LAND USE AND INNOVATIVE FUNDING IMPACTS IN A PERMANENT BUSWAY/PARK-AND-RIDE TRANSIT SYSTEM: LAND USE DATA BASE FOR HOUSTON'S TRANSITWAY CORRIDORS AND SECOND YEAR SUMMARY

by

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ABSTRACT

This report summarizes research performed during the second year under Project 9-10-85-1085 (between State and Goodman Associates) and Project 2-10-85-1086 (between State and the Texas Transportation Institute). The data collection and analysis are closely tied to the basic procedures used in other transit/land use impact studies. The research plan (Technical Report 1086-2) outlined how the work is being performed and set forth the basic framework for the data collection activities and anticipated results. This five year research effort examines transportation and land use impacts resulting from the implementation of an extensive priority system of busways (transitways) and park-and-ride facilities in Houston, Texas. A comparison (Technical Report 1086-3) of the Houston system was made with priority treatments implemented in other urban areas of the U.S. and Canada. Over the duration of this research, three high-occupancy vehicle (HOV) lanes with supporting park-and-ride facilities will be placed in operation in Houston's north (I-45N), west (I-10W) and southeast (I-45S) freeway corridors. The impacts resulting from these HOV treatments are the object of this research. Preliminary results indicate that while the transportation impacts of those elements of the Houston Transitway system which are operational have been substantial, no substantial land use impacts can be identified at this time. It appears that a more definitive assessment of land use impacts may not be possible until the transitway system is fully operational and more fully integrated into the community's total transportation system.

Key Words: Land Use, Transportation Impacts, Transitways, Busways, HOV Lanes, Park-and-Ride, Priority Treatment, Development, Retail Sales, Mode Split, Travel Demand, Transportation Planning, Fixed Guideway, Bus Rapid Transit, Express Bus, Impact Studies, Economic Assessment.

IMPLEMENTATION STATEMENT

This project is oriented toward assisting the Texas State Department of Highways and Public Transportation (SDHPT) in the planning and impact evaluation of high-occupancy vehicle (HOV) lanes or transitways. The study concentrates on the freeway corridors in Houston, Texas where priority facilities for HOVs are being constructed.

Identification of secondary data sources and a survey (Technical Report 1086-1) of relevant literature on similar impact studies provided the primary data bases for development of the study's work program (Technical Report 1086-2). An assessment of other HOV projects in the U.S. and Canada (Technical Report 1086-3) along with a pilot examination of Houston's North (I-45N) transitway corridor (Technical Report 1086-4) impacts was undertaken prior to the work presented herein for the Gulf (I-45S) and Katy (I-10W) corridors. The results of this research, when completed, should assist the State Department of Highways and Public Transportation in evaluationg potential land use and transportation impacts resulting from implementation of transitways and/or park-and-ride facilities.

This research may be applied nationwide by local, state and federal officials responsible for, or concerned with, busway/park-and-ride system development. Evaluation of land use impacts (if any) associated with permanent transit facility construction will provide valuable guidance to transportation planners and policy makers in assessing alternative improvements.

The study findings will be of particular interest to the State Department of Highways and Public Transportation, the Urban Mass Transportation Administration, and Federal Highway Administration, other State Departments of Transportation, local transit agencies, city planners, and various professional societies or organizations (e.g., ITE, TRB, ASCE, AASHTO).

DISCLAIMER

The contents of this report reflect the views of the authors who are responsible for the opinions, findings and conclusions presented herein. The contents do not necessarily reflect the official views or policies of the Urban Mass Transportation Administration, U.S. Department of Transportation or of the Texas State Department of Highways and Public Transportation. This report does not constitute a standard, specification or regulation.

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SUMMARY

This report presents the preliminary results of a study of the land use and transportation impacts resulting from implementation of HOV priority treatments in the North (I-45N), West (I-10W), and South (I-45S) Freeway corridors in Houston, Texas. Preliminary results indicate that while the HOV priority treatments implemented in the corridors have produced substantial improvments in vehicle person movement capacity, the land use impacts appear to be relatively insignificant at this time.

In the I-45N corridor, traffic operation has progressively improved since the implementation of the median transitway. Occupancy rates on the total facility climbed from 1.5 passengers per vehicle to 1.7 passengers per vehicle. Based upon average transitway volumes in the first year of transitway operation, transitway users cumulatively realized an average travel time savings of almost 2,200 person-hours per day over parallel freeway mainlane travelers. These travel time savings translate into a benefit of almost $4.3 million each year. Combining these travel time savings with reduced bus operating cost savings, a total direct benefit of $42.0 million over a 20-year period is anticipated. With direct costs of $15.2 million, the transitway confirms its cost-effectiveness with a benefit/cost ratio of almost 3:1.

At the present time, some 3,100 person trips per peak period are accommodated by the Katy Transitway in 220 vehicles. This represents an overall, average vehicle occupancy of about 14 persons when all authorized modes (buses, vanpools and carpools) are considered. During the 12-month period from August 1985 through July 1986, some 71% of the total person trips were accommodated by buses, 20% by vanpools and 9% by carpools.

The preliminary results of the land use impacts phase of the research are inconclusive. No substantial land use changes of a nature which would appear to be related to the presence of the transitway and/or park-and-ride lots could be identified. It appears that a more definitive assessment of

the land use impacts will not be possible until some time after the transitway and associated support facilities have become fully operational and established as integral elements of the corridor's transportation system. The North and West Freeway corridor study sites all have substantial amounts of undeveloped land and, as such, should serve as excellent test sites for monitoring the long-term land use impacts of park-and-ride lots.

The preliminary results of the study suggest that continued monitoring of land uses in the Houston Transitway corridors, along with completion of the developer interview portions of the research, should result in a reasonable assessment of the potential land use impacts of transitway systems.

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1. INTRODUCTION

1.1 BACKGROUND

The tremendous growth experienced in urban areas of Texas in recent years has caused concern by State and local transportation officials over degradation of mobility. Future growth and economic vitality in the Texas metropolitan regions are in jeopardy unless major improvements are implemented in the existing urban transportation system. It is not economically or physically possible to provide sufficient additional highway capacity through major cross section expansion or to expand transit services to accommodate anticipated demand (1). Therefore, new and innovative means of freeway system management have been examined as possible remedies.

One alternative to increase roadway capacity is to provide high-occupancy vehicle (HOV) priority treatments. The first major priority treatment effort in Texas, the Houston I-45N Contraflow Lane (CFL), proved operationally successful and received favorable public acceptance. Implementation of three, more permanent HOV projects on the Katy (I-10W), North (I-45N) and Gulf (I-45S) Freeways in Houston began in 1982 and will continue through 1987.

The Houston Metropolitan area is implementing one of the most extensive HOV priority treatment networks in the nation. There are three basic types of HOV lanes that can be implemented on urban freeways: 1) contraflow lanes; 2) concurrent flow lanes; and, 3) transitways. The first two types of HOV lanes are frequently classified as commuter lanes. The fundamental difference between commuter lanes and transitways is the increased level of service provided. 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 (2).

1.2 RESEARCH OBJECTIVES

This multi-year study has two primary objectives:

1. To measure, analyze, and evaluate the transportation and land use impacts resulting from the construction of permanent busways (transitways) and park-and-ride facilities in the Houston area; and,

2. To evaluate the "turnkey" procurement concept use by Houton METRO and to determine its nationwide potential for park-and-ride facility development.

The evaluation of land use and transportation impacts will require before and after data to be collected throughout the five year study period. During the initial phase of the study, six secondary, supportive objectives were identified:

- To prepare a detailed work program compatible with other prior or ongoing impact evaluation studies;

- To conduct, based upon available data, case studies of transitway facilities in cities other than Houston for comparison of design and operational characteristics;

- To examine land use impacts of the contraflow lane in Houston's north (I-45N) freeway corridor;

- To develop a "before" or pre-busway land use data base in Houston's north (I-45 North), southeast (I-45 South) and west (I-10 West) freeway corridors;

- To project anticipated land use impacts, in the three Houston freeway corridors, which are likely to occur from implementing permanent busways and park-and-ride facilities; and,

- To document the study data and findings in one or more reports.

The evaluation of turnkey development for park-and-ride facilities by Houston METRO examines the key ingredients of the program. This portion of the research also explores problems, opportunities and potential costs and benefits of the concept applied on a nationwide basis.

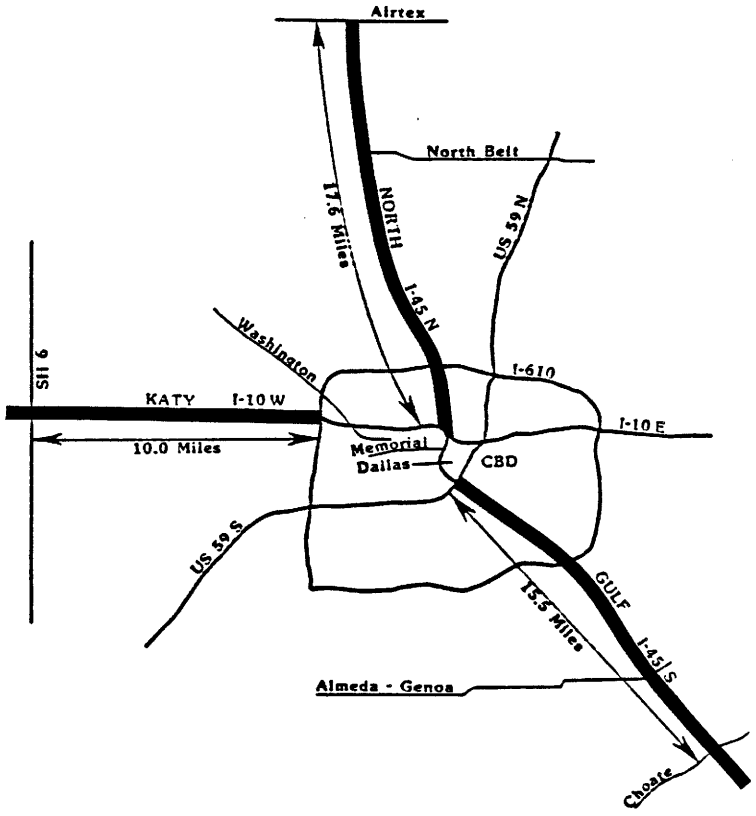
1.3 SCOPE

Houston, Texas is in the process of implementing exclusive, physically separated HOV priority facilities along three major radial freeway corridors. These facilities, referred to locally as Authorized Vehicle Lanes (AVLs) and more commonly as transitways or busways, are located in the following corridors:

- Katy Freeway (I-10W)
- North Freeway (I-45N)
- Gulf Freeway (I-45S)

The Katy, North and Gulf priority facilities have similar designs with a cross-section of approximately 20 feet. They are single, reversible lanes; traffic travels inbound toward downtown in the morning and outbound in the afternoon. These lanes are typically constructed within the existing median of the involved freeways and are protected from other freeway lanes by concrete barriers.

Adequate space is provided for emergencies and breakdowns within the transitway cross section. Access points are limited and controlled. However, each facility differs slightly from the others in particular design, construction, and operational features. Figure 1 shows the transitway system being implemented on the three freeway corridors now being monitored as part of this research.



Source: Ref (1), p. 3

Figure 1: Transitways or Permanent Busways Under Construction in Houston, Texas

This research report provides an overview of the progress to date along with the before land use documentation within the Katy (I-10W) and Gulf (I-45S) transitway corridors. Before land use data in the North (I-45N) corridor were presented in the initial or "pilot" examination detailed previously within Technical Report 1086-4 (5). The research products prepared and submitted under this SDHPT sponsored project include:

Land Use and Innovative Funding Impacts In A Permanent Busway/Park-and-Ride Transit System: An Annotated Bibliography, Technical Report 1086-1, December 1985 (3).

Land Use and Innovative Funding Impacts In A Permanent Busway/Park-and-Ride Transit System: Work Program, Technical Report 1086-2, January 1986 (4).

Land Use and Innovative Funding Impacts In A Permanent Busway/Park-and-Ride Transit System: Survey of Transitway Projects in the United States and Canada (Draft), Technical Report 1086-3, April 1986 (2).

Land Use and Innovative Funding Impacts In A Permanent Busway/Park-and-Ride Transit System: Preliminary Assessment of Land Use Impacts In Houston's North (I-45N) Transitway Corridor (Draft), Technical Report 1086-4, July 1986 (5).

Land Use and Innovative Funding Impacts In A Permanent Busway/Park-and Ride Transit System: Turnkey Park-and-Ride Facility Investigation (Draft), Technical Report 1085-1, unknown date (6).

