Land Use Impacts of the Houston Transitway System

JAMES A. MULLINS III, EARL J. WASHINGTON, AND ROBERT W. STOKES

This research effort was directed toward assisting the Texas State Department of Highways and Public Transportation in the planning and impact evaluation of high-occupancy vehicle (HOV) lanes or transitways. The primary objective of this research effort was to measure, analyze, and evaluate the land use impacts of the construction of permanent transitways and park-and-ride facilities on freeway corridors in Houston, Texas. Given the relative newness of transitways in the nation, very little data have been collected or experience gained with the land use impacts of this type of transportation improvement. A review of the literature failed to identify any direct literature on this subject. A survey of operational transitways identified some locations where transitway facility land use impacts possibly had occurred. The prevailing opinion among transitway operators is, and evidence suggests, that land use impacts of transitways are likely to be highly localized and that transitways may induce some shifts in development and settlement patterns rather than generate entirely new development. This paper presents the results of before-after analyses of land use changes in the vicinity of a typical park-and-ride lot in Houston's North Freeway (I-45N) corridor. The results indicate that the land use impacts of the HOV treatments have been relatively insignificant. The study site showed only three possible instances of land use impacts. However, study areas in the corridors surveyed have substantial amounts of undeveloped land, and it may prove necessary to wait until the transitways and associated support facilities become fully operational before a more definitive assessment of land use impacts is possible.

Houston is in the process of implementing high-occupancy vehicle (HOV) projects on five radial freeways in the area. This network is one of the most extensive HOV priority treatment networks in the nation. Over 25 miles of transitways now are operational, 18 miles currently are under construction, and another 23 miles are 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 (*1*). Figure 1 shows the location and status of the transitway facilities. As can be seen in this figure, these facilities, referred to locally as Authorized Vehicle Lanes (AVLs) and more commonly as transitways or busways, are or will be located in the Katy (I-10W), North (I-45N), Gulf (I-45S), Northwest (US-290), and Southwest (US-59S) freeway corridors.

The 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 typically are constructed within the existing median of the 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 its particular design, construction, and operational features.

The primary objective of this limited research effort was to measure, analyze, and evaluate the land use impacts resulting from the construction of permanent transitways and park-and-ride facilities in the Houston area. During the initial phase of this small-scale study, the following specific objectives were identified:

1. To conduct, based upon available data, case studies of transitway facilities in cities other than Houston for comparison of design and operational characteristics;
2. To examine land use impacts of the contraflow lane in Houston's North (I-45N) Freeway corridor;
3. To develop a "before" or prebusway land use data base in Houston's North (I-45N), Gulf (I-45S), and Katy (I-10W) freeway corridors; and
4. To project anticipated land use impacts, in the three Houston freeway corridors, that are likely to occur from implementing permanent busways and park-and-ride facilities.

This paper summarizes the land use impacts at one of seven study sites, the North Shepherd park-and-ride lot, which serves the North Freeway (I-45N) Transitway. The results from this site are typical of those found at the other study sites. More detailed discussions of the overall study results are presented elsewhere (*2–7*).

PREVIOUS RESEARCH

The impacts of public transportation on land use and land values were reviewed in four categories: environmental, economic, social, and political or policy. Given the relative newness of transitways in the nation, very little data have been collected or experience gained with land use impacts resulting from these types of transportation improvements. Most previous research and evaluations have concentrated on rail development impacts.

In addition to a review of the previous research on land use impacts, a review of operational transitways in the United States and Canada was performed. This review focused on identifying the transportation and land use impacts the transitway facilities have had or were expected to have on the urban areas in which they are located.

Texas Transportation Institute, Texas A&M University System, 333 West Loop North, Suite 116, Houston, Tex. 77024.

