

**TCRP PROJECT H-1
Transit and Urban Form**

**PUBLIC POLICY
AND TRANSIT ORIENTED DEVELOPMENT:
SIX INTERNATIONAL CASE STUDIES**

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TABLE OF CONTENTS

1.0 TRANSIT ORIENTED DEVELOPMENT..... 1
1.1 INTRODUCTION..... 1
1.2 SUMMARY OF PRINCIPLES..... 1
1.3 METHODS 3
1.4 THE CASE STUDY REGIONS..... 3
1.5 REPORT ORGANIZATION 5
2.0 HOUSTON CASE STUDY..... 7
2.1 INTRODUCTION..... 7
2.2 THE HOUSTON CONTEXT 8
2.3 TRANSIT IN HOUSTON..... 18
2.4 TRANSIT AND URBAN FORM..... 27
2.5 CONCLUSIONS 31
3.0 WASHINGTON, D.C. CASE STUDY 37
3.1 INTRODUCTION..... 37
3.2 CONTEXT FOR STATION AREA DEVELOPMENT..... 38
3.3 STATION AREA DEVELOPMENT 50
3.4 CONCLUSIONS 65
4.0 PORTLAND CASE STUDY 71
4.1 INTRODUCTION..... 71
4.2 THE PORTLAND REGION..... 74
4.3 PORTLAND'S LIGHT RAIL SYSTEM..... 77
4.4 PLANNING IN THE PORTLAND REGION..... 79
4.5 STATION AREA DEVELOPMENT TOOLS 83
4.6 STATION AREA STORIES 89
4.7 CONCLUSIONS 91
5.0 VANCOUVER, BC CASE STUDY 99
5.1 INTRODUCTION..... 99
5.2 CONTEXT FOR STATION AREA DEVELOPMENT..... 101
5.3 STATION AREA DEVELOPMENTS..... 112
5.4 STATION AREA STORIES 120
5.5 CONCLUSIONS 129
6.0 OTTAWA-CARLETON CASE STUDY 137
6.1 INTRODUCTION..... 137
6.2 REGIONAL CONTEXT 140
6.3 THE CURRENT OC TRANSPOR SYSTEM 143
6.4 COORDINATED LAND USE AND TRANSPORTATION PLANNING 148
6.5 STATION AREA DEVELOPMENT 154
6.6 STATION-AREA DEVELOPMENT IN A REGIONAL CONTEXT..... 161
6.7 CONCLUSION..... 166
7.0 CURITIBA CASE STUDY 173
7.1 INTRODUCTION..... 173
7.2 CONTEXT FOR INTEGRATING TRANSIT AND LAND USE PLANNING 175
7.3 EVOLUTION OF INTEGRATED PLANNING IN CURITIBA 176
7.4 LAND-USE REGULATIONS AND SUPPORTIVE POLICIES..... 186
7.5 RIDERSHIP AND PERFORMANCE BENEFITS 190
7.6 CONCLUSION..... 193

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1.0 TRANSIT ORIENTED DEVELOPMENT

1.1 INTRODUCTION

This report examines the integration of land use and transit planning in station areas and corridors using case studies of six metropolitan areas--three in the United States and three from other nations. Planners and researchers have long debated how, when, and why development occurs around transit stations and in transit corridors. Planners want to know how much development will occur if an investment in transit is made. They also need to know what institutions, policies, and development tools will assist development near transit stations. These case studies allow identification of the factors that facilitate transit supportive development at the station area.

The objectives of the case studies are to:

- Identify the role of transit, in combination with supportive public policies and institutions, in influencing the built environment at transit stations and in transit corridors.
- Identify the unique cultural and institutional issues and barriers in the United States which mediate between transit and urban form.
- Furnish case studies of successful and unsuccessful station area development patterns and an analysis of the reasons for these outcomes.

Transit oriented development is only an example of outcomes which result from more systemic forces in the region. The culture, institutions, leaders, and policies of the entire region have as much to do with what happens along transit lines as local ordinances and the prerogatives of private land owners. Hence, each case study looks broadly at the characteristics of the region as well as discussing development along particular transit corridors and stations.

1.2 SUMMARY OF PRINCIPLES

The case studies illustrate a number of principles for integrating transit and land in stations areas that are summarized below.

Regional Vision. Regions that have successfully integrated transit and land use planning have developed a vision of the preferred future settlement pattern for their region. Local governments share this vision and develop land use regulations that implement the vision. Transit investments are used to support the land use vision.

Strong, Respected Institutions. The regions have governmental agencies--transit providers, regional planning bodies, or redevelopment agencies--with the authority (sometimes granted by the state or province, sometimes based on performance) to make transit oriented development work. There are strong working relationships between local and regional government agencies.

Leadership. A leader who articulates the regional vision and oversees its implementation is often critical to its success.

Transit-Supportive Cultures. People in these regions believe that transit is an important component of the urban fabric and an efficient, reliable alternative to the automobile.

High Quality Transit Service. All the transit agencies provide efficient, clean, and on-time service, have well managed systems, and use transit technology that fits the particular needs of their region. Many are innovators in transit infrastructure and service delivery.

Regional Growth. In the most successful regions, transit investments were made just prior to or during a period of rapid population growth. Development was occurring that could be channeled to transit corridors and station areas.

Station Areas With Development Potential. Stations are located in areas with vacant or underutilized land, where both the market and station area policies support development.

A Variety of Tools to Focus Growth. The region use a variety of tools to provide the incremental steps to achieving their vision. These include:

Regional Tools

- **Limiting the urban area** with urban growth boundaries, agricultural reserves, greenbelts, or other policies.
- **Locating major activity centers** (employment centers, regional shopping malls) near transit.
- **Transit-friendly subdivision guidelines** that put all homes within walking distance of transit.
- **Limited freeway construction.**

Station Area Tools

- **Innovative zoning** including density bonuses, upzoning, and transfer of development rights in station areas.
- **Site design guidelines** that show how development can be more transit friendly and have better connections to transit stations.
- **Parking management** that limits the supply of parking and regulates its location in downtowns and station areas.
- **Siting public facilities** such as agency headquarters and convention centers near stations.

- **Using redevelopment agencies** with innovative financing, land assembly, and other development tools to support private development in station areas.
- **Building subsidized housing** near stations.
- **Integrating feeder bus service** with high-capacity transit.

Incremental Steps Towards a Long Term Process. Transit-oriented development takes decades. Small steps with quick results, however, build support for the long-term goal.

1.3 METHODS

Each case study examines the following factors that influence transit supportive development:

- **Political culture:** What responsibilities does the region see as belonging in the public or private realms? What role do people think transit plays in their urban environment? What are the beliefs about the role of land use and transit planning in determining settlement patterns?
- **Planning policy framework:** What vision does the region have for the way it should develop? What process does the region use to implement its vision?
- **Institutions:** Is there a regional body that develops and implements a comprehensive vision for the region? What are the roles of local jurisdictions in implementing the vision? What is the role of the transit agency in station area development? Are redevelopment agencies involved in station area development? Have certain leaders played a pivotal role?
- **Transit technology and operating characteristics:** What are the service characteristics of transit that support or detract from station area development? Did land use objectives influence the choice of transit technology and service characteristics?
- **Station area plans, policies, and actions:** What tools have been developed and used to encourage transit oriented development? How well have they worked?
- **Exogenous factors:** How have the local economy, population growth, and other factors outside the control of land use and transit planners affected station area development?
- **Results:** How much and what type of development has occurred near transit stations? How well does this development integrate with the station? What opportunities have been missed? Why has development occurred at some stations and not at others?

1.4 THE CASE STUDY REGIONS

Six large metropolitan areas (between 0.7 and 4.4 million residents) with exemplary transit service were chosen as the case studies. Houston, Texas, represents regions where transit is mainly designed to serve a low density pattern of settlement, while the other five

case study regions exemplify places where transit has been used as a tool for focusing regional development. A comparison of the three international case studies with three from the United States helps clarify some of the cultural and institutional factors that mediate between transit and urban form in the U.S. The cases include a variety of transit technologies -- exclusive busways, high occupancy vehicle lanes, light rail, advanced light rail, high speed passenger ferry, and rapid rail.

United States Cases

Houston, Texas, has an all-bus system serving a sprawling 1,279 square mile region with over two million residents. Houston's transit provider was one of the most successful in the nation in the 1980s in increasing patronage. The region has the nation's largest system of HOV lanes. HOV lanes are used by buses, vanpools, and carpools with carpools carrying the bulk of the users. Houstonians generally believe that the market should decide the type and location of development and that transportation investments should support the resulting pattern of development.

Washington, D.C. is a metropolitan area with 4.4 million residents in two states and District of Columbia. Rapid transit has been used in the District and in some suburban counties as a means of focusing development during a period of population and economic growth. The region developed a plan in the 1960s for corridor development centered on stations, and rail has subsequently been routed through corridors in the path of urban development. The regional transit agency has been highly supportive of jointly sponsored development at stations, and transit-supportive development has occurred in many areas.

Portland, Oregon, has been a leader in developing state-of-the art, multi-jurisdictional planning programs for light rail station areas. A 15 mile light rail line has been in operation for almost ten years, and an 18 mile extension is under construction in this urbanized area with about one million people. Both of these support a radially-oriented bus system focused on a CBD with a high level of urban amenities. Private developers and public agencies have built and renovated buildings near light stations downtown and in a commercial-institutional district adjacent to downtown. Other station area development has been slower to materialize. Plans are now being made to create transit supportive communities on large tracts of vacant land near stations along the new line.

International Cases

Vancouver, B.C., the third largest metropolitan area in Canada (1.6 million residents), has used SkyTrain, an advanced light rail system, and SeaBus, a high speed passenger ferry, to focus office and commercial development in regional centers as envisioned in their regional plan. Transit investments have been a catalyst for redevelopment of underutilized areas within a rapidly growing metropolitan area, supported by government investments and public-private partnerships. As a result the region has four bustling regional centers that are connected to each other and to the Vancouver central business district by high capacity transit.

Ottawa-Carleton, Canada, the national capitol and sixth largest metropolitan area in Canada (0.7 million residents), has the most extensive system of exclusive busways in North America. The busways have been a major tool for achieving a regional vision of

primary and secondary employment centers connected to low density residential neighborhoods by transit. Frequent and rapid service on the busways has provided the accessibility advantages needed to attract office buildings, shopping malls, and compact residential development to station areas. The busways have helped produce an urban area inside the greenbelt that is more compact and mixed in uses than has occurred elsewhere in the region, and bus ridership is higher than on any similarly sized transit system in North America.

Curitiba, Brazil, a city with 1.6 million residents, has been one of the most successful at integrating transit and land use planning to achieve a desired settlement pattern. The city has an innovative all bus system that has served as a major policy tool for creating a linear city. Higher density housing and jobs are concentrated in transportation corridors with exclusive busways in the center and high speed roads used by both cars and "speedy" express buses on either edge. The coordination of land use regulation and transit service has resulted in one of the highest rates of transit use anywhere, despite a population that is more affluent and owns more cars than in the typical Brazilian city.

1.5 REPORT ORGANIZATION

Each of the remaining sections is an individual case study beginning with the three United States cases followed by the international examples.

2.0 HOUSTON CASE STUDY

2.1 INTRODUCTION

Houston is the epitome of places where the market prevails and the role of government is limited. Even the widely used urban practice of zoning is not accepted. Given the preference for a limited governmental role in development decisions, it is not surprising that transit is designed to fit with the existing urban development pattern of Houston, not to shape it.

Houston has a well-funded, all bus system that serves a 1,279 square mile region with widely dispersed residences and employment locations. After years of debate about transit technology, the region has decided to concentrate on an all bus system and expand its network of High Occupancy Vehicle (HOV) lanes used by buses, carpools, and vanpools. The Metropolitan Transit Authority of Harris County (METRO) operates both local and commuter buses and was one of the most successful transit systems in the nation in attracting new riders in the 1980s. Houston has the most extensive HOV system in the United States with 63.6 miles operating in 5 corridors and about 40 more miles in the planning and development stages.

Factors That Limit Transit's Influence on Urban Form

Houston illustrates many of the institutional and cultural factors in the United States that limit the ability of transit to influence urban form. In Houston these factors include:

The pattern and style of development

1. A belief that the market should decide the type and location of development
2. Widely dispersed residential development
3. Decentralized employment
4. Employment centers outside downtown generally not conducive to transit service

An emphasis on automobile transportation

5. Major investments in freeway and arterial improvements to manage congestion including development of the nation's largest HOV system that is largely used by carpools
6. A powerful, well-liked mayor who believes in an all bus system and substantial use of transit funds for "general mobility"

Effective Transit Service in a Polycentric City

Houston also illustrates ways that transit can effectively serve a dispersed, polycentric city. These include:

1. Identifying markets and developing appropriate services
 - A local bus system connects city neighborhoods with locations throughout the city via transit centers and downtown transfers
 - A commuter service provides non-stop rides from suburban park-and-ride lots to the central business district
 - HOV facilities provide faster commutes by non-stop bus service, vanpools, and carpools
2. Building major activity centers and transit facilities that work together
 - Concentrated development with easy pedestrian access from streets to buildings facilitates bus service
 - Cooperative working relationships between transit agencies and activity center owner/business groups support the development of transit service
 - HOV facilities that directly access major activity centers provide the best transit connections

Organization of the Report

This report examines these factors in greater detail to explain the relationship between transit and urban form in the Houston area. The remainder of the report is divided into four parts. Section 1 outlines the economy, urban form, and political culture that set the context for transit investments and urban development. Section 2 describes the transit system, the reasons for its success at boosting ridership, and the decision to stay with an all bus system. Section 3 considers the relationships between transit and urban form at the regional, employment center, and neighborhood level. Finally, some conclusions are drawn about how the political culture and institutions in Houston limit the ability of transit to influence urban form as well as lessons that could be applied to other dispersed cities.

2.2 THE HOUSTON CONTEXT

Houston is the fourth largest city in the U.S. with nearly 1.7 million residents (See Table 1). Houston covers about one-third of the land area within Harris County but is home to over half the county's residents (See Figure 1). The population density of 3,131 persons per square mile in Houston is about the same as in Dallas and Denver and slightly lower than in Portland, Oregon. Population densities are much lower outside the city limits because development is scattered and much land is undeveloped.

Figure 1. Houston and Harris County

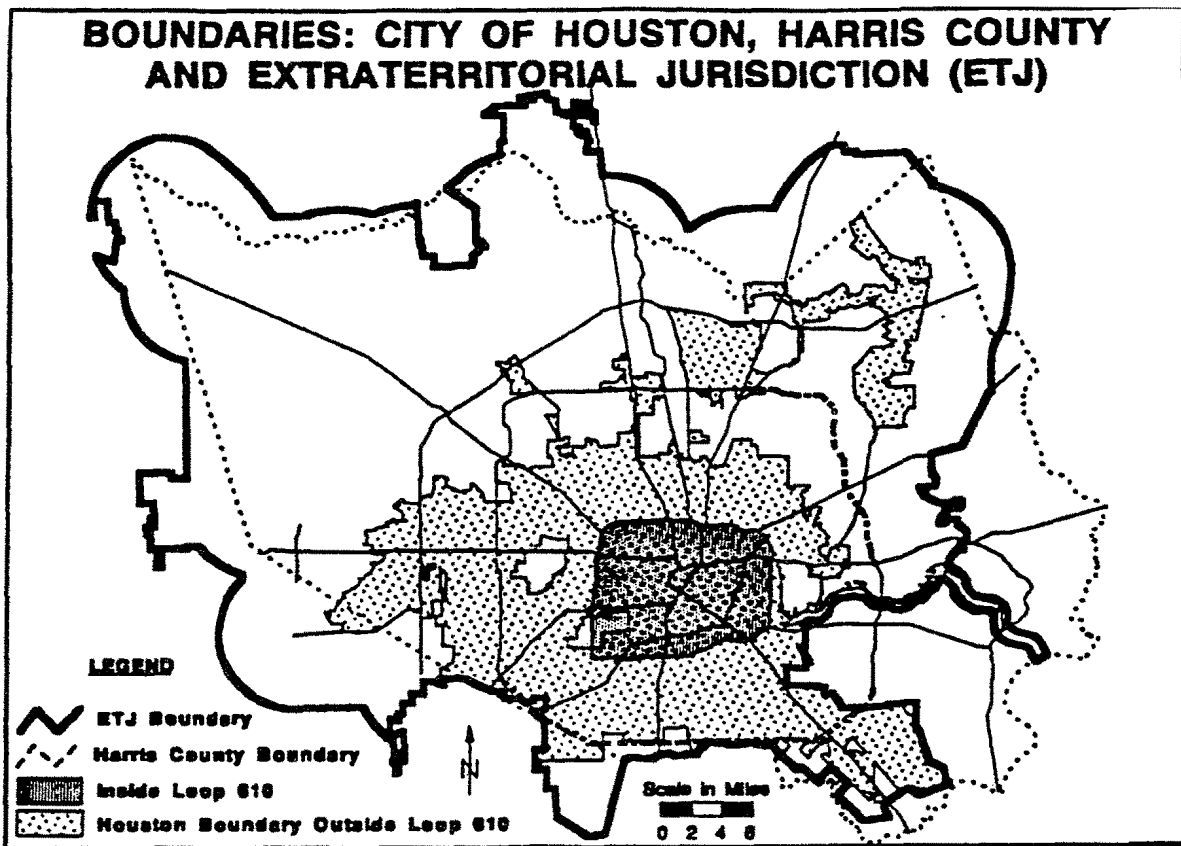


Table 1. Characteristics of City of Houston and Harris County

		Houston	Harris County
Population	Population (1992)	1,690,180	2,971,755
	Size (square miles)	539.9	1,729
	Population Density (persons/sq. mile)	3,131	1,719
	Population Growth, 1980-1990	2.2%	17.0%
	Population Growth, 1990-1992	3.7%	5.4%
Housing	% owner occupied	44.6%	52.0%
	% single family homes	51.5%	58.3%
	% housing built 1970-1990	48.1%	58.0%
Commuting	Automobiles per household	1.5	1.6
	Mode of Travel to Work (1990)		
	Drive alone	71.7%	75.3%
	Carpool	15.5%	14.4%
	Transit	6.5%	4.6%
	Other (includes working at home)	6.3%	5.7%
	Average Travel time to work (minutes)	24.7	25.8

Source: County and City Data Book, 1994

Houston is a multi-nucleated, dispersed city where the automobile is the dominant mode of transportation. Less than half of the housing units within Houston and just over half in Harris County are owner-occupied. About 52 percent of housing units in Houston and 58 percent in Harris County are single-family.

Cyclical Economic Growth

Houston's economy is based on the energy industry, NASA-related high technology, banking, computers, and medical technology. Houston is known for its boom and bust cycles. The 1970s oil embargoes accelerated Houston's growth producing a boom in home and office construction. Declining oil prices in the early 1980s hit Houston hard. The number of manufacturing employees decreased by 35 percent between 1982 and 1987. Office vacancy rates reached record levels of over 30 percent in 1987. The economy has recovered in the late 1980s and 1990s with job growth primarily outside the energy industry and its related financial institutions.

Table 2 shows that the highest share of jobs in Harris County are in services and wholesale and retail trade. Job growth over the past 10 years has been strongest in services and government while the number of jobs in manufacturing, mining, construction, and finance, insurance, and real estate has declined.

Table 2. Share of Jobs and Growth Rates by Sector, Harris County, 1984-1994

Sector	1984	1994	Rate of growth or decline
Manufacturing	12%	11%	-2%
Mining	6%	4%	-28%
Construction	9%	7%	-14%
Transportation, Utilities, Communications	7%	7%	17%
Finance, Insurance, Real Estate	7%	6%	-9%
Wholesale and Retail Trade	26%	24%	1%
Service	22%	27%	38%
Government	11%	13%	29%
Overall Job Growth Rate			9%
Total Number of Jobs (1,000s)	1362.9	1486.0	

Source: City of Houston Planning and Development Department, Winter 1994

Limited Role for Government in Shaping Development Patterns

Houston is noted for its laissez-faire, anti-regulation, low taxes, and pro-growth attitudes. Houstonians generally believe the marketplace works better than government regulation in determining the type and location of new development. Voters have defeated zoning proposals in 1947, 1962, and 1993. Instead of zoning, a private system of deed restrictions and home owner associations works to keep undesirable uses out of residential

neighborhoods. Many homeowner associations are vigilant at enforcing deed restrictions in order to maintain the character of their neighborhoods. Some neighborhoods, however, lack the financial resources needed to sue violators. In addition, deed restrictions have often expired in older neighborhoods. These older and poorer neighborhoods then have no control over the type of development that occurs in their areas. Both commercial and light industrial activities have located in residential areas that lack effective deed restrictions.

A Dispersed Sunbelt City

Although Houston is the only major U.S. city without zoning, its pattern of development is not substantially different from that of other dispersed sunbelt cities with abundant land for development. Houston looks like other cities with the tallest buildings in the central business district, shopping centers along arterial streets and freeways, scattered employment sites, higher density housing along major transportation corridors, and many single family neighborhoods. Feagin (1989) credits land prices and deed restriction in Houston and the propensity of other cities to make pro-development decisions with producing similar patterns of development throughout the sunbelt.

Much of Houston has been built in the last 25 years. About half of Houston's housing and over three-fourths of housing outside the city limits in Harris County have been built in the last 25 years (See Table 1). More than three-fourths of the large office buildings were built between 1970 and 1987 significantly changing the character and scale of Downtown Houston and furthering the growth of other activity centers.

The population of Houston's suburbs continued to grow in the 1980s while the city's population stabilized. Without annexations, the city would have lost population; with annexation, it grew by two percent (See Table 1). In contrast, the population of Harris County outside of the city increased by 46 percent, and the suburbs continue to grow at a faster pace than the city. Suburbs are attractive because they have newer single family homes and are in suburban school districts with fewer problems. In addition, more people were able to afford moving out of Houston to the suburbs when housing prices plummeted during the 1980s recession.

Although redevelopment in older parts of Houston has been gaining momentum recently, most recent residential development has been in planned communities at the northern and western edges of Harris County and in neighboring counties. Master-planned communities offer homebuyers the assurance that nearby land uses will not change to activities they do not want. Some of the master-planned communities, like The Woodlands, are trying to achieve a jobs-housing balance but others are built primarily as residential areas for Houston workers. Because this type of development requires large tracts of land, they are often built 20 or more miles from Downtown Houston where acreage in single ownership is available. Considerable vacant land exists closer in (only about 10 percent of the land between 10 and 20 miles from downtown is developed), but land ownership is fragmented making it difficult to assemble enough property for a master planned community.

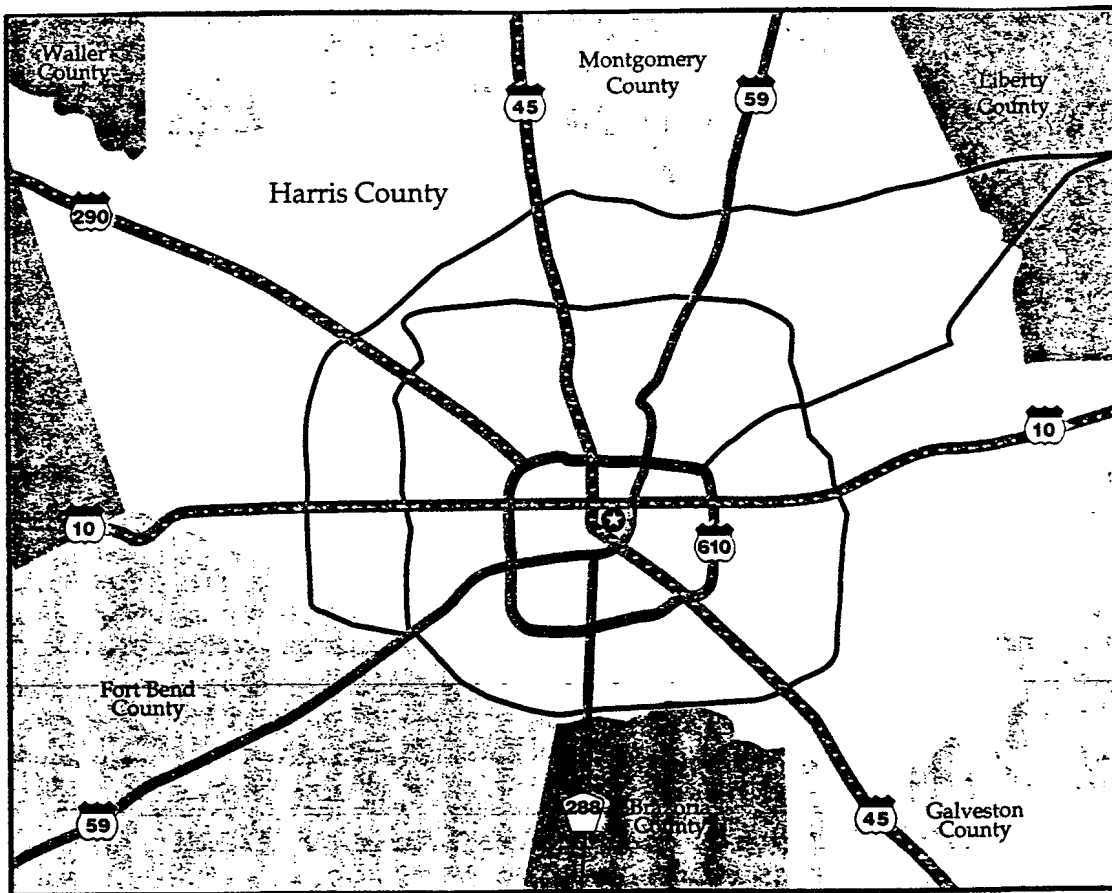
Freeways Influence Urban Form

Houston's freeway network facilitates this growth at the edges of the region as well supporting the development of activity centers at major intersections. As shown in Figure

2, eight freeways and major roads converge on Downtown Houston. These freeways are linked by three beltways (not counting the freeway that encircles downtown) at approximately 5, 10, and 15 miles from downtown. The innermost beltway, I-610, surrounds the 100 square miles of Houston that developed prior to the 1960s and is known as the Inner Loop. Although the second and third beltways are not complete on the east and south sides, a fourth beltway called the Grand Parkway has been proposed by developers who are assembling right-of-way for this 180 miles loop road.

The design of Houston's freeways also results in linear corridors of development. Freeways have continuous frontage roads on both sides and frequent access points. Retail and personal service businesses have taken advantage of the visibility and accessibility of these locations forming nearly continuous strip malls along most of the freeways. Numerous apartment complexes were built behind the commercial strips during the 1970s boom.

Figure 2. Houston Area Freeways



Multiple Employment Centers Including a Large Central Business District

Downtown Houston is the 6th largest business district in the United States when measured in terms of multi-tenant office space, but less than a 10th of the Harris County workers work there. Houston has several other large activity centers including Uptown Houston (Galleria), the 13th largest business district in the country (Harris County Improvement District #1, 1991). Garreau (1988) identified nine existing and two emerging "Edge Cities" in the Houston area. ("Edge Cities" have a minimum of five million square feet of office space and substantial retail activity.) Today the five largest activity centers outside downtown are Uptown Houston (Galleria), Greenway Plaza, the Texas Medical Center, Greenspoint, and the Energy Corridor. The map in Figure 3 shows that Greenway Plaza and the Texas Medical Center are inside the I-610 Inner Loop with Uptown just outside. Greenspoint and the Energy Corridor are more suburban. Regional modeling shows that future employment growth is likely to be outside the downtown area. Due to overbuilding in the 1980s, office supply is not expected to grow. Houston development activity today is mostly in the residential, hotel, retailing, and entertainment sectors.

Table 3 compares the employees, office space, and other characteristics of these activity centers and Downtown Houston, each of which is described in more detail below. Despite the size of these centers, they collectively provide only 26 percent of the County's employment. The remaining three-fourths of the jobs are scattered throughout the region.

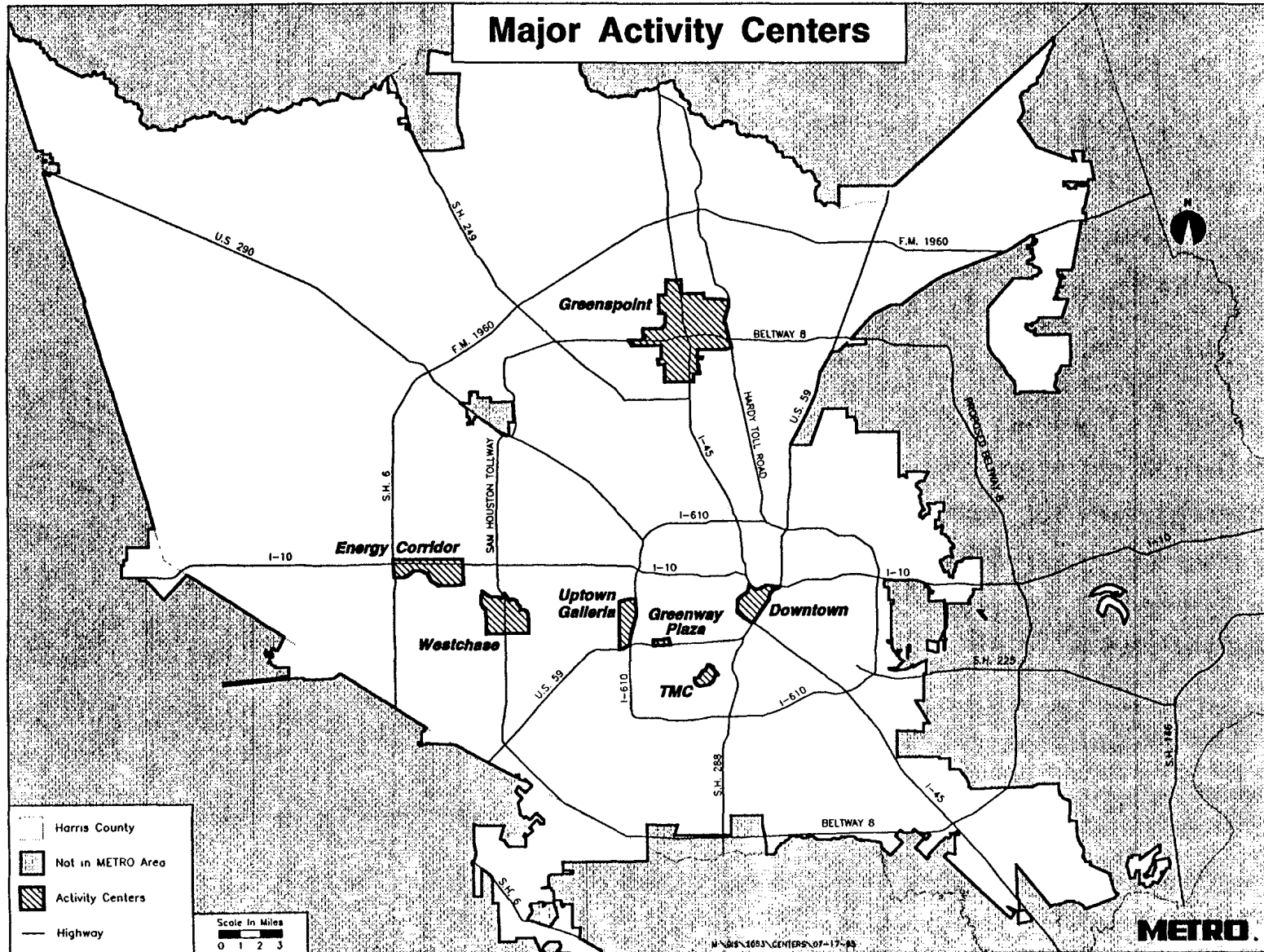
Table 3. Characteristics of Houston's Largest Activity Centers

Activity Center	Employment	Share of Harris County Employment	Office Space (square feet)	Parking Charges	Share of Work Trips on Transit (1990)
Downtown	137,530	9%	41,365,171	Yes	29%
Uptown (Galleria)	87,673	6%	25,483,003	No	7%
Texas Medical Center	62,195	4%	2,875,729*	Yes	13%
Energy Corridor	33,703	2%	7,180,304	No	
Greenway Plaza	32,524	2%	9,555,239	No	8%
Greenspoint	29,093	2%	9,023,965	No	
Total	382,718	26%	25,759,508		

* Does not include hospital space.

Sources: Employment and office data supplied by the Houston Galveston Area Council from the 1993 Interim Forecasts and the December 1994 BACA/Landata Office Building Inventory File. Work trips on transit provided by METRO.

Figure 3. Major Activity Centers



Downtown Houston

Downtown Houston has the greatest concentration of high rise office buildings and of employment. Figure 4 shows the density of downtown development. Almost 10 percent of Harris County jobs are downtown mainly in managerial, administrative, professional, and clerical jobs. City, county, and other governmental agencies are also located downtown. No new office buildings have been built since 1987, and office vacancy rates are currently about 20 percent.

Figure 4. Downtown Houston



Source: METRO

As already noted, all the radial freeways converge on downtown. It also has the best transit service in the region with all commuter and the majority of local bus routes stopping there. Buses use a number of north-south and east-west streets with the greatest concentration of local service on Main Street, the only two-way street in downtown. About 29 percent of downtown workers use transit to get to work. Over 40 garages and numerous surface lots provide an abundance of parking. Monthly parking in garages cost between \$40 and \$131 in 1993. A 1992 survey of downtown workers at firms with 100 or more employees revealed that about one-third of the firms subsidize employee parking and another third subsidize transit or ride sharing (Employee Trip Reduction Task Force,

1993). Because of Houston's climate, much pedestrian activity is in a 6.3 mile tunnel system that connects most buildings and has over 100 shops and restaurants rather than on sidewalks.

Uptown and Greenway Plaza

These two activity centers developed in the 1970s and 1980s as office, retail, hotel, and entertainment complexes about five miles west and southwest of Downtown Houston. This discussion will focus on Uptown, the second largest employment center in the region with six percent of regional employment and 2.5 times the office space of the next largest center. Uptown developed around the Galleria shopping mall near the intersection of I-610 and Westheimer Road, the most heavily traveled arterial in Houston. The Southwest Freeway (US 59) is at the south end of the area and the Katy Freeway (I-10) a couple miles north. Development is low to high rise, as shown in Figure 5, and has occurred on superblocks with massive parking garages separating streets from buildings. Most sidewalks were built to residential standards. Seven bus routes connect Uptown with Downtown, two regional transit centers, limited commuter bus services (some through Downtown and a transit center), and nearby neighborhoods. About seven percent of Uptown workers ride transit.

Figure 5. Uptown Houston



Source: METRO

The Texas Medical Center

This unique employment center is the largest health care center in the world. Over 40 research, education, and patient care organizations are located in the center employing over 60,000 people and bringing an addition 40-50,000 people into the area each day. The center began developing in the 1940s about five miles south of Downtown near Rice University. It is near the Southwest Freeway (US 59), I-610, and State Highway 288 and is connected to Downtown via Main Street. Most buildings are mid to high rise. Buildings front on the sidewalks on major streets making the area like a downtown in appearance.

Fifteen bus routes connect the Medical Center with six transit centers, five park-and-ride lots, Downtown, and a variety of Houston neighborhoods. As a result the Medical Center has the highest rate of commuter travel by transit outside Downtown (13 percent). Parking garages are located on the periphery of the center, and there is a charge for parking. Free shuttle services provided by METRO with Medical Center subsidy make it possible to get around the center without a car. Buses run from 5:00 a.m. to midnight with 2.5 to 5.0 minute headways during peak periods. About 8,000 boardings are made daily on the circulator buses.

The Energy Corridor and Greenspoint

These two activity centers are farther from the city center and much lower in density than the previous ones. The Energy Corridor is a collection of low-rise office campuses built in the 1980s by old Houston companies along the Katy (I-10) Freeway 10 miles or more west of Downtown. Park-and-ride lots are located in the area, but there is virtually no local transit service.

Greenspoint is a growing activity center about 10 miles north of Downtown near the Houston International Airport along Beltway 8 (the Sam Houston Tollway) and the North Freeway (I-45). It includes the Greenspoint Shopping Mall and dispersed low to high rise office buildings. A transit center near the mall links three routes providing service within part of the Greenspoint area and travel to the airport, Downtown, and points along FM 1960, the third beltway from Downtown.

Solving Congestion Caused by Rapid Growth

The rapid growth in population, employment, and vehicle miles traveled in the 1970s and 80s combined with limited expansion of freeways to make Houston one of the most congested cities in the United States. In 1981, the Chamber of Commerce spear-headed a campaign to increase funding for transportation from local, state, federal, and private sources and to build and expand freeways, arterials, and toll roads. As a result, the region has nearly doubled its transportation budget to about \$1 billion a year and used the funds to increase freeway capacity, build new arterials, expand bus service, and develop HOV facilities (Dunphy, 1993).

The net result is that Houston is one of the few metropolitan areas where congestion levels decreased while employment levels and traffic volumes rose in the 1990s. In 1982, only Los Angeles had a higher score on a Texas Transportation Institute congestion index, which compares peak period flows on freeways and principal arterials to free-flowing

standards. Houston's 1982 score of 1.17 declined to 1.12 by 1990, a four percent decline, while the 34 largest metropolitan areas had an average increase of 18 percent (Schrank et al., 1993). In addition, average speeds on freeways during the evening rush hour increased from 38 mph to 46 mph, and the area within a half-hour commute of Downtown nearly doubled from 350 to 600 square miles (Snyder, no date).

Most residents of Houston and Harris County use cars to get to work, but 6.5 percent of city resident workers and 4.6 percent of county resident workers ride transit to work (See Table 1). Houston is one of a few major metropolitan areas where the number of work trips by bus increased substantially in the 1980s. The 39 metropolitan areas with over one million residents collectively had a 6.8 percent decline in work trips by bus, but the Houston metropolitan area increased bus work trips by 50.1 percent to around 64,000 riders or 3.6 percent of the metropolitan workforce per day (Rossetti and Eversole, 1993). The proportion of Houston residents riding a bus to work increased from 4.8 percent in 1980 to 6.5 percent in 1990 while the Harris County share rose from 3.5 to 4.6 percent (City and County Data Book, 1983, 1994).

2.3 TRANSIT IN HOUSTON

The Metropolitan Transit Authority of Harris County (METRO) operates an all bus transit system in a 1,279 square mile service area that covers three-fourths of Harris County including the city of Houston. About 60 million passenger trips are made annually on Metro's 2,000 miles of bus routes. METRO is governed by a nine member Board of Directors appointed by the mayor of Houston (five members), Harris County Judge (two), and the mayors of the 14 other cities in the service area (two). Metro's original goals were to upgrade the bus system and develop a regional rail system.

METRO Boosts Bus Ridership

Voters approved the creation of METRO in 1978 with a one percent sales tax dedicated to transit. Today the sales tax generates about \$250 million annually for the transit agency. When METRO began operations, it inherited an aging bus fleet known for its mechanical failures and service delays. Ridership had been declining for years. METRO has replaced and expanded the bus fleet, added new services, and made the system reliable. Ridership has increased from 33 million in 1978 to around 60 million in 1994. Ridership has stabilized in the 1990s.

HOV facilities that provide fast, direct bus service for commuters from park-and-ride lots to Downtown Houston have been part of METRO's services since 1979. This type of service has been successful in attracting young, well-educated, white collar workers who have a car available to transit (Wade et al., 1992). The Houston metropolitan area also has one of the highest rates of commuting by vanpool or carpool (14.6 percent in 1990) of large metropolitan areas (Rossetti and Eversole, 1993). Although Houston was considered the vanpool capital of the world during the 1970s energy crises, vanpool ridership has been declining since the early 1980s.

METRO Operates Two Bus Systems

METRO provides two distinct types of services--local and commuter. Local services on 83 routes serve the neighborhoods of Houston and surrounding areas throughout the day and evening. Seven express routes also pick passengers up in neighborhoods and then go directly to transit centers and Downtown during peak periods. Local services are linked together at transit centers and in Downtown Houston. Ninety-two percent of METRO's daily passenger boardings are on the local system. Commuter services operate like a commuter rail system providing peak period service from park-and-ride lots to Downtown Houston. About eight percent of METRO boardings are on this system. The two systems generally use different buses and have operated on different streets in Downtown Houston until recently. Few transfers occur between the systems.

Table 4 shows the differences in the ways riders access the two bus systems. Most of the local riders walk short distances to bus stops while most of the commuter bus riders drive to park-and-ride lots. Sixty percent of the commuters drive four or more miles to park-and-ride lots. Almost three-fourths of the local riders do not have access to an automobile as an alternative mode for their trip, while nearly all of the commuters do have access to an automobile (and used it to reach the park-and-ride lot). In addition, about two-thirds of the local riders are minorities while 80 percent of the commuters are white.

Table 4. Mode of Access and Distance to Transit of Local and Commuter Riders

Local Bus Riders		Commuter Bus Riders	
Mode of Access to Transit			
Walk	93%	Walk	2%
Drive	3%	Drive	92%
Dropped-off	4%	Dropped-off	6%
Distance to Transit Stop			
Walk 1 block or less	53%	Drive 1 mile or less	11%
Walk 2-3 blocks	33%	Drive 2-3 miles	29%
Walk 4 or more blocks	14%	Drive 4-5 miles	26%
		Drive more that 5 miles	34%
Have access to an automobile	28%	Have access to an automobile	93%

Source: METRO, 1991

METRO Adopts Bus Plan After Years of Debate About Transit Technology

Even before METRO was formed, the region engaged in a debate about the appropriate transit technology. Like many other metropolitan areas, Houston considered a variety of rail options. Voters turned down proposals for heavy rail systems in 1973 and 1983. Voters approved a light rail system connecting Downtown, Greenway Plaza, and Uptown

(Galleria) as part of a long term transit service plan in 1988. METRO continued to evaluate rail options until 1992, when Bob Lanier, a strong bus advocate and former METRO board chair, became mayor. Lanier had campaigned on the theme of building more cost-effective transit than rail and using the savings for more pressing problems in the region.

A few months after the election, the METRO Board adopted an all bus plan know as the Regional Bus Plan. This plan implements a "Better Bus Alternative" that includes extensions and improvements to the HOV system, more cross-town service, more direct service to major activity centers for both local and commuter buses, and an expanded bus fleet. The goal is to increase transit ridership from the current 60 million annual passengers to nearly 90 million per year in 2010 (Kain, 1992; METRO, March 1995).

Houston Develops Extensive HOV System

While the region debated its choice of transportation technology, METRO and the Texas Department of Transportation (TxDOT) began cooperatively developing HOV lanes in the medians of radial freeways. A demonstration project using a contraflow lane on 1-45 (the North freeway) was opened in 1979 and was highly successful in attracting transit riders and encouraging vanpool development. Because the contraflow lane was separated from opposing traffic only by plastic pylons, it was open exclusively to buses and authorized vanpools. Within one year, the contraflow lane carried about 15,000 people per day. The contraflow lane carried about twice as many persons during peak periods as adjacent freeway lanes. This project demonstrated that HOV facilities could increase the capacity of highway facilities (Turnbull, 1990).

The demonstration project was never intended as a permanent facility, and in the early 1980s METRO and TxDOT developed plans to replace it with a reversible, barrier separated lane in the median of the freeway. A similar project was also developed for the Katy Freeway (1-10) to the West (See Figure 6). In 1984 the first phases of the North and Katy Freeway HOV lanes opened and remaining phases were completed by 1987. Subsequently the Gulf, Northeast, and Southwest Freeway HOV facilities have opened. These facilities were developed without an overall plan for an HOV network. Instead individual projects were developed in conjunction with freeway improvements as the opportunities arose (Sedlak, 1995; Turnbull, 1990).

As Figure 6 shows, all HOV lanes are in the radial freeways that converge on Downtown. There now are 63.6 miles of operating HOV lanes and plans for 104 miles in seven corridors by 2000. HOV lanes operate as one-way reversible lanes with traffic heading towards Downtown in the morning and out in the evening. Ramps connect HOV facilities directly with park-and-ride lots. About 78,000 trips are made each weekday on the HOV network. Facilities are generally closed on weekends.

Figure 6. HOV System

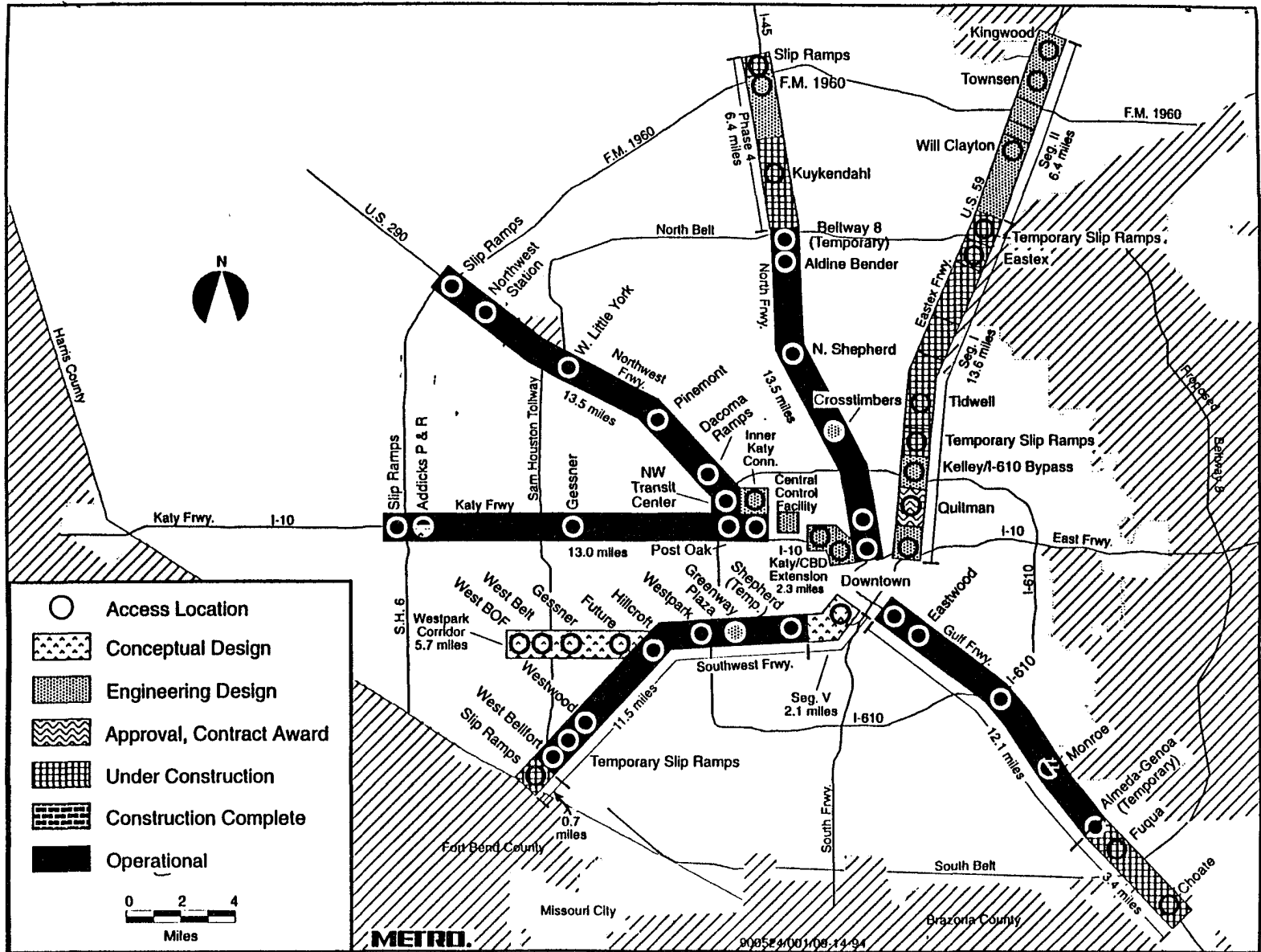


Table 5 shows that the main HOV users are car-poolers. They account for 94 percent of the vehicles and 61 percent of the persons on the HOV lanes. Only three percent of the vehicles are buses, but they carry a third of the passengers. The North HOV facility, the oldest in the network, is the only HOV facility where a majority of the person trips are by bus. For the first 10 years of operations (including the years of the demonstration contraflow lane that preceded the current HOV lane), only buses and vanpools were allowed. Although carpools were added in 1990, this corridor has retained many of its bus riders. The Katy HOV was also restricted to buses and vanpools when it opened in 1984. Although the lane carried more persons than an adjacent freeway lane at peak periods, few vehicles used the route creating the perception that the lane was underutilized. Public pressure for more use of the facility forced METRO to open the lane to carpools six months later. More recently opened HOV facilities have always been open to car-poolers.

Table 5. Summary of Average Daily Ridership on Houston's HOV Network, June 1994

	Vehicles		Passengers	
	Number	Percentage	Number	Percentage
Buses	764	3%	26,400	34%
Carpools	22,480	94%	47,477	61%
Vanpools	443	2%	3,362	4%
Motorcycles	133	1%	133	0% *
Total	23,820	100%	77,372	100%

* Less than 0.5 percent

Source: Sedlak 1995

The Houston HOV projects are unusual because of the large role that the transit agency has played in their development and operation. In most cities in the United States, HOV facilities have been built and are operated by state highway departments. While the history of each HOV corridor varies, METRO has had primary responsibility for funding many of the projects and operates the facilities. The North Freeway HOV, for example, was built at a time when the freeway was heavily congested and TxDOT was laying off people due to a funding shortage. METRO provided most of the project funding, and TxDOT the construction expertise. As a result, TxDOT was able to move more people on existing freeways despite its temporary lack of funding. At the same time, METRO began the process of developing a fixed route transit system and improved bus service for commuters (Turnbull, 1990).

Commuter Bus Service on HOV Lanes

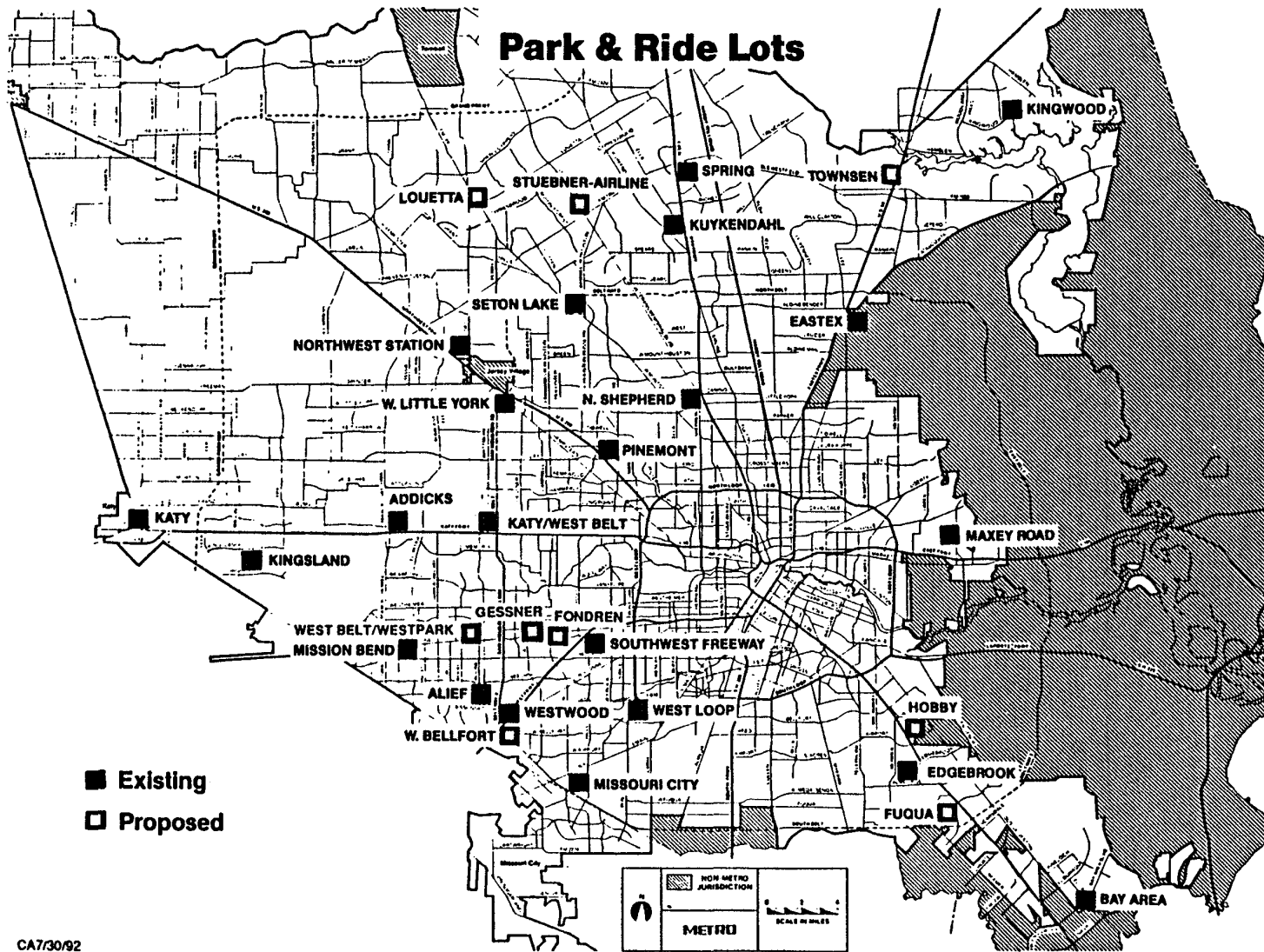
METRO operates 22 park-and-ride routes providing direct, frequent, peak hour commuter service from park-and-ride lots to Downtown Houston and other activity centers (See Figure 8). Lots are 10 to 30 miles from Downtown. Nine more lots are planned by 2000. Most commuter bus routes operate on HOV lanes reducing travel times by eight to 12 minutes over what they would be on the regular freeway lanes. METRO's park-and-ride lots have spaces for 26,089 vehicles and are designed as safe, attractive places for transit riders and car-poolers to leave their cars. Park-and-ride lots are fenced, landscaped, and have on-site security (See Figure 7). Parking is free, but the commuter bus service costs two to four times the price of local bus service. Car-poolers may also park in the lots at no charge (METRO, October 1992).