Highlights of the above technical reports (2, 3, 4, 5, 6) are presented within Section 2 of this document. A general overview and description of Houston's three transitway corridors is included in Section 3. Documentation of "before" land use data is set forth in Section 4 which expands the pilot evaluation of the North (I-45N) corridor (5) to the Gulf (I-45S) and Katy (I-10W) corridors.

2 OVERVIEW OF RESEARCH PRODUCTS

2.1 An Annotated Bibliography

The first project product (Report No. 1086-1, December 1985) documented the results of an intensive literature search and provided annotations of relevant impact studies (3). These studies provided the basic framework for designing the detailed work program (4) to guide the multi-year research activities.

The bibliography (3) provides a summary and cross referencing of over 200 identified publications. One section of the report presents an alphabetical guide to the publications. A "Cross-Reference" section categorizes the citations by subject areas, which include the following 14 topics:

- BART (San Francisco);
- Economic Impact Investigations/Studies
- Highway Impact Investigations/Studies;
- Land Use and Development;
- MARTA (Atlanta);
- Methodologies and Models;
- Mode Change Facilities/Stations;
- Rail Transit Systems (Other);
- Ridesharing Programs;
- Transitways, HOV Lanes and Priority Treatments;
- Transportation and Travel Impact Investigations/Studies;
- Turnkey Development;
- Value Capture; and
- Washington METRO.

Annotations for each of the referenced citations are provided along with a reference number relating the citation to one or more of the above subject areas (3).

2.2 WORK PROGRAM

The work program (Report No. 1086-2, January 1986) summarizes the relationship of previous research (3) to the Houston transitway investigation and outlines the various work elements, proposed research approach and anticipated scheduling (4). Given the thrust of the research (to analyze the impacts of transitways constructed on highway rights-of-way), the methodology set forth attempted to blend the rail transit impact studies' approach with highway impact analyses. In as much as possible, given the available resources, the work program (4) maintains consistency with rail impact study methodology within the highway environment of the transitways and park-and-ride facilities.

The research technique outlined is commonly referred to as the "before-after" study approach. This approach is based upon the timing of data collected for the analyses and considers changes in land uses, land values, and traffic characteristics attributed to a transit facility. Data, from a time period prior to the transportation improvement, are compared to similar data collected after the completion of the improvement in the affected area. Therefore, effects of the transportation change are determined by comparing data from the "before" period to data from the "after" period which are collected and updated on an annual basis. The time frames initially proposed for analysis in the three corridors were (4):

North (I-45N) Transitway - 1973 to 1989 (16 yr)
Gulf (I-45S) Transitway - 1979 to 1989 (10 yr)
Katy (I-10W) Transitway - 1979 to 1989 (10 yr)

The data points or intervals within the suggested time frames were to be determined by the availability of survey data. The actual before/after periods for an individual transitway are determined by the date when the facility is placed in operation and also by the available secondary data (4).

2.3 SURVEY OF TRANSITWAY PROJECTS IN THE U.S. AND CANADA

The third research publication (Report No. 1086-3, April 1986) presented a review of transitways currently in operation in the United States and Canada (2). The review of transitway facilities focused on identifying the design and operating features of existing transitways and on summarizing the general character of the urban areas in which the transitway projects were located. The results of the review were intended to provide a preliminary data base for evaluating the transferability of data from this Houston transitway impacts study (2).

The information on current transitway projects in the U.S. and Canada was obtained from three sources: 1) literature search; 2) mail-out and phone surveys; and, 3) site visits. The literature search consisted of a manual search of Texas Transportation Institute publications, and a computer assisted search of the Transportation Research Information Service (TRIS) files. The second phase consisted of mail-out and phone surveys of project operators to update information from the literature search and to solicit additional data on transitway projects. The following 15 urban areas were surveyed (2):

- Atlanta, Georgia
- Baltimore, Marland
- Denver, Colorado
- Garden Grove (Orange County), California
- Houston, Texas
- Los Angeles, California
- Miami, Florida
- Minneapolis/St. Paul, Minnesota
- Oakland, California
- Ottawa, Canada
- Phoenix, Arizona
- Pittsburgh, Pennsylvania
- San Francisco, California
- Seattle, Washington
- Washington, D.C.

The U.S./Canadian projects survey was designed to solicit the following general information (2):

1. A general description of the urban area (e.g., population, land area, land uses, employment, and general traffic conditions);

2. Information on current and/or projected system configuration (length, cross-section, access points, terminals and transfer facilities), current and projected traffic volumes, authorized users, and enforcement/operating procedures and problems; and,

3. Reports and studies on existing and/or proposed transitways in addition to any maps, artist renderings, and/or plan sheets.

Eight operational transitways in four states and one Canadian Province were identified and reviewed (2). Site visits were made in three of the urbanized areas: 1) Ottawa, Canada; 2) Pittsburgh, Pennsylvania; and, 3) San Francisco, California. Table 1 presents a summary of the design and operating characteristics of the transitways surveyed. The identified transitway projects are described individually in Research Report 1086-3 (2).

2.4 LAND USE IMPACTS IN HOUSTON'S NORTH (I-45N) TRANSITWAY CORRIDOR

The results of a pilot test (5) of methods to identify land use and transportation impacts resulting from the implementation of HOV treatments in the North Freeway (I-45N) Corridor in Houston, Texas are presented in Report 1086-4, dated July 1986. Preliminary findings indicate that while the HOV priority treatment have produced substantial improvements in corridor capacity, the land use impacts to date appear to be relatively insignificant (5).

Overall, corridor-wide traffic operation on I-45N progressively improved since the implementation of the median transitway. Occupancy rates on the total facility climbed from 1.5 passengers to 1.7 passengers per vehicle. Based upon average transitway volumes in the first year of transitway

Table 1. Characteristics of Transitways in the U.S. and Canada

Transitway/Location	Year Operational	Type of Facility	Length/Direction	Eligible Vehicles	Estimated Ridership (persons)	
					Peak Hour	Daily
Shirley Highway HOV Lanes Northern Virginia	1969	2-lane reversible roadway	11.5 miles Fairfax Co. to Washington, D.C.	Buses, vanpools, 4+ carpools	22,000	80,000
I-66 HOV Facility Northern Virginia	1982	4-lane, 2-way exclusive facility (peak hours and direction only; rest of the time is open to regular traffic)	9.6 miles I-495 Beltway to Roosevelt Bridge	Buses, vanpools, 3+ carpools	8,100	28,000
San Bernardino Freeway El Monte Busway Los Angeles, CA	1973	2-lane (1 in each direction) exclusive HOV facility	11.2 miles El Monte Bus Station to Los Angeles CBD	Buses, vanpools, 3+ carpools	3,400	36,000
East King Busway Pittsburgh, PA	1983	2-way exclusive, partially grade separated, ROW shared with Conrail	6.8 miles Wilkinsburg CBD	Public buses, certified private operators	--	19,000
South Patway Busway Pittsburgh, PA	1977	2-way exclusive, partially grade separated, ROW shared with trolley	4.5 miles SW suburbs to CBD	Public buses, certified private operators	--	20,000
Katy Freeway Transitway Houston, TX	1984	1-lane reversible median busway	4.7 miles (Phase 1) W. Harris Co. to Houston (11.5 miles when completed)	Authorized vanpools buses, and 3+ carpools	1,100	5,700
North Freeway Transitway Houston, TX	1985	1-lane reversible median busway	9.6 miles (Phase 1) N. Houston to CBD (15 miles when completed)	Authorized vanpools and buses	3,300	16,000
Ottawa Transitway System Canada	1984	2-lane, 2-way exclusive facility	7 miles of proposed 18 mile system currently in operation	Buses only	13,500[a]	--

[a]Approximately 5900 riders from West Transitway, 7600 from East and Southeast Transitways.

Source: Ref (2), p. 7.

operation, transitway users cumulatively realized an average travel time savings of almost 2,200 person-hours per day over parallel freeway mainlane travelers (5).

The preliminary results of the land use impacts phase of the research were inconclusive. No substantial land use changes of a nature which would appear to be related to the presence of the transitway and/or park-and-ride lots could be identified. It appears that a more definitive assessment of the land use impacts will not be possible until some time after the transitway and associated support facilities have become fully operational and established as integral elements in the corridor's transportation system (5).

The North Freeway corridor study sites all have substantial amounts of undeveloped land and, as such, should serve as excellent test sites for monitoring the long-term land use impacts of park-and-ride lots. The sites evaluated in Report 1086-4 (5) and intended for long-term monitoring include:

- North Shepherd Park-and-Ride Area;
- Aldine - Bender Interchange Area;
- Kuykendahl Park-and-Ride Area; and,
- Spring Park-and-Ride Area.

The study (5) suggests that continued monitoring of land uses in the Houston transitway corridors, along with completion of the developer interview portions of the research, should result in a reasonable assessment of the potential land use impacts of the transitway systems.

2.5 TURNKEY PARK-AND-RIDE FACILITY INVESTIGATION

This research product (Report No. 1085-1) was documented and submitted by Barry M. Goodman (BMG) and Associates of Houston, Texas. BMG and the Texas Transportation Institute have different responsibilities under the contract terms of the two research projects (No. 9-10-85-1085 and No. 2-10-85-1086). Actual report preparation and submittal responsibilities are assumed by a single organization; in the case of the turnkey document (6), by BMG and Associates, Inc.

The purpose of this report (6) was to investigate the potential benefit which can be achieved through the turnkey development approach, utilizing Houston METRO's successful park-and-ride development program as an example; to review the legal compatibility of "turnkey" with State and federal funding and procurement regulations; and, to determine the benefit and cost savings which can be realized on a nationwide basis with the widespread use of developing transit facilities by the turnkey method. The report (6) describes in full detail how one of METRO's park-and-ride facilities in Clear Lake City was developed by the turnkey method, and discusses problems, issues, and opportunities associated with the turnkey process.

The research findings are presented in seven chapters within the report (6):

- Chapter Two describes METRO's current park-and-ride facilities, the historical development of METRO's park-and-ride facilities, and future park-and-ride facility expansion plans. A comparative description of the various types of park-and-ride development methods METRO has used, including the turnkey method, are also presented.

- Chapter Three shows how METRO used the turnkey method in its development of the Clear Lake City Park-and-Ride facility in 1984.

- Chapter Four addresses an analysis of issues and problems with the turnkey method.

- Chapter Five discusses compatibility of the turnkey's method of procurement policies and practices at the State and federal level. Examples of other states' public-private initiatives in other forms of the turnkey method are documented, to the extent possible, to illustrate the potential widespread application of the turnkey method from a legal/procurement context.

- Chapter Six projects the potential economic savings of the turnkey method if applied on a national basis.

- Chapter Seven discusses the compatibility of UMTA policy, legislation, and procedures with the turnkey method of development. It identifies changes to State and federal procurement requirements which would enhance more widespread application of turnkey development in the future.

During the early 1980's, the Houston Metropolitan Transit Authority (METRO) pioneered an approach to capital improvement development, called "turnkey", which saved substantial public dollars, significantly involved the private sector, and achieved implementation of Houston's extensive park-and-ride network in the shortest possible time frame. The turnkey method is where the transit operator awards a competitively-negotiated fixed-price contract to a developer for land acquisition and construction of a completed facility according to specifications; the transit operator buys the "key" or title to the finished facility to own and operate. METRO's turnkey method is an offshoot of the turnkey method used in commercial industry (6).

Traditionally, transit operators purchase property, solicit several proposals by competitive-negotiation for design, and award construction to the lowest responsive, responsible bidder. In the traditional process several companies are involved in the design, construction, and testing of the park-and-ride facility. In the Houston experience, it takes about seventeen months to implement a park-and-ride facility by the traditional method but only about nine months by METRO's turnkey process (6).

From 1980 to 1985, METRO used the turnkey process to develop the majority of its park-and-ride facilities. In addition, METRO reduced administrative costs traditionally incurred by public transit agencies in facility development and realized a substantial cost and time savings. The Houston experience indicates the potential for significant cost savings for the improvement of capital facilities if the "turnkey" approach is used on a widespread basis. Transit operators who need to expand their facilities, and have several site options in their target areas for facility development, should benefit from using the turnkey method. This public-private approach maximizes private sector strength for the benefit of public transportation and also reinforces the objectives of sound planning and land use compatibility (6).

