Southwest Region University Transportation Center

DALLAS AREA RAPID TRANSIT IMPACT STUDY: A FRAMEWORK FOR ASSESSING LAND USE AND DEVELOPMENT IMPACTS

Patrick J. Coleman, Mark A. Euritt,
and C. Michael Walton

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CENTER FOR TRANSPORTATION RESEARCH
THE UNIVERSITY OF TEXAS AT AUSTIN

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EXECUTIVE SUMMARY

Accessibility plays a significant role in land development. Simply stated, any plot of land targeted for economic activity must be accessible both to developmental activity and to the potential markets that such activity seeks to attract. Historically, it was this principle of accessibility that determined in each U.S. city the particular center of commercial activity, later termed the central business district (CBD).

Now, with urban development giving way to *suburban* development, cities are increasingly exploring ways in which accessibility—through public transportation—can be used to foster economic development in these suburban areas as well. And one of the ways in which cities chart the success (or failure) of transit investment is through the land use impact study. This report, then, investigates strategies for measuring land use impacts. Its particular focus is the city of Dallas, where a starter system in the $2.4 billion Dallas Area Rapid Transit (DART) project is currently under construction. The framework outlined in this document provides a strategy and a schedule for measuring changes in land use and development in the Dallas area.

In weighing strategies for measuring land-use impacts, we reviewed seven existing transit impact studies, each selected on the basis of the quality of the impact study, system characteristics (type, size, and age), and the demographic characteristics of the city. From these existing studies some commonly used techniques were identified and then used to form the basis for the land use component of the DART impact study design.

As the conclusions make clear, whether the DART starter system influences land use is a difficult and complex question to answer. Many factors will ultimately determine the success of its economic development plan. Interagency coordination, for example, is an important factor; how public/private opportunities are promoted is another. Other variables range from the tangible (ridership, on-time performance, operating efficiency) to the abstract (civic pride, "world-class-city" status, desirable urban form).

The DART starter line's success will depend in part on its ability to attract new riders away from automobiles. Establishing park-and-ride lots at outlying stations is seen as one method that, given the current congestion of the Dallas freeway system, will certainly attract such riders. Another approach is to promote, in the station areas, development that will enhance ridership.

An important mechanism for DART's success will be government/business joint development. Government and business have in the past 20 years shown their commitment to rebuilding and sustaining America's urban areas. Encouraging examples, some of which are described in this report, are found in Washington, D.C., Denver, Portland, and Seattle.

ABSTRACT

Seven transit system impact reports were reviewed in an effort to identify strategies for measuring land-use impacts for Dallas Area Rapid Transit's (DART) light rail starter line. These systems were selected on the basis of impact study quality, system characteristics (type, size, and age), and city demographics. From these existing studies some commonly used techniques are identified and then used to form the basis for the land use component of the DART impact study design. The report concludes that DART's success in fostering economic growth will depend on many factors, including interagency coordination and, perhaps most importantly, how public/private opportunities are promoted. Other variables range from the tangible (ridership, on-time performance, operating efficiency) to the abstract (civic pride, "world-class-city" status, desirable urban form).

ACKNOWLEDGMENTS

Support for this research project was provided by a grant from the Office of the Governor of the State of Texas, Energy Office, to the Southwest Region University Transportation Center. This project is a component of the "Comprehensive Study Design for the 'Before' and 'After' Assessment of the Dallas Rail Transit Starter Line" conducted by the Texas Transportation Institute at Texas A&M University and the Center for Transportation Research at The University of Texas at Austin.

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CHAPTER 1. INTRODUCTION

BACKGROUND

The accessibility provided by public transportation has, historically, played a key role in urban land development. But with urban growth now giving way to *suburban* development, the challenge to public transportation today is to serve both the traditional central business district (CBD) and these suburban locations.

The challenge is an important one, for it raises, at the same time, fundamental questions regarding public transit's ability to stimulate suburban economic activity. Knight and Trygg (Ref 2), in their study on major transit investments and land use changes, concluded that major transit improvements led to intensified land use both in the CBD and in the suburbs *only* when other, non-transit factors acted favorably. They further reported that the effects of bus rapid and light rail systems on development are inconclusive. On a regional scale, no net urban population or economic growth, according to the researchers, has occurred as a result of transit investment.

But at the time of Knight and Trygg's study (1977), the "new" transit systems—BART, METRO, MARTA, among others—were just opened or being built. Thus it may be that system maturity is a factor in stimulating land development; that is, the "timing" of any land use impact may depend substantially on economic conditions that are themselves the result of new transit investment. For example, transit improvement can lead to major policy changes for land use and, consequently, to new land development in a cycle similar to that illustrated in Figure 1.1; Figure 1.2 incorporates policy decisions and economic conditions into the scheme.

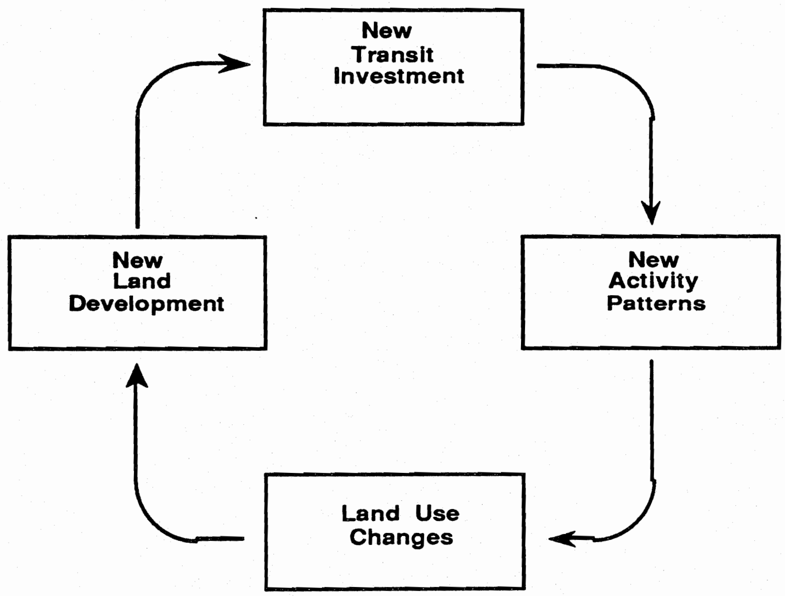

Figure 1.1. Relationship between transit investment and land use changes.

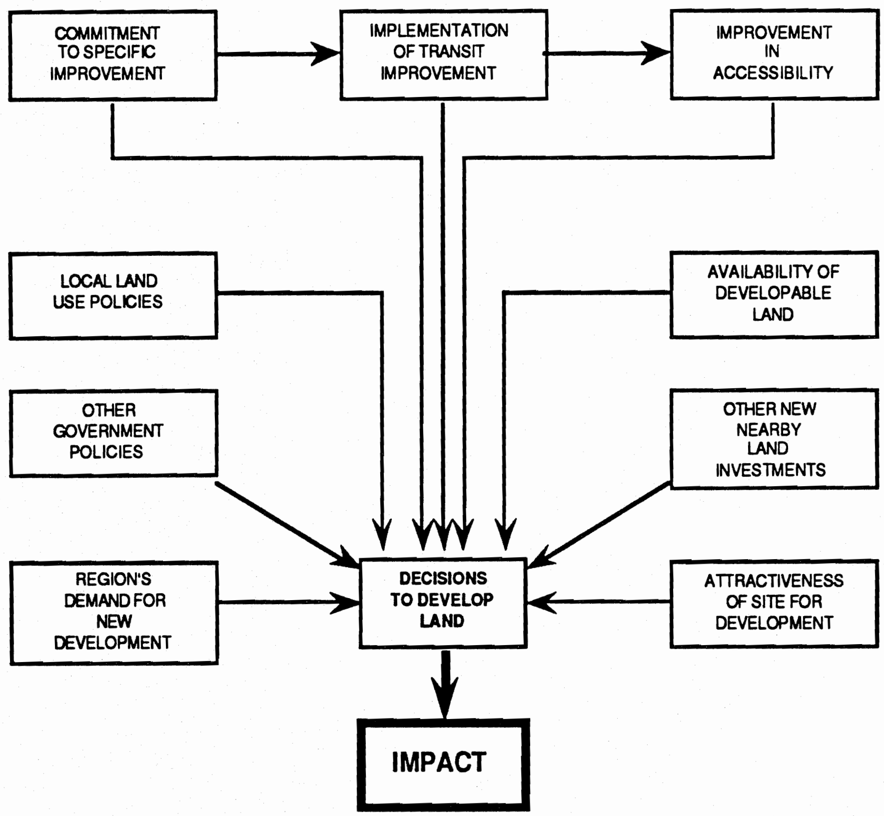

Figure 1.2. A model for land use and development impacts (Ref 2).

PURPOSE OF LAND USE STUDIES

Land use studies are undertaken for several reasons. First, because cities interested in building transit systems envision urban development benefits, any development that occurs must be measured to determine both its magnitude and its relationship to the system. Additionally, because transit improvements can often be partially supported or financed under joint development or through value-capture techniques, potential sponsors will need projections of economic benefits. Finally, land use studies provide source material for community groups rightfully concerned about the long-term effects of transit development on their neighborhoods.

OBJECTIVE

This report, then, investigates strategies for measuring land use impacts. Its particular focus is the city of Dallas, where a starter system for the $2.4 billion Dallas Area Rapid Transit (DART) project is currently under construction. Seven transit system impact studies, selected on the basis of the study quality, system characteristics (type, size, and age of system), and geographic location, are reviewed. As illustrated in Figure 1.3, the study design process consists of obtaining the impact studies, analyzing them, and then using them to formulate a study design. Because the timeframe, study area, and data collection in this project have necessarily been guided by the principle of "most information at least cost," existing data sources and collection procedures have been incorporated wherever possible.

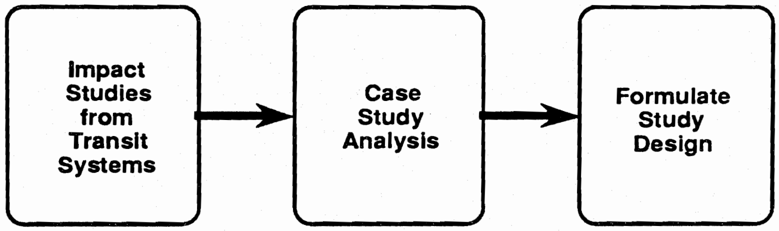

Figure 1.3. The study design process.

Finally, from these studies we identify some commonly used techniques that we then use to form the basis for the land use component of the DART impact study design.

CHAPTER 2. OVERVIEW OF DART'S LIGHT RAIL CORRIDORS

BACKGROUND

The plan for Dallas Area Rapid Transit's $2.4 billion transit system includes 66 miles of light rail transit, 18 miles of commuter rail transit, and 37 miles of high-occupancy-vehicle lanes. Scheduled for construction over the next 20 years, the system was adopted by the DART Board of Directors in June 1989. In July of 1989, the DART Board adopted a "starter system," the construction of which began in 1990. This starter system—representing the transit segments targeted for initial operation—will include 20 miles of light rail transit, 18 miles of commuter rail transit, and 18 miles of interim high-occupancy vehicle lanes (Ref 3).

Table 2.1 lists all stations in the DART light rail starter system, while Figure 2.1 charts the system on a map (the North Central Corridor is highlighted). Also shown in the figure is the Railtran line, a future DART commuter rail corridor (not reviewed in this study). The sections that follow provide an overview of each of the corridors and the CBD.

TABLE 2.1. STARTER SYSTEM STATIONS.

Station	Corridor	Parking	Comments
Park Lane	NC	1150/400	Parking reduced with line extension
Lovers Lane	NC	420	
Mockingbird	NC	950/700	Near SMU
Cityplace (future station)	NC	0	Subway, Joint Development with Cityplace Corp.
Bryan/Harwood	CBD	0	Transit mall
Pacific/Field	CBD	0	Transit mall
Pacific/Lamar	CBD	0	Transit mall, near West End
Union Station	CBD	0	Possible major transfer center
Convention Center	CBD	0	
Corinth	SOC	0	Transfer with West Oak Cliff
Morrell	SOC	0	
Illinois	SOC	400-800	
Kiest	SOC	500	At Lancaster/Kiest Shopping Center
VA Hospital	SOC	0	
Ledbetter	SOC	150-400	
Camp Wisdom	SOC	400	Not a part of SOC AA/DEIS
Zoo	WOC	0	Tourist development opportunity
Tyler/Vernon	WOC	0	
Hampton	WOC	0	
Westmoreland	WOC	400	

NC: North Central Corridor
CBD: Pacific Bryan Transit Mall
SOC: South Oak Cliff Corridor
WOC: West Oak Cliff Corridor
Source: This table was compiled from Refs 3, 4, and 5.