Figure 7. Pinemont Park-and-Ride



Park-and-ride service is only provided during peak periods. Service frequencies vary with the level of use. Addicks Park-and-Ride on the Katy HOV, for example, has 1,600 parking spaces that are 90 percent utilized. To carry this volume of traffic, articulated buses leave the station every three minutes during the peak period. Other smaller or less utilized park-and-ride lots are served by buses with 15-minute headways at the busiest periods. Downtown stops are mainly along the four streets west of Main Street where office buildings are concentrated. Few people walk more than two blocks to their destination.

Figure 8. Park and Ride Lots



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Most service to activity centers outside of the central business district has been on routes that stop Downtown first. Buses from the Kuykendahl Park-and-Ride on the North Freeway, for example, stop Downtown and at the Greenway Transit Center before going to Uptown, resulting in out-of-direction travel and a longer trip. The Regional Bus Plan calls for more direct service to Uptown, Greenway Plaza, and the Texas Medical Center. Full operation of a system that serves these activity centers requires changes in the design of the HOV facilities to allow access and egress at intermediate points. This service would also be facilitated by connections between HOV lanes and two-way flows. Intermediate access and egress points are being developed as part of the Regional Bus Plan, and the latest HOV facility was built so that it could easily be converted to two-way operations.

Since 1991, reverse commuting from Downtown to work locations near park-and-ride lots has also been a METRO service. Workers have express service to areas near park-and-ride lots such as Clear Lake, part of the FM 1960 area, and Woodcreek and Hyatt Office Parks.

Local Transit Services for a Polycentric City

Because many work sites, shopping areas, schools, and social service agencies are scattered throughout the community, METRO began developing transit centers in 1984. Transit centers facilitate transfers between local bus routes without a trip Downtown. METRO now has 14 transit centers and plans for five more including one Downtown (See Figure 9). These centers provide a safe, protected place to transfer between local and express buses. Transit centers have covered areas with seating, phones, and transit information. Over half the bus routes stop at a transit center. Four regional transit centers are connected to the HOV system and are served by park-and-ride bus routes, while the remainder connect local and express service from neighborhoods to the larger community. Five transit centers have parking with a total of 2,146 parking spaces. Most neighborhood transit centers have no designated parking (METRO, December 1993a).

METRO also has a diverse fleet of buses to match their service needs and the areas they serve. The standard local service bus is 40 feet long, but 30-foot and mini-buses are used in neighborhoods where demand is low or where streets are too narrow for larger buses. Larger articulated buses are also used where demand requires. Motorcoaches are used for many park-and-ride routes (METRO, July 1992).

METRO Provides Transportation Services Other Than Transit

METRO is unusual for its involvement in non-transit transportation functions. The 1988 referendum on the long term transit service plan allowed METRO to spend one-fourth of its sales tax revenue on "general mobility." During Mayor Lanier's administration, METRO has been spending more on car facilities than on bus facilities. In addition to primary funding for HOV facilities, METRO has been building more city streets than the city or county roads than the county. In 1994, METRO spent about \$100 million of its \$240 million sales tax revenue on street improvements (Wallstin, 1995). METRO is also a partner with TxDOT, Harris County, and City of Houston in the development of an automated traffic control system that will facilitate both car and bus flows.

2.4 TRANSIT AND URBAN FORM

Transit and land use interactions can occur at the regional, activity center, and neighborhood levels. This section describes how transit and land use interact at each of these levels.

Buses and HOV Lanes Serve Dispersed Land Uses

In Houston, transit serves development. This philosophy is consistent with Houston's emphasis on the market determining when, where, and what type of development occurs. Transit provides mobility for those without cars and the HOV lanes increase the capacity of freeways. Although the transit system supports Downtown Houston by providing good bus access, the transit system is not designed to influence the way the region grows.

Buses are the preferred technology because they are flexible and service can be tailored for the wide variety of land uses that exists within the service area. An example of this is METRO's use of a diverse fleet of buses to efficiently meet the transit needs of different sections of the region. HOV facilities can also serve a variety of corridors. While commuter bus service is primarily to Downtown, car-poolers can efficiently reach other destinations from HOV facilities. The Regional Bus Plan improvements will allow both commuter bus and carpool more direct access to the activity centers in or near the Inner Loop.

Surveys of HOV facility users indicate that people do consider the location and advantages of HOV facilities when making decisions about where to live and work (Mullins et al., 1989). HOV facilities are, however, used by only about five percent of the Harris County workforce. Since the proportion of residents who use the facilities is small and worksites are widely dispersed in the region, the effects of HOV lanes on regional form are most likely small. Where there is an effect, HOV lanes, like the freeways they are part of, support dispersed living by providing an efficient means of travel for people who live in the suburbs to more centralized places of employment. In the long run, this could support the movement of jobs farther out to where people live.

Transit System Supports Downtown Offices

METRO's development of the HOV facilities and improvements in local bus service in the 1980s, helped keep Downtown competitive during the economic downturn of that decade. Transit service has not, however, affected the way Downtown has developed because nearly all Downtown buildings were constructed or under construction before METRO had made significant improvements in service. Now METRO is beginning to invest in the Downtown bus facilities as part of its Regional Transit Plan.

As discussed earlier, Downtown Houston has the most transit service, the best access to the HOV system, and highest rate of commuting by bus (29 percent). Downtown benefits from a centrally focused bus and HOV system because a larger labor pool has access to the area. Transit service is used as selling point for the area by the Downtown's business recruitment program. About a third of the large employers subsidize transit passes or ride sharing.

HOV facilities and bus service, however, have had little effect on the design of Downtown buildings. The last period of office construction was in the early 1980s when transit service was just beginning to improve. The last building built Downtown was started in 1985 and completed in 1987; most other office buildings were finished in the early 1980s.

Although Downtown needs fewer parking spaces because more than a fourth of its workforce commutes by bus, parking supplies have not been limited because of transit. Like the office buildings, most Downtown parking was developed before major improvements in bus service. Thus, Downtown parking is abundant and fairly inexpensive. Commuter bus service costs \$2.00 to \$4.00 per ticket or \$63.00 to \$126.00 per monthly pass depending on the location of the park-and-ride lot. Downtown parking is readily available at lower rates than the most expensive bus rides, and many employers subsidize employee parking.

Main Street is the one street where bus service may have influenced development, and the impact has been negative. Streets to both the east and west had more development of high rise buildings than Main Street during the building boom of the 1970s and 1980s. Two transit-related factors may have inhibited Main Street Development. First, there was uncertainty about the future of the street during the years the region debated rail technologies. If the region developed a rail system, it was expected to be located on Main Street. METRO's Regional Bus Plan, especially the Transit Street Program described below, ends that uncertainty. Second, the large number of people waiting for transfers on the local bus system along Main Street have been seen as a deterrent to more upscale development. The rerouting of some buses off Main and the building of a Downtown Transfer Center will reduce the number of people waiting for buses on this street.

METRO is beginning design work to improve 32 miles of Transit Streets in Downtown and Midtown (the area between Downtown and the Texas Medical Center). Seven north-south streets and 13 cross streets and their sidewalks will be rebuilt. In some cases, sidewalks will be extended to provide more room for transit stops and pedestrians. Main Street, in particular, will be reduced from a six lane thoroughfare to four lanes. About a third of bus service previously on Main has already been moved to other streets. Bus shelters, street lighting, information kiosks, and trees will also be added to the streetscape. The Downtown District, the downtown improvement association, is developing a plan for the private sector to build on this public sector \$177 million investment in Downtown and Midtown (METRO and Downtown Management District, 1995).

Transit Service for Major Activity Centers

While Downtown Houston has the best transit service in the region, other major activity centers within this polycentric city have less service and lower shares of commuting by transit (see Table 3). The Texas Medical Center has the largest transit market share of the three major employment centers near or inside the I-610 Loop. Bus service is better at this activity center than any of the others with 15 routes providing local and commuter service to the area. The area is easier to serve than other major activity centers because it is more like a downtown with denser development, buildings close to streets, pedestrian amenities, and parking charges. METRO and the Medical Center have also developed a working relationship. They work together to provide the circulator transit service within

the area and are now developing plans for improving the sidewalks along Main and other transit streets as part of the Regional Bus Plan improvements.

In contrast, the Greenway Plaza and Uptown areas were built near freeway interchanges with primary consideration for automobile access. These areas have large parking garages separating the streets from the main buildings and sidewalks designed for the residential development that preceded conversion to today's commercial and retail complexes.

The Uptown area formed a Transportation Improvement District in 1987 with the authority to assess *ad valorem* or benefit based assessments on property owners to finance improvements. The Uptown District has funded landscaping, traffic signals, and pedestrian crossings using these assessments. In addition, the District developed a transportation strategy in conjunction with public transportation agencies in 1991. Many of the arterial streets' improvements in the transportation strategy have been completed. The strategy also recommended improvements in bus service to the area and high capacity transit on the main north-south street, Post Oaks Boulevard. Transit service improvements have not yet been made, and METRO and the Uptown property owners have been unable to agree on the design and location of high capacity transit. METRO has proposed 1.5 miles of bus only lanes in the middle of Post Oaks Boulevard, but property and business owners do not want to lose the landscaped median in the boulevard and question the value of putting bus stops in the middle of a busy street.

The current HOV network was not built to directly serve Uptown or Greenway Plaza although both are close to the Southwest HOV and the Katy HOV is a few miles north of Uptown. The nearest exit on the Katy HOV facility to Uptown, for example, is three miles west of the area. Better connections are part of the long-range plan for HOV facilities. Construction is scheduled to begin this year on the ramp connecting Greenway Plaza to the Southwest Freeway HOV lane, but Uptown connections have not yet been scheduled. To fully serve these activity centers, HOV facilities need to be connected so traffic can move from one to another. The facilities also must allow two-way traffic that serves the reverse commuter. Because the HOV system was built incrementally during debates about the best fixed guideway transit in Houston, it was not developed as a system with these features. In hindsight, the region might have built a different system that better serves its dispersed activity centers (Sedlak, 1995). Now it faces the need to retrofit the system, and some of the changes like wider facilities are difficult and expensive projects.

Other more suburban activity centers like the Energy Corridor and Greenspoint are even more difficult to serve with transit. They have very low densities with campus style development (especially the Energy Corridor) and considerable undeveloped land.

Park-and-Ride Lots and Transit Centers Have Few Impacts on Neighborhoods

Park-and-ride lots and transit centers have had little effect on the land uses where they are located. This is partly due to the fact that many are located in places where little development has occurred in recent years. It is also related to the location and design of facilities, especially park-and-ride lots.

METRO has built its park-and-ride lots and transit centers in a variety of styles depending upon the neighborhoods where they are located. Neighborhoods are consulted about the

design and location of the facilities. Several projects have won design and neighborhood improvement awards. All facilities are landscaped, well maintained, have security, and provide people activity within a neighborhood. The Heights Transit Center in a historic neighborhood, for example, resembles a Victorian railroad station (See Figure 10). The intent was to sensitively blend 20th century technology within an historical context. Several projects including the Magnolia and Heights Transit Centers have replaced neighborhood eyesores. The Mesa Transit Center included parking at the neighborhood's request by leasing 100 spaces from a grocery store chain that was building a store near the site (METRO, 1992, 1993a).

Figure 10. Heights Transit Center



A Texas Transportation Institute analysis of land use patterns near park-and-ride lots and transit centers associated with HOV facilities found few, if any, land use changes that could be attributed to the facilities. Developers working in these areas said the facilities had no influence on their activities. The researchers noted that there was ample developable land near some of these facilities and that both an improved economy and more time needed to elapse before development impacts would be visible (Washington and Stokes, 1989). This study was conducted during the early years of HOV facility operations and may not have waited long enough for development to occur, especially when Houston was in a recession during much of the 1980s. In addition, park-and-ride lots are not designed to encourage transit-supportive development. They serve a population that largely arrives and departs by car, and access and egress is designed to be convenient for cars and buses, not people on foot. High fences and vast parking areas separate the people at the loading and unloading area from any nearby development.

Transit centers are generally located closer in than park-and-rides in areas where little development has occurred in the last 10 years. In some cases, transit centers have improved neighborhoods by removing neighborhood problems. In other cases the

neighborhood transit centers have lead to improvements in nearby properties, but not to changes in land uses or density. At the Southeast Transit Center, one of the oldest in the system, some nearby buildings have been rehabilitated and new businesses have opened. Homes near other transit centers have been spruced up. But at many transit centers, no changes in nearby properties have been noted.

2.5 CONCLUSIONS

Houston illustrates a number of institutional and cultural factors that mediate between transit and urban form in the United States. Limitations on transit influencing development include four facets of the development process in Houston and two ways the region has emphasized automobiles over transit.

Pattern and style of development

Houston is a prototypical sunbelt city with an emphasis on private sector decision making in the development process. This is reflected in:

1. A belief that the market should decide the type and location of development
2. Widely dispersed residential development
3. Decentralized employment
4. Employment centers outside downtown generally not conducive to transit service

While Houston is unique in its lack of zoning, it is not alone in emphasizing the market approach to development. Private property rights are strongly cherished throughout United States, and most communities grapple with where the balance should be between the common good and individual rights. Houston has a strong emphasis on individual property rights, but as Feagin (1989) noted most other sun-belt cities have made pro-development decisions that produce sprawling patterns of development like Houston's.

Residential development is widely dispersed in Houston for a variety of reasons including abundant developable land and middle class preferences for master planned communities that control externalities. These communities are most often built 20 or more miles from the central business district because large tracts of land in single ownership can only be found that far out.

Employment in Harris County is widely dispersed with less than 10 percent Downtown and 16 percent in the other five largest activity centers. That leaves the vast majority of employment outside these concentrations.

Transit serves Downtown Houston better than other major activity centers because employment is concentrated, the grid street system has room for many bus routes, pedestrians move easily from buses to buildings, and the HOV lanes all converge on downtown. As a result, more than a quarter of downtown workers use transit. The Texas Medical Center, which resembles a downtown in its design, has the second highest share of bus commuters. Other activity centers have lower densities, few streets that transit

can use, and an environment that is oriented to automobile, not pedestrian, access. Transit shares are accordingly lower.

Emphasis on automobile transportation

Because of Houston's widely dispersed residences and workplaces, the automobile is the primary means of mobility. The region has invested heavily in highways and streets, including using significant shares of the one percent sales tax originally designated for transit for these purposes. Two factors stand out as limiting the role of transit:

5. Major investments in freeway and arterial improvements to manage congestion including development of the nation's largest HOV system that is largely used by car-poolers
6. A powerful, well-liked mayor who believes in an all bus system and substantial use of transit funds for "general mobility"

Because congestion was seen as a major threat to growth, the region has invested heavily in transportation improvements. The region was able to reduce congestion while growing in population and jobs in the 1980s by improving freeways, building new arterials, developing HOV lanes, and adding transit service. Most of the \$1 billion in annual transportation funds were used for freeway and arterial expansions and improvements, but significant improvements were also made in transit service. METRO was heavily involved in planning, funding, and operating the HOV system although HOV systems in other cities are usually developed and managed by the state transportation department. While commuter bus service is faster because of HOV lanes, the primary users are car-poolers.

Houston has a strong mayor system of government, and a powerful person currently serving as mayor who has shaped transportation decision making. As METRO Board Chair after the 1988 referendum favoring light rail, Bob Lanier led an effort to re-evaluate light rail. After Mayor Kathy Whitmore refused to reappoint him to the METRO Board because of his advocacy of an all bus system, he successfully ran for Mayor in 1991. After his election, the METRO Board adopted the Regional Bus Plan that Lanier preferred and increased the share of METRO funds devoted to street projects. METRO has become more of a general transportation agency--building streets and roads, developing and operating HOV facilities, and providing bus service.

Transit that serves a dispersed polycentric city

Despite the difficulties of serving a sprawling 1,279 square mile territory, METRO has successfully boosted ridership. Keys to success include:

1. Identifying markets and developing appropriate services
2. Recognizing the possibilities and limitations of serving major activity centers

METRO has developed two distinct bus systems as well as HOV facilities that serve buses, vanpools, and carpools. Local services connect city neighborhoods with locations throughout the city via transit centers and downtown transfers. Commuter buses bring

suburban residents from park-and-ride lots to downtown jobs. The HOV system allows commuter buses to move at faster speeds than automobile traffic while also serving a large number of car-poolers.

Most activity centers outside downtown are not well served by transit. This is partly due to the design of the activity centers and the dispersion of activities within them. Transit has worked in some activity centers, such as in the Texas Medical Center, where the property and business owners recognize the value of transit and work with METRO to develop appropriate service. In other areas, METRO and the activity center groups have been unable to agree on services.

METRO built an HOV system without an overall plan for the network and in the process bypassed major activity centers. They are now retrofitting the system to provide ramps from HOV lanes to major activity centers as well as considering future changes in the system that would allow reverse commuters to use the HOV system. By improving the facilities and adding direct buses from park-and-ride lots, METRO will provide better service to the centrally located activity centers.

In sum, Houston's political culture is not amenable to developing a transit system that shapes the way the region grows. Rather the transit system fits with the region's pattern of development. Like most Americans, Houston area residents value the suburban lifestyle and the advantages of the automobile. Nonetheless, they have funded a transit system that serves their large area and has been successful in attracting riders who choose not to drive. The system serves the region's pattern of dispersed residential areas and provides commuter service to some of the region's major employment centers. If the transit system has had any affect on urban form, it has been to support the dispersed pattern of living.

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3.0 WASHINGTON, D.C. CASE STUDY

3.1 INTRODUCTION

The Washington, DC, area has coordinated transit investments and land use planning to achieve transit-focused development. Regional plans of the 1960s emphasized concentrations of development along transportation corridors in this growing region. The Metrorail rapid transit system was designed to serve radial corridors extending from downtown Washington into the suburbs. It became a key component of the planned metropolitan growth patterns of the regional plan. Where local governments have embraced the regional vision in their local plans, development has concentrated around rapid rail stations. Development has also been aided by a transit agency that has managed the rapid rail system to encourage ridership by providing frequent, clean, and reliable service. The transit agency has also actively solicited and supported joint development opportunities around stations.

Highlights of Lessons Learned

- Because regional agencies in Washington came to an early agreement on the need to match rail system planning with strategic planning for regional development, local jurisdictions were given a head start in preparing for transit-oriented development. The fact that large, powerful counties control development in the Maryland and Virginia suburbs aided coordination of transit and land development, despite the absence of subsequent regional planning support.
- Several local jurisdictions adopted transit-focused planning as a primary tenet of their planning for community development, providing the positive policy context for promoting station-area development.
- The Washington Metropolitan Area Transportation Authority (WMATA), as the region's primary transit agency, has proactively promoted development near transit stations, adopting supportive policies and assigning staff to work directly with developers and local governments to spur transit-related development.
- WMATA has allowed local jurisdictions to assume prime responsibility for planning and design of development around transit stations, providing a means for reconciling conflicting community goals.
- In a strong market, with vigorous policy support by both WMATA and public agencies, the station areas studied attracted major development, although some non-transit related suburban centers also developed rapidly. Evidence from development in four station areas suggests that a transit station presence helped to attract development.
- Station-area development has occurred in market locations considered desirable independently of a transit presence and during a strong development period in Washington. In some cases, the recent real estate recession has left projects financially marginal and station-area development incomplete.

- The importance of rail transit to development near Washington-area stations has undoubtedly been enhanced by the frequency of service and the construction schedule that lured commuters to the system early in its development.
- Parking costs and shortages of supply in the central city supported use of transit by employees and visitors, while parking availability and inexpensiveness around suburban stations probably encouraged park-and-ride transit ridership but reduced the attraction of suburban stations as commuter transit destinations.
- At each of the station areas studied, problems with intermodal conflicts, especially pedestrian movements, continue to vex project designers and local governments.

Report Organization

The remainder of this report tells the story of how station area development has occurred in Washington. Section 2 sets the context for station area development by describing the characteristics of the community, the public policy framework, the role of rail transit in shaping development, and the primary characteristics of the rail system. Section 3 describes the development process and the results at Friendship Heights, Bethesda, Ballston, and Silver Spring Stations. Section 4 draws some conclusions about the lessons learned.

3.2 CONTEXT FOR STATION AREA DEVELOPMENT

Community Characteristics

The Washington metropolitan area includes 13 counties in Virginia and Maryland plus the District of Columbia. With a population of 4.4 million in 1994, it is the nation's eighth largest metropolitan area and is growing at a rate of 21 percent a decade. Until World War II, although Washington was the nation's capital, it was a rather unprepossessing small city outside the downtown concentration of federal buildings and monuments. Its explosive development began in the 1940s, and since then development has expanded into the counties surrounding the District of Columbia, creating bedroom communities and suburban business centers. Table 6 shows the regional growth in population, households, and employment between 1970 and 1990.

The Washington region ranks high nationally in terms of household incomes, educational attainment, and concentrations of professional workers. Many of these workers are employed by agencies of the federal government, centered in downtown Washington but also located in a myriad of suburban office complexes. In addition, the Washington economy supports a vast array of private businesses, including professional and service firms, many of them oriented to serving government agencies. Another important component of economic activity is the hundreds of national associations headquartered in the capital.

Table 6. Population, Households, and Employment

The Washington Region and Individual Jurisdictions
1970, 1980, 1990
(In Thousands)

Place	Population				Households				Employment			
	1970	1980	1990	% Change 1970-90	1970	1980	1990	% Change 1970-90	1970	1980	1990	% Change 1970-90
District of Columbia	756.7	638.3	606.9	-20%	262.5	253.1	249.6	-5%	618.1	666.0	747.3	21%
Arlington County	174.3	152.6	170.9	-2%	69.4	71.7	78.8	14%	140.3	141.0	183.1	31%
City of Alexandria	110.9	103.2	111.2	0%	42.5	49.2	53.3	25%	46.7	64.6	92.2	97%
Central Jurisdictions	1041.9	894.1	889.0	-15%	374.4	374.0	381.7	2%	805.1	871.6	1022.6	27%
Montgomery County	522.8	579.1	757.0	45%	156.7	207.3	282.0	80%	219.7	302.0	465.5	112%
Prince George's County	661.7	665.1	729.3	10%	193.0	225.4	258.0	34%	191.6	245.0	310.1	62%
Fairfax County	454.3	595.8	818.6	80%	126.5	205.3	292.3	131%	173.8	214.5	407.8	135%
City of Fairfax	22.0	20.5	19.6	-11%	6.1	7.2	7.4	21%	12.6	18.6	26.9	113%
City of Falls Church	10.8	9.5	9.6	-11%	3.7	4.3	4.2	14%	6.6	8.0	9.2	39%
Inner Suburbs	1671.6	1870.0	2334.1	40%	486.0	649.5	843.9	74%	604.3	788.1	1219.5	102%
Loudon County	37.2	57.4	86.1	131%	10.4	18.7	30.7	195%	10.0	17.5	39.3	293%
Prince William County	95.1	144.7	215.7	127%	27.8	43.8	69.7	151%	32.8	37.0	65.8	101%
Calvert County	20.7	34.6	51.4	148%	5.5	10.7	17.0	209%	6.1	7.6	14.7	141%
Charles County	47.7	72.8	101.2	112%	12.1	21.4	33.0	173%	15.5	22.2	38.7	150%
Frederick County	84.9	114.8	150.2	77%	24.9	37.5	52.6	111%	32.8	43.5	54.0	65%
Stafford County	24.6	40.5	61.2	149%	6.7	12.2	19.4	190%	1.1	2.3	5.7	418%
Outer Suburbs	310.2	464.8	665.8	115%	87.4	144.3	222.4	154%	98.3	130.1	218.2	122%

Source: Metropolitan Washington Council of Governments

As the Washington rail system was being planned in the 1960s, downtown Washington was by far the primary location of business and government in the region. Downtown has expanded as the region has grown; although zoning restrictions keep building heights generally below 13 stories, office and retail development has spread west to Georgetown and north to Massachusetts Avenue, and in the 1980s private redevelopment of the older downtown commenced. Today, most downtown blocks are developed at average floor area ratios (FAR's) of about eight (gross FAR is estimated at about five or six FAR) and almost a third of all employees in the region work in the District.

Although Washington employment remains quite centralized compared to many other metropolitan areas, a considerable amount of development and redevelopment has taken place in suburban centers, some of them quite large. Mini-cities such as Rosslyn, Crystal City, Tysons Corner, and Bethesda, each of which boasts millions of square feet of office space accompanied by regional shopping malls and a vast array of business services, now rival downtown Washington as economic centers. Their emergence has been aided by public policies that have encouraged development and provided highway and transit connections to these development nodes. However, gross densities in suburban centers outside Rosslyn and Crystal City generally average less than one FAR.

Public Policy Framework

Unlike many urban regions in the United States, the Washington metropolitan area is made up of relatively few jurisdictions. In both Virginia and Maryland, counties are the key units of government for most of the area around Washington, except for the District of Columbia, the city of Alexandria, and a few relatively small suburban cities and towns. County officials possess authority to guide development over considerable expanses of territory. Officials in Maryland counties have tended to wield that power with considerable force to channel development into designated areas and regulate its quality and timing. Montgomery County is known nationally for its aggressive growth management program, and other Maryland counties routinely follow rigorous planning and zoning practices.

By contrast, officials in most Virginia counties have felt bound by state restraints on their planning and zoning, and have made relatively timid moves to guide urban growth. The exceptions are Arlington County and the city of Alexandria, which have acted more boldly to impress public objectives on the development process, as will be described in the Ballston case.

The third component in the region's governmental structure, the District of Columbia, was not granted self-government until after Metrorail was planned and under construction. Congress continues to restrict its exercise of municipal powers. Like many other metropolitan centers, the District has a large share of the region's minority population and the poor and suffers a high crime rate and a problem-ridden school system.

The District's relationships with suburban jurisdictions have been increasingly strained. Regional coordination of development policies and regulations has been quite weak; the District and the urban counties are jealous of their powers and feel inclined to go their individual ways unencumbered by actions of adjoining jurisdictions. The Washington Council of Governments has played a role as facilitator and consensus-builder on regional

issues but has refrained from crafting a regional growth strategy that would link the development aims of the various local jurisdictions. Its transportation arm, which acts as the metropolitan planning organization for the region, suffers from similar problems in surmounting jurisdictional rivalries.

Some regional planning guidance for area jurisdictions was provided in earlier decades by the National Capital Planning Commission, a federal agency that produced a plan in 1960 ("A Policies Plan for the Year 2000") calling for development organized in a system of radial corridors, supported by highway and transit lines, separated by green "wedges" of open space and low-density development as shown in Figure 11 and Figure 12. This planning concept found its way into many of the local governmental plans since the 1960s, thus introducing to local development policies the role of transit in shaping urban form.

Rail Transit as an Element of Development Policy

The U.S. Congress enacted the National Capital Planning Act in 1952 mandating preparation of regional plans for transportation systems, which was followed in 1954 by establishment of an interjurisdictional commission. In 1960, the National Capital Transportation Act created an agency to plan a rapid-rail system. Upon completion of a plan for a 25-mile system capable of being expanded into the region, the Washington Metropolitan Area Transit Authority (WMATA) was established by Congressional action and an interstate compact was signed in 1966 by the states of Maryland and Virginia and the District of Columbia.

The rapid transit system envisioned by the compact was designed to serve radial corridors extending from downtown Washington into the suburbs (see Figure 13), thus becoming a key component of planned metropolitan growth patterns laid down by the National Capital Planning Commission. In fact, joint development or transit-oriented development has taken place at many of the stations, especially those in the District's downtown area and in certain suburban centers.

When planning for the rail transit system was initiated, the potential relationships between rail transit and development were understood differently among the jurisdictions involved. The jurisdictions most immediately affected by the construction schedule for the transit system were the District, Montgomery and Prince George's counties in Maryland, Arlington County in Virginia, and the city of Alexandria. These jurisdictions were highly receptive to the potential advantages of rail transit in promoting and directing development, particularly economic development.

The District and Alexandria, both older cities whose population and proportion of regional jobs had been shrinking, were interested in attracting job growth for their ailing downtowns and community centers. Montgomery, Prince George's, and Arlington counties saw the coming Metrorail system as an opportunities to stimulate employment increases to balance their past development as bedroom communities and to direct planned growth to compact centers in and near existing settlements and along major corridors. As a result, transit-oriented development was woven into many general plans and zoning ordinances, and transit development proceeded hand-in-hand with land use development.

Figure 11. Year 2000 Wedges and Corridors Regional Concept

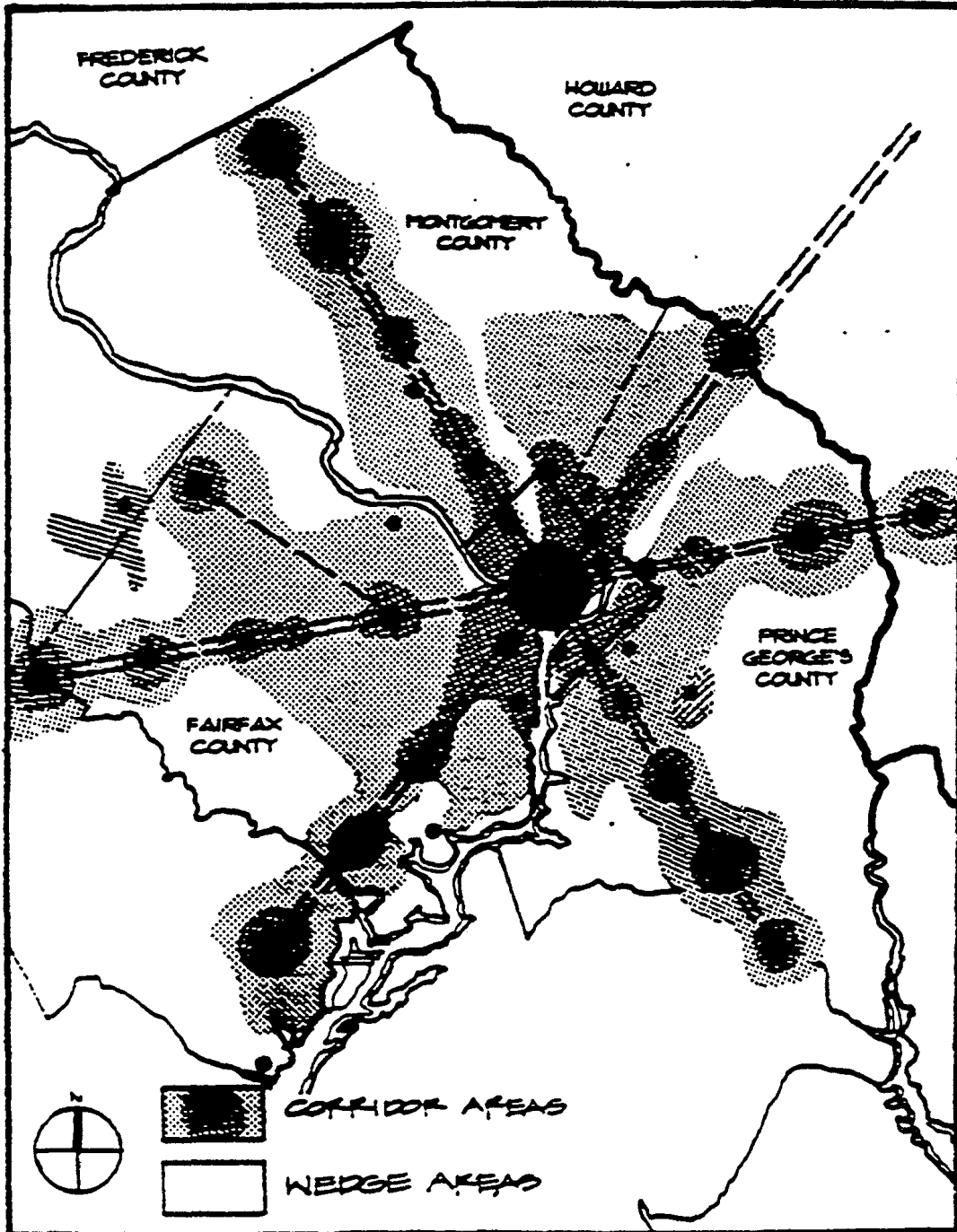
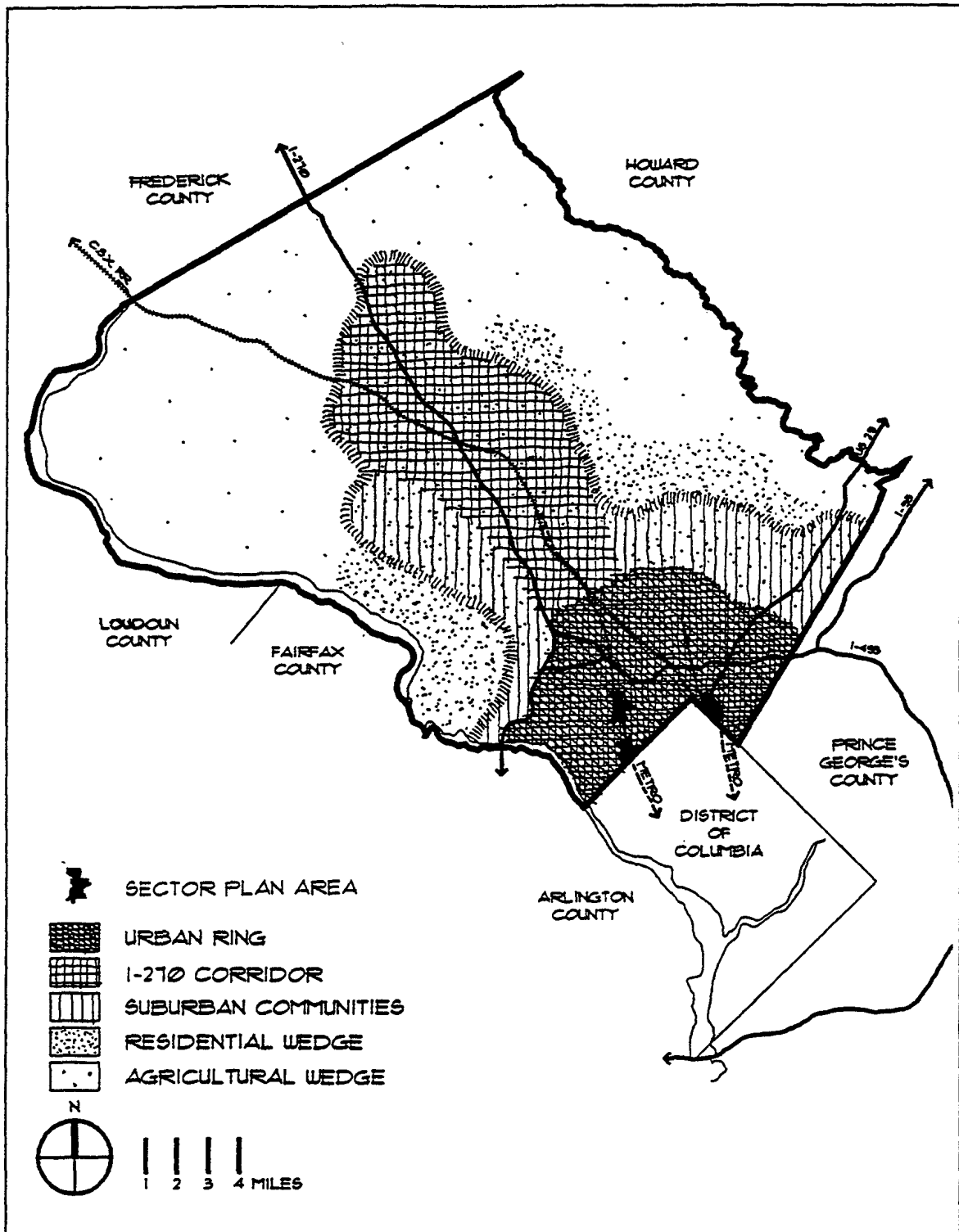


Figure 12. Sketch of Wedges and Corridor Plan for Montgomery County, Maryland



BETHESDA CBD SECTOR PLAN

PLANNING BOARD (FINAL) DRAFT

By contrast, jurisdictions scheduled for Metrorail service at a later time (some of which are still waiting for completion of the system) have been considerably less enthusiastic about transit-supportive development. Fairfax County, to which service was extended in the mid-1980s (with another extension still planned), was unable to reach consensus on station-area development opportunities, in part because so much business development was taking place in areas not served by rail transit, including the Tysons Corner megacenters. Prince George's County, whose expectations for development around its first transit extension proved overblown, has found communities along the line planned for the late 1990s extremely reluctant to respond to growth opportunities. Also, although ideas for additional lines and extensions have been explored, the jurisdictions most affected by them have remained decidedly cool about their potential impacts. In addition, in this fiscally conscious age, all Washington-area jurisdictions are greatly troubled by potential costs of such extensions.

The variety of jurisdictional attitudes toward the rail system is reflected in parking policies. In the main group of federal buildings in the Federal Triangle, which includes buildings bordering the Mall, the General Services Administration provides free spaces mostly for official vehicles. Few other parking facilities except on-street parking are available within the area, which encourages most employees and visitors to use transit. In the District outside the Federal Triangle, federal and other employees pay rather steep parking rates (currently about \$8 to \$10 per day), although private firms often provide some free parking for employees. WMATA provides no park-and-ride facilities in the central area.

In suburban jurisdictions, parking generally is less costly and more plentiful. In the case study areas, for example, parking is readily available and the local jurisdictions have constructed garages to support business development. In one case, Silver Spring, WMATA has leased park-and-ride spaces, a practice that it follows in many of the outlying station areas. Federal facilities, depending on the facility, provide some free parking for employees but require many workers to pay modest rates. Thus employees working in these areas have less pressure to use transit.

For many local jurisdictions, however, WMATA's Metro rail and bus system are considered a key component of metropolitan growth strategies. As described in the next sections, the agency's and jurisdictions' policy and regulatory efforts at supporting development around transit stations, combined with a decades-long real estate boom, have transformed the region's development patterns.

Primary Characteristics of the Rail System

In 1968, WMATA approved plans for a 98-mile regional rapid rail system with 86 stations. In 1974, the transit agency purchased four private bus companies operating in the metropolitan area to better coordinate rail and bus service. As rail stations opened, WMATA reorganized bus lines to feed them, dropping many of the longer and express routes paralleling the rail lines.

As Figure 14 shows the system consists of four lines, all designed to follow the major corridors of existing or planned higher-density development in the various jurisdictions. Often these follow existing major road and highway alignments, although parts of the system utilize former rail rights-of-way. Stations were located at existing and future nodes

of activity designated in regional and local plans. Much of the system in the District and close-in jurisdictions is underground.

From the first, METRO's construction and operational policies were oriented to maximizing ridership, especially from commuting workers employed in the District. By 1978 the Red and Blue lines had opened stations along major commuting corridors to Silver Spring, the Connecticut Avenue corridor, federal buildings along the mall, the Rosslyn and Crystal City office districts and National Airport, and the eastern corridor to Capitol Hill and Prince George's County. Construction during the 1980s extended service farther into the commute-shed in the Maryland and Virginia counties. In addition, Metrorail established headways of 3 to 5 minutes on most lines during peak hours to attract commuters. Although parts of the Red and Blue lines served the District's eastern half, only in the 1990s did construction of the Green and Yellow lines begin to provide service to many heavily minority residential sections of the District.

In 1995, although 89 miles of the rail system and 75 stations are in service, parts of the system (now planned for 103 miles) are still in the planning stage or under construction. (See Table 7). The rail system carries about 520,000 riders on an average weekday, up from 447,000 in 1987.

Table 7. Miles and Stations When Metro is Completed

<u>Jurisdiction</u>	<u>Miles</u>				<u>Stations</u>
	<u>Subway</u>	<u>Surface</u>	<u>Aerial</u>	<u>Total</u>	
District of Columbia	27.7	7.5	3.0	38.3	39
Montgomery County	10.4	7.3	0.7	18.4	11
Prince George's Co.	4.1	10.0	2.7	16.9	13
Alexandria	0.8	4.6	0.7	6.1	3
Arlington County	6.9	4.0	1.2	12.2	11
Fairfax County	0.1	10.2	0.9	11.2	6
Totals	50.1	43.8	9.2	103.0	83

Source: Washington Metropolitan Area Transit Authority, 1995.

METRO's interest in planning for station-area development emerged early. The authority solicited proposals for joint development as early as 1973, three years before the system began operation, and by 1988 had executed agreements with developers for projects at nine stations. Two projects that got underway soon after Metrorail construction began set the tone for subsequent efforts. The development of air rights and surplus WMATA land at the Farragut North station, virtually the "100-percent corner" of new office development in the District, began with an invitation for developer interest in 1975. Six developer groups responded and the office/retail project quickly set the standard for subsequent station-area development. During the same period, a system interface agreement was reached with the Woodward and Lothrop company to allow direct access from the Metro Center station into the company's flagship downtown store. The immediate increase in sales experienced at the store helped sell the concept of transit-related development throughout the system.

These and subsequent agreements were initiated by staff detailed to pursue joint-development opportunities, usually a lead person with some background in real estate and a brief to encourage dealmaking. This led to establishment of an office of planning and development in 1981, with the development branch charged with carrying out an ambitious program of station-area development. The program focuses on three aspects of development:

- joint development of property owned or controlled by WMATA, primarily air rights over stations or small parcels leftover from station development;
- system interfaces of stations with adjoining properties, including new buildings constructed to access the stations;
- transit zone development, where WMATA will cooperate with landowners and jurisdictions in generating development within 3,000 feet of a station entrance.

WMATA's policy in initiating the program was to "promote, encourage, and assist in the creation of high-quality, more intensive development at or near appropriate stations areas." WMATA proposed to analyze development potential at existing and proposed station areas and prepare short-range and long-range development programs.

Studies in 1981 involved joint development opportunities at 20 stations and identified 150 potential system interface opportunities. Based on these possibilities, WMATA adopted specific goals and policies to guide its joint development and system interface efforts. (See Table 8 for a list of WMATA goals and policies.) As stations are planned, development possibilities are evaluated and requests for developer interest are solicited. By 1994, WMATA had participated in 22 projects and was requesting proposals for development at several additional stations. WMATA also continues to monitor station-area development around stations already in operation.

Table 8. Synopsis of WMATA Goals and Policies for Joint Development and System Interface Activities

Goals for Joint Development (Adopted 1986)

1. Increase ridership on the transit system and obtain additional revenue from the ridership.
2. Obtain additional revenues and other considerations from development activities.
3. Complement and support local land use and development policies, social goals, and transportation programs.

Policies for Joint Development (Selected) (Adopted 1986)

1. Projects shall be conceived, designed, constructed, operated, and maintained to preserve and enhance the missions of the Authority.
2. Joint development projects shall be initiated and pursued in full coordination and cooperation with affected local jurisdictions.
3. The Authority's board shall approve the annual work program for joint development.
4. The board shall approve all disposition and joint development plans, site prospectuses, and developers recommended by the general manager.
5. The board shall ratify and authorize the general manager to execute the joint development lease agreement negotiated by the general manager.
6. Evaluation criteria for development shall include rental and incremental farebox income, taxes, developer fees and contributions, value of transit facilities provided by developers, municipal service costs, other expenses, incremental bus and rail ridership, and established real estate policies and procedures.

Policies for System Interfaces (Adopted 1969, reaffirmed 1986)

1. Business establishments will be permitted "to construct entrances, at their expense, directly into the free area of Metro station mezzanines in those cases where benefits to the Authority in terms of revenues from potential increased ridership or convenience to patrons are anticipated and the nature of the proposed commercial enterprise is otherwise acceptable to the board."
2. "Because each proposed commercial tie-in will involve circumstances peculiar unto itself in terms of size, location and nature of the business enterprise, it is further recommended that such tie-ins be negotiated on a case-by-case basis on terms and conditions tailored to the individual case, including compensation to the Authority where possible. Each request for the tie-in privilege will be presented to the board for authorization to negotiate as well as to execute a contract."
3. If a local jurisdiction has spent money to assist a property or properties in making an interface connection, reimbursement to the jurisdiction should take precedence before fee compensation to WMATA.

3.3 STATION AREA DEVELOPMENT

Development experience at four station areas illustrates WMATA's approach to and success with station-area development, including joint development, system interfaces, and associated station-area development. Three are in Montgomery County and one in Arlington County, all demonstrating the variety of approaches to coordinating transit and land use development.

Friendship Heights

The Friendship Heights Metrorail station straddles the line between the District of Columbia and Montgomery County about five miles north of downtown Washington. In the 1970s, Friendship Heights was a growing commercial, employment, and high-density residential center and the historic location of terminals for the former trolley lines and the bus network. Both District and county plans anticipated continued major development of the area as a regional center due to its accessibility by higher-income residents of Northwest D.C. and the Chevy Chase and Bethesda neighborhoods of Montgomery County. Figure 15 shows the location of the Friendship Heights Station (and the Bethesda Station discussed next) on the Metrorail Red Line along Wisconsin Avenue.

When planning for the Friendship Heights station began, a neighborhood shopping center adjoined the bus terminal and the quarter-mile area around the station encompassed two department stores and a number of small retail shops, some office and medical buildings, an insurance company's headquarters' offices, and several highrise residential buildings. Figure 16, from the 1974 Sector Plan, shows the central position of the Metro Station in the Friendship Heights commercial center. Figure 17 shows the principal design guidelines for the Friendship Heights Metrorail Station joint development project. By 1995, Friendship Heights had become one of the premier regional shopping and office centers in the region, boasting five major department stores, two prominent retail arcades, top-of-the-line retailers, several major office buildings, and additional luxury highrise residential buildings. At the center of this mixed-use regional complex, with direct access via a joint development project and three system interface projects, is the rail station and bus terminal.

The joint development project was constructed over the rebuilt bus terminal which, with an adjoining private tract, provided a 60,000 square-foot site at the corner of the two main streets, Wisconsin Avenue and Western Avenue. The owner of the shopping center adjoining the site had already indicated interest in developing a mixed-use project. After a zoning skirmish with area residents over initial development proposals, the Montgomery County Planning Board adopted a special zoning district for the site that allowed an optional doubling of density under special hearing and design review procedures.

With this policy framework in place and planning board staff cooperating, the developer entered into negotiations with WMATA. Each party had something to gain from joint development. The developer, Chevy Chase Land Company, needed to consolidate WMATA's and its own properties to create a buildable site. WMATA also required the larger site to enable reconstruction of the bus terminal and provide convenient access to the underground transit station. The planning board hoped for a well-designed project that would stimulate creation of an attractive regional center at a key down-county location.