3. HOUSTON'S TRANSITWAY CORRIDORS - GENERAL

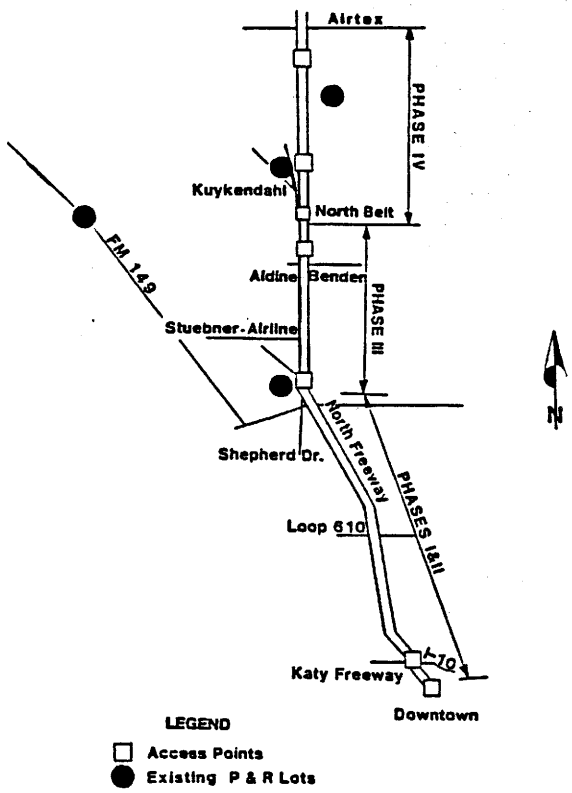
3.1 NORTH (I-45N)

As set forth in the research work program (4), the North (I-45N) Transitway Corridor was used as a "pilot" for land use analyses resulting from the implementation of relatively permanent transit facilities (i.e., busways, park-and-ride lots). The results of this initial effort were summarized in Section 2.4 of this report and are fully documented in Technical Report 1086-4 (5).

The North Freeway carries more than 150,000 vehicles each weekday. Population in the freeway corridor is expected to grow 38% by 1995, with traffic volumes expected to increase accordingly (1). The transitway is being built and operated in four phases as shown in Figure 2. Phases I and II include both transitway and mainlane construction for 9.6 miles from downtown to North Shepherd Drive. This portion of the construction replaced Houston's contraflow lane with a physically separated transitway. Phase I, began in April 1983 and, upon completion of Phase II, became operational in May 1985. Phase III will extend the lane 4.9 miles from North Shepherd Drive to North Belt (Beltway 8) with Phase IV continuing the transitway an additional 3.1 mile from North Belt to Airtex (1). Phase III construction is currently underway with an estimated completion date of September 1988 (7). Phase IV (from North Belt to near FM-1960) was anticipated to begin in August 1985 and to end in June 1987 (1); however, this portion of the transitway has not been designed and is awaiting the finalization of reconstruction plans by SDHPT (7).

The North Transitway will be constructed in the median of the freeway and separated from the other mixed-flow traffic lanes by concrete barriers. Since the construction is part of the SDHPT work to upgrade and expand the North Freeway to eight to ten lanes, disruption for building the HOV lane will be minimal. The North (I-45N) Transitway should significantly reduce peak hour travel time. When completed, the travel time for transitway users

during peak periods is estimated to be approximately half that for current mainlane users (1).



Source: Ref. (1), p.6.

Figure 2: North (I-45N) Transitway, Phase Construction

The HOV facility will significantly increase the person-carrying capacity of the freeway. During its first full year of operation, the I-45N Transitway was expected to benefit 26,000 commuters daily in vanpools and buses (1). Demand has been relatively stable over the first year of barrier-separated median operation. In an average day, the transitway carries more than 14,000 people in some 800 vehicles (5, 9). These transitway users are able to save an average of 9 minutes on every trip made from North Shepherd Drive to downtown Houston (about one minute per traveled mile). Although total transitway ridership/utilization remained more or less constant in the

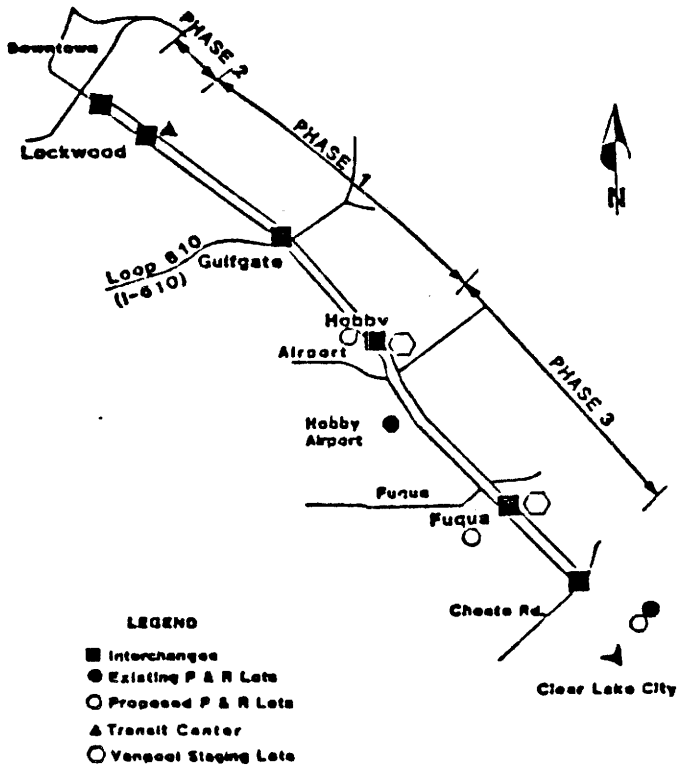
first year, park-and-ride utilization climbed by 14% over the same 12-month period (9). The increase in bus ridership was offset by an equivalent decrease in vanpool ridership. This decrease is likely the result of the discontinuation of vanpool sponsorship by various downtown companies due to the severe decline in the oil market. Crude oil prices have fallen from over $30 per barrel in November 1985 to less than $15 at the present time.

Overall, corridor-wide traffic operation has progressively improved since the November 1984 opening of the median transitway. Passenger through put increased from less than 18,600 passenger-trips in a typical 3-hour peak period to more than 19,500 passenger-trips with vehicle occupancy rates climbing from 1.5 passengers per vehicle to 1.7 passengers per vehicle (9). Based upon average transitway volumes in the first year of operation, transitway users cumulatively realized an average travel time savings of almost 2,200 person-hours per day over parallel freeway mainlane travelers. These travel time savings in combination with reduced bus operating costs, result in a total direct benefit of $42.0 million over a 20-year period; compared to direct costs of $15.2 million, the transitway confirms its cost-effectiveness with a benefit/cost ratio of almost 3:1 (5, 9).

3.2 Gulf (I-45S)

Currently, the Gulf Freeway serves some 150,000 vehicles on a typical weekday with traffic in the peak periods exceeding 1,900 vehicles per hour per lane (1). The transitway will be built and operated in three phases as shown in Figure 3. The first phase construction began in 1982 and extends five miles from Lockwood Drive to Airport Boulevard. The second phase will extend the lane 2.5 miles from Lockwood to down-town; this section is planned to open as an interim facility in early 1988. The eight-mile third phase will extend the lane from Airport Boulevard south to Choate Road near Ellington Air Force Base. This phase may be built in segments as traffic demands dictate. The total Gulf (I-45S) Transitway will be 15.5 miles long when completed (1) and will extend from downtown Houston to the vicinity of Ellington Air Base (8).

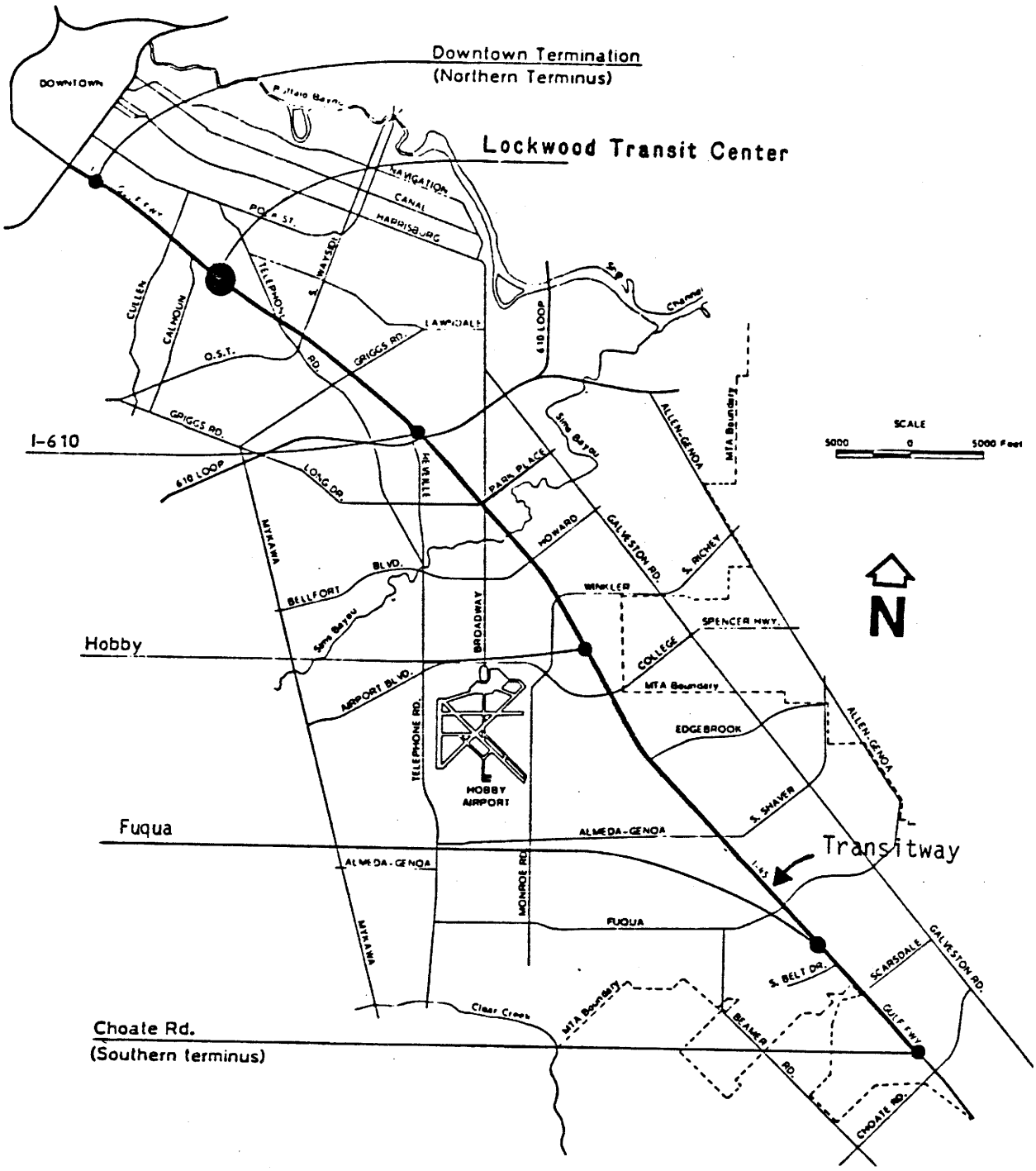
Four intermediate, grade-separated interchanges will allow direct access to the Gulf Transitway and connections to other transit facilities. Interchanges at Lockwood, Hobby and Fuqua employ elevated ramps and bridges over the freeway for entry and exit. Construction will include improvements to general traffic freeway ramps and to intersections at several major cross streets (1). The Gulf (I-45S) Transitway and intermediate egress/ingress points are shown in Figure 4 (10).



Source: Ref (1), p.7

Figure 3. Gulf (I-45S) Transitway, Phase Construction

The Lockwood Transit Center will serve commuters going to and from the University of Houston, Texas Southern University, and the Texas Medical Center. Following implementation, a trip from Clear Lake City and Southeast Harris County will be reduced from 55 to 25 minutes for transitway users (8); a reduction of 55 percent.