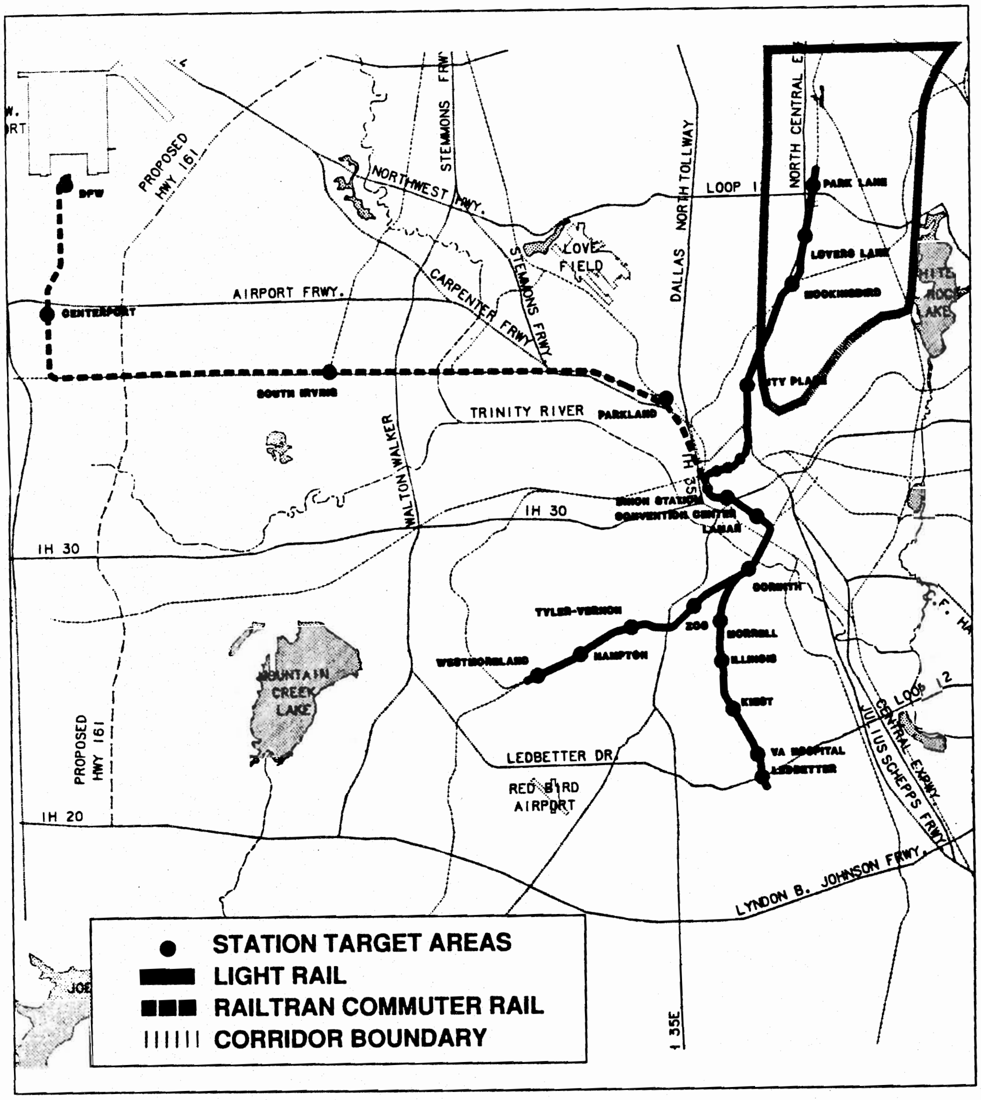

Figure 2.1. The DART Starter System (Ref 3).

NORTH CENTRAL

The North Central Corridor extends from the CBD to Park Lane, roughly paralleling the North Central Expressway. Above the Mockingbird Station, the right-of-way (ROW) is primarily reserved and at-grade in the Old Southern Pacific ROW. Below the Mockingbird Station, the guideway will be in a subway tunnel under the expressway. Existing development along the ROW includes scattered office and hotel complexes, shopping centers, and strip malls. These developments form a commercial "band," with apartments and other residential development located behind the band. Of particular note is the Cityplace Station, which is a joint development venture of Cityplace Corporation and DART. Station area maps for the North Central Corridor are shown in the appendix.

CENTRAL BUSINESS DISTRICT

The guideway will emerge from the tunnel near San Jacinto Street and will extend through the CBD as a transit mall down Pacific and Bryan Streets. The mall will allow limited vehicular access but no through access. Development along the ROW, almost exclusively commercial, will serve high-rise office complexes, the Arts District, the Convention Center, and the West End. Union Station will become a major transfer point with DART's light and commuter rail service, AMTRAK's Eagle Line (San Antonio to Chicago), and, potentially, the Texas TGV. A station area map for the CBD is shown in the appendix.

SOUTH OAK CLIFF

The South Oak Cliff corridor, extending from the CBD south to the Ledbetter Station just outside Loop 12, utilizes the Atchison, Topeka, and Santa Fe crossing of the Dallas Floodway. Above the Illinois station, the guideway uses the old TU Electric (Interurban) ROW until it meets the Santa Fe rail line at the Corinth Station. Below the Illinois Station, the guideway uses the Lancaster Avenue median up to the Ledbetter Station, where it veers onto an exclusive guideway to the terminus at Camp Wisdom. Development is primarily small business along the ROW, with single-unit dwellings behind the commercial band. Major employment centers include the VA Hospital and the Sears Roebuck & Company Distribution Center. Station area maps for the South Oak Cliff Corridor are located in the appendix.

WEST OAK CLIFF

The West Oak Cliff corridor extends from the Corinth Station west along the Atchison, Topeka, and Santa Fe ROW. The guideway is reserved except for grade crossings. Development here is primarily residential (mainly older, single-unit dwellings), though there is some industry (e.g., the Dixie Cup plant). A major attraction on the line is the Dallas Zoo. Station area maps for the West Oak Cliff Corridor are shown in the appendix.

CHAPTER 3. REVIEW OF SELECTED IMPACT STUDIES

Land use impact studies selected for review were based on the transit system type studied, availability, and the thoroughness of the data and methodology. With one exception, the transit systems were at the time of the study less than 20 years old. Both bus rapid and heavy rail system studies were examined.

As Table 3.1 indicates, the cities in which the systems are located are distinguished by size and geographic location. While the studies for each were carefully reviewed, those of smaller, newer systems (San Diego, Ottawa, and Houston) were reviewed more thoroughly, given their closer resemblance to the DART system.

TABLE 3.1. CITIES (AND SYSTEM TYPES) WHOSE LAND USE IMPACT STUDIES WERE REVIEWED.

City	System Type
Atlanta	Heavy Rail
S.F. Bay Area	Heavy Rail
Boston	Heavy Rail
Houston	Bus Rapid
Ottawa	Bus Rapid
San Diego	Light Rail
Washington, D.C.	Heavy Rail

ATLANTA

System Overview

Atlanta's rapid rail system, operated by the Metropolitan Atlanta Rapid Transit Authority (MARTA), has 32.1 miles of line and 29 stations. The system, as illustrated in Figure 3.1, is expected to be completed by 1996.

Impact Study

The Transit Impact Monitoring Program is an outgrowth of the earlier Transit Station Area Development studies conducted by the Atlanta Regional Commission (ARC) and the Urban Mass Transit Administration (UMTA) in the early 1970's. The Transit Impact Monitoring Program, an annual effort from 1978 to 1983, was discontinued in 1984.[1] The particular study under review here is the *1982 Transit Impact Monitoring Program Annual Report* published in March 1983 by ARC. Annual data collection focuses on residential and commercial activity, with residential data including sales data, rental rates, and building and demolition permits; commercial activity is measured through land sales, office supply, leasing data, building and demolition permits, and

[1] Telephone conversation with Karl Fromberg, ARC, February 26, 1991.

proposals for rezoning.[2] The methodology involves documenting annual changes and includes a land-use case study for the Brookhaven Station.

General Findings

According to the ARC study, high-density development, both public and private, occurred at or near the CBD and center city station areas. Most of the major development was multi-story and occurred within two blocks of a station, with several joint development projects having direct access to stations. Public and private developments completed since 1975 were documented for fourteen stations on all four lines—an example being Georgia's Twin Towers in the air rights over the Georgia State Station. Thus, certain station areas in the CBD and center city experienced and are continuing to experience high-density public and private development. There is some evidence of stabilization and improvement in neighborhoods along the East Line, which extends from the Five Points Terminal to the Perimeter Highway (Interstate 285).

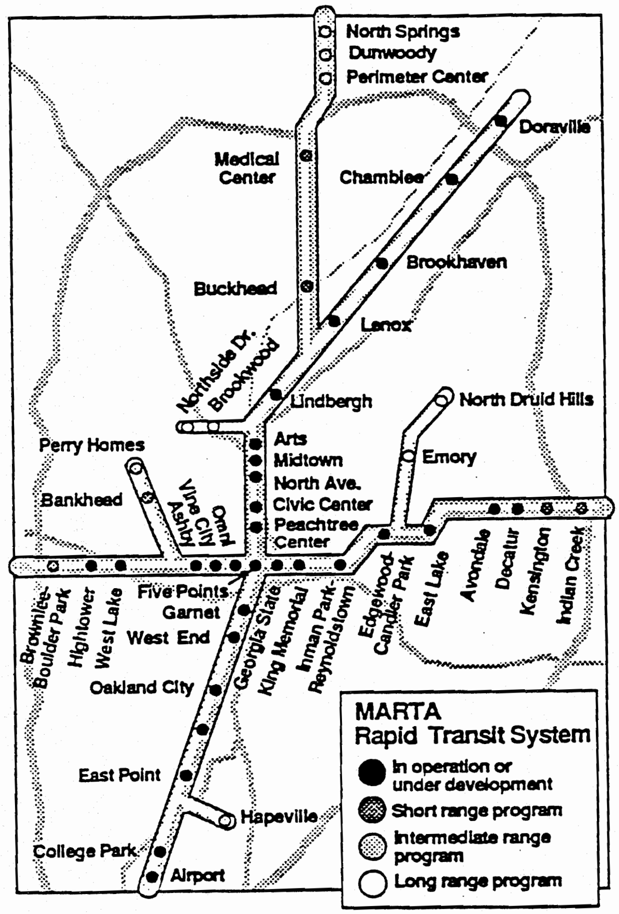

Figure 3.1. The MARTA System (Ref 7).

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[2]Atlanta Regional Commission, *Transit Impact Monitoring Program, Annual Report*, ARC, Atlanta, March 1983, p. 85.

WASHINGTON, D.C.

System Overview

The rapid rail system in Washington, D.C., known as METRO or Metrorail, is operated by Washington Metropolitan Area Transit Authority (WMATA). METRO, which initiated rail service in 1976, ultimately will have 103 miles of line and 87 stations. To date (1991), 77 stations and 89 miles have been completed. Figure 3.2 shows the layout of the Metrorail system.

Impact Study

Two documents were reviewed that measure before-and-after land use: *Trends before Metrorail* (July 1982) and *Metrorail Station Area Planning* (August 1983). Both studies were part of the "Metrorail Before-and-After Study Report" series and both were prepared by the Metropolitan Washington Council of Governments (MWCOG). *Trends before Metrorail* presents data from 1972 to 1976 on employment trends, retail sales, and housing activity in station areas to identify regional patterns and, hence, the market potential for Metrorail. *Metrorail Station Area Planning*, which evaluates land use changes through case studies in station area planning, examines 1982-1983 land use and zoning issues in great detail for 18 METRO stations (listed in Table 3.2). Joint development cases are particularly addressed.

TABLE 3.2. CASE STUDY STATIONS.

Anacostia	Ballston
Farrugut North	Court House
Farrugut West	King Street
Metro Center	Friendship Heights
Gallery Place	Silver Spring
Navy Yard	Addison Road
Rhode Island Avenue	New Carrollton
Takoma	Huntington
Rosslyn	Rockville

General Findings

According to the reports, changes in land use around the studied METRO stations resulted in mixed-use developments, with office space being the primary focus. High-density residential units have not been as common, the suburban communities preferring instead to develop the more profitable office projects. Unfortunately, most of the workers using these offices live outside the station area (they drive to work). Therefore, "such development would be unlikely to generate many additional transit users" (Ref 8). This is in contrast to office developments in the district, where there is high transit usage by suburban commuters.