Figure 15. Location of Friendship Heights and Bethesda Metrorail Stations

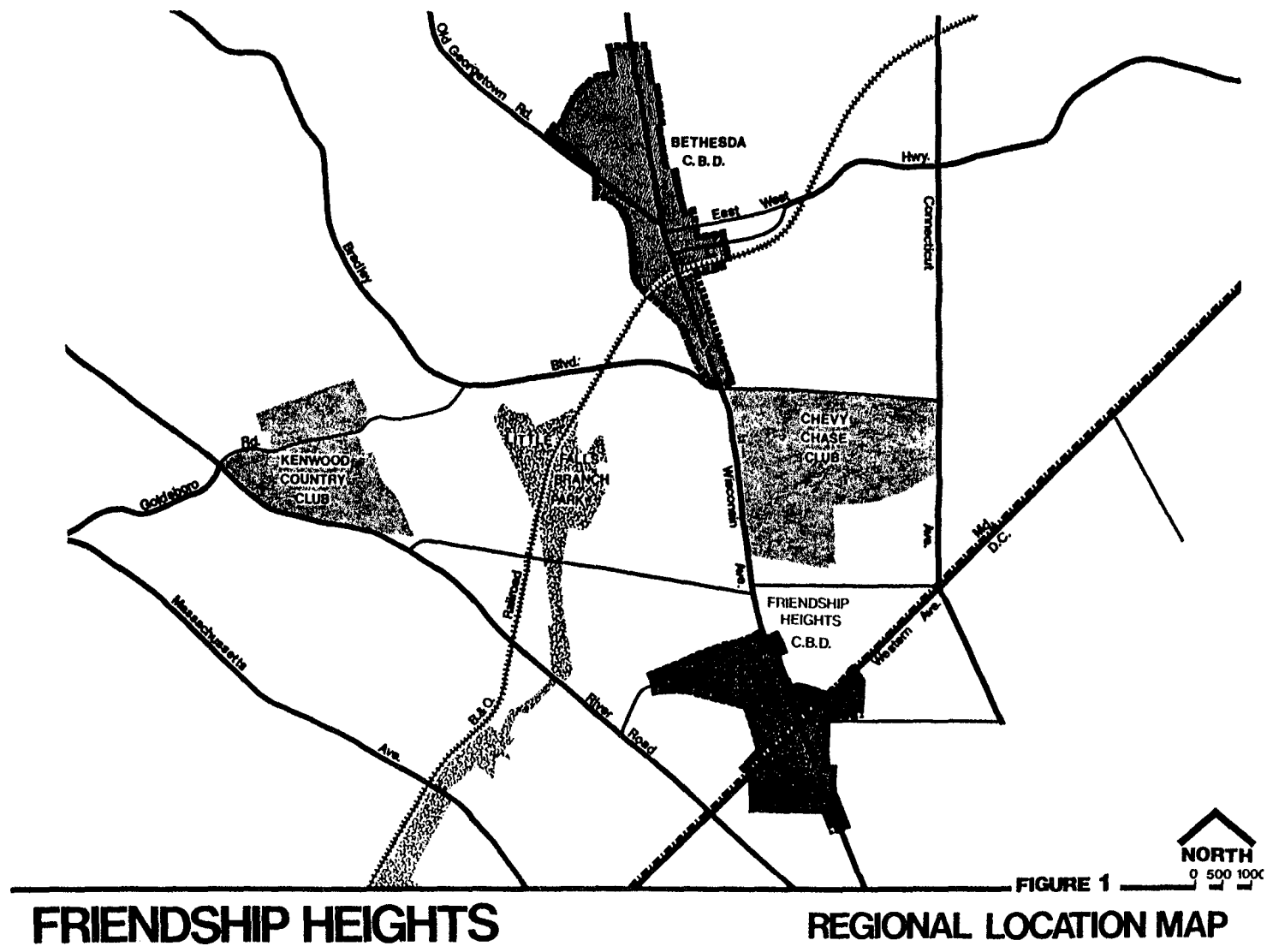
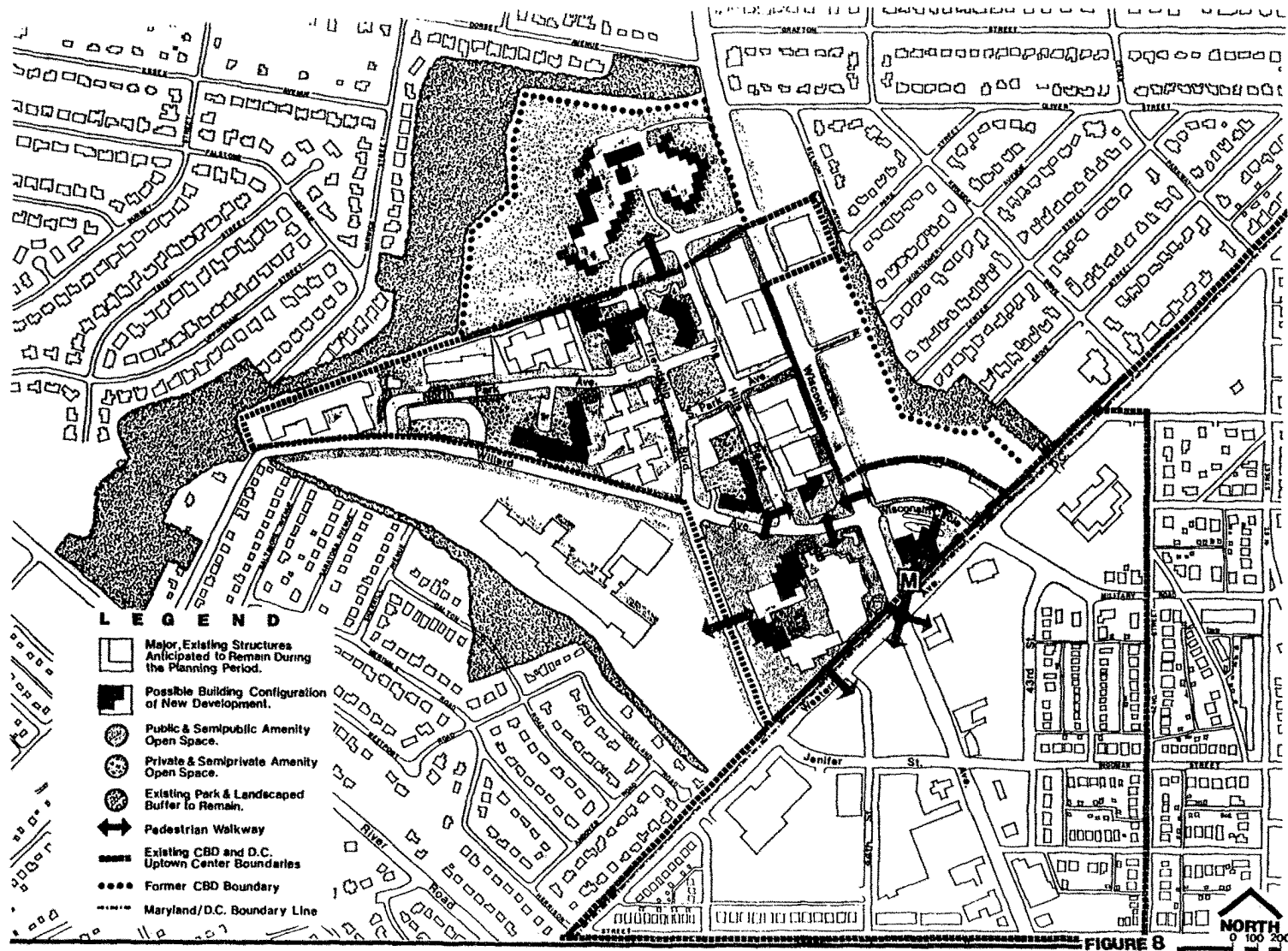


Figure 16. Design Concept for Friendship Heights Metrorail Station



FRIENDSHIP HEIGHTS

DESIGN CONCEPT

Figure 17. Design Criteria for Friendship Heights Metrorail Station Joint Development Project

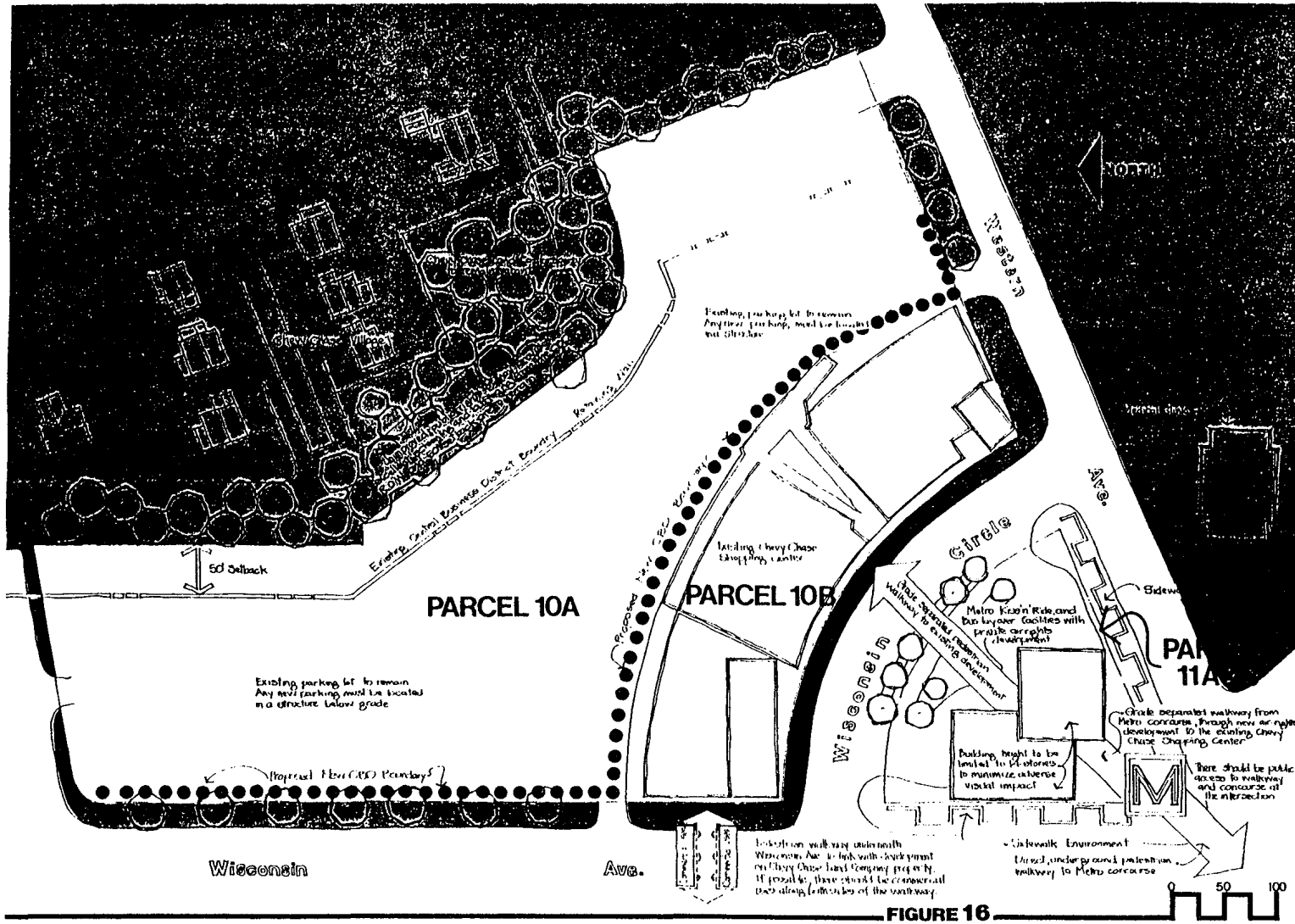


FIGURE 16

FRIENDSHIP HEIGHTS

DESIGN CRITERIA PARCELS 10 & 11

The resulting development is a 13-story, 240,000 square-foot building with 11 floors of office space and two floors of retail space, constructed over the ground-floor bus terminal and Metrorail escalators and three floors of underground parking with 381 spaces. This project is shown in Figure 18.

Figure 18. Joint Development Project at Friendship Heights Metrorail Station



Although WMATA established basic guidelines for ensuring adequate bus and rail service, such as geometrics for bus bays, bus turning radii, specifications for park-and-ride lots, and so forth, it allowed the planning board to advise on major design aspects of the project. A small design group created by the board worked with the developer and WMATA to hammer out a host of design issues, including the configuration of bus bays, pedestrian access, and safety and security. Protracted reviews by local citizen groups concerned with proposed densities and impacts on pedestrian movements and nearby uses required special analyses and redesigns.

Negotiations over details of the joint development agreement were extended and complex. The final agreement, signed in 1979, conveyed the Metro property to the developer in fee simple, with WMATA carrying back a permanent easement for bus operations and Metrorail access. The developer was to construct all facilities except the Metrorail entrance, including bus terminal facilities, and agreed to pay an annual fee of \$26,600 as

a license for the direct connection to Metrorail. Covering a period of 30 years, renewable, the license has generated \$270,000 to date for WMATA.

Interface connections with other nearby developments included one with the existing Woodward and Lothrop department store (now Hechts) executed in 1972 as part of the downtown store connection agreement, a second in 1983 to the Mazza Gallerie shopping arcade, and the third in 1988 to the Chevy Chase Pavilion, a mixed-use development. Another potential connection to additional development is available. All garnered fees for WMATA, some paid over extended periods.

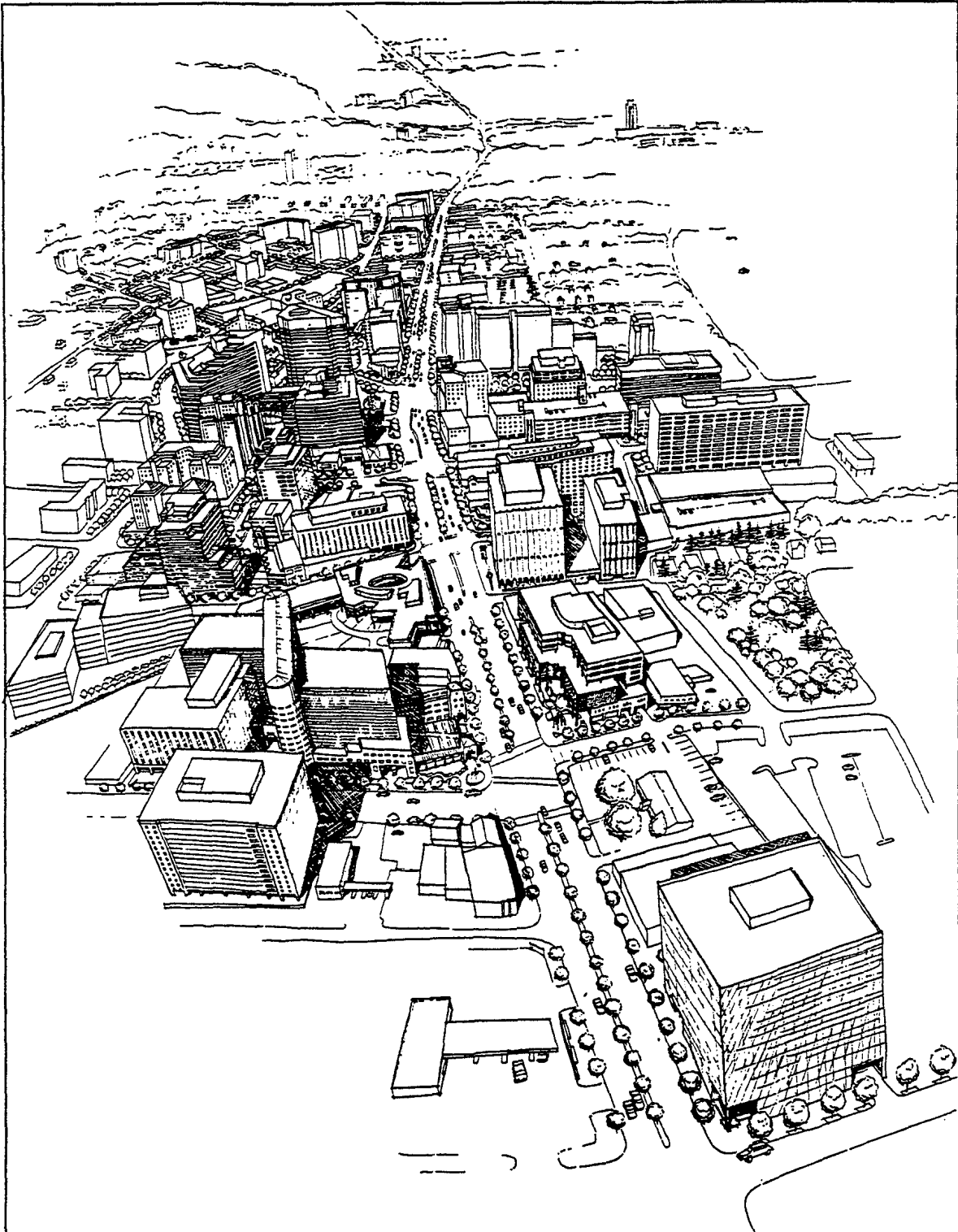
Only a few park-and-ride spaces are leased by WMATA to serve the station. No other public parking is provided; WMATA's original plans to build a major garage were successfully fought by local residents who feared ensuing traffic problems. However, a considerable amount of parking was provided by existing facilities and all the new private developments constructed underground garages. At the present time, two hours of free parking is provided in much of the new space and long-term parking is relatively cheap.

The Friendship Heights station occupies a particularly central position in this regional center, and ridership has remained strong. Daily passenger boardings averaged 8,343 in 1995 compared to 5,674 in 1985. (No studies have been carried out to define the contribution of station-area development ridership to the total.) Pedestrian connections between the joint development project and adjoining shopping center remain a problem, but the overall functional and financial performance of the project has been exemplary. With completion of additional development expected over the next decade, Friendship Heights will present an unusually effective mix of employment, retail, and residential uses closely associated with rail and bus transit.

Bethesda

The next station north of Friendship Heights in Montgomery County is in Bethesda, the site of a much larger joint development project as well as a system interface. A traditional commercial and business center for Montgomery County, Bethesda was decidedly low-key in character when Metrorail arrived in the late 1970s. A few highrise office and residential buildings contrasted with the predominantly one- and two-story buildings located on or near Wisconsin Avenue. However, its proximity to one of the highest-income residential areas in the region plus the presence of National Institutes of Health and Bethesda Naval Hospital less than a mile north had stimulated increasing interest by developers. In addition, the area was designated as a regional center on county plans and a sector plan supporting a considerable amount of new development had been approved by the county in 1976. (See Figure 19) Accordingly, WMATA found a private sector ready to act and the county government interested in promoting opportunities for joint development.

Figure 19. Aerial View of Downtown Bethesda



BETHESDA CBD SECTOR PLAN

PLANNING BOARD (FINAL) DRAFT

The primary site was a tract of 115,000 square feet purchased by WMATA in 1975 to provide space for station construction. Located at the 100-percent corner of Bethesda, the intersection of Wisconsin Avenue with East-West Highway and Old Georgetown Road, the tract was bordered by properties ripe for redevelopment. The county planning board, in fact, designated the entire block for unified design treatment; the area included the WMATA property, a county property originally acquired for parking, the corner tract for which an office building had been proposed, and another large parcel. Two smaller parcels and the Bethesda post office were included in the block but excluded from the development.

In 1977, as acquisition of the Bethesda station site was being completed, WMATA joint development staff solicited the interest of the county's planning staff in combining the WMATA and county properties to form a developable parcel. Some studies were done but not until late 1978, when a proposal for developing the corner property was submitted to the county, did the planning board seize the initiative. With a "handshake agreement," planning staff agreed to the idea of consolidating the site and preparing county guidelines for WMATA's use in selecting a developer. A design concept and urban design principles were soon completed and by the end of 1979 the planning board recommended council approval to concentrate planned business development around the WMATA station and to use an optional zoning district procedure that permitted an increase in densities from three FAR to six FAR in exchange for contributions of public spaces and amenities. Major design features are shown in Figure 20.

The design guidelines called for creating an exciting mixed-use project that would become the center of Bethesda activities, including a lively urban plaza over a bus terminal, bordered by high office buildings, a retail complex, and a hotel. Building masses and open space diagrams were included in the guidelines. WMATA's request for developer proposals, incorporating the design guidelines, were issued in June, 1980 and attracted three serious proposals. The winning proposal, and the subsequent built project, included 370,000 square feet of office and retail space in a 17-story building, a 12-story, 380-room Hyatt hotel, 38,000 square feet of retail space mostly located in a food court on the plaza, and 1,400 parking spaces. The 90,000 square-foot plaza stepped down to the corner and contained a clock tower, sculptures, fountains, and landscaping. This project is shown in Figure 21 with the project's plaza and Metro entrance at the center of the scene.

The project linked directly to the 17-story office building constructed separately on the corner parcel, and was to also connect to another office building still to be developed. A pedestrian bridge connects the project with a county parking and residential structure farther west. An underground pedestrian passage also connects the rail and bus stations to an office building on the eastern side of Wisconsin Avenue.

The developer offered an annual payment of \$1.6 million for a 99-year lease on the site, including easement lease-backs to WMATA for the bus terminal, rail station access, storage facilities, and kiss-and-ride facilities. The lease also promises WMATA 7.5 percent of the project's gross annual income above a base of \$31 million, a income level which has not yet been reached. The developer constructed all WMATA facilities above the rail-station escalators and the public plaza, and executed a cooperative agreement with the owner of the corner building to maintain the plaza.

Figure 20. Urban Design Guidelines for Bethesda Metro Center

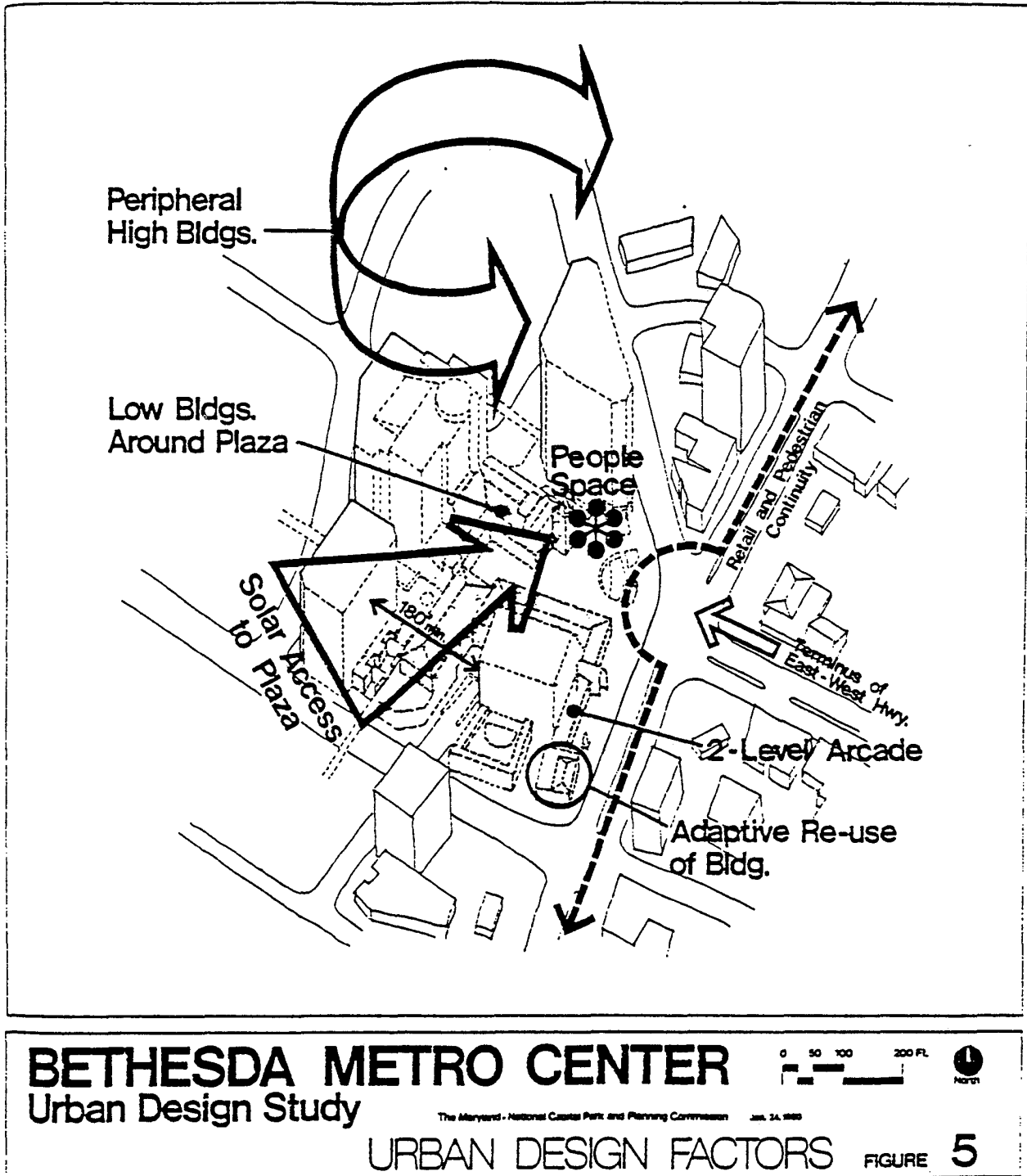


Figure 21. Metro Center Project at Bethesda



Other projects developed near the station, including eight major office complexes and a hotel constructed through the optional zoning procedure that became known as the "beauty contest." The 1976 sector plan had established a ceiling on development. County planners announced that projects offering a high quality of construction and significant public amenities would be first in line for approval. In the subsequent competition, developers supplied open space, public art, and other community-oriented facilities to satisfy the pedestrian-oriented design criteria of the sector plan.

In addition, west and south of the commercial core hundreds of luxury condominium and rental apartments were built and the Bethesda Urban District raised funds to redesign and redevelop the downtown streetscape. The office boom in the 1980s coincided with a restaurant and arts boom that continues to this day. In 1995, Bethesda's downtown area, about two-thirds of a square mile, contains seven million square feet of office space, 2.3 million square feet of retail space (mostly small shops, services, and restaurants), and 5,000 housing units, with a total employment of 39,000.

This development has been supported by a county-initiated program to finance and build public parking structures. Bethesda has about 6,500 public spaces in garages and on the

street. County garage spaces cost \$75 per month or \$.50 per hour for short term parking. These garages operate virtually at capacity. Metro Center's garage, which charges more, is seldom full.

The Metro Center project has proven commercially successful, although the retail shops have never functioned as well as hoped and the office tower, whose financing was highly leveraged, was taken over by the lenders during the recent real estate recession. Some of the problems are due to the postponement of the county's residential and parking project west of the site, on which construction is now underway, and the third office building south of the site; completion of these buildings over the next few years will generate increased activity on the plaza level as well as additional rail and bus ridership. Even without those components, daily passenger boardings have risen from 5,811 in 1985 to 7,501 in 1995. All in all, the Bethesda Metro Center joint development project -- and station-area development in general -- has transformed Bethesda's downtown area.

Ballston

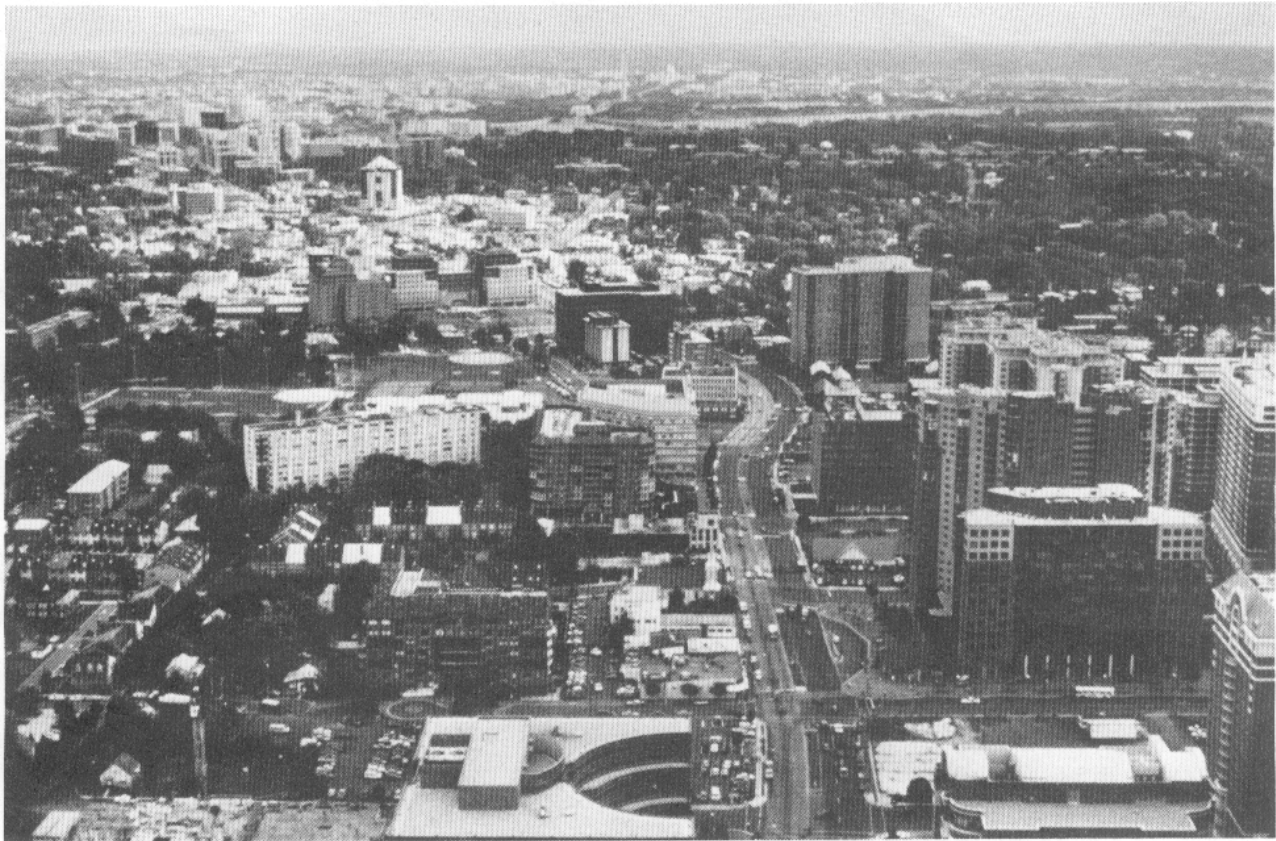
Arlington County has been the most aggressive county in Northern Virginia in seeking to focus growth near transit stations to achieve tax and job benefits. It began planning as early as 1968 to evaluate the potential ways that transit might benefit its economic objectives, and a 1972 plan, RB '72: Rosslyn-Ballston Corridor Alternative Land Use Patterns, proposed to concentrate future intensive development around the five stations in that corridor. The plan reasoned that focusing intensive development around transit stations would help to preserve existing neighborhoods from commercial intrusions. However, the 1960s building boom in Rosslyn, just across the Potomac from Georgetown, proclaimed the potential downside of intensive development: massive buildings, a loss of pedestrian scale and street life, and wholesale change. In response to that earlier experience, a citizen's advisory group bought the concept of intensively development station areas but recommended that high-density development around transit stations be accompanied by attention to pedestrian access and mobility as well as architectural quality and amenities. Ballston represents the culmination of a series of county and citizen-supported planning endeavors to avoid repeating the Rosslyn experience.

Ballston is a 39-block, 270-acre redevelopment area located just ten minutes from Capitol Hill and the White House. Metro service to Ballston began in 1979, when the area consisted of parking lots and aging commercial buildings along the main streets. The Ballston sector plan completed in 1980, however, envisioned Ballston as a new mixed-use center, combining high-density commercial and residential development within a one-quarter mile radius of the transit station. The area was to include open space, neighborhood retail shops, and pedestrian walkways. Soon after the plan was issued, the area immediately around the station was zoned for coordinated mixed-use development that provided major density incentives for projects that are half commercial and half residential. The permitted floor/area ratio of 3.5 for commercial uses could be increased to six; even higher ratios could be achieved with more residential space. Street-level retail uses were required in all commercial buildings.

In 1982, the county agreed to help finance a 3,200-car parking structure to assist in development of the new Ballston Commons shopping center on the site of a 1950s center. The garage also provides Metrorail parking just three blocks from the Ballston station. In

1985, a group of developers, businesses, residents, and public officials formed the Ballston Partnership to promote high-quality urban design and coordinate infrastructure improvements and marketing in the area. During the mid to late 1980s, bolstered by the robust real estate climate and Arlington County's prime location, nearly two dozen projects were undertaken within one-third of a mile of the station. About 3.7 million square feet of commercial space, 4,300 dwelling units, and three hotels have been built since 1984; 2.5 million square feet of office/retail space and 1,000 dwelling units have been approved for future construction. The joint development project is shown on the right among a variety of new and older buildings in Figure 22.

Figure 22. Joint Development at Ballston Metrorail Station



One of the major new projects was Ballston Metro Center directly above the WMATA station. It consists of a 12-story, 217,000 square-foot office and retail building, a 26-story building housing 277 condominium units and 209 hotel rooms, both over a platform that contains 760 parking spaces plus rail and bus facilities. The \$96 million development was completed in 1990.

WMATA had marketed the site in 1982 as a joint development project but could find no takers for the 72,000 square-foot parcel. Convinced that the parcel should be combined with an adjoining one of 31,000 square feet to produce a developable site, WMATA granted the owner of that parcel exclusive negotiating rights to come up with a developer capable of undertaking a mixed-use project on the entire tract. In 1984, the owner entered into a partnership with a local developer and with several minority partners to develop the project.

Several issues were resolved during negotiations over the final agreement.

- The developer persuaded the transit authority and local government to accept seven instead of 13 bus bays to simplify the site design;
- The bus bays were provided on Stuart Street in front of the project and separated from normal traffic circulation by restricting movements of private vehicles on some parts of the street, thus effectively enlarging the site;
- The county refused to grant additional density bonuses in return for the developer's construction of the public plaza but did allow the buildings to rise 18 feet higher than nearby buildings;
- Recognizing that condominium sales would require a fee-simple land transaction, the site was divided into two parts, one conveyed to the Ballston Metro Partnership for the residential and hotel tower and the other leased by WMATA for the office/retail tower and public facilities; for the latter part of the project, WMATA receives its usual periodic payments based on eight percent of gross commercial income above a threshold level; for the housing/hotel part, WMATA participates in the gross proceeds from condominium sales in addition to three lump-sum progress payments.

Project construction began in 1987. The hotel and retail shops opened in 1989 and the condominiums were sold in 1990. The office tower, hit by the late-1980s real estate recession, was slower in leasing up but is now fully occupied.

Some small problems have arisen. Because there is only one access point to the rail station, the escalators and elevators often operate at capacity and experience frequent breakdowns. Constructing additional underground connections would be quite costly. In addition, bus operations create a complex mix of bus, auto, and pedestrian traffic that will grow worse with increasing traffic. Pedestrian movements also have been hampered by the state department of transportation's insensitivity to pedestrian needs at intersections on the several state highways traversing the Ballston area. Parking is not a problem, however. The slowdown in real estate activity left many lots available for surface parking at relatively low rates.

Nevertheless, the Ballston project has been commercially successful. In terms of transit ridership, the record is not so clear. Daily passenger boardings for the rail station averaged 9,892 in 1995, barely up from 9,352 in 1980. In the interim, however, the line to Vienna opened so that stations farther out on the line captured a substantial part of the park-and-ride market. Boardings at Ballston peaked at 11,325 in 1986. The project at Ballston may

have forestalled an even sharper drop in boardings. In any case, a considerable amount of proposed development in the Ballston area was put on hold during the real estate downturn; ridership may revive once that development proceeds.

Silver Spring

Transit-focused development at the Silver Spring Metrorail station has been impressive despite obstacles to joint development. In addition, development of a new multi-modal center that will put Metrorail, bus, and commuter rail service in close proximity promises to add vitality and convenience to the area.

Silver Spring is a traditional commercial center in Montgomery County, located in the eastern part of the county on the other leg of the Metrorail Red Line. At one time it functioned as a rather significant shopping area for that part of the county and upper northwest and northeast Washington, with four mainline department stores and well-known specialty shops. However, the retail area declined as shoppers were siphoned farther north by newer shopping centers and, although a number of office buildings and hotels punctuated the skyline, Silver Spring's position as a down-county commercial center deteriorated through the 1960s and 1970s.

The Metrorail station and bus terminal opened in 1978 to mixed reviews. Located on the rail line providing Amtrack and Maryland commuter rail service to points north and west of Washington, the station lies about a quarter-mile south of the main business district. The station entrance opens onto a huge bus terminal, the third busiest in the entire system. Nearby, Montgomery County built several large parking structures to promote park-and-ride service. WMATA leases four floors in the garage closest to the station that provide 715 parking spaces, leased for \$30 per month to Metrorail riders. In addition, Silver Spring has almost 11,000 on-street, surface-lot, and garage spaces available. The county's garages supply many of these spaces at a monthly lease rate of \$75 and short-term hourly rate of \$.50. According to the county's parking manager, there is a huge surplus of available spaces.

The parking facilities and complex traffic movements around the station, and distances from existing activities, seemed a daunting obstacle to station-area development. The possibility of joint development directly adjoining the station was deemed infeasible because densities of potential development could not support the cost of decking the large bus area.

Nevertheless, after the station opened, the office building boom experienced throughout the Washington area occurred in Silver Spring as well, almost entirely on sites near the station. During the 1980s and into the mid-1990s, almost three million square feet of office space, 188,000 square feet of retail space, and 640 residential units were developed within a quarter-mile of the station. Three additional projects near the station have been approved for construction, including the ambitious Silver Triangle project.

According to the planning board's coordinator for the Silver Spring area, development was attracted to the station area in large part because of the availability of relatively inexpensive land zoned for commercial use. Much of the area had been developed for low-density warehouse and auto-sales uses, and other sites in the Silver Spring business area

were either scarce or more expensive. However, developers also sought to take advantage of access to the station. For example, some development took place near the station on awkwardly shaped sites that otherwise might not have been developed. However, no studies of tenants of the new buildings have been carried out to determine their rail ridership.

The Silver Triangle project was proposed by a developer in 1987 as a major redevelopment of the old retail shopping area. Located on an eight-acre site, it was to include a regional shopping mall and a substantial amount of office and hotel space and bridge Georgia Avenue in the direction of the Metrorail station. It was to be supported by county contributions to parking and infrastructure, as well as some property assemblage. Some citizens' groups in nearby neighborhoods, however, opposed the project as too grandiose, poorly designed, and likely to generate immense traffic problems. After lawsuits, referendums, and countless hearings and meetings, a mediation process led to an agreement between the county and the developer. Meanwhile, the economy worsened and the developer could not assemble the required retail anchor stores. In 1995, the county reopened bidding for the site and is now studying a proposal by the Canadian developers of the Mall of America for a mixed retail/entertainment facility.

During this eight-year period, however, the business district has remained moribund except for the opening of a off-price mall developed within one of the old department stores, which apparently has been relatively successful. The real estate recession also has meant almost a complete halt in further office building development.

The major exception has been the construction of a new 1.3 million square foot office building to house the National Oceanic and Atmospheric Administration (NOAA). The building is part of a plan to create a multi-modal center linking the Silver Spring rail station to a relocated MARC commuter rail station and ultimately to a proposed light-rail line connecting to Bethesda. The Maryland Transit Administration prepared a conceptual plan several years ago for the multi-modal center and worked with the developer of the office building, the Montgomery County Planning Board and Department of Transportation, and WMATA to determine a final plan. The office building incorporates a new entrance to the WMATA station from the south and a bridge across the tracks to the new MARC station. The county acquired some land to expand the site and MARC expects to build the new station in 1997. Figure 23 shows the view north along the Red Line of the station platform and major new office projects near it, including the National Oceanic and Atmospheric Administration building on the left.

WMATA's contributions to this newest effort were relatively limited. The Maryland Transit Administration led the planning effort and county staff worked with the developer to resolve design issues. WMATA turned down the opportunity for gaining a second entrance to the rail station, which was proposed as part of the project, because it lacked funds to install additional farecard machines and gates. Meanwhile, daily rail transit boardings have dropped from 16,414 in 1980 to 11,331 in 1995, much of that decline occurring since 1989 when the Wheaton station opened further out on the line and absorbed some of Silver Spring's park-and-ride market.

Silver Spring is still developing as a transit-oriented business center. It has made great strides in expanding its employment and residential base near the station and in providing a unique multi-modal center for the area.

Figure 23. Development near the Silver Spring Metrorail Station



3.4 CONCLUSIONS

1. Washington's experience points up the immense importance of coordinating transit and land use planning to achieve transit-focused development. In the Washington area, regional planning for both transit and regional development began with agencies established by federal action that took the long view and provided a strategic context for local planning. The regional plan formulated in 1960, shortly before planning began in earnest for the rail transit system, emphasized concentrations of development along transportation corridors that would provide transit as well as highway service. This preplanning for matching transit construction with development, although advisory in nature, gave local jurisdictions a head start in planning as the transit system was being constructed.
2. Several local jurisdictions took the initiative to base their future plans on development of intensive centers around transit stations. Their primary objective was to steer expected major economic development to locations that could be

- served by transit and act as community nodes. Their early interest in pursuing transit-focused development has succeeded in promoting a substantial amount of station-area development.
3. The fact that most suburban development is controlled by a few large and powerful counties both aided and hindered coordination of development planning with transit construction. On one hand, the jurisdictions that chose to pursue transit-focused development were able, with strong citizen support, to direct development and redevelopment to that end. On the other hand, jurisdictions that were uninterested in supporting focused, higher-density development around rail transit stations were free to ignore the 1960 regional plan. The federal agency that formulated that plan had no implementing powers except with regard to federal facilities. The voluntary council of governments that might have urged adherence to the plan deliberately forswore any involvement in regional planning.
 4. As a transit agency, WMATA has been highly supportive of jointly sponsored and related development around stations. It has organized and assigned staff to seek development opportunities and to work directly with developers and local jurisdictions to secure transit-focused development. The agency also has remained responsive to site-specific problems and issues. As the Ballston development illustrates, WMATA has been willing to package development opportunities in a variety of ways and to adjust its financial and other requirements to meet development conditions.
 5. WMATA has also allowed local jurisdictions to take prime responsibility for planning and design of development around transit stations. This strategy has provided a means by which community and neighborhood development issues could be resolved by those most directly responsible for them, and has vested community interest in the results. The downside is that WMATA must live with local decisions, such as the failure to promote development around several stations in Fairfax County.
 6. Experience at the four station areas demonstrates that, at least in a vigorous development market, availability of transit service lends some value to nearby sites, particularly if positively supported by public development policies and actions. Proximity to transit at the Silver Spring station, for example, appears to have helped to attract major investments to its neighborhood (assisted by public policies that provided the necessary zoning for this movement). Developers of joint development projects at Friendship Heights and Bethesda have concluded that immediate access to transit stations gives them an edge on the market. On the other hand, a number of major centers such as Tysons Corner grew vigorously without transit service.
 7. Experience at the four locations also demonstrates the importance of the real estate market in securing desired development. All locations were considered desirable areas for development independently of the availability of transit service (three of the four are among the most up-scale communities in the region). All rode the crest of the massive surge of development that occurred throughout the Washington area during the 1970s and 1980s. It could be concluded that the primary contribution of

transit availability was that it supported the public policy rationale for permitting high-density development around the stations.

8. Parking cost and availability constraints in downtown Washington and the Federal Triangle undoubtedly have lent support for transit ridership to and from downtown Washington by commuters, visitors, and residents. The federal government has pursued a policy of limiting the supply of parking for downtown agencies more than that for suburban locations. Development pressures have limited surface parking and promoted more costly underground parking. For visitors, especially, the supply of parking for museums and other attractions is severely limited. In suburban locations, parking is often free and more generally available; public programs have provided a great amount of parking in Bethesda, Silver Spring, and Ballston that supports ridership to downtown but probably diminishes potential ridership to those destinations.
9. Development in each of the areas ground to a halt during the real estate recession of the past few years, leaving gaps in the urban pattern that are unlikely to be filled for several years. The fact that real estate cycles almost always will interrupt the development process points up the necessity of planning for discrete phases of development that will remain economically viable in the context of incomplete overall development patterns.
10. Station-area development undoubtedly has been enhanced by the management of the system, which features frequent service (usually 5 to 10 minute headways) and clean cars and stations and the transit construction schedule that gave priority to attracting commuters from the start. Because Washington-area residents see the system as user-friendly, developers can count on its use by employees and residents located near stations.
11. One of the most difficult issues that project designers wrestled with at every station is reconciling car, bus, and pedestrian movements. Fitting new travel patterns into existing street and path networks and development patterns has proven a prickly problem, without ideal solutions, and the problem changes over time as development occurs.

The most fitting conclusion about factors shaping transit-oriented development in Washington is drawn from a 1985 analysis of WMATA's benefit-sharing techniques:

It is significant that WMATA is a new transit system, being developed not in a stagnant or slow-growth area, but very deliberately routed through corridors in the path of urban development and redevelopment. Bethesda is a place where change and redevelopment would have occurred to some extent anyway. Metro afforded an opportunity to organize the redevelopment in a particular way. Conversely, the opportunity to accomplish WMATA's joint development was the result of many years of preparatory groundwork -- in policy, planning and market-shaping interventions -- by local government and citizens [p. C-195].

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4.0 PORTLAND CASE STUDY

4.1 INTRODUCTION

The Portland, Oregon, region is known for its statewide land use planning efforts that limit urban sprawl, its vibrant downtown, and its determination to use transit to focus urban development. Urban growth boundaries have limited the spread of suburban development. Downtown Portland has revitalized by integrating transit, parking, and development policies. An eastside light rail has helped link downtown with the commercial and institutional Lloyd District across the Willamette River and supported development in that district. State-of-the-art planning is underway to make the westside light rail an active force in building new transit-oriented communities on large tracts of vacant land along this corridor.

This integration of transit and land use is a hallmark of Oregon's largest metropolitan area. About 1.7 million people live in the Portland-Vancouver Primary Metropolitan Area with about one million people in the urbanized portion of the region in Oregon. This urbanized area covers parts of three counties and includes 24 cities and numerous special districts. The nation's only elected regional government, Metro, is responsible for the regional aspects of transportation and land use planning in this area.

Transit in the Portland area

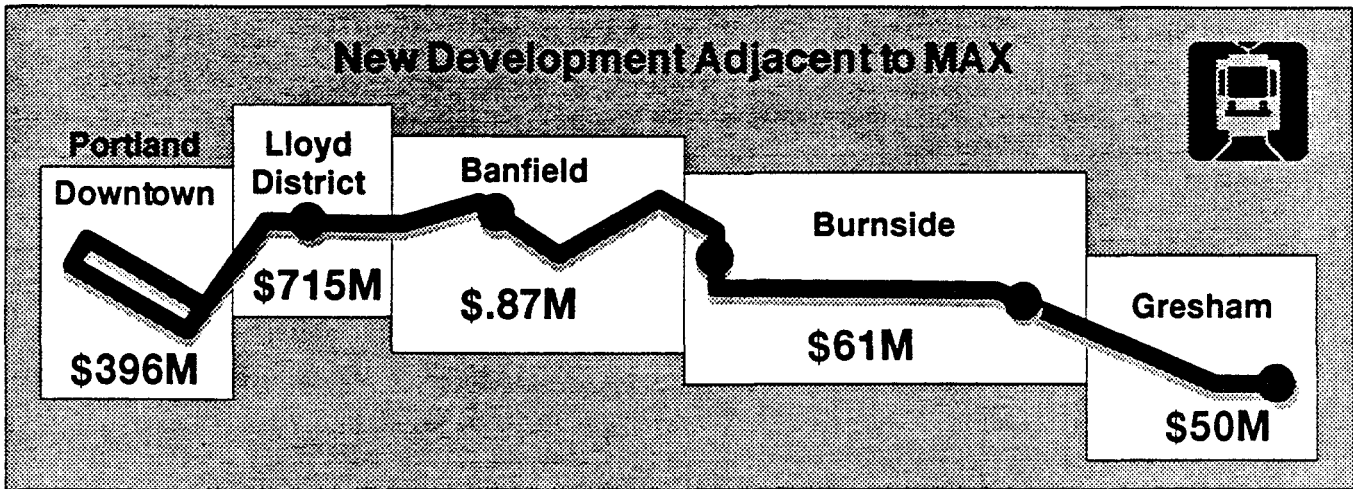
The Tri-County Metropolitan Transit District (Tri-Met) operates light rail and bus service in most of the urbanized portion of the Portland metropolitan area. About 80 bus routes serve the metropolitan area with most routes making stops downtown. An eastside light rail line with 30 stations opened in 1986 connecting downtown Portland with suburban Gresham 15 miles to the east. An 18 mile westside line through Beaverton and Hillsboro is under construction with opening scheduled for 1987-88.

Portland believes in transit. The region replaced a freeway-dominated transportation plan with one that emphasized a balance of highways and transit in 1975. Regional leaders have developed a consensus on transportation plans, including light rail, through a committee of local government and transportation agency representatives that advises the Metro Council on transportation matters. Voters have overwhelmingly supported light rail by approving bond measures to generate the local share of construction funds for westside light rail in 1990 and south-north in 1994.

Light Rail Influences Development Patterns

About \$1.23 billion worth of development has occurred adjacent to the eastside light rail since the decision to construct the project. Over half of the investments have been in the Lloyd District in a variety of public and private projects (See Figure 24). Light rail has influenced the location and design of buildings and the amount of parking included in major projects (Arrington, 1995).

Figure 24. New Development Adjacent to Eastside Light Rail



Over \$1.23 billion worth of development has occurred immediately adjacent to the MAX line since the decision to construct the project.

Source: Arrington, 1995

The second highest level of investments along light rail have been in downtown Portland, which has been transit-oriented since the 1970s when the bus transit mall was built. In the 1990s, infill has been occurring along the suburban segment of the light rail line with the development of over 1,000 units of multifamily housing.

Current westside light rail station area planning is state-of-the-art. Interim zoning preserves options in the station areas while detailed plans are being developed. Public-private partnerships are developing detailed master plans for three large vacant parcels surrounding light rail stations.

Transferable Ideas

The Portland region has tested a number of policies and methods that may be useful elsewhere for encouraging transit support development. These include:

Regional Growth Management and Transportation Strategies

1. Using urban growth boundaries to limit suburban sprawl
2. Developing regional consensus on balancing transit and highway investments
3. Encouraging a pedestrian friendly environment

4. Managing parking supply and location to support transit use
5. Shaping public opinion and policy through non-profit groups that advocate alternatives to automobiles including transit-supportive development patterns

Transit Agency Involvement in Land Use Issues

6. Advocating transit-supportive development policies and facilitating their implementation
7. Having leaders with the skill and authority to carry out complex multi-jurisdictional, public-private negotiations

Station Area Policies

8. Locating stations where there is vacant land or redevelopment potential
9. Zoning station areas for higher density, transit-friendly development
10. Using interim zoning to prevent unacceptable uses during planning period
11. Creating public-private partnerships for developing master plans for station area communities
12. Using local improvement districts to improve the pedestrian and transit-rider environment in business districts
13. Locating regional people attractors such as convention centers and sports arenas at stations
14. Pursuing joint development that combines excess right-of-way with privately owned property
15. Using redevelopment agencies to facilitate private investments in station areas

Organization of the Report

The remainder of this report describes in more detail the way these policies have been developed and implemented in the Portland region. Section 2 outlines the context in which the station-area development has occurred. It describes the urban form, economy, and dominant forms of transportation within the region. Section 3 describes the light rail system and the reasons light rail technology was selected. Section 4 describes general planning for the region that has supported station area development. This includes the 20-year legacy of statewide land use planning, recent regional growth management policies, the regional transportation planning processes, downtown planning, transit agency advocacy of transit-supportive development, and non-profit advocacy groups role in shaping public opinion and policy. Section 5 identifies specific station area planning and development tools that have been tried in Portland including an evolving station area planning program, joint development, local improvement districts, public facility siting, and

use of economic development agencies to facilitate private development. Section 6 describes the outcomes in the Lloyd District and at residential suburban stations. Finally, section 7 draws conclusions about the transferability of policy tools to other areas.

4.2 THE PORTLAND REGION

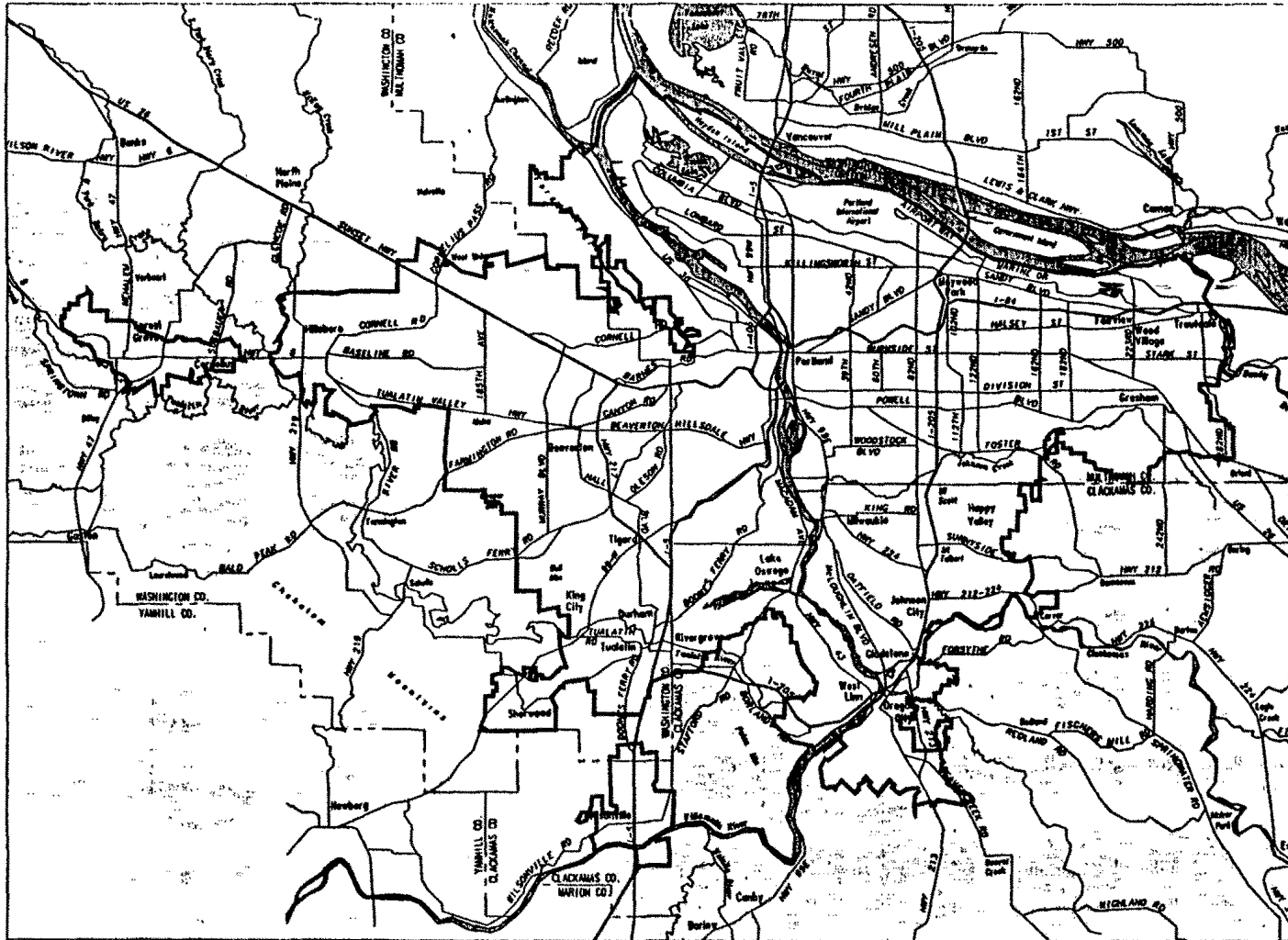
This report is mainly concerned with the urbanized portion of the metropolitan area in Oregon which covers 364 square miles and is home to about 1 million residents. This part of the region is inside the metropolitan urban growth boundary, and is shown in Figure 25. Table 9 summarizes some characteristics of Portland, the urbanized core of the region, and the three counties that include the urbanized core. The population densities of Portland and the urbanized area are 3,572 and 2,836 persons per square mile respectively. This is about average for metropolitan areas in the western United States (Metro, June 1994, Institute of Portland Metropolitan Studies, December 1994).


Table 9. Portland and Regional Characteristics

		City of Portland	Clackamas, Multnomah, and Washington Counties	
			Entire Counties	Urbanized Portions
Population	population (1994)	495,090	1,285,000	1,032,471
	size (square miles)	124.7	3,027	364
	population density	3,572	408	2,836
	population growth, 1980-1990	19.2%	11.8%	
	population growth, 1990-1994	12.8%	9.4%	
Housing	% owner occupied	53.0%	60.4%	
	% single family homes	64.4%	66.4%	
	% housing built 1970-1990	17.6%	41.5%	
Commuting	Automobiles per household	1.4	1.7	
	Work Trips (1990)			
	Drive alone	65.0%	72.7%	
	Carpool	12.9%	12.3%	
	Transit	11.0%	6.3%	
	Working at home	3.4%	3.8%	
	Other	7.7%	4.9%	
Average travel time to work (minutes)	20.3	21.8		

Sources: County and City Data Book, 1983 and 1994; Center for Population and Research, 1994; Metro, June 1994.

Figure 25. Portland Metropolitan Urban Growth



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Urban Growth Boundary
September 21, 1995

The majority of area residents live in single family homes that they own. The population of Portland increased by a fifth in the 1980s due to annexation of developed residential areas on the city's eastside. Without annexation the city would have lost population. Both the city and the region have been growing rapidly in the early 1990s. The Tri-County region's population has increased by over nine percent in four years. Portland has grown more rapidly than the region because of annexation.

The Regional Economy

The Portland metropolitan area is the economic hub of Oregon and southwest Washington, and downtown is the economic center of the region. About 20 percent of the metropolitan area's employment and 60 percent of leasable office space is downtown (Metro, September 1994). Downtown Portland had all the region's Class A office space 25 years ago, but about one-quarter of premium office space is now in the suburbs. Washington and Clackamas County each have a regional mall and numerous smaller shopping centers. The growing electronics industry is primarily located in Washington County where over 60 percent of employed residents work within the county (Abbott, 1994a).

The Portland metropolitan area is a regional trade and distribution center with international shipping through the Port of Portland. As Table 10 shows, wholesale and retail trade have consistently provided about one quarter of the region's jobs over the last two decades. Table 10 also shows the declining importance of manufacturing and rapid growth of service jobs, consistent with national trends. Regional manufacturing has been shifting from an agricultural and forestry base to high tech electronics. The top ten private employers include two electronics firms, three health care providers, two utilities, two retailers, and one bank (Metro, June 1994; Institute of Portland Metropolitan Studies, December 1994).

