Factors Influencing Land Development Around Rail Transit Stations

by

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Abstract

Many of the factors which have influenced development around transit stations over the past thirty years differ from those that shaped the nature of land development at the dawn of rail transit technology, 100 years ago. Rapid transit systems which have been built in the modern era represent investments in a mode of transport that nearly all other political, economic, institutional, and regulatory factors have been aligned to defeat. However, construction of a rail transit network does provide the opportunity to re-orient metropolitan area development in a manner which will take advantage of the travel efficiencies afforded by this transit mode and affect regional travel behavior and quality of life. This thesis examines the factors which have influenced development at over 55 transit stations built in the last 30 years in the Atlanta, Boston, Miami, Toronto, and Washington metropolitan areas.

A typology is constructed which classifies station areas based upon the "intensity" and auto- or pedestrian-orientation of surrounding development, and similar station areas are examined in terms of their development state both prior to station construction and at present. Station areas which exhibit "special" characteristics including "new town" development, urban renewal status, or proximity to a major institution are also examined. The analysis provides several significant implications for planning and developing new rail transit facilities. On a system-wide level, transit network design and station siting must consider the relationships between land uses in station areas and their trip generating behavior. Regional intermodal transportation strategies and policies must be coordinated on an institutional level so that highway, transit, and land use plans may also complement one another, and not undercut each other's effectiveness. Citizen input and individual station design play critical roles in facilitating or precluding potential area development. Although transit access may catalyze land development in a growing district, a new rail station alone is not enough to reverse poor station area economic and land development trends. In this case, a coordinated suite of supporting incentives and regulations must be employed to increase development opportunities.

Comprehensive plans form the basis through which other strategies and tools may be implemented. Effective methods for encouraging appropriate development include permitting construction on transit facility air rights, utilizing urban renewal and public land assemblage powers, and directing investment in properly designed public facilities towards station areas, while pedestrian and transit-friendly zoning guidelines, parking restrictions, tax incentives, and travel demand management programs can also help make transit a more favorable travel option. Experiences in the five case cities indicate that low and medium intensity mixed-use station areas are most likely to be able to be transformed into high intensity districts, while residential neighborhoods are least likely to foster intensification.

The lessons and implications of this research are applied to the case of the proposed Tren Urbano light rail system in San Juan, Puerto Rico. Recommendations are made for development strategies at each of the fifteen proposed stations in this system.

Thesis Advisor: Dr. Nigel H. M. Wilson
Title: Professor of Civil and Environmental Engineering

Acknowledgments

In the fall of 1990, midway through my five years of undergraduate studies at Purdue, I opened my mailbox one day to find a letter from the transportation program at MIT. This letter planted a seed in my mind about pursuing a master's degree in transportation, and the person who signed it was "Nigel H. M. Wilson." As my remaining years at Purdue passed, I had the opportunity to visit transportation programs at UC Berkeley and Northwestern, and I even spent a whole summer at the University of Texas in Austin. I expressed my interest in studying about public transit, and everyone I spoke to extolled the virtues of their program, but never failed to add "of course at MIT there's Nigel Wilson." I became more intrigued by this MIT program, and especially the transit guru with two middle initials. So I finally went to visit the renowned Institute in the spring of 1993—the last school visit on my list, and Professor Wilson was away on sabbatical! No fear, everyone said, Nigel is the one professor you wouldn't *need* to meet to make your decision to come here—he is *the* person to study with if you are into transit...

Over two years have passed since I made the fateful decision to come here, and I have never once considered regretting it. I am thankful and proud to have had the opportunity to study under Nigel, but even more so to have been able to know him and his family as friends. I can say sincerely that the glowing reputation that proceeded him was entirely true. My interest in the field of transit and transportation policy had come from my experiences as a bus and train rider, and as an urban dweller. Nigel has broadened my view to include many nuances of transit service provision from the operator's view, and has instilled in me great confidence in dedicating my professional career to the effective provision of public transport service. My experience with the Chicago Transit Authority last summer was that much richer for being able to view the agency through the lens of Nigel's Transit Operations and Planning class. I look forward to continuing pursuits in this exciting field, and a continuing relationship with the man who has skillfully and thoughtfully guided me through my academic and research endeavors while at MIT.

