	34	68	170

Source: Reference 14

Table 34
Workplace Survey Sample Quotas
1990 Brownsville Travel Survey

Area Type	Industry Type			Total
	Retail	Basic	Service	
Central Business District	1	1	0	2
Central Business District Fringe	3	0	0	3
Urban	6	3	2	11
Suburban	14	21	12	47
Suburban Fringe	4	2	3	9
Rural	0	1	1	2
Total	28	28	18	74

Source: Reference 15

Table 35
Workplace Survey Sample Quotas
1991 Tyler Travel Survey

Area Type	Industry Type			Total
	Retail	Basic	Service	
Central Business District	19	10	11	40
Suburban	22	31	13	66
Rural	13	36	24	73
Total	54	77	48	179

Source: Reference 16

Table 36
Workplace Survey Sample Quotas
1991 Sherman-Denison Travel Survey

Area Type	Industry Type			Total
	Retail	Basic	Service	
Central Business District/ Central Business District Fringe	63	17	10	90
Urban/Suburban/Suburban Fringe	18	42	14	74
Rural	24	12	17	53
Total	105	71	41	217

Source: Reference 17

In the surveys done in San Antonio, Amarillo, and Brownsville, the workplaces were selected for sampling by use of a weighted systematic sampling procedure. In the other two areas, workplaces were selected through a random sampling of workplaces by employment size, industry, type, and area type. The procedure used ensured a good proportion of small, medium, and large establishments with a geographic representation of the urban area being surveyed. The key issue in the selection of workplaces was that the workplaces were selected randomly and each had an opportunity for being selected.

After being selected, each workplace was contacted and requested to participate in the survey. Those agreeing to participate in the survey were asked additional questions concerning their hours of operation, number of employees (full and part time), whether there were different work shifts at the workplace, information on parking, delivery information, transit information, etc. An example of the form used for recording this information is shown in Figure 14. Each establishment agreeing to participate was assigned a travel day and that was the day the survey was conducted at that location.

Two surveys were done at each establishment agreeing to participate. One was a survey of the employees, and one was a survey of the nonemployees (i.e., visitors, customers, etc.) to the worksite. The employees were asked to complete a travel diary

SAN ANTONIO - BEXAR COUNTY TRAVEL SURVEY

WORKPLACE GENERAL INFORMATION SURVEY FORM

Work Place:
Address:

SIC Code: _____
Serial Zone: _____
Area Type: _____
Employer Type: _____

_____ Name
_____ Street Address
_____ City State Zip Code
_____ Telephone

CEO/Administrator: _____ Name _____ Title _____ Telephone

Personnel Manager: or Other Contact _____ Name _____ Title _____ Telephone

Security Director: _____ Name _____ Title _____ Telephone

Weekday Hours of Operation: _____

Employment Information

Total Employees: (Full and Part-Time) _____

If Shifts: _____ Times _____ Employees (# / shift)

Parking Information

Spaces: _____ Number / Location _____ Number / Location

Cost of Parking: _____ _____

Delivery Information

Loading Docks: _____ Location(s) _____ Location(s)

Delivery Hours: (if restricted) _____ _____

Transit Information

Bus Stops: _____ Location(s) _____ Location(s)

Bus Routes: _____ Numbers / Names _____ Numbers / Names

Layout / Site Plan

Requested: _____ Date Location _____ Date Location

Received: _____ Date Location _____ Date Location

Parsons Brinckerhoff Parsons Brinckerhoff Quade & Douglas, Inc. Engineers • Architects • Planners	*San Antonio-Bexar County Travel Survey*	Figure
	WORKPLACE GENERAL INFORMATION SURVEY FORM	2.06
	Source: Parsons Brinckerhoff Quade & Douglas, Inc., 1990	

Figure 14. San Antonio-Bexar County Travel Survey, Workplace General Information Survey Form.

detailing each trip they made during a specified day. The travel diary was similar to that used in the household surveys. The following information was requested:

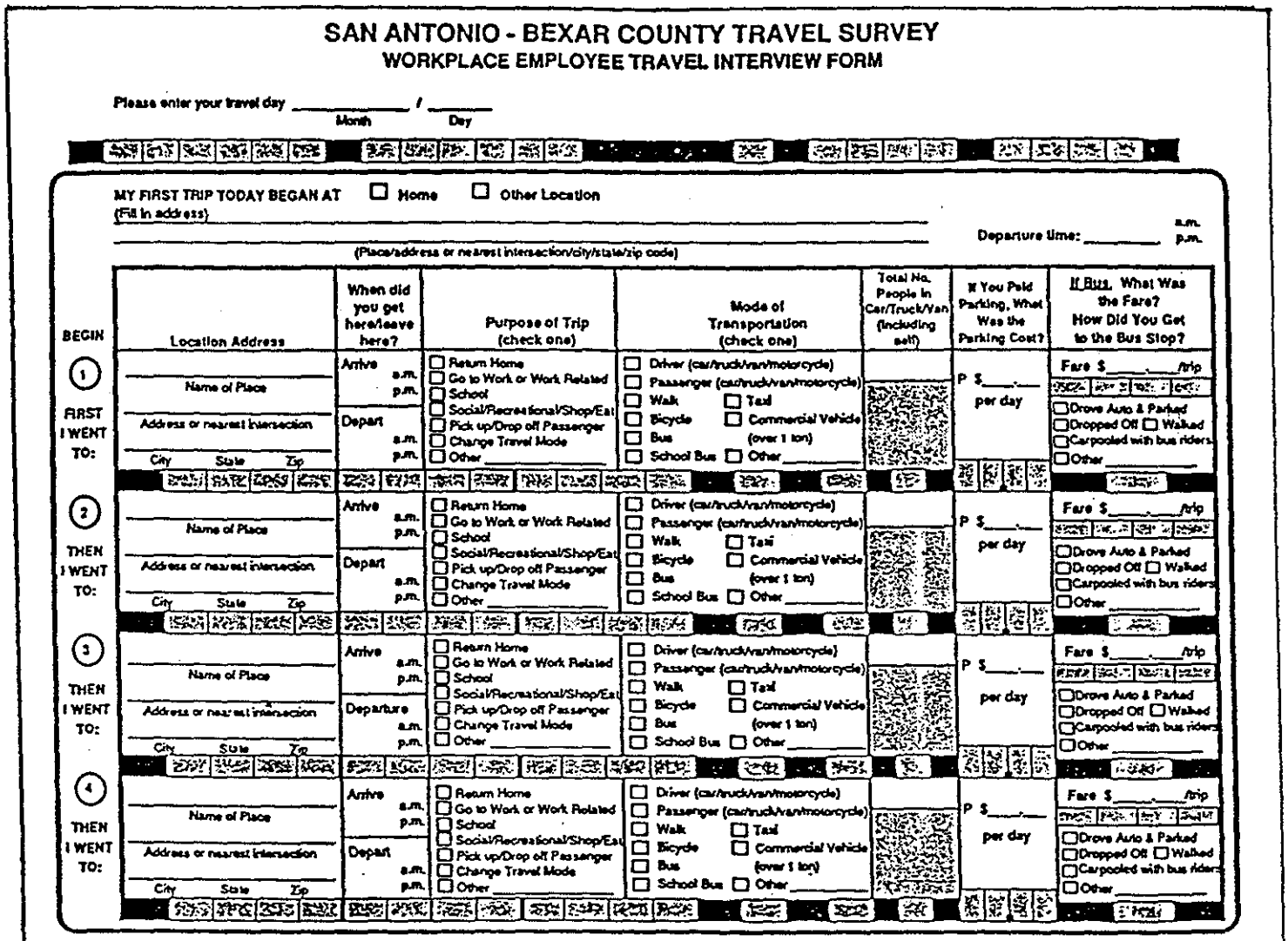
1. The location where they began their first trip on their travel day.
2. The address of each location they traveled to during the day.
3. The time they arrived and the time they departed each location.
4. The purpose of each trip.
5. The mode of travel for the trip and if by car/truck/van/motorcycle, the number of persons in the vehicle (including the driver).
6. The amount paid for parking (if any).
7. If the trip was made by bus, the amount of fare paid and the mode used to access the bus stop.

Figure 15 shows an example of the employee survey instrument used.

The nonemployee (i.e., visitor, customer, etc.) survey was an intercept survey where nonemployees were randomly selected (usually every Nth person) and were interviewed by a trained surveyor. After explaining to the person what they were doing, the first question asked was whether the person worked at that establishment. If not, then the interview would continue and the following information would be requested:

1. If they had traveled from their home or another location to that place.
2. The time they arrived at that location.
3. Their mode of travel to that location.
4. If their mode of travel was auto/truck/van/motorcycle, they were asked the number of persons in the vehicle including the person being interviewed. If their mode of travel was bus, they were asked the amount of fare paid for the trip.
5. Their reason for coming to that establishment (options were given for them to select).
6. When they left that location, if they would be going directly home or to another location.

Figure 16 shows an example of the nonemployee interview form.



SAN ANTONIO - BEXAR COUNTY TRAVEL SURVEY
WORKPLACE EMPLOYEE TRAVEL INTERVIEW FORM

Please enter your travel day ____ / ____ (Month / Day)

MY FIRST TRIP TODAY BEGAN AT ☐ Home ☐ Other Location
(Fill in address)
(Place/address or nearest intersection/city/state/zip code)
Departure time: ____ a.m. p.m.

	Location Address	When did you get here/leave here?	Purpose of Trip (check one)	Mode of Transportation (check one)	Total No. People in Car/Truck/Van (including self)	If You Paid Parking, What Was the Parking Cost?	If Bus, What Was the Fare? How Did You Get to the Bus Stop?
BEGIN ① FIRST I WENT TO:	Name of Place Address or nearest intersection City State Zip	Arrive a.m. p.m. Depart a.m. p.m.	☐ Return Home ☐ Go to Work or Work Related ☐ School ☐ Social/Recreational/Shop/Eat ☐ Pick up/Drop off Passenger ☐ Change Travel Mode ☐ Other	☐ Driver (car/truck/van/motorcycle) ☐ Passenger (car/truck/van/motorcycle) ☐ Walk ☐ Taxi ☐ Bicycle ☐ Commercial Vehicle (over 1 ton) ☐ Bus ☐ School Bus ☐ Other		P $____ per day	Fare $____/trip ☐ Drove Auto & Parked ☐ Dropped Off ☐ Walked ☐ Carpooled with bus riders ☐ Other
② THEN I WENT TO:	Name of Place Address or nearest intersection City State Zip	Arrive a.m. p.m. Depart a.m. p.m.	☐ Return Home ☐ Go to Work or Work Related ☐ School ☐ Social/Recreational/Shop/Eat ☐ Pick up/Drop off Passenger ☐ Change Travel Mode ☐ Other	☐ Driver (car/truck/van/motorcycle) ☐ Passenger (car/truck/van/motorcycle) ☐ Walk ☐ Taxi ☐ Bicycle ☐ Commercial Vehicle (over 1 ton) ☐ Bus ☐ School Bus ☐ Other		P $____ per day	Fare $____/trip ☐ Drove Auto & Parked ☐ Dropped Off ☐ Walked ☐ Carpooled with bus riders ☐ Other
③ THEN I WENT TO:	Name of Place Address or nearest intersection City State Zip	Arrive a.m. p.m. Departure a.m. p.m.	☐ Return Home ☐ Go to Work or Work Related ☐ School ☐ Social/Recreational/Shop/Eat ☐ Pick up/Drop off Passenger ☐ Change Travel Mode ☐ Other	☐ Driver (car/truck/van/motorcycle) ☐ Passenger (car/truck/van/motorcycle) ☐ Walk ☐ Taxi ☐ Bicycle ☐ Commercial Vehicle (over 1 ton) ☐ Bus ☐ School Bus ☐ Other		P $____ per day	Fare $____/trip ☐ Drove Auto & Parked ☐ Dropped Off ☐ Walked ☐ Carpooled with bus riders ☐ Other
④ THEN I WENT TO:	Name of Place Address or nearest intersection City State Zip	Arrive a.m. p.m. Depart a.m. p.m.	☐ Return Home ☐ Go to Work or Work Related ☐ School ☐ Social/Recreational/Shop/Eat ☐ Pick up/Drop off Passenger ☐ Change Travel Mode ☐ Other	☐ Driver (car/truck/van/motorcycle) ☐ Passenger (car/truck/van/motorcycle) ☐ Walk ☐ Taxi ☐ Bicycle ☐ Commercial Vehicle (over 1 ton) ☐ Bus ☐ School Bus ☐ Other		P $____ per day	Fare $____/trip ☐ Drove Auto & Parked ☐ Dropped Off ☐ Walked ☐ Carpooled with bus riders ☐ Other

Parsons Brinckerhoff Parsons Brinckerhoff Quade & Douglas, Inc. Engineers • Architects • Planners	*San Antonio-Bexar County Travel Survey*	Figure
	WORKPLACE EMPLOYEE TRAVEL INTERVIEW FORM	2.04
	Source: Parsons Brinckerhoff Quade & Douglas, Inc., 1990	

Figure 15. San Antonio-Bexar County 1990 Travel Survey, Workplace Employee Travel Interview Form.

SAN ANTONIO - BEXAR COUNTY TRAVEL SURVEY
WORKPLACE NONEMPLOYEE TRAVEL INTERVIEW FORM

Date
Zone
Employer #
Area Type
Interviewer

Date: _____ Location: _____

"Hello, my name is _____. I am conducting a travel survey for the San Antonio - Bexar County Metropolitan Planning Organization. Will you give me a few minutes of your time?"

Thank you for your time !

QUESTIONS:	Person # 1	Person # 2	Person # 3	Person # 4	Person # 5	Person # 6
1. Do you work in this building? a. Yes – stop interview b. No – continue questionnaire	1) Yes 2) No	1) Yes 2) No	1) Yes 2) No	1) Yes 2) No	1) Yes 2) No	1) Yes 2) No
2. Did you travel straight from your home or from another location to get here today?	1) Home 2) Other	1) Home 2) Other	1) Home 2) Other	1) Home 2) Other	1) Home 2) Other	1) Home 2) Other
3. What approximate time did you arrive at this location today?						
4 How did you arrive here today? (choose from options below)						
a. If car/truck/van, ask: How many persons including yourself were in the vehicle? b. If bus, ask: What fare did you pay?	# People / Fare $__.__	# People / Fare $__.__	# People / Fare $__.__	# People / Fare $__.__	# People / Fare $__.__	# People / Fare $__.__
5. What is your reason for coming here today? (choose from options below)	No. / Other	No. / Other	No. / Other	No. / Other	No. / Other	No. / Other
6. When you leave here, are you going immediately home?	1) Yes 2) No	1) Yes 2) No	1) Yes 2) No	1) Yes 2) No	1) Yes 2) No	1) Yes 2) No

Interviewer Notes:

Initials: _____

Transportation Mode Options:

1) Driver (car/truck/van/motorcycle)
2) Passenger (car/truck/van/motorcycle)
3) Walk
4) Bicycle
5) Bus
6) Taxi
7) School bus
8) Commercial vehicle (over 1 ton)
9) Other _____

Trip Purpose Options:

1) Work related
2) School
3) Social / recreational
4) Delivery
5) Other (specify in block)

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Parsons Brinckerhoff Quade & Douglas, Inc.
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San Antonio-Bexar County Travel Survey

WORKPLACE NONEMPLOYEE TRAVEL INTERVIEW FORM

Source: Parsons Brinckerhoff Quade & Douglas, Inc., 1990

Figure 2.05

Figure 16. San Antonio-Bexar County 1990 Travel Survey, Workplace Nonemployee Travel Interview Form.