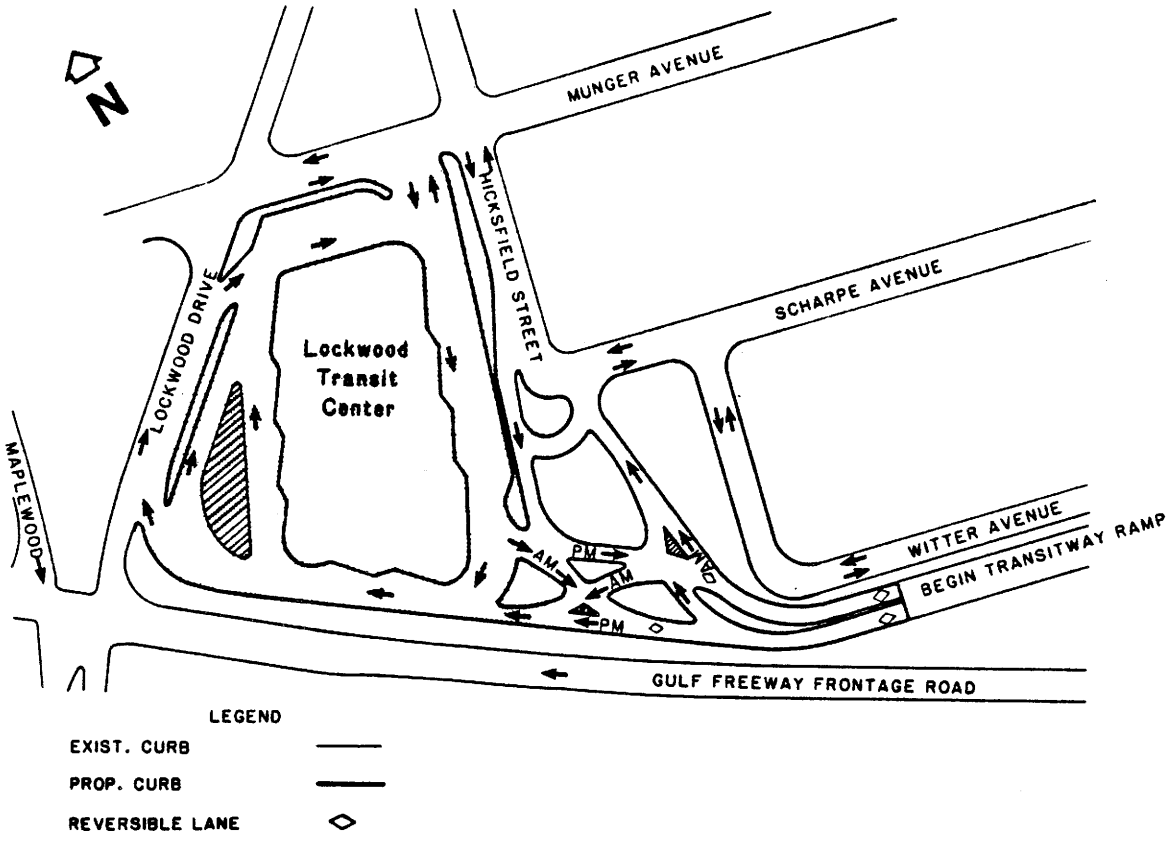


Note: Gulf Freeway Transitway extends from downtown Houston to Choate Road Indicated by Bold Line in Figure.

Source: Ref (10), p. 4.

Figure 4. Gulf (I-45S) Transitway Corridor and Intermediate Egress/Ingress Points

The need for a transit center at Lockwood to serve as an on-line station for the Gulf (I-45S) Transitway was first identified by METRO staff and, in 1983, evaluated by Levinson and TTI (10). The evaluation of existing and proposed transit operations suggested that, in the year 2000, 95 buses per hour would use the Center and that 13 to 15 bus berths (to provide berthing by geographic location) would be required (10). A transit center of sufficient size to serve this demand was recommended for development on a site bounded by the Gulf Freeway frontage road, Lockwood Drive, Munger Avenue, and Hicksfield as shown in Figure 5.



Source: Ref (10), p.2.

Figure 5. Preliminary Layout and Site Location for the Lockwood Transit Center

In conjunction with the transit center at Lockwood, major restructing of transit routes was proposed to permit easier, faster access to major activity centers other than the downtown area (10). Transit patrons board buses from a number of park-and-ride and express routes originating along the Gulf Freeway corridor. Selected trips on each route will regularly stop at the Transit Center to interface with local buses destined to other activity and employment centers. Maximum wait times per patron at the Center will be minimal during peak periods. Operation of the Lockwood Transit Center is primarily intended for weekday, transitway operating hours (10).

The Lockwood Transit Center (the largest of the initial transit centers) served as a "prototype" for subsequent centers. Being a prototype, care was exercised in selecting a suitable site, developing the design, and operation of buses. Accordingly, the following criteria were observed in selecting the site and developing the design (10):

1. Land Availability and Costs. The center was to be developed on land that was vacant or easily acquired.

2. Land Use Compatibility. The transit center was to be located where it could complement nearby land-uses such as retail stores and residences. (Land in or adjacent to industrial uses was to be avoided).

3. Passenger Attraction. The design of the center and its relation to nearby areas was intended to maximize passenger attraction. (This implied an attractive design, clear signing and amenities, and no incompatible activities in surrounding areas that would discourage people from changing buses).

4. Passenger Clarity. Separate berthing areas were to be provided by major "geographic" destination, or route groupings.

5. Passenger Interchange. The design of the transit center was to encourage direct and convenient transfer from one bus to another.

6. Bus - Vanpool Conflicts. Conflicts between buses and vanpools were to be clearly defined.

7. Bus Circulation. Buses, through the design layout, were to enter and leave the center with a minimum number of turns, conflicts, and travel indirection.

8. Design Flexibility. The transit center was to be able to accommodate both standard 40-foot and articulated 65-foot buses.

The Lockwood Transit Center and surrounding area is being monitored as part of this research on land use impacts resulting from major facility development. The center is nearing completion with sealed bids for furnishing and installing the necessary signage received by Houston METRO in July 1986.

The Gulf HOV facility should significantly reduce peak hour travel time for users of the facility. On the five-mile Phase I section, travel time is estimated to be reduced 5 to 10 minutes (1). When all 15.5 miles are completed, a bus trip on the transitway to downtown should be about half the current travel time. The facility will significantly increase the person carrying capacity of the freeway with about 18,600 daily commuters expected to travel the lane in vanpools and buses during its first full year of operation (1). The completed transitway should allow the movement of some 14,000 commuters per peak-hour in 280 buses and vans (1).

Park-and-Ride utilization within the Gulf Corridor has steadly increased during the nine year period from 1977 to the present as graphically depicted in Figure 6. Table 2 summarizes the number of parked vehicles at the mode-change facilities along I-45S. Given the current corridor capacity of 2165 parking spaces, the observed demand is approximately 55% of available parking; the Edgebrook Park-and-Ride Lot is about 65% utilized whereas the Bay Area Lot is operating at approximately 47% capacity.

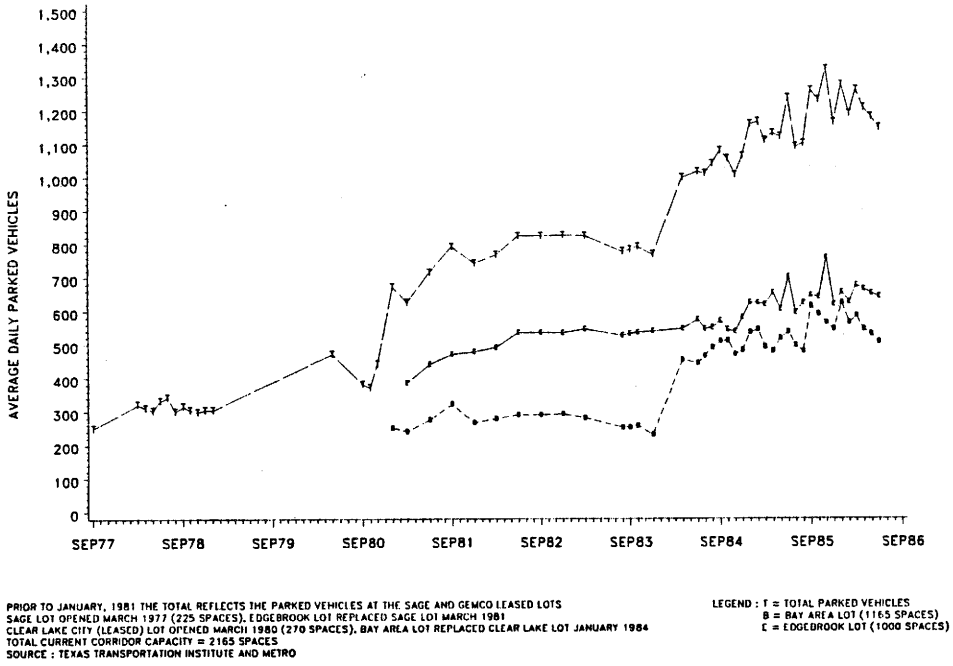


Figure 6. Utilization of Park-and-Ride Facilities Within the Gulf (I-45S) Transitway Corridor

3.3 Katy (I-10W)

The Katy Freeway is a major Interstate highway serving travel demands from western Harris County to various parts of Houston. Traffic volumes have increased at annual rates in excess of 4% throughout the 1970's. Currently, weekday traffic volumes approach 25,000 vehicles per lane; peak-direction flow exceeds 1,900 vehicles per hour per lane (1).

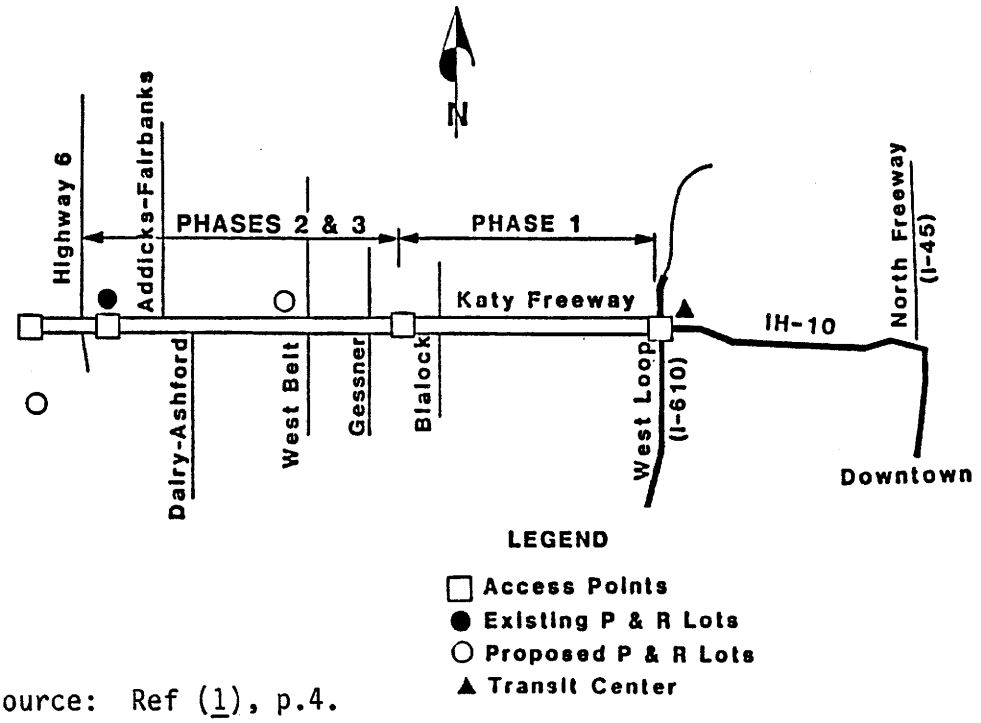
The Katy (I-10W) Transitway will be built and operated in three phases as shown in Figure 7. The first phase became operational in late 1984 and extends some five miles from Post Oak (near I-610) to near Gessner. The second phase extends the transitway another five miles to SH 6 and the third phase will include an interchange at Addicks (SH 6). When fully completed, the Katy Transitway will extend 11.5 miles from near I-610 (the West Loop) to Addicks and have intermediate access near Gessner (1). Construction on

Table 2. Utilization of Park-and-Ride Facilities Within the Gulf (I-45S) Transitway Corridor

Month	Edgebrook Lot	Bay Area Lot	Temporary Lots*	Total
SEP77	.	.	250	250
MAR78	.	.	321	321
APR78	.	.	311	311
MAY78	.	.	303	303
JUN78	.	.	331	331
JUL78	.	.	341	341
AUG78	.	.	300	300
SEP78	.	.	315	315
OCT78	.	.	304	304
NOV78	.	.	298	298
DEC78	.	.	304	304
JAN79	.	.	304	304
MAY80	.	.	470	470
SEP80	.	.	380	380
OCT80	.	.	370	370
NOV80	.	.	440	440
JAN81	.	.	671	671
MAR81	385	.	240	625
JUN81	440	.	274	714
SEP81	470	.	321	791
DEC81	477	.	265	742
MAR82	490	.	277	767
JUN82	534	.	289	823
SEP82	534	.	289	823
DEC82	533	.	291	824
MAR83	544	.	279	823
AUG83	525	.	251	776
SEP83	531	.	251	782
OCT83	534	.	256	790
DEC83	538	.	229	767
APR84	545	451	.	996
JUN84	572	442	.	1014
JUL84	544	464	.	1008
AUG84	548	489	.	1037
SEP84	569	508	.	1077
OCT84	542	510	.	1052
NOV84	536	468	.	1004
DEC84	579	481	.	1060
JAN85	623	533	.	1156
FEB85	621	542	.	1163
MAR85	617	490	.	1107
APR85	651	478	.	1129
MAY85	603	516	.	1119
JUN85	698	535	.	1233
JUL85	593	495	.	1088
AUG85	621	477	.	1098
SEP85	644	612	.	1256
OCT85	638	589	.	1227
NOV85	757	562	.	1319
DEC85	617	543	.	1160
JAN86	653	620	.	1273
FEB86	624	562	.	1186
MAR86	674	583	.	1257
APR86	662	542	.	1204
MAY86	649	528	.	1177
JUN86	639	505	.	1144
Average (Prior 12-mo)	648	552	.	1200

*Note: Sage Lot (225 spaces) opened in 1977 and was replaced by Edgebrook Lot (1000 spaces) in March 1981. Clear Lake Lot (270 spaces) opened in March 1980 and was replaced by Bay Area Lot (1165 spaces) in January 1984.