Fred Salvucci's conviction, moral integrity, dedication to improving the welfare of fellow citizens, sincere concern for transportation issues and the quality of urban life, and profound wisdom that he has acquired over thirty years of public activism and leadership has made him a mentor for many people including myself. Fred has also given me confidence that positive social change is possible, even in the presently troubled political environment. I am grateful for his contributions to my thesis, and my academic and professional development at MIT.

My thesis itself would not have been possible without the contribution of many, many individuals (some of whom don't even know it!), and I will attempt to recognize as

many as I can at this time. First, my mother, father, sister, and brother, have never once failed to support me in any way throughout my life, and I owe the largest part of my present good fortune to this fact. More pragmatically, the National Highway (ironic, isn't it?) Institute of the United States Department of Transportation made my studies at MIT possible through a "Dwight D. Eisenhower Graduate Transportation Fellowship." The vision of the U.S. Congresspeople who authorized funding for this program several years ago will be rewarded. Let us hope that more vision will be returning to Congress soon. I am grateful for the assistance of Ilene Payne and Judith Turner of NHI and Jackie Sciacca, Fellowship Coordinator of the office of the Dean of the Graduate School, who were most effective whenever issues arose related to my grant.

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I am deeply indebted to most of my friends here and elsewhere for reasons which are too numerous to mention, but which I will try to summarize: thanks to Bill Cowart, Joan Walker, Daniel Roth, and Tilly Chang, whom I first met when I visited MIT as a prospective student. It was my impression of them that gave me confidence that I would be returning to Boston after that visit, and their ensuing friendships have reaffirmed this initial feeling. The personal relationships I have developed with John Wilson, Nicola Shaw, Marty Schlenker, Jiang Chang, and Kazi Ahmed will continue throughout our lives, and I cannot imagine having experienced the MST program with a better class.

For making it more than clear that there is a real world quite independent of Building 1, I am thankful for my friendships with Nummi, Teresa Lau, Pam Prasarttongosoth, and Alan Shihadeh. For being there whenever I call at 2am (for the last 14 years!), Shaalu Mehra. For being there especially in the last 14 days: Produyt Dutt, Omar Baba, Marcus Fahimi, Rajesh "Shendi" Shenoi, Denise Brehm, Joe Bambenek and Mimi Murase. An finally, for providing ample reason to interrupt my thesis work to check email: Jeff "J. Scott" Schmitz <schmitz@utxvms.cc.utexas.edu>, Rieko Hase <rieko@gn.ecn.purdue.edu>, Kali Wyncott <kew3@lehigh.edu>, Ray Moore <rjmoore@utxvms.cc.utexas.edu>, Hyon-Hee Kahng <rice_cake@mail.utexas.edu>, Hohn Cho <hohncho@uclink2.berkeley.edu>, Mina Mazdai <mazdaims@ttown.apci.com>, and Doris F. Chang <chang@psyche.sscnet.ucla.edu>.

Dedication

This thesis is dedicated to the idea of the city, and to its realization in countless forms throughout the world. My work is particularly dedicated to those cities which have had the most significant impacts on my life and my views so far: South Bend, Indiana; West Lafayette, Indiana; Indianapolis, Indiana; Milwaukee, Wisconsin; Austin, Texas; San Francisco, California; Toronto, Ontario; Washington, D.C.; Boston, Massachusetts; and most of all Chicago, Illinois. I look forward to being inspired by the remainder of the world's great (and less notable) cities as my life progresses.

"We human beings are the only city-building creatures in the world. The hives of social insects are fundamentally different in how they develop, what they do, and their potentialities. Cities are in a sense natural ecosystems too—for us. They are not disposable.