In addition to the employee and nonemployee surveys, vehicle and/or person counts were made at each establishment to provide a basis for the expansion of the survey data. These counts were either made for a 24-hour period or during the period of time the establishment was open (this time was usually extended to cover likely arrivals before and after the establishment opened and closed).

The workplace surveys done in each of the five urban areas used essentially the same forms and procedures. For that reason, the discussion presented here has not delineated any particular urban area and may be assumed applicable to all five urban areas.

EVALUATION

The objective of a workplace survey is to obtain information on trip generation characteristics of employees and the number of trip ends occurring at workplaces due to nonemployees. This information is used to develop attraction rates for the travel demand modeling process. These rates should be accurate enough to estimate the total attractions by trip purpose within a reasonable level of the estimate of total productions. The evaluation as discussed in this report is directed at the workplace surveys done in 1990 and 1991. These were analyzed as a part of this project whereas the prior two workplace surveys had been implemented and evaluated under the contracting agencies involved. The surveys done in 1990 and 1991 were consistent and accomplished under similar survey designs. Four areas were evaluated, sample size, sample selection, data collection methodology, and data specifications. These are discussed in the following sections of this report.

Sample Size

The unique nature and complexity of workplace surveys pose an interesting challenge to the estimation of the proper sample size to achieve some statistical level of accuracy. Attraction rates as used in Texas are typically stratified by area type and employment type. Five area types are most widely used but these have varied from a low of three types to as many as six types. They are defined in accordance with a measure of the population and employment density within a zone. The more dense areas such as the central business district are expected to have different attractions than less dense areas such as suburban

areas. The employment types typically used are retail, basic, and service with each being defined as including specific standard industrial code classifications of industries. The typical stratification of attraction rates used is five categories of area type and three categories of employment type. The challenge in estimating the number of establishments in each cell of the stratification matrix that will produce statistically reliable attraction rates for modeling.

In the workplace surveys done in 1990 and 1991 (as well as the prior surveys), the sampling unit was a business establishment. In effect, the unit represented a cluster sample of employees and nonemployees. Within the unit, independent surveys are done, one for the employees and one for the nonemployees, with the results from each being combined to represent the total attractions for the establishment. Attraction rates are computed by dividing the total attractions to the establishment by the total employment at the establishment. It is important to note that the total employment for an establishment is not necessarily the same value as the number of employees at work on the day of the survey. Thus the estimated attraction rate includes a measure of absenteeism for the establishments surveyed.

From a statistical view, several measures of variance may be computed. The first would be the variance of employee attractions between employees in the same levels of stratification. A second measure could be the variance in the employee attractions per employee between establishments in the same stratification levels. A third measure could be the variance in the number of nonemployee attractions per employee between establishments in the same stratification level. A fourth measure could be simply the variance in the total attractions per employee between establishments in the same stratification level. Each of these measures could produce different sampling requirements to achieve certain levels of accuracy.

The sample sizes established for the five urban areas surveyed in 1990 and 1991 varied between the areas. In San Antonio, the stratified sample sizes were developed using data from the workplace survey in the Dallas-Fort Worth area. In Brownsville and Amarillo, a maximum number of workplaces was agreed upon between the consultant and the contracting agencies. In Tyler and Sherman-Denison, the stratified sample sizes were

estimated using statistical data from the Texarkana workplace survey. The level of accuracy that had been established for the workplace surveys was $\pm$12 percent with a confidence level of 90 percent.

An evaluation of the attraction rates developed from the survey results revealed that the desired level of accuracy was not met in any of the five urban areas surveyed. Subsequent evaluation indicated that the reason was not necessarily the sample size as much as the methodology employed in the surveys. This is discussed in the section on data collection methodology. In terms of future workplace surveys, a need still exists for a reasonable method of establishing sampling requirements. A method is proposed in the recommendation section of this chapter.

Sample Selection

The methodology used for selecting the sample of workplaces in each of the five urban areas is considered reasonable from a statistical standpoint. There are two concerns: one that each workplace has a non-zero probability of being selected and second that the selection method is not biased toward large or small size establishments. In each of the urban areas, it appeared that these concerns were addressed. Table 37 shows the range and median size of the establishments surveyed in each employment category for the five urban areas. These data are not shown broken down by area type due to the small sample size in many of the cells which could be misinterpreted. It is of interest to note that the selection methodology used in San Antonio, Amarillo, and Brownsville appeared to achieve a wider range of different sized establishments. This is indicated by the larger median size of establishments surveyed in those three urban areas as compared with those surveyed in Tyler and Sherman-Denison.

Data Collection Methodology

As previously discussed, the data collection methodology used in the workplace surveys in 1990 and 1991 were essentially the same. Each workplace was surveyed in the same manner. After analyzing the attraction rates developed from the surveys, it appeared

Table 37
Average and Range of Size
Establishments Surveyed
1990-1991 Workplace Surveys

Urban Area	Type Employment	Number Establishments	Size of Establishments Surveyed		
			Low	High	Median
San Antonio	Basic	36	6	1000	65
	Retail	71	1	200	25
	Service	62	2	300	60
Amarillo	Basic	26	2	766	22
	Retail	67	2	276	23
	Service	61	1	408	25
Brownsville	Basic	17	3	750	22
	Retail	28	3	125	25
	Service	29	1	200	23
Tyler	Basic	41	2	150	10
	Retail	47	1	170	10
	Service	48	2	200	6
Sherman-Denison	Basic	45	2	700	8
	Retail	65	1	150	7
	Service	37	1	170	7

a significant imbalance existed between the trip production rates from the household survey and the trip attraction rates from the workplace surveys. When applied, the total attractions tended to exceed the total productions by as much as two to three times. This implied that an error existed in the survey, since these differences were not considered to be reasonable. Further review and intuitive reasoning led to the conclusion that the survey methodology used in the workplace surveys was theoretically flawed. In essence, it was reasoned that any survey method used should produce an accurate estimate of the variable being surveyed if

the survey were conducted at every workplace (i.e., if a 100 percent survey were done). In the case of the workplace surveys in 1990 and 1991, this was reasoned not to be the case. If every workplace had been surveyed, the number of attractions from the survey would exceed substantially the number of productions due to double counting that would occur at activity centers containing multiple establishments where significant walk trips would occur between the different establishments in the activity centers. On the production end of the trip (i.e., the household), generally only one trip would be recorded to an activity center because walk trips were not included in the trip production rates. At the activity center, an individual could visit multiple establishments and, if each were surveyed, that individual would be counted/surveyed at every establishments. This would result in one production and multiple attractions. Thus the basic methodology was considered theoretically flawed and inconsistent with the development of trip production rates. A revised methodology is presented in the recommendations for future workplace surveys.

Data Specifications

The data collected in the 1990 and 1991 workplace surveys were found to be adequate for the development of trip attraction rates. The problem was not the data being collected as much as the methodology being used. There were some areas where the data being collected were unclear and clarifications were needed. One of these areas was the employee survey. As previously discussed, employees were asked to provide information on their household and record all of their trips for a selected survey day in a travel diary. This was essentially the same information being requested in the household survey. In analyzing the trips made by each employee, the only trips actually used in developing attraction rates were those that had one end (beginning or ending) at the place of employment. In a number of cases, it was not possible to distinguish work-related trips that occurred away from the place of employment from those that occurred at the place of employment. In addition, the trip purposes indicated on the travel diary for both the household and workplace surveys should be consistent. With the exception of clarifying trips beginning or ending at the workplace location and maintaining consistency with the household survey

instruments and expanding the survey instrument to collect data for use in air quality modeling, few changes were felt necessary for the employee survey instrument.

The nonemployee survey instruments were also felt to be adequate for the most part. Some improvements were felt to be warranted to clarify information and to address data requirements for air quality modeling. Other modifications to the data specifications were made in conjunction with modifications to the methodology of collecting the data. These are discussed in the recommendations section of this chapter.

RECOMMENDATIONS

The development of an adequate survey design requires a clear delineation of the survey objectives with an understanding of the desired survey result. While there is no guarantee that the final survey design will produce the desired results and accomplish the objectives, a clear understanding of what is desired has a greater probability of success.

The objective of a workplace survey is to obtain information on trip generation characteristics of employees and the number of trip ends occurring at workplaces due to nonemployees. This information will be used to develop attraction rates for use in the travel demand modeling process. These rates should be accurate enough to estimate the total attractions by trip purpose within a reasonable level of the estimate of total productions. To achieve this objective, a series of intermediate objectives is defined to address the different aspects of the workplace survey and the components of information needed.

The first aspect considered is stratifying the attraction rates. The variables used for stratifying attraction rates are employment type and area type in the current trip generation models used in Texas. One concern is the number of area types used and the grouping of employment types. An additional consideration is that the information obtained from a workplace survey should be sufficient to allow for development of alternative models for estimating attraction rates and/or total attractions.

The initial objective is to obtain information for developing attraction trip rates stratified by employment type and area type for each trip purpose. It is assumed here and throughout that the trip purposes being used are home based work, home based non-work,

non-home based, and truck-taxi. There may be some need or justification for the use of other trip purposes. The survey design, as proposed, will obtain the information to delineate rates for some additional trip purposes.

The second aspect to address is the type/location of workplaces to be surveyed. In this case, type refers to freestanding and non-freestanding. The objective is to attempt to survey these in some proportion to the population mix. Unfortunately, this information is not likely to be available; and the survey design will have to have a provision for determining this information. It is also likely that the mix will not be the same for workplaces located in different area types. In fact, a reasonable argument may be made for this being one of the primary reasons for attraction rates being different between area types. A minimum acceptable condition in the survey design would be that a reasonable mix of the two types be included in the survey.

The third concern is that three independent data collection efforts are required. One survey must deal with employees, one must deal with nonemployees, and a third effort must obtain the total number of vehicles and/or persons arriving and departing the workplace during its hours of operation. The survey design will be similar for freestanding and non-freestanding workplaces but some additional information will be required for non-freestanding workplaces. The objective is to design the survey such that the necessary information to develop reasonable estimates of attraction rates will be obtained for both freestanding and non-freestanding workplaces.

There are several issues/areas that must be considered to ensure that the survey as designed will accomplish the intended result. Some of the issues identified are:

- The survey of employees deals primarily with two trip purposes: home based work and non-home based.
- The survey of nonemployees primarily yields information on the purpose of the trip (i.e., home based non-work or non-home based), the vehicle occupancy, and the mode of travel.
- The survey must include 24-hour vehicle counts for use as a consistent base to expand the survey data. Where it is not possible to obtain 24-hour vehicle

counts, it will be necessary to count all persons entering and exiting the workplace/center.

- Two types of information must be obtained: the total number of employees at the site and the number of employees present at the site on the day of the survey.
- The size of the sample will depend on the number of employees that must be surveyed to achieve a reasonable estimate of employee attractions.

The recommended survey design for accomplishing a workplace survey is a multi-faceted process of gathering information which may be used to develop reasonable estimates of attraction rates stratified by employment type and area type. The most variable aspect is that which deals with area type; since the process of designating zones by area type is not standardized, and these may be significantly different between urban areas. The assumption is made that the process for defining the area type for zones is non-regimented and may be based strictly on professional judgment. The major concern in this aspect is that a reasonably good estimate of the mix of freestanding and non-freestanding workplaces be obtained by area type.

The proposed survey design has several aspects, each of which may be considered an independent effort which obtains information that feeds into the final product. These are described and discussed in the following sections.

Sample Size and Selection Procedure

Computing the desired sample size and selecting the workplaces to be surveyed may be accomplished by following these steps:

1. Obtain the listing of all employers in the urban area from the Texas Employment Commission (TEC). Include in the listing the Standard Industrial Classification (SIC) code and the total employment for each employer.
2. Group the employers into three categories: basic (SIC codes 1000 through 5199), retail (SIC codes 5200 through 5999), and service (SIC codes 6000 through 9799).

3. Remove those workplaces and/or employers which are classified as "special generators" from the list.

4. Rank (i.e., sort) and list the remaining employers in each group from largest to smallest. Develop a table containing the following columns of information:

   - Assign a sequential number to each firm in order of its size, i.e., the largest employer would be assigned the number 1, the next largest firm the number 2 and so on, and place in column 1.

   - Place the employment for each firm in column 2.

   - Compute the cumulative number of employees and place in column 3.

   - Assign beginning and ending numbers to the employees at each firm based on the cumulative number of employees, and place in columns 4 and 5 (see Table 37).

5. Select a 5 percent random sample of employers from the listing for each employment type. For example, if an area has 1,500 basic employers, a 5 percent sample would be 75. Select the employers using a weighted systematic sampling procedure as follows:

   - Divide the total employment for each type of employment by the number of employers desired in the sample. For example, if five basic employers are desired in the sample and the total basic employment is 5,600, the result of this division would be 1,120.

   - Select a random number between 1 and the value from the previous computation. For the example shown, this would be a number between 1 and 1,120. Select this number using a random number generator or a table of random digits found in most statistical texts. Assume for the example being used that the random number picked was 649.

   - Using the table developed in Step 4, the first firm picked in the sample is the firm with employee number 649 found by scanning columns 4 and 5 (see Table 37).

   - The second firm picked is the firm with employee number 649 + 1,120 = 1,769 found by scanning columns 4 and 5 again.

- The third firm picked is the firm with employee number 1,769 + 1,120 = 2,889 found by again scanning columns 4 and 5.

- This process is repeated until all five firms have been selected. An example of this is shown in Table 37.

6. One of the difficulties encountered with TEC information in the past has been employers with one central address and multiple workplaces scattered throughout an urban area. There is no way to avoid this, and one of these may be selected in the random selection process. When this occurs, the following steps should be taken:

   - Contact the central office, explain what you are doing (i.e., the entire survey, etc.) and request a listing of all their workplaces, the employment at each, the address of each, and the total employment at the central office (this information will not be necessary if the central office is located at another city or urban area).

   - If the central office will not provide the information, compile a list of the workplaces and addresses manually using the telephone book or secondary information (e.g., chamber of commerce, criss-cross directory, etc.). Employment for each site will be estimated as the average site employment for the employer (i.e., total employment from TEC divided by the number of workplaces found).

   - Assign each workplace for the employer a sequential number beginning with 1.

   - Randomly select a 5 percent sample of the workplaces. For example, if an employer has 50 workplaces, these are numbered between 1 and 50. A 5 percent sample would be 2.5 (rounded to 3). Pick three random numbers between 1 and 50 using a random number generator or a table of random digits. Include the workplaces with those numbers in the sample of employers.

   - List the workplaces with their SIC code, estimated employment, and address with the other employers from Step 5.

7. Once the sample employers/workplaces have been selected, use the addresses to determine the zone and area type in which they are located. Conduct a visual observation of each workplace to determine if it is freestanding or non-freestanding in accordance with the following definitions:

- Freestanding Workplace: A workplace where the points of vehicle access can clearly be established and those points of vehicle access are designed to serve that workplace only. Examples might include a restaurant, a service station, or a convenience type grocery store where the points of vehicle access and parking are clearly defined as being for that establishment only.
- Non-Freestanding Workplace: A workplace located in an area where the vehicle access points and parking are designed to serve more than just that establishment. An example would be a grocery store located in a community shopping center.