Table 10. Portland Metropolitan Employment Trends 1972 to 1993

Sector	Percent of Employment in Sector		
	1972	1993	Rate of change
Manufacturing	22	16	-27%
Construction, Mining	5	4	-20%
Transportation, Utilities	7	6	-14%
Financial, Insurance, Real Estate	7	8	14%
Wholesale and Retail Trade	24	25	4%
Services	19	27	42%
Government	16	14	-13%

Source: Metro, June 1994, p. 27

Portland Developers

Development in this region is mostly a small scale activity. Portland has few "community builders" who develop and build large-scale mixed-use and residential communities. Most subdivisions are small, and often the land developers are different people than those who construct buildings. Only a few builders put up 100 homes a year; most construct two to eight. Builders of large apartment complexes have generally come from outside the region (Tri-Met, 1993b).

Most Travel by Automobile

Automobiles are the dominant mode of travel in the region. In 1990, each person averaged 12.4 vehicle miles of travel per day. Ninety-two percent of all trips were made by auto, three percent by transit, and five percent walk or bike.

In 1990, six percent of the Tri-County residents and 11 percent of Portland residents commuted to work by transit (See Table 1). Downtown Portland has the most transit service in the region and the work trip mode split to the central business district is 40 percent by transit, 58 percent by car, and two percent by walk or bike. The Lloyd District has the second highest number of transit lines, and eight percent of workers in this area use transit.

The share of work trips by transit and carpooling has declined as jobs have suburbanized. Between 1980 and 1990 the shares of work trips in the Primary Metropolitan Area that were on transit declined from eight to five percent. The share of trips by carpool also declined by about three percent, while the share of workers who drove to work rose from 73 to 79 percent (Rossetti and Eversole 1994). In the city of Portland, the share of workers who used transit declined from 16 percent in 1980 to 11 percent in 1990. Likewise, the share of car-poolers dropped from 16 to 13 percent. The share of those who drove alone increased from 56 to 65 percent (City and County Data Book, 1983 and 1994).

4.3 PORTLAND'S LIGHT RAIL SYSTEM

The Tri-County Metropolitan Transportation District (Tri-Met) was created by the Oregon legislature in 1969 to take over operations from failing private bus companies. The governor appoints the seven members of the Tri-Met board, and they select the general manager of the agency. Tri-Met manages and operates bus, light rail, and paratransit systems in the region. Tri-Met's average monthly passenger count for 1995 is 24,600 on light rail and 177,600 on buses. According to Tri-Met's mission statement the purpose of the transit system is to provide increased mobility in a growing urban area. To do this, the transit agency must expand service as well as increase carpooling, biking, and walking. The agency needs an expanded revenue base and new development patterns that encourage the use of alternatives to the automobile to provide these services (Tri-Met 1993a).

Light Rail Service

The 15 mile eastside light rail opened in 1986 connecting downtown Portland with suburban Gresham. An 18 mile westside line from downtown to Hillsboro is under construction with a 1997-8 opening scheduled. A third line connecting downtown with Clackamas County and Vancouver, Washington (south-north) is being planned (see Figure 26).

Figure 26. Existing and Planned Light Rail in Portland



Source: Arrington, 1995

Light rail operates from 4:30 a.m. to 1:00 a.m. with seven minute headways during peak periods and 15 minute headways during most of the day, seven days a week. The 15 mile line has 30 station areas --11 in downtown Portland, four in the Lloyd District, three along the I-84 freeway, and 12 in suburban areas (some of these are in the recently annexed parts of Portland). There are five park-and-ride lots at suburban stations with a total of 1,917 spaces. Most park-and-ride lots are full on weekdays. Four transit centers and other transfer points outside downtown connect light rail with 35 bus routes. Connections to other buses can be made downtown on the bus mall.

Eastside Light Rail--An Alternative to Building a Freeway

Plans for light rail emerged in the 1970s when the region needed a transit project to use the federal funds from the withdrawn Mt. Hood Freeway. Two types of transit projects were seriously considered--a busway and light rail. The busway from downtown to Gateway had few supporters other than the Oregon Department of Transportation (ODOT),

the agency that would plan and build, but not operate, the facility. Tri-Met advocated light rail for its greater operating efficiency, higher passenger capacity, and ability to focus develop. Multnomah County officials favored a light rail line to Gresham because it would provide better service to the east county area and it offered more development potential. Citizen activists were more enamored with a futuristic light right system than a busway that motorists might perceive as under-used highway space. Ultimately the region chose light rail as the preferred alternative for a variety of technical and political reasons (Edner and Arrington, 1985).

Light Rail Expansion

Light rail continues to be built. Supporters of new lines contend that light rail is attractive to riders who would not use a bus, has higher farebox recovery ratios than buses, and can influence development patterns. Metropolitan voters have overwhelmingly approved general obligation bonds backed by property taxes for the local share of financing for westside and south-north lines. Most recently in November 1994, metropolitan voters approved the largest bond measure in the history of the state, \$475 million, for the southnorth line with a 63 percent "yes" vote.

Primary Transit Network

Tri-Met is also planning a Primary Transit Network. The Primary Transit Network aims to shape the way the region grows by identifying places where land use and development support transit and where transit service is frequent and easy to use. The Primary Transit Network of 2015 will include existing and currently planned light rail as well as express bus service. Tri-Met is identifying the network routes, refining the operating and service characteristics for each type of service, and estimating the resources needed to put the network into place. The Primary Transit Network will be part of the regional transportation system plan, guide bus service improvements, and provide information to cities and counties about planned transit service so they can put in place the appropriate zoning, design standards, and street improvements to support transit.

4.4 PLANNING IN THE PORTLAND REGION

Station area planning and implementation grew out of an Oregon tradition of effective land use planning. Statewide land use planning and the Portland Downtown Plan were both adopted in the early 1970s providing a basis on which to build station area planning. Current station area planning builds on recent regional efforts to manage growth. This section describes the general planning efforts that set the stage for the more specific station area planning described in the next section.

Oregon's Pioneering Land Use Laws Limit Urban Sprawl

Oregon adopted statewide land use planning in 1973 to preserve farm and forest land and direct urban growth to areas where it could most efficiently be provided with urban services. The state Land Conservation and Development Commission (LCDC) sets statewide goals. Cities and counties are responsible for writing and implementing land use plans that must comply with statewide goals. Over time, LCDC has refined and added to

the list of statewide goals. When this occurs local plans must be revised to comply with the new rules.

Oregon's planning system has been credited with, among other things:

- Preserving Willamette Valley farmland and slowing urban sprawl
- Providing predictability to land owners and developers
- Equitably distributing low and moderate income housing
- Making allies of the state land use and transportation agencies (Abbott et al., 1994).

One of the original statewide goals required that every city and the Portland metropolitan area have an urban growth boundary identifying where urban activities would be located in the next 20 years. The Metro Council adopted the Portland metropolitan area urban growth boundary in 1979 and has made only minor revisions in the boundary since then.

In 1991 LCDC refined the transportation goal to require changes in land use and transportation planning to reduce per-capita vehicle miles traveled (VMT) by 20 percent in 30 years. The revised goal, generally known as the Transportation Planning Rule, aims to reduce reliance on the automobile; avoid the air pollution, traffic and livability problems faced by other growing areas; and provide better planning for transit, walking, and bicycling. Local jurisdictions are currently changing their land use standards for building access, parking lots, pedestrian and bicycle networks, transit stations, and other aspects of the built environment to comply with this rule (Brody, 1994; Moore and Thorsnes, 1994).

Regional Growth Management in the 1990s

Some feel that the real test of Oregon's land use system in the metropolitan area has just begun. The twenty year supply of land included in the 1979 urban growth boundary has not been used up due to generous estimates of need and very low growth during the recession of the early 1980s. But pressures are now mounting as the region has grown and some cities are running out of developable land.

Recent metropolitan growth has increased concerns about maintaining the livability of the area. If current trends continue for the next 50 years, the urban area will need to expand by more than 50 percent. This type of growth raises concerns about traffic congestion, air pollution, loss of community identity, encroachment of residential development on agricultural activities, and reduced access to natural areas (Metro, June 1995, September 1995). Given this outlook, the metropolitan area has begun to collaboratively seek a better way to grow.

Metro has worked with local governments and citizens to develop a consensus conceptual statement on future settlement patterns in the region in a process known as Region 2040. The adopted growth concept accommodates future growth with limited expansions of the urban area by concentrating growth in regional centers that are connected by multi-modal arterials and transit service (Metro, December 1994). Now that the urban growth concept has been adopted, Metro is moving forward with more specific plans that will eventually affect city and county land use and transportation plans.

Regional Consensus on Transportation

The process of developing a regional consensus on land use builds on a process that has been in place for transportation planning for over 15 years. Metro is the designated Metropolitan Planning Organization (MPO) required by federal highway and transit legislation. Since its formation in 1979, the Metro Council has been advised on transportation issues by a committee of elected officials and transportation agency representatives called the Joint Policy Advisory Committee on Transportation (JPACT). JPACT is credited with developing widely-accepted regional positions on transportation. JPACT decides most issues by developing consensus rather than voting (Abbott, 1994b; Oliver, 1994; JPACT, 1990).

In the late 1960s the region had a totally automobile-oriented transportation plan. The energy crises and the freeway revolt of the 1970s produced a "revolution" in regional transportation thinking that spelled the end of an era of freeway building and a shift to a balance of highway and transit investments (Edner and Arrington, 1985).

Downtown Portland Emphasize Transit

Planning for downtown Portland, in particular, has emphasized transit as a primary mode of travel to and within the downtown since the adoption of the Downtown Plan in 1972. The center piece of the Downtown Plan was a transit-mall that consolidated bus service and visually symbolized a new commitment to the city's core. The other main elements of the plan were 1) a pedestrian-friendly environment, 2) a mix of densities, activities, and land uses including housing, and 3) good access to downtown based on greater reliance on transit and the management of parking. Transit and parking restrictions were key elements of the development strategy because congestion and air pollution were two of the issues facing the downtown. The Downtown Plan was the consensus of business people, neighborhood activists, and government leaders. Its implementation was vigorously pursued during the administration of Mayor Neil Goldschmidt who took office four days after its adoption.

The most visible symbol of the Downtown Plan was the bus mall built on two one-way streets through the heart of downtown. The mall made bus service more understandable, improved the pedestrian environment, and speeded bus travel times (Abbott, 1983).

In addition, as part of its carbon monoxide reduction program, the city adopted a lid on the number of parking spaces downtown, limited the number of spaces allowed in new office development, and restricted the development of commercial lots and garages. The number of parking spaces in new developments are directly tied to transit access with buildings on the bus mall having the lowest ratios (0.7 parking spaces per 1,000 square feet of space) and those farther away having higher ratios (up to 2.0). At the same time, the city encouraged shopper parking by building city-owned garages for short-term parking.

The combination of transit, parking, and development policies has resulted in 40 percent of work trips to downtown by transit. Employment has risen without a significant increase in parking spaces. In 1973 there were 3.4 parking spaces for every 1,000 square feet of office space downtown; by 1990 there were 1.5 parking spaces (Shiels and Oblatz, 1992). The city is now removing the parking lid so that development will continue to

occur downtown, but it is retaining the parking ratios and other limitations on downtown parking development. In addition, it is extending the idea of tying maximum parking ratios to transit service levels to the larger Central City area which includes the Lloyd District and other close-in areas.

Tri-Met Influences Land Use Planning

Tri-Met is a strong advocate of development patterns that support transit use. Tri-Met first became involved in land use planning when it worked with local jurisdictions to put in place transit-supportive zoning around the eastside light rail stations. Station area planning has evolved as new light rail lines have been planned. Tri-Met is providing local jurisdictions with \$209,000 of its general revenue for westside station area planning. Tri-Met has also developed guidelines for transit supportive development that identify potential markets, present planning and design principles, and identify steps the public and private sector needs to take to make this type of development a reality. Tri-Met's planning and design guidelines contain recommendations on locating transit stops, configuring streets and sidewalks, placing facilities in commercial areas, mixing housing types, providing parks and community buildings, integrating with existing neighborhoods, and designing different types of station area neighborhoods. A model zoning code has also been developed (Tri-Met 1993b).

In 1993 Tri-Met adopted a Strategic Plan that included the goal of locating the majority of new housing and jobs within a five-minute walk of the Primary Transit Network. To carry out this goal, Tri-Met has provided funding for the Metro Region 2040 planning process, advocated a transit-supportive urban form in that process, developed educational materials, and worked with local communities to help translate these concepts into zoning codes as they implement the Transportation Planning Rule.

Non-Profit Groups Advocate Transportation and Land Use Alternatives

One of the reasons Oregon's planning system has worked well is 1000 Friends of Oregon, an independent monitoring group supported by its members. 1000 Friends of Oregon has provided education and advocacy on land use planning since 1975. It has litigated when it believed local governments were not complying with the state's land use laws. Recently it has put together a demonstration project on alternatives to traditional suburban development called Making the Land Use, Transportation, Air Quality Connection (LUTRAQ). LUTRAQ addresses transportation problems using land use and design changes coupled with transit improvements instead of more highways. LUTRAQ demonstrated that 65 percent of new homes and 78 percent of new jobs in suburban Washington County could be located within walking distance of transit without increasing the currently planned density of the county (1000 Friends, 1992). This advocacy work has played an important role in shaping public opinion about alternative transportation and land use policies.

Other groups have coalesced around general transportation issues (e.g. Sensible Transportation Options for People (STOP)) or specific modes (e.g. Willamette Pedestrian Coalition) and are actively involved in educating the public and influencing transportation policy.

4.5 STATION AREA DEVELOPMENT TOOLS

The Portland region has used a variety of tools to influence development in station areas. With each light rail project, new lessons have been learned about what it takes for light rail to shape development patterns. Planning for the eastside light rail line focused on station area planning to allow transit supportive development to occur. Planning for the westside route has included greater involvement by land owners and developers especially in the development of master plans for four station areas with between 112 and 400 acres of developable land each. These large tracts of land offer the possibility of creating transit-oriented communities whereas on the eastside most development potential was infill and redevelopment. The Hillsboro extension of the westside line brought urban design issues onto the table earlier and explicitly included them in the process of determining the alignment and station locations.

Other tools used to influence development in station areas include local improvement districts to help finance streetscape improvements in business districts, locating public facilities or subsidized housing near stations, and using the powers and financing tools of economic development agencies to facilitate private development.

Station Area Planning

Eastside

The Portland area pioneered station-area planning with a Transit Station Area Program (TSAP) for the eastside light rail. This was a cooperative venture of Tri-Met, Metro, Portland, Gresham, and Multnomah County. The program prepared development plans for each stations area by analyzing the demand for office, retail, and residential development at each station, evaluating park-and-ride and other means of accessing light rail stations, studying urban designs, and changing zoning ordinances.

One result of TSAP was the decision to build only five park-and-ride lots with 1,917 spaces. Most people would arrive at stations by walking or using a rerouted feeder bus system. Another product was the decision to move a station in the Lloyd District to better connect with planned office development. The major result was the development of special transit station area zoning that allowed higher density development near stations. The new zoning also regulated building set-backs, parking lot locations, and the pedestrian environment.

A recent evaluation of TSAP (Barney and Worth, 1993a, 1993b) identified the preparation of station area plans as the major outcome of TSAP, but noted the lack of implementation strategies such as incentives to build transit-supportive development. In part the lack of implementation was the result of dropping a planned implementation phase of TSAP due to a lack of funds. The evaluation also attributed the lack of implementation to the recession in the early 1980s, confusions about responsibilities at a time when political boundaries were changing, and uncertainty about what light rail could do.

An example of a lost opportunity because of changing political boundaries is Gateway, a suburban station that serves as a major transfer point between bus and light rail. This area had vacant land and a shopping center that was ready for redevelopment. When light rail was built, Gateway was in unincorporated Multnomah County. Shortly thereafter the

cities of Gresham and Portland began annexing all the unincorporated area between them, and Gateway became part of Portland. When Portland annexed the area, it did not keep the county's transit overlay as part of its zoning. The city, therefore, had no leverage to require the new shopping center to orient towards the transit station. The result was a standard auto-oriented shopping center.

Westside

A cooperative planning effort involving Tri-Met, Metro, the Oregon Department of Transportation, Portland, Beaverton, Hillsboro, and Washington County similar to TSAP is underway for the westside light rail. New land use plans, capital improvement plans, and implementation strategies will be developed for all stations by the spring of 1996.

A coordinated set of interim development regulations have been put in place in three of the four jurisdictions to keep transit-supportive options open while final community plans are being developed. The interim zoning prohibits certain auto-oriented uses within one-half mile of stations, sets minimum densities, limits parking supplies, and requires that buildings be oriented to the light rail stations (Arrington, 1995).

Another innovation is public-private master planning. The westside has four large tracts of vacant land where transit-supportive communities could be built. Tri-Met knew they needed a demonstration project for a transit-oriented community. They hired a new person to coordinate station area planning, and the agency has brought together a public-private partnership involving Tri-Met, Beaverton, Metro, the Oregon Department of Environmental Quality, and the four private property owners at Murray West. This group is developing a master plan that goes beyond the development of comprehensive plans and zoning ordinances to site designs and market analysis for actual projects. The landowners/developers are paying over half of the costs for this master planning effort.

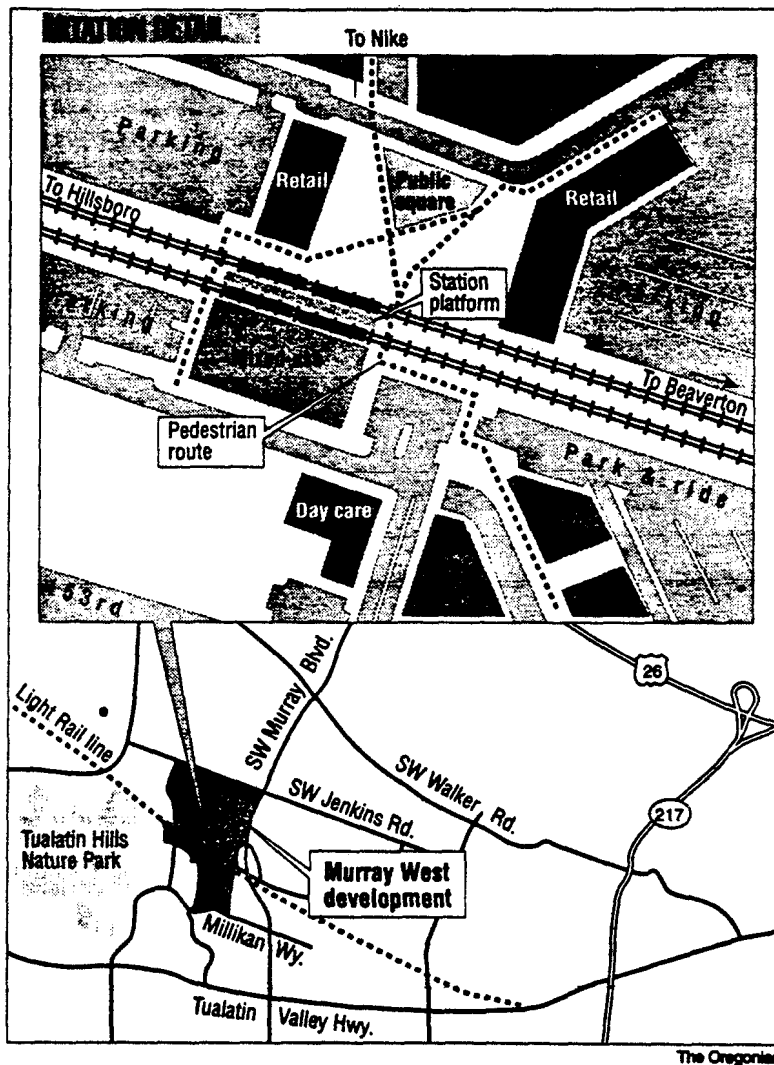
The Murray West station area has 112 acres of vacant land in large parcels near Nike's World Headquarters and a Tektronix campus. The joint planning process has resulted in moving the station to the center of the parcel, changing the location of the park-and-ride lot, and developing detailed plans for apartments, small lot single-family, and commercial, light industrial, and community facilities as shown in Figure 27.¹ Private investors appear to be quite interested in the project and individuals are already trying to obtain home sites. This type of planning identifies the desirable and feasible types of development for an area by adding the reality check of what private investors can and will do.

This model of public-private master planning is being used for two larger tracts of vacant land near stations in the Hillsboro area. The city of Hillsboro has hired two urban designers specifically to work on these projects. The owners of the fourth large vacant tract near a westside transit station are developing their own master plan.

The Hillsboro extension, the six miles of the line west of 185th, includes two further planning innovations. First, the Federal Transit Administration (FTA) made regional and transit area planning a condition for full funding. The region has five years to adopt transit-supportive plans based on Metro's 2040 plan and the state Transportation Planning Rule as well as develop station area plans that support ridership or Tri-Met will need to refund the \$75 million from FTA (Arrington 1995). Second, prior to preliminary engineering, architects and urban planners sat at the table with engineers and environmental planners

to determine the route and station locations. During the five week process, the group moved four stations and eliminated two others. A committed and knowledgeable group of people were able to do this work in a relatively short period of time without one phase of the planning proceeding too far for corrections to be made for other reasons. The result is an alignment that costs less and a design that maximizes the opportunity for transit-supportive development.

Figure 27. Murray West Station Plan



Joint Development

Tri-Met has been pursuing joint development since the eastside light rail decision was made. They hired a joint development specialist to develop and negotiate these public-private agreements. Although large projects have been planned, only modest projects have come to fruition.

The first joint development proposal was for a YMCA over the parking lot at the Gateway station. The YMCA would provide off-peak riders and set the stage for further transit-oriented development at this major bus and light rail transfer station. The proposal made it through a complex Urban Mass Transit Agency (UMTA) approval process, but the YMCA withdrew from the project after it lost its tax exempt status (Howard et al., 1985; Barney and Worth, 1993b).

Further east in Gresham, the Winmar Company of Seattle had proposed a \$100 million, 900,000 square foot regional mall as a joint-development project at the largest vacant parcel on the eastside. Congress had earmarked \$14.5 million in Section 3 funds for Tri-Met's share of the project. Winmar, however, withdrew from the project during the real estate recession of the early 1990s, and the federal funding has expired. In 1995, a public-private partnership developed a new master plan for the Winmar site that calls for a mix of office, retail, and residential development (Arrington, 1995).

Tri-Met has recently been successful with a modest joint development project for an apartment complex. Tri-Met sold about 28,000 square feet of excess land purchased for the right of way to a developer who combined the small parcel with adjacent lots to assemble enough land for a 42-unit apartment complex. The project was built in 1992 and generates about 70 daily light rail riders. Tri-Met is currently negotiating other similar projects along the eastside line (Porter, 1994).

Local Improvement Districts

Local Improvement Districts (LIDs) have been created to finance the local share of amenities that support transit use and transit area development. Property owners vote to form a LID with authority to levy a benefits-based tax. LIDs have raised the local share of funds for amenities that make station areas more attractive, but they have not been used to finance transit service itself.

Businesses along the Morrison-Yamhill light rail streets downtown formed an LID to upgrade the street pavement and add artwork and other amenities as shown in Figure 28. Property owners pay 20-year benefit assessments to pay off the \$1.5 million in bonds that provided the local contribution to a \$5.5 million project. UMTA provided the remaining funds. Merchants therefore received almost \$4 in improvements for every \$1 they contributed which made selling the idea easy (Howard et al., 1985).

Another LID was formed in the Lloyd District in the 1980s to turn Holladay Street into a pedestrian mall between the arena, coliseum, and convention center at the west end and Lloyd Center regional mall at the east end. Businesses in downtown Hillsboro are considering forming another LID to improve the appearance of their station areas.

Locating Public Facilities

Another way to generate ridership is to locate public facilities at transit stations. Federal, state, and regional office buildings have been built or renovated near the line in the Lloyd District and downtown. These include a federal office building and ODOT's Region One headquarters in downtown and federal, state, and port buildings in the Lloyd District.

Figure 28. Artwork and Brick Sidewalks Along Morrison Street Light Rail



Two generators of off-peak riders have located at transit stations at the west end of the Lloyd Center area. Both have been built with limited parking. The \$85 million Oregon Convention Center was built in 1990 fronting on a new station. Although the Convention Center is located near the intersection of I-84 and I-5, it has only 800 parking spaces that are in back of the building. Light rail provides an easily understood connection between the convention center and hotels, restaurants, and shops both in downtown and in the eastern end of the Lloyd District. \$34 million in public funds are also being invested in the \$262 million Trailblazers Arena under construction at the Coliseum (or Rose Court) Transit Station. The arena will seat 20,340 people, but have only 3,446 nearby off-street parking spaces. Instead, most fans will arrive on light rail or be shuttled on Tri-Met buses from parking garages farther east in the Lloyd District (Arrington, 1995).

Economic Development Agencies and Powers

Many of those who evaluated the TSAP process suggested that an experienced development agency provide a pro-active development program for the entire corridor. Tri-Met has been the only agency taking a corridor-wide perspective. Prior to light rail they had no experience with economic development, and they do not have the powers of a redevelopment agency.

Although it does not have a corridor-wide perspective, the city of Portland's economic development agency, the Portland Development Commission (PDC), has been involved in a number of station area projects. PDC was the primary mover behind the development of Pioneer Place, a festival marketplace and office complex, at the intersection of the downtown light rail and bus malls. PDC assembled the land, selected the developer, and financed parts of the project with tax increment financing. The project opened in 1990 and includes two light rail stations. Figure 29 shows a light rail station at Pioneer Place. PDC has also helped finance the rehabilitation of historic buildings in the Skidmore/Old Town and Yamhill Historic Districts along the light rail line.

Figure 29. Pioneer Place Light Rail Station



In addition, PDC created an urban renewal district around the Oregon Convention Center to facilitate the development process. Voters, however, approved a statewide property tax limitation measure in 1992 that has eliminated PDC's ability to use tax increment financing. No urban renewal activities are, therefore, taking place in the Convention Center area.

PDC has also identified transit station areas in Portland as one of their ten target areas in their 1994-1999 business plan. PDC's goal for station areas is to provide technical assistance and facilitate private development using private funds and federal transportation funds such as Congestion Mitigation Air Quality (CMAQ) dollars (PDC, 1994).

Subsidized Housing

PDC also coordinates a number of housing programs. Prior to westside, none of them had specifically targeted transit station areas. Now, PDC is planning a multi-family housing project on surplus land between the tracks at a station in Goose Hollow, a mixed residential and commercial area immediately west of downtown Portland. Investors are interested in this project, but the project hinges on FTA releasing its interest in the land. Like other downtown housing projects, this project will require some subsidy to be feasible. PDC and Tri-Met are hoping FTA will provide the subsidy by foregoing its share of the land costs.

4.6 STATION AREA STORIES

Over \$1.23 billion worth of development has occurred or is under construction near the eastside light rail line. This section tells the story of two areas--the Lloyd District and suburban stations. Over half of the investments along the light rail were made in the Lloyd District. While slow in getting started, the suburban areas have recently had a burst of infill apartment development.

The Lloyd District

The Lloyd District is located across the Willamette River from downtown Portland near the intersection of I-84 and I-5. It has a mix of public facilities, office buildings, a regional mall, and other retailing. The Lloyd Corporation owned and developed most of the land in the area until the late 1980s when the mall was sold to Melvin Simon and 70 other acres of land and buildings to Pacific Development Corporation. The Bonneville Power Administration and the Port of Portland have had offices in the area for many years, and the city built the Memorial Coliseum at the western end of the district in the late 1950s.

Light rail provided a new way of physically and psychologically bridging the river that divided the Lloyd District from Downtown. In 1988 the city adopted a Central City plan that provides a framework for development in downtown, the Lloyd District, and other nearby areas. The Lloyd District is envisioned as the eastern retailing anchor of the Central City and the home of regional sports and convention facilities. As densities increase, more travel to and within the district will be by transit rather than automobile. The city is currently adopting transit and parking management policies similar to those used downtown. Plans include metering on-street parking, linking the number of parking spaces allowed in new development based on the level of transit service, and providing free service on light rail between the Lloyd District and downtown.

There are four light rail stations in the Lloyd District. At the western end the Coliseum (or Rose Court) station is a transit center connecting with 9 bus lines. Moving to the east the Convention Center Station is at the front door of the convention center, the 7th Avenue

station serves office buildings along Holladay Street, and the Lloyd Center/11th Avenue station serves the mall, cinemas, and Bonneville Power Administration offices.

Both public policies and private strategies have supported investments in this area. A public-private master plan was developed for the area after ownership of major properties changed. The district has become a primary office area close to, but outside of, the downtown core as well as a place for shopping and entertainment.

Major investments located within one block of the light rail line include (Arrington, 1995):

- Rose Garden Arena, a \$262 million 20,340 seat sports arena and entertainment complex
- Lloyd Center renovation and expansion, a \$200 million project expanding the regional shopping center to 1.5 million square feet
- Oregon Convention Center, a \$85 million 400,000 square foot building fronts on a new light rail station
- Federal Office Building East, a \$55 million, 545,000 square foot building that houses the Bonneville Power Administration
- Lloyd Center Red Lion Inn, \$38 million to renovate and add 530 rooms
- Lloyd Center Tower, a \$33 million 400,000 square foot office building built by the Lloyd Corporation
- Holladay Corridor Improvements, \$22 million project to improve the pedestrian environment along the light rail street
- State Office Building, \$11.5 million, 264,000 square foot building
- Lloyd Cinemas, \$3 million multi-screen theater

Suburban Infill

The seven stations along Burnside are in established mostly single-family residential neighborhoods that have commercial activities at major intersections. When light rail was built, some areas were stable single family neighborhoods where little change was expected while others were ready for redevelopment. Redevelopment areas were zoned for multi-family housing. During the early years of light rail operations little happened. This part of Multnomah County lost population during the early 1980s recession, and apartments were not being built anywhere in the area. The market has turned in the 1990s, and 14 different apartment complexes ranging from 11 to 195 units have been built near stations. One of these projects is the joint development project described earlier. The developer of that project has built several of the complexes that provide economical housing for people who ride light rail to work.

4.7 CONCLUSIONS

The Portland region values planning as a means of shaping its future and avoiding problems of growth. It has a long history of developing and implementing plans that have shaped the way the region grows. The region views planning as a work in progress and frequently revises the process as conditions change and it learns from past successes and failures. The region has developed institutions that facilitate cooperation between jurisdictions and continuity of efforts. One of the areas where these processes are evident is in light rail station area planning and development.

The region is an innovator in station area planning that allows transit-supportive development to occur. The market has responded with transit-supportive development at some, but not all, station areas. In the Portland region transit-oriented station area development has occurred where:

- The market supports development
- Stations are located in places with development potential
- Transit supportive land use policies are in place
- Public investments support development through infrastructure provision or financial assistance
- The business community helps create pedestrian friendly environment through the formation of local improvement districts
- Leadership is available to make the deals and handle the coordination required of public-private, multiple-jurisdiction activities
- The development community is involved in a planning process that includes market feasibility as well as traditional land use planning

Development has not occurred or has occurred more slowly than anticipated when:

- The local economy is not strong
- Economic development tools (e.g. land assembly, financial assistance) are not available or not used
- Stations are located in developed single family neighborhoods that do not want to change
- Land owners and developers prefer standard auto-oriented projects

Fifteen policies and implementation tools have been identified that have supported development in station areas or are expected to facilitate that process on the next light rail. While these policies and tools were crafted in the unique political culture of Portland, they provide ideas that can be adapted to other areas.

Regional Growth Management and Transportation Strategies

State, regional, and local policies support the integration of transit and land use planning. This integration has developed and evolved over the last 20 years as the region has learned from past experiences and new opportunities. The major components of these strategies are to:

1. Use urban growth boundaries to limit suburban sprawl
2. Develop regional consensus on balancing transit and highway investments
3. Encourage a pedestrian friendly environment
4. Manage parking supply and location to support transit use
5. Shape public opinion and policy through non-profit groups that advocate alternatives to automobiles including transit-supportive development patterns

While there is currently considerable debate about where and how much the metropolitan urban growth boundary should be expanded as the region grows, the boundary has successfully defined where urban development could occur for the past 16 years. This has kept the region from expanding farther into the countryside and encouraged development, including redevelopment and infill, inside the urban growth boundary. This supports higher density development near transit stations.

Essentially the region is building the transit system that regional leaders adopted in the 1970s when they replaced a freeway-dominated transportation plan with one that balanced highways and transit. The consensus-based process of JPACT has kept light rail projects moving with each part of the region benefiting from a project over time. Planners and policymakers anticipate that light rail will generate development opportunities and support regional centers.

Transit use is highly dependent upon the pedestrian environment. Downtown Portland emphasized the pedestrian environment in its 1972 plan by requiring buildings to be built to the sidewalk, have no blank walls, and have 60 percent retail on ground floors. These policies combined with the city's small blocks (200 × 200 feet) to make an environment that is conducive to walking. The pedestrian environment has also been a major concern of station area design and zoning. More emphasis is being placed on this environment throughout the region as cities and counties implement the Transportation Planning Rule by changing their land use ordinances.

Transit use in the downtown has been encouraged by limiting the supply of parking available to commuters. Similar policies are being adopted in areas adjacent to downtown. Transit station zoning also regulates the supply and location parking in station areas to encourage transit use.

Non-profit groups have played a vital role in researching and advocating new ways of developing communities and a greater emphasis on non-automotive modes of travel. 1000 Friends of Oregon's LUTRAQ project, in particular, has demonstrated that locating suburban higher density development near transit would support ridership without increasing the planned density of the suburbs. The LUTRAQ alternative has been included in the Westside Bypass Major Investment Study and has generated considerable discussion about the way the region should grow.

Transit Agency Involvement in Land Use Issues

Tri-Met has played a major role in coordinating station area land use planning, urban design, and development. These were new roles for the transit agency that have not always been understood and appreciated both within and outside the agency. Nonetheless, the agency has persisted in being actively involved in land use and development issues without being a land use planning or economic development agency. The agency has played two major roles:

6. Advocating transit-supportive development policies and facilitating their implementation
7. Having people with the skill and authority to carry out complex multi-jurisdictional, public-private negotiations

The transit agency has been a strong advocate of transit-supportive development in regional and local planning processes and has provided funding and coordination for station area planning. Tri-Met recognizes that development requires people who can put together packages and coordinated programs. They have hired staff to bring together people from various technical fields, multiple jurisdictions, and the private sectors to carry out demonstration projects, joint development, and station area planning. Leaders need both skills and authority to conduct these negotiations.

Station Area Policies

A wide variety of policies and tools to shape station-area development are being used in the Portland region. The toolbox has evolved over time and some of the following have not been fully tested.

8. Locate stations where there is vacant land or redevelopment potential
9. Zone station areas for higher density, transit-friendly development
10. Use interim zoning to prevent unacceptable uses during planning period
11. Create public-private partnerships for developing master plans for station area communities
12. Use local improvement districts to improve the pedestrian and transit-rider environment in business districts
13. Locate regional people attractors such as convention centers and sports arenas at stations
14. Pursue joint development that combines excess right-of-way with privately owned property
15. Use economic development agencies to facilitate private investments in station areas

The eastside light rail line traversed a mostly developed area where most development had to be infill or redevelopment. While the urban Lloyd District has had considerable development, the suburban areas are not significantly different from pre-light rail days. Because the westside has stations in four large tracts of vacant land, the hope is that transit-oriented, mixed-use communities will be built near these stations.

When the eastside light rail was built, station area zoning was an entirely new concept. Now, everyone in the region assumes it will be part of the light rail building process. While zoning by itself is not enough to produce development, it allows transit-oriented development to occur where the market supports it. Interim zoning is currently being used to preserve options while the planning process is taking place on the westside. Many evaluators of the eastside planning felt that it was too much of a public planning process with little input from the development community. Tri-Met is now involving the private sector in three public-private partnership on the westside and one on the eastside to develop master plans that include evaluations of the feasibility of actual projects. The hope is that development will occur more quickly and be more transit supportive as a result of this process.

Local improvement districts have generated the local share of funds to improve the pedestrian environment in business districts. By making the area more interesting and easier to use, people are encouraged to come to the area. This generates more business and fosters development.

Locating regional facilities like convention centers and sports arenas at stations benefits light rail by providing off-peak riders and benefits the facilities by reducing their parking needs.

Considerable time and effort has gone into large joint development efforts that have not come to fruition because of changes in the real estate market or other factors. Recently a small scale project has satisfied the objectives of the both the developer and Tri-Met. The developer built an apartment complex that he sold at a profit. Tri-Met found a use for excess property and has attracted riders who do not need park-and-ride spaces. Tri-Met was not successful, however, in retaining project revenues as the Federal Transit Agency required repayment of its grant money.

Economic development agencies have powers and means of financing projects that are not available to transit agencies. The Portland Development Commission has assembled land and put together major projects such as Pioneer Place near the light rail line. Although their activities have been curtailed by limitations on the use of tax increment financing, they continue to administer housing and economic development loan and assistance programs that could facilitate development in station areas within the city.

In sum, by actively pursuing a vision of development shaped by light rail and learning from its experiences, the Portland region has developed a number of policies and tools to support station area development. Over \$1.23 billion of investments have been made along the 10-year old eastside light rail line. The state-of-the-art planning process on the westside holds the promise of building 100 to 400 acre communities in station areas that will change the way suburbs develop.

Notes:

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1. Nike, Inc., recently purchased this site saying that they intended to use it to expand their headquarters.

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5.0 VANCOUVER, BC CASE STUDY

5.1 INTRODUCTION

Vancouver BC has used transit as the primary tool to implement its vision of a multi-centered region. Advanced light rail and passenger ferry service has been the catalyst for redevelopment of underutilized properties in four designated regional centers. The centers now have transit-friendly office, retail, and residential development. This metamorphosis was aided by supportive zoning, government agency tenants in new developments, and a number of other policies of the provincial, regional, and local governments.

This integration of transit and land use planning is the product of a long history of regional comprehensive planning. Regional planning in the Greater Vancouver Metropolitan Area can be traced back to as early as the 1920s and 30s. This long history of regional planning has led to a vision of a system of Regional Town Centres or mini-downtowns, linked by a fast and efficient public transit system, as opposed to uncontrolled suburban growth. The regional growth vision was crystallized in the region's historic Livable Region Plan in the early 1970s. The concept of a regional system of development nodes linked by transit has been supported by a majority of the local, regional, and provincial governments for over twenty-five years.

Transit has also been able to influence development patterns because the population of Greater Vancouver has doubled in the last 15 years. Stately old homes on gracious in-town lots are being torn down and replaced by three or four large modern homes. In neighborhoods near downtown, high density redevelopment is occurring on even smaller sized lots, with a mixture of retail and residential replacing mostly industrial and large-scale commercial, as well as some traditional single-purpose residential developments. All this creates an environment in which land is very valuable and where median housing prices are in the range of between \$300,000 and \$400,000 (1995 Canadian Dollars [CAD]; GVRD: Greater Vancouver Key Facts).

BC Transit, in a 1989 report called SkyTrain, A Catalyst for Development, claimed that private investments directly linked to its high capacity transit system totaled in excess of \$5.14 billion CAD, and that related construction spending, or spin-off development, could be in the range of as much as \$15 billion CAD.

Greater Vancouver

The Greater Vancouver Regional District(GVRD) is the third largest metropolitan area in Canada and home to approximately 1.8 million inhabitants. The Greater Metropolitan Area of Vancouver is a conglomeration of numerous municipalities and townships. In all, some eleven cities, six districts, three villages and two electoral areas make up what is commonly referred to as Greater Vancouver. Political control of the region is shared by local, regional, and provincial agencies. The level of cooperation between these governments has varied in the past. However, the regional community has developed a capacity for developing a vision of its future, built on consensus, and generally supported at all levels of government.

The Transportation Network of Greater Vancouver

Unlike most other North American cities, the Vancouver Region has not built an extensive freeway network. The region only has about 106 miles of freeway, and these facilities generally terminate at the edge of the population core of the region. Inhabitants of the region rely on public transit and arterials to maneuver around the city.

BC Transit, a provincial Crown Corporation, operates an extensive network of regional and local buses, 28 kilometers (17.4 miles) of advanced light rail transit (ALRT) called SkyTrain, and a three kilometer (1.9 mile) high-speed passenger ferry system called SeaBus. Eight percent of the population live within one kilometer (two-thirds of a mile) of a rapid transit system, and approximately 87 percent live closer than 400 meters (one quarter mile) of a bus route. In the absence of an extensive freeway network, the high level of transit accessibility provided by the BC Transit system has acted to guide development towards a regional pattern which supports transit.

Transferable Ideas

Fourteen specific policies, methods, and institutional factors can be identified which have led to the success of the region in attracting private, transit -sensitive investment to its station area. These fourteen policies, methods, and institutional factors are potentially transferable to other urban areas. They include:

Regional Housing, Transportation, and Employment Policies

1. The limiting of freeway construction;
2. The constraining of available developable land with an agricultural reserve policy;
3. High land prices that result in denser development that is more conducive to transit service;
4. The policy of not subsidizing private mortgages;
5. The development of a strong regional vision, supported by a long history of metropolitan planning within a regional framework and intergovernmental cooperation at the local level;
6. The concentration of office, retail, and high density residential development in regional centers connected by transit.

Transit Operations and Agency Structure

7. Provincial control of regional transportation functions;
8. The use of public Crown Corporations (redevelopment agencies) and a capital projects division within the transit agency to generate private investment interest in conjunction with major public transit investments;

9. The use of traditional transit routes for high capacity transit system construction;
10. The routing of bus routes to force feed the rail system.

Station Area Policies

11. An enterprising approach to station placement and private partnering;
12. Local zoning ordinances restricting the placement of parking within Regional Town Centres;
13. The use of right-of-way easements which do not limit original land owners from utilizing land below and air rights above the ALRT guideway; and,
14. The decision on the part of primary utility companies, government agencies, and Crown Corporations to place their headquarters strategically within town centers and station-area developments.

Report Organization

In the remainder of this report, the reader is provided with a historical picture of how the fourteen points outlined above have led to successful public-private cooperation in constructing transit sensitive developments. Section 2 describes the urban form, the economy and people of the Greater Vancouver Region, as well as the transit system itself. Section 3 discusses station area development strategies, and Section 4 presents a specific case study. Section 5 explores the transferability of various concepts used in the Greater Vancouver Region.

The goal of this report is to provide the reader with an understanding of the unique social and political characteristics of the Vancouver region which have allowed public/private transit investments to flourish; for it is out of these unique social and political characteristics that the fourteen policies, methods, and institutional factors used to encourage transit-sensitive developments, have evolved.

5.2 CONTEXT FOR STATION AREA DEVELOPMENT

Urban Form

The Greater Vancouver metropolitan region lies at the southwest corner of the British Columbia mainland, spanning the Fraser River Delta and Burrard Inlet. The Greater Vancouver Regional District occupies some 2,930 square kilometers (approximately 1,131 square miles including both land and water) and is bounded on the north by the Coastal Mountain range, and on the south by the US border.

The region's location, combined with its rich history of international cultures, has resulted in an urban area comprised of a wide mix of both large and small communities. The region is focused on the City of Vancouver, located on the Burrard Peninsula. Adjoining cities located to the east of Vancouver include Burnaby, New Westminster, Coquitlam, Port Coquitlam, and Port Moody. To the north lie the cities of West Vancouver, Lions Bay,

North Vancouver (City and District), Belcarra and Anmore, all located on the south slope of the Coastal Mountains and separated from the City of Vancouver by Burrard Inlet. To the south of the City of Vancouver, between the Fraser River and the US border are the municipalities of Richmond, Delta, Surrey, White Rock, and Langley (City and Township). These eighteen municipalities comprise the Greater Vancouver Regional District (GVRD). Summary statistics for the largest communities within the GVRD and the region as a whole are provided in Table 11 and Table 12.

A somewhat larger district, identified by Statistics Canada as the Vancouver Census Metropolitan Area or CMA, includes portions of the Central Fraser Valley Regional District and Dewdney-Alouette Regional Districts to the east of the GVRD (See Figure 30). Municipalities from these regions included in the CMA are Maple Ridge and Pitt Meadows. The addition of Maple Ridge and Pitt Meadows adds approximately 317 square kilometers or approximately 123 square miles to the GVRD gross area for a total of 3,249 square kilometers (1,254 square miles including both water and land area, GVRD Strategic Planning Key Facts). In June 1995, both of these municipalities formally joined the GVRD.

The Greater Vancouver Metropolitan Area (CMA) is home to some 1.8 million people. Approximately 1.6 million of those inhabitants live within the GVRD (not including Pitt Meadows and Maple Ridge), resulting in a gross density of approximately 1,457 people per square mile. Actual densities are much higher due to the fact that the region is crisscrossed by two major water-ways and because of the mountainous portions of the region, unsuitable for urban development. This results in a net density in excess of 10,000 persons per square mile (Wilson and Anderson, 1993). The buildable area within the urbanized region is also artificially constrained by an agricultural reserve policy which restricts large portions of the region in a land preserve controlled by the provincial government to maintain a viable agricultural industry within the lower mainland region (GVRD, 1994). There is debate on how this latter policy has affected the development market. It is clear that based on existing high density development patterns, there is still significant unused capacity within the urbanized areas of the region. Hence, some in the Vancouver area argue that the agricultural reserve policy has not restricted development. Others argue, however, that it has removed significant portions of the region from speculative development and focused demand into higher density urban areas served by transit.

The Vancouver metropolitan region serves as a major business center for all of British Columbia. According to Statistics Canada, employment in the Vancouver CMA totaled 801,500 in 1994 (889,000 GVRD 1995 first quarter employment estimate), with a 9.3 percent unemployment rate. Average household income (1991 census) was approximately \$50,573 CAD.

Table 11. Summary Population and Household Statistics of the Greater Vancouver Region

Regional Population Estimates and Other Statistics	1993	Gross Area		Gross Density	1993
	Population Estimate	Hectares	Sq. Mi.	Pop/Sq.Mi.	Vehicles per Capita
Greater Vancouver Regional District	1,614,226	198,872	767.8	2,102	0.6
Vancouver Census Metropolitan Area	1,700,186	231,605	894.2	1,901	NA
City of Vancouver	494,487	11,615	44.8	11,027	0.5
City of Burnaby	168,636	10,674	41.2	4,092	0.7
City of Richmond	134,681	16,807	64.9	2,076	0.7
City of Surrey	270,337	37,104	143.3	1,887	0.6
City of New Westminster	45,424	2,200	8.5	5,347	0.6
City of North Vancouver	40,339	1,267	4.9	8,244	NA

Regional Household and Other Statistics	1971	All Households		Growth in	1993	% of HH
		1991	% CMA Total	Households	Registered vehicles	That are Apartments
Greater Vancouver Regional District	229,840	588,750	97%	156%	970,802	35%
Vancouver Census Metropolitan Area	238,025	609,370	100%	156%	NA	34%
City of Vancouver	153,240	201,150	33%	31%	254,309	50%
City of Burnaby	38,655	62,750	10%	62%	114,815	42%
City of Richmond	16,950	44,455	7%	162%	88,187	26%
City of Surrey	26,960	82,155	13%	205%	149,671	16%
City of New Westminster	15,445	21,205	3%	37%	28,250	65%
City of North Vancouver	11,525	18,220	3%	58%	NA	59%

Source: Greater Vancouver Key Facts (GVRD and Statistics Canada)

Table 12. Summary Employment Statistics for the Greater Vancouver Region

Regional Employment	Employment		
	1971	1991	% Change
Greater Vancouver Regional District	387,915	775,505	100%
Vancouver Census Metropolitan Area	394,204	792,485	101%
City of Vancouver	225,108	321,450	43%
City of Burnaby	42,528	93,495	120%
City of Richmond	24,188	85,695	254%
City of Surrey	15,865	77,360	388%
City of New Westminster	20,809	26,985	30%
City of North Vancouver	9,920	22,800	130%

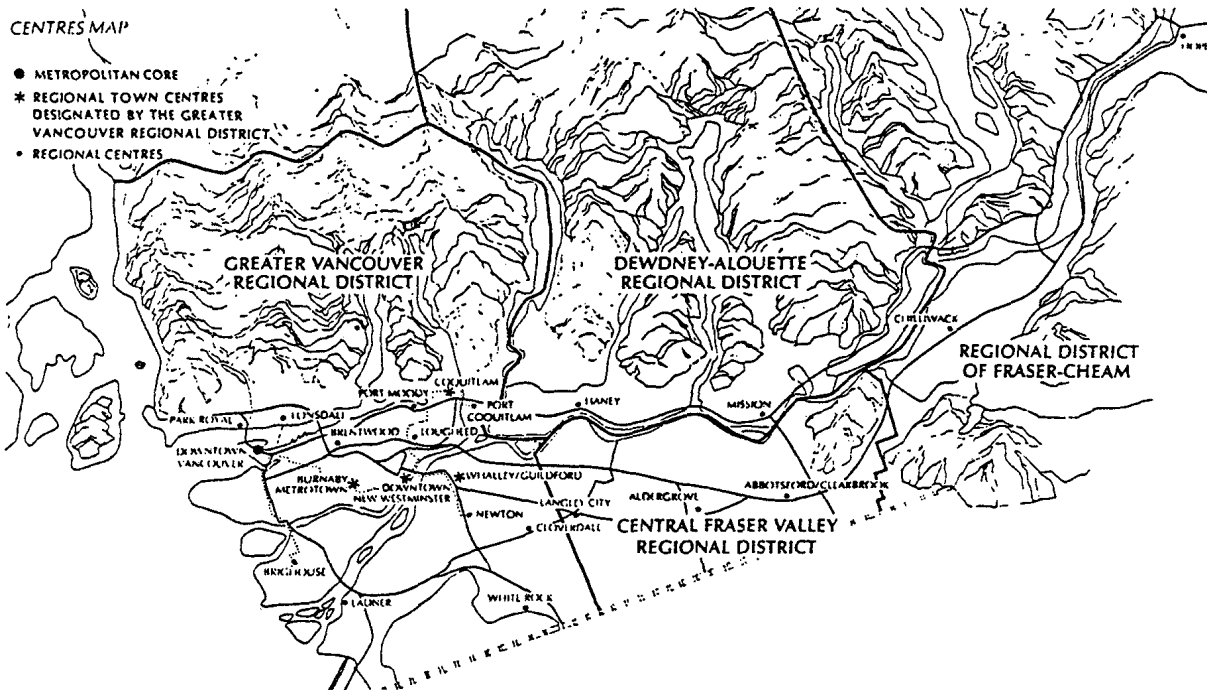
Source: Greater Vancouver Key Facts (GVRD and Statistics Canada)

1991 CMA Employment by Sector

Sector	1991 by Sector
Manufacturing	13%
Construction	5%
Transportation/Utilities	11%
Financial/Insurance/Real Estate	9%
Government	5%
Trade	20%
Services	35%
Primary	2%

Source: Greater Vancouver Key Facts (GVRD and Statistics Canada)

Figure 30. British Columbia's Lower Mainland Regional Districts



Source: GVRD: Major Centres in Greater Vancouver: Current Status and Policy

Within the GVRD, Statistics Canada counted a total of 588,750 households as of 1991. Of these, 334,420 were privately owned and 254,170 were rentals (e.g., approximately 43 percent of all households within the GVRD were rental). Single family households (1991) accounted for 51 percent of the total housing stock. Single family housing is relatively expensive in the Greater Vancouver Region. Median housing prices in the fourth quarter of 1993 were between \$310,000 and \$365,000 CAD (GVRD, 1994).

Average housing prices and land costs within the metropolitan region can vary dramatically. It is not uncommon to find standard building lots in the City of Vancouver (50 ft x 120 ft) selling for \$1 million CAD (1995 Value). Much of the high cost associated with such properties are driven by the location of the lot within the central city, the scarcity of close-in residential lands, and the in-migration of large populations of wealthy immigrants from other Commonwealth Countries and Crown Colonies throughout the world. Such high prices have been an encouragement to the construction of high-rise apartment buildings and condominiums throughout the region. (Source: Ted Droettboom, 1995)

A Historical Perspective

To fully understand the processes by which transit-oriented developments have occurred within the framework of the Greater Vancouver Metropolitan Area, requires an understanding of the region, as well as the historical background of both the transit industry and regional planning tradition within the region.

The Economy

Incorporated in 1886, Vancouver has become an economic center for the region and for all of western Canada, providing the linkage between trading partners around the Pacific Rim and inland Canadian markets. Much of the business culture today is based on the export of raw and finished materials such as forestry and mining products bound for the US and Pacific Rim. Agricultural products from the Canadian interior and energy production are also a major share of the economic base within the region.

Like in other North American cities, the Greater Vancouver economy is shifting to a more service oriented one, with banking and insurance agencies as well as a thriving tourist industry playing important rolls in the modern economy. However, the BC economy remains rooted in its timber, mining, energy production and agricultural heritage.

The Greater Vancouver Region is the headquarters for 161 major Canadian corporations. Pertinent data for the eight largest corporations headquartered in the Greater Vancouver area are shown in Table 13.