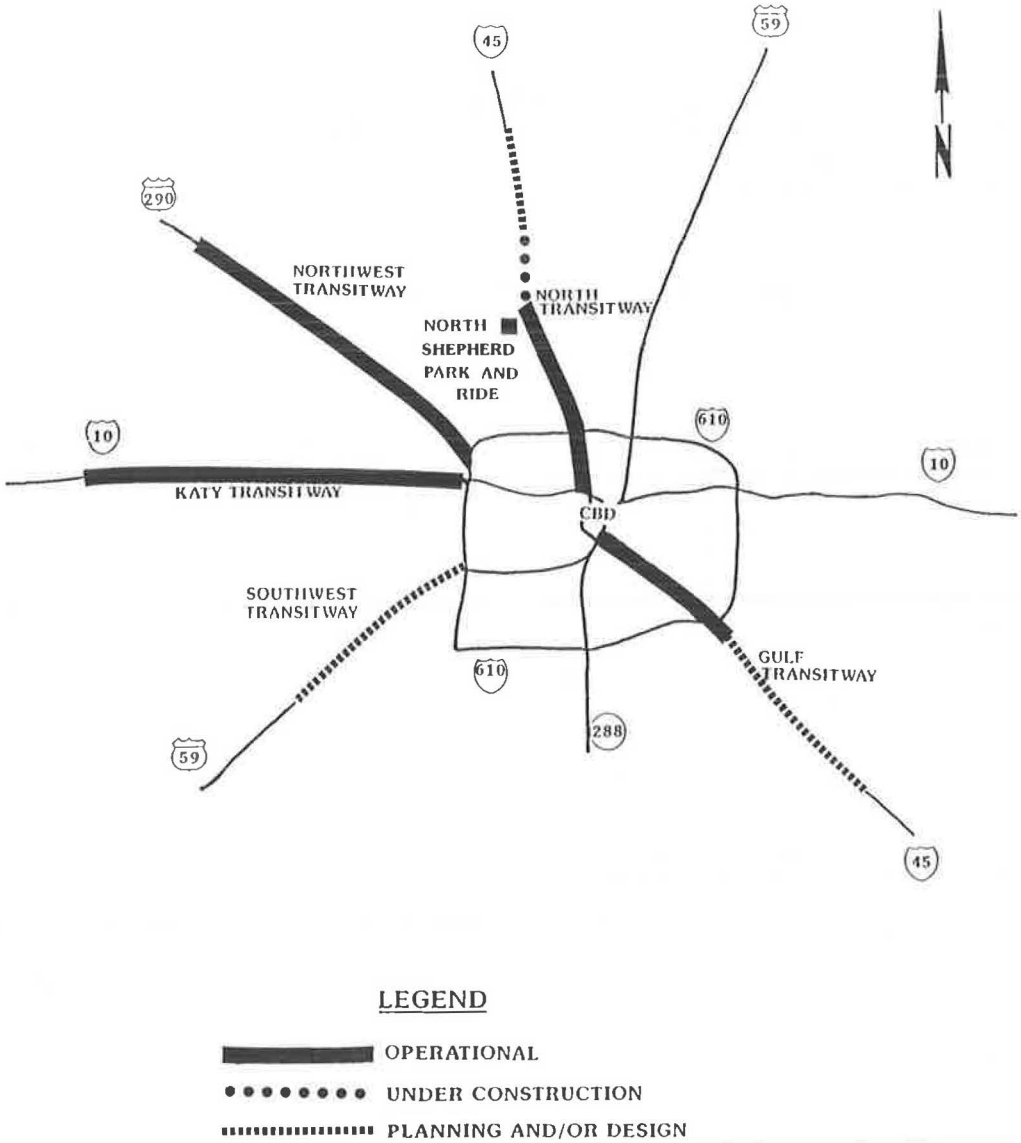

FIGURE 1 Status of the Houston transitways–June 1988.

According to studies by Graff and Knight (*8*), the Bay Area Rapid Transit (BART) system has not had much impact on its environment. The FHWA (*9*) reported in its study on the influence of central city radial freeways on manufacturing decisions that no major negative environmental impacts were identified beyond those normally associated with urban development or beyond the scope of contemporary performance standards.

In many instances, economic and development impacts are included as positive objectives of major transportation investments. This contention is supported by Rollins et al. (*10*). The authors state that "the effect of improving existing urban roadways on surrounding land use is an important consideration in highway agency decisions regarding roadway improvements. Such decisions should consider the economic impact of proposed improvements." Also, Berechman and Paaswell (*11*) report that anticipated increases in service employment, retail activity, and land development, mainly in the declining central business district (CBD) area, were viewed as the major benefits of Buffalo, New York's, light rapid rail transit system.

Another frequently cited impact of transportation improvements is increasing land values. This is evident in the Washington Metropolitan Area Transit Authority (WMATA) system of Washington, D.C., where a sample of land value increases generated by the opening of METRO led to the finding that a minimum of $2 billion in land values has already been added to the existing land value base (*12*).

The social implications associated with transportation improvements and land use indicate that the effects have been small, relative to expectations. When assessing the BART system, however, it is becoming a highly ranked factor in the location decisions of households and employers. Also, characteristics of the transportation system such as freeway configuration and proximity and access to other modes affect cluster and corridor development.

Recent actions aimed at the promotion and coordination of land use and transportation planning concentrate on pool-

ing arrangements and joint development activities. These measures usually are administered under Transportation System Management (TSM) programs and emphasize more efficient use of existing facilities. Although many people fail to take advantage of or even resist these opportunities when offered, the future remains bright for the coordination of land use management and transportation planning.

In summary, the review of the literature did not identify any direct literature assessing the land use impacts of transitways. Therefore, this small-scale study effort is new to the research community and to the literature.

The second phase of the survey effort consisted of mail and telephone surveys of project operators to update information from the literature review and to solicit additional data on transitway projects. Six operational transitways in three states and one Canadian province were identified and reviewed. Table 1 presents a summary of the results of the survey.

The prevailing opinion among transitway operators is that given the exclusive line-haul nature of transitways, their land use impacts are likely to be highly localized, occurring around station areas and major access points.

Preliminary evidence from Ottawa suggests that these localized developments may be substantial. The building industry has expressed interest in pursuing major developments at a number of existing and planned transitway stations. Table 2 summarizes these preliminary development proposals. However, transit use in Ottawa is the highest for all bus-only systems in North America, and experiences there may not be representative of the potential development impacts of transitways. Additionally, indications from the Ottawa experience are that the presence of a transitway may be but one factor in decisions regarding the timing and location of developments. Specifically, discussions with transitway officials in Ottawa indicate that the presence of the transitway system may merely have accelerated the timing of developments rather than influencing location decisions.