8. Sum the number of employers/workplaces and the estimated employment by workplace type (i.e., freestanding or non-freestanding) for each area type and employment type. Compute the percentage of freestanding and non-freestanding workplaces and employment for each area type and employment type and save for use later. This information will not be needed for the sample selection. Develop two tables; one containing the number (from the sample) of employers/workplaces in each area type for each employment type and one containing the number (from the sample) of employees in each area type for each type of employment. Examples of each are shown in Tables 38 and 39 for San Antonio.
9. Using the information from Step 8, compute the average number of employees per workplace. Table 40 presents an example of these values for San Antonio based on the values in Tables 38 and 39.

Table 38
Example of Selecting Firms Using
Weighted Systematic Sampling Technique

Firm	No. of Employees	Cumulative No. of Employees	Numbering of Employees		Selected Firms
			Low	High	
1	1,650	1,650	1	1,650	X
2	1,200	2,850	1,651	2,850	X
3	725	3,575	2,851	3,575	X
4	530	4,105	3,576	4,105	
5	412	4,517	4,106	4,517	X
6	350	4,867	4,518	4,867	
7	285	5,152	4,868	5,152	X
8	250	5,402	5,153	5,402	
9	134	5,536	5,403	5,536	
10	64	5,600	5,537	5,600	

Number of firms to be selected: 5
Total employees per selected firms: 1,120
Random number between 1 and 1,120: 649

Selected Sample by Employee No.	Firm	Number of Employees
649	1	1,650
1,769	2	1,200
2,889	3	725
4,009	5	412
5,129	7	285
		4,272 (Total)

Table 39
Distribution of a 5 Percent Sample of Employers/Workplaces in San Antonio-Bexar County

Employment Type	Area Type					Totals
	1	2	3	4	5	
Basic	7	13	12	19	3	54
Retail	4	20	16	53	5	98
Service	10	24	25	39	9	107
Totals	21	57	53	111	17	259

Table 40
Total Employment for a 5 Percent Sample of Employers/Workplaces in San Antonio-Bexar County

Employment Type	Area Type					Totals
	1	2	3	4	5	
Basic	2,254	1,047	777	1,873	790	6,741
Retail	51	867	589	1,379	407	3,293
Service	589	1,329	2,194	1,960	456	6,528
Totals	2,894	3,243	3,560	5,212	1,653	16,562

Table 41
Average Employment per Workplace for a 5 Percent Sample of Employers/Workplaces in San Antonio-Bexar County

Employment Type	Area Type					Totals
	1	2	3	4	5	
Basic	322.00	80.54	64.75	98.58	263.33	124.83
Retail	12.75	43.35	36.81	26.02	81.40	33.60
Service	58.90	55.38	87.76	50.26	50.67	61.01
Totals	137.81	56.89	67.17	46.95	97.24	63.95

10. Using information from Step 8, compute the percentage of workplaces and employees in each area type for each employment type. Tables 41 and 42 present examples of these for the values shown in Tables 38 and 39.

11. As a result of the analysis of the workplace surveys done in 1990-91, the recommended sampling rates for employees are shown in Table 43. The values in Table 43 are in terms of percentages and are different for large urban areas (with > 200,000 population) versus small urban areas (with ≤ 200,000 population).

Table 42
Estimated Percentage Distribution of Employers/Workplaces
By Employment Type in San Antonio-Bexar County

Employment Type	Area Type					Totals
	1	2	3	4	5	
Basic	12.96	24.07	22.22	35.19	5.56	100.00
Retail	4.08	20.41	16.33	54.08	5.10	100.00
Service	9.35	22.43	23.36	36.45	8.41	100.00
Totals	8.11	22.01	20.46	42.86	6.56	100.00

Table 43
Estimated Percentage Distribution of Employees
By Employment Type in San Antonio-Bexar County

Employment Type	Area Type					Totals
	1	2	3	4	5	
Basic	33.44	15.53	11.53	27.78	11.72	100.00
Retail	1.55	26.33	17.89	41.87	12.36	100.00
Service	9.02	20.36	33.61	30.02	6.99	100.00
Totals	17.47	19.58	21.50	31.47	9.98	100.00

Table 44
Recommended Percentage of Employees
To Be Surveyed in Workplace Surveys

Employment Type	Sampling Percentage Urban Areas > 200,000 Population	Sampling Percentage Urban Areas ≤ 200,000 Population
Basic	3.0	10.0
Retail	5.0	15.0
Service	1.0	5.0

12. Compute the number of employees to be sampled in the urban area by applying the appropriate sampling rate to the total employment (by type). An example is shown in Table 44 using values for the San Antonio-Bexar County area.

Table 45
Sample Sizes Required for San Antonio
(Example)

Employment Type	Total Employment	Sampling Percentage	Employees to be Surveyed
Basic	114,900	3.0	3,447
Retail	106,800	5.0	5,340
Service	301,800	1.0	3,018

13. Distribute the number of employees to be sampled by area type based on the percent distribution of employees observed and computed in Step 10. Table 6 illustrates an example distribution and was used to compute the example values shown in Table 45.

Table 46
Number of Employees to Be Sampled by Area Type
In San Antonio-Bexar County

Employment Type	Area Type					Totals
	1	2	3	4	5	
Basic	1,153	535	397	958	404	3,447
Retail	83	1,406	955	2,236	660	5,340
Service	272	615	1,014	906	211	3,018
Totals	1,508	2,556	2,366	4,100	1,275	11,805

14. The number of employees to be sampled (computed in Step 13) is the minimum number desired. Compute an estimate of the number of workplaces to be sampled by dividing the number of employees (by area type and employment type) by the average number of employees per workplace as computed in Step 9 (see Table 40). Using the values shown in Table 40 and those from Table 45, the number of workplaces to be selected is shown in Table 46. Note that the values are rounded up in all cases.

15. The values from Step 14 compose the second minimum criteria which must be met in the selection of workplaces to be surveyed. If, however, the number of sites to be selected is less than 10, set the minimum number to 10. In some cases, this may mean sampling all of the workplaces of an employment type within a particular area type.

Table 47
Estimated Number of Workplaces to Be Sampled
In San Antonio-Bexar County

Employment Type	Area Type					Totals
	1	2	3	4	5	
Basic	4	7	7	10	2	30
Retail	7	33	26	86	9	161
Service	5	12	12	19	5	53
Totals	16	52	45	115	16	244

16. There are two minimum criteria for selecting the number of workplaces to be surveyed: the number of employees and the number of workplaces (i.e., sites). It is recommended that both be met. To avoid the possibility of over-sampling, a maximum number of sample sites of 50 is also recommended. This means that if 50 workplaces are selected without meeting the minimum number of employees (to be sampled), the quota for that cell would be met; and no more samples would be drawn for it. Table 47 shows the values that would be used in the example from Tables 45 and 46.

17. The actual workplaces to be surveyed may now be selected. Use the method described in Step 5 except that the number of workplaces to be surveyed for each employment type will be the values obtained from Steps 15 and 16. In the example shown, the number of workplaces would be those shown in the "Totals" column in Table 47, i.e., 50 basic workplaces, 128 retail workplaces, etc. To reduce the possibility of fulfilling the sample size requirement before making a complete pass through all employers (one replicate), select the workplaces in 10 replicates. For example, in the first computation, the total basic employment would be divided by the desired number of basic workplaces, divided by ten. In the example above, this would be 5, and five workplaces would be selected in each replicate. The selection process is described in Step 5.

Table 48
Minimum Sample Sizes for Workplace Survey
In San Antonio-Bexar County

Employment Type	Sampling Unit	Area Type					Totals
		1	2	3	4	5	
Basic	Employees	1,153	535	397	958	404	3,447
	Workplaces	10	10	10	10	10	50
Retail	Employees	83	1,406	955	2,236	660	5,340
	Workplaces	10	33	26	50	10	128
Service	Employees	272	615	1,014	906	211	3,018
	Workplaces	10	12	12	19	10	63
Totals	Employees	1,508	2,556	2,366	4,100	1,275	11,805
	Workplaces	30	55	48	79	30	242

18. As workplaces (or employers) are selected, geo-code them to determine the area type within which the workplace is located. Then use the criteria previously established to determine when a sufficient number of workplaces for each employment type have been selected for each area type. The decision hierarchy for each area type is as follows:

a. Have the minimum number of employees to be surveyed been met? If yes, go to *b*. If no, go to *c*.

b. Have at least 10 workplaces been selected to be surveyed? If no, continue to select workplaces for that area type and employment type to be surveyed. If yes, go to *d*.

c. Have at least 50 workplaces been selected to be surveyed in that area type and employment type? If yes, the quota for that area type and employment type have been satisfied. If no, go to *d*.

d. Have the minimum number of workplaces to be surveyed been met? If yes, the quota for that area type and employment type have been

satisfied. If no, continue to select workplaces for that area type and employment type.

19. Contact the employers and determine if they will participate in the survey. If the employer refuses, replace the workplace using the same random sample selection process.

20. The final step(s) is the implementation of the survey.

It is recommended that the sample calculation and selection process be done by TxDOT or the MPO for the area being surveyed.

Data Collection Methodology and Specification

The actual survey implementation is done in a manner very similar to the way it was done in the 1990-91 surveys. The only real difference is the way non-freestanding workplaces are treated. No mention is made of the solicitation procedure because the same procedure as employed previously will be used. Those firms not agreeing to participate will be replaced through the same selection process. The procedure for surveying freestanding workplaces will differ slightly from that for non-freestanding workplaces.

Freestanding Workplaces

The survey of freestanding workplaces will involve four primary data collection efforts. The first is the employee survey, the second is the nonemployee survey, the third is the employer survey, and the fourth is the data collection effort to obtain the vehicle and/or person arrivals and departures to the workplace during its hours of operation.

Employee Survey

On the survey day, employees will use a self-administered survey form to provide trip information. The recommended survey form is shown in Figures 17 and 18. The same procedures as used in the 1990-91 surveys will be followed.

Record Types 1, 2, and 3

TRAVEL SURVEY
PART 1: HOUSEHOLD INFORMATION

10/01/93

Sample # _____

Thank you for agreeing to participate in this important travel survey. If you have any questions, please call _____.

(1) A. Is this your correct mailing address? ☐ Yes ☐ No If not, please enter the correct information.

_____

_____

_____

B. Is your residence: ☐ Single family detached
☐ Multi-unit (apartment/condo/townhouse)

C. How many people live at this address?_____

D. How many people who live at this address are five years or older?_____

E. How many people visited your residence on this day who do not live there? _____

F. How many people in your household are employed?_____

G. How many vehicles (cars, vans, light trucks, and motorcycles) are available for use by members of your household?_____

(2) Please assign a "Person Number" to each person residing in your household who is five years or older, starting with "Person Number 1" as the designated head of the household. (Fill in appropriate question boxes for each person.)

Person Number	Sex M/F	Age	Licensed Driver? (circle one)	Relation to Person No. 1 (check box) 2 Spouse	3 Child	4 Relative	5 Not Related	Employed? (circle one)	Did He/She Travel on the "Travel Day"? (circle one)
Head of House			1) Yes 2) No	☐	☐	☐	☐	1) Yes 2) No	1) Yes 2) No
2			1) Yes 2) No	☐	☐	☐	☐	1) Yes 2) No	1) Yes 2) No
3			1) Yes 2) No	☐	☐	☐	☐	1) Yes 2) No	1) Yes 2) No
4			1) Yes 2) No	☐	☐	☐	☐	1) Yes 2) No	1) Yes 2) No
5			1) Yes 2) No	☐	☐	☐	☐	1) Yes 2) No	1) Yes 2) No
6			1) Yes 2) No	☐	☐	☐	☐	1) Yes 2) No	1) Yes 2) No
7			1) Yes 2) No	☐	☐	☐	☐	1) Yes 2) No	1) Yes 2) No
8			1) Yes 2) No	☐	☐	☐	☐	1) Yes 2) No	1) Yes 2) No
9			1) Yes 2) No	☐	☐	☐	☐	1) Yes 2) No	1) Yes 2) No
10			1) Yes 2) No	☐	☐	☐	☐	1) Yes 2) No	1) Yes 2) No

(3) Please list all vehicles available to your household (including company cars, rental cars, motorcycles, etc.) and complete the following:

Vehicle Number	Year	Make	Model	Circle One	Odometer Readings On Travel Day Beginning	Ending
1				Diesel Gas		
2				Diesel Gas		
3				Diesel Gas		
4				Diesel Gas		
5				Diesel Gas		

(4) If you add up the annual income of all household members, into what range does it fall? (check one)

1) ☐ Less than $5,000
2) ☐ $5,000 to $9,999
3) ☐ $10,000 to $14,999
4) ☐ $15,000 to $19,999
5) ☐ $20,000 to $24,999
6) ☐ $25,000 to $29,999
7) ☐ $30,000 to $34,999
8) ☐ $35,000 to $39,999
9) ☐ $40,000 to $49,999
10) ☐ $50,000 or more

This completes the household information needed. Please proceed to Section 2 of this survey.

Thank you for your cooperation!

Figure 17. Workplace Employee Travel Survey, Part 1: Household Information.

Record Type 7

WORKPLACE EMPLOYEE TRAVEL SURVEY

PART 2: TRIP INFORMATION

10/01/03

SITE #: _____

SAMPLE #: _____

BEGIN: MY FIRST TRIP TODAY BEGAN AT: ☐ (1) Home ☐ (9) Other Location

_____
(Fill in address)

_____
(Place/address or nearest intersection) (city/state/zip code)

PLEASE ENTER YOUR:

TRAVEL DAY: _____

DEPARTURE TIME: _____ a.m. p.m.