Table 13. Corporate Entities in Greater Vancouver

Company	Head Office Location	Type of Business	1993 Revenues (\$000)	Ownership	Ranking		Number of B.C. Employees
					B.C.	CAN.	
MacMillan Bloedel	Vancouver	Forestry	\$3,762,000	Public	1	73	12,900
Westcoast Energy	Vancouver	Energy	\$3,627,000	Public	2	962	1,548
The Jim Pattison Group	Vancouver	Diversified	\$3,109,000	Private	3		9,000
BC Telecom	Burnaby	Utility	\$2,209,600	Public	4	15	13,478
BC Hydro	Vancouver	Utility	\$2,178,000	Crown	5		6,318
ICBC	North Vanc	Insurance	\$2,041,778	Crown	6		3,905
Weyerhaeuser Canada	Vancouver	Forestry	\$1,400,000	Private	7		1,700
Placer Dome	Vancouver	Mining	\$1,284,800	Public	9	34	388

Ownership Categories

1. Public = companies listed on Canadian stock exchanges
2. Private = companies which do not issue publicly traded shares
3. Crown = Crown Corporations of the Government of British Columbia

Source: (GVRD Strategic Planning Key Facts)

1. Rank of BC from BC Business Top 100, July 1993
2. Ranking for Canada (Ranked by Profits) = Globe & Mail Report on The Top 1000 Companies, July 1993
3. The Business In Vancouver Book of Lists, BTW Publications, September 1993

As indicated by Table 13, business in Canada and in the Greater Vancouver Region can generally be classified as one of three types of business: publicly traded, privately owned, or Crown Corporations. Crown Corporations are agencies of the British Columbia Provincial Government, typically entrusted to provide a public utility. In the Greater Vancouver Region, the transit agency, BC Transit, is a Crown Corporation, charged with maintaining transit service within the Vancouver Metropolitan Region as well as within the Victoria Metropolitan Region and other smaller communities throughout BC. As such, BC Transit is responsible to the Provincial government rather than directly to a local governmental body or local electorate.

The People of Greater Vancouver

The people of Greater Vancouver live in a diverse cultural center, unique to Canada. Their European and Asian heritage engenders a greater willingness to support transit and to live in more dense apartment-style housing. These cultural and social attitudes towards transit and transit-supportive development are reinforced by the surrounding environment of the lower Fraser Delta.

Cultural Heritage

The Greater Vancouver Region is home to a multicultural mix of populations, both dispersed throughout the region and organized into well defined enclaves. Like other Canadian cities, Vancouver has a strong European heritage. The region's heritage is also strongly influenced by an established Asian culture as well as many other more recent immigrant groups. In 1994, some fifty-two percent of all people moving to British Columbia were international immigrants, compared to just forty-eight percent migrating from other parts of Canada (Vancouver Sun, April 7, 1995). This diverse culturalism has made Vancouver a unique metropolitan region in Canada and North America, much more reminiscent of old-world cities than comparable cities in other parts of Canada and the United States.

Housing

Canadian cities and their inhabitants have been characterized as typically more frugal than their American counterparts. This is largely out of necessity and has led to a more conservative approach to land consumption throughout Canada. Another factor supporting this concept is the fact that Canada does not subsidize the private mortgage and housing markets by allowing an annual tax write-off for interest payments. Hence, ownership of a private home lacks the same incentives that it has in the US. As stated previously, private housing prices are very high. Buildable land in the Greater Vancouver region is significantly constrained by natural features of the surrounding landscape and by governmental policy. Prices for individual residential properties are well out of the range for many people. This encourages, or requires, a willingness to accept apartment living at higher densities that are typically more supportive of transit.

Transit Acceptance

The European and Asian heritage of the region has also made the Vancouver community more accepting of transit. Transit is seen as a viable link in the regional transportation

system. This acceptance of transit is inspired by a conscious effort on the part of the region to limit freeway construction. Currently, Vancouver has only about 106 miles of freeway, less than half that seen in US cities of similar size (Willson and Anderson, 1993).

Public transit is seen by a significant proportion of the population as a high-speed, reliable alternative to the automobile. Average annual ridership in Greater Vancouver is around 86 trips per capita.

Transit Service in Vancouver

Public Transit has been an integral part of the Greater Vancouver region's economic success since the turn of the twentieth century. The history of public transportation in the Greater Vancouver Region can be divided into four primary periods (Oberlander and Smith, 1993).

The first of these periods dates from 1890. Streetcar service was provided by B.C. Electric Railway Company, a private corporation. Service between Vancouver, Burnaby, and New Westminster was provided over approximately 1,800 miles of track, with a peak vehicle stock of 300 streetcars.

The second period was marked by the introduction of trolley buses into the transit market linking more distant suburbs with the existing streetcar network. By 1955, the trolley bus network had all but replaced the network of streetcar lines seen from the earlier period in Vancouver's transit history. The trolley bus was typically more flexible and easier to maintain than the old streetcar lines.

The third period in Vancouver's transit history, roughly from 1952 through 1966, is one of neglect and decline. As seen throughout North America, the trolley bus system fell to neglect as investment in the private automobile and highway network escalated.

This period of decline for the local and regional transit network came to a head in 1966 when a freeway system was proposed for the Greater Vancouver Region that would have cut through long-established residential neighborhoods and ethnic communities near the central city. The resulting controversy within the City of Vancouver, often called the "Great Freeway Debate," resulted in considerable public outcry against a freeway system and against local and provincial officials backing the freeway option. The freeway revolt generated such a formidable movement within the Greater Vancouver political community that it ultimately resulted in the formation of a separate political party called The Electors Action Movement (TEAM) which took control of the Vancouver City Council between 1968 and 1974. TEAM was able to exercise considerable control over local transportation politics during this period and set the foundations for a revitalization of public transportation within the Greater Vancouver region.

The fourth period began with the coming of age of TEAM. With the defeat of proponents of the freeway model, attention was shifted to basing Vancouver's future on public transit. This period is also marked by a significant increase in the role of the provincial government in the provision of local transit service. Through a series of steps, the provincial government established a regional transit authority responsible for transit operations within Greater Vancouver. The Greater Vancouver Regional District (regional government) did not

have authority over the transit agency. Authority resided with the provincial government alone. Although several changes in structure have been made over the years, the resulting Crown Corporation, BC Transit, founded in 1982, functions essentially as an extension of the provincial government, operating local and regional transit within the Greater Vancouver urbanized area (Oberlander and Smith, 1993).

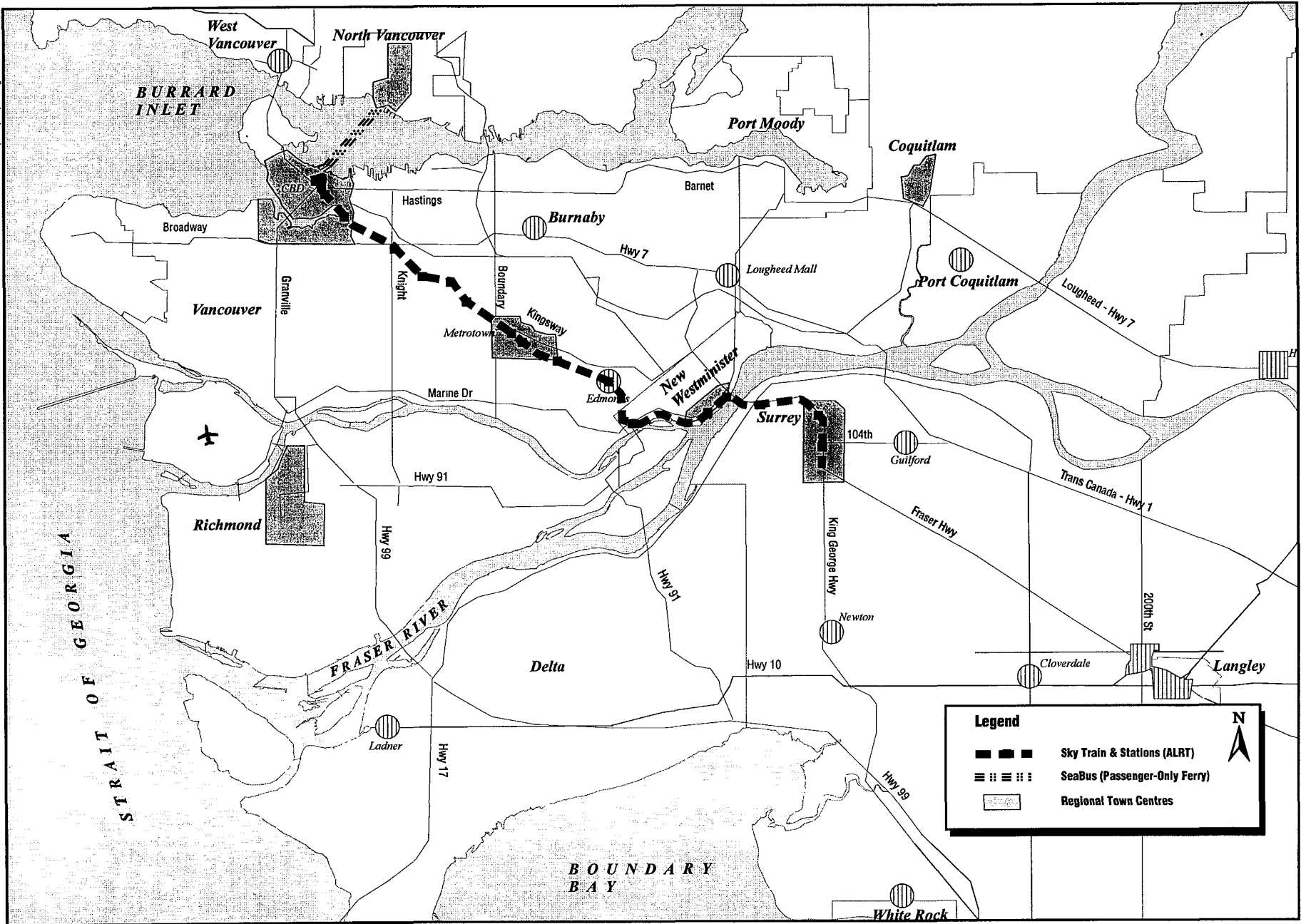
BC Transit has been responsible for expanding transit service throughout the urbanized Vancouver area and for constructing a truly multimodal system. The existing BC Transit system includes bus, advanced light rail transit (ALRT) called SkyTrain, as well as high speed passenger-only ferry service (SeaBus) across Burrard Inlet. BC Transit operates some 28 kilometers (17.4 miles) of ALRT with 20 active stations. Accessibility to transit is relatively high (See Figure 31). For 1991/92 approximately 8 percent of the population lived within 1 km (2/3 of a mile) of a high capacity transit line (SkyTrain), and in all, 87 percent of the Vancouver population lived within 400 meters (1/4 mile) of a bus route. Transit's share of travelers during the morning peak hour is approximately 13 percent (1992/93). For the same year, the ALRT system carried approximately 20.1 million passenger trips.

SkyTrain service is provided on a five minute frequency, using completely automated train sets. Four-car trains are generally run on a twenty-four hour basis, with two-car trains being substituted during lower demand periods. The high level of automation within the system allows BC Transit to maintain very high service frequencies throughout the day and night operating periods without incurring additional costs normally associated with such operations.

In addition to the ALRT system, a high speed passenger ferry system, SeaBus, across Burrard Inlet connects downtown Vancouver with Lonsdale / North Vancouver Quay via a round-trip route of approximately three kilometers (1.9 miles). Passenger ferry service between Lonsdale Quay and the Vancouver waterfront operates on a 15 minute service headway, Monday through Friday excluding times between 1:00 AM and 6:00 AM. Weekend service is provided on a frequent basis as well. The SeaBus system serves as an extension of the ALRT SkyTrain system, linking the Burrard Peninsula with the North Vancouver mainland (See Figure 31). In 1992/93, the SeaBus system carried approximately 2.1 million passenger trips.

Urban Planning in Vancouver

The history of regional planning in the lower British Columbian mainland is a colorful one, consisting of alternating periods of conflict and cooperation between local, regional, and provincial powers. Regional planning in Greater Vancouver can be traced to the formation of a voluntary planning association in 1937, comprised of the six metropolitan municipalities of Vancouver, Burnaby, Coquitlam, Port Moody, and North and West Vancouver. This original planning body was organized to address common flooding and sewage problems experienced by inhabitants of the lower mainland. Although this governing body began humbly and many changes have occurred over the years, regional planning and a spirit of cooperation among local governments have continued to the present.



Legend

- Sky Train & Stations (ALRT)
- SeaBus (Passenger-Only Ferry)
- Regional Town Centres

N
↑



Vancouver Regional High Capacity Transit System
FIGURE #31

Formal regional governance was introduced to the region in 1949 in the form of the Lower Mainland Regional Planning Board (LMRPB). Under this agency, regional planning focused on developing an "Official Regional Plan" or ORP which would determine major land use patterns throughout the region and which would be binding upon all the member municipalities. Member municipalities, twenty-eight in all, were required not to enact zoning codes or land use regulations which would conflict with the ORP. The plan was later updated in 1966 under the title of Change and Challenge and received broad regional consensus support (in excess of two-thirds of the member agencies approved the plan). The updated plan was very successful in framing the regional land use development policy for the region. In doing so, however, the LMRPB found itself in conflict with the provincial government. The result was that the provincial government dissolved the LMRPB and divided its powers amongst several regional districts, including the Greater Vancouver Regional District (GVRD).

The purpose of the GVRD was to provide regional planning services as well as manage numerous other regional services (e.g., water, sewer, garbage, housing, and air quality) while not becoming a new level of government which its predecessor, the LMRPB, very nearly became. The GVRD was empowered to develop regional plans for land use and transportation. In 1975, the GVRD adopted its Livable Region Plan (LRP). The LRP, based on an extensive citizen involvement campaign, strove to create regional development guidelines based on statistical forecasts, citizen preferences, and economic conditions projected for the future. Two key components of the LRP were the organization of regional development around Regional Town Centres and the linking of these centers by light rapid transit. The purpose of the town center approach was to create a better job-housing balance, bring urban services to suburban municipalities, increase the range of housing opportunities, and to take development pressure off of the central City of Vancouver. The LRP had wide spread support among the member agencies of the GVRD and led to the crystallization of a regional vision, consisting of a system of town centers linked by high capacity transit.

In 1983, friction between the GVRD and the provincial government led to the removal of authority for land use and transit planning from the GVRD. However, the consensus built through the LRP process has enabled the region to maintain its regional vision of decentralizing employment from the City of Vancouver into a series of six town centers strategically placed within the greater urbanized region. These town centers have become the foci for higher density development and for the location of high capacity transit linkages to downtown Vancouver. After the removal of formal planning powers from the GVRD, local municipalities worked together to bring the major points of the LRP to fruition by enacting local municipal ordinances that essentially mirrored much of the LRP.

As argued by Oberlander and Smith (1993), the fact that the GVRD has been successful in continuing to obtain policy consensus in the development of the LRP and in the subsequent updating of the plan in 1990 without formal planning authority, attests to the fact that there is a strong sense of regionalism in the Greater Vancouver Metropolitan Area and a common vision of the region's development future.

5.3 STATION AREA DEVELOPMENTS

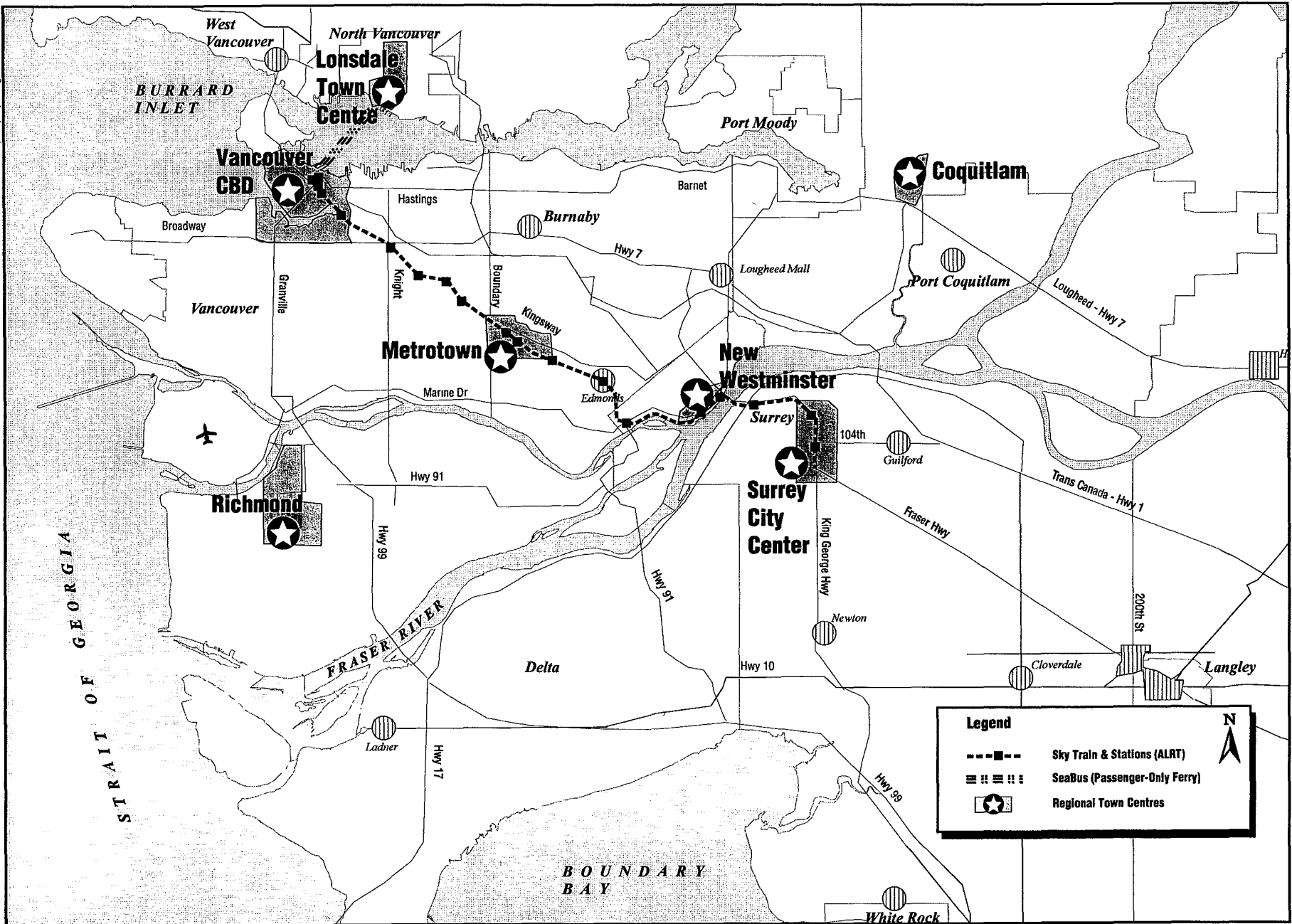
The Livable Region Plan (LRP) developed by the GVRD in the early 1970's led to the region-wide development policy of focusing new growth into a series of Regional Town Centres. An integral part of the LRP was the linking of these Regional Town Centres with a high capacity transit system. Within each of the Regional Town Centres, development has been facilitated by transit access as well as local municipal planning allowing for higher floor to area ratios consistent with the regional plan (LRP).

It is clear that the existence of high capacity transit (SkyTrain or SeaBus) is necessary for private development within town centers, but it is not sufficient to generate the development in itself. Many of the successful town centers in the Vancouver Region that are connected to the high capacity transit system were slow to generate development after implementation of ALRT, mainly due to a lack of zoning incentives in the surrounding neighborhoods. Nodal development requires a concentrated effort by the community and government authorities to accomplish a comprehensive center. It requires incentives to developers such as zoning controls in other locations not associated with town centers to force nodal development. For example, North Vancouver Quay (served by SeaBus) and Richmond (served only by transit bus) have become attractive development nodes because of favorable zoning encouragement.

The Regional Town Centre Concept

The purpose of the Regional Town Centre, as originally defined in the LRP, was to provide locations for higher density residential communities, commercial businesses, community services, social services, and public amenities. There are currently six Regional Town Centres in the Greater Vancouver Metropolitan Region. Each center was to serve as the downtown for a community of between 100,000 to 200,000 people, living and working in the area. Shown in Figure 32 is a map of the resulting system of Regional Town Centres as they relate to the existing regional transit system. Note that North Vancouver is linked to the SkyTrain system via the SeaBus, high-speed ferry system; and that Coquitlam and Richmond are not linked to the high capacity transit system at all. Access to these latter two town centers is now being debated, with commuter rail and express bus transit being considered as opposed to new extensions of SkyTrain. A profile of the major Regional Town Centres is provide in Table 14, Table 15, and Table 16.

Development within each of the Town Centres is controlled by the local municipality in which the center is located. There is a strong emphasis on pedestrian orientation within centers, resulting in commercial districts with limited or no building setbacks. On-street parking is generally allowed in most town centers, much like the traditional neighborhood model, but surface parking for new developments is generally restricted. Parking, if not accommodated on-street, is typically required to be underground or within structures. This yields a more compact development pattern and discourages the provision of excess parking due to the cost of constructing it (Willson and Anderson, 1993).



Legend	
	Sky Train & Stations (ALRT)
	SeaBus (Passenger-Only Ferry)
	Regional Town Centres



Regional Town Centres
FIGURE #32

Table 14. Regional Town Centres Primary Land Uses (Acreage)

Town Centers	Metrotown	Coquitlam Town Center	Lonsdale Town Center (N Vanc. Quay)	New Westminster
Land Area (acres)				
All Land Uses	735	450	625	170
Commercial Area	138	244	108	80
Residential Area	206	49	250	41
Parks and Open Spaces	238	143	32	6
Regional Transit Link	SkyTrain		SeaBus	SkyTrain

Town Centers	Richmond Town Center	Surrey City Center
Land Area (acres)		
All Land Uses	1,766	980
Commercial Area	445	210
Residential Area	956	685
Parks and Open Spaces	169	85
Regional Transit Link		SkyTrain

Source: GVRD, Greater Vancouver Key Facts

Table 15. Regional Town Centres Development Floor Space (Square Feet)

Town Centers	*Vancouver CBD	Metrotown	Coquitlam Town Center	Town Center (N Vanc. Quay)
Building Floorspace				
Office	22,819,490	2,400,000	170,000	1,200,000
Shopping Center		1,800,000	1,142,000	30,000
Other Retail	11,195,865	64,000	98,000	959,000
Total Commercial	34,015,355	4,840,000	1,410,000	2,189,000

Town Centers	New Westminster	Richmond Town Center	Surrey City Center
Building Floorspace			
Office	928,000	1,500,000	35,200
Shopping Center		1,360,000	1,100,100
Other Retail	929,000	1,670,000	382,000
Total Commercial	1,857,000	4,530,000	1,834,100

* Vancouver CBD values are for 1991, Town Center values are for 1993/94

Source: GVRD Strategic Planning Department and Greater Vancouver Key Facts, 1994 Edition.

Table 16. Regional Town Centres Services Provided

Town Center	Cinema	Library	Rec Center	College Campus /Secondary Ed	Court House	Municipal Hall	Hospital	Art Gallery	Museum	Theater	Public Market	Arena/Stadium	Child Care Center	Youth Center	Senior Center	Health Center	Assisted Housing	Public Square	Ethnic Shopping District	Regional Transit	
Metrotown	●	●	●							●	●	●	●	●	●	●	●	●		SkyTrain	
Coquitlam	●	●	●	P		P	P	P	P		●		P	P		N	P				
Lonsdale Quay	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		SeaBus
New Westminster		●	●			N	●	●			N	●	●	●	●	●	●	●	P		SkyTrain
Richmond	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
Surrey City Center (Whalley)		●	●				●	●					●	●	●	●	●	●	P		SkyTrain

Key: ● = Available
P = Planned
N = Nearby

Source: GVRD, Major Centers in Greater Vancouver: Current Status and Policy

High Capacity Transit as A Development Component

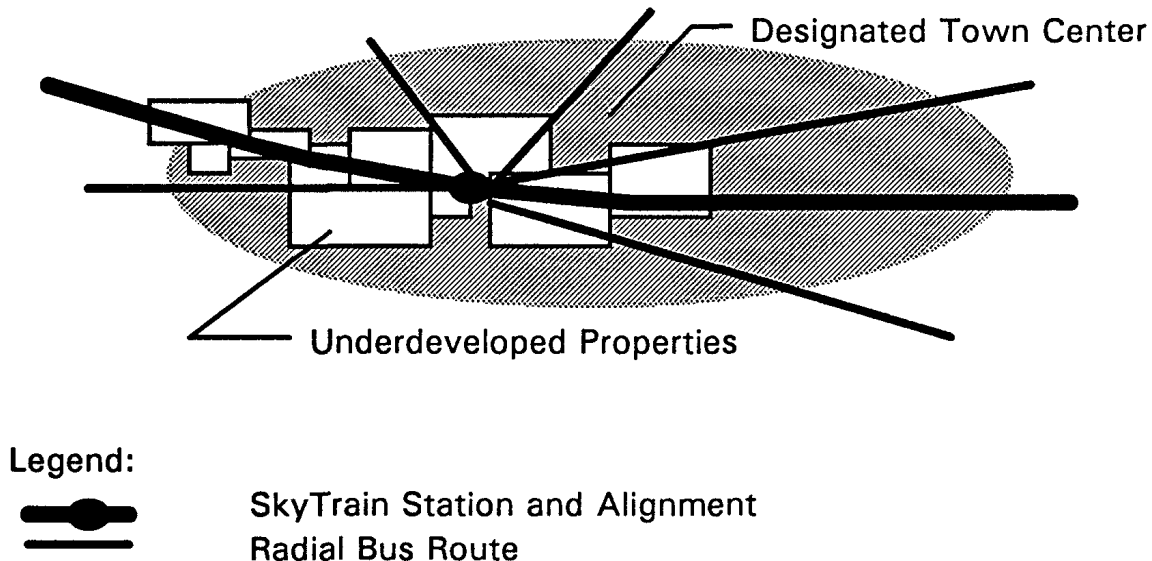
In April of 1989, BC Transit published a report tabulating the development associated with the SeaBus and SkyTrain systems. That report indicated that some \$5.14 billion CAD worth of private investment could be directly linked to the high capacity transit system (developments included in this tabulation were all within 10 to 15 minute walking distances of the high capacity transit line). That report went further to suggest that the SkyTrain system and connecting SeaBus were the major catalyst in assisting and encouraging these economic investments. The effect of the five billion dollars in private investment was claimed to have generated a trickle down private investment of as much as \$15 billion CAD in the Greater Vancouver economy.

Understanding these claims requires an examination of the planning and construction of the existing high capacity transit system. Phase I of the SkyTrain system was built to provide transportation during the 1986 Canadian Expo and to provide the initial leg of a regional high capacity transit network. The SkyTrain system connected major event centers developed for Expo and also linked downtown Vancouver with its sister cities of Burnaby and New Westminster.

The original Phase I route followed a historic interurban rail line, previously abandoned by the regional transit system during its move to the trolley-bus system of the 1950's. The Phase I route traversed traditional residential neighborhoods of relatively high density, but immediately adjacent to much of the right-of-way there existed many older industrial properties, warehouses, and under-utilized lands. These under-utilized properties were seen by both the regional governments and the development community as ripe for redevelopment.

Upon completion of the initial phase of SkyTrain, BC Transit rerouted its bus system to force feed the high capacity transit system with riders, providing no parking at many of its rail stations. BC Transit, being a Crown Corporation reporting to the provincial government rather than local entities, was somewhat insulated from local outcry over the disconnecting of traditional bus routes in favor of a forced transfer between bus and rail. The policy assured high ridership levels at opening day, necessary to justify the public investment. The policy also allowed the transit authority to build SkyTrain through the underdeveloped areas and to facilitate the redevelopment of these properties. An illustration of this policy is provided in Figure 33.

Figure 33. Transit Policy



The lands surrounding many of the successfully integrated stations were in industrial or warehouse use, reducing public opposition to redevelopment. As one source reported, the station areas in the Phase I construction of SkyTrain were placed strategically in "NIMBY"-free zones (NIMBY standing for "not in my back yard"). For example, the latest extension of SkyTrain terminates at the King George station, located in a vacant field which is slated for future development (See Figure 34).

Figure 34. King George Station



The siting of stations on underdeveloped properties is reminiscent of the approach taken by electrical utilities in the early part of this century in extending interurban lines into the country and then profiting from the suburban development that the transit service enabled. In the case of SkyTrain, and SeaBus to a lesser extent, the same policy was used, only in an in-city development environment. The force-feeding of bus travelers onto the rail line assured immediate success for the line and financial prudence while the redevelopment of lands around the station areas allowed for transit-sensitive development and the aggregation of public services. It is important to note however, that the increased value in properties surrounding the stations does not benefit the transit agency. In other words, there is no benefit sharing of the increased land values between BC Transit and the private land owner.

Another important factor which enables high capacity transit to serve as a development component comes from the right-of-way acquisition process used by BC Transit in building the mostly aerial SkyTrain System. BC Transit does not typically own the land over which their aerial system traverses. Through the use of easements, the transit authority protects its right to operate transit and maintain the trackage while the land remains with the original owner. The important issue with regards to this policy is that the original land owner maintains the right to use the land under the guideway and the air rights over the guideway. Hence, in residential areas where there is little development potential, some private land owners have built garages or other structures underneath the guideway. In locations which are more conducive to redevelopment however, land owners have built high density developments around and on top of the SkyTrain guideway, only having to compensate BC Transit if a station connection is required. In some cases, the ALRT guideway traversed a private parcel in such a way that the private land owner lost most or all of its original use. In many such cases, BC Transit purchased these properties and resold them to developers who could make the best use of the property.

A similar approach to the above policy is one used by BC Transit to transfer density credits to other properties not affected by the guideway. Because the original SkyTrain alignment followed a traditional interurban line, the original right-of-way was owned by BC Transit. Some of this land was sold to private developers even though it could not be built upon. The purchasing developers were allowed to transfer the development rights of those lands underneath the guideway to nearby properties, thus enabling them to construct larger scale developments on properties they might not otherwise have been able to utilize for their developments. The unused lands under the guideway were then turned into public open space as an added benefit of the transaction. Similarly, in another case, a private developer was able to "create" additional land by lidding a portion of the SkyTrain right-of-way which had previously been in a submerged trench. The developer essentially built a wide overpass and landscaped it to provide a new park, transferring the development rights from the newly created parcel to a nearby office development.

Station Area Developments Supported by Government Tenants

The ability of government agencies to move their operational headquarters to offices within station-area developments and provide anchor tenants for private investments is another factor which has enabled station area development.

In the Greater Vancouver Regional Area, the federal government is the largest single employer and landowner. Federal responsibilities include operations at the Port of Vancouver; landlord for Granville Island Market, parts of the North Shore Mountains, veterans' hospitals, military bases, and regional offices for numerous federal departments and crown agencies; and provision of numerous public utilities. Additionally the BC provincial government has also chosen to locate many of its ministries and Crown Corporations in the Greater Vancouver Region. The combined market forces of the federal and provincial presence has a substantial impact on local development markets (Oberlander and Smith, 1993). For instance, BC Transit moved its corporate headquarters to Surrey City Center's Gateway Station on the SkyTrain System, providing an anchor tenant for a station-area development, and ICBC (Insurance Corporation of British Columbia) located its headquarters in the Lonsdale Quay Town Centre which is at the northern terminus of the SeaBus System. Similarly at the regional level, the Greater Vancouver Regional District maintains its offices in Metrotown.

Like their US counterparts, Canadian federal and provincial governments are required to seek the most cost-effective locations for their facilities via a request for proposals or RFP for office space, but that RFP can be tailored so that location can be a critical element. Governmental agencies have chosen to locate within the Regional Town Centres and most notably within station area developments and, hence, require in their RFP that the location proposals be located on-line.

In the development of the SeaBus System and the North Vancouver Quay terminal, the provincial BC government took even a more proactive approach to encouraging private investment and development in the Lonsdale Quay development. The provincial government formed a Crown Corporation to oversee the land assemblage and initial public development. The Crown Corporation assembled the necessary land for the SeaBus terminal through expropriation, and in addition bought considerable lands surrounding the Quay. At the same time, the BC government was in the process of forming ICBC, the Insurance Corporation of British Columbia which was to be the sole provider of all vehicle insurance within British Columbia. It was felt by the leaders of ICBC and the provincial government that a consolidated headquarters location for the agency would be advantageous to a multiple site location in downtown Vancouver. With considerable influence from the BC government, ICBC located in North Vancouver. The Crown Corporation charged with developing the Lonsdale Quay sold excess lands to a private developer who in turn built the required office space for ICBC. Because ICBC was already scheduled for tenancy, the developer was assured some level of success in a neighborhood which had previously been surplus industrial and warehouse property.

An Enterprising Approach to Station Placement

The Greater Vancouver Region has developed under a strong regional sense of purpose and with a well defined regional vision of how development should occur. In addition to providing a broad regional sense of direction, this regional vision extends to the site-specific and station-area level of design as well.

Within each of the Regional Town Centres, including those which are not directly served by high capacity transit, there is a commitment on the part of local governments and regional agencies to develop transit sensitive spaces for people to work and live in.

The station-area commitment to transit oriented design begins during the station site selection process. BC Transit, like many transit agencies in Canada, has the ability to identify early in the planning process future corridors for high capacity transit lines. It is not uncommon for moneys to be appropriated for corridor preservation long before construction of the system begins.

In reserving future right-of-way corridors, BC Transit has most recently taken an enterprising approach to selection of individual station locations. In the Phase III extension of SkyTrain into both the Whalley Town Centre and the City of Surrey, BC Transit identified the corridor and reserved right-of-way for construction of the track needed for SkyTrain. Instead of identifying specific station locations along the line, BC Transit issued a request for proposals (RFP) to local developers. Specifications were given for station spacing, station amenities, station length, etc. Developers were asked to provide cost proposals, indicating the proposed design, the development to occur in conjunction with the station, and the financial support they expected to invest in the construction of the station. The BC Transit RFP simply required that the net cost to BC Transit be zero and that the operational characteristics and schedule for beginning service not be impacted in any way. Developers were asked to pay for right of access to the station (Leicester, 1995). The net result of this approach has been that developers have willingly brought successful proposals forward which integrate public and private facilities. In the last round of station-area construction, BC Transit solicited proposals for direct access to the SkyTrain system, each worth in the range of \$6 million CAD per station access point.

The enterprising approach to station development used by BC Transit is supported by its Capital Projects Division which oversees the design and construction of all capital projects. This department within BC Transit is charged with the responsibility of managing interaction between the private development community and the transit system, and actively seeks private participation and integration of the elevated transit system into the urban environment. BC Transit also maintains an "open door" policy to development, and through its Capital Projects Division strives to take advantage of unsolicited opportunities that are offered to the transit system. For instance, there have been several occasions within the City of Vancouver and the City of Burnaby where developers have requested air rights over the SkyTrain system for the purpose of building both private developments as well as providing additional park land in return for higher density allowances on other nearby property. Because of BC Transit's enterprising approach to development, these projects were able to be brought to completion, aiding both local municipalities and private development. Both projects were built while BC Transit maintained continuous rail service through the corridor without interruption.

5.4 STATION AREA STORIES

Station area development stories are unique for each of the Regional Town Centres. The character of each center is based on its historical background and upon the cultural characteristics of its inhabitants. However, to understand how transit investments have been used to reinforce a system of Regional Town Centres, it is instructive to examine two individual town centers: Metrotown and Lonsdale.

Each center presents a very different story of evolution into a regional hub of activity. However, there are also commonalities between the two centers that indicate a coordinated approach to station-area development and transit integration.

Metrotown Station

Metrotown is a Regional Town Centre located in Burnaby, the municipality immediately adjacent and east of the City of Vancouver. The Town Centre is approximately 735 acres in size and lies at the geographic population core of the Greater Vancouver Region, some 9.5 kilometers (5.9 miles) east of downtown Vancouver. The center serves as the downtown for a community of between 150,000 and 200,000 people, all living within three miles of the Metrotown Station. The Town Centre and Metrotown Station were designed to take advantage of an older retail center and warehouse environment, in need of redevelopment (e.g., a Sears Department store and abandoned warehouses). Hence, the Metrotown Station and surrounding development fit the pattern of opportunistic development strategies pursued by both BC Transit and the regional government. As of 1989, private and public developments within Metrotown supported by SkyTrain totaled over \$500 million CAD (See Figure 35).

Designation of Metrotown as a Regional Town Centre predates the construction of the SkyTrain station but the introduction of the high capacity transit line had a profound effect on the surrounding development market. According to representatives of the City of Burnaby, development since the introduction of SkyTrain measures nearly two or three times that seen before (Sanderson, 1995). BC Hydro, the utility company supplying electricity to much of British Columbia, has located half its corporate offices just outside of Metrotown at Edmonds Station on the SkyTrain system. BCTel, the regional telephone company has also located its headquarters on the edge of Metrotown. These corporations have had a positive effect on the entire Metrotown and Burnaby development market.

As with other town centers, the policy followed in planning and developing Metrotown is one of developing a new-town approach in an already urbanized area. Community outreach programs helped the city to formulate an Official Community Plan (OCP) for Metrotown. The plan outlined the broad policy goals and objectives of the community, and determined the form of development desired within the bounds of the plan. The community is divided into a number of comprehensive zoning districts. For each district, the city has developed additional refinements to the OCP which highlight development opportunities within specific sub-areas of the community and specify the type of land uses allowed. Zoning regulations consistent with the comprehensive zoning districts have been developed on a site-by-site basis. Zoning regulations typically used within the Metrotown Center specify the character of the building, placement on the property, and even its architectural design.

**Figure 35.
Residential Development in Metrotown**



In addition to using community planning and zoning regulations within the town center to control urban form, the community also provided investments in parks and other public infrastructure to encourage private development. Transit was used to link the center to the Vancouver downtown, as well as other town centers along the SkyTrain system. A general zoning map of Metrotown is provided in Figure 36, reprinted from GVRD's Major Centres in Greater Vancouver: Current Status and Policy report.

Although transit is used as a major element of the transportation network within Metrotown, a multimodal approach has been taken to assure adequate access to the center. For instance, some 10,000 free parking spaces in the primary core are provided to serve the retail and office uses now located there. Ninety percent of these spaces are provided in-structure or below ground. Numerous pedestrian and bicycle paths connect the station to surrounding residential and commercial developments, and a bus loop provides timed transfer access to the BC Transit system.

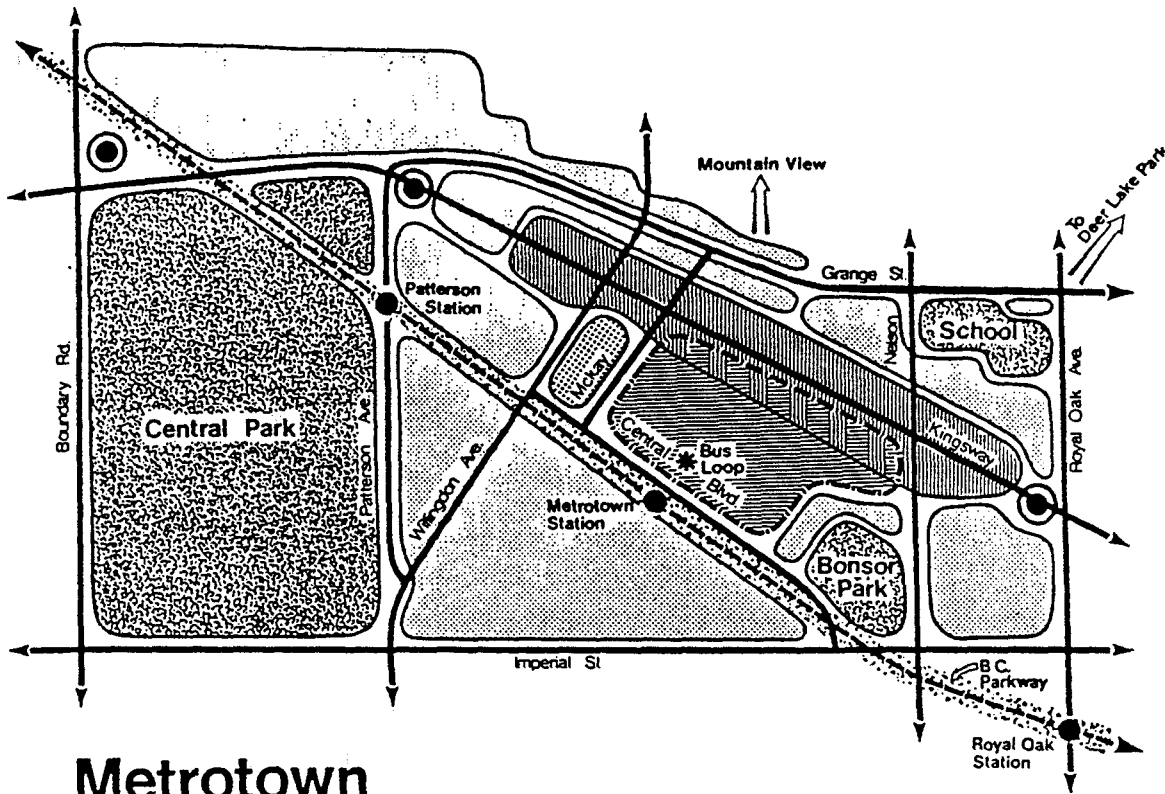
Metrotown Investments

Metrotown represents a planned community, consisting of both public and private investments. The western side of the town center is dominated by a 200 acre Central Park, ringed with high rise apartments and condominiums. Another park, Bonsor Park sits on the eastern side of the district. Sports and recreational complexes are provided by the community, as are three SkyTrain Stations. Metrotown is also the home to British Columbia's largest retail center with retail stores and services approaching 450 individual retailers (City of Burnaby, 1992).

Major developments within Metrotown include:







- Metrotown Centre, a \$100 million CAD project providing a four-level galleria retail mall with 150 stores, and offices; total gross floor area: 910,000 gross square feet;
- Eaton Centre, a \$130 million CAD investment providing 1,146,000 gross square feet of office and retail, including Eaton's Department store, Kelly Douglas Megastore, Bretton's Department store (now out of business);
- Metrotower, providing 264,000 gross square feet of office space, has also been built in conjunction with Eaton Centre;
- Station Square, a \$90 million CAD commercial retail, movie/theater, hotel, and residential complex, provides 50 stores, 12 movie theaters, theater, 100 room hotel, 250 apartments;
- Bonsor Park, a \$9 million CAD recreation center developed by the City of Burnaby, provides swimming pools, gym, senior citizens center, banquet rooms, racquet ball courts, and daycare center for the surrounding community; and,

Figure 36. Metrotown Developments



Metrotown Diagrammatic Concept

Legend:

-  Primary Core-Commercial/Mixed Use
-  Kingsway Commercial Corridor
-  Public Development Area
-  Apartment Oriented
-  Gateway Features
-  SkyTrain Line



Planning And Building Department

(Source: The Corporation of the District of Burnaby, Planning and Building Department: Burnaby Metrotown, a Summary Statement)

- Resource library and civic square, constructed by the City of Burnaby.

(Sources: BC Transit, [SkyTrain - A Catalyst for Development](#) and GVRD [Major Centres in Greater Vancouver: Current Status and Policy](#))

Lonsdale / North Vancouver Quay

Lonsdale is the historical business district of the City of North Vancouver, located across Burrard Inlet, approximately 1.5 kilometers from downtown Vancouver. Lonsdale is home to some 20,000 residents and supports some 15,300 employment opportunities (GVRD, 1994). The larger City of North Vancouver actually has a higher number of job opportunities than it does residents, making the city as a whole an employment destination.

Lonsdale and the Lonsdale Quay development serve as a Regional Town Centre for the Vancouver Region. Unlike other Regional Town Centres, the Lonsdale Town Centre is nearly built-out under its community plan and new regional growth over the next twenty years is not being actively focused into this area.

North Vancouver and Lonsdale are connected to the Burrard Peninsula and the City of Vancouver via two bridges, the Lions Gate Bridge and Second Narrows Bridge. In 1977, SeaBus operations were initiated to avoid the need for another bridge spanning Burrard Inlet. The resulting high speed transit link to downtown Vancouver, and subsequent location of several major institutional agencies helped to develop what had been abandoned docklands and warehouses into a bustling community (See Figure 37).

Redevelopment of the waterfront, and most notably the Lonsdale Quay, was accomplished through a Crown Corporation, the British Columbia Development Corporation (BCDC) and its subsidiary the Lonsdale Quay Development Company (LQDC). Using its public powers to aggregate properties, the BCDC and LQDC expropriated private lands to build the SeaBus terminal and encourage the development of an institute of marine studies. These investments in turn attracted B.C. Railways and the Insurance Corporation of British Columbia to locate their corporate headquarters in the vicinity of the SeaBus Terminal. Working closely with local city officials, the provincial Crown Corporations developed parks, a public market, and residential properties to further encourage private investments.

Although much of the development occurred under the supervision of the Crown Corporations, the City of North Vancouver participated hand-in-hand with the project. The City passed supporting zoning regulations which allowed for special use designations and higher floor-to-area ratios in the vicinity of the SeaBus terminal. The City also had authority to review and approve all design concepts, both during the conceptual and final design processes.

Figure 37. Lonsdale Quay After Redevelopment, 1995



The result of this cooperation between provincial and local officials has resulted in pedestrian and transit supportive design being incorporated in the redevelopment of the Lonsdale Quay (See Figure 38). Development in the Lonsdale Quay would not likely have occurred if not for the introduction of SeaBus. Had the third bridge crossing of Burrard Inlet been built, instead of SeaBus, Lonsdale would have lost its regional significance as a transportation center and connection to Greater Vancouver.

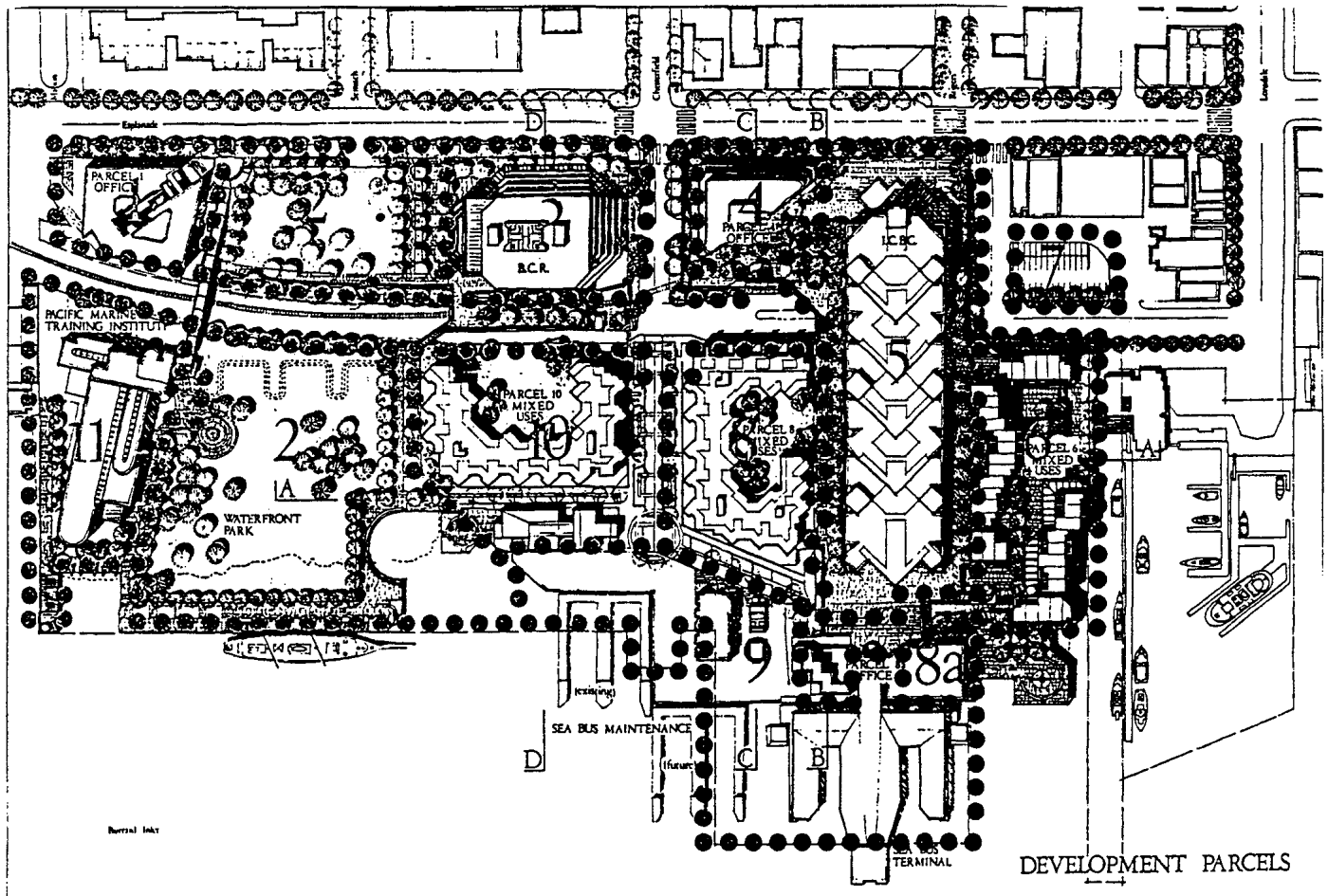
Lonsdale Investments

Investments in the Lonsdale Quay and Lonsdale Regional Town Centre began in the mid to late 1970s and has continued to the present. Development in the Quay and surrounding area exceeds 880,000 square feet of office, residential, institutional, and retail services. Total investments are estimated in excess of \$143.6 million (1993 \$CAD), all directly linked to the SeaBus terminal and surrounding properties. Specific developments include,

- Pacific Marine Training Institute (PMTI), an \$8.2 million CAD training facility for the education of maritime trades, total gross floor space: 58,250 square feet, and 35 permanent employees;
- Insurance Corporation of British Columbia (ICBC), a \$39.5 million CAD private investment, serving as the headquarters for the sole provider of auto and general insurance in British Columbia; total gross floor space: 301,447 square feet, 1098 permanent employees;
- Lonsdale Quay Public Market, a \$17.1 million CAD public investment housing a public market and specialty retail shops, total gross floor space: 144,316 square feet, 426 permanent employees;
- British Columbia Railway (BCR) headquarters, a \$17.4 million CAD private investment serving as the headquarters for one of Canada's main railway companies; total gross floor space: 160,041 square feet, 500 permanent employees;
- Lonsdale Quay Development Corporation (LQDC), a combined public and private investment of \$11.6 CAD million, consisting of residential units and various public services (e.g., parks, markets, etc.); total gross floor space in excess of 135,000 square feet;
- SeaBus Terminal, a \$10.5 million CAD public investment, provides direct linkage to downtown Vancouver via the SeaBus system.

(Source: The Corporation of the City of North Vancouver, Development Services, Historical Development of Lonsdale Quay, Draft.)

Figure 38. Lonsdale Quay Development Site Plan



Source: GVRD: Major Centres in Greater Vancouver: Current Status and Policy, 1993

Common Development Strategies

As can be seen from the Metrotown and Lonsdale Regional Town Centre stories, transit-oriented development depends on a number of factors. In both centers, town councils, as well as regional and provincial governments, worked together to focus development into areas connected with the proposed high capacity transit system (e.g., SeaBus and SkyTrain). However, it is clear from these examples that transit alone is not enough to generate development.

In both centers, planning for a Regional Town Centre either predated or coincided with the insertion of the transit element. Crown Corporations or local community investments were used to "prime the pump" for private investment (e.g., the development of the maritime educational facility in Lonsdale and the provision of recreational and park facilities in Metrotown). Likewise, governmental agencies and large corporations were actively encouraged to locate within the developing centers, further creating an environment where private investment could be fostered.

In both the Metrotown and Lonsdale Town Centres, development was focused on under utilized properties. In the case of Metrotown this consisted of the redevelopment of aging retail and warehouse facilities and in Lonsdale it consisted of the redevelopment of an historic waterfront industrial area. This resulting in-town new-towns, fed by high speed reliable transit connections to downtown Vancouver, thus received broad public support and governmental backing.

5.5 CONCLUSIONS

The Greater Vancouver Region has been successful in generating development in conjunction with high capacity transit investments (e.g., SkyTrain and SeaBus). Some of this success has been the result of opportunities which have come to light, but much of this success has been the result of a concerted effort on behalf of the local, regional, and provincial governments and the citizens of the region.

The purpose of this report has been to provide the reader with a basic understanding of the regional and social factors contributing to this success as well as an understanding of the opportunities which the region availed itself of to reach the current state of public-private investment cooperation.

Fourteen specific policies, methods, and institutional factors have been identified which have led to the success of urban development in conjunction with high capacity transit service. These fourteen policies, methods, and institutional factors can be divided into three groupings: regional housing, transportation and employment policies; transit operations; and site-level design factors.

Regional Housing, Transportation and Employment Policies

Six long-term policies at the regional and provincial level have contributed to an environment conducive to transit-oriented development. These include

1. The limiting of freeway construction;

2. The constraining of available developable land with an agricultural reserve policy;
3. High land prices that result in denser development that is more conducive to transit service;
4. The policy of not subsidizing private mortgages;
5. The development of a strong regional vision, supported by a long history of metropolitan planning within a regional framework and intergovernmental cooperation at the local level;
6. The concentration of office, retail, and high density residential development in regional centers connected by transit.