Because of the increased accessibility the Shirley Highway HOV lanes in Washington, D.C., offer to persons employed in downtown Washington and the Pentagon, Rosslyn, and Crystal City areas, substantial residential development has occurred along the corridor to the south. People have found that they can reside at locations farther away than many other suburban sites but still commute to work in less time. With housing costs decreasing with the distance from the D.C. core, the result has been major new housing developments at such locations as Dumfries, Triangle, Montclair, and Dale City.

Development impacts of the East M. L. King Busway in Pittsburgh at the time of the survey had been limited to small-scale redevelopments of a service-oriented nature at or near station areas.

Although neither the North (I-45N) Transitway or Katy (I-10W) Transitway in Houston had been in operation long enough at the time of the survey to assess their impacts on land uses in their respective corridors, data from the I-45N freeway contraflow lane, which preceded the transitway, suggest that the presence of HOV facilities may affect choices regarding

TABLE 1 CHARACTERISTICS OF TRANSITWAYS IN THE UNITED STATES AND CANADA (*4*)

Transitway/Location	Year Operational	Type of Facility	Length/Direction	Eligible Vehicles	Estimated Peak Hour Ridership (persons[a])	Transitway Land Use Impacts
Shirley Highway HOV Lanes	1969	1-lane reversible roadway	11.5 miles Fairfax Co. to Washington, D.C.	Buses, vanpools, 4+ carpools	22,000	Possible
I-66 HOV Facility Northern Virginia	1982	4-lane, 2-way exclusive facility -- peak hours and direction only; rest of the time open to regular traffic	9.6 miles I-495 Beltway to Roosevelt Bridge	Buses, vanpools, 3+ carpools	11,200	None
El Monte Busway Los Angeles, CA	1973	2-lane, 2-way exclusive HOV facility	11.2 miles El Monte Bus Station to Los Angeles CBD	Buses, vanpools, 3+ carpools	16,600 6,000	None
East King Busway Pittsburgh, PA	1983	2-way exclusive, partially grade separated.	6.8 miles Wilkinsburg to CBD	Public buses, certified private	6,000	Possible
South Patway Busway Pittsburgh, PA	1977	2-way exclusive, partially grade separated.	4.5 miles SW suburbs to CBD	Public buses, certified private	2,950	None
Katy Freeway Transitway Houston, TX	1984	1-lane reversible median busway	11.5 miles W. Harris County to Houston	Vanpools, buses, 2+ carpools	4,300[b]	None
North Freeway Transitway Houston, TX	1985	1-lane reversible median busway	9.6 miles N. Houston to CBD (20 miles when completed)	Authorized vanpools and buses	4,000[b]	Possible
Ottawa Transitway System, Canada	1984	2-lane, 2-way exclusive facility	7 miles of proposed 18 mile system currently in operation	Buses only	19,200[c]	Possible

[a]ITE 1985 Survey of Operating Transitway Projects, unless noted otherwise.
[b]Katy and North Transitway Operational Summary, TTI, June 1988.
[c]6900 from West Transitway, 12300 from Southeast and Southwest Transitways.

TABLE 2 DEVELOPMENT PROPOSALS IN VICINITY OF OTTAWA TRANSITWAY STATIONS (*4*)

Class of Development	Size of Development	Approximate Investment Value ($ Million)
Office	2 Million Square Feet	$180
Retail	232,000 Square Feet	$33
Residential	5000 Units	$180
Mixed Use (Residential/Office/Retail)	140 Acres	$200

where people live and work. Table 3 summarizes data from surveys of park-and-ride lots served by the I-45N contraflow lane and surveys of lots not served by the contraflow lane or other HOV lane. The table presents a breakdown of whether the presence of the park-and-ride and/or contraflow lane influenced people's decisions regarding job and residential locations (for those respondents who indicated they had changed their residential or job location since the park-and-ride or contraflow lane opened). These data indicate that the presence of both park-and-ride and priority treatment (in this case, contraflow) may influence location decisions. The trend is particularly strong for those who indicated a change of residential location.

The evidence from Houston suggests that the presence of a busway may affect choices regarding where people live and work. This would seem to indicate that the transitways may induce some shifts in development and settlement patterns instead of generating entirely new development.

No land use impacts or development impacts of transitways could be identified in the remaining survey locations in Houston.

METHODOLOGY

The methodology used in the research for this pilot study is referred to as the "before-after" study approach. Data from a time period before the transportation improvement are compared to similar data collected after the completion of the improvement in the affected area. Therefore, the effects of the transportation change are determined by comparing "before" period data with "after" period data, which are collected and updated on an annual basis. This approach was applied to seven sites of the Houston transitway system.

To satisfy the study objectives, land use data were obtained from (a) aerial photographs of study areas, (b) site visits, (c) *Cole's City Directory*, and (d) developer interviews.

