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16. Abstract

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To increase potential utilization, a decision was made to permit authorized 4+ carpools to begin using the AVL on a test basis in April 1985. This research study, funded jointly by the Metropolitan Transit Authority of Harris County and the Texas State Department of Highways and Public Transportation, was initiated to undertake a comprehensive analysis of the effects of permitting carpool utilization.

This report documents the data collected in March 1985 before carpool utilization of the AVL was permitted. Comprehensive traffic data, both on the AVL and the freeway, were collected. In addition, surveys of transit users on the AVL, vanpool drivers on the AVL, vanpool passengers on the AVL and motorists not using the AVL were undertaken. Those data, in addition to a state-of-the-art assessment, are documented in this research report.

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THE IMPACTS OF CARPOOL UTILIZATION ON THE KATY FREEWAY AUTHORIZED VEHICLE LANE "BEFORE" DATA

by
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Research Engineer
and
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Research Engineer

Research Report 484-1

An Evaluation of the Impact of Permitting
Carpools to Use the Katy Transitway
Research Study Number 2-10-85-484

Sponsored by
Metropolitan Transit Authority of Harris County
and
State Department of Highways and Public Transportation

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

December 1985

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
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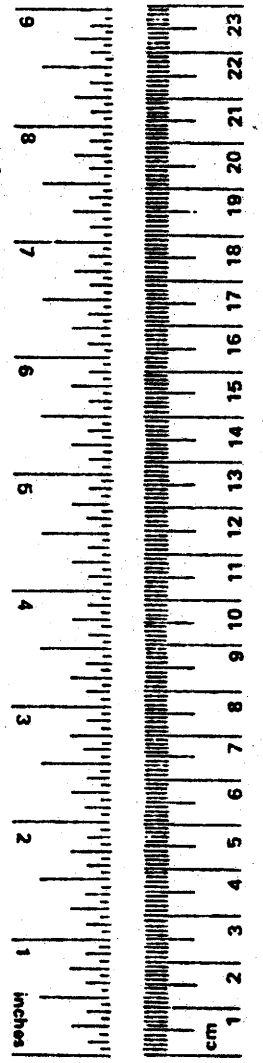
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C



Approximate Conversions from Metric Measures

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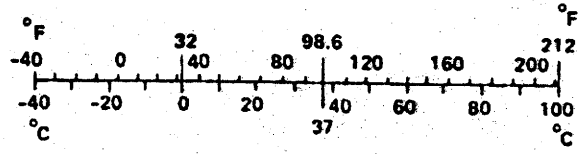
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	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.

ABSTRACT

A major commitment has been made in the Houston area to develop median, physically separated authorized vehicle lanes. The lanes are reserved for specially authorized high-occupancy vehicles. To date, only buses and vanpools have been permitted to use the special lanes.

Phase 1 of the first completed authorized vehicle lane (AVL) opened on the Katy Freeway (I-10) in October 1984. Since that is the first of many such lanes, in some respects it is being used as a laboratory to determine desirable approaches for operating the AVL facilities.

To increase potential utilization, a decision was made to permit authorized 4+ carpools to begin using the AVL on a test basis in April 1985. This research study, funded jointly by the Metropolitan Transit Authority of Harris County and the Texas State Department of Highways and Public Transportation, was initiated to undertake a comprehensive analysis of the effects of permitting carpool utilization.

This report documents the data collected in March 1985 before carpool utilization of the AVL was permitted. Comprehensive traffic data, both on the AVL and the freeway, were collected. In addition, surveys of transit users on the AVL, vanpool drivers on the AVL, vanpool passengers on the AVL and motorists not using the AVL were undertaken. Those data, in addition to a state-of-the-art assessment, are documented in this research report.

This is the first of a series of reports to be prepared as part of this research effort.

Key Words: High-Occupancy Vehicle Lanes, Transitways, Busways, Carpools, HOV Facilities, Authorized Vehicle Lanes

SUMMARY

As part of efforts by the Metropolitan Transit Authority of Harris County (METRO) and the Texas State Department of Highways and Public Transportation (SDHPT) to maintain mobility, Houston is in the process of implementing an extensive freeway transitway program. These transitways are typically located in the freeway median, are about 20-feet wide, are one-lane reversible, and are separated from the mixed-flow traffic lanes by concrete median barriers.

Little experience exists in the planning, design, and operation of this type of facility; in many cases, it has been necessary to develop guidelines as the planning and design process progressed. The same type of process will be necessary in learning how to operate the transitways.

The first fully completed transitway opened on the Katy Freeway (I-10) in Houston in October 1984. Phase 1 of that facility, about 5 miles in length, is now in operation. In some respects, this section of transitway is serving as a laboratory to test different approaches for operating the transitways.

Based on the experience with the contraflow lane on the North Freeway (I-45N), only authorized buses and vans were allowed to use the Katy Transitway. This resulted in fewer than 100 vehicles using the transitway in the peak hour, and a perception developed that the transitway was underutilized.

In response to this perception, a decision was made to allow authorized 4+ carpools to use the transitway on a test basis. Numerous concerns were expressed over the possible impacts of carpools on transitway utilization, level-of-service, and operations. As a result, the carpool use was established as an experiment. This study, jointly funded by METRO and SDHPT, was initiated to carefully analyze and evaluate the impacts of carpool utilization of the transitway on both the transitway and the mixed-flow lanes.

The data presented in this report were collected in March 1985; carpool utilization of the transitway began in April 1985. Thus, this report documents the "Before" data base.

State-of-the-Art Overview

Other high-occupancy vehicle (HOV) priority projects implemented elsewhere in the United States were reviewed. At least 8 of those projects found it necessary to change the definition of eligible high-occupancy vehicles in order to either increase HOV lane utilization and/or decrease the violation rate in the HOV lane.

The following five observations are most relevant to the Houston study.

1. With the exception of contraflow lanes where carpools are excluded for safety reasons, the Houston transitways are the only freeway HOV lanes that do not allow some cars onto the lanes.

2. Houston is the only city that requires authorization to use HOV lanes.

3. The only project that has successfully maintained a 4+ carpool definition is the Shirley Highway serving Washington, D.C. Other projects define carpools as either 2+ or 3+. The District of columbia, served by the Shirley Highway, has approximately 70% more office space than does downtown Houston. Outside of the peak hour, there are currently proposals to lower the 4+ definition on the Shirley HOV lanes.

4. There is reason to believe that allowing carpool utilization of the transitway will increase total person movement on the priority lane. In all instances where the carpool definition has been changed to allow more carpools to use the HOV lane, total person movement in the priority lane increased.

5. On at least two HOV projects, over time carpool volumes have increased to the point where level-of-service in the priority lane(s) is threatened. This is a concern in Houston since, for successful transitway projects, over the first five years utilization can be expected to increase at annual rates of approximately 40%.

Evaluation Criteria

Since carpools are being allowed on the Katy Transitway on an experimental basis, the general criteria for assessing the "success" of this experiment were agreed to in advance. These criteria are shown in Table S-1.

Traffic Data Collection and Analysis

The effects of changes in the design and operating regulations of the Katy AVL are measured in terms of travel times, volumes, speeds and incidents. Most of the traffic data presented in this report was collected before the AVL was opened to authorized carpools on April 1, 1985. However, since the AVL was to be extended 1.7 miles to the West Belt overpass on May 2, 1985, the data were collected in a manner that makes it possible to measure the changes in travel time to AVL users. Some of the benefits of the extended AVL length were measured and are discussed in this report.

The operational characteristics are classified according to whether persons and vehicles are authorized (AVL Traffic) or not authorized (Non AVL Traffic) to use the AVL.

The travel time studies determined that time savings to the AVL traffic vary greatly by time of day, with an average reduction of 7 minutes in the morning and 8 minutes in the afternoon.

Traffic volumes were collected on the access ramps to the freeway and arterial streets that are used by AVL traffic, the mainlanes of the freeway, and the AVL. The vehicular volumes (vans and buses) on the AVL are less than

Table S-1. Criteria For Judging the Success of the Katy AVL Carpool Experiment

Proposed Evaluation Factor	Proposed Relative Weighting	Resulting Impact
1. Change in Person Movement on the Katy AVL directly attributable to carpooling	25	Highly Successful: Total AVL person movement increases by at least 20% due to carpooling Successful: Person movement increases by between 5% and 20% Somewhat Unsuccessful: Person movement essentially unchanged (0% to 5% increase) Highly Unsuccessful: Person movement decreases.
2. Non-User Perception of Katy AVL Utilization	30	Highly Successful: At least 70% of non-users respond that AVL is sufficiently utilized. Successful: Between 50% and 70% of non-users respond that AVL is sufficiently utilized. Somewhat Unsuccessful: Between 50% and 70% of non-users respond that AVL is not sufficiently utilized. Highly Unsuccessful: More than 70% of non-users respond that AVL is not sufficiently utilized.
3. Change in Average Travel Time On the AVL	20	Highly Successful: No change. Successful: Average travel speed decreases by no more than 3 mph. Somewhat Unsuccessful: Average travel speed decreases by between 3 mph and 6 mph. Highly Unsuccessful: Average travel speed decreases by more than 6 mph.
4. Change in Person Delay to Mixed-Flow Traffic	15	Highly Successful: No change or a decrease in total delay. Successful: Delay increases by less than 5%. Somewhat Unsuccessful: Delay increases by 5% to 10%. Highly Unsuccessful: Delay increases by more than 10%.
5. Increase in Frequency of Breakdowns on the AVL	5	Highly Successful: None. Successful: Less than 5%. Somewhat Unsuccessful: Increase by between 5% and 15%. Highly Unsuccessful: Increases by more than 15%
6. Increase in Authorization and Enforcement Costs	5	Cost values need to be developed by METRO.

In this matrix, items #1 3, and 4 indirectly address change in total corridor delay. In this matrix, item 5 indirectly addresses trip reliability.

150 vehicles during each of the 3-hour operating periods. Even though the person volume is significant (2500), the impact of the relatively low AVL vehicle volume on freeway volumes is difficult to measure because of the normal variation in traffic flow. The normal daily use of the AVL is 60 buses and 90 vanpools.

Operating conditions experienced by the AVL traffic on the AVL are, for the most part, free flow. Headway studies at the entrance and exit to the AVL indicate that the speeds of 15% of the AVL traffic may be affected by other vehicles. The travel speeds on the AVL average 52 MPH for buses and 56 MPH for vans, with an overall average speed of 55 MPH.

On the freeway mainlanes in the sections adjacent to the AVL, the Non AVL traffic has average speeds of 26 MPH in the morning and 25 MPH in the afternoon.

The AVL has had no incidents during the first five months of operation, and the Non AVL traffic has had typical accident experience. In the freeway section adjacent to the AVL, at least one accident occurs during 10% of the morning peak periods and 30% of the afternoon peak periods. During these incidents and others involving disabled vehicles that block a freeway lane, the travel time savings to the AVL traffic can increase by 2 or 3 times the normal rate.

For the 5 months of operation prior to the introduction of carpools, the Katy AVL has provided time savings that exceed the level of 1 minute per mile of transitway recommended in previous Federal Highway Administration research. The usage of the priority lane by buses and vanpools is at comparable levels to the first months of operation of the North Freeway contraflow project. Based on accident experience, it appears that the design of the AVL and the resultant restrictions to the normal freeway roadways have not resulted in unsafe operations.

Surveys of Transitway Users and Non Users

In addition to the traffic data collection, surveys of both users and non users of the transitways were undertaken. Surveys were conducted of: 1) patrons on transit buses using the transitway; 2) drivers of vanpools using the transitway; 3) passengers in vanpools using the transitway; and 4) motorists on the Katy Freeway mixed-flow lanes not using the transitway.

Mode Choice

In several respects, the personal and trip characteristics of both transitway users and non users are similar (Table S-2). Perhaps the important difference is trip destination. While virtually all transit trips are to downtown, less than half of total trips are to downtown. Increased transitway service to employment centers other than downtown could offer a means of increasing transitway utilization.

A major concern associated with allowing carpools on the transitway is the number of transit and vanpool users who will switch to carpools. On the El Monte Busway in Los Angeles, as many as 25% of carpoolers were former transit patrons.

In reviewing the previous mode of travel for transit patrons and vanpooler, the largest percentage previously drove alone (Table S-3). The park-and-ride service had attracted 16% of its ridership from vanpools or carpools. The vanpools had attracted 15% of their ridership from buses and 22% from carpools. Thus, the vanpool to park-and-ride bus mode switch was 7% of resulting bus ridership; the bus to vanpool mode switch was 15% of resulting vanpool ridership. Combining this finding with the response to the question of whether the survey respondent will switch to a 4+ carpool once 4+ carpools are allowed on the transitway, it appears that the modal "overlap" in Houston may be smaller than the 25% found in Los Angeles. In fact, if the survey data are accurate, the volume of 4+ carpools attracted to the transitway may be small, and the primary source of that volume will be carpools currently operating in the mixed-flow lanes. Most commuters can identify several factors that make their current commuting mode attractive to them.

Table S-2. Personal and Trip Characteristics of Survey Respondents

Characteristic	Transitway Users		Non Transitway Users
	Transit	Vanpool	Motorists
Age, years (50th Percentile)	33	36	40
Sex, % Male	49%	52%	64%
Education, years (average)	15.6	15.4	15.7
Occupation			
% Professional	56%	55%	51%
% Managerial	13%	21%	19%
% Clerical	21%	20%	9%
% Sales	4%	2%	12%
Trip Purpose, Percent Work	99%	100%	94%
Trip Frequency (5 or more days/week)	91%	95%	84%
Trip Destination			
Downtown	96%	70%	38%
Galleria/City Post Oak	0%	11%	24%
Texas Medical Center	1%	5%	9%
Greenway Plaza	0%	3%	8%
University of Houston	3%	0%	2%
Percent of Home Zip Codes (origin) in 77079, 77084, or 77449	46%	44%	31%

Table S-3. Factors Influencing Mode Choice, Survey Respondents

Factor	Transitway Users		Non Transitway Users
	Transit	Vanpool	Motorists
Previous Mode of Travel			
Drove Alone	44%	34%	----
Carpool or Vanpool	16%	35%	----
Bus	10%	15%	----
Didn't make Trip	27%	16%	----
Primary Reasons for Selecting Mode			
Convenience	23%	17%	17%
Traffic/Don't Like to Drive	28%	13%	0%
Cost	18%	31%	2%
Need Car for Job	----	----	22%
No Bus or Van Available	----	----	22%
% Having at least part of bus fare, van cost, or parking cost paid by employer	57%	50%	54%
Will You Change To Transitway 4+ Carpool			
Continue Present Mode	86%	93%	76%
Change to Carpool	0%	1%	5%
Not Sure	14%	6%	19%
How Important is the Transitway in Your Decision to bus or van			
Very Important	39%	25%	----
Somewhat Important	26%	16%	----
Not Important	35%	59%	----
Would You Bus or Van If There Were No Transitway			
Yes	69%	87%	----
No	15%	6%	----
Not Sure	16%	7%	----

Perceived Utilization of the Transitway

The surveys confirm that a perception exists especially among non-users of the transitways that the transitway is not sufficiently utilized (Table S-4). Of the non users of the transitway, only 3% felt the transitway was sufficiently used to justify the project. Of the vanpoolers who use the transitway, a majority felt it was not sufficiently utilized. Most, although not a majority, of transit users felt the transitway was sufficiently utilized.

Thus, it appears that the perception of utilization is a very real problem that needs to be addressed.

One final observation is appropriate. While 90% of the motorists felt the transitway was underutilized, 41% thought it was a good transportation improvement. While that is not a majority, it does exceed the 35% who indicated it was not a good improvement.

Table S-4. Perceptions of the Level of Utilization of the Katy Transitway

Measure of Effectiveness or Success	Transitway Users		Non Transitway Users
	Transit	Vanpool	Motorists
Is the Transitway Sufficiently Utilized			
Yes	49%	30%	3%
No	33%	51%	90%
Not Sure	18%	19%	7%
Is the Transitway a Good Improvement			
Yes	----	----	41%
No	----	----	35%
Not Sure	----	----	24%

IMPLEMENTATION STATEMENT

Since there is relatively little experience with operating exclusive, reversible high-occupancy vehicle lanes, many of the operating procedures and approaches to be used in Houston will be developed through experience. A key operating issue involves the type of vehicles that will be allowed to utilize the special lanes.

This study was specifically undertaken to assist the Metropolitan Transit Authority and the State Department of Highways and Public Transportation in the implementation and operation of the authorized vehicle lanes. The study, through analysis and comparison of both "before" and "after" data, assesses the impacts of permitting 4+ authorized carpools to utilize the special high-occupancy vehicle lanes.

DISCLAIMER

TABLE OF CONTENTS

TABLE OF CONTENTS CONTINUED

TABLE OF CONTENTS

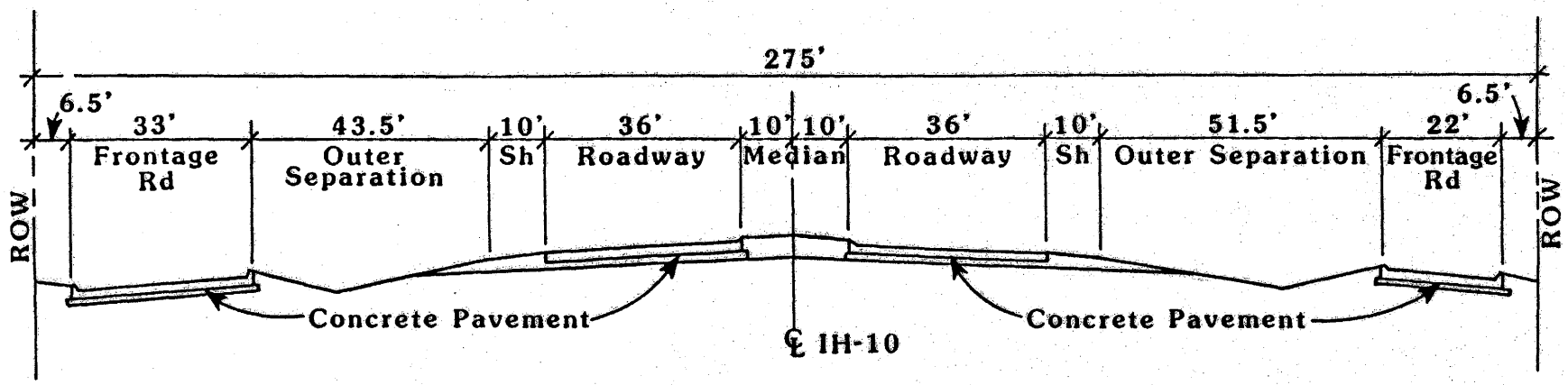
INTRODUCTION

In order to help cope with the mobility problem in the Houston area, both the Metropolitan Transit Authority of Harris County and the Texas State Department of Highways and Public Transportation have committed to developing an extensive system of transitways on freeways. The "typical" Houston transitway, which is reserved for exclusive use by authorized high-occupancy vehicles, is located in the median of a freeway, is one-lane reversible, is approximately 20-feet in width, and is separated from the mixed-flow traffic by concrete median barriers. A typical section is shown in Figure 1.

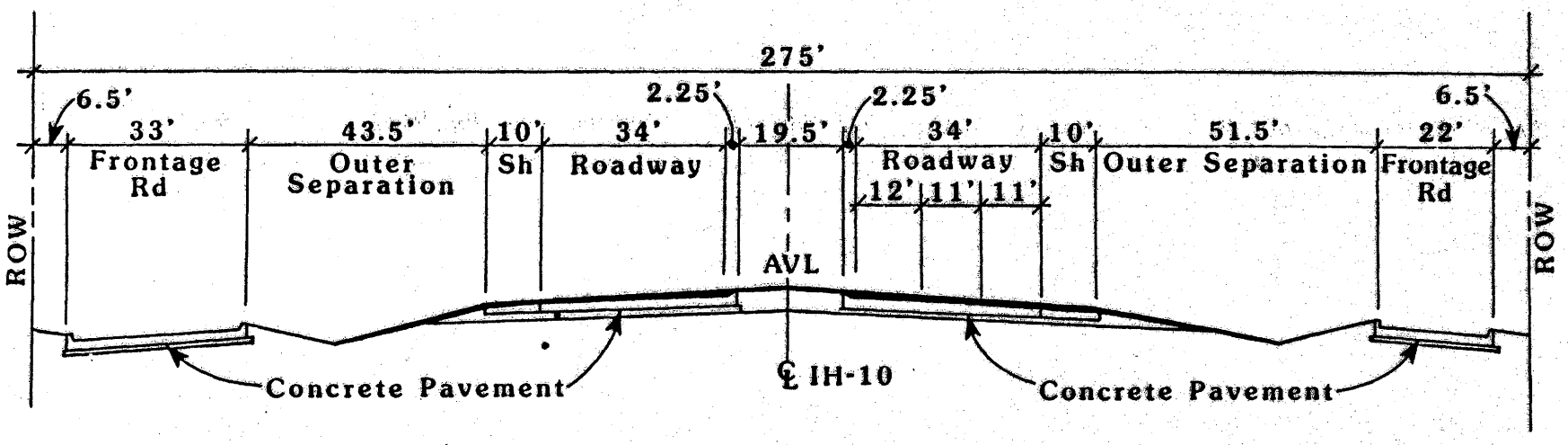
The commitment to transitways in Houston is more extensive than that of any other city. Over 40 miles of transitways are currently under construction with another 23 miles in the final planning and design stages. The ultimate commitment to transitways may result in over 100 miles of these facilities in operation with a total capital cost in excess of $1 billion. The currently committed transitway system is depicted in Figure 2.

Relatively little experience exists in the planning, design, and operation of these transitways. As a result, throughout the planning and design process it has, in effect, been necessary to develop the planning and design guidelines as the projects progressed. That same procedure will be required in establishing the desirable approaches for operating the transitway projects.

This research assists in addressing one aspect of the operational issues; that is, should carpools be permitted to use the transitway facilities.



Typical Section Before AVL Construction



Typical Section After AVL Construction

Figure 1. Typical Sections, Before and After AVL Construction, Katy Freeway Transitway

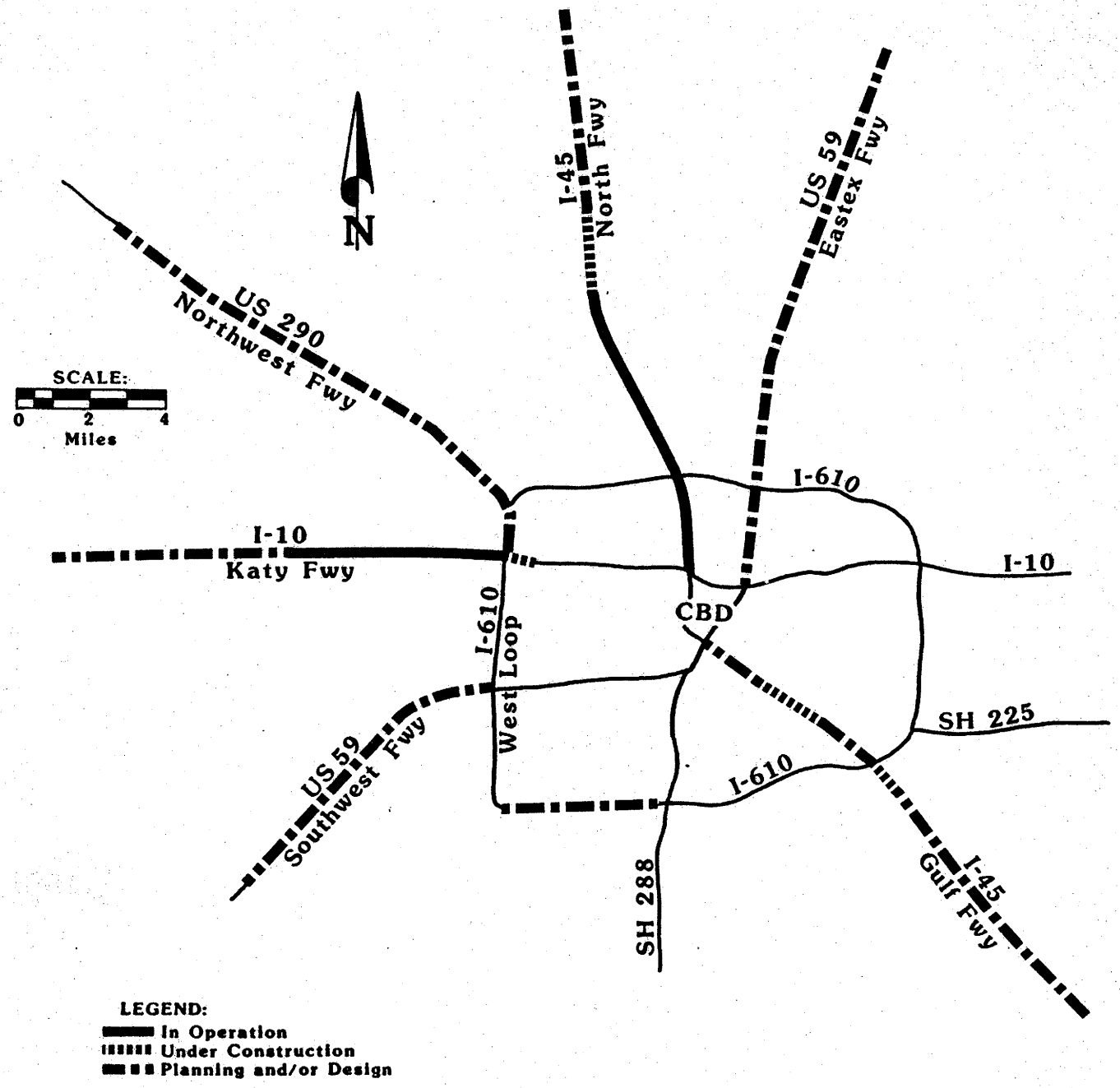


Figure 2. Current Status of the Committed Transitway System, Houston

THE PROBLEM AND ISSUES TO BE ADDRESSED

The first phase of the transitway on the Katy Freeway (I-10) in Houston became operational in October 1984. Approximately 5 miles of transitway was completed between Bunker Hill and the West Loop (I-610). The location of this section is shown in Figure 3. A detailed description of the project is available in other references (1, 2).* Since this is the first of several transitways to become operational, it is, in some respects, being used as a laboratory to test various approaches for operating these priority lanes.

The Authorized Vehicle Concept

Primarily for safety reasons, when the contraflow lane was implemented on the North Freeway (I-45N) in 1979, only vehicles authorized by METRO and the State were allowed to use the priority lane. Only buses and vanpools were considered for authorization. Authorization involved actions such as driver instruction, vehicle inspection, certain insurance requirements, and a minimum number of registered riders.

This approach worked well on the North Freeway and generated a substantial level of utilization (Figure 4). As a result, it was decided to use this same approach in operating the Katy Transitway; locally the transitways are referred to as authorized vehicle lanes. In addition to providing a level of operational control, the authorization process was considered desirable to require some sort of driver training; this is particularly desirable due to restricted geometrics associated with the AVL.

Thus, when the Katy AVL opened in October 1984, only transit buses and vanpools were allowed to use the priority lane.

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*Denotes number of reference listed at end of report.

