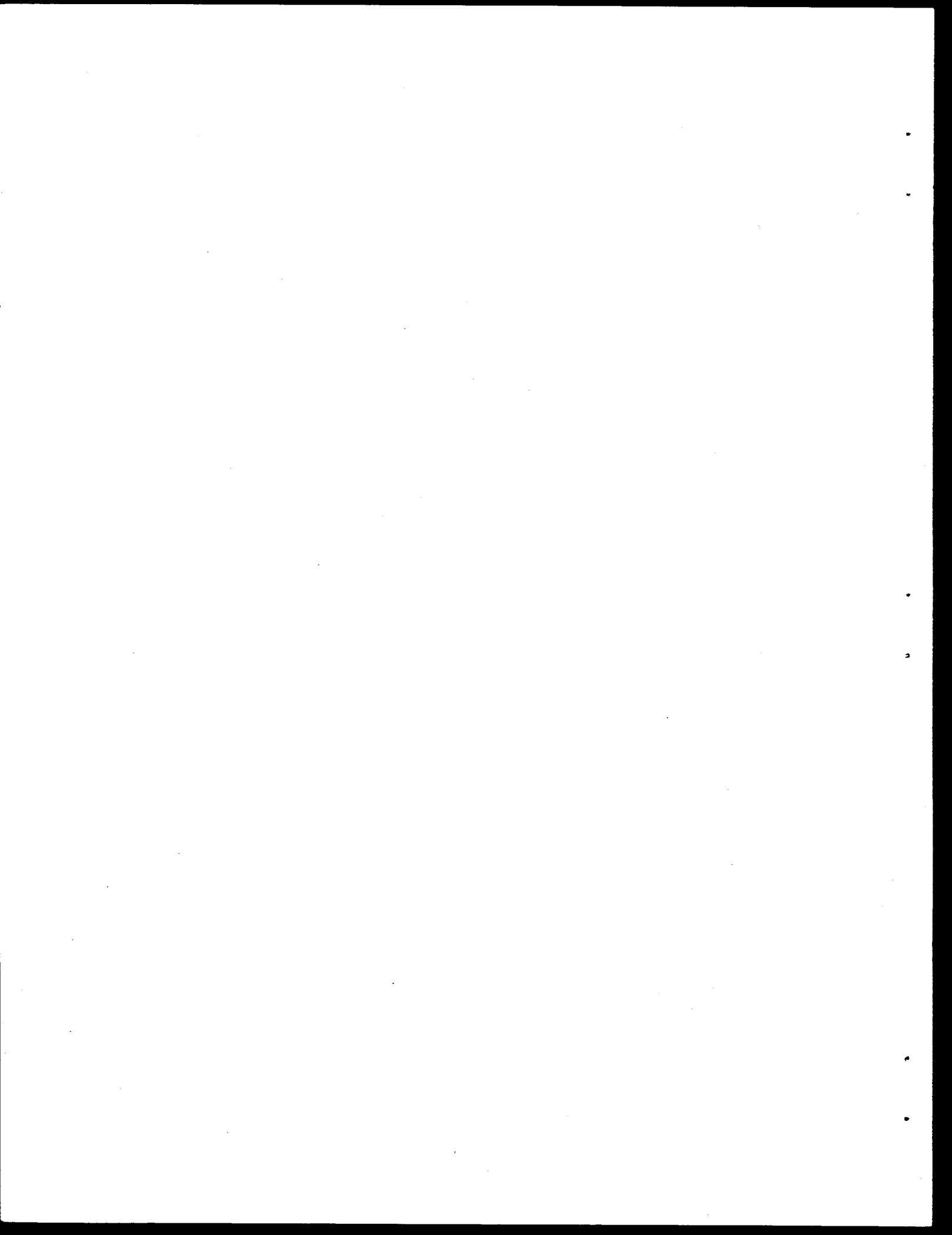


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TECHNIQUES FOR ESTIMATING
VANPOOLING DEMAND

by

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Research Report 205-17
Priority Use of Transportation Facilities
Research Study Number 2-10-74-205

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August 1982

ABSTRACT

It has been found that allowing vanpools to use high-occupancy vehicle (HOV) lanes is an effective means of increasing the vehicular utilization of those facilities. Vanpools are readily identifiable and, as a result, can be relatively easily controlled. They are compatible with the Houston philosophy that only "authorized vehicles" be permitted to use the HOV lanes.

Vanpools have increased rapidly in Texas over the past several years. In planning high-occupancy vehicle lanes, if vanpools are to be potential users, it is critical to be able to obtain "ballpark" estimates of potential vanpooling. This report develops techniques for estimating vanpool demand primarily using data from Houston, Texas.

Key Words: Vanpools, Modal Split, High-occupancy Vehicles, Priority Treatment, Ridesharing.

IMPLEMENTATION STATEMENT

Project 205 is oriented toward assisting the Department in the planning, implementation, and evaluation of priority treatment projects. At present, a number of single-lane, high-occupancy vehicle facilities are in the operating, design, and planning process, particularly in Houston.

It has been found that bus volumes alone do not effectively use all the vehicular capacity provided by these single-lane, high-occupancy vehicle facilities. Allowing vanpools to use the lane can greatly increase utilization while at the same time providing an identifiable and controllable user group.

Vanpooling in Houston has increased from 9 vans (1974) to 1900 (1982) over the last 8 years. Techniques for predicting demand in Texas cities are not available, and whether vanpool utilization will generate 100 vph or 400 vph is a significant concern in planning and operating high-occupancy lanes. This report documents procedures that can be used to gain a "ballpark" estimate of vanpool demand using readily available data.

DISCLAIMER

The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views of policies of the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

SUMMARY

A substantial number of high-occupancy vehicle lanes are being developed in major Texas cities. The current philosophy is that only "authorized" vehicles will be allowed to use those lanes. Analyses have demonstrated that vanpools represent, in addition to transit vehicles, optimum users of the finite lane capacity available. As a result, techniques are needed that can be used to estimate the vanpool demand.

Vanpooling in Texas began in 1974. By 1982, over 2500 vans were in operation in the state, representing 17% of the vans operating nationwide. Nearly 2000 of these vans were in the Houston area, and most all (90%) are employer sponsored vans. The analyses used in this report are based on Houston data. Since vanpooling shows the potential for further increases in Houston, the estimates should be conservative for that area. Conversely, since vanpooling in Houston is much greater than in other Texas cities, the estimates may be high for those cities.

Vanpooling serves one-way trips commonly in excess of 15 miles. Using the available Texas data, the following represent guidelines for use in estimating vanpool demand.

- For areawide analyses, there is one vanpool sharing a common trip end per 1500 persons.
- The contraflow lane on I-45N in Houston is used only by vanpools and buses. There are 3.75 vans for every one bus.
- On those exclusive HOV lanes that are utilized by both buses and car-pools/vanpools (Shirley Highway in Washington, D. C., San Bernardino Busway in Los Angeles, I-45N contraflow in Houston), the pools move 40% to 50% of total person movement. These percentages appear to hold even though the definition of pools (number of persons per vehicle) varies.
- For a radial freeway, approximately 10% to 15% of the person work trips to downtown (CBD) are served by vanpools. This percentage is similar for all corridors evaluated since all radials provide a similar accessibility level to downtown. For other major activity

centers, the percentage of total person work trips using vans appears to be generally lower than the CBD percentage. Since different freeways provide different accessibility levels to these other major generators, the percentage of person trips in vans will vary between freeways.