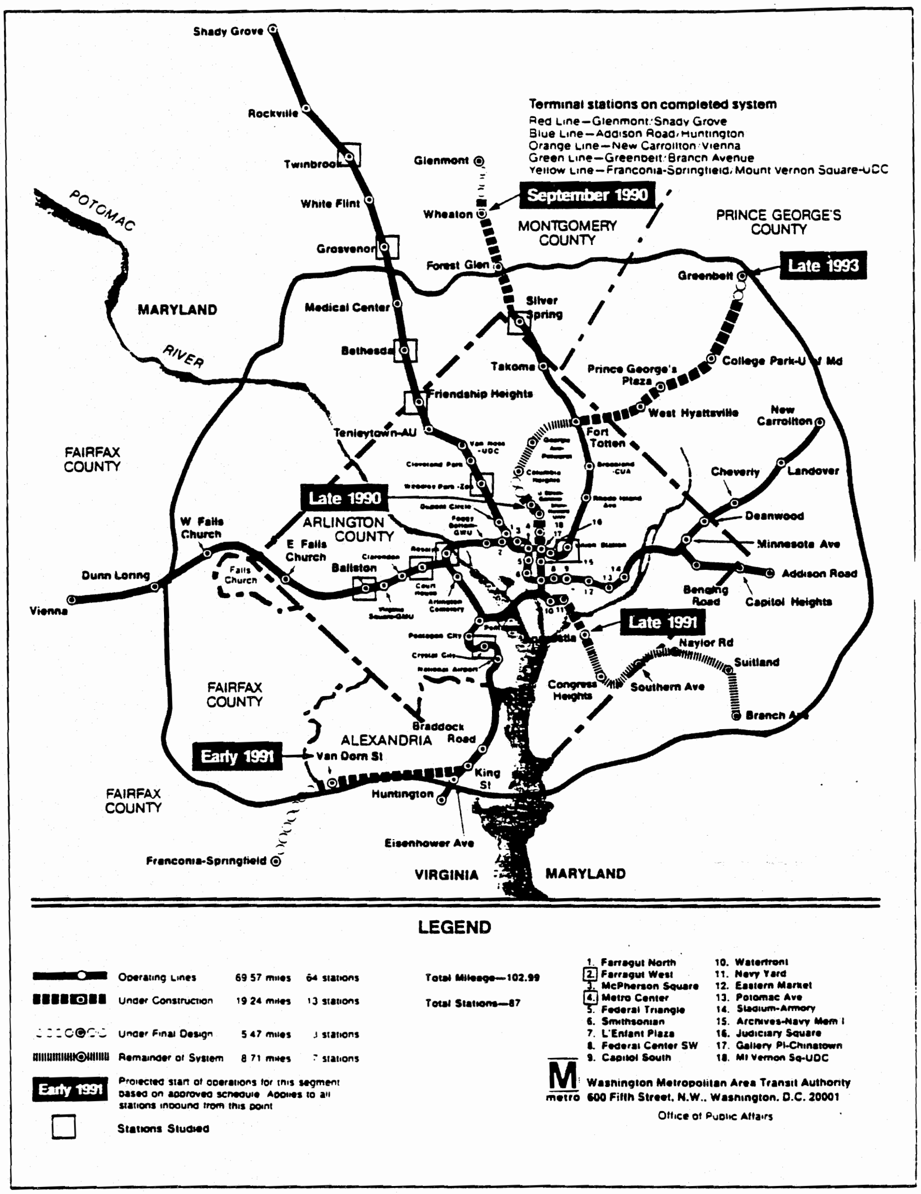

Figure 3.2. The Metrorail System (Ref 9).

SAN FRANCISCO BAY AREA

System Overview

The Bay Area Rapid Transit System (BART) is a 71-mile rail rapid transit system (20 subway miles, 24 elevated miles, and 27 ground-level miles). The 34 stations are scattered across San Francisco, Oakland, Berkeley, and other parts of the Bay Area. The system, illustrated in Figure 3.3, had a five-point phase-in of service between September 1972 and September 1974.

Impact Study

The BART Impact Program, conducted by the Metropolitan Transportation Commission, produced nine documents. Two documents that relate to land use impacts are *Land Use and Urban Development Impacts of BART* (April 1979) and *BART in the San Francisco Bay Area: Summary of the Final Report of the BART Impact Program* (December 1979). An "after" land use inventory was established by examining (1) aerial and street-level photographs of the station areas, (2) land use maps from various local planning offices, and (3) building permits. Three surveys were conducted: a household location survey, a downtown workers' survey, and a retail shoppers' survey.[3] For data collection, 1965 was used as the "before" year, 1975 as the "interim" year, and 1977 as the "after" year. The surveys, covering about a 3-year period, were conducted in the mid-1970s.[4]

General Findings

BART Impact Program researchers determined that, during the study period, BART exerted little influence on land use and development. Specifically, only 10 percent of new office development (mostly on San Francisco's Market Street) could be attributed to the transit system.[5] While access to BART was not a key factor in employer location decisions, it did influence, somewhat, workers' job decisions.[6] BART also had little effect on retailers' location decisions. Additionally, while BART did not generate much high-density residential development in station areas, it did effectively extend commuting distances. BART's influence on developer decisions was determined to be variable, showing no permanent influence on property values or rents.[7]

BART is one of many interacting forces that shape land use/land development decisions in the Bay area. At the time of the study, BART had its strongest impact at the local, or station area, level. BART has influenced redevelopment projects, zoning modifications, and some residential and commercial location decisions. BART has generally not induced development in blighted areas, but may have stabilized decentralization by improving access to center cities. Land uses were only moderately influenced by BART where demand, community support, and

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[3]Metropolitan Transportation Commission, *Land Use and Urban Development Impacts of BART*, BIP, San Francisco, April 1979, p. 20-21.

[4]Ibid., p. 20-21.

[5]Metropolitan Transportation Commission, *BART in the San Francisco Bay Area: Summary of the Final Report of the BART Impact Program*, BIP, San Francisco, December 1979, p. 13

[6]Ibid., p. 14.

[7]Ibid., p. 15.

public policy were favorable. Because changes in land use occur over a long period, it will be several years (from 1979) before BART's impact on land use and development can be determined.[8]

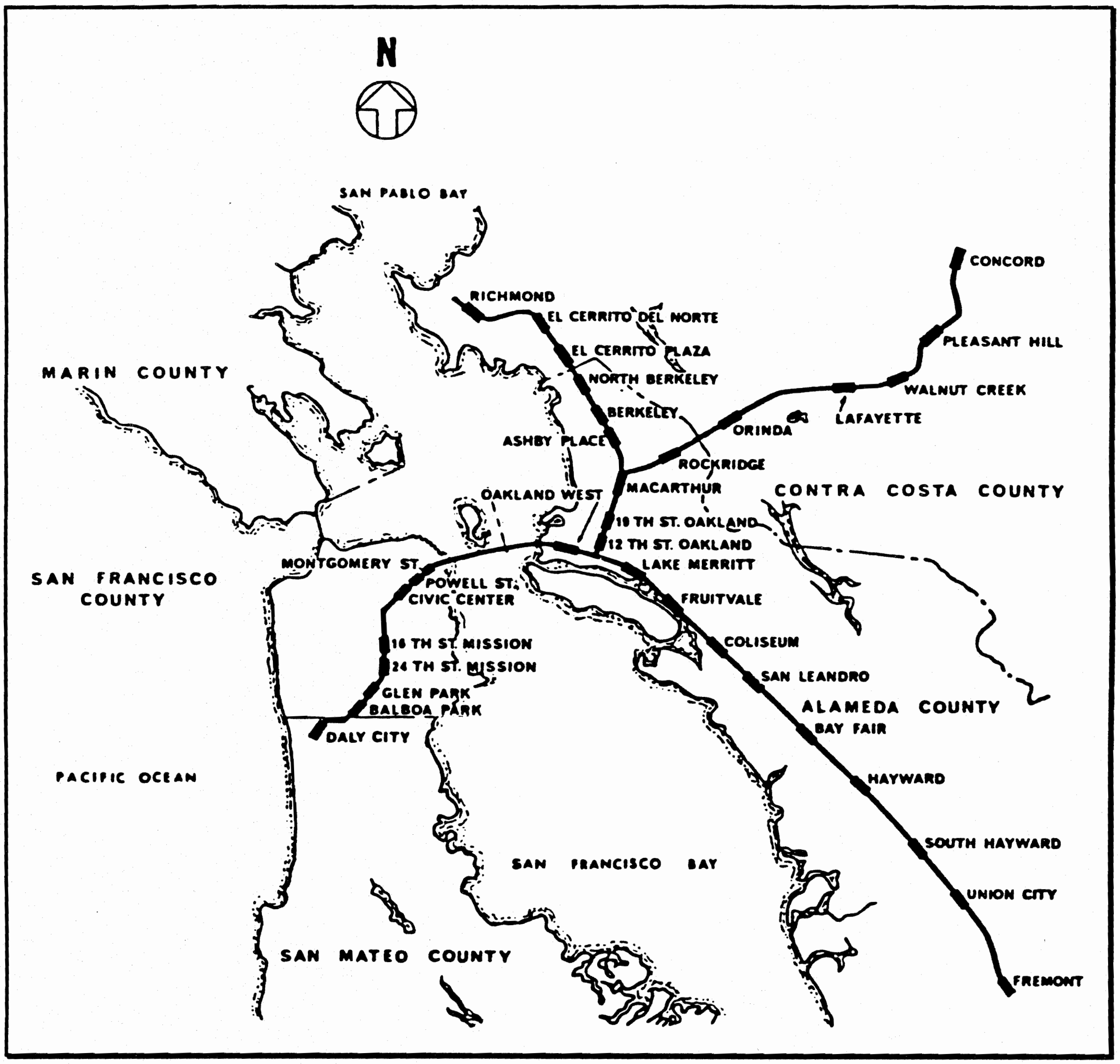

Figure 3.3. The BART System.

[8]Metropolitan Transportation Commission, *BART in the San Francisco Bay Area: Summary of the Final Report of the BART Impact Program*, BIP, San Francisco, December 1979, p. 16.

BOSTON

System Overview

Boston has an extensive multimodal (rapid rail transit [RRT], light rail transit [LRT], and bus) transit system operated by the Massachusetts Bay Transportation Authority (MBTA). The study of interest concerns only an extension of the Red Line (RRT) from Harvard Square to Alewife. This extension, completed in March 1985, is 3.2 miles long and has three stations: Porter Square, Davis Square, and Alewife (the rebuilding of the Harvard Square Station is also reviewed). The Red Line extension cuts through areas which, at the time, were undergoing major redevelopment. Figure 3.4 shows MBTA's rail system, with the dotted line indicating the Alewife extension.

Impact Study

The study, *Red Line Extension to Alewife: Before/After Study*, was completed by the Central Transportation Planning Staff of the Metropolitan Area Planning Council in December 1987.[9] The Alewife study categorized basic land use as industrial, retail and service, office, residential, and parking/open space. These categories varied slightly by station. The methodology, relatively straightforward, inventories land use changes within the transit station areas before (1978) and after (1986) the extension.

General Findings

The Alewife Station area experienced major land use changes and significant increases in land prices. The Davis Square and Porter Square Stations also saw favorable changes, but not to the extent of Alewife's. In sum, 1.4 million square feet of commercial space was added and another 2.5 million (1987) was planned with, interestingly, no discernible impact on housing prices.[10]

The Red Line extension was a contributing factor to the land use changes occurring near the three new stations. However, long-term demographic impacts of the Red Line extension will not be completely determined until 1990 census data are available, at which time another study is recommended.[11]

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[9]Borchelt, D. J., *Red Line Extension to Alewife: Before/After Study: Appendix A: Red Line Extension Land Use Study,* MAPC, Boston, December 1987, p. 1.

[10]Ibid., p. 13.

[11]Ibid., p. 6.

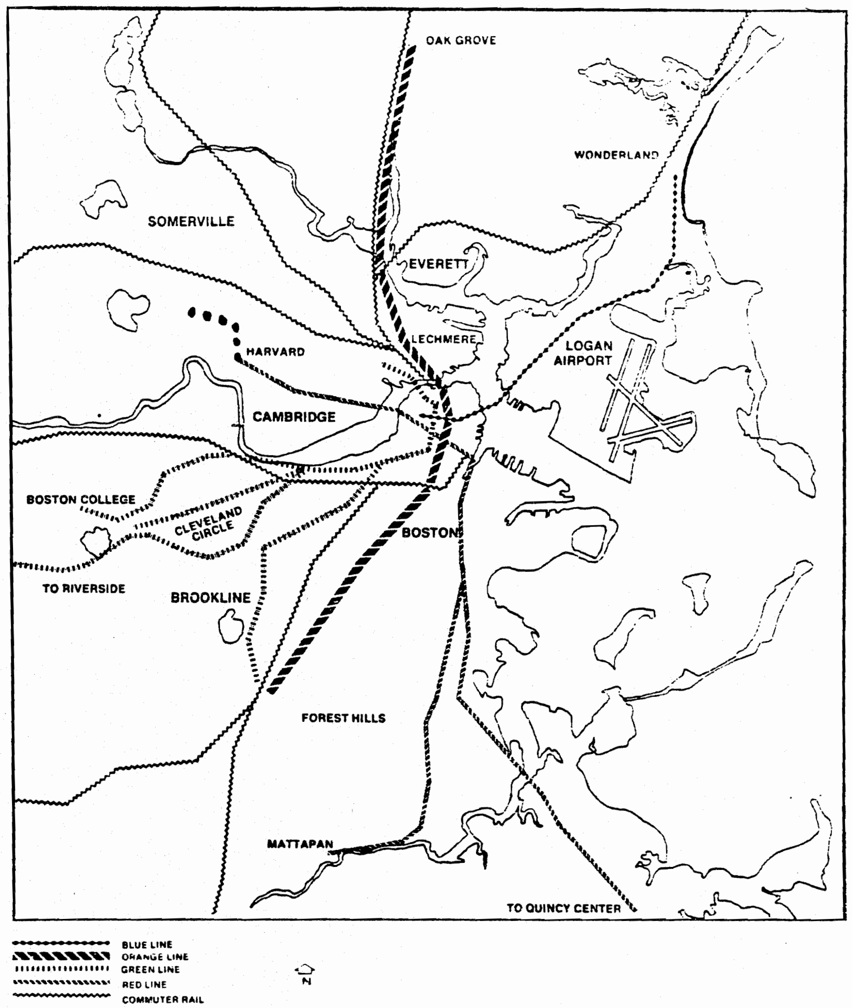

Figure 3.4. The MBTA Rail System (Ref 13).

SAN DIEGO

System Overview

The San Diego LRT system, known as the San Diego Trolley, began service in July 1981. The system currently consists of two lines totaling 38.8 miles and 34 stations. Figure 3.5 shows the layout of the San Diego Trolley system.

Impact Study

The impacts of the Trolley are summarized in two documents: *Trends Before the San Diego Trolley* (1982) and *San Diego Trolley: The First Three Years* (1984). Both studies, conducted by the San Diego Association of Governments (SANDAG), evaluate the first line of the system only. *Trends Before the San Diego Trolley* outlines basic land use categories (Table 3.3) and acreage used. *San Diego Trolley: The First Three Years* measures changes in these categories by cataloging building permits issued and zoning modifications made.