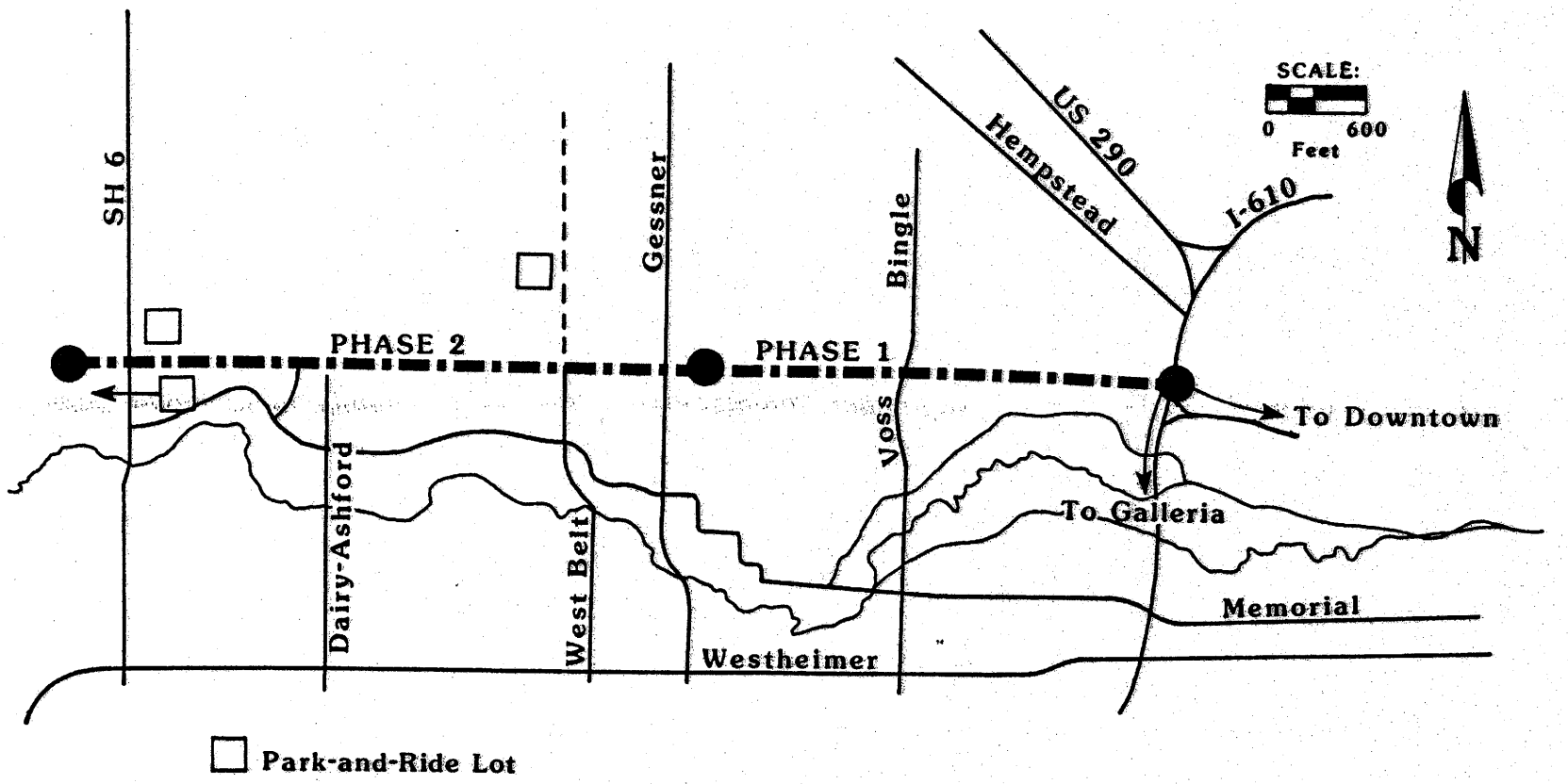


Figure 3. Katy Freeway Transitway, Phases 1 and 2

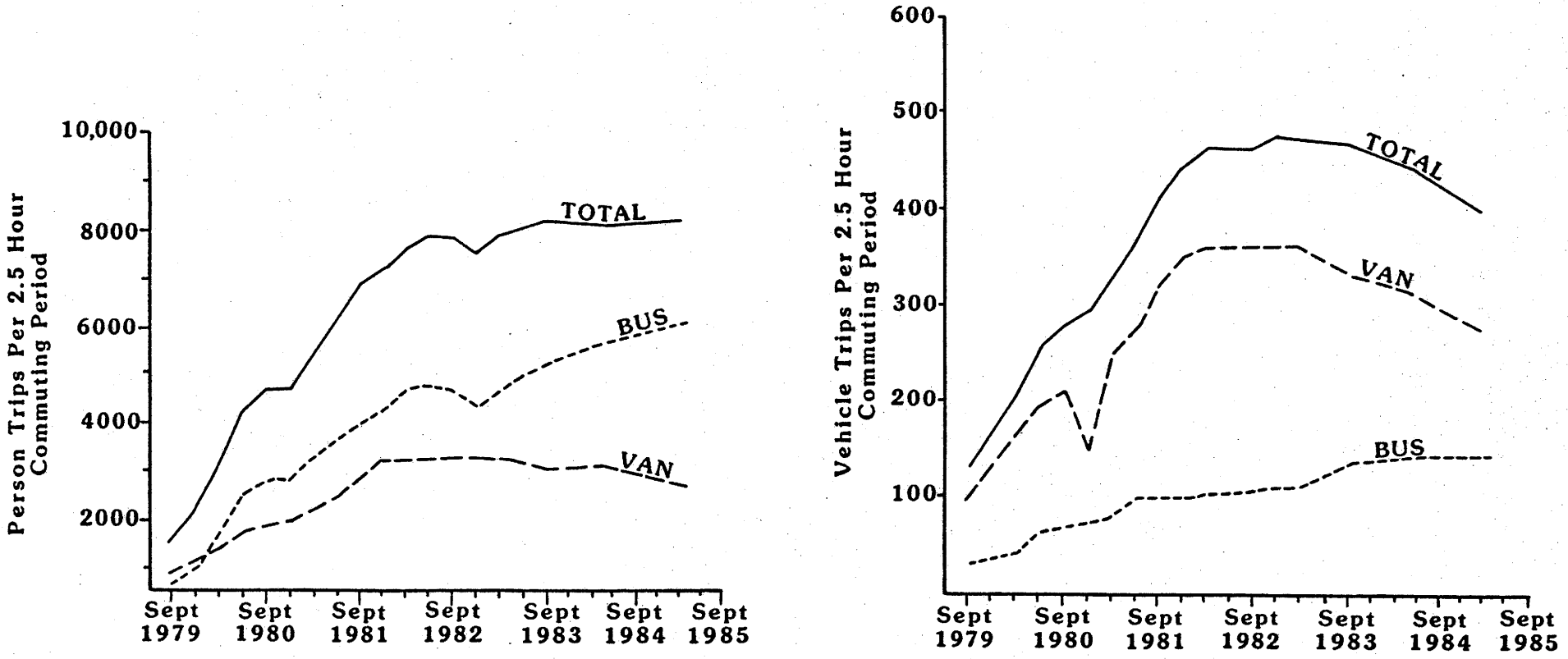


Figure 4. I-45N Contraflow Lane, Houston, Trends in Utilization

Peak-Period Utilization

The Katy Transitway, approximately 5 miles in length, does provide significant travel time savings, particularly in the p.m. peak. Actual and perceived time savings are shown in Table 1.

However, allowing only buses and vanpools onto the lane resulted in the appearance, to some individuals, of the AVL being underutilized; less than 300 vehicles used the Katy AVL on a daily basis (Table 2). Less than 100 vehicles operated on the lane during the peak hour.

A Decision to Introduce Carpools

As a possible means of increasing utilization of the Katy AVL, a decision was made to permit carpool utilization on a test basis. Authorized 4+ carpools would be allowed to use the AVL beginning April 1, 1985. Authorization for carpools involved: 1) carpools on the AVL have 4 or more persons; 2) drivers are certified and issued identification cards after passing a written test; 3) vehicles have a valid Texas inspection sticker no more than 6 months old; 4) each vehicle pass a visual inspection by METRO; 5) minimum state insurance coverage be met; and 6) drivers take at least one transitway trip in an authorized vehicle to become familiar with the AVL geometrics.

At the same time, this study was initiated to comprehensively assess the impacts of allowing carpools to utilize the priority lane.

Concerns Regarding Carpool Utilization

The objective of the transitway is to provide reliable, high speed service for authorized vehicles. In terms of priorities, the greatest attention is given to maintaining high bus operating speeds.

Due to concerns that existed over carpool utilization of the relatively narrow (19.5-feet wide) transitways, the introduction of carpools was allowed only as a test to be carefully monitored. While numerous concerns were

Table 1. Actual and Perceived Travel Time Savings, Peak Period, Katy Transitway

Actual or Perceived Time Savings	Peak-Period Travel Time Savings (minutes)	
	a.m.	p.m.
Actual Time Savings[1]	7	8
Perceived Time Savings (avg.)[2]		
Vanpool Drivers	7	13
Vanpool Passengers	8	12
Transit Patrons	9	13

[1]Source: Texas Transportation Institute travel time studies.

[2]Surveys of AVL users performed by TTI and presented in this report.

Table 2. Utilization of the Katy Transitway, January 1985

Type of Vehicle	A.M.		P.M.		Total Daily
	Peak Hour	Peak Period	Peak Hour	Peak Period	
Transit Bus					
Vehicles	23	47	16	39	86
Persons	1020	2030	740	1735	3765
Vanpools					
Vehicles	68	81	63	91	172
Persons	745	886	670	950	1836
Total					
Vehicles	91	128	79	130	258
Persons	1765	2916	1410	2685	5601

Source: Texas Transportation Institute counts.

expressed regarding carpool utilization, these concerns generally fall into two areas: 1) utilization impacts; and 2) operational problems.

Utilization Impacts

The principal objective of the transitway is to increase person movement. Allowing carpools on the lane, according to some, might: 1) simply attract riders from buses and vanpools, thereby moving no more people but requiring more vehicles; this might require a reduction in the level of bus service, resulting in a loss of more patronage; 2) the capacity of the lane is finite, and introducing carpools might exceed the capacity of the lane; the result would be a lowering of the level-of-service provided which, again, could reduce patronage.

Thus, concern existed that, by allowing carpool utilization, the best result might be moving the same volume of persons with more vehicles, while the worst result might be moving fewer people with more vehicles.

Some concern also existed that the level of AVL utilization necessary for the AVL to appear sufficiently utilized to mixed-flow traffic was greater than the capacity of the AVL. Thus, the introduction of carpools, with all the possible problems associated with it, might not be capable of alleviating the perceived utilization problem it was intended to address.

Operational Concerns

Allowing carpools onto the AVL would result in more vehicles on the lane; quite possibly, the mechanical condition of the carpools would be inferior to the buses and the vans. The result might be increased breakdowns. Given the narrow width of the AVL, increased breakdowns could adversely impact trip time reliability for all AVL vehicles, thus negating a major advantage of the AVL. Similarly, accidents and safety-related concerns might increase.

Transitways elsewhere in the United States (I-395, Shirley Highway and the El Monte Busway) that allow carpools are beginning to experience capacity

concerns; some lowering of the transitway level-of-service during portions of the peak hour is occurring . To date, no HOV project has changed the definition of eligible vehicles upward (i.e., change carpool definition from 3+ to 4+). It is conceivable that, if carpools are allowed to use the AVL, at some future date it may become necessary to reduce the number of vehicles allowed to use the AVL in order to assure level-of-service. This may be a difficult action to implement.

Also, other minor problems were expected. Authorization costs and complexities would increase, as would potential enforcement problems.

Objectives of the Study

The Metropolitan Transit Authority and the Texas State Department of Highways and Public Transportation jointly funded this research effort. The intent is to carefully and comprehensively evaluate the technical impacts of allowing carpools to use the Katy AVL.

The following are the objectives of this study.

Objective 1. Identify Project Goals

Before carpools are allowed to use the lane, the involved agencies should agree on what needs to occur for the carpool test to be considered "highly successful", "somewhat successful", "somewhat unsuccessful", or "highly unsuccessful".

Objective 2. Impacts On AVL Traffic

A detailed traffic analysis of the impact on operations within the AVL associated with carpool utilization will be performed.

Objective 3. Identify Mode Choice Trade-offs

Identify the factors that cause individuals to select to use a bus, van, or carpool, and define the "modal overlap" that results (i.e., how many of

the carpool patrons would use buses or vans if carpools were not eligible users of the AVL).

Objective 4. Assess Overall Corridor Mobility

Identify changes in corridor person movement, both volumes and time patterns, resulting from carpool utilization.

Objective 5. Impacts On Non AVL Traffic

A detailed operations analysis of the impact on non-AVL traffic, if any, associated with carpool utilization of the AVL will be performed.

Objective 6. Improved Operating Techniques

If the carpool test is found to be a "success" and carpool utilization is to continue, operating/enforcement/authorization techniques that will cause the projects to be even more successful will be identified.

STATE-OF-THE-ART OVERVIEW

Several priority lane projects have been implemented on freeways in the United States. This section of the report reviews some of the data relative to carpool utilization of those facilities.

Eligible Users on HOV Projects

Carpools have not been allowed on freeway contraflow lanes; that decision has been made for safety reasons. Also, on the exclusive bus roadways in Pittsburgh and Ottawa--developed entirely by transit agencies on separate rights-of-way--only buses are allowed to use the facilities.

However, on all other freeway priority lane projects--both exclusive lanes and concurrent flow lanes--some user group other than buses has been allowed on the priority lane (Table 3). As shown subsequently in this section, some of the projects shown in Table 3 did begin operation allowing only bus utilization of the lane; vehicles eligible to use those projects have changed over time.

Of the projects shown in Table 3 that permit carpool utilization, eligible carpools are defined as follows: 4+ = 7%, 3+ = 64%, 2+ = 29%.

Another point also should be made. None of the projects shown in Table 3 require any driver training or authorization to be able to use the priority lane. The impact the authorization process in Houston will have on AVL carpool volume is unknown at this time.

Table 3. Eligible User Groups on Freeway HOV Projects, Exclusive Lanes and Concurrent Flow Lanes

Project	Type of HOV Lane	Eligible User Groups[1] During Operating Periods	Status
Washington, D.C.			
I-395, Shirley Highway	Exclusive	Buses, 4+ Carpools	Operational
I-66	Exclusive	Buses, 3+ Carpools	Operational
Los Angeles, El Monte Busway	Exclusive	Buses, 3+ Carpools	Operational
Boston, S.E. Expressway	Concurrent Flow	Buses, 3+ Carpools	Terminated
Honolulu, Moanalua Freeway	Concurrent Flow	Buses, 3+ Carpools	Terminated
Los Angeles, Santa Monica	Concurrent Flow	Buses, 3+ Carpools	Terminated
Miami, I-95	Concurrent Flow	Buses, 2+ Carpools	Operational
New Jersey, Garden St. Pkwy.	Concurrent Flow	Buses, 2+ Carpools	Terminated
New York City, Brooklyn-Queens	Concurrent Flow	Buses, Taxis[2]	Operational
Orlando, I-4	Concurrent Flow	Buses, 2+ Carpools	Operational
Portland, Banfield	Concurrent Flow	Buses, 2+ Carpools	Operational
San Francisco			
I-280	Concurrent Flow	Buses, 3+ Carpools	Operational
I-580	Concurrent Flow	Buses, 3+ Carpools	Terminated
Route 101	Concurrent Flow	Buses, 3+ Carpools	Operational
Seattle, SR 520	Concurrent Flow	Buses, 3+ Carpools	Operational

[1]This is either the current eligible usage or the eligible usage at the time the project was terminated.

[2]Utilization is restricted due to merge capacity at the termination.

Carpools As A Percent of Total Utilization

Carpools and vanpools provide a significant portion of total HOV lane ridership. A survey of utilization on nine projects is summarized in Table 4. For the projects shown, between 21% and 88% of total person movement is served by either carpools or vanpools. On average, roughly half the total HOV ridership is served by carpools and vanpools, the other half being served by transit vehicles.

Table 4. Estimated Carpool and Vanpool Utilization of HOV Lanes

Facility and Time Period	Bus Passengers		Vanpool and Carpool Passengers		Total Passengers
	No.	%	No.	%	
Houston, I-45N Contraflow					
(buses and vanpools)					
6-8:30 a.m.	5,100	63%	3,000	37%	8,100
Houston, Katy Transitway					
(buses and vanpools)					
6-9:00 a.m.	2,000	69%	900	31%	2,900
Shirley Highway, Wash. D.C.					
(buses and 4+ carpools)					
7-8:00 a.m.	11,800	52%	11,000	48%	22,800
6-9:30 a.m.	23,700	55%	19,700	45%	43,400
El Monte Busway, Los Angeles					
(buses and 3+ carpools)					
6-10:00 a.m.	8,470	54%	7,330	46%	15,800
peak-hour	3,450	53%	3,040	47%	6,490
I-66, Washington, D.C.					
(buses and 3+ carpools)					
a.m. peak hour	2,600	29%	6,500[1]	71%	9,100
I-95 Miami Concurrent Flow					
a.m. peak hour	640	23%	2,200[1]	77%	2,840
U.S. 101 Marin County					
a.m. peak hour	3,700	79%	980	21%	4,680
Santa Monica, Los Angeles					
peak period	3,810	20%	15,289	80%	19,099
Banfield, I-80, Portland					
(buses and 2+ carpools)					
a.m. peak hour	300	12%	2,100	88%	2,400
Average, non-weighted	----	46%	----	54%	----

[1]Includes illegal vehicles (i.e., less than 3 persons/vehicle) in the priority lanes

Source: Texas Transportation Institute Surveys

Figures 5 and 6 show historical utilization trends on both the Shirley Highway in Washington, D.C. and the El Monte Busway in Los Angeles. At present, carpools carry about half the ridership on both those exclusive HOV projects.

Impact of Changing the Definition of Eligible Users

Numerous HOV projects have found it necessary to change the definition of eligible users. This has occurred for two principal reasons: 1) the lane appeared to be underutilized; and 2) the violation rate was not acceptable.

The definition of eligible users has been changed on at least eight HOV projects in the United States. A summary of the impacts of the changed definition on 7 of those projects is shown in Table 5. The data for the other project, SR 520 in Seattle, is limited and complicated by factors not relating to the change in definition of eligible vehicles.

In interpreting Table 5, it should be realized that reliable and comparable volume data are not available for several of the projects. Several estimates were developed by TTI to assemble the Table 5 data. While it may not be appropriate to give a high level of credence to any one specific number in the table, it does appear noteworthy that, in all cases, total person movement increased when more vehicles were allowed to use the HOV lane. In general, there was no significant change in operating speed on the HOV lane after volumes were increased. In those instances where the carpool definition was lowered to reduce the violation rate, a reduction in that rate was realized.

Limited data exist regarding the previous mode of the new carpoolers allowed to utilize the HOV lane. The data from the El Monte Busway suggest that 50% of the carpools were formed as a result of being able to use the priority lane; however, roughly 25% of carpoolers had been bus passengers prior to carpooling (14). Thus, carpool usage of that HOV facility increased total person movement, but it also apparently attracted riders from the bus operation.

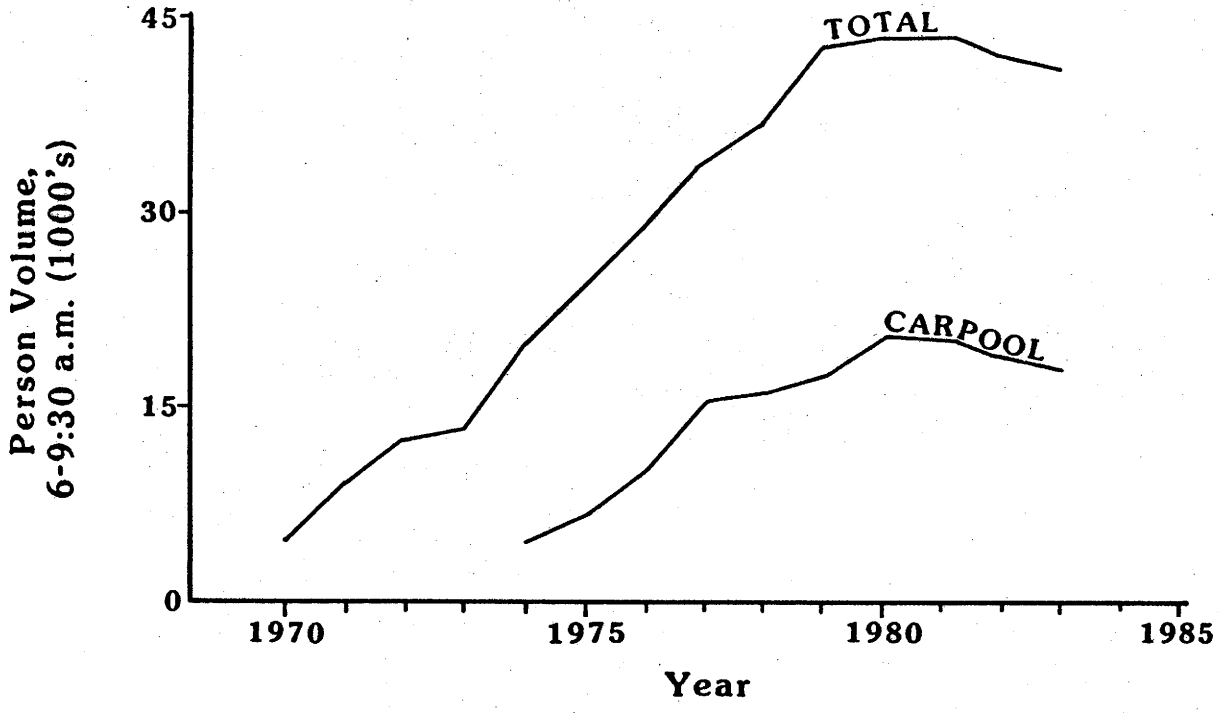


Figure 5. Shirley Highway, Virginia, Trends in Utilization

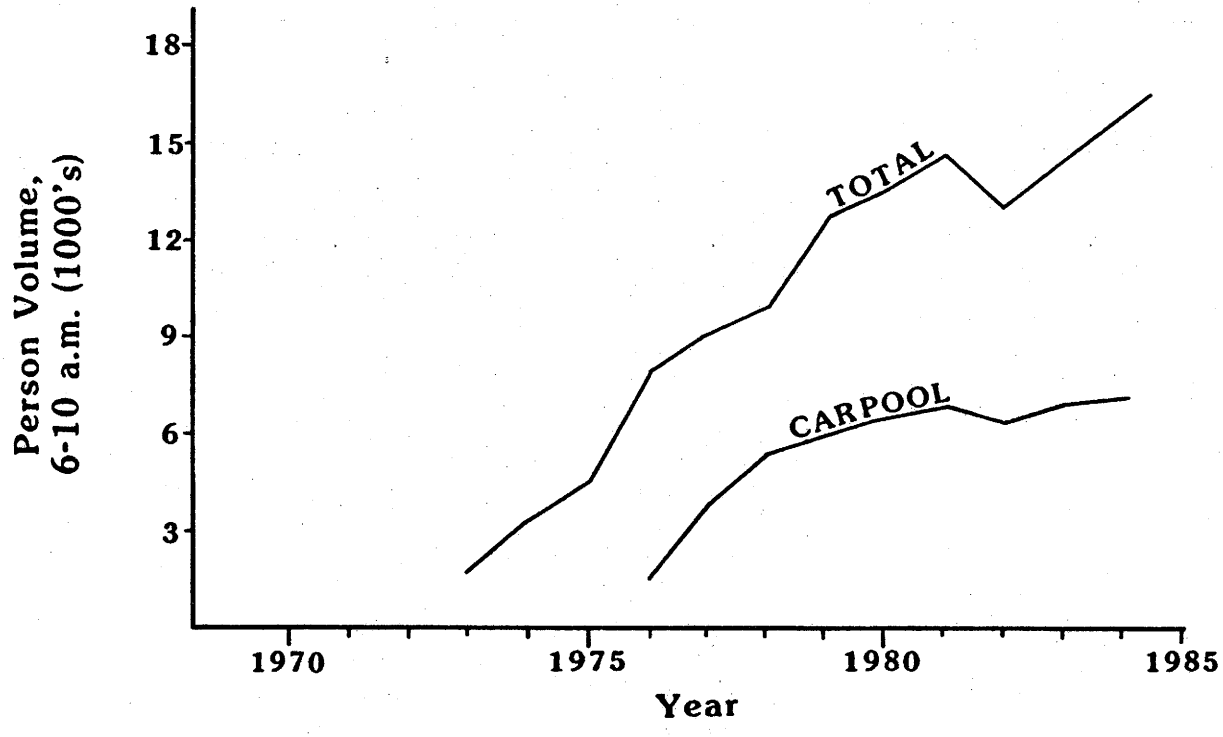


Figure 6. El Monte Busway, Los Angeles, Trends in Utilization

Table 5. Estimated Impact of Increasing the Volume of Vehicles Eligible to Use a High-Occupancy Vehicle Facility

Project Time Period Type of HOV References	Vehicles Allowed in HOV Lane		HOV Vehicle Volume			HOV Person Volume			Violation Rate		HOV Speed (MPH)	
	Before (date)	After (date)	Before	After	% Chg.	Before	After	% Chg.	Before	After	Before	After
Banfield, I-80	Buses	Buses										
Portland, Ore.	3+	2+										
(WB, A.M. Peak Hour)	(1975)	(1979)										
Bus			16	16		300	300					
Carpool			200	900		550	2100					
TOTAL			216	916	324%	850	2400	182%	18%-22%	6%-10%	48	50
I-95, Miami	Buses	Buses										
	3+	2+										
(Peak Hour)	(1976)	(1977)										
Bus			20	20		600	640					
Carpool			915	1100		1900	2200					
TOTAL			935	1120	20%	2500	2840	14%	63%	36%	50-55	50-55
Route 101, Concurrent	Bus	Buses										
San Francisco	Only	3+										
(SB, A.M. Peak Hour)	(1974)	(1976)										
Bus			94	97		3600	3700					
Carpool			---	288		---	979					
TOTAL			94	385	310%	3600	4679	30%	1%-3%	6%-18%	46	46
Garden State Pkwy.	3+	2+										
New Jersey	(1980)	(1981)										
(peak hour)												
Carpool			320	900	181%	870	1800	106%	10%-35%	6%-18%	58	56
El Monte, Los Angeles	Buses	Buses										
(WB, 6-10 AM)	Only	3+										
	(1973)	(1977)										
Bus			160	160		5200	5200					
Carpool			---	1200		----	4000					
TOTAL			160	1380	763%	5200	9200	77%	0%	10%	55	55
I-66, Virginia	Buses	Buses										
(AM, Peak Hour)	4+	3+										
	(1982)	(1984)										
Bus			70	79		2240	2600					
Carpool			900	1900		3900	6500					
TOTAL			970	1979	104%	6140	9100	48%	10%	10%	52	51
Shirley Hwy., Virginia	Buses	Buses										
(EB, 6-9:30 AM)	Only	4+										
	(1970)	(1973)										
Bus			310	350		13500	15700					
Carpool			---	1100		----	4500					
TOTAL			310	1450	367%	13500	20200	50%	0%	10%	NA	NA

Note: Some of the data, as presented in this table, are not available. In those cases, the estimates shown were made by combining data from several sources. Thus, some numbers shown are TTI estimates.

Sources: References 3-13.

The experience nationwide suggests that permitting additional vehicle groups to use an HOV lane will increase person movement as long as level-of-service is not adversely impacted. It should be noted that, in none of the instances shown in Table 5, the addition of new vehicle groups to the lane did not result in exceeding the HOV lane capacity. Thus, HOV operating speeds were not greatly affected. Close measurement of bus travel times on El Monte before and after carpool introduction found that bus speeds remained unchanged (14). Had the level-of-service in the HOV lane been allowed to deteriorate, the results of adding the new HOV users to the lane may have been quite different.

It might also be noted that, while carpools did not affect level-of-service at the time they were introduced, over time carpool volumes have come to create concerns on both the Shirley Highway and the El Monte Busway. Peak-hour passenger car equivalents per lane on El Monte exceed 1100; on Shirley Highway this value is in the range of 1500 vehicles per hour per lane. Both these projects are now considering alternatives to reduce peak-hour HOV volumes.

Allowing more carpools/vanpools to use an HOV lane will increase the percentage of total HOV movement served by vanpools and carpools. Some bus patronage will likely be lost to these alternative forms of ridesharing. This occurrence might be viewed in two manners. From the viewpoint of society as a whole, it may be desirable that total person movement is increased, and that more of that movement is occurring in carpools and vanpools that do not require a direct subsidy per passenger. From the viewpoint of the transit operator, it is likely that potential transit patronage will be reduced. And, since a relatively high-level of bus service must be made available for facilities such as park-and-ride lots to function satisfactorily, it may not be possible to reduce bus service by the same percentage as the patronage lost; thus, allowing more carpools to use a HOV lane may increase the per passenger subsidy required for those individuals continuing to use transit.

Federal Highway Administration Policy

Some of the projects shown in Table 5 lowered carpool occupancy requirements from 3+ to 2+. Current federal policy can be summarized by the following.

> "According to a national study and FHWA's own analysis of existing vehicle occupancy, an HOV-2 priority lane accomplishes little more than rearranging traffic in lanes according to number of occupants. The number of vehicles using the HOV lane may increase but this is offset by a decrease in the average vehicle occupancy in the other lanes. Use of HOV-2 does not generally accomplish the purpose for which priority treatments are implemented, i.e., to move more people in fewer vehicles and encourage people to use high occupancy vehicles.
>
> Therefore, on HOV projects not yet opened to traffic and for which Federal-aid funds are used for construction, a minimum three persons per vehicle criteria is required. There may be unusual circumstances that would justify consideration of HOV-2. These situations will have to be sent to Washington headquarters for approval. For existing HOV lanes which are presently using two occupant vehicles as the minimum criteria, you are encouraged to increase the minimum criteria to HOV-3."

Significant Observations

Based on the experience in operating HOV lanes across the country, the following observations appear relevant to the Houston transitway system.

1. With the exception of contraflow lanes where carpools are excluded for safety reasons, the Houston transitways are the only freeway HOV lanes that do not allow carpool utilization.

2. Houston is the only city that requires authorization to use HOV lanes.

3. The only project that has successfully maintained a 4+ carpool definition is the Shirley Highway serving Washington, D.C. The District of Columbia has approximately 70% more office space than does downtown Houston. Outside of the peak hour, there are proposals to lower the 4+ definition on the Shirley Highway.

4. There is reason to believe that allowing carpool utilization will increase total person movement on the priority lane. On all projects when the carpool definition has been changed to allow more vehicles into the HOV lane, total person movement in the priority lane increased. Some of the carpoolers (25% in Los Angeles) will be former bus patrons.

5. On at least two HOV projects, over time carpool volumes have increased to the point where level-of-service in the priority lane(s) is threatened. Alternatives for reducing peak-hour HOV volumes are being considered for both of those projects. This is a concern since, on successful transitway projects, for the first 5 years utilization can be expected to increase at an annual rate of 40%.

CRITERIA FOR MEASURING THE SUCCESS OF CARPOOL UTILIZATION

Carpool utilization of the Katy Authorized Vehicle Lane is being allowed on an experimental basis. It was decided by METRO and the State that the general criteria to use for measuring whether the experiment is successful or not should be agreed upon in advance.

The principal reason for allowing carpool use was to increase AVL volumes in an effort to address the perception of underutilization. Thus, unless a "significant" volume of carpools used the AVL, the experiment would not be considered successful regardless of what else occurred. While a "significant" volume was not precisely quantified, a feeling seemed to exist that a peak-period volume of at least 75 to 100 carpools would have to exist to even begin to increase the perception of AVL utilization.

With that background, Table 6 was developed to serve as a general guide in evaluating the carpool experiment. Data collection was oriented to develop information that could be used to quantify the criteria shown in Table 6.

It was also agreed that, during the duration of the experiment, circumstances might arise that would justify some modification in the criteria shown in Table 6.

Table 6. Criteria For Judging the Success of the Katy AVL Carpool Experiment

Proposed Evaluation Factor	Proposed Relative Weighting	Resulting Impact
1. Change in Person Movement on the Katy AVL directly attributable to carpooling	25	Highly Successful: Total AVL person movement increases by at least 20% due to carpooling Successful: Person movement increases by between 5% and 20% Somewhat Unsuccessful: Person movement essentially unchanged (0% to 5% increase) Highly Unsuccessful: Person movement decreases.
2. Non-User Perception of Katy AVL Utilization	30	Highly Successful: At least 70% of non-users respond that AVL is sufficiently utilized. Successful: Between 50% and 70% of non-users respond that AVL is sufficiently utilized. Somewhat Unsuccessful: Between 50% and 70% of non-users respond that AVL is not sufficiently utilized. Highly Unsuccessful: More than 70% of non-users respond that AVL is not sufficiently utilized.
3. Change in Average Travel Time On the AVL	20	Highly Successful: No change. Successful: Average travel speed decreases by no more than 3 mph. Somewhat Unsuccessful: Average travel speed decreases by between 3 mph and 6 mph. Highly Unsuccessful: Average travel speed decreases by more than 6 mph.
4. Change in Person Delay to Mixed-Flow Traffic	15	Highly Successful: No change or a decrease in total delay. Successful: Delay increases by less than 5%. Somewhat Unsuccessful: Delay increases by 5% to 10%. Highly Unsuccessful: Delay increases by more than 10%.
5. Increase in Frequency of Breakdowns on the AVL	5	Highly Successful: None. Successful: Less than 5%. Somewhat Unsuccessful: Increase by between 5% and 15%. Highly Unsuccessful: Increases by more than 15%
6. Increase in Authorization and Enforcement Costs	5	Cost values need to be developed by METRO.

