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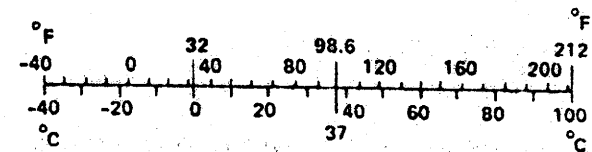
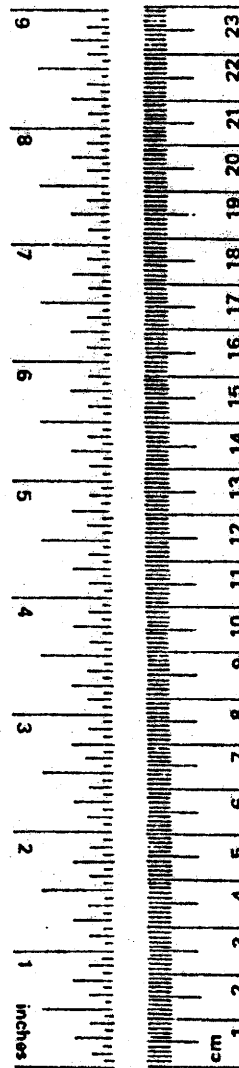
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
AREA				
in ²	square inches	6.5	square centimeters	cm ²
ft ²	square feet	0.09	square meters	m ²
yd ²	square yards	0.8	square meters	m ²
mi ²	square miles	2.6	square kilometers	km ²
	acres	0.4	hectares	ha
MASS (weight)				
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
VOLUME				
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft ³	cubic feet	0.03	cubic meters	m ³
yd ³	cubic yards	0.76	cubic meters	m ³
TEMPERATURE (exact)				
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
AREA				
cm ²	square centimeters	0.16	square inches	in ²
m ²	square meters	1.2	square yards	yd ²
km ²	square kilometers	0.4	square miles	mi ²
ha	hectares (10,000 m ²)	2.5	acres	
MASS (weight)				
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
VOLUME				
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m ³	cubic meters	35	cubic feet	ft ³
m ³	cubic meters	1.3	cubic yards	yd ³
TEMPERATURE (exact)				
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



* 1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price \$2.25, SD Catalog No. C13.10:286.

PARK-AND-POOL LOTS
DALLAS/FORT WORTH AREA
AN ANALYSIS OF SURVEY DATA

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Research Report 205-18
Priority Use of Transportation Facilities
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College Station, Texas 77843

May 1982

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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 State Department of Highways and Public Transportation. This report does not constitute a standard, specification, or regulation.

ABSTRACT

This report documents the results of a Park-and-Pool study undertaken at selective locations along the I-30 freeway corridor in the Dallas-Fort Worth urbanized area. Considerable data were obtained on Park-and-Pool activity through a user survey. The information provided by the survey respondents, when considered in light of other transportation planning data, should prove useful in a number of ways including:

- The evaluation of existing Park-and-Pool programs in urbanized areas;
- The assessment of potential Park-and-Pool Demand;
- The analysis of benefits and costs of proposed Park-and-Pool projects; and
- The development of planning, programming and design criteria for Park-and-Pool facilities.

Key Words: Park-and-Pool, Ridesharing, Carpool, Vanpool, Corridor Parking, Demand Estimation, Transportation Planning.

SUMMARY

The increasing cost of commuting has resulted in the acceptance of ridesharing by the traveling public as a viable mode of transportation. The purpose of this research effort was to investigate Park-and-Pool activity in the Dallas-Fort Worth urbanized area and to formulate planning guidelines for predicting demand and assessing the benefit/cost of proposed facilities.

Twenty-one informal, or non-designated, Park-and-Pool sites, having a total of 669 parked commuter vehicles, were identified along the I-30 freeway corridor. The distribution and collection of a user survey resulted in the identification of personal characteristics and travel behavior of commuters engaged in pooling activity.

The user survey indicated that the majority of individuals participating in Park-and-Pool within the Dallas-Fort Worth region are employed in either professional or managerial positions, have attended at least one-year of college, are approximately 37 years old, and are participating in ridesharing to save money.

Travel patterns indicated by the survey participants revealed the average home-to-lot distance to be 5.9 miles, and the average lot-to-destination distance to be 23.2 miles, representing a typical daily travel distance of slightly more than 58 miles. Some 55 percent of the poolers indicated that they drove alone prior to using Park-and-Pool. Ninety-eight percent of the survey respondents stated that their trip purpose was for work. Approximately 31 percent of the commuters vanpool from the parking facility to their final destination with an average van occupancy of 8.81 persons, while an additional 62 percent travel by carpool with an average vehicle occupancy of 3.36 persons.

Seventy-five to 80 percent of the commuters originated from within the city where the parking facility was located. About 75 percent of the poolers had a final destination located in the City of Dallas, with over half (56 percent) of these commuters traveling to the Dallas central business district.

Based upon the research data, a methodology for estimating Park-and-Pool demand and related benefits of Park-and-Pool facilities was developed. Using the travel distances and average vehicle occupancies for 9 potential Park-and-Pool sites, the average annual reduction in vehicle-miles of travel (VMT) ranged from 2830 to 9400 miles per commuter with an overall mean reduction of 6460 vehicle-miles per year. Investigation of the catchment zone or market area for Park-and-Pool participants revealed a circular or elliptical configuration having an area of approximately 65 to 70 square miles as being a general guide for estimating pooler demand. Relationships between potential poolers and vehicle ownership density and population density within the market areas were investigated to aid the transportation planner in estimating demand and in sizing a proposed facility. The demand relationships for the larger, more successful, Park-and-Pool facilities indicate ratios of .22 percent to .24 percent of vehicle ownership and about .15 percent of population within a given catchment zone to provide an estimate of the number of pooler commuters.

Benefit/cost (B/C) ratios were developed, using very conservative estimates of benefits and high estimates of costs, for 9 potential Park-and-Ride facilities. In all cases the B/C ratios exceeded unity or the threshold level for economic investment. The benefit/cost analyses revealed the positive nature of the B/C ratios associated with these types of transportation improvement projects.

IMPLEMENTATION STATEMENT

Over the years, Project 205 has been directed at assisting the State Department of Highways and Public Transportation (SDHPT) in planning and implementing improvements for high occupancy vehicles (HOV's). Park-and-Pool facilities are an important component of these HOV improvement strategies.

Park-and-Pool facilities have been constructed at numerous locations throughout Texas, with the SDHPT being instrumental in the planning, design, financing and operation of many of these improvements. The increasing cost of commuting has made ridesharing a viable and acceptable transportation mode to the traveling public. The demand for Park-and-Pool facilities has continued to grow with the popularity of ridesharing. The information presented in this report should assist transportation professionals in estimating potential demand for Park-and-Pool facilities located in urbanized areas and in determining relative benefit/cost ratios for alternative projects.

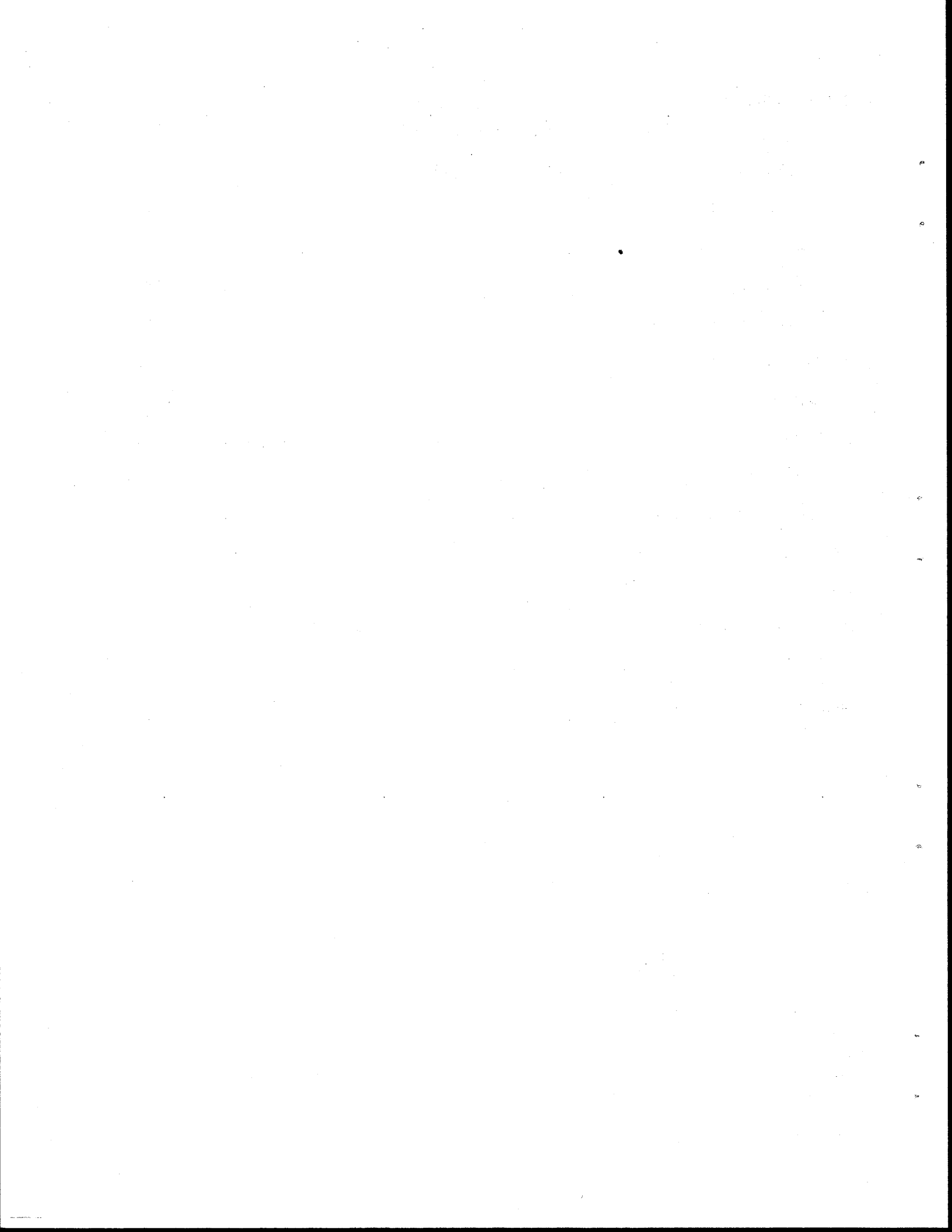
The planning techniques and procedures outlined herein should provide valuable interim guidance in analyzing alternative Park-and-Pool facilities. Through a continuing process of monitoring of pooling activities, the methodologies contained herein may be refined to further aid the transportation professional in evaluating these types of HOV strategies.

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INTRODUCTION

Urban freeways are designed to provide a high level-of-service for relatively long urban trips. The large urbanized areas in Texas are primarily dependent upon their freeway systems for the mobility of persons and goods to support existing and future land uses and their economic bases.

The rapid population growth of the State's urbanized areas has resulted in a correspondingly rapid growth in transportation demand and traffic congestion. In addition to rapid population growth, the problem of sustaining urban mobility is compounded by a general reduction in the people-moving capacity of existing freeways. During the last 30 years, the average vehicle occupancy rate has declined from about 4 persons per vehicle to less than 1.3 persons per vehicle. This vehicle occupancy reduction has essentially resulted in a 68% decrease in the effective capacity of existing urban freeways.

The State Department of Highways and Public Transportation is responsible for the design, construction and operation of urban freeways to accommodate present and future transportation demand. In an attempt to increase the effective capacity and productivity of existing freeway facilities and to reduce transportation energy consumption, the Department has initiated studies and evaluations of various priority treatment strategies for high-occupancy vehicles. Park-and-Pool facilities are an example of a priority treatment strategy to increase the productivity of the freeway system in Texas and to reduce energy consumption.

Park-and-Pool is a term used to describe a parking area or facility where commuters can rendezvous, park one or more of their vehicles, and share a ride to a common destination. The parking areas are normally designated

lots which are delineated by signs or by promotional activities of public agencies. The State Department of Highways and Public Transportation has constructed parking lots in both rural and urban areas to encourage ridesharing by the commuting public. Unfortunately, limited data exist to aid in the planning and design of Park-and-Pool facilities.

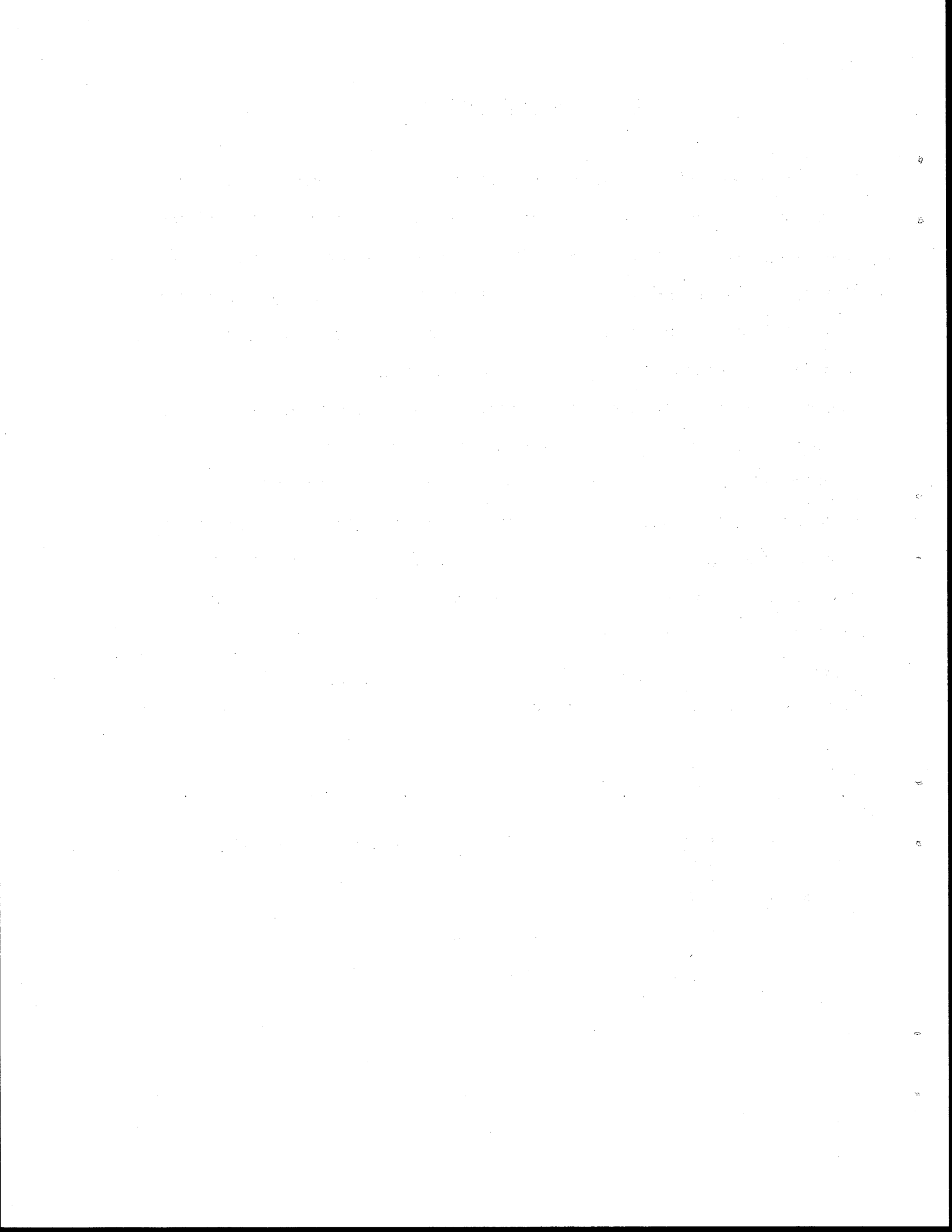
The research effort documented herein is a continuation of, and a complement to, previous studies of priority treatment strategies sponsored by the State Department of Highways and Public Transportation and conducted by the Texas Transportation Institute. A 1981 study (Research Report 205-13) investigated some 25 formal Park-and-Pool lots within the San Antonio and Houston urbanized areas. The results of this research effort, in combination with prior work, should provide useful guidelines for planning future Park-and-Pool facilities in major urbanized areas throughout the State.

STUDY OBJECTIVES AND PROCEDURE

The objective of this research effort was to provide data useful in establishing planning guidelines for locating, sizing and assessing the cost-effectiveness of Park-and-Pool facilities in major urbanized areas. This study investigates pooling activity along the I-30 freeway corridor within the Dallas-Fort Worth urbanized area and complements previous research and data collection efforts of Park-and-Pool users in the San Antonio and Houston areas. Where appropriate, comparisons are made between the pooling characteristics of the three urbanized areas studied. Whereas the previous research effort surveyed formal or designated Park-and-Pool facilities, this study identified and investigated informal ridesharing activities occurring along the I-30 freeway corridor. Informal Park-and-Pool lots are distinguished from formal lots in that no expenditure of public funds has been made to construct, operate, maintain or promote the use of the informal facilities.

The following presents an outline of the major tasks accomplished in performing this study:

- Review of relevant literature, local planning data, and prior studies;
- Identification of existing Park-and-Pool locations adjacent to the I-30 freeway corridor;
- Design and performance of data collection effort;
- Analysis of Park-and-Pool data; and,
- Documentation of the study, major findings and appropriate recommendations.



LITERATURE REVIEW

In an attempt to assess the current state-of-the-art for planning Park-and-Pool facilities and to assemble relevant data for the Dallas urbanized area, two primary sources were utilized in the literature investigation.

1. Texas A&M University's Automated Information Retrieval Service (AIRS)
2. Local transportation professionals in the Dallas-Fort Worth Urbanized Area

The Automated Information Retrieval Service (AIRS) provides customized searches of published literature in over 150 indexes, abstracting services, and directories. Identification of relevant work is based on the occurrence of data elements, keywords, subject codes, author names, etc. The researcher creates a profile of the particular subject area being investigated and specifies the key words or terms used by AIRS in the literature search. Two principal transportation directories were used in the AIRS search for relevant Park-and-Pool data.

1. Transportation Research Information Service (TRIS)
2. National Technical Information Service (NTIS)

Over 300 reports and publications were identified by AIRS which related to ridesharing and parking activities. Abstracts of these published works were obtained and reviewed for possible utilization in this Park-and-Pool research. The applicable publications have been referenced herein where appropriate and are included in the References at the end of the text.

Relevant transportation, population, and employment data were provided by numerous transportation officials within the Dallas-Fort Worth region.

Agencies which provided information and greatly assisted in the Park-and-Pool study include the:

- City of Arlington;
- City of Dallas;
- North Central Texas Council of Governments; and
- State Department of Highways and Public Transportation.

To the extent possible, analysis areas used by local jurisdiction (i.e., census tracts, serial zones, sectors, zip code zones, etc.) were applied in the data analysis to facilitate any subsequent local application of the research results. Sources of local transportation data used in the study are referenced herein as appropriate.

PARK-AND-POOL SURVEY

Location Identification

To date, no formal Park-and-Pool facilities have been constructed or delineated by the State Department of Highways and Public Transportation adjacent to I-30 within the Dallas urbanized area. The pooling activity identified along the freeway corridor in this research effort was being performed in an informal fashion at a variety of non-designated locations. The identification of Park-and-Pool activity was necessary prior to data collection and the distribution of pooler surveys. Whereas formal Park-and-Pool lots are constructed and maintained with public funds, no public resources have been used in designating or promoting the informal facilities. Three methods of location identification were employed in the study effort.

1. Previous observations by State Maintenance Personnel
2. Aerial photography (taken in early 1980) of the I-30 corridor
3. On-site field investigation conducted by the research team

The Dallas District's maintenance personnel had observed some 7 different locations or interchanges where Park-and-Pool activity was believed to be occurring. Subsequent field investigation was used to verify these locations. These field investigations resulted in a total of 10 different sites with 262 potential Park-and-Pool vehicles. The use of aerial photography and on-site inspection proved to be very valuable in locating additional sites and potential poolers. Eleven more sites with 407 potential pooler vehicles were added to the initial list of Park-and-Pool locations.

The combination of identification procedures used in the study resulted in a total of 21 different sites and 669 vehicles.

Figure 1 shows the 21 sites identified for data collection and study located adjacent the I-30 Freeway. Table 1 presents an abbreviated description of these locations, and identifies the number of potential pooler vehicles for each site. Of the 21 sites identified, 17 locations were on private property which amounted to 476, or 71%, of the potential Park-and-Pool vehicles.

Data Collection Forms

Survey forms were prepared for the data collection effort to obtain information for the accomplishment of the study's objectives. In addition, an attempt to satisfy the following criteria was also made in designing the data collection forms.

1. Data should complement prior Park-and-Pool research conducted in Houston and San Antonio.
2. Data should, inasmuch as possible, be compatible with work and research conducted throughout the nation.
3. Survey methodology should be compatible with, and comparable to, prior data collection efforts by local agencies within the Dallas urbanized area.
4. Survey procedures and instruments should facilitate the highest possible return of statistically significant and meaningful information.

Appendix A contains the survey instruments used in the data collection effort and includes the following.

- Cover letter
- Park-and-Pool Survey form
- Park-and-Pool Site Investigation form

DALLAS-FORT WORTH URBANIZED AREA

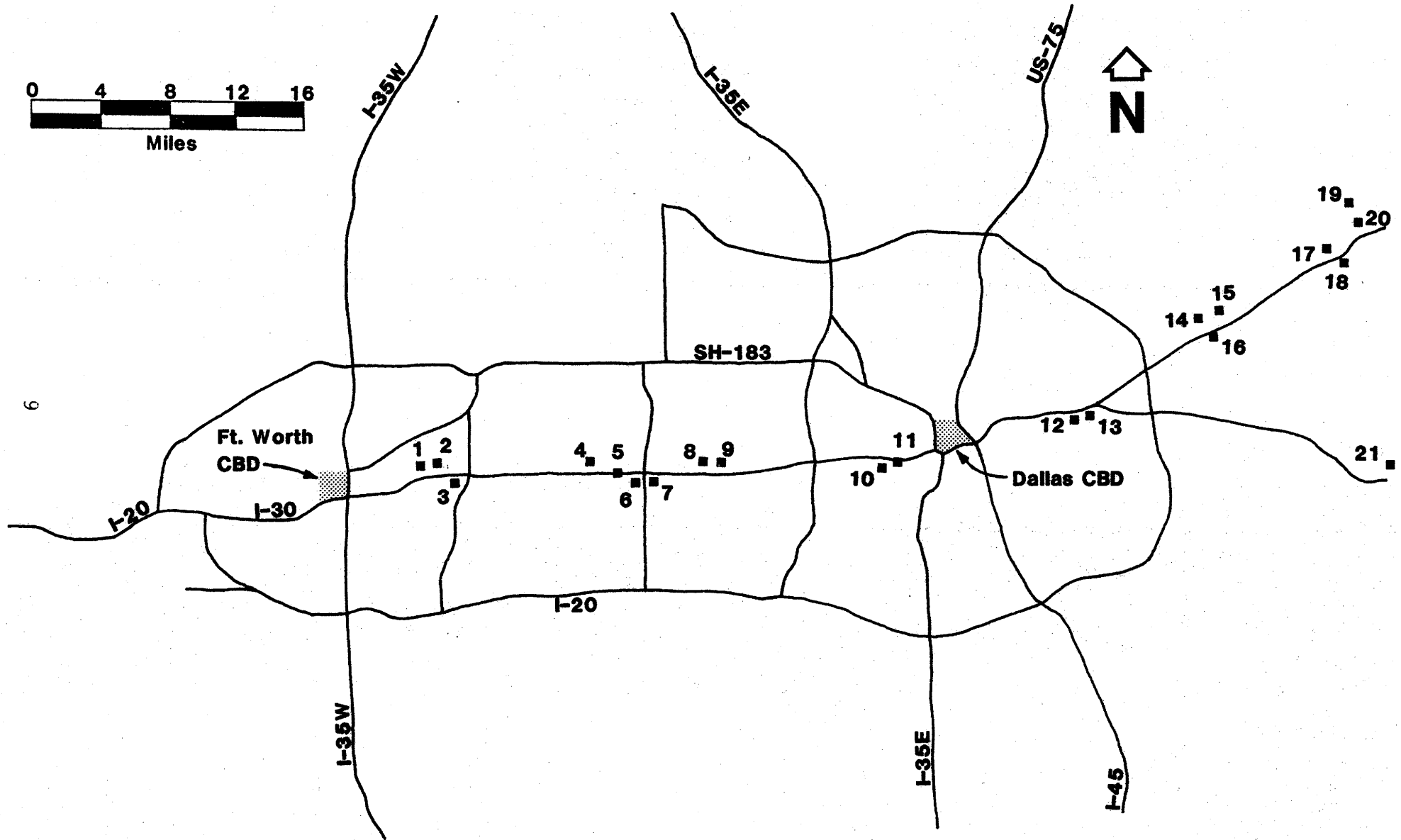


Figure 1: Park-and-Pool Locations and Site Numbers

Table 1: Park-and-Pool Sites

Site Number	Identified Pooler Vehicles	Location	Abbreviated Description
1	45	Northeast Quadrant of I-30 and Oakland Blvd.; Fort Worth	Paved parking lot; Oakland Mall-Buddies Store (Private Property)
2	11	North Side of I-30 at Bridge and Woodhaven; Fort Worth	Paved parking lot; Kroger (Private Property)
3	118	Southwest Quadrant of I-30 and Loop-820; Fort Worth	Paved parking lot; Church of Christ (Private Property)
4	11	North Side of I-30 within FM-157 Interchange; Arlington	Unimproved, Grassy Area between Old Toll Booth Facility and SDHPI Maintenance Yard (Public Property)
5	133	Adjacent to I-30 (south and north sides) at Turnpike Plaza; Arlington	Paved parking areas; adjacent to Mexican Food Restaurant and abandoned Service Station (Public Property)
6	23	Southwest Quadrant of I-30 and SH-360; Arlington	Paved parking lot; Bowling Alley (Private Property)
7	8	Southeast Quadrant of I-30 and SH-360; Arlington	Paved parking area-very small; adjacent to Old Toll Booth Facility (Public Property)
8	18	Northwest Quadrant of I-30 and Beltline Road; Grand Prairie	Paved parking lot; Fire Museum (Private Property)
9	41	Northeast Quadrant of I-30 and Beltline Road; Grand Prairie	Improved, gravel area adjacent to entrance/exit ramps by Old Toll Facility Site; (Public Property)
10	15	South of I-30 on Southwest Corner of Hampton Road and US-80 Business; Dallas	Paved parking lot; Stevens Park Shopping Center (Private Property)
11	21	South of I-30 on Northeast Corner of Hampton Road and US-80 Business; Dallas	Paved parking lot; Food Basket (Private Property)
12	12	Southeast Quadrant of I-30 and Jim Miller/Samuell; Dallas	Paved parking lot; Safeway (Private Property)
13	20	Southwest Quadrant of I-30 and Loop-12; Dallas	Paved parking lot; K-Mart (Private Property)
14	80	Northwest Quadrant of I-30 and Belt Line Road; Garland	Paved parking lot; K-Mart (Private Property)
15	30	Northeast Quadrant of I-30 and Belt Line Road; Garland	Paved parking lot; Shopping area (Private Property)
16	19	Southwest Quadrant of I-30 and Belt Line Road; Garland	Paved parking lot; Beltline 30 Shopping Center (Private Property)
17	6	Northwest Quadrant of I-30 and FM-740; Rockwall County	Improved gravel parking area; Mr. Catfish (Private Property)
18	7	Southeast Quadrant of I-30 and FM-740; Rockwall County	Unimproved area; adjacent to old abandoned gas station (Private Property)
19	22	North of I-30 and South of "Y" Intersection of FM-740 and SH-205; Rockwall	Paved parking lot; Ridge Road Shopping Center (Private Property)
20	24	Northwest Quadrant of I-30 and SH-205; Rockwall County	Paved parking lot; Wal-Mart (Private Property)
21	5	Northeast corner of US-80 and SH-205 (South of I-30 and just North of I-20); Terrell	Paved parking lot; Wal-Mart (Private Property)

Data Collection Procedure

To obtain the maximum amount of information possible, a 100% sampling of all identified Park-and-Pool sites and potential poolers was undertaken. Each of the 21 parking areas was surveyed between the hours of 10:00 a.m. and 3:00 p.m. by the research team on one of three days (Tuesday through Thursday, December 8-10, 1981).

Three primary tasks were undertaken at each of the Park-and-Pool locations.

1. Distribution of User Surveys
2. Recording License Plate and Vehicle data
3. Recording Parking Area Location and Description

Each of the User Surveys was coded for cross-reference purposes to identify the parking area and for subsequent matching of vehicle license plate data. The cover letter and the Park-and-Pool Survey form (See Appendix A) were inserted in an envelope and placed on the windshield of the pooler vehicles. For the convenience of the driver, and in an attempt to increase the return rate, a postage-paid return envelope was also enclosed with the survey form.

In addition, each vehicle's license plate number and vehicle type (i.e., Subcompact, Standard, Pickup, Van) were recorded along with the following general information:

- Lot designation/description,
- Lot location,
- Date of survey,
- Day of week,
- Observer,

- Total number of vehicles, and
- Time observed.

Survey Results

The distribution of 669 survey forms resulted in 235 surveys being returned for a response rate of 35%. A summary of the survey response is shown, by site, in Table 2.

This section presents a summary of the information obtained from the returned surveys and is divided into the following major areas:

- Personal characteristics of poolers,
- Park-and-Pool lots,
- Factors influencing decision to pool,
- Travel patterns,
- Origins and destinations of poolers, and
- Remarks and comments.

Where possible, a comparison of the data collected for Park-and-Pool activity in San Antonio and Houston (Research Report 205-13) is made and presented herein. It should be noted that summaries of survey data, disaggregated by city and/or county, may result in certain findings which are not statistically significant.

Personal Characteristics of Poolers

In an attempt to obtain a profile of the Park-and-Pool participant, a series of questions was asked relating to the individual's age, sex, education and occupation. The information obtained from these questions is highlighted below.

TABLE 2: Survey Distribution and Response; By Site

Site No.	Lot Location			Surveys Distributed	Surveys Returned	Response Rate
	Interchange	City	County			
1	I-30 & Oakland	Fort Worth	Tarrant	45	18	40.0%
2	I-30 & Bridge/Woodhaven	Fort Worth	Tarrant	11	2	18.2%
3	I-30 & Loop 820	Fort Worth	Tarrant	118	42	35.6%
4	I-30 & FM-157	Arlington	Tarrant	11	8	72.7%
5	I-30 & Plaza	Arlington	Tarrant	133	63	47.4%
6	I-30 & SH-360	Arlington	Tarrant	23	9	39.1%
7	I-30 & SH-360	Arlington	Tarrant	8	3	37.5%
SUB-TOTAL	---	---	Tarrant	349	145	41.5%
8	I-30 & Belt Line	Grand Prairie	Dallas	18	0	0%
9	I-30 & Belt Line	Grand Prairie	Dallas	41	23	56.1%
10	US-80 & Hampton	Dallas	Dallas	15	1	6.7%
11	US-80 & Hampton	Dallas	Dallas	21	5	23.8%
12	I-30 & Jim Miller/Samuell	Dallas	Dallas	12	4	33.3%
13	I-30 & Loop-12	Dallas	Dallas	20	4	20.0%
14	I-30 & Belt Line	Garland	Dallas	80	31	38.8%
15	I-30 & Belt Line	Garland	Dallas	30	1	3.3%
16	I-30 & Belt Line	Garland	Dallas	19	5	26.3%
SUB-TOTAL	---	---	Dallas	256	74	28.9%
17	I-30 & FM-740	Unincorporated	Rockwall	6	3	50.0%
18	I-30 & FM-740	Unincorporated	Rockwall	7	0	0%
19	FM-740 & SH-205	Rockwall	Rockwall	22	2	9.1%
20	I-30 & SH-205	Unincorporated	Rockwall	24	11	45.8%
SUB-TOTAL	---	---	Rockwall	59	16	27.1%
21	US-80 & SH-205	Terrell	Kaufman	5	0	0%
SUB-TOTAL	---	---	Kaufman	5	0	0%
TOTAL	---	---	---	669	235	35.1%

Age

Question #19 of the survey requested the respondent to indicate their age. Some 94% of the returned surveys, or 220, had age information included which ranged from 15 to 66 and averaged 37 years. Table 3 shows, by city, the range, average and standard deviation of the respondents' age.

Table 3: Age of Survey Respondents; By City

City	Minimum Age (Years)	Maximum Age (Years)	Average (Mean) Age (Years)	Standard Deviation (Years)
Arlington (n = 82)	20	62	34.0	10.5
Dallas (n = 14)	15	54	31.1	9.8
Fort Worth (n=57)	21	66	42.8	13.9
Garland (n = 33)	25	55	36.9	9.6
Grand Prairie (n = 21)	21	57	37.5	9.6
Rockwall (n = 13)	23	51	35.5	8.6
All Cities (n = 220)	15	66	36.9	11.7

The age of poolers surveyed in San Antonio and Houston averaged 37 years and ranged from 16 to 62. Figure 2 shows the cumulative frequency distribution for all responses to the age question.

Sex

Question #20 asked the sex of the respondent. A total of 228 respondents, or 97%, indicated their sex, with 48% being male and 52% being female. Table 4 presents the split, by city, of male and female responses to the survey.

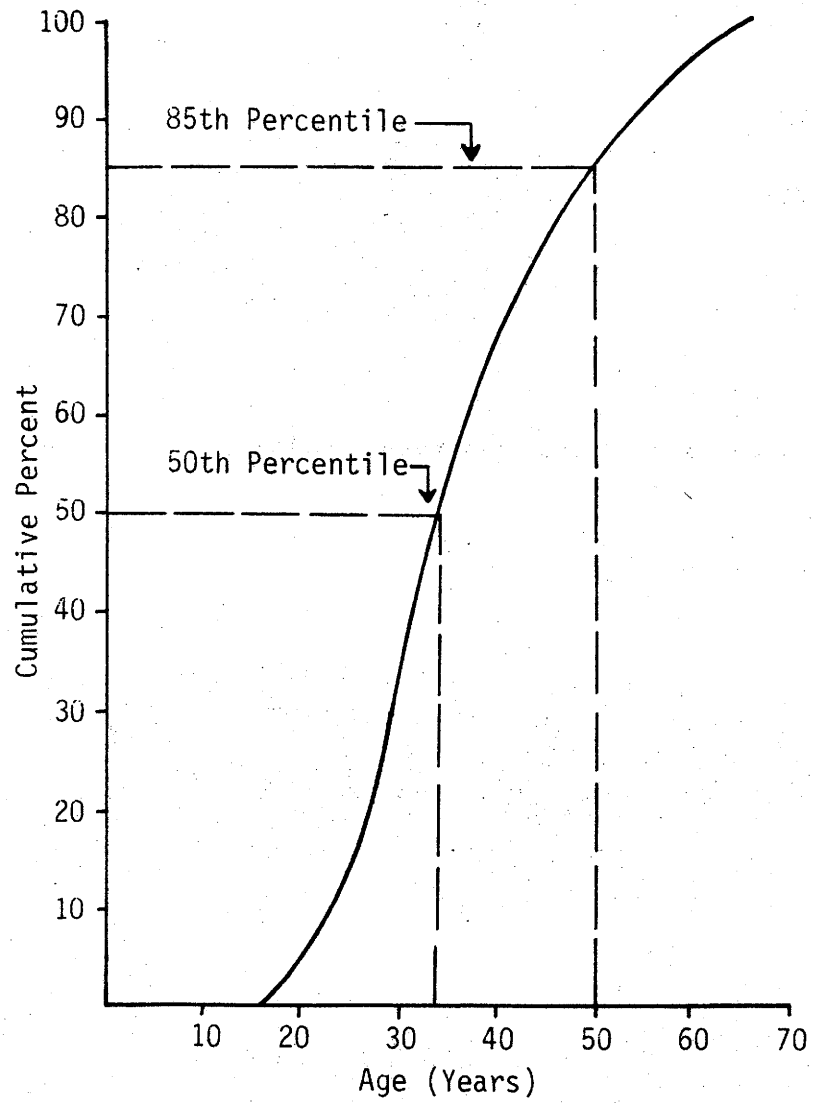


Figure 2: Cumulative Frequency Distribution, Age of Park-and-Poolers (n=220)

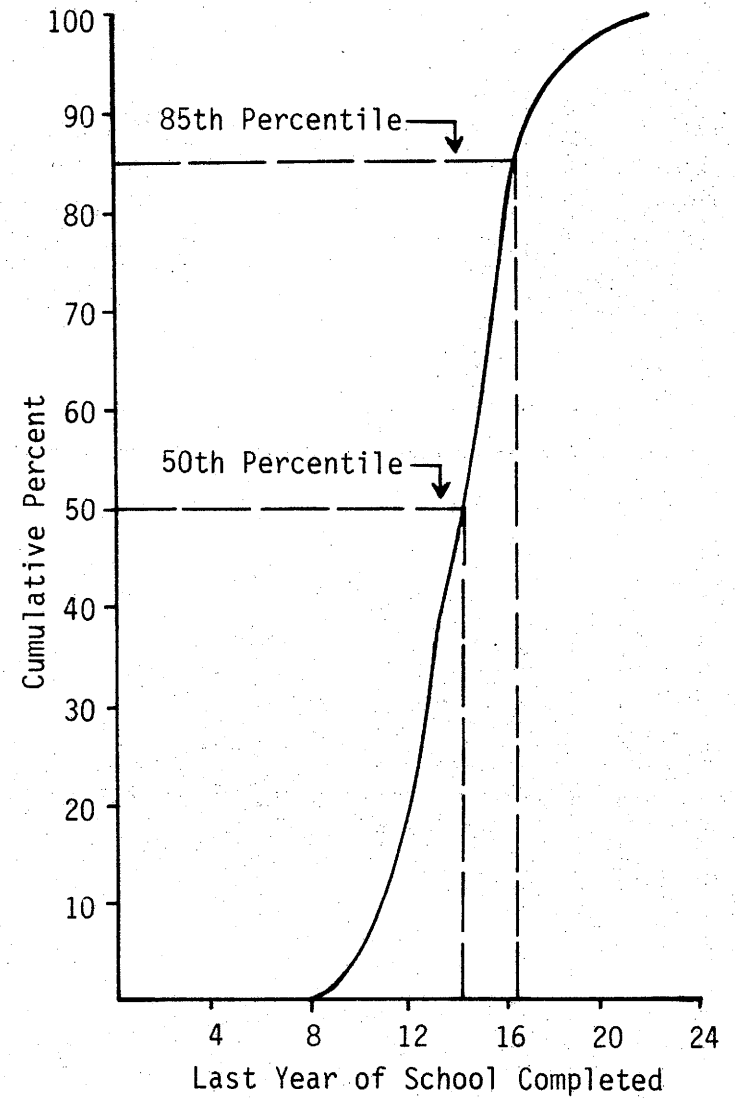


Figure 3: Cumulative Frequency Distribution, Education Level of Park-and-Poolers (n=225)

Table 4: Sex of Survey Respondents; By City

City Sex	Arlington (n=83)	Dallas (n = 14)	Fort Worth (n = 59)	Garland (n = 35)	Grand Prairie (n = 22)	Rockwall (n = 15)	Total (n = 228)
Male	40%	64%	54%	51%	41%	53%	48%
Female	60%	36%	46%	49%	59%	47%	52%
Total	100%	100%	100%	100%	100%	100%	100%

The percentages of female responses varied from a high of 60% in Arlington to a low of 36% in Dallas. The male-female split in the San Antonio/Houston study was 61% male and 39% female.