	Location Address	When did you get here/leave here?	Purpose of Trip (check one)	Mode of Transportation (check one)	Total number of people in car/truck/van (including driver)	If Driver, what vehicle was used? (make/model)	If Bus, what was the fare? How did you get to the bus stop?
① FIRST I WENT TO:	Name of Place Address or nearest intersection City/State/Zip Do you normally work at or out of this location? ☐ Yes ☐ No	Arrive a.m. p.m. Depart a.m. p.m.	☐ (1) Return Home ☐ (2) Go to Work ☐ (3) Work Related ☐ (4) School ☐ (5) Social/Recreation/Eat ☐ (6) Shop/Buy Gas, etc. ☐ (7) Pick up/Drop off Passenger ☐ (8) Change Travel Mode ☐ (9) Other _____	☐ (1) Driver (car/truck/van/motorcycle) ☐ (2) Passenger (car/truck/van/motorcycle) ☐ (3) Walk ☐ (4) Bicycle ☐ (5) Bus ☐ (6) School Bus ☐ (7) Taxi ☐ (8) Commercial Vehicle (over 1 ton) ☐ (9) Other _____	_____ number of people If you paid parking, what was parking cost? $_____.____	Year Make Model	Fare: $_____.____ ☐ (1) Drove and Parked ☐ (2) Dropped off ☐ (3) Walked ☐ (4) Carpooled ☐ (5) Other _____
② THEN I WENT TO:	Name of Place Address or nearest intersection City/State/Zip Do you normally work at or out of this location? ☐ Yes ☐ No	Arrive a.m. p.m. Depart a.m. p.m.	☐ (1) Return Home ☐ (2) Go to Work ☐ (3) Work Related ☐ (4) School ☐ (5) Social/Recreation/Eat ☐ (6) Shop/Buy Gas, etc. ☐ (7) Pick up/Drop off Passenger ☐ (8) Change Travel Mode ☐ (9) Other _____	☐ (1) Driver (car/truck/van/motorcycle) ☐ (2) Passenger (car/truck/van/motorcycle) ☐ (3) Walk ☐ (4) Bicycle ☐ (5) Bus ☐ (6) School Bus ☐ (7) Taxi ☐ (8) Commercial Vehicle (over 1 ton) ☐ (9) Other _____	_____ number of people If you paid parking, what was parking cost? $_____.____	Year Make Model	Fare: $_____.____ ☐ (1) Drove and Parked ☐ (2) Dropped off ☐ (3) Walked ☐ (4) Carpooled ☐ (5) Other _____
③ THEN I WENT TO:	Name of Place Address or nearest intersection City/State/Zip Do you normally work at or out of this location? ☐ Yes ☐ No	Arrive a.m. p.m. Depart a.m. p.m.	☐ (1) Return Home ☐ (2) Go to Work ☐ (3) Work Related ☐ (4) School ☐ (5) Social/Recreation/Eat ☐ (6) Shop/Buy Gas, etc. ☐ (7) Pick up/Drop off Passenger ☐ (8) Change Travel Mode ☐ (9) Other _____	☐ (1) Driver (car/truck/van/motorcycle) ☐ (2) Passenger (car/truck/van/motorcycle) ☐ (3) Walk ☐ (4) Bicycle ☐ (5) Bus ☐ (6) School Bus ☐ (7) Taxi ☐ (8) Commercial Vehicle (over 1 ton) ☐ (9) Other _____	_____ number of people If you paid parking, what was parking cost? $_____.____	Year Make Model	Fare: $_____.____ ☐ (1) Drove and Parked ☐ (2) Dropped off ☐ (3) Walked ☐ (4) Carpooled ☐ (5) Other _____

Figure 18. Workplace Employee Travel Survey, Part 2: Trip Information.

Nonemployee Survey

Nonemployees will be surveyed using the same method as employed in the 1990-91 surveys. The nonemployee questionnaire is shown in Figure 19. Every Nth person arriving at the workplace will be surveyed. If the number of arrivals is small (judgment will be required), an attempt will be made to interview every arrival. If the establishment is a 24-hour operation, the nonemployee survey will be conducted in two 8-hour shifts. The first will run from 6 a.m. until 2 p.m. The second will run from 4 p.m. until 12 midnight. If the establishment is open for business only 8 to 10 hours per day, the nonemployee survey will be conducted during two 4-hour shifts. The time of the shifts will be determined jointly by the consultant and TxDOT on a site-by-site basis.

Vehicular/Person Movement Survey

On the day of the survey, 24-hour vehicle counts will be made at each access point serving the workplace. A determination will be made jointly by the consultant and TxDOT as to whether this may be done by mechanical counter or by another method. For example, a combination of mechanical counts with visual observation and/or video cameras may be required to accurately collect the data. If it is not possible to obtain 24-hour vehicle counts, the persons entering and exiting the establishment will be counted during its hours of operation.

Employer Survey

The information to be collected from the employer at the workplace is shown in Figure 20. Note that this also includes the number of commercial trucks servicing the workplace on the survey day. If this information is not available, a means will have to be devised by the consultant in cooperation with TxDOT staff to obtain this information for the survey day. The primary data elements for estimating total attractions to the workplace will be the vehicular counts (or person counts) at the access points serving the workplace. It is, therefore, emphasized that these data be collected as accurately as possible.

Record Type 8

WORKPLACE VISITOR TRAVEL INTERVIEW FORM
FREE STANDING WORKPLACE

10/01/93

Site #: _____
Date: ___/___/___
Area Type: _____
Interviewer: _____

Date: _____ Location: _____

Questions	Person 1	Person 2	Person 3	Person 4
1. Do you work in this building? a. Yes - stop interview b. No - continue interview	1) Yes 2) No	1) Yes 2) No	1) Yes 2) No	1) Yes 2) No
2. Did you travel straight from your home or from another location to get here today?	1) Home 2) Other	1) Home 2) Other	1) Home 2) Other	1) Home 2) Other
3. Where did you start your trip that brought you to _____? (place/address or nearest intersection/city/state/zip code)	_____ _____ Address	_____ _____ Address	_____ _____ Address	_____ _____ Address
4. What approximate time did you arrive at this location today?	1) a.m. 2) p.m.	1) a.m. 2) p.m.	1) a.m. 2) p.m.	1) a.m. 2) p.m.
5. How did you arrive here today? (Choose from Arrival Options below)				
a. If car/truck/van: How many persons including yourself were in the vehicle? b. If bus: What fare did you pay?	a. # People _____ b. Fare $___.__	a. # People _____ b. Fare $___.__	a. # People _____ b. Fare $___.__	a. # People _____ b. Fare $___.__
6. What is your reason for coming here today? (Choose from Trip Purpose Options below)	No. Other	No. Other	No. Other	No. Other
7. When you leave here, are you going immediately home?	1) Yes 2) No	1) Yes 2) No	1) Yes 2) No	1) Yes 2) No
8. What is the address of the place you will be going?	_____ _____ Address	_____ _____ Address	_____ _____ Address	_____ _____ Address
	Arrival Options 1) Driver (car/truck/van/motorcycle) 2) Passenger (car/truck/van/motorcycle) 3) Walk 4) Bicycle 5) Bus 6) School Bus 7) Taxi 8) Commercial Vehicle (over 1 ton) 9) Other (specify in block)		Trip Purpose Options 1) Work related 2) School 3) Social/recreational/meal 4) Shop/Buy Gas, etc. 5) Pick up/Drop off Passenger 6) Change travel mode 7) Delivery 8) Other (specify in block)	

Figure 19. Workplace Visitor Travel Interview Form, Freestanding Workplace.

Survey Date: _____
Record Type 9

10/01/93
Site # _____
SIC Code: _____
Serial Zone: _____
Area Type: _____
Employment Type: _____
☐ Free Standing
☐ Non-Free Standing

WORKPLACE GENERAL INFORMATION SURVEY FORM

Workplace Information

_____ Name

_____ Street Address

_____ City _____ State _____ Zip Code _____ Telephone

Management Information

CEO/Administrator: _____ Name _____ Telephone

_____ Title

Personnel Manager or Other Contact: _____ Name _____ Telephone

_____ Title

Security Director: _____ Name _____ Telephone

_____ Title

Weekday Hours of Operation: _____

Commercial Truck Count[2] _____ Vehicle Count[1] _____ Person Count[2] _____

Employment Information

Total Employees: (Full- and Part-time) _____ No. of Employees at Work on Survey Day _____

If Multiple Shifts: _____ Times *If Multiple Shifts:* _____ No. of Employees per Shift

Parking Information (Optional)

Parking spaces: _____ Number & Location Parking fee(s): _____

Delivery Information

Loading Docks: _____ Number & Location(s)

Delivery Hours (If restricted): _____ No. of Deliveries on Day of Survey _____

Transit Information

Bus Stop(s): _____ Number & Location(s)

Bus Route(s): _____ Name(s)/Number(s)

Layout / Site Plan

Requested: _____ Date _____ Location

Received: _____ Date _____ Location

[1] 24-Hour Count
[2] Total Count During Hours of Operation

Figure 20. Workplace General Information Survey Form.

Non-Freestanding Workplaces

A non-freestanding workplace is, by definition, located in an area with other workplaces which share common access points and parking. These workplaces will require five specific data collection efforts. These include a survey of the activity center where the workplace is located, a survey of the employees at the workplace, a survey of the nonemployees arriving at the center, a survey of the employer, and a vehicle/person count of all arrivals at the center during its hours of operation.

Activity Center Survey

A visual inspection of the workplace site should be done to determine the number of workplaces in the center by employment type. The workplaces in the center will be surveyed to obtain the information shown in Figure 21.

Employee Survey

The employees of the workplace will be surveyed using the self-administered survey form as used in the freestanding workplace survey (see Figures 17 and 18). The same procedures will be used in administering the employee survey.

Nonemployee Survey

The nonemployee survey, however, will be conducted as an intercept survey randomly selecting arrivals throughout the activity center. The center or site will have certain boundaries. Nonemployees will be selected randomly at different locations in the center and surveyed using the intercept method (as used in the freestanding workplace nonemployee survey). A slightly different survey form will be used and is shown in Figure 22. The hours during which the nonemployee survey will be conducted will depend on the hours of operation for all workplaces in the center. This will have to be determined jointly by the consultant and TxDOT staff.

Record Type 10 10-01-93

ACTIVITY CENTER
GENERAL INFORMATION SURVEY FORM

Traffic Count[1]: _____ Commercial Truck Count[2]: _____ Person Count[2] (if applicable): _____

Workplace to be surveyed on: _____
month/day

_____
Name

_____
Site Number

Other Workplaces

1) Name: _____

Employment Type: _____ Total Employees: (Full- and Part-Time) _____ No. Employees at Work on Survey Day: _____

2) Name: _____

Employment Type: _____ Total Employees: (Full- and Part-Time) _____ No. Employees at Work on Survey Day: _____

3) Name: _____

Employment Type: _____ Total Employees: (Full- and Part-Time) _____ No. Employees at Work on Survey Day: _____

4) Name: _____

Employment Type: _____ Total Employees: (Full- and Part-Time) _____ No. Employees at Work on Survey Day: _____

5) Name: _____

Employment Type: _____ Total Employees: (Full- and Part-Time) _____ No. Employees at Work on Survey Day: _____

6) Name: _____

Employment Type: _____ Total Employees: (Full- and Part-Time) _____ No. Employees at Work on Survey Day: _____

[1] 24-Hour Count
[2] Total for Hours of Operation

Figure 21. Activity Center General Information Survey Form.

Record Type 11

WORKPLACE VISITOR TRAVEL INTERVIEW FORM
NON-FREE STANDING WORKPLACE

10/01/93

Site #: _____
Date: ___/___/___
Area Type: _____
Interviewer: _____

Date: _____ Location: _____

Questions	Person 1	Person 2	Person 3	Person 4
1. Do you work in this center? a. Yes - stop interview b. No - continue interview	1) Yes 2) No	1) Yes 2) No	1) Yes 2) No	1) Yes 2) No
2. Did you travel straight from your home or from another location to get here today?	1) Home 2) Other	1) Home 2) Other	1) Home 2) Other	1) Home 2) Other
3. Where did you start your trip that brought you to _____ (place/address or nearest intersection/city/state/zip code)	_____ _____ Address	_____ _____ Address	_____ _____ Address	_____ _____ Address
4. What approximate time did you arrive at this location today?	1) a.m. 2) p.m.	1) a.m. 2) p.m.	1) a.m. 2) p.m.	1) a.m. 2) p.m.
5. How did you arrive here today? (Choose from Arrival Options below)				
a. If car/truck/van: How many persons including yourself were in the vehicle? b. If bus: /What fare did you pay?	a. # People _____ b. Fare $____.__/trip	a. # People _____ b. Fare $____.__/trip	a. # People _____ b. Fare $____.__/trip	a. # People _____ b. Fare $____.__/trip
6. What is your reason for coming here today? (Choose from Trip Purpose Options below)	No. Other	No. Other	No. Other	No. Other
7. How many stores/businesses have you visited in this center during this trip?				
8. How many more stores/ businesses do you plan to visit in this center during this trip?				
9. When you leave here, are you going immediately home?	1) Yes 2) No	1) Yes 2) No	1) Yes 2) No	1) Yes 2) No
10. What is the address of the place you will be going?	_____ _____ Address	_____ _____ Address	_____ _____ Address	_____ _____ Address

Arrival Options		Trip Purpose Options	
1) Driver (car/truck/van/motorcycle)	6) School Bus	1) Work related	6) Change travel mode
2) Passenger (car/truck/van/motorcycle)	7) Taxi	2) School	7) Delivery
3) Walk	8) Commercial vehicle (over 1 ton)	3) Social/recreational/meal	8) Other (specify in block)
4) Bicycle	9) Other _____	4) Shop/Buy Gas, etc.	
5) Bus		5) Pick up/Drop off Passenger	

Figure 22. Workplace Visitor Travel Interview Form, Non-Freestanding Workplace.

Vehicular/Person Movement Survey

On the day of the survey, 24-hour vehicle counts will be made at each access point serving the center where the workplace being surveyed is located. A determination will be made jointly by the consultant and TxDOT as to whether this may be done by mechanical counter or by another method. For example, a combination of mechanical counts with visual observation and/or video cameras may be required to accurately collect the data. If it is not possible to obtain 24-hour vehicle counts, the persons entering and exiting the center will be counted during its hours of operation.

Employer Survey

In the same manner as the freestanding workplaces, the non-freestanding workplace employer will be surveyed to obtain general information concerning the workplace. The information and form to be used is shown in Figure 20.

Non-Freestanding Alternative

It is understood that there will be some non-freestanding workplaces that are located in areas where the exact boundaries of the activity center are not identifiable. An example of this would be an establishment located in a downtown area surrounded by other establishments with no clear boundary except for the entire downtown area. In these cases, the workplace may be surveyed using the same method as for the freestanding workplace with a minor modification. The nonemployee survey instrument should be modified to ask the question as to whether this establishment was the first visited by the individual since arriving in the area (either by vehicle, bus, or walking). Those individuals indicating that this is the first place visited are used in computing the attraction rate. Those individuals indicating that it is not the first place will be excluded from the computation of the attraction rate for the establishment. Note that proportions must be used to estimate the totals for expansion purposes.

General Considerations

The major difference in the survey of non-freestanding workplaces is the information which must be obtained from the employers in the center where the workplace is located. This information is shown in Figure 21 and must be obtained for all employers located in the center or site where the surveyed workplace is located. The most difficult portion of the survey may be obtaining participation (i.e., information) from all of the employers in the center where the surveyed workplace is located. If this participation is not obtained, an agreement may be reached between the consultant and TxDOT on an appropriate method for estimating that information (e.g., visual observation). If a sufficient number of the workplaces refuse to participate, the workplace will be replaced.

The primary information used for estimating total attractions will be the vehicle and/or person counts taken at the access points serving the center during its hours of operation. An exception to the above design is the survey of a workplace in a high-rise office building located in an area where no clear determination may be made as to the vehicle access and parking locations for residents of the building. In this situation, person counts will be required of all persons arriving and exiting the building. Information will still be required on the total employment and number of employees at work on the survey day at all workplaces in the building. These data may have to be estimated using a methodology acceptable to the TxDOT staff. The persons arriving at the building will be interviewed in the same manner as the nonemployees at other non-freestanding sites.

It is considered critical that during the implementation of the workplace survey, an experienced transportation engineer/planner be involved in the selection, visual inspection, and survey design for each workplace. It is expected that a number of workplaces selected in the sample will not be situated in a manner in which an accurate workplace survey may be done. It will be necessary to have an experienced transportation engineer/planner on site to make decisions regarding the ability to survey workplaces and achieve reliable results.