In this matrix, items #1 3, and 4 indirectly address change in total corridor delay. In this matrix, item 5 indirectly addresses trip reliability.

TRAFFIC DATA COLLECTION AND ANALYSIS

In order to have the necessary "before" data base to comprehensively assess the carpool impact on both AVL and non AVL traffic extensive traffic operations data were collected. These data, presented in this section, address the following areas: 1) travel time; 2) volumes; 3) speeds; 4) total trip time; and 5) incidents/accidents.

Travel Time

Travel time studies were conducted on the Katy Freeway between the SH 6 interchange and the S.P.R.R. overpass east of the Washington Avenue interchange. The studies were conducted in February and March of 1985 to measure the effects of the opening of the Katy AVL from Gessner to Post Oak. Additional studies were made after the AVL was extended to the West Belt interchange on May 2.

The study length of 13.2 miles was divided into 4 sections and numbered in the direction of travel (Table 7).

Table 7. Section Limits for Travel Time Runs

Section Number		Limits of Section
AM Designation	PM Designation	
1	4	SH 6 to the West Belt Access Ramps to the AVL (4.6 mi.)
2	3	West Belt Access Ramps to the Gessner Access Ramps (1.7 mi.)
3	2	Gessner Access Ramps to the east terminus of the AVL at Post Oak (4.7 mi.)
4	1	Post Oak to the S.P.R.R. overpass of I-10 (2.2 mi.)

Travel runs were made on the freeway mainlanes at 15 minute intervals, and on the AVL and Katy Road/Washington Avenue route at more frequent intervals.

AM Peak Period

Total Length

Travel times vary by time of day as traffic congestion develops on the freeway lanes in the study area. Figure 7 shows the average travel times from several studies for the AVL and the non AVL traffic over the entire 13.2 mile study length. Table 8 illustrates the variation that occurs in the daily studies.

For the 3-hour peak period, the average travel time for the non AVL traffic is 26.5 minutes, or an average speed of 30 MPH. The average travel time for the AVL traffic is 23.6 minutes with the AVL open at Gessner, and 21.2 minutes with the AVL open at West Belt; this is equivalent to 33.6 MPH and 36.5 MPH, respectively.

Since the majority of the AVL traffic uses the lane during the 2 hours when traffic congestion peaks, travel times and speed impacts of the AVL are more significant during this time period (Table 9.) For the non AVL user, the average travel time is 30.6 minutes and 26 MPH. The corresponding measures of travel time and speed for the AVL traffic during the 2-hour peak are 26.5 minutes with the AVL open at Gessner and 23.5 minutes with the AVL open at West Belt.

Each of the four sections described in Table 7 were analyzed in a similar manner to determine the impact of the AVL.

Section 1. Section 1, from SH 6 to the West Belt access ramp to the AVL, is 4.6 miles long. The travel times in this section have the greatest variability , because they are dependent on the traffic flow rates that load the freeway from the west. The length of congestion will vary from zero to 4.6 miles. This section operates with the AVL and non AVL traffic both in

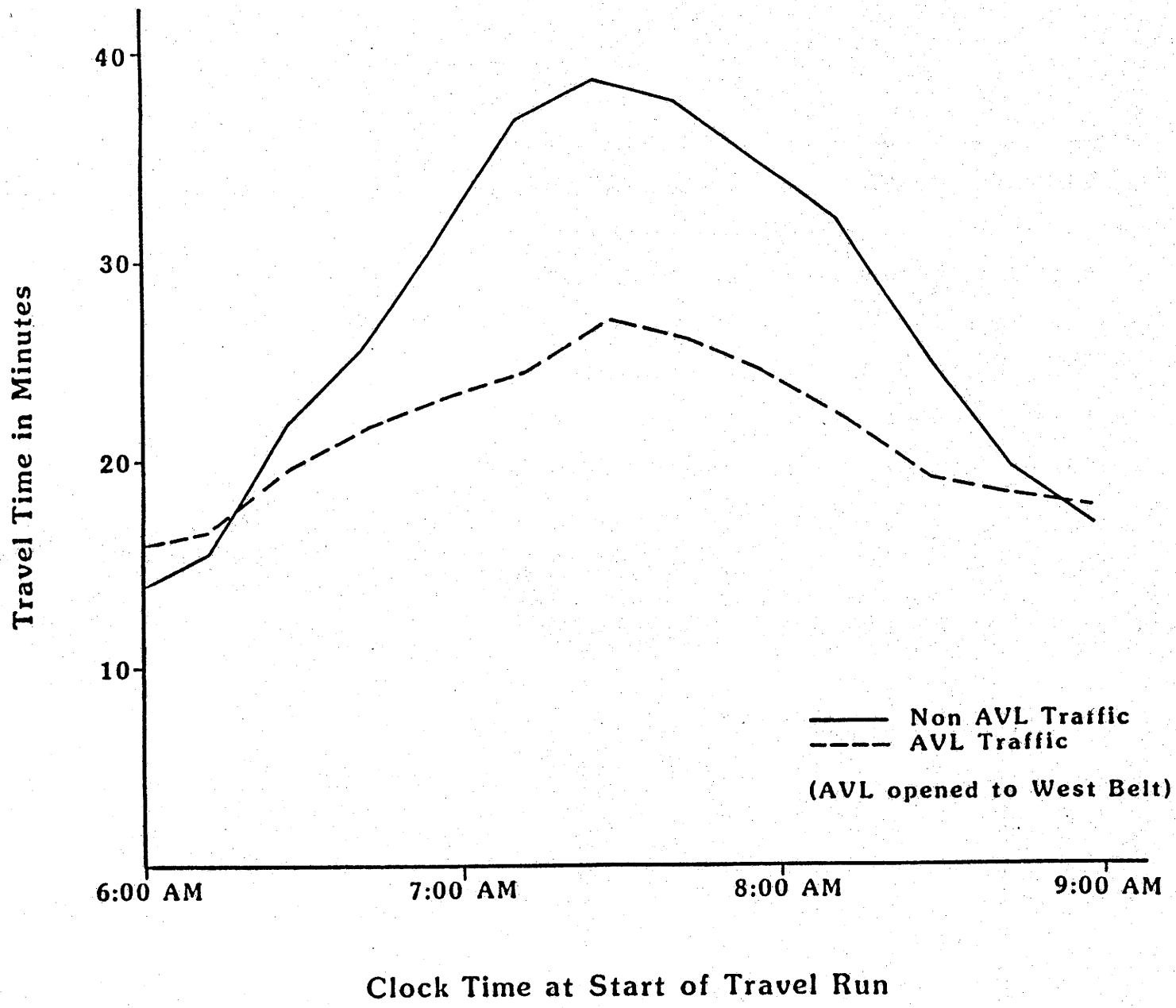


Figure 7. Katy Freeway Travel Times, A.M. Eastbound, SH 6 to S.P.R.R

Table 8. Eastbound A.M. Speeds In the Katy Freeway Mainlanes

Date of Study	Begin Time (AM)	Average Speeds in MPH			
		Sec 1	Sec 2	Sec 3	Sec 4
February 5, 1985	6:00	54	52	51	51
	6:15	44	40	45	49
	6:30	27	28	35	43
	6:45	19	24	23	49
	7:00	17	15	20	48
	7:15	13	12	18	48
	7:30	11	13	18	49
	7:45	12	13	20	49
	8:00	43	48	28	45
	8:18	17	16	24	52
	8:30	21	22	25	51
	8:45	51	27	27	52
February 12, 1985	6:00	55	55	55	56
	6:15	43	55	51	56
	6:30	38	32	41	54
	6:45	33	26	42	55
	7:00	27	25	34	58
	7:15	21	19	22	58
	7:30	20	17	22	52
	7:45	20	17	22	57
	8:00	26	16	25	59
	8:18	27	21	28	58
	8:30	41	21	28	56
	8:45	52	26	34	58
February 14, 1985	6:00	54	58	58	57
	6:15	52	51	54	57
	6:30	27	38	41	51
	6:45	27	27	37	59
	7:00	23	26	29	57
	7:15	26	18	25	57
	7:30	22	23	22	56
	7:45	22	20	25	55
	8:00	29	19	24	59
	8:18	47	26	27	57
	8:30	56	46	30	57
	8:45	55	57	37	58

Table 9. Eastbound A.M. Travel Times and Average Speeds, Freeway Mainlanes and Katy AVL, Katy Freeway, SH 6 to S.P.R.R. (13.2 miles)

Traffic and Time Period	Average Travel Time (minutes)	Average Speed (MPH)
3-hour Period, 6-9 a.m.		
Non AVL Traffic	26.5	30
AVL Traffic-Gessner Entrance	23.6	34
AVL Traffic-West Belt Entrance	21.2	37
2-Hour Period, 6:30-8:30 a.m.		
Non AVL Traffic	30.6	26
AVL Traffic-Gessner Entrance	26.5	30
AVL Traffic-West Belt Entrance	23.5	34

Table 10. Eastbound A.M. Travel Times and Average Speeds, Freeway Mainlanes And Katy AVL, Katy Freeway, SH 6 to West Belt AVL Entrance (4.6 miles)

Traffic and Time Period	Average Travel Time* (minutes)	Average Speed (MPH)
3-hour Period, 6-9 a.m.		
Non AVL Traffic	10.2	27
AVL Traffic	(same)	(same)
2-Hour Period, 6:30-8:30 a.m.		
Non AVL Traffic	12.6	22
AVL Traffic	(same)	(same)

*Travel time at 55 MPH is 5 minutes.

mixed flow. Travel times in this section indicate a potential savings of 7.6 minutes in travel time for AVL traffic when the AVL is extended to SH 6 (Table 10).

Section 2. Section 2, from the West Belt AVL access ramp to the Gessner AVL access ramp, is approximately 1.7 miles long (gate to gate). This section of the AVL was included in the first phase of construction but was not opened to AVL traffic until May 2, 1985. Travel times on the freeway mainlanes adjacent to this section were measured in order to calculate the benefits associated with operating this extension of Phase 1 (Table 11). The travel time savings in this short section are 3 minutes for the AVL traffic.

Section 3. Section 3, from the Gessner access ramp to the eastern terminus at Post Oak, is 4.7 miles long. The freeway cross section is 3 lanes to the Wirt entrance ramp, a distance of 3.5 miles, and 4 lanes for the remaining 1.2 miles. Traffic congestion normally extends only to the Wirt entrance ramp, thus increasing the average speeds on the freeway (Table 12). The savings to AVL users in this section are 6 minutes.

Section 4. Section 4 is the 2.2 mile distance from Post Oak to the S.P.R.R. overpass. The AVL traffic uses Old Katy Road to Washington Avenue, where it enters the I-10 eastbound lanes. Freeway travel speeds during the AM peak period are high in this section, except for traffic exiting at the I-610 interchange. The average freeway travel time and speeds are 2.4 minutes and 55 MPH throughout the peak period (Table 13).

The AVL traffic that continues on I-10 eastbound has higher travel times because of both traffic signal delays at Post Oak and Washington and the lower speed limits on Old Katy Road and Washington Avenue. The average travel time and speeds for AVL traffic in Section 4 are 4 minutes and 33 MPH. Thus, AVL traffic in this section has a greater travel time than does non AVL traffic by 1.6 minutes.

Table 11. Eastbound A.M. Travel Times and Average Speeds, Freeway Mainlanes and Katy AVL, Katy Freeway, West Belt AVL Entrance to Gessner AVL Entrance (1.7 mi.)

Traffic and Time Period	Average Travel Time (minutes)	Average Speed (MPH)
3-Hour Period, 6-9 a.m.		
Non AVL Traffic	4.3	24
AVL Traffic	1.9	55
2-Hour Period, 6:30-8:30 a.m.		
Non AVL Traffic	4.9	21
AVL Traffic	1.9	55

Table 12. Eastbound A.M. Travel Times and Average Speeds, Freeway Mainlanes And Katy AVL, Gessner AVL Entrance to Post Oak (4.7 mi.)

Traffic and Time Period	Average Travel Time (minutes)	Average Speed (MPH)
3-hour Period, 6-9 a.m.		
Non AVL Traffic	9.1	29
AVL Traffic	5.1	55
2-Hour Period, 6:30-8:30 a.m.		
Non AVL Traffic	10.9	26
AVL Traffic	5.1	55

Table 13. Eastbound A.M. Travel Times and Average Speeds, Freeway Mainlanes And Katy AVL, Post Oak to S.P.R.R. (2.2 mi.)

Traffic and Time Period	Average Travel Time (minutes)	Average Speed (MPH)
3-Hour Period, 6-9 a.m.		
Non AVL Traffic	2.4	55
AVL Traffic	4.0	33
2-Hour Period, 6:30-8:30 a.m.		
Non AVL Traffic	2.4	55
AVL Traffic	4.0	33

PM Peak Period

Total Length

The variation in travel times by time of day is similar to the AM peak period (Figure 8). Variations of average speeds by day and by section are shown in Table 14 for three days. Congestion normally extends into Section 3 during the peak hour, and the speeds in Section 1 vary depending on the loading flow rates from the CBD.

For the 3-hour PM peak period, the average travel time for the freeway (measured at 15 minute headways) is 21.3 minutes. The average travel time for the AVL traffic is 18.8 minutes with the AVL exiting at Gessner, and 16.3 minutes with the AVL exiting at West Belt.

The two hour PM peak period has a small change in average speeds (Table 15).

Section 1. Section 1, from the S.P.R.R. to Post Oak, is 2.2 miles long. The travel times measured in this study on the freeway indicated an average speed of 40 MPH (Table 16). However, this speed can vary over a wide range

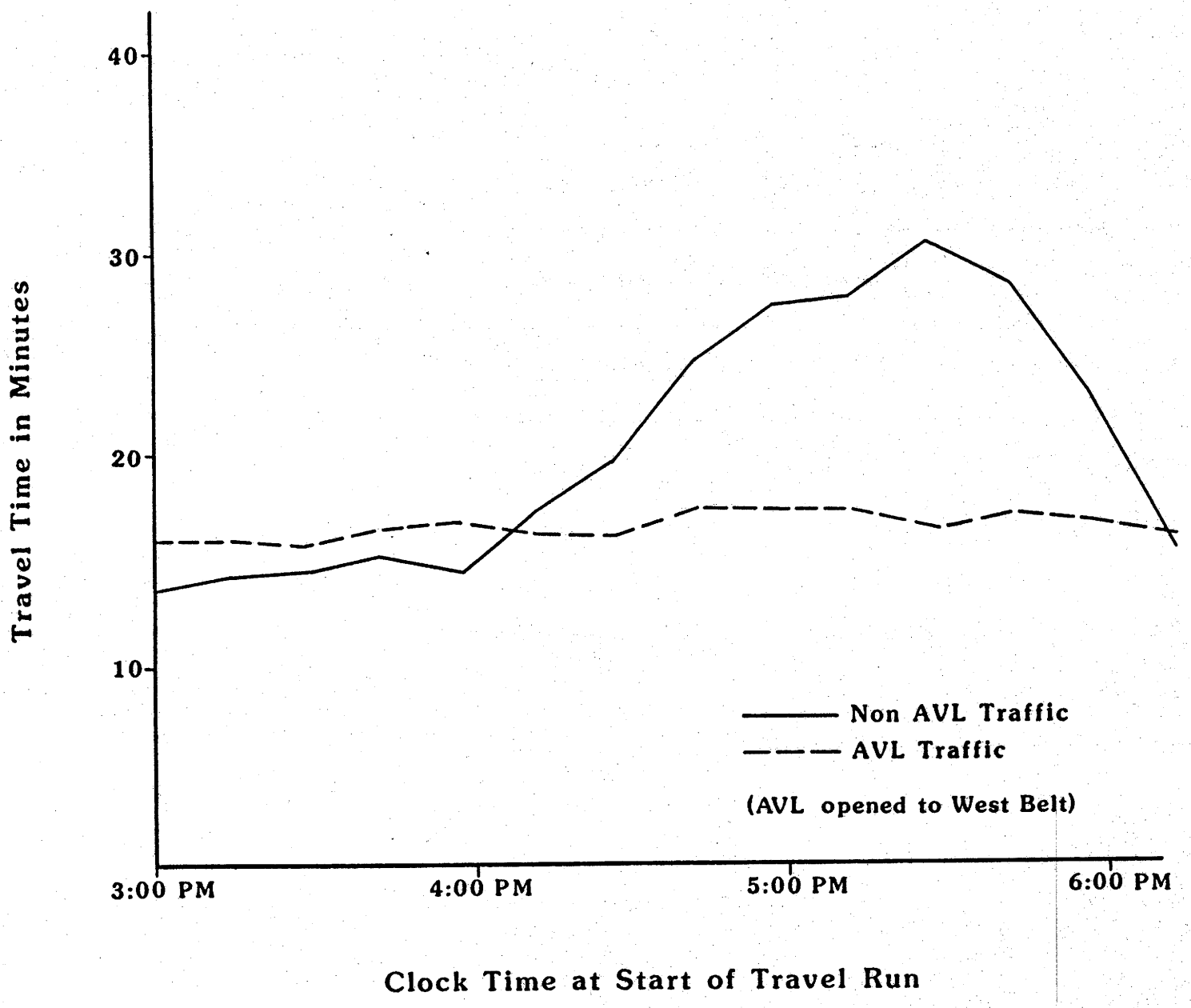


Figure 8. Katy Freeway Travel Times, PM Westbound, S.P.R.R. to SH 6

Table 14. Westbound PM Speeds in the Katy Freeway Mainlanes

Date of Study	Begin Time (PM)	Sec 1	Sec 2	Sec 3	Sec 4
February 5, 1985	3:00	54	57	62	56
	3:15	54	56	57	58
	3:30	55	57	57	59
	3:45	55	46	64	46
	4:00	53	43	51	56
	4:15	34	39	50	56
	4:30	45	38	44	59
	4:45	47	34	34	46
	5:00	49	29	26	56
	5:15	57	29	21	53
	5:30	47	24	20	56
	5:45	56	27	32	38
	6:00	55	40	50	55
February 12, 1985	3:00	61	62	71	59
	3:15	56	56	57	51
	3:30	37	52	57	58
	3:45	55	46	61	56
	4:00	58	58	68	58
	4:15	57	49	50	51
	4:30	55	43	29	50
	4:45	59	31	25	50
	5:00	64	27	24	48
	5:15	54	23	23	48
	5:30	36	20	19	48
	5:45	52	18	24	49
	6:00	60	26	25	45
February 14, 1985	3:00	59	62	66	51
	3:15	60	58	59	57
	3:30	51	50	49	55
	3:45	57	54	49	57
	4:00	57	50	61	50
	4:15	54	44	23	58
	4:30	48	24	29	54
	4:45	20	19	26	37
	5:00	14	19	21	35
	5:15	34	15	23	37
	5:30	22	15	19	42
	5:45	34	17	20	39
	6:00	60	17	22	50

Table 15. Westbound P.M. Travel Times and Average Speeds, Freeway Mainlanes And Katy AVL, Katy Freeway, S.P.R.R. Overpass to SH 6 (13.2 mi.)

Traffic and Time Period	Average Travel Time (minutes)	Average Speed (MPH)
3-hour Period, 3:15-6:15 p.m.		
Non AVL Traffic	21.3	37
AVL Traffic-Gessner Exit	18.8	42
AVL Traffic-West Belt Exit	16.3	49
2-Hour Period, 4:15-6:15 p.m.		
Non AVL Traffic	24.7	32
AVL Traffic-Gessner Exit	19.1	44
AVL Traffic-West Belt Exit	16.6	48

Table 16. Westbound P.M. Travel Times and Average Speeds, Freeway Mainlanes and Katy AVL, Katy Freeway, S.P.R.R. Overpass to Post Oak (2.2 miles)

Traffic and Time Period	Average Travel Time (minutes)	Average Speed (MPH)
3-hour Period, 3:15-6:15 p.m.		
Non AVL Traffic	3.0	44
AVL Traffic	4.0	33
2-Hour Period, 4:15-6:15 p.m.		
Non AVL Traffic	3.3	40
AVL Traffic	4.0	33

because the traffic from Washington approaches I-610 in 5 lanes and only 2 continue west on I-10. This section can become overloaded early in the peak period and lower average speeds into the 20-30 MPH range.

The travel times for AVL traffic along Washington and Katy Road will vary a small amount due to delays at the traffic signals, but the peak hour averages are consistent.

Section 2. Section 2, from Post Oak to Gessner, has severe congestion with average speeds less than 30 MPH (Table 17). Travel time savings by the AVL traffic average 6 minutes during the 2-hour peak period.

Section 3. Section 3, from Gessner to West Belt, has traffic conditions equivalent to Section 2 (Table 18). The benefits to AVL traffic are 2 minutes over the 1.7 mile section.

Section 4. The section from West Belt to SH 6 operates in mixed flow. The last bottleneck section is at Westview, approximately 1 mile west of the AVL exit. Therefore, average speeds on the section are high (Table 19).

Travel Time Savings

Travel time saved by the AVL traffic is calculated in Tables 20 and 21 for the AVL open to West Belt. The distribution of travel times for non AVL and AVL traffic, shown in Figures 7 and 8, are used to determine the travel time savings by time of day for the AVL traffic. The distribution of AVL vehicle volumes is converted to persons using occupancy rates of 30 persons per bus, 8 persons per vanpool, and 4 persons per carpool. The occupancy rates are assumed to be uniform for the entire peak period. This is a good assumption for vans and carpools. Actual data from bus ridership studies can be used to correct the bus passenger numbers if necessary.

The total time saved is 490 person hours per day. The PM peak period has some time lost as a result of the time traveling on Washington Avenue and Old Katy Road. However, this occurs early in the peak period when AVL volumes are low.

Table 17. Westbound P.M. Travel Times and Average Speeds, Freeway Mainlanes and Katy AVL, Katy Freeway, Post Oak to Gessner AVL Exit (4.7 miles)

Traffic and Time Period	Average Travel Time (minutes)	Average Speed (MPH)
3-hour Period, 3:15-6:15 p.m.		
Non AVL Traffic	8.6	33
AVL Traffic	5.1	55
2-Hour Period, 4:15-6:15 p.m.		
Non AVL Traffic	11.4	25
AVL Traffic	5.1	55

Table 18. Westbound P.M. Travel Times and Average Speeds, Freeway Mainlanes and Katy AVL, Katy Freeway, Gessner AVL Exit to West Belt AVL Exit (1.7 miles)

Traffic and Time Period	Average Travel Time (minutes)	Average Speed (MPH)
3-hour Period, 3:15-6:15 p.m.		
Non AVL Traffic	3.4	30
AVL Traffic	1.9	55
2-Hour Period, 4:15-6:15 p.m.		
Non AVL Traffic	3.9	26
AVL Traffic	1.9	55

Table 19. Westbound P.M. Travel Times and Average Speeds, Freeway Mainlanes and Katy AVL, Katy Freeway, West Belt AVL Exit to SH 6 (4.6 miles)

Traffic and Time Period	Average Travel Time (minutes)	Average Speed (MPH)
3-hour Period, 3:15-6:15 p.m.		
Non AVL Traffic	5.6	49
AVL Traffic	5.6	49
2-Hour Period, 4:15-6:15 p.m.		
Non AVL Traffic	5.9	47
AVL Traffic	5.9	47

Table 20. Eastbound AM Travel Time Savings For Katy AVL Traffic, May 1985

Time of Day	Average Travel Time		Time Saved by AVL (minutes)	AVL Volumes				Travel Time Saved (Person Minutes)
	Non-AVL (minutes)	AVL (minutes)		Vans	Buses	Carpools	Persons	
6:00 am	13.8	15.6	- 1.8	0	3	0	90	- 162
6:15	15.9	16.8	- 0.9	4	4	0	152	- 137
6:30	21.5	19.7	1.8	4	1	1	66	119
6:45	25.7	21.4	4.3	23	9	3	466	2,004
7:00	30.2	23.2	7.0	21	4	0	288	2,016
7:15	36.4	25.1	11.3	10	9	2	358	4,045
7:30	38.2	26.9	11.3	8	5	1	218	2,463
7:45	37.2	25.7	11.5	2	5	0	166	1,909
8:00	32.7	24.4	8.3	3	7	1	238	1,975
8:15	28.5	21.3	7.2	1	6	0	188	1,354
8:30	24.4	18.8	5.6	0	3	0	90	504
8:45	19.3	18.4	0.9	0	2	0	60	54
9:00	17.2	17.3	- 0.1	0	2	0	60	- 6
9:15								
3 Hr. Total				76	60	8	2,380	16,138
2 Hr. Total				72	46	8	1,988	15,885

Table 21. Westbound PM Travel Time Savings For Katy AVL Traffic, May 1985

Time of Day	Average Travel Time		Time Saved by AVL (minutes)	AVL Volumes				Travel Time Saved (Person Minutes)
	Non-AVL (minutes)	AVL (minutes)		Vans	Buses	Carpools	Persons	
3:00 am	13.7	16.0	- 1.7					
3:15	14.2	16.0	- 0.9					
3:30	14.8	15.8	- 1.0	0	4	0	120	-120
3:45	15.3	16.1	- 0.8	1	5	0	158	-126
4:00	14.5	16.5	- 2.0	8	4	3	164	-328
4:15	17.3	16.1	1.2	16	4	0	248	298
4:30	19.6	16.1	3.5	25	4	1	324	1,134
4:45	24.7	17.3	7.4	7	9	1	330	2,442
5:00	27.2	17.2	10.0	4	3	0	122	1,220
5:15	27.5	17.1	10.4	20	7	1	374	3,890
5:30	30.3	16.7	13.6	6	5	0	198	2,693
5:45	28.1	17.6	10.5	2	5	0	166	1,743
6:00	23.2	16.5	6.7	0	2	0	60	402
6:15	15.5	15.8	- 0.3	0	4	0	120	-36
3 Hr. Total				89	56	6	2,384	13,212
2 Hr. Total				80	39	3	1,822	13,822

The 2-hour peak period indicates average savings of approximately 8 minutes per person per trip.

Volumes

AVL Volumes

The volumes of traffic using the Katy AVL have increased since the facility was opened in October 1984. METRO has added bus transit service to the Addicks Park-and-Ride facility and to the recently completed West Belt Park-and-Ride facility; METRO has also rescheduled some existing bus routes from the Memorial area. At the time that carpools were authorized to use the AVL, the daily volumes on the AVL were:

Period	Buses	Vanpools	Total
AM	58	76	134
PM	56	89	145

These volumes will vary by 2 or 3 vehicles each day, but the totals have been consistent since April.

The distribution of volumes is shown in Figures 9 and 10. During the morning operation, 90% of the vanpools arrive in 1 hour. In the afternoon, there are two distinct peaks at 4:30 and 5:00. The buses are evenly distributed, apparently as a result of the regular headways used at the park-and-ride facilities.

The maximum hourly volumes are 64 vph in the morning and 78 vph in the afternoon. Peak 15-minute flow rates are 168 vph in the morning and 144 vph in the afternoon. Since the AVL was opened to carpools of 4 persons or more, 8 carpools have used the lane on a regular basis. These vehicles are included in the volumes shown in Figures 9 and 10.