Education

Question #18 asked, "How many years of school have you completed?" Some 225 responses were received to this inquiry, which represents 95% of the returned surveys. Table 5 presents a summary of education, expressed in number of years, for each of the cities surveyed.

Table 5: Educational Level of Survey Respondents; By City

City	Years of School			Standard Deviation
	Minimum	Maximum	Average (Mean)	
Arlington (n = 82)	12	22.	15.4	2.3
Dallas (n = 13)	9	20	14.6	3.2
Fort Worth (n = 59)	8	22	14.2	2.5
Garland (n = 35)	12	22	15.0	2.4
Grand Prairie (n = 22)	12	19	14.0	2.6
Rockwall (n = 14)	12	20	14.8	2.5
All Cities (n = 225)	8	22	14.8	2.5

Information provided indicates that Park-and-Pool participants are relatively well educated. Only 3.6% of the respondents indicated less than

a high school education while over 65% have attended at least one year of college. More than 14% of those surveyed have completed in excess of 16 years of schooling--equivalent to the graduate level of higher education. Park-and-Poolers surveyed in San Antonio and Houston indicated that 51% and 61%, respectively, had attended college, while some 11% and 8%, respectively, had more than 16 years of schooling.

Figure 3 presents the cumulative frequency distribution of all responses received to the level of education question.

Occupation

Question #17 asked, "What is your current occupation (please be specific)?" A total of 224 responses were received, representing some 95% of the returned surveys. Answers to the occupation question were grouped into 13 categories; the results of this grouping are presented by county in Table 6.

Table 6: Occupation of Survey Respondents; By County

Occupation	Dallas (n = 70)	Rockwall (n = 15)	Tarrant (n = 139)	Total (n = 224)	San Antonio (n = 67)	Houston (n = 181)
Professional	37%	27%	36%	36%	39%	39%
Clerical	20%	20%	23%	22%	21%	21%
Managerial	17%	27%	22%	21%	8%	9%
Sales	10%	7%	6%	8%	1%	3%
Craftsman	9%	---	6%	6%	24%	25%
Laborer	3%	---	4%	3%	---	1%
Service Worker	2%	13%	2%	3%	---	1%
Student	1%	---	1%	1%	7%	---
Operative	1%	---	---	---	---	1%
Housewife	---	6%	---	---	---	---
Private Household Worker	---	---	---	---	---	---
Unemployed	---	---	---	---	---	---
Retired	---	---	---	---	---	---
TOTAL	100%	100%	100%	100%	100%	100%

The responses to this question indicate some 58% of the Park-and-Poolers are either professional or managerial. Occupations in Dallas and Tarrant Counties are very similar. However, the low sample size (n = 15) from Rockwall County portrays an inaccurate profile of occupation; the 6% housewife response only represents one individual.

For comparison purposes, the occupations of 248 Park-and-Poolers surveyed in San Antonio and Houston are also shown in Table 6. The combined total of professional and managerial amounts to 47%, or some 11% fewer than those surveyed in the Dallas urbanized area.

Park-and-Pool Lots

Several questions were included on the survey form which dealt with the participants' use of the Park-and-Pool lots. Due to the informal nature of the Park-and-Pool facilities in the Dallas urbanized area, the following statement was included at the beginning of the survey form:

We have tried to identify only individuals parked for the purpose of sharing a ride to another destination. If you do not travel from this parking area to another location, please help us by returning the questionnaire with any comments on the reverse side.

Of the 235 returned questionnaires, only 4, or 1.7%, were non-poolers. The following presents the responses received from ridesharing participants (poolers) which pertain to the use of the informal, nondelineated Park-and-Pool lots.

How Poolers Learned of Lot

Question #15 asked "How did you first learn about this Park-and-Pool location?" A total of 222 responses, representing some 96% of the 231

poolers, were received. Table 7 provides a summary, by Park-and-Pool site, of how the poolers learned of the lot locations.

Eighty-seven percent of the respondents learned of the lot from co-workers, their employers or noticed others using the area. From 264 respondents surveyed in the San Antonio and Houston area, some 57% indicated learning about the Park-and-Pool facilities by either noticing the lot being built or by seeing a highway sign; neither of these observation methods are applicable to learning of parking areas in the Dallas urbanized area since the Dallas lots are all informal.

Effect of Parking Area on Decision to Rideshare

Question #11 asked, "How did the availability of this parking area effect the formation of your carpool/vanpool or using the bus?" A total of 225 responses were received and are summarized by city and county in Table 8.

Some 51% of the 265 respondents surveyed in San Antonio and Houston indicated that the parking area was one of several factors in the decision to rideshare, while 37% said that the lot had no effect. Twelve percent of poolers in both studies (San Antonio/Houston and Dallas) indicated that they would not be participating in ridesharing if it were not for the parking lot.

Security of Lot

Question #14 of the survey asked, "Do you feel it is safe to leave your car parked at this location?" A total of 226 responses were received and are summarized, by city, in Table 9.

Table 7: How Poolers Learned of Lot; By Site

How Learned of Lot	Site Number, n = (*)																					Total (n = 222)
	1 (18)	2 (1)	3 (40)	4 (8)	5 (63)	6 (9)	7 (3)	8 (0)	9 (22)	10 (1)	11 (4)	12 (2)	13 (4)	14 (29)	15 (1)	16 (4)	17 (3)	18 (0)	19 (0)	20 (10)	21 (0)	
Co-Workers or Employer	50%	---	40%	88%	49%	56%	33%	---	23%	---	50%	---	50%	52%	---	---	33%	---	---	50%	---	45%
Noticed Others Using Area	40%	100%	38%	12%	38%	33%	67%	---	77%	---	25%	100%	25%	38%	100%	25%	67%	---	---	40%	---	42%
Friends or Relatives	5%	---	20%	---	8%	11%	---	---	---	100%	---	---	---	7%	---	50%	---	---	---	---	---	9%
Radio/TV/ Newspaper	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	10%	---	---
Other	5%	---	2%	---	5%	---	---	---	---	---	25%	---	25%	3%	---	25%	---	---	---	---	---	4%
TOTAL	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	100%

*Number of responses received for question from particular site.

Table 8: Effect of Parking Area on Decision to Rideshare; By City and County

Effect of Area	City						County			Total (n=225)
	Arlington (n=82)	Dallas (n=13)	Ft. Worth (n=61)	Garland (n=33)	Grand Prairie (n=22)	Rockwall (n=14)	Dallas (n=68)	Rockwall (n=14)	Tarrant (n=143)	
This parking was one of several factors which encouraged me to carpool/vanpool/bus.	71%	38%	46%	61%	50%	50%	53%	50%	60%	57%
This parking area had no effect on my use of carpool/vanpool/bus.	21%	38%	36%	36%	32%	50%	35%	50%	27%	31%
I would not be using carpool/vanpool/bus if this parking area was not here.	8%	24%	18%	3%	18%	---	12%	---	13%	12%
Totals	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 9: Feeling of Security at Parking Area; By City

Safe to Leave Car	City						Total (n=226)
	Arlington (n=82)	Dallas (n=13)	Fort Worth (n=60)	Garland (n=35)	Grand Prairie (n=22)	Rockwall (n=14)	
Yes	73%	54%	70%	74%	45%	100%	70%
No	12%	15%	3%	9%	23%	----	10%
Not Sure	15%	31%	27%	17%	32%	----	20%
Total	100%	100%	100%	100%	100%	100%	100%

Some 78% of 258 poolers surveyed in San Antonio and Houston responded "yes", with 16% saying "no" to a similar question. Several comments pertaining to vandalism and the need for improved security were received from participants in the Dallas area survey; however, such comments were highly dependent upon the location of the particular site (see Remarks and Comments section).

Desire for Express Bus Service

Question #7 asked, "If convenient express bus service was provided from this location to your destination, would you prefer to continue carpooling/vanpooling, or ride the bus?" The survey was structured to ask only those participants presently carpooling or vanpooling to respond. A total of 204 responses were received to the question, which represents some 96% of the 212 carpool or vanpool participants. Table 10 presents a summary, by city, of the respondents' answers. It should be noted that the question provides no information pertaining either to frequency or cost of bus service.

Table 10: Desire for Express Bus Service; By City

If Convenient Express Bus Service was Provided, would:	City						Total (n=204)
	Arlington (n=80)	Dallas (n=12)	Fort Worth (n=46)	Garland (n=32)	Grand Prairie (n=21)	Rockwall (n=13)	
Continue Carpooling/ Vanpooling	63%	75%	44%	78%	62%	46%	60%
Ride the Bus	36%	25%	54%	22%	38%	54%	39%
Other	1%	---	2%	---	---	---	1%
Total	100%	100%	100%	100%	100%	100%	100%

The stated desire for bus service in the Dallas urbanized area closely compares to responses received in the San Antonio-Houston Study. Of 245 participants surveyed in San Antonio and Houston, 61% expressed a desire to continue carpooling or vanpooling, while 39% indicated they would prefer to ride the bus.

Factors Influencing Decision to Pool

In addition to question #11 regarding the effect the parking area had on the participants' decision to rideshare, several questions were asked to

determine if saving time, money or energy were influencing factors in the decision to Park-and-Pool. Individuals were also asked if their employers or schools provided any incentives for carpooling/vanpooling. Responses to these questions are summarized and presented.

Incentives Provided by Employer/School

Question #8 asked, "Does your employer or school provide any incentives for carpools or vanpools?" If the respondent answered "yes," the type of incentive provided was requested. A total of 225 responses was received to this question with 89, or approximately 40%, answering "yes." The types of incentives provided by employers or schools were categorized into 5 groups and are summarized, by county, in Table 11.

Table 11: Incentives Provided by Employer/School for Carpooling and Vanpooling; by County

Incentive	County			Total (n=82)
	Dallas (n=28)	Rockwall (n=7)	Tarrant (n=47)	
Vanpool Program	50%	57%	45%	48%
Subsidized Parking	21%	29%	38%	32%
Money	18%	---	11%	12%
Carpool Matching	11%	---	6%	7%
Flexible Work Hours	---	14%	---	1%
Total	100%	100%	100%	100%

The use of Park-and-Pool lots apparently complement incentives provided by the private sector to increase vehicle occupancy. The incentives listed by poolers in the Dallas study closely relate to those indicated in the San Antonio/Houston study. Of 107 responses obtained from a similar question in San Antonio/Houston, the following four incentives were listed most frequently:

- Vanpool Program - 49%
- Subsidized Parking - 28%
- Carpool Matching - 8%
- Money - 7%

By far the most popular incentives provided for carpooling/vanpooling by employers and schools are subsidized parking and vanpool programs. These two incentives amount to about 80% of all incentives listed in both the San Antonio/Houston and the Dallas studies.

Time, Money, and Energy Factors

Three questions (#6, #12 and #13) were included on the survey form to determine which factors were considered most important to the individual's decision to rideshare. Question #6 asked, "In deciding to carpool or vanpool, which one of the following considerations was most important to you: cost of driving; cost of parking; stress of driving; energy savings; or other?" Table 12 summarizes, by county, the 213 responses received to this question.

Table 12: Most Important Consideration in Decision to Carpool or Vanpool; By County

Consideration	County			Total (n=213)
	Dallas (n=68)	Rockwall (n=14)	Tarrant (n=131)	
Cost of Driving	75%	71%	77%	76.1%
Cost of Parking	9%	21%	11%	10.8%
Stress of Driving	10%	---	5%	6.1%
Energy Savings	6%	8%	5%	5.2%
Other	---	---	2%	1.8%
Total	100%	100%	100%	100%

Some 87% of the respondents indicated that the cost of either driving or parking was the most important factor in deciding to rideshare. A similar question asked in the San Antonio/Houston study revealed even a higher percentage (91% of the 266 surveyed) pooled to save money.

Money

Question #12 asked, "Do you save money by using this Park-and-Pool location?" If the respondent answered "yes" or "no" to the question, they were asked how much money they either saved or lost per month. A total of 224 responses were received to this question. Table 13 provides a summary, by county, of the participants' answers.

Table 13: Save Money Using Park-and-Pool;
By County

Response	County			Total (n=224)
	Dallas (n=68)	Rockwall (n=13)	Tarrant (n=143)	
Yes	84%	77%	85%	84%
Not Sure	12%	8%	10%	10%
No Difference	4%	8%	4%	5%
No	---	7%	1%	1%
Total	100%	100%	100%	100%

Ninety-four percent of those surveyed (n = 255) in San Antonio/Houston felt that they did save money in using Park-and-Pool; some 10% more than those responding "yes" in the Dallas survey. As previously mentioned, those poolers indicating a savings or loss of money were asked how much was saved or lost per month. Table 14 summarizes the mean responses obtained to the dollar amount inquiry for the total survey and by county.

Table 14: Perceived Money Saved or Lost per Month; By County

Response	County			Average
	Dallas	Rockwall	Tarrant	
Dollars Saved Per Month	\$63 (n=51)	\$58 (n=9)	\$59 (n=111)	\$61 (n=171)
Dollars Lost Per Month	--- (n=0)	\$20 (n=1)	\$63 (n=1)	\$42 (n=2)

The money saved per month ranged from \$5 to \$200 and averaged some \$61 with a standard deviation of \$40. The poolers surveyed in San Antonio indicated a per month savings of \$67, while those in Houston said they saved \$71 per month. Figure 4 presents a cumulative frequency distribution of the dollars saved per month for all 171 responses received.

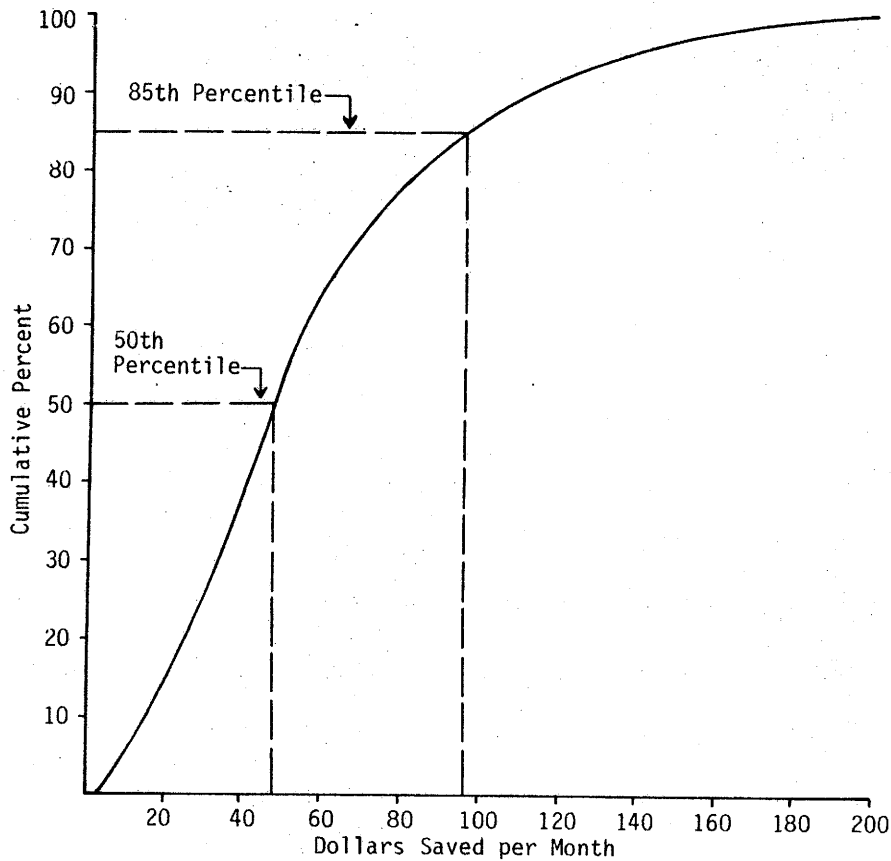


Figure 4: Cumulative Frequency Distribution, Dollars Saved by Using Park-and-Pool (n=171)

Time

Question #13 asked, "Do you save time by using this Park-and-Pool location?" Similar to the money question, those answering either "yes" or "no" were requested to indicate how many minutes were either saved or lost per day. Table 15 presents the 221 responses received to this question and includes a summary of answers by county.

Table 15: Save Time Using Park-and-Pool;
By County

Response	County			Total (n=221)
	Dallas (n=67)	Rockwall (n=13)	Tarrant (n=141)	
No	39%	39%	34%	36%
Yes	24%	23%	30%	28%
No Difference	24%	15%	28%	26%
Not Sure	13%	23%	8%	10%
Total	100%	100%	100%	100%

Forty-eight percent of the 254 poolers surveyed in San Antonio/Houston did not feel they saved time using Park-and-Pool, while only 17% felt that they did save time. Table 16 presents the mean, or average, times lost or saved by those participants in the Dallas survey who responded "no" or "yes" to the question.

Table 16: Time Lost or Saved Per Day;
By County

Response	County			Average
	Dallas	Rockwall	Tarrant	
Time Lost Per Day	16 min. (n=25)	15 min. (n=4)	20 min. (n=43)	18 min. (n=72)
Time Saved Per Day	19 min. (n=12)	12 min. (n=3)	23 min. (n=38)	22 min. (n=53)

The time lost per day ranged from 0 minutes to 60 minutes and averaged 18 minutes with a standard deviation of approximately 13 minutes. The time saved per day ranged from 2 minutes to 60 minutes and had a mean of 22 minutes with a standard deviation of about 14 minutes. Figures 5 and 6 present cumulative frequency distributions for the time lost and time saved responses received from the questionnaire respondents.

Travel Patterns

To better understand past and present travel patterns of the Park-and-Pool participants, a series of questions were asked relating to previous and present modes of travel, arrival/departure times at lots, travel times and distances between lot to home and lot to destination, and trip purpose and frequency. Responses received to the travel pattern questions are summarized herein.

Prior Mode of Travel

Question #10 asked, "Before you started using this parking area, how did you normally travel from home to your current destination?" Table 17 summarizes the responses received to this question for each of the involved counties and for the total sample.

Some 67% of those surveyed (n = 264) in the San Antonio/Houston Park-and-Pool study indicated that they drove alone prior to participating in ridesharing. Approximately 30% of the San Antonio/Houston sample, compared to 27% of the Dallas area sample, stated that their previous mode of travel was by carpool or vanpool.

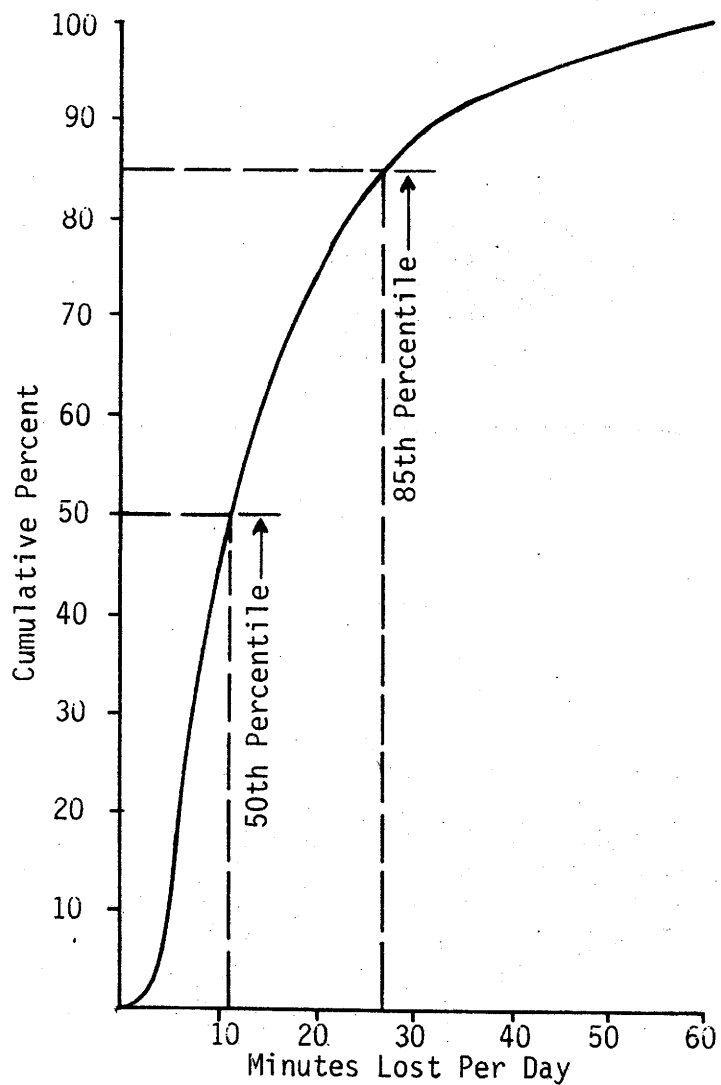


Figure 5: Cumulative Frequency Distribution, Time Lost per Day by Using Park-and-Pool (n=72)

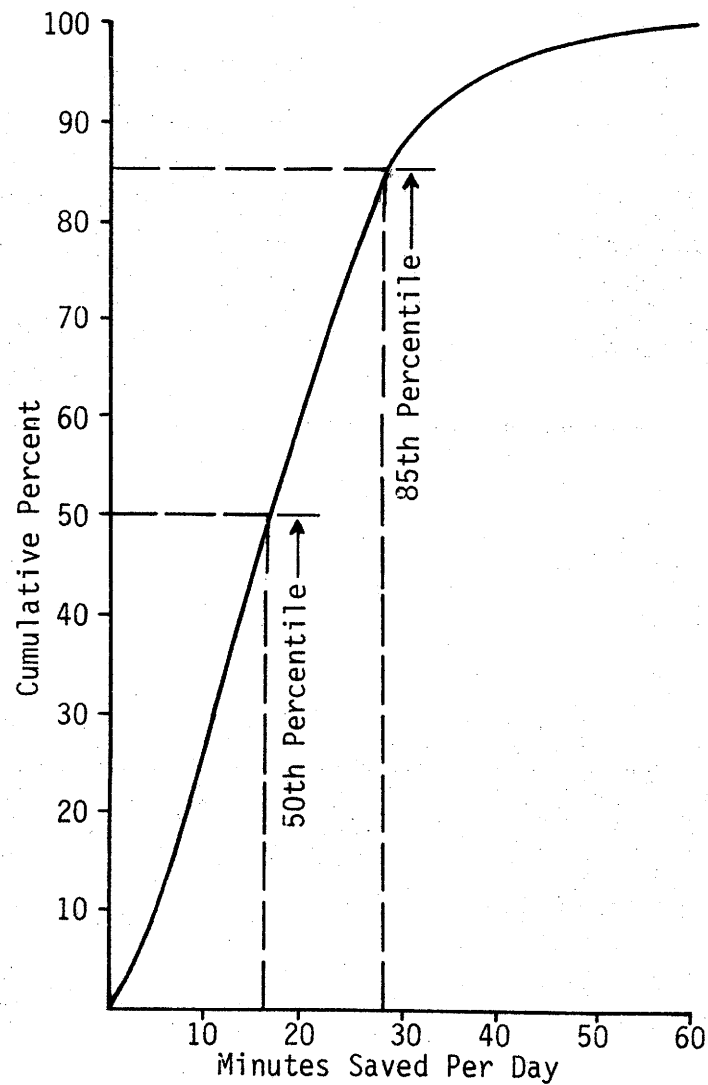


Figure 6: Cumulative Frequency Distribution, Time Saved per Day by Using Park-and-Pool (n=53)

Table 17: Prior Travel Mode to Destination;
By County

Response	County			Total (n=224)
	Dallas (n=69)	Rockwall (n=13)	Tarrant (n=142)	
Drove Alone	57%	54%	55%	55%
Carpool/Vanpool	29%	8%	27%	27%
Did Not Make Trip	10%	38%	10%	12%
Bus	4%	---	6%	5%
Other	---	---	2%	1%
Total	100%	100%	100%	100%

Present Mode of Travel

Question #3 asked, "How many days per week do you travel from this parking area to your destination by: carpool; vanpool; bus; or other?" Table 18 summarizes the present mode of travel indicated by the respondents. Table 19 presents the frequency, in days per week, of travel from the parking locations.

Table 18: Present Travel Mode from Lot to Destination;
By County

Response	County			Total (n=228)
	Dallas (n=70)	Rockwall (n=14)	Tarrant (n=144)	
Carpool	66%	71%	60%	62.3%
Vanpool	34%	29%	29%	30.7%
Bus*	---	---	10%	6.6%
Other	---	---	1%	.4%
Total	100%	100%	100%	100.0%

*Note: Local transit service is provided from certain lots within the City of Fort Worth by CITRAN.

Table 19: Frequency of Travel by Present Mode;
By County

Response	County			Total (n=229)
	Dallas (n=70)	Rockwall (n=14)	Tarrant (n=145)	
6 Days Per Week	3%	---	1%	1.3%
5 Days Per Week	91%	86%	94%	92.6%
4 Days Per Week	1%	14%	5%	4.8%
3 Days Per Week	3%	---	---	.9%
2 Days Per Week	---	---	---	---
1 Day Per Week	2%	---	---	.4%
Total	100%	100%	100%	100.0%

A slightly higher "5 day per week" frequency was observed in the Dallas area compared to the San Antonio/Houston Study -- 93% versus 87%. Given the trip purpose (described below) as being primarily for "work" (98%) and the absence of widespread 4 day work weeks, the high 5-day per week frequency can be expected. The mean or average of all 229 responses received was 4.93 days of travel per week by present mode to destination.

Trip Purpose

Question #2 requested information on the purpose of the poolers' trips after leaving their vehicles parked at the study site locations. Table 20 summarizes, by county, the trip purposes indicated by the survey respondents.

Table 20: Trip Purpose; By County

Response	County			Total (n=229)
	Dallas (n=71)	Rockwall (n=14)	Tarrant (n=144)	
Work	96%	100%	99%	97.8%
School	3%	----	1%	1.7%
Other	1%	----	----	.5%
Total	100%	100%	100%	100.0%

Mode of Arrival at Parking Location

Question #1 asked, "How many persons (including yourself) arrived at this location in this vehicle?" Since questionnaires were only distributed to parked vehicles at the study site during the day, the question replaced a similar question "How did you arrive at the Park-and-Pool lot this morning?" asked of individual poolers in the San Antonio/Houston study. Table 21 presents a summary, by county, of the responses received.

Table 21: Mode of Arrival at Lot; By County

Response	County			Total (n=231)
	Dallas (n=72)	Rockwall (n=14)	Tarrant (n=145)	
1-Single Occupant	81%	79%	88%	85%
2-Rideshare	19%	7%	7%	11%
3-Rideshare	---	7%	1%	1%
4-Rideshare	---	7%	3%	2%
5-Rideshare	---	---	1%	1%
Total	100%	100%	100%	100%

As seen in Table 21, vehicle occupancy ranged from 1 to 5 persons upon arrival at the parking location. The average (mean) vehicle occupancy for

all 231 respondents to the survey was 1.23 persons per vehicle for the home to lot journey, as shown in Table 22.

Table 22: Mean Vehicle Occupancy - Home to Lot; By County

County	Mean or Average Persons per Arriving Vehicle	Range	
		Minimum	Maximum
Dallas (n=72)	1.19	1	2
Rockwall (n=14)	1.43	1	4
Tarrant (n=145)	1.23	1	5
All Counties (n=231)	1.23	1	5

Of 265 poolers surveyed in San Antonio and Houston, some 87% indicated that they drove alone to the parking area, while 10% indicated that they rode with someone else to the lot. A slightly higher percentage (15%) of those surveyed in the Dallas area ride with others to the parking area.

In addition to the distribution of questionnaires, data were collected by the survey team pertaining to the types of vehicles parked at the Park-and-Pool locations. Table 23 summarizes the types of vehicles observed, by city, for the Park-and-Pool study conducted in the Dallas urbanized area.

Table 23: Arrival Mode at Lot: Vehicle Types; By City

Vehicle Type	City							Total (n=669)
	Arlington (n=175)	Dallas (n=68)	Fort Worth (n=174)	Garland (n=129)	Grand Prairie (n=59)	Rockwall (n=59)	Terrell (n=5)	
Standard	54%	59%	64%	55%	44%	47%	60%	56%
Subcompact	39%	16%	17%	26%	31%	25%	20%	26%
Pickup	6%	22%	18%	16%	24%	24%	20%	16%
Van	1%	3%	1%	3%	1%	4%	----	2%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Some 26% of all vehicles observed were classified as subcompacts ranging from a low of 16% in Dallas to a high of 39% in Arlington. Comparable data were not collected in the San Antonio/Houston Study.

Time of Arrival/Departure of Poolers

The first part of Question #16 asked, "What time did you arrive at this parking area this morning?" Responses varied from 5:30 a.m. to 11:45 a.m. with the most frequent (modal) arrival time of 7:00 a.m.

The second part of the question asked, "What time did you leave this parking area this evening?" Times of departure listed by the respondents varied from 1:52 p.m. to 9:30 p.m. with the most frequent (modal) time being 5:30 p.m.

The average arrival time in San Antonio was 6:49 a.m. while Houston poolers arrived at about 6:20 a.m. Departure times from San Antonio lots averaged 5:21 p.m. while departures in Houston averaged 5:13 p.m.

Figures 7 and 8 present cumulative frequency distributions for arrival and departure times recorded in the Dallas Park-and-Pool survey.

Mode of Departure from Parking Location

As previously discussed, some 62% of the respondents carpool and 31% vanpool from the parking location to their final destinations. This represents a total of some 93% of those responding to the survey. Question #4 asked, "If you carpool or vanpool to your final destination in the morning, how many persons (including yourself) leave together from this location?" Responses received from this inquiry ranged from 1 to 14 and averaged 5.19 persons per vehicle.

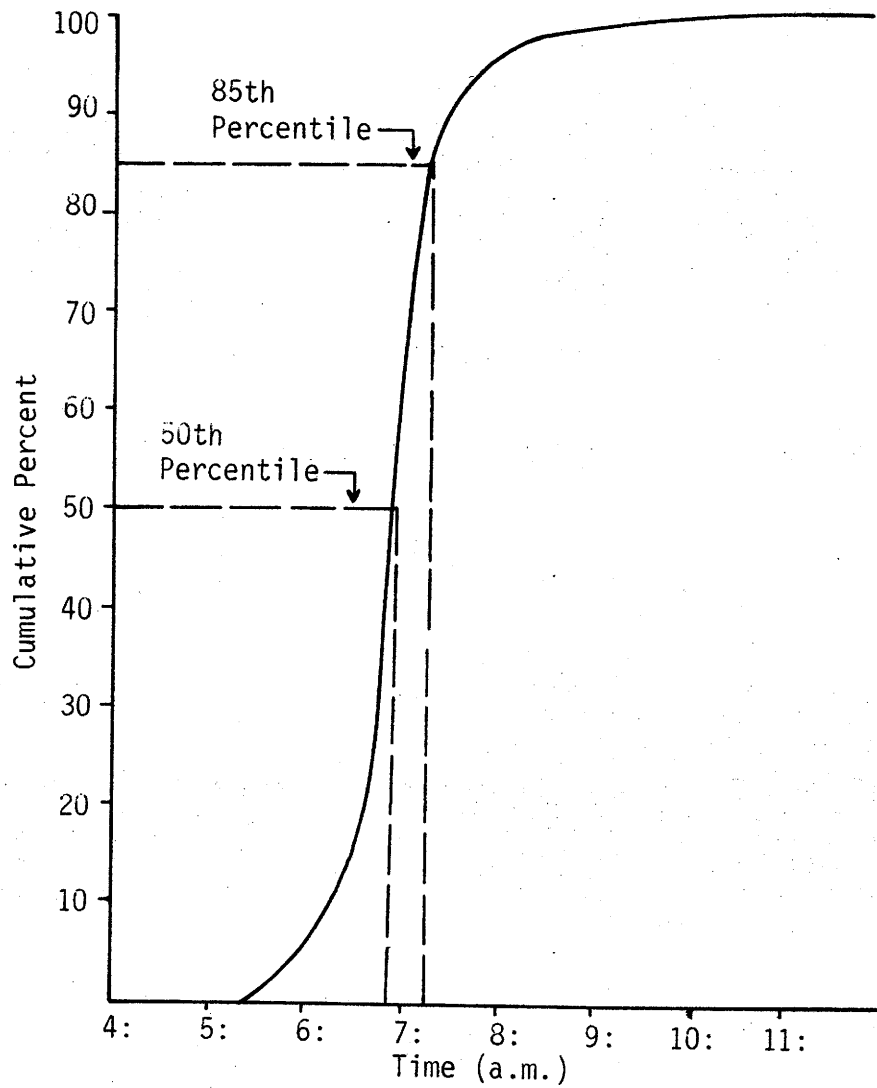


Figure 7: Cumulative Frequency Distribution, Time of Arrival at Park-and-Pool Lot (n=227)

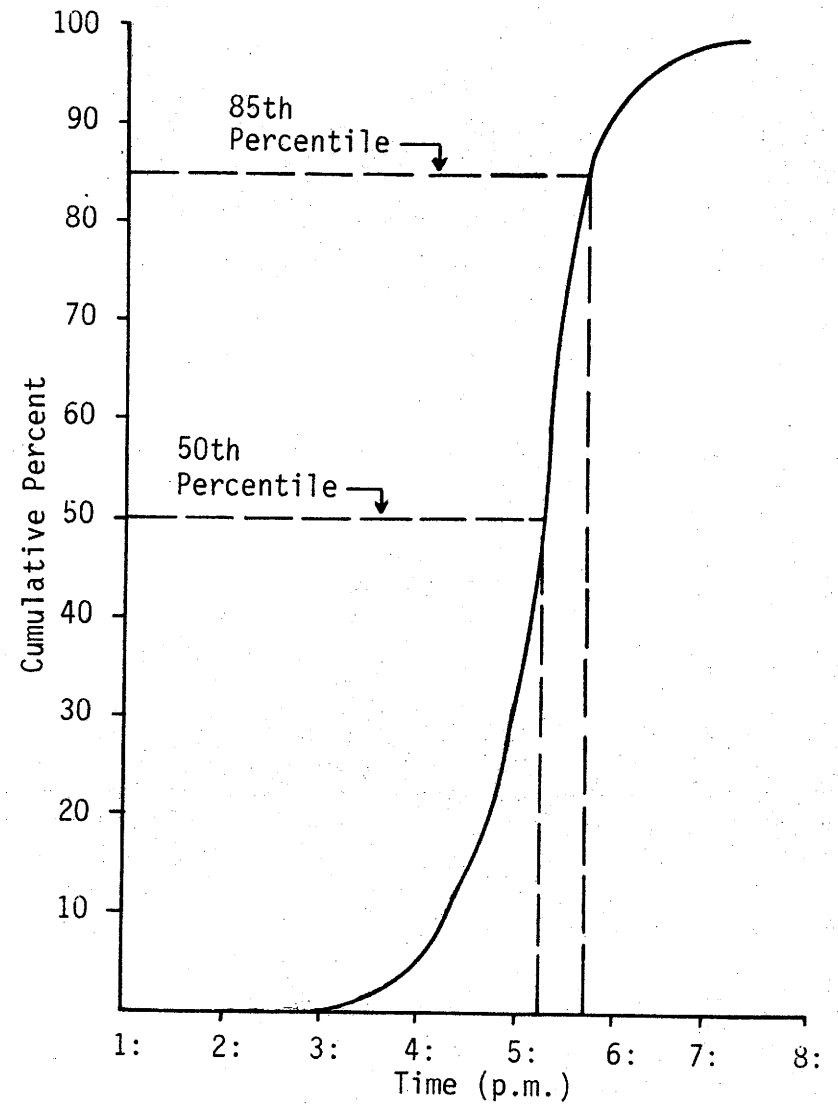


Figure 8: Cumulative Frequency Distribution, Time of Departure from Park-and-Pool Lot (n=223)

Table 24 summarizes the mode of departure, by county, for the 211 responses received. Table 25 presents the average, or mean, number of persons per vehicle for the lot to destination journey indicated by the survey data.

Table 24: Mode of Departure from Lot; By County

Number Departing from Lot in Vehicle	County			Total (n=211)
	Dallas (n=67)	Rockwall (n=14)	Tarrant (n=130)	
1-Single Occupant	1%	----	----	----
2-Rideshare	25%	14%	11%	16%
3-Rideshare	16%	50%	24%	23%
4-Rideshare	30%	7%	28%	27%
5-Rideshare	4%	7%	9%	8%
6-Rideshare	3%	----	2%	2%
7 or More Rideshare	21%	22%	26%	24%
Total	100%	100%	100%	100%

Table 25: Mean Vehicle Occupancy - Lot To Destination; By County

County	Mean or Average Persons Per Departing Vehicle	Range	
		Minimum	Maximum
Dallas (n=67)	4.63	1	12
Rockwall (n=14)	4.64	2	11
Tarrant (n=130)	5.54	2	14
All Counties (n=211)	5.19	1	14

Average vehicle occupancies for carpools and vanpools in San Antonio and in Houston were 4.1 and 5.4 persons per vehicle, respectively. Figure 9 presents a cumulative frequency distribution of vehicle occupancies recorded from the Dallas study.

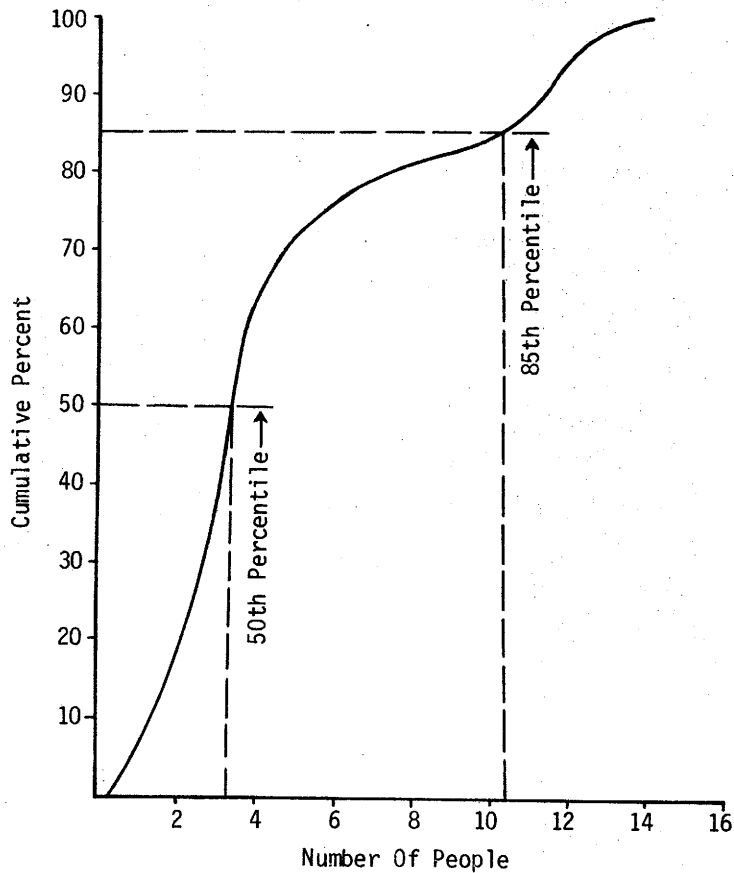


Figure 9: Cumulative Frequency Distribution Vehicle Occupancy from Lot to Destination (n = 211)

How Carpool/Vanpool Was Formed

Question #5 asked, "How was your carpool or vanpool formed?" A total of 213 responses were received from the poolers throughout the study area. Table 26 summarizes, by county, the manner in which the carpools and vanpools were formed.