SPECIAL GENERATOR SURVEYS

Special generators are those establishments with unique characteristics that preclude estimating or projecting travel demand with normal or typical trip generation models. For these establishments, surveys are done to establish travel characteristics typical for each class of special generator. Special generator categories may include regional shopping centers, hospitals, colleges/universities, airports, regional recreational facilities, military bases, and other unique land use activities as identified by the urban area planning agency. These categories may or may not be the same among urban areas and are generally defined at the beginning of the survey with specific establishments identified for inclusion in the survey. Provision must be made for possible refusal to participate; and, when feasible, more than one facility may be identified.

1990-1991 SPECIAL GENERATOR SURVEYS

Special generator surveys were done in three urban areas in 1990 and 1991. The methodology used was similar to the workplace surveys but included obtaining data on the unique characteristics of the generators being surveyed. The information gathered is for the purpose of developing trip attraction rates, both person and vehicular, for internal person, auto-driver, and truck-taxi trips. As in the workplace surveys, the special generator surveys consisted of four parts, an employee survey, a nonemployee survey, a truck-taxi survey or count, and the collection of specific data on the establishment. Because only one special generator is typically surveyed in each category, sample size was not a major determinant. The major considerations were the information to be collected, the methodology, and the quality control. These, for the most part, were the same as in the workplace survey.

San Antonio (18)

Ten special generators were surveyed in San Antonio. These included two universities, a regional shopping center, two major hospitals, three military bases, the international airport, and a major tourist attraction. The procedure used in these surveys was the same as used in the workplace surveys. The survey included a general characteristics survey, an employee survey,

a nonemployee survey, and a count of truck deliveries. In addition, 24-hour counts of either vehicles or persons entering and leaving the site were made.

The additional information needed for the special generators is based on the data's anticipated use in developing specific models for estimating travel demands produced by the special generators. Information on specific characteristics of the special generator (as well as standard data) was obtained during the initial contact and negotiation with the establishment. The additional information typically obtained for airports is the number of flights per day, number of deplaning passengers per day, and amount of parking. The additional information for colleges or universities typically includes student enrollment and the number of students living on and off campus. Information on regional malls will typically include the number and names of the anchor stores, gross leasable square footage, and amount of parking. Additional information for hospitals will normally include the number of beds and amount of parking. Other special generators may require different information. The basis for identifying that information will depend on the type of special generator and its attributes which may be explanatory relative to the number of trip attractions. The data mentioned in this section are typical but are not meant to be the only information which may be collected. In addition, the surveys may be modified depending on the special generator. For example, in San Antonio the question regarding the trip purpose in the nonemployee survey at the hospitals was eliminated due to the potentially sensitive nature. As in the workplace surveys, vehicle and person counts were made to determine the total number of trips being made to each special generator.

Amarillo (19)

Six special generators were surveyed in Amarillo. These included one college, one hospital, one regional shopping center, the international airport, a major manufacturing plant, and a prison. The procedures used were the same as those in San Antonio.

Tyler (20)

Five special generators were surveyed in Tyler. These included one hospital, the airport, a regional shopping center, a major university, and one major manufacturing plant. The procedures used were the same as those in San Antonio and Amarillo.

EVALUATION

The survey forms used in the special generator survey were the same as those used in the workplace survey for employees and nonemployees. Figures 23 through 25 show examples of the survey instruments used in the general characteristics survey, the employee survey, and the nonemployee survey.

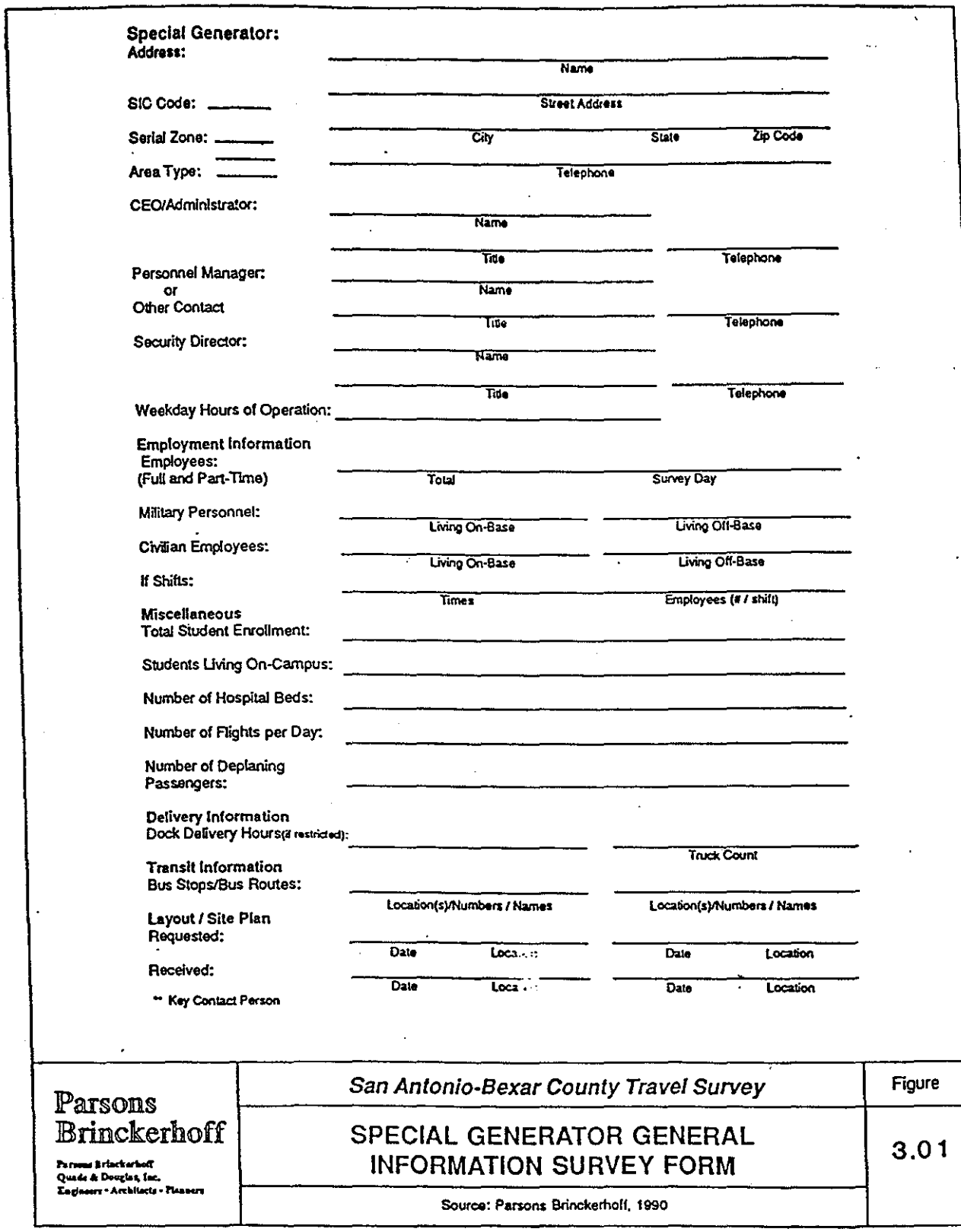
Quality control was maintained in the same manner as in the workplace surveys. Surveyors were trained and supervised during the conduction of the survey. The surveys were checked both visually and by computer for errors. As the surveys were processed, certain statistical tests were also performed to determine the adequacy of the sample being obtained. A minimum response of 20 percent or a minimum of 100 completed surveys was identified as desirable in the case of the employee surveys. For the nonemployee survey, at least 30 trips for each trip purpose and mode and 100 auto-driver and auto-passenger were to be obtained if possible. If feasible, a representative sample of trucks and taxis would be surveyed; and, as a minimum, truck counts would be done.

In evaluating the special generator surveys, no significant problems were found that were different than those from the workplace survey. A need was identified to obtain household information from the employees, to clarify certain data elements and to maintain consistency with the household travel survey. In addition, data for air quality modeling were also felt to be needed.

RECOMMENDATIONS

No changes are recommended to the procedures used in surveying special generators. Each survey is unique and must be designed independently. The survey instruments are fairly standard for employees and nonemployees. The recommended survey forms are shown in Figures

26, 27, and 28. A data form for household information and expanded information on vehicles available are included.



Parsons Brinckerhoff Parsons Brinckerhoff Quade & Douglas, Inc. Engineers • Architects • Planners	*San Antonio-Bexar County Travel Survey*	Figure
	SPECIAL GENERATOR GENERAL INFORMATION SURVEY FORM	3.01
	Source: Parsons Brinckerhoff, 1990	

Figure 23. San Antonio-Bexar County 1990 Travel Survey, Special Generator General Information Survey Form.

SAN ANTONIO - BEXAR COUNTY TRAVEL SURVEY
SPECIAL GENERATOR EMPLOYEE TRAVEL INTERVIEW FORM

Please enter your travel day _____ / _____
Month Day

MY FIRST TRIP TODAY BEGAN AT ☐ Home ☐ Other Location
(Fill in address) _____
_____ Departure time: _____ a.m. p.m.
(Place/address or nearest intersection/city/state/zip code)

	Location Address	When did you get here/leave here?	Purpose of Trip (check one)	Mode of Transportation (check one)	Total No. People in Car/Truck/Van (including self)	If You Paid Parking, What Was the Parking Cost?	If Bus, What Was the Fare? How Did You Get to the Bus Stop?
BEGIN ① FIRST I WENT TO:	Name of Place Address or nearest intersection City State Zip	Arrive a.m. p.m. Depart a.m. p.m.	☐ Return Home ☐ Go to Work or Work Related ☐ School ☐ Social/Recreational/Shop/Eat ☐ Pick up/Drop off Passenger ☐ Change Travel Mode ☐ Other _____	☐ Driver (car/truck/van/motorcycle) ☐ Passenger (car/truck/van/motorcycle) ☐ Walk ☐ Taxi ☐ Bicycle ☐ Commercial Vehicle ☐ Bus (over 1 ton) ☐ School Bus ☐ Other _____		P $____.____ per day	Fare $____.____/trip ☐ Drove Auto & Parked ☐ Dropped Off ☐ Walked ☐ Carpooled with bus riders ☐ Other _____
② THEN I WENT TO:	Name of Place Address or nearest intersection City State Zip	Arrive a.m. p.m. Depart a.m. p.m.	☐ Return Home ☐ Go to Work or Work Related ☐ School ☐ Social/Recreational/Shop/Eat ☐ Pick up/Drop off Passenger ☐ Change Travel Mode ☐ Other _____	☐ Driver (car/truck/van/motorcycle) ☐ Passenger (car/truck/van/motorcycle) ☐ Walk ☐ Taxi ☐ Bicycle ☐ Commercial Vehicle ☐ Bus (over 1 ton) ☐ School Bus ☐ Other _____		P $____.____ per day	Fare $____.____/trip ☐ Drove Auto & Parked ☐ Dropped Off ☐ Walked ☐ Carpooled with bus riders ☐ Other _____
③ THEN I WENT TO:	Name of Place Address or nearest intersection City State Zip	Arrive a.m. p.m. Departure a.m. p.m.	☐ Return Home ☐ Go to Work or Work Related ☐ School ☐ Social/Recreational/Shop/Eat ☐ Pick up/Drop off Passenger ☐ Change Travel Mode ☐ Other _____	☐ Driver (car/truck/van/motorcycle) ☐ Passenger (car/truck/van/motorcycle) ☐ Walk ☐ Taxi ☐ Bicycle ☐ Commercial Vehicle ☐ Bus (over 1 ton) ☐ School Bus ☐ Other _____		P $____.____ per day	Fare $____.____/trip ☐ Drove Auto & Parked ☐ Dropped Off ☐ Walked ☐ Carpooled with bus riders ☐ Other _____
④ THEN I WENT TO:	Name of Place Address or nearest intersection City State Zip	Arrive a.m. p.m. Depart a.m. p.m.	☐ Return Home ☐ Go to Work or Work Related ☐ School ☐ Social/Recreational/Shop/Eat ☐ Pick up/Drop off Passenger ☐ Change Travel Mode ☐ Other _____	☐ Driver (car/truck/van/motorcycle) ☐ Passenger (car/truck/van/motorcycle) ☐ Walk ☐ Taxi ☐ Bicycle ☐ Commercial Vehicle ☐ Bus (over 1 ton) ☐ School Bus ☐ Other _____		P $____.____ per day	Fare $____.____/trip ☐ Drove Auto & Parked ☐ Dropped Off ☐ Walked ☐ Carpooled with bus riders ☐ Other _____

Parsons Brinckerhoff Parsons Brinckerhoff Quade & Douglas, Inc. Engineers • Architects • Planners	*San Antonio-Bexar County Travel Survey*	Figure
	SPECIAL GENERATOR EMPLOYEE QUESTIONNAIRE	3.02
	Source: Parsons Brinckerhoff, 1990	

Figure 24. San Antonio-Bexar County 1990 Travel Survey, Special Generator Employee Questionnaire.

SAN ANTONIO - BEXAR COUNTY TRAVEL SURVEY
SPECIAL GENERATOR NON-EMPLOYEE TRAVEL INTERVIEW FORM

Date
Zone
Employer #
Area Type
Interviewer

Date: _____ Location: _____

"Hello, my name is _____, I am conducting a travel survey for the San Antonio - Bexar County Metropolitan Planning Organization. Will you give me a few minutes of your time?"

Thank you for your time !

QUESTIONS:	Person # 1	Person # 2	Person # 3	Person # 4	Person # 5	Person # 6
1. Do you work in this building? a. Yes – stop interview b. No – continue questionnaire	1) Yes 2) No	1) Yes 2) No	1) Yes 2) No	1) Yes 2) No	1) Yes 2) No	1) Yes 2) No
2. Did you travel straight from your home or from another location to get here today?	1) Home 2) Other	1) Home 2) Other	1) Home 2) Other	1) Home 2) Other	1) Home 2) Other	1) Home 2) Other
3. What approximate time did you arrive at this location today?						
4 How did you arrive here today? (choose from options below)						
a. If car/truck/van, ask: How many persons including yourself were in the vehicle? b. If bus, ask: What fare did you pay?	# People / Fare $__.__	# People / Fare $__.__	# People / Fare $__.__	# People / Fare $__.__	# People / Fare $__.__	# People / Fare $__.__
5. What is your reason for coming here today? (choose from options below)	No. / Other	No. / Other	No. / Other	No. / Other	No. / Other	No. / Other
6. When you leave here, are you going immediately home?	1) Yes 2) No	1) Yes 2) No	1) Yes 2) No	1) Yes 2) No	1) Yes 2) No	1) Yes 2) No

Interviewer Notes:

Initials: _____

Transportation Mode Options:

1) Driver (car/truck/van/motorcycle)
2) Passenger (car/truck/van/motorcycle)
3) Walk
4) Bicycle
5) Bus
6) Taxi
7) School bus
8) Commercial vehicle (over 1 ton)
9) Other _____

Trip Purpose Options:

1) Work related
2) School
3) Social / recreational
4) Delivery
5) Other (specify in block)

Parsons Brinckerhoff Parsons Brinckerhoff Quade & Douglas, Inc. Engineers • Architects • Planners	*San Antonio-Bexar County Travel Survey*	Figure
	SPECIAL GENERATOR NON-EMPLOYEE QUESTIONNAIRE: MALL, MILITARY BASE	3.03
	Source: Parsons Brinckerhoff, 1990	

Figure 25. San Antonio-Bexar County 1990 Travel Survey, Special Generator Nonemployee Questionnaire: Mall, Military Base

Record Types 13 and 14

10/01/93

Site #: _____

Sample #: _____

Survey Location: _____ Travel Day: _____
Month/Day

SPECIAL GENERATOR EMPLOYEE TRAVEL SURVEY

PART 1: HOUSEHOLD INFORMATION

(If you have participated in prior surveys, please fill this form out anyway)

Employee's
Home Address: _____
Street Address

_____

_____
City State ZIP

How many people live at your home address? (Do not count guests) _____

How many people in your household (including yourself) are employed? _____
(Include full- and part-time.)