TABLE 3 CHANGES IN JOB AND RESIDENTIAL LOCATIONS SINCE PARK-AND-RIDE LOT OPENED, WITH AND WITHOUT PRIORITY FREEWAY LANES (*13*)

Question	Contraflow Lane Lots	Non-Contraflow Lane Lots	Total Sample
Have you changed job locations since park-and-ride (or park-and-ride and contraflow lane) opened?	(n=1118)	(n=558)	(n=1676)
Yes	41%	27%	36%
No	59	73	64
If "yes", did the availability of Park-and-Ride (or park-and-ride and contraflow lane) influence decision?	(n=445)	(n=147)	(n=592)
Yes	51%	40%	48%
No	49	60	52
Have you changed residential locations since park-and-ride (or park-and-ride and contraflow lane) opened?	(n=1122)	(n=563)	(n=1685)
Yes	55%	54%	55%
No	45	46	45
If "yes", did the availability of park-and-ride and contraflow lane influence decision?	(n=603)	(n=303)	(n=906)
Yes	57%	50%	54%
No	43	50	46

n = Sample Size

Aerial photographs of the study areas were examined to identify land use changes in the vicinity of the study sites. The process of identifying land use changes consisted of taking the earliest available photos (between 1973 and 1975) and overlaying them with the next interval (time frame) photos. This procedure was repeated until the latest available (1986) photos were examined.

Site visits were made to the study areas to verify and supplement the results obtained from the aerial photograph analysis. The visits also were used to assess the types of development and their approximate age.

Because the aerial photography analysis can identify only "new developments," changes in the use of existing structures (prior to the "before" time frame) had to be identified through site visits and the city directory.

Cole's City Directory contains information on each occupied address in the Greater Houston area. Land use changes were identified by reviewing the addresses listed within the study area on an annual basis. The addresses listed for the first year of observation (1973) were compared to those for the following year (1974) and so on through the most current year of the study period available (1986). Also, any new addresses within the study area were listed and observed for the remainder of the study period.

As part of this limited research effort, it was decided that interviews with the developers of major office and commercial projects within the freeway corridors would be an expedient and direct method of assessing the interaction between the transitway and its support facilities and the developer's decision concerning where, when, what, why, and how much to develop. The information obtained from the interviews, combined with the other data, should then provide as complete a picture as possible of the impacts of the transitway and support facilities on the freeway corridors. The interviews were conducted with developers of various projects along the I-45N freeway corridor.

ZONE OF INFLUENCE

The zone of influence or "impact area" is commonly an area of a specified dimension inside which may occur land use impacts as a result of a transportation improvement. For this small-scale study a distance of one-quarter mile was chosen as the limit for the impact area of all study locations. This distance was chosen in order to maintain consistency with prior rail and rapid transit impact studies. The one-quarter-mile distance has become somewhat of a standard definition for the zone of influence of transit improvements and is consistent with the general approach used in numerous other impact studies (*10, 14, 15*).

Because of funding limitations, a more rigorous and desirable experimental design could not be applied. Future research in this area might include investigation of larger areas as well as a control site.

RESULTS

The North Transitway or AVL, is a one-lane reversible authorized bus and vanpool facility located in the median of I-45N, known locally as the North Freeway. Implementation of the project was divided into four phases, in conjunction with freeway improvements, as can be seen in Figure 2. Phases I and II extend 9.1 miles from the Houston CBD at Franklin Street to North Shepherd Drive. This portion of the construction replaced Houston's contraflow lane with a physically separated transitway. Phase I construction began in 1983 and, upon completion of Phase II, became operational in May 1985. Phase III will extend the transitway 5.0 miles from North Shepherd Drive to Beltway 8, known locally as the North Belt, with Phase IV continuing the lane an additional 5.6 miles from North Belt to FM 1960. Phase III construction currently is under way with an estimated completion date of early 1989. Construction of Phase IV currently is planned to begin in 1990 and should be completed by 1994.

The entire 20-mile transitway improvement is a joint project between the Texas State Department of Highways and Public Transportation (SDHPT) and the Metropolitan Transit Authority of Harris County (METRO). Financial assistance for the median facility and the interchange ramps is being provided by the FHWA and UMTA.

The I-45N corridor is one of Houston's more heavily traveled corridors and is bordered by significant residential and commercial activity. The facility serves the CBD, the Greenspoint Development at Beltway 8, the Houston Intercontinental Airport, and a number of residential areas and developments (e.g., the Woodlands, Spring, and Conroe areas).

For the sake of brevity, the results presented in this paper focus on one of the seven study sites—the North Shepherd park-and-ride lot. The North Shepherd site possesses similar characteristics to the other sites, and the results here are representative of the findings at the other study sites.

Tables 4 through 6 present parcel data for the North Shepherd park-and-ride lot impact area from the *Cole's City Directory*. The data cover the years 1973 through 1986, with years 1973 through 1980 comprising the before period and years 1981 through 1986 comprising the after period. Parcels along three roadways in the impact area—North Shepherd Drive, Veterans Memorial Drive, and the I-45N freeway—are presented. Figure 3 indicates the location of these streets in relation to the park-and-ride lot, as well as the general location of the parcels monitored for this study. Table 4, which presents land use information for parcels along I-45N, indicates that land uses along I-45N have been and remain exclusively of a commercial nature. This feature is quite natural and would be expected along most if not all interstate roadways in the Houston area. The data also indicate that there has been an increase in the number of commercial land uses throughout the study period until 1985, when a modest decline took place. This particular characteristic is most likely tied to the overall economic growth and mid-1980s economic decline during the study period. There is no evidence of any influence on these land use changes by the transitway or the park-and-ride lot.