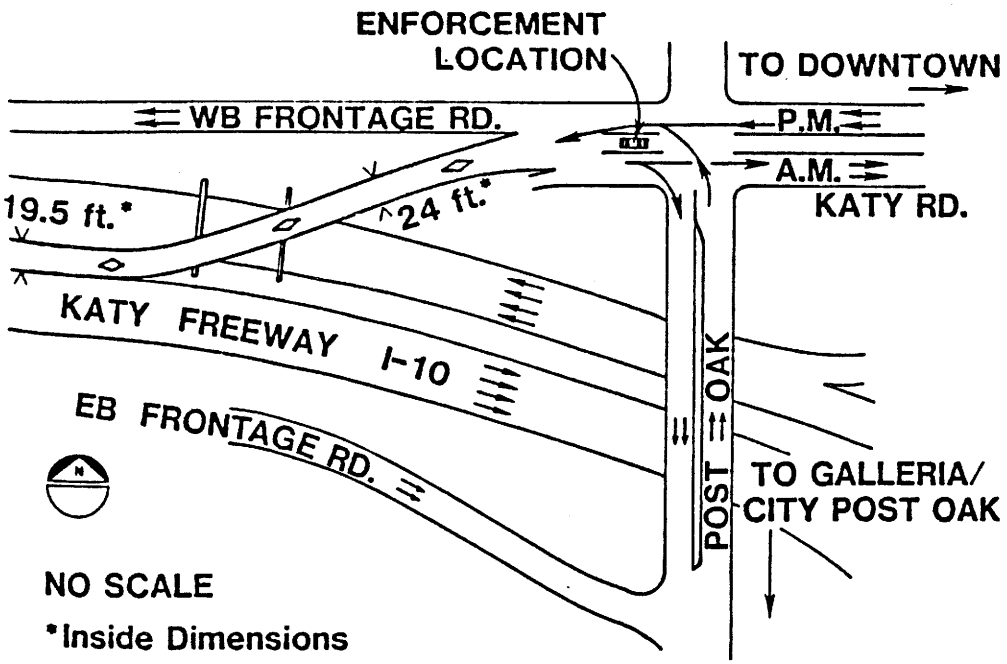
the first phase began in June 1983 and became operational in October 1984. The remaining phase two portion of the transitway, now under construction, is scheduled for completion in February 1987 (8).



Source: Ref (1), p.4.

Figure 7: Katy (I-10W) Transitway, Phase Construction

At the eastern end, near I-610, a bridge or "fly-over" ramp crosses the westbound freeway mainlanes and connects the median transitway to Katy Road at the Post Oak intersection. From this intersection, the HOV traffic can turn north or south to reach major employment centers along the West Loop, or continue eastward on Katy Road to downtown as shown in Figure 8. At Gessner, a ramp provides direct access to and from the freeway mainlanes. Additional ramps will eventually be located at the western end at Addicks (1) to provide direct access to the transitway from the Park-and-Ride lot (8).



Source: Ref (11), p. 8

Figure 8. Eastern Terminus of Phase I, Katy (I-10W) Transitway

By 1987, in the peak-hour alone, the Katy (I-10W) Transitway was anticipated to accommodate approximately 60 buses and 190 vanpools, or 3,900 persons (1). Daily ridership was estimated to exceed 15,000 commuters. Peak-hour travel time from the Addicks Park-and-Ride lot to downtown, via the lane, should be reduced from the "before" condition of 45 minutes to 25 minutes; a reduction of some 20 minutes, or 56% of the peak-hour freeway mainlane travel time (1).

As of July 1986, some 3100 person trips per peak period were accommodated by the Katy Transitway in 220 vehicles. This represented an overall, average vehicle occupancy of about 14 persons when all authorized modes (buses, vanpools and carpools) were considered. Peak period utilization of the priority facility is shown in Table 3 and graphically presented in Figure 9. During the 12-month period from August 1985 through

Table 3. Katy (I-10W) Transitway Peak Period Utilization (Persons and Vehicles)

MONTH	PERSON TRIPS				VEHICLE TRIPS			
	BUS	VANPOOL	CARPOOL*	TOTAL	BUS	VANPOOL	CARPOOL*	TOTAL
OCT84	1430	652	.	2082	39	80	.	119
NOV84	1430	652	.	2082	39	80	.	119
DEC84	1510	713	.	2223	40	81	.	121
JAN85	1590	818	.	2408	45	86	.	131
FEB85	1760	820	.	2580	49	83	.	132
MAR85	1725	798	.	2523	50	85	.	135
APR85	1745	801	20	2566	52	83	5	140
MAY85	1650	779	25	2454	53	84	6	143
JUN85	1890	636	25	2551	60	79	7	146
JUL85	1940	618	56	2614	58	77	14	149
AUG85	2050	603	65	2718	61	73	19	153
SEP85	1990	667	164	2821	62	81	44	187
OCT85	2205	684	185	3074	61	82	51	194
NOV85	2368	667	279	3314	70	80	78	228
DEC85	2195	666	316	3177	69	79	88	236
JAN86	2363	604	323	3290	75	73	93	241
FEB86	2218	576	343	3137	78	69	96	243
MAR86	2220	586	330	3136	80	67	95	242
APR86	2151	590	353	3094	80	70	102	252
MAY86	2055	611	349	3015	79	70	104	253
JUN86	2240	608	252	3100	79	69	75	223
JUL86	2213	600	235	3048	79	68	71	218
Average (Prior 12-mo)	2189	622	266	3077	79	73	76	222

*Note: Authorized 4+ carpools first allowed on the Katy (I-10W) Transitway in April 1985. The requirement was lowered to Authorized 3+ carpools in September 1985. Pre-authorization was eliminated in August 1986 with 2+ carpools allowed to use the facility.

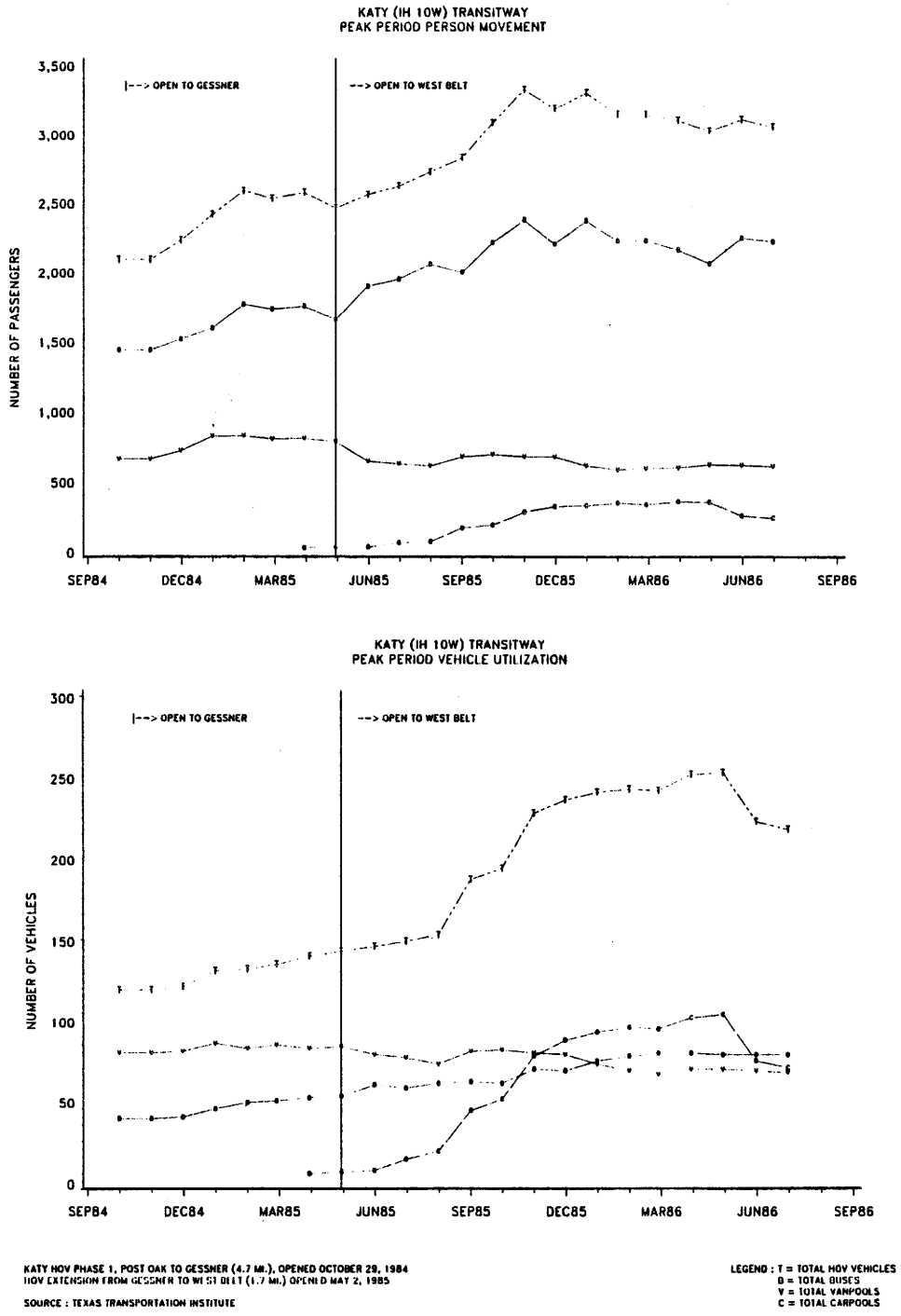


Figure 9. Katy (I-10W) Transitway Peak Period Utilization (Persons and Vehicles)

July 1986, some 71% of the total person trips were accommodated by buses, 20% by vanpools and 9% by carpools.

The Katy Transitway was opened to authorized 4+ carpools in April 1985. To generate additional carpool utilization, 3+ carpools were permitted to use the facility in September 1985 (12). Since opening, person trips on the Katy Transitway increased by 46%; vehicle trips increased by 87%. Carpools, through July 1986, represented approximately 34% of total vehicles using the priority facility but transported only 8% to 9% of total persons.

A review of carpooling on other freeway HOV lanes (12) indicated the following observations:

1. The Katy Transitway, with 50 to 75 carpools per peak hour, was operating at a significantly lower volume than other HOV facilities.

2. A consensus exists among the agencies operating freeway HOV lanes that, to maintain a reliable high-speed lane, per lane capacity is in the range of 1,000 to 1,500 vehicles per hour. Access/egress on the Katy Transitway will cause capacity to be somewhat lower than these values, but considerably greater than existing volumes.

3. On several HOV facilities, carpools and vanpools move 50% or more of total person volume. On the Katy Transitway, carpools and vanpools prior to August 1986 moved approximately 30% of total volume.

4. Most freeway HOV lanes have resulted in substantial increases (approximately 288%) in carpooling. With 3+ carpool authorization the Katy AVL generated little or no increase in total carpooling.

5. Relative to other projects, growth in person movement has been slow. The average annual growth rate for the first two years on the Katy Transitway has been 22%. For the first two years on other HOV projects, the average was 67% on the Shirley Highway, 68% on the El Monte busway, and 89% on the North Freeway contraflow.