How many vehicles (cars, vans, light trucks, motorcycles) are available for use by members of your household? _____

Please list all vehicles available to your household (including company cars, rental cars, motorcycles, etc.) and complete the following:

Vehicle Number	Year	Make	Model	Circle One	Odometer Readings On Travel Day Beginning	Ending
1				Diesel Gas		
2				Diesel Gas		
3				Diesel Gas		
4				Diesel Gas		
5				Diesel Gas		
6				Diesel Gas		
7				Diesel Gas		

If you add up the annual incomes of all members of your household, into what range does it fall? (Check one)

1) ☐ Less than $5,000
2) ☐ $5,000 to $9,999
3) ☐ $10,000 to $14,999
4) ☐ $15,000 to $19,999
5) ☐ $20,000 to $24,999
6) ☐ $25,000 to $29,999
7) ☐ $30,000 to $34,999
8) ☐ $35,000 to $39,999
9) ☐ $40,000 to $49,999
10) ☐ $50,000 or more

This completes the general information needed. Please fill out the attached travel questionnaire to record the trips you make on the travel day. Thank you for your help.

Figure 26. Special Generator Employee Travel Survey, Part 1: Household Information Survey

10/01/93

SPECIAL GENERATOR
GENERAL INFORMATION SURVEY FORM

Record Type 12

Survey Date: _____

Special Generator:
Address:

Site #: _____ Name

SIC Code: _____ Street Address

Serial Zone: _____

Area Type: _____ City State Zip Code

Employment Type: _____ Telephone

CEO / Administrator: Name Telephone

Title

Personnel Manager: (or Other Contact) Name Telephone

Title

Security Director: Name Telephone

Title

Weekday Hours of Operation:

24-Hour Counts: Vehicles Persons

Employment Information
Employees: (Full and Part-Time) Total Survey Day

Military Personnel: Living On-Base Living Off-Base

Civilian Employees: Living On-Base Living Off-Base

If Shifts: Times Employees (# / shift)

Miscellaneous
Total Student Enrollment:

Students Living On-Campus:

Number of Hospital Beds:

Number of Flights Per Day:

Number of Deplaning Passengers:

Delivery Information
Dock Delivery Hours (if restricted) : Commercial Truck Count

Transit Information
Bus Stops / Bus Routes: Location(s) / Numbers / Names Location(s) / Numbers / Names

Parking Information (Optional)
Amount: Spaces / Type Spaces / Type

Cost:

Layout / Site Plan
Requested: Date Location Date Location

Received: Date Location Date Location

Figure 27. Special Generator General Information Survey Form.

Record Type 15

SPECIAL GENERATOR EMPLOYEE TRAVEL SURVEY

PART 2: TRIP INFORMATION

SITE #: _____ 10/01/93

SAMPLE #: _____

PLEASE ENTER YOUR:

TRAVEL DAY: _____

DEPARTURE TIME: _____ a.m. p.m.

BEGIN: MY FIRST TRIP TODAY BEGAN AT: ☐ (1) Home ☐ (9) Other Location

_____
(Fill in address)

_____
(Place/address or nearest intersection) (/city/state/zip code)

	Location Address	When did you get here/leave here?	Purpose of Trip (check one)	Mode of Transportation (check one)	Total number of people in car/truck/van (including driver)	If Driver, what vehicle was used? (make/model)	If Bus, what was the fare? How did you get to the bus stop?
① FIRST I WENT TO:	_____ Name of Place _____ Address or nearest intersection _____ City/State/Zip Do you normally work at or out of this location? ☐ Yes ☐ No	Arrive a.m. p.m. Depart a.m. p.m.	☐ (1) Return Home ☐ (2) Go to Work ☐ (3) Work Related ☐ (4) School ☐ (5) Social/Recreation/Eat ☐ (6) Shop/Buy Gas, etc. ☐ (7) Pick up/Drop Off Passenger ☐ (8) Change Travel Mode ☐ (9) Other _____	☐ (1) Driver (car/truck/van/motorcycle) ☐ (2) Passenger (car/truck/van/motorcycle) ☐ (3) Walk ☐ (4) Bicycle ☐ (5) Bus ☐ (6) School Bus ☐ (7) Taxi ☐ (8) Commercial Vehicle (over 1 ton) ☐ (9) Other _____	_____ number of people If you paid parking, what was parking cost? $_____.____	Year Make Model	Fare: $_____.____ ☐ (1) Drove and Parked ☐ (2) Dropped Off ☐ (3) Walked ☐ (4) Carpooled ☐ (5) Other _____
② THEN I WENT TO:	_____ Name of Place _____ Address or nearest intersection _____ City/State/Zip Do you normally work at or out of this location? ☐ Yes ☐ No	Arrive a.m. p.m. Depart a.m. p.m.	☐ (1) Return Home ☐ (2) Go to Work ☐ (3) Work Related ☐ (4) School ☐ (5) Social/Recreation/Eat ☐ (6) Shop/Buy Gas, etc. ☐ (7) Pick up/Drop Off Passenger ☐ (8) Change Travel Mode ☐ (9) Other _____	☐ (1) Driver (car/truck/van/motorcycle) ☐ (2) Passenger (car/truck/van/motorcycle) ☐ (3) Walk ☐ (4) Bicycle ☐ (5) Bus ☐ (6) School Bus ☐ (7) Taxi ☐ (8) Commercial Vehicle (over 1 ton) ☐ (9) Other _____	_____ number of people If you paid parking, what was parking cost? $_____.____	Year Make Model	Fare: $_____.____ ☐ (1) Drove and Parked ☐ (2) Dropped Off ☐ (3) Walked ☐ (4) Carpooled ☐ (5) Other _____
③ THEN I WENT TO:	_____ Name of Place _____ Address or nearest intersection _____ City/State/Zip Do you normally work at or out of this location? ☐ Yes ☐ No	Arrive a.m. p.m. Depart a.m. p.m.	☐ (1) Return Home ☐ (2) Go to Work ☐ (3) Work Related ☐ (4) School ☐ (5) Social/Recreation/Eat ☐ (6) Shop/Buy Gas, etc. ☐ (7) Pick up/Drop Off Passenger ☐ (8) Change Travel Mode ☐ (9) Other _____	☐ (1) Driver (car/truck/van/motorcycle) ☐ (2) Passenger (car/truck/van/motorcycle) ☐ (3) Walk ☐ (4) Bicycle ☐ (5) Bus ☐ (6) School Bus ☐ (7) Taxi ☐ (8) Commercial Vehicle (over 1 ton) ☐ (9) Other _____	_____ number of people If you paid parking, what was parking cost? $_____.____	Year Make Model	Fare: $_____.____ ☐ (1) Drove and Parked ☐ (2) Dropped Off ☐ (3) Walked ☐ (4) Carpooled ☐ (5) Other _____

Figure 28. Special Generator Employee Travel Survey, Part 2: Trip Information.

EXTERNAL STATION SURVEYS

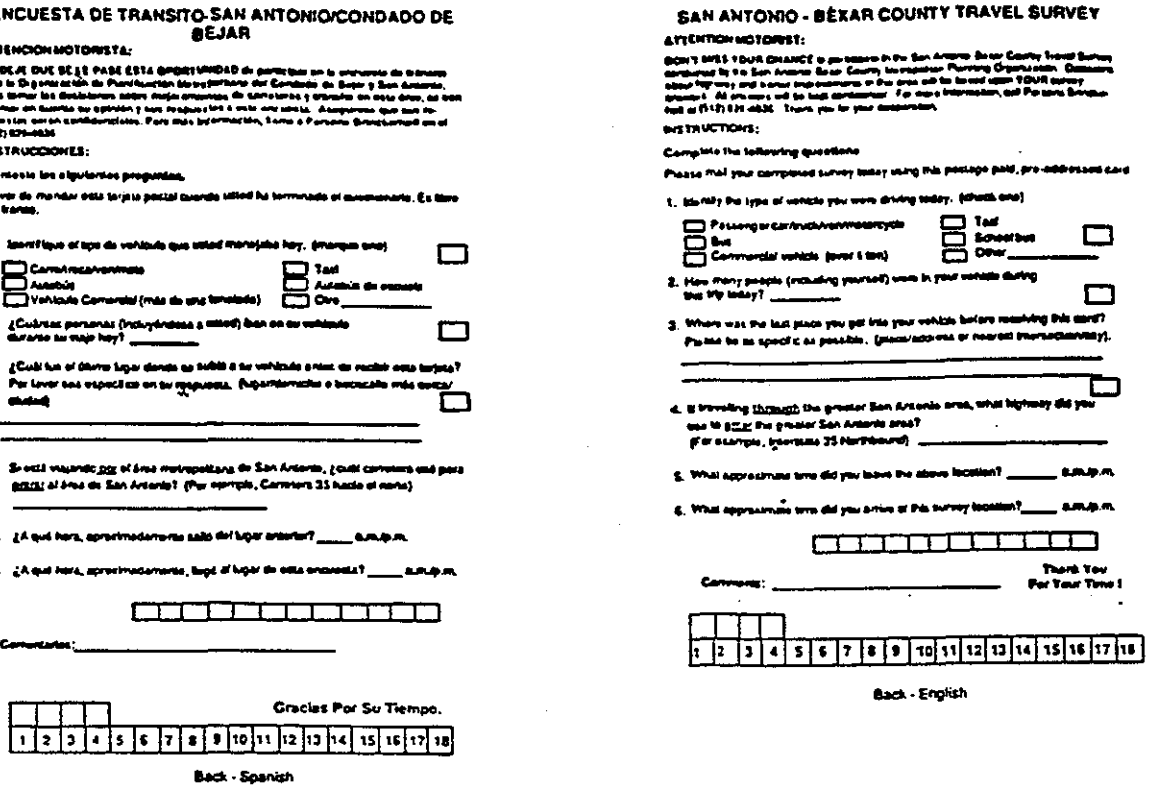
External station surveys were conducted at all five urban areas surveyed in 1990 and 1991. The purpose of an external station survey is to obtain data on the amount, type, and trip length of person and vehicular travel into and out of the study area. An external station is defined as a highway or street which crosses the imaginary study area boundary. Trips crossing this boundary are defined as external-local (those which begin outside the study area and end within the study area or vice versa) or external-thru (those that travel through the study area completely).

The external station surveys in 1990 and 1991 were outbound surveys which explicitly assumed that the inbound traffic would mirror the outbound traffic over a 24-hour period. Two types of surveys were accomplished. One was an intercept survey in which vehicles were stopped, pulled to the side of the road, and interviewed (if they agreed to participate). In the other survey a postcard was handed to each driver with a request they complete the card and mail it back.

Figures 29 and 30 show examples of the postcard and interview survey instruments used in San Antonio, Amarillo, and Brownsville. Figures 31 and 32 show examples of the postcard and interview survey instruments used in Tyler and Sherman-Denison. The basic information obtained was the type of vehicle, number of occupants, whether the trip was a thru trip or a local trip; and, if a local trip, the location of the last place they got into the vehicle before being surveyed, the time they left that location, and the time they arrived at the survey station. The following sections briefly describe the surveys done in each of the urban areas.

San Antonio (21)

External surveys were conducted at 19 external stations in San Antonio. Two survey methods were used. Postcard surveys were conducted at those sites with over 10,000 average daily traffic. Personal interviews were conducted at sites with less than 10,000 average daily traffic. In addition, 24-hour traffic counts were made at each location surveyed (both directions). The desired sample size was a minimum of 400 completed



Parsons Brinckerhoff Parsons Brinckerhoff Quade & Douglas, Inc. Engineers • Architects • Planners	*San Antonio-Bexar County Travel Survey*	Figure
	POSTCARD SURVEY INSTRUMENT	4.02
	Source: Parsons Brinckerhoff Quade and Douglas, Inc., 1990	

Figure 29. San Antonio-Bexar County 1990 Travel Survey, Postcard Survey Instrument.

Highway:_____

Date of Survey:_____

AMARILLO TRAVEL SURVEY
EXTERNAL TRAVEL SURVEY INTERVIEW FORM

INTERVIEWER
ZONE:
DATE:

Interviewer:_____
Interviewer Responsibility for Each Surveyed Vehicle:

	Vehicle 1	Vehicle 2	Vehicle 3	Vehicle 4	Vehicle 5
Time	a.m. p.m.	a.m. p.m.	a.m. p.m.	a.m. p.m.	a.m. p.m.
Number people in vehicle					
Vehicle type (choose from option)					
1. Are you traveling through the Amarillo area on route to your final destination or did your trip begin in the Amarillo area?	A. Through Amarillo area B. Amarillo origin	A. Through Amarillo area B. Amarillo origin	A. Through Amarillo area B. Amarillo origin	A. Through Amarillo area B. Amarillo origin	A. Through Amarillo area B. Amarillo origin
2. Where was the last place you got into your vehicle ? (place/address/nearest intersection/city).					
3. What approximate time did you leave the above location?	a.m. p.m.	a.m. p.m.	a.m. p.m.	a.m. p.m.	a.m. p.m.
4. What highway did you use to enter the greater Amarillo area?					
5. What city were you traveling from on on your way through Amarillo today?					

Interviewer Notes:

Initials:_____

Vehicle Type Options:

1) Passenger car/truck/van/motorcycle
2) Bus
3) Taxi
4) School bus
5) Commercial vehicle (over 1 ton)
6) Other (specify in block)

Thank you for your time !

Source: Parsons Brinckerhoff Quade & Douglas, Inc., 1990.

Parsons Brinckerhoff Parsons Brinckerhoff Quade & Douglas, Inc. Engineers • Architects • Planners	*Amarillo Travel Survey*	Figure
	INTERVIEW SURVEY INSTRUMENT	5.02

Figure 30. Amarillo 1990 Travel Survey, External Travel Survey Interview Form.