Table 26: How Pools Were Formed; By County

Response	County			Total (n=213)
	Dallas (n=68)	Rockwall (n=14)	Tarrant (n=131)	
Co-Workers	80%	50%	67%	70%
Employer	17%	22%	25%	22%
Friends	1%	6%	5%	4%
DFW Rideshare Program	----	22%	2%	2%
Classmates	1%	----	1%	1%
Other	1%	----	----	1%
Total	100%	100%	100%	100.0%

Combining "Co-Workers" and "Employer" responses results in some 92% of the poolers indicating that their carpool or vanpool was formed or influenced by their employment. This corresponds to the high percentage (98%) of trips being made for the purpose of work and resembles the responses expressed by 238 poolers in San Antonio and Houston on how their carpool or vanpool was formed.

- At the office - 86%
- Classmates - 6%
- In neighborhood - 4%
- METRO carshare - 2%
- Other - 2%

Travel Times and Distances

Several questions (#2, #2.a., #9, and #9.a.) were included on the survey form to determine the travel distance and time required for the following two segments of the home to work (or the home to school) trip:

- Home to Park-and-Pool lot; and,
- Park-and-Pool lot to destination.

Question #2 asked the respondents to indicate their final destinations after parking their vehicles at the particular study site. Question #2.a. asked, "How far is it from this location to your destination (in miles and in minutes)?" A total of 219 responses indicating the number of miles and 218 responses for amount of time were received. The average (mean) lot to destination distance was 23.2 miles. The mean travel time from lot to destination was 31.5 minutes, representing an average travel speed of slightly more than 44 miles per hour.

Table 27 presents a summary, by city, of the average travel distances from the parking area to the participants' destinations.

Table 27: Average Travel Distance - Lot To Destination; By City

City	Mean Travel Distance	Range		Median Trip Length (Approx.)
		Min. Dist.	Max. Dist.	
Arlington (n=80)	21.4 miles	15 miles	45 miles	27 miles
Dallas (n=12)	17.5 miles	4 miles	40 miles	12 miles
Fort Worth (n=58)	25.5 miles	6 miles	46 miles	26 miles
Garland (n=33)	27.2 miles	12 miles	60 miles	23 miles
Grand Prairie (n=22)	19.4 miles	10 miles	38 miles	15 miles
Rockwall (n=14)	26.4 miles	21 miles	32 miles	25 miles
All Cities (n=219)	23.2 miles	4 miles	60 miles	22 miles

Table 28 summarizes, by city, the average travel times and the average travel speeds from the lot to destination information.

Table 28: Average Travel Time and Speed - Lot To Destination;
By City

City	Mean Travel Time	Range		Median Travel Time (Approx.)	Computed Average Travel Speed
		Min. Time	Max. Time		
Arlington (n=80)	28.8 min.	15 min.	60 min.	25 min.	44.6 mph
Dallas (n=13)	26.2 min.	15 min.	60 min.	20 min.	40.1 mph
Fort Worth (n=58)	34.1 min.	15 min.	60 min.	30 min.	44.9 mph
Garland (n=32)	36.6 min.	15 min.	60 min.	35 min.	44.6 mph
Grand Prairie (n=22)	26.7 min.	15 min.	60 min.	20 min.	43.6 mph
Rockwall (n=13)	37.7 min.	30 min.	50 min.	35 min.	42.0 mph
All Cities (n=218)	31.5 min.	15 min.	60 min.	30 min.	44.2 mph

The number of miles travelled by San Antonio poolers averaged 35.7 while the average distance in Houston was 29.3 miles.

Figures 10 and 11 present cumulative frequency distributions for travel distances and times, respectively, for the lot to destination journey.

Question #9 asked, "How far do you travel in the morning to reach this parking area (in miles and in minutes)?" A total of 222 responses indicating travel distance and 218 indicating travel time were received. The average (mean) home to lot distance was 5.9 miles, while the average time was 10.7 minutes. The computed average travel speed was about 33 miles per hour from home to lot.

Table 29 presents a summary, by city, of the mean and median travel distances from the participant's home to lot. The median trip length for all Dallas area respondents was between 3 and 4 miles. This closely resembles data collected in San Antonio and Houston. Median home to lot distances slightly exceeded 4 miles in San Antonio and were between 3 and 4 miles in Houston.

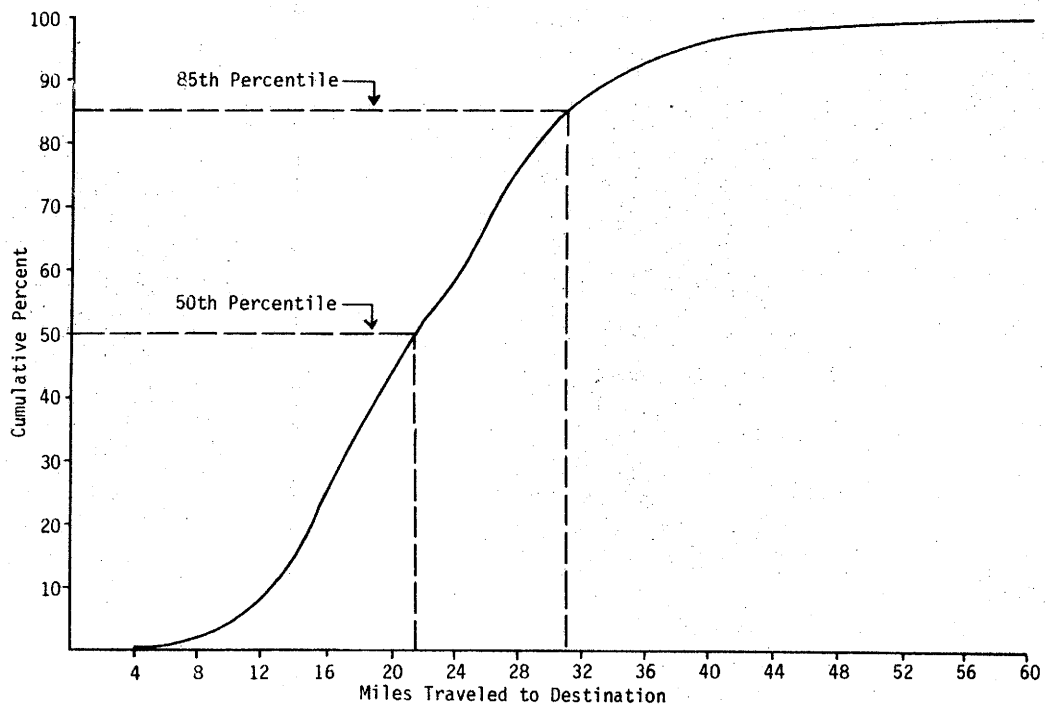


Figure 10: Cumulative Frequency Distribution, Travel Distance from Lot to Destination (n=219)

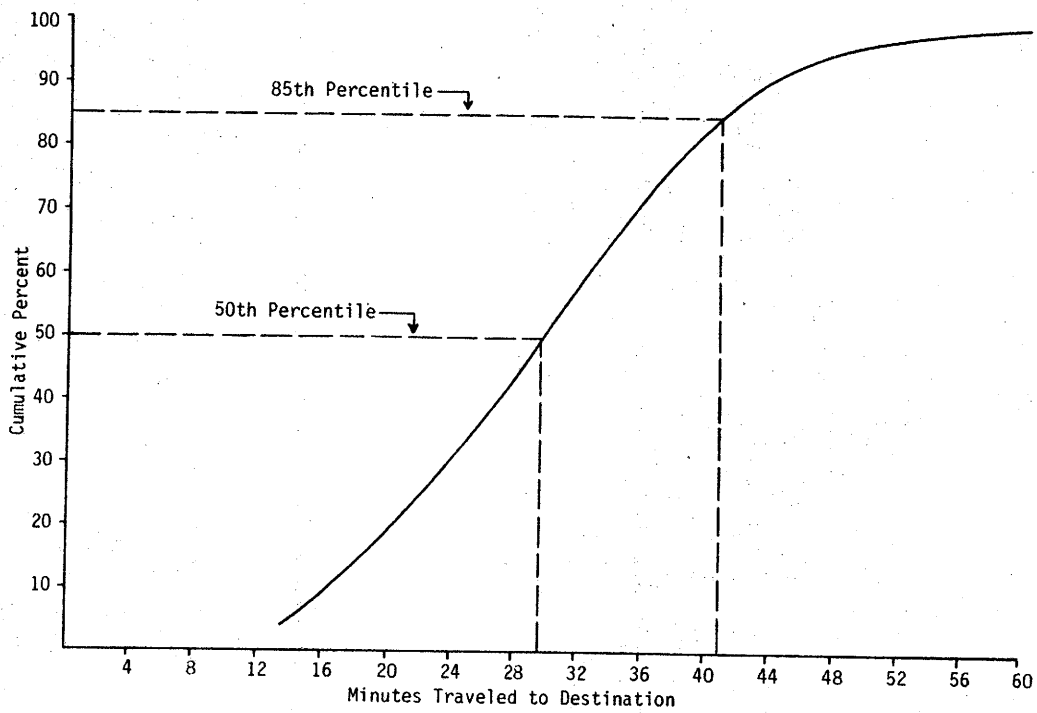


Figure 11: Cumulative Frequency Distribution, Travel Time from Lot to Destination (n=218)

Table 29: Average Travel Distance - Home to Lot; By City

City	Mean Travel Distance	Range		Median Trip Length (Approx.)
		Min. Dist.	Max. Dist.	
Arlington (n=82)	5.2 miles	0.5 miles	25.0 miles	3 miles
Dallas (n=12)	5.9 miles	1.0 miles	18.0 miles	4 miles
Fort Worth (n=58)	6.5 miles	0.5 miles	35.0 miles	3 miles
Garland (n=35)	5.3 miles	1.0 miles	35.0 miles	3 miles
Grand Prairie (n=22)	7.0 miles	1.5 miles	25.0 miles	5 miles
Rockwall (n=13)	7.2 miles	2.0 miles	25.0 miles	5 miles
All Cities (n=222)	5.9 miles	0.5 miles	35.0 miles	3 miles

Table 30 provides a summary, by city, of mean and median travel times between the poolers' homes and the lot location. In addition, average travel speeds are included for comparative purposes.

Table 30: Average Travel Time and Speed - Home To Lot; By City

City	Mean Travel Time	Range		Median Trip Time (Approx.)	Computed Average Travel Speed
		Min. Time	Max. Time		
Arlington (n=79)	10.2 min.	3 min.	30 min.	8 min.	30.6 mph
Dallas (n=13)	12.7 min.	5 min.	25 min.	10 min.	27.9 mph
Fort Worth (n=60)	10.9 min.	3 min.	45 min.	8 min.	35.8 mph
Garland (n=32)	9.3 min.	3 min.	45 min.	7 min.	34.2 mph
Grand Prairie (n=21)	12.8 min.	5 min.	30 min.	10 min.	32.8 mph
Rockwall (n=13)	12.0 min.	4 min.	40 min.	8 min.	36.0 mph
All Cities (n=218)	10.7 min.	3 min.	45 min.	8 min.	33.1 mph

Figures 12 and 13 present cumulative frequency distributions for travel distance and travel time, respectively, for the home to lot journeys of all Dallas area poolers.

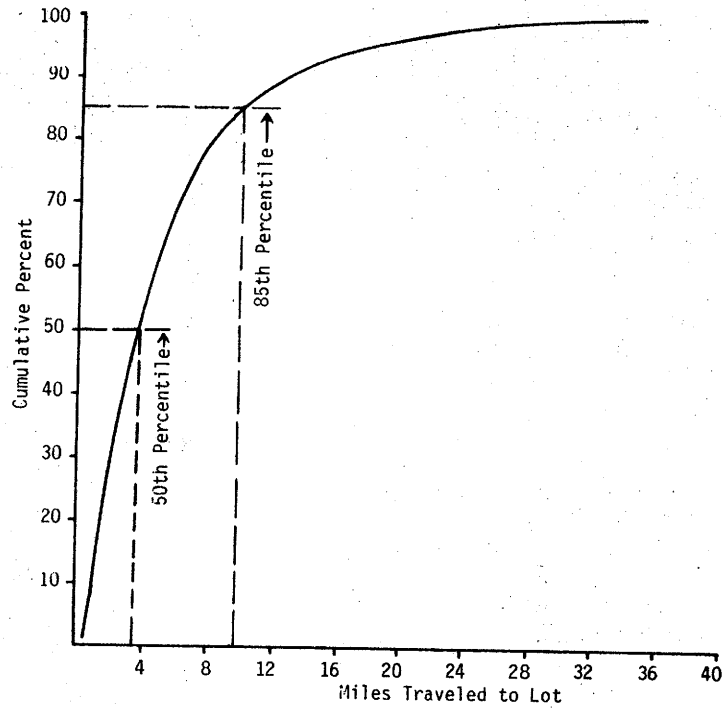


Figure 12: Cumulative Frequency Distribution,
Travel Distance from Home to Lot.
(n=222)

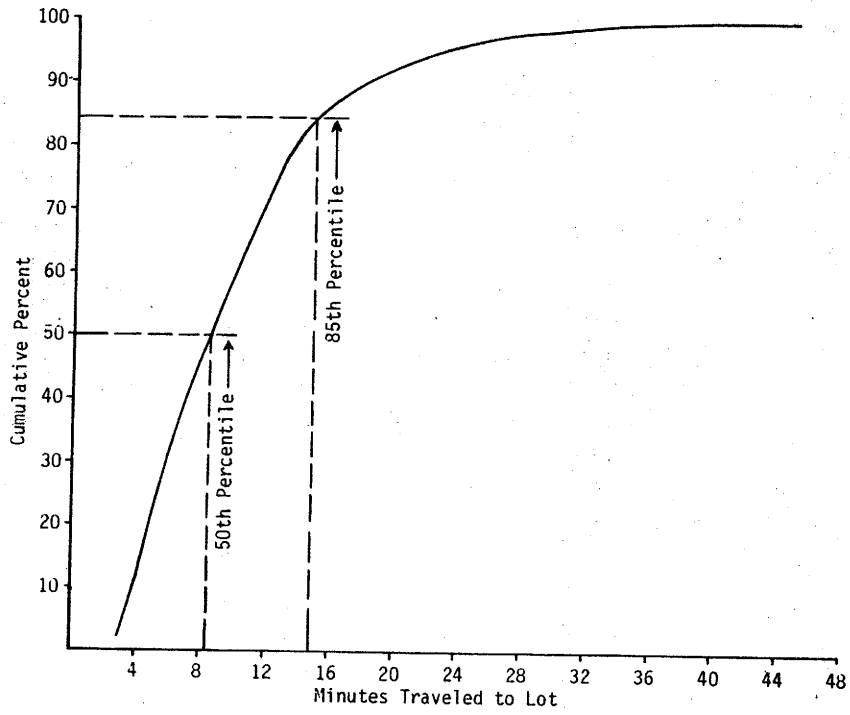


Figure 13: Cumulative Frequency Distribution,
Travel Time from Home to Lot (n=218)

Origins and Destinations of Poolers

Questions #2 and #9.a requested information on the Park-and-Poolers' trip origin and destination. Question 9.a asked "Where does your trip originate (home city and zip)?" Question #2 asked, "After leaving your car parked at this location, what was your final destination (Address, Building or Company, City, and Zip)?"

Based upon the 213 returned surveys which provided home zip codes for trip origins, an examination of each Park-and-Pool site was made to determine the extent of interjurisdictional travel from home to the parking facility. Table 31 summarizes the percent of pooler responses which had a trip origin, indicated by zip code number, from within the city where the site was located. Table 32 provides a similar summary of trip origins of study participants but is organized by city.

In addition to data supplied by survey respondents, the vehicle license plate numbers were recorded during the site investigations. These plate numbers were processed by the State Department of Highways and Public Transportation to obtain the home zip codes for the vehicle owners. Of the 669 parked vehicles, state vehicle registration data were available for some 644, or 96%, of the vehicles surveyed. Comparing the state registration data for home zip codes to the information provided by the 213 survey respondents indicates a correlation of approximately 63% (only 135 of the 213 zip codes supplied by study participants were the same). Tables 33 and 34 present a summary of some 632 trip origins by site and by city based upon data supplied by the survey respondents and supplemented with the vehicle registration information; 12 home zip codes were eliminated from the combined data due to their being outside of the study region.

Table 31: Trip Origins of Survey Respondents; By Site

Site Number:	City Where Site Located	Percent of Trip Origins From	
		Within City	Other Locations or Cities
1 (n=16)	Fort Worth	93.8%	6.2%
2 (n=2)	Fort Worth	50.0%	50.0%
3 (n=38)	Fort Worth	81.6%	18.4%
4 (n=8)	Arlington	75.0%	25.0%
5 (n=60)	Arlington	86.7%	13.3%
6 (n=8)	Arlington	87.5%	12.5%
7 (n=2)	Arlington	50.0%	50.0%
8 (n=0)	Grand Prairie	-----	-----
9 (n=21)	Grand Prairie	52.4%	47.6%
10 (n=1)	Dallas	100.0%	0.0%
11 (n=4)	Dallas	75.0%	25.0%
12 (n=4)	Dallas	50.0%	50.0%
13 (n=4)	Dallas	50.0%	50.0%
14 (n=27)	Garland	59.3%	40.7%
15 (n=1)	Garland	0.0%	100.0%
16 (n=4)	Garland	25.0%	75.0%
17 (n=3)	Rockwall	100.0%	0.0%
18 (n=0)	Rockwall	-----	-----
19 (n=0)	Rockwall	-----	-----
20 (n=10)	Rockwall	70.0%	30.0%
21 (n=0)	Terrell	-----	-----
Total (n=213)	-----	74.6%	25.4%

Table 32: Trip Origins of Survey Respondents; By City

City Where Sites Located:	Number of Trips Originating From							Percent of Trip Origins from Within City
	Arlington	Dallas	Fort Worth	Garland	Grand Prairie	Rockwall	Other Locations	
Arlington (n=78)	<u>66</u>	0	8	0	2	0	2	84.6%
Dallas (n=13)	0	<u>8</u>	0	0	0	0	5	61.5%
Fort Worth (n=56)	2	0	<u>47</u>	0	1	0	6	83.9%
Garland (n=32)	1	3	0	<u>17</u>	0	0	11	53.1%
Grand Prairie (n=21)	3	2	0	0	<u>11</u>	0	5	52.4%
Rockwall (n=13)	0	0	0	0	0	<u>10</u>	3	76.9%
Total (n=213)	72	13	55	17	14	10	32	74.6%
Percent Respondents	33.8%	6.1%	25.8%	8.0%	6.6%	4.7%	15.0%	

Table 33: Trip Origins of Park-and-Pool Participants; By Site

Site Number:	City Where Site Located	Percent of Trip Origins From	
		Within City	Other Locations or Cities
1 (n=42)	Fort Worth	85.7%	14.3%
2 (n=10)	" "	30.0%	70.0%
3 (n=115)	" "	84.4%	15.6%
4 (n=11)	Arlington	81.8%	18.2%
5 (n=126)	"	77.0%	23.0%
6 (n=20)	"	75.0%	25.0%
7 (n=8)	"	62.5%	37.5%
8 (n=18)	Grand Prairie	33.3%	66.7%
9 (n=39)	" "	46.2%	53.8%
10 (n=15)	Dallas	80.0%	20.0%
11 (n=18)	"	72.2%	27.8%
12 (n=12)	"	50.0%	50.0%
13 (n=19)	"	31.6%	68.4%
14 (n=76)	Garland	55.3%	44.7%
15 (n=27)	"	25.9%	74.1%
16 (n=17)	"	17.7%	82.3%
17 (n=5)	Rockwall	80.0%	20.0%
18 (n=7)	"	85.7%	14.3%
19 (n=20)	"	65.0%	35.0%
20 (n=22)	"	59.1%	40.9%
21 (n=5)	Terrell	40.0%	60.0%
Total (n=632)		79.3%	20.7%

Data Source: Survey Responses and State Vehicle Registration File.

Some 170, or 72%, of the returned surveys indicated the destination zip code for their place of work or school. An additional 43 respondents provided sufficient information to determine the destination zip code, resulting in a total sample size of 213. Tables 35 and 36 present the destinations, by site and by city, of the survey respondents.

Figure 14 shows a map of the zip code zones for the Dallas-Fort Worth Urbanized Area used in the origin-destination study. A complete listing of

Table 34: Trip Origins of Park-and-Pool Participants; By City

City Where Sites Located:	Number of Trips Originating From							Percent of Trip Origins from Within City
	Arlington	Dallas	Fort Worth	Garland	Grand Prairie	Rockwall	Other Locations	
Arlington (n=165)	<u>126</u>	3	17	---	5	---	14	76.4%
Dallas (n=64)	---	<u>37</u>	---	3	---	---	24	57.8%
Fort Worth (n=167)	7	3	<u>136</u>	---	1	---	20	81.4%
Garland (n=120)	1	22	1	<u>52</u>	---	2	42	43.3%
Grand Prairie (n=57)	11	6	2	---	<u>24</u>	---	14	42.1%
Rockwall (n=54)	---	2	---	1	---	<u>36</u>	15	66.7%
Terrell (n=5)	---	---	---	---	---	1	4	40.0%
Total (n=632)	145	73	156	56	30	39	133	79.3%
Percent Origins	22.9%	11.6%	24.7%	8.9%	4.7%	6.2%	21.0%	

Data Source: Survey Responses and State Vehicle Registration File

Table 35: Trip Destinations of Park-and-Pool Participants; By Site

Site Number:	City Where Site Located	Percent of Trip Destinations to Locations	
		Within City	In Other Cities
1 (n=18)	Fort Worth	44.4%	55.6%
2 (n=1)	" "	100.0%	0.0%
3 (n=40)	" "	12.5%	87.5%
4 (n=8)	Arlington	0.0%	100.0%
5 (n=60)	"	0.0%	100.0%
6 (n=8)	"	0.0%	100.0%
7 (n=2)	"	0.0%	100.0%
8 (n=0)	Grand Prairie	-----	-----
9 (n=21)	" "	0.0%	100.0%
10 (n=1)	Dallas	100.0%	0.0%
11 (n=3)	"	33.3%	66.7%
12 (n=3)	"	100.0%	0.0%
13 (n=4)	"	100.0%	0.0%
14 (n=27)	Garland	0.0%	100.0%
15 (n=0)	"	-----	-----
16 (n=4)	"	0.0%	100.0%
17 (n=3)	Rockwall	0.0%	100.0%
18 (n=0)	"	-----	-----
19 (n=1)	"	0.0%	100.0%
20 (n=9)	"	0.0%	100.0%
21 (n=0)	Terrell	-----	-----
Total (n=213)		10.8%	89.2%

Table 36: Trip Destinations of Park-and-Pool Participants; By City

City	Number of Trips Destined To							Percent of Trip Destinations to Other Cities
	Arlington	Dallas	Fort Worth	Garland	Grand Prairie	Rockwall	Other Locations	
Arlington (n=78)	0	75	0	0	0	0	3	100.0%
Dallas (n=11)	0	9	1	0	0	0	1	18.2%
Fort Worth (n=59)	0	33	14	0	3	0	9	76.3%
Garland (n=31)	0	17	0	0	0	0	14	100.0%
Grand Prairie (n=21)	0	16	3	1	0	0	1	100.0%
Rockwall (n=13)	0	12	0	0	0	0	1	100.0%
Total (n=213)	0	162	18	1	3	0	29	89.2%
Percent Respondents	0	76.0%	8.6%	.4%	1.4%	0%	13.6%	

zip codes, cross-referenced to cities within the study region, is presented in Appendix C.

Approximately 75% of the Park-and-Poolers surveyed originated from within the city where the parking area was located. However, almost 90% of the poolers had destinations to another city. It is interesting to note that with the exception of the two principal cities (Dallas and Fort Worth), all surveyed Park-and-Poolers were destined to locations in cities other than where the parking facility was located or where their trip began.

Some 47% of the poolers surveyed in San Antonio and 29% of those surveyed in Houston had destinations to neighboring cities. This compares to approximately 76% of poolers in Fort Worth and 18% of poolers in Dallas traveling to locations "external" to the principal city.

Remarks and Comments

Space was provided at the end of the questionnaire for respondents to make personal comments or remarks. A total of 69 surveys were returned with one or more comments concerning Park-and-Pool activities. These comments and remarks were grouped into 9 categories and are summarized, by city, in Table 37. In addition, all comments provided by participants have been arranged by the specific Park-and-Pool site or location and are included in Appendix B.

Comments tend to express the popularity of parking facilities for ridesharing activities and appreciation to the private property owners for allowing parking for pooling purposes. Several comments were received which referred to security or safety of the parked vehicles at particular locations. However, these comments were somewhat isolated to particular sites which apparently had vandalism problems in the past.

Table 37: Comments Provided by Park-and-Pool Survey Respondents; By City

General Nature of Comment	City						Total	Percent of Total Response
	Arlington	Dallas	Fort Worth	Garland	Grand Prairie	Rockwall		
Need More Park-and-Pool Lots	10	1	1	2	9	1	24	27.3%
Need Bus or Transit Service	11	--	8	2	1	1	23	26.1%
Need Better Security at Lot	4	1	2	1	4	--	12	13.6%
Appreciate Having Parking Area	2	--	1	3	1	1	8	9.1%
Lot Needs to be Paved	4	--	--	--	2	--	6	6.8%
Lot Needs to be Lighted	3	--	--	1	2	--	6	6.8%
Lot Needs to be More Accessible	1	--	4	--	--	--	5	5.7%
Need Telephone at Lot	3	--	--	--	--	--	3	3.4%
Need Trash Receptacles at Lot	--	--	--	--	1	--	1	1.2%
Total	38	2	16	9	20	3	88	100.0%

ESTIMATING PARK-AND-POOL DEMAND

General

Park-and-Pool experience in other states has shown that vehicles parked in roadside areas do not provide a reliable indication of potential usage of commuter parking areas. The presence and number of parked commuter vehicles should not be used as the sole basis for establishing a priority listing for facility development. (Jain, 1981)

The State of Connecticut identified 69 interchanges having informal commuter parking during the summer of 1969. By 1972, the development of commuter parking facilities had become a continuous program of the Connecticut Department of Transportation. Some 123 facilities, having a total of about 10,300 parking spaces, or an average of 84 spaces per lot, were constructed and in operation by March 1980. Thirty seven, or 30%, of the 123 parking areas are served by express buses. Approximately 7500 vehicles park at the facilities on a typical work day, representing a 73% utilization of available space. (Connecticut, 1980)

The Park-and-Pool usage in Connecticut has shown a doubling of commuter parking at several locations where informal pooling was occurring prior to construction of a formalized facility. To accommodate the phenomenal demand for commuter parking, the State of Connecticut has established a goal of doubling the number of spaces available to commuters by 1986-87. A computer program, called "PARKLOT," has been developed to aid in the identification and prioritization of new Park-and-Pool facilities. PARKLOT utilizes a battery of transportation planning programs, origin-destination trip tables, census journey to work records, and other information to produce a tabulation

of trips passing through a highway intersection or interchange. Park-and-Pool surveys were used in the development and calibration of the computerized aid. The PARKLOT program and user surveys indicate that up to 10% of the work trips passing a particular interchange or intersection can be diverted to a higher vehicle occupancy mode if their travel times fall within the average home-to-lot and lot-to-destination times. (Gudaitis, 1981)

Planners in Connecticut have concluded that the most probable candidates for commuter ridesharing are persons with one-way daily commute trips of between 20 and 60 minutes. In addition, they have also found that the optimum lot location for diverting commuters to pooling activity is within 15 or 20 minutes of the trip origin.

Park-and-Pool planning in Texas has not advanced to the degree of sophistication presently being employed on the east coast. This study and other related work should assist in the planning and design of Park-and-Pool facilities to better meet the mobility needs of the traveling public. To date, experience with Park-and-Pool in Texas has not been extensive on a statewide basis. By the end of 1981, the San Antonio District Office had some 15 Park-and-Pool facilities in operation ranging in size from 12 to 88 spaces and having a total capacity for 544 vehicles. Two of the 15 lots have been operating at or above their designed capacity. However, average overall usage of all lots for 1981 has varied from month to month and has ranged from a low of 40% to a high of 60% utilization. (Gadeke, 1982)

Given the diverse destinations typically associated with Park-and-Pool commuters, the determination of pooling demand is significantly different than estimating transit demand. Demand for transit service basically starts with determining the overall quantity of person travel for selective freeway corridors destined to a particular activity center (i.e., central business

district) and estimating a modal split or percent transit potential. A recent Park-and-Ride study conducted in the Dallas North Central Expressway Corridor (US-75) estimated transit demand, or modal split, to be 7% to 8% of the CBD oriented demand. The same study presented general guidelines for transit ridership as a percentage of total population within the market area served by Park-and-Ride transit; the guideline suggested for the Dallas area was 0.4% to 1.3% of market area population. (Nordstrom, 1981) The demand for vanpool and carpool parking is, however, more widespread in terms of freeway corridors, activity centers and interchanges involved than transit oriented demand. (Barton Aschman, 1970)

Geographic Grouping

To facilitate analysis of trip origins and related demand associated with Park-and-Pool activity in the Dallas urbanized area, the 21 parking sites were grouped into 10 common geographic areas as shown in Figure 15 and as summarized in Table 38. A summary comparison of travel parameters for the 10 geographic groups and for the total survey sample are presented in Table 39.

None of the five survey forms distributed at geographic group J (Terrell) were returned for analysis; therefore, further consideration of park-and-Pool activity at this location has been excluded.

Market Area Considerations

Demand estimation for Park-and-Pool has been attempted with varying degrees of success and a variety of analytical approaches. Some of the following methods, typically used for Park-and-Ride (transit) demand estimation, appear applicable to Park-and-Pool. (Tennyson, 1981)

DALLAS-FORT WORTH URBANIZED AREA

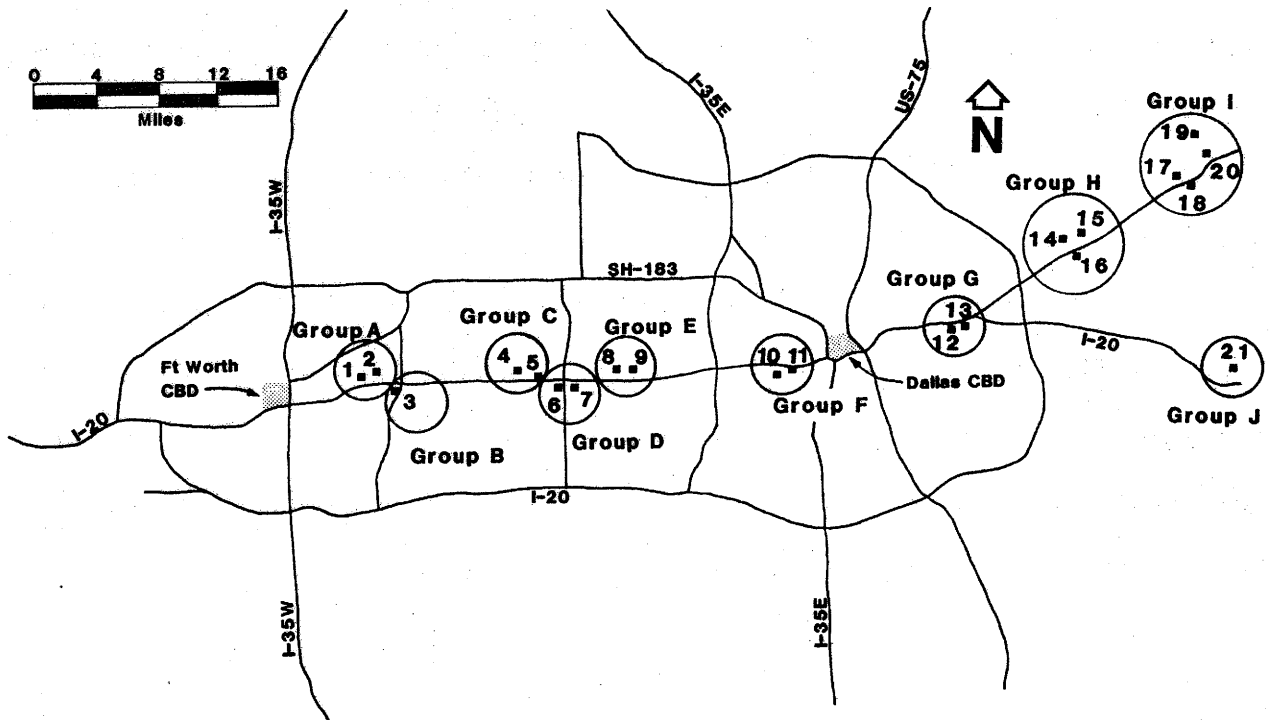


Figure 15: Geographic Grouping of Park-and-Pool Sites for Travel Demand Analysis

Table 38: Grouping of Park-and-Pool Sites

Geographic Group	Sites Included in Group	City Where Located	Number of Vehicles Surveyed	Percent of Surveys Returned
A	1,2	Fort Worth	56	35.7%
B	3	Fort Worth	118	35.6%
C	4,5	Arlington	144	49.3%
D	6,7	Arlington	31	38.7%
E	8,9	Grand Prairie	59	39.0%
F	10,11	Dallas	36	16.7%
G	12,13	Dallas	32	25.0%
H	14,15,16	Garland	129	28.7%
I	17,18,19,20	Rockwall	59	27.1%
J*	21	Terrell	5	0.0%
Total	-----	-----	669	35.1%

*Note: Eliminated from subsequent analysis.

Table 39: Travel Parameters for Pooling Demand; By Group

Parameter	Mean Value for Geographic Group:										Mean Value for Total Sample	
	A	B	C	D	E	F	G	H	I	J		
Avg. Vehicle Occupancy -Home to Lot (Persons/Vehicle)	1.10 (n=20)	1.29 (n=42)	1.25 (n=71)	1.08 (n=12)	1.26 (n=23)	1.00 (n=5)	1.38 (n=8)	1.14 (n=36)	1.43 (n=14)	---	(n=0)	1.23 (n=231)
Avg. Vehicle Occupancy -Lot to Destination (Persons/Vehicle)	4.00 (n=14)	5.85 (n=34)	5.20 (n=70)	8.42 (n=12)	4.18 (n=22)	3.75 (n=4)	3.25 (n=8)	5.36 (n=33)	4.64 (n=14)	---	(n=0)	5.19 (n=211)
Avg. Trip Distance -Home to Lot (Miles)	5.50 (n=19)	7.06 (n=39)	4.68 (n=70)	8.25 (n=12)	6.95 (n=22)	5.75 (n=4)	6.00 (n=8)	5.29 (n=35)	7.23 (n=13)	---	(n=0)	5.89 (n=222)
Avg. Trip Distance -Lot to Destination (Miles)	20.18 (n=17)	27.68 (n=41)	21.00 (n=68)	30.36 (n=11)	19.36 (n=22)	26.00 (n=4)	13.25 (n=8)	27.15 (n=33)	37.69 (n=13)	---	(n=0)	23.24 (n=217)
Avg. Trip Time -Home to Lot (Minutes)	10.79 (n=19)	10.90 (n=41)	9.49 (n=67)	13.83 (n=12)	12.76 (n=21)	14.00 (n=5)	11.88 (n=8)	9.34 (n=32)	12.00 (n=13)	---	(n=0)	10.74 (n=218)
Avg. Trip Time -Lot to Destination (Minutes)	29.12 (n=17)	36.12 (n=41)	28.52 (n=69)	30.36 (n=11)	26.68 (n=22)	33.00 (n=5)	21.88 (n=8)	35.56 (n=32)	37.69 (n=13)	---	(n=0)	31.49 (n=218)
Avg. Days Per Week for Pooling (Days)	4.90 (n=20)	4.95 (n=42)	4.97 (n=71)	4.92 (n=12)	4.70 (n=23)	5.25 (n=4)	5.12 (n=8)	4.94 (n=35)	4.86 (n=14)	---	(n=0)	4.93 (n=229)

Note: Refer to Figure 15 for location of geographic group.

1. Empirical analogy (using annual trips per capita, distance to activity centers, average vehicle occupancy rate, etc.)
2. Gravity model
3. Ratio of automobile ownership in catchment area
4. Ratio of households in catchment area
5. Ratio of passing traffic volume

Common to all demand estimation methods is the definition of a tributary or market area. The shape of the market area which typically defines a Park-and-Ride facility for transit is parabolic in nature with an axis of 7 miles and a cord of 8 miles as shown in Figure 16. (Christiansen, 1981) The market area for Park-and-Pool facilities has been suggested to be a hyperbola with focal points at the facility and at the primary destination as shown in Figure 17. The area within the hyperbolic commutershed, based upon a nationwide survey of 150 Park-and-Pool lots, was found to range from 20 square miles to 170 square miles and was a function of facility size, distance from lot to primary destination, home-to-lot distance, and regional setting. (Voorhees, 1981)

Since the market area configurations previously suggested for Park-and-Pool and Park-and-Ride both depend upon the existence of a primary destination, an investigation of pooler dispersion was undertaken for the Dallas urbanized area. Two of the larger geographic groups (Group C and Group H) were selected for more detailed analysis to better define a representative commutershed and travel characteristics of Park-and-Pool users. The combined number of vehicles surveyed at these two groups totaled 273, or about 41% of all Park-and-Pool vehicles identified in the study.