Table 5 and 6 present land use information for parcels along North Shepherd Drive and Veterans Memorial Drive, respectively. Table 5 indicates that land uses have changed from being evenly distributed between residential and commercial uses in the early years of the study period to overwhelmingly commercial uses by 1986. As can be seen in Table 5, commercial uses that started at, roughly, a 50 percent level gradually grew to represent roughly 70 to 75 percent of the impact area land uses by the end of the before period. The after

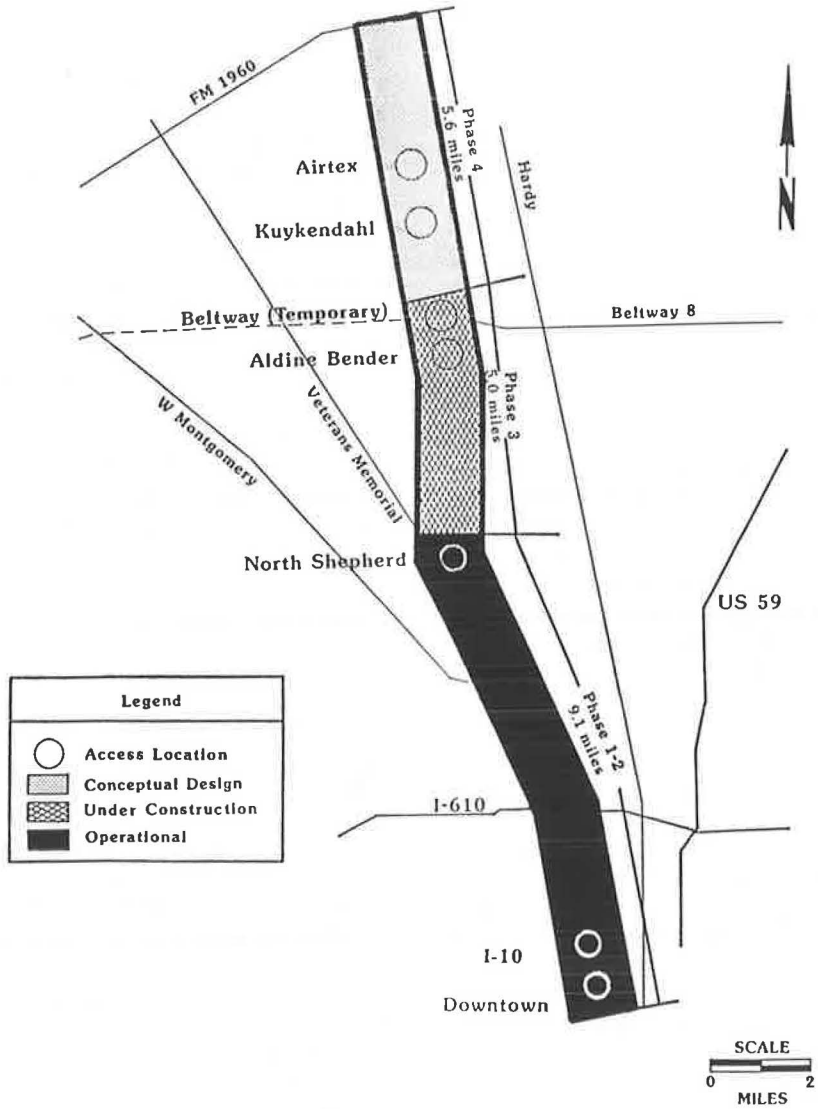

FIGURE 2 North (I-45N) Freeway Transitway (*16*).

period has seen commercial use grow from an 80 percent level to a 95 percent level by the latest available data. All of the residential uses that existed during the before period had become vacant or changed uses by the latest study year. Over 72 percent of the commercial uses that existed during the latest study year previously had been vacant sometime in the study period. These facts indicate that the change in the character of the area may have been controlled more by developmental influences than transportation influences.

The trend of gradual elimination of residential uses and incremental increases in commercial uses appears to be fairly typical of land use changes along arterial roadways in areas that grew increasingly urban in nature as Houston's economy grew. Like the situation along the North Freeway, the land use changes along North Shepherd Drive are more likely a result of the economic growth of the area and appear not to have been influenced by the location of the transitway or park-and-ride lot.

Table 6 details land use changes of parcels along Veterans Memorial Drive. The data indicate that there has been a gradual reversal of dominant land uses throughout the study period. The table shows only one parcel that changed land uses within the study period and involved residential uses changing to commercial uses, and it shows as well that both original residential uses that existed in the before period had become vacant by the latest year of study. Additionally, 80 percent (four of five) of the commercial uses that remained in existence during the latest year of the study originally were vacant parcels. One land use change, that of Parcel Number 47, might represent a partial impact of the park-and-ride lot. The impact may have resulted from the fact that this parcel is located immediately outside the park-and-ride lot, and the business on this parcel—auto repair—is of a nature that could benefit from being located adjacent to such a facility. However, the overall increase in commercial land uses from 1973 until 1985 as well as the decline from 1985 to 1986 more likely is influenced by the economic conditions of the Houston area during the study period.