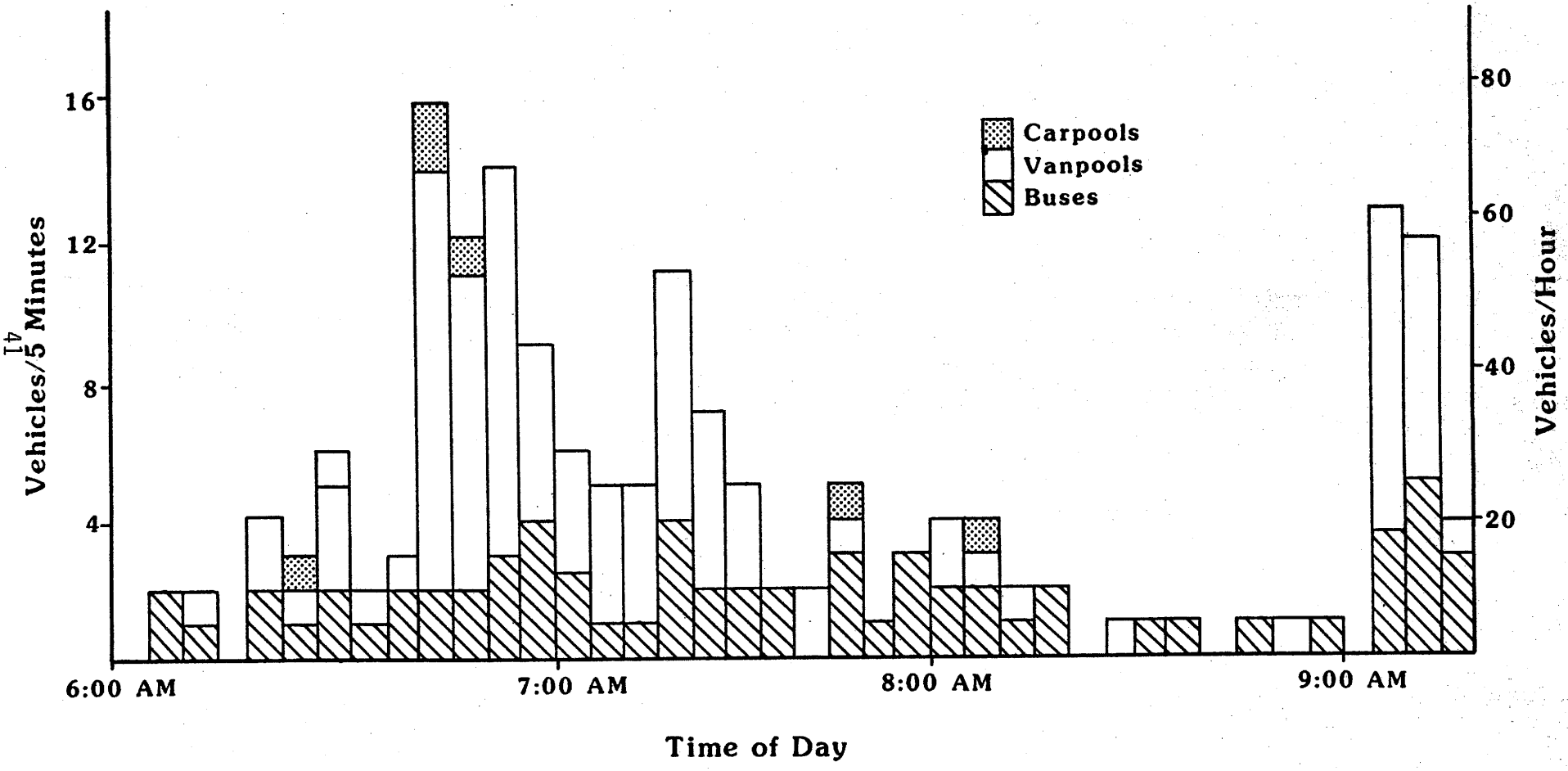


Figure 9. Katy Freeway AVL Volumes, AM Peak Period, May 1985

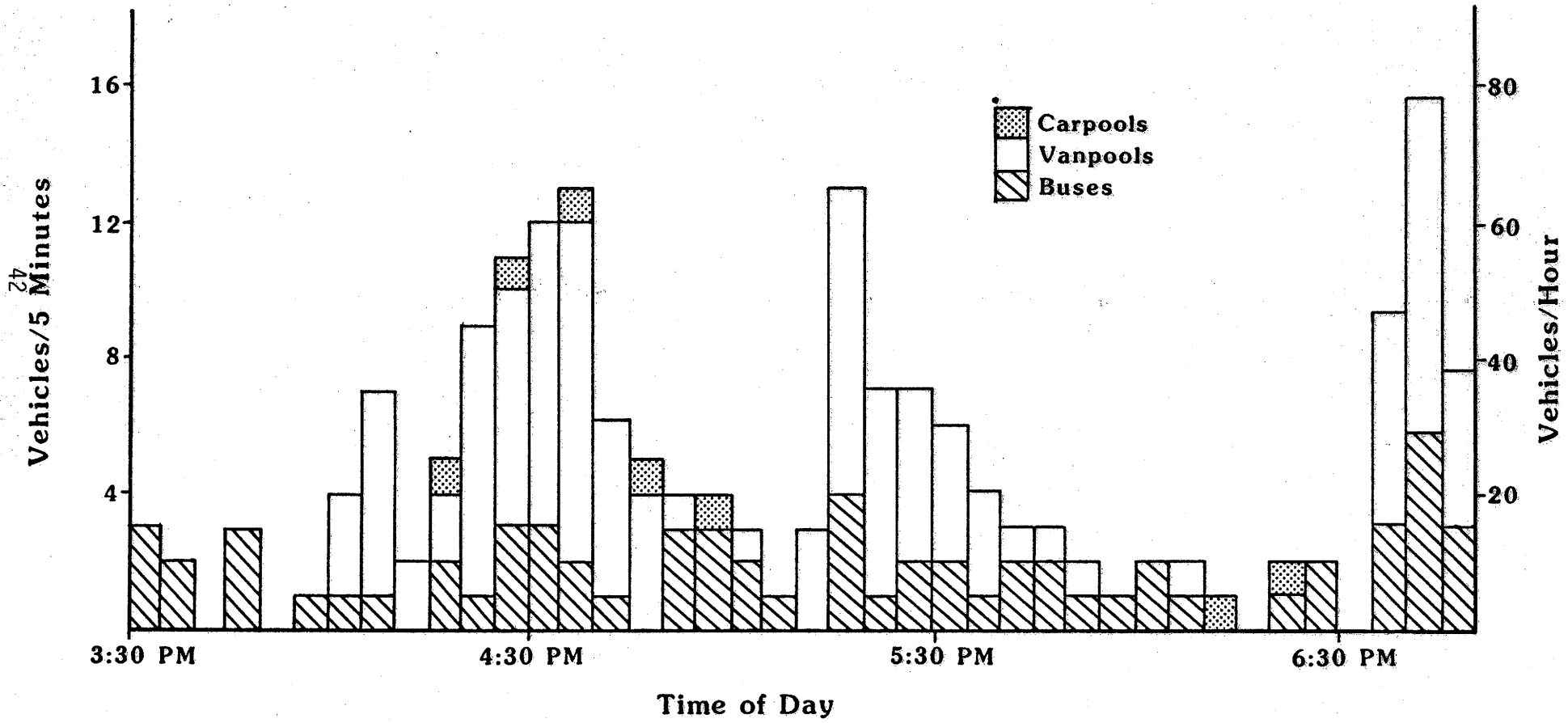


Figure 10. Katy Freeway AVL Volumes, PM Peak Period, May 1985

Freeway Mainlanes

Volume counts were taken from loop detectors installed in the mainlanes of I-10 at the Silber overpass and the Gessner overpass (Table 22). These counts were made during 2 days in March just prior to the opening of the AVL to carpools. The counts are very consistent for the 2 days, with the total counts differing by less than 3%, and with the peak-period counts differing by less than 5%. Even though the peak-hour volumes agree very well, 3-hour volumes may have a difference of 1000 vehicles or more. As a result, changes in freeway demands as a result of a modal shift or use of an alternate route, such as the AVL, cannot be measured if the diverted volumes are small.

Ramp Volumes

The ramps used by AVL traffic to enter or leave the Katy Freeway at Washington Avenue were counted in March (Table 23). The results for the 2 days agree very closely, and a change in AVL traffic should be detectable on these ramps. The significance of these data is the impact on traffic delays that might be caused by an increase in volume at the Washington Avenue/I-10 intersections.

Katy Road Intersection Volumes

The volumes on the westbound approach to Post Oak intersection of Katy Road were counted in March (Table 24). The afternoon volumes are important in the analysis of traffic signal delay to AVL traffic.

Speeds

Average Travel Speeds

Time mean speeds were measured for each vehicle on the Katy AVL. The times the vehicle entered and exited the lane were recorded to the nearest second, and the travel time was divided into the length of the lane to calculate average travel speeds. The distance used in the speed survey was

Table 22. 1985 Traffic Volumes, Katy Freeway Mainlanes Prior to AVL Carpool Utilization

Location, ADT and Time	Direction and Date			
	Eastbound		Westbound	
	March 26	March 27	March 26	March 27
Silber Overpass - 4 Lanes				
ADT	88,368	92,283	85,980	87,976
6:30-9:30 am	20,673	20,505	14,285	14,504
3:30-6:30 pm	16,852	15,960	17,890	17,187
Peak Hour	7,417	7,172	6,496	6,239
Gessner Overpass - 3 Lanes				
ADT	69,507	70,631	70,119	71,718
6:30-9:30 am	15,583	14,942	12,089	12,171
3:30-6:30 pm	13,210	13,884	14,560	13,981
Peak Hour	5,524	5,516	5,063	4,908

Table 23. 1985 Traffic Volumes on the Washington Avenue Access Ramps to the Katy AVL, Prior to AVL Carpool Utilization

ADT and Time Period	Location and Date			
	Washington Entrance To I-10 Katy Eastbound		Washington Exit To I-10 Katy Westbound	
	March 26	March 27	March 26	March 27
ADT	9,651	9,908	9,329	9,369
6:30-9:30 am	2,329	2,284	2,240	2,228
3:30-6:30 pm	2,205	2,247	2,450	2,413
Peak Hour	960	905	977	937

Table 24. 1985 Traffic Volumes, Old Katy Road Westbound Approach to North Post Oak, Prior to AVL Carpool Utilization

ADT and Time Period	Study Date	
	March 26	March 27
ADT	6,379	6,543
6:30-9:30 am	993	903
3:30-6:30 pm	2,235	2,476
Peak Hour	989	1,078

Table 25. Time Mean Speeds, Katy AVL, March 1985

Average Speed (mph)	Type of Vehicle		
	Bus	Vans	Total
Average Travel Speeds	52 MPH	56 MPH	55 MPH
Standard Deviation	8.7	3.3	3.5
Coefficient of Variation	0.17	0.06	0.06

Table 26. Spot Speed Survey, Katy AVL, March 1985, Eastbound AM

Date	Number of Vehicles			Speeds Missed	Less Than 45	45-50	50-54	54-57	57-60	60-63	63-66	66-70	Average Speed (MPH)
	Vans	Buses	Total										
Mar. 13	76	56	132	12	0	0	9	26	22	26	17	20	60
Mar. 14 (Rain)	82	55	137	11	0	26	50	34	11	2	2	1	53
Mar. 15	69	57	126	19	0	0	19	25	25	13	18	7	59
Mar. 18	67	57	124	23	0	9	38	22	16	8	4	4	55
Mar. 19	72	54	126	19	0	5	33	23	24	12	6	4	59
Mar. 20	68	54	122	10	0	15	44	23	20	2	0	7	54
Mar. 21	59	55	114	20	0	4	25	20	16	14	7	8	57
Mar. 22	71	49	120	20	0	3	18	25	25	20	6	3	57

4.7 miles. Since the vehicles had to reduce speeds to enter and exit the lane, the time mean speeds are less than the speeds attained within the lane.

Average speeds range between 45 and 62 MPH, but the overall average speed is 55 MPH, with buses traveling approximately 5 MPH slower than vanpools (Table 25). On a typical day, 15% of the AVL vehicles are restricted by other vehicles in traveling at the speed limit, even though the total volume over 3 hours is less than 200 vehicles. This is the result of the peaking of flow rates for the vanpools, as shown in Figures 9 and 10.

The running speeds are very close to the speed limit for the AVL, and the measure of dispersion, as expressed by the coefficient of variation, indicates a narrow range of speeds, with the buses having a much larger spread.

Spot Speeds

A set of vehicle detectors were placed in the AVL near Wirt Road to measure spot speeds. A speed classifier was used to measure the length of the vehicle and its speed, which was recorded by bins (speed ranges). The results of the study are presented in Tables 26 and 27. The results are not as accurate as the time mean speed because of the variation in the vehicle detectors and the limitation of the speed recorder. Several vehicle speeds were not recorded, and some were recorded at unreasonably high speeds.

The value of the data is to confirm that speeds for the most part were unrestricted by other vehicles and were in a narrow range around 55 MPH. The average for the speeds recorded was higher than the time mean speeds by 2 to 4 MPH. The obvious effect of rain on speeds is noted in the March 14 survey.

Total Trip Time

For persons using one of the 3 park-and-ride facilities along Katy Freeway, the total trip time to the central business district (CBD) is the significant measure of the level-of-service. The travel time surveys reported in this section concentrated on the time saving provided by the Katy

Table 27. Spot Speed Survey, Katy AVL, March 1985, Westbound PM

Date	Number of Vehicles			Speeds Missed	Less Than 45	Number of Vehicles with Speeds of:							Average Speed (MPH)
	Vans	Buses	Total			45-50	50-54	54-57	57-60	60-63	63-66	66-70	
Mar. 12	68	56	124		0	3	31	21	21	26	11	10	59.3
Mar. 13	90	55	145	13	0	3	27	35	33	20	9	5	57.3
Mar. 14	95	74*	169	36*	12	2	16	23	29	17	19	15	58
Mar. 15	60	66	126	26	0	7	26	29	18	8	10	3	56.3
Mar. 18	86	57	143	3	0	3	40	35	37	14	8	3	57
Mar. 19	87	55	142	20	0	3	24	32	31	19	9	4	57
Mar. 20	86	53	139	0	0	2	30	34	28	22	12	11	58
Mar. 21	87	49	136	20	0	3	30	33	24	12	10	4	57

*Date Questionable

AVL when compared to the freeway trip from SH 6 to the S.P.R.R. overpass. These limits usually encompass the traffic congestion that develops during the commuter hours, and travel from the S.P.R.R. to the CBD would be the same for AVL and non AVL traffic.

However, travel time to and from the park-and-ride lots and the freeway can be significant percent of the total trip. Limited studies of the 3 lots are presented in the following sections.

Katy/Mason Road Park-and-Ride

The distance from the Mason Road lot to the I-10 entrance ramp is 0.9 miles. However, there is considerable delay caused by traffic signals and high volumes on Mason Road, and travel delays of 5 to 7 minutes are common (Table 28). The distance on the freeway to SH 6 is 7.4 miles, and travel is at free flow speeds. The total trip from the lot to the S.P.R.R. would be approximately 46 minutes without the AVL. The 7 minutes in travel time savings on the AVL represents a 13% reduction in trip time to the S.P.R.R.

Table 28. Bus Travel Time (min.) From the Mason Road Park-and-Ride Lot to the S.P.R.R. Via the Katy AVL, March 1985

Trip Segment	Departure Time From Lot		
	5:55 AM	6:15 AM	6:55 AM
Exit from Mason Road Lot	0:00	0:00	0:00
Entrance Ramp to I-10	6:53	11:45	12:30
SH 6 Entrance Ramp to I-10	11:40	16:45	17:30
West Belt Entrance to AVL	16:09	27:04	25:25
Gessner Entrance to AVL	18:14	29:30	30:11
AVL Terminal	23:12	35:13	35:18
Post Oak Intersection	24:25	35:41	36:03
Washington Ave. at I-10 Intersection	27:16	39:33	38:53
S.P.R.R. Overpass	27:26	39:58	39:20

Note: Clear weather

Table 29. Bus Travel Time (min.) From the Addicks Park-and-Ride Lot to the S.P.R.R. Via the Katy AVL, March 1985

Trip Segment	Departure Time From Lot			
	6:05 AM	6:55 AM	7:20 AM	8:45 AM
Exit from Addicks Lot	0:00	0:00	0:00	0:00
SH 6 Entrance Ramp to I-10	4:18	7:07	5:04	5:17
West Belt Entrance to AVL	8:50	15:44	12:10	10:07
Gessner Entrance to AVL	10:49	20:30	17:22	12:08
AVL Terminus	16:21	25:43	22:47	17:18
Post Oak Intersection	17:51	26:11	23:27	18:20
Washington Ave. at I-10 Intersection	20:32	28:52	26:20	21:57
S.P.R.R. Overpass	20:56	29:20	26:44	22:25

Note: Clear weather

When the AVL is completed to the SH 6 interchange, the travel time savings will double.

Similar delays are experienced on the return trip to the lot, but the magnitude and duration of delays are less.

Addicks Park-and-Ride

The distance from the loading terminal to the entrance to I-10 eastbound is 1.6 miles. Buses have to double back to the westbound service road and u-turn at the SH 6 intersection. This travel time is approximately 6 minutes (Table 29). The construction of a direct connection from the completed AVL into the park-and-ride lot will save more than 5 minutes.

The return trip will be shorter since the travel distance is less, and a single right turn at SH 6 will have less delay.

The average trip time from the Addicks park-and-ride lot to the S.P.R.R. would be 36 minutes during the 2-hour peak period. The savings in travel time on the AVL represents a 20% reduction in travel time. When the AVL is completed to the SH 6 interchange and a direct connection to the lot is provided, the trip time will be reduced an additional 13 minutes, reducing the travel time to 16 minutes.

West Belt Park-and-Ride

The buses from West Belt Park-and-Ride travel a distance of 1.2 miles to enter I-10 on the priority ramp. They must then travel in mixed flow another 1.3 miles and enter the AVL at the Gessner terminal. Total travel time from the park-and-ride to the AVL will vary with traffic conditions on the freeway but will average 8 minutes during peak conditions (Table 30).

The return trip in the afternoon may be less because conditions on both the freeway and West Belt will be less severe.

Table 30. Bus Travel Time (min.) From the West Belt Park-and-Ride Lot to the S.P.R.R. Via the Katy AVL, March 1985

Trip Segment	Departure Time From Lot		
	6:30 AM	7:09 AM	7:50 AM
Exit Gate of West Belt Lot	0:00	0:00	0:00
West Belt Entrance Ramp to I-10	3:57	4:05	3:22
Gessner Entrance to AVL	7:15	8:33	7:47
AVL Terminus (large beam)	12:22	13:45	12:43
Post Oak Intersection	13:08	14:42	13:36
Washington Ave. at I-10 Intersection	16:19	18:03	16:48
S.P.R.R. Overpass	16:40	18:20	17:17

Note: Clear weather

Table 31. Estimated Vehicle-Miles of Travel on the Katy AVL

Time Period	Vehicle-Miles of Travel			
	Buses	Vans	Carpools	Total
Oct. 26, 1984 to Apr. 1, 1985	44,630	78,960	----	123,590
Apr. 1, 1985 to June 28, 1985	44,820	63,500	6,000	114,320
TOTAL	89,450	142,460	6,000	237,910

A direct connection from the park-and-ride lot to the AVL would save 7 minutes, in addition to the 4 minute saving on the AVL from Gessner to the S.P.R.R. overpass.

Incidents/Accidents

AVL

After 8 months of operation there have been no reported incidents on the AVL involving disabled vehicles or traffic accidents. This involves approximately 105 days of operation prior to the opening of the lane to carpools, and a total of 170 days to date (June 26, 1985). The number of vehicle miles traveled on the AVL are estimated in Table 31.

Freeway

Although there are no records kept on the number of incidents involving disabled vehicles on the freeway mainlanes, the number of reported accidents can be analyzed. Accident data for the 2- and 3-hour peak periods on weekdays when the AVL operates have been tabulated for the 5-month period from November 1, 1984 to March 31, 1985 (Table 32). Excluding 3 holidays in this period, the AVL operated a total of 103 days. During this time, the mainlanes of the freeway experienced 29 accident days in the morning and 43 accident days in the afternoon.

The accident data are divided into 2 segments of the Katy Freeway from SH 6 to the I-610 interchange:

- Segment 1 is 5.0 miles long from SH 6 to West Belt. During the study period this section was not modified from the standard cross-section of six 12-foot lanes and shoulders on both sides of the roadway.

- Segment 2 is 6.6 miles long from West Belt to I-610. The cross-section has been reconstructed to place the AVL in the median by eliminating the inside shoulders and reducing the lane widths.

Freeway accident data for the 5 months that the AVL operated with buses and vanpools is summarized in the following sections:

Segment 1 - SH 6 to West Belt

Traffic conditions in Segment 1 in the morning are stop-and-go in the eastbound direction and free flow in the westbound direction. This high accident experience (14 accidents) in the morning is typical for this type of operation. This represents an accident rate of 1.59 accidents per million vehicle miles (MVM).

Segment 2 - West Belt to I-610

Traffic conditions in the morning are good. Traffic volumes are high, but speeds are moderate and uniform in the peak direction. In the off-peak direction, volume is light and speeds are high. Conditions in Segment 2 have been improved by the removal of entrance ramps between Campbell and Bingle/Voss as part of the construction of the AVL. In the afternoon, however, the accident experience in both directions in Segment 2 is high. In the peak direction, traffic congestion and stop-and-go operations are evident throughout the segment length. In the off-peak direction, there is queueing that forms on the right lanes of the freeway approaching the I-610 interchange which may account for some of the large numbers of accidents.

The accident experience in Segment 2 is important in that AVL traffic is not involved and, therefore, suffers no extra delay. In the AM period, there were 7 accidents that occurred in the peak direction which would cause major disruptions to traffic. There were 7 accidents in the off-peak direction which would cause minor disruptions due to visual distractions, and 1 accident of unknown direction. These 15 accidents occurred on 11 days.

In the afternoon, the accident experience in Segment 2 is high (Table 32). There are 21 accidents in the peak direction and 17 accidents in the off- peak direction and 7 of an unknown direction. These 45 accidents occurred on 31 days. Therefore, the time saved by AVL traffic calculated in

Table 32. Accident Experience on the Katy Freeway, November 1984 Through March 1985

Segment and Peak Period	Number of Accidents (Number of Days with Accidents)				Accident Rate (Accidents Per MVM)
	Eastbound	Westbound	Unknown	Total	
AM Peak (6-9)					
Segment 1	14 (13)	2 (2)	4 (4)	20 (18)	1.50
Segment 2	7 (6)	7 (7)	1 (1)	15 (11)	0.85
Total	21 (19)	9 (9)	5 (5)	35 (29)	
PM Peak (4-7)					
Segment 1	7 (6)	4 (3)	0 (0)	11 (12)	0.82
Segment 2	17 (14)	21 (19)	7 (6)	45 (31)	2.14
Total	24 (20)	25 (22)	7 (6)	56 (43)	

the previous section is very conservative, particularly for the afternoon section.

Although the frequency of accidents is high, the accident rates for the Katy Freeway during peak periods is less than 1.5 accidents per million vehicles miles.

The two critical sections are eastbound Segment 1 in the morning, with a rate of 1.70 accidents per MVM, and westbound Segment 2 in the afternoon, with a rate of 2.10 accidents per MVM.

Comparison of Accidents -- 1982-1985

The AVL was under construction from June 1983 to October 1984. Accident records for similar time periods of November through March (5 months) were compared for the year before construction (1982-83), the year of construction (1983-84), and the year after construction (1984-85) (Table 33). The data are presented for informational purposes, since the time period was limited to 103 days and the accident data to 6 hours per week day. The data suggest that the introduction of the transitway in the median has not caused unsafe conditions which could increase the accident frequency. However, no statistical significance tests are applied to the data at this time.

Table 33. Accident Experience (5 mo.) Before, During, and After Construction of Katy AVL to West Belt

Segment and Peak	Direction			
	Eastbound	Westbound	Unknown	Total
Segment 1, AM Period				
Before Construction	16	6	2	24
During Construction	10	6	0	12
After Construction	14	2	4	20
Segment 1, PM Period				
Before Construction	4	1	1	6
During Construction	2	18	0	20
After Construction	7	4	0	11
Segment 2, AM Period				
Before Construction	21	4	4	29
During Construction	25	27	4	56
After Construction	7	7	1	15
Segment 2, PM Period				
Before Construction	24	32	10	66
During Construction	18	18	7	43
After Construction	17	21	7	45
TOTAL				
Before Construction	65	43	17	125
During Construction	55	69	11	135
After Construction	45	34	12	91

SURVEYS OF AVL USERS AND NON-USERS

In addition to the traffic data collection described previously, surveys of both users of the authorized vehicle lane and non-users of the authorized vehicle lane were undertaken. Surveys were conducted of: 1) patrons on transit buses using the AVL; 2) drivers of vanpools using the AVL; 3) passengers in vanpools using the AVL; and 4) motorists on the Katy Freeway mainlanes not using the AVL.

While the surveys collected data concerning general travel characteristics and demographic data, the surveys were primarily intended to: 1) determine perceptions of the level of utilization of the AVL; 2) identify why individuals have chosen their present travel mode and whether their choice of mode might change once carpools are allowed to use the AVL; and 3) assess attitudes concerning the AVL and the impacts of the AVL.

Survey Procedures

All survey forms and procedures were analyzed to assure that findings would be statistically significant. From a statistical reliability standpoint, the least reliable data will be the motorist survey information. Even when those data are cross classified into a four-by-four matrix, based on the actual response rate, the accuracy of the least reliable cell in the cross classification matrix will be $\pm$ 15%.

All survey data were collected by TTI personnel during the month of March 1985. The survey results were subsequently entered into a computer data base for purposes of analysis.

On-Board Transit Surveys, AVL Users

On-board surveys were conducted on all METRO routes using the Katy AVL during the a.m. peak period (6-9 a.m.). The objective was to survey 100% of the seated passengers on approximately 30% of the bus runs. Service was provided on one express route and from 3 park-and-ride lots. TTI staff were present on all buses surveyed to direct the survey effort. Surveys were

distributed and collected by the TTI staff on-board the buses. Table 34 summarizes the survey distribution. The survey instrument is included in Appendix A.

Table 34. On-board Transit Survey Distribution, METRO AVL Routes

Route	No. of Surveys Distributed	No. of Surveys Completed	Response Rate
Katy-Mason Road P/R	81	73	90%
Addicks, SH 6 P/R	96	94	98
West Belt P/R	55	55	100
Memorial Limited	137	136	99
TOTAL	369	358	97%

The specific bus runs surveyed are shown in Table 35.

Vanpool Surveys, AVL Users

Vanpools were surveyed in the p.m. peak. All vanpools were stopped at the entrance to the AVL by METRO police. TTI staff distributed the surveys. A separate survey was given to the drivers; that survey requested more detailed data than did the passenger survey. A different survey was given to each passenger. Postage-paid return envelopes were included with the surveys, and drivers and passengers were requested to return the surveys in the mail. The survey instruments used are included in Appendix A. Table 36 summarizes the response rate to the surveys.

Motorist Survey

During the 6-9 a.m. peak period, license plates of motorists operating inbound on the Katy Freeway were recorded by TTI observers. These plates were read at a location on the freeway between Voss and Campbell. The Department of Public Safety license plate files were accessed to obtain addresses. A survey was mailed to each address (excluding corperate addresses and leasing agencies). Postage-paid return envelopes were included

Table 35. Bus Runs Surveyed, Katy AVL Transit User Survey

Route and Block	Departure Time[1]
Route 221, Katy/Mason Park-and-Ride	
222	5:55 a.m.
225	6:15 a.m.
226	6:55 a.m.
Route 228, Addicks Park-and-Ride	
222	6:05 a.m.
227	6:55 a.m.
222	7:20 a.m.
227	8:45 a.m.
Route 210, Katy/West Belt Park-and-Ride	
202	5:45 a.m.
201	6:30 a.m.
202	7:09 a.m.
201	7:50 a.m.
Route 31, Memorial Limited	
301	5:23 a.m.
331	5:42 a.m.
330	6:04 a.m.
327	6:32 a.m.
301	5:23 a.m. (2nd run)

[1]For park-and-ride lots, this is the departure time from the lot. For Memorial Limited, this is the departure time from the garage.

Table 36. Vanpool Survey Distribution, Katy AVL Vanpool Survey

Survey Group	No. of Surveys Distributed	No. of Surveys Completed	Response Rate
Vanpool Drivers	85	66	78%
Vanpool Passengers	604	399	66
TOTAL	689	465	67%

with each of the surveys. The motorists were to complete the survey and return it to TTI.

The survey instrument used is included in Appendix A. A separate color was used for each hour surveyed (6-9 a.m.), and, thus, the data can be cross classified by time period. Table 37 summarizes the responses to the survey.

Table 37. Motorist (Non AVL User) Survey Distribution, Katy Freeway

Time Period (a.m.)	No. of License Plates Read	No. of Surveys Mailed	No. Returned, Address Unknown	No. Returned, Vehicle Not On Katy Fwy.	No. of Surveys Completed	Response Rate (% of Surveys Mailed)
6-7	545	368	28	5	122	33%
7-8	867	594	35	14	166	28%
8-9	678	473	31	8	166	35%
TOTAL	2090	1435	94	27	454	32%

Comparison to Los Angeles El Monte Data

Some of the questions used in the Katy AVL surveys are similar to those used in an evaluation of the El Monte Busway in Los Angeles. When possible, for comparative purposes, the El Monte data are also presented in this study. Additional data collected for the El Monte study will be of interest in subsequent "after" evaluations to be performed as part of this study.

AVL TRANSIT USER SURVEY

Users of the 3 park-and-ride lots and the one express route that use the AVL were surveyed during the a.m. peak period. The survey instrument is included in Appendix A.

The questions on the survey, in general, addressed 3 areas: 1) personal characteristics; 2) travel patterns and trip characteristics; and 3) attitudes and impacts pertaining to the AVL. The information is presented in this section in that order.

For the most part, the survey responses from the patrons at the 3 park-and-ride lots are similar; the responses from the West Belt lot, the only lot to open after the AVL opened, differ in some respects from the Mason and Addicks lot responses. The responses from the one express route surveyed, the Memorial Limited, differ in some respects from the park-and-ride responses. These differences are highlighted in this section of the report.

Personal Characteristics

Questions were asked to identify age, sex, occupation, and last year of school completed.

Age

As has been determined in previous on-board transit park-and-ride surveys, the average age of the patrons is in the mid 30's. These data are shown in Table 38. The average age for the patrons on the Memorial Limited is approximately 4 years greater than the age of park-and-ride patrons.

Sex

Between 44% and 55% of the ridership on all routes surveyed is male. Again, this is in general agreement with previous park-and-ride survey data (Table 38).

Table 38. Personal Characteristics of Katy AVL Transit Patrons

Personal Characteristic	Total Houston Sample	Memorial Limited	W. Belt P/R	Mason P/R	Addicks P/R	Los Angeles El Monte
Age (years)	(n=351)	(n=132)	(n=54)	(n=71)	(n=94)	----
50th Percentile	33	37	33	33	32	----
Sex	(n=351)	(n=133)	(n=55)	(n=69)	(n=94)	(n=410)
% Male	49%	53%	44%	55%	44%	44%
% Female	51%	47%	56%	45%	56%	56%
Occupation	(n=343)	(n=128)	(n=55)	(n=67)	(n=94)	
% Professional	56%	54%	62%	54%	56%	----
% Managerial	13%	14%	15%	13%	12%	----
% Clerical	21%	20%	16%	18%	28%	----
% Sales	4%	4%	7%	3%	2%	----
% Other	6%	8%	0%	12%	2%	----
Education (years)	(n=346)	(n=131)	(n=54)	(n=69)	(n=92)	
Average	15.6	15.9	15.2	15.7	15.3	

Occupation

The greatest number of riders at all lots are classed as "professional". A significant ridership component is also drawn from "managerial" and "clerical" job positions (Table 38). Nearly 70% of total ridership is "professional" or "managerial".

Education

As has been found in previous park-and-ride surveys, users of this type of bus service are highly educated. The average patron has completed over 3.5 years of college (Table 38).

Travel Patterns and Trip Characteristics

Questions were asked concerning trip purpose, days per week the trip is made, trip origin, trip destination, whether the employer pays for part of the bus fare, and whether a car was available for the trip.

Trip Purpose

Virtually all the transit trips surveyed are work trips (Table 39). The only non-work trips identified in the survey were on the Memorial Limited route, and that was a small percentage.

Trip Frequency

As would be expected for a transit service catering to work trips, virtually all the trips are made on a daily basis (Table 39).

Trip Origin

The origin of the trip, by zip code, was requested. The data are summarized in Figures 11, 12, 13 and 14 and in Table 40. The park-and-ride origin data are consistent with market areas as defined in previous surveys.

Both the West Belt and Addicks lots are located north of the Katy Freeway, and that is where the majority of the ridership originates. Approximately 60% of West Belt ridership originates north of the freeway, and 70% of Addicks ridership originates north of the freeway. At Mason Road, the lot is located south of the freeway, and 62% of the ridership originates from south of the freeway.

The ridership on the Memorial Limited primarily originates from zip codes immediately adjacent to Memorial Drive.