Constraining the freeway system within the Greater Vancouver Region has had a significant effect on travel in the region and is likely the single most influential policy affecting transit related developments. Transit has remained a viable and preferred alternative over the arterial network for moving quickly through the region. Because transit has played an important role in the average person's life, relative to the average North American city, transit-sensitive developments have been the product (e.g., more compact urban neighborhoods, high-rise developments, and station area developments).

Land preservation via an agricultural reserve policy, as well as the policy of not subsidizing private mortgages through the use of tax credits for interest payments, have had similar effects. The policy of land preservation has taken large portions of the region out of the speculative market, allowing development to focus in more dense centers. While the land preservation policy is widely thought to have little significant effect on housing prices, the lack of an annual housing subsidy (*i.e.*, a tax deduction for mortgage interest payments) drives up the cost of the private single-family home and therefore discourages ownership. Although the latter may not be a desired policy in itself, the result has been to encourage more high-rise developments and town-house style residential developments in connection with transit corridors.

The development of a strong, consensus-based vision of how the region should develop has played an important role in station area development. Regional plans leading to the Regional Town Centre concept began in the early 1960s and actually had their roots dating as far back as the 1930s. The success of the Vancouver Region in gaining a regional development pattern that focuses new growth into centers rather than encouraging urban sprawl has allowed integration of development with transit. Local municipal zoning codes and ordinances which have been enacted in support of the Regional Town Centre concept have assisted in the aggregation of developments in the centers and ultimately in the station-areas.

The strong regional vision has provided a mechanism for shifting employment from the central urban core to designated town center locations. An important factor that has enabled this regional vision to evolve has been the support of the City of Vancouver in allowing employment oriented development to shift to suburban centers. Downtown Vancouver has remained strong in its development potential while encouraging office style

developments and high density residential developments to locate along the SkyTrain system. This dispersion of employment from the central business district to the town centers provides for more efficient transit operations by providing two-way demand characteristics for the SkyTrain and SeaBus systems, thus encouraging higher transit usage of the overall transit infrastructure.

Transit Operations and Agency Structure

Four important transit operation policies and agency structure policies have encouraged transit-oriented development both at the regional scale and at the station level of design. Each of these policies has been controversial in terms of local participation in the process. However, their effect on transit-oriented development patterns cannot be ignored. These policies include:

7. Provincial control of regional transportation functions;
8. The use of public Crown Corporations (redevelopment agencies and a capital projects division within the transit agency) to generate private investment interest in conjunction with major public transit investments;
9. The use of traditional transit routes for high capacity transit system construction;
10. The routing of bus routes to force feed the rail system.

The Greater Vancouver Region is unique in Canada in that its transit system, run by BC Transit, is a function of the provincial government. Although this has caused friction between local and provincial interests, the fact that BC Transit is responsible to the provincial government rather than local municipalities has insulated it somewhat from local opposition to route structuring decisions and station location decisions. For instance, BC Transit's decision to reroute traditional bus routes to force feed the SkyTrain system allowed the rail line to be placed in underdeveloped lands. This policy provided for immediate ridership levels, in turn providing an immediate return on the transit investment while at the same time taking advantage of vacant land to develop transit-sensitive designs. The policy of rerouting transit routes as well as the agency structure has allowed BC Transit to pursue a policy of in-town new-town development.

In addition to operating the regional transit system, the British Columbia provincial government has experienced other success stories using Crown Corporations to "prime the pump" for private investment. North Vancouver Quay is an excellent example where a Crown Corporation assembled the properties necessary to initiate a major station-area development, attracted private investors, and encouraged transit-sensitive designs. Again, the underlying policy was to develop an in-town new-town. Similarly, BC Hydro relocated its Provincial Headquarters to a station just down line of the Metrotown Town Centre and BC Transit itself relocated to the Surrey Town Centre. These moves, like the policy in North Vancouver, primed the pump for development by providing major investments in station area developments which in turn encouraged other private investments to locate within the station areas as well.

The in-town new-town approach to station area development, coupled with the regional pursuit of the Regional Town Centre growth concept, has worked successfully to encourage transit-oriented developments. BC Transit as well as regional planners have expressed concern over whether the same level of success will be achievable in the future. To a certain degree, the success seen so far has been opportunistic. It could not have been achieved if the underdeveloped properties incorporated in the station development process had not existed, and if the previously abandoned interurban lines used for construction of the system had not been available. Future extensions of the SkyTrain system may be forced to follow highway corridors for lack of other alternatives. Future routes, serving newer suburban communities, may not be as conducive to transit-sensitive developments as those serving older, close-in suburbs. This lowered expected ability to encourage transit-sensitive design may also be a reflection of market forces which have not yet acted on these outer suburbs to make them conducive to transit-sensitive design. It is likely that the prevailing market forces acting on these outer suburbs have encouraged an auto oriented development pattern instead. Land costs have been inflated to a much lesser degree by physical and political constraints. Also, freeway construction was not halted in these districts until after primary highways and freeway facilities were already constructed (e.g., Canadian Highway 1 and the King George Highway serve the next tier of suburban communities to which SkyTrain might be extended). This latter characteristic makes these suburbs more auto dependent, as compared to their in-city counterparts.

Station Area Policies

In addition to regional policies, local and regional agencies have worked at the station-area level to encourage transit oriented design (TOD). Specific actions taken by local, regional and provincial agencies include:

11. BC Transit's enterprising approach to station placement and development;
12. Local zoning ordinances requiring most new parking constructed in the designated town centers to be within structure or underground;
13. The use of right-of-way easements which do not limit the use of original land owners to use land and air rights below and above the ALRT guideway; and,
14. The decision on the part of primary utility companies, government agencies, and Crown Corporations to place their headquarters strategically within town centers and station-area developments.

BC Transit has developed an enterprising approach to station area planning. The local development community has become well educated over time as to the advantages of on-site transit access. Individual developers are willing and eager to invest in the high capacity transit system so as to have direct access to SkyTrain, SeaBus, or even a major bus loop. Responding to this interest, BC Transit has a Capital Projects Division which actively seeks private investment in station areas. Transit service is viewed as a marketable commodity.

Local zoning codes also assist in the station-area design of transit-sensitive projects. Within most Regional Town Centres, on-street parking is allowed and encouraged. Surface

parking is typically not allowed. Private developers are required to include parking as an underground or in-structure feature of their developments if they offer it at all. This policy drives up the cost of providing parking, making developers more willing to rely on transit access as the primary form of transportation service to their developments. The policy also makes parking less visible, allowing developments to cover more of their land area. This in turn discourages auto usage by making parking harder to locate. The provision of on-street parking provides a buffer between street traffic and the sidewalk, making it safer and more convenient for pedestrian activity. Likewise, in-structure parking reduces the space between buildings, making the individual neighborhoods more compact and more pedestrian friendly.

The timing of zoning changes has also played an important roll in encouraging transit oriented development. It is important to note that not all stations along the 28 Km SkyTrain system are situated within high density urban nodes. Some of the stations, for instance the Broadway and Nanaimo stations, have surrounding neighborhoods that are predominantly single family households. This phenomenon can be attributed to local station area planning and the desire of the existing community not to become a high density development node. Selective station-area up-zoning has allowed development attracted to transit to focus in identifiable "lumps". This in turn creates a sense of success which attracts or encourages additional or subsequent development (Source: Ted Sebastian, 1995).

Zoning codes also allow for density transfers. Since most zoning regulations regarding density speak to floor-to-area ratios, land reserved for park lands (e.g., under and around the SkyTrain guideway) can be used as credits which allow higher density developments on more transit oriented properties, closer to planned stations.

The use of guideway easements as opposed to outright purchase is also significant, because the easements used by BC Transit do not preclude development under or on top of the guideway.

The fourth site-level policy is played out at the regional level. That is, local and regional agencies, public utilities, provincial ministries, and Crown Corporations have used their ability to seek new office locations to support the Regional Town Centre concept and transit sensitive design at the site-specific level. Numerous agencies have relocated from traditional downtown Vancouver locations to on-line locations at SkyTrain and SeaBus stations. The locational choice of these agencies has a profound impact on private development in the region. As the largest single employer in the region, government agencies can literally shift the market in terms of demand for specific types of developments. In specific station-area designs, they can provide the anchor tenant for new developments, making it easier for private investors to find financial backing as well as attract spin-off businesses to the same location. Local municipalities have also made a commitment to locating public services such as cultural centers, health and fitness centers, and other public services in town centers, and often adjacent to high capacity transit stations. This concerted effort on behalf of the regional, local, and provincial governments, whether coincidental or coordinated, has resulted in a positive influence on station area development and the network of Regional Town Centres.

In conclusion, the Greater Vancouver Region has been successful in attracting transit-supportive private investment in response to its commitment to high-capacity transit service and a network of local and regional bus routes. Private investments, as a result of the public investment in transit, are estimated to be in excess of \$5 billion CAD. However, as demonstrated by the Greater Vancouver Region, transit investment alone cannot generate private investments. The Vancouver success is based on a tradition of regional land use planning which has led to a regional vision, widely supported at all levels of government and within the electorate at large. Thus, the argument as to the source of Vancouver's success in obtaining private investment and transit-oriented design at the station-area level is that it requires a concerted effort at the regional and local level to develop an urban fabric which first allows such development to survive, and then provides the high capacity transit infrastructure to support it.

In the case study of Vancouver, it can be seen that all levels of government (e.g., local, regional, provincial, and even federal) have consciously chosen to support transit-oriented urban development by their choice of office locations, their construction of public service facilities in conjunction with station-area developments, and their insistence on the presence of a transit network in preference to a system of highways. Thus, in the case of Vancouver, the underlying filament that has led to a successful integration of transit and private development is the pursuit of a common regional vision in which transit plays a dominant role in the transportation environment.

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6.0 OTTAWA-CARLETON CASE STUDY

6.1 INTRODUCTION

In Ottawa-Carleton, a regional municipality of 678,000 inhabitants in the Canadian Province of Ontario, policymakers have understood and taken advantage of the two-way interaction between land-use policies and transportation investments. They have developed a plan for a multi-centered regional structure, with Ottawa as the dominant center orbited by other primary and secondary employment centers. The most extensive exclusive busway system in North America is the cornerstone for achieving this vision.

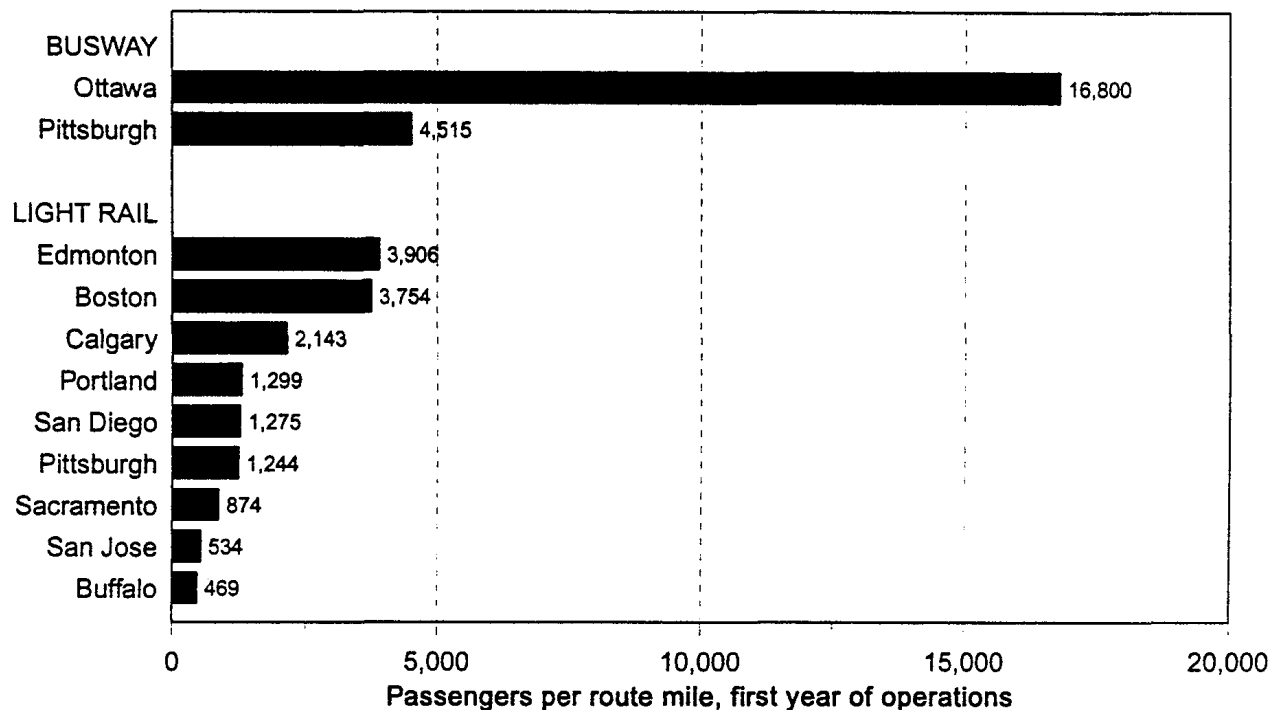
The busway investments have been used as a lever to guide employment and commercial growth in a region that has been growing at over two percent per year. Long-range plans call for nearly all future large-scale office and retail development to be sited within walking distance of a busway station. At the same time, Ottawa-Carleton's transit network is well suited to serving the low-density residential settlement pattern of this 370 square kilometer region.¹ The same vehicles that operate mainline services on dedicated rights-of-way can leave the transitway and feed into Ottawa-Carleton's sprawling residential neighborhoods, thus reducing the need for what has become suburban transit's Achilles Heal -- the dreaded transfer.

The hub-and-spoke bus network is also well suited to delivering workers to downtown Ottawa, where a third of the region's labor force works. Currently, some 825 buses provide 50 million kilometers (31 million miles) of service each year, carrying around 80 million passengers. In 1990, while ranked 72nd in population size in North America, Ottawa-Carleton had the 12th largest public transit system (measured in annual bus kilometers of service).

An important advantage of the region's busways has been their staging flexibility; sections can be immediately put into service when completed, regardless if they are connected to the rest of the system. This has allowed the busway to provide prompt relief to congestion hot-spots and to exploit land development opportunities as they avail themselves.

Today, Ottawa-Carleton averages more riders per capita than any similar sized transit system in North America. Around 200,000 people per day use Ottawa-Carleton's Transitway compared to the approximately 100,000 daily riders on the Calgary and Vancouver rail systems and fewer on Edmonton's. And while peak-period transit ridership decreased across Canada in the 1980s, it grew by 10 percent in Ottawa-Carleton. On a passenger per route mile basis, Ottawa's busway outperforms all other North American busway and light rail systems built over the past two decades by nearly four to one (Figure 39).

Figure 39. Comparison of Passengers per Route Mile Among North American Busway and Light Rail Systems



Source: American Public Transit Association, *Transit Fact Book* (various years).

Transferable Ideas

The Ottawa-Carleton region has developed a number of policies, methods, and investment strategies that may be applied elsewhere to support development near transit. These are:

Regional Land Use and Transportation Policies

1. In 1974 and in later updates, the Regional Council adopted a vision of the desired settlement pattern as a response to concerns about suburbanization. The vision called for a multi-centered region with transit connections between centers.
2. The regional development plan, which guides implementation of the vision, and the regional transit system support one another. Features include
 - Multiple centers served by transit
 - Office and retail activities near Transitways to support bi-directional flows
 - A flexible, integrated transit network.
3. The regional plan is a framework plan that guides local land use plans.

4. The region has a "transit first" transportation policy whereby rapid transit investments have priority over road construction.
5. Transit is considered an essential neighborhood service, like streets and water.
6. Regional government and transit agency planners have cooperatively prepared transit supportive design guidelines. Transit planners review all subdivision plans to ensure transit compatibility.

Transit Operations

7. Service on the Transitway is frequent (three minutes in peak, five minutes during the day) and rapid (45 to 60 km per hour). The large number of people using the Transitway confers an accessibility advantage to sites near transit stations.
8. The transit agency provides a rich mix of complementary service. Express bus service directly connects neighborhoods to most employment centers during the peak period. Timed-transfer service at Transitway stations is available during the remainder of the day.
9. Transit agency policies restrict park-and-ride lots to the ends of the Transitway where they serve rural patrons; feeder bus service is provided elsewhere, in part to preserve land for development opportunities.
10. Transitways were built "outside-in" with construction in rapidly developing suburban areas preceding construction in already developed urban places. Because transit facilities were built as the suburbs grew they were in a position to channel commercial and retail growth.
11. Transitway stations are being constructed in developing urban areas outside the greenbelt far in advance of Transitway construction in order to serve as a focal point for development.

Station Area and Corridor Policies

12. The regional plan requires that large employment centers (with 5,000 or more jobs) be located within a five-minute walk of the Transitway and smaller employment centers (with 2,000 or more jobs) be located near all-day transit service.
13. The regional plan also requires that all regional shopping centers with more than 375,000 square feet of space be located within a five minute walk of transit stations.
14. The federal government, the largest downtown employer, has limited parking supplies and charges employees for parking.
15. The City of Ottawa allows a reduction in parking spaces if development includes bus stops or is integrated with a Transitway station.

16. The transit agency works with private developers to integrate new projects with transit stations.

The Ottawa-Carleton region was able to adopt and implement these policies because it has a regional government backed by provincial enabling legislation. The regional government was created by the Province specifically to plan comprehensively for the rapidly growing region. The transit agency is an operating arm of the regional agency. Some of the Transitway funding comes from the provincial government and is dedicated to providing more frequent service.

Transit Supportive Development

Ottawa-Carleton has numerous examples of mid-rise office, commercial, and residential development near Transitway stations. Inside the greenbelt, developed is more compact, mixed in uses, and transit-oriented than it would have been without the Transitway. Four regional malls and several office complexes have been redesigned to integrate with transit stations. Although the regional government has not promoted high density residential development near stations, over 2,300 housing units in apartments and mid-rise condominiums have been built near stations. In addition, several new subdivisions have been built that adhere to the region's transit-friendly site guidelines that put virtually all residents within a five minute walk of a bus stop.

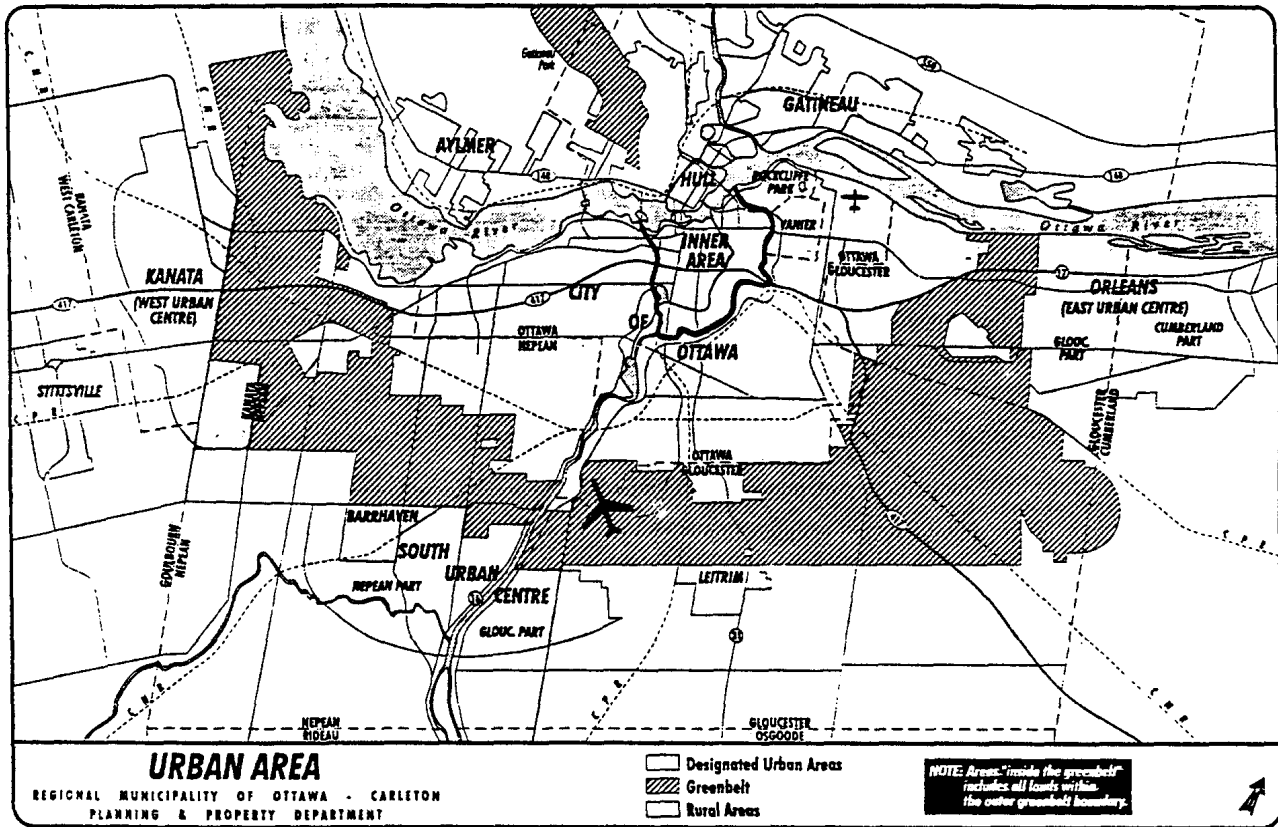
Organization of the Report

The report provides more details about how Ottawa-Carleton developed and implemented policies that supported development near transit. Section 2 provides information on the urban form, people, and economy of the region as the context for station area development. Section 3 describes the Transitways and complementary transit services. Section 4 outlines the history of the regional development, transit, and subdivision strategies. Section 5 describes the development that has occurred in station areas. Section 6 compares station area growth in housing, offices, retail stores, and employment with regional growth rates. Section 7 draws some conclusions about why Ottawa-Carleton has been so successful at integrating transit and development.

6.2 REGIONAL CONTEXT

The Regional Municipality of Ottawa-Carleton (RMOC) lies in northeastern Ontario, south of the Ottawa River and the municipality of Outaouais, which includes Hull, Quebec. To contain urban sprawl and preserve open space, a protective greenbelt was formed around the urbanized center during 1959-62 shown in gray in Figure 40. This map of the urban area is used for regional planning purposes and divides the region into: (1) an inner area (including downtown Ottawa); (2) the remaining urban area inside the greenbelt (made up of all or portions of the cities of Ottawa, Nepean, Gloucester, Vanier, and Rockcliffe Park); (3) the protective greenbelt; (4) urban areas outside the greenbelt [consisting of Orleans (East Urban Centre), Kanata (West Urban Centre), Barrhaven (South Urban Centre), and Stittsville]; and (5) remaining rural areas.

Figure 40. Urban Area of the Regional Municipality of Ottawa-Carleton



Source: Regional Municipality of Ottawa-Carleton, *Community Profile*, 1994.

Population, Socio-Demographic, and Employment Profiles

The Regional Municipality of Ottawa-Carleton (RMO) consists of 11 municipalities with a total population of about 650,000, about 90 percent of whom live in the urban area.² The largest city is Ottawa, Canada's capital, with a population of over 300,000. In recent years, the urban centers outside the greenbelt, primarily Kanata, Orléans, and the southern part of Nepean, have captured about 80 percent of new single family homes and townhouses built in the region. Between 1986 and 1991, more than twice as many people were added to the urban centers outside the greenbelt as inside the greenbelt, almost doubling the population there.

During the 1980s, the RMO grew at an annual rate of 2.1 percent, faster than any urban area in Canada. While its growth has slowed since, Ottawa-Carleton still retains one of the nation's healthiest economies, with relatively low unemployment and high incomes compared to other parts of Canada. Per capita disposable income in 1992 was 33 percent above the national average, 18 percent higher than in Ontario, and 12 percent higher than

in Metro Toronto. Because of high transit usage, car ownership rates are currently slightly lower in Ottawa-Carleton than in other regions in Canada of similar affluence (RMOC, 1995B).

Unlike some federal districts, Ottawa-Carleton is not a one industry town. While the federal government remains the number one employer, the labor force employed in government services fell from 33 percent in 1977 to 24 percent in 1991. Today, the region is home to numerous high-technology companies and continues to attract jobs in business services and health-related industries.

The inner area, encompassing the core of Ottawa city, contains about one-quarter of the region's labor force and around half of all federal jobs. Downtown Ottawa itself accounts for about 28 percent of all employment. Still, as elsewhere in the industrial world, jobs are rapidly suburbanizing. In the late 1980s and early 1990s, employment grew fastest in business parks and scattered developments.

Institutional Structure

The RMOC is the upper level of a two-tier municipal government structure. Modeled after Metro Toronto, the regional government was formed in 1969 to carry out regional planning, invest in major infrastructure, and provide regional services within a geographic spread almost four times the size of Metro Toronto. RMOC's elected members serve on the Regional Council, whose responsibilities include overseeing regional transit services and planning for future development.³ The Regional Council appoints members within their own ranks to the Ottawa-Carleton Regional Transit Commission, or OC Transpo, the region's transit operating authority.⁴ A standing committee of the Regional Council, the Transportation Committee, manages the Transitway Programme. In addition to overseeing public transit services, the Regional Council retains certain approval and veto powers with respect to municipal zoning, subdivision plans, and traffic by-laws. Because all local municipalities are represented on the Regional Council, the Council rarely overrules the wishes of a municipality in matters of purely local interest (Gault, 1989).

RMOC was created, through an Act of the Ontario government, in direct response to rapid suburbanization and growth overspilling the boundaries of the City of Ottawa. Comprehensive planning within an area large enough to encompass the region's commutershed was considered to be the appropriate response. While there was some local support for regional planning, it only occurred because it was a legislatively imposed requirement of the Provincial government.

Local governments, making up the second tier of decision-making, perform primarily local functions, like waste collection and fire services. Localities also regulate land use through zoning by-laws and subdivision approvals, consistent with the Official Plan for the region. Other important players in the planning process are the Province of Ontario (which subsidizes transit services and empowers RMOC with enabling legislation) and the federal government, in particular the National Capital Commission, which owns large amounts of land in the region.

consists of bus-only lanes, and the 3.3 kilometer segment along the Ottawa River Parkway is a mixed-traffic facility. Though not formally considered part of the Transitway, a shoulder lane on the Queensway freeway dedicated to buses during the morning peak connects the Blair Station with the Place d'Orléans Station to the east.

The transitway operates just like a Metro rail system. Buses stop at all stations (which are spaced around a half kilometer apart in the central area and several kilometers apart elsewhere). The two-lane (13 meter wide) facility has passing lanes at stations so that buses can overtake each other. Platforms are up to 55 meters long to accommodate as many as three buses. Stations look and function like those of a subway system; all are equipped with elevators, are weather-protected, and have seats and schedule information. Some are connected to surrounding areas by pedestrian skywalks. The geometrics and overhead clearances of the busway were designed to allow an eventual conversion to fixed-rail transit if and when demand warrants such a change.

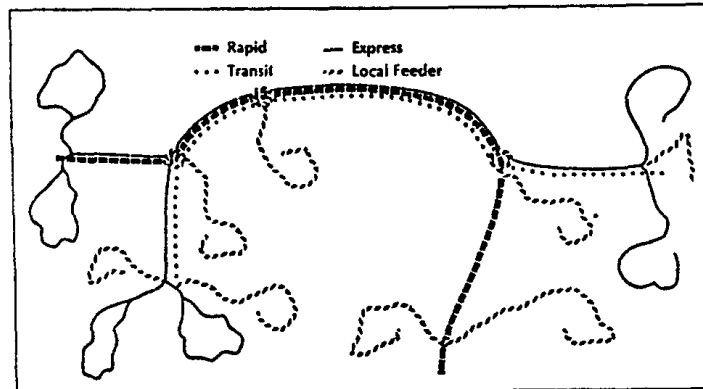
Downtown, the busway operates on a one-way couplet along Albert and Later Streets. The second lane, rather than the curb lane, is the dedicated bus right-of-way. This avoids conflicts with stopped and parked vehicles. Also at downtown stops, sidewalks are widened into the curb lane to provide more waiting space for passengers. Presently, downtown stops accommodate over 30 different bus routes during peak hours and handle up to 25,000 boardings and alightings each day. Over 60 percent of regional transit traffic passes through the Albert-Later Street one-way couplet. Because of these high loads and with passenger throughput approaching the capacity of a surface transit system, OC Transpo is currently studying the feasibility of operating downtown segments in a subway alignment.⁶

On a per kilometer basis, the Transitway presently carries ten times as many person kilometers of travel as the regional road system (Bonsall and Stacey, 1992). About 60 percent of all transit rides in the region include a significant component of Transitway service. At peak load points, nearly 10,000 passengers per hour are carried on the transitway. If these trips were instead made by automobile, five freeway lanes per direction would be required.

Service Features

OC Transpo's all-bus rapid transit system features a rich mix of complementary services (Figure 42). The core of the network are three routes, that operate solely along the exclusive busway, stopping at each station. The Province of Ontario provides a special subsidy that allows OC Transpo to run Transitway routes at a frequency almost double that which could be supported by demand (three minutes in peak and five minutes in the daytime off-peak). True to its billing, OC Transpo's rapid transit system is "rapid." Buses operating along the Transitway average speeds in the 45 to 60 km per hour range, even taking into account stops, and peak period bus loads are, on average, 15 to 20 percent higher than those of surface-street buses. These high performance levels are mainly attributable to the better schedule adherence afforded by busway operations, along with the use of multiple door loadings at stations (Bonsall, 1993). Signal priority at key traffic lights also expedites bus movements in congested areas.

Figure 42. Schema of OC Transpo's Mix of Route Types



Source: Bonsall (1993).

During peak hours, express buses operate between residential neighborhoods and employment centers off the busway. Express buses run on eight to 20 minute headways; some operate in a skip-stop mode.⁷ To serve outlying employment centers, OC Transpo also provides counter-peak, or reverse commute, services. Most express and reverse-commute runs eliminate the need to transfer for a large number of commuters. Because buses operate on local streets as well as on the Transitway, the same bus that picks people up near their residence also provides rapid transit service to their destination via the Transitway. These services are adapted to, and as a result, help reinforce, the region's suburban landscape. In Ottawa-Carleton, it is accepted that low-density living environments are preferred by most residents, and that transit programs should in no way seek to alter this settlement pattern, but rather to serve it. Being able to attract high ridership rates among suburbanites -- presently around 70 percent of those heading downtown to work -- is one of the region's crowning achievements.

During off-peak hours, services convert to timed-transfer operations. Under this arrangement, the Transitway functions mainly as a trunkline -- the three Transitway routes continue operations, though on slightly longer, five minute headways. Local feeder bus routes fan into surrounding neighborhoods, connected to Transitway stations, in synch, on 30 minute pulse schedules. Park-and-ride lots at the Place d'Orléans and Baseline Stations function as intercept points for rural catchments, serving passengers living beyond the Region's urban areas.

An important part of OC Transpo's infrastructure is the fully automated telephone passenger information system. All stations and stops in OC Transpo's service area have been assigned a telephone number with a 560 prefix. Customers can dial and find out, for a particular stop, when the next two buses are scheduled to arrive as well as route status information, such as unexpected delays -- a valuable service in a place where sub-freezing winter temperatures are the norm. Similar information is also displayed on large video displays at major transit terminals and shopping malls -- a real convenience to those who prefer to spend the five or so minutes before a bus arrives window shopping rather than waiting.

Each month, OC Transpo responds to more than 700,000 inquiries on the automated telephone system, primarily during the off-peak when headways are longer. The information system enjoys high visibility -- one survey found 82 percent of regional households knew about it, and 26 percent used it on a regular basis (Cervero, 1986). The system has increased OC Transpo's off-peak patronage by an estimated 8 percent, based on a controlled statistical comparison of ridership changes in neighborhoods with and without access to the information service (Bonsall and Whelan, 1981).

Fares and Finance

OC Transpo has a refined fare structure, in 1995 charging \$1.60 for off-peak services, \$2.10 for regular peak-hour services, and \$2.70 for longer-haul peak-hour express services. The peak/off-peak fare differential is efficient in that prices are pegged to the level of service, which in turn is dictated by demand. Presently, around 80 percent of riders pay their fares off of buses, mainly in the form of passes and coupons, thus expediting transfers and allowing for greater punctuality. The use of a barrier-free "honor" fare system, enforced by roving fare inspectors, allows for rear-door entry, thus reducing vehicle dwell times.

OC Transpo's target cost-recovery ratio is 65 percent (excluding capital expenses). In 1993, the system returned 67 percent of peak and midday operating costs through the farebox, and 33 percent of operating expenses for evening and weekend service. The overall cost-recovery rate was 60 percent (OC Transpo, 1994B).

Transit operations and capital expenditures are subsidized at rates of approximately 17.5 percent and 25 percent respectively through a transit levy of local taxpayers. All remaining financial support comes from the Province.

Ridership Trends

Ridership Levels and Modal Splits

In 1994, OC Transpo served 78.6 million unlinked passenger trips, down slightly from 81 million trips in 1991; all Canadian systems lost riders in the early 1990s due to the economic recession (Pucher, 1994). Express buses serving low-density neighborhoods carry the majority of OC Transpo's passengers.

OC Transpo currently serves around 35 percent of all peak-hour vehicle trips originating in the urbanized area. It handles around 70 percent of peak-period work trips to downtown⁸ and nearly 30 percent of trips generated by suburban employment centers near the busway. Even regional shopping centers designed for the automobile, but on the busway, enjoy all-day transit modal splits for shopping trips in the 25 to 30 percent range.⁹ At suburban job centers and retail plazas off the Transitway, transit modal splits tend to be in the five to ten percent range. The region's high suburban transit modal splits are a testament to the fast, efficient, no-transfer features of busway systems.

Ridership Impacts of Transit-Oriented Development

The best evidence about the Transitway's impact on ridership comes from the 1986 regional travel survey, the most recent accounting of travel demand in the region. In 1986, the Transitway stretched from the Baseline Station to the Hurdman Station, a distance of 16.4 kilometers (including the two kilometer downtown mixed-traffic buslane section). Table 17 compares the 1986 transit modal splits for two mixed-use neighborhoods and three local universities. Among the two neighborhoods (both with mixes of office, commercial, and residential development), the one with a Transitway station, Tunney's Pasture, averaged nearly a 20 percentage point higher share of trip ends by transit than the Confederation Heights neighborhood, which is off the Transitway. (Confederation Heights is several kilometers farther from downtown Ottawa than Tunney's Pasture, however its land-use and household income profiles as well as its level of local bus services are similar.)

Table 17. Comparison of Transit Modal Splits Among Neighborhoods and University Campuses by Transitway Location, 1986

	<u>Percent of all Vehicular Trips¹ in the Urbanized Area² of Ottawa-Carleton</u>	
	<u>As a Destination, 6-9 A.M.</u>	<u>As an Origin, 3-6 P.M.</u>
<i>Mixed-Use Neighborhoods</i>		
Tunney's Pasture *	47%	49%
Confederation Heights	29%	31%
<i>Universities</i>		
University of Ottawa *	68%	50%
Algonquin College (Woodroffe Campus) *	51%	44%
Carleton University	38%	40%

Notes

* Directly served by a Transitway station

¹ For all trip purposes. Includes only trips made by mass transit, automobiles, or other motorized vehicles. Walk, bicycling, ice-skating, and other non-motorized means of travel are excluded.

² Includes OC Transpo's service area within the RMOC and the central part of Hull, Quebec.

Source: 1986 National Capital Area Origin-Destination Survey, Transportation Department, Regional Municipality of Ottawa-Carleton.

Among the three university campuses, Algonquin College, located beside the Baseline Station at the present-day western terminus of the Transitway, had higher transit modal splits than Carleton University, which is more centrally located but farther from the

Transitway. Over two-thirds of those headed to the University of Ottawa, situated next to the Campus Station, arrived by transit, a modal split that is in line with other core-area locations.

6.4 COORDINATED LAND USE AND TRANSPORTATION PLANNING

The Official Plan

All development within the region takes place within the framework of the Regional Official Plan. This document sets overall regional development policies, determines the types and locations of major permitted land uses, and identifies regional infrastructure investments that are necessary to support land-use objectives. The Regional Planning Department of RMOC is responsible for coordinating development of the Plan. Plan development and approval is a shared responsibility of RMOC and the eleven local municipalities. Amendments to the plan are made from time to time based on requests from developers or local municipalities.

Regional Development Strategy

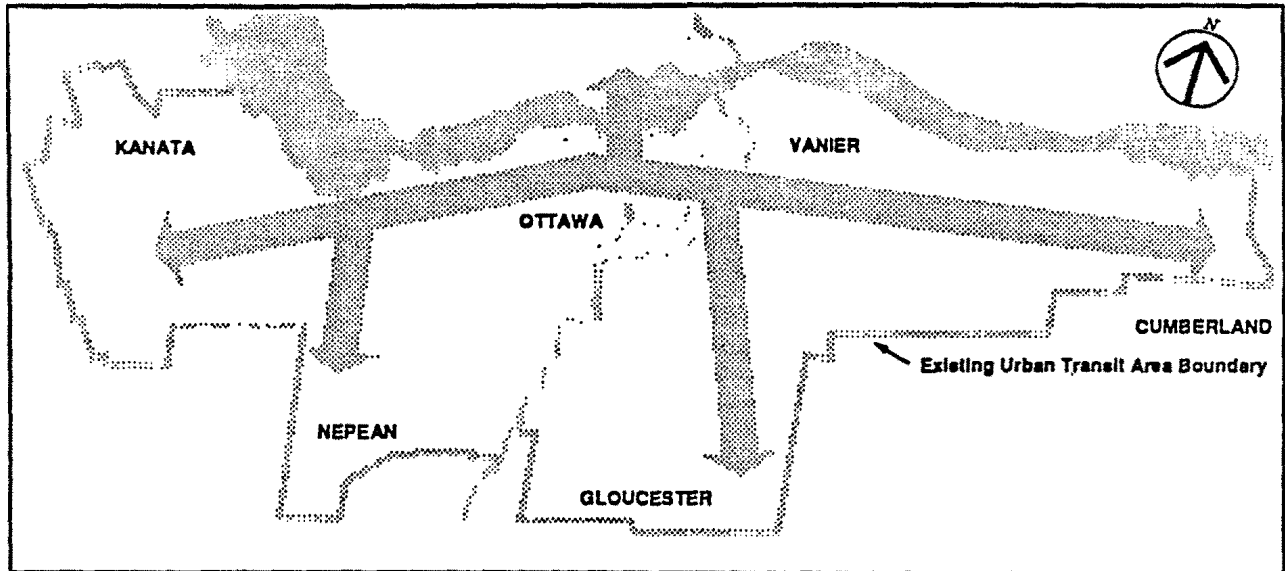
As with all good plans, the Regional Council first established a vision of the region's preferred future settlement pattern -- referred to in the plan as a Regional Development Strategy. Over time, the Regional Council has endorsed a multi-centered urban structure, with Ottawa retaining its position as the dominant commercial, employment, and cultural center of the region. The plan calls for a hierarchy of primary and secondary urban centers that orbit the core.

The chief instrument for achieving this physical form has been the Transitway. The 1974 plan made mention of the Transitway only in concept; the updated 1988 plan was more specific, designating new concentrations of mixed commercial-office development that would be linked to the continuing development of the Transitway facility (Figure 43 and Figure 44).

Channeling Employment Growth

RMOC's Official Plan minces no words -- it forcefully calls for a substantial increase in the share of regional jobs located near Transitway stations. By the turn of the century, the plan calls for 40 percent of the region's jobs to be within walking distance (400 m) of the Transitway. Currently, the figure is about 32 percent. This means that over the next two decades, more than half of all new jobs created in the region must be near transitway stations.

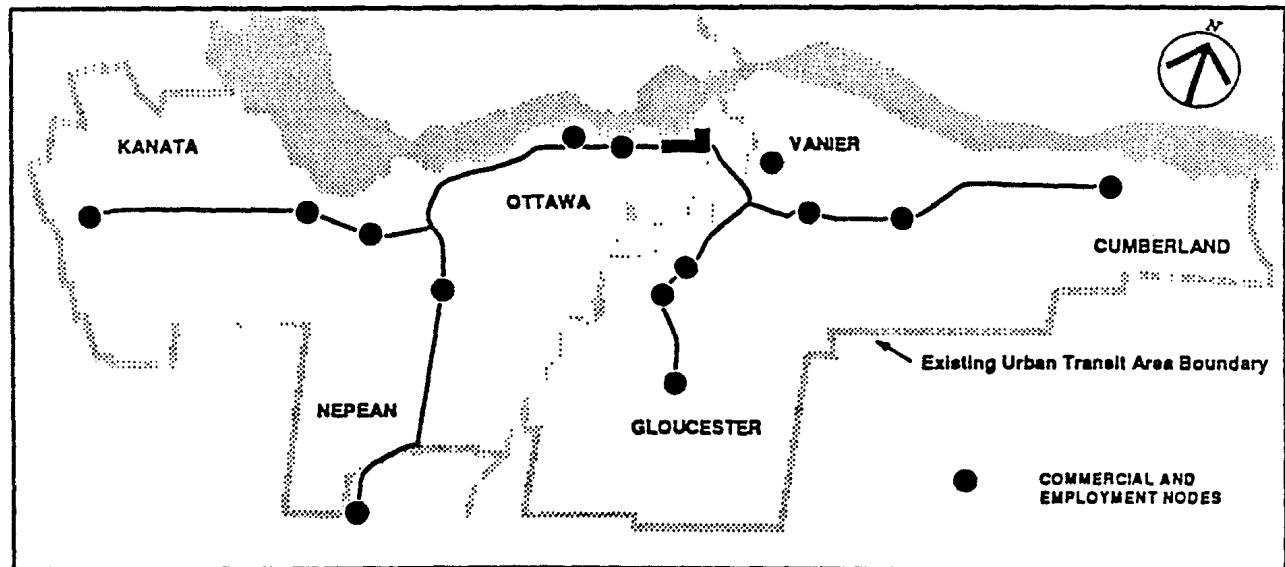
Figure 43. Rapid Transit Concept in the 1974 Official Plan



Source: Rapid Transit Appraisal Study

Sources: Regional Municipality of Ottawa-Carleton, *Rapid Transit Appraisal Study*, 1976, and Bonsall and Stacey (1992).

Figure 44. Regional Growth Centers Strategy, 1998 Official Plan



Source: Part 3.

Sources: Regional Municipality of Ottawa-Carleton, *Official Plan*, Schedule B, 1994, and Bonsall and Stacey (1992).

Under the plan, downtown Ottawa is to remain the region's dominant employment center. Next in the urban hierarchy are nine Primary Employment Centers (PEC), each with 5,000 jobs or more, located within 400 meters of existing or future Transitway stations. The two principle suburban catchments for job growth, the Orléans and Kanata urban centers, are planned for over 10,000 new jobs. The seven other designated PECs are Baseline, Tunney's Pasture, Vanier, St. Laurent, Cyrville, Blair, and South Keys. PECs are to feature a mix of offices, shops, offices, hotels, community facilities, and civic functions that are architecturally integrated. Provided that PECs meet employment targets, residential units will also be allowed within PEC catchments. To achieve compact and pedestrian-oriented development, PECs are expected to have relatively high densities.

The Official Plan also calls for smaller Secondary Employment Centers (SEC), each averaging 2,000 to 5,000 jobs. SECs are allowed off the Transitway, but must have access to frequent and efficient all-day transit services. Most new development is to occur within or be contiguous to PECs and SECs to avoid pockets of isolated development that are inefficient to serve, including by mass transit.

Channeling Retail-Commercial Growth

The Official Plan also requires that large regional shopping centers with more than 375,000 square feet of gross leasable space be sited near the Transitway or future extensions.¹⁰ Currently, the Place d'Orléans, St. Laurent, Rideau Centre, and Gloucester shopping complexes are located near transitway stations; future regional centers at South Keys, Kanata, and Barrhaven will likewise be.

Transportation Strategy

Complementing the Official Plan's Regional Development Strategy is a Transportation Strategy that sets targets for transportation investments and gives specificity to the Transitway concept.

Transit First Policy

Over the past two decades, an overriding objective of the Official Plan has been to rely on public transit to provide much of the growth in capacity needed to meet the long-range travel needs generated by population and employment growth. The 1974 Official Plan embraced a "transit first" philosophy. It stated that improvements to the existing transit system and the development of rapid transit should take precedence over all forms of road construction and widening. The plan specifically called for creating rapid transit services. No commitments were made on preferred routing or transit technologies.

The impact of the region's "transit first" policy is unmistakable. From 1975 to 1986, approximately one-third of the growth in total trips and virtually all of the increase in trips to downtown Ottawa were absorbed by the transit system (RMOC, 1994B). During the same time, few improvements were made to the road network serving the central area. In fact, in 1986 fewer automobiles left the central area in the evening peak hour than in 1975.

Cornerstone of the Plan: The Transitway

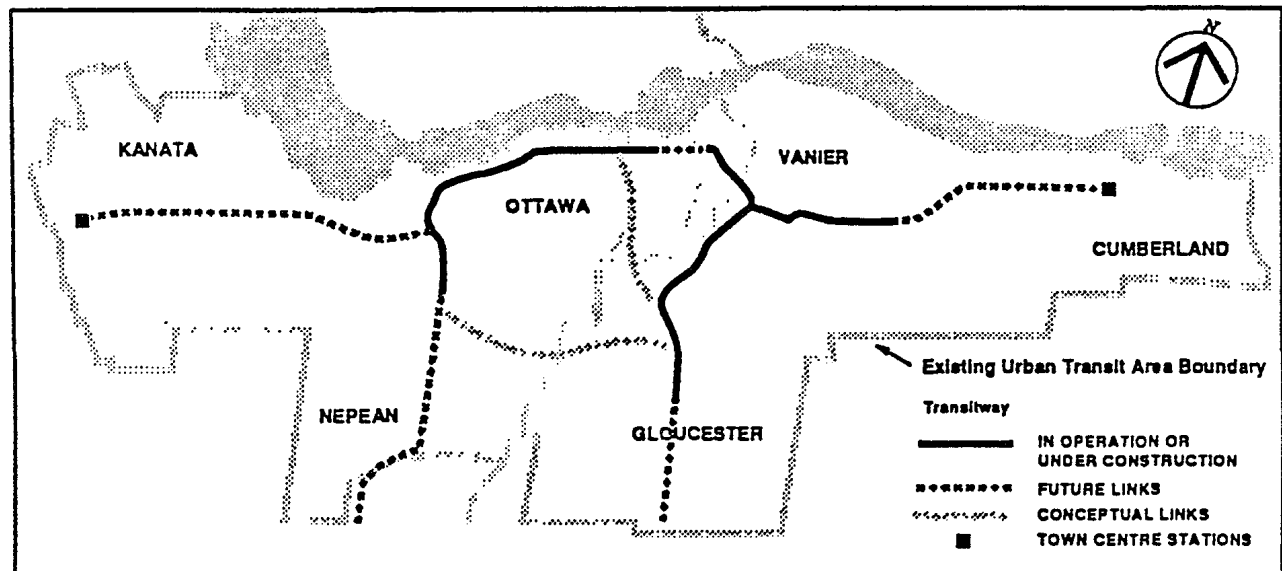
The regional Transitway is the cornerstone of the Regional Council's strategy to promote transit usage. The idea of a Transitway first emerged in the early 1970s in response to the mobility needs of a rapidly growing population. As shown previously in Figure 43, this was described in conceptual form in the original Official Plan as a five-corridor system extending ultimately to the new urban growth areas outside the greenbelt. In later refinements of the plan, the initial phases of the Transitway were specified as the 31 kilometer system shown in Figure 45 (identified as the segments "in operation or under construction"). The updated 1988 Official Plan identified conceptual links to three suburban centers outside the greenbelt -- Kanata Town Centre in the west, Orleans in the east, and Barrhaven in the south. It also stated that all Primary Employment Centres should be no more than 40 minutes travel time by public transit to most parts of the region.

The Regional Council chose a novel approach for creating the regional rapid transit system -- building it "outside-in." That is, rather than constructing the more expensive downtown sections first, the Council instead concentrated on first getting some of the outlying segments of the busway installed. This "outside-in" approach allowed more kilometers of exclusive busway to be built faster with available funding. This established momentum as well as political credibility. It also allowed completed sections to be put into operation while other sections were being built. Moreover, it meant that transit could influence the development of the region to a much greater extent than had the inner lines serving the already built-out urban core been constructed first. It was fortuitous that Ottawa-Carleton was the fastest growing urban area in Canada during the height of busway construction; as a result, busway segments opened in the rapidly growing rings outside of the urban core were in a position to channel growth. Today, per capita peak period transit usage in Ottawa-Carleton is as high in suburban areas, where the Transitway first opened, as in the older established parts of the city (Bonsall and Stacey, 1992).

In 1988, the Regional Council updated its Official Plan to extend the rapid transit system. The updated plan calls for initially continuing the busway to the inner edge of the greenbelt, and constructing stations in the town centers of new urban communities beyond the greenbelt. After these links are completed, the plan assumes the construction of the busway across the greenbelt to the new town centers and the grade separation of the downtown link (Figure 45). Cross-town links that by-pass the central core are also proposed in the 1988 plan update. Eventually, the region's Transitway is to extend some 70 kilometers in distance.

The updated plan is well along in implementation. By 1995, lines had been extended to the greenbelt edge in east and southeast corridors; by the turn of the century, the west and southwest corridors should also reach the greenbelt. Soon thereafter, local officials anticipate that the Transitway will be extended beyond the greenbelt to the new urban communities in the east (Orléans) and west (Kanata), establishing a strong east-west growth axis. Depending on the availability of funding, the transitway will be extended to the south urban center sometime later.

Figure 45. Rapid Transitway Network and Future Extensions Defined in the 1988 Official Plan



Sources: Regional Municipality of Ottawa-Carleton, *Official Plan*, Schedule E, 1994, and Bonsall and Stacey (1992).

Transit Modal Split Targets

To assist in the ongoing evaluation of transit services, the Official Plan sets targets for peak-hour transit modal shares at screenlines along each major travel corridor. These targets are used in setting priorities among competing road and transit projects along each corridor. Today's targets are ambitious, calling for transit to attain a market share of 70 percent of trips to the downtown core, 40-45 percent for destinations near Transitway stations in the central area, and 30 to 35 percent for trips generated by development near suburban stations and on the outer limits of the system. These are lofty goals, but are considered achievable by extending Transitway services and giving transit preferential treatment.

Subdivision Reviews and Design Guidelines

While much of the Official Plan is oriented toward guiding development at a macro-scale, more micro-scale design considerations are not overlooked. Specifically, the plan recognizes the need to design individual projects and subdivisions so that they are transit- and pedestrian-friendly. In Ottawa-Carleton, transit is viewed as an essential service, along with streets, waterlines, and sewers, and is one of the central focuses of community designs, not a token addition.

Working together, planners from RMOC and OC Transpo, have prepared transit-supportive design guidelines. At the concept plan stage, developers must work with transit planners to ensure that proposed collector roads allow efficient on-site transit circulation and that bus stops and shelters are conveniently located. Guidelines call for placing the densest

land uses, retail centers, and senior citizens' residences closest to transit lines, and siting single-family homes and recreational parks farthest away. They also encourage mixed-use development at Secondary Employment Centres (SECs) so that office workers are less inclined to drive in order to access off-site restaurants, banks, and other consumer services.

In RMOC, collector roads are generally designed first to meet transit service requirements; any additional needs for auto access to a community are added later. Residential subdivisions are typically served by transit on their internal collector roads rather than from adjacent arterials. This is partly because pedestrians would need to walk longer distances and would require traffic signals to cross busy arterials.¹¹ Collector roads must have adequate geometrics (e.g., widths and curves) to accommodate buses and must be continuous so that vehicles are not forced to turnaround and retrace their paths. There must also be a sidewalk on at least one side of each collector designated for transit use.¹² As early as 1981, RMOC's Transportation Department adopted a standard that all buildings needed to be within a desirable walking distance of 300 meters and a maximum allowable distance of 400 meters of a transit stop. In reviewing subdivision proposals, the department strives to have two-thirds of the potential catchment within 200 meters of transit stops.

Supportive Policies

A number of other transit-supportive policies have been introduced over the years in Ottawa-Carleton that also bear mentioning. Most important have been restraints on parking. At the time the Transitway opened, the federal government began eliminating free parking for its employees and reducing downtown parking supplies. By 1984, downtown parking was 15 percent below the 1975 inventory, despite a near doubling of office space. The federal government also introduced flexible working schedules for its employees, thus encouraging a more even distribution of transit usage over the course of the day. Some have noted that transit has been helped in all Canadian cities by two other federal "non-initiatives:" the absence of a federal freeway program (such as the federally funded interstate highway program in the U.S.) and the inability to deduct interest payments for home mortgages when filing federal taxes, thus removing one of the incentives for single-family home ownership found in the U.S. (Soberman, 1983; Cervero, 1986). Also beneficial to transit have been the high taxes levied on gasoline sales, more than twice as high as in the U.S. (Pucher, 1994).