In addition to the one possible site of potential park-and-ride lot land use influence along Veterans Memorial Drive identified through *Cole's City Directory*, two other Veterans Memorial sites, identified through site visits, show potential

TABLE 4 NORTH (I-45N) FREEWAY LAND USE DATA (1973–1986)

Parcel Number	Land Use and Year													
	73	74	75	76	77	78	79	80	81	82	83	84	85	86
26					CM	X	X	X	X	X				
27	CM	X			CM	X	X	X	X	X		CM		
28														CM
29													CM	X
30														CM
31	RS	X	X	X										
32	CM	X	X	X	X	X	X	X	X	X	X	X	X	X
33	CM	X	X	X	X	X	X	X	X	X	X	X	X	X
34	CM	X	X	X	X	X	X	X	X	X	X	X	X	X
35	CM	X	X	X	X	X	X	X	X	X	X			
36														CM
37												CM	X	X
38													CM	
39			CM	X	X	X	X	X	X	X	X	X	X	X
40								RS						
41					CM	X	X	X	X	X	X	X	X	X
42	CM						CM	X	X	X	X	X	X	X
% CM/RS	53/47	57/43	47/53	59/41	76/24	79/21	76/24	68/32	81/19	83/17	93/7	94/6	94/6	95/5

CM = Commercial Land Use
RS = Residential Land Use
X = Continuance of Previously Listed Use
Blank = No Occupant
Note: All parcels within zone of influence. See Figure 3.

TABLE 5 NORTH SHEPHERD LAND USE DATA (1973–1986)

Parcel Number	Land Use and Year													
	73	74	75	76	77	78	79	80	81	82	83	84	85	86
1	CM	X	X	X	X	X	X	X	X	X				
2				CM										
3	CM	X	X	X	X	X	X	X	X	X	X	X	X	X
4	CM		CM	X				CM	X	X	X	X	X	X
5								CM						
6								CM						
7	CM	X	X	X	X	X	X	X	X	X	X	X	X	X
8							CM	X	X	X	X			
9	CM	X	X	X	X									
10									CM	X	X	X	X	X
11										CM	X	X	X	X
11												CM	X	X
13					CM									
14			CM											
15							CM	X	X	X	X	X	X	X
16											CM	X	X	X
17												CM	X	X
18												CM	X	X
19					CM	X								
20							CM	X	X	X	X	X	X	X
21						CM	X	X	X	X	X	X	X	X
22	CM	X	X	X	X	X								
23						CM	X	X	X	X	X	X		CM
24									CM	X	X	X		CM
25	CM	X	X	X	X	X	X	X	X	X	X	X	X	X
% CM/RS	100/0	100/0	100/0	100/0	100/0	100/0	100/0	100/0	100/0	100/0	100/0	100/0	100/0	100/0

CM = Commercial Land Use
RS = Residential Land Use
X = Continuance of Previously Listed Use
Blank = No Occupant
Note: All parcels within zone of influence. See Figure 3.

land use impacts of the park-and-ride lot. Because these sites are located on either side of the initially identified site (just outside the park-and-ride lot) and are engaged in a similar business (automobile service), it is felt that they may also represent possible land use impacts of the North Shepherd park-and-ride lot.

Tables 4, 5, and 6 show that the impact area of the North Shepherd park-and-ride lot has become dominated by commercial land uses. The data suggest that over the length of the study period, particularly after 1980, the character of the area began to change, resulting in large numbers of residential land uses becoming vacant and commercial uses appearing in areas that previously had been vacant. However, other than the three automobile repair establishments, there is little direct

TABLE 6 VETERANS MEMORIAL DRIVE LAND USE DATA (1973–1986)

Parcel Number	Land Use and Year													
	73	74	75	76	77	78	79	80	81	82	83	84	85	86
43	CM	X	X	X	X	X	X	X	X	X	X	X	X	
44							CM	X	X	X	X	X	X	
45							CM	X	X	X	X	X		CM
46					CM	X	X	X	X	X	X	X	X	
47														CM
48	CM	X				CM	X	X	X	X	X	X	X	
49												CM	X	
50					CM	X	X	X	X	X	X	X	X	X
51			CM	X	X	X	X	X	X	X	X	X	X	X
52	CM	X	X	X	X	CM	X	X	X	X	X	X		
53				RS	CM	X	X	X						
54											CM	X	X	
55	RS	X												
56				CM										
% CM/RS	38/62	30/70	27/73	36/64	46/54	50/50	67/33	62/38	69/31	64/36	75/25	73/27	77/23	71/29

CM = Commercial Land Use
RS = Residential Land Use
X = Continuance of Previously Listed Use
Blank = No Occupant
Note: All parcels within zone of influence. See Figure 3.