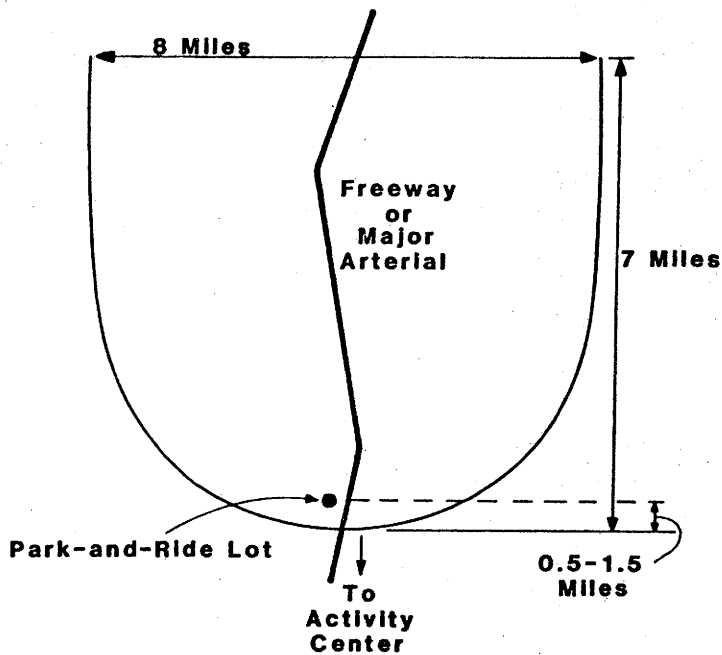


Figure 16: General Parabolic Shape of Typical Park-and-Ride Market Area

Source: Christiansen, 1981

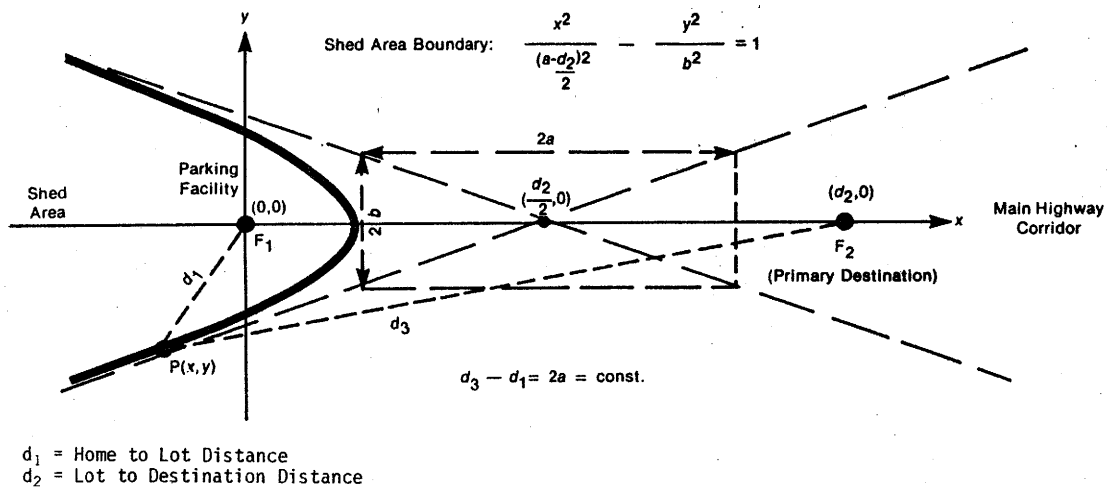


Figure 17: Commuter Shed Area Boundary for Park-and-Pool Defined as a Hyperbola

Source: Voorhees, 1981

Pooler Dispersion

Figures 18 and 19 show graphically the "lot to destination" journeys for Group C and Group H areas, respectively. Trips are shown from the group areas to the approximate center of the destination zip code zones. Tables 40 and 41 present the destinations of commuters from Group C and Group H areas, respectively. The most frequent destination for Poolers from Group C is the Dallas central business district (CBD), attracting over 57% of the respondents. The Dallas CBD is also a popular destination for Group H Poolers and attracts some 32% of the survey participants. Another, frequent destination from Group H was Greenville which attracts 32% of the respondents.

For comparative purposes, the principal destinations from each geographic group are summarized and presented in Table 42. Of the 213 survey participants, some 75% were destined to locations within the City of Dallas with over half (56%) of these having a destination in the Dallas CBD.

Figures 20 and 21 present graphic representation of the "home to lot" journeys for geographic Groups C and H, respectively. The trip origins are shown from the approximate center of zip code zones identified by the user survey and supplemented with the State Vehicle Registration file.

Tables 43 and 44 present a listing of all home zip codes and places of origin identified by Park-and-Poolers from Group C and Group H, respectively. Over 77% of the Park-and-Pool participants in geographic Group C were from one of four zip code zones within the City of Arlington. Some 69% of the Group H vehicles were from one of four zip code areas located in Garland,

DALLAS-FORT WORTH URBANIZED AREA

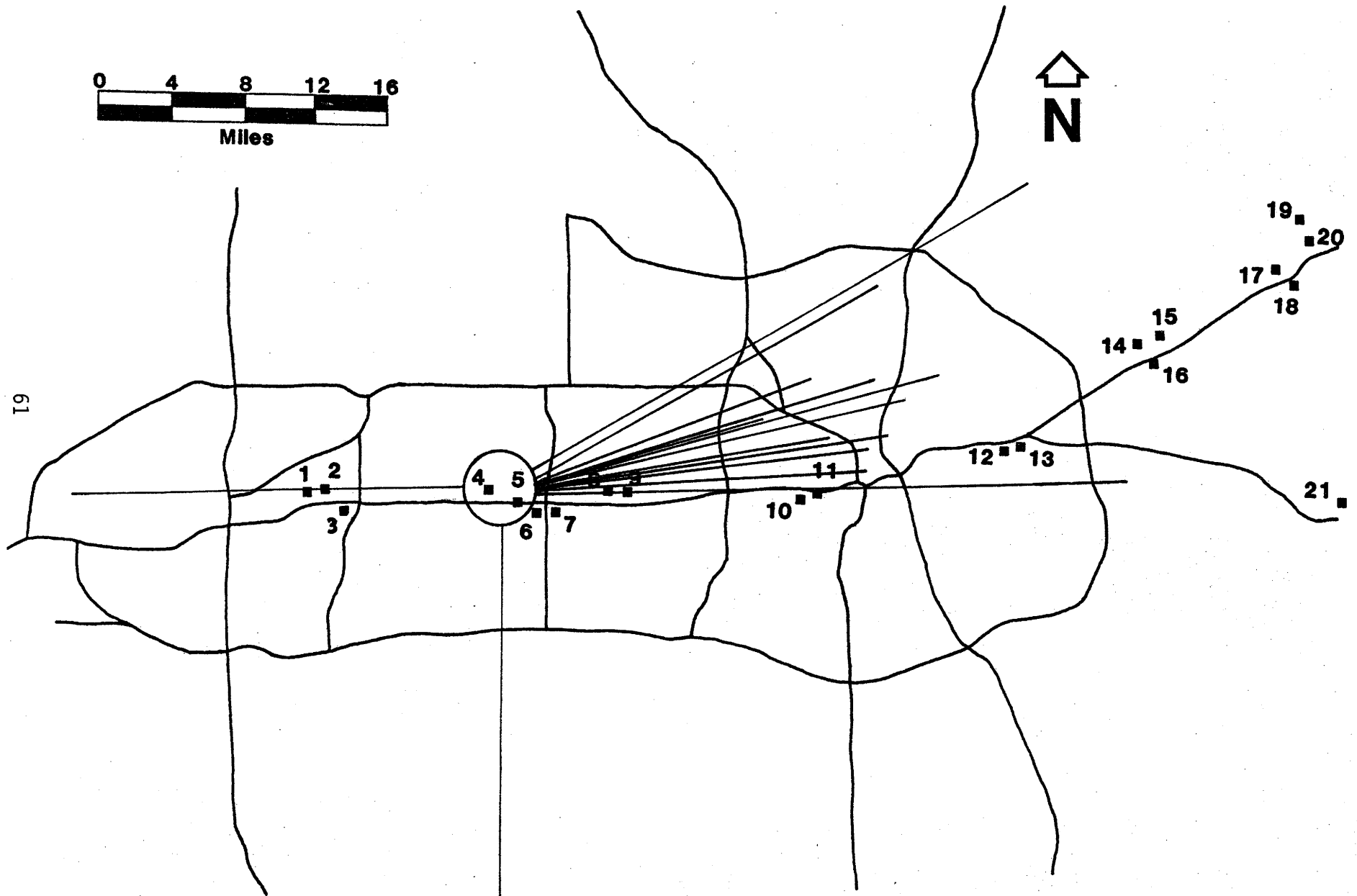


Figure 18: Destinations of Poolers from Group C (n=68)

DALLAS-FORT WORTH URBANIZED AREA

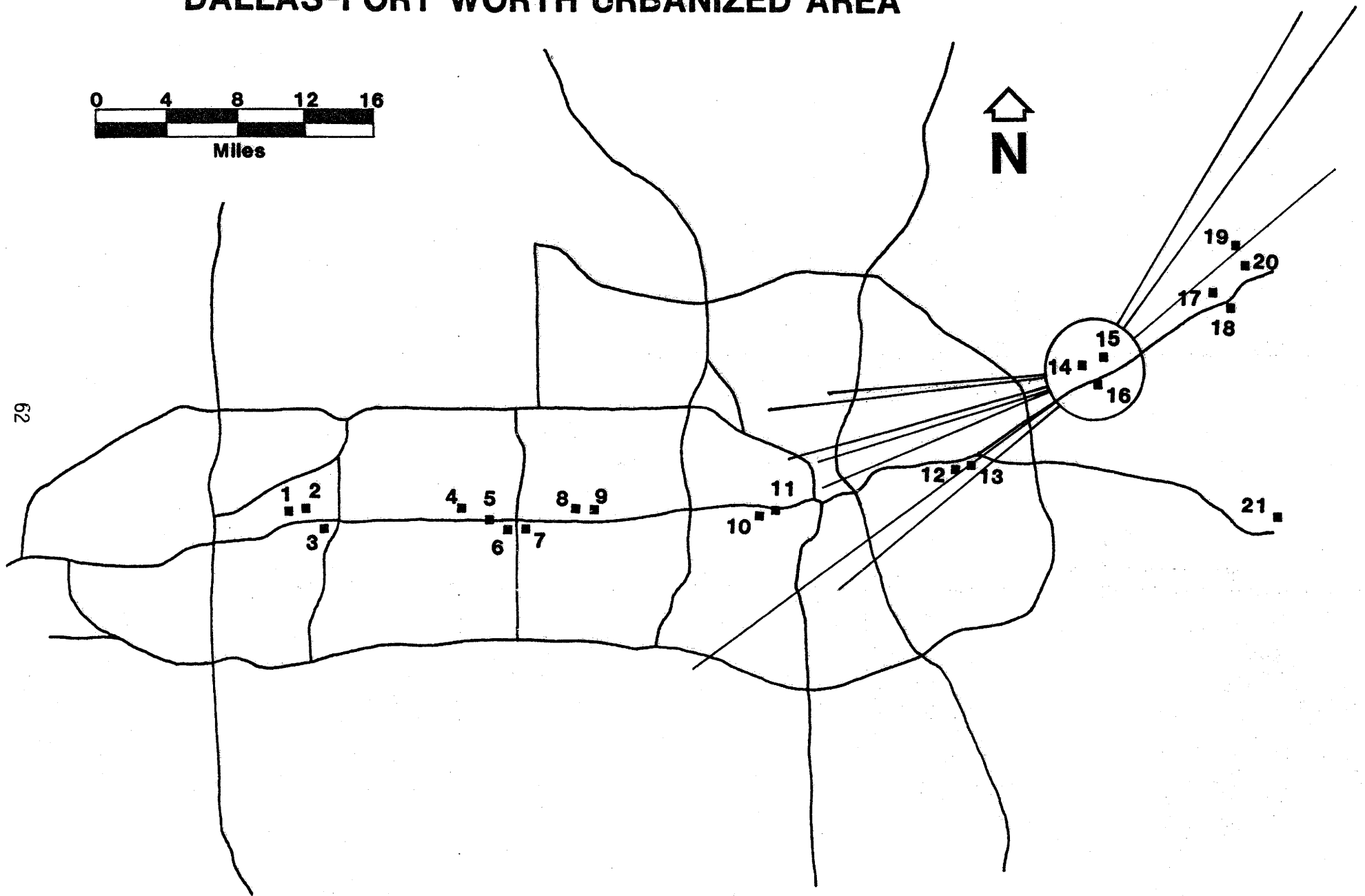


Figure 19: Destinations of Poolers from Group H (n=31)

Table 40: Pooler Destinations from Group C Area

Destination Zip Code Zones	Destination Location	Number of Respondents	Percent of Respondents
75201	Dallas CBD	17	25.0%
75202	Dallas CBD	14	20.6%
75283	Dallas	5	7.4%
75204	Dallas CBD	5	7.4%
75221	Dallas	4	5.9%
75242	Dallas	3	4.4%
75207	Dallas CBD	3	4.4%
75250	Dallas	2	2.9%
75230	Dallas	2	2.9%
75235	Dallas	2	2.9%
75205	Dallas	2	2.9%
75214	Dallas	2	2.9%
76101	Fort Worth	1	1.4%
76502	Temple	1	1.4%
75247	Dallas	1	1.4%
75270	Dallas	1	1.4%
75206	Dallas	1	1.4%
75081	Richardson	1	1.4%
75149	Mesquite	1	1.4%
Total	--	68	99.4% (Due to Rounding)

Rowlett and Mesquite. The summary information presented in Tables 43 and 44 is pictorially represented by zip code origin in Figures 22 and 23 for the two geographic group areas. The primary catchment zones for pooler origins are presented in Figure 24 for both Group C and Group H areas.

Table 41: Pooler Destinations from Group H Area

Destination Zip Code Zones	Destination Location	Number of Respondents	Percent of Respondents
75401	Greenville	10	31.0%
75201	Dallas CBD	7	22.6%
75428	Commerce	3	9.7%
75235	Dallas	2	6.5%
75202	Dallas CBD	2	6.5%
75265	Dallas	1	3.2%
75295	Dallas	1	3.2%
75216	Dallas	1	3.2%
75221	Dallas	1	3.2%
75205	Dallas	1	3.2%
75207	Dallas CBD	1	3.2%
75089	Royce City	1	3.2%
Total	--	31	98.7% (Due to Rounding)

Table 42: Principal Destinations of Park-and-Pool Participants; By Group

Geographic Group	Number of Participants from Geographic Group Destined to:							Total Number Participants Indicating a Destination
	Dallas CBD	Dallas	Fort Worth CBD	Fort Worth	Greenville	Addison	Other Locations or Unknown	
A	1	4	3	6	--	3	2	19
B	13	15	--	5	--	1	6	40
C	39	25	--	1	--	--	3	68
D	5	5	--	--	--	--	0	10
E	11	5	2	1	--	--	2	21
F	1	1	--	1	--	--	1	4
G	3	4	--	--	--	--	0	7
H	10	7	--	--	10	--	4	31
I	7	5	--	--	1	--	0	13
J	--	--	--	--	--	--	--	0
Total	90	71	5	14	11	4	18	213
Percent	42.3%	33.3%	2.3%	6.6%	5.2%	1.9%	8.5%	

DALLAS-FORT WORTH URBANIZED AREA

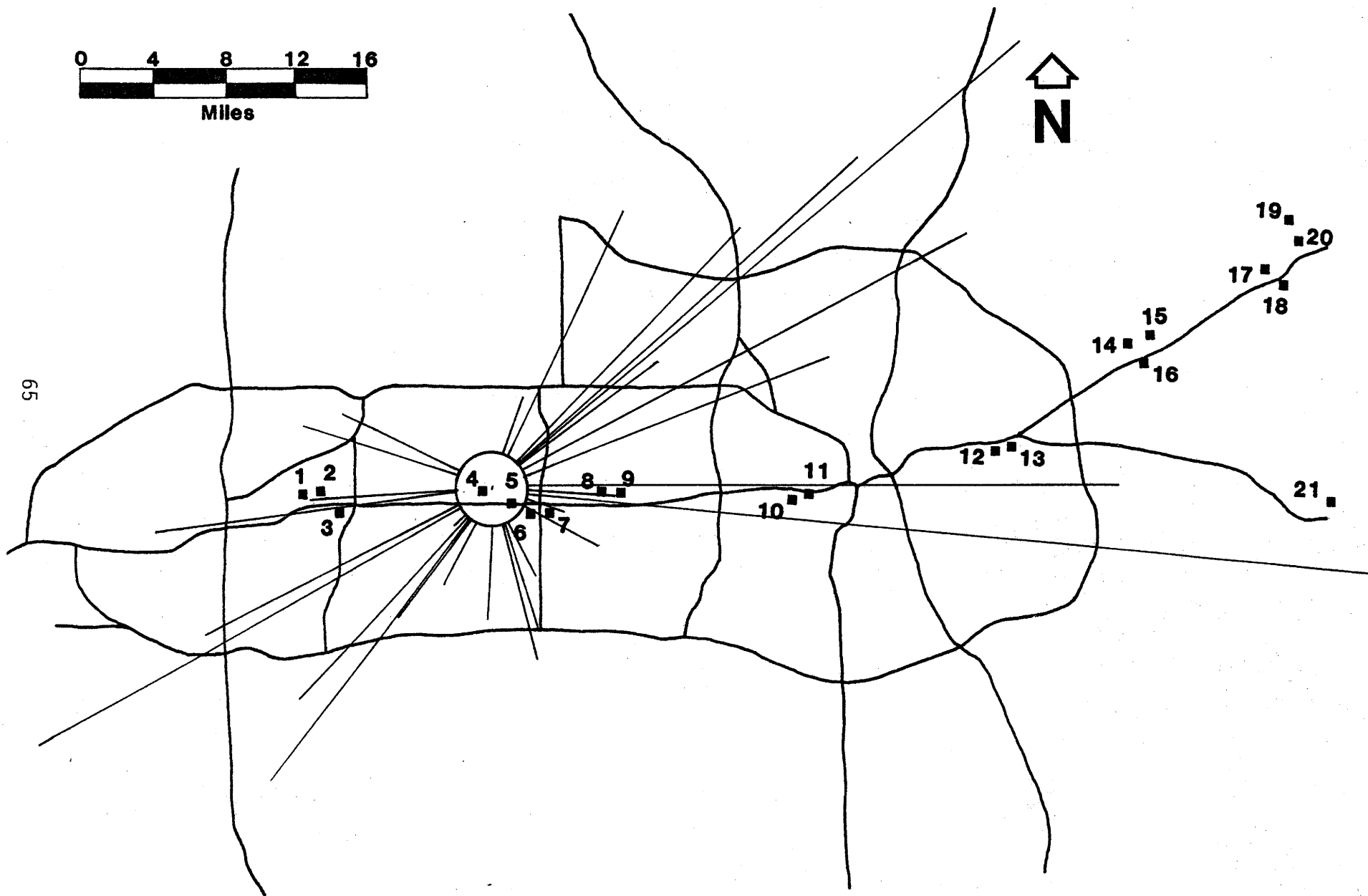


Figure 20: Origins of Poolers to Group C - Home Addresses from Survey and Vehicle Registrations (n=137)

DALLAS-FORT WORTH URBANIZED AREA

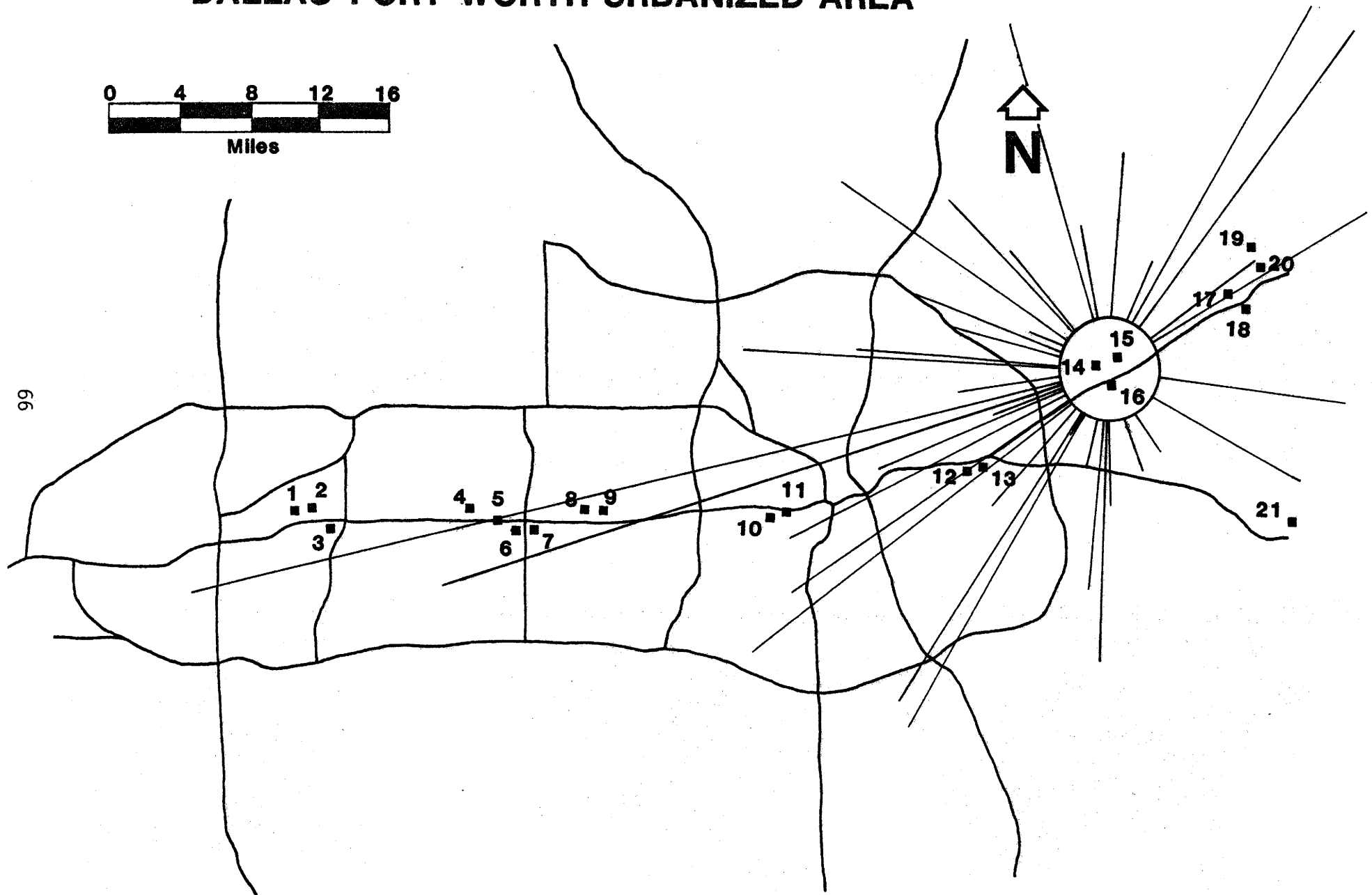


Figure 21: Origins of Poolers to Group H - Home Addresses from Survey and Vehicle Registrations (n=120)

Table 43: Pooler Origins of Group C Area, By Zip Code

Origin Zip Code	Origin Location	Number of Survey Respondents	Percent of Respondents
76011	Arlington	25	36.8%
76012	"	11	16.2%
76010	"	10	14.7%
76013	"	7	10.3%
76014	"	3	4.4%
76112	Fort Worth	3	4.4%
75050	Grand Prairie	2	2.9%
76016	Arlington	1	1.5%
76018	"	1	1.5%
76039	Euless	1	1.5%
76063	Mansfield	1	1.5%
76103	Fort Worth	1	1.5%
76107	" "	1	1.5%
76118	" "	1	1.5%
Total		68	100.2% (Due to Rounding)

Catchment Zones

The primary catchment zones, shown in Figure 24, are composites of the home zip code zones for Park-and-Poolers. The irregular shapes of the catchment areas are due to zip code boundaries and are not necessarily representative of the true home origin of the poolers. In an attempt to approximate a representative market area for a majority of Park-and-Pool participants, the travel characteristics or parameters of the total survey

Table 44: Pooler Origins of Group H Area, By Zip Code

Origin Zip Code	Origin Location	Number of Survey Respondents	Percent of Respondents
75043	Garland	13	40.6%
75088	Rowlett	4	12.5%
75150	Mesquite	3	9.4%
75041	Garland	2	6.2%
75040	"	1	3.1%
75042	"	1	3.1%
75089	Royse City	1	3.1%
75141	Hutchins	1	3.1%
75180	Balch Springs	1	3.1%
75182	Mesquite	1	3.1%
75227	Dallas	1	3.1%
75228	"	1	3.1%
75243	"	1	3.1%
76013	Arlington	1	3.1%
Total	-----	32	99.7% (Due to Rounding)

sample were reexamined. The major characteristics important to market area definition are:

Average (mean) home-to-lot distance - 5.9 miles;

Modal (most frequent) home-to-lot distance - 2.0 miles;

Median (50th percentile) home-to-lot distance (approx.) - 3.5 miles;

75th percentile home-to-lot distance (approx.) - 7.5 miles;

85th percentile home-to-lot distance (approx.) - 9.8 miles;

90th percentile home-to-lot distance (approx.) - 12.0 miles.

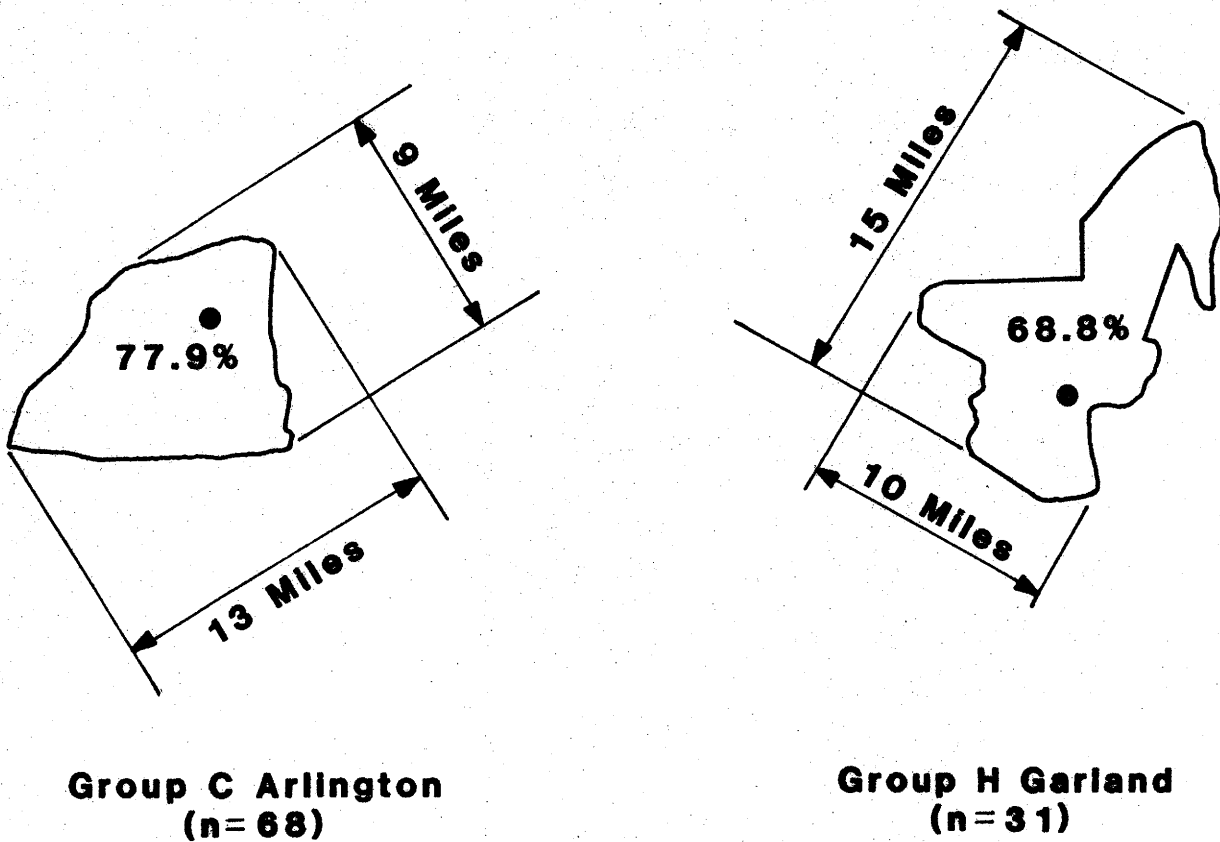


Figure 24: Primary Catchment Zones for Park-and-Pool Origins: Geographic Groups "C" and "H"

Considering the above travel parameters in conjunction with the catchment zones for the two geographic groups, a representative market area for Park-and-Pool facilities appears to be more closely related to an ellipse or a circle instead of a parabola. Examination of the catchment areas for the two largest groups (Figure 24) would tend to indicate an elliptical shape with a major axis 1.5 times as long as the minor axis. However, if an ellipse is used to describe the primary catchment zones for Groups C and H, the major axis is eccentrically oriented to the freeway

corridor and to the center of the group location. This eccentricity may, in part, be accounted for by the roadway (access) system and population concentrations (density) supporting the Park-and-Pool activity. The concept of the elliptical market area is illustrated in Figure 25; however, prior to application, further research will be necessary to substantiate this observation.

Estimation of Park-and-Pool demand developed herein is based upon the relationship of existing pooling activity to population densities and vehicle densities surrounding each of the geographic groups. Average travel characteristics obtained from survey respondents are used in defining the primary influence area surrounding each geographic group. Ratios of poolers

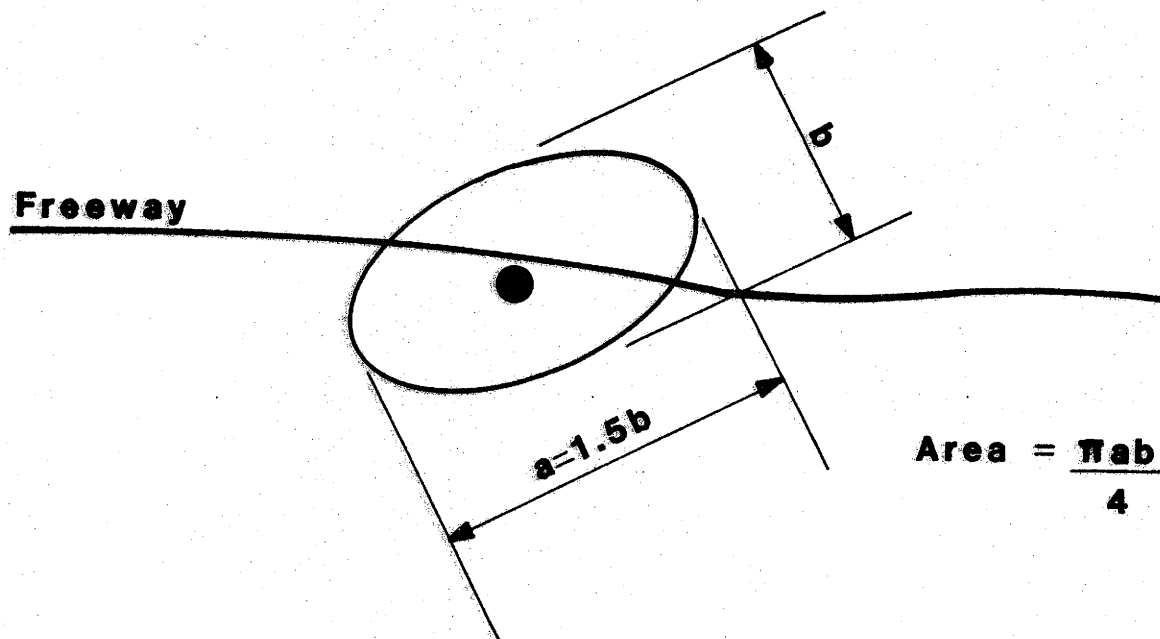


Figure 25: Illustration of Estimated Geographic Group (EGG) Market Configuration - Group C and Group H Only

to population and poolers to vehicles are calculated based upon the 50th percentile (median) travel distance from origin to lot as illustrated in Figure 26.

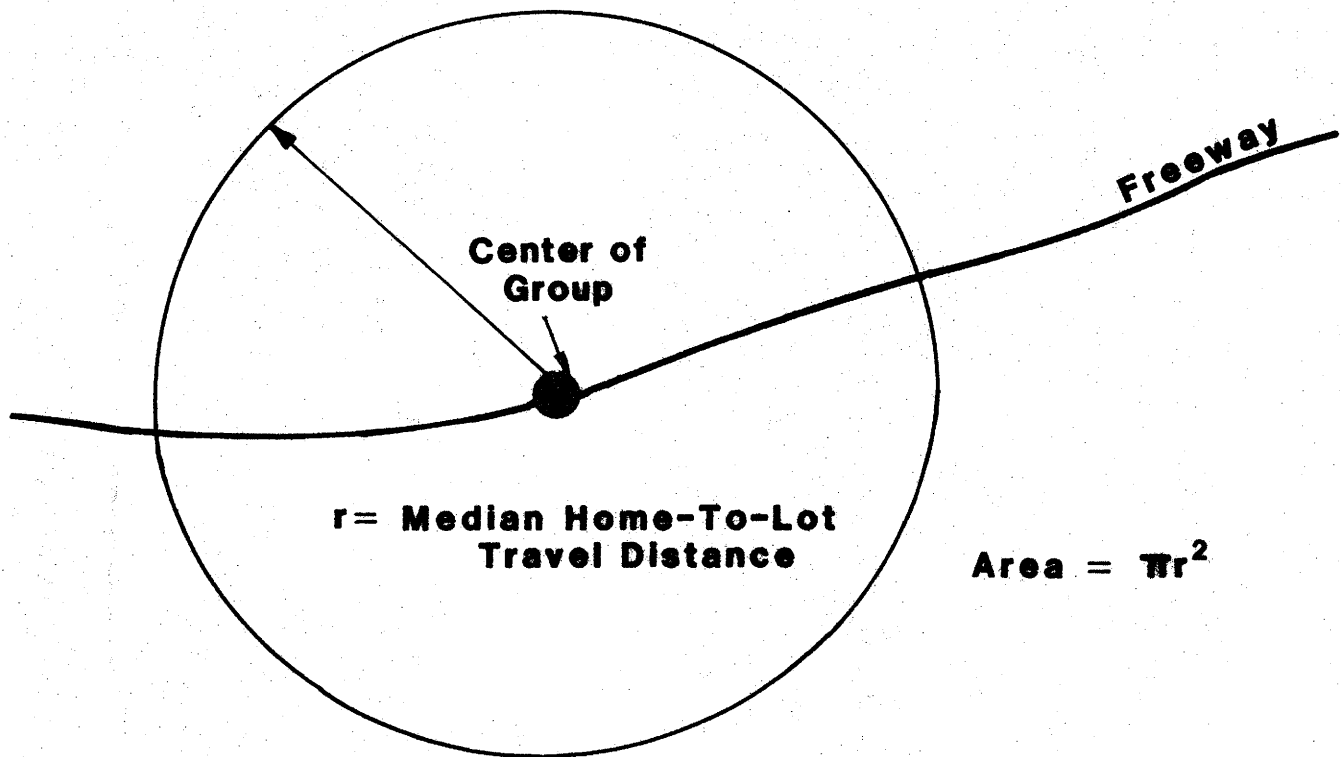


Figure 26: Market Area Configuration Used for Estimating Park-and-Pool Demand

Transportation Planning Data

Transportation planning zones and data in common use within the Dallas urbanized area were supplemented with available information from the 1980 census. Figure 27 presents the largest geographic planning divisions utilized in the Dallas-Fort Worth Region. Figure 28 shows the geographic units known as serial zones which subdivide the region's sector planning areas. Data on total land area, population and employment were available for

DALLAS-FORT WORTH SECTOR MAP
SECTOR DECK 6

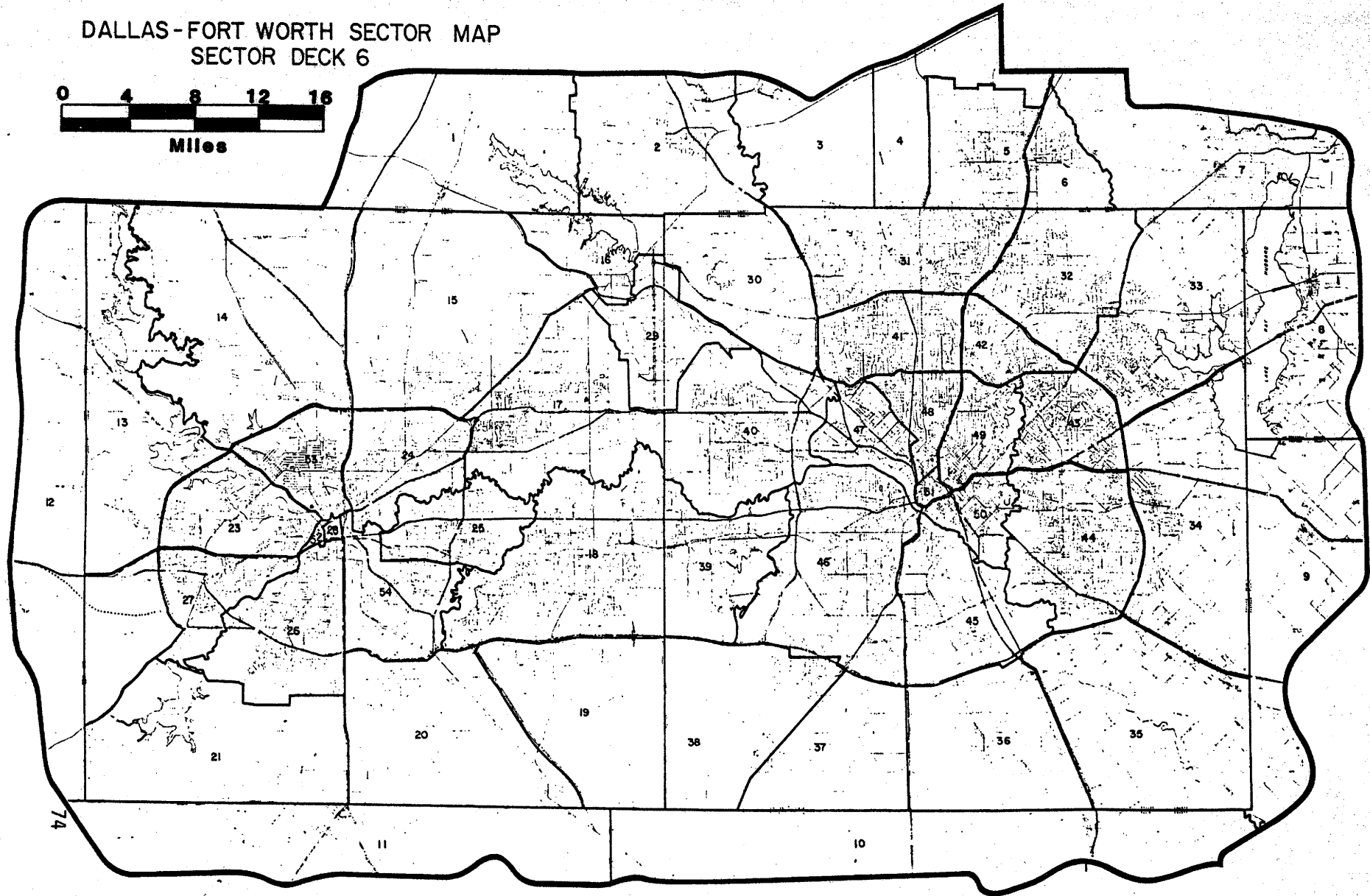
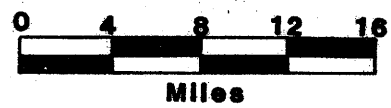


Figure 27: Transportation Planning Divisions: Sector Map



Figure 28: Transportation Planning Divisions: Serial Zones

each sector and for each serial zone within the sectors. (Walden, 1981) An attempt was made to correlate the 1980 census tracts with selective sectors adjacent the I-30 corridor to obtain the most recent population and population density information. A summary cross reference of sectors to serial zones and of sectors to census tracts is included in Appendix D.