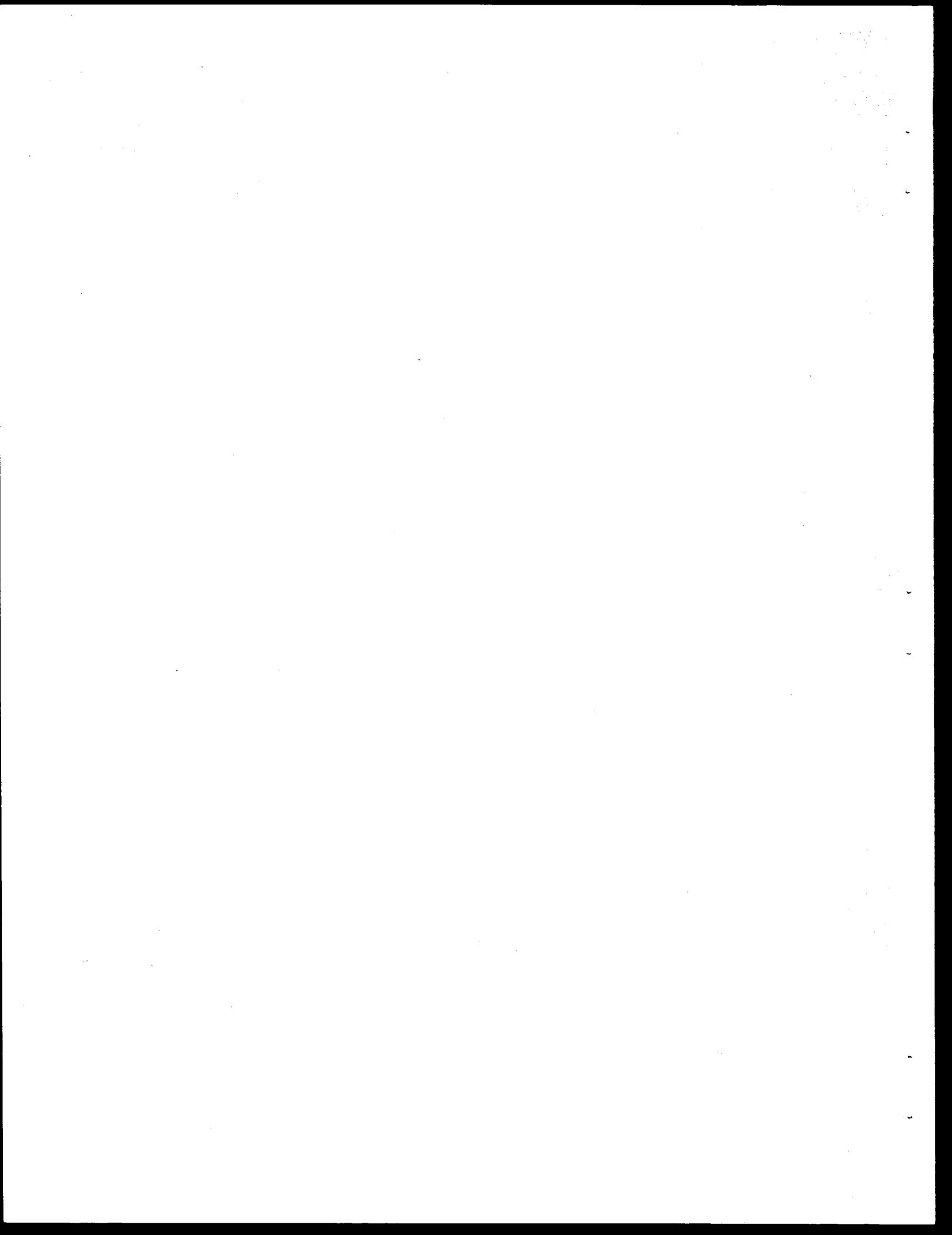
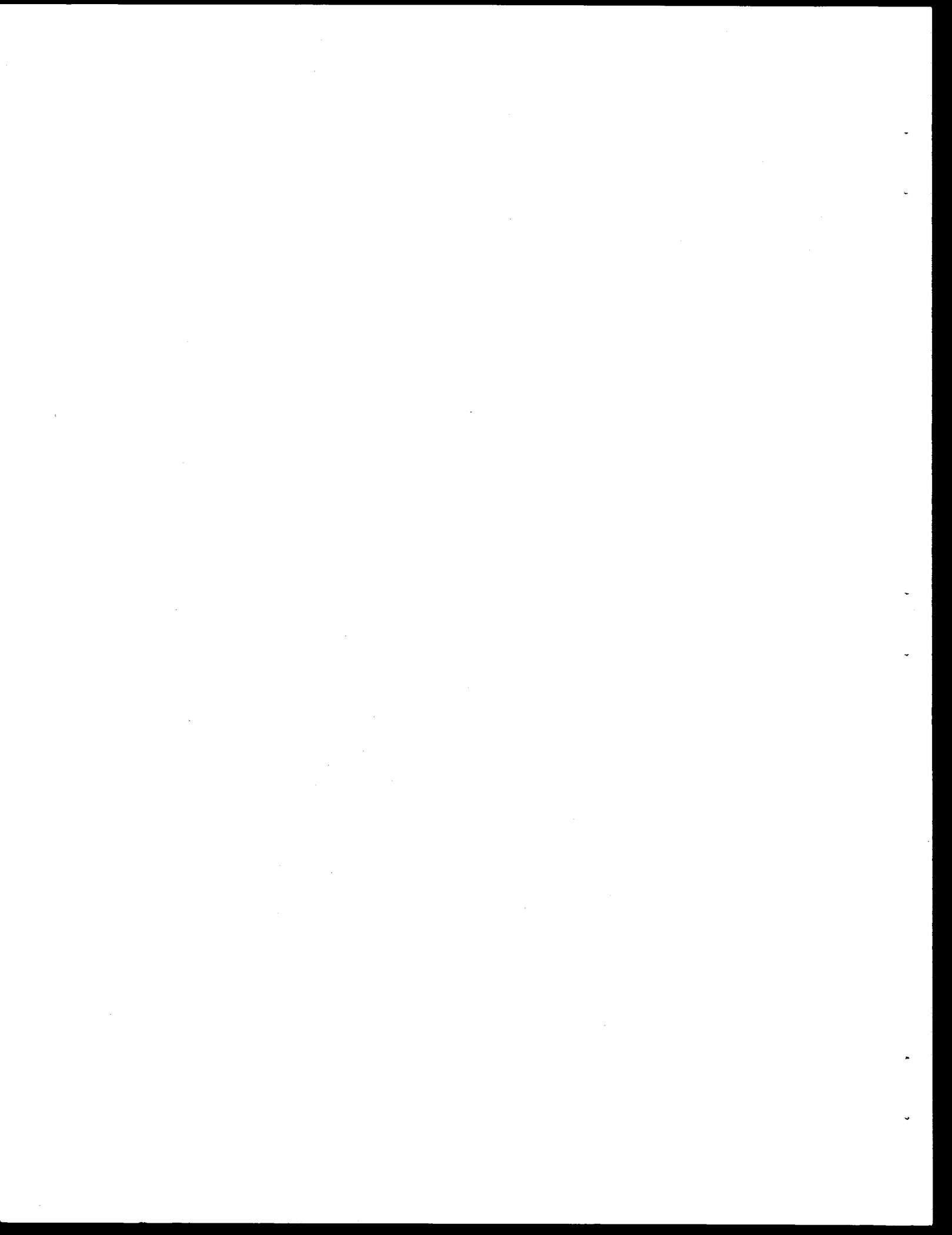


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INTRODUCTION

Due to increasing congestion and commuting costs, ridesharing is becoming a more popular means of urban commuting. Vanpooling has increased rapidly in the past several years, particularly in the Houston area. This phenomenon has had considerable impacts on planning, designing, and operating high-occupancy vehicle (HOV) facilities.

Vanpooling and HOV Lanes

The contraflow lane on I-45N in Houston represents the first freeway HOV lane implemented in Texas. Exclusive median lanes are presently being planned or designed for several other Houston freeways.

In planning these facilities, it was recognized that transit vehicles are the logical first priority users. However, demand estimation suggests that bus volumes in the range of 100 buses per hour represent maximum flow rates. Since HOV lanes have capacities more in the range of 1000 vehicles per hour, bus volumes alone do not begin to use the available capacity. Also, particularly in the case of the contraflow lane¹, visibility of vehicles using the priority lane was considered important. Bus volumes alone might, in terms of vehicular visibility, cause the lane to appear unused. That could create safety problems (mixed-flow traffic might feel safe in encroaching upon the contraflow lane) as well as adverse public reaction to the HOV improvement due to the appearance of underutilization.

Thus, considerable study (e.g., Research Report 205-6) was undertaken to identify other potential users of HOV lanes. The following special conditions associated with HOV lanes restrict potential user groups.

¹A more detailed description of the contraflow operation on I-45N in Houston is included in Research Report 205-16.

- HOV lanes have few, if any, intermediate access and egress points. All vehicles using the lane must have similar travel patterns.
- Only a finite amount of excess capacity exists in the lane. The volume associated with alternative user groups must be sufficiently large to increase lane usage but, at the same time, must not be so large as to exceed available capacity.
- In the case of contraflow, operating safety is a major concern. In the case of median HOV lanes, the operation of the facility can be very complex. Thus, users of the lane should desirably be readily identifiable; a vehicle authorizing procedure may be advantageous to assure that lane operation is both safe and efficient. This authorization procedure, now in use in Houston, requires among other things, driver training.

An extensive vanpool program is in place in Houston (refer to subsequent part of this section). The analyses performed in Houston indicated that vanpools represent an optimum potential user of HOV facilities. Experience to date on the contraflow lane has substantiated those analyses. It is highly likely that, other than transit vehicles, vanpools will be considered as the primary eligible user group for HOV facilities in the Houston area, and possibly, in other Texas cities.

Growth in Vanpooling

Vanpooling, particularly in Houston, has grown rapidly (Figure 1). The reasons and economics behind this growth are well documented in other references.² Houston has become the "vanpool capital" of the United States.

² Maxwell, Donald, et al. "Economics of Vanpooling." Technical Memorandum #1, prepared by Texas Transportation Institute for Governor's Office of Energy Resources, May 1979.
 Maxwell, et al. "How Much Fuel Does Vanpooling Really Save?" Technical Memorandum #2, prepared by Texas Transportation Institute for Governor's Office of Energy Resources, January, 1980.
 Maxwell, et al. "Vanpooling in Texas: Past, Present and Future." Prepared for the 1982 Meeting of the Transportation Research Board.
 Maxwell, et al. "The Texas Vanpool Census, July 1981." Prepared by Texas Transportation Institute for Governor's Office of Energy Resources, July 1981.