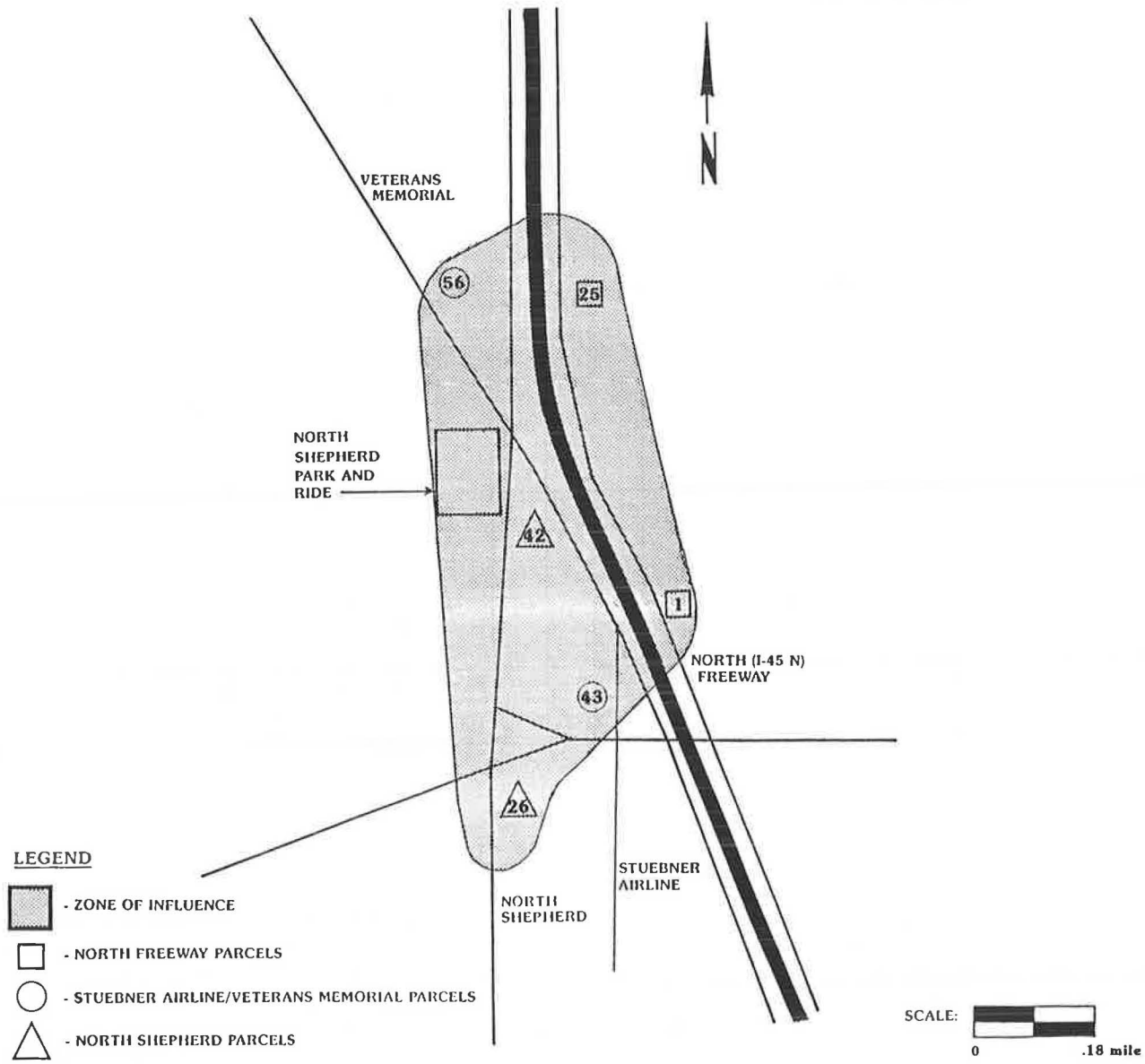

FIGURE 3 North Shepherd park-and-ride study site.

evidence of any land use impacts that can be attributed either to the North Shepherd park-and-ride lot or the North Freeway Transitway (i.e., the uses do not appear to be of a nature that would benefit from their proximity to the park-and-ride lot).

The interviews with I-45N freeway developers revealed that most of the developers generally were aware of the transitway and park-and-ride facilities in the area of their project. Most developers stated that the presence of the transitway and park-and-ride facilities was not a consideration in their decision making regarding the location, timing, and sizing of past development projects. Also, a majority of developers stated that the presence of the transitway did not affect their ability to market their development. Many developers felt that the transitway may benefit the area as a whole but did not affect, positively or negatively, their interests. Almost all of the developers interviewed stated that they did not anticipate that the transitway or park-and-ride facilities or the extension of the former would affect their decisions with regard to any future project.

CONCLUSIONS

A review of previous research and of the literature was conducted in order to determine the extent of work that has been performed previously in this area. A review of operational transitways in the United States and Canada focused on identifying the general design and operating characteristics of transitways and the transportation and land use impacts these facilities have had (or were expected to have) on the urban areas in which they are located. The transportation impacts of transitways are well documented elsewhere. Consequently, this review focused primarily on the land use and development impacts of transitways.

The results of the review indicated that virtually no research had been conducted on the land use impacts of transitways. Additionally, the majority of the transitway operators surveyed indicated that no such research was being considered in the near future. The prevailing opinion among transitway operators was that given the exclusive line-haul nature of transitways, their land use impacts are likely to be highly localized, occurring around station areas and major access points. Preliminary evidence from Ottawa suggests that these localized developments may be substantial. However, transit use in Ottawa is the highest for all bus-only systems in North America, and experiences there may not be representative of the potential development impacts of transitways.