Supportive parking policies have also been introduced at Transitway stations themselves. OC Transpo restricted park-and-ride facilities to the eastern and western terminuses to encourage the use of feeder and expresses as well as to maximize the development potential of certain stations. (Currently, the Place d'Orléans Station has 550 spaces and the Baseline Station has 185, meant mainly to serve those residing beyond OC Transpo's service jurisdiction.)

Several municipalities have introduced transit-supportive parking policies of their own. The City of Ottawa, for example, allows a reduction of 25 parking stalls at all retail centers for every bus stall provided, either in the form of an on-site bus stop or a Transitway station physically integrated with the retail center.

6.5 STATION AREA DEVELOPMENT

The Ottawa-Carleton region has seen considerable land-use changes around some Transitway stations. Outside of downtown, several hundred thousand square meters of office and commercial floorspace have been added within a five minute walk of suburban stations, with Blair and Place d'Orléans as notable standouts. Stations like Westboro, Tunney's Pasture, and Hurdman have attracted new mid-rise apartment and condominium towers. Several regional shopping malls, most notably St. Laurent and Gloucester Centre, have also been physically linked to the Transitway.

From 1988 to 1991, local officials estimate that a billion Canadian dollars of development was added, under construction, or at various stages of planning within a five minute walk of the Transitway.¹³ This is nearly four times the \$275 million spent on the 25 kilometers of Transitway that were in place in 1991. While the Transitway did not induce anywhere near this amount in new real estate investments within the region, it unquestionably had a strong bearing on where new office, retail, and residential construction took place.

It should be emphasized that it never was the intent that land around all station areas be intensified. Western sections of the Transitway were built on open parkland owned by the National Capital Commission where there is no potential for development. Other stations, like Iris and Lincoln Fields, were placed in locations where physical site constraints and the presence of established single-family neighborhoods preclude any significant new development from occurring.

This section summarizes the most significant development activities to date associated with Ottawa-Carleton's Transitway. Summaries are presented for co-developed projects, office-commercial development, retail sales, and residential housing. Missed opportunities for transit-linked development are also pointed out.

Co-Development

There have been two noteworthy examples of co-development, wherein the transit authority and private developers worked hand-in-hand to physically link their respective projects, to the benefit of all: one at the St. Laurent Station, the other at the Riverside Station.

St. Laurent. Concurrent with the opening of the St. Laurent Transitway Station in 1987, the St. Laurent shopping mall was expanded to include 80 new retail outlets. The coincidental timing allowed the shopping mall to be physically integrated with the station. The St. Laurent Station has three levels: local bus routes use the top level, the mezzanine connects directly to the shopping center, and downstairs are the Transitway platforms. The station cost \$15 million to build, by far the most expensive on the system. Part of the cost, however, was absorbed by the shopping center developer, who donated all of the land for the station and built connecting passageways. The developer also expanded the mall in the direction of the station to put stores near the station portal, creating an enclosed pedestrian environment, similar to that of the downtown Montreal Metro system. Owners felt integrated development would not only attract more shoppers but would also save on parking costs. The city of Ottawa allowed them to reduce on-site parking by 25 spaces for each transit bay in the station.

Riverside. Perhaps the best example of a medical facility linked to a transit line anywhere can be found on the Southeast Transitway at the Riverside Station. In the conceptual plan, the Transitway traversed the grounds of this hospital, though no station was planned. Fortuitously, Riverside Hospital was planning an expansion at the same time the Transitway was being planned. An agreement was reached that allowed the Transitway to penetrate the hospital site in return for adding a station that connected directly to the expanded hospital. In 1991, the Riverside Hospital opened a new 4,200 square foot administrative wing directly over the Riverside Station, providing patients, visitors, and medical staff direct transit access (Figure 46). A four-story medical office building was also recently built beside the Riverside Hospital which includes an enclosed pedestrian skybridge linked to the hospital and station.

Office-Commercial Development

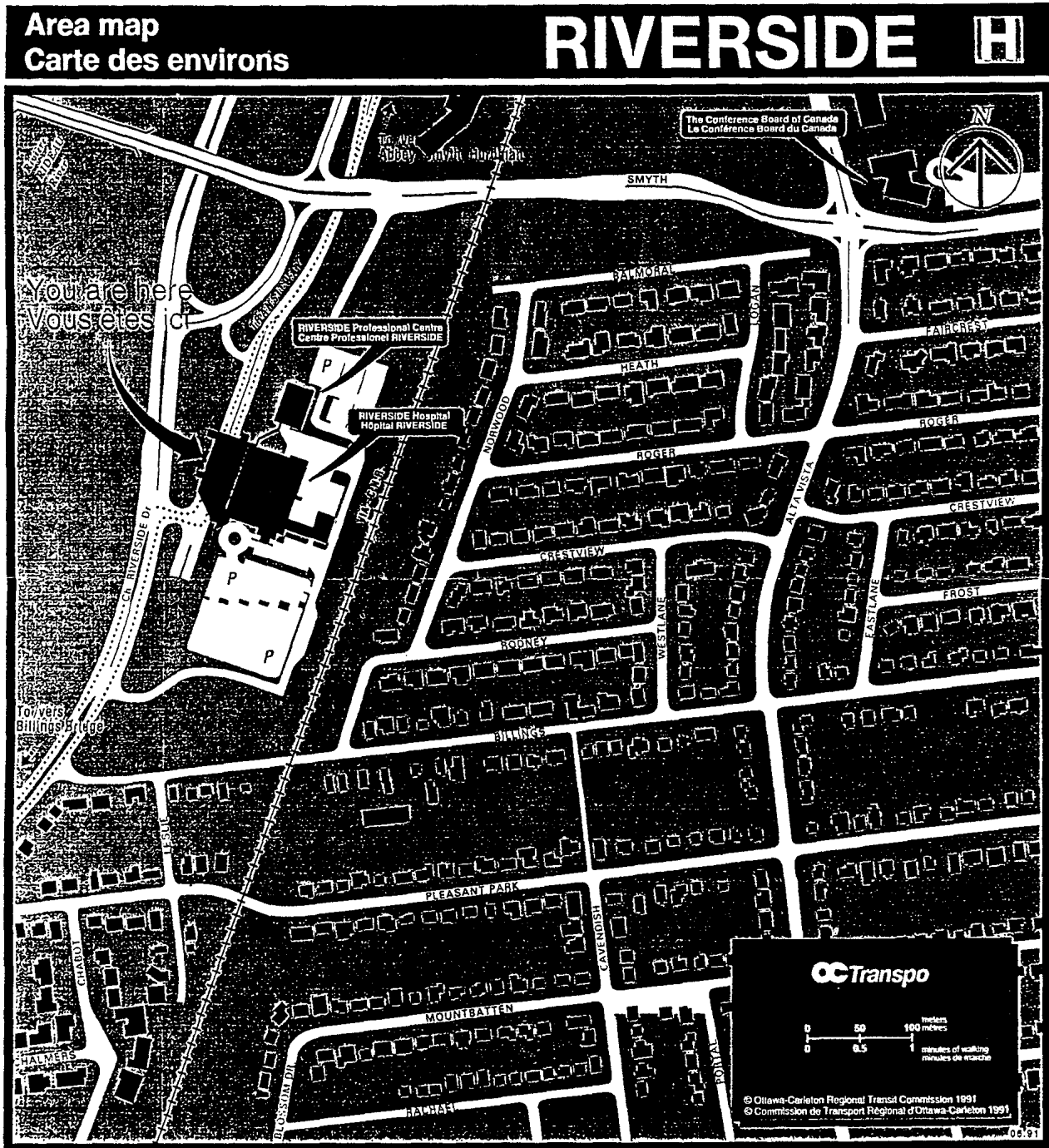
To date, the most significant concentrations of office and commercial development have occurred near the Blair, Tunney's Pasture, Rideau Centre, Baseline, and Cyrville Stations.

Blair Station. By far, the largest inventory of transit-oriented office and commercial floorspace to date has been added near the Blair Station, currently the eastern terminus of the exclusive busway (Figure 47). Consistent with the Official Plan, Blair Station has emerged as a Primary Employment Centre. Four mid-rise office towers have been built within a five-minute walk of the station. A pedestrian skybridge links offices south of the Queensway freeway to the Transitway. The skybridge was funded by the Municipality of Gloucester to promote economic development. Local officials believed that having good access to the Transitway would be a critical factor in luring several projects to the area. Overall, within five years of the Blair Station's 1989 opening, an estimated \$90 million in commercial-office development was built nearby, and another 155,000 square meters was on the drawing board.

One of OC Transpo's site design "success stories" was securing the redesign of the Gloucester Centre shopping mall, directly north of the station. Original plans called for the Gloucester Centre to face away from the Transitway station, which would have forced transit customers to wade through a sea of parking to reach the mall's entrances. OC Transpo planners convinced the developers to totally revise the site plan to reorient Gloucester Centre toward the Blair Station. The developers were sold on the idea when it was pointed out that more people pass through the Blair Station on buses than on the adjacent Queensway freeway during shopping hours. Since three-quarters of OC Transpo passengers use monthly passes, most can stop and shop on the way home to the eastern suburbs without having to pay an additional fare.

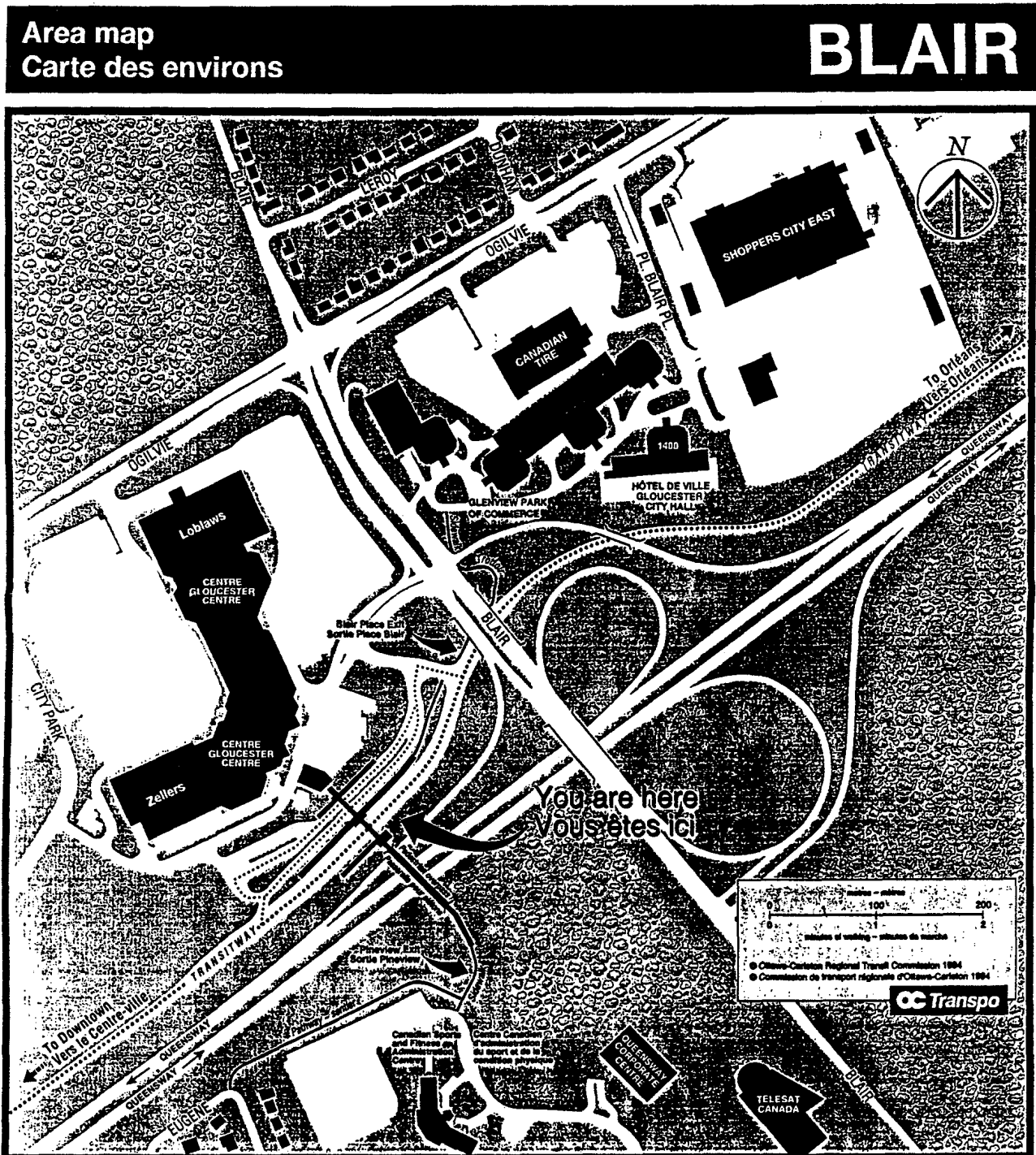
Tunney's Pasture. A federal complex employing around 10,000 civil servants surrounds and predates the Tunney Pasture Station (Figure 48). Few of these office buildings are transit-supportive in their designs (e.g., parking often fronts structures), and many are beyond a five-minute walk to the station. Since the Tunney's Pasture Station opened, however, a massive mixed-use project, Holland Cross, has been built in a redevelopment zone, featuring 18,200 square meters of ground-floor retail and upper-level offices, and nearby residential towers with 638 units. Holland Cross's developers requested and

Figure 46. Riverside Station Area



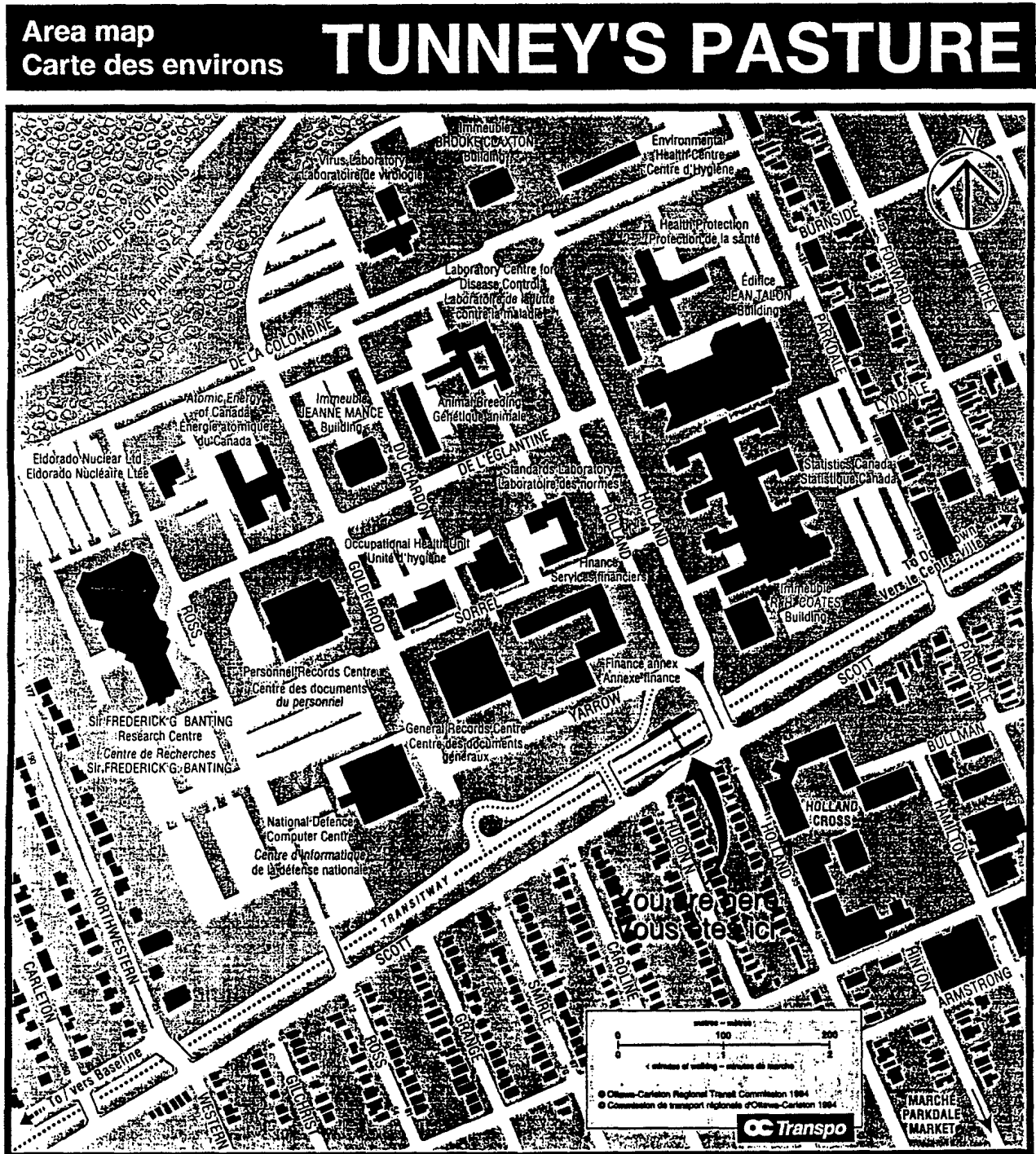
Source: OC Transpo, 1991.

Figure 47. Blair Station Area



Source: OC Transpo, 1991.

Figure 48. Tunney's Pasture Station Area



Source: OC Transpo, 1991.

received approval to lower the project's parking requirements in light of its proximity to transit. Without the Transitway, some believe, Holland Cross would not have been built.¹⁴

Rideau Centre. By all accounts, Rideau Centre, an attractive indoor mall on the northeast edge of downtown, is the region's most successful transit-oriented shopping complex. Around 60 percent of shoppers reach Rideau Centre by transit, a market share in line with the rest of downtown. By convention, the Rideau Centre should have been laid out east-west, along Rideau Street, with an anchor tenant on each end. Instead, its principal axis is north-south, which gives the mall direct access to heavy bus traffic on perpendicular Rideau Street and the Mackenzie King Bridge.¹⁵ As a result, Rideau Centre enjoys access to every bus route downtown. Thousands of passengers use the Rideau Centre each day to transfer between buses.

Other Stations. Though not as large or as dense, significant concentrations of office and commercial development have also occurred near two other non-downtown stations since the Transitway's 1983 opening. At Baseline Station over 40,000 square meters of mixed office and retail space has been added, along with the construction of new buildings at Algonquin College. At Cyrville Station some 12,000 square meters of administrative office space and ground-floor retail were added in the 1988-92 period.

Retail Sales

Presently, four regional shopping centers with over 375,000 square feet of gross leasable space each are sited near the transitway: St. Laurent, Rideau Centre, Gloucester Centre, and Place d'Orléans.¹⁶ Older shopping centers with 200,000 to 300,000 square feet of leasable floorspace that are served by the Transitway include Lincoln Heights, Billings Bridge, and Gloucester Centre, as well as the entire downtown core.¹⁷ A by-product of having retail development oriented toward transit has been increased retail sales among businesses near transitway stations. A 1986 survey conducted by the Ottawa-Carleton Board of Trade found that nearly two-thirds of all bus passengers felt that public transit was important to them for shopping, and more than a third said bus routes influenced where they shopped. Nearly one-third said they went shopping during their trips, spending upwards of \$500 million each year. While this is largely a redistributive impact, in that these sales would have most likely taken place at more auto-oriented retail outlets with the busway, these findings suggest that merchants locating near the transitway are reaping direct financial benefits. Such experiences can only be expected to stimulate more retail investments near the Transitway in the future.

New Urban Centers

As part of the region's long-range urbanization strategy, Transitway stations are being planned and built in urban centers beyond the greenbelt *in advance* of extending the Transitway. These stations function as focal points for concentrated, mixed-use development. The first beyond-the-greenbelt station opened in Orléans in 1992, a predominantly residential community of around 50,000 inhabitants. Early on, the Regional Council engaged a consultant to work with a committee consisting of its own staff and representatives from OC Transpo, local planners, two major landholders, and Provincial roadway and transit authorities to determine the best location for a Transitway station. Today, the Place d'Orléans Station lies prominently in the heart of a massive mixed-use,

pedestrian-friendly urban center that includes a retail complex and the Cumberland township's new civic center. A similar process of transit-led development is currently being planned for future urban centers in Kanata and Barrhaven.

Residential Development

OC Transpo's extensive network of express buses and timed-transfer connections has effectively brought rapid transit services to the front doors of many suburban residents. In so doing, it has reinforced the region's fairly low-density residential settlement pattern. The Regional Council has refrained from promoting high-rise residential development, such as found in Metro Toronto, near Transitway stations. This has freed up prime real estate around stations for more intensive (and from a transit ridership standpoint, more potentially productive) commercial and office development.¹⁸ In Ottawa-Carleton, carefully configured and integrated transit services has largely eliminated the need for transit-based housing. Nearly everyone, including those living in the lowest-density suburbs, enjoys good quality service -- an estimated 95 percent of residents served by OC Transpo presently live within 400 meters of a bus stop.

While the Transitway was never explicitly called upon in the Official Plan to attract concentrated residential development, the market has nonetheless given rise to apartment complexes and mid-rise condominium towers close to several stations, notably: Westboro (290 townhouses and apartments were built in 1990-91), Tunney's Pasture (in addition to Holland Cross, 393 mid- and high-rise units were built, mainly on redeveloped land, between 1989 and 1993), Lees (over 450 non-profit residential units were added in 1990-93), and Hurdman. Since the opening of the Hurdman Station, the upscale three-tower Riviera complex has added 387 condominium units to the immediate area. Riviera's developers have publicly stated that the presence of the Transitway was a major factor in securing financing for the project. Also nearby is the Classics high-rise tower which has added another 195 units, with 313 more to be included in future phases. (While developers of the Riviera and Classics projects note that having a Transitway station nearby was an added bonuses to developing these sites, a more important marketing factor has been the river vistas.) It should also be noted that compact, mid-rise housing development around several stations, notably around the Smyth, Abbey, and Baseline Stations, predated the Transitway.

Despite the low priority set for transit-based housing, OC Transpo services, nonetheless, appear to have some bearing on residential locational choices. The 1986 retail survey of nearly 1,000 OC Transpo customers, cited previously, revealed that 72 percent indicated the availability of bus service influenced their housing choice. Overall, Ottawa-Carleton's experiences debunk the myth that people eschew living near bus-transit nodes (e.g., to avoid fumes, noise, or pedestrian traffic), and that densification only occurs around heavy rail stations. Transitway stations have become integral and accepted parts of several established residential neighborhoods in the Ottawa-Carleton region.

Transit-Oriented Site Designs

Ottawa-Carleton boasts several new subdivisions that have carefully adhered to the region's transit-friendly site design guidelines. In these places, transit's needs were addressed at the design stage rather than as an afterthought. An example of a community

currently being planned that is emphasizing transit provisions is River Ridge south of the airport, designed for 30,000 inhabitants. Transit planners have worked closely with the City of Gloucester and a developer to create a concept plan wherein a transitway will be the centerpiece of the new community. This has meant protecting corridor right-of-way, siting the station in the community core, and distributing land uses to take advantage of transit's proximity. Collector streets have also been laid out to allow efficient transit circulation, and the road network has been platted to enable easy access to the bus-served collectors. The objective is to have virtually everyone within a five minute walk (400 meters) of a bus stop.

Missed Opportunities

Not all new developments near existing or planned Transitways in Ottawa-Carleton have been successfully tied to them. One missed opportunity was at the Lincoln Fields Station, a hub on the west leg of the Transitway. A community shopping center was built within 400 meters of the station, but no agreement could be reached on site connections. As a result the passages between the station and nearby shopping center are circuitous and inconvenient. Another "near miss" was the Greenboro community, located just east of the South Keys and Greenboro Transitway Stations. Regional planners had high hopes that Greenboro would one day serve as a paragon of transit-oriented development for the region. Well before the residential subdivision broke ground, right-of-way was preserved to build a busway right through the heart of the community. The initial land-use concept was for higher-density commercial uses and apartments along the central busway, with densities tapering off with distance from the right-of-way. Instead, developers managed to gain enough political support to allow parkland, a school, and recreational facilities to be sited near the busway, hardly intensive, transit-oriented land uses. New development was also approved south of an arterial serving the Greenboro community, a distance that is too far to conveniently reach the busway by foot. This development further detracted from the busway corridor as the area's focal point. As a result, the Greenboro busway is being eliminated from official plans, to be replaced by conventional feeder bus services.

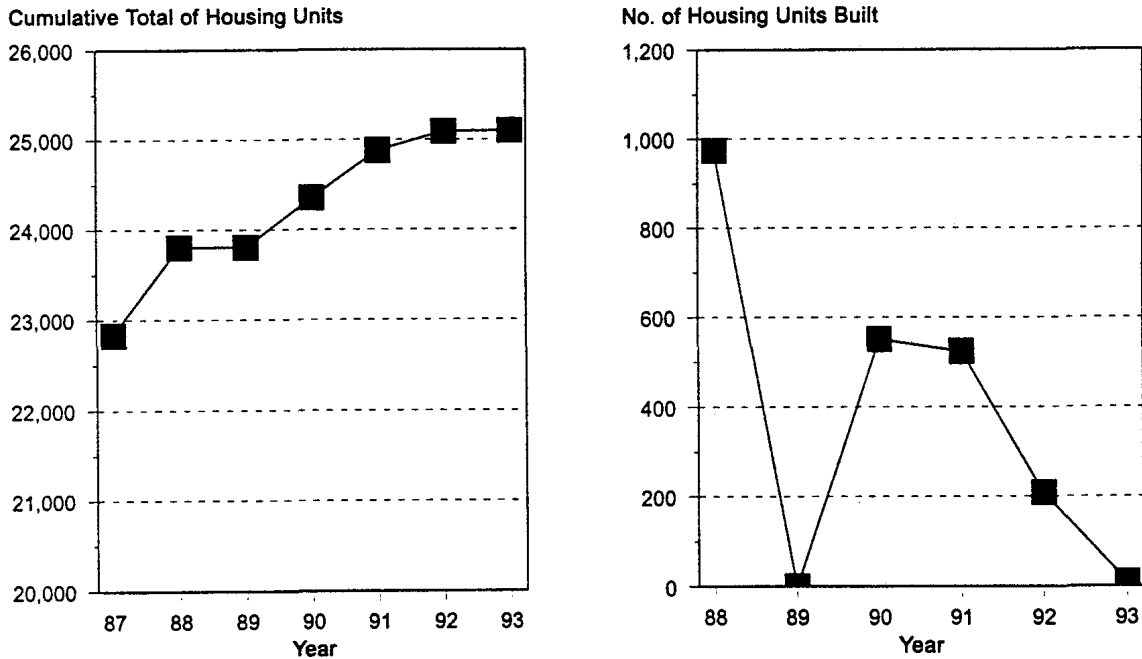
6.6 STATION-AREA DEVELOPMENT IN A REGIONAL CONTEXT

The Regional Official Plan explicitly calls for a significant share of future employment growth and retail-commercial development to take place near Transitway stations. To evaluate the degree to which land-use objectives are being achieved, RMOC has instituted a program to monitor development within an 800-meter walking "envelope" of all Transitway stations that are operational, except those in the central area (i.e., excluding Lebreton, Canal, and the six downtown stops). Monitoring reports have been produced for 1988/89, 1990/91, and 1992/93. This section summarizes findings to date on levels of station-area development.

Residential Development

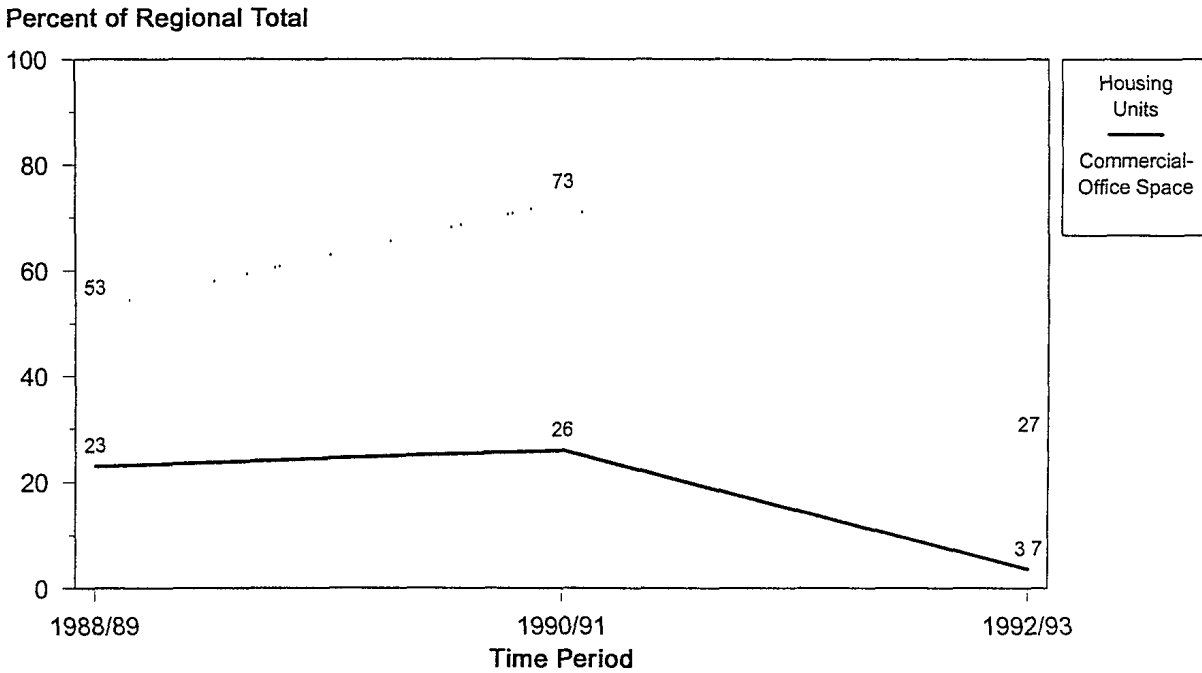
Over 2,300 housing units were built within a 800 meter radius of the fourteen surveyed Transitway stations from 1988 to 1993 (Figure 49). As noted earlier, most of the housing additions occurred near the Tunney's Pasture and Hurdman Stations. In terms of market shares, Figure 50 shows that around a quarter of all housing units constructed in the region in 1988/89 and 1990/91 were within a short walk of Transitway stations. In 1992/93, a period when no new stations opened, the regional share of housing units built near Transitway stations plummeted to under four percent. This drop-off appears to reflect a saturation of the high-density, transit-oriented housing market in the Ottawa-Carleton region.

Figure 49. Trends in Housing Development in Transitway Station-Area Envelopes



Note: For transitway stations outside of the central area. For the 1987-90 period, data are for twelve station areas. For 1991-93, data are for fifteen stations, accounting for the opening of the Abbey, Smyth, and Riverside Stations during this period.

Figure 50. Share of Regional Development Near Transitway Stations, Residential and Commercial-Office Land Uses

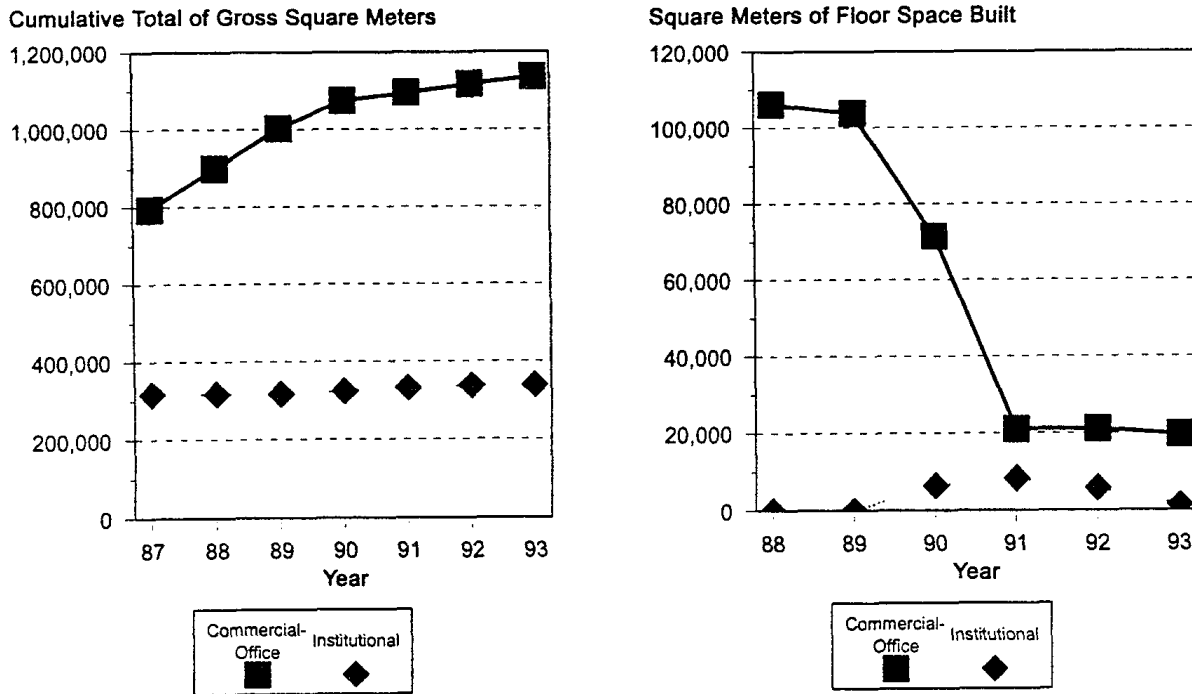


Note: For transitway stations outside of the central area.

Non-Residential Development

During the late-1980s, when Ottawa-Carleton's economy was expanding, over 100,000 square meters of commercial and office floorspace was built each year in Transitway station areas (Figure 51). However, by the early 1990s, this figure had plummeted to around 20,000 square meters annually, reflecting the impact of the recession experienced across Canada. Most station-area development in the late-1980s was in the retail sector; in 1989, in particular, around three-quarters of non-residential development was attributable to the expansion of two regional shopping centers along the Transitway, St. Laurent and Place d'Orléans. In the 1990s, offices accounted for nearly all of what little non-residential floorspace got built. Figure 51 also reveals that relatively little institutional land use was added to Transitway station areas during the 1987-93 period. The most significant activities were the expansion of the Riverside hospital and addition of buildings at the Algonquin College and University of Ottawa campuses.

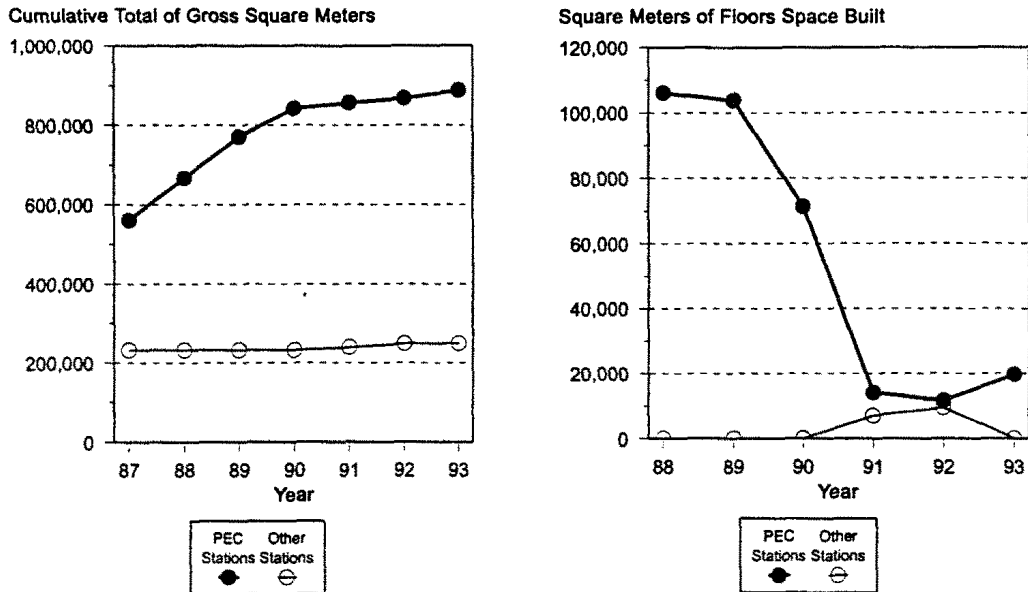
Figure 51. Trends in Non-Residential Development in Transitway Station-Area Envelopes



Note: For transitway stations outside of the central area. For the 1987-90 period, data are for twelve station areas. For 1991-93, data are for fifteen stations, accounting for the opening of the Abbey, Smyth, and Riverside Stations during this period.

The Regional Official Plan stressed the need to target significant shares of future office and retail-commercial development in the nine designated Primary Employment Centers (PECs). Figure 52 breaks down trends in commercial-office development between the six Transitway station areas that are PECs (Baseline, Tunney's Pasture, St. Laurent, Cyrville, Blair, and Place d'Orléans) and all remaining (non-PEC) station areas. The figure reveals that nearly all commercial-office development along the Transitway has occurred near PEC stations; from 1988 to 1990 and in 1993, 100 percent of office-commercial construction occurred at PEC stations.

Figure 52. Trends in Office-Commercial Development, PEC versus Other Stations



Note: For transitway stations outside of the central area. For the 1987-90 period, data are for twelve station areas. For 1991-93, data are for fifteen stations, accounting for the opening of the Abbey, Smyth, and Riverside Stations during this period.

As a share of total regional development, Transitway stations have captured a significant part of the commercial-office market, though the share fell sharply in 1992/93 -- to 27 percent of the total, from a high of 73 percent in 1990/91 (Figure 50). Evidently, the economic recession has been felt more strongly in station areas than elsewhere in the region. Several station-area projects that had already secured planning approval in the early-1990s were postponed because of the economic downturn. Not only did these projects not proceed, but new commercial projects failed to materialize.

Employment Trends

Employment Surveys conducted by RMOc in 1986 and 1991 also provide insights into development trends around Transitway stations. Between 1986 and 1991, 13,700 new jobs were created within 600 meters of a Transitway station (RMOc, 1992B). The central area accounted for 54 percent of this increase. There were also significant gains at the Blair (3,670 jobs), Place d'Orléans (1,410 jobs), and Tunney's Pasture (1,300 jobs) stations. The share of regional employment in the vicinity of transitway stations, however, remained stable at 35 percent in both 1986 and 1991. According to RMOc (1992B, p. vii), this shows there has been: "no progress toward achievement of the regional official plan objective of increasing the proportion of urban jobs at transitway stations."

Of the six Transitway stations designated as PECs, all but one (St. Laurent) saw employment grow at a faster rate during the 1986-91 period than the 11.6 percent growth rate registered for the region as a whole.¹⁹ Over this five year period, employment at the

Blair Station grew by 912 percent (from 402 to 4,068 jobs) and at the Orléans Station by 155 percent (from 908 to 2,315 jobs). While no progress was made in achieving the 40 percent market share target set for the Transitway, clearly several station areas have experienced phenomenal rates of employment growth.

Concluding Remarks on Development Trends

Overall, an impressive amount of development has been attracted to some Transitway stations, most notably Blair and Place d'Orléans on the office-commercial side and Tunney's Pasture and Hurdman in terms of residential construction. Some of the growth near the Blair and Place d'Orléans Stations can be attributed to the general suburbanization of employment that occurred throughout Canada and the U.S. in the 1980s. The availability of Transitway infrastructure, however, made these two station sites all the more attractive to prospective businesses. Other factors that lured new development to Transitway station areas included the availability of vacant, serviced land at attractive prices and local planning policies permitting higher densities that made redevelopment (such as at Tunney's Pasture) financially feasible (RMOC, 1992A). Public sponsorship of below-market rate housing, in combination with the availability of land and special financing within the redevelopment zone, have been particularly instrumental in expanding the housing stock near the Tunney's Pasture, Westboro, and Lees Stations.

Despite these success stories, the Regional Council has expressed concern over the lack of progress in increasing the share of regional jobs near Transitway stations. In response, RMOC commissioned a study in 1995 to investigate the development potential of selected Transitway stations. The intent is to choose up to three stations for preparing a detailed development strategy and concentrating future marketing efforts.

6.7 CONCLUSION

As a result of careful and dedicated planning, Ottawa-Carleton is today one of the most transit-oriented metropolises in North America. Around 70 percent of all peak-hour trips heading to downtown Ottawa are by transit. OC Transpo's share of trips to suburban shopping and employment centers is as high as that to the downtowns of many other North American communities.

The foundation for Ottawa-Carleton's world-class bus transit network was established during the 1970s with the passage of an Official Plan, and strengthened in subsequent updates. A multi-centered settlement pattern was called for, and a Transitway was enlisted as the chief instrument for achieving this built form. The Regional Official Plan contains policies that encourage commercial and office development at Transitway stations designated as primary and secondary urban centers. By spreading trip destinations throughout the region, an efficient busway network with bi-directional flows could be economically sustained. The Regional Plan is very explicit in its objectives, most notably by setting ambitious transit performance targets that serve to guide on-going infrastructure investment decisions. Transit modal split targets in the 30 to 40 percent range outside the urban core will demand a continuing emphasis on delivering fast, efficient transit services in coming years.

Today, Ottawa-Carleton boasts numerous examples of mid-rise office, commercial, and residential development in the vicinity of Transitway stations. These have been partly an outcome of market forces and partly an outcome of a receptive planning environment. Since the Transitway's 1983 opening, Ottawa-Carleton has experienced a wave of auto-oriented suburban development, just as in other regions of Canada and the U.S. More jobs, for instance, have located beyond the greenbelt than near Transitway stations over the past decade or so. However, within the greenbelt, there can be no question that the Transitway has strongly influenced the spatial organization of growth that took place. It is more compact, mixed in land uses, and transit-oriented in design than would have occurred without the Transitway. Without regional governance to create a truly integrated regional land-use and transportation vision of the future, such achievements would not have been possible.

It is important to note that the Regional Council first established a regional land-use vision, and then developed a transportation strategy to achieve that vision -- that is, transportation policies were the "means" to a land-use "end." For example, the regional plan accepts that most residents prefer to live in low-density residential settings and does not attempt, through any specific policies, to alter these preferences. Except for a few station areas with mid-rise apartments and condominiums, most of the region's housing stock is single-family detached. The transportation "means" to support this land-use "end" was the introduction of a highly flexible, integrated surface transit network. Buses fan into neighborhoods, and either provide direct express services to destinations or feed into nearby Transitway stations on a timed-transfer basis. In contrast to most U.S. rapid transit systems, park-and-ride has been discouraged as an access means to Transitway stations. This not only reduces parking lot expenses and frees land for more productive commercial-office uses, but also yields environmental benefits by eliminating short-hop automobile access trips to stations. (Transit provides few air quality benefits if a car is used to access stations because of the cold start cycle).

Equally impressive has been the care given to micro-scale, neighborhood-level planning of transit service. From the early conceptual designs of new subdivisions, transit is viewed as an essential neighborhood service. In a special feature of the *Ottawa Business News* (November 30, 1991, p. 3), titled "Public transit no longer an afterthought to development," it was noted that:

It used to be the accepted way for a community to grow: homes, shopping centres and office blocks were put up wherever it appeared to make the most economic sense for developer and buyer, and transit routes were squeezed in almost as an afterthought. Public transit, after all, merely complemented the private automobile. In the Ottawa-Carleton region, that thinking has been turned upside down...by dramatic improvements in public transit that center on the Transitway. This rapid transit system not only serves new developments, it influences their location and to some extent even their design.

In Ottawa-Carleton, each proposed subdivision or new major development is carefully scrutinized by transit planning staff to ensure convenient transit access is provided. Once regarded as an addition and even an afterthought to the developer's plans, integrating transit into the development process is now a priority consideration.

Currently, the region is engaged in a debate over whether to continue emphasizing a radial transit system focused on downtown -- specifically, whether scarce dollars should go to improve downtown busway circulation by constructing tunnels or instead be used to extend the transitway to new town centers. This debate turns on the question of whether downtown Ottawa will retain its dominance as the region's employment hub, or whether future growth will be decentralized. True to Ottawa-Carleton's tradition, land-use objectives can be expected to guide which of these two transit investment strategies the region pursues over the next decade.

Notes:

1. 370 square kilometers equals about 143 square miles.
2. The region encompasses the Cities of Ottawa, Gloucester, Kanata, Nepean, and Vanier, the Townships of Cumberland, Goulbourn, Osgoode, Rideau, and West Carleton, and the Village of Rockcliffe Park.
3. Other responsibilities of regional government include: water distribution, wastewater treatment, solid waste disposal, region roads, social and health services, and maintaining homes for the aged.
4. OC Transpo is a separate corporate body run by a nine member Commission which reports to the Regional Council. OC Transpo serves a designated Urban Transit Area, which in 1990 had a population of 586,000 and included the Cities of Ottawa, Gloucester, Kanata, Nepean, and Vanier, the Township of Cumberland, and the Village of Rockcliffe Park.
5. The 1.8 kilometer segment from Riverside to Billings Bridge stations was opened in 1995; the future 4.3 kilometer extension to South Keys will expand the Transitway to over 31 kilometers.
6. The downtown couplet can theoretically handle a maximum of about 200 buses per lane per hour under ideal operating conditions. Scheduled bus volumes are today approaching 200 buses per hour (Bonsall and Stacey, 1992). Incidents of total system failure with downtown travel times of 45 minutes or more on cross streets now occur once very two to three months.
7. Under skip-stop operations, buses skip certain stations and stops unless there is a waiting customer at one of these stops who hails the vehicle for a ride.
8. The radial orientation of the system is reflected by the fact that downtown Ottawa, with about 28 percent of the region's employment, accounts for almost half of all peak-hour travel.
9. The main sources for these estimates are the 1989 Retail Survey and the 1986 National Capital Area Origin-Destination Survey, both conducted by RMOC. The 1986 survey found the following transit modal splits for shopping centers that are currently served by the Transitway (or dedicated freeway lanes connected to the busway): Rideau Centre -- 61 percent; Billings Bridge -- 22 percent; Carlingwood -- 21 percent; St. Laurent -- 16 percent; Bayshore -- 13 percent; and Place D'Orléans -- 9 percent. At the time of the survey, however, the Transitway did not extend to Billings Bridge, St. Laurent, or Place D'Orléans. According to local officials, transit modal splits have significantly increased to all of these shopping centers over the past decade, at least up to the 30 percent market. 1993 figures released by the management of the St. Laurent shopping center, for example, showed a transit modal splits of 32 percent.
10. The only exception is the Carlingwood shopping complex which for historical and geographic reasons is being accepted as a retail destination that will be reached predominantly by private automobile.
11. In Ottawa-Carleton's suburbs, most homes abutting busy roads are constructed with reverse frontage -- i.e., they face internal roads and back onto major roads. As a result, there tends to be few access points to the arterials since signalized entrances to neighborhoods are typically at least a quarter mile (400 meters) apart.
12. Design guidelines focus mainly on ensuring that traditionally low-density, residential subdivisions are suitable to transit services. It is commonly understood that commercial centers and central-area developments should be designed for convenient transit access, such as siting off-street parking in the rear of buildings and orienting building facades to transit-served corridors. Other site design strategies that are pursued in residential settings in Ottawa-Carleton include: orienting corner houses toward side streets to avoid having front yards facing bus stops on that are sited on collector streets; creating internal sidewalk networks where street access impose longer walking distances; and siting bus shelters and pads (paved waiting areas at stops) in strategic locations.
13. The actual amount constructed during the 1988-1991 period surpassed \$47.5 million.
14. Correspondence from Colin Leech, head of long range planning for OC Transpo, dated June 23, 1992.

15. The Mackenzie King Bridge is part of the Transitway while some 60,000 OC Transpo passengers use the Rideau Bus Mall daily.
16. A fifth large regional shopping mall, Bayshore, is located off of the planned western extension of the Transitway.
17. The Billings Bridge Plaza has historically been one of the region's most heavily transit patronized shopping centers even though, up until 1995, it was not located near the Transitway. In 1991, around 18,000 shoppers reached the plaza via the bus terminal at Billings Bridge Plaza. Today, the number is considerably higher.
18. It should be noted that although single-family detached homes are common throughout the region's suburbs, most housing in the central area consists of attached walk-up units, garden apartments, and mid-rise towers. This has produced relatively high average residential densities, at least by North American standards. Overall, Ottawa-Carleton has fewer single-detached houses, 42 percent of total units, than most Canadian cities. In 1986, only Montreal and Quebec City had smaller percentages of singles. In 1991, single-family detached homes made up 32 percent of the stock inside the greenbelt but 65 percent in the urban centers outside the greenbelt (RMOC, 1994A).
19. The St. Laurent station lost over 900 jobs during this period due to a factory closing and retail downsizing.

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7.0 CURITIBA CASE STUDY

7.1 INTRODUCTION

Curitiba, Brazil is a medium size city in a developing country that through visionary planning and inspired leadership has applied highly inventive yet low-cost strategies to cope with rapid growth. The careful, methodical development of a world-class all-bus transit network, in close coordination with physical land-use planning sets Curitiba apart. For both first and third world cities alike, the lessons of Curitiba are important and insightful.

Comprehensive urban planning -- and specifically, integrated transportation and land-use planning -- found a receptive home in Curitiba because of rapid population growth and the fear that Curitiba was poised to becoming an uncontrollable, sprawling metropolis, like São Paulo to the north. Early on, a number of important guiding principles were established that have been religiously adhered to over the past three decades. Among these are:

- a realization that Curitiba's downtown had reached saturation and that future growth should be channeled along several defined linear corridors;
- the belief that transportation investments and land-use regulations, in coordination, are the most powerful tools for directing growth along these corridors; and
- decision to plan for the mobility of people rather than cars, giving both pedestrians and mass transit priority over automobiles in highly congested locations.

Transferable Ideas

Curitiba's integration of land use and transit planning has produced a number of policies, methods and institutional factors that could be applied elsewhere. These include policies for regional planning, transit operations, and corridors (or station areas).

Regional Planning Policies and Actions

1. Curitiba began with a vision for their city; in this case, a vision of a linear city that preserved downtown and concentrated new development in corridors.
2. The city uses coordinated transportation investments and land use regulations, such as higher density mixed use in transit corridors to direct growth to transit corridors.
3. Curitiba's planners think of mobility as moving people, not moving cars.
4. Curitiba's leaders have been pragmatic, taking small, affordable steps to achieve their vision rather than making commitments to complex or large systems and projects.
5. Curitiba's leaders are willing to experiment and take risks.

Transit Operations

6. The city's planners designed and implemented multi-modal transportation corridors, known as the trinary road system, that are integrated with land uses.
7. "Express" (frequent-stop) bus service was developed on exclusive right-of-way in the center of the trinary road system.
8. "Speedy" (direct) bus service developed later on the high-capacity roads that flank the trinary road system when additional transit service was needed.
9. An integrated system of exclusive right-of-way, feeder, cross-town, and direct bus service has been developed to serve all parts of the city and support a linear pattern of development.
10. Service improvements and innovations have been made with land use considerations in mind.

Corridor Policies

11. Transit corridors are zoned for mixed use residential and office development to guarantee that buildings both produce and attract trips.
12. Density bonuses encourage retail shops and restaurants on the first two floors of all buildings fronting on the transitways.
13. Areas outside the transit corridors are zoned for residential neighborhoods.
14. Large-scale shopping centers are only allowed in transit corridors.
15. Public housing for low income families has been built along the transitways.
16. In downtown the parking supply is restricted and a pedestrian environment is emphasized.

Organization of the Case Study

This case study describes in more detail how and why these policies were developed in Curitiba. Section 2 describes the region and its bus system. Section 3 describes the 50-year evolution of planning as Curitiba has more than quadrupled in size. This planning has successfully integrated transit and land use planning to shape the way the region has grown and to produce high bus ridership levels in a relatively affluent city. Section 4 outlines the land-use regulations and other policies that have supported transit-oriented development along transitways. Section 5 identifies the ridership and performance benefits of integrating transit and land use. Section 6 summarizes the lessons from Curitiba that may be applicable elsewhere.

7.2 CONTEXT FOR INTEGRATING TRANSIT AND LAND USE PLANNING

The City of Curitiba and Its Economy

Curitiba is the capital of Paraná, a mainly agricultural state in the south of Brazil. Situated 900 meters above sea level, near the coastal mountain range, Curitiba grew rapidly during the second half of the nineteenth century, propelled by the arrival of mostly European immigrants and the opening of new economic frontiers. However, it has been during the past three decades that the city's population has mushroomed most rapidly and Curitiba has emerged as a vibrant industrial and commercial center. In 1965, Curitiba had 400,000 inhabitants. By 1995, its population surpassed 1.6 million, all within a 431 square kilometer area.¹ (Greater Curitiba's population today exceeds 2.2 million, spread over a land area nearly twice the size of Curitiba proper.) During the 1970s and early 1980s, Curitiba grew faster than any Brazilian city, eclipsing 4 percent annually. Much of Curitiba's recent population surge has been fueled by migrants from rural areas and small towns flocking to the city in search of economic opportunities. Presently, around 35 percent of Curitiba's workforce is employed in retail-commercial and services industries, and 19 percent works in the manufacturing sector. The 1990 national census classified 9 percent of the economically active population of Curitiba as unemployed, fairly low by Brazilian standards. With a 1994 Gross Domestic Product per capita of US\$5,149 (compared to a national average of US\$3,157), Curitiba is one of Brazil's wealthiest cities.