TABLE 3.3. LAND USE CATEGORIES FOR SAN DIEGO (REF 14).

- Residential
- Agriculture
- Manufacturing
- Federal Reservations
- Transportation Facilities
- Commercial
- Public/Institutional
- Water Areas
- Wildlands
- Recreational/Open Space

Again, the methodology in both reports is relatively straightforward. *Trends Before the San Diego Trolley* makes use of land inventories as well as business and windshield surveys. *San Diego Trolley: The First Three Years* measures development changes through building permits and through developer and merchant surveys. The entire study was divided into three phases:

Phase I: Study Area Inventory (1980-1981)
Phase II: Initial Operating Stage (1981-1982)
Phase III: Impact Evaluation (1982-1983)

Phase I is covered in *Trends Before the San Diego Trolley.* Phases II and III are reported in *San Diego Trolley: The First Three Years.*

General Findings

Figure 3.6 summarizes the changes in land use and development. Overall, the Trolley had a small impact on new construction. While it definitely provides a location advantage, it is not the sole determinant for new construction. Market forces are significantly more influential than the trolley in development. At the time of the study, local governments paid little attention to station area development (Ref 14).

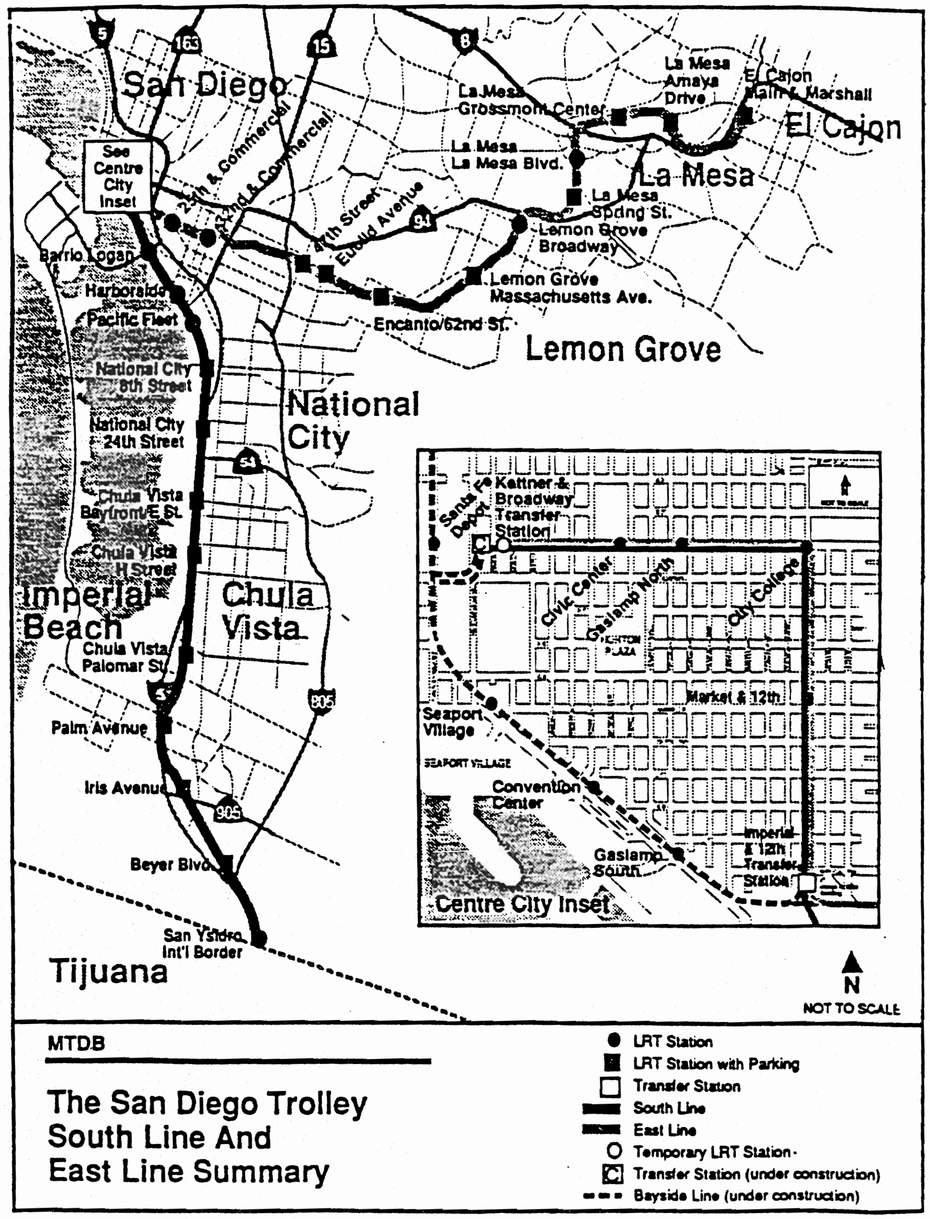

Figure 3.5. The San Diego Trolley (Ref 16).

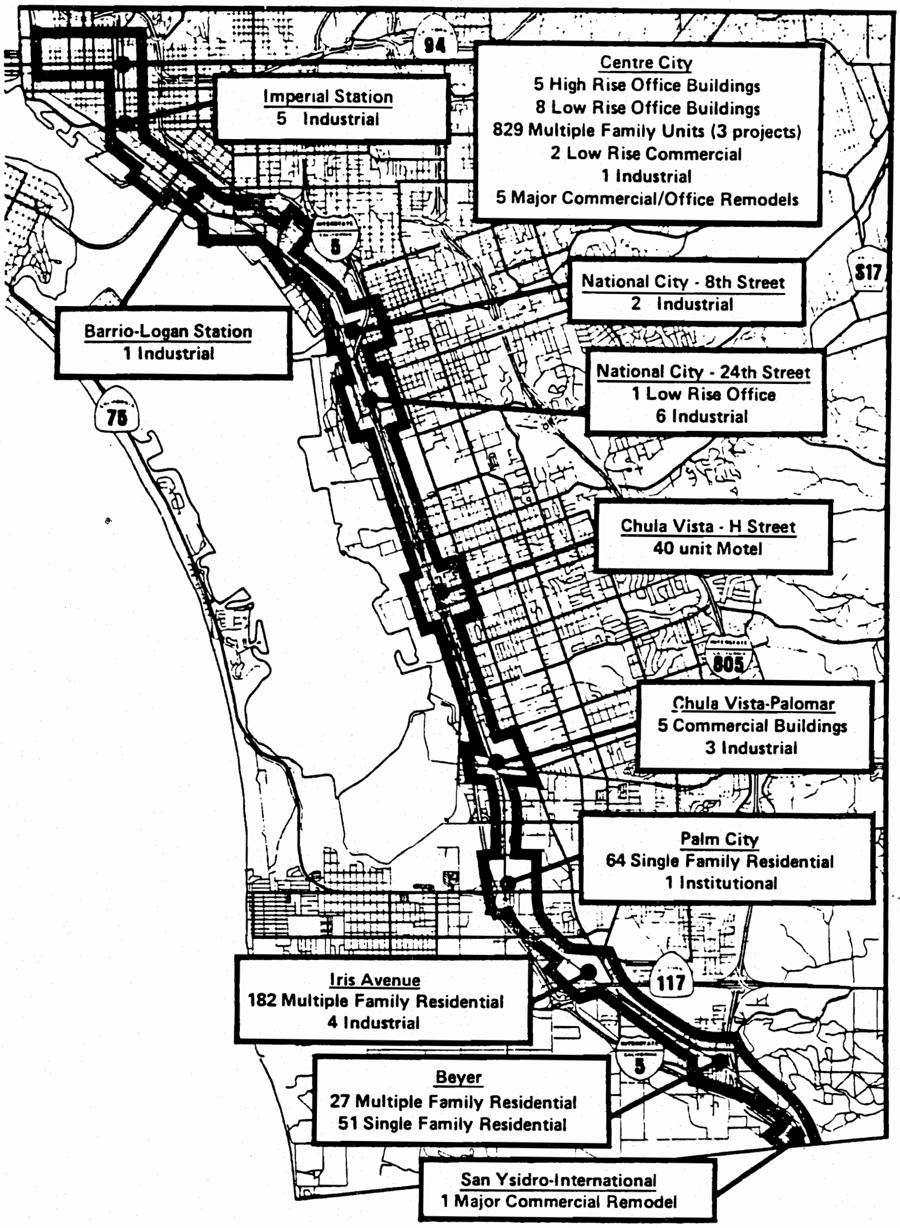

Figure 3.6. Building permits issued near station, 1980-1984 (Ref 15).

3.6 OTTAWA

System Overview

The Regional Municipality of Ottawa-Carleton has a Bus Rapid Transit (BRT) system operated by the Ottawa-Carleton Regional Transit Commission (OC Transpo). BRT service, which began in December 1983, currently consists of three lines totaling 20 kilometers (31 kilometers planned) and 14 stations (23 by 1994). Figure 3.7 shows the Ottawa transitway system.

Impact Study

Land use and development impacts are reviewed by the Planning Department, Policy and Programs Division, Regional Municipality of Ottawa-Carleton in the December 1990 edition of *Development in the Vicinity of Transitway Stations*. The report identifies the four basic land use categories shown in Table 3.4.

TABLE 3.4. LAND USE CATEGORIES FOR OTTAWA-CARLETON.

Major Institutional:	Secondary Schools Hospitals
Commercial/Office:	Office Retail Malls Strip Development
Residential:	Low Density Medium Density High Density
Industrial:	Manufacturing Warehousing Distribution of goods

The methodology in the report focuses on an inventory of land use changes within an 800-meter development envelope surrounding the transit station (the size of this enveloped was determined by the walk-access distance to each transit station). Participating municipalities received a "data collection package" for recording development within the envelope. Information on each of the land-use categories was collected annually to determine the magnitude of development over the previous year. The Central City, believed to be fully developed at this point, was excluded from the report.[12] The monitoring program is intended to be ongoing.

General Findings

This type of monitoring is geared toward providing recent "snapshots" of development. For this reason, pre-transitway data have been included for comparison. On the whole, there are an additional 260,000 square meters of institutional and commercial/office development and 1,305 square meters of residential space estimated at $270 million (Canadian). Overall, there are many positive indicators that the transitway stations are influencing development within the "envelopes."[13]

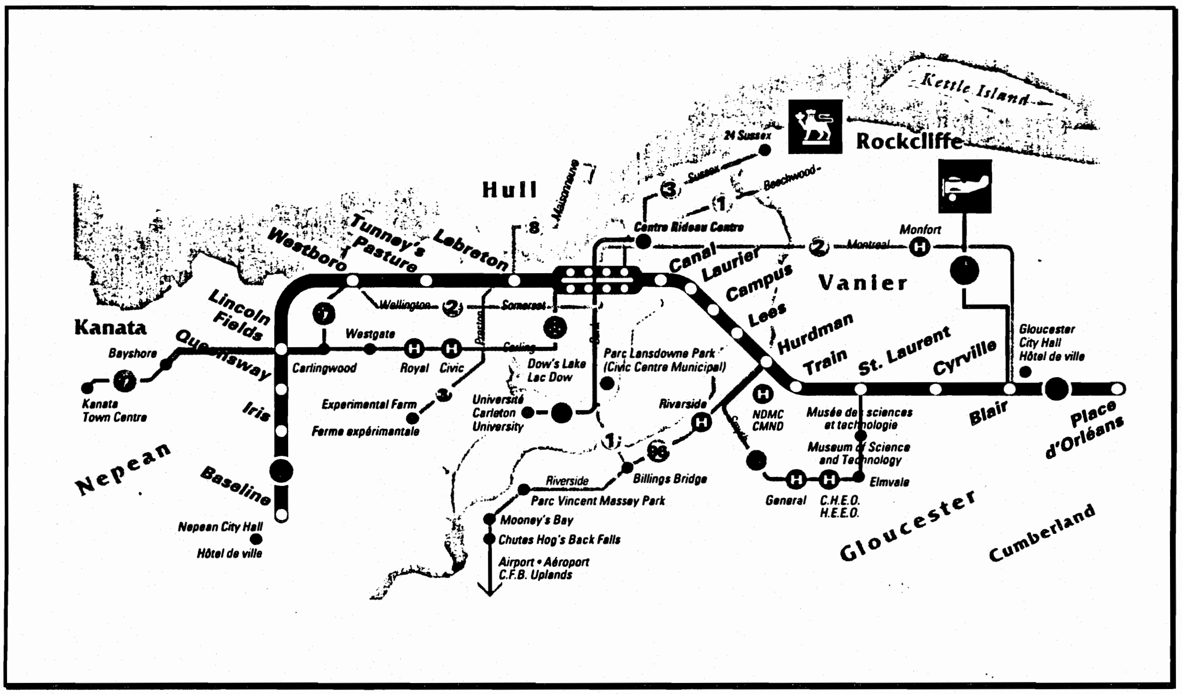

Figure 3.7. The Ottawa Transitway System (Ref 18).