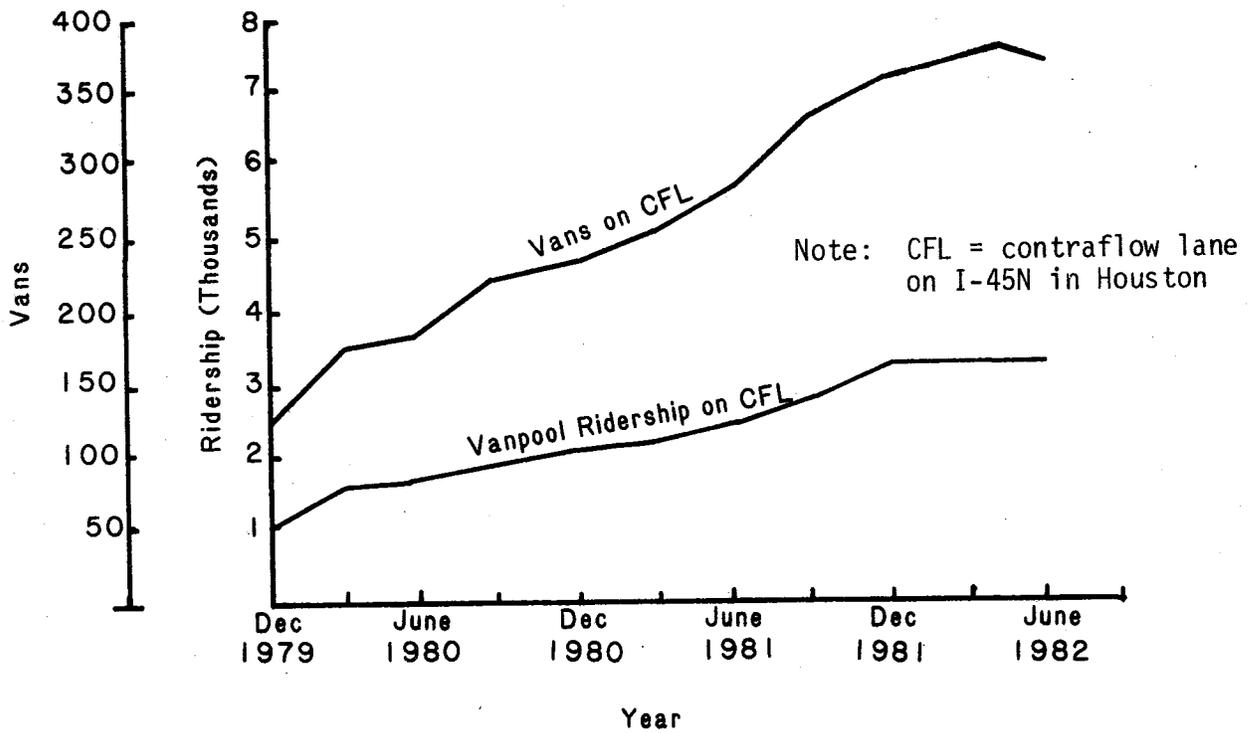
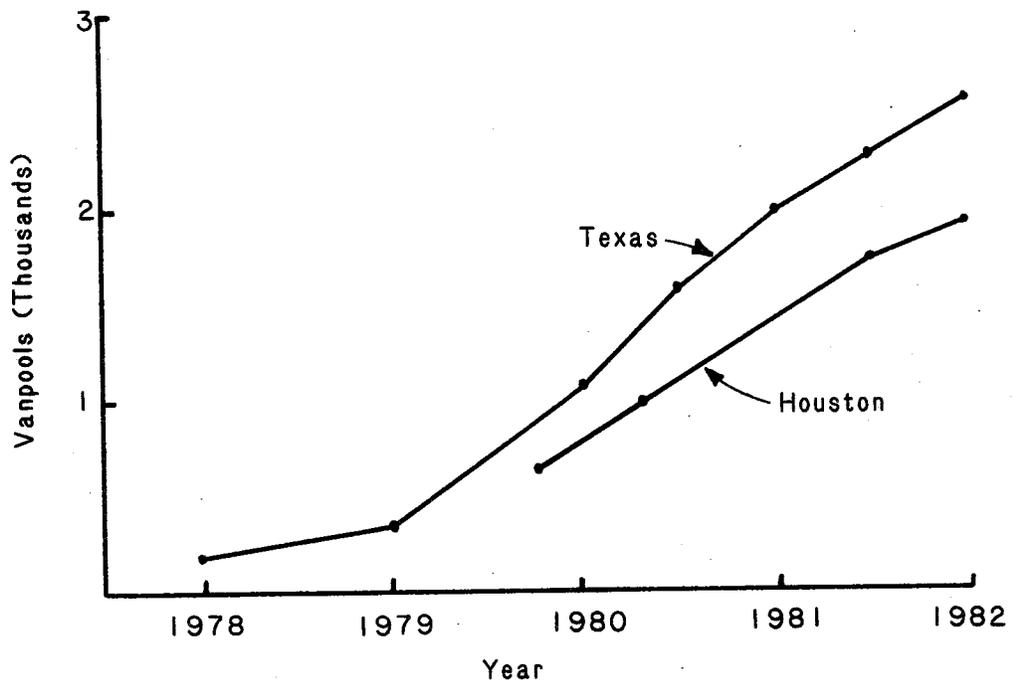
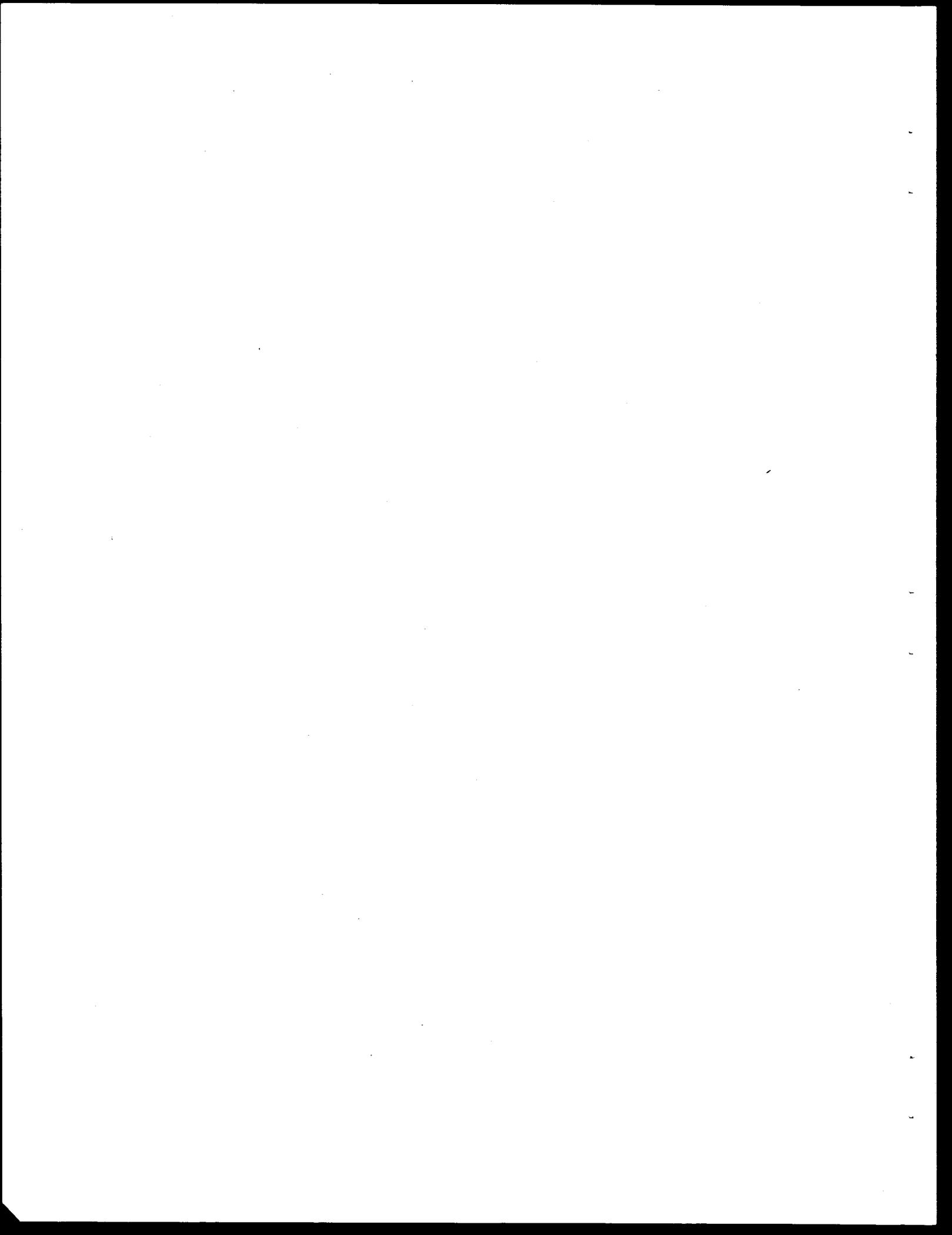


Figure 1: Measures of Growth of Vanpooling in Texas



FACTORS INFLUENCING PAST AND FUTURE VANPOOL GROWTH

In Texas, vanpooling got its start in March 1974 when Texas Instruments initiated a 9-van pilot program in Dallas. CONOCO followed one year later with a 10-van pilot program in Houston. Since that time vanpooling has grown dramatically in Texas (see Figure 1). As of January 1, 1982, there were 136 programs at 148 sites around the state totaling 2572 vans on the road (17% of the vans in the nation). These vans conserve 10.4 million gallons of gasoline per year and provide almost one-third of billion passenger-miles of service.

Despite governmental enthusiasm over the potential of vanpooling to conserve energy, reduce pollution, shift balance of payments, and reduce traffic congestion, these as well as other such lofty motivations were not reasons given by employers for implementing programs. The 140-Texas employers who have initiated vanpool programs cite the following reasons for starting programs.

1. Reduce the cost of the employer's share of parking expense, this being the major factor in Houston in 1982.
2. Protect and expand the firm's position in the labor market in a region of low unemployment as well as reduce tardiness and increase employee morale.

In short, these employers believe that the benefits of having an employee vanpool program outweigh the possible liability exposure and capital risk. To this end they have invested \$23 million in van purchases to support their programs.

The Texas Vanpool Program is based on the assumption that people will vanpool to save money -- if it is not significantly less convenient than driving alone. The 28,000 employees who participate in the vanpool programs generate the cash flow necessary to underwrite the costs of owning and operating the vehicles. Specific reasons that have been cited are:

1. Vanpooling is very attractive to long-distance commuters. Ninety-five percent of vanpoolers live 15 miles from work or more. The higher the price of fuel, the more attractive it becomes,
2. The price of automobiles has risen dramatically in the past three years. "Sticker shock" has helped to maintain interest in the face of the recent decrease in gasoline prices, and
3. In Houston the hassle-free ride to work is becoming an increasingly popular reason as freeway congestions grows.