Curitiba's Bus System

Curitiba has a highly integrated bus network with a rich mix of services, including high-capacity buses operating on dedicated transitways, limited-stop high-speed buses paralleling transitways on one-way couplets, orbital routes that interconnect the busways, and over 100 feeder lines that run between low-density neighborhoods and trunkline services. Twenty intermodal stations along Curitiba's five transitway corridors allow efficient and convenient transfers. A single fare enables one to go nearly everywhere in the greater Curitiba region for around US\$0.40. All ten private bus companies who operate Curitiba's bus services earn a profit.

Presently, Curitiba averages around 350 unlinked transit trips per capita each year, which is the highest rate in Brazil.² This approaches the per capita ridership figures of North America's largest metropolises, New York City and Mexico City, both of which have extensive underground rail systems. Curitiba's transit system is used by more than a million passengers each weekday, or about 75 percent of all commuters, a modal split that is much higher than in other Brazilian cities. Transit's work trip market share is 57 percent in Rio de Janeiro and 45 percent in São Paulo (Rabinovitch and Leitmann, 1993). What makes these differences all the more remarkable is that Curitiba has among the highest median household incomes and the second highest automobile ownership rate (267 cars per 1,000 inhabitants, just behind Brazilia) in Brazil. Curitiba boasts Brazil's most successful transit system even though it is one of the country's most affluent cities with among the highest automobile ownership rates.

7.3 EVOLUTION OF INTEGRATED PLANNING IN CURITIBA

To understand how Curitiba became a successful transit metropolis, with a world-class bus network and transit-oriented built form, one must first track the evolution of joint transportation and land-use planning over the past half century. There were three key periods. The first was the formation of comprehensive visions about Curitiba's future, leading to the establishment of bedrock planning principles that have guided development decisions over the ensuing years (1943-1970). This was followed (1972-1988) by an active period of plan execution, highlighted by the implementation of the Integrated Transit Network (ITN). The most recent period (1989-present) has witnessed the refinement and differentiation of regional transit services, the most significant action being the introduction of high-speed express services (locally referred to as "direct line" services) and high-capacity tube stations.

Curitiba's present settlement pattern and transportation system are not the result of a one-shot visionary plan or a string of fortuitous and lucky events. Early master plans set out broad visions of the future. Actual implementation occurred in small steps, often in fits and starts and on a trial-and-error basis. Mistakes were made, providing lessons that were later put to good use. By keeping the urban development process simple and transparent, as well as emphasizing low-cost, fast-turnaround solutions to problems, Curitiba has been able to get things done quickly, thus creating momentum and establishing political credibility. According to Jaime Lerner, the popular three-time mayor of Curitiba and current Governor of Parana province who is widely credited for many of Curitiba's innovations, "simplicity is our system" (Brooke, 1992, p. A4).

It is tempting to try to distill Curitiba's many lessons into a set of prescriptions that can be transplanted elsewhere. Rabinovitch and Hoehn (1993, p. 2) note:

A city should not be regarded as a turn-key model for reproduction elsewhere. Cities are too different in context and resources for wholesale adaptation. The Curitiba experience, however, does demonstrate how significant improvements may be accomplished incrementally and at relatively low cost. The transportation system continues to struggle with the challenges of growth and change. The difference in Curitiba is that there is a continual effort to upgrade equipment, to improve the system, and to offer greater convenience and quality to passengers.

Forming Planning Visions and Principles

1943 Agache Plan

In anticipation of the post-World War II building boom that was to follow, Curitiba's first comprehensive plan was crafted in 1943 by a French urban planner, Alfred Agache. A central premise of this plan was that automobile traffic would grow exponentially and that grand boulevards radiating from the central core were needed to accommodate traffic increases. In the French Haussman tradition of monumental public works projects, the Agache Plan called for massive infrastructure investments, including a large overpass that would span across two squares in the downtown core while leveling some of Curitiba's oldest buildings. A proposed widening of the city's main thoroughfare to 60 meters would

have required that virtually all buildings along the corridor, including some of the largest and oldest homes in the city, be razed. The Agache Plan sought to strengthen Curitiba's core by building radial avenues that linked downtown with the rest of the city as well as concentric ring roads, creating a hub-and-spoke road system. The plan's assumption that Curitiba would be besieged by automobiles seemed well-founded. This was a period of extremely cheap oil when Brazil was seeking to become a world leader in automobile manufacturing. The city was prospering and, many believed, was on an urban development pathway similar to São Paulo's, the nearest of Brazil's emerging megalopolises.

1965 Curitiba Master Plan

In reality, the city never had the money to implement the Agache Plan. The plan did, however, increase public awareness about the need to orchestrate future growth in the wake of rapid post-WWII expansion. With the financial support of the state's Development Bank, civic leaders organized a plan competition among local architects and planners that led to the adoption in 1965 of the Curitiba Master Plan. The new master plan broke away radically from the circularly conceived city of the 1943 plan. Curitiba would no longer grow in all directions but rather along designated axes. Curitiba was to become a linear city. The city's downtown and historic sector would be partly closed to vehicular traffic and given back to pedestrians. Unlike the earlier plan that required most cross-town trips to go through the center, the new plan treated the downtown as a hub and terminus. And most importantly, mass transit, versus the private automobile, was to become the primary means of conveyance within the city.

It was this notion that Curitiba would meet the mobility needs of people rather than automobiles that set its master plan apart from others. At the time, most Brazilian cities were being planned for cars, epitomized by the spaciousness and extensive highway grid of the nation's master-planned capital, Brasilia. By the 1960s, central Curitiba was showing signs of overcrowding and serious traffic congestion. In an attempt to avoid replicating the sprawling landscape of São Paulo and other megacities, the master plan sought to channel overspill growth along what was initially two and would eventually become five "structural axes." These were integral elements of the plan that stood in marked contrast to the radial avenues of the previous plan. The radial avenues of the earlier Agache Plan would have produced a uni-directional, tidal pattern of commuting from low-density outskirts to the downtown core. Under the new plan, the linear corridors, or structural axes, would become the main catchments for new development, vis-à-vis the core. These corridors would function as high-density pathways for new growth. This would lead to more balanced, bi-directional traffic patterns, and thus help sustain a municipal transit system (by keeping buses full in all directions). The core itself would be preserved primarily for pedestrians and transferring transit passenger, with automobiles relegated to a second-tier status.

The goal of creating a linear city spawned the guiding principle that urban development, mass transit services, and hierarchical road networks must be closely integrated and harmoniously planned. The primary tool for creating structural axes would be exclusive busways. Main transit lines would form the backbone of the new metropolis. Also within the structural axes would be a hierarchy of high-capacity lanes for automobile traffic (and eventually express, direct-line bus services) as well as auxiliary lanes for adjoining land

uses. Through zoning laws, little new development was allowed downtown; instead, mixed-use development was promoted along the transit-served structural axes, with densities tapering with distance from the busway.

It is important to note that in Curitiba, larger land-use objectives drove transportation decisions, and not vice-versa. Planners and civic leaders first reached agreement on what physical form the city would take -- a linear one that would achieve more balanced growth and preserve the social and cultural heritage of the central city. Realizing the "derived" nature of travel demand, transportation decisions were then made to reinforce land-use objectives -- namely, building axial transitways that would help guide and serve the linear growth. Thus, while land use and transportation planning were carefully coordinated, it was this collective vision of Curitiba's ideal future settlement pattern that took precedent and eventually lead to the decision to build a transitway.

Besides the principle of integrating transportation and land-use planning, the Curitiba Master Plan and subsequent revisions also called for a cultural, social, and economic transformation of the city. Changes that were achieved over time included: a revival of the city center as a cultural center and meeting place; preservation of historical buildings; creation of public squares and parks throughout the city; solid waste recycling; and the formation of the Curitiba Industrial City on the western outskirts (an area of 40 square kilometers currently with over 400 clean industries, including electronic firms and automotive assembly plants).

Plan Implementation

The first serious steps toward implementing the Curitiba Master Plan were taken in 1971 with the election of Jaime Lerner as mayor. Prior to this, Jaime Lerner served as President of the Curitiba Research and Urban Planning Institute (IPPUC), the organization created in 1965 to implement the master plan.³ Only after Lerner's election was IPPUC given the power, resources, and political mandate to put the plan into practice. Lerner quickly proved himself a visionary, willing to challenge conventional wisdoms, to take risks, and to try new experiments in urban planning.

The importance of Jaime Lerner's strong and decisive leadership in seeing Curitiba's plan through to implementation cannot be overstated. From 1964 to 1979, Brazil was under a military dictatorship. National policies favored large infrastructure projects financed through foreign loans, which at the time meant most Brazilian cities were building motorways and viaducts to accommodate cars and trucks. The "bigger is better" philosophy prevailed. Most observers viewed initiatives which sought to restrain the automobile as leftist politics and tantamount to political suicide. Press censorship left but one outlet for criticism and creative expression: local administrations. To gain credibility and establish momentum, Lerner's philosophy was to do things simply and quickly, which generally also meant at a low cost. Brazil's tenuous political situation demanded this.

Reclaiming Downtown

Once Lerner took office in 1971, the fastest, simplest thing that could be done in implementing the master plan was to convert downtown streets to pedestrian ways. As Lerner (1992, p. 14) tells it:

On a cold, icy night in the winter of 1972, from Friday to Saturday, an army of strange-looking silhouettes surrounded the accesses to the main street in downtown Curitiba. The first ones to arrive were armed with wooden horses bearing the inscriptions "Traffic Not Allowed," and signs indicating alternative routes. Those who came next....started to methodically destroy the asphalt pavement of the main street with picks, electric power-drills and mechanical shovels.

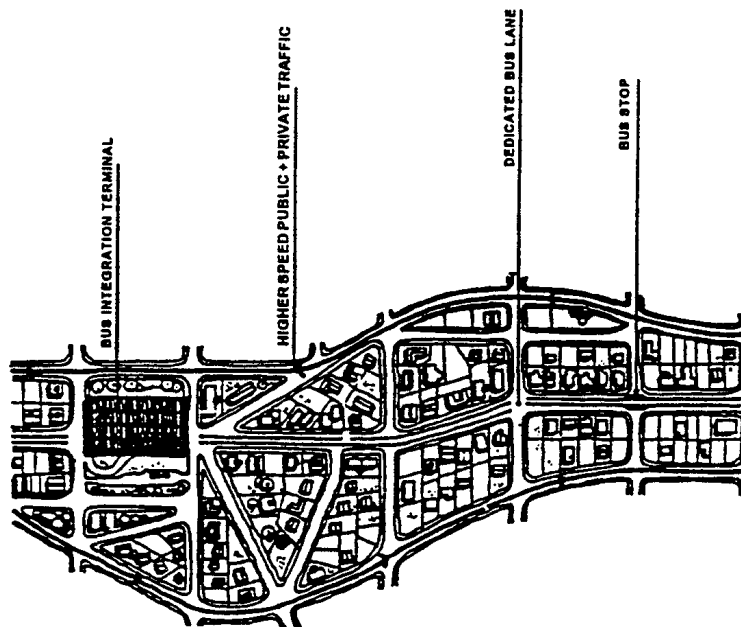
This "surprise attack" to transform Curitiba's main thoroughfare, XV of November Avenue, into a pedestrian-only street had been carefully planned for over a year. Soon after lodging protests and threatening to file lawsuits, shop owners noticed sharp increases in retail sales and quickly became allies; merchants in other sections of downtown began demanding that their streets be turned over to pedestrians too. The theater continued. A band of automobile supporters planned a motorized invasion of the pedestrian streets that would retake them by force. The city administration reacted through passive resistance: when the cars arrived, the street had become a promenade, crowded with children drawing and painting an immense ecological mural that stretched nearly the entire length of the street. Over the past twenty years, it has become a tradition that on Saturday mornings, children take over the XV of November promenade.

From these early beginnings, Curitiba's ped-way system has expanded to 49 downtown blocks, clogged on any given day with shoppers and strollers. Other initiatives taken to improve the downtown environment during Lerner's first years in office included refurbishing historical buildings, expanding programs in support of local arts and culture, and upgrading parks and public squares.

Trinary Road System

A pivotal step towards creating Curitiba's structural axes was the development of the trinary road concept to integrate mass transit, roadways, and land uses. Figure 53 provides an overhead perspective of the trinary road concept. In the center are two restricted lanes dedicated to high-capacity buses. Buses feed into transfer points, called "terminals" in Curitiba (even though most are not at the end of a line), where convenient connections to feeder and cross-town buses can be made. The central busway is flanked by two local one-way roads that function as auxiliary lanes, providing direct access to buildings fronting the busway. Running parallel to the central axis, a block away, are high-capacity one-way streets heading opposite directions. As discussed later, these one-way couplets would eventually be enlisted by Curitiba's transit planners to accommodate limited-stop, "direct line" (or what in the U.S. would be called "express") bus services. These one-way streets also define the perimeter boundaries of the structural axes. As envisaged, trinary roads stretch the entire length of most structural axes, a distance of some 10 to 15 kilometers from the core.

Figure 53. Layout of the Trinary Road System



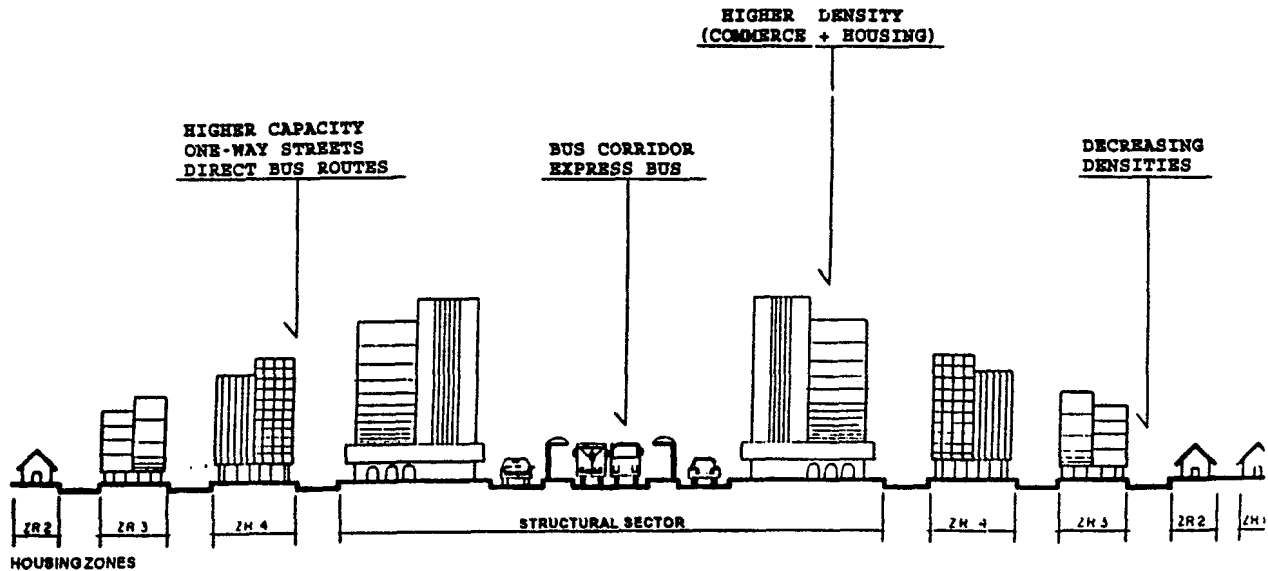
Sources: IPPUC; Rabinovith and Hoehn (1993)

Figure 54 reveals how mass transit services and hierarchical roadways were physically integrated in a complementary way. The third important element of the trinary road concept is land use, whose integration is portrayed by the cross-section shown in Figure 54. Directly fronting the main transit corridor are high-rise buildings, typically with retail-commercial uses on the ground and second floors, and either housing or offices (or sometimes both) on remaining floors. These buildings typically cover the entire block sandwiched between the busway and one-way streets, and thus wholly make up the land uses within the structural axes. The two most important features of the trinary system's built environment are density and mixed land uses. High densities pack enough trip origins and destinations along the dedicated transitway to sustain frequent, high-capacity mainline bus services. And mixed land uses guarantee that buildings will both produce and attract transit trips -- that is, there will be balanced, two-way flows along the transit lines. Having comparable directional splits was identified as essential toward maintaining a financially viable transit system early on, and mixed land uses were viewed as the best way to assure this. The trinary scheme is arguably the purest example of integrating transit and land use anywhere.

Outside of the structural axis, but within easy walking distance of the main transit lines, is a "housing zone." Residential densities fall off with distance from the busway. On the outer sides of the one-way trinary couplets are mid-rise (8-12 story) condominium and apartment towers. The next roads out from the one-way couplets are local streets, with low-rise garden apartments and condominiums (3-5 stories). And farther out, most residences consist of zero lot-line structures (e.g., row houses, duplexes) as well as single-

family detached units. While predominantly residential, these zones permit some neighborhood retail uses (e.g., small groceries and drug stores).

Figure 54. Hypothetical Cross-Section of the Trinary Road System



Sources: IPPUC; Rabinovitch and Hoehn (1993)

The trinary concept is careful to ensure that land uses and roadways are compatible. Land uses that benefit from exposure and busy traffic, namely retail shops and consumer services, are placed on the ground and first floors of the auxiliary lanes and one-way couplets. High-volume roads are buffered from low-density residential neighborhoods by higher rise buildings. Low-volume local streets help preserve a sense of place and attachment to neighborhood.

In his manuscript on *Curitiba: The Ecological Evolution*, Jaime Lerner (1992, p. 16) pays tribute to the trinary road concept:

First, it preserved the scale and memory of the city -- instead of a highway within the city, (there are) three streets of normal size and width, each with its own functions, its specific "philosophy." Secondly, the greatest obstacle to the implementation of the express-bus system was precisely the lack of space for the construction of exclusive lanes Finally, it was possible to implement, within a year's time and at perfectly acceptable costs, practically 20 kilometers of the trinary system.

Lerner also argues that, given Curitiba's phenomenal rate of growth at the time, by guiding urban development as opposed to leaving it up to the whims of the private real estate market, the trinary system helped to keep land speculation in check. That is, private

developers knew precisely where they could build high-rise office towers and where they could not. Reducing land speculation not only helped keep the price of housing purchases in line with the budgets of the middle class, but also economized on the cost of extending new infrastructure and community services.

Interestingly, the trinary road concept partly owes its existence to the 1943 Agache Plan that called for 60 meter-wide radiating boulevards. The city had acquired the necessary rights-of-way along a number of corridors in anticipation of one day building super-wide roads. However, there was no money to do so. Fortuitously, public ownership of land along main thoroughfares gave birth to the idea of creating an integrated corridor of transit, roadways, and compatible land uses within the 60 meter rights-of-way, as opposed to 60 meters of continuous pavement. Thus, quite by accident, the Agache Plan served the useful purpose of encouraging land banking. Without the initial plan to build grand boulevards, the rights-of-way necessary to accommodate the trinary system and create a linear city would not have been available.⁴

It is also interesting to note that the trinary concept embraces the idea of hierarchical roads, something which the "new urbanism" movement and proponents of neo-traditional neighborhood designs steadfastly reject (Katz, 1993). New urbanists consider uniform grid street networks to be more pedestrian friendly because they require cars to stop frequently and shorten walking distances. They also, however, usually require more roadspace per square foot of land area than hierarchical networks (Moundon and Untermann, 1991). In Curitiba, hierarchical roads were viewed as being compatible with the hierarchy of land uses, urban densities, and transit services that co-exist along trinary corridors. With the trinary scheme, all roads and transit lines operate at-grade, meaning there are no huge overpasses and flyovers that dwarf pedestrians or splinter the trinary corridor and its adjoining neighborhoods.

Integrated Transit Network

By mid-1974, the first 20 kilometers of exclusive bus lanes were opened. The trinary road system was beginning to take form and Curitiba had taken its first steps toward creating a consolidated and integrated transit system. Prior to this, there was a loose confederation of competing private bus companies operating in Curitiba. Most competed for the most lucrative markets, running buses along the busiest streets to downtown. The confluence of buses increased downtown traffic congestion.

Early on, the Lerner administration wrestled with the choice of continuing with a surface-bus system or constructing a capital-intensive rail network. It opted for bus transit, with exclusive-lane mainline services, on the grounds that rubber-tire services were more appropriate for a medium-sized third-world city -- far cheaper and more adaptable. This was consistent with Lerner's philosophy of doing things quickly and at a low cost as a means to gain legitimacy. A surface bus system was also viewed as organic -- it could be built incrementally in pace with Curitiba's rapid growth. It could also operate on preexisting roads.

In 1974, Curitiba's 20-kilometer exclusive busway formed the first north-south spine of the linear city (Figure 55). What was called "express bus" services operated on the busway, even though express bus stops were spaced around a half kilometer apart. (Regardless,

the term "express bus" is still used to describe these services.) Some 45 kilometers of feeder buses tied into the two busway termini. Average weekday ridership on the entire system was around 45,000 passengers. By 1978, a third busway was opened along the southeast corridor, forming a new structural axis.

In 1979, the concept of the Integrated Transit Network (ITN) was born to better serve cross-town trips. In response, interdistrict buses which encircled the city were put into service. The initial route, a 44 kilometer circuit, intersected the three exclusive busways at intermediate stations. By the end of the seventies, the ITN had 9 intermediate and terminal stations where customers could transfer between feeder, express, and interdistrict routes. Daily ridership had surpassed 200,000. By 1982, four concentric interdistrict routes served the city: one close to the center, the second a little farther out, the third even farther, and the fourth reaching out almost to the municipal boundaries. The 167 kilometers of interdistrict services were complemented by 294 kilometers of local routes and 54 kilometers of express bus services. Daily ridership had eclipsed the half million mark, more than twenty times what it was eight years earlier.

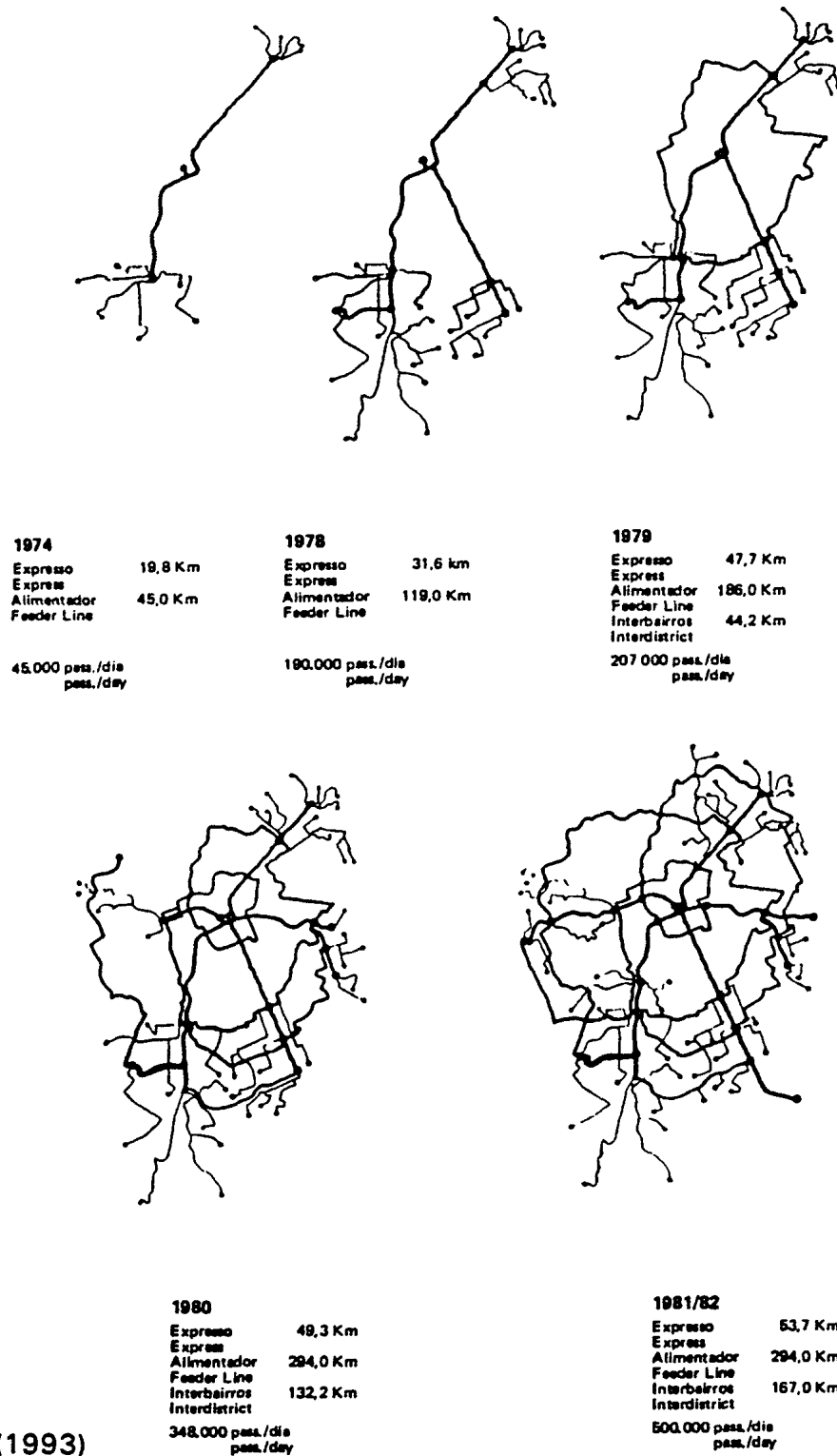
As Curitiba's bus system evolved, it required incremental improvements in fare payment, scheduling, and facility design to ensure the transferring process was fairly effortless. An important step in this direction was to design enclosed and secured transfer stations that functioned like subway stations. Besides boarding platforms, most stations today have benches, shelters, schedule information, and newsstands. The end stations (terminal de ponta) are larger than intermediate ones (terminal de meio) since they serve a larger ridership catchment as well as inter-municipal services (i.e., private buses that arrive from outside of Curitiba). End stations also have a wider assortment of retail concessions and passenger amenities. Inside stations, passengers are free to shop, chat, make a phone call, read a newspaper, and switch buses without having to pay another fare. Those who walk to stations from nearby neighborhoods enter a turnstile and pay attendants.

Service Refinement and Differentiation

By the mid-1980s, Curitiba's bus system had become a victim of its own success. Ridership was steadily rising and express buses were oversubscribed. Schedule delays became common. An initial response was to operate articulated buses, though this proved to be only a stopgap. New capacity unleashed new waves of demand. Along the inaugural north-south busway, convoys of articulated buses were hauling close to 10,000 passengers per lane per hour, volumes that begin to match the loads of many fixed-guideway rail systems. Strains on the system prompted Curitiba officials to consider converting express buses to rail services. Studies were carried out; however, capital costs were prohibitive.

In Curitiba's case, necessity proved to be the mother of invention. Unable to afford an underground metro system, Curitiba's transit planners came up with a new concept in bus service delivery that exploited the available capacity of the trinary road system and provided the passenger throughput of a rail system. The idea was to operate high-capacity buses on the one-way couplets paralleling exclusive bus lanes. Vehicles would only stop at transfer stations resulting in at most two to three intermediate stops. A key component of the system was the use of boarding tubes that would allow same-level boarding and alighting with fare payment occurring prior to the arrival of a bus.

Figure 55. Evolution of Curitiba's Integrated Transit Network



Source: URBS (1993)

This new transit service was called "Linha Direta," Portuguese for "Direct Line" service. The popular name, however, is "Ligeirinho," or "Speedy." Direct-line buses (with 110 passenger capacities) served by boarding tubes can serve 3.2 times as many passengers per hour as a standard bus route, and nearly 70 percent more than articulated buses operating on Curitiba's busways. True to Curitiba tradition, the direct-line service with boarding tubes was conceived and designed because it was far cheaper, faster, and less disruptive to build -- around US\$200,000 per kilometer, compared to an estimated US\$90- US\$100 million per kilometer for an underground subway system and US\$20 million per kilometer for a combined exclusive-lane/shared right-of-way light rail system.

Direct-line services were started in 1991 with four routes that paralleled busways; within the first year, these routes were carrying around 100,000 passengers per day. Because of the express, limited-stop service features, transit officials estimate that the Direct Line services provide an average of 15 minutes travel time savings for each segment of a work trip.⁵ Presently, Curitiba boasts 12 direct line routes serving over 225,000 daily trips, most siphoned away from exclusive (frequent-stop) busway lines. "Speedy" has become so popular that many bus lines are filled to capacity at nearly all hours of the day. Learning from past experiences, Curitiba's transit officials refrained from expanding direct-line services because they feared even more customers would switch from the busway lines. Instead, local officials have begun to expand the capacity of express (frequent-stop) services by operating bi-articulated buses (with capacities of 270 passengers), the first of their kind. By late-1995, over 100 bi-articulated buses were in operation. Curitiba officials are also currently studying the possibility of sometime within the next five or so years of converting exclusive busway operations to a rail system. The prospect of operating laborintensive convoys of bi-articulated buses would appear to justify such a conversion.⁶

The variety of transit service offerings along structural axes complement the variety of land uses and trip purposes. Those traveling longer distances, say from the outskirts to downtown, usually opt for limited-stop, direct-line services. Those traveling shorter distances, say from their residence to a shopping plaza along a structural axis, are more likely to ride exclusive (frequent-stop) busway services.

It is noteworthy that the transit planners who created Curitiba's direct-line services, as well as other system innovations, were trained as architects. The city's chief transit planner and head of the municipal transit organization, Carlos Ceneviva, was previously a Vice-Director with IPPUC, Curitiba's comprehensive planning organization. Having architect-planners run municipal transit operations has meant that service strategies have evolved with land use considerations in mind, and that many design-oriented solutions, like tube stations, were crafted to respond to day-to-day operational problems.

Summary: Evolution of a Linear Transit-Oriented City

The road to becoming a transit-oriented city was at times bumpy and uncertain. Curitiba's highly integrated and innovative transit network is the product of many ad hoc, incremental decisions -- most aimed at doing things quickly, pragmatically, and at an affordable price. However, guiding these decisions was an overarching vision of the future -- one of a linear city with well-defined structural axes that could accommodate much of the city's future growth and would physically integrate transit services, roadways, and

complementary land uses. Creating exclusive busways in the center of trinary roads, eventually supplemented by circular routes, transfer stations, and direct-line services with boarding tubes, has brought this vision closer to reality. Thus, while important decisions were made piecemeal, a clear vision of the future ensured that they added up to something meaningful. Add to this the political adroitness and dedication of Jaime Lerner and others, as well as fortuitous events (such as the availability of rights-of-way to accommodate the trinary system), and you have the ingredients for designing a linear, transit-oriented city like Curitiba.

7.4 LAND-USE REGULATIONS AND SUPPORTIVE POLICIES

While integrated planning, politics, and personalities account for much of Curitiba's successes, a number of specific public policy initiatives have also been taken over the years that all deserve some credit. Among these have been incentive zoning, housing development programs, parking policies, and employer-paid transit subsidies. These initiatives are discussed in this section.

Zoning Regulations and Incentives

Curitiba's creative use of zoning within and along the trinary structural axes has produced a "wedding cake" pattern of densities, as revealed by the cross-section shown earlier in Figure 54. Various bonuses are also granted that encourage land use mixing.

Mixed Commercial-Residential Zoning

Curitiba's zoning practices deserve much of the credit for creating a rich mix of storefronts lining transitways as well as attracting high-rise office and residential towers that have captured much of the overspill growth from downtown Curitiba. Nearly all parcels within two blocks of the trinary road system have been zoned for mixed commercial-residential uses.⁷ Densities of six times the plot size (i.e., Floor Area Ratios, or FARs) were initially permitted. In 1992, maximum FARs were lowered to five for office towers and four for residential towers, as discussed below, to deal with overspill parking problems and to adjust for the lower-than-expected ridership generated by high-rise condominiums. Higher densities are permitted for office use based on the experience that offices generate more transit ridership per square foot than residential uses.

For structures that directly face exclusive busways and auxiliary lanes, current zoning laws allows the first two floors to extend to property lines. This leaves 1.5 meters between buildings and street curbs for sidewalks. Zoning rules require that at least 50 percent of the ground and second floors be devoted to retail-commercial uses (e.g., shops, restaurants, and consumer services). Whatever floorspace is applied to retail-commercial use, moreover, does not count against permissible FARs. Thus, in practice nearly all of the first two floors of buildings that front transitways are devoted to retail shops and eateries. This typically means that buildings can go two stories above FAR maximums. Zoning regulations also requires that above the second floor, buildings be set back at least five meters from property lines. This reduces the amount of shadow cast on transitway, auxiliary lanes, and sidewalks.

Residential Zones

As discussed earlier, beyond the structural axes, residential densities taper with distance from transitways. Mixed-use development is encouraged through density bonuses. Between five and 10 percent of building space can be devoted to neighborhood commercial uses (e.g., bakeries, flower shops). Through these zoning practices, a more fine-grained mixture of uses has been achieved within the predominantly residential neighborhoods that flank Curitiba's structural axes.

Transfer of Development Rights

Within the Curitiba Historic Area, owners of historical buildings are allowed to sell and transfer their development rights to property owners elsewhere in the city. This has both served to protect historically significant buildings and to transfer densities to locations where they are most beneficial, such as structural axes. Many of the density transfers have gone to parcels within the structural axes because these properties receive extra bonuses.

Transit-Supportive Housing Policies

Through land acquired along or close to structural axes, the city of Curitiba has been able to direct new community-assisted housing to transportation corridors. In all, housing for 17,000 lower-income families has been built near transportation corridors over the past 25 years (Rabinovitch and Leitmann, 1993).

Another transit-supportive housing initiative has been the "buy up" program. Since 1990, through the Municipal Housing Fund Act, developers can "buy up" to two extra floors of residential buildings by contributing to a low-income housing fund. Contributions go to the municipal housing authority, COHAB, which channels the money as housing assistance for poor families. Contributions are set at 75 percent of the market value of the extra building area provided. To date, these density bonuses have only been granted to residential parcels that lie within walking distance of the transitway -- i.e., where existing infrastructure can support the higher residential densities. During its first four years, the program generated around US\$2 million in funds, most of which went to site and services improvements on parcels owned by poor households, some near the transitway, though most on the outskirts where Curitiba's poorest neighborhoods are located.

Siting of Shopping Centers

The location of any proposed shopping center in Curitiba must first be approved by IPPUC, the municipal planning authority. Since 1970, the only large-scale shopping centers permitted have been those built within structural axes. Plans to build several large American-style shopping malls on the city's periphery have been rejected. These policies have not only strengthened structural axes by channeling new retail growth to transit-served corridors, but have also helped retain the vitality of downtown Curitiba by prohibiting auto-oriented retail centers from proliferating.

Impacts on Urban Development Patterns

The cumulative impacts of Curitiba's integrated planning of transit, land uses, and road space on the city's built form can be most appreciated from a bird's eye view. As envisaged in the 1965 Master Plan, Curitiba has become a linear city (see Figure 56). High-rise mixed-use towers hug the transit way, surrounded by lower-density residential neighborhoods. The boundaries between neighborhoods are clearly defined, commercial centers stand out, and protected green areas dot the landscape.

Figure 56. Curitiba's Western Structural Axis, Looking from Observation Tower



The most built-up areas of the structural axes lie just beyond downtown: on the southern axis, some five kilometers in length (between the Guadeloupe and Agua Verde transitway stations); on the northern axis, around two kilometers in length (up to the Cabral station); on the western axis, stretching over four kilometers (from the 29 de Marco to the Campina do Siqueira stations); and on the eastern axis, around one kilometer in length (just beyond the Rodoferroviaria, or main inter-city bus station). In 1992, nearly nine percent of Curitiba's population resided within one of the four high-density structural axes. Another 30 percent of the population lived within two or three blocks of the structural axis. In contrast, little development has been allowed or has occurred on the southeast axis because this area is flood-prone. Rather than guiding growth, the southeast corridor functions mainly to connect low-income households in low-density areas to the central city.

Many of the households living in the condominiums along Curitiba's structural axes are of upper-middle income and higher income brackets. Generally, household incomes rise along the structural axes with proximity to downtown. The high premium placed on proximity to commercial and cultural amenities in the core have driven up housing prices close to downtown. Given their incomes, it is no surprise that households along the structural axes have the city's highest vehicle ownership rates and generate relatively few transit work trips. Although no formal survey data are available to confirm this, the low boarding counts at bus stops along some of the denser residential portions of the transitway suggest ridership rates among affluent households are relatively low. Besides having automobiles available to get to work, low transit usage could also reflect the fact that most express and direct-line buses are generally full once they reach closer-in areas and that the flat fare of around US\$0.40 penalizes short trips.

It is odd that Curitiba's structural axes have generally attracted the very households that are unlikely to patronize transit to get to work. Curitiba officials believe that the transitway does attract higher shares of non-work bus trips among those living in the structural axes, such as trips to downtown shops and cultural events. It is hoped that by expanding capacity along the transitway (e.g., using bi-articulated buses) and restraining parking downtown, that the transit modal splits of those residing within the structural axes will increase with time. Still, it appears that income, versus density, is a more dominant factor in influencing travel choices along Curitiba's structural axes.

Other Transit-Supportive Policies

Besides land-use regulations, other public policy initiatives have helped shape travel demand in Curitiba. One example is parking policies. In downtown, the only public parking available is along streets, in limited areas. Curbside parking is restricted to two hours, and time limits are vigorously enforced. All off-street parking spaces are privately owned and expensive. The number of on- and off-street spaces have steadily increased over the past decade, though nowhere near as fast as vehicle ownership. In mid-1995, there were over a half million registered cars in Curitiba, up an astonishing 20 percent from one year earlier. This explosion in vehicle ownership is mainly due to the revaluation of the Brazilian currency, the Real, that has fueled consumer spending since mid 1994. While Brazilian officials have discussed levying higher registration fees and import duties as ways to curb the growth in vehicle population, auto-disincentives are highly unpopular and politically risky. Most observers agree that carrots, like Curitiba's integrated transit system, are preferable to sticks.

Outside of downtown Curitiba, on-street parking is generally prohibited on all except local streets, where it is free. Within structural axes, the city imposed no parking requirements until the early 1980s. Developers could build thirty-story skyscrapers with no parking. In practice, off-street parking was supplied, though at far lower levels than found elsewhere in the city. Since higher-income households owned most of the condominiums along the transitway, parking demands quickly outstripped supplies, and parked cars began spilling over into surrounding neighborhoods. In the early 1980s, the city imposed the same parking standards as elsewhere in the city. For residences, this meant at least one parking space per dwelling unit. Even retail shops within the structural axes today face the same parking standards as retail plazas on the periphery of the city. In fact, retail parking

demands in outlying areas tend to be less than along transitways since poor households without cars generally reside on the outskirts and shop nearby. Curitiba planners struggle with the paradox that outside of downtown, the highest parking demands per unit of land area are in the high-density, transitway corridors. Income, not urban density, is clearly the determinant of parking demand in Curitiba.

A national policy that has benefited mass transit mandates that employers subsidize a portion of their workers' transportation costs. Brazilian law establishes that, as a norm, 20 percent of personal income should go towards covering transportation expenses. This law also stipulates that no more than six percent of what a wage-earner brings home should be spent on transportation. Any amount above this, up to the 20 percent ceiling, must be paid by employers. As a result, transportation allowances have become a standard practice in Brazil, particularly among low-skilled, low-paid jobholders. (Most professionals and skilled workers spend less than six percent of gross earnings on monthly transit fares, and thus receive no employer subsidies.) In Curitiba, employers are the primary purchasers of bus tokens. At the time they pick up their pay checks, many workers also receive a packet of tokens to last the month.

7.5 RIDERSHIP AND PERFORMANCE BENEFITS

Ridership Benefits

The ultimate measure of the success of Curitiba's impressive transit system is ridership, and in particular the number of passengers who switched over from driving cars. Traffic relief and environmental improvements depend on luring motorists to transit, ideally at a reasonable cost.

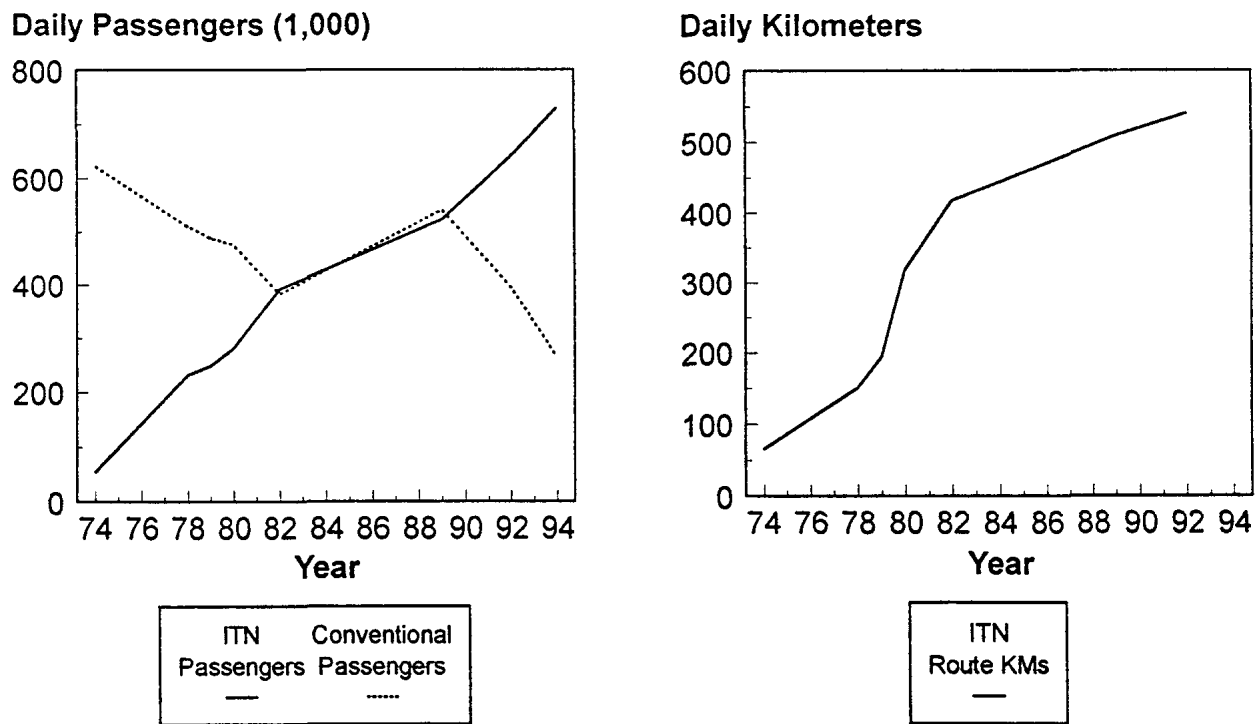
Figure 57 shows changes in ridership and route kilometers of service over the 1974 to 1994 period. During this twenty year span, there was a dramatic shift in transit's ridership base -- from conventional to integrated services (i.e., express, direct-line, interdistrict, and feeder). The rise in ITN ridership -- from 45,000 passengers in 1974 to 730,000 passengers twenty years later -- closely parallels the increase in ITN route kilometers of service -- from 65 to 540 over the same period.⁸ (Route kilometer data were unavailable for conventional services.) From 1974 to 1994, ITN ridership grew by an average annual rate of 15 percent. ITN's market share rose from 8 percent to over 70 percent during the same period. Express buses accounted for most of the growth in the 1970s, feeder and interdistrict services in the 1980s, and direct-line services in the 1990s. Rabinovitch (1992) estimates that nearly two-thirds of Curitiba's population patronize public transportation each day.

The best evidence of the impact of Curitiba's transit network on traffic and environmental conditions comes from a survey of those patronizing direct-line services. The survey, conducted by the Bonilha Institute in 1991, found that within a month of initiating services, 28 percent of those commuting on "speedy" bus runs previously drove their car to work. Using this finding and Curitiba's per capita transit usage statistics, Rabinovitch and Hoehn (1993) estimate that the ITN has reduced automobile usage by some 27 million trips per year and has saved some 27 million liters of fuel annually.⁹ According to Rabinovitch (1992, p. 66), "Curitiba's public transportation system is directly responsible for the city having one of the lowest rates in ambient air pollution in Brazil."

High rates of transit usage and reasonable fares (made possible by efficient operations) have yielded another benefit: low per capita transportation expenditures. Currently, residents spend only around 10 percent of their incomes on transportation, which is a relatively low proportion in Brazil (Rabinovitch, 1992).

An important ridership benefit of mixed-use development, particularly along structural axes, has been a balancing of directional splits. In 1970, when conventional buses serving downtown dominated Curitiba's transit services, 90 percent of buses operated in the peak direction. Today, directional splits are 60:40. With trip origins and destinations aligned along structural axes, near-empty buses have become a thing of the past. Surveys also show that only 45 percent of express bus passengers go downtown. This further substantiates that integrated transportation and land-use programs have decongested downtown and lead to more efficient, bi-directional traffic flows.

Figure 57. Trends in Ridership and Route Kilometers Among Service Types, 1972-1994



Performance Comparison with Other Brazilian Cities

Peer comparisons with other Brazilian cities underscore the success of Curitiba's transit system -- services are intensively used and efficiently provided.¹⁰ Despite the caveat that cities differ in topography and financial resources, comparisons among Brazilian operators are insightful if used as general benchmarks. Since Curitiba has among the highest per

capita incomes and automobile ownership rates in Brazil, one can rule out any distorting effects of income and vehicle availability on its ridership rates. That is, Curitiba is a transit success story in spite of high average incomes and auto ownership rates.

Table 18 compares characteristics of Curitiba's transit system with those of six other Brazilian cities -- three larger, two (Fortaleza and Brasília) the same approximate size, and one smaller than Curitiba. Belo Horizonte and Curitiba averaged over 200 (linked) passenger trips per capita in 1990 -- almost 30 percent higher than São Paulo (which has a rail system). They achieve this partly through more intensive services -- around one bus per 1,000 residents -- with one exception. The one exception is the heavily automobile-oriented, master-planned national capital of Brasília, which, on a per capita basis, averages around 15 percent more buses yet serves 40 percent fewer transit trips.

Table 18. Comparisons of Transit Services in Brazilian Cities, 1990

<u>City</u>	<u>Population (Millions)</u>	<u>Transit Journeys Per Capita</u>	<u>Fleet Buses Per 1000 Inhabitants</u>	<u>Route Kilometers Per 1000 Inhabitants</u>	<u>Kilometers Traveled Per Route KM (1000 KM)</u>	<u>Passengers Per KM Traveled</u>
Belo Horizonte	3.8	208	0.98	2.47	30	2.77
CURITIBA	1.6	202	0.97	0.76	74	3.59
Fortaleza	1.6	184	0.61	0.96	53	3.58
São Paulo	16.0	158	0.66	4.09	--	--
Santos	0.6	140	0.47	1.79	--	--
Brasilia	1.6	129	1.15	--	--	2.42
Porto Alegre	2.7	120	0.58	--	--	--

Sources: Bushell (1993), and Rabinovitch and Hoehn (1993).

Where Curitiba and Belo Horizonte markedly differ is in terms of service coverage. Belo Horizonte's services are geographically far more expansive. Curitiba, on the other, has the fewest route kilometers of the five cities for which data were available -- even compared to Santos, a much smaller city. This finding reflects two factors: as a linear city, Curitiba's market areas are concentrated and clearly delineated, thus supporting intensive mainline services; and the existence of an integrated, carefully planned system that maximizes efficiency and avoids duplication.

The last two columns of Table 18 further highlight the efficiency of Curitiba's transit system. Buses are deployed more than twice as intensively on Curitiba's network as Belo Horizonte's. This, in part, accounts for Curitiba's 30 percent higher passenger load per bus kilometer traveled. On a vehicle kilometer per capita basis (not shown in the table), Curitibaanos actually receives 25 percent less service -- 56 kilometers per capita in Curitiba versus 75 kilometers per capita in Belo Horizonte. Overall, Curitiba's integrated network

allows it to provide more frequent services, spend fewer resources, and generate higher ridership rates.

7.6 CONCLUSION

Curitiba has a highly integrated system of land use and transit that has shaped the way the region has grown and supported some of the highest per capita ridership levels anywhere. Civic leaders set a vision, built community support, and proceeded to implement, step-by-step, a highly innovative and integrated transit network that is today the envy of many. Importantly, policymakers started out with a vision of the city's ideal future settlement pattern -- a predominantly linear one -- and proceeded to grow an integrated, trunk-and-branch transit network that complemented this vision. Thus, land use and community development objectives, coupled with a fiscally-responsible desire to hold costs down, determined the types of transit technologies selected and kinds of services delivered.

Early on, the goal was to transport people rather than move cars. Instead of starting off with some pre-conceived idea of a transportation "solution," city leaders instead asked what would be the most cost-effective transport investments that are consonant with building a linear city as well as the goals of preserving the inner core, improving environmental quality, and keeping costs reasonable? This led to conceptualizing transportation as part of an integrated system -- one linked to housing, land uses, road networks, mixed-use commercial districts, historic preservation, and public spaces. In more concrete terms, it led to the designation of structural axes, to the creation of trinary road systems, to the construction of dedicated busways, to the building of mixed residential-commercial towers along busways, and eventually to the implementation of an integrated transit network.

A willingness to experiment and take risks, tempered by a desire to get things done quickly and cheaply, led to many successes -- the creation of trinary roads, introduction of zoning bonuses, and the initiation of direct-line services that tie into boarding tubes. Luck also played a role. Having generous amounts of preserved rights-of-way, acquired under the original plan calling for Parisian-style radiating boulevards, for example, gave rise to the trinary road system. However, it was bold and utopian visions matched by sheer determinism and cleverly designed programs, more than anything, that brought Curitiba's integrated transportation and land-use system to life.

More generally, Curitiba offers important lessons in urban management. One lesson, preached often by former mayor and now Governor, Jaime Lerner, is to keep things simple. Curitiba set off with a small set of long-range goals. These goals then served as guides to three decades of incremental, pragmatic change. Rabinovitch and Hoehn (1993, p. 43) note:

From the outset, the planning process was pragmatic. It recognized financial and social constraints. Curitiba began with buses because it had buses. Rather than replace its bus system with a one-step, grand plan using a subway or rail system, Curitiba began with a series of small improvements. It first added a modest express route system with dedicated bus lanes. Over the course of twenty years, it sought out ways to improve and extend the system. The result is a surface system that provides the high quality service

of well-known underground systems at a much lower capital cost. These low costs mean that mass transit is entirely financed by passenger fares.

Experiences with creating a highly successful transit system have been put to good use in other areas of urban policy -- such as solid waste disposal, refuse recycling, refurbishing housing, open space preservation, and the greening of the city. In these areas too, the approach has been pragmatic in that it begins with real problems and practical solutions (Rabinovitch and Hoehn, 1993). For Curitiba, what matters most is that these small, incremental steps have summed to dramatic improvements in quality of life and put the city on a path to a sustainable future.

Notes

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1. 431 square kilometers equals about 166 square miles.
 2. These consist of unlinked transit trips (i.e., treating each segment of a multi-leg transit trip as a single trip). On a single-fare, linked transit trip basis, there were around 202 trips per capita in 1994. This is still among the highest in Brazil.
 3. Among the functions assigned to IPPUC were to review and update the master plan, prepare studies and projects for integrated development planning, create conditions for project implementation, and coordinate local planning with policies at a regional, state, and national levels.
 4. By the early 1970s, many main routes emanating from downtown Curitiba already had three parallel roads that, together, constituted 60 meters of right-of-way. During the post-WWII era, the city proceeded to extend and improve roads as Curitiba expanded outward, and the public rights-of-way established under the Agache Plan allowed these road improvements to be made, albeit at a much more modest scale than envisaged in the initial plan.
 5. Curitiba's transit officials estimate that workers patronizing Direct Line services save an average of one hour per day. This consists of four segments of a trip: from home to work in the morning; from work to home in the midday (for lunch); from home back to work in the early afternoon; and from work back to home in the evening. Thus, the average time savings per work trip segment is 15 minutes.
 6. If express services were converted to rail, existing articulated and bi-articulated bus fleets would likely be filtered down to other services, including inter-district runs. One scenario would be to convert some segments of inter-district lines to exclusive-lane operations.
 7. All laws governing land use are contained in the *Legislacao do Uso do Solo* (Land Use Legislation), a volume that contains the text of 14 municipal laws and 52 degrees passed to date.
 8. These are paid passenger weekday trips. Counting free transfers, there were around 1,345,000 weekday trips made on the ITN in 1994.
 9. These estimates assume 20 percent of ITN's ridership would have otherwise traveled by private automobile, an average vehicle occupancy level of 2, an average trip length of 7.5 kilometers, and an average fuel consumption of 1 liter per 7.5 kilometers.
 10. This section is drawn largely from Rabinovitch and Hoehn (1993).

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Abbreviations used without definitions in TRB publications:

AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
IEEE	Institute of Electrical and Electronics Engineers
ITE	Institute of Transportation Engineers
NCHRP	National Cooperative Highway Research Program
NCTRP	National Cooperative Transit Research and Development Program
NHTSA	National Highway Traffic Safety Administration
SAE	Society of Automotive Engineers
TCRP	Transit Cooperative Research Program
TRB	Transportation Research Board
U.S.DOT	United States Department of Transportation