HOUSTON

System Overview

Houston's Bus Rapid Transit (BRT) system consists of three transitways on the North, Gulf, and Katy Freeways, with other transitways on other freeways radiating from central Houston

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[12] Planning Department, Policy and Programs Division, Regional Municipality of Ottawa-Carleton, *Development in the Vicinity of Transitway Stations*, Ottawa, December 1990, p. 1-2.
[13] Planning Department, p. 7.

currently under construction or planned. Service on the first transitway was initiated in 1982. Figure 3.8 illustrates the Houston transitway system.

Impact Study

Land Use Impacts of the Houston Transitway System (8 volumes) reviewed land use and development impacts. The latest update was completed in February 1988 by the Texas Transportation Institute (TTI), Texas A&M University. Land use is categorized according to three basic areas: commercial, residential, and public/quasi-public. The report studies four transit centers: North Shepard Park-and-Ride, Aldine-Bender, Kuykendahl, and Spring. Data collection involved station-specific itemization of changes and 5-year aerial photography conducted by the Texas Department of Transportation (formerly the Texas State Department of Highways and Public Transportation). The monitoring is a semi-annual program.

General Findings

Volume 8F, a summary report, basically indicates that transitway development has had little effect on land use changes. However, it recommends that definite conclusions about land use impacts not be made until the system has "matured."[14]

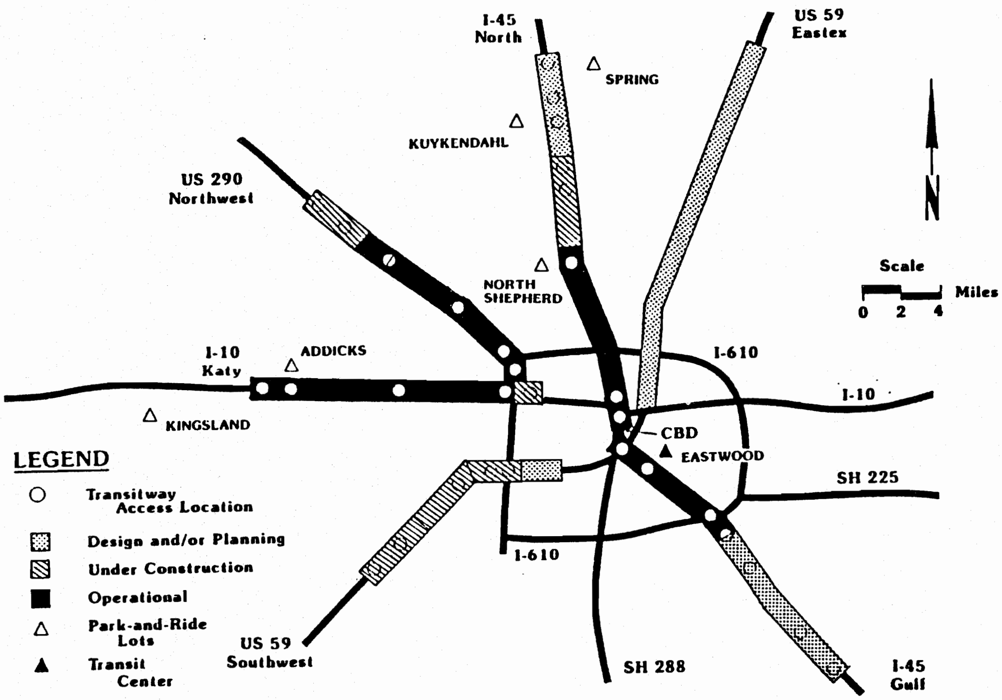

Figure 3.8. The Houston Transitway System (Ref 19).

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14 TTI, *Land Use Impacts of the Houston Transitway System: Summary Report*, TTI: College Station, TX, February 1988, p. 47.

COMPARISONS AMONG STUDIES

Table 3.5 compares the methodologies used in each land use impact study reviewed. "Yearly Monitoring" indicates that land use changes are documented annually during the life of the study. (The Ottawa study, in particular, has an excellent yearly monitoring program. The Atlanta study also monitored land use annually while its program was in operation.) "Phase Monitoring" indicates that land uses are studied during specific phases or "snapshots," typically with a "before-and-after" format. When specific stations were examined for land use changes, a "Case Study" format was used. (The Washington, D.C., and Houston studies are good examples of this approach.) "System Wide" implies all stations are examined, a methodology used by the Ottawa and San Diego studies. (The Atlanta study used both the case study and system-wide approach to examine different issues.) "Land Use Categorization" indicates that a few standardized land use categories are defined, providing an easy basis for station comparisons. (Ottawa, Boston, and Houston had the most generalized categories in their studies.) Finally, "Location Surveys" are used in three of the studies, including those undertaken for San Francisco and San Diego.

TABLE 3.5. STUDY METHODOLOGIES.

	Yearly Monitoring	Phase Monitoring	Case Studies	System Wide	Land Use Categorization	Location Surveys
Atlanta	•		•	•		
Washington, D.C.		•	•			
SF Bay Area		•	•		•	•
Boston		•	•		•	•
San Diego		•		•	•	•
Ottawa	•			•	•	
Houston		•	•		•	

CHAPTER 4. AN APPROACH FOR DART

The suggested approach to measuring the land use and development impacts of the DART starter line makes use of a "flexible framework" model. This model, based on "the most-information-at-least-cost" principle, is favored for its adaptability to changing land-use intensity.

The framework consists of fixed and flexible elements. The fixed elements do not change, regardless of the intensity of the measured impact. The flexible elements, on the other hand, can be modified to reflect changes in the significance of the impact. More informative and labor-intensive techniques can be employed if the impact is greater than anticipated. Likewise, if the impact is not as significant as predicted, a less informative and labor-intensive technique can replace the initial technique.

FIXED ELEMENTS

Timeframe

Data collection for the land use and development component of the DART impact study should occur during crucial "snapshots" in time, with a yearly monitoring effort included after the system has begun operation. The first time frame, termed "pre-rail," identifies the period extending from the date of initial study publication to the point when major construction commences. The "interim" timeframe will occur while the rail line is under construction, most likely in late 1993 or early 1994. Surveys would then be conducted at 5-year intervals following construction, with the yearly monitoring program commencing at system start-up (scheduled for 1996). Figure 4.1 outlines the timeframe and summarizes the data collection effort.

Study Area

Stations outside the CBD: The study area for land use and development impacts surrounds the rail station over a quarter-mile radius. This area, widely accepted in the transit industry as the zone of influence for a transit station, is considered the typical distance for walk-access to a station.[1] Beyond this distance, the likelihood of a rider accessing the station on foot diminishes rapidly. Residential impacts, however, extend beyond the quarter-mile radius, since location decisions may be determined by automobile-access to a park-and-ride facility.[2] This commuter area resembles a paraboloid approximately 7 miles long and 8 miles wide for Texas cities.[3]

Stations inside the CBD: The size of the study area for the Central Business District (CBD) is dependent on whether DART continues its downtown circulator (known as Hop-a-Bus). The light rail line would pass through a transit mall on Pacific and Bryan Streets. If the circulator is

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[1]Vuhic, V., *Urban Public Transportation: Systems and Technology*, Englewood Cliffs, NJ: Prentice-Hall, 1981, p.427.

[2]Metropolitan Transportation Commission, *BART in the San Francisco Bay Area: Summary of the Final Report of the BART Impact Program*, p. 15.

[3]Nungesser, L. G., and N. P. Ledbetter, *Procedures for Estimating Park-And-Ride Demand in Large Texas Cities*, TTI, College Station, February 1987, p. 24.

continued or improved, the quarter-mile rule will apply not only to the rail transit mall, but also to the circulator stops. Obviously this blankets the CBD. If the circulator is discontinued, only the rail transit mall station radii will be examined.

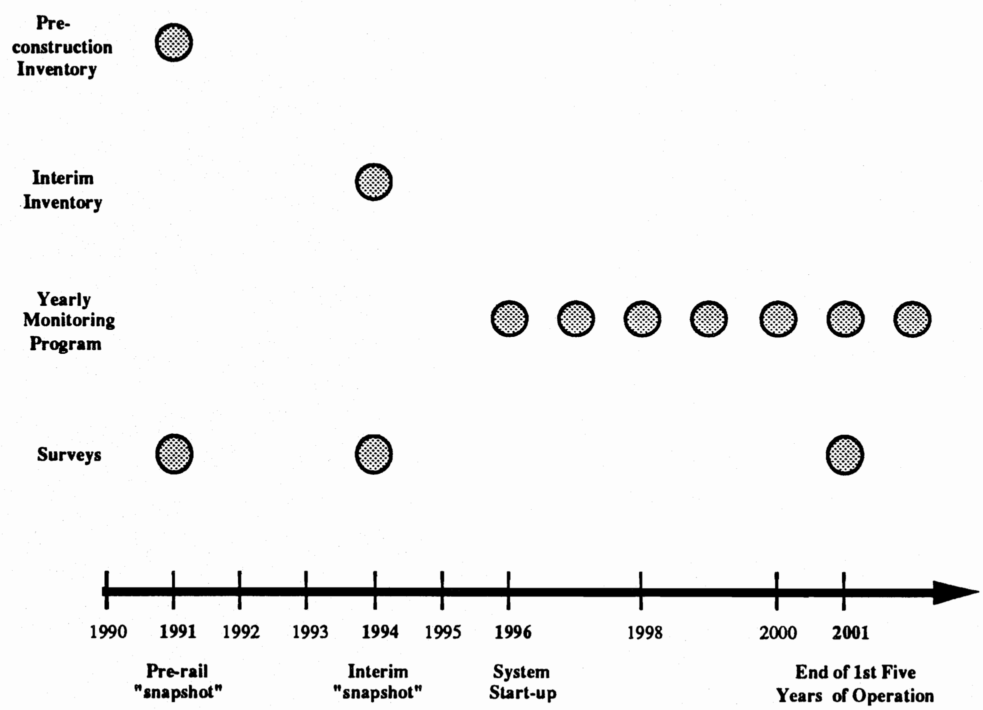

Figure 4.1. Project timeline.

Land Use and Development Inventories

Pre-construction and interim land use inventories, along with a yearly monitoring program, should be conducted over the entire study area. Land use data for these inventories can be collected by visual inspection, by land use maps, and by building permits obtained from the City Planning Office. These data can also be coordinated with regularly scheduled Texas Department of Transportation (TxDOT) flyovers.

Data for these inventories should be simple and broad. They should also be as uniform as possible, so as to allow not only comparisons among stations, but a chronological comparison of a single station as well. Suggested land-use data types, taken from the Houston and Ottawa experiences, include commercial/retail, office, major institutional, industrial, and residential.

A matrix database should be developed during the pre-construction inventory and added to during both the interim phase and the yearly monitoring program. In addition, a clarification of roles played by DART, the North Central Texas Council of Governments (NCTCOG), and the City

Planning Office is essential. A framework for intergovernmental coordination through a single lead agency is necessary to maintain an accurate database and a continuous program.

FLEXIBLE ELEMENTS

Survey Methodology

Six survey types commonly used in transit studies include: (1) the origin-destination (O-D) survey, (2) census journey-to-work (JTW) files, (3) the on-board transit survey, (4) the telephone survey, (5) the mailout survey, and (6) the windshield survey. The first three methods are general procedures used to identify travel patterns, while the last three methods can be tailored to meet specific informational needs.

Origin-destination surveys could provide information on the travel patterns of DART patrons. Land use changes might be inferred from the changes in travel patterns over time as the DART system begins operation. This is, however, a labor-intensive and indirect method for measuring land use changes. Journey-to-work data from the 1990 census can provide demographic, economic, housing, and geographic (place of work, place of residence) information about DART patrons living within specific census tracts. While not as labor-intensive, the use of census data is still an indirect method for measuring land use changes. An on-board transit survey could directly measure patrons' residential and commercial location decisions. This method, while less labor-intensive than the O-D survey, presents problems in its coordination and duplication of results. Also, with a surveyor actually on board the transit vehicle, there is the risk of biasing data.[4]

Telephone surveys, which can also be used to measure location decisions, generally have a high response rate and quick turn-around time. Unfortunately, this method is costly and labor intensive. Mailout surveys are less expensive than telephone surveys in that mailouts essentially replace labor costs with postage costs. However, response time is obviously slower and the response rate can vary.

Another disadvantage to both the telephone survey and the mailout survey is that they require costly market analyses to determine survey targets.[5] One way to avoid this expenditure is to perform (as the San Diego study did) a windshield survey in which the same package used in a mailout survey is placed on the windshield of a vehicle parked in a park-and-ride lot. But while this method is extremely cost-effective, response time and rate can vary.

Table 4.1 summarizes the advantages (+) and disadvantages (-) of the survey types. The "Cost" column includes everything except labor, which was separated so that labor intensiveness could be compared. "Response" indicates past experience regarding the percentage of responses to the survey. "Data Quality" refers to how direct the survey data are in measuring land use changes. Finally, "Analysis" quantifies the time and effort required to assemble the data into the desired land use information.

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[4]Washington, E. J., and R. W. Stokes, *Planning Guidelines for Suburban Transit Services*, Final Report, TTI, College Station, August 1988, p. 24-35.
[5]Ibid.

TABLE 4.1. METHOD ADVANTAGES AND DISADVANTAGES (REF 21).

Method	Cost	Labor	Response	Data Quality	Analysis
O-D	-	-	+	-	-
Census JTW	+	+	+	-	-
On-Board	+	-	+	-	-
Telephone	-	-	+	+	+
Mailout	+	+	?	+	+
Windshield	+	+	?	+	+

The question marks under "Response" for the mailout and windshield surveys indicate the potential variability in response for these methods. The following steps can increase the response rate and/or measure non-response bias:

(1) Use an "official" cover letter that legitimizes the survey, assures anonymity, urges a prompt reply, and thanks the respondent for his or her cooperation.