Successful programs have three requirements. First, there must be an enthusiastic and capable coordinator who is supported by top management. (Top management is the key decision-maker in the organization. This is true in a private firm, a public agency or a third-party situation.) Although top management support is necessary, this alone will not guarantee a successful program. This "right" coordinator is an absolutely essential ingredient for success. Second, a situation where vanpooling is financially attractive to the employees is a must. Third, it is necessary to locate, train, and maintain a cadre of capable drivers, including backups.

Although each vanpool program has certain characteristics which make it unique, all of them fall into four major classifications.

1. The employer administers the program and owns and/or leases the vans (This kind of program is usually referred to an Employer program).
2. The employer administers the program but the employees own the vans (Employer/Driver).
3. The driver administers the program and owns the vans (Owner/Operator).
4. An outside party owns the vans and leases them to the driver. The employer or some public body (as a third party to the lease) guarantees the lease (Third-party).

In Texas, the vans are distributed among the program types as follows: 2328 in employer programs; 78 in employer/driver; 32, owner/operator; and 119, third-party. The significant difference in the four classifications lie in

the mode of ownership and the financial and tax advantages (or disadvantages) of that type of ownership.

The percentage of employer vans (90%) is a measure of the financial advantage enjoyed by the employer programs. In a program in which the vans are employee-owned, the vans are essentially "company cars" that are made available to the employees for use as commuter vehicles. Since certain tax benefits are available only to employers (the vans become part of the depreciable assets of the company), this type of ownership is the most cost-effective. It is cost-effective because the tax benefits can reduce substantially the cost of ownership. These savings are then passed on to the riders in the form of reduced fares, making the program more attractive to the employees.

Other types of programs grew out of situations in which employees wanted to participate in a vanpool program but the employer was either unable or unwilling to accept financial responsibility for the program. It is illegal for some non-private organizations (for example, Federal Government and some of its corporate agencies such as Tennessee Valley Authority (TVA) and the Postal Service) to provide transportation to-and-from work. The same is true for some state and local governments. In addition, some employers have too few employees to form effective pools, so they must join with others to make pooling possible. With employer/employee programs, the company usually gives active administrative support to the program by helping organize "pools," by providing parking, and by absorbing certain administrative costs generated by the program. Owner/operators generally organize and operate their van independent of any outside assistance.

Third-party arrangements can take a variety of forms. Traditionally, the van provider has been a for-profit leasing company which recovers the full cost of owning and operating the van, plus his overhead and profit from the driver

and the riders. The "third party", usually a nonprofit corporation, operating under a grant agreement with one or more funding agencies, bears the burden of: keeping the vans full; initiating new vanpools; and promotion of the concept. With the cut-back in federal funds, employer contributions are being used to make up the difference. This (in the author's opinion) is showing signs of evolving into a "for profit" vanpool situation where the van provider assumes a more active role. Depending upon the circumstance, a third-party arrangement receives varying degrees of support from the employers.

Along with understanding what vanpooling is, and what forms it can take, it is equally important to understand the segment of the transportation market it serves best. A 1981 sample of 1745 vans suggests that the average-one-way vanpool trip is 21 miles (see Figure 2). This is down from 26 miles in 1978 and is assumed to reflect the effect of more than doubling the price of gasoline during this period. There are few vanpool trips less than 10 miles and, for program design purposes, 15 miles one way is generally considered the minimum acceptable distance.

Based upon this analysis, the "best guess" is that vanpooling is feasible for 3-5% of the total commuters. Based on urban transportation planning data from the 24 urbanized areas in Texas, 15% of the peak hour trips, (both internal-to-internal and external-to-internal), are greater than 15 miles. Assuming that 2/3 to 3/4 of these trips will be ineligible because of employer/driver/rider mismatches, only 3%-5% of the total commuters remain as possible vanpool candidates. Since the trip lengths in the larger urban areas are significantly longer, a higher percentage of commuters will be "eligible" vanpoolers in those areas. In Texas, there appears to be a potential for 40-50,000 vanpools.

The most important limiting factor to the growth of vanpooling is what people are willing to pay. Figure 2 shows the results of an analysis of monthly fares (adjusted to 12-passenger equivalency) versus daily roundtrip cost. The

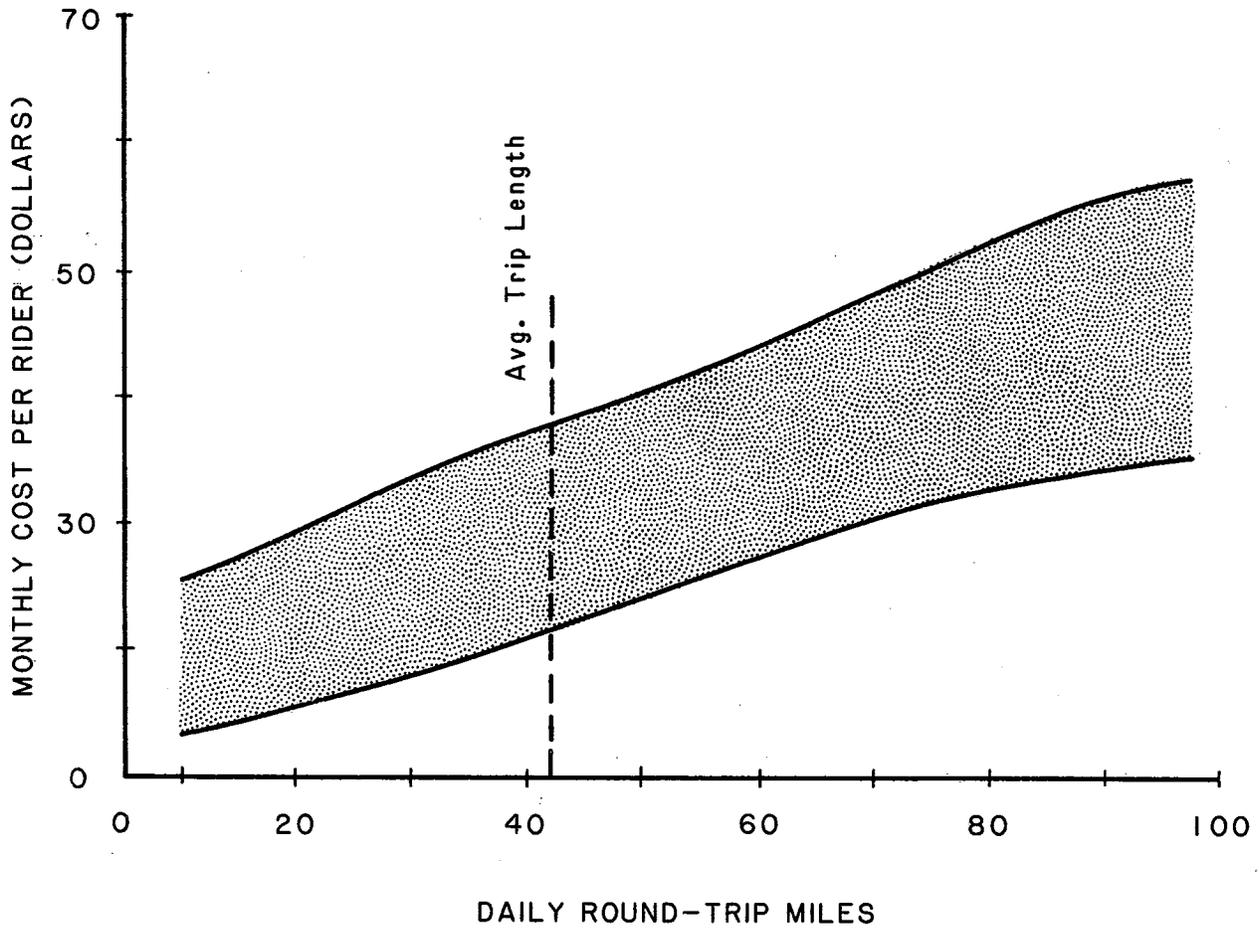


Figure 2: Relationship Between Rider Fares and Round-Trip Travel Distance for Successful Vanpool Programs

shaded band contains all but four of the "successful" vanpool programs in the state. Generally, "successful" is used to mean that the program has moved out of the pilot stage into or through a period of rapid growth. Programs that have fares above the line have either failed entirely or are stalled in the pilot stage. This indicates a relationship between fare structure and program success, as measured by growth.

Figure 2 also answers the question why third-party operations and owner/operator programs have not shown the same rapid increase in numbers as private employer programs. Computing vanpool fares according to typical practice, a

company can put a van on the road at an after-tax cost per vanpooler of \$20-\$45, per month, depending upon tax accounting practices. An owner/driver or third party non-profit operation cannot put the same van on the road for much less than \$50-\$75 per rider per month. Since this is clearly outside the "acceptable range," all but the typical employer vanpool operations will suffer a staggering price handicap.

Figure 3 is a plot of company size (as measured by the number of employees) versus the percentage of employees participating in vanpool programs. There is no apparent relationship between the two. This indicates that company size is not a good predictor of program success as measured by market penetration. Nevertheless, the larger companies do tend to have the most vans. Where programs in larger companies have not grown, poor program design resulting in high fares and/or lack of an enthusiastic coordinator can be seen as major factors.