Table 45 presents a summary of population and population densities for 14 of the sectors within, or immediately adjacent to, the I-30 corridor. In addition, an estimate of the total number of personal use automobiles and light-duty trucks was available for each of the sectors; Table 46 presents a summary of the total number of vehicles, by sector, within the study area. (Young, 1982)

Based upon the average vehicle occupancies indicated by the survey participants and the total number of parked vehicles, the number of ridesharing persons from each geographic area was calculated and is presented, along with the median home-to-lot travel distance, in Table 47.

Demand Analysis

Figure 29 shows the generalized Park-and-Pool market configuration for geographic Groups A through I based upon the 50th percentile travel distance from home to lot. Table 48 provides a summary of population estimates encompassed by each group's market configuration and the computed ratio of poolers to population.

Table 45: Population and Population Density for Demand Analysis;
DFW Intensive Study Area (ISA)

Sector	Total Area	Location (Primary)	Population	Population Density
8	46.8 Sq.Mi.	Rockwall County -DFW ISA	* 14,528	* 310.6/Sq.Mi.
9	77.1 Sq.Mi.	Kaufman County -DFW ISA	* 4,090	* 53.1/Sq.Mi.
17	62.0 Sq.Mi.	Hurst-Eules -Bedford	79,587	1,283.7/Sq.Mi.
18	68.6 Sq.Mi.	Arlington	*149,957	*2,184.8/Sq.Mi.
24	30.3 Sq.Mi.	Haltom City -N.E. Ft. Worth	62,175	2,053.4/Sq.Mi.
25	25.4 Sq.Mi.	Fort Worth	* 44,443	*1,748.2/Sq.Mi.
33	60.5 Sq.Mi.	Garland -N.E. Dallas County	* 81,395	*1,345.6/Sq.Mi.
34	72.8 Sq.Mi.	Mesquite -East Dallas County	* 48,251	* 663.0/Sq.Mi.
39	31.2 Sq.Mi.	Grand Prairie	* 58,023	*1,859.1/Sq.Mi.
40	55.1 Sq.Mi.	Irving	112,194	2,035.5/Sq.Mi.
43	24.1 Sq.Mi.	N.E. Dallas	100,922	4,190.2/Sq.Mi.
44	48.1 Sq.Mi.	S.E. Dallas	94,911	1,974.5/Sq.Mi.
46	68.9 Sq.Mi.	S.W. Dallas	178,868	2,596.4/Sq.Mi.
54	29.8 Sq.Mi.	S.E. Ft. Worth	72,527	2,436.0/Sq.Mi.

*Population and Population Density Derived from 1980 Census of Population and Housing, U.S. Department of Commerce, Advanced Report Issued March 1981, for Census Tracts shown in Appendix.

Table 46: Vehicle and Vehicle Density for Demand Analysis;
DFW Intensive Study Area (ISA)

Sector	Total Area	Location (Primary)	Number of Vehicles	Vehicle Density
8	46.8 Sq.Mi.	Rockwall County -DFW ISA	4,861	103.9/Sq.Mi.
9	77.1 Sq.Mi.	Kaufman County -DFW ISA	1,870	24.3/Sq.Mi.
17	62.0 Sq.Mi.	Hurst-Euless -Bedford	50,346	812.0/Sq.Mi.
18	68.6 Sq.Mi.	Arlington	99,702	1453.4/Sq.Mi.
24	30.3 Sq.Mi.	Haltom City -N.E. Ft. Worth	39,315	1297.5/Sq.Mi.
25	25.4 Sq.Mi.	Fort Worth	31,233	1229.6/Sq.Mi.
33	60.5 Sq.Mi.	Garland -N.E. Dallas County	47,251	781.0/Sq.Mi.
34	72.8 Sq.Mi.	Mesquite -East Dallas County	26,677	366.4/Sq.Mi.
39	31.2 Sq.Mi.	Grand Prairie	28,746	921.3/Sq.Mi.
40	55.1 Sq.Mi.	Irving	67,320	1221.8/Sq.Mi.
43	24.1 Sq.Mi.	N.E. Dallas	68,951	2861.0/Sq.Mi.
44	48.1 Sq.Mi.	S.E. Dallas	55,067	1144.8/Sq.Mi.
46	68.9 Sq.Mi.	S.W. Dallas	99,649	1446.3/Sq.Mi.
54	29.8 Sq.Mi.	S.E. Ft. Worth	40,483	1358.5/Sq.Mi.

Table 47: Estimated Poolers and Median Home-To-Lot Travel Distances; By Geographic Group

Geographic Group	Number of Parked Vehicles	Average Vehicle Occupancy	Estimated Number of Poolers	Median Home-To-Lot Travel Distances (Miles)
A	56	1.100	62	2.0
B	118	1.286	152	3.0
C	144	1.254	181	3.0
D	31	1.083	34	6.0
E	59	1.261	74	4.8
F	36	1.000	36	4.0
G	32	1.375	44	4.0
H	129	1.139	147	3.5
I	59	1.429	84	4.0
Totals	664	-----	814	---

DALLAS-FORT WORTH SECTOR MAP
SECTOR DECK 6

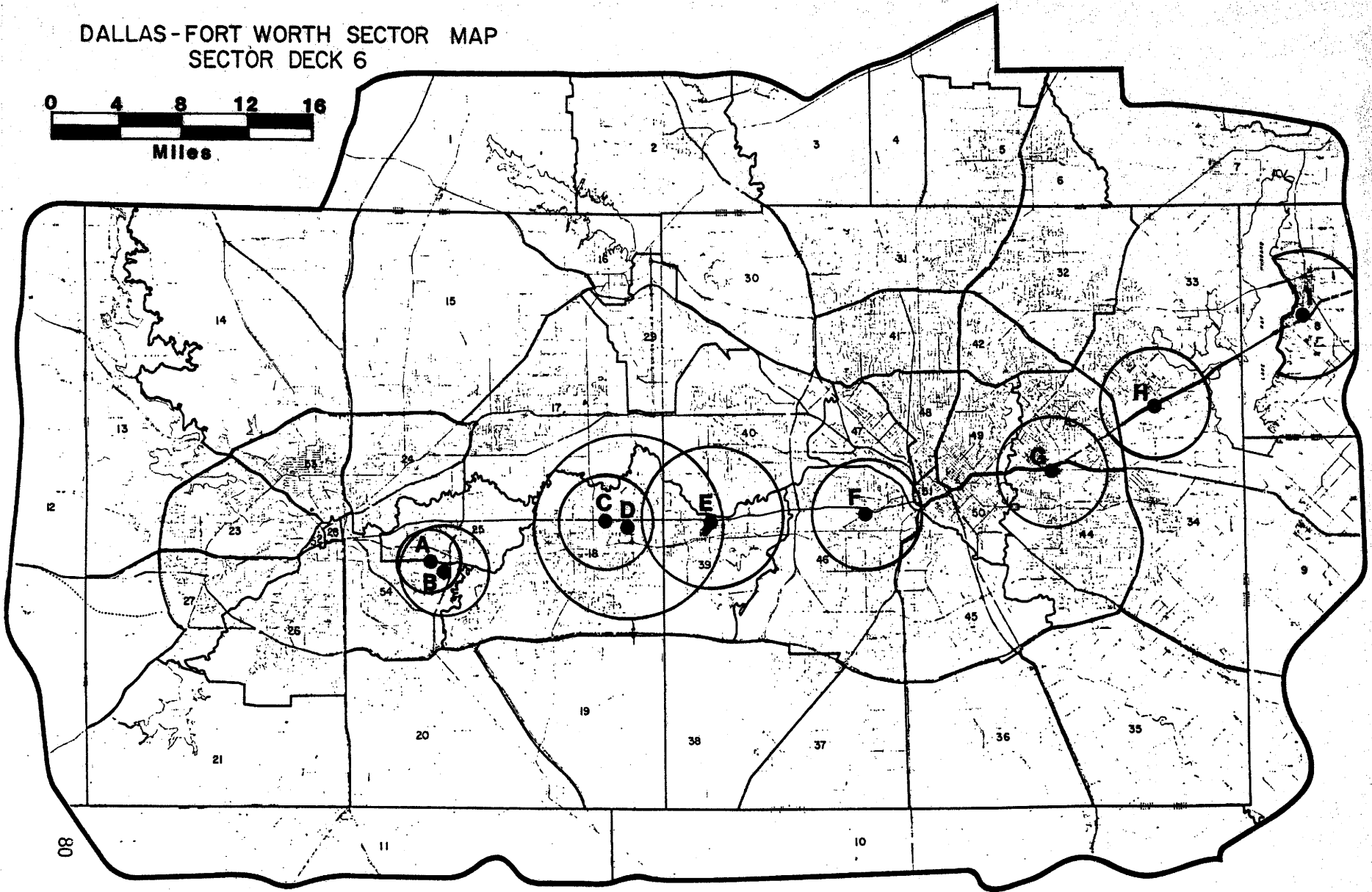


Figure 29: Park-and-Pool Market Configuration as a Function of 50th Percentile Home-to-Lot Distances, By Group

Table 48: Demand Analysis as a Function of Population

Geographic Group	Population Density (Per Sq. Mile)	50% of Poolers	50th Percentile Home-to-Lot Distance (Miles)	Area of Market Configuration (Square Miles)	Population Within Market Configuration	Ratio of Poolers to Population (Percent)
A	1748	31	2.0	12.6	22,025	.14%
B	1748	76	3.0	28.3	49,468	.15%
C	2185	90	3.0	28.3	61,836	.15%
D	2100	17	6.0	113.1	237,510	.01%
E	1950	37	4.8	72.4	141,180	.03%
F	2596	18	4.0	50.3	130,579	.01%
G	3080	22	4.0	50.3	154,924	.01%
H	1300	73	3.5	38.5	50,050	.15%
I	310	42	4.0	*30.2	9,356	.45%
Totals	----	406	---	-----	856,928	.05%

*Area adjusted due to Lake Ray Hubbard Constraint (60% of normal market configuration).

Figure 30 illustrates the number of poolers as a percentage of population and as a percentage of workers. Superimposed on the graph is an estimated demand line for the 100 to 600 workers per square mile range. This demand line was based upon an investigation of 150 Park-and-Pool facilities throughout the country. (Voorhees, 1981) It is interesting to note that only two of the geographic groups of Park-and-Pool facilities studied in the Dallas area fall within the demand range of 100 to 600 workers per square mile; however, both groups I and H have percentages of poolers to population very close to the estimated demand line. Ratio values vary from a low of .01% to a high of .45%, with an overall average of approximately .05% of population.

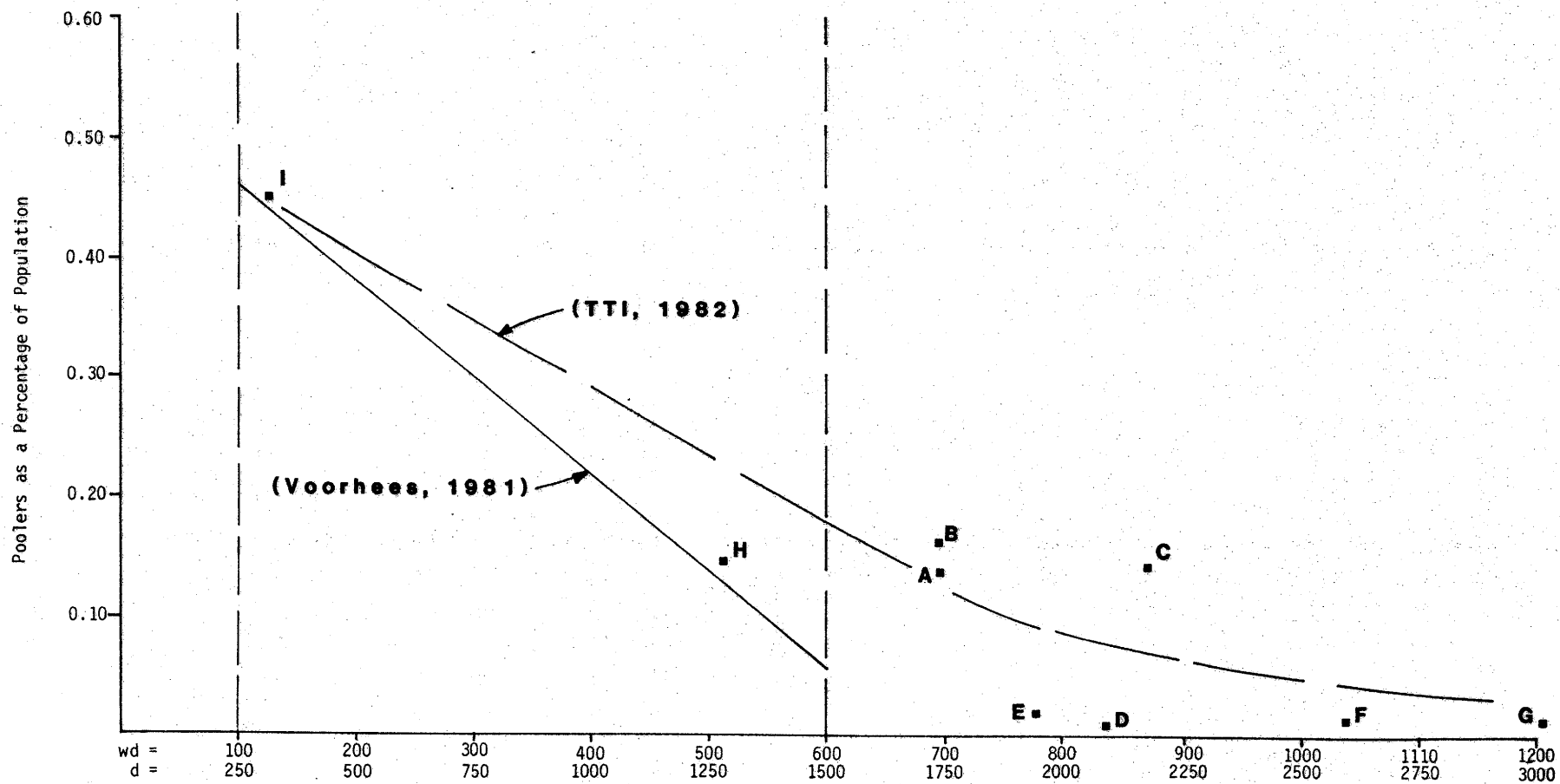


Figure 30: Poolers as Percentage of Population vs. Population Density (Worker and Total)

Table 49 presents the vehicle ownership figures and calculated ratio of poolers to vehicles for each of the nine geographic groups. Figure 31 graphically portrays the number of poolers as a percentage of vehicle ownership based upon the data analysis. Ratio values for poolers to vehicle ownership range from .01% to 1.34% and have an overall average of about .08% of total vehicles.

Table 49: Demand Analysis as a Function of Vehicle Ownership

Geographic Group	Vehicle Ownership Density (Per Sq. Mile)	50% of Poolers	50th Percentile Home-to-Lot Distance (Miles)	Area of Market Configuration (Square Miles)	Vehicles Within Market Configuration	Ratio of Poolers to Vehicles (Percent)
A	1230	31	2.0	12.6	15,498	.20%
B	1230	76	3.0	28.3	34,809	.22%
C	1453	90	3.0	28.3	41,120	.22%
D	1340	17	6.0	113.1	151,554	.01%
E	1070	37	4.8	72.4	77,468	.05%
F	1446	18	4.0	50.3	72,734	.02%
G	2003	22	4.0	50.3	100,751	.02%
H	780	73	3.5	38.5	30,030	.24%
I	104	42	4.0	*30.2	3,139	1.34%
Totals	----	406	---	-----	527,103	.08%

*Area adjusted due to Lake Ray Hubbard Constraint (60% of normal market configuration).

The application of pooler to population and pooler to vehicle ownership ratios for transportation planning purposes is difficult, if not impossible, without a more precise definition of total market area. In order to relate actual Park-and-Pool activity to the computed ratios, an investigation of each geographic group was undertaken to determine a range of representative

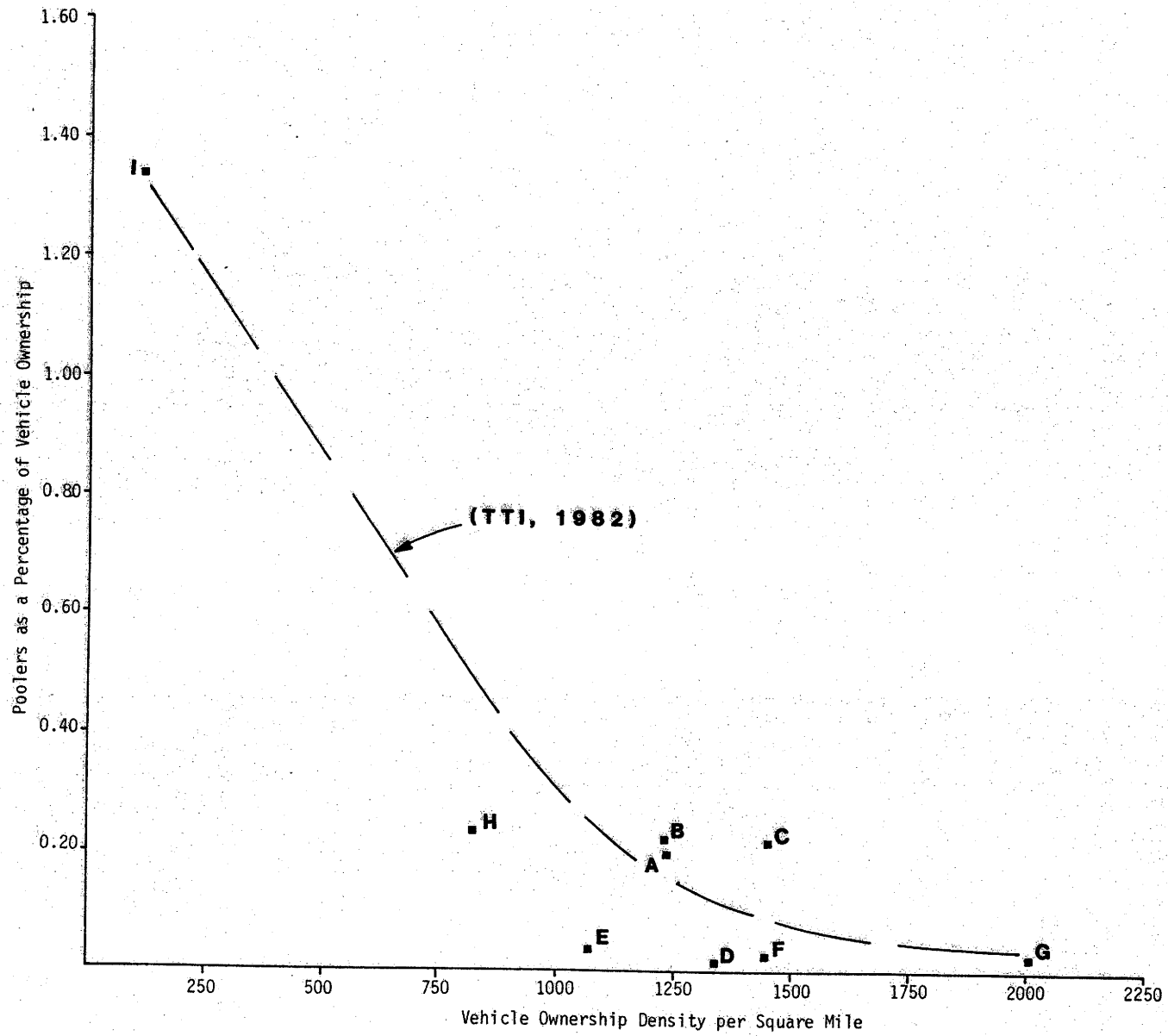


Figure 31: Poolers as Percentage of Vehicle Ownership vs. Vehicle Ownership Density

market areas which could be more directly applied to pooler demand estimation.

Tables 50 and 51 present the computed area, in square miles, necessary to support the existing participation in Park-and-Pool at each of the geographic groups based upon the population and vehicle ownership ratios, respectively. The small discrepancy between computed areas using the population ratios and the vehicle ratios for certain geographic groups arises from the use of adjusted population figures for certain sectors based upon the 1980 Census.

The computed size of the market areas range from about 25 square miles to over 220 square miles for supporting the existing Park-and-Pool activity. It should be noted, however, that the computed market areas assumes uniformly distributed population and vehicle ownership densities within the expanded catchment zones for each geographical area.

The three largest geographic groups (B, C and H) have marked similarities in their pooler to population ratios and in their market area size. The ratios of poolers to population for these three groups range from .15% to .24% while market area size ranges from about 56 square miles to 78 square miles.

Figure 32 presents the approximate dimensions of computed market area size for all groups; dimensions for both a circular and elliptical catchment area are included.

Initial inspection of the range of computed market area size would tend to make suspect the applicability of the data for planning purposes. However, one must consider the nature of each geographic group; its accessibility, its utilization, its proximity to other Park-and-Pool sites, and its relationship to urban employment and housing densities. Group A,

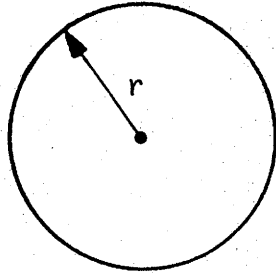
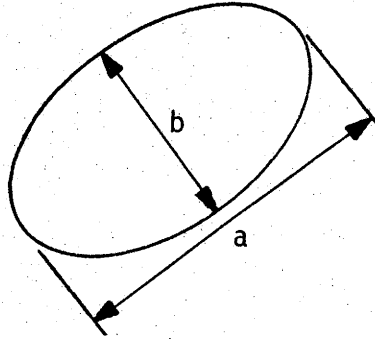
Table 50: Computed Market Areas Based Upon Population Ratios

Geographic Group	Total Number of Poolers	Population Density (Per Square Mile)	Poolers to Population Ratio (Percent)	Population to Support Pooling	Computed Market Area (Sq. Miles)
A	62	1748	.1408%	44,034	25.2
B	152	1748	.1536%	98,958	56.6
C	181	2185	.1456%	124,313	56.9
D	34	2100	.0072%	472,222	224.9
E	74	1950	.0262%	282,443	144.8
F	36	2596	.0138%	260,869	100.5
G	44	3080	.0142%	309,859	100.6
H	147	780	.2431%	60,469	77.5
I	84	310	.4489%	18,712	60.4

Table 51: Computed Market Areas Based Upon Vehicle Ratios

Geographic Group	Total Number of Poolers	Vehicle Density (Per Square Mile)	Poolers to Vehicle Ownership Ratio (Percent)	Vehicles To Support Pooling	Computed Market Area (Sq. Miles)
A	62	1230	.2000%	31,000	25.2
B	152	1230	.2183%	69,629	56.6
C	181	1453	.2189%	82,686	56.9
D	34	1340	.0112%	303,571	226.5
E	74	1070	.0478%	154,812	144.7
F	36	1446	.0247%	145,749	100.8
G	44	2003	.0218%	201,835	100.8
H	147	780	.2431%	60,469	77.5
I	84	104	1.3380%	6,278	60.4

Figure 32: Dimensions of Computed Market Areas, By Group

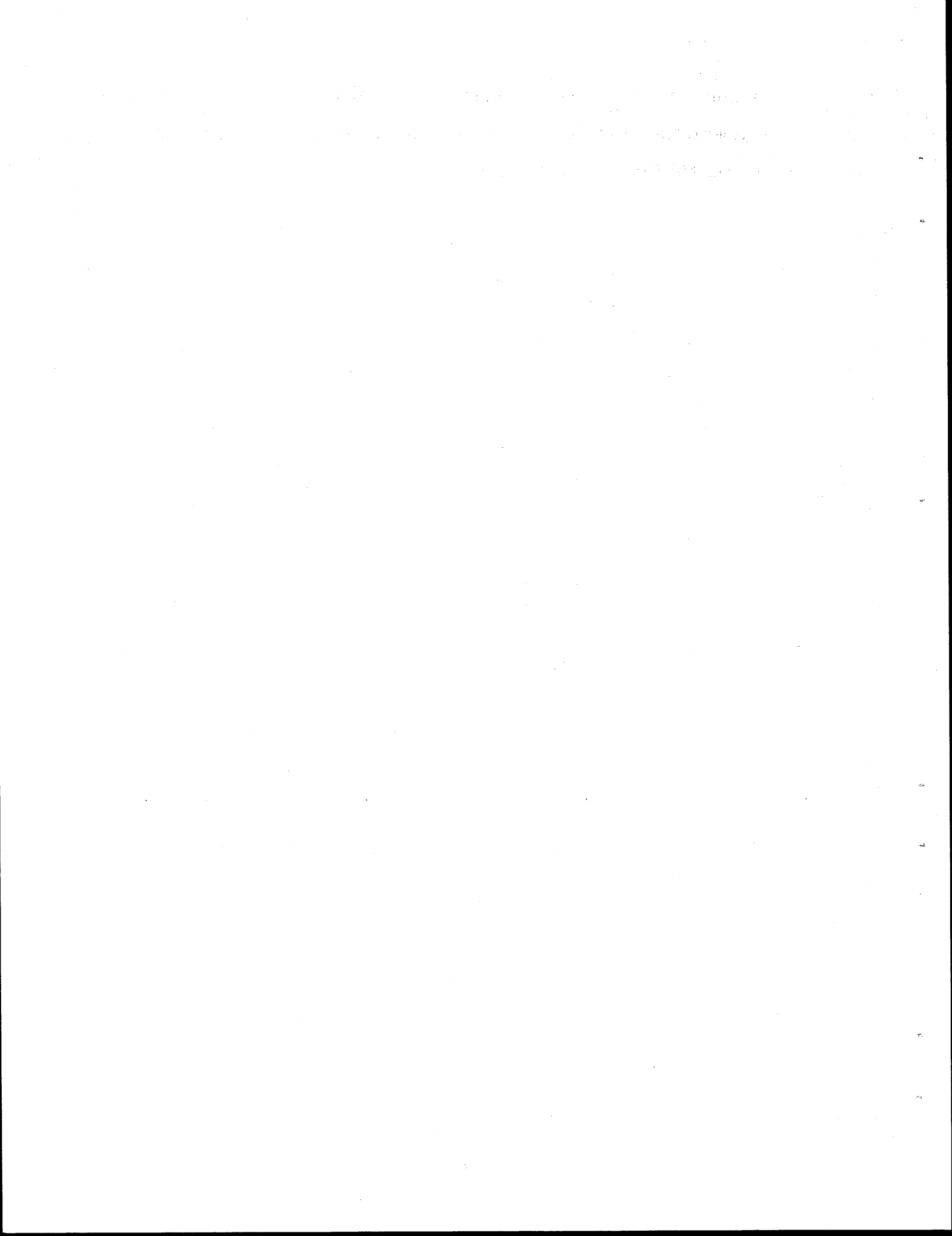
Geographic Group	Computed Area (sq.mi.)	Dimensions in Miles for		
		Circular Market Area	Elliptical Market Area	
		 $\text{Area} = \pi \cdot r^2$	 $\text{Area} = \frac{\pi \cdot a \cdot b}{4}$	
r =	a =	b =		
A	25.2	2.8	6.9	4.6
B	56.6	4.2	10.4	6.9
C	56.9	4.3	10.4	6.9
D	224.9	8.5	20.7	13.8
E	144.8	6.8	16.6	11.1
F	100.5	5.7	13.9	9.2
G	100.6	5.7	13.9	9.2
H	77.5	5.0	12.2	8.1
I	60.4	4.4	10.7	7.2

consisting of two smaller facilities in the City of Fort Worth, has a computed market area of only 25.2 square miles. Both sites within the group are served by transit and are considered more special-use facilities by residents within the neighborhood. Group D's market area was the largest computed catchment zone--having an area of 224.9 square miles. This group is located in Arlington at the interchange of SH-360 and I-30 making it easily accessible by commuters from considerable distances away from the site. The group's accessibility contributes to a low pooler to population ratio and, consequently, a large computed market area. Similar to Group D, Group E, located on Belt Line Road in Grand Prairie, also has a relatively large computed market area of 144.8 square miles and a relatively low pooler to population ratio.

The exclusion of these three areas (Groups A, D and E) narrows the range of computed market areas to about 56 to 100 square miles for the remaining geographic groups. The range of pooler to population ratios remains unchanged at .01% to .45%; however, the average ratio becomes .07% of population.

As previously mentioned, further investigation of the market area configuration will be necessary to substantiate the circular or elliptical pattern. The appropriate pattern for any given location is believed to vary as a function of roadway access, physical constraints and boundaries, and urban development within the area. However, for transportation planning purposes, a rough approximation of the market area and related Park-and-Pool potential can be estimated based upon the data presented herein. As with all transportation improvements, professional judgement and first-hand knowledge of a specific area or site must be incorporated in the analysis process when attempting to estimate Park-and-Pool demand.

The section of this report entitled Application of Study Findings contains a generalized example of how the research data may be applied to analyzing a specific Park-and-Pool facility.



VANPOOL VERSUS CARPOOL RIDESHARING

Commuter parking areas like Park-and-Pool facilities provide the means for increased vehicle occupancy rates when they are developed in conjunction with a well-coordinated ridesharing effort. (Gudaitis, 1981) Both Dallas and Fort Worth sponsor areawide rideshare programs to assist commuters in forming vanpools and carpools. Since their beginnings, these programs have actively promoted ridesharing for the purpose of increasing vehicle occupancy rates throughout the region. During 1979-80, the Dallas program added over 17,000 commuters to their rideshare data base while Fort Worth added almost 12,000. (Metroplex Transportation News, March 1981)

Some 93% of the surveyed Park-and-Pool participants either vanpool or carpool to their final destination. The travel characteristics of these ridesharing participants have been investigated, with the findings presented in this section.

The number of vanpools operated in the State of Texas grew from less than 200 in 1977 to more than 2300 by mid-1981. With the increasing cost of fuel and parking, the vanpool form of ridesharing has become more attractive to commuters. Initial data suggested a minimum trip length of 15 miles to make vanpooling a viable ridesharing alternative. More recent data indicates a reduction in the minimum trip length to approximately 12 miles. (Maxwell, 1982)

Data collected in the Dallas Park-and-Pool study were examined to determine trip characteristics of those individuals presently engaged in both vanpool and carpool travel. Some 31% of the survey respondents indicated their present mode of travel from the parking site to their destination was by vanpool. An additional 62% of the respondents indicated

their mode of travel was by carpool. Table 52 summarizes the travel parameters for vanpool and carpool respondents and presents a comparison of the parameters for all survey respondents.

Table 52: Vanpool and Carpool Travel Parameters

Parameter	Vanpoolers (31% of Respondents)	Carpoolers (62% of Respondents)	All Survey Respondents (100%)
Avg. Vehicle Occupancy -Home to Lot (Persons/Vehicle)	1.09 (n=70)	1.32 (n=142)	1.23 (n=231)
Avg. Vehicle Occupancy -Lot to Destination (Persons/Vehicle)	8.81 (n=69)	3.36 (n=138)	5.19 (n=211)
Avg. Trip Distance -Home to Lot (Miles)	5.00 (n=67)	6.30 (n=138)	5.89 (n=222)
Avg. Trip Distance -Lot to Destination (Miles)	24.54 (n=67)	22.86 (n=137)	23.24 (n=217)
Avg. Trip Time -Home to Lot (Minutes)	9.87 (n=62)	11.31 (n=137)	10.74 (n=218)
Avg. Trip Time -Lot to Destination (Minutes)	33.15 (n=67)	31.05 (n=135)	31.49 (n=218)
Avg. Days Per Week for Pooling (Days)	4.97 (n=70)	4.91 (n=142)	4.93 (n=229)

The most apparent, and expected, difference in travel characteristics is the vehicle occupancy of vanpools versus carpools for the lot-to-destination journey--8.81 persons per vanpool compared to 3.36 persons per carpool. The mean one-way trip length from parking area to destination is slightly more for vanpoolers than for carpools--24.5 miles versus 22.9 miles. Figures 33 and 34 graphically portray cumulative

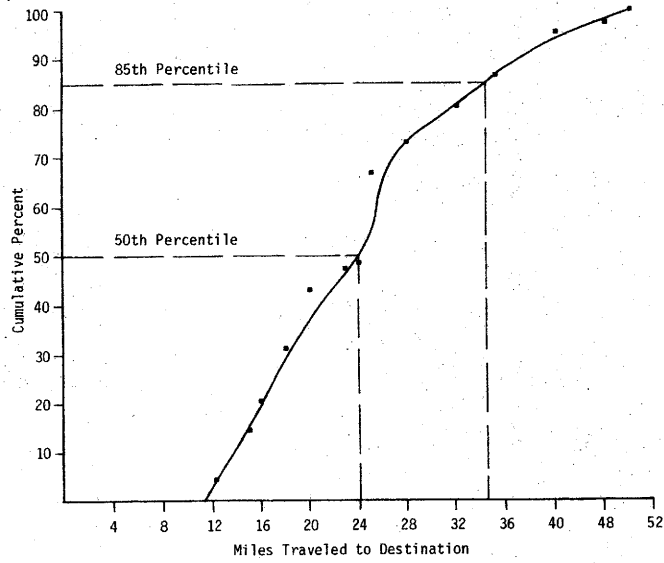


Figure 33: Cumulative Frequency Distribution, Travel Distance from Lot to Destination for Vanpools (n=67)

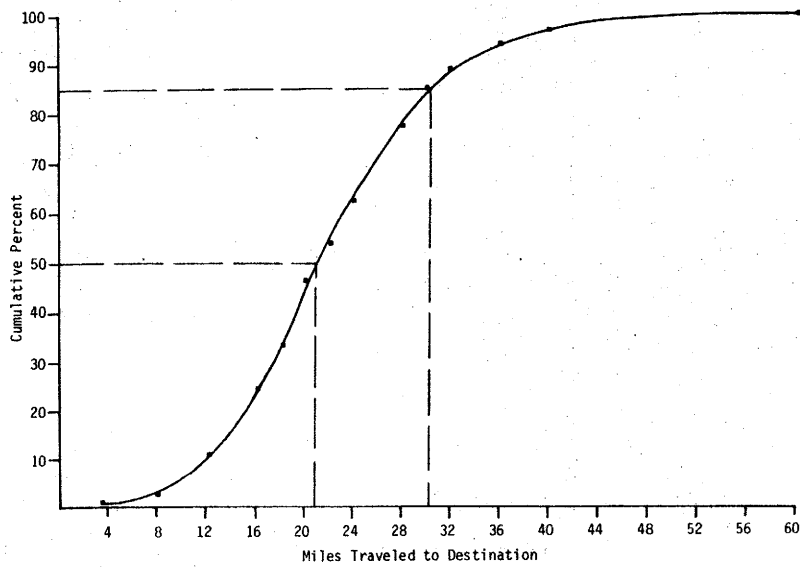


Figure 34: Cumulative Frequency Distribution, Travel Distance from Lot to Destination for Carpools (n=137)

frequency distributions of one-way travel distances from lot to destination for vanpoolers and carpoolers, respectively.

The average statewide roundtrip for vanpools in Texas is 53.6 miles, while the average occupancy is 11.2 persons per van. (Maxwell, 1980) The data collected from the Dallas-Fort Worth urbanized area indicates the length of an average roundtrip for vanpoolers from home to lot to destination and back is about 59 miles. The average roundtrip length for carpoolers is just slightly less, or some 58.4 miles. Vanpool occupancies observed in the Dallas-Fort Worth urbanized area appear somewhat low when compared to the statewide average (8.8 persons per van versus 11.2 persons per van). No information was collected to determine the length of time that respondents have been pooling or how mature the pool has become in terms of attracting a full complement of vehicle occupants.

Table 53 presents a comparison of average trip lengths and passenger miles of travel for vanpool and carpool participants surveyed in the study.

Table 53: Average One-Way Trip Lengths and Passenger-Miles for Vanpoolers and Carpoolers

Trip	Vanpool			Carpool		
	Trip Length (Miles)	Occupancy	Passenger-Miles	Trip Length (Miles)	Occupancy	Passenger-Miles
Home to Lot	5.00	1.09	5.45	6.30	1.32	8.32
Lot to Destination	24.54	8.81	216.20	22.86	3.36	76.81
Totals	29.54	----	221.65	29.20	----	85.13

It is interesting to note that both transportation modes (vanpool and carpool) travel approximately the same distance; however, one vanpool accommodates over two and one-half times the number of passenger miles of travel served by an average carpool. Even if the overall vehicle occupancy rate during the peak periods is 1.38 persons per vehicle within the study area (Metroplex Transportation News, March 1981), a carpool participating in Park-and-Pool activity serves approximately 2.1 times the number of passenger miles provided by the typical rush-hour commuter vehicle. A Park-and-Pool van, however, would provide over 5.4 times the number of passenger miles of travel when compared to the average commuter vehicle.

Table 54 presents a summary, by geographic group, of those survey participants indicating that they vanpool from the parking area to their destination. As shown in Table 54, some 40% of the vanpoolers have a destination to the Dallas Central Business District.

Studies conducted in the late 1960's and early 70's indicated that exceedingly long trip lengths were characteristic of ridesharing commuters. Average one-way trip lengths of over 40 miles and one hour in duration were commonly experienced by carpoolers (Barton Aschman, 1970). As shown herein, the attractiveness of ridesharing has grown with the cost of driving and, in turn, has significantly reduced the average trip lengths necessary to support ridesharing activity.

Table 54: Destinations of Vanpool Participants; By Group

Geographic Group	Number of Vanpoolers Originating From Group and Traveling to:									Total Vanpool Participants
	Dallas CBD	Dallas	Green-ville	Addison	Grand Prairie	Richard-son	Fort Worth	Grand-view	Other Location or Unknown	
A	---	---	---	3	---	---	---	1	---	4
B	1	3	---	---	2	1	---	---	---	7
C	10	12	---	---	---	1	---	---	1	24
D	4	2	---	---	---	---	---	---	1	7
E	5	---	---	---	---	---	---	---	---	5
F	---	---	---	---	---	---	1	---	---	1
G	---	2	---	---	---	---	---	---	---	2
H	6	2	7	---	---	---	---	---	1	16
I	2	1	1	---	---	---	---	---	---	4
J	---	---	---	---	---	---	---	---	---	0
Totals	28	22	8	3	2	2	1	1	3	70
Percent	40.0%	31.4%	11.4%	4.3%	2.9%	2.9%	1.4%	1.4%	4.3%	100.0%

Note: Location of geographic groups is shown in Figure 15.