(2) Include a business-reply envelope.

(3) Send a follow-up mailing to non-respondents. (This may not be possible with a windshield survey.)

(4) Make the questionnaire comprehensible by using a multiple-choice format, if possible.

(5) Use available socioeconomic data to compare respondents with non-respondents (and locate possible bias in the data).

(6) Funding permitting, conduct personal interviews with a sample of non- respondents.[6]

The mailout and windshield surveys are recommended for their modest cost and ease of implementation. The mailout surveys should be used in situations where predicted impacts are great (i.e., in the station areas) and should be coupled with personal interviews (with a sampling of non-respondents to remove bias in the data). The windshield survey should be employed in situations where minimal information is needed, the predicted impact is low, and the sample's geographic area is large. If the actual impact is higher than expected, a mailout survey can then be conducted to ensure an accurate response.

Location Decision Surveys

Location decision surveys are used to (1) confirm measured changes in the land use inventory and (2) measure impacts in the study area. This information is obtained by asking

[6]Washington, E. J., and R. W. Stokes, p. 24-35.

individuals if DART's proximity influenced their business or residence location decision. Because they are relatively inexpensive, these surveys can be used extensively.

The types of surveys used should match the land use data types—that is, the survey should be specific to a business, a residence, or to a parking facility. Surveys should also be conducted at the pre-rail, interim, and 5-year-interval time periods (a time sufficient to allow for a change in public perception). Finally, surveys should be conducted only at stations where the data type applies. For example, a residential commuter survey would be conducted at a suburban park-and-ride, not at a CBD station (since commuters parking at CBD locations are unlikely to be DART patrons).

The station area location survey will determine whether the proximity of the DART light rail line influences an owner's decision to locate. Since the anticipated impacts within the station area (covering a quarter-mile radius) are relatively high, the mailout survey will be employed initially. Thus, every new resident, public institution, and commercial establishment in the study area will be mailed a survey card. Recruiting a local real estate agent may facilitate this task.

The station extra-area location survey will capture the residential location decisions of those commuters residing outside the station impact area. While these DART patrons reside beyond the walk-access of a station, they may still have chosen their residential location based on relative proximity to the DART light rail line (these commuters travel to park-and-ride stations by private vehicle). For purposes of measuring location decisions, the number of commuters arriving in Dallas by feeder bus is relatively small.

Both the BART impact program and the MBTA Red Line extension study examined residential locational decisions within this watershed. In looking at watershed residential locational decisions at Walnut Creek Station, BART researchers found only 5 percent of new residents there claimed BART influenced their decision.[7] The MBTA study reported that 8 percent of new users of the Alewife Station garage relocated their housing.[8]

Given the modest impact of watershed residential location decisions on these two rapid rail systems (and the automobile-oriented nature of Dallas), we predict the impact will be small. Accordingly, a windshield survey would be initially employed at all the park-and-ride locations along the starter line. A card asking commuters for their residential address (but not their identity) would be placed on vehicle windshields. Commuters would also be asked how influential the DART line was in their decision to locate in the area. If the impact is greater than predicted, a follow-up mailout survey can be conducted.

Parking Management and Land Use

Parking management attempts to alter the supply, demand, or operation of a parking system in a jurisdiction in order to help achieve transportation, environmental, or economic goals. Factors influencing parking demand include land uses, density of surrounding development, price of parking, parking availability, and transit service. There are five general parking

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[7]Metropolitan Transportation Commission, *Land Use and Urban Development Impacts of BART*, p.51.

[8]Quackenbush, K. H., et al., *Red Line Extension to Alewife: Before/After Study,* MAPC, Boston, December 1987, p. 26.

management techniques: (1) controlling the on-street parking supply, (2) controlling the off-street supply, (3) pricing, (4) fringe parking, and (5) enforcement. Cities with rail transit systems (e.g., Washington, D.C., San Francisco, and Portland) all have parking management plans.[9] The benefits of parking management in a CBD include more efficient and aesthetic use of space, reduced road maintenance costs, increased transit ridership, and improved air quality.

The first step in adopting a parking management plan is determining the public's willingness to accept changes in parking in the Dallas CBD. Following a preliminary windshield survey in all major parking facilities in the Dallas CBD, a user survey and an employers' survey should be conducted to gauge public support for such changes. The user survey could, for example, determine at what point parking becomes too expensive for the motorist. In other words, at what point will the motorist, faced with increased parking costs, switch to DART trains to get to work? An answer to this question will establish a threshold value for parking pricing.

An employers' survey would attempt to locate employers willing to implement parking management by encouraging their employees to use DART. A mailout survey would be appropriate initially.

These surveys are important because they define a potential market for DART if parking policies and space reductions can be coordinated with Dallas planners. The city can then use for other purposes the space previously used for parking. Given the reduction in parking, the new land uses would be compatible with the transit mode. These surveys should follow the same timeframe as that followed by the location surveys (refer to Figure 4.1). In addition, these surveys, while geared primarily toward the CBD, may be employed in non-CBD study areas where parking is plentiful.

Using the Framework

Figure 4.2 shows the "flexible framework" model. The techniques identified in this model can vary from the windshield survey to an annual monitoring program (not to be confused with the fixed yearly monitoring program), depending on the significance of the impact. The station extra-area location survey is presented as an example. Initially, a windshield survey would be used for all station areas. If the impact on residential development in the commuter watershed proved greater than initially anticipated, then the monitoring would be expanded to include a mailout survey or even a yearly monitoring program. Thus the methodology would be iterative and re-evaluated at the end of each timeframe (see Figure 4.1). Given the limited scope of this project and the uncertainty of land use changes over time, it is difficult to identify station areas that warrant a case study. A case study is possible, but only after results of the yearly monitoring program indicate that one may be necessary. Table 4.2 lists the recommended flexible elements for the first methodology iteration.

[9]Seattle METRO, *Encouraging Public Transportation Through Effective Land Use Actions*, Seattle, May 1987, p. 51-53.

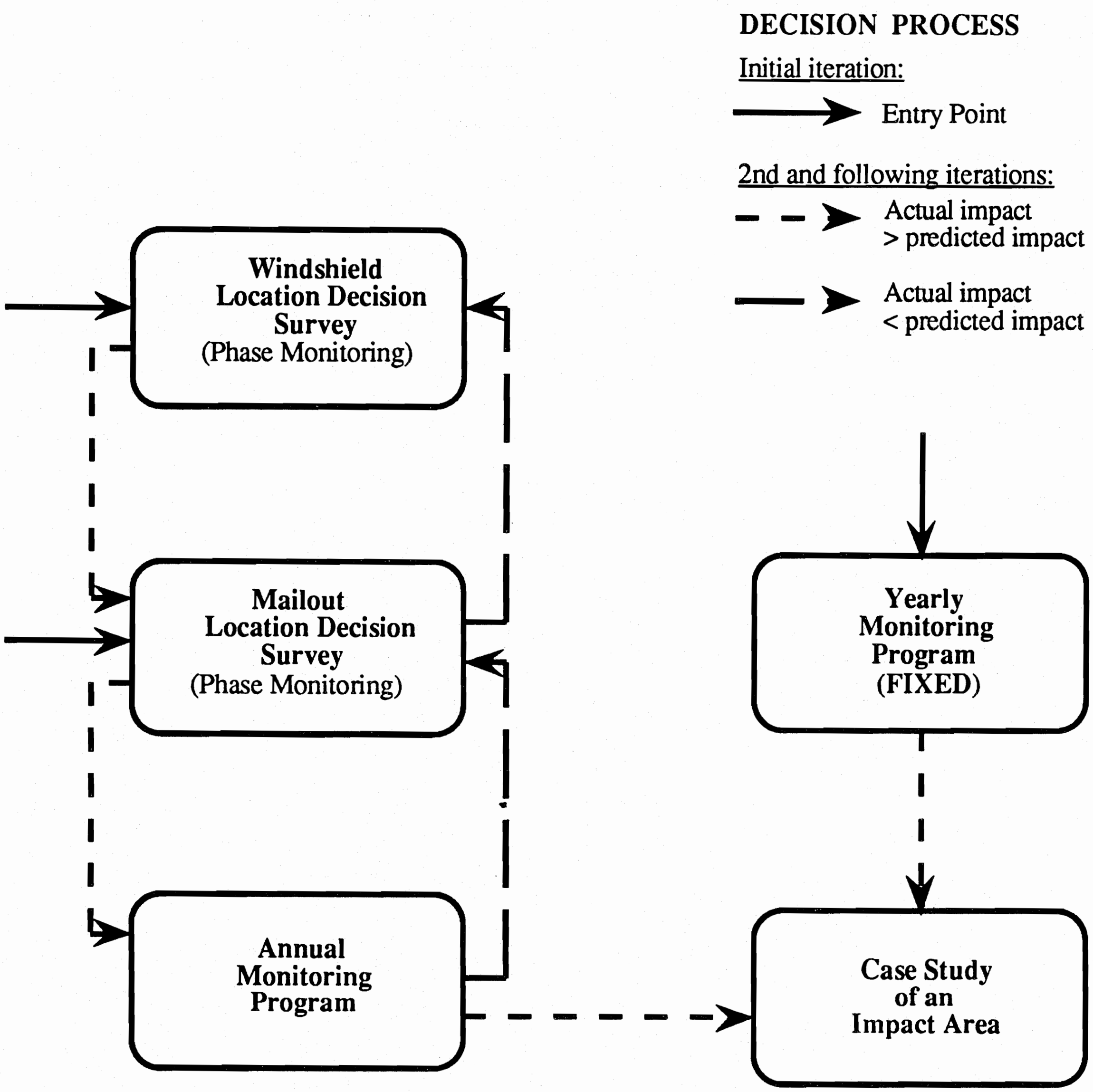

Figure 4.2. The Flexible Framework Model.

TABLE 4.2. FLEXIBLE ELEMENTS OF THE DALLAS FRAMEWORK.

	Initial Survey Iteration			
	Location Decision		Parking Management/Land Use	
Station	Area	Extra-Area	Employer	User
North Central				
Park Lane	M	W		
Lovers Lane	M	W		
Mockingbird	M	W		
Cityplace	M		M	W
CBD				
Bryan/Harwood	M		M	W
Pacific/Field	M		M	W
Pacific/Lamar	M		M	W
Union Station	M		M	W
Convention Center	M		M	W
South Oak Cliff				
Corinth	M			
Morrell	M			
Illinois	M	W		
Kiest	M		M	W
VA Hospital	M		M	W
Ledbetter	M	W		
Camp Wisdom	M	W		
West Oak Cliff				
Zoo	M		M	W
Tyler/Vernon	M			
Hampton	M			
Westmoreland	M	W		

Note: M = Mailout survey
W = Windshield survey

CHAPTER 5. CONCLUSIONS

COMPARISON WITH OTHER IMPACT STUDIES

As outlined in Chapter 4, the land use component of the DART impact study should consist of a series of inventories and surveys. Within the defined station area (a quarter-mile radius), a yearly monitoring program (following an initial land use inventory) would evaluate changes in land use. Location surveys would then determine the relationship of these changes to the DART starter line. Outside the station areas, a location survey at park-and-rides will determine the impact of residential decisions. Finally, a commuter and employer opinion survey would be conducted to provide information for future implementation of a parking management program for the Dallas CBD. All such surveys would occur at critical "snapshots" in time; that is, they would be conducted during system construction, at start-up, and at 5-year intervals thereafter.

Table 5.1 compares the proposed land use component of the DART impact study with the studies reviewed in Chapter 3. As can be seen, the DART study would include more components than any of the other studies reviewed. Because the components of the DART study were selected by the "most-information-at-least-cost" principle, case studies are not part of the initial DART impact study. Given the limited scope of this project and the uncertainty of land use changes over time, it is difficult to identify those station areas that warrant a case study. The information provided in this initial land use study could, however, serve as a basis for future case study analysis, if desired.

TABLE 5.1. COMPARISON WITH OTHER IMPACT STUDIES.

	Yearly Monitoring	Phase Monitoring	Case Studies	System Wide	Land Use Categorization	Location Surveys
Dallas	•	•		•	•	•
Atlanta	•		•	•		
Washington, D.C.		•	•			
SF Bay Area		•	•		•	•
Boston		•	•		•	•
San Diego		•		•	•	•
Ottawa	•			•	•	
Houston		•	•		•	

LAND USE AND DART'S SUCCESS

Whether the DART starter system is capable of fostering economic development through more productive use of land is a difficult and complex question to answer. Many factors will influence its ultimate success: Interagency coordination, for example, will be an important element; how public/private opportunities are promoted will be another. Other variables range from the concrete (ridership, on-time performance, operating efficiency) to the abstract (civic pride, "world-class-city" status, desirable urban form, etc.). And even if all variables are identified, the answer to the land use and development question, undoubtedly, will be interpreted in many ways. This study is designed to evaluate reasonably predicted land use impacts based on other systems' experiences. Because hindsight is 20/20, periodic analysis and review are essential.