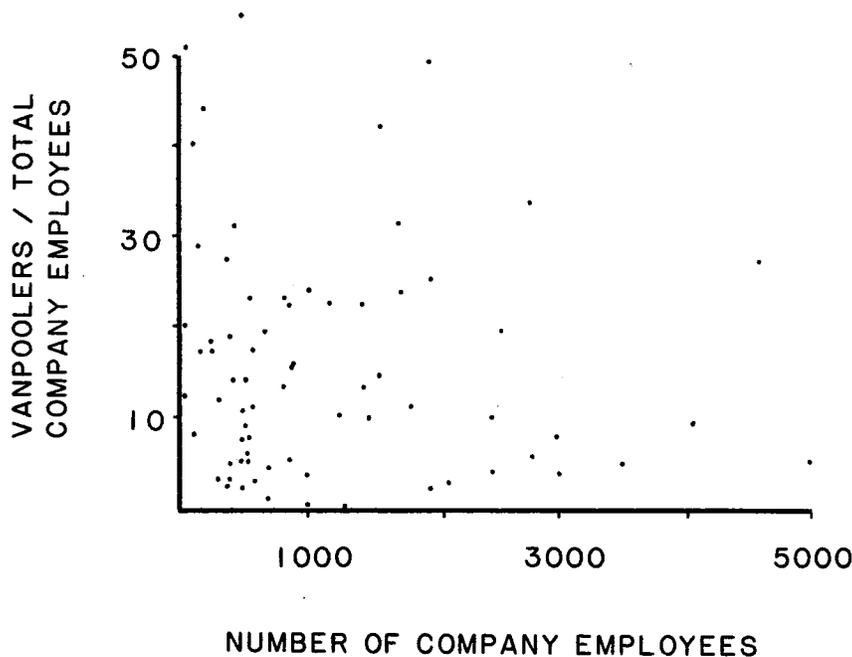


Figure 3: Relationship Between Company Size and Percent of Employees Choosing to Vanpool

Overview

The number of vans-on-the-road is a function of the price of gasoline, its availability, and the general economic climate. This is reflected in the fact that there are about 200 less vans-on-the-road in the Houston area now (September 1982) than in January. The potential volume of vanpools is influenced by the following.

1. There are 85 vanpool programs in Houston now. Under any circumstances it is hard to imagine there are 85 more firms ready to "plunge into" vanpooling in the next three years. Therefore, corporate vanpool programs will probably contribute less than 1000 additional vans over the next three years.
2. Unless third-party programs (like that operated by Metro) are able to develop fare structures in the acceptable range, there will be less than a 500 van contribution from this section.
3. Owner/operators are a negligible share of the total picture.
4. The greatest potential lies in the "for profit" third party operator. There are experiments underway in Dallas and Fort Worth to tap the market of employees and property owners who need vanpooling but do not want to be "in the transportation business." If the proper legal structure can be found (take maximum advantage of the tax structure and still avoid regulation and insurance problems) this shows as great a potential as employee organized programs.

On the other hand, if there is a war in the Middle-East and oil supplies are interrupted for 6 months or more, it will not be possible to make vans fast enough.

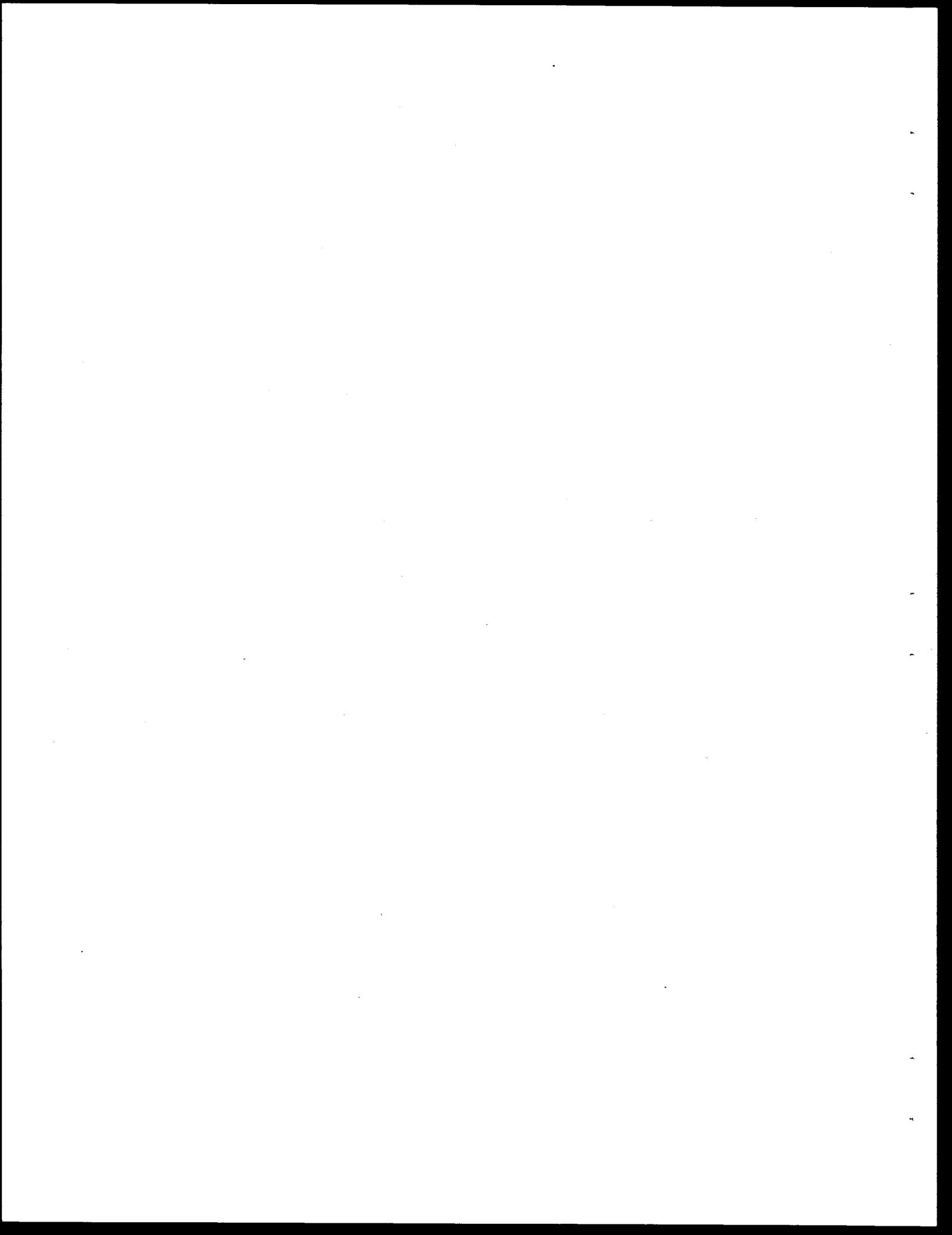


OBJECTIVES OF THE STUDY

It has been found that vanpoolers can be an integral part of high-occupancy vehicle improvements on major Texas freeways. However, at present it is not possible to estimate with reasonable certainty the vanpool demand for such facilities. The extent of that demand is a critical concern in planning, designing, and operating HOV facilities.

The intent of this study is to develop relatively simple techniques that make use of readily available data and are intended to provide "ballpark" estimates of current vanpooling demand. Several alternative techniques are presented. It is not the intent of this study to determine which is the best technique; rather, it is suggested that several techniques be used to devise a range of potential usage. The analyst can then use his judgment in formulating a specific demand estimate. Since the estimates are based on current demand in Houston and since that demand has been increasing, the procedures documented in this report may provide a conservative estimate of the future extent of vanpooling.

Data collected in Houston, Texas, are used to develop the estimating procedures. Based on current conditions, using these Houston data will result in a high estimate of vanpooling in other Texas cities since, to date, vanpooling has been more popular in Houston than in other Texas cities.



THE DATA BASE

As shown in Figure 1 and described in more detail in the references listed in footnote², the majority of vanpools in Texas are presently located in Houston. The more rapid growth of vanpooling in Houston is at least partially the result of the greater level of congestion present in that city. As other major cities, such as Dallas-Fort Worth and San Antonio, experience further growth, the level of vanpooling in those cities will no doubt continue to increase. Since Houston is the leader in vanpooling, Houston data are used in this report as the basis for developing demand estimation procedures for vanpooling.

It should be noted that, in this report, existing Houston data are used to estimate vanpool demand. Vanpooling has been growing rapidly, both in Houston and Texas, and there is no reason to believe that the growth will not continue in the long run. As a result, the estimates developed in this report are based on current travel conditions; this may result in conservative estimates of the future demand for vanpooling.

A variety of sources are used in this study to develop demand estimation guidelines. Extensive surveys were undertaken to collect these data. Those surveys are described in other references, and are only briefly described in this section.

Vanpool Census

The Texas Transportation Institute, under contract with the Governor's Office of Energy Resources, undertakes a census of vanpools operating in the state several times per year. Data are collected by city. These studies have been performed since 1977.

Copies of the material may be obtained by contacting:

Donald Maxwell
Texas Transportation Institute
The Texas A&M University System
College Station, Texas 77843

Contraflow Lane Data

Vanpoolers are eligible users of the contraflow lane located on I-45N (North Freeway) in Houston. The Metropolitan Transit Authority (MTA) has monitored vanpool utilization of that lane since its opening in August 1979. This particular facility, due to contraflow, has a high level of vanpool usage. In addition, MTA has performed surveys of those vanpoolers to identify characteristics and travel patterns of the vanpoolers. This information may be obtained by contacting:

Mr. Chuck Fuhs
Metropolitan Transit Authority
P. O. Box 61429
Houston, Texas 77208

Origin-Destination Surveys

The Texas Transportation Institute, under contract with the State Department of Highways and Public Transportation and the Metropolitan Transit Authority, has performed two origin-destination studies on Houston freeways. The Southwest Freeway (U.S. 59) was surveyed in the spring of 1981 and the Katy Freeway (I-10) was surveyed in the fall of 1981.