Most of the other HOV facilities referred to above are at least 10 miles in length. While volumes have been relatively low on the Katy Transitway, there is reason to expect significant increases in utilization once Phase 2 of the AVL opens in early 1987 (12). Also, carpool utilization is expected to significantly increase with changes in transitway operation occuring on Monday, August 11, 1986; pre-authorization requirements for users have been dropped and 2+ carpools are now permitted. On the first two mornings of relaxed carpool authorization, total peak period vehicles increased some 500%. Transitway person movement during the same peak period increased by approximately 75% from 3,100 to some 5,360. The 2+ carpools constituted about 90% of the peak period vehicles and provided priority travel for some 50% of all transitway users. Other research (12) being performed by the Texas Transportation Institute is monitoring and documenting the carpool utilization of the Katy (I-10W) Transitway. Table 4 presents some preliminary data on the peak period travel demands for the facility under the revised operating policies; some 45% to 55% of the peak period demand (shown in Table 4) occurs during the peak hour.

The Katy (I-10W) Transitway demand along with the freeway mainlane demand is graphically represented in Figure 10 for both the morning (a.m.) and afternoon (p.m.) peak periods. As shown, HOV user demand remains fairly constant from 6:30 am to about 7:45 am. The afternoon peak period climaxes at approximately 5:15 pm, based upon the observations.

Park-and-Ride utilization in the Katy (I-10W) Corridor has steadily increased since the opening of the Kingsland Lot in 1980 as shown in Figure 11. The number of parked vehicles at the Park-and-Ride facilities is presented in Table 5. During the prior 12-month period (July 1985 through June 1986), some 1114 vehicles parked at one of the three mode change facilities on a typical weekday. Given the total capacity within the corridor of 3556 spaces, this utilization represents about 32% of available parking. This average utilization varies by Park-and-Ride facility and ranges from 19% for the Kingsland lot up to 55% for the Addicks lot.

Table 4. Preliminary Travel Demands for the Katy (I-10W) Transitway Under Relaxed Pre-Authorization and 2+ Carpool Requirements[1]

Measure	Prior 12-Month Average[2]	AM Peak Period For	
		First Day[3]	Second Day[4]
Vehicles			
Buses	79 (34.6%)	83 (6.9%)	77 (5.0%)
Vanpools	73 (32.0%)	64 (5.3%)	59 (3.9%)
Carpools	76 (33.3%)	1058 (87.8%)	1390 (91.1%)
All	118 (100.0%)	1205 (100.0%)	1526 (100.0%)
Persons			
Buses	2189 (71.1%)	2300 (44.6%)	2134 (38.3%)
Vanpools	622 (20.2%)	545 (10.6%)	503 (9.0%)
Carpools	266 (8.6%)	2306 (44.8%)	2942 (52.7%)
All	3077 (100.0%)	5151 (100.0%)	5579 (100.0%)
Vehicle Occupancy[5]			
Buses	27.71	27.71	27.71
Vanpools	8.52	8.52	8.52
Carpools	3.50	2.18	2.12
Overall	13.50	4.27	3.66
3+ Carpools Only[6]			
Vehicles	76	141	130
Persons	266	472	422

Notes: [1]Pre-authorization requirement dropped and 3+ carpools reduced to 2+ carpools on Monday, August 11, 1986.

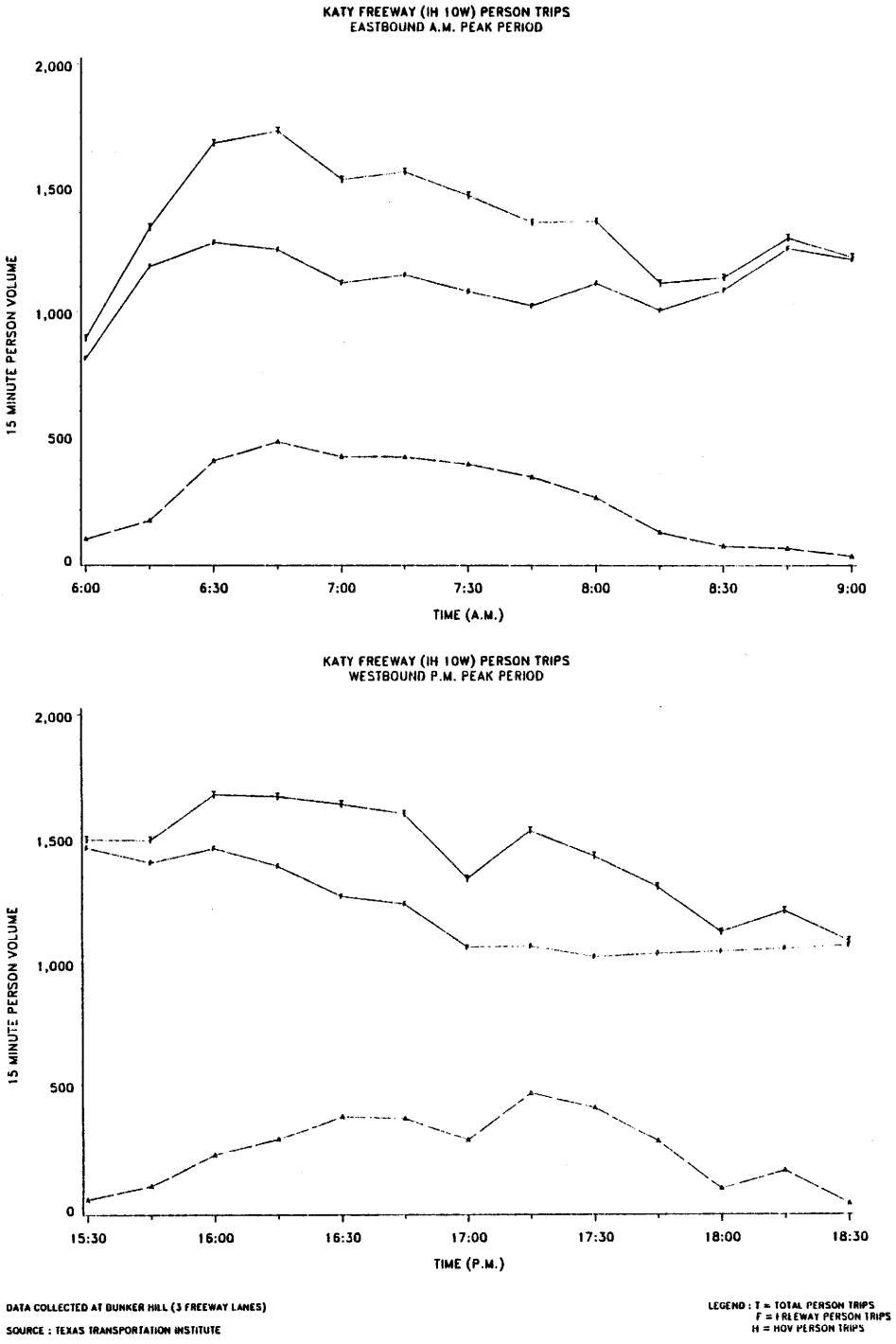
[2]From June 1985 through July 1986.

[3]Monday, August 11, 1986 (5:45 a.m. - 9:30 a.m.).

[4]August 12, 1986 (5:45 a.m. - 9:30 a.m.).

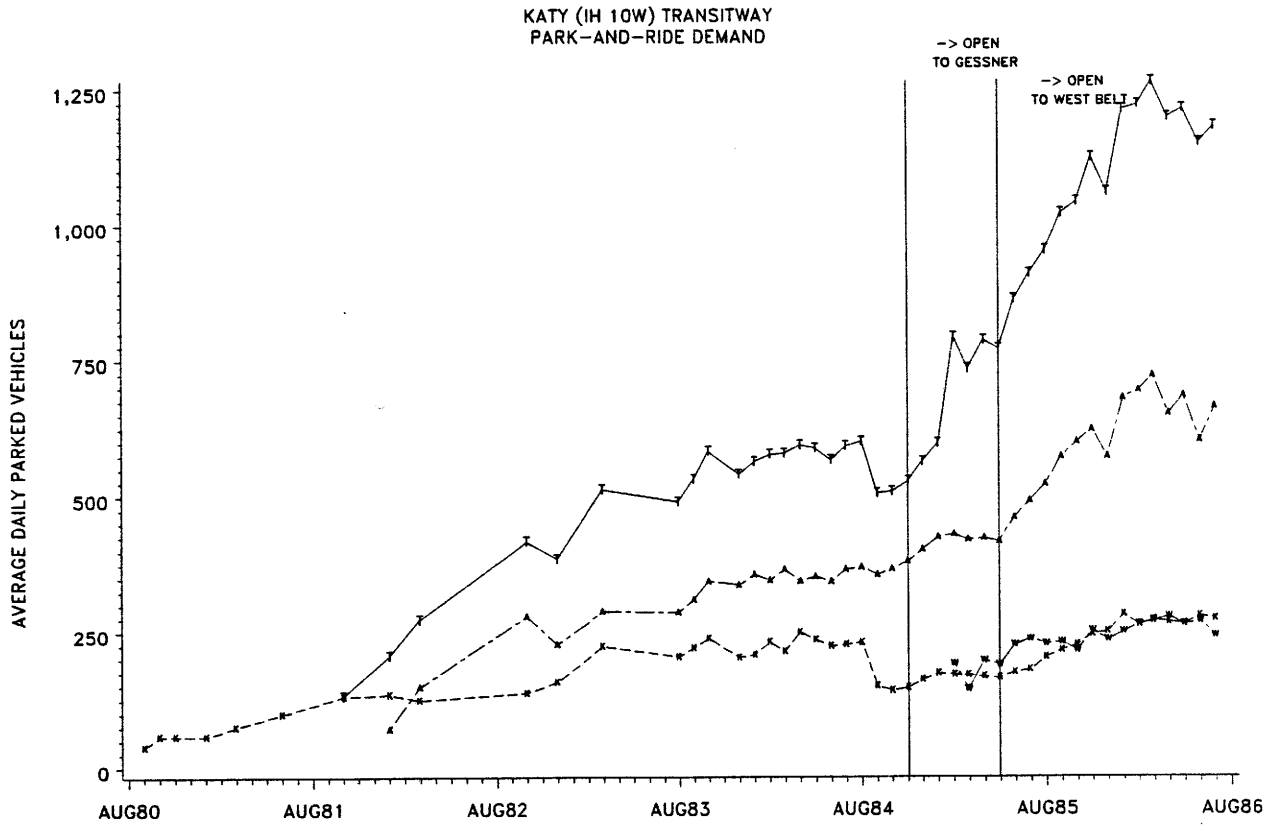
[5]Persons per vehicle; bus and vanpool occupancies assumed constant.

[6]For comparative purposes of relaxed pre-authorization requirement.



Note: Morning and afternoon person demands recorded on Dec. 3, 1985 (Tues), March 18, 1986 (Tues), and on June 10, 1986 (Tues).

Figure 10. Peak Period Person Demand for the Katy (I-10W) Transitway and Freeway Mainlanes



KATY HOV PHASE 1, POST OAK TO GESSNER (4.7 MI.), OPENED OCTOBER 29, 1984
HOV EXTENSION FROM GESSNER TO WEST BELT (1.7 MI.) OPENED MAY 2,1985
CURRENT TOTAL CORRIDOR PARKING CAPACITY = 3556 SPACES

SOURCE : TEXAS TRANSPORTATION INSTITUTE

LEGEND : T = TOTAL PARKED VEHICLES
K = KINGSLAND LOT (1326 SPACES)
A = ADDICKS LOT (1119 SPACES)
W = WEST BELT LOT (1111 SPACES)

Figure 11. Utilization of park-and-Ride Facilities Within the Katy (I-10W) Transitway Corridor

Table 5. Utilization of Park-and-Ride Facilities Within the Katy (I-10W) Transitway Corridor

MONTH	KINGSLAND	ADDICKS	WEST BELT	TOTAL
SEP80	40	.	.	.
OCT80	59	.	.	.
NOV80	59	.	.	.
JAN81	59	.	.	.
MAR81	76	.	.	.
JUN81	100	.	.	.
OCT81	132	.	.	.
JAN82	135	72	.	207
MAR82	125	149	.	274
OCT82	138	280	.	418
DEC82	158	228	.	386
MAR83	224	289	.	513
AUG83	204	287	.	491
SEP83	221	311	.	532
OCT83	239	345	.	584
DEC83	203	338	.	541
JAN84	208	357	.	565
FEB84	232	346	.	578
MAR84	214	366	.	580
APR84	250	345	.	595
MAY84	236	353	.	589
JUN84	224	344	.	568
JUL84	227	366	.	593
AUG84	231	370	.	601
SEP84	150	356	.	506
OCT84	142	367	.	509
NOV84	147	381	.	528
DEC84	162	403	.	565
JAN85	173	425	.	598
FEB85	171	430	191	792
MAR85	170	420	144	734
APR85	167	423	197	787
MAY85	165	417	189	771
JUN85	175	461	226	862
JUL85	180	492	237	909
AUG85	203	522	228	953
SEP85	216	573	231	1020
OCT85	226	600	215	1041
NOV85	246	623	253	1122
DEC85	250	573	235	1058
JAN86	282	680	250	1212
FEB86	263	694	264	1221
MAR86	272	721	270	1263
APR86	268	651	278	1197
MAY86	265	684	264	1213
JUN86	279	602	269	1150
Average (Prior 12-mo)	246	618	250	1114

4. LAND USE DATA BASE

4.1 NORTH (I-45N) TRANSITWAY CORRIDOR

As set forth in the research work program (4), the North (I-45N) Transitway corridor was used as a "pilot" for land use analyses resulting from the implementation of relatively permanent transit facilities (i.e., busways, park-and-ride lots). The results of this initial effort were summarized in Section 2.4 of this report and fully documented in Technical Report 1086-4 (5). An overview of the transitway corridor was also presented in Section 3.1 herein.