Whenever and wherever societies have flourished and prospered rather than stagnated and decayed, creative and workable cities have been at the core of the phenomenon; they have pulled their weight and more. It is the same still. Decaying cities, declining economies, and mounting social troubles travel together. The combination is not coincidental.

It is urgent that human beings understand as much as we can about city ecology—starting at any point in city processes."

—Jane Jacobs, 1992

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Chapter 1

Introduction and Motivation

There was a time when transit-supportive design was as common to land developments as parking spaces are today. This chapter details many of the factors which have transformed most of urban North America from transit-oriented neighborhoods and downtowns into deserts of suburban parking lots and tract housing. Some of the societal costs of these policies are presented and several proposed remedies are examined. If a more transit-supportive urban environment is desirable, the policies which have led to our present state of development must be understood and addressed effectively. Ultimately several strategies will be needed to change the nature of our cities and suburbs, but one particularly appropriate technique should be optimizing the access provided by existing and proposed rail transit systems by pursuing the most desirable development strategies in their vicinities. Construction of rail transit in several North American cities has presented an opportunity to examine many strategies for influencing station area development, and the remainder of this thesis is dedicated to this pursuit.

1.1 Streetcar suburbs and the seeds of their demise

The "streetcar suburb" is a familiar model of early transit oriented planning. In the late 1800's and early 1900's, the parallel developments of a labor-intensive industrial economy in North America and massive immigration from foreign countries strained the traditional pre-industrialization concept of a "walking city"—where all personal needs could be reached on foot. Technological innovations of this industrial era were able to provide solutions to these problems, but they brought about an unprecedented change in the nature of cities. The advent of steam engine and electrical motor technology, advances in water and sanitary engineering, and steel wheel on steel rail traction allowed a shift from walking-based cities to mass transit-based cities. An entirely new form of urban environment took shape as frontier outposts and older towns grew into modern cities with the nascent mass transit technology.

The early urban transit lines fell into two categories, steam and electric powered "rapid" rail lines and horse and electric powered streetcar lines. These lines were able to carry commuters to and from new, less crowded "suburban" neighborhoods beyond the

city limits to the offices, stores, and factories of the central city. This type of transport system allowed the central city to be easily accessible to most of the regional population. In turn, downtown areas became the centers of commerce, government, and culture for their respective regions, and their significance and size increased dramatically. As transit lines were extended to open pastures just beyond the urban limits, the land adjoining the tracks was parceled off and sold to home builders. The new housing was generally purchased or rented by a growing middle class population, who left the crowded central city tenements behind to be occupied by new waves of immigrants.

Transit operators and land developers were well aware of the symbiotic relationship between transportation and land usage at that time. As the privately operated transit systems could only function profitably when their service areas were fully developed, the land along the railroads was often subdivided and sold by the railroad operators themselves to help finance additional construction and expand service. Development tended to cluster around the regularly spaced rapid rail stations, and paralleled the linear streetcar routes. In many respects, the early transit lines allowed each growing metropolis to become essentially a collection of "walking" villages connected by transit lines. As the mass transportation still required access by foot, all the new suburban residences and commercial establishments were within easy walking distance of the transit line, and the "pedestrian-oriented" nature of their design followed quite naturally. The absence of alternate access modes made such planning principles common sense. Wide sidewalks were standard features, street trees were a valued amenity, and storefronts pressed right up to the sidewalk and tended to cluster along streetcar routes—where the most potential customers could be found. Vestiges of this turn of the century pattern of urban design can still be seen along former streetcar routes and in the "railroad suburbs" of older cities.[1]

The early 1900s was also the era of another nascent technology—the automobile. The advent of assembly line production, successfully implemented by Henry Ford just ten years into this century, transformed both the nation's economy and the nature of urban and rural life. The auto and the first Federal Road Act of 1916 not only allowed farming families to escape the isolation that characterized this lifestyle during most of the previous century, but also established a precedent for federally funded highway improvements. In the cities, bicyclists were ironically leading the movement for local governments to pave the gravel and cobblestone streets to facilitate cycling.[2] Mass production and other technological innovations of the age made possible the manufacture of inexpensive consumer goods. A new managerial class of workers developed to market, distribute and

[1]See Meyer and Wade (1969), Warner (1962)
[2]Van (1994)

sell these products, and these people were eager to purchase automobiles of their own to drive on the newly paved streets.