Postcards were handed out at all inbound entrance ramps for a 12-hour period. These cards were given to about 50 percent of the entering traffic. A return rate of about 35 percent was realized. A limited number of questions such as trip origin, trip destination and type of vehicle were included on this survey which was also coded by ramp location and time of day. Vehicle

occupancy was also recorded by the survey crew. The origin-destination information may be obtained by contacting:

John Mounce
Texas Transportation Institute
The Texas A&M University System
College Station, Texas 77843

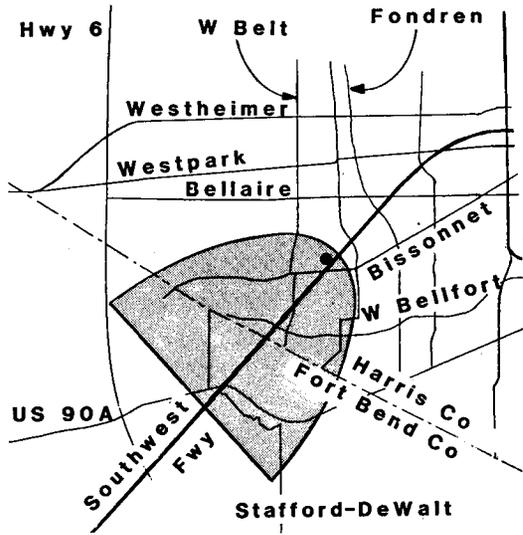
Home Mail-Out Surveys

As part of park-and-ride survey work performed by the Texas Transportation Institute for the State Department of Highways and Public Transportation and the Metropolitan Transit Authority, approximately 5000 surveys were mailed to residents in three Houston freeway corridors, namely the North, Southwest, and Gulf Freeways (Figure 4). Most of the findings of these surveys as well as the survey instruments are documented in Research Reports 205-11 and 205-16. A return rate of about 45 percent was realized. An additional mail-out was performed by the Metropolitan Transit Authority in the vicinity of Katy. That material is available from:

Dennis Christiansen
Texas Transportation Institute
The Texas A&M University System
College Station, Texas 77843

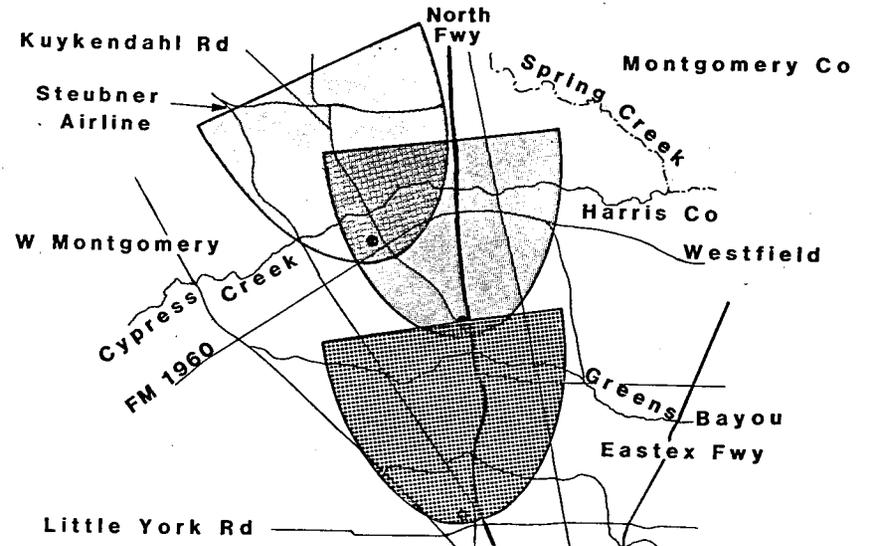
or

Chuck Fuhs
Metropolitan Transit Authority
P. O. Box 61429
Houston, Texas 77208



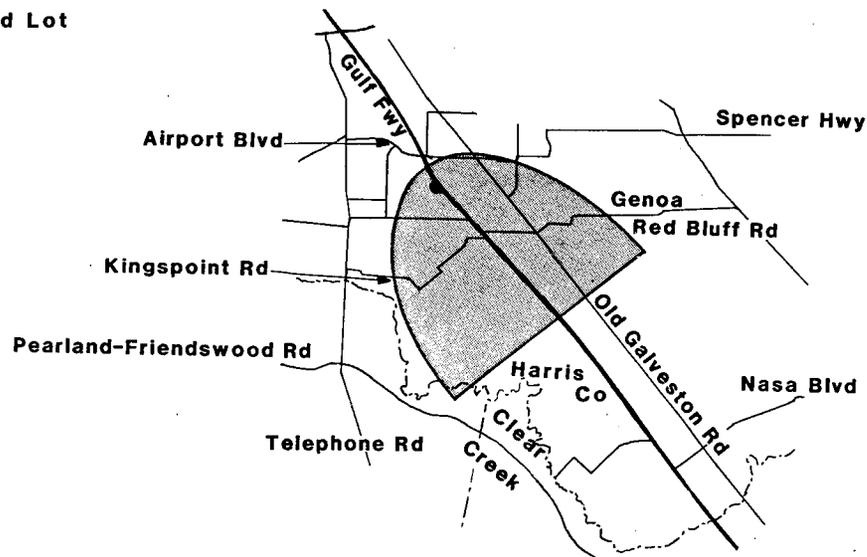
LEGEND

-  Westwood Lot Market Area
-  Westwood Lot



LEGEND

- Market Areas
-  North Shepherd
 -  Kuykendahl
 -  Champions
 -  Park-and-Ride Lot



LEGEND

-  Edgebrook Lot Market Area
-  Edgebrook Lot

Figure 4: Market Areas for Home Mail-Outs, Houston Park-and-Ride Surveys

VANPOOL DEMAND ESTIMATION GUIDELINES

At present, approximately 2000 vanpools are operating in the Houston area. This is equivalent to about one vanpool per 1500 population for the urban area. A recent survey in one area of Houston by MTA suggests that the demand for vanpooling may be greater than the present supply (Table 1). This survey also found large increases in persons desiring to ride buses (e.g., while 0% of persons currently travelling to Greenway Plaza used the bus, 25% stated that was their preferred mode). In spite of this large stated preference for buses, the percentage preferring to vanpool still, in general, increased.

Table 1: Current and Preferred Commuting Mode, Katy Area

Destination (Figure 2)	Percent Currently Commuting by Vanpool	Percent Preferring to Commute by Vanpool
Downtown	11.9%	15.2%
Galleria	3.8	13.7
Greenway Plaza	14.1	14.1 ¹
Medical Center	18.4	15.8 ²
Total, All Destinations (incl. destinations not shown in Table)	4.5	10.2

¹ Vanpooling percentage remains constant due to 25% increase in bus transit percentage.

² Vanpooling percentage declines due to 26% increase in bus transit percentage.

Source: Metropolitan Transit Authority, "Katy Area Transit Survey", June 1981.

It might be interpreted from the data in Table 1 that, for person travel from outlying areas (the Katy area is located about 20 miles west of downtown)

to major activity centers, between 10% and 20% will choose to vanpool. Information presented subsequently in this report offers further substantiation of these percentages. Data shown previously suggest that the one-way trip distance needs to be about 15 miles for vanpooling to become attractive.

Several relatively independent techniques exist that can be used to provide estimates of the current demand for vanpooling. The remainder of this section is divided into the following major parts.

- Data from existing HOV lane projects.
- Home Survey Data, Houston.
- Freeway Origin-Destination Data, Houston.

Existing HOV Lane Projects

Data from existing exclusive lane HOV projects suggest that pooling demand (as opposed to bus demand) represents roughly 45% of total HOV person movement demand (Table 2). This implies that, to obtain a "ballpark" estimate of pooling demand, if either total HOV lane demand or bus demand is known, a pooling demand can be calculated using the percentages in Table 2. The percentages shown in Table 2 are generally consistent even though different definitions of pooling are used on the various projects. This would appear to be the case since, as the occupancy requirements for pooling are reduced, the vehicle utilization of the lane will significantly increase, but the total person movement will not exhibit the same level of increase.

On the contraflow lane in Houston, during the peak period (2.5 hours), there are about 100 bus trips and 375 van trips, or 3.75 van trips per one bus trip. Approximately 60% of those trips take place in the peak hour.

I-45N Contraflow, Houston

Buses and vanpools are the only authorized users of the contraflow lane.

Table 2: Bus and Pool Utilization of Exclusive High-Occupancy Vehicle Lanes

Project and Time Period	Bus Passengers		Vanpool/Carpool Passengers		Total Passenger	
	No.	%	No.	%		
Houston, I-45 Contraflow (buses and vanpools) 6:00-8:30 a.m.	4,350	56%	3,350	44%	7,700	
Shirley Highway, Wash. D.C. (buses and 4+ carpools)	7:00-8:00 a.m.	11,800	52	11,000	48	22,800
	6:00-9:30 a.m.	23,700	55	19,700	45	43,400
El Monte Busway, Los Angeles (buses and 3+ carpools) 6:00-10:00 a.m.	7,600	52	7,200	48	14,800	

Sources: Contraflow Lane, Metropolitan Transit Authority, Houston
 Shirley Highway, Virginia Department of Highways and Transportation
 El Monte Busway, California Department of Transportation

Figure 1 indicates the substantial growth that has occurred in vanpooling, Table 2 indicates the current extent of that vanpooling. In recent months, the number of vans using contraflow has increased at a rate of approximately 1.5% per month.