Four primary study sites were investigated for land use changes resulting from the priority HOV system development within the North (I-45N) corridor. These sites were selected based upon their proximity to the transitway and upon egress/ingress considerations. Aerial views, taken in July 1985, of the four sites are shown in Figures 12, 13, 14 and 15. These study areas and associated land uses are described in more detail within Report 1086-4 (5).

4.2 GULF (I-45S) TRANSITWAY CORRIDOR

Recent land use changes in the vicinity of the Lakewood Transit Center are presented in Figure 16. As shown in Figure 16, the area surrounding the site does not contain a great deal of vacant land. No land use changes of a nature which would appear to benefit from (or result from) the Transit Center could be identified. However, since the Center is still under construction, it is probably too early to detect any land use impacts. Figures 17 and 18 show aerial views of the study site as it appeared in July 1985.

4.3 KATY (I-10W) TRANSITWAY CORRIDOR

Figures 19 and 20 summarize land use trends in the vicinity of the Addicks and Kingsland Park-and-Ride lots. Land use changes which have occurred since the Addicks Lot opened (Figure 19) are generally of a service

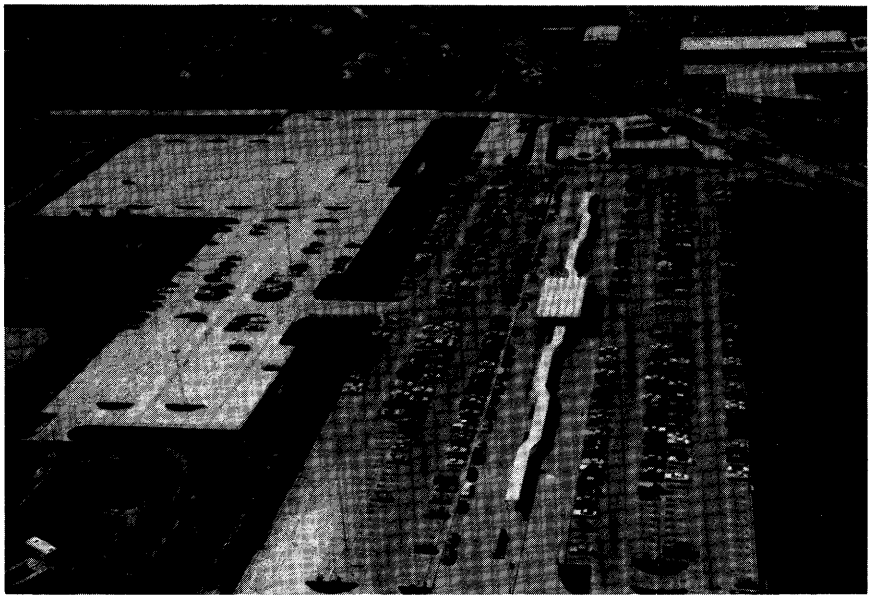


Figure 12. Aerial View of North Shepherd Park-and-Ride Lot Looking to the Northeast

Figure 13. Aerial View of Aldine-Bender Interchange Area Looking to the South

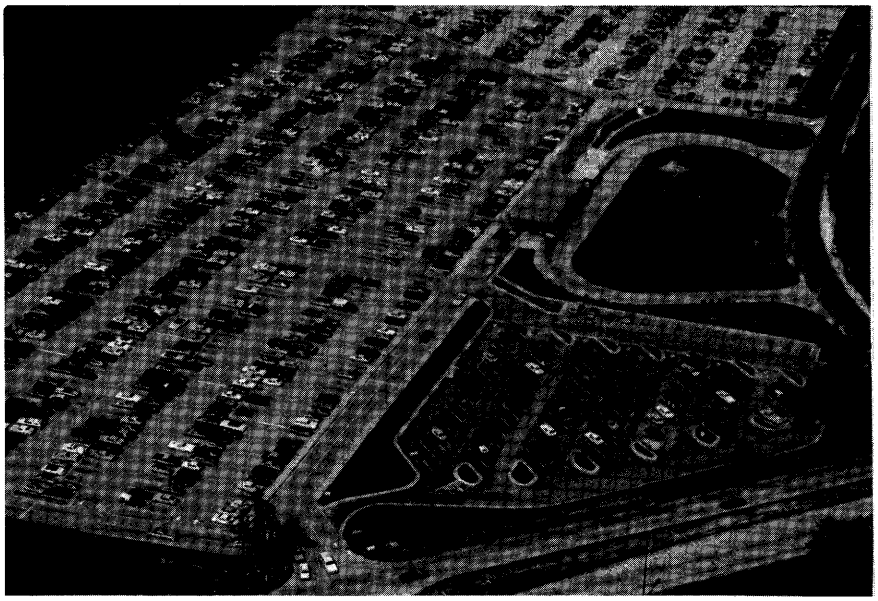


Figure 14. Aerial View of Kuykendahl Park-and-Ride Lot Looking to the Northeast

Figure 15. Aerial View of Spring Park-and-Ride Lot Looking to the West

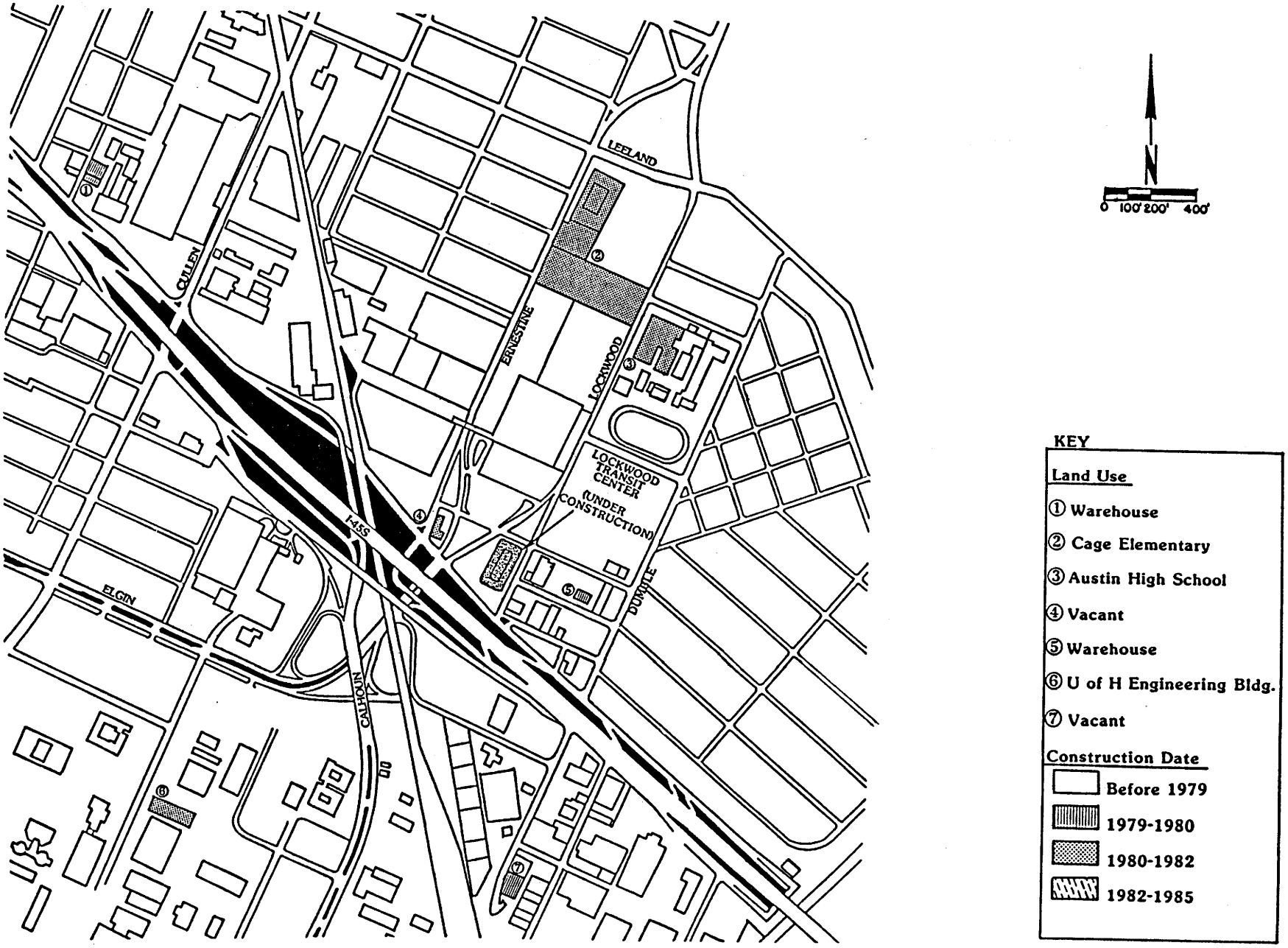


Figure 16. Land Use Trends in the Vicinity of the Lockwood Transit Center (1979-1985)