Table 39. Trip and Travel Characteristics of Katy AVL Transit Patrons

Trip Characteristic	Total Houston Sample	Memorial Limited	W. Belt P/R	Mason P/R	Addicks P/R	Los Angeles El Monte
Trip Purpose	(n=358)	(n=136)	(n=55)	(n=73)	(n=94)	
% Work	99%	96%	100%	100%	100%	----
% School	1%	3%	0%	0%	0%	----
% Other	0%	1%	0%	0%	0%	----
Trip Frequency (days/wk)	(n=355)	(n=136)	(n=54)	(n=73)	(n=92)	
0-1	1%	0%	0%	3%	1%	----
2	1%	1%	0%	1%	1%	----
3	2%	2%	4%	1%	0%	----
4	5%	6%	6%	3%	7%	----
5 or more	91%	91%	90%	92%	91%	----
Trip Destinations	(n=357)	(n=135)	(n=55)	(n=73)	(n=94)	
Downtown	96%	94%	98%	97%	97%	----
Medical Center	1%	1%	0%	0%	2%	----
Greenway Plaza	0%	1%	0%	0%	0%	----
Univ. of Houston	3%	4%	2%	3%	1%	----
Employer Payment of Bus Fare	(n=355)	(n=134)	(n=54)	(n=73)	(n=94)	
Pays All	19%	17%	22%	16%	23%	----
Pays Part	38%	26%	46%	44%	45%	----
Pays None	43%	57%	32%	40%	32%	----
Auto Available for Trip	(n=354)	(n=134)	(n=55)	(n=72)	(n=93)	(n=424)
No	7%	11%	2%	7%	4%	17%
Yes, but inconvenient	10%	13%	2%	13%	9%	11%
Yes	83%	76%	96%	80%	87%	72%

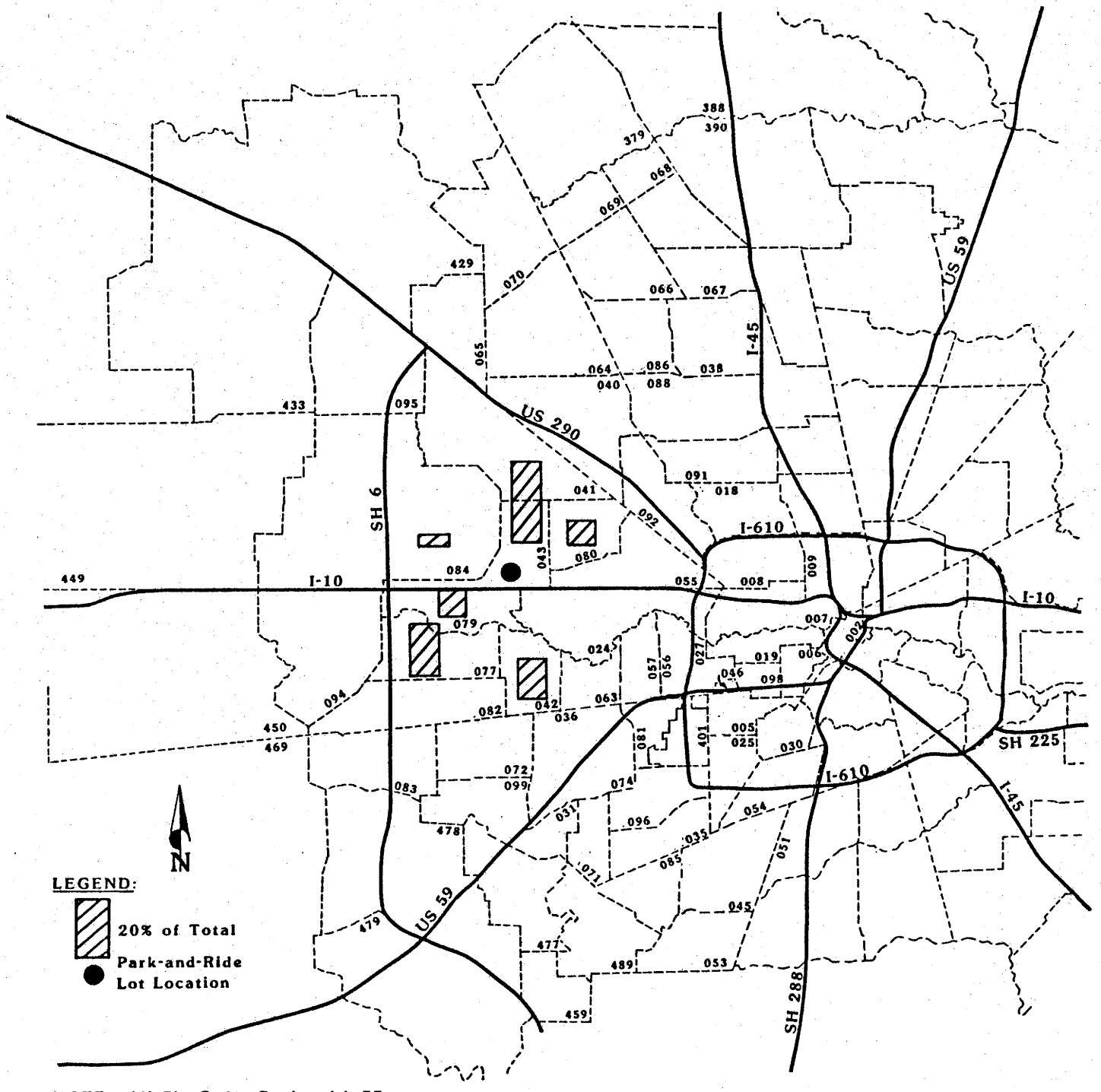


Figure 11. Home Origins of Patrons at the West Belt Park-and-Ride Lot

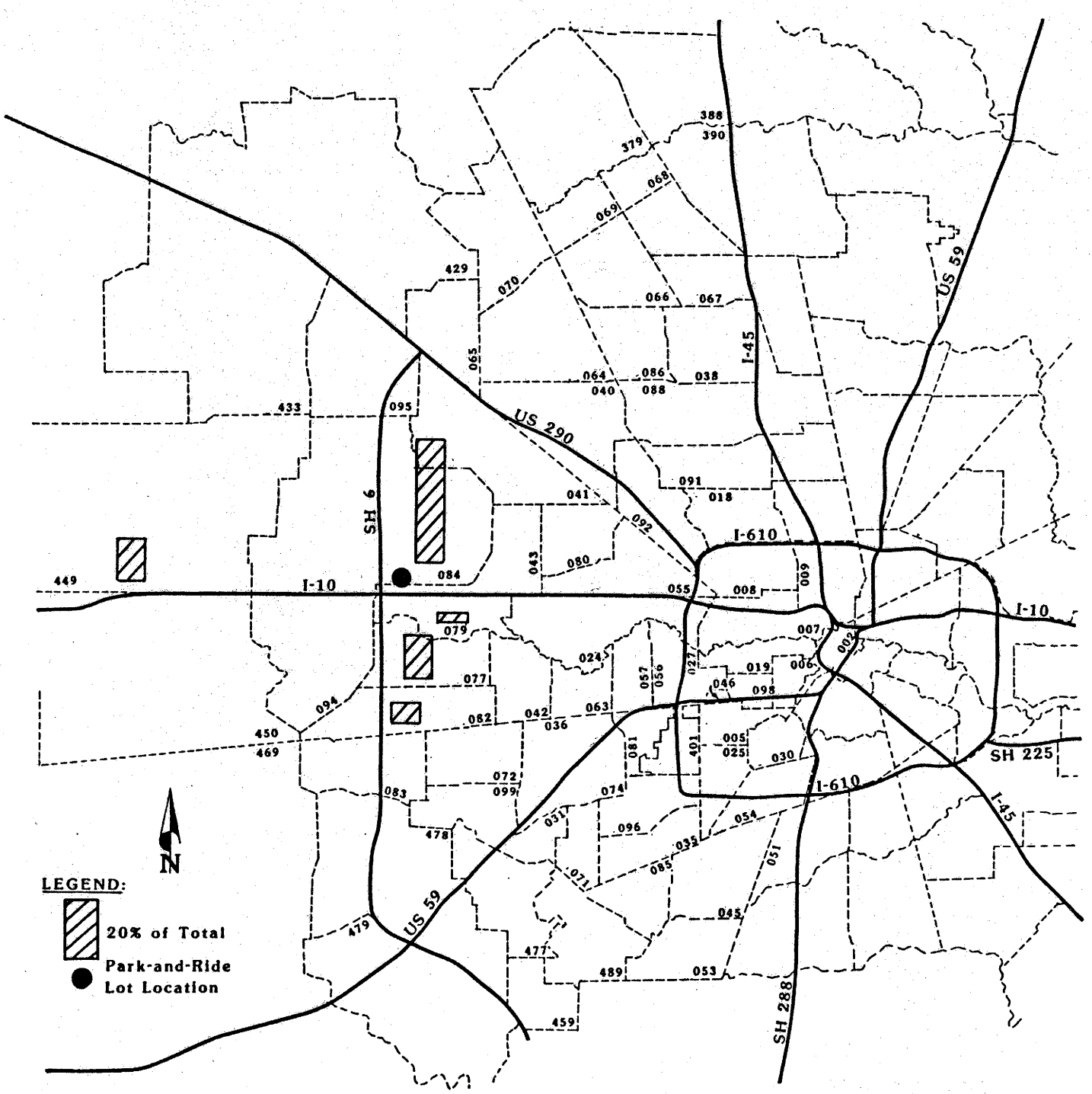


Figure 12. Home Origins of Patrons of the Addicks Park-and-Ride Lot

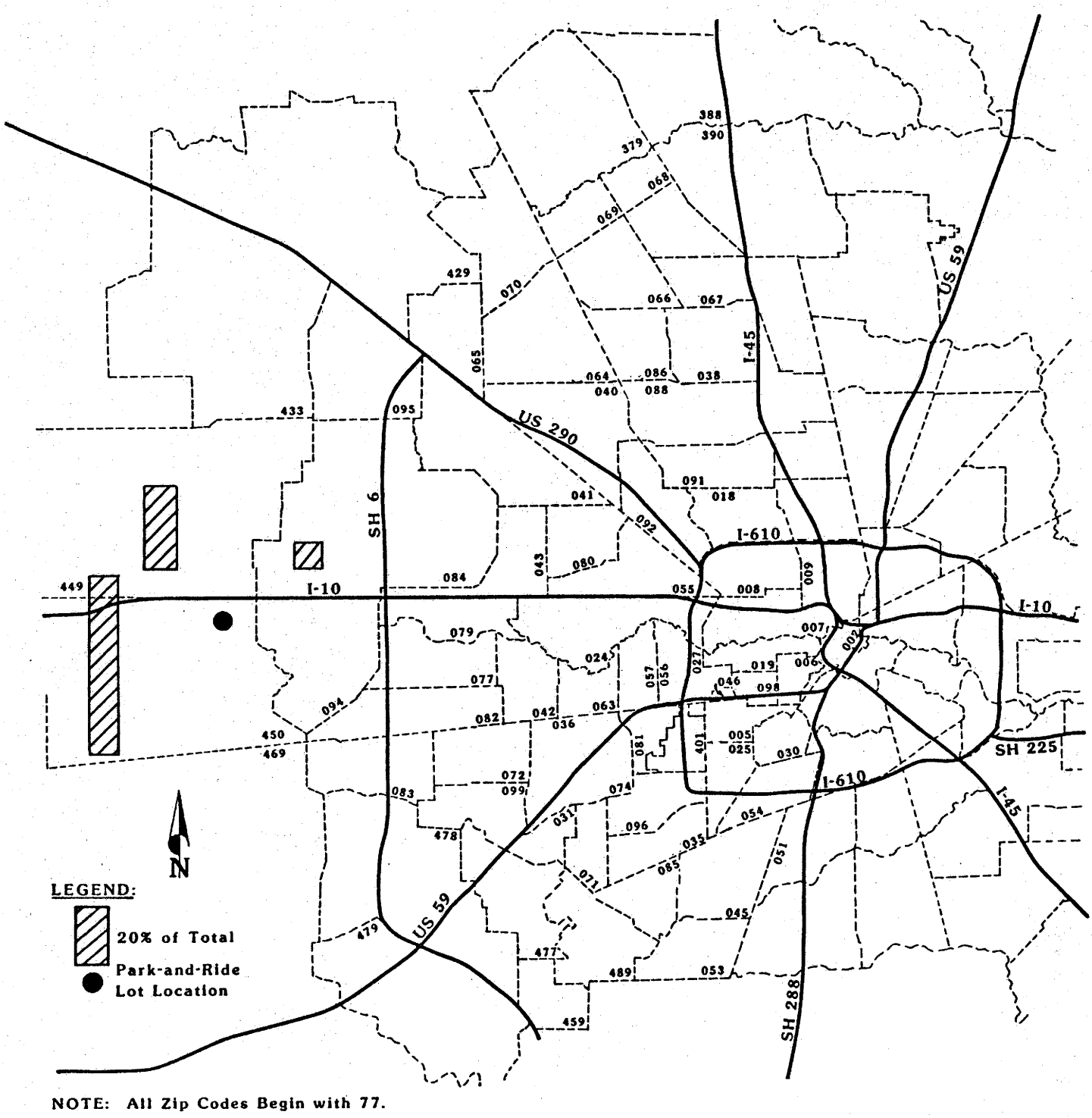


Figure 13. Home Origins of Patrons of the Mason Road Park-and-Ride Lot

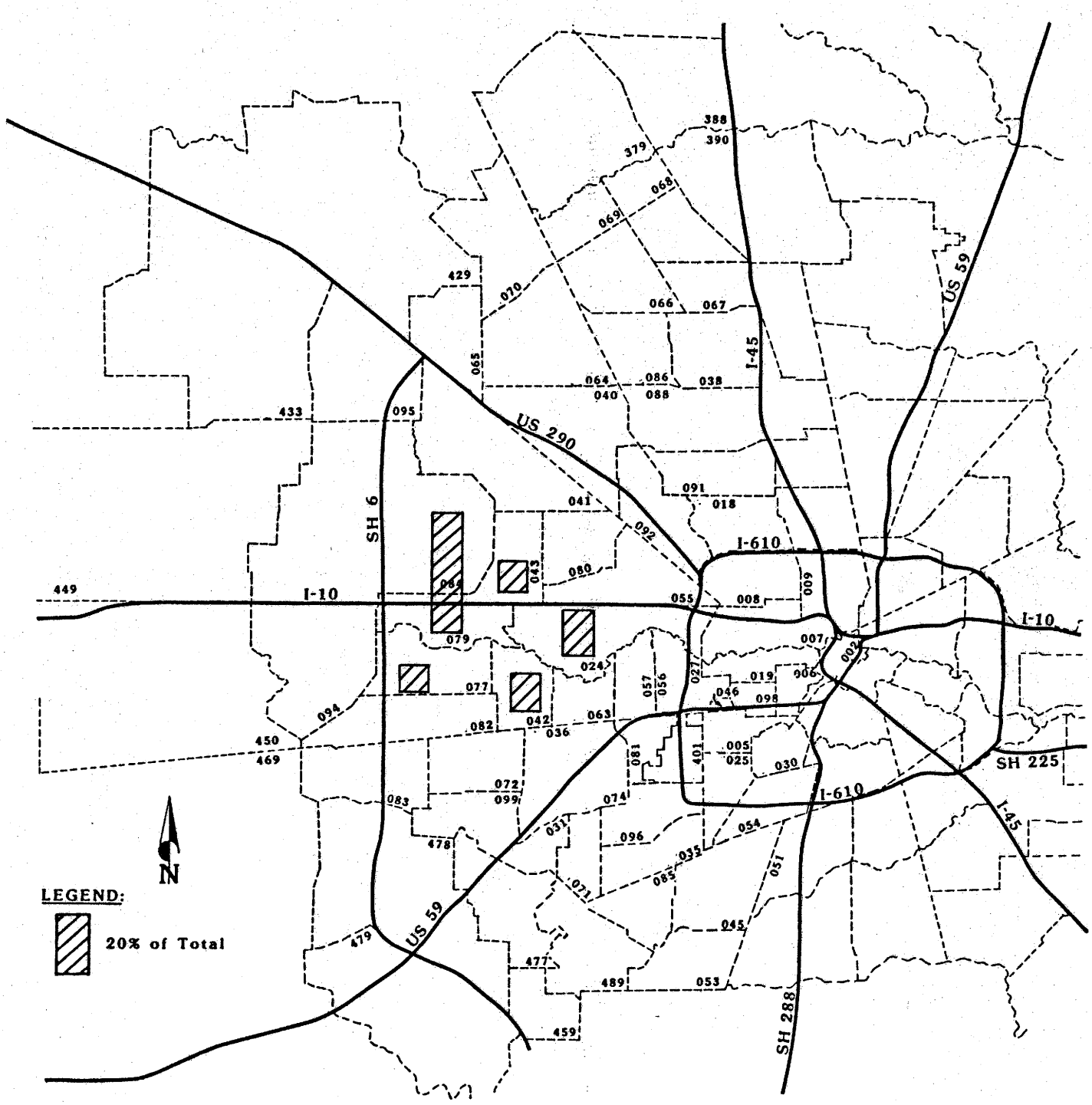


Figure 14. Home Origins of Patrons of the Memorial Limited Route

Table 40. Zip Codes of Origin For Katy AVL Transit Trips, Transit User Survey

Bus Route	Zip Code	Location Relative to I-10	% of Total Origins
Memorial Limited	77079	----	41%
	77024	----	15%
	77042	----	13%
	77077	----	9%
	77043	----	7%
	Other	----	15%
West Belt P/R	77043	North	33%
	77077	South	18%
	77042	South	13%
	77079	South	10%
	77080	North	9%
	77084	North	5%
	Other	----	12%
Mason P/R	77450	South	62%
	77449	North	29%
	77084	North	8%
	Other	----	1%
Addicks P/R	77084	North	43%
	77077	South	15%
	77449	North	14%
	77082	South	6%
	Other	----	22%

Trip Destinations

The only destination served directly by the bus operation is the downtown; virtually all transit trips being served are downtown trips (Table 39).

Employer Contribution to Fare Payment

For about one-fifth of the transit ridership, the employer pays the entire fare (Table 39). At the park-and-ride lots, approximately two-thirds of the ridership has all or part of its fare paid by the employer; less than half the ridership on the Memorial Limited has part or all of its fare paid by the employer.

Auto Availability

The riders of the transit service are "choice" riders; the overwhelming majority have an auto available to serve the trip (Table 39).

Attitudes and Impacts Pertaining to the AVL

Approximately half of the survey questions were intended to collect data concerning the AVL. For purposes of presentation, these responses are grouped into the following five categories: 1) time savings and duration of use; 2) modal selection and prior mode; 3) impacts of AVL on mode choice; 4) AVL impacts on ridesharing and freeway congestion; and 5) perception of the level of AVL utilization.

Time Savings and Duration of Use

The average perception of time saved (Table 41) is somewhat greater than the time savings determined through travel time runs (Table 1). Due to "backtracking" required in the route, users of the Memorial Limited do not receive the same p.m. time savings as do the park-and-ride patrons; those individuals are forced to use the West Belt exit and then "backtrack" to Gessner. A frequency distribution of perceived time savings due to the AVL is shown in Figure 15.

Approximately 71% of the AVL transit ridership has used the AVL since it opened (it had been open 5 months at the time of the survey); thus, transit ridership on the AVL should have increased by about a third since the AVL opened. A higher percentage of West Belt patrons have used the AVL a shorter

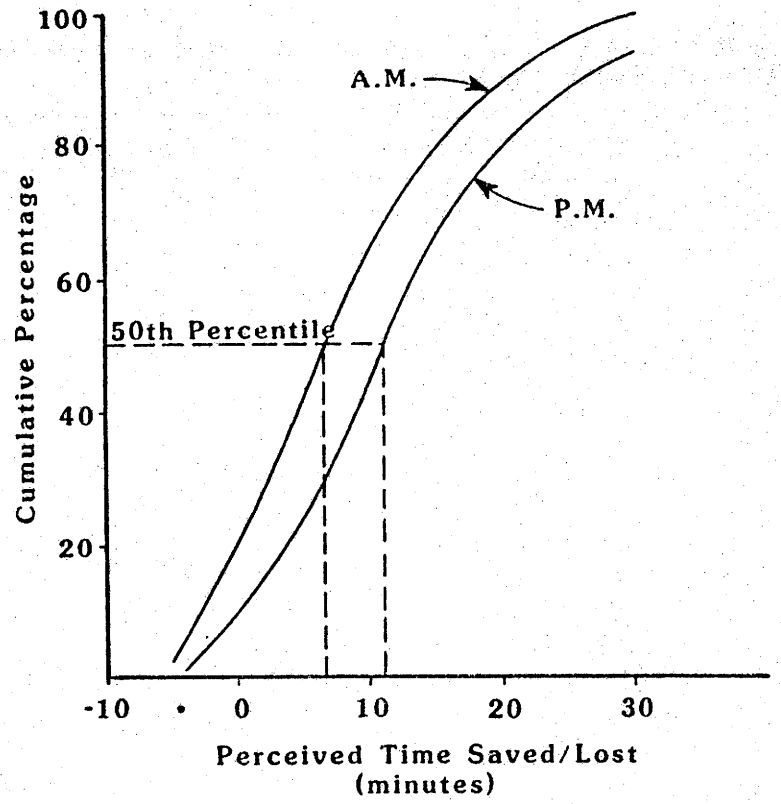


Figure 15. Perceived AVL Travel Time Savings, Transit User Survey

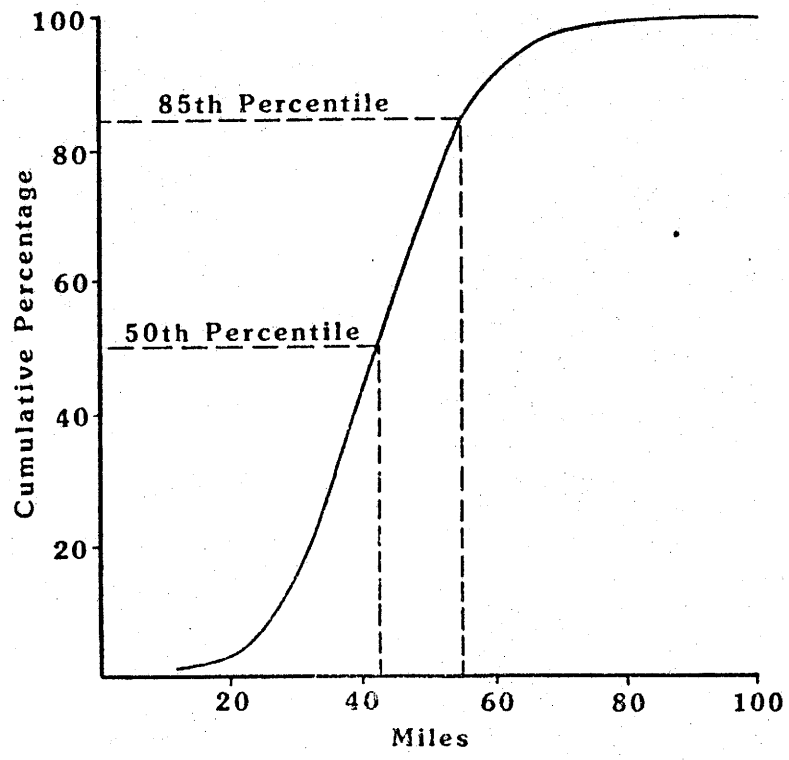


Figure 16. Round Trip Mileage For Vanpools

Table 41. Characteristics of AVL Utilization and Reasons for Modal Choice, Katy AVL Transit User Survey

Attitude/Impact	Total Houston Sample	Memorial Limited	W. Belt P/R	Mason P/R	Addicks P/R	Los Angeles El Monte
Perceived Time Savings (min) 50th Percentile	(n=328)	(n=120)	(n=51)	(n=70)	(n=87)	
a.m.	9	8	13	8	9	-----
p.m.	13	7	17	14	14	-----
Duration of AVL Use (mo.)	(n=352)	(n=130)	(n=55)	(n=73)	(n=94)	
Less Than 1	5%	1%	13%	4%	4%	-----
1	9%	8%	20%	3%	9%	-----
2	7%	8%	9%	8%	3%	-----
3	5%	4%	9%	3%	7%	-----
4	3%	4%	0%	5%	3%	-----
5, Since Opened	71%	75%	49%	77%	73%	-----
Travel Mode Before AVL	(n=355)	(n=133)	(n=55)	(n=73)	(n=94)	
Drove Alone	24%	14%	31%	25%	33%	-----
Carpooled	5%	6%	2%	4%	5%	-----
Vanpooled	4%	1%	4%	7%	7%	-----
P/R	23%	1%	16%	48%	39%	-----
Regular-Route Bus	31%	66%	31%	1%	3%	-----
Did not make trip	12%	11%	14%	15%	12%	-----
Other	1%	1%	2%	0%	1%	-----
Why Ride the Bus*	(n=1175)	(n=428)	(n=199)	(n=225)	(n=323)	(n=934)
Freeway Congestion	18%	13%	21%	68%	20%	24%
Time to Relax	17%	15%	17%	19%	18%	18%
Cost Less	15%	19%	15%	10%	15%	22%
Reliable Trip Time	14%	14%	15%	12%	16%	-----
Saves Time	14%	13%	18%	14%	13%	11%
Dislike Driving	13%	14%	11%	13%	11%	11%
Someone Else Use Car	4%	5%	2%	4%	3%	5%
Vanpool/Carpool Broke Up	2%	3%	0%	0%	1%	9%
No Other Mode	1%	1%	0%	3%	1%	6%
Why Bus Rather Than Van*	(n=417)	(n=180)	(n=58)	(n=76)	(n=103)	
More convenient	63%	51%	71%	76%	69%	-----
Cost Less	18%	28%	14%	5%	13%	-----
Van Not Available	16%	16%	14%	16%	16%	-----
Other	3%	5%	1%	3%	2%	
Ride Bus If No AVL	(n=356)	(n=135)	(n=55)	(n=72)	(n=94)	
Yes	69%	79%	49%	69%	64%	-----
No	15%	4%	36%	14%	20%	-----
Not Sure	16%	16%	15%	17%	16%	-----
How Important Was AVL In Decision to Ride Bus	(n=357)	(n=135)	(n=55)	(n=73)	(n=94)	
Very Important	39%	25%	51%	45%	47%	-----
Somewhat Important	26%	24%	33%	30%	21%	-----
Not Important	35%	51%	16%	25%	32%	-----

*For these questions, it was possible to check more than one answer. The n value is the total number of answers checked, not the total number of surveys completed.

period of time, since the lot opened in January and the AVL opened in October. The 49% shown as "since opened" for West Belt may, in effect, pertain to since the lot, rather than the AVL, opened. However, as shown subsequently, a portion of the West Belt transit patronage previously used other park-and-ride lots. These data are summarized in Table 41.

Prior Travel Mode and Modal Selection

Tranist patrons on the buses using the AVL were asked how they normally made the trip prior to using transit on the AVL. Approximately 33% either drove themselves, carpooled, or vanpooled. Fifty-four percent rode either a regular-route bus or a park-and-ride bus, while 12% did not previously make the trip. These data are summarized in Table 41. It is of interest to note that almost a third of the patrons using the new West Belt lot previously rode a regular-route bus.

Transit users were asked why they chose to use a bus on the AVL. They were able to check more than one reason. The major reasons were freeway congestion, time to relax, cost less, reliable trip time, and saves time. These data are summarized in Table 41.

Bus riders were also asked why they selected the bus rather than use a vanpool. Again, more than one reason could be checked. The convenience of the bus was cited as the overwhelming reason (Table 41).

Impact of the AVL On Mode Choice

Another question was intended to determine whether the individuals would be riding the bus if the AVL had not opened. While over two-thirds responded "yes", it is of interest to note that nearly one third responded "no" or "not sure" (Table 41). A related question asked how important the AVL was in the decision to ride the bus. Nearly 40% of the respondents stated "very important" (Table 41). Since the West Belt lot opened after the AVL opened, it is not surprising that a greater percentage of "no" responses were received from that lot.

In an effort to identify possible modal overlap, transit patrons were asked if they would choose to carpool in a 4+ pool rather than ride the bus once carpools were allowed on the AVL. While about 15% of transit riders were not sure, essentially no one said they would definitely carpool (Table 42). Bus riders were also asked why they responded in this manner; their response reflected both positive aspects of the bus service and negative aspects of the carpool service.

Table 42. Perceived Impact of Carpool Utilization on Transit Ridership, Transit User Survey

Impact	Total Sample	Memorial Limited	W. Belt P/R	Mason P/R	Addicks P/R
Will you change to a carpool	(n=356)	(n=135)	(n=55)	(n=72)	(n=93)
Continue Bus	86%	85%	95%	83%	83%
Carpool	0%	0%	0%	2%	0%
Not Sure	14%	15%	5%	15%	17%
Why continue to ride bus	(n=124)	(n=42)	(n=17)	(n=30)	(n=35)
Flexible Bus Service	43%	38%	53%	30%	54%
Like Bus More	19%	12%	35%	23%	17%
No Carpool Available	11%	19%	12%	7%	6%
Carpool Inconvenient	7%	10%	0%	10%	6%
Other	20%	21%	0%	30%	17%

Perceived Impacts of the AVL On Ridesharing and Congestion

Transit patrons were asked a series of questions regarding the impact of the AVL on transit ridership, vanpool ridership, and congestion on the Katy Freeway mainlanes. The area where transit riders would have the best information--the impact on transit ridership--showed that over two-thirds of the riders felt the AVL had increased transit ridership. Most were unsure of the impacts on vanpool utilization, and most felt the AVL had reduced travel time for transit patrons. While the greatest number of respondents felt the

AVL had decreased mainlane congestion, many also felt it had not or were unsure of the impacts. These responses are summarized in Table 43.