Modal Split

The contraflow lane primarily serves traffic destined to downtown Houston. The contraflow lane begins 9.6 miles north of downtown; no intermediate access/egress exists between the northern terminus and downtown.

The following data are relevant in estimating the modal split (percentage of person movement to downtown travelling by vanpool) at the northern end of the contraflow lane

- A total of approximately 25,000 person work trips enter downtown from the North Freeway (I-45N). At the northern terminus of the lane (9.6 miles north of downtown) approximately 14,000 work trips

utilize this facility (Source: Houston Corridor Study, prepared for Metropolitan Transit Authority by Texas Transportation Institute, page 31, July 1979).

- Of the 375 vans using contraflow, approximately 70%, or 262, are destined to the CBD (Source: MTA contraflow surveys).
- The average vanpool has an occupancy of 8.9 persons (Source: MTA contraflow surveys). Thus, the contraflow lane moves about 2330 persons (262 x 8.9) to the CBD in vans. The modal split at the northern end of the contraflow lane is 16.6% (percent using vanpools).

The 16.6% modal split number occurring at the northern terminus of contraflow is consistent with the modal split values for the Katy (I-10) corridor shown in Table 1.

Modal Split Versus Distance from Downtown

As documented previously, vanpooling primarily serves long-distance trips. Thus, most of the van trips using contraflow lane have travelled a considerable distance in the corridor before arriving at the northern terminus of contraflow.

Table 3 summarizes vanpool travel to downtown and total travel to downtown on I-45N, based on distance from the central business district. Figures 5 and 6 graphically present those data.

Due to the characteristically longer trip lengths using vanpools, the percentage of total CBD person work trips being served by vanpools on a given roadway increases with increasing distance from downtown. As shown in Figure 6, while vanpools are serving 16.6% of total CBD work trips on I-45N at the northern terminus of the contraflow lane (9.6 miles from downtown), at a distance of 30 miles from downtown approximately 30% of the CBD person work trips on I-45N are served by vanpools. Of all the work trips arriving downtown on I-45N, 9.3% are in vanpools.

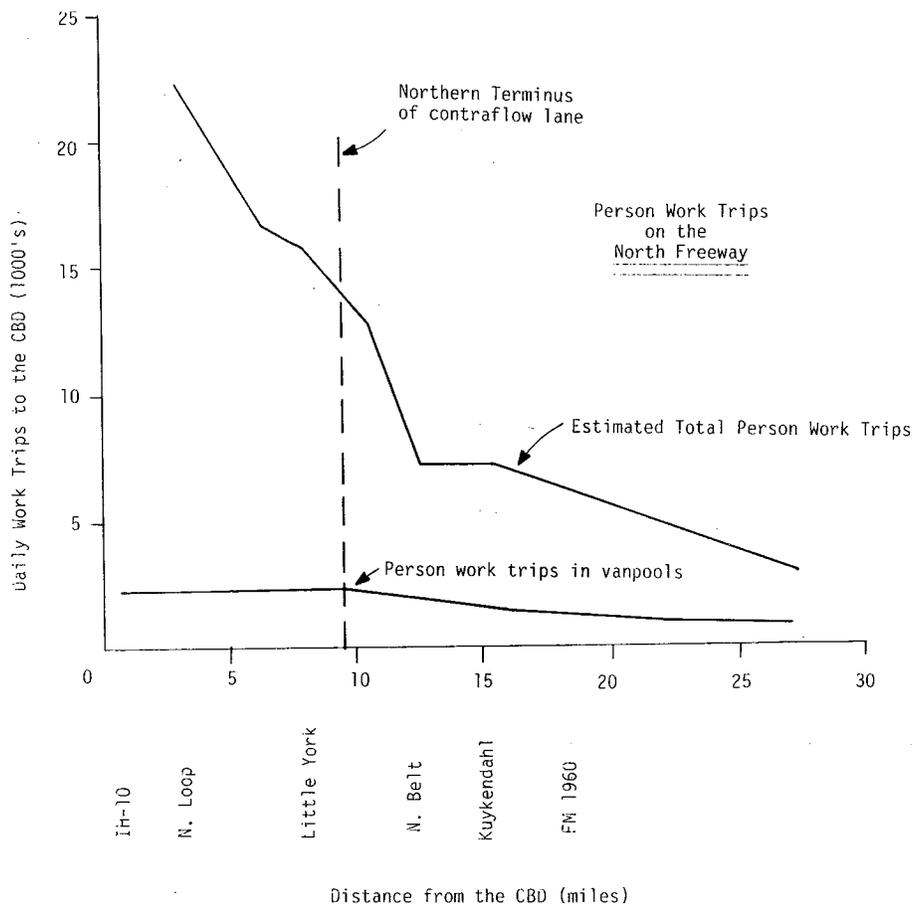


Figure 5: Estimated Person Work Trips to the CBD on the North Freeway, Total and vanpool Trips

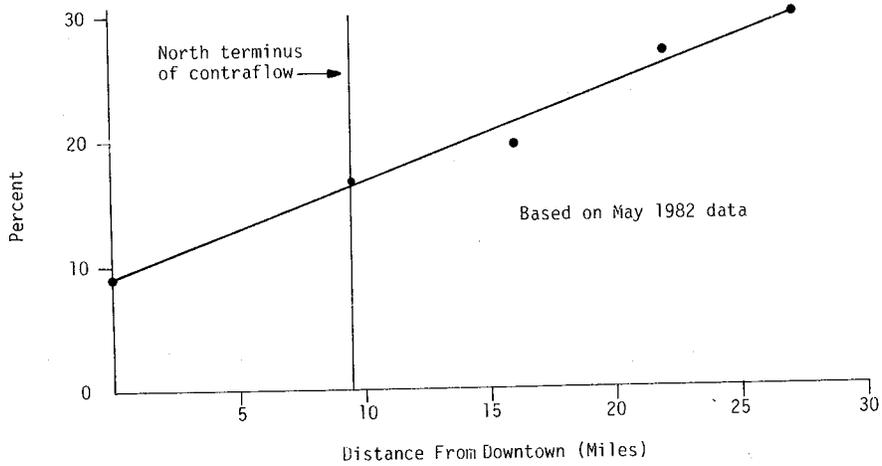


Figure 6: Vanpool Person Trips as a Percent of Total Person Work Trips to Downtown on I-45N, By Distance From Downtown, Based on Contraflow Lane Vanpool Data

Table 3: Estimated Person Work Trips to Downtown Houston on I-45

Distance from Downtown (Miles)	Total Trips on I-45N	Vanpool Trips on I-45		
		No. of Vans	No. of Persons	% of Total
0	25,000	262 ¹	2,330	9.3%
10	14,000	262	2,330	16.6
16	7,500	164	1,459	19.5
22	4,500	139	1,237	27.9
27	3,000	101	899	30.0

¹This assumes no vans enter I-45 between downtown and the northern terminus of contraflow. In actuality, an unknown number of vans do enter I-45, particularly from I-610.

Estimated from the following sources:

Houston Corridor Study, Prepared for MTA by TTI, July 1970.

Results of Contraflow Vanpool Surveys, Prepared by MTA, March 1980.

Home Mail-Out Survey Data

As part of park-and-ride studies performed in the Houston area for Project 205, surveys³ were mailed to residents living in selected park-and-ride lot market areas. A portion of this survey was used to identify the means of travel used by the residents to major activity centers in the Houston area.

The park-and-ride market areas into which the surveys were mailed are shown in Figure 4. Table 4 summarizes the percentage of persons using vanpools to travel to the particular activity centers.

These data are generally consistent with the data shown in Figure 6 in that the percentage of persons using vanpools is highest for the area (Champions) located the greatest distance from downtown. The values in Table 4 do not

³A more detailed description of these surveys is included in Research Report 205-15. Specific questions asked and survey instruments used are included in that report.

Table 4: Vanpool Mode Split Data, Travel to Downtown, Based on Home Mail-Out Surveys, January 1981 Data

Freeway Corridor	Distance to CBD (miles)	Percent of Person Trips By Vanpool
Gulf	10	8%
Southwest	14	8
North N. Shepherd	10	9
Kuykendahl	16	8
Champions	21	14

reflect the growth that has occurred in vanpooling since the date of the survey. On a citywide basis, vanpooling has increased by about 33% (Figure 1) since the survey; however, for the North Freeway corridor, vanpooling has increased by about 67% since the survey was undertaken (Figure 1). To update the original home survey data to make it compatible to the Figure 6 data, it might be assumed that the modal split values presented in Table 4 would increase by the same percentage as the increase in operating vanpools.

For activity centers other than the CBD, a sufficient number of responses was not received to show modal split by corridor; for several activity centers, the response rate was also too low to be significant. However, by combining the responses from all of the corridors noted in Table 4, some additional modal split data can be obtained for the Galleria Post Oak complex. This information is summarized in Table 5.

Table 5: Percent of Trips to Major Activity Centers Made by Vanpools,
Based on Home Mail-Out Surveys

Activity Center	Percent of Trips By Vanpool
All major activity centers	9%
Downtown Houston	12
Galleria	8

Note: Based on responses from market areas shown in Figure 4.

Origin-Destination Survey Data

Origin-destination surveys⁴ have been performed at entrance ramps on both the Southwest (US 59) and Katy (I-10) Freeways. Unlike the North Freeway (I-45) which has the contraflow lane, neither of these facilities has a priority lane for vanpools. Two priority entry ramps for buses and vanpools are available on the Southwest Freeway.