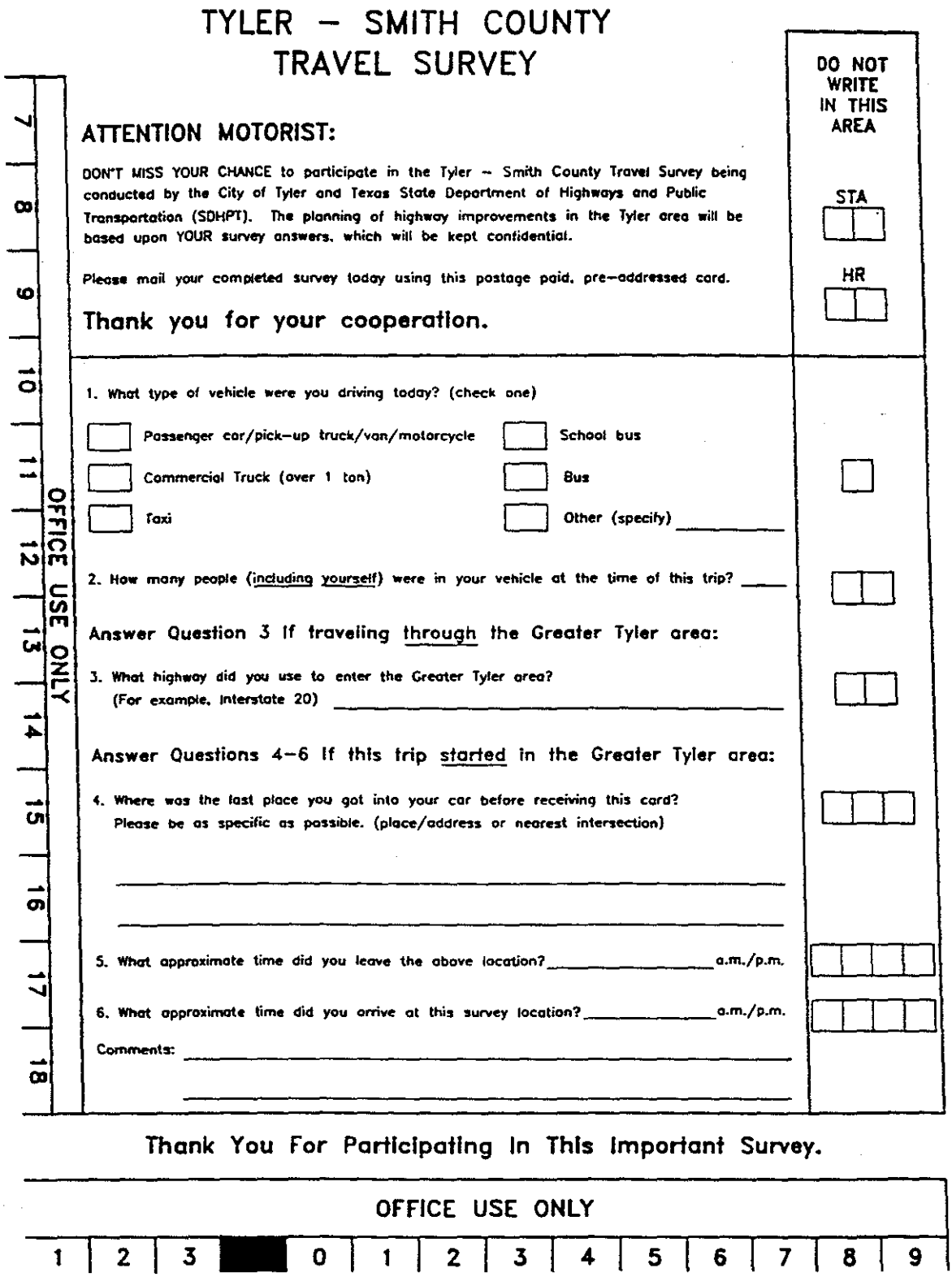


Figure 31. Tyler-Smith County 1991 Travel Survey.

TYLER – SMITH COUNTY TRAVEL SURVEY

EXTERNAL TRAVEL SURVEY INTERVIEW FORM

STATION

Interviewer: _____

	Vehicle 1	Vehicle 2	Vehicle 3	Vehicle 4	Vehicle 5
Interviewer Responsibility for Each Surveyed Vehicle: Time of Interview	a.m. p.m.	a.m. p.m.	a.m. p.m.	a.m. p.m.	a.m. p.m.
Number of people in vehicle (including driver)					
Vehicle Type (see options at bottom of page)					

INSTRUCTIONS:
Ask Part A IF traveling through the Tyler area; Ask Part B IF originated in Tyler area.

1. Are you traveling through the Tyler area en route to your final destination or did your trip begin in the Tyler area? (circle one)	A. Through Tyler Area B. Tyler Origin	A. Through Tyler Area B. Tyler Origin	A. Through Tyler Area B. Tyler Origin	A. Through Tyler Area B. Tyler Origin	A. Through Tyler Area B. Tyler Origin
Part A If traveling through: 1. What highway did you use to enter the greater Tyler area?					
Part B If local: 1. Where was the last place you got into your vehicle? (place/address or nearest intersection)					
2. What approximate time did you leave the above location?	a.m. p.m.	a.m. p.m.	a.m. p.m.	a.m. p.m.	a.m. p.m.

Vehicle Type Options:

1) Passenger car/pick-up truck/van/motorcycle
2) Commercial truck (over 1 ton)
3) Taxi
4) School Bus
5) Bus
6) Other (specify in block)

Interviewer Notes:

Figure 32. Tyler-Smith County 1991 Travel Survey, External Travel Survey Interview Form.

surveys from the outbound traffic. The surveys were conducted during daylight hours only on Mondays through Thursdays (one day at each site).

Amarillo (22)

External station surveys were conducted at 19 sites in the Amarillo urban area. The survey method used was personal interviews. At six sites, interviews were conducted for a minimum of three hours or until a minimum of 300 completed interviews were obtained. At the other 13 sites, interviews were conducted during daylight hours. Vehicles were either stopped or pulled over to the side of the road for surveying. Only outbound vehicles were surveyed and the surveys were conducted only on Mondays through Thursdays. Twenty-four hour counts were made at each location in both directions. The percentage of the total vehicles crossing the boundary surveyed ranged from 4 percent at high volume locations to 90 percent at low volume locations.

Brownsville (23)

External station surveys were conducted at nine locations in the Brownsville study area in 1990. In addition to the vehicle surveys, pedestrians were surveyed at two of the international bridge crossings from Mexico. Figure 33 shows the survey instrument for the pedestrian interview at the international crossings. The vehicle survey method used was personal interviews where vehicles were stopped (or pulled over to the side) and an interviewer surveyed the driver of the vehicle directly. Outbound traffic was surveyed during daylight hours Mondays through Thursdays. The sample sizes varied depending on the length of time each station was surveyed. Twenty-four-hour counts were taken at each station.

Tyler (24)

External station surveys were conducted at 32 sites in the Tyler study area. Two survey methods were used. The postcard mailback method was used at the ten highest volume locations and direct interviews were conducted at the remaining locations. Only

Highway: _____

Date of Survey: _____

BROWNSVILLE TRAVEL SURVEY
PEDESTRIAN EXTERNAL TRAVEL SURVEY INTERVIEW FORM

INTERVIEWER
ZONE:
DATE:

Interviewer: _____
Interviewer Responsibility for Each Surveyed Person:

	Person 1	Person 2	Person 3	Person 4	Person 5
Time	a.m. p.m.	a.m. p.m.	a.m. p.m.	a.m. p.m.	a.m. p.m.
Trip Purpose (choose from option)					
1. Did you use the bus in Brownsville?					
2. Where was the last place you stopped? (place).					
3. What approximate time did you leave the above location?	a.m. p.m.	a.m. p.m.	a.m. p.m.	a.m. p.m.	a.m. p.m.
4. How many times per week do you make this trip?					

Interviewer Notes:

Initials: _____

Trip Purpose Options:

1) Work related
2) School
3) Social / recreational
4) Other (specify in block)

Thank you for your time !

Source: Parsons Brinckerhoff Quade & Douglas, Inc., May 1991.

Parsons Brinckerhoff Parsons Brinckerhoff Quade & Douglas, Inc. Engineers • Architects • Planners	*Brownsville Travel Survey*	Figure
	PEDESTRIAN INTERVIEW SURVEY INSTRUMENT	4.03

Figure 33. Brownsville 1990 Travel Survey, Pedestrian External Travel Survey Interview Form.

outbound traffic was surveyed during daylight hours. Surveys were conducted only on typical weekdays (Mondays through Thursdays). Manual classification counts were done during the daylight hours at all locations in conjunction with 24-hour traffic counts.

Sherman-Denison (25)

External station surveys were conducted at 14 locations in the Sherman-Denison urban area. Two survey methods were used. The postcard mailback method was used at two locations and the direct interview method at the others. Only outbound traffic was surveyed during daylight hours. Surveys were conducted on typical weekdays (Monday through Thursday). Manual classification counts during daylight hours and 24-hour traffic counts were done.

EVALUATION

The data from the external station surveys were reasonably good, with sound procedures being used in nearly all instances. There were, however, several areas where the data were questionable in terms of expandability. These were the areas where the survey was done for limited periods of the daylight period. The survey methods were based on an assumption that inbound traffic would be a mirror of the outbound traffic. If only a portion of the outbound traffic were surveyed during the daylight hours (e.g., for three to four hours), this sample would not necessarily be representative of the traffic flow over the entire daylight period, since it was surveyed only in one direction. The expansion of these data requires substantial assumptions with regard to the data. The surveys were done only during daylight hours for safety reasons, and surveying for only a portion of those hours in one direction is not considered representative for the entire daylight period.

The second area of concern was the use of two different methods for collecting the data. Those were the postcard mailback and the direct interview methods. A comparative assessment of the two methods was made in the San Antonio survey with the conclusion that the direct interview method produced better and more complete information. The findings of that evaluation were that the postcard mailback survey under-represented the commercial trucks and other non-private vehicles, there was an uncertainty as to when the postcard was actually filled out, and there was less control of the sample size and survey administration. Subsequent

evaluation of the external station survey data has also revealed some areas of additional data needs. Information on the purpose of the trip was not obtained in the 1990 and 1991 surveys. Other data such as more information on the type of vehicle in terms of year, make, model, and odometer readings have been defined as desirable.

RECOMMENDATIONS

The following recommendations are made relative to external station surveys:

- Survey methodology should be direct interview.
- Survey of outbound vehicles should be done for all daylight hours. The number of vehicles to be surveyed should be as many as possible under the traffic conditions at the specific location. It is recommended that vehicle queuing be kept to a minimum with suspension of surveying activities when vehicles have queued more that one-quarter of a mile. It is recommended that, if possible, at high volume locations, the traffic control plan allow for those vehicles being surveyed to be moved out of the traffic stream to allow for other vehicles to continue through the site.
- Twenty-four-hour counts by direction and time of day (minimum hourly) should be obtained at each external station location.
- Manual classification counts should be made at all survey locations during the daylight hours.
- If only a limited number of the external stations may be surveyed, the high volume stations should be given first priority for surveying and a random sampling of the low volume stations should be used to select those for surveying with traffic counts being taken at all locations.

The recommended survey instrument is shown in Figure 34. This instrument is subject to change depending on the identification of additional data elements for travel demand modeling needs.

Record Type 16

EXTERNAL TRAVEL SURVEY INTERVIEW FORM

2/27/94

External Station #: _____ Survey Date: _____

External Station Name/Location: _____ Interviewer: _____

For each vehicle you collect:	Vehicle 1	Vehicle 2	Vehicle 3	Vehicle 4
Time	1 a.m. 2 p.m.	1 a.m. 2 p.m.	1 a.m. 2 p.m.	1 a.m. 2 p.m.
Number of people in vehicle				
INSTRUCTIONS: **Ask of driver Part A questions if traveling through (city) area; Ask Part B questions if local (city) origin.**				
Vehicle Classification (See back)				
1.a. What year is this vehicle?	_____ Year	_____ Year	_____ Year	_____ Year
b. Gas or diesel? Other?	1 Gas 2 Diesel 3 _____ (Other, specify)	1 Gas 2 Diesel 3 _____ (Other, specify)	1 Gas 2 Diesel 3 _____ (Other, specify)	1 Gas 2 Diesel 3 _____ (Other, specify)
2. What is the mileage on your odometer?				
3. Are you traveling through the greater (city) area en route to your final destination or did your trip begin in the (city) area?	1 Through (city) 2 (City) origin	1 Through (city) 2 (City) origin	1 Through (city) 2 (City) origin	1 Through (city) 2 (City) origin
PART A If traveling through: What highway did you use to enter the greater (city) area?				
PART B If local: Where was the last place you got into your vehicle? (place/address or nearest intersection/city)				
What was your purpose for being at that location? (Choose option)				
What is your purpose for traveling to your next destination? (Choose option)				
4. What approximate time did you leave the above location?	1 a.m. 2 p.m.	1 a.m. 2 p.m.	1 a.m. 2 p.m.	1 a.m. 2 p.m.

Trip Purpose Options

1) Home/Return home
2) Go to work
3) Work related
4) School
5) Social/Recreational/Eat
6) Shop/Buy gas/Etc.
7) Pick up/Drop off passenger
8) Change travel mode
9) Delivery
10) Other (specify in block)

Vehicle Classification (See back)

1) Passenger car
2) Small light-duty truck
3) Large light-duty truck
4) Heavy-duty truck
5) Bus
6) Motorcycle

Figure 34. External Travel Survey Interview Form.

TRUCK SURVEYS

Truck surveys were conducted in all five urban areas in 1990 and 1991. These surveys were intended to obtain information on the number of trips being made daily by commercial trucks within the urban areas being surveyed. Truck and taxi trips are modeled separately in Texas, and this information was to provide updated information for those models. The following paragraphs discuss each of the truck surveys.

San Antonio (13)

In the San Antonio truck survey, industrial firms were selected at random from the phone book, contacted by phone, and asked if they would participate in the survey. The survey was designed to gather trip information for trucks weighing one ton or more. In certain cases, the firm allowed surveyors access to their truck travel logs; and the survey data were collected directly from the logs. The following information was collected in the truck survey:

1. The date the trips were made and the type of vehicle, i.e., payload weight, number of axles, description, etc.
2. The location or address where the first trip of the day began and the departure time for the first trip.
3. The destination (i.e., address) of each trip as well as the arrival and departure time.

Provision was made on each survey for information on up to 18 trips. The last question asked was how many more trips would the person make in that truck that day. Figure 31 5 shows the survey instrument used in the San Antonio survey.

In the San Antonio survey, 397 useable truck surveys were obtained which included a representative mix of different types of trucks, all one or more ton payload capacity. This number has varied in some later surveys.

Prior to the survey, surveyors underwent training for both soliciting of the firms' participation as well as the actual data collection. Training also included how the data would be used and kept confidential and how to deal with individuals reluctant to participate in the survey. The surveys were checked, edited, and computer checked for inconsistencies.

Amarillo (26)

The Amarillo truck survey methodology involved eight steps. An establishment was selected for recruitment, they were recruited for truck driver participation, truck logs were transcribed or a survey form completed, questionnaires were edited, data were entered into computer files, and results were analyzed and then reported.