BENEFIT/COST ANALYSIS

General

Following the identification of potential sites and the estimation of Park-and-Pool demand, the transportation engineer can analyze the cost-effectiveness of a proposed project. This analysis involves the development of cost estimates for constructing and operating a given facility and comparing those costs to the potential benefits anticipated to be derived over time. The benefit/cost analysis is one of the more common techniques used in investigating alternative projects. The benefit/cost (B/C) ratio expresses the net benefits to the net costs computed on an annualized basis and provides an indication of which alternative has the biggest bang for the buck.

The B/C ratio can be expressed mathematically by the following equation:

$$B/C = \frac{B - M}{C(R) - S(F)}$$

Where:

B = Annual net benefits accruable

M = Annual maintenance and operating cost

C = Capital cost or initial investment

R = Capital recovery cost for a given interest rate and time period

S = Salvage value at end of time period

F = Sinking fund factor for a given interest rate and time period

The numerator of the equation represents the repetitive annual cash flows while the denominator represents the capital cost or investment necessary to construct the facility.

Benefits

The annual benefits to accrue as a result of a Park-and-Pool project are usually expressed as a reduction in costs to the traveling commuter and to the public in general. The following list provides some of the potential items of benefit to be considered during analyzing a Park-and-Pool project. (Voorhees, 1981)

1. Commuters' cost of operating and owning a vehicle (fuel, oil, tires maintenance, repairs, insurance, depreciation, finance charges, taxes, fees, etc.)
2. Commuters' parking costs
3. Non-quantifiable commuter costs (increased safety, reduced hazard of vandalism, reduced stress, companionship, increased travel time)
4. Reduced vehicle-miles of travel (VMT)
5. Reduced energy consumption
6. Possible reduction in automobile emissions
7. Possible reduction in traffic congestion
8. Reduced parking demand at destination

For simplicity, only the following estimates will be used in calculating the benefit potential of Park-and-Pool in the Dallas urbanized area.

1. Operating Costs
 - Subcompact Vehicles \$.093/mi.
 - Standard Vehicles \$.141/mi.

2. Fuel Consumption

- Subcompact Vehicles .04 gal/VMT
(25 MPG)
- Standard Vehicles .07 gal/VMT
(15 MPG)

Other benefits should also be included in site specific B/C analyses during the actual planning and design phase of a project. For example, the reduction in destination parking demand could be a very significant benefit that could easily be included in the calculation of the B/C ratio. Some 42% of the survey participants indicated the Dallas central business district as their primary destination. A parking deficiency of some 12,000 to 18,000 spaces has been estimated for the Dallas CBD by 1985 if CBD employment increases some 34% as predicted. (City of Dallas, 1981) This parking deficiency amounts to an estimated capital cost (in 1982 dollars) of some \$60 to \$90 million based upon an estimated construction cost of \$5,000 per space. Nevertheless, these benefits have not been considered in computing the B/C ratios for the Dallas Park-and-Pool facilities.

Costs

The costs to be considered in computing the B/C ratio include both capital investment costs and annual maintenance and operating costs. The estimated annual cost of maintaining and operating a Park-and-Pool facility (represented by "M" in the B/C equation) reduces the net annual benefits derived from the project.

The capital investment costs appear in the denominator of the B/C equation and take into account the initial cost of construction, the project life, any salvage value at the end of a project's useful life, and the time value of money or interest rate. When analyzing a corridor parking facility, a relative short time period (i.e., 5 to 10 years) should be used

in developing the B/C ratio. Forecasting Park-and-Pool utilization beyond this period of time can be risky and can significantly affect the results and validity of the B/C analysis.

In a nationwide survey of 150 Park-and-Pool facilities, operating and maintenance costs varied widely from jurisdiction to jurisdiction depending upon the services provided. Estimates developed during the survey ranged from \$20 to \$50 per parking space with a median value of some \$40 per space per year. (Voorhees, 1981) The same survey determined typical development costs, excluding land acquisition, for commuter parking facilities to range from \$400 to \$1800 per space throughout the midwest region, depending upon the degree of improvement and the type of surfacing involved.

Construction costs will also vary depending upon who actually performs the work (i.e., by contract or by maintenance forces). The San Antonio District of the State Department of Highways and Public Transportation has, in the past, utilized maintenance personnel to construct Park-and-Pool facilities. Some 386 parking spaces were constructed from 1978 through 1980 by State forces which ranged in cost from \$154 to \$633 per space with an average cost of some \$285 per space. Cost estimates developed in 1980 for 187 additional spaces ranged from \$344 to \$783 per parking space and averaged \$456 per space. (Tucker, 1980)

For illustrating the feasibility of Park-and-Pool in the Dallas area, the following cost estimates have been used.

- | | |
|------------------|------------------|
| 1. Capital Cost | \$1000 Per Space |
| 2. Project Life | 5 Years |
| 3. Salvage Value | \$0 |
| 4. Interest Rate | 15% |

5. Operating and Maintenance Cost Per Year \$40 Per Space

The estimated capital cost of \$1000 per parking space is intended to include roadway lighting, signing, marking and other incidentals necessary to place the facility into full operation.

Cost Effectiveness Analysis

Based upon the data obtained from the Dallas Park-and-Pool survey, the following major travel parameters for ridesharing activity along the I-30 corridor were identified.

- Average vehicle occupancy: Home to lot - 1.23 persons/vehicle
- Average vehicle occupancy: Lot to destination - 5.19 persons/vehicle
- Average trip distance: Home to lot - 5.9 miles
- Average trip distance: Lot to destination - 23.2 miles
- Average days per week for pooling - 4.9 days

Estimating that 98% of the 669 vehicles surveyed are actual Park-and-Poolers, the total number of person trips per day identified in the study amounts to 1612. Using the average vehicle occupancies and trip distances, the total number of vehicles miles of travel for all poolers is some 14,950 miles per day, or about 73,700 vehicle miles per typical week.

However, the significance of Park-and-Pool and its impacts are more apparent when person miles of travel are considered. Using the average vehicle occupancies and trip distances listed above, some 47,000 person miles of travel per day, or 231,600 person miles of travel per typical week, were identified in the study. If the normal vehicle occupancy for the study area was 1.38 persons per vehicle (Metroplex Transportation News, March 1981), some 167,800 vehicle miles of travel per week would be required to

supply the demand--approximately 94,000 more vehicle-miles than are currently required to support the Park-and-Pooler travel. This reduction in vehicle miles of travel (VMT) resulting from Park-and-Pool is even more staggering if the normal vehicle occupancy rate is assumed to be lower than 1.38. A 1.28 average occupancy would indicate a net weekly savings in VMT of some 107,000 miles.

The intent of a cost-effectiveness analysis, however, is to compare specific alternative projects in an attempt to determine a priority ranking based upon a comparison of costs and benefits. Several assumptions have been made in order to determine representative B/C ratios for the 9 geographic groups in the Dallas area for which data were obtained. These assumptions follow.

1. Each of the geographic groups represent a viable Park-and-Pool project.
2. Sufficient public right-of-way presently exists within the geographic area to construct the desired Park-and-Pool facility.
3. The survey data obtained from the Park-and-Pool participants is representative of both existing and potential users.
4. Initial construction will accommodate existing demand plus a 50% increase.
5. Utilization of the facilities will average 80% over the useful project life.
6. Calculation of annual VMT reduction is based upon an average vehicle occupancy of 1.38 persons per vehicle and 50 weeks per year.
7. Subcompact vehicles amount to 26% of all privately owned vehicles and related VMT contributions.

Based upon the above design assumptions and the suggested unit cost estimates, a summary by geographic group of Park-and-Pool facility costs is presented in Table 55. Calculated benefits for each geographic group are presented in Table 56. Benefits associated with reduced vehicle-miles of

Table 55: Costs of Park-and-Pool Facilities; By Group

Geographic Group:	Design Size (Number of Spaces)	Construction Cost (C)	Annual Maintenance/ Operating Cost (M)	Annualized Capital Cost R=.29832 (C) (R)
A	82	\$ 82,000	\$ 3,280	\$ 24,462
B	173	173,000	6,920	51,609
C	212	212,000	8,480	63,244
D	46	46,000	1,840	13,723
E	87	87,000	3,480	25,954
F	53	53,000	2,120	15,811
G	47	47,000	1,880	14,021
H	190	190,000	7,600	56,681
I	87	87,000	3,480	25,954
Totals	977	\$977,000	\$39,080	\$291,459

Table 56: Benefits of Park-and-Pool Facilities; By Group

Geographic Group	Average Number of Commuters Using Facility	Annual VMT Reduction	Annual Operating Cost Savings (B)	Annual Fuel Savings (gallons)
A	72	302,127	\$ 38,829	18,792
B	179	1,326,377	170,466	82,501
C	212	1,367,206	175,713	85,040
D	40	329,323	42,325	20,484
E	88	368,842	47,404	22,945
F	42	227,643	29,257	14,160
G	52	147,083	18,903	9,149
H	173	1,179,514	151,591	73,366
I	100	941,478	120,999	58,560
Totals	958	6,189,593	\$795,487	384,997

Note: Annual benefits only consider VMT reduction in this comparison; additional benefits should be included for site specific analyses.

travel (VMT) are computed based upon travel patterns indicated by data obtained from survey respondents presently engaged in ridesharing within the particular geographic group.

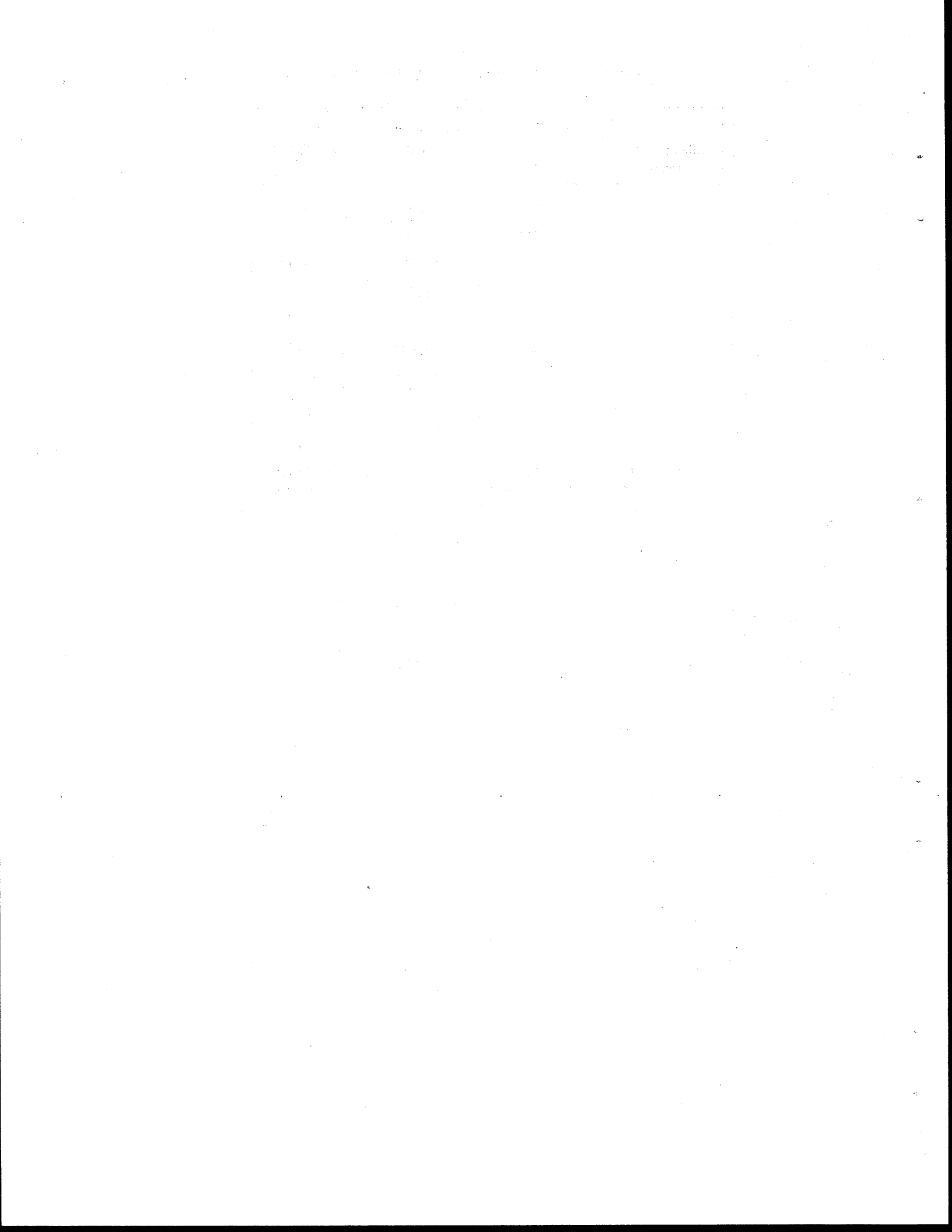
The calculated benefit/cost (B/C) ratios for each group are summarized in Table 57. B/C ratios range from a low of 1.21 to a high of 4.53. The highest B/C ratio was indicated for the Rockwall area which is more of a rural Park-and-Pool facility than the other geographic groups. The relatively high net benefits for this particular group arise from the longer than average lot-to-destination distances indicated by the survey data.

The computed B/C ratios, shown in Table 57, are believed to be a very conservative estimate of the actual effectiveness of Park-and-Pool facilities. If the construction cost of the parking areas was estimated at \$500 per space (instead of \$1000 per space), the B/C ratios would double, and range from 2.42 to 9.06. Likewise, if the useful life of the facility was considered to be 10 years (instead of 5 years) for the \$1000 per space investment, the B/C ratios would increase by 50% and would range from 1.82 to 6.78. In addition, the B/C ratios would be significantly higher if net benefits other than VMT reduction and related out-of-the-pocket vehicle operating cost were included in the calculations. The intent of the B/C analysis, contained herein, is to illustrate the analysis process and to suggest the importance of determining travel characteristics of specific Park-and-Pool locations. The analysis also shows, beyond any doubt, the positive nature of the B/C ratio associated with these types of projects.

Table 57: Benefit/Cost Ratios; By Groups

Geographic Group	Net Annual Benefits (B) - (M)	Annualized Cost (C) (R)	B/C Ratio
A	\$ 35,549	\$24,462	1.45
B	163,546	51,609	3.17
C	167,233	63,244	2.64
D	40,485	13,723	2.95
E	43,924	25,954	1.69
F	27,137	15,811	1.72
G	17,023	14,021	1.21
H	143,991	56,681	2.54
I	117,519	25,954	4.53

Note: The B/C ratios shown in this table, as a result of the assumptions used in the analysis, can be considered to be extremely conservative.



MAJOR FINDINGS

The Park-and-Pool survey and data analysis performed in the Dallas urbanized area have provided considerable information on personal characteristics and travel patterns of individuals currently engaged in rideshare activity. Also of importance is the methodology developed for investigating potential demand of Park-and-Pool facilities and the assessment of benefits and costs of such facilities. The data presented herein should prove useful in a number of areas including:

- The evaluation of existing Park-and-Pool programs in urbanized areas;
- The assessment of potential Park-and-Pool demand;
- The analyses of benefits and costs of proposed Park-and-Pool projects; and
- The development of planning, programming and design criteria for Park-and-Pool facilities.

Personal Characteristics of Park-and-Pool Participants

The personal characteristics of individuals involved in Park-and-Pool activity indicate that the majority are engaged in professional or managerial positions, have attended at least one year of college, are approximately 37 years old and are engaged in pooling because of the cost of driving. Table 58 presents a summary of the characteristics indicated by the survey respondents from the Dallas area compared to Park-and-Poolers surveyed in Houston and San Antonio.

Table 58: Summary of Personal Characteristics
of Park-and-Pool Participants

Characteristic	Houston/ San Antonio Poolers	Dallas Area Poolers
Age (years)		
50th Percentile	35.7	34.5
85th Percentile	49.8	51.5
Sex		
Male	61%	52%
Female	39%	48%
Years of Education		
50th Percentile	13.5	14.8
85th Percentile	15.8	16.9
Occupation		
Professional	39%	36%
Clerical	21%	22%
Managerial	8%	21%
Reason for Pooling		
Cost of Driving	---	76%
Cost of Parking	---	11%

Travel Patterns of Park-and-Pool Participants

The Park-and-Pool participants in the Dallas urbanized area live an average of 5.9 miles from the parking area and travel 23.2 miles to their final destination. Fifty percent of the poolers, however, live within 3.5 miles of the parking facility and travel with 2 or 3 others no more than 21.5 miles to their destination. A majority (55%) of the survey respondents indicated their mode of travel prior to becoming involved with Park-and-Pool was to drive alone. A summary of the major travel characteristics identified in the study are presented in Table 59 along with a comparison to characteristics of Houston and San Antonio poolers.

Table 59: Summary of Travel Patterns of Park-and-Pool Participants

Travel Pattern	Houston/ San Antonio Poolers	Dallas Area Poolers
Prior Mode of Travel		
Drove Alone	67%	55%
Carpooled/Vanpooled	30%	27%
Number of Persons in Pool		
50th Percentile	3.4	3.4
85th Percentile	11.0	10.2
Average (Mean)	----	5.2
Distance Traveled: Home To Lot (Miles)		
50th Percentile	3.7	3.5
85th Percentile	9.8	9.8
Average (Mean)	----	5.9
Distance Traveled: Lot To Destination (Miles)		
50th Percentile	28.0	21.5
85th Percentile	44.7	31.2
Average (Mean)	----	23.2

Pooler Origins/Destinations

Seventy-five to 80 percent of the Park-and-Poolers originate within the city where the parking facility is located. Almost 90 percent of the poolers had destinations to a city in the Dallas-Fort Worth metroplex other than the city where the Park-and-Pool site was located.

Some 75% of the survey respondents indicated their final destination as being located in the City of Dallas with over half (56%) of these destinations being located in the Dallas central business district.

Demand Estimation

Estimating demand for Park-and-Pool facilities depends, to a large extent, upon the catchment or market area definition. The study examined the applicability of parabolic and hyperbolic shapes to describe the areas of pooler origins. Data analysis seems to indicate that the market zone for Park-and-Pool in the Dallas urbanized area can best be described with a circle or an ellipse (Figure 35).

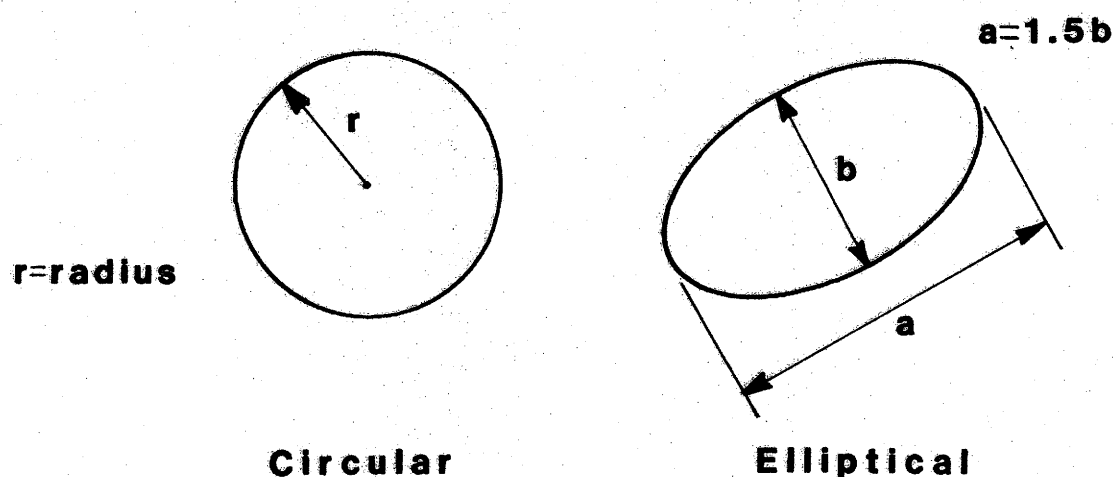


Figure 35: Suggested Market Area Configurations for Park-and-Pool in Dallas Urbanized Area

The size, configuration and orientation of the market area varies widely and appears to be related to the roadway or access system, physical or geographic constraints, and urban development surrounding the Park-and-Pool site. Professional judgement and knowledge of the local area must be applied in the definition of a market area for any given site. The three Park-and-Pool groups with the highest patronage were represented by

market areas ranging from 56 to 78 square miles in size and having a radius (r) of between 4.2 to 5.0 miles. As a general guideline, a market area of 65 to 70 square miles may be used for facilities intended to accommodate 100 to 150 commuters.

Existing Park-and-Pool patronage was compared to both population and vehicle ownership within the market area of the facilities studied. Ratios of poolers to vehicle ownership varied from .01% to 1.34% with the three most utilized facilities having ratios of between .22% and .24%. The calculated ratios for current poolers to population ranged from a low of less than .01% to a high of .45% with the three largest facilities all having ratios of approximately .15% of the population within the market area. The utilization of the ratios must be performed with sound judgement and knowledge of local conditions. The computed ratios represent existing conditions only and indicate the baseline of Park-and-Pool demand. Experience in other states has indicated as much as a doubling of Park-and-Pool utilization when informal facilities are converted to formal facilities.

Vanpool/Carpool Ridesharing

A special investigation of vanpool and carpool characteristics was undertaken as part of the Park-and-Pool study. Some 31% of the survey participants vanpool from the parking facilities to their final destination with an average of 7 or 8 other individuals.

The average daily round trip distance of an individual participating in a vanpool is about 59 miles. The most common destination of individuals engaged in vanpooling is the Dallas CBD attracting some 40% of the vanpool participants. The vanpool mode accommodates, on the average, over 5.4 times the number of passenger miles of travel accommodated by a typical commuter

vehicle and approximately 2.6 times the passenger miles supplied by a carpool participating in the Park-and-Pool.

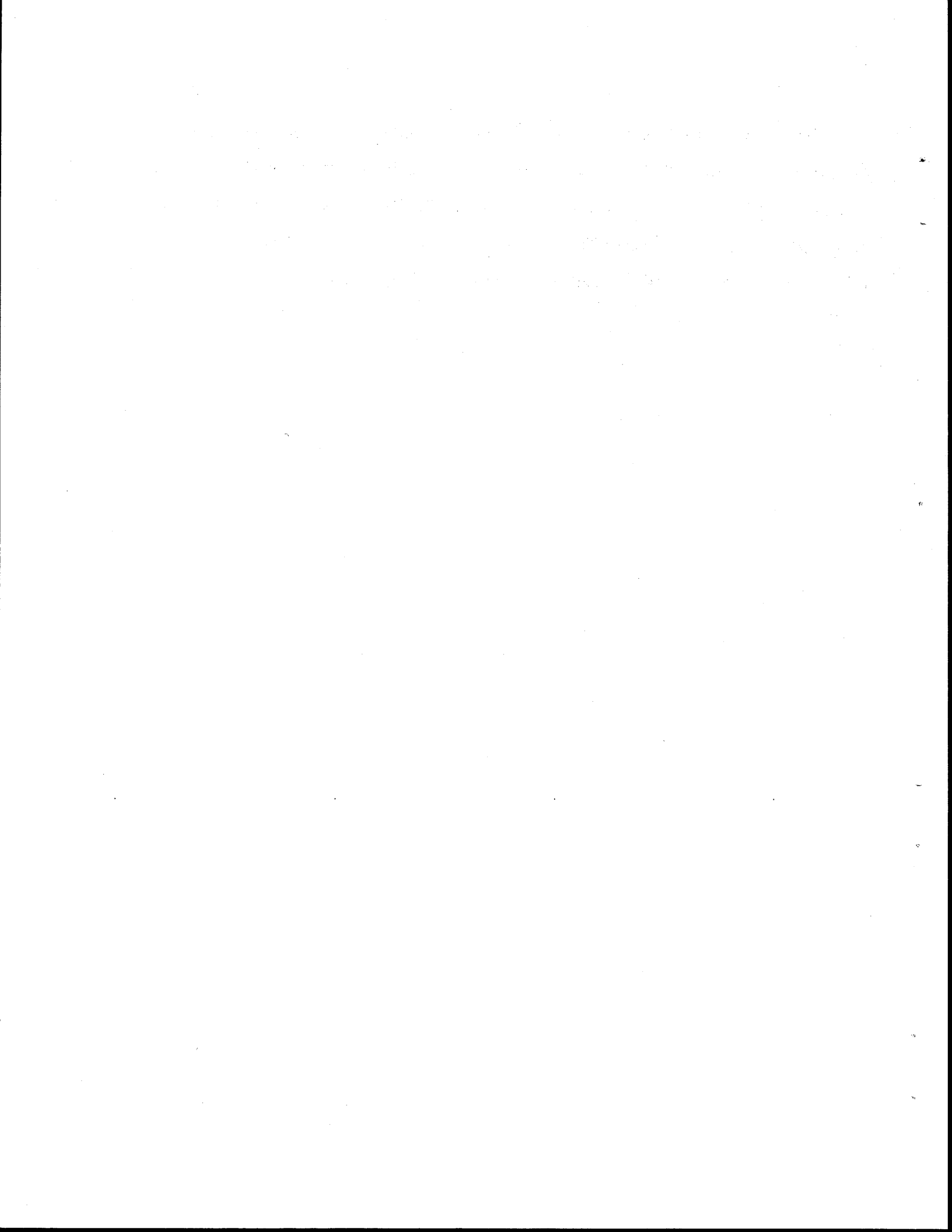
Some 62% of the survey respondents carpool to their final destination from the Park-and-Pool facility. The average carpool occupancy is 3.36 persons per vehicle with an average daily round trip commute distance of slightly more than 58 miles. The carpools participating in Park-and-Pool activity accommodate some 2.1 times the number of passenger-miles supplied by the typical commuter vehicle.

Benefit/Cost (B/C) Analysis

B/C ratios were calculated for 9 potential Park-and-Pool sites using very conservative estimates for the value of net benefits accrued and high estimates of costs involved. All B/C ratios exceeded unity or the threshold level for economic investment. The highest B/C ratio determined for any location was for the Rockwall site and indicated the influence that longer trip lengths have on net benefits of Park-and-Pool facilities. It should be noted that, in calculating the B/C ratios, only out-of-the-pocket vehicle operating costs were used for determining the net value of benefits. Significantly higher B/C ratios can be realized if the following benefits are considered and quantified.

- Commuters' cost of owning a vehicle (insurance, depreciation, finance charges, taxes, fees, etc.)
- Commuters' parking costs
- Reduced vehicle miles of travel (VMT)
- Reduced energy consumption
- Possible reduction in automobile emissions
- Possible reduction in traffic congestion
- Reduced parking demand at destination

Based upon the travel characteristics indicated by survey participants, the potential annual VMT reduction ranged from 2,830 to over 9,400 miles per commuter, with an overall average of some 6,460 VMT. The approximate annual fuel savings per site ranged from 9,000 to 85,000 gallons and averaged some 400 gallons reduction per commuter for the nine locations.



APPLICATION OF STUDY FINDINGS

General

The data collected in the Dallas Park-and-Pool study should prove useful in assessing the potential for pooling demand and in analyzing the benefits and costs of alternative projects. Application of the computed demand ratios and generalized market area configurations must be accompanied with professional transportation judgement and knowledge of local conditions (i.e., urban development, roadway access system, available right-of-way, etc.). A step-by-step illustration of how the study findings can be applied to analyze a potential Park-and-Pool facility is included.

Planning Methodology

Based upon the identified travel characteristic of Park-and-Pool participants along the I-30 freeway corridor and other related study efforts, the following outline of planning methodology is suggested.

1. Major corridor identification
2. Potential site identification
3. Market area analysis
4. Estimation of Park-and-Pool demand
5. Investigation of available land
6. Analysis of benefit/cost ratios
7. Programming and preliminary design (sketch plan)
8. Monitoring and evaluation

The identification of major corridors and potential sites should be accomplished as part of the "3-C" planning process and the development of the Transportation System Management (TSM) element of an urbanized area's

transportation Improvement Program (TIP). Identification of potential sites should be an on-going endeavor. However, the actual programming of viable Park-and-Pool improvements or projects should follow an evaluation of potential demand and a detailed analysis of probable benefit/cost ratios of proposed facilities.

Evaluation of Potential Facilities

The documented study findings should be particularly useful to the transportation professional in accomplishing:

- Market area analysis,
- Estimation of demand, and
- Analysis of benefit/cost ratios.

The definition of a market area is highly contingent upon the local roadway or access system and the topography surrounding any particular site. Knowledge of the urban area is essential in defining a representative catchment zone or market area for a particular location. As a general guide, based upon the Dallas study findings, the initial area to be defined for investigation should be approximately 50 to 100 square miles in size. The configuration most easily applied is a circle with its center located at the proposed site. However, when topography is considered, an ellipse or even a semicircle may be more appropriate for a particular location. The initial market area may be adjusted when the amount of informal pooling is taken into account. The 65 to 70 square mile area appears to be representative of the more successful Park-and-Pool facilities observed in the Dallas urbanized area. Figure 36 graphically presents the relationship between the number of existing, or informal, poolers and the defined market area for the nine geographic groups located within the study area. In the

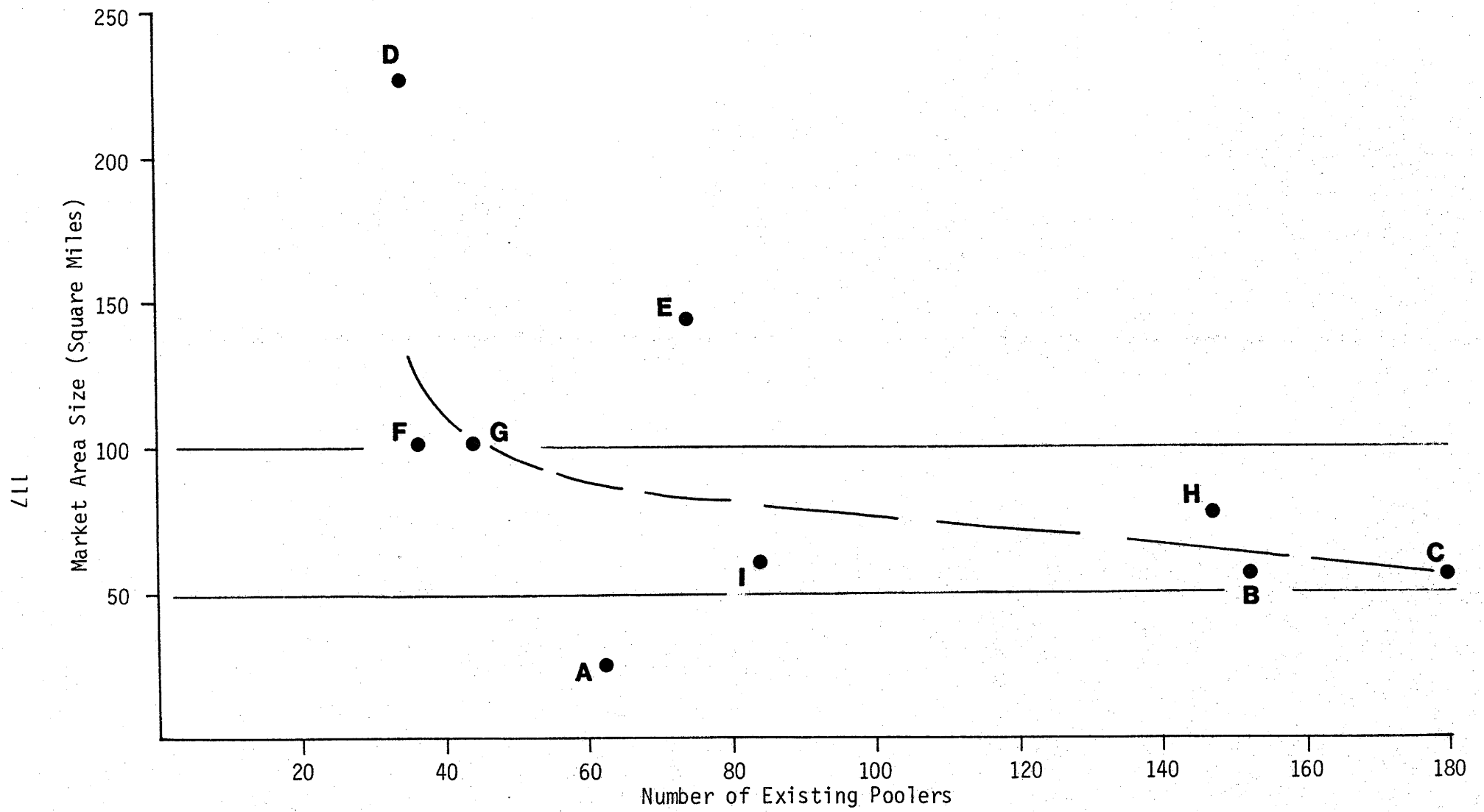


Figure 36: Market Area Approximation as a Function of Existing Informal Poolers

absence of additional research data, a market area of 65 to 70 square miles may be used for Park-and-Pool facilities intended to accommodate 100 to 150 urban commuters.

Following the definition of a market area, the analyst should determine the approximate population or vehicle ownership contained within the catchment zone. Using the total area of the catchment zone, expressed in square miles, the population density and/or vehicle ownership density can be computed.

Once the population density or vehicle ownership density has been computed, the analyst can obtain percentage ratios from either Figure 30 or Figure 31 (contained in the section titled "Estimating Park-and-Pool Demand; Demand Analysis"). The overall average of poolers to population is about .07% when the market area falls in the 50 to 100 square mile range. However, the more successful Park-and-Pool facilities, or those with over 100 commuters, appear to have pooler to population ratios in the range of .15% to .24%.

Following the selection of the demand ratio to be used, multiply the percentage ratio by the total population or vehicle ownership contained within the market area of the particular site. The product provides an estimate of the potential demand based upon the results of the Dallas Park-and-Pool study. If informal pooling is currently occurring at or near the site being investigated, the analyst should compare the computed estimate to the actual pooling demand. Remember that the computed pooling demand represents individuals or commuters and not the number of vehicles. Average or observed vehicle occupancy rates should be applied to the demand estimate for conversion to the number of vehicles or parking spaces required.

Prior to analyses of B/C ratios, an investigation of available land should be undertaken. The lack of existing public right-of-way can significantly affect the feasibility of a proposed project by substantially increasing the implementation cost. For planning purposes, the estimated parking or vehicle demand should be multiplied by 450 square feet per vehicle to determine the amount of land required. The possibility of future expansion should also be considered during the on-site inspection along with other design elements (i.e., safety, sight distance, egress and ingress, visibility, etc.).

Following the accomplishment of the above tasks, the analyst may undertake the computation of benefit/cost (B/C) ratio(s) for the proposed project(s). A discussion of the B/C analysis is contained as a separate section of this report and has been based upon the reduction in vehicle miles of travel (VMT) for the various locations investigated. Several factors contribute to changes in VMT including:

- Distance from park-and-pool facility to the final destinations;
- Distance from commuters' origins to facility;
- Average vehicle occupancy rates from origin to facility and from facility to final destination; and,
- Typical vehicle occupancy rates of commuters not participating in Park-and-Pool.

The necessary data to determine VMT reduction should, if possible, be derived from pooler surveys for a particular area (i.e., Table 39) or from generalized information on Park-and-Pool characteristics for an urbanized area. It is recommended, however, that a sampling of pooler travel characteristics be undertaken for more accurate B/C computation and project comparisons.

In addition to VMT reduction, other potential benefits are highly recommended for inclusion in the B/C analysis. Benefits which may be included are:

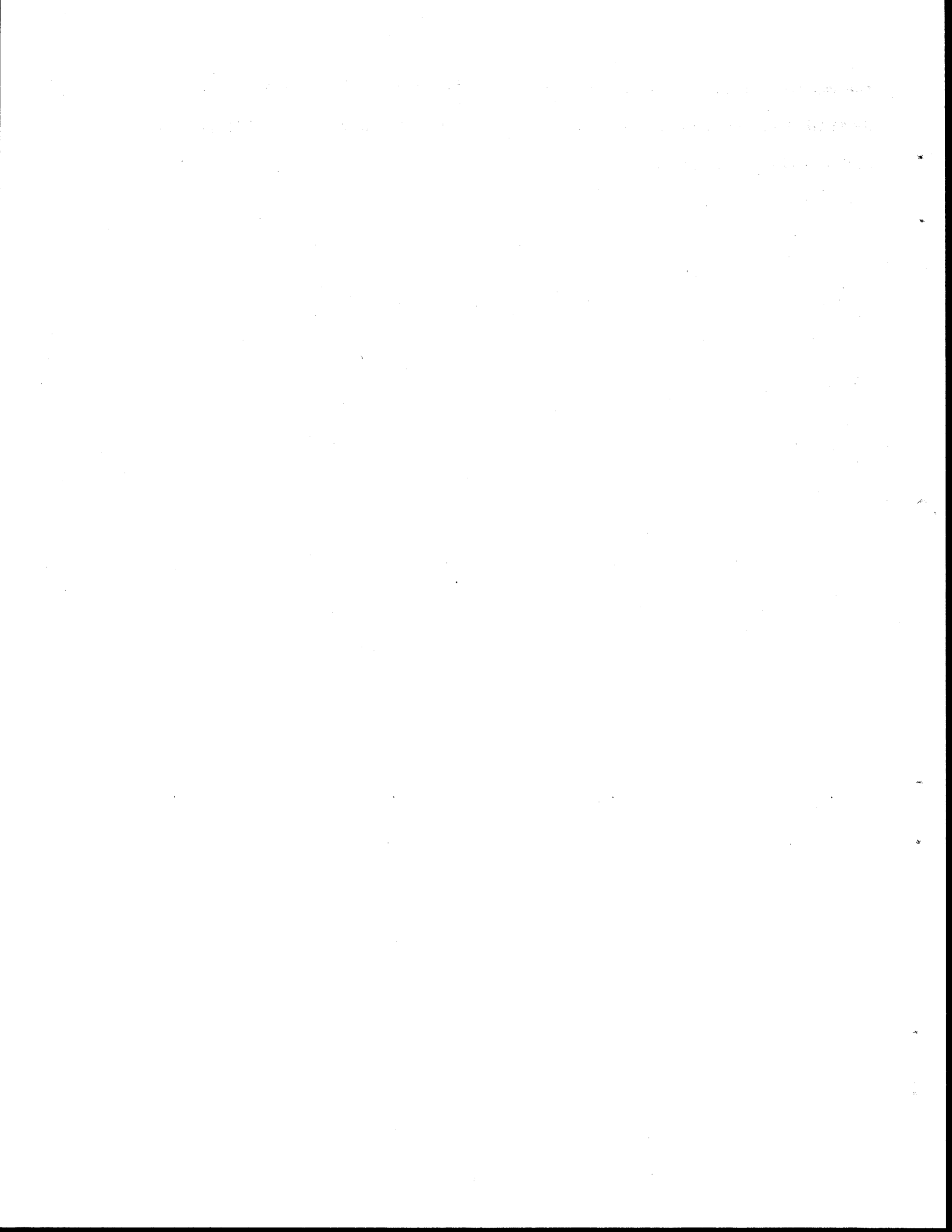
- Commuters' parking costs,
- Reduction in the need for new transportation facilities,
- Reduction in energy consumption,
- Possible reduction in automobile emissions,
- Possible reduction in traffic congestion, and,
- Reduction in parking demand at Destination.