Postcards were handed to each vehicle entering the freeway. Based on the returned postcards, vehicle and person movements (origin-destination), by ramp, were recorded. The return rate (postcards returned versus postcards distributed) was approximately 35%.

Due to the relatively low volume of vanpools (less than 2% of the entering vehicles at several ramps), the return rate makes it difficult to analyze data on a ramp by ramp basis. However, on a total facility basis, it is possible to

⁴More detailed descriptions of these surveys are included in the following references.

"Southwest Freeway Origin-Destination Survey." Prepared for State Department of Highways and Public Transportation by Texas Transportation Institute, 1981.

"Katy Freeway Origin-Destination Study." Prepared for State Department of Highways and Public Transportation by Texas Transportation Institute, January 1982.

aggregate data collected from all ramps. In performing this analysis, only vans with 5 or more occupants were considered to be "vanpools." All vans with fewer than 5 occupants were omitted from the analysis.

Tables 6 and 7 summarize the analysis of all vehicles and person trips entering the study freeways and destined to specific activity centers.

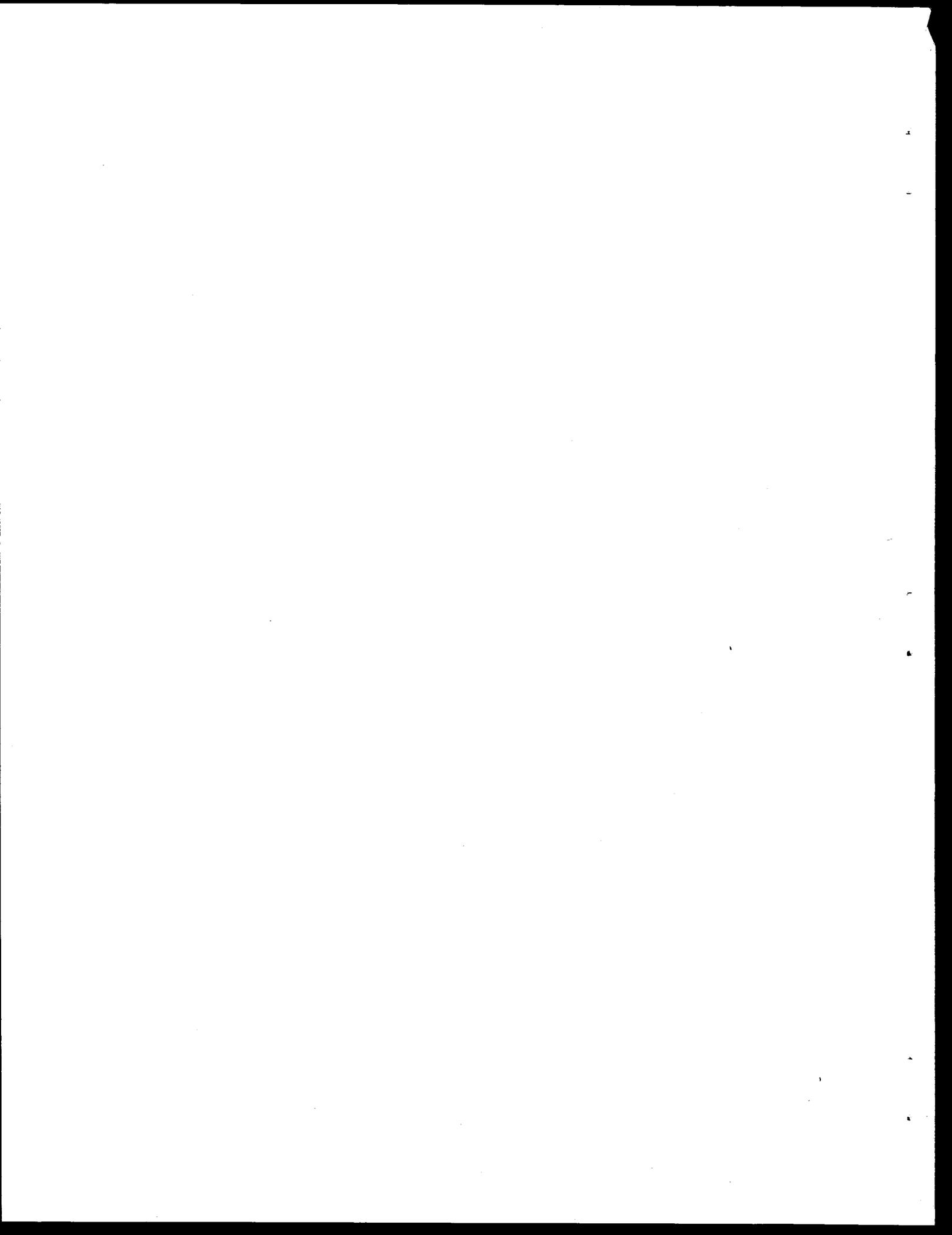
Table 6: Southwest Freeway (US 59) Modal Split By Vanpool to Specific Houston Activity Centers, Based on Freeway Origin-Destination Surveys, A.M. Peak Period

Activity Center	Vehicle Trips			Person Trips		
	Total	Van	% Van	Total	Van	% Van
Downtown	4874	45	0.9%	6861	481	7.0%
Greenway Plaza	2067	34	1.6%	2863	368	12.9%
Galleria Post Oak	1093	5	0.5%	1347	51	3.8%

Table 7: Katy Freeway (I-10) Modal Split By Vanpool to Specific Houston Activity Centers, Based on Freeway Origin-Destination Surveys, A.M. Peak Period

Activity Center	Vehicle Trips			Person Trips		
	Total	Van	% Van	Total	Van	% Van
Downtown	4222	44	1.0%	5584	467	8.4%
Greenway Plaza	412	1	0.2%	608	14	2.3%
Galleria Post Oak	1616	2	0.1%	1942	20	1.0%

For freeway person trips to the major activity centers, the percentage served by vans ranges from 1 to 13. For the major downtown activity center, this percentage is in the 7 to 9 range.



MAJOR FINDINGS

In congested major travel corridors, a significant percentage of travel to large activity centers can be served by high-occupancy vehicles. Data presented in this study relate to vanpooling and were primarily collected in Houston, Texas. Houston is considered the "vanpool capital of the world," with approximately 2000 vans currently in operation. That represents about 1 van per 1500 persons in the metropolitan area.

Data collected from 3 exclusive lanes for high-occupancy vehicle projects--the I-45 contraflow lane in Houston, the Shirley Highway in Washington, D.C., and the El Monte Busway in Los Angeles--show that buses generally move 55% of the person trips with pools moving the other 45%. These percentages were reasonable consistent for all projects even though the definition of a pool was different for all 3 projects. The Houston project allowed only vanpools to use the lane in addition to buses. On that project, 3.75 vans operate for each 1 bus.

A variety of data were collected that show the modal split (percentages of person movement to major activity centers) for vanpools. These data are reasonably consistent for travel to downtown, since all freeways considered provide about equal access to the CBD. Since the different freeways provide different accessibility to other major activity centers, the modal split percentages are also different between freeways.

Table 8 summarizes the modal split data for travel to downtown. Two percentages are shown. One is the percentage determined in the study, the other is an attempt to update that percentage to reflect increases in vanpooling that have occurred since the study date.

Table 8: Summary of Modal Split Data for Travel to Downtown By Vanpool, Houston Data

Study and Corridor	Percent of Peak-Period Total Person Work Trips (By Van)	
	Study Data	Updated Data ¹
<u>Katy Corridor</u>		
● Survey in residential area ~20 mi. from CBD, located west on I-10	11.9	15.0
● Origin-Destination survey at freeway entrance ramps between CBD and Brookshore (35 miles west of CBD)	8.4	10.0
<u>I-45N Corridor</u>		
● Surveys based on contraflow lane utilization	9.3	9.3
● Vicinity of N. Shepherd Park-and-Ride lot, ~10 miles from CBD	9.0	15.0
● Vicinity of Kuykendahl Park-and-Ride lot, ~16 miles from CBD	8.0	13.4
● Vicinity of Champions Park-and-Ride lot, ~21 miles from CBD	14.0	23.4
<u>Southwest Freeway</u>		
● Vicinity of Westwood Park-and-Ride lot, ~14 miles from CBD	8.0	12.1
● Origin-destination survey at freeway entrance ramps between CBD and county line (~13.5 miles southwest of CBD)	7.0	9.6
<u>Gulf Freeway</u>		
● Survey in vicinity of Edgebrook Park-and-Ride lot, ~10 miles from CBD	8.0	12.1

¹ Due to the rapid growth of vanpooling in Houston, an attempt was made to "update" the original survey data to account for that growth. This update was done simply by factoring the study data percentage upward based upon the estimated growth in vanpooling in the corridor since the survey. Updated data reflect June 1982.

The data in Table 8 lead to several general conclusions. The original survey data, which due to subsequent growth in vanpooling will be conservative estimates of vanpool modal split, suggest vanpools serve about 10% of total person trips to the downtown. The crude procedures used to update the original survey data would suggest that vanpools are now typically serving 12% to 15% of work trips.

One other point is also apparent from the Table 8 data. Since vanpool trips are relatively long trips, as distance from downtown increases so does the percentage of trips served by van. For example:

- In the North Freeway (I-45) corridor, the modal split in the vicinity of the Champions park-and-ride lot, located the greatest distance from downtown, is highest;
- In the Katy corridor, the modal split in the vicinity of the City of Katy, located over 20 miles from downtown, is greater than the modal split identified through an origin-destination survey at all ramps between the downtown and Katy; and
- In the Southwest corridor, the modal split in the vicinity of the Westwood Mall park-and-ride lot is greater than the split identified through an origin-destination survey at all ramps from downtown to 13 miles southwest of downtown.