The DART starter line's success will depend in part on its ability to attract new riders away from automobiles. One way to achieve this is by establishing park-and-ride lots at outlying stations. (Given the current congestion of the Dallas freeway system, it should not be difficult to persuade automobile users to make use of this service.) Another approach is to promote, in the station areas, development that will enhance ridership, since automobile use is restrained and transit use encouraged with high-density urban development. Yet high-density development has two elements: a significant CBD and high residential densities. A significant CBD exists in Dallas, but whether high-density residential development occurs remains to be seen. With some modification, development that occurs at major freeway interchanges (i.e., shopping malls, apartments, hotels, office towers) can fit within the quarter-mile radius of a DART station. The goal is to create "transit-sensitive" developments. A mechanism for reaching this goal is joint development.

Transit-sensitive Development

A transit-sensitive development should include the following components:

(1) a location within an existing developed area;

(2) medium-to-high-intensity site use;

(3) proximity to a transit station (ideally within 1/4 mile);

(4) the ability to generate off-peak (other than midday and evening) ridership, if possible (a shopping center is an example);

(5) the ability to generate transit trips (e.g., through office buildings, high-intensity commercial uses, and medium-to-high-density residential uses);

(6) integration into the transit route (i.e., street, rail line);[1] and

(7) minimum parking (within local requirements).[2]

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[1] Parking should not separate the transit facility from the development. Direct access to transit should be provided.

[2] Seattle METRO, p. 29.

Figure 5.1 compares two shopping centers. One (Figure 5.1a) is the conventional plan, with parking in the front and where customers walk across several rows of parking to reach the transit station. Because this scheme offers no incentive for the customer to use transit, it is not considered a transit-sensitive development. The second plan (Figure 5.1b), in which the transit station is located in the shopping center, makes a transit trip more attractive to the customer. Parking is still provided, though to a lesser extent.

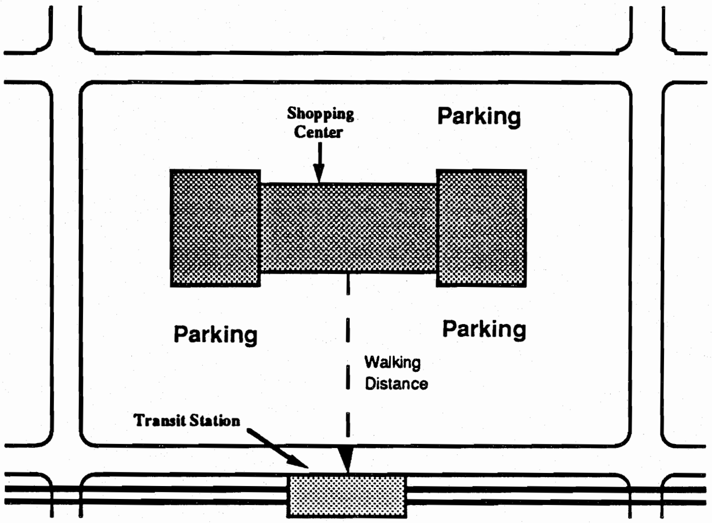

Figure 5.1a. Conventional development.

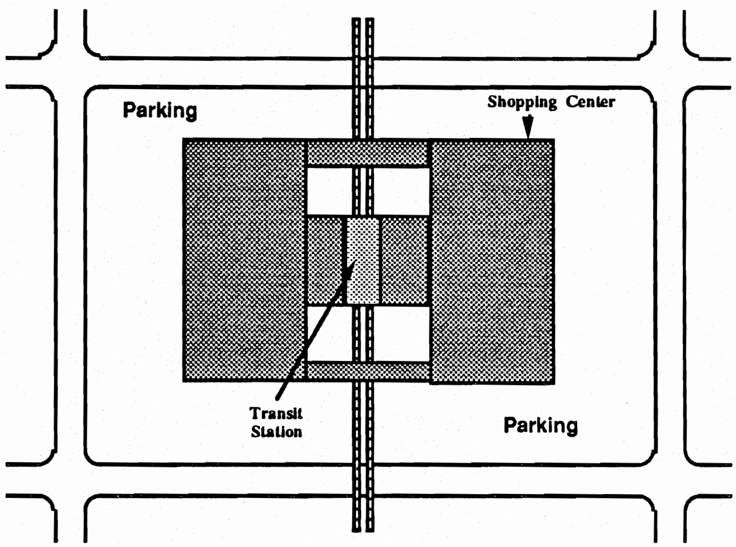

Figure 5.1b. Transit-sensitive development.

Joint Development

The Urban Land Institute defines joint development as "real estate development that is directly related to the location and operation of public transportation station facilities."[3] Joint development projects typically include some sort of direct access to the transit station, such as skyway or underground passageways. Both public and private sectors benefit from a joint development project through:

(1) increased economic development in a community;
(2) increased return on investment realized by the developer;
(3) increased transit ridership;
(4) a partial recovery of capital costs for the transit system; and
(5) enhanced urban design and growth.[4]

A successful joint development requires close cooperation—and contractual agreements—between all parties concerned. Joint development policies cover four main areas:

(1) land use planning and zoning coordination;
(2) access and station location considerations;
(3) acquisition of land and transfer policies; and
(4) institutional powers and arrangements.[5]

Decisions made regarding these issues significantly affect the outcome of both the development and the transit system. Thus, these issues should be addressed early in the planning stages.

In a joint development scheme, each party in the venture has specific interests. The developer desires a project that reasonably amortizes the capital investment, provides a return on equity investment, and assures the lender of loan repayment. Generally, the public sector wants development that increases transit ridership, provides some capital cost recovery, and boosts the local economy.[6]

Given these policies and interests, planners seeking a successful project should follow the following guidelines:

(1) evaluate property potential prior to transit system use;
(2) determine the feasibility of using property for transit based on standard practices in the real estate industry;
(3) structure the roles, commitments, and private sector incentives on site-specific market conditions;
(4) clearly define and administer roles and commitments; and

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[3]Urban Land Institute, p. 21.
[4]Ibid., p. 1.
[5]Ibid., p. 6.
[6]Ibid., p. 10.

(5) distribute risk fairly among the concerned parties.[7]

Figure 5.2 illustrates a joint development project of WMATA (Washington, D.C., Metro) and Miller/Connecticut Associates. The project, located at 1101 Connecticut Avenue, is a retail and office development having direct, below-grade access to Metro's Farrugut North Station. The knockout panels allow access to the building through the station mezzanine and provide two basement-level retail floors. The total cost to the private sector was $12 million (1979). WMATA incurred no additional cost other than the transit station, which was already planned and programmed.[8]

CONCLUSION

For the past 20 years, government and business have demonstrated a commitment to rebuilding and sustaining U.S. urban areas, with encouraging examples found in Denver, Portland, Seattle, and in Washington, D.C. DART should move quickly to capitalize on the accessibility advantage it will soon offer Dallas. Transit-sensitive development realized through joint development techniques is one way for DART to ensure success. The framework outlined in this document provides a strategy and a schedule for measuring changes in land use and development in the Dallas area.

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[7] Ibid., p. 15.
[8] Ibid., p. 70-71.

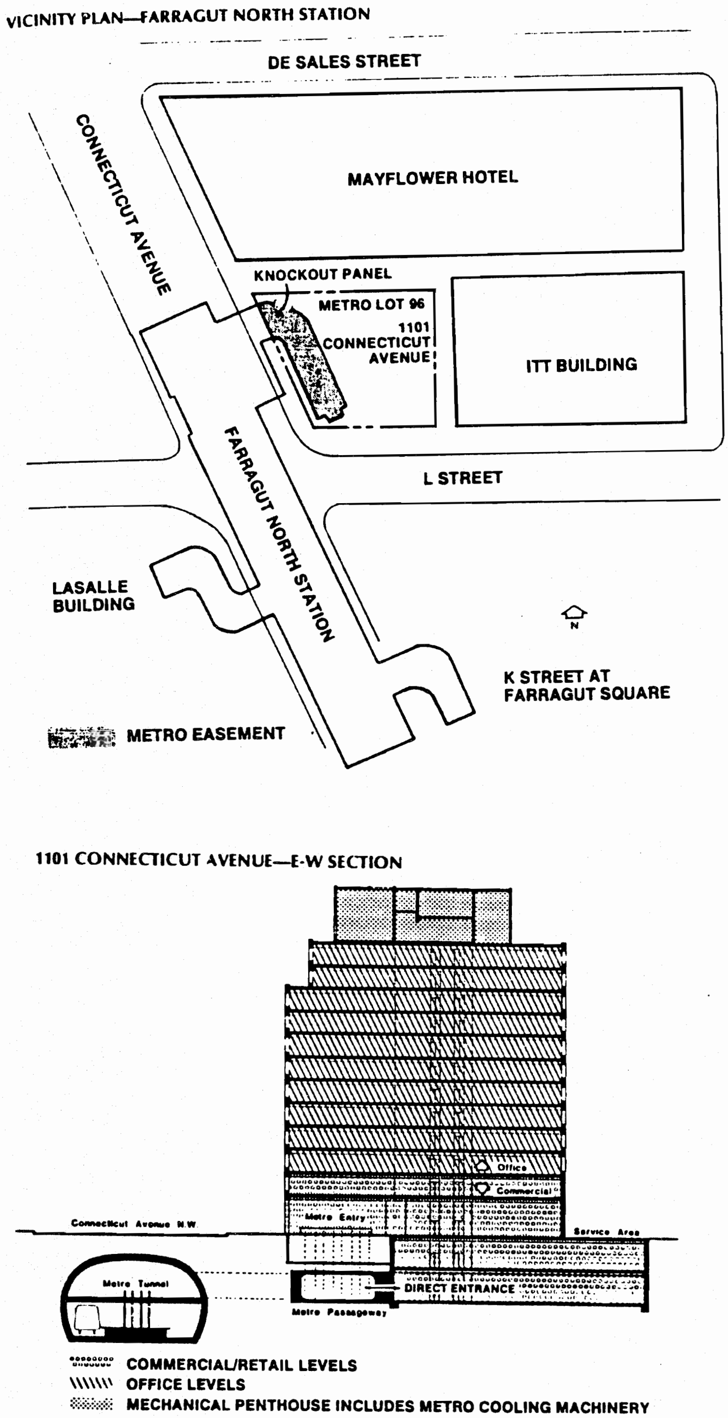

Figure 5.2. Layout of 1101 Connecticut Avenue, Washington, D.C. (Ref 13).

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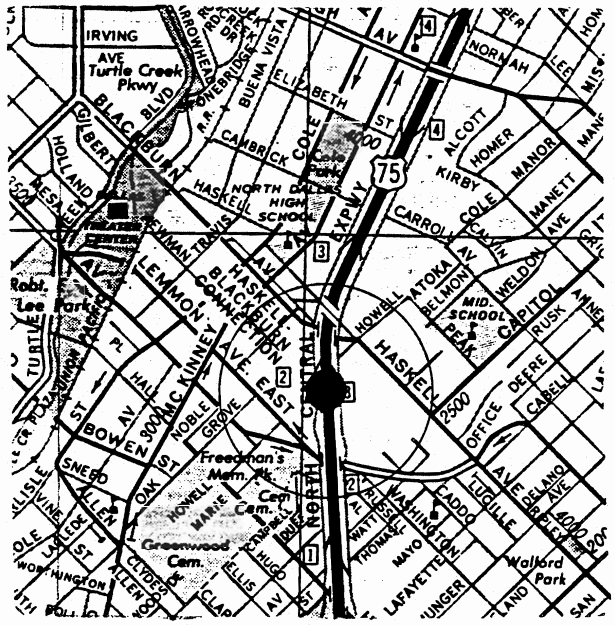
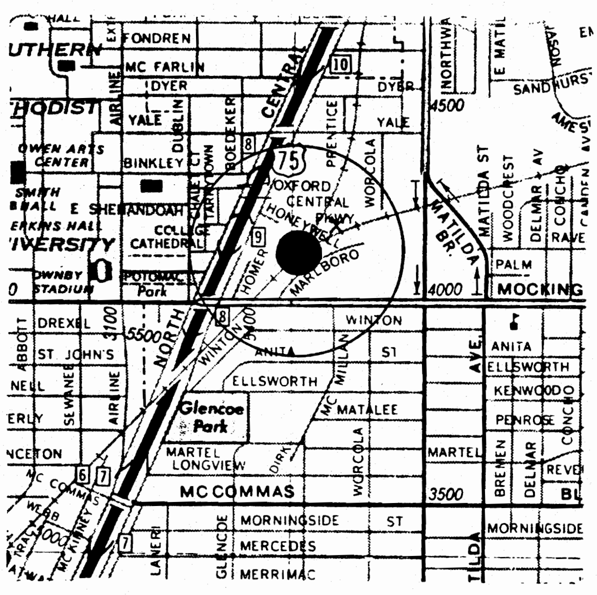
Appendix: Station Area Maps

North Central Corridor

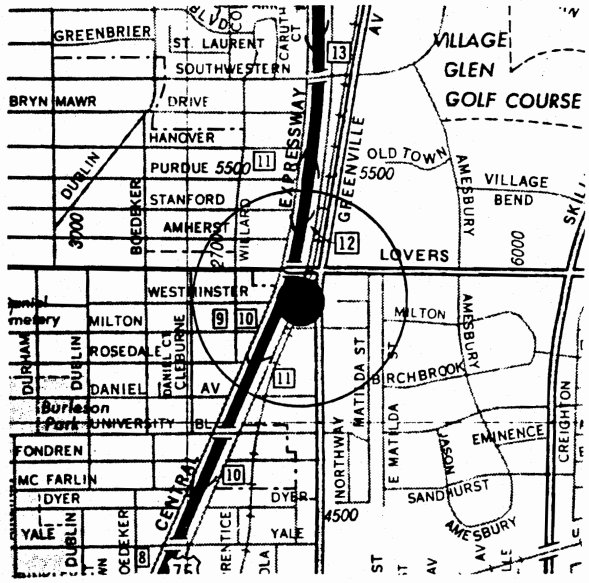
Dot indicates approximate station location
Circle indicates 1/4 mile radius