Recognizing the obvious advantages to roadway and energy efficiency, Park-and-Pool facilities should always be designed with possible evolution to Park-and-Ride in mind. If site specific studies suggest that express transit service may be warranted, design provisions should be made for future expansion and incorporation of features to support Park-and-Ride operation. (Voohees, 1981) If such evolution appears justifiable at a particular site or sites, the transportation analyst may need to adjust the cost/benefit analysis and corresponding B/C ratios to reflect the net benefits and net costs associated with Park-and-Ride operation to support buspooling.

Monitoring and Evaluation

Undoubtably, the planning techniques for demand estimation should and will be refined as more experience is gained with formalized Park-and-Pool facilities in major urban areas. For this reason, a procedure for monitoring and evaluating Park-and-Pool activity has been incorporated as an integral part of the planning methodology. Additional data obtained from

the monitoring of future pooling activity will aid in the refinement of the demand estimation techniques and in the assessment of any proposed Park-and-Pool projects.



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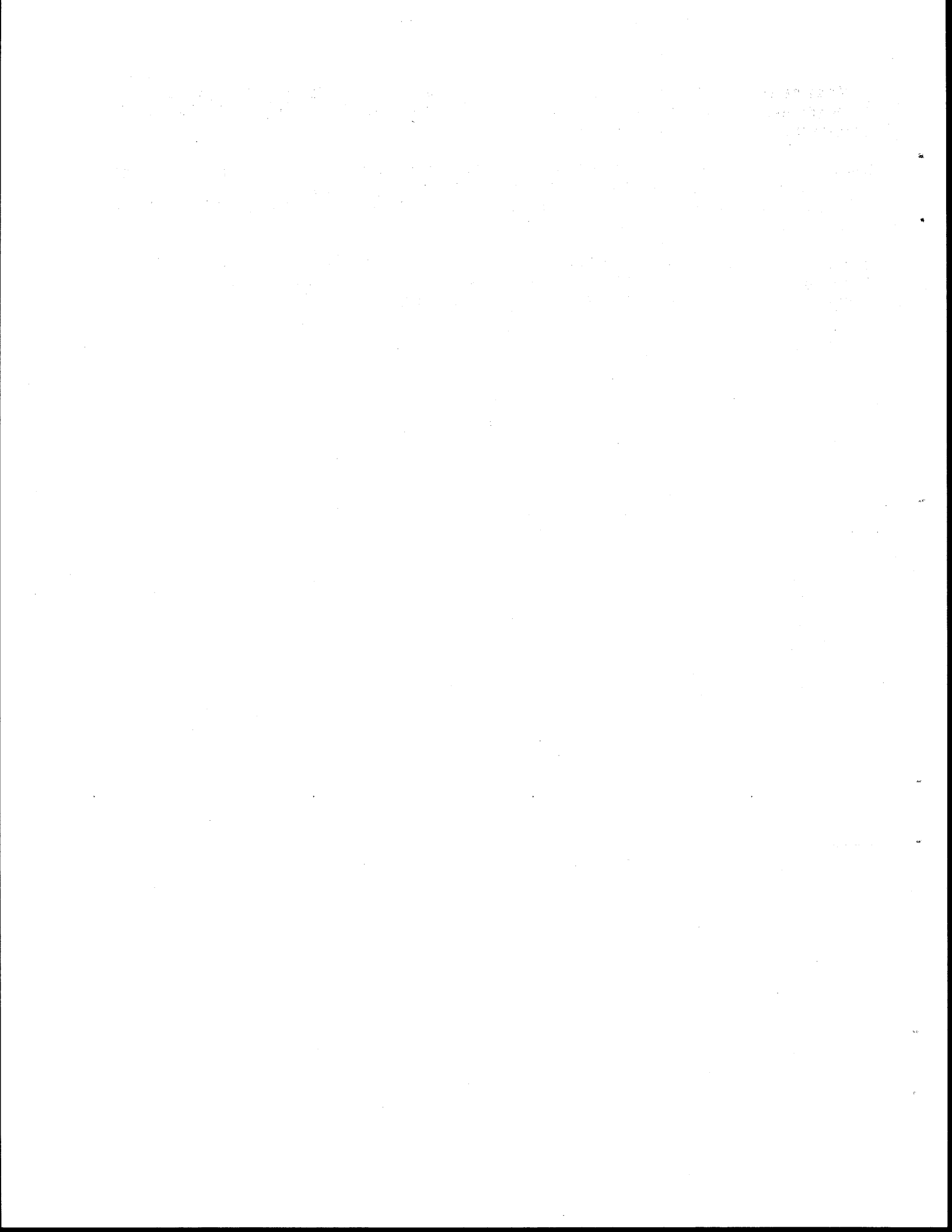
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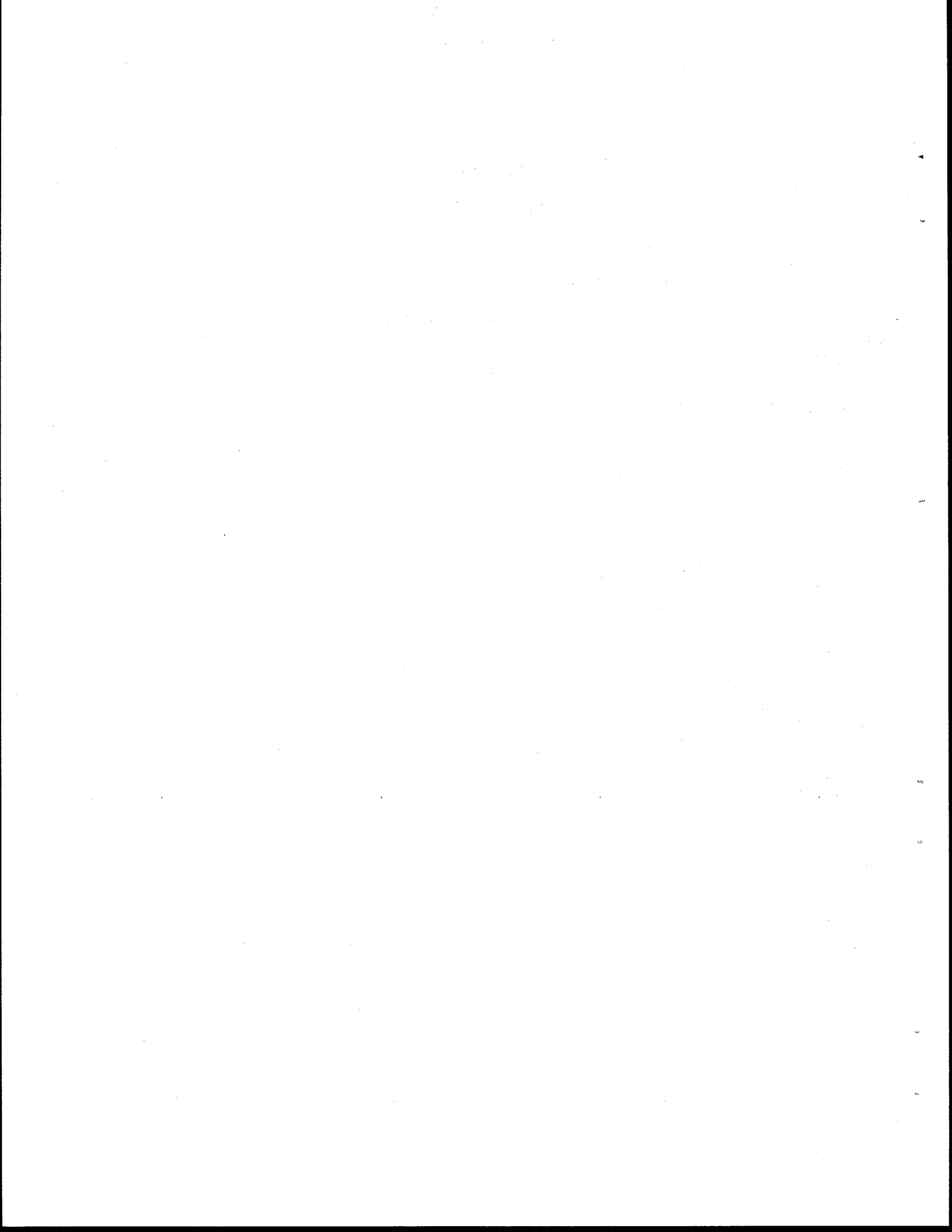
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APPENDIX A

Data Collection Forms

- Cover Letter
- Park-and-Pool Survey
- Park-and-Pool Site Investigation





STATE DEPARTMENT OF HIGHWAYS
AND PUBLIC TRANSPORTATION

AUSTIN, TEXAS 78763

COMMISSION

A. SAM WALDROP, CHAIRMAN
DEWITT C. GREER
RAY A. BARNHART

ENGINEER-DIRECTOR
M. G. GOODE

December 8, 1981

IN REPLY REFER TO
FILE NO.

PARK-AND-POOL SURVEY

The Texas Transportation Institute, The Texas A&M University System, is conducting a study of parking areas known as Park-and-Pool lots along the I-30 freeway corridor. The purpose of this study is to obtain information about your use of, and opinions concerning, Park-and-Pool lots to assist in the planning of possible improvements of parking areas adjacent to the freeway for use by carpoolers and vanpoolers.

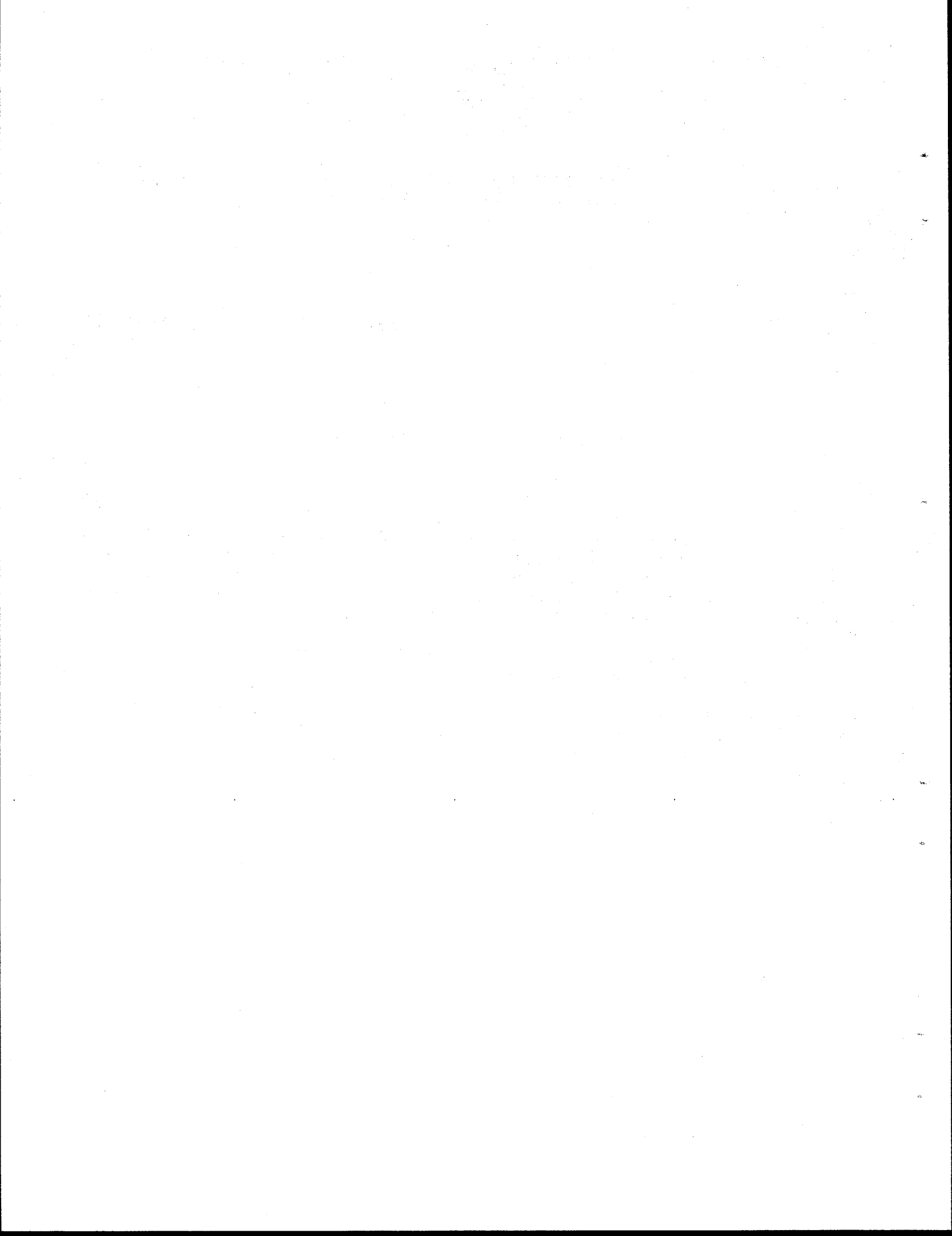
Since there are only a very small number of Park-and-Poolers, your participation is essential to ensure the success of this project.

Please complete the attached survey form and return it to us in the postage-paid envelope at your earliest possible convenience. We are grateful for your participation in this transportation study.

Sincerely,

Phillip L. Wilson
State Planning Engineer,
Transportation

PLW/jem
Attachments



PARK-AND-POOL SURVEY

*Undertaken by the Texas Transportation Institute, Texas A&M University
in cooperation with the Texas State Department of Highways and Public Transportation
and the U.S. Department of Transportation, Federal Highway Administration*

Dear Driver: We need your advice! Please complete this survey and return it in the postage-paid envelope at your earliest possible convenience.

We have tried to identify only individuals parked for the purpose of sharing a ride to another destination. If you do not travel from this parking area to another location, please help us by returning the questionnaire with any comments on the reverse side.

1. How many persons (including yourself) arrived at this location in this vehicle? _____
2. After leaving your car parked at this location, what was your final destination and trip purpose?
Address, Building or Company: _____ City: _____ Zip: _____
TRIP Purpose: Work School Other (Specify) _____
- 2.a. How far is it from this location to your destination? Miles: _____; and, Minutes: _____
3. How many days per week do you travel from this parking area to your destination by:
 Carpool _____ day/wk Vanpool _____ day/wk Bus _____ day/wk
 Other (Specify) _____; _____ day/wk

****If you travel by "Bus" or "Other", please skip to Question #8 below****

4. If you carpool or vanpool to your final destination in the morning, how many persons (including yourself) leave together from this location? _____
5. How was your carpool or vanpool formed?
 Co-Workers Classmates Friends Employer
 DFW Rideshare Program Other (Specify) _____
6. In deciding to carpool or vanpool, which one of the following considerations was "most" important to you (choose only one)?
 Cost of Driving Cost of Parking Stress of Driving
 Energy Savings Other (Specify): _____
7. If convenient express bus service was provided from this location to your destination, would you prefer to:
 Continue Carpooling/Vanpooling Ride the Bus
8. Does your employer or school provide any incentives for carpools or vanpools?
 Yes No
If YES, what incentives?: _____

9. How far do you travel in the morning to reach this parking area?

Miles: _____; and, Minutes: _____

9.a. Where does your trip originate? Home City: _____ Zip: _____

10. Before you started using this parking area, how did you normally travel from home to your current destination?

- Drove Alone
- Carpool/Vanpool
- Did Not Make Trip
- Bus
- Other (Specify): _____

11. How did the availability of this parking area effect the formation of your carpool/vanpool or using the bus?

- This parking area had no effect on my use of carpool/vanpool/bus.
- I would not be using carpool/vanpool/bus if this parking area was not here.
- This parking was one of several factors which encouraged me to carpool/vanpool/bus.

12. Do you save money by using this Park-and-Pool location?

- Yes If Yes, how much do you save? \$ _____ per month
- No If No, how much do you lose? \$ _____ per month
- Not Sure
- No Difference

13. Do you save time by using this Park-and-Pool Location?

- Yes If Yes, how much do you save per day? _____ minutes
- No If No, how much do you lose per day? _____ minutes
- Not Sure
- No Difference

14. Do you feel it is safe to leave your car parked at this location?

- Yes
- No
- Not Sure

15. How did you first learn about this Park-and-Pool Location?

- Friends or Relatives
- Noticed Others Using Area
- Co-Workers or Employer
- Radio/TV/Newspaper
- Other (Specify): _____

16. What time did you arrive at this parking area this morning? _____ a.m.

What time did you leave this parking area this evening? _____ p.m.

17. What is your current occupation (Please Be Specific)? _____

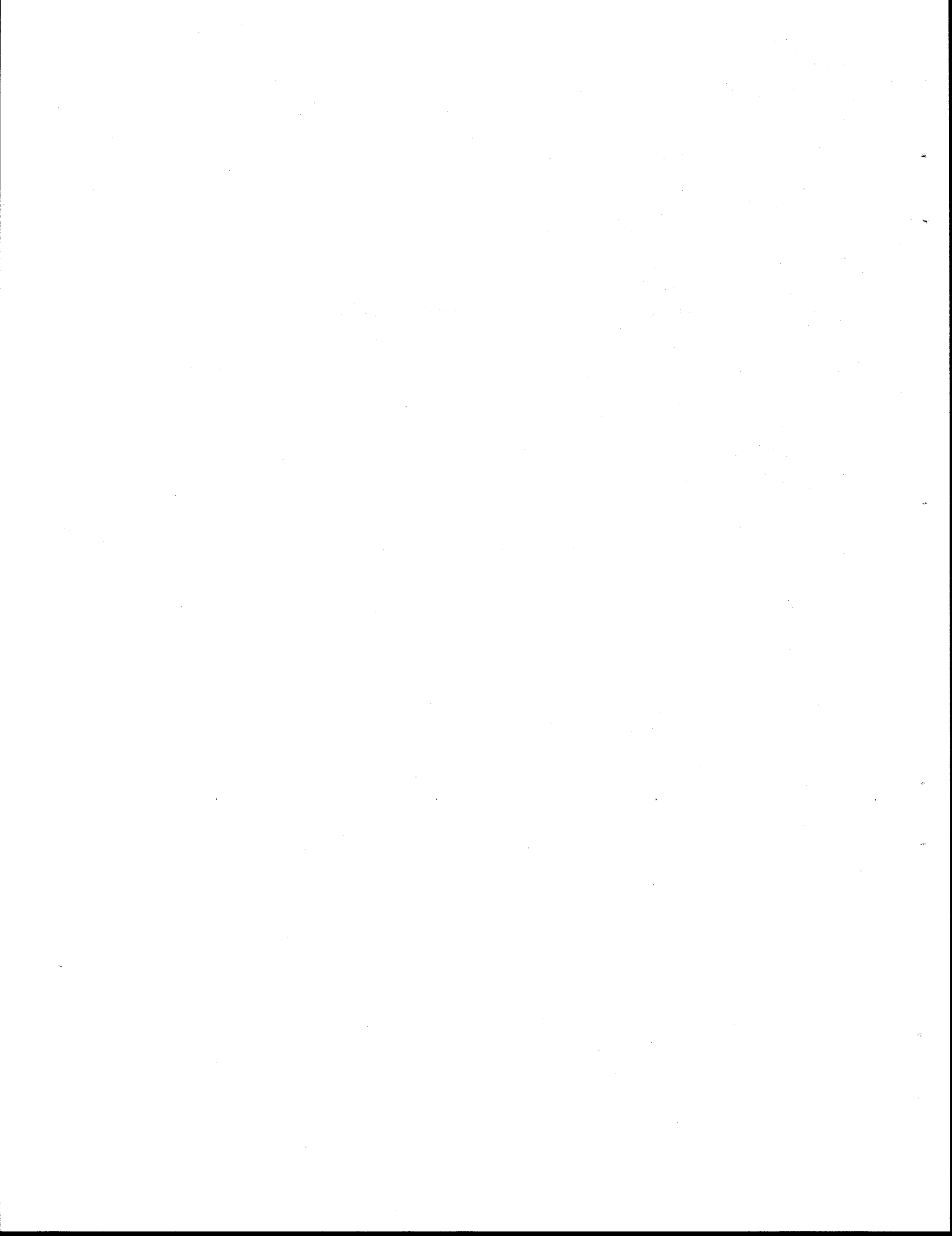
18. How many years of school have you completed? _____ 19. Age: _____

20. Sex: Male Female 21. Please provide comments or suggestions below:

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APPENDIX B

Remarks and Comments of Survey Respondents



APPENDIX B

Remarks and Comments Received in Response to Park-and-Pool Survey

The listings contained herein are the comments provided by the respondents to the Park-and-Pool Survey conducted in the Dallas Urbanized Area during December, 1981. Comments received have been organized by the individual Park-and-Pool sites surveyed in this research effort. Minor modifications have been made for the sake of clarification; however, any editorial changes or modifications are delineated by parentheses within the text of the comment. Any names, addresses and/or phone numbers have been deleted to protect the confidentiality of the respondent.

The following comments were received from Park-and-Pool Site Number 1, located at I-30 and Oakland Boulevard, Fort Worth.

- The bus is a convenience letting the driver fight the traffic. If bus fares go up again, I will probably quit riding the bus, unless gasoline gets scarce. About 25% of our bus riders quit last year when fares went up.
- Sporting events in Dallas, or large attendance gatherings, should be available by bus from here. Were price reasonable-I'd use it (for) Maverick Home Games, Dallas State Fair, Dallas Symphony, Ft. Worth Stock Show, Air Shows, (and) many other events.
- At one time we had bus service to work, which we fought to get. Forty-five people were required for this service (to be offered) but with people being laid off, shifted to other facilities, or (different work) shifts, 33 people were left--bus cancelled!
- We tried to ride the bus but it was inconvenient, took 1-1/2 hours longer, undependable, and costly.
- It (the Park-and-Pool facility) should have easy access on and off I-30.
- Would be most interested in keeping this parking area.
- I'd rather be working in Ft. Worth.

The following comment was received from Park-and-Pool Site Number 2, located on the northside of I-30 at Bridge and Woodhaven, Fort Worth.

- I am presently not a permanent resident of this State or City, but will be moving into my home in the City of Arlington at Fiedler Rd. & Pioneer Prkw. by January, 1982.

The following comments were received from Park-and-Pool Site Number 3, located at I-30 and Loop-820, Fort Worth.

- The carpool saves on gasoline. I also feel more safe riding with others and not being alone in the car (since the) crime (rate) is awful.
- (My preference to continue pooling or riding a convenient bus) depends on how much (the bus would) cost. I feel the Park-and-Pool locations need good security. I have already had one truck stolen and I am sure there have been others.
- This location is convenient for access to I-30 but there is a traffic problem; particularly around 5-5:30 p.m. Another entrance to I-30 is needed for east Ft. Worth (perhaps Sandy Lane). Note: I am the only one in my carpool who received this survey. The others were not at work and one drove (alone).
- This lot is hard to leave going north; signal light (is) needed on the corner of Brentwood & Brentwood-Stair. There have been several accidents at this location.
- Completion of entry to Loop 820 from I-30 will relieve congestion at Handley exit and expedite traffic from I-30 to other areas of City of Ft. Worth.
- Access to and from the freeway is severely worsened by this location. Easy off and on parking locations similar to roadside parks would be good.
- Don't think buses are the answer to mass transit; especially this route. Rapid transit train would be better. One thing is certain, since tolls were removed from this highway, traffic has increased dramatically. It is becoming more and more like Dallas' North Central Expressway. If not Mass Transit, we certainly need another alternate route.
- Federal funding should be given to companies that provide carpool parking to help promote park & ride facilities.
- Keep as many (buses) and as fast a bus service as possible. Time away from home is valuable. Our bus just started making an out of the way pick up in the evening that added 15 min. to our day.

- The lot is as safe as any can be. My wheel covers have been stolen once and I know of 2 cars that have been stolen; however, that can happen in front of your own house.
- Parking area CL is a "church" parking lot and, as such, is not publicly supported and could not benefit by any type of assistance (grant).
- A few people have lost hub caps and tags on this lot. Police should drive through a few times a day to check on cars.
- We really enjoy riding the bus. I drove for 16 years before I found out about the bus. I wore out several cars and lots of tires in the last 22 years.
- Some (form) of (direct) transportation to the Dallas VA hospital would be a great service for patients, workers and visitors going to see family members confined for treatment. A suggested favorable route would be one that could include brief stops in areas to include East Ft. Worth-Arlington and Grand Prairie. Presently, transportation involves too many transfers.
- The two people that carpool with me from this location carpool to (this lot) from Hurst. This lot is approximately half way for them. They work with me and were encouraged to carpool by me. We have been doing this for several years and it has worked out very satisfactorily.
- This church has been very generous in letting us park here. When I rode (the) bus for a short time, (a) hat was passed to help (pay the church for) lot maintenance. Our contributions (were) probably less than 1% of actual cost of lot maintenance. Most (poolers at the beginning were) government employees transferred to Dallas (from Fort Worth) when Regional Office was moved there-"Politics." Now I guess we are about 40-50% gov. employees. Rest are mostly other Dallas workers.
- Need more locations of this type.
- I read this (survey) three times before I decided it was not an Aggie Joke.
- We need help!

The following comments were received from Park-and-Pool Site Number 4, located at I-30 and FM-157, Arlington.

- Paving the Parking Area would be beneficial during bad weather days. Using this area is a good deal for commuters and a good use of land otherwise not put to use. No difference in money spent (for Question #12) refers to fact that vanpool could be "caught" at another location. This location mainly saves time.

- This area is getting crowded. Parking on dirt or grass is necessary, and this can be bad in wet weather. Several people have gotten stuck in the mud. A street light on the east side would also be helpful.
- It would be nice to have a complete concrete parking lot, so that I would not have to go through the mud on rainy days.
- This parking lot is very convenient in location. It would be better if paved.

The following comments were received from Park-and-Pool Site Number 5, located at I-30 and the Old Turnpike Plaza, Arlington.

- Park & Pool is an excellent idea. I wish there would be more parking areas like this. It would be very helpful if we could have a pay phone near by the lot that car or van poolers can use in case of emergency.
- More parking is needed. I started parking here in February (or some 8 months ago) and now you hardly can find a parking place.
- I would like to see other Park & Pool locations and/or more spaces available in this one.
- We feel it is an ideal place to meet; convenient and the traffic is not half as bad as it was at SH-360 or Skaggs parking lot where we had been meeting. I feel carpooling is for everyone's best interest. (Carpooling) should be encouraged for all who have to drive any long distance for (the reasons of) safety, money, energy, and last (but not least) my car (is a) wreck.
- The parking lot should be expanded soon. The number of cars utilizing the lot continually grows. Also, I feel consideration should be given to securing the lot to prevent any stolen autos or malicious damage. A sign designating lots used for park & ride would prevent trucks from using the lot.
- It would be better if there were more (parking) areas available near main highways/Interstates. There is much theft of the cars left here during the day.
- I, and the people that ride (in) our van, (are) from the Arlington area. (We) have wondered how much the Arlington police patrol the (parking) area, and how safe it is to leave our cars so near I-30.
- Our carpool previously met Randall-Mill and Collins--getting on I-30 was much more difficult and took more time. This is an ideal location and has made going to work much more pleasant for me.
- Due to the price of fuel, carpooling is essential. I would be willing to participate in an effort to provide a cost-saving mass transit system for the metroplex.

- I think more publication of the advantages of car/vanpooling would improve participation. (Recommend) bumper-stickers (which say) "I JUMPED IN A POOL."
- I was thinking about this last week. Good luck! Could you send me the results of this survey? (Name and address omitted)
- I rode the bus until June 1980. The service just got progressively worse--no air, standing room only and buses just not arriving to pick us up at night. There is no way I could go back to (riding the bus).
- The (availability of this) lot makes (pooling) work. Buses are a pain because they make too many stops (and it) takes too long to get where they are going. The time of the trip is as important as the distance and the money saved. If I had to leave (or exit from) the freeway much further (than I do now), I probably wouldn't carpool. I have used mass transit before and the trains in Chicago are the only acceptable way (to go). They are cheap, fast and get you very close to your destination.
- This parking area is very convenient to all riders since we live in different areas of Arlington.
- Would love to see some rapid transit systems developed in the metroplex.
- I would prefer to use convenient express bus service if I had a parking space much nearer my home in Arlington, Texas.
- Need more carpools. I bet 95% of cars on (the) freeways are occupied by one person. Need more incentives (for carpools) such as tax breaks, or may be even laws, to encourage their use. Mass transportation, at least in the metroplex for the next several years, is not the answer.
- Carpools are o.k.--but I would prefer an express bus that ran (at) several different times, especially in the afternoon, so I could have the option of leaving work early or working late without having to drive in myself or worrying about other time schedules.
- Generally like the (parking) space provided. Appreciate the city stressing, and helping out, the carpool system--even though Dallas-Ft. Worth is in need of a more modern transit system.
- Cars with less than 3 people should pay a toll charge to enter the City of Dallas before 10:00 a.m. (A toll charge) would cut down considerably on the parking problem and traffic. We definitely need these park & pool areas; without them (more) people would be forced to drive into the cities of Ft. Worth and Dallas.
- My fellow carpooler (who did have a form to complete) originates her drive in east Ft. Worth. She drove alone before I transferred to (my

present job and formed this carpool). She also is a supervisor, has some college, and she is 35 yrs. old.

- The accessibility of the freeway (to and from a Park-and-Pool facility) is a major factor in deciding where to park and in streamlining the whole travel routine. We need more areas like this! (The parking area) is starting to get crowded. We need to do everything possible to encourage Ride-Sharing. It can really help reduce the traffic snarls.
- If a new carpool parking lot is established, I would suggest (that) policing the area is important, since many have lost their hub-caps!
- Express bus service from this location would be well received and utilized to a great extent.
- If carpools were not available, the cost of present bus routes is prohibitive even when compared to driving my own car. (Travel time by bus) would be 75-100% longer. I do prefer rapid transit like Montreal and San Francisco.
- My van has 12 riders--8 of whom meet at another location. There is no time flexibility with vanpooling. On occasion--(like) once a week I would like to ride a bus home later if it would drop me off by my car.
- Lets get mass transit in the metroplex or we will end up like Houston. Need a telephone at the parking area.
- The metroplex area desperately needs a mass transit system, particularly as more and more people move into this area. Parking space is already at a premium in the downtown areas. Even if you can afford (downtown parking), it's extremely difficult to find.
- I'm presuming from the line of questioning, you may be considering another means of transportation for us. My carpool is the cheapest means of transportation. In order for me to even consider another alternative it would have to beat my (present) cost and that means for you to charge \$1.00 a day!
- Gig-em!

The following comments were received from Park-and-Pool Site Number 6, located at I-30 and SH-360 in southwest quadrant, Arlington.

- Since I am parking on the private lot of the bowling alley, it is by the management's good nature that my car hasn't been towed away; there is always that fear though. Please put some nice safe lots for (carpool) parking purposes; they would certainly be used.
- This location is not a regular Park & Ride; it belongs to the Bowling Alley but they don't care if we use it.

- Are intercity trains/trolleys possible in this area?

The following comments were received from Park-and-Pool Site Number 7, located at I-30 and SH-360 in the southeast quadrant, Arlington.

- It's a good idea to have areas like this for people in bedroom communities. Some lots need to be expanded. A (street) light at night would help provide security.
- At times we could use more space. (Recommend) signs for carpool/vanpool use only (and) striped parking spaces, lighting, (and a) pay phone.

The following comments were received from Park-and-Pool Site Number 9, located at I-30 and Belt Line Road in northeast quadrant, Grand Prairie.

- I enjoy carpooling and appreciate the availability of this parking area.
- Need more parking area.
- Enlarge (parking) area--pave part of opposite (side) of street.
- Please enlarge the parking area. Since I started using this area, the (number of) cars parked here has increased tremendously.
- Would like to see more parking area since it is usually over capacity every day. Also, would like (parked cars) spot checked to help (improve) security of the cars.
- Enlarge parking area at this site.
- Some days there are no places to park, so I have to park wherever there is a spot. I would like to see more spaces available. There are a lot of people who park and ride, so it would be nice. There are a lot of cars who park on the sides of the street and on the hill.
- Enlarge parking lot (and) furnish minimum (street) lighting, litter barrel, (and marked) parking lanes.
- This area should be better lighted; it took me 4 days to finally pin down the exact location in the dark at 5:40 a.m.! Should be expanded and paved too--maybe even a message board (signing) would be helpful.
- When I leave this area, I'm not sure that my car is safe. I wish someone would be here to look (out) for the car. I (wish) all (of) the cars parked here would find somebody (like a security guard) to look (out) for the cars and we (would) pay him.
- A hubcap on my car was bent in an attempt to steal it; (a hubcap)

lock prevented it (from) being taken. (I) no longer feel safe in parking at this location.

- I feel like this area should be patrolled by the Police Department so our vehicles will be safe; we have had a battery stolen. Possibly a monthly charge for parking (accompanied with) and I.D. sticker for (designating) authorized vehicles (would identify) unauthorized vehicles and possible vandals (to Police). Some days it is impossible to find a place to park.
- There will be a serious auto wreck if some facilities improvements are not instituted. Speeds are 55 mph (on the entrance/exit ramps) and cutting across traffic is normal and no one slows down. Pedestrian traffic is heavy (at Park-and-Pool Site) and people are nearly hit every day.
- We all would be very interested in some express form of transportation--rail or bus--which was reasonably convenient and fairly priced.
- Carpool twice a year for (seasonal) training at Lake Hubbard.

The following comments were received from Park-and-Pool Site Number 11, located south of I-30 at Hampton Road and US-80 BR on northeast corner, Dallas.

- By taking my car and driving to work from my home, it takes me 55 minutes in the morning and 1 hour and 15 minutes in the afternoon. The difference in time going to (and from) work is due to the fact that there is more traffic in the afternoon. This information is based on the 55 MPH law.
- I do not park & pool. Since I am in sales, it is necessary for me to use my own car for work.
- It is very nice to have someone who cares about our driving and this carpool has been a lot of help.

The following comments were received from Park-and-Pool Site Number 12, located at I-30 and Jim Miller/Samuell, Dallas.

- I'm glad you put this thing on my car because I wasn't really sure if I was parking (at Safeway) legally or not.
- This is not a park & pool location--it is a Safeway parking lot.

The following comments were received from Park-and-Pool Site Number 13, located at I-30 and Loop-12 in southwest quadrant, Dallas.

- Would (like to have) park & pool (facility) at Gres Phomasson and I-30. We all come from Garland (area) and Rowlett.

- I would park-and-pay for (a) more secure parking (area).

The following comments were received from Park-and-Pool Site Number 14, located at I-30 and Belt Line Road in northwest quadrant; Garland.

- I thought (this) was a K-Mart parking lot. Thanks for the information and assuring me my car won't be towed. Carpooling is a valuable asset to the nation and is a habit we must learn to perform.
- I hope this parking area will continue to be made available by K-Mart.
- Thanks for supplying the place.
- Need some supervision to make sure no one steals (our) cars.
- Toll (charges should be placed) on cars with (less than) 3 or 4 persons. Mass transit (is needed).
- Verbal pleads from city, state, and federal (governments), to join carpools, are plentiful while carpooling is in reality discouraged by cities, state, and businesses because nearly all of these prohibit carpool parking. My vanpoolers are very grateful to K-Mart and deliberately patronize them for permitting our parking.
- The idea of pooling is great; however, the inconvenience of time lost waiting for someone who is late, (and) also coping with the special problems of others, is annoying when you are use to driving alone. I am certain (that pooling) works better for others than it does for me.
- I would love to see a bus service and a park and pool from the I-30 & Broadway location. Though I work at K-Mart, I would use the service to go to the downtown area. It would also alleviate the disorganized parking mess poolers now create. Many in my immediate family would use this bus service to get to and from work. I hope to see this service soon!
- If Garland Park-N-Ride was anywhere near reasonable, I would probably ride the bus. But this is working out great, at the moment.
- It would be nice to have a few lights (turned) on in the parking area in the early morning hours. This park & pool situation is a life saver and fun too. I hope we get to continue this way. Thank you.
- Repair I-30 in Rockwall County.
- Sorry I didn't get this to you earlier.

The following comments were received from Park-and-Pool Site Number 16, located at I-30 and Belt Line Road in the southwest quadrant, Garland.

- It is very important to us to have a place to park our cars during these hours; otherwise we would have to seek another location. There is a definite need for a good parking area near here.
- I work at Kroger and the area (of the store's parking lot) by I-30 or Beltline are our designated (employee) parking areas.

The following comments were received from Park-and-Pool Site Number 17, located at I-30 and FM-740 in northwest quadrant, Rockwell County.

- All efforts to retain and enhance this parking facility, encourage car/vanpooling, and other mass transit facilities, are priority items to assure the future of a quality life style and preserve natural resources.
- I don't feel at this time questions #17 thru 20 are necessary to answer. (Questions pertaining to occupation, schooling, age and sex).

The following comment was received from Park-and-Pool Site Number 19, located north of I-30 at the intersection of FM-740 and SH-205, Rockwall.

- I have used Park & Pool locations in other cities (where) I have lived. I think they are worthwhile and necessary in encouraging conservation.

The following comments were received from Park-and-Pool Site Number 20, located at I-30 and SH-205, Rockwell County.

- I thought this property was (a) Wal-Mart Parking lot. I was not aware this area was for Park & Ride. Thanks!
- The Wal-Mart parking lot is very conveniently located for people to meet to carpool to Dallas, but if we were prevented from parking here, we would have to leave our cars at someone's home and probably park on the street.
- The only reason it is more time consuming to vanpool is because we often must wait for the driver and that could also be a factor with (riding the bus). Inconvenience is made up by the money saved. If it were not for the vanpool, I would be unable to work in Dallas.
- I carpool from Rockwall to Downtown Dallas. I ride with a couple from Royce City, Texas. The husband works at the same company I do and they pick me up in Rockwall.

- Please note that my vanpool commutes away from Dallas (to Greenville). I'm sure this isn't the norm for Rockwall County. Thanks for your interest! Hook 'Em!

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that this is crucial for ensuring transparency and accountability in the organization's operations.

2. The second part of the document outlines the various methods and tools used to collect and analyze data. It highlights the need for a systematic approach to data collection and the importance of using reliable sources of information.

3. The third part of the document focuses on the analysis of the collected data. It discusses the various techniques used to identify trends, patterns, and anomalies in the data, and how these insights can be used to inform decision-making.

4. The fourth part of the document discusses the importance of communication and reporting. It emphasizes that the results of the data analysis must be clearly and effectively communicated to the relevant stakeholders in order to drive positive change.

5. The fifth part of the document concludes by summarizing the key findings and recommendations. It reiterates the importance of a data-driven approach to decision-making and the need for ongoing monitoring and evaluation of the organization's performance.

6. The sixth part of the document provides a detailed overview of the data collection process, including the identification of data sources, the design of data collection instruments, and the implementation of the data collection plan.