Through the second and third decades of this century, development of streetcar systems ground to a halt while the direct and indirect costs of auto ownership fell and auto production and worker wages rose. Oil from the Southwestern US was becoming cheap and plentiful, and the urban environment began to make accommodations for the increasing number of cars. The abundant land beyond walking distance to transit was now available for development to the tastes of the car owning classes. Neighborhood design incorporated the concept of a rear alley and automobile garage—a technique adapted from the era of horse stables behind exclusive urban residences. Stoplights were installed, traffic police were hired, and streets were widened (often to the peril of wide sidewalks and shade-providing street trees) at public expense to accommodate moving and parked cars. Increasing auto use augmented the ridership woes of the street railways and was encouraged by this public provision of auto-oriented infrastructure and services which effectively subsidized the costs of driving. Public transit was operated primarily from passenger revenues and had to conform with burdensome local regulations which often required low fares and high frequencies which were not warranted by ridership.

In many other ways, the nature of an "automobile-compatible" urban environment began to impose costs on non auto users from a very early date. Although crowded by today's standards, the new "suburban" residences of the 1920s were often placed on lots at a much lower density than the tenements or even "garden-style" courtyard apartment buildings that clustered near the urban core or along transit lines. Consequently, the expense of constructing and maintaining sewer, water, electricity, and other urban services including police and fire protection for the new neighborhoods was borne disproportionately by the poorer residents of the denser neighborhoods. These misallocated costs were the first of many policies which would have the perverse effects of degrading the urban environment while creating financial incentives to own and use a private automobile. In spite of these early inequities though, most urban Americans of this era were still able to rely upon convenient and effective public transit service. Our cities did not turn into the auto dependent environments of today without further government policy intervention.

The new industrial capacity of the nation eventually outstripped the ability of Americans to consume the agricultural and manufactured products they were producing. Based on a model of continuous economic growth, the financial markets of the day eventually collapsed in 1929. As the era of the Great Depression unfolded, federal aid for provision of automobile infrastructure was looked upon as one way to reinvigorate the

economy. Not only did construction projects achieve high political visibility and employ large numbers of workers, but the car and the ancillary oil, rubber, steel, and cement industries were increasingly important and powerful parts of the national economy and saw the tremendous profits which could be garnered by putting more Americans behind the wheel. The potentially destructive effects of excessive auto use on the natural and built environment were not even conceived. Public transit, still a private industry in most urban areas, took an especially hard hit during the depression. In many cities, the transit operators became vulnerable to takeover by a number of General Motors affiliated companies who were set up to replace their antiquated streetcar systems with GM buses—a move widely regarded as lowering transit service quality.[3] Ironically, streetcar technology worldwide was making great advances at this time, but cities in the United States were being left behind. Over the same period, the federal government revived the moribund construction industry by insuring home loans through the Federal Housing Administration (FHA). This program succeeded in lowering interest rates and down payments while extending the length of mortgages, and encouraged millions of families to purchase new houses. However, the houses that qualified for FHA guaranteed mortgages were predominantly detached single family homes in the suburbs—a housing pattern that was anathema to effective transit provision, and a public policy that encouraged disinvestment in older urban property.