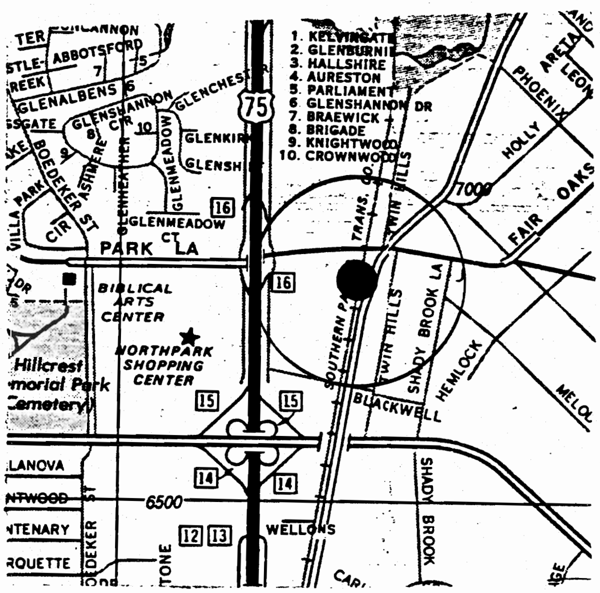
Cityplace Station Area



Mockingbird Station Area



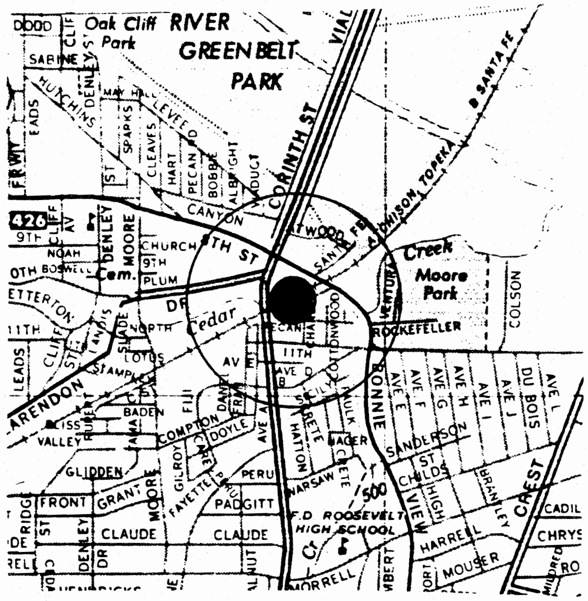
Lovers Lane Station Area



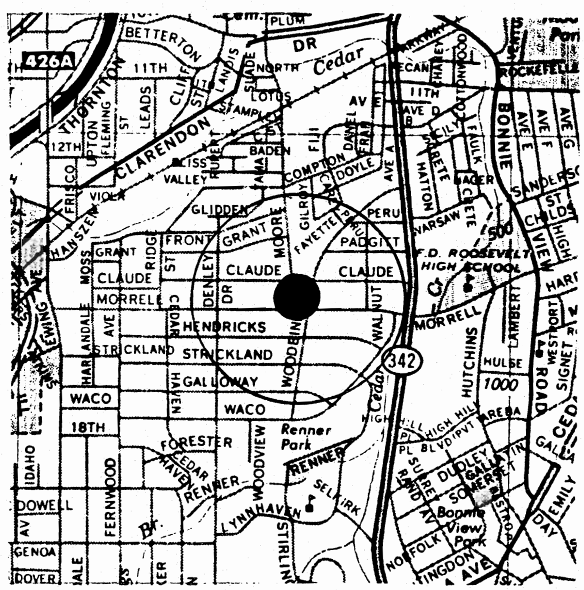
Park Lane Station Area

South Oak Cliff Corridor

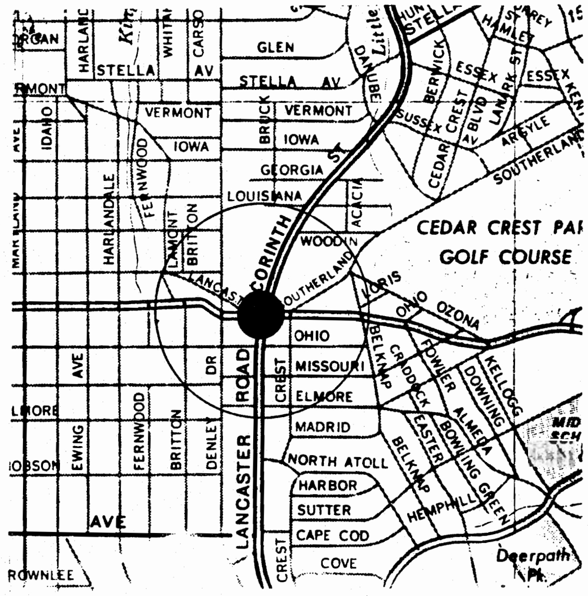
Dot indicates approximate station location
Circle indicates 1/4 mile radius



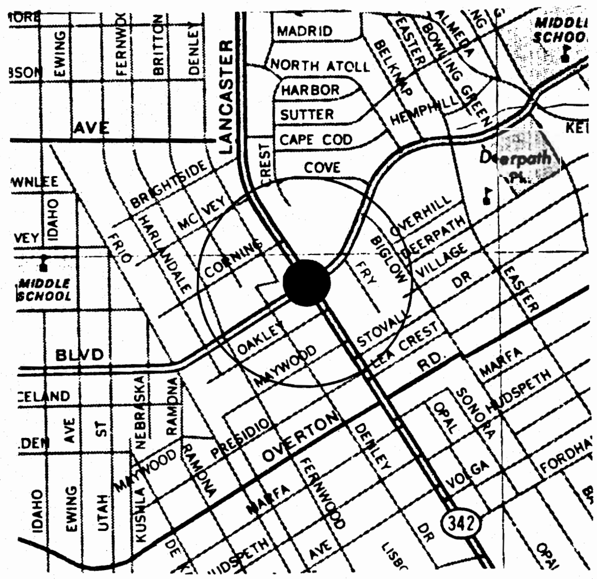
Corinth Station Area



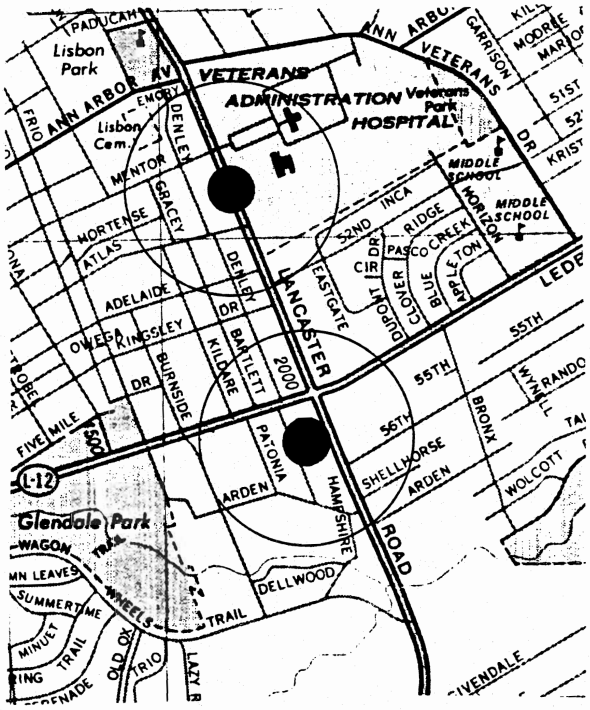
Morrell Station Area



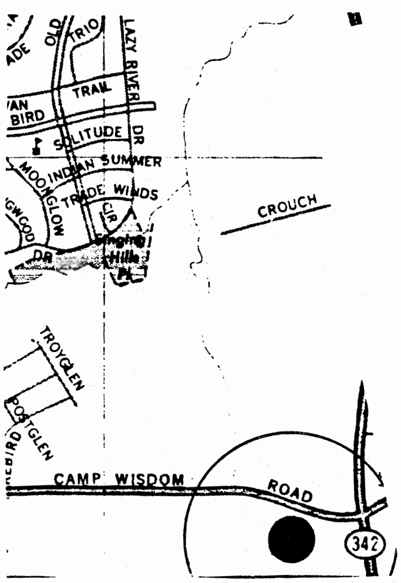
Illinois Station Area



Kiest Station Area



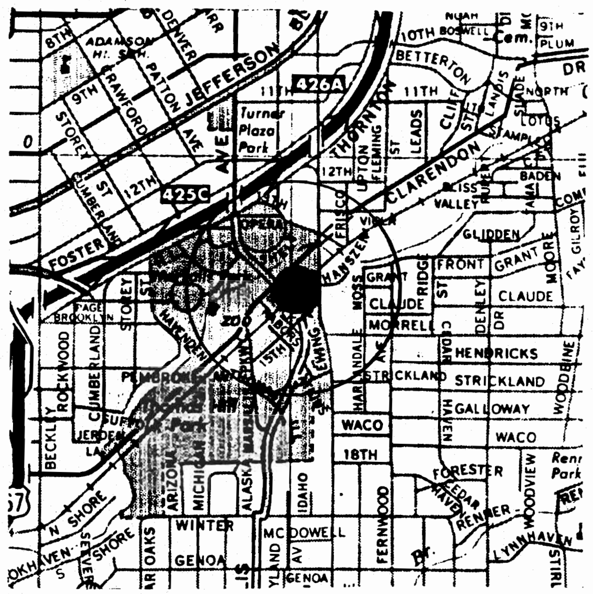
VA Hospital and Ledbetter Station Areas



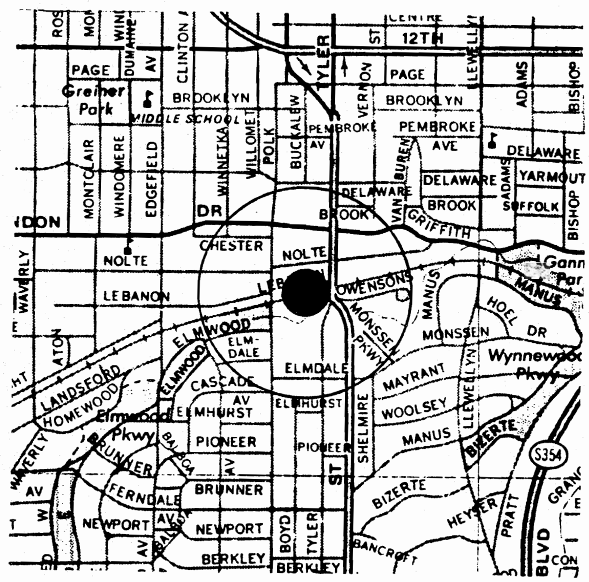
Camp Wisdom Station Area

West Oak Cliff Corridor

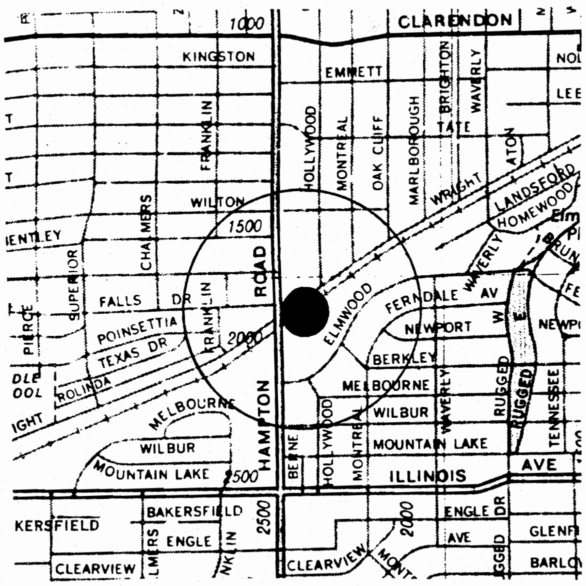
Dot indicates approximate station location
Circle indicates 1/4 mile radius



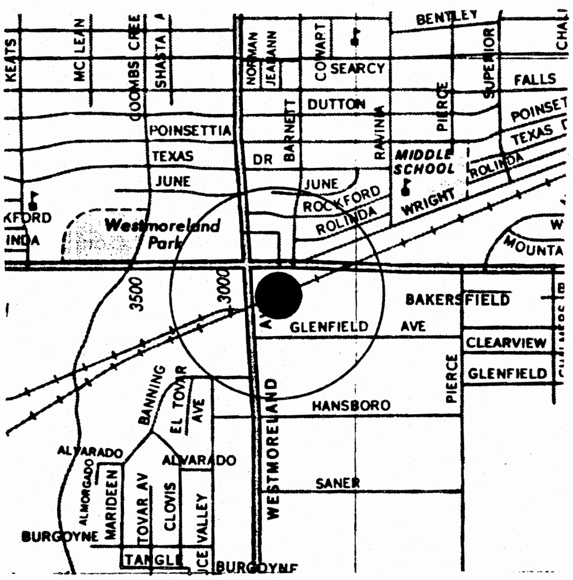
Zoo Station Area



Tyler/Vernon Station Area



Hampton Station Area



Westmoreland Station Area

CBD Transit Mall