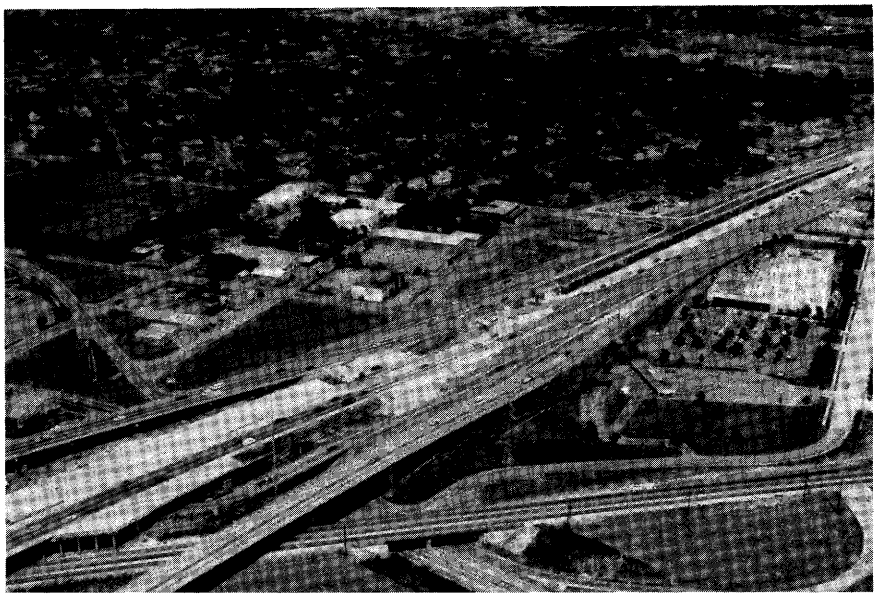


Figure 17. Aerial View of Lockwood Transit Center Looking to the Southeast

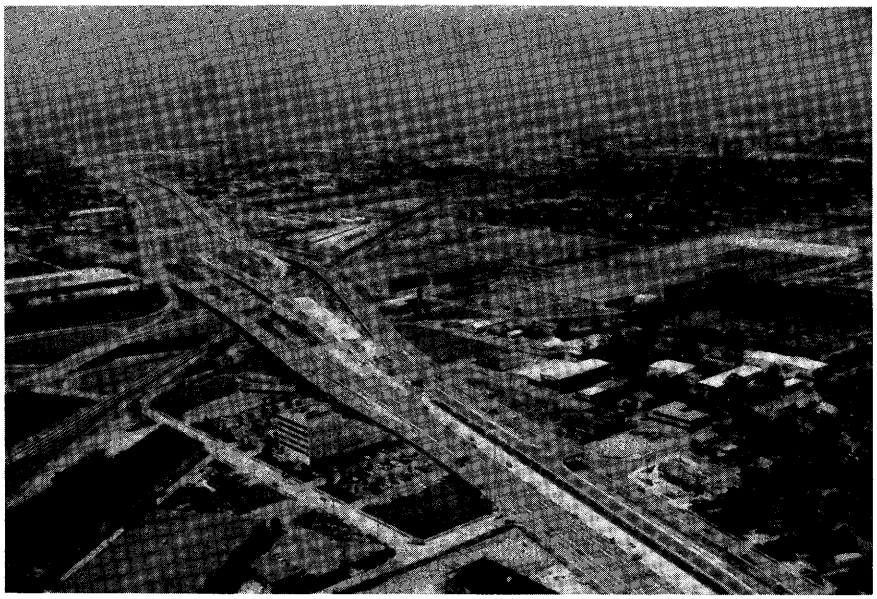


Figure 18. Aerial View of Lockwood Transit Center Looking to the Northeast

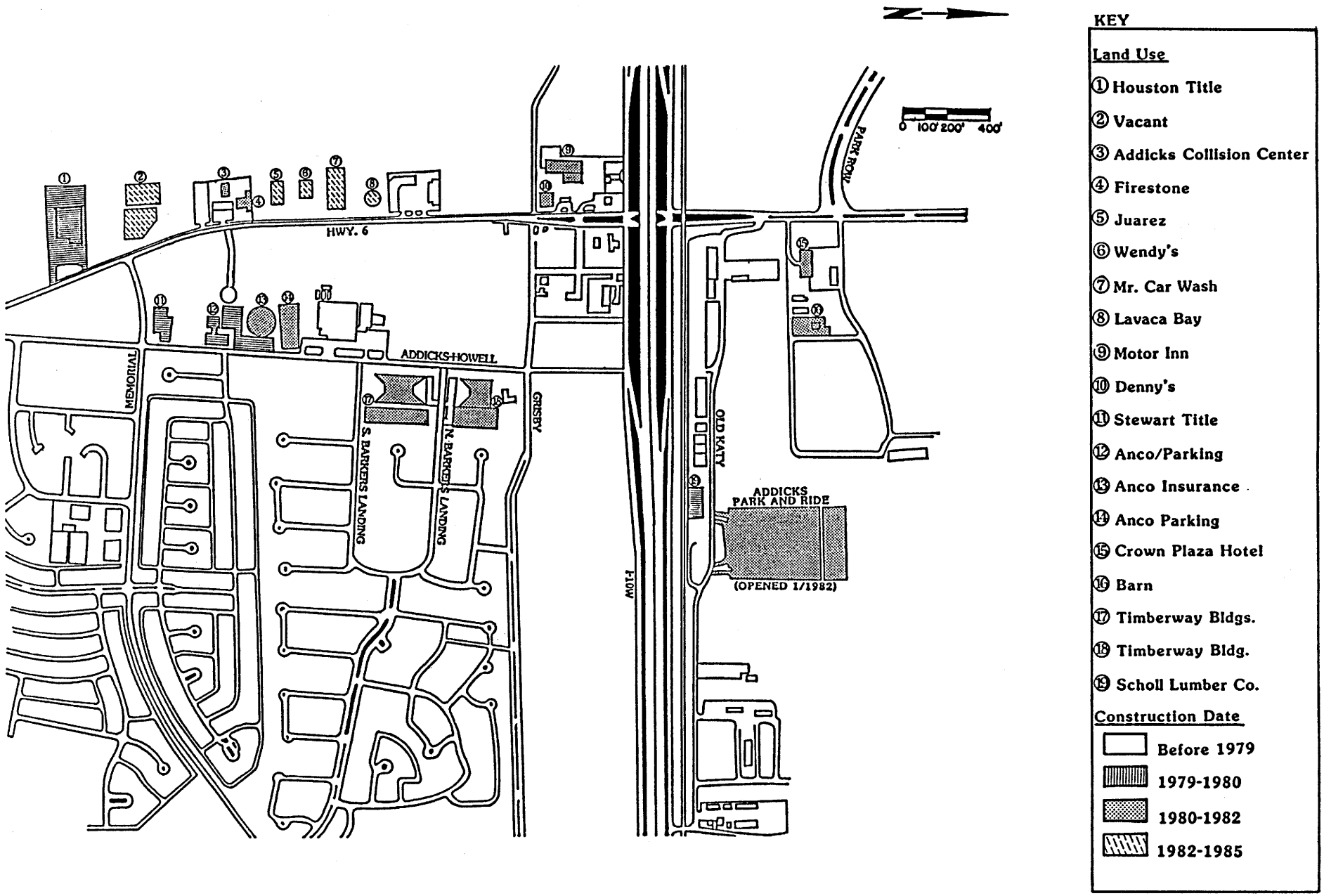


Figure 19. Land Use Trends in the Vicinity of the Addicks Park-and-Ride Lot (1979-1985)

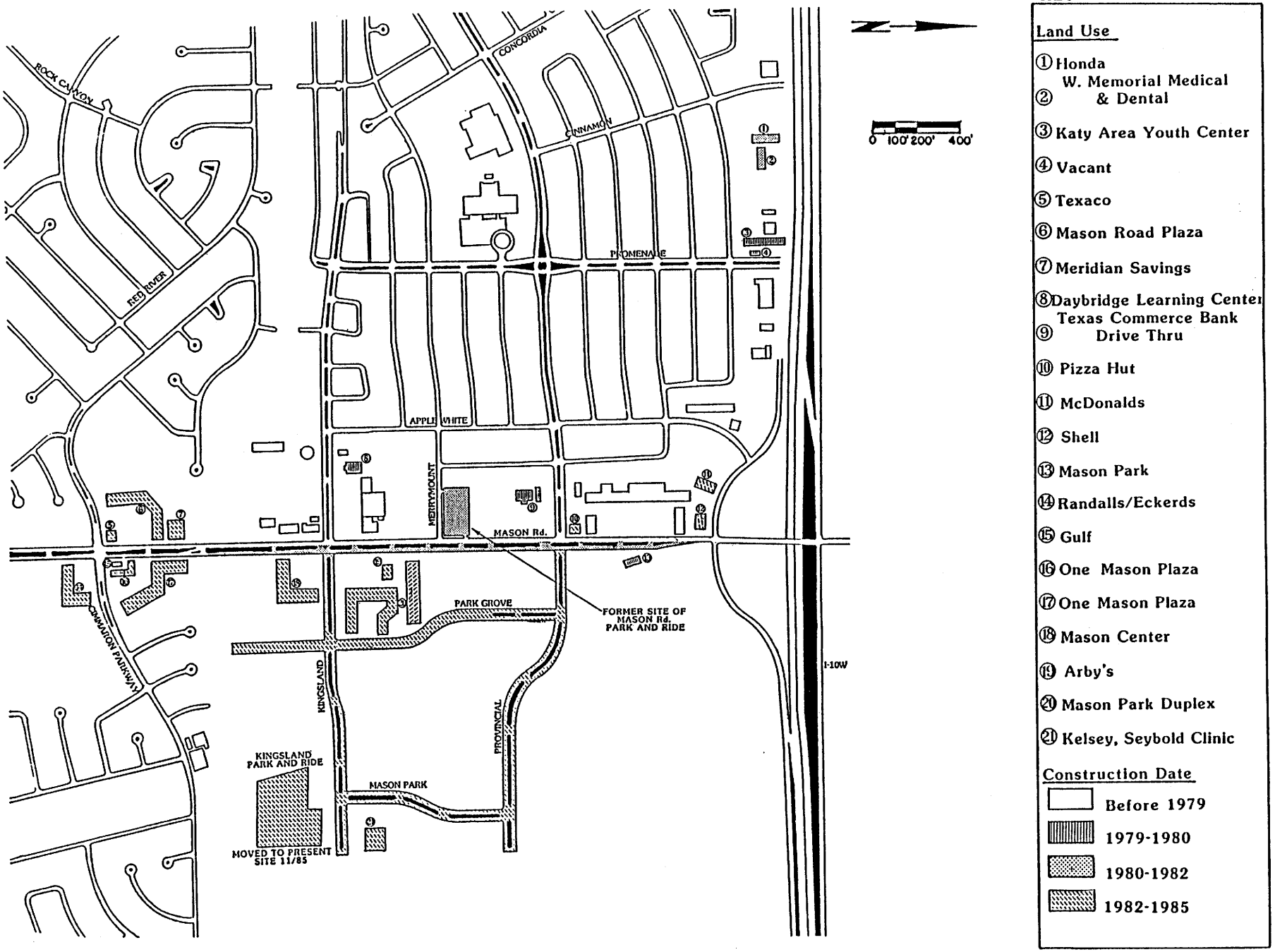


Figure 20. Land Use Trends in the Vicinity of the Kingsland Park-and-Ride Lot (1979-1985)

or office-use nature. As shown in Figure 19, there is considerable vacant land in the vicinity of the Addicks Lot. As a result, the Addicks Lot should provide an excellent test site to monitor the land use impacts of the Katy Transitway and associated park-and-ride lots.

The Kingsland Park-and-Ride lot area (Figure 20), like the Addicks area, has considerable undeveloped land. Recent developments in the vicinity of the Kingsland Lot are of a service (fast food, convenience store) nature. Some office space development has also occurred in recent years. However, since the Kingsland Lot did not open until November 1985, it is not clear at this time whether the changes can be attributed to the Kingsland Lot, its predecessor (the Mason Road Lot), or some other factors.

Figures 21 and 22 show aerial views of the Addicks Park-and-Ride facility looking to the Southeast and Northeast, respectively. The aerial photography was performed by TTI staff in July 1985. Unfortunately, no aerial views were taken for the Kingsland Park-and-Ride lot at that time.

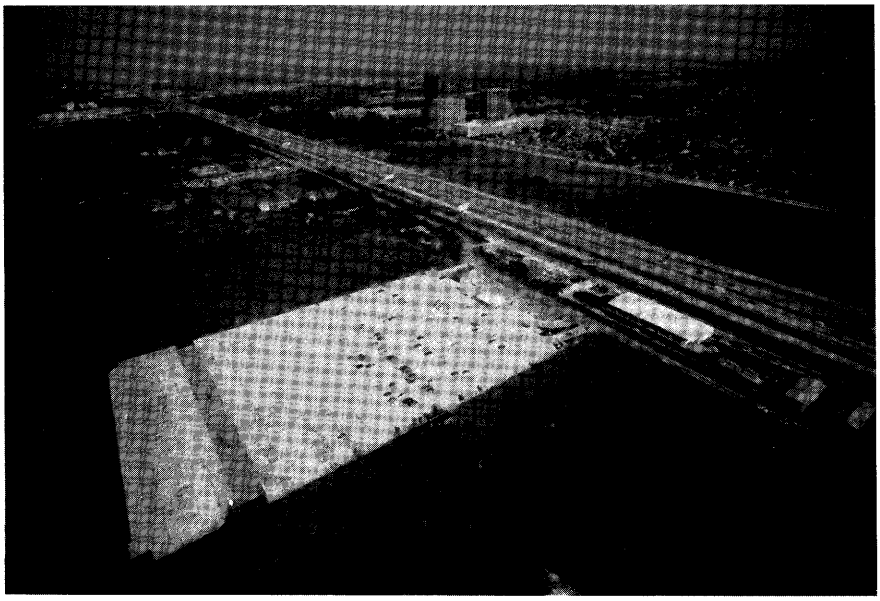


Figure 21. Aerial View of Addicks Park-and-Ride Facility Looking to the Southeast

Figure 22. Aerial View of Addicks Park-and-Ride Facility Looking to the Northeast

5. CONCLUSIONS

The preliminary results of this study indicate that while the HOV priority treatments implemented in I-45N and I-10W corridors have produced substantial improvements in corridor capacity, the land use impacts of the HOV treatments have been relatively insignificant. However, the study areas in most of the corridors all have substantial amounts of undeveloped land and it may be necessary to wait until the transitways and associated support facilities become fully operational before a more definitive assessment of land use impacts will be possible. Continued monitoring of land uses and completion of the developer interview portions of the research should result in a reasonable assessment of the potential land use impacts of transitway systems.

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