1.2 An auto-dependent society

When the United States entered World War II, oil and rubber were rationed and the nation's transit infrastructure was strained by record ridership; the years of deferred capital maintenance made the crowded ride even more uncomfortable. Rather than directing investment back into the worn out cities, postwar federal policies such as increased FHA funding, Veterans Administration mortgages, and mortgage interest tax deductions only exacerbated the deteriorating urban condition. The pent up demand for housing was almost exclusively accommodated by more detached single family suburban homes—by now the only fiscally prudent option for a large portion of the population. Auto ownership in these increasingly spread out neighborhoods became a necessity, and transit ridership plummeted. Many of the remaining private urban transit operators succumbed to bankruptcy, and were replaced by chronically underfunded public agencies. Meanwhile, generously funded federal highway aid programs, culminating in the 1956 Congressional approval of the Interstate Highway Act, were supported to fuel the auto centered postwar economy. The new discipline of traffic engineering replaced the art of urban design, and

[3]See Kunstler (1993) and Jackson (1985)

urban planners were reduced to approving zoning plans. Now that the automobile-oriented access infrastructure was being provided by the government, land developers had every incentive to take advantage of it and design their developments accordingly. Cul-de-sacs replaced sidewalks, crash barriers replaced street trees, commercial development was attracted to the busiest highways, and industry relocated to open fields in the hinterlands. Transit became the mode of last resort, and was stigmatized in the eyes of land developers by the social status of the people who still used it. Conventional wisdom dictated that no new development could be successful—even in established downtowns—unless it accommodated cars. Employer-paid parking was not treated as a taxable benefit and merchants paid for "free" customer parking, thereby hiding these costs from motorists, penalizing non-motorists, and creating yet more financial incentives to drive.[4] Almost universally, new developments in the US soon accommodated cars to the exclusion of all other modes—walking, bicycling, *and* transit.

By the late 1960s, the new auto-centered urban form had changed the way (now primarily "sub"urban) people interacted with their families, their neighbors, and their communities. The neighborhood street, a historical center for socializing and organizing among friends and strangers of all ages, was no longer a hospitable climate for human interaction. First, contemporary traffic design standards ruled out the possibility of creating narrow or short residential streets with sharp turns, on street parking, and shade trees—all features that might make it a desirable public space for engaging in social activities. By putting the speed and "safety" of the motorist ahead of the well being of the pedestrian or resident, new suburban streets were expected to behave like miniature expressways with sweeping curves, wide intersections and travel lanes, and very little chance of encountering an obstacle to driving—like a tree, a parked car, or children at play. In addition to the nature of the street itself, the spatial relationships between the buildings along the streets had changed. Abundant cheap land allowed large residential lots to be sold profitably at reasonable prices—creating incentives to develop the ubiquitous monotonous neighborhoods of look-alike vinyl or aluminum covered tract houses isolated behind expansive, poorly landscaped front yards. Commerce also became car-oriented and as such, an "obnoxious" land use. Exclusionary zoning practices which were previously used to protect residential and commercial uses from heavy (and dirty) industry were now called upon to segregate commercial from residential districts since no one wanted to live near large parking lots and increasingly auto-choked arterial streets. Walking to the corner store to get a loaf of bread (or walking anywhere, for that matter), finding decent affordable housing above a place of work, or enjoying a public park near your home became

[4]See Shoup (1992)

opportunities of the past. Correspondingly, social relationships between different and diverse members of neighborhoods and an entire "public" way of life was largely replaced by a private world viewed through a windshield or on a television set.[5] The young, old, and poor became increasingly isolated from their community, and aided by racially motivated lending and insuring practices, many neighborhoods became monocultural enclaves. The economies of older, formerly transit-oriented neighborhoods were destroyed or severely impaired by flight of capital and higher income residents to the new suburbs, and public transit accounted for a smaller and smaller fraction of trips every year.