In a more areawide context, preliminary evidence from Houston suggests that the presence of a transitway may affect choices regarding where people live and work. This would seem to indicate that transitways may induce some "shifts" in development and settlement patterns instead of generating entirely new development.

The conclusion drawn from the Houston developer interviews is that neither the North (I-45N) Freeway Transitway nor its support facilities have influenced land use or development decisions over the last 7 years. Interviews with CBD developers might prove more significant in that this type of facility may not influence land use in areas paralleling the facility, as one might initially expect. The influence may be more readily felt where the service is apparent—that is, at the delivery end of the "pipeline."

The results of this limited analysis, although preliminary in nature, indicate that while the HOV priority treatments implemented in the Houston freeway corridors may have produced substantial improvements in corridor capacity, the land use impacts of the HOV treatments have been relatively insignificant. The specific site detailed in this presentation certainly follows this pattern. Only three parcels within the North Shepherd park-and-ride lot impact area showed any change in land use that may have resulted from the HOV facilities. However, study areas in the corridors surveyed have substantial amounts of undeveloped land, and it may prove 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 provide a reasonable assessment of the potential land use impacts of the Houston transitway system.

ACKNOWLEDGMENTS

The research reported in this paper was conducted as part of a research project entitled "Land Use and Innovative Funding Impacts in a Permanent Busway/Park-and-Ride Transit System," sponsored by the Texas SDHPT in cooperation with UMTA.

REFERENCES

1. D. L. Christiansen and W. R. McCasland. *The Impacts of Carpool Utilization on the Katy Freeway Authorized Vehicle Lane: Before Data*. Research Report 484-1. Texas Transportation Institute, College Station, Tex., July 1985.
2. R. L. Peterson and R. W. Stokes. *Land Use and Innovative Funding Impacts in a Permanent Busway/Park-and-Ride Transit System: An Annotated Bibliography*. Technical Report 1086-1. Texas Transportation Institute, College Station, Tex., Dec. 1985.
3. R. L. Peterson, R. W. Stokes, and Barry M. Goodman and Associates. *Land Use and Innovative Funding Impacts in a Permanent Busway/Park-and-Ride Transit System: Work Program*. Technical Report 1086-2. Texas Transportation Institute, College Station, Tex., Jan. 1986.
4. R. W. Stokes and R. L. Peterson. *Survey of Transitway Projects in the United States and Canada*. Technical Report 1086-3. Texas Transportation Institute, College Station, Tex., Nov. 1986.
5. R. L. Peterson and R. W. Stokes. *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*. Technical Report 1086-4. Texas Transportation Institute, College Station, Tex., Jan. 1987.
6. R. L. Peterson and R. W. Stokes. *Land Use and Innovative Funding Impacts in a Permanent Busway/Park-and-Ride Transit System: Land Use Data Base for Houston's Transitway System and Second Year Summary*. Technical Report 1086-5. Texas Transportation Institute, College Station, Tex., March 1987.
7. J. A. Mullins, III, E. J. Washington, and R. W. Stokes. *Land Use Impacts of the Houston Transitway System: Third Year Update*. Technical Report 1086-6. Texas Transportation Institute, College Station, Tex., Aug. 1987.
8. D. L. Graff and R. L. Knight. *Environmental Impacts of BART: Final Report*. U.S. Department of Transportation, 1979.
9. *The Influence of Central City Radial Freeways on Manufacturing Location Decisions*, Vol. 1. FHWA, U.S. Department of Transportation, 1973.
10. J. B. Rollins, T. L. Memmott, and J. L. Buffington. *Effects of Roadway Improvements on Adjacent Land Use: An Aggregative Analysis and the Feasibility of Using Urban Development Models*.

State Department of Highways and Public Transportation, Austin, Tex., 1981.
11. J. Berechman and R. E. Paaswell. *Rail Rapid Transit Investment and CBD Revitalization: Methodology and Results*. University of Illinois, Chicago, 1983.
12. U.S. House of Representatives. *Metrorail Impacts on Washington Area Land Values*. U.S. Government Printing Office, Washington, D.C., 1981.
13. D. L. Christiansen. *Alternative Mass Transportation Technologies: Technical Data*. Research Report 339-4. Texas Transportation Institute, College Station, Tex., Dec. 1985.
14. T. J. Baerwald. Land Use Change in Suburban Clusters and Corridors. In *Transportation Research Record 861*, TRB, National Research Council, Washington, D.C., 1982.
15. H. Bain and E. Escudero. *Land Use and Urban Development, Project Research Plan* (Planning Document-Final). U.S. Department of Transportion, Sept. 1975.
16. D. W. Borchardt and S. E. Ranft. *The North Freeway Transitway: Evaluation of Second Year of Barrier Separated Operation*. Research Report 339-12. Texas Transportation Institute, College Station, Tex., Aug. 1987.

The contents of this paper reflect the views and conclusions of the authors. They are not necessarily those of the Texas SDHPT or UMTA.

Publication of this paper sponsored by Committee on Transportation and Land Development.