7. The seventh part of the document discusses the various methods used to analyze the data, including descriptive statistics, inferential statistics, and qualitative analysis. It also discusses the importance of using appropriate statistical tests and measures.

8. The eighth part of the document focuses on the interpretation of the data analysis results. It discusses the importance of understanding the context of the data and the implications of the findings for the organization's operations and strategy.

9. The ninth part of the document discusses the importance of communication and reporting. It emphasizes that the results of the data analysis must be clearly and effectively communicated to the relevant stakeholders in order to drive positive change.

10. The tenth part of the document concludes by summarizing the key findings and recommendations. It reiterates the importance of a data-driven approach to decision-making and the need for ongoing monitoring and evaluation of the organization's performance.

11. The eleventh part of the document provides a detailed overview of the data collection process, including the identification of data sources, the design of data collection instruments, and the implementation of the data collection plan.

12. The twelfth part of the document discusses the various methods used to analyze the data, including descriptive statistics, inferential statistics, and qualitative analysis. It also discusses the importance of using appropriate statistical tests and measures.

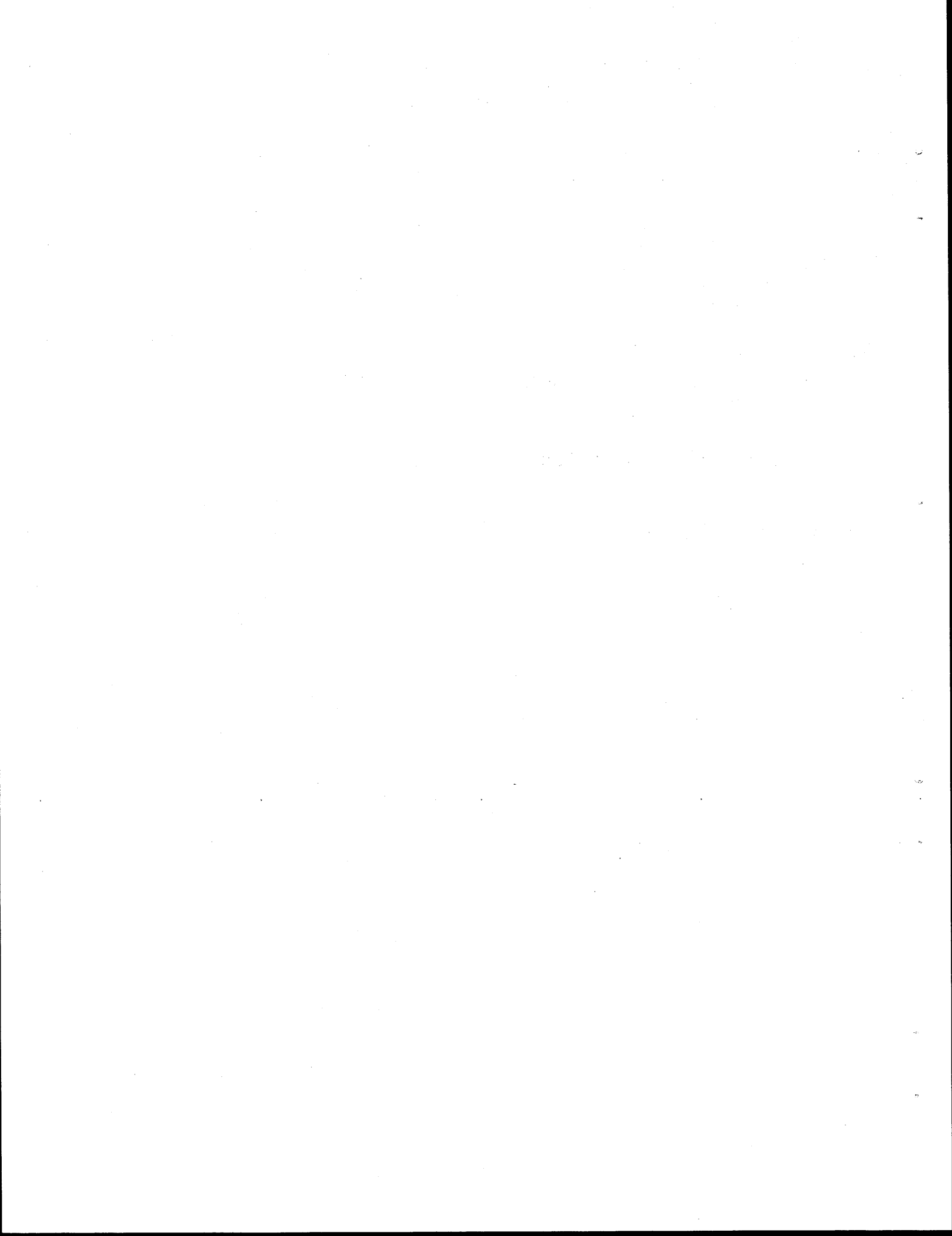
13. The thirteenth part of the document focuses on the interpretation of the data analysis results. It discusses the importance of understanding the context of the data and the implications of the findings for the organization's operations and strategy.

14. The fourteenth part of the document discusses the importance of communication and reporting. It emphasizes that the results of the data analysis must be clearly and effectively communicated to the relevant stakeholders in order to drive positive change.

15. The fifteenth part of the document concludes by summarizing the key findings and recommendations. It reiterates the importance of a data-driven approach to decision-making and the need for ongoing monitoring and evaluation of the organization's performance.

APPENDIX C

Dallas-Fort Worth Zip Codes



ZIP CODE ZONES FOR ORIGINS/DESTINATIONS
Dallas-Fort Worth Urbanized Area

Zip Code Number:	City Location:	Zip Code Number:	City Location
75001	ADDISON	75203	DALLAS
75007	CARROLLTON	75204	DALLAS CBD
75031	FARMERSVILLE	75205	DALLAS
75040	GARLAND	75206	DALLAS
75041	GARLAND	75207	DALLAS CBD
75042	GARLAND	75208	DALLAS
75043	GARLAND	75209	DALLAS
75050	GRAND PRAIRIE	75211	DALLAS
75051	GRAND PRAIRIE	75212	DALLAS
75052	GRAND PRAIRIE	75214	DALLAS
75060	IRVING	75216	DALLAS
75061	IRVING	75217	DALLAS
75062	IRVING	75218	DALLAS
75074	PLANO	75220	DALLAS
75080	RICHARDSON	75221	DALLAS
75087	ROCKWALL	75222	DALLAS
75088	ROWLETT	75224	DALLAS
75089	ROYSE CITY	75225	DALLAS
75102	BARRY	75226	DALLAS CBD
75103	CANTON	75227	DALLAS
75126	FORNEY	75228	DALLAS
75141	LANCASTER	75229	DALLAS
75142	LANCASTER	75230	DALLAS
75149	MESQUITE	75231	DALLAS
75150	MESQUITE	75232	DALLAS
75180	MESQUITE	75234	DALLAS
75182	MESQUITE	75235	DALLAS
75201	DALLAS CBD	75236	DALLAS
75202	DALLAS CBD	75237	DALLAS

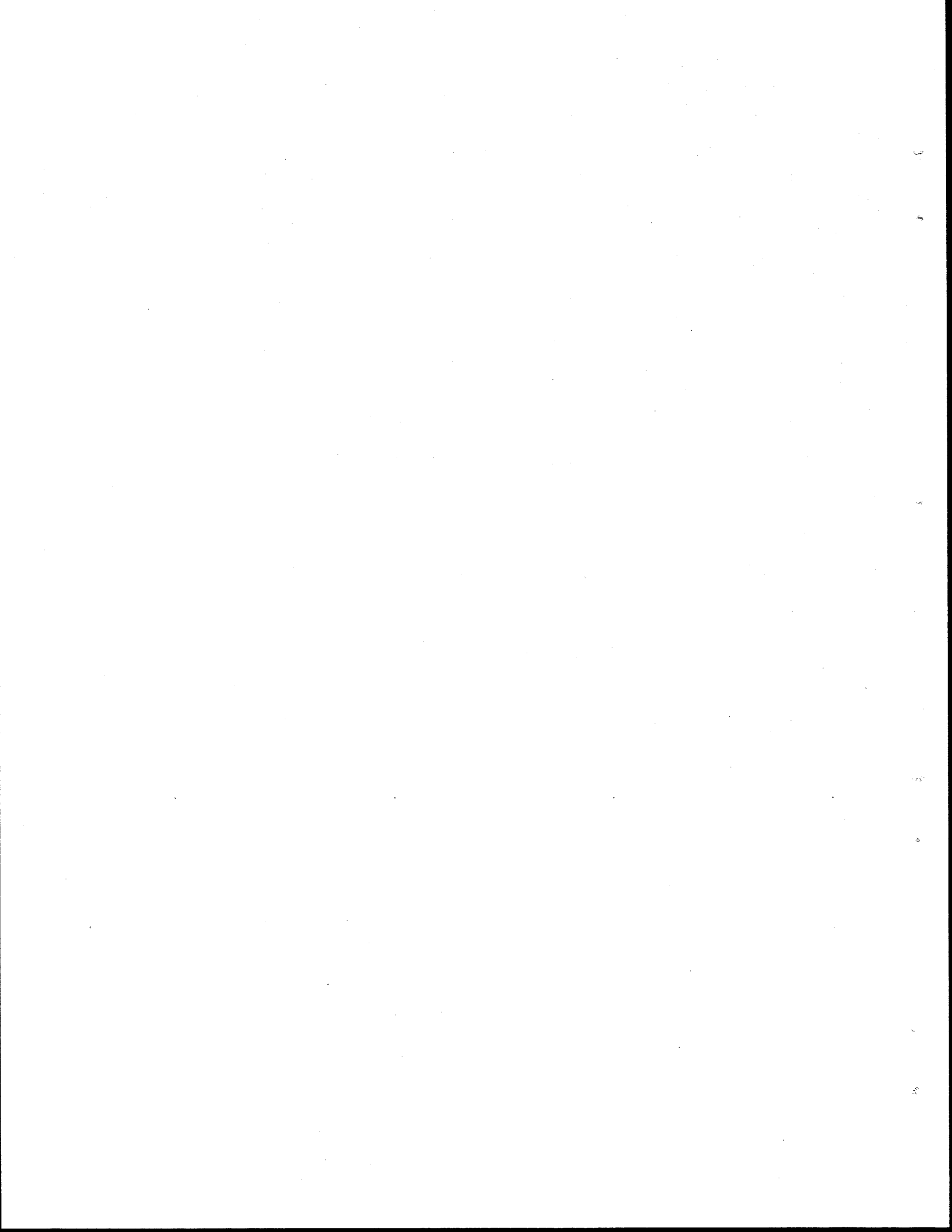
ZIP CODE ZONES FOR ORIGINS/DESTINATIONS
 Dallas-Fort Worth Urbanized Area

Zip Code Number:	City Location:	Zip Code Number:	City Location:
75238	DALLAS	76050	GRANDVIEW
75240	DALLAS	76053	HURST
75241	DALLAS	76060	KENNEDALE
75242	DALLAS	76063	MANSFIELD
75243	DALLAS	76086	WEATHERFORD
75246	DALLAS	76101	FT WORTH GENERAL DYNAMICS
75247	DALLAS	76102	FT WORTH CRD
75248	DALLAS	76103	FT WORTH
75250	DALLAS	76104	FT WORTH
75261	DALLAS	76105	FT WORTH
75262	DALLAS	76106	FT WORTH
75265	DALLAS	76107	FT WORTH
75266	DALLAS	76108	FT WORTH
75270	DALLAS	76109	FT WORTH
75283	DALLAS	76110	FT WORTH
75295	DALLAS	76111	FT WORTH
75401	GREENVILLE	76112	FT WORTH
76010	ARLINGTON	76114	FT WORTH
76011	ARLINGTON	76115	FT WORTH
76012	ARLINGTON	76116	FT WORTH
76013	ARLINGTON	76117	FT WORTH
76014	ARLINGTON	76118	FT WORTH
76015	ARLINGTON	76119	FT WORTH
76016	ARLINGTON	76126	FT WORTH
76017	ARLINGTON	76133	FT WORTH
76018	ARLINGTON	76134	FT WORTH
76019	ARLINGTON	76137	FT WORTH
76028	BURLESON	76140	FT WORTH
76039	EULESS	76179	FT WORTH
		76201	DENTON

ADDENDIX D

Transportation Planning Data

- Sectors
- Serial Zones
- Census Tracts



1977 SECTORS (DECK 6): EMPLOYMENT, POPULATION AND AREA
 Dallas-Fort Worth Intensive Study Area

Sector No.	Employment	Employment Density	Population	Population Density	Area (Sq. MI.)
1	313	4.3	3184	44.27	71.962
2	3756	61.6	24037	394.36	60.952
3	252	5.8	11670	268.24	43.506
4	190	5.6	548	16.06	34.114
5	6553	221.7	41122	1391.24	29.558
6	6636	402.4	20885	1266.30	16.493
7	1430	22.7	6713	106.68	62.927
8	1321	28.2	7613	162.78	46.769
9	364	4.7	3336	43.22	77.095
10	709	7.1	7809	77.96	100.165
11	3140	33.7	14936	160.50	93.057
12	318	3.7	3190	37.02	86.180
13	2113	35.9	14254	242.37	58.811
14	5130	45.1	13704	120.58	113.649
15	5718	58.5	35924	367.53	97.745
16	1811	97.4	6676	359.13	18.589
17	27850	449.2	79587	1283.67	61.999
18	69376	1011.1	143417	2090.26	68.612
19	2094	33.6	5979	95.99	67.285
20	12748	170.2	27812	371.30	74.904
21	2802	34.6	7394	91.32	80.972
22	530	20.0	2545	96.15	26.469
23	48093	1684.9	61666	2160.40	28.544
24	29359	969.6	62175	2053.38	30.279
25	9971	392.2	38020	1495.54	25.422
26	56218	1391.7	93732	2320.40	40.395
27	13175	652.7	49017	2428.16	20.187
28	34997	44724.6	1005	1284.35	0.782

1977 SECTORS (DECK 6): EMPLOYMENT, POPULATION AND AREA
Dallas-Fort Worth Intensive Study Area

Sector No.	Employment	Employment Density	Population	Population Density	Area (Sq. Mi.)
29	13854	478.7	44	1.52	28.940
30	1000	22.2	3291	73.18	44.970
31	66750	1396.5	149759	3133.26	47.797
32	65334	1496.6	90652	2076.56	43.655
33	7842	129.6	73327	1212.17	60.492
34	7198	98.9	48224	662.64	72.775
35	1150	13.4	8395	99.71	84.190
36	4649	79.1	16910	287.80	58.756
37	4270	94.7	19302	428.26	45.071
38	4589	82.9	25468	459.86	55.383
39	21100	676.1	54380	1742.38	31.210
40	38302	694.9	112194	2035.50	55.119
41	65688	2155.5	98474	3231.35	30.475
42	18921	1262.8	69544	4641.49	14.983
43	19903	826.3	100922	4190.16	24.085
44	18841	392.0	94911	1974.50	48.068
45	15430	402.4	100786	2628.55	38.343
46	58989	856.3	178868	2596.45	68.889
47	130913	6978.0	22852	1218.07	18.761
48	49660	3556.6	69784	4997.79	13.963
49	60304	3594.1	83846	4997.25	16.778
50	31153	2286.6	41183	3022.81	13.624
51	115386	84454.5	398	291.31	1.366
52	7200	8882.0	1071	1321.20	0.811
53	17272	872.2	35699	1802.74	19.803
54	19405	651.8	72527	2436.04	29.772

1977 SERIAL ZONES: EMPLOYMENT, POPULATION AND AREA
Dallas-Fort Worth Intensive Study Area

Serial Zones	Sector No.	Employment	Employment Density	Population	Population Density	Area (Sq. Mi.)
498	25	5	4.27	5	4.27	1.17078
500	25	71	63.20	16	14.24	1.12344
501	18	0	0.00	549	318.55	1.72344
502	18	3	2.75	105	96.28	1.09062
503	18	0	0.00	12	5.40	2.22094
507	25	203	234.01	1624	1872.05	0.86750
508	25	404	188.77	3271	1528.39	2.14016
509	25	40	29.60	774	572.74	1.35141
510	25	23	24.43	139	147.65	0.94141
511	25	19	14.75	87	67.53	1.28828
512	25	39	32.08	114	93.78	1.21562
513	18	601	309.87	3245	1673.08	1.93953
514	18	68	137.72	1360	2754.43	0.49375
515	18	1330	1256.38	6087	5750.08	1.05859
516	18	501	750.91	525	786.89	0.66719
517	18	0	0.00	42	83.95	0.50031
518	18	856	1556.36	832	1512.73	0.55000
519	18	90	167.44	15	27.91	0.53750
520	18	89	45.83	12	6.18	1.94187
521	18	3576	4739.37	0	0.00	0.75453
522	18	4810	5145.24	646	691.02	0.93484
523	18	94	129.18	1304	1792.05	0.72766
524	18	634	1810.62	0	0.00	0.35016
525	25	166	379.84	1313	3004.36	0.43703
526	25	229	339.42	352	521.72	0.67469
527	25	229	339.42	927	1373.97	0.67469
528	25	443	312.28	4076	2873.27	1.41859
529	25	557	525.78	4687	4424.31	1.05937
530	25	29	32.07	1088	1203.04	0.90437
531	25	18	8.58	82	39.07	2.09875
532	18	32	45.89	2376	3407.21	0.69734
533	18	241	404.83	1527	2585.04	0.59531
534	18	131	189.08	1531	2209.83	0.69281
535	18	921	1376.55	2147	3208.97	0.66906
536	18	138	210.44	735	1120.80	0.65578
537	18	2086	2552.66	9	11.01	0.81719
538	18	6747	9001.63	0	0.00	0.74953
539	18	1511	1847.96	1255	1534.87	0.81766
541	25	1395	2711.21	1060	2060.13	0.51453
542	25	1102	1370.27	3724	4630.58	0.80422
543	25	1369	1361.13	3673	3651.89	1.00578
544	25	566	775.34	3054	4183.56	0.73000
545	25	1720	2632.86	2158	3303.32	0.65328
546	25	300	483.87	9	14.52	0.62000
547	25	750	480.77	4410	2826.92	1.56000
548	25	118	111.14	1054	992.73	1.06172

1977 SERIAL ZONES: EMPLOYMENT, POPULATION AND AREA
Dallas-Fort Worth Intensive Study Area

Serial Zones	Sector No.	Employment	Employment Density	Population	Population Density	Area (Sq. Mi.)
549	18	674	663.53	316	311.09	1.01578
550	18	1109	991.56	4548	4066.39	1.11844
551	18	1202	1373.71	2759	3153.14	0.87500
552	18	1982	2594.03	4061	5315.01	0.76406
553	18	645	1116.28	2511	4345.70	0.57781
554	18	1772	3818.45	0	0.00	0.46406
555	18	3205	6238.44	0	0.00	0.51375
561	18	100	124.93	415	518.45	0.80047
562	18	599	730.91	4735	5777.69	0.81953
563	18	618	643.65	3481	3675.45	0.96016
564	18	2321	1977.95	6396	5450.65	1.17344
565	18	6399	5378.72	4891	4111.16	1.18969
566	18	1214	2714.74	694	1551.92	0.44719
567	18	556	567.89	5592	5711.59	0.97906
568	18	3759	8210.78	170	371.33	0.45781
569	18	536	529.30	7668	7572.16	1.01266
570	18	469	1576.47	0	0.00	0.29750
571	18	611	538.33	4995	4400.88	1.13500
572	18	1520	2421.71	1821	2901.27	0.62766
575	18	28	29.65	46	48.72	0.94422
576	18	207	317.70	1757	2696.59	0.65156
577	18	904	1734.29	1393	2672.42	0.52125
578	18	647	840.77	2460	3196.25	0.76953
579	18	814	1022.29	3948	4958.24	0.79625
580	18	753	882.31	4000	4686.93	0.85344
581	18	1051	1172.05	6149	6857.22	0.89672
582	18	661	763.89	5415	6257.85	0.86531
583	18	544	835.52	3369	5174.37	0.65109
584	18	740	1074.90	1387	2014.71	0.68844
585	18	555	1989.92	0	0.00	0.27891
593	18	184	137.46	4233	3162.27	1.33859
594	18	25	30.48	1994	2430.78	0.82031
595	18	102	79.10	536	415.65	1.28953
596	18	1049	886.05	3252	2746.84	1.18391
597	18	1362	1997.89	1912	2804.68	0.68172
598	18	766	1449.99	329	622.77	0.52828
599	18	401	345.36	6037	5199.41	1.16109
600	18	591	493.59	6614	5523.89	1.19734
601	18	25	62.60	225	563.38	0.39937
602	18	322	306.67	1321	1258.10	1.05000
603	18	1875	3780.72	0	0.00	0.49594
604	18	437	381.82	12	10.48	1.14453
605	18	0	0.00	12	19.00	0.63156
610	25	176	159.05	789	713.02	1.10656
613	18	64	33.68	555	292.11	1.90000
614	18	43	50.43	581	681.40	0.85266

1977 SERIAL ZONES: EMPLOYMENT, POPULATION AND AREA
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Serial Zones	Sector No.	Employment	Employment Density	Population	Population Density	Area (Sq. Mi.)
615	18	9	17.54	946	1844.17	0.51297
616	18	67	44.01	1097	720.54	1.52250
617	18	86	82.03	295	281.37	1.04844
618	18	456	456.64	1506	1508.12	0.99859
619	18	85	88.03	1627	1684.92	0.96562
620	18	124	113.97	986	906.28	1.08797
621	18	6	8.62	22	31.59	0.69641
622	18	643	549.43	3	2.56	1.17031
623	18	0	0.00	28	23.96	1.16844
624	18	0	0.00	3	6.44	0.46594
1006	40	567	425.92	516	387.61	1.33125
1007	40	4	3.12	0	0.00	1.28109
1008	40	128	425.56	13	43.22	0.30078
1010	40	177	195.48	48	53.01	0.90547
1023	40	132	55.32	1028	430.86	2.38594
1024	40	155	114.30	2705	1994.70	1.35609
1025	40	69	87.69	1601	2034.63	0.78687
1026	40	50	36.52	3	2.19	1.36922
1027	40	733	628.43	581	498.11	1.16641
1028	40	15	24.42	3	4.88	0.61437
1029	40	1201	2055.19	0	0.00	0.58437
1030	40	78	103.50	3	3.98	0.75359
1045	40	24	22.56	603	566.70	1.06406
1046	40	252	374.46	4132	6139.96	0.67297
1047	40	1457	2152.04	2558	3778.76	0.67703
1048	40	616	835.08	5996	8128.45	0.73766
1049	40	492	934.36	1986	3771.63	0.52656
1050	40	834	918.22	6333	6972.51	0.90828
1051	40	837	1928.99	2929	6750.31	0.43391
1052	40	366	397.29	4339	4709.91	0.92125
1053	40	646	939.85	5562	8092.02	0.68734
1054	40	2086	1452.08	847	589.60	1.43656
1055	40	0	0.00	0	0.00	0.16031
1056	40	667	1007.74	0	0.00	0.66187
1094	8	0	0.00	97	60.39	1.60625
1096	33	213	197.22	661	612.04	1.08000
1097	33	15	21.62	307	442.52	0.69375
1098	33	0	0.00	28	62.22	0.45000
1099	33	0	0.00	43	22.93	1.87500
1100	33	0	0.00	217	188.21	1.15297
1101	33	0	0.00	498	444.33	1.12078
1112	33	0	0.00	47	23.27	2.01953
1113	33	5	3.82	53	40.50	1.30859
1114	33	0	0.00	78	57.98	1.34531
1123	33	0	0.00	53	72.63	0.72969
1124	33	1	0.65	119	76.96	1.54578

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Serial Zones	Sector No.	Employment	Employment Density	Population	Population Density	Area (Sq. Mi.)
1125	33	0	0.00	272	54.60	4.98203
1126	33	0	0.00	229	193.86	1.18125
1136	33	22	28.39	2061	2659.89	0.77484
1147	33	99	191.42	2718	5255.35	0.51719
1148	33	79	51.35	1980	1286.89	1.53859
1158	33	783	1363.59	1872	3260.08	0.57422
1159	33	504	1753.04	797	2772.17	0.28750
1160	33	85	102.06	1161	1394.07	0.83281
1161	33	12	7.19	1359	814.76	1.66797
1162	33	10	3.98	256	101.97	2.51062
1163	33	2	2.44	130	158.66	0.81937
1164	33	1	0.55	678	371.51	1.82500
1173	33	77	237.72	573	1769.03	0.32391
1174	33	178	239.03	5385	7231.22	0.74469
1175	33	293	308.52	5113	5383.88	0.94969
1176	33	82	508.03	3	18.59	0.16141
1177	33	2	2.98	940	1399.40	0.67172
1178	33	13	23.38	111	199.61	0.55609
1179	33	28	16.26	345	200.33	1.72219
1180	33	47	252.35	25	134.23	0.18625
1181	33	175	273.17	794	1239.41	0.64063
1182	33	3	4.14	74	102.09	0.72484
1183	33	12	7.03	311	182.30	1.70594
1192	33	159	418.59	1971	5188.98	0.37984
1193	33	601	553.92	5109	4708.76	1.08500
1194	33	169	543.79	1692	5444.34	0.31078
1195	33	317	313.72	3486	3449.88	1.01047
1196	33	29	21.09	815	592.73	1.37500
1197	33	0	0.00	55	59.48	0.92469
1198	33	9	16.70	43	79.77	0.53906
1199	33	0	0.00	28	30.01	0.93297
1200	33	2	1.90	172	163.18	1.05406
1208	33	612	631.13	3906	4028.10	0.96969
1209	33	440	488.63	4396	4881.90	0.90047
1210	33	530	448.20	4049	3424.10	1.18250
1211	33	536	634.67	1828	2164.51	0.84453
1212	33	42	25.48	364	220.82	1.64844
1213	33	174	114.33	931	611.75	1.52187
1214	34	11	35.61	1179	3816.69	0.30891
1215	34	0	0.00	0	0.00	0.18500
1224	33	769	1534.16	2319	4626.43	0.50125
1225	33	185	369.42	2750	5491.42	0.50078
1226	33	199	252.70	4056	5150.48	0.78750
1227	33	25	44.37	6	10.65	0.56344
1228	33	204	273.48	2940	3941.35	0.74594
1229	33	21	21.13	2044	2056.86	0.99375

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Serial Zones	Sector No.	Employment	Employment Density	Population	Population Density	Area (Sq. Mi.)
1239	33	0	0.00	706	1339.58	0.52703
1240	33	60	81.13	3	4.06	0.73953
1241	33	18	14.65	367	298.60	1.22906
1242	34	75	132.23	2409	4247.27	0.56719
1243	34	70	49.49	1914	1353.25	1.41437
1244	34	42	26.41	324	203.75	1.59016
1245	8	0	0.00	117	114.15	1.02500
1246	8	0	0.00	16	30.48	0.52500
1247	8	0	0.00	590	417.70	1.41250
1248	40	1214	504.03	476	197.63	2.40859
1249	40	366	384.95	679	714.15	0.95078
1250	40	2129	3003.22	3592	5066.96	0.70891
1251	40	1959	2529.27	3913	5052.09	0.77453
1252	40	1915	3417.74	2387	4260.12	0.56031
1253	40	815	1919.06	2181	5135.54	0.42469
1254	40	1048	2006.34	3301	6319.59	0.52234
1255	40	842	1068.57	2985	3788.22	0.78797
1256	40	1959	3322.98	2565	4350.91	0.58953
1257	40	1083	1626.28	2245	3371.19	0.66594
1258	40	625	935.02	4951	7406.83	0.66844
1259	40	641	703.79	4572	5019.87	0.91078
1260	40	4879	2594.57	1297	689.72	1.88047
1266	40	75	50.31	482	323.35	1.49062
1267	40	91	72.71	1582	1264.02	1.25156
1268	40	331	340.36	3709	3813.88	0.97250
1269	40	283	290.30	6650	6821.61	0.97484
1270	40	1164	1879.31	3708	5986.68	0.61937
1271	40	1725	2266.94	3492	4589.08	0.76094
1272	40	841	1210.89	2870	4132.28	0.69453
1273	40	470	274.10	1311	764.57	1.71469
1276	40	888	699.04	94	74.00	1.22031
1277	40	78	38.50	1869	922.61	2.02578
1278	40	397	299.98	5470	4133.18	1.32344
1279	40	415	282.25	3293	2239.66	1.47031
1280	40	93	112.64	550	666.16	0.82562
1281	40	21	12.95	74	45.63	1.62187
1282	39	13	23.82	864	1583.05	0.54578
1283	39	48	51.97	9	9.73	0.92453
1284	40	21	18.89	19	17.09	1.11172
1285	39	85	76.40	1849	1662.02	1.11250
1286	40	323	145.8	78	35.20	2.21562
1287	39	6	9.7	6	9.70	0.61828
1288	39	516	524.9	0	0.00	0.98297
1289	40	25	20.6	13	10.71	1.21406
1290	39	58	73.3	0	0.00	0.79156

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Serial Zones	Sector No.	Employment	Employment Density	Population	Population Density	Area (Sq. Mi.)
1300	39	95	184.7	945	1837.74	0.51422
1301	39	622	763.0	4535	5563.35	0.81516
1302	39	1209	1688.0	1481	2067.71	0.71625
1303	39	1314	1865.9	2217	3148.17	0.70422
1304	39	1002	924.6	4510	4161.48	1.08375
1305	39	906	858.8	2585	2450.24	1.05500
1306	39	409	284.5	1720	1196.52	1.43750
1307	39	118	210.6	9	16.06	0.56031
1313	39	796	529.5	1509	1003.70	1.50344
1314	39	390	442.4	5409	6135.70	0.88156
1315	39	279	261.8	3311	3107.10	1.06562
1316	39	268	348.1	2512	3262.34	0.77000
1317	39	8501	10672.1	410	514.71	0.79656
1318	39	1250	1758.2	0	0.00	0.71094
1319	39	426	331.9	364	283.58	1.28359
1338	39	1360	1470.0	1364	1474.35	0.92516
1339	39	433	490.7	4479	5075.35	0.88250
1340	39	324	419.8	3141	4069.31	0.77187
1341	39	55	38.7	2201	1547.28	1.42250
1352	39	8	6.5	34	27.60	1.23187
1353	39	269	279.3	4671	4849.05	0.96328
1354	39	35	20.1	9	5.16	1.74281
1368	39	57	49.0	12	10.31	1.16344
1369	39	169	147.9	1419	1241.50	1.14297
1370	39	79	37.8	2805	1342.11	2.09000
1523	34	4	13.9	299	1041.70	0.28703
1524	34	5	6.1	985	1196.66	0.82312
1525	34	10	14.9	42	62.66	0.67031
1526	34	0	0.0	153	111.39	1.37359
1534	34	12	7.4	247	151.30	1.63250
1535	34	0	0.0	238	131.42	1.81094
1542	34	1484	833.6	143	80.33	1.78016
1543	34	20	8.7	209	90.84	2.30078
1544	34	30	14.0	51	23.74	2.14844
1545	34	0	0.0	68	48.71	1.39609
1557	34	165	590.9	139	497.82	0.27922
1558	34	9	23.2	77	198.39	0.38812
1559	34	5	12.8	0	0.00	0.39063
1560	34	5	7.8	57	88.98	0.64063
1561	34	10	11.6	119	138.10	0.86172
1562	34	5	4.1	62	50.35	1.23141
1574	34	156	187.8	5137	6184.50	0.83062
1575	34	982	1208.2	5963	7336.26	0.81281
1576	34	80	162.8	1310	2666.67	0.49125
1577	34	262	120.2	938	430.37	2.17953

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Serial Zones	Sector No.	Employment	Employment Density	Population	Population Density	Area (Sq. Mi.)
1578	34	77	55.0	54	38.54	1.40109
1586	34	165	438.2	179	475.65	0.37656
1589	34	625	2867.4	249	1142.37	0.21797
1590	34	519	851.9	376	617.18	0.60922
1591	34	600	557.9	20	18.60	1.07547
1592	34	37	17.1	23	10.64	2.16141
1599	34	89	123.72	1782	2477.15	0.7194
1600	34	569	502.64	4661	4117.38	1.1320
1601	34	48	37.53	2726	2126.56	1.2791
1602	34	20	16.62	79	65.65	1.2034
1603	34	45	22.53	76	38.05	1.9972
1612	34	0	0.00	11	22.42	0.4906
1613	34	18	46.66	900	2332.93	0.3858
1623	34	0	0.00	11	21.78	0.5052
1624	34	5	15.15	52	157.58	0.3300
1625	34	0	0.00	85	125.96	0.6748
1626	34	0	0.00	34	25.07	1.3561
1627	34	0	0.00	21	25.15	0.8348
1628	34	0	0.00	73	40.46	1.8042
1637	34	169	340.77	624	1258.22	0.4959
1638	34	11	7.33	192	127.91	1.5011
1639	34	0	0.00	12	10.67	1.1250
1640	34	0	0.00	9	3.78	2.3798
1648	34	194	230.82	2504	2979.29	0.8405
1649	34	171	160.26	3279	3073.01	1.0670
1650	34	1	0.52	964	499.77	1.9289
1659	34	26	17.06	798	523.71	1.5237
1660	34	8	4.85	718	435.28	1.6495
1661	34	0	0.00	195	77.72	2.5089
1662	34	0	0.00	6	4.61	1.3014
1683	34	83	57.68	632	439.17	1.4391
1685	34	77	85.19	687	760.03	0.9039
1686	34	6	19.96	329	1094.39	0.3006
1688	34	0	0.00	728	443.73	1.6406
1689	34	0	0.00	153	106.64	1.5203
1690	34	49	90.71	1037	1919.81	0.5402
1691	34	0	0.00	3	2.11	1.4206
1692	34	144	45.71	1842	584.70	3.1503
1693	9	0	0.00	0	0.00	2.3250
1694	9	0	0.00	3	1.69	1.7750
1695	9	0	0.00	160	72.70	7.0500
1696	9	13	1.28	380	37.53	10.1250
1697	9	18	2.68	98	14.58	6.7225
1838	34	0	0.00	43	73.00	0.5891
1899	9	0	0.00	6	4.96	1.2105

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Serial Zones	Sector No.	Employment	Employment Density	Population	Population Density	Area (Sq. MI.)
1900	9	10	2.88	34	9.78	3.4750
1901	9	0	0.00	126	21.07	5.9800
1902	9	16	2.20	260	35.74	7.2750
1903	8	5	1.57	107	33.63	3.1812
1904	8	0	0.00	198	24.71	8.0130
1905	8	12	4.03	103	34.62	2.9750
1906	8	0	0.00	379	275.64	1.3750
1907	8	10	4.30	159	68.39	2.3250
1908	8	75	51.83	711	491.35	1.4470
1909	8	130	157.87	1623	1971.01	0.8234
1910	8	712	1383.78	1274	2476.04	0.5145
1911	8	25	16.89	136	91.89	1.4800
1912	8	200	160.00	46	36.80	1.2500
1913	8	55	74.89	8	10.89	0.7344
1914	8	19	34.92	198	363.93	0.5441
1915	8	10	9.14	25	22.84	1.0945
1916	8	20	32.51	67	108.92	0.6152
1917	8	9	2.416	759	203.76	3.22500
1918	8	0	0.000	39	18.40	2.12000
1919	8	14	10.000	228	162.86	1.40000
1920	8	0	0.000	150	44.94	3.33750
1921	8	0	0.000	106	103.41	1.02500
1922	8	20	10.959	329	180.27	1.82500
1923	8	5	2.088	148	61.79	2.39516
1925	9	0	0.000	11	32.38	0.33969
1926	9	0	0.000	22	11.81	1.86250
1927	9	0	0.000	109	13.66	7.98000
1928	9	7	4.085	34	19.84	1.71359
1929	9	6	3.855	657	422.17	1.55625
1930	9	7	3.394	73	35.39	2.06250
1931	9	18	2.599	76	10.97	6.92500
1932	9	75	400.000	293	1562.67	0.18750
1933	9	78	121.371	686	1067.44	0.64266
1934	9	58	111.807	182	350.84	0.51875
1935	9	50	13.201	28	7.39	3.78750
1936	9	8	2.234	98	27.36	3.58125

1980 CENSUS TRACTS AND POPULATION-BY SECTORS
 Dallas-Fort Worth Intensive Study Area

Census Tract	Sector No.	Population	Census Tract	Sector No.	Population
17.01	51	77	157.00	39	3035
21.00	51	165	158.00	39	2474
31.01	51	2474	159.00	39	3656
32.01	51	189	160.00	39	6061
99.00	40	265	161.00	39	3004
141.04	40	8668	162.00	39	6131
142.00	40	6861	163.00	39	3892
143.01	40	9243	164.00	39	14169
143.02	40	6816	170.00	34	3376
143.03	40	7386	172.00	34	2363
143.04	40	23	173.01	34	4559
144.01	40	1957	173.02	34	5896
144.02	40	7362	174.00	34	4700
145.00	40	6845	175.00	34	2423
146.00	40	6334	176.01	34	1224
147.00	40	7613	177.00	34	11798
148.01	40	1416	178.03	34	4745
148.02	40	1277	181.04	34	1342
149.00	40	3265	181.05	33	5897
150.00	40	5386	181.06	33	3742
151.00	40	5357	181.07	33	3945
152.01	40	12621	181.08	33	4168
152.02	40	2563	181.09	33	2766
153.01	40	2620	181.10	33	3147
153.02	40	6535	181.11	33	4959
154.00	39	8630	181.12	33	9320
155.00	39	2781	181.13	33	5079
156.00	39	4190	181.14	33	4287

**1980 CENSUS TRACTS AND POPULATION-BY SECTORS
Dallas-Fort Worth Intensive Study Area**

Census Tract	Sector No.	Population	Census Tract	Sector No.	Population
181.15	34	5825	1065.05	25	263
182.01	33	7595	1115.05	18	4996
182.02	33	5305	1115.06	18	4789
183.00	33	6227	1115.07	18	6088
184.01	33	3879	1115.08	18	8990
184.02	33	4410	1115.09	18	9129
184.03	33	1440	1115.10	18	10587
187.00	33	5229	1130.00	18	5510
401.00	8	1183	1131.00	18	13434
402.00	8	1401	1216.01	18	6081
403.00	8	5697	1216.04	18	5205
404.00	8	2541	1216.05	18	3248
405.00	8	3706	1216.06	18	2190
502.00	9	4090	1216.07	18	10520
1012.01	25	272	1217.01	18	5356
1013.01	25	4206	1217.02	18	2940
1013.02	25	2682	1218.00	18	285
1014.01	25	4276	1219.01	18	3874
1014.02	25	2723	1219.02	18	5529
1014.03	25	4298	1220.00	18	6906
1015.00	25	3377	1221.00	18	5600
1018.00	28	992	1222.00	18	1773
1019.00	52	344	1223.00	18	3486
1035.00	25	4894	1224.00	18	5622
1065.01	25	4673	1225.00	18	3509
1065.02	25	2667	1226.00	18	3979
1065.03	25	4959	1227.00	18	4055
1065.04	25	5153	1228.00	18	6276