Table 43. Perceived Impacts of AVL on Ridesharing, Travel Time, and Freeway Congestion, Katy AVL Transit User Survey

Impact	Total Sample	Memorial Limited	W. Belt P/R	Mason P/R	Addicks P/R
Has AVL Increased Vanpooling	(n=304)	(n=114)	(n=45)	(n=64)	(n=81)
Yes	18%	20%	18%	20%	15%
No	11%	11%	9%	14%	10%
Not Sure	71%	69%	73%	66%	75%
Has AVL Increased Transit Ridership	(n=335)	(n=124)	(n=50)	(n=69)	(n=92)
Yes	69%	61%	72%	65%	79%
No	7%	10%	6%	12%	1%
Not Sure	24%	29%	22%	23%	20%
Reduce AVL Travel Time	(n=344)	(n=129)	(n=52)	(n=70)	(n=93)
Yes	79%	68%	88%	82%	88%
No	11%	19%	4%	14%	1%
Not Sure	10%	13%	8%	4%	11%
Has AVL Reduced Traffic Congestion	(n=332)	(n=127)	(n=50)	(n=66)	(n=89)
Yes	40%	36%	44%	42%	43%
No	25%	29%	28%	20%	22%
Not Sure	35%	35%	28%	38%	35%

Is The AVL Sufficiently Utilized

One of the main reasons for allowing carpools onto the AVL is to increase the perception of utilization. Transit patrons were asked whether they felt the AVL was sufficiently utilized to justify the project.

In considering the response, it must be realized that the transit user sees the AVL from inside a crowded bus. He does not have a good perception

of the vehicle flow rate on the AVL, and he has a good feeling for the number of persons moved per bus.

About half of the transit users felt the AVL was sufficiently utilized. About a third felt it wasn't, and the remainder was unsure. These responses are summarized in Table 44.

Table 44. Is the AVL Sufficiently Utilized to Justify the Project, Katy AVL Transit User Survey

Response	Total Sample	Memorial Limited	W. Belt P/R	Mason P/R	Addicks P/R
	(n=348)	(n=130)	(n=52)	(n=73)	(n=93)
Yes	49%	37%	62%	52%	55%
No	33%	46%	11%	34%	27%
Not Sure	18%	17%	27%	14%	18%

Comments

Survey participants were encouraged to offer comments. Approximately 25% of the participants did provide comments. A representative selection of comments is presented in Appendix B.

The comments can generally be summarized as shown below.

	Comment	Percent of Total Comments
1.	Extend the AVL	22%
2.	Provide more peak buses	16%
3.	Poor entry/exit design	16%
4.	Lose time doubling back (Memorial Route)	8%
5.	Bus fare too high	7%
	Other	31%

AVL VANPOOL USER SURVEYS

Surveys of vanpoolers were conducted during the p.m. peak. One survey form was given to the vanpool drivers, and a second survey was given to each passenger. The driver survey was more detailed than was the passenger survey. The survey instruments are included in Appendix A.

As was the case with the transit user surveys, 3 primary areas were addressed: 1) personal characteristics; 2) travel patterns and trip characteristics; and 3) attitudes and impacts pertaining to the AVL.

In general, the responses from the drivers and the passengers are similar.

Personal Characteristics

Questions were asked to identify age, sex, occupation, and last year of school completed.

Age

The average age for users of vanpools is in the upper 30's (Table 45).

Sex

Almost two thirds of the drivers are male, while about half of the passengers are male (Table 45).

Occupation

Between 65% and 75% of the vanpoolers are considered "professional" or "managerial" (Table 45).

Education

The average vanpooler has completed over 3 years of college (Table 45).

Table 45. Personal Characteristics of the Katy AVL Vanpool Users

Characteristic	Total Sample	Vanpool Drivers	Vanpool Passengers
Age (years)	(n=449)	(n=64)	(n=385)
50th Percentile	36	33	37
Sex	(n=452)	(n=63)	(n=389)
% Male	52%	65%	50%
% Female	48%	35%	50%
Occupation	(n=446)	(n=63)	(n=383)
% Professional	55%	46%	56%
% Managerial	21%	30%	19%
% Clerical	20%	19%	20%
% Sales	2%	0%	3%
% Laborer	1%	3%	0%
% Operative	1%	2%	1%
% Other	0%	0%	1%
Education (years)	(n=445)	(n=63)	(n-382)
Average	15.4	15.2	15.4

Travel Patterns and Trip Characteristics

Questions were asked regarding formation and operation of the vanpool, days per week the trip is made, trip origin, and trip destination.

Formation and Operation of the Vanpool

Several questions were asked relating to various aspects of vanpool formation and operation. These have been divided into the following categories: 1) formation of vanpool; 2) trip length; and 3) occupancy of vanpool; 4) employer contribution to vanpool costs; and 5) impact on personal car use.

Formation of Vanpool

Most all of the vanpools were formed by the employer, and the employer is also the primary provider of vanpools. The "average" vanpooler joined the vanpool in 1983. Drivers have been in the vanpool longer than passengers.

When asked why vanpoolers began vanpooling, the most common responses were more economical, convenience, dislike driving, and moved to either a new job or a new residential location where vanpooling became possible. Most vanpoolers previous mode of travel was either drive alone or carpool.

These responses are summarized in Table 46.

Trip Length

Vanpoolers were asked how long their round trip would be if they drove and how much longer their round trip is because they vanpool. Trip length frequencies are shown in Figure 16 (page 69).

The 50th percentile responses are shown in Table 47. As is typical of vanpooling, the average one-way trip is in excess of 20 miles. The average round trip is about 2 miles longer due to vanpooling.

Occupancy of Vanpool

The actual occupancies of vanpools entering the lane are shown in Table 47, as is the number of registered vanpool members. Average occupancy was 8.1 members per van; there was an average of 11.5 registered members per van. Actual occupancy was 70% of registered members.

Employer Contribution to Vanpool Costs

For vanpool drivers, about two thirds have all or part of their vanpooling costs paid by their employers. For vanpool passengers, about half have all or part of their vanpooling costs paid by their employers, although very few (5%) have all their costs paid.

Table 46. Characteristics of the Formation and Operation of the Vanpool, Katy AVL Vanpool Users

Characteristic	Total Sample	Vanpool Drivers	Vanpool Passengers
How Was Vanpool Group Organized		(n=64)	
By employer	----	78%	----
I found the riders	----	11%	----
METRO Carshare	----	3%	----
Residential Developer	----	0%	----
Texas Medical Center	----	3%	----
Greenway Transportation	----	2%	----
Commuter Express	----	2%	----
Other	----	1%	----
Who owns/Leases Van		(n=66)	
Employer Provides Van	----	80%	----
Third Party Provides Van	----	17%	----
I Own Van	----	2%	----
METRO Van	----	1%	----
Year Joined Vanpool	(n=439)	(n=60)	(n=379)
1978	3%	5%	2%
1979	6%	12%	5%
1980	10%	12%	10%
1981	10%	18%	9%
1982	14%	16%	14%
1983	15%	8%	16%
1984	32%	27%	33%
1985	10%	2%	11%
Why Joined Vanpool*	(n=642)	(n=90)	(n=552)
More economical	27%	31%	27%
Convenience	12%	17%	11%
New Job or residential location	12%	2%	13%
Dislike Driving	9%	0%	11%
Saves Auto Wear	7%	10%	7%
No Congestion on AVL	4%	4%	3%
Company Started Vanpool	3%	4%	2%
Carpool Broke Up	3%	2%	3%
Only Own One Car	1%	6%	1%
Other	22%	24%	22%
Previous Mode of Travel	(n=461)	(n=66)	(n=395)
Drove alone	34%	36%	33%
Carpooled	22%	17%	22%
Didn't Make Trip	16%	9%	18%
Different Vanpool	13%	21%	12%
Regular Bus	8%	11%	8%
Park and Ride Bus	7%	5%	7%
Other	0%	1%	0%

*Respondents were able to check more than one reason. Thus, "n" refers to the number reasons checked, not the number of surveys completed.

Table 47. Characteristics of Trip Length, Occupancy, Payment, and Impact On Personal Auto Use of Vanpooling on the Katy AVL

Characteristic	Total Sample	Vanpool Drivers	Vanpool Passengers
Round Trip Distance if Drove Alone (miles)	(n=450)	(n=64)	(n=386)
50th Percentile	45	49	44
Round Trip Average	44	46	44
Extra Miles to Vanpool	(n=428)	(n=61)	(n=367)
50th Percentile	0	1	0
Average	2.2	4.6	1.8
Actual Vanpool Occupancy		(n=66)	
Less Than 5	----	9%	----
6	----	14%	----
7	----	14%	----
8	----	23%	----
9	----	21%	----
10	----	3%	----
11	----	8%	----
12 or more	----	8%	----
Registered Vanpool Members		(n=66)	
7	----	3%	----
8	----	3%	----
9	----	11%	----
10	----	20%	----
11	----	12%	----
12	----	21%	----
more than 12	----	30%	----
Employer Portion of Vanpool Cost	(n=461)	(n=65)	(n=396)
Pays All	8%	25%	5%
Pays Part	42%	40%	42%
Pays None	50%	35%	53%
When Car Left at Home, Is it Used			(n=391)
Yes	----	----	14%
No	----	----	40%
Not Applicable (car left at pickup point)	----	----	46%

Use of Auto Left At Home

The survey indicated that most vanpoolers use a car to drive to a central pick-up point. Therefore, no additional auto is left at the home. Even in those instances when an auto is left at home due to vanpooling, it is not commonly used (Tables 47 and 48).

Trip Frequency

As would be expected for a mode serving the work trip, virtually all vanpools surveyed operate every weekday. All vanpools operated Monday through Thursday, and 95% operated on Friday.

Trip Origin

Several questions were asked relating to the origin of the trip. For presentation purposes, these are grouped into the following categories: 1) vanpool staging or pick-up location; 2) freeway ramp used; and 3) home zip code.

Vanpool Staging or Pick-Up Location

Over 80% of vanpool passengers stated they travel to a pick-up location; only 18% are picked up at their home. Ninety percent of the vanpool drivers responded that they pick up their passengers at a common location (Table 48). Sixty-seven separate pick up locations were listed by the vanpool drivers.

Freeway Ramp Used

There was some confusion in the response to which freeway ramp was used to enter the freeway. The information requested was for the a.m. peak; since the survey was performed in the p.m., many vanpoolers responded with the p.m. ramp.

The most common a.m. entry ramp for vanpools were West Belt and Gessner. This is interesting since you are not supposed to enter the freeway at

Table 48. Characteristics of Trip Frequency, Trip Origin, and Vanpool Pickup Point, Katy AVL Vanpool Survey

Characteristic	Total Sample	Vanpool Drivers	Vanpool Passengers
Katy AVL Trip Frequency		(n=66)	
% Using Daily	----	100%	----
Do you pick up riders		(n=61)	
at home	----	10%	----
at common staging point(s)	----	90%	----
Do you drive your car to pick-up point			(n=397)
Yes	----	----	76%
No, dropped off by someone else	----	----	6%
No, picked up at my door	----	----	18%
A.M. Freeway Entrance Ramp		(n=42)	
Gessner	----	29%	----
West Belt	----	29%	----
Fry	----	17%	----
SH 6	----	10%	----
Mason Road	----	7%	----
Wilcrest	----	5%	----
Other	----	3%	----
Home Zip Code of Vanpoolers	(n=454)	(n=64)	(n=390)
77084	22%	20%	23%
77450	15%	17%	15%
77079	12%	9%	13%
77077	11%	8%	12%
77449	10%	13%	10%
77042	6%	5%	6%
77043	5%	8%	4%
77082	4%	5%	4%
77083	4%	6%	3%
Destination of Vanpoolers		(n=64)	
Downtown	----	70%	----
Galleria	----	11%	----
Texas Medical Center	----	5%	----
Greenway Plaza	----	3%	----
Bellaire	----	3%	----
Other	----	8%	----

Gessner to access the AVL. For this reason, many of these vans don't use the AVL in the a.m. peak. A high volume also enters the freeway at Fry Road. Responses are summarized in Table 48.

Home Zip Code

The home zip code for nearly 90% of vanpoolers is in one of 9 zip codes. These are depicted in Figure 17 and summarized in Table 48. Over 20% of vanpoolers reside in a zip code (77084) located north of Katy Freeway and generally bounded by Barker-Cypress, Spencer, and Wycliff.

Trip Destination

While the majority of destinations are in the downtown, it is not as dominant of a destination as it was in the transit user survey. Several other destinations also attract vanpool trips. These data are summarized in Table 48.

Attitudes and Impacts Pertaining to the AVL

Approximately half the survey questions were intended to collect data concerning attitudes and travel patterns as impacted by the Katy AVL. For purposes of presentation, these responses are divided into the following categories: 1) AVL van operating procedures, time savings, and duration of use; 2) modal selection; 3) impacts of AVL on mode choice; 4) AVL impacts on ridesharing and freeway congestion; and 5) perception of utilization.

AVL Operating Procedures, Time Savings, and Duration of Use

Driver training is required to operate a vanpool on the AVL. The driver must carry with him a license authorizing him to drive on the lane. The average vanpool has 2.6 authorized drivers; some vans have as few as 1 driver, others as many as 4 (Table 49).

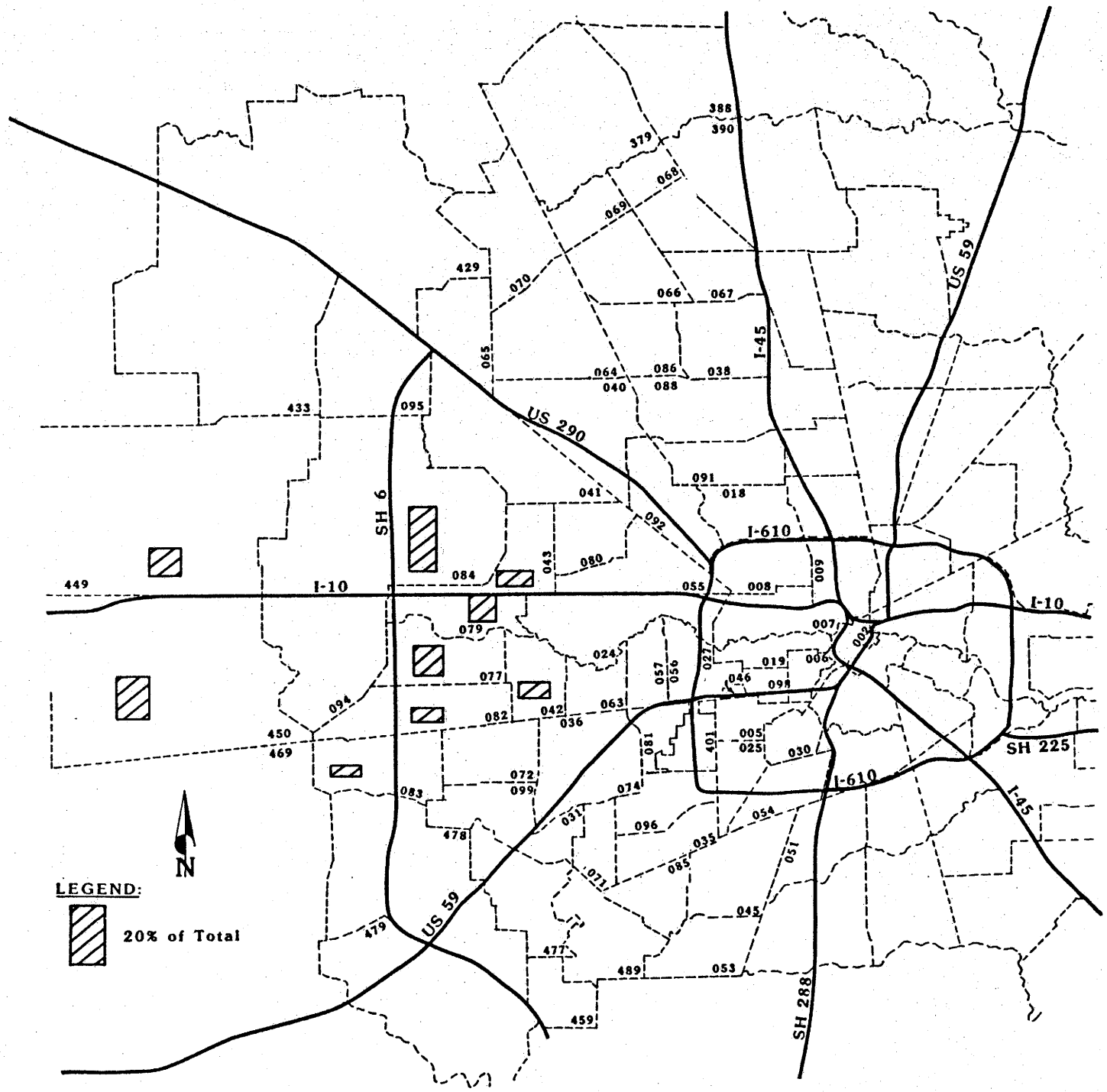


Figure 17. Home Origins of Vanpoolers Using the Katy AVL

Table 49. Characteristics of AVL Operating Procedures, AVL Time Savings, and Duration of AVL Utilization, Katy AVL Vanpool Survey

Characteristic	Total Sample	Vanpool Drivers	Vanpool Passengers
No. of Authorized Vanpool Drivers		(n=66)	
1	----	3%	----
2	----	36%	----
3	----	50%	----
4	----	11%	----
Percent of Vans Using AVL		(n=66)	
a.m.	----	83%	----
p.m.	----	100%	----
Perceived AVL Time Savings (min.)	(n=417)	(n=55)	(n=362)
50th Percentile			
a.m.	6	6	5
p.m.	10	12	10
Duration of AVL Use (mo.)		(n=66)	
1	----	2%	----
2	----	2%	----
3	----	3%	----
4	----	4%	----
5, Since Opened	----	89%	----

Volume counts had noted that more vans use the AVL in the p.m. than in the a.m. This was confirmed by the survey; 83% of the vans surveyed in the p.m. indicated they used the AVL in the a.m. Vanpoolers were asked why they did not use the AVL in both peak periods. Of the vans that do not use the AVL in both peaks, their reasons for not using the AVL are: 1) the AVL takes more time or is inconvenient in the a.m. (55%); 2) the AVL is not open at 3 p.m. in the p.m. (27%); and 3) it is necessary to backtrack (those vans entering at Gessner) in the a.m. (18%). Quite obviously, reasons 1) and 3) are related.

Perceived AVL Time Savings

Perceived time savings in the a.m. are about half of those in the p.m. That is part of the reason for the lower a.m. vanpool volume; many of the vans that enter at Gessner in the a.m. perceive they lose more time by backtracking to use the AVL than they gain by using the AVL.

Perceived time savings by vanpool drivers and passengers are similar; the 50th percentile is 6 minutes in the a.m. and 10 minutes in the p.m. (Table 49). A frequency distribution of perceived time savings is shown in Figure 18.

Duration of AVL Use

Nearly 90% of the vanpools using the AVL have used it since it opened. This would suggest that the volume of vanpools has increased by about 12% in the 5 months since the AVL opened (Table 49).

Modal Selection

The vanpool mode was selected primarily because: 1) the level of congestion on the freeway; 2) save time; 3) save money; and 4) provide time to relax. Vanpooling was selected instead of the bus primarily because: 1) vanpooling is more convenient; 2) vanpooling cost less; and 3) no bus service to destination.

These data are summmarized in Table 50.

Impacts of Katy AVL on Mode Choice

A question was asked to determine whether individuals would be vanpooling if the AVL had not opened. Almost everyone responded "yes". This is consistent with the previous finding that about 90% of the vanpools were operating at the time the AVL opened (Table 51).

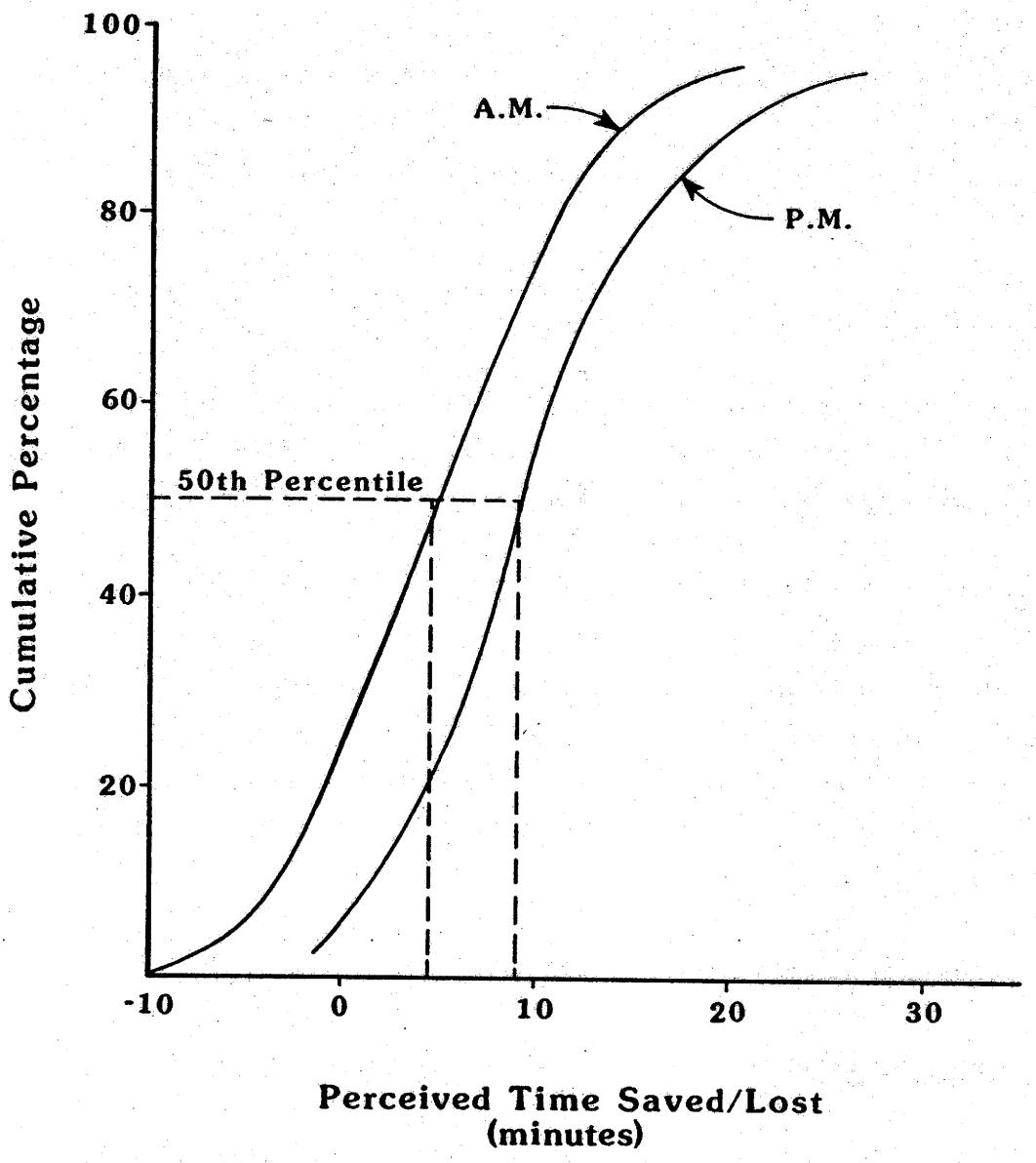


Figure 18. Perceived AVL Travel Time Savings, Vanpool Survey

Table 50. Reasons For Selecting the Vanpool Mode on the AVL, Katy AVL Vanpool Survey

Reason For Vanpooling	Total Sample	Vanpool Drivers	Vanpool Passengers
Main Reasons for Vanpooling*	(n=1667)	(n=192)	(n=1475)
Freeway Too Congested	18%	23%	17%
Saves Time	17%	26%	16%
Cost less	16%	18%	15%
Time to Relax	14%	0%	15%
Reliable Schedule	13%	18%	12%
Dislike Driving	12%	0%	13%
No Bus to Destination	3%	4%	3%
Car Used by Others	3%	3%	3%
Carpool Broke Up	1%	1%	1%
No Other Way Available	1%	1%	1%
Other	2%	6%	2%
Why Vanpool Rather Than Bus*	(n=282)	(n=115)	(n=667)
Vanpooling is More Convenient	42%	42%	42%
Vanpooling Cost Less	29%	36%	28%
No Buses to Destination	13%	11%	13%
Too far from House to P/R Bus	8%	3%	8%
Vanpool Faster	1%	2%	1%
Friends in Vanpool	1%	0%	1%
Bus Undependable	1%	0%	1%
Don't Like Buses	1%	1%	1%
Other	4%	5%	5%

*On these questions, it was possible to check more than one reason. Thus, the "n" value is the total number of reasons checked, not the number of surveys completed.

A related question asked how important the opening of the Katy AVL was in the decision to vanpool. While most individuals said they would be vanpooling even if there were no AVL, over a third of the vanpoolers said the Katy AVL was either "very important" or "somewhat important" in their decision to vanpool (Table 51).

Table 51. Perceived Impacts of the AVL On Mode Choice, Katy AVL Vanpool Survey

Aspect of Mode Choice	Total Sample	Vanpool Driver	Vanpool Passenger
Would You Vanpool if No AVL	(n=461)	(n=65)	(n=396)
Yes	87%	92%	86%
No	6%	6%	6%
Not Sure	7%	2%	8%
How Important Was AVL in Decision to Vanpool	(n=457)	(n=64)	(n=393)
Very Important	25%	27%	24%
Somewhat Important	16%	8%	18%
Not Important	59%	65%	58%
Will You Choose to Carpool	(n=463)	(n=65)	(n=398)
Continue to Vanpool	93%	97%	93%
Use a Carpool	1%	3%	1%
Not Sure	6%	0%	6%

To attempt to identify modal overlap, vanpoolers were asked if they would choose to carpool in a 4+ pool rather than vanpool once carpools were allowed on the AVL. Essentially no one said they would carpool, and only 6% indicated they were "not sure" (Table 51).

Perceived Impacts of the AVL On Ridesharing and Congestion

Vanpoolers were asked a series of questions to help determine their perceptions concerning the AVL. About a third of the vanpoolers felt the AVL had been successful in increasing vanpool and transit ridership; over three-

quarters felt it had reduced travel time for AVL users, and just less than a third thought the AVL had reduced traffic congestion on the Katy Freeway.

Attitudinal questions indicated the following: 1) nearly two-thirds disagreed that vanpooling takes more time than driving alone; 2) about half agreed that bus driving takes more time than driving alone; 3) almost all agreed that vanpooling was cheaper than riding the bus; 4) about two-thirds agreed that bus riding is cheaper than driving alone; 5) three-quarters agreed that vanpooling is more pleasant than driving alone; 6) less than a third agreed that bus riding was more pleasant than driving alone; and 7) two-thirds agreed that they enjoyed riding with other people.

These responses are summarized in Tables 52 and 53.

Table 52. Perceptions of Vanpoolers Regarding the Impacts of the Katy AVL On Ridesharing and Congestion, Katy AVL Vanpool Survey

Effectiveness Measure	Total Sample	Vanpool Drivers	Vanpool Passengers
Has the Katy AVL			
Increased Vanpool Ridership	(n=441)	(n=58)	(n=383)
Yes	32%	38%	31%
No	26%	36%	24%
Not Sure	42%	26%	45%
Increased Transit Ridership	(n=434)	(n=57)	(n=377)
Yes	35%	39%	35%
No	14%	10%	14%
Not Sure	51%	51%	51%
Reduced AVL Travel Time	(n=453)	(n=61)	(n=392)
Yes	80%	90%	78%
No	11%	0%	13%
Not Sure	9%	10%	9%
Reduced Freeway Congestion	(n=449)	(n=61)	(n=388)
Yes	29%	26%	29%
No	36%	38%	36%
Not Sure	35%	36%	35%

Table 53. Attitudes Concerning Vanpooling, Transit Riding, Driving Alone, and Level of Utilization, Katy AVL Vanpool Survey

Attitude	Total Sample	Vanpool Drivers	Vanpool Passengers
Vanpooling takes more time than driving alone	(n=448)	(n=63)	(n=385)
Agree/Disagree/Neutral	26%/65%/9%	21%/71%/8%	27%/65%/8%
Bus Riding takes more time than driving alone	(n=410)	(n=54)	(n=356)
Agree/Disagree/Neutral	48%/26%/26%	50%/19%/31%	48%/27%/25%
Vanpooling is cheaper than driving alone	(n=454)	(n=64)	(n=390)
Agree/Disagree/Neutral	96%/2%/2%	98%/0%/2%	95%/2%/3%
Bus Riding is cheaper than driving alone	(n=415)	(n=57)	(n=358)
Agree/Disagree/Neutral	66%/12%/22%	65%/12%/23%	66%/12%/22%
Vanpooling is more pleasant than driving alone	(n=453)	(n=63)	(n=390)
Agree/Disagree/Neutral	77%/9%/14%	86%/5%/9%	75%/10%/15%
Bus Riding is more pleasant than driving alone	(n=409)	(n=53)	(n=356)
Agree/Disagree/Neutral	30%/30%/40%	36%/17%/47%	29%/32%/39%
I enjoy riding with other people	(n=450)	(n=62)	(n=388)
Agree/Disagree/Neutral	69%/4%/27%	82%/3%/15%	67%/4%/29%
Is the AVL Sufficiently Utilized	(n=448)	(n=62)	(n=386)
Yes	30%	47%	27%
No	51%	35%	54%
Not Sure	19%	18%	19%

Is the AVL Sufficiently Utilized

One of the main reasons for allowing carpools onto the AVL is to increase the perception of utilization. Vanpoolers were asked whether they felt the AVL was sufficiently utilized to justify the project.

There are significant differences in the responses between the drivers and the passengers. More drivers, those responsible for the operation of the vehicle in the AVL, felt the AVL was sufficiently utilized than felt it was not. However, twice as many passengers indicated they felt it was not sufficiently utilized as compared to these stating they felt it was sufficiently utilized.

These responses are summarized in Table 53.

Comments

Survey participants were encouraged to offer comments. Over 460 comments were received; some of these were multiple comments on a single survey. A respresentative selection of comments as presented in Appendix B.

The comments can generally be summarized as shown below.

Comment	Percent of Total Comments
1. Extend the AVL	28%
2. Poor entry/exit design	13%
3. Carpools on AVL good idea	6%
4. AVL good idea	5%
5. Open earlier in the p.m.	4%
6. AVL is underutilized	4%

NON AVL USERS, MOTORIST SURVEY

Surveys were conducted of motorists in the Katy Freeway mainlanes during the a.m. AVL operating period. The survey was conducted between 6 a.m. and 9 a.m.; the survey results are presented by hour, although in most cases this stratification of the data does not identify any particular differences between the time periods. The survey instrument is included in Appendix A.

Three primary areas are addressed in the survey: 1) personal characteristics; 2) travel patterns and trip characteristics; and 3) attitudes and impacts pertaining to the AVL. The organization of this section follows that sequence.