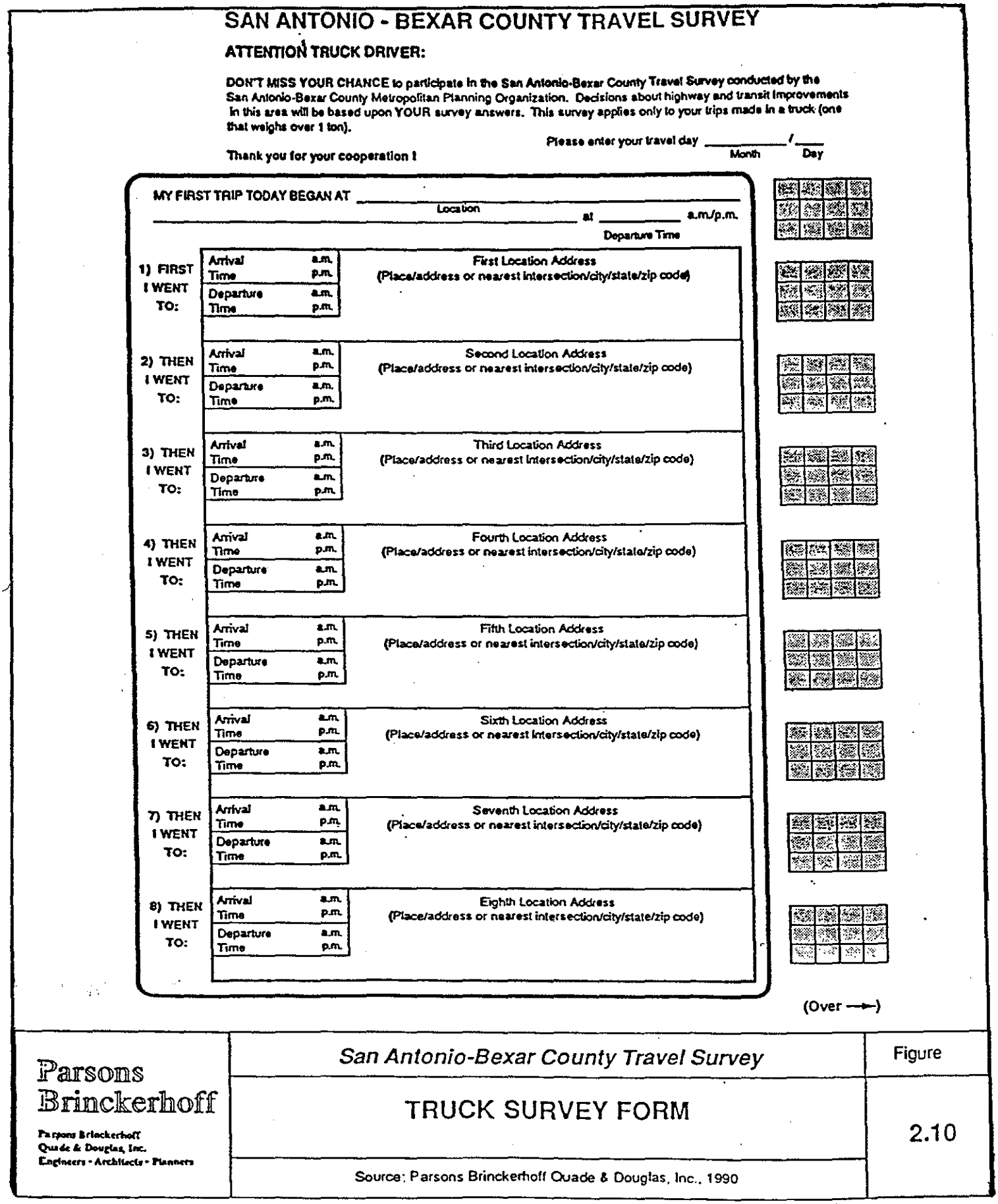
A systematic telephone number scheme was used to pull every Nth establishment which operated trucks. The sample was taken from the telephone directory. The desired sample size was 400 trucks. For those truck drivers agreeing to participate, the data were collected in one of three ways: transcription directly from the vehicle logs, the company agreed to revise their logs to collect the data needed, or the truck drivers actually recorded their trips on a travel diary. The survey instrument used was the same as that used in the San Antonio truck survey (see Figure 35). Completed surveys were obtained for 444 trucks in Amarillo.

Brownsville (27)

The Brownsville truck survey was done using the same methodology as used in Amarillo including the same survey instrument. The sample was selected in the same manner, and travel data were obtained for 404 trucks.

Sherman-Denison (28)

The commercial truck survey in Sherman-Denison was similar to the household survey in that the methodology involved a telephone/mail/telephone technique. Businesses and owners of commercial trucks registered in the respective study areas were randomly selected and telephoned to request their participation in the survey. Those agreeing were mailed a survey packet which included a travel diary for recording all trips made by the selected vehicle. They were asked to mailed the completed survey instrument back after



SAN ANTONIO - BEXAR COUNTY TRAVEL SURVEY

ATTENTION TRUCK DRIVER:

DON'T MISS YOUR CHANCE to participate in the San Antonio-Bexar County Travel Survey conducted by the San Antonio-Bexar County Metropolitan Planning Organization. Decisions about highway and transit improvements in this area will be based upon YOUR survey answers. This survey applies only to your trips made in a truck (one that weighs over 1 ton).

Please enter your travel day ____/____ (Month / Day)

Thank you for your cooperation !

MY FIRST TRIP TODAY BEGAN AT _____ (Location) _____ at _____ a.m./p.m. (Departure Time)

1) FIRST I WENT TO:	Arrival Time a.m. p.m. Departure Time a.m. p.m.	First Location Address (Place/address or nearest intersection/city/state/zip code)
2) THEN I WENT TO:	Arrival Time a.m. p.m. Departure Time a.m. p.m.	Second Location Address (Place/address or nearest intersection/city/state/zip code)
3) THEN I WENT TO:	Arrival Time a.m. p.m. Departure Time a.m. p.m.	Third Location Address (Place/address or nearest intersection/city/state/zip code)
4) THEN I WENT TO:	Arrival Time a.m. p.m. Departure Time a.m. p.m.	Fourth Location Address (Place/address or nearest intersection/city/state/zip code)
5) THEN I WENT TO:	Arrival Time a.m. p.m. Departure Time a.m. p.m.	Fifth Location Address (Place/address or nearest intersection/city/state/zip code)
6) THEN I WENT TO:	Arrival Time a.m. p.m. Departure Time a.m. p.m.	Sixth Location Address (Place/address or nearest intersection/city/state/zip code)
7) THEN I WENT TO:	Arrival Time a.m. p.m. Departure Time a.m. p.m.	Seventh Location Address (Place/address or nearest intersection/city/state/zip code)
8) THEN I WENT TO:	Arrival Time a.m. p.m. Departure Time a.m. p.m.	Eighth Location Address (Place/address or nearest intersection/city/state/zip code)

(Over →)

Parsons Brinckerhoff Parsons Brinckerhoff Quade & Douglas, Inc. Engineers • Architects • Planners	*San Antonio-Bexar County Travel Survey*	Figure
	TRUCK SURVEY FORM	2.10
	Source: Parsons Brinckerhoff Quade & Douglas, Inc., 1990	

Figure 35. San Antonio-Bexar County 1990 Truck Travel Survey.

their travel day. Reminder calls were made prior to and following the survey day. The survey instrument used in the truck survey is shown in Figure 36. A total of 141 trucks were surveyed in the Sherman-Denison survey.

In addition to the truck survey, contacts were made with the taxicab companies, and those companies furnished the trip records for all of the taxi vehicles.

Tyler

A commercial truck survey was also done in Tyler. The methodology and procedures were the same as in Sherman-Denison. A total of 81 trucks were surveyed.

EVALUATION

There were no major flaws found in the truck surveys conducted in 1990 and 1991. The only flaw found in the procedure was the inability to use the trip rates once they were developed. This was a result of the lack of a method for determining the number of trucks operating within an urban area. The trip rates which resulted from the surveys were felt to be reasonable, but it was not clear what data the trip rates could be applied to estimate the total truck trips in the urban area.

RECOMMENDATIONS

No significant changes were seen as necessary in the methodology used in the truck surveys. Some additional data elements have been identified for inclusion on the survey instruments, but the major need in this survey was a means to estimate the number of trucks operating in an urban area. A need was also identified for an additional survey in urban areas of for-hire passenger vehicles, i.e., taxicabs, limousines, etc. The following discussions present recommended survey procedures for commercial trucks and for hire passenger vehicles including discussions of the methodology for expansion of the survey data.

Commercial Truck Survey

It is necessary to identify the ultimate objectives of any survey if the survey is to be designed successfully. The truck survey has the following proposed objectives:

SHERMAN–DENISON AREA
COMMERCIAL TRUCK TRAVEL SURVEY
PART 2: TRIP INFORMATION
(continued)

OFFICE USE ONLY

Please provide the location and arrival/departure times for each trip made in the selected vehicle on the day of travel.

Enter travel day: _____ / _____ / _____
Month Day Year

Thank you for your cooperation !

MY FIRST TRIP TODAY BEGAN AT _____
Location (Place/address or nearest intersection/city/state/zip code)

_____ at _____ a.m./p.m.
Departure Time

	Arrival Time a.m. p.m.	Departure Time a.m. p.m.	Location Address (Place/address or nearest intersection/city/state/zip code)
1) FIRST I WENT TO:			First Location Address
2) THEN I WENT TO:			Second Location Address
3) THEN I WENT TO:			Third Location Address
4) THEN I WENT TO:			Fourth Location Address
5) THEN I WENT TO:			Fifth Location Address
6) THEN I WENT TO:			Sixth Location Address
7) THEN I WENT TO:			Seventh Location Address
8) THEN I WENT TO:			Eighth Location Address

Figure 36. Sherman-Denison Area Commercial 1991 Truck Travel Survey.

- Estimate the total internal truck trips occurring within the urban area.
- Estimate the proportion of internal truck trips which occur by time of day within the urban area.
- Estimate the average trip length in miles and minutes and the trip length frequency distribution for truck trips.
- Estimate the proportion of trucks operating within the urban area by type and age of vehicle including the type of fuel used.
- Estimate the mileage accumulation rates for trucks by type and age of vehicle.
- Estimate the truck trip ends by type of land use activity.

The objectives are intended to meet the data requirements for both travel demand and air quality modeling within the urban area.

Key Data Elements and Clarifications

One of the critical clarifications which must be established is exactly what is to be classified as a truck. Two elements are important in this designation. First, the type of vehicle must be easily identifiable and have a readily available data source for drawing a random sample in the survey. Second, a reasonable means must be employed to expand the survey data once collected. It is recommended that only trucks with six or more wheels on the ground be classified as a truck for purposes of this survey. It is understood that there are other vehicles which are, in fact, trucks; but including those vehicles in the survey increases the probability of trips being double counted in both the household survey and the truck survey.

The sample of trucks to be surveyed should be drawn randomly from vehicle registration data for vehicles classified as light duty gas trucks type 2 (i.e., empty vehicle weight from 6,000 pounds to 8,500 pounds), heavy duty gas vehicles, and heavy duty diesel vehicles. These categories of vehicles may be identified in the vehicle registration data for the urban area being surveyed. This is the recommended data base to use for the selection of a random sample of vehicles to be surveyed. The recommended sample size is 500 trucks (i.e., survey would yield 500 useable truck surveys). The survey methodology would consist of selecting a vehicle randomly from the registration data, contacting the owner/operator, and requesting their participation in the survey. If they agree, they will be asked to record all of their trips during

one weekday (Monday through Friday) and during Saturday or Sunday (the selection of which would be split equally between the trucks surveyed). Vehicles that were not operating within the study area region would be replaced in the survey. The vehicles surveyed must have been operating in the study area region on the selected weekday and weekend travel day or it must be replaced in the survey. The key data elements desired are as follows:

- Origin and destination (addresses) of each trip made by the truck.
- Departure and arrival time for each trip.
- Type of land use activity at the destination end of each trip, i.e., residential, retail, industrial, office, government, education, or medical.
- Type of truck, classified according to pre-defined categories (these categories would typically be the standard used in vehicle classification. studies).
- Odometer reading on truck at the beginning and end of each travel day.
- Type of fuel used by truck.
- Model year of the truck.

The expansion of the survey data will be done using the estimated total vehicle miles of travel developed from vehicle classification counts made by facility type. For example, Table 48 presents the estimated proportion of total vehicle miles of travel by eight vehicle classifications in the Houston-Galveston region. Using those proportions, an estimate of the total vehicle miles of travel by vehicles classified as light duty gas trucks type 2, heavy duty gas vehicles, and heavy duty diesel vehicles may be developed. After removing the estimated truck vehicle miles of travel made by trucks passing through the external cordon of the study area, the total vehicle miles of travel for each classification of trucks will be divided by the vehicle miles of travel for the trucks surveyed to compute an expansion factor. The expansion factor will be applied to the truck trips recorded in the survey to estimate the total truck trips being made within the study area.

Table 48
Proportionate Distribution of
Vehicle Miles of Travel (VMT)
By Vehicle Classification
Houston-Galveston Region

Vehicle Classification	Proportion of VMT
Light Duty Gas Vehicles	0.513
Light Duty Diesel Vehicles	0.005
Light Duty Gas Trucks Type 1	0.289
Light Duty Diesel Trucks	0.004
Light Duty Gas Trucks Type 2	0.079
Heavy Duty Gas Vehicles	0.071
Heavy Duty Diesel Vehicles	0.037
Motorcycles	0.002

For-Hire Passenger Carrier Survey

One area of travel often neglected in travel surveys is the travel made by for-hire passenger commercial carriers, e.g., taxicabs, limousines, vans, etc. As a part of an overall travel survey in an urban area, it is recommended that the survey design include tasks to ascertain the population of these for-hire passenger commercial carrier vehicles.

Survey Methodology

The proposed methodology for this survey is to first ascertain the number of franchised taxicabs, limousines, and/or vans licensed and authorized to operate within the study area for the purpose of carrying passengers for hire. Excluded from this population would be public transportation operators such as a local transit system. After identifying the number and location of vehicle operations, a random sample of vehicles would be drawn and the owners/operators asked to participate in the survey. Those agreeing to participate would be asked to complete a travel diary which would record the origin and destination as well as the arrival and departure time of each trip. Due to the commercial nature of these operators, care should be exercised to

assure them that all of the information would be held in the strictest confidence with no names or business addresses used. The intent is to develop an estimate of the number of trips made each day by these vehicles, the average trip length, and the trip length frequency distribution for these trips. The recommended sample size is 400 useable surveys.

GAPS IN TRAVEL SURVEYS

The five surveys implemented in 1990 and 1991 represented a significant effort in both cost and data collection. The resulting data are perhaps the most comprehensive ever collected in urban areas in Texas and will provide insight into travel demand for many years. However, some areas of travel were not addressed in those travel surveys. They are discussed here only to identify them as areas of possible concern for future survey efforts.

The first has already been mentioned and a recommended survey design presented. That is the travel by for-hire passenger carrier vehicles. In most urban areas, these trips may represent a relatively small proportion of overall travel. Current surveys do not address this travel. Models for estimating this travel are based on data that are either very dated or transferred from other areas.

The second area of travel which is not being addressed in travel surveys is travel made by visitors to the urban area. This travel actually consists of two parts. One part is made up of the internal travel by persons that live outside the study area boundary but travel into the study area on a daily (or frequent) basis for work and shopping. The external station survey estimates this travel into and out of the study area, but none of the surveys or models estimate the amount of travel for these individuals during the time they are inside the study area. Depending on the location of the study area boundary, this could be a significant amount of travel. The second part of this visitor travel is that daily travel by true visitors (e.g., tourists) within the urban area. These individuals may arrive in the area by different modes and, during their stay, travel extensively within the urban area. Current surveys and models do not address the estimation of this travel in Texas.

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