Personal Characteristics

Questions were asked to identify age, sex, occupation, and last year of school completed.

Age

The motorists are an older group than the AVL users. The average motorist's age is in the low 40's (Table 54).

Sex

While the sex of the AVL users was divided about evenly between male and female, almost two-thirds of the motorists are male (Table 54).

Occupation

Similar to the AVL users, over two-thirds of the motorists are either "professional" or "managerial" (Table 54).

Table 54. Personal Characteristics of Motorists on the Katy Freeway

Characteristic	Total Sample	6-7 a.m.	7-8 a.m.	8-9 a.m.
Age (years)	(n=445)	(n=120)	(n=162)	(n=163)
50th Percentile	40	41	40	39
Sex	(n=437)	(n=120)	(n=160)	(n=151)
% Male	64%	73%	60%	62%
% Female	36%	27%	40%	38%
Occupation	(n=431)	(n=118)	(n=157)	(n=156)
% Professional	51%	49%	48%	54%
% Managerial	19%	22%	20%	15%
% Sales	12%	13%	10%	14%
% Clerical	9%	6%	11%	9%
% Craftsman	3%	5%	1%	2%
% Service Workers	2%	1%	3%	1%
% Student	2%	2%	3%	3%
% Other	2%	2%	4%	2%
Education (years)	(n=439)	(n=121)	(n=158)	(n=160)
Average	15.7	15.5	15.4	16.2

Education

Similar to AVL users, the typical motorist has completed over 3 years of college (Table 54).

Travel Patterns and Trip Characteristics

Questions were asked regarding choice of the auto mode, trip purpose, trip frequency, vehicle occupancy, trip origin, trip destination, employer incentives, and awareness of METRO services.

Reasons for Choosing the Auto Mode

The reasons most often given for using an auto in the mixed flow lanes rather than a high-occupancy vehicle in the Katy AVL were: 1) need car for job; 2) convenience and flexibility of auto; 3) no bus available; 4) work odd hours; and 5) no van available. Of those motorists surveyed, over 95% either drive alone or carpool on a regular basis.

Nearly three-quarters of the motorists believe their job requires an auto either "always" or "sometimes".

These responses are summarized in Table 55.

Trip Purpose

As was the case with the transit and vanpool surveys, virtually all of the peak period trips are to work (Table 56).

Trip Frequency

Approximately 85% of the trips surveyed occur at least 5 days per week (Table 56).

Vehicle Occupancy

The average peak-period occupancy (occupants/vehicle) is 1.2 (Table 56).

Trip Origin

Two questions were asked concerning trip origin. One asked for the freeway entrance ramp that was used. The second asked for the home zip code. The survey was conducted at a location between Voss and Campbell.

The most common entrance ramps used were Gessner and Wilcrest, although large volumes also originated at several other ramps. Fifty separate zip codes were listed. Twenty percent of the origins were in a single zip code

Table 55. Reasons for Choosing to Use the Auto Travel Mode, Katy Motorist Survey

Travel Mode Characteristic	Total Houston Sample	6-7 a.m.	7-8 a.m.	8-9 a.m.	Los Angeles El Monte
Why did you choose the auto*	(n=564)	(n=158)	(n=200)	(n=206)	(n=565)
Need car for job	22%	19%	25%	22%	17%
Convenience and flexibility	17%	19%	13%	20%	17%
No bus available	15%	20%	17%	11%	6%
Work odd hours	10%	9%	10%	11%	20%
No van available	7%	8%	6%	6%	6%**
Don't work in CBD	6%	4%	7%	6%	---
Car is faster	3%	3%	2%	3%	3%
Other	20%	18%	20%	21%	31%
How do you usually make this trip	(n=445)	(n=122)	(n=162)	(n=161)	
Drive alone	88%	83%	87%	94%	---
Carpool	8%	15%	8%	4%	---
Vanpool	1%	1%	1%	1%	---
Other	3%	1%	4%	1%	---
Does you job require a car	(n=441)	(n=119)	(n=165)	(n=157)	
Yes, always	37%	29%	41%	40%	---
Yes, sometimes	37%	40%	35%	37%	---
No	26%	31%	24%	23%	---

*Respondents were able to give more than one reason. Thus, "n" refers to the number of reasons given, not the number of surveys completed.

**No carpool available.

Table 56. Trip Purpose, Frequency, and Vehicle Occupancy, Katy Motorist Survey

Trip Characteristic	Total Houston Sample	6-7 a.m.	7-8 a.m.	8-9 a.m.	Los Angeles El Monte
Trip Purpose	(n=451)	(n=122)	(n=163)	(n=166)	
Work	94%	95%	95%	92%	---
School	3%	2%	2%	4%	---
Recreational	1%	2%	1%	1%	---
Other	2%	1%	2%	3%	---
Trip Frequency (days/week)	(n=442)	(n=120)	(n=160)	(n=162)	
1 or less	5%	2%	4%	7%	---
2	4%	3%	4%	4%	---
3	3%	3%	4%	3%	3 or more
4	4%	2%	6%	2%	100%
5 or more	84%	90%	82%	84%	
Vehicle Occupancy (persons/vehicle)	(n=445)	(n=121)	(n=164)	(n=160)	(n=565)*
1	83%	80%	82%	88%	100%
2	12%	13%	14%	9%	---
3	3%	4%	3%	1%	---
4 or more	2%	3%	1%	2%	---

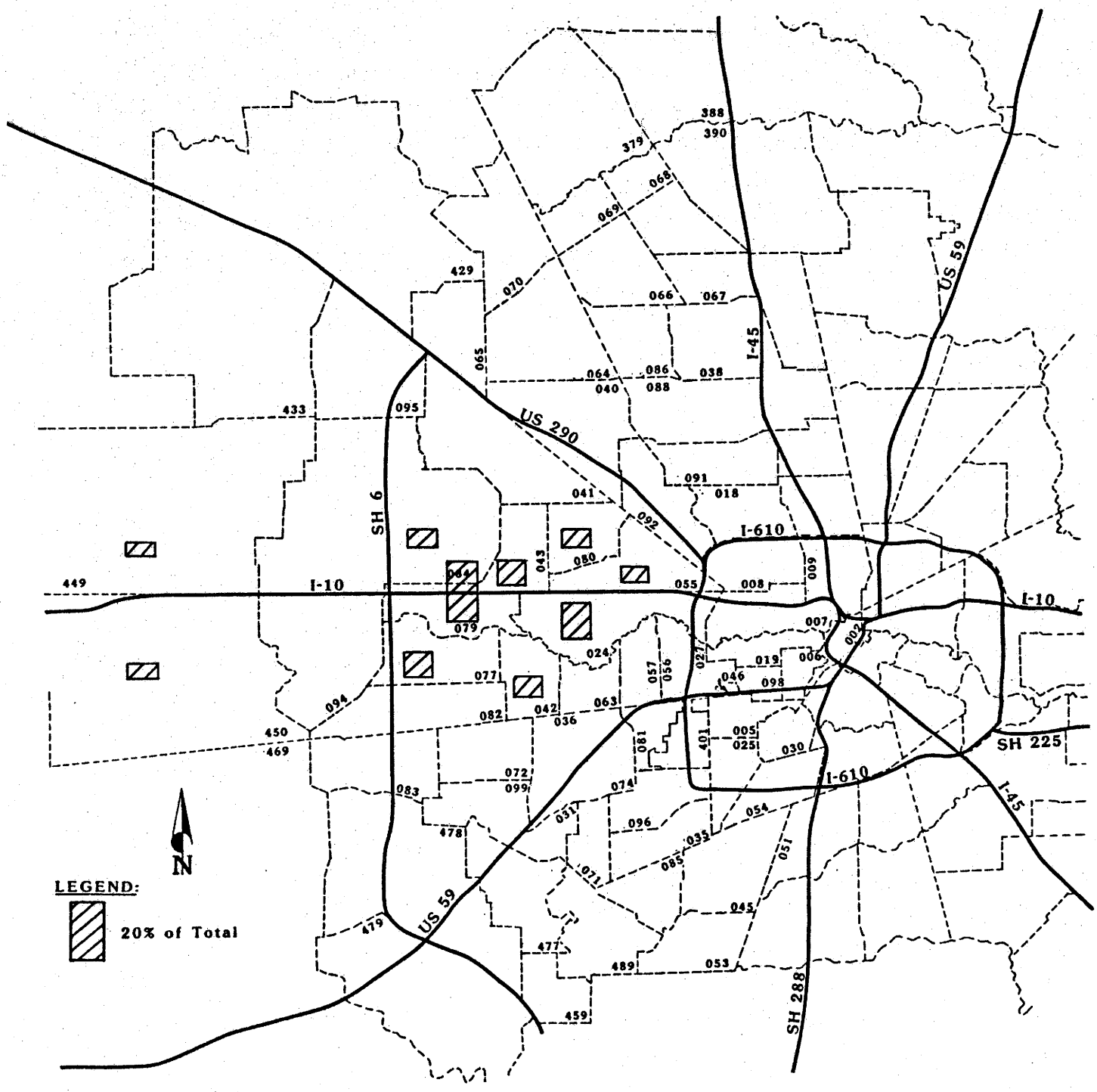
*Only single occupant vehicles were surveyed

(77079) located generally between Katy Freeway and Buffalo Bayou and between West Belt and Addicks-Howell. These zip codes are depicted in Figure 19.

These data are summarized in Table 57.

Table 57. Characteristics of Trip Origins and Trip Destinations, Katy Motorist Survey

Origin/Destination Description	Total Sample	6-7 a.m.	7-8 a.m.	8-9 a.m.
A.M. Freeway Entrance Ramp	(n=438)	(n=116)	(n=162)	(n=160)
Gessner	13%	10%	13%	14%
Wilcrest	12%	12%	14%	11%
Blalock	10%	13%	10%	8%
West Belt	9%	9%	12%	7%
Dairy Ashford	9%	6%	6%	14%
Bunker Hill	9%	8%	9%	10%
SH 6	8%	7%	8%	9%
Kirkwood	8%	6%	9%	8%
Fry Road	6%	5%	9%	5%
Mason	4%	7%	2%	3%
Barker-Cypress	3%	3%	2%	3%
Other	9%	14%	6%	8%
Home Zip Code	(n=444)	(n=121)	(n=161)	(n=162)
77079	20%	17%	22%	20%
77024	12%	8%	14%	12%
77043	9%	10%	6%	12%
77077	7%	7%	7%	8%
77080	7%	14%	4%	6%
77084	6%	8%	7%	3%
77042	6%	3%	6%	7%
77055	5%	4%	5%	5%
77450	5%	7%	4%	4%
Other	23%	22%	25%	23%
Trip Destination	(n=302)	(n=85)	(n=99)	(n=118)
Downtown	38%	24%	46%	41%
Galleria	24%	26%	20%	25%
Texas Med. Center	9%	8%	8%	10%
Greenway Plaza	8%	12%	10%	3%
University of Houston	2%	5%	1%	2%
Astrodome Arena	2%	5%	1%	1%
Other	17%	20%	14%	18%



NOTE: All Zip Codes Begin with 77.

Figure 19. Home Origins of Motorists on the Katy Freeway Between Voss and Campbell

Trip Destination

While the downtown was the predominant destination for users of the AVL, less than 40% of the motorists on the Katy Freeway at the survey location are destined to downtown. A significant number of trips are also destined to Galleria/City Post Oak, Texas Medical Center, Greenway Plaza, the University of Houston, and the Astrodome area. In fact, during some time periods, downtown is not the primary destination. No other single destination had as much as 1% of the survey response. Over 40 total destinations were identified. These data are summarized in Table 57.

Employer Incentives

Several questions were asked to determine what type of incentives the employer provided that might encourage selection of a particular mode.

For about half of the respondents, the employee pays all of the parking cost. These data were cross classified by destination. About 32% of downtown employees have all their parking cost paid, while 71% of Galleria employees, 38% of Medical Center employees, and 52% of Greenway Plaza employees have their entire parking cost paid.

Nearly 90% of survey respondents indicated their employer would pay none of their bus fare, nearly 90% said the employer offered no incentives for carpooling, and over 80% said the employer would pay none of their van fare. Of those who said their employer did provide incentives to carpool, the principal incentives were: 1) special parking (32%); 2) carpool matching (21%); and 3) minor subsidy (13%).

Thus, most motorists perceive their employer is providing an incentive to drive their car by paying at least part of the parking cost. Almost all motorists claim their employer is not providing any incentives to switch to a rideshare mode.

These data are summarized in Table 58. Rather than stratifying the data by time period, the data in Table 58 are stratified by destination.

Table 58. Employer Incentives For Modal Choice, Katy Motorist Survey

Employer Incentive	Total Houston Sample	Destination				Los Angeles El Monte
		Downtown	Galleria	Med. Center	Greenway	
Pay All or Part of Parking	(n=414)	(n=107)	(n=70)	(n=24)	(n=21)	
Yes, Pays All	46%	32%	71%	37%	52%	----
Yes, Pays Part	8%	17%	4%	13%	10%	----
No	46%	51%	25%	50%	38%	----
Pays All or Part of Bus Fare	(n=415)	(n=107)	(n=69)	(n=24)	(n=19)	
Yes, Pays All	2%	5%	0%	0%	5%	----
Yes, Pays Part	3%	7%	1%	0%	0%	----
No	87%	82%	93%	79%	90%	----
Don't Know	8%	6%	6%	21%	5%	----
Pays All or Part of Van Cost	(n=411)	(n=104)	(n=68)	(n=24)	(n=20)	
Yes, Pays All	2%	2%	2%	0%	5%	----
Yes, Pays Part	7%	13%	6%	8%	0%	----
No	83%	79%	85%	17%	90%	----
Don't Know	8%	6%	7%	75%	5%	----
Any Special Carpool Incentives	(n=420)	(n=101)	(n=68)	(n=23)	(n=19)	(n=529)
Yes	11%	13%	6%	17%	21%	24%
No	89%	87%	94%	83%	79%	76%

Awareness of METRO Services

The motorists were also asked if they were aware of special services provided by METRO to encourage ridesharing. About two-thirds of the respondents had heard of METRO CarShare; of those that had heard of the program, only 5% had used it.

Nearly 85% of the respondents were familiar with the park-and-ride service provided by METRO in the corridor. Of that 85%, 7% had used park-and-ride.

Attitudes and Impacts Pertaining to the AVL

Approximately one-third of the survey questions were intended to collect data concerning attitudes toward, and impacts associated with, the Katy AVL. For purposes of presentation, these responses are divided into the following categories: 1) modal use of the AVL; 2) AVL impacts on ridesharing and freeway congestion; and 3) perception of utilization.

Modal Use of the Katy AVL

Almost all motorists felt that buses, vanpools, and 4+ carpools should be allowed to use the AVL. However, fewer than 5% of the motorists surveyed indicated they would choose to carpool once the AVL is opened to carpools. These data are shown in Table 59. The Table 59 data are stratified by vehicle occupancy. As would be expected, a higher percent of the vehicles already carpooling plan to use the AVL. However, only 13% of the 4+ carpools said they would use the AVL.

When asked why they would not carpool, the responses were: 1) need car for work (24%); 2) need more passengers (22%); 3) work odd hours (16%); 4) don't work in CBD (5%); 5) car is convenient (4%); 6) use car for personal reasons (3%); and 7) other (26%).

Perceived Impacts of the AVL On Ridesharing and Congestion

The motorists were asked questions to help determine their perceptions concerning the AVL. Very few motorists felt that the AVL had reduced freeway congestion. About a fifth of the motorists felt the AVL had increased vanpooling, and just over a quarter felt it had increased transit ridership. The majority did agree that the AVL reduced travel time for users of the AVL.

Attitudinal questions indicated the following; 1) less than half of the motorists agreed that vanpooling takes more time than driving; 2) about half agreed that bus riding takes more time than driving; 3) nearly 80% agreed that vanpooling is cheaper than driving; 4) over 75% agreed that bus riding

Table 59. Attitudes Concerning the Vehicles Allowed on the Katy AVL, Motorist Survey

Attitude or Response	Total Houston Sample	Vehicle Occupancy				Los Angeles El Monte
		1	2	3	4+	
Should the following be allowed on the AVL						
Buses	(n=449)	----	----	----	----	(n=518)
Agree	97%	----	----	----	----	80%
Disagree	2%	----	----	----	----	14%
Neutral	1%	----	----	----	----	6%
Vanpools	(n=450)					
Agree	96%	----	----	----	----	----
Disagree	3%	----	----	----	----	----
Neutral	1%	----	----	----	----	----
Carpools (4+)	(n=451)					3+ Carpools
Agree	88%	----	----	----	----	77%
Disagree	7%	----	----	----	----	18%
Neutral	5%	----	----	----	----	5%
Will You Carpool in the AVL	(n=444)	(n=367)	(n=50)	(n=12)	(n=8)	
Yes	5%	4%	10%	17%	13%	____
No	76%	79%	66%	67%	37%	----
Not Sure	19%	17%	24%	16%	50%	----

is cheaper than driving; 5) about a third felt that vanpooling or bus riding is more pleasant than driving alone; and 6) about half indicated they enjoyed riding with other people.

These responses are shown in Table 60.

Table 60. Perceived Impacts of the Katy AVL on Ridesharing and Congestion, Motorist Survey

Effectiveness Measure	Total Houston Sample			Los Angeles El Monte Agree/Disagree/Neutral
	Yes or Agree	No or Disagree	Not Sure or Neutral	
Has the Katy AVL				
Increased vanpool ridership (n=448)	20%	39%	41%	----
Increased transit ridership (n=447)	28%	26%	46%	----
Reduced AVL Travel Time (n=447)	61%	12%	27%	----
Reduced Freeway Congestion (n=450)	14%	70%	16%	----
Vanpooling takes more time than driving (n=431)	43%	33%	24%	61%/20%/19%
Bus riding takes more time than driving (n=436)	52%	28%	20%	76%/12%/12%
Vanpooling is cheaper than driving (n=435)	79%	7%	14%	83%/6%/11%
Bus riding is cheaper than driving (n=432)	76%	9%	15%	53%/30%/17%
Vanpooling is more pleasant than driving (n=432)	36%	31%	33%	26%/43%/31%
Bus riding is more pleasant than driving (n=436)	32%	37%	31%	14%/64%/22%
I enjoy riding with other people (n=433)	47%	19%	34%	30%/22%/48%

Is the AVL Sufficiently Utilized

The perception of whether the AVL is sufficiently utilized is a major reason that carpools are to be allowed on the AVL. The motorists were asked whether, in terms of both person movement and vehicle movement, they felt the AVL was sufficiently utilized. The responses were overwhelmingly negative. It was hypothesized that, due to the sharp peaking characteristics of the AVL, perceptions might change by time period. A cross classification of the data indicated that the utilization perceptions are relatively consistent by

time period, although responses in the 7-8 a.m. period are somewhat more favorable. There was little difference in the perception of utilization based on whether vehicle movement or person movement was being considered.

The motorists were asked if they felt the Katy AVL was a good transportation improvement. In spite of their strong feelings that the AVL is underutilized, most responses--but less than a majority of the responses--indicated the Katy AVL was a good transportation improvement.

These responses are summarized in Table 61.

Table 61. Perceptions of Utilization and Desirability of Katy AVL Improvement, Motorist Survey

Measure of Effectiveness or Success	Total Houston Sample	6-7 a.m.	7-8 a.m.	8-9 a.m.	Los Angeles El Monte
In terms of vehicles, is the AVL Sufficiently Utilized	(n=451)	(n=122)	(n=164)	(n=165)	
Yes	3%	2%	6%	2%	----
No	90%	91%	87%	91%	----
Not Sure	7%	7%	7%	7%	----
In terms of persons moved, is the AVL Sufficiently Utilized	(n=451)	(n=122)	(n=164)	(n=165)	
Yes	4%	5%	6%	2%	----
No	85%	83%	85%	88%	----
Not Sure	11%	12%	9%	10%	----
Is the AVL a Good Improvement	(n=441)	(n=120)	(n=162)	(n=159)	(n=545)
Yes	41%	35%	46%	41%	64%*
No	35%	39%	35%	31%	25%
Not Sure	24%	26%	19%	28%	11%

*Carpools were users of the El Monte Busway at the time of the survey.

Comments

Survey participants were encouraged to offer comments. Over 469 comments were received; some of these were multiple comments on a single survey. A representative selection of comments is presented in Appendix B.

The comments can generally be summarized as shown below.

Comment	Percent of Total Comments
1. The AVL is a waste of money	14%
2. The AVL is underutilized	12%
3. Open the AVL to all	8%
4. Allow carpools on the AVL	7%
5. Ban trucks on I-10	5%
6. The AVL is a good idea	5%
7. Need more lanes	4%
8. Extend the AVL	3%
9. Advertise the AVL	3%
10. Provide more bus routes	3%
11. Congestion no better	3%

COMPARISON OF SURVEY FINDINGS

The preceding 3 sections of this report present considerable data derived from surveys of transit users, vanpool drivers, vanpool passengers, and motorists on the Katy Freeway. Those data are cross classfied in a variety of manners.

For purposes of this study, perhaps the most important data are those that relate to choice of commuting mode and perceptions of the authorized vehicle lane.

Personal Characteristics and Trip Characteristics

In several respects, the characteristics of AVL users and non users are similar (Tables 62 and 63). Occupation, education, trip purpose and trip frequency all exhibit similarities. The motorists on the freeway are somewhat older and consist of a greater percent of males.

The AVL users and non users have, to a significant extent, similar trip origins (home Zip codes). However, trip destinations indicate a possible reason why more trips aren't being served on the AVL.

During the peak period, less than half of the total trips (AVL user and non user) are destined to downtown Houston. Yet, essentially all bus service caters to downtown trips. Vanpools demonstrate more capability to serve trips to destinations other than the downtown.

Mode Choice Considerations

One concern involving carpool utilization is the number of bus or van patrons that will change to carpooling. As presented previously, as many as 25% of the carpoolers on the El Monte Busway in Los Angeles were attracted from buses.

In looking at previous travel modes (Table 64) of the bus patrons and vanpoolers in the Katy corridor, the largest percentage previously drove

Table 62. Personal Characteristics of Users and Non Users of the Katy AVL

Characteristic	Authorized Vehicle Lane Users		Non AVL Users
	Transit	Vanpool	Motorists
Age (years), 50th Percentile	33	36	40
Sex			
% Male	49%	52%	64%
% Female	51%	48%	36%
Education (years), avg.	15.6	15.4	15.7
Occupation			
% Professional	56%	55%	51%
% Managerial	13%	21%	19%
% Clerical	21%	20%	9%
% Sales	4%	2%	12%
% Other	6%	2%	9%

Table 63. Personal Characteristics of Users and Non Users of the Katy AVL

Trip Characteristics	Authorized Vehicle Lane Users		Non AVL Users
	Transit	Vanpool	Motorists
Trip Purpose			
% Work	99%	100%*	94%
Trip Frequency (days/wk)			
5 or more	91%	95%	84%
Trip Destination			
Downtown	96%	70%	38%
Galleria/City Post Oak	0%	11%	24%
Medical Center	1%	5%	9%
Greenway Plaza	0%	3%	8%
University of Houston	3%	----	2%
Other	0%	11%	19%
Percent of Home Zip Codes (origins)			
in 77079, 77084, or 77449	46%	44%	31%

*Assumed

Table 64. Reasons for Selecting Current Commuting Mode

Reason or Characteristics	Authorized Vehicle Lane Users		Non AVL Users
	Transit	Vanpool	Motorists
Previous Travel Mode			
Drove Alone	44%*	34%	----
Carpooled	9%	22%	----
Vanpool	7%	13%	----
P/R Bus	----	7%	----
Regular Route Bus	10%	8%	----
Didn't Make Trip	27%	16%	----
Other	3%	0%	----
Primary Reasons For Selecting Mode			
Convenience	23%*	17%	17%
Don't Like to Drive	16%	9%	0%
Cost	18%	31%	2%
Traffic	12%	4%	0%
Need Car For Job	----	----	22%
No Bus or Van Available	----	----	22%
% Having at Least Part of Bus Fare, Van Cost, or Parking Cost Paid by Employer	57%	50%	54%
Will You Change to AVL Carpool			
Continue Present Mode	86%	93%	76%
Change to Carpool	0%	1%	5%
Not Sure	14%	6%	19%

*Data for Addicks park-and-ride lot as reported in Technical Report 1077-1F.

alone. The park-and-ride service had attracted 16% of its ridership from vanpools or carpools. The vanpools had attracted 15% of their ridership from buses and 22% from carpools.

Most commuters receive some sort of monetary incentive from their employer for using the mode. The employer generally pays all or part of the cost of a bus pass, van operations, or downtown parking. Not too surprisingly, individuals using all different modes perceive their mode as being convenient. A significant number of motorists perceive the need for an auto during the day.

General satisfaction with the existing travel mode is indicated by the responses to whether individuals will change to carpools once 4+ pools are allowed on the AVL. Essentially no bus or van passengers said they would; 5% of motorists in the mainlanes said they would (Table 64).

Based on these data, it appears that the 25% of carpoolers whose previous mode was transit (the El Monte Busway data from Los Angeles) may represent a high estimate of modal overlap for Houston. If the survey perceptions are accurate, the number of persons who will carpool may be relatively small, and the majority of the AVL carpool users will be attracted from carpools in the mainlanes (Table 59).

Impacts of the AVL On Mode Choice

The AVL appears to have had at least some impact on mode choice (Table 65). While 69% of the transit patrons and 87% of the vanpool patrons indicated they would be using that mode even if there were no AVL, 15% of transit patrons and 6% of vanpoolers said they would not. It would appear that, after 5 months of operation, the AVL has encouraged at least some individuals to switch travel modes. Furthermore, 25% of vanpoolers and 39% of transit patrons said the AVL was very important in their decision to use their current mode.

Table 65. Impact of the Katy AVL On Mode Choice

Impact on Mode Choice	Authorized Vehicle Lane Users		Non AVL Users
	Transit	Vanpool	Motorists
How Important is the AVL in Your Decision to Bus or Van			
Very Important	39%	25%	----
Somewhat Important	26%	16%	----
Not Important	35%	59%	----
Would You Bus/Van if There Were No AVL			
Yes	69%	87%	----
No	15%	6%	----
Not Sure	16%	7%	----
Has the AVL Increased Transit Ridership			
Yes	69%	35%	28%
No	7%	14%	26%
Not Sure	24%	51%	46%
Increased Vanpool Ridership			
Yes	18%	32%	20%
No	11%	26%	39%
Not Sure	71%	42%	41%
Reduced Freeway Congestion			
Yes	40%	29%	14%
No	25%	36%	70%
Not Sure	35%	35%	16%
Reduced AVL Travel Times			
Yes	79%	80%	61%
No	11%	11%	12%
Not Sure	10%	9%	27%

Perceived Impact of the AVL On Ridesharing and Congestion

The perceived impacts of the AVL on ridesharing and freeway congestion are not clear. There was general agreement that travel times for users of the AVL had been reduced (Table 65). Motorists felt that freeway congestion had not been lessened by the AVL operation. As to whether the AVL had increased vanpooling or transit ridership, the greatest percentage response tended to be "not sure".

Perceived Utilization of the AVL

A major reason for allowing carpools to use the AVL was that it was felt a perception existed that the AVL, with only bus and vanpool operation, was underutilized. The surveys confirmed that such a perception does exist (Table 66).

Table 66. Perceptions of the Level of Utilization of the Katy Authorized Vehicle Lane

Measure of Effectiveness of Success	Authorized Vehicle Lane Users		Non AVL Users
	Transit	Vanpool	Motorists
Is the AVL Sufficiently Utilized			
Yes	49%	30%	3%
No	33%	51%	90%
Not Sure	18%	19%	7%
Is the AVL a Good Improvement			
Yes	----	----	41%
No	----	----	35%
Not Sure	----	----	24%

Of the non users of the AVL, only 3% felt the AVL was sufficiently utilized to justify the project. A majority of vanpoolers -- individuals who are using and benefitting from the AVL -- felt it was not sufficiently

utilized to justify the project. Just less than half of the transit patrons -- individuals who view the AVL from inside a crowded bus -- felt the AVL was sufficiently utilized.

Thus, the perception of utilization is a very real problem that may be alleviated by carpool use of the authorized vehicle lane.

One final observation. While 90% of the motorists felt the AVL was underutilized, 41% thought it was a good transportation improvement. While this is not a majority, it is more than the 35% indicating it was not a good improvement.

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APPENDICES

APPENDIX A: Survey Instruments

APPENDIX B: Selected Comments From Surveys

APPENDIX A, SURVEY INSTRUMENTS

Presented in this appendix are the survey instruments and cover letters used in collecting the "Before" data. Included in this appendix are the following survey instruments.

1. Transit User Survey
2. Vanpool Driver Survey
3. Vanpool Passenger Survey
4. Motorist Survey

KATY AUTHORIZED VEHICLE LANE (AVL) TRANSIT USER SURVEY

1. What is the purpose of your bus trip this morning?
   _____Work _____Shopping _____Other (specify)_____
   _____School _____Recreational _____

2. How many days per week do you normally make this trip?_____

3. What is the Zip Code of the area where this trip began? (For example, if this trip began from your home this morning, you would list your home Zip Code.)_____

4. What is your final destination on this trip? _____Downtown _____Galleria/City Post Oak
   _____Texas Medical Center _____Greenway Plaza _____Other (specify Zip Code)_____

5. What are your main reasons for using the bus on the Katy Authorized Vehicle Lane (AVL)? (Check one or more)
   _____No other way available _____Dislike driving _____Carpool broke up
   _____Freeway too congested _____Gives me time to relax _____Vanpool broke up
   _____Saves time _____Allows someone else to use car _____Other (specify)_____
   _____Reliable travel schedule _____Costs less _____

6. Since you use the Katy AVL, why have you decided to ride a bus rather than a vanpool?
   _____Bus is more convenient _____Bus costs less _____Vanpool not available
   _____Other (specify)_____

7. How important was the opening of the Katy AVL in your decision to ride the bus?
   _____Very important _____Somewhat important _____Not important

8. If the Katy AVL had <u>not</u> opened, would you be riding a bus now? _____Yes _____No _____Not sure

9. How many minutes, if any, do you believe this bus presently saves by using the Katy AVL instead of the regular traffic lanes? _____Minutes in the morning _____Minutes in the evening

10. How long have you been a regular user of the Katy AVL?_____

11. Does your employer pay for any part of your bus pass? _____Yes, pays all _____Yes, pays part _____No

12. Was a car (or other vehicle) available to you for this trip? (check one)
    _____No, bus was only practical means _____Yes, but with considerable inconvenience to others
    _____Yes, but I prefer to take the bus

13. Before you began using the Katy AVL, how did you <u>normally</u> make this trip? (check one)
    _____Drove alone _____Rode a park-and-ride bus on the regular freeway lanes
    _____Carpooled _____Rode a regular route bus
    _____Vanpooled _____Did not make this trip prior to using the Katy AVL
    _____Other (specify)_____

14. When the Katy AVL is opened to carpools (with 4 or more persons), will you continue to ride the bus or will you choose to carpool? _____Continue to ride a bus _____Use a carpool _____Not sure
    Why?_____

15. Based on your knowledge of the Katy AVL operation, do you think that the AVL has been successful in:

Increasing vanpool ridership?	_____Yes	_____No	_____Not sure
Increasing transit ridership?	_____Yes	_____No	_____Not sure
Reducing travel times for AVL users?	_____Yes	_____No	_____Not sure
Reducing traffic congestion on the Katy Freeway?	_____Yes	_____No	_____Not sure

16. Do you feel that the Katy AVL is, at present, being sufficiently utilized to justify the project?
    _____Yes _____No _____Not sure

17. What is your... Age?_____ Sex?_____ Occupation?_____

18. What is the last level of school you have completed?_____

Please use the back of this form for additional comments. Thank you for your cooperation.

STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

IN REPLY REFER TO
FILE NO.

Dear Vanpooler:

We need your help in a special study of the Katy Authorized Vehicle Lane (AVL) being conducted by the Texas Transportation Institute, The Texas A&M University System. Because the Katy AVL is the first of its kind to operate in Texas, it is extremely important that we determine how it is being used and by whom.

Please take a few minutes to answer the enclosed survey questionnaire. Your answers will provide valuable information concerning vanpooling on the Katy AVL. Because of the small number of participants in this survey, your specific reply is essential to insure the success of the project. All information you provide will remain strictly confidential. Only a summary of the survey results will be available for review.

Your cooperation and timely return of the completed questionnaire in the enclosed postage-paid envelope will be greatly appreciated. Thank you for your time and assistance in this important undertaking.

Sincerely,

Phillip L. Wilson

Phillip L. Wilson
State Transportation Planning Engineer

PLW:DLB:dll

Enclosures

KATY AUTHORIZED VEHICLE LANE (AVL) VANPOOL DRIVER SURVEY

Undertaken by the Texas Transportation Institute, The Texas A&M University System, in cooperation with the Texas State Department of Highways and Public Transportation, METRO, and the U.S. Department of Transportation

1. Which days does your vanpool usually travel on the Katy Authorized Vehicle Lane (AVL)?
   _____Mon _____Tue _____Wed _____Thu _____Fri _____Less than once a week

2. Which commuting periods does your vanpool use the Katy AVL? _____a.m. _____p.m.
   If not both a.m. and p.m., why?_____

3. How many members are registered in your vanpool (including yourself)?_____

4. How many riders were in your vanpool today (including yourself)?_____

5. How many of the vanpool members (including yourself) are authorized to drive on the Katy AVL?_____

6. How long have you been a regular user of the Katy AVL?_____

7. How was the vanpool group first organized?
   _____By my employer _____I found the riders _____Other (specify)_____
   _____METRO CarShare _____Residential developer _____

8. What is the owning/leasing arrangement for this van?
   _____Employer provides van _____A third party (not employer or driver) provides van
   _____I own the van _____Other (specify)_____

9. Which on-ramp did you use to enter the Katy Freeway for this trip?_____

10. What is your vanpool destination? _____Downtown _____Galleria/City Post Oak _____Greenway Plaza
    _____Texas Medical Center _____Other (specify Zip Code)_____

11. When did you join this vanpool? Month:_____ Year:_____

12. Why did you begin vanpooling when you did?_____
    _____

13. Does your employer pay for "all" or "part" of your vanpool fare?
    _____Yes, pays all _____Yes, pays part _____No

14. How important was the opening of the Katy AVL in your decision to vanpool?
    _____Very important _____Somewhat important _____Not important

15. If the Katy AVL had <u>not</u> opened to vanpools, would you be vanpooling now?
    _____Yes _____No _____Not sure

16. Since you use the Katy AVL, why have you decided to vanpool rather than ride a METRO bus?
    _____Vanpooling is more convenient _____Too far to nearest park-and-ride lot or bus stop
    _____Vanpooling costs less _____None of the buses stop near my destination
    _____Other (specify)_____

17. Before you joined this vanpool, how did you usually make this trip? (check one)
    _____Used a different vanpool _____Rode a METRO regular route bus
    _____Drove alone _____Did not make this trip
    _____Carpooled _____Used another means (specify)_____
    _____Rode a METRO park-and-ride bus _____

18. When carpools (with 4 or more passengers) are allowed to use the Katy AVL, will you continue to vanpool or will you choose to carpool? _____Continue to vanpool _____Use a carpool _____Not sure
    Why?_____

Vanpool Driver Survey Continued

19. How many minutes, if any, do you believe your vanpool saves by using the Katy AVL instead of the regular traffic lanes? _____Minutes in the morning _____Minutes in the evening

20. What are your main reasons for vanpooling on the Katy AVL? (You may check more than one.)

_____No other way available	_____Allows someone else to use car	_____Other (specify)_____
_____Freeway too congested	_____No bus service to my destination	_____
_____Saves time	_____Costs less	_____
_____Reliable travel schedule	_____Carpool broke up	_____

21. Based on your knowledge of the Katy AVL operation, do you think that the AVL has been successful in:

Increasing vanpool ridership?	_____Yes	_____No	_____Not sure
Increasing transit ridership?	_____Yes	_____No	_____Not sure
Reducing travel times for AVL users?	_____Yes	_____No	_____Not sure
Reducing traffic congestion along the Katy Freeway?	_____Yes	_____No	_____Not sure

22. Do you feel that the Katy AVL is, at present, sufficiently utilized to justify the project?
_____Yes _____No _____Not sure

23. Please tell us your feelings about vanpooling or bus riding <u>on the Katy AVL</u>.

Vanpooling takes more time than driving alone	_____Agree	_____Disagree	_____Neutral
Bus riding takes more time than driving alone	_____Agree	_____Disagree	_____Neutral
Vanpooling is cheaper than driving alone	_____Agree	_____Disagree	_____Neutral
Bus riding is cheaper than driving alone	_____Agree	_____Disagree	_____Neutral
Vanpooling is more pleasant than driving alone	_____Agree	_____Disagree	_____Neutral
Bus riding is more pleasant than driving alone	_____Agree	_____Disagree	_____Neutral
I enjoy riding with other people	_____Agree	_____Disagree	_____Neutral

24. If you drove alone, how many miles long would your daily round trip be?_____miles

25. How many miles <u>longer</u> is your round trip as a result of your participation in this vanpool?_____miles

26. Do you have a common point (or points) where vanpool members meet to depart for work each morning?
_____No, I pick up each member at his or her door
_____Yes, I pick up vanpool members at the following location(s):
(list street intersection or subdivision name below)

_____ Zip code?_____
_____ Zip code?_____
_____ Zip code?_____
_____ Zip code?_____
_____ Zip code?_____

27. What is your... Age?_____ Sex?_____ Occupation?_____

28. What is the last level of school you have completed?_____

29. What is your home Zip Code?_____

30. We would appreciate your additional comments:_____

_____

_____

_____

THANK YOU FOR YOUR COOPERATION.

Please return this form at your earliest convenience in the postage-paid envelope.

KATY AUTHORIZED VEHICLE LANE (AVL) VANPOOL PASSENGER SURVEY

Undertaken by the Texas Transportation Institute, The Texas A&M University System
in cooperation with the Texas State Department of Highways and Public Transportation,
the Metropolitan Transit Authority, and the U.S. Department of Transportation

1. On the mornings you are a vanpool passenger, do you use your car to drive to a pick-up point?
_____Yes _____No, I am dropped off by someone else _____No, I am picked up at my door

2. When your car is left at home, is it used by a driver who otherwise has no car?
_____Yes _____No _____Not applicable (my car is always parked at the pick-up point)

3. When did you join this vanpool? Month:_____ Year:_____

4. Why did you begin vanpooling when you did?_____
_____

5. Does your employer pay for "all" or "part" of your vanpool fare?
_____Yes, pays all _____Yes, pays part _____No

6. How important was the opening of the Katy Authorized Vehicle Lane (AVL) in your decision to vanpool?
_____Very important _____Somewhat important _____Not important

7. If the Katy AVL had <u>not</u> opened to vanpools, would you be vanpooling now?
_____Yes _____No _____Not sure

8. Since you use the Katy AVL, why have you decided to vanpool rather than ride a METRO bus?
_____Vanpooling is more convenient _____Too far to nearest park-and-ride lot or bus stop
_____Vanpooling costs less _____None of the buses stop near my destination
_____Other (specify)_____

9. Before you joined this vanpool, how did you usually make this trip? (check one)
_____Used a different vanpool _____Rode a METRO regular route bus
_____Drove alone _____Did not make this trip
_____Carpooled _____Used another means (specify)_____
_____Rode a METRO park-and-ride bus _____

10. When carpools (with 4 or more passengers) are allowed to use the Katy AVL, will you continue to vanpool or will you choose to carpool? _____Continue to vanpool _____Use a carpool _____Not sure

Why?_____
_____

11. How many minutes, if any, do you believe your vanpool saves by using the Katy AVL instead of the regular traffic lanes? _____Minutes in the morning _____Minutes in the evening

12. What are your main reasons for vanpooling on the Katy AVL? (You may check more than one.)
_____No other way available _____Gives me time to relax _____Carpool broke up
_____Freeway too congested _____Allows someone else to use car _____Dislike driving
_____Saves time _____No bus service to my destination _____Other (specify)
_____Reliable travel schedule _____Costs less _____

13. Based on your knowledge of the Katy AVL operation, do you think that the AVL has been successful in:

Increasing vanpool ridership?	_____Yes	_____No	_____Not sure
Increasing transit ridership?	_____Yes	_____No	_____Not sure
Reducing travel times for AVL users?	_____Yes	_____No	_____Not sure
Reducing traffic congestion along the Katy Freeway?	_____Yes	_____No	_____Not sure

Vanpool Passenger Survey Continued

14. Do you feel that the Katy AVL is, at present, being sufficiently utilized to justify the project?
_____Yes _____No _____Not sure

15. Please tell us your feelings about vanpooling or bus riding on the Katy AVL.

Vanpooling takes more time than driving alone	_____Agree	_____Disagree	_____Neutral
Bus riding takes more time than driving alone	_____Agree	_____Disagree	_____Neutral
Vanpooling is cheaper than driving alone	_____Agree	_____Disagree	_____Neutral
Bus riding is cheaper than driving alone	_____Agree	_____Disagree	_____Neutral
Vanpooling is more pleasant than driving alone	_____Agree	_____Disagree	_____Neutral
Bus riding is more pleasant than driving alone	_____Agree	_____Disagree	_____Neutral
I enjoy riding with other people	_____Agree	_____Disagree	_____Neutral

16. If you drove alone, how many miles long would your daily round trip be?_____miles

17. How many miles longer is your round trip as a result of your participation in this vanpool?_____ miles

18. What is your... Age?_____ Sex?_____ Occupation?_____

19. What is the last level of school you have completed?_____

20. What is your home Zip Code?_____

21. We would appreciate your additional comments:_____

_____

_____

_____

_____

THANK YOU FOR YOUR COOPERATION.

Please return this form at your earliest convenience in the postage-paid envelope.

STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

IN REPLY REFER TO FILE NO.

Dear Motorist:

We need your help in a special study being conducted by the Texas Transportation Institute, The Texas A&M University System. As you are aware, the Katy Freeway is becoming increasingly more congested. To relieve some of this congestion, the State Department of Highways and Public Transportation and the Metropolitan Transit Authority have constructed the Katy Authorized Vehicle Lane (AVL) for use by buses and vanpools. Buses and vanpools using the lane travel inbound toward downtown in the morning and outbound in the afternoon. The Katy AVL has been constructed within the median of the freeway and is protected from other traffic by concrete barriers. The location of the AVL in the median has not reduced the number of general traffic lanes available to motorists.

Because the Katy AVL is the first of its kind to operate in Texas, we need your help to determine how it is working and what effect it has had on your travel. Please take a few minutes to answer the enclosed survey questionnaire. The questions on this survey concern your routine trips made on the Katy Freeway in the mornings, from 6:00 a.m. to 9:00 a.m. Because of the small number of motorists contacted, your specific reply is essential to insure the success of the project. Your answers will remain strictly confidential. Only a summary of the survey results will be available for review.

Please complete the requested information and return it in the enclosed postage-paid envelope at your earliest convenience. Thank you for your time and assistance. The information you provide will assist in determining the most efficient means of operating the Katy AVL, and will be of value in the planning, design and operation of future authorized vehicle lanes in Houston.

Again, thank you for your help.

Sincerely,

Phillip L. Wilson

Phillip L. Wilson
State Transportation Planning Engineer

PLW:DLB:dll

Enclosures

KATY FREEWAY MOTORIST SURVEY

Undertaken by the Texas Transportation Institute, The Texas A&M University System,
in cooperation with the Texas State Department of Highways and Public Transportation,
the Metropolitan Transit Authority, and the U.S. Department of Transportation

Your vehicle was observed traveling eastbound on the Katy Freeway between 6:00 and 9:00 a.m. the week of March 4. To the best of your recollection, please complete this survey as it pertains to that trip.

1. What was the purpose of your trip?
   _____Work _____Shopping _____Other (specify)_____
   _____School _____Recreational _____

2. What were your reasons for choosing an auto rather than a bus or vanpool in the Katy Authorized Vehicle Lane (AVL) for this trip?_____
   _____

3. How many days per week do you normally make this trip?_____

4. How do you usually make this trip?
   _____Drive alone _____Vanpool _____METRO regular route bus
   _____Carpool _____METRO Park-and-Ride bus _____Other (specify)_____

5. How many people (including yourself) were in your vehicle for this trip?_____

6. Which on-ramp did you use to enter the Katy Freeway for this trip?_____

7. What was the destination of your trip?
   _____Downtown _____Texas Medical Center _____Other (specify Zip Code below)
   _____Galleria/City Post Oak _____Greenway Plaza _____

8. Do you agree or disagree that the following vehicles should be allowed to use the Katy AVL?

Buses (park-and-ride, express, intercity, etc.)	_____Agree	_____Disagree	_____Neutral
Vanpools (with 8 or more registered passengers)	_____Agree	_____Disagree	_____Neutral
Carpools (with 4 or more persons)	_____Agree	_____Disagree	_____Neutral

9. Based on your observation of the number of vehicles using the Katy AVL, do you feel that it is being sufficiently utilized?
   _____Yes _____No _____Not sure

10. Based on your perception of the number of persons being moved on the Katy AVL, do you feel that it is being sufficiently utilized?
    _____Yes _____No _____Not sure

11. When the Katy AVL is opened to carpools (with 4 or more persons), will you choose to carpool in the AVL?
    _____Yes _____No _____Not sure
    Why?_____
    _____

12. Based on your knowledge of the Katy AVL operation, do you think that the AVL has been successful in:

Reducing traffic congestion on the Katy Freeway?	_____Yes	_____No	_____Not sure
Increasing vanpool ridership?	_____Yes	_____No	_____Not sure
Increasing transit ridership?	_____Yes	_____No	_____Not sure
Reducing travel times for AVL users?	_____Yes	_____No	_____Not sure

(over)

Motorist Survey Continued

13. Even if you have never used the Katy AVL, please tell us your feelings about vanpooling or bus riding on the Katy AVL:

Vanpooling takes more time than driving alone	_____Agree	_____Disagree	_____Neutral
Bus riding takes more time than driving alone	_____Agree	_____Disagree	_____Neutral
Vanpooling is cheaper than driving alone	_____Agree	_____Disagree	_____Neutral
Bus riding is cheaper than driving alone	_____Agree	_____Disagree	_____Neutral
Vanpooling is more pleasant than driving alone	_____Agree	_____Disagree	_____Neutral
Bus riding is more pleasant than driving alone	_____Agree	_____Disagree	_____Neutral
I enjoy riding with other people	_____Agree	_____Disagree	_____Neutral

14. Do you feel that the Katy AVL was a good transportation improvement?
_____Yes _____No _____Not sure

15. Does your employer pay for "all" or "part" of your parking expense?
_____Yes (pays all) _____Yes (pays part) _____No

16. Does your employer pay for "all" or "part" of your bus fare if you ride a bus?
_____Yes (pays all) _____Yes (pays part) _____No _____Don't know

17. Does your employer pay for "all" or "part" of your vanpool fare if you ride in a vanpool?
_____Yes (pays all) _____Yes (pays part) _____No _____Don't know

18. Does your employer give any special treatment to encourage carpools? _____Yes _____No
If "yes," please describe_____

_____

19. Does your job require that you have a car available during the day?
_____Yes (always) _____Yes (sometimes) _____No

20. Have you ever heard of METRO CarShare (the carpool & vanpool matching service)? _____Yes _____No
If "yes," have you ever used their services? _____Yes _____No

21. Are you familiar with the park-and-ride service provided by METRO along the Katy Freeway?
_____Yes _____No
If "yes," have you ever used park-and-ride? _____Yes _____No

22. What is your... Age?_____ Sex?_____ Occupation?_____

23. What is the last level of school that you have completed?_____

24. What is your home Zip Code?_____

25. We would appreciate your additional comments:_____

_____

_____

_____

THANK YOU FOR YOUR COOPERATION.

Please return this form at your earliest convenience in the postage-paid envelope.

APPENDIX B, SELECTED COMMENTS FROM SURVEYS

All survey participants were encouraged to provide comments. An unusually large number of repondents did offer comments. Those comments were summarized by category in the main report.

A representative sample of comments from all the surveys is reproduced in this appendix. The comments range from highly favorable comments concerning the AVL to highly unfavorable comments. No attempt has been made to edit the comments.

Comments From Transit User Survey

I don't understand why the entrance to the AVL is so far down the freeway from West Belt. It does not make sense to me to get on the freeway and have to sit in traffic for miles before the bus can even get on the AVL. The same is also true coming from downtown. The bus has to get off the AVL miles before we get to the West Belt exit. Please have your designer, architect or whatever explain this to me. Also, have somebody explain to me why the bus I filled this survey out on, is not leaving at 7:45 like it is supposed to. We are leaving now at 7:55. I don't appreciate this at all. Now I'll probably be late for work. Let me know why!

I have worked downtown 2 1/2 years, and in that time period the freeway traffic has increased greatly. Until the "210" opened, I always drove. I have been very pleased with the service, and plan to continue using the service. The driver's are the best part, they are friendly and very pleasant to greet in the morning. It's nice to know about and benefit from such a useful service that is derived from tax dollars.

In my opinion, the AVL has proven to be a monumental waste of money if the objective of building it was to decrease commuting time and, therefore, to increase ridership. Metro planners failed to consider the extra time it takes to get on the AVL and the extra time needed to exit the AVL outside the

loop and then go through several traffic lights before getting back on I-10 inside the Loop. Additionally, the AVL has no impact on the bottleneck and resulting delays, just outside the downtown area around the 8:00 a.m. hour. I would be very glad to discuss my opinion of the AVL with anyone desiring more information from a regular bus rider.

The entrance and exit is very poorly designed - there was a better way.

Whomever is running this survey should have their name on it.

Project costs, both in capital outlay and the enormously increased transit time during the construction phase, are not justified by the minimal amount of time now saved with the AVL. Diversion onto Old Katy Road at the point when traffic is least congested is stupid. Most of the time saved in the AVL is lost to the series of lights on Old Katy.

Addicks 228. The 4:50 to 5:50 buses are very crowded. One more bus should be scheduled around 5:00 p.m.! Overall, the present system rates very good in my opinion. The Katy contraflow lanes are very good but should be lengthened as soon as possible. Cars with 4 or more passengers should be allowed to use the AVL as well.

I think the Katy AVL would be a lot more successful if the lane was extended so the buses to enter and exit at West Belt instead of Bunker Hill. It takes 35 to 40 minutes just to get to the Lane at Bunker Hill therefore no significant time is saved. Also, the temperature on the bus is either TOO HOT or TOO COLD because the drivers turn on the air on high and there is no middle setting.

Since the opening of the AVL, ridership has increased on this line (the 228) but there has not been a commensurate increase in service. The buses are frequently uncomfortably overcrowded, especially in the evening around 5:00 p.m. - 6:00 p.m. This discomfort discourages people from riding the bus.

Additional buses need to be added around 5:00 - 5:20 p.m.!

Your pricing yourself out of the market!! (If you haven't already). With fuel prices dropping versus your rates, carpools are looking awfully good. You can't subsidize the rest of the system at the expense of the people who travel on park-and-ride!

As it stands, the AVL is not long enough to bypass heavy traffic. It needs to be extended further out. The fares are too high. The buses need to travel in other areas of the city besides the downtown area such as the the Post Oak area in Houston. Buses should be re-routed to reenter the freeway; too much time is lost on Old Katy Road because of too many stop lights.

I believe that for a congested city like Houston, the AVL is a very good idea. As it stands now, the AVL is too short, thus only saves 5 - 10 minutes (morning) since my bus leaves so early in the morning (6 a.m.). Once it is stretched out to highway 6, time saved will increase and ridership will too. Allowing carpool is both a plus and a minus. A plus in the sense that hopefully there will be less traffic congestion. A minus in the sense of potentially slowing down traffic on the AVL and people abuse of carpool privileges (say one person/car). The bus loses time after it gets off AVL as it goes thru too many lights on Old Katy. I believe that bus fares on park-and-ride bus are quite expensive, Metro probably feels that the suburb and professional people can go on affording higher fares. There is also a need for direct bus service to other major work centers (Greenway Plaza, Post Oak, University of Houston) changing bus downtown/riding city bus is a pain.

I believe ridership would have increased substantially however the rate increase (which in the past 2 years has been ridiculous!!) offset this possibility. Metro is going to price themselves out the commuter market. (I still can't believe that the price differential between Katy-Mason and Highway 6 is so drastic!!) I cannot justify the rate increase as well as the stiff rate fare!!

Wish they would get the rest of it opened. Would save time at night. I do not feel that raising fares is justified. Vanpool is cheaper however I need the flexibility of the trips.

Comments From Vanpool Passenger Survey

Transitway users would save more time if, in addition to opening the AVL further west, a ramp were added on the east end merging back on to I-10 just east of the 610 Loop for those users continuing on to the downtown area. Use of Old Katy Road is slow due to 3 sets of traffic lights, which we catch red 90% of the time, at Posk Oak and I-10 overpass.

The Katy AVL is underutilized. I may ride the Metro bus in the future because GULF may discontinue the Vanpool service.

The entry and exit points for the transitway seem to be placed in very peculiar positions. You cannot exit in time to get off at Gessner, yet it is still a long way to West Belt. Similarly, when you get on at West Belt, you must travel quite a distance before entering the transitway.

Believe if four passenger autos use AVL project would be justified after approximately six months.

I like the AVL. Opening it to car poolers should significantly increase its utilization. There seem to be fewer vanpools now than 3 or 4 years ago - and I think this has affected utilization of the AVL.

I think car pooling is a good idea for the AVL to help cost justify the AVL.

I think opening the AVL to carpools could be a great and more efficient use of the taxpayer's dollars. Even with opening the unused section of AVL will save more time for vanpools.

The Katy AVL is not busy enough. Should allow 3-person carpools to drive it.

AVL is a waste of taxpayers' money since it is so underutilized.

The lane needs to be open up all the way to Highway 6.

Need improvements on the Katy AVL get-on and get-off routes.

Enter and Exit lane of AVL should be improved and somehow reroute so the van does not have to enter or exit right into the congested area. (something like in Los Angeles).

Metro lane is difficult to enter and exit for workers of 610 Loop.

AVL needs to open earlier on Fridays as many companies release earlier on Fridays than Monday - Thursday.

Open up extension of the lane further west!

The Katy AVL is a great idea. It certainly reduces travel time when the freeway is backed up by accidents, weather conditions, etc.

I am surprisingly pleased at the smoothness with which the Katy AVL operates/ moves vehicles.

Vanpooling is the best thing that has ever happened and using the Katy AVL is also.

Comments From Vanpool Driver Survey

Making the AVL entrance and exit off the freeway is crazy. All the time saved on the AVL is loss by having to go through three traffic lights and driving on a street with a 45 mph speed limit. The AVL should have entered and exited the freeway at both ends or even better gone all the way downtown.

AVL is a good thing except the enter and exit (townside or east end) planning was very bad. Loose to much time on Old Katy Road. Speed limit and lights.

Advertise more-appeal to "yuppies"; get those "one-person" cars off freeway.

The AVL needs to be extended west as soon as possible to benefit more people and the one major drawback of the existing AVL is that of lot of time gained

by using the lane is just once you transfer to the Old Katy old section between Old Post Oak and Washington Blvd.

AVL saves a lot of time when there's an accident or bad weather. I will ride the AVL farther when completed. Good answer to traffic. More people will ride when completed.

My riders and I are very pleased with the AVL. It takes much of the stress out of our commute.

Comments From Motorist User Survey

I think everyone would profit more with a truck lane. The lanes on the freeway seem too close now and the trucks own lane would make more sense than a bus or vanpool lane. I never see enough vans or buses to make the lanes profitable. I've lived here 25 years and think the lane was definitely a mistake.

What about letting 18-wheelers and big trucks using the Katy AVL?

Forget the buses, the vans. Put the gravel trucks and trucks on the AVL. I'd be for it and so would they! However, the inadequate access bridge probably wouldn't support them. Good Luck!

The Katy AVL as presently designed and as presently being utilized has been a waste of tax funds. The Metro Park-and-Ride service along Katy Freeway is only benefitting those people who work in "downtown" Houston. It is not practical for people working in other areas, such as Greenway Plaza.

I feel that the AVL is a huge waste of money given the percentage of the freeway space it requires vs. the percentage of the freeway users it serves.

At this point in time, AVL I honestly see and believe is a total failure. Far too much good money was completely wasted on a system that looks good on TV and radio commercials but has not changed the congestion on the Katy

Freeway in the slightest. It has to be a failure to anyone not blind to honest facts: No one is using the Katy AVL. Everyone was told before it opened that it would help Houston and it has done absolutely nothing of the sort. The AVL is empty at peak traffic periods and the Katy Freeway is jammed with private autos and 18-wheelers. In my opinion there are several clear reasons for this: No one wants to give up the freedom offered by their own auto; The Katy AVL is extremely limited in scope; Far too many people who live in the west of Houston work in areas that the AVL does not even begin to serve. Many people have said that the AVL is interested in ONLY people who work in certain exclusive and selected areas of the city like the Galleria or the Medical Center and I also believe this is your basic attitude and too many citizens know this to be true.

I think it was a waste of money, time and has accomplished nothing but make me angry every time I see it!

Katy Transitway is biggest waste of space and money I have seen in years. The freeway should have been widened, adding more lanes in all directions. That way everyone could benefit. I resent having my tax dollars wasted senseless projects.

So far the construction has been a total waste of time and money. It was a dangerous strip during construction and probably will be again during the proposed extension. The only benefits obtained so far were those going to the contractors who are the awarded the work. To condense my opinion, "it's a Joke"! (A very expensive joke!)

I think AVL is a tremendous waste. I never see anyone using it - 2 buses a few vans; that's it. But, I do see all that nicely paved freeway. I suggest one of 2 things: 1) Let anyone who wants to use the lane and go wherever it goes be allowed to do so; or 2) better yet, get rid of it and make Katy Freeway 4 or 5 lanes each way (with a Contraflow lane as a variation to this alternative).

I believe AVL is underutilized, a waste of money, a project that is a failure because of lack of understanding of the market in Houston. Now after being

built, AVL is forced on drivers who will not change their behavior just because AVL is there. AVL caused all sorts of traffic problems while being built and still does after being completed. Just observe the speed of the traffic when cars are "free to go" after being "squeezed" for miles because of this absurd project and also observe the bottleneck that it causes in the evening when there are only 2 lanes downtown to access I-10W. Knock it down, please, and think TRAINS! (A trip to the Northeast of the country or maybe Europe(?) would help to get some more feasible ideas!

The AVL is grossly under utilized!! On this basis, I feel the AVL is a present waste of taxpayer money.

I feel that the AVL would be best utilized as an "extra" lane for all traffic going intown in the morning and outbound in the evening.

AVL should be open to more vehicles; I hardly ever see anybody on it.

I am in total agreement with the Katy AVL concept. It is a good first step.

I think the AVL is a progessive step toward transportation problems - Thank you for your concern toward citizen statisfaction.

Keep up the excellent work and the positive attitude to alleviate the city's traffic hellaciousness.

I think AVL lane is a waste of money. Why not increase its use to all - 4 lanes in and outbound would help. I took the bus to work once and it took 2 hours door to door. Can do it in car in 20 minutes. Also, sue the contractor who paved I-10 -- it's breaking up already!

The AVL is the most under utilized facility created by METRO. It's a disgrace to waste that lane for so few vehicles -- very poor planning.

I would prefer to see the AVL lane as an additional lane for <u>all</u> traffic. In the morning as an eastbound lane in the afternoon as a westbound lane.

Katy Freeway is the worst freeway in Houston and a death trap!

Nice, you now have open what is almost a 24 hour vacant parking lot. While we unendowed users of the "crowded/crawling" lanes still fight the traffic in lanes that are still in need of repairs after all of the construction work. Who are the inspectors who should be making sure the contractors perform work that meets an acceptable standard. They don't give quality now!

The contractor who re-constructed the Katy Freeway was either crooked or incompetant for the Katy had large pot holes within 60 days of reopening.

I, as an engineer, feel that the bus entry lane outbound is very poorly designed. Who ever designed this should have their P.E. revoked. There already has been one wreck where a bus and four cars "met". The AVL should have been three lanes; two cars and one bus. This would have allowed for nine lanes of traffic, six in any given direction. Also during road repairs there would have been six lanes for use with three (or less) closed. I believe that I, as a taxpayer, got a poor product for the money invested. A good lawyer could have a field day with the designers or engineers.

All traffic would, I feel, be improved if trucks (all but pickups) were added to the AVL lanes. The AVL would be more fully utilized, lessening congestion and accidents in non AVL lanes and I feel accidents would be fewer in AVL lanes.