Auto-oriented land usage also linked the mobility and economic stability of the entire nation to the availability of cheap oil to fuel the automobiles. Unlike earlier in the century when most of the oil consumed in this country came from within the national borders, the political order following World War II left the huge oil reserves of the Middle Eastern nations under US influence, and the proportion of imported oil used in the US rose dramatically. In 1973 and again in 1977, threats of a cartel among major oil producing countries set the oil distribution and pricing apparatus in this country in uproar. These events radically altered the national attitude towards energy consumption and auto use, and the federal government was called upon to address these related problems. However, the consequent federal energy initiatives did not necessarily promote questioning fundamental assumptions regarding our automobile and oil dependent economy, or even get at underlying issues related to our societal values and our urban environments, and how automobiles affect them. *These* goals were ostensibly implicit in the actions and structure of the Department of Housing and Urban Development (HUD) and its sister agency, the Department of Transportation (USDOT), which had both been created in the previous decade. In the end, the federal response to the energy crisis ended up being primarily boosting military spending to tighten US influence over the production and distribution of foreign oil, and lesser efforts towards encouraging and subsidizing the development and production of more "efficient" automobiles and alternative energy in general (nuclear, hydro, solar, wind, etc.) More efficient automobiles were still automobiles though, and demographic changes over the last twenty years such as continuing suburbanization and a growing number of women in the workforce have resulted in increasing rates of automobile purchase and use. To make matters worse, a post-cartel oil glut in the 1980's helped gas prices fall in real terms (unlike the prices of other goods which had also been affected by oil crisis induced inflation).

The auto-weary attitudes inspired by the oil crises and the contemporary citizen-led "highway revolts" which were preventing the completion of many urban sections of the

[5]See Kunstler, (1993)

Interstate Highway System fueled a growing desire to build new heavy rail transit systems in many cities. The deplorable condition or lack of rapid transit in large and small metropolitan areas now stood in stark contrast to the billions of dollars recently invested in brand new highway facilities, and states won permission to use some of the remaining federal interstate highway funds for expanding and rehabilitating transit infrastructure. The first all new rapid transit systems to be built in North America in nearly twenty years opened in San Francisco and Washington DC in 1972 and 1975 respectively, and impressed many observers with their quick, clean, quiet, and comfortable service. The recently established Urban Mass Transit Administration (UMTA) was prepared to fund more major capital expansions and rehabilitations, and suddenly a rapid transit system became a symbol of prestige and a political necessity for any city that aspired to be "world class." Understandably, powerful proponents of (and some would say apologists for) increased transit spending were also the transit consultant, contracting, and manufacturing industries—who would make money on these initiatives whether or not the transit operators or cities would benefit significantly. In spite of extenuating factors influencing potential ridership, major new rail transit investments were soon on the drawing boards for Atlanta, Miami, Baltimore, San Diego, Portland, Buffalo, Sacramento, and St. Louis, while system extensions were proposed for New York, Chicago, Philadelphia, Boston, and Washington. Federal grants were also used to study a host of other transit technologies and service concepts including people movers, articulated and advanced design buses, exclusive bus lanes and busways, and paratransit/dial-a-ride services. The prevalent wisdom towards transit investment seemed to assume that new capital, high technology, and improved service planning and administrative procedures could reverse the downward spiral of transit ridership in the postwar era. Although these were all very real obstacles to increased transit usage, the highway landscape and continuing subsidies for driving made auto-dependency hard to kick, no matter how nice the new transit service was. In the end, the major capital investments of the past twenty years seem to have helped stem the decline in overall transit ridership, but as total trip making has risen dramatically transit has been unable to maintain, let alone increase its mode share.

1.3 Automobile use: The Great "Free Ride"

Many researchers have documented the "hidden" costs and subsidies of auto use. Two recent studies detail the nature of the problem well, and recommend charging urban motorists for roadway use in proportion to the fully allocated costs they impose on society. Komanoff and Ketcham point out that, "US motorists pay less in gas taxes, tolls and fees than the government spends building and repairing roads and providing accident and

emergency response, traffic control, police services, and general transportation administration. Compounding this involuntary gift from the taxpayers to motorists, the [New York City] region loses an estimated $55 billion per year in time, health, well being, and lives lost to traffic congestion, air pollution, road accidents, highway noise, and other harm and waste created by motor vehicles."[6] Estimated "hidden costs" from their 1992 report on the New York City region are presented in Table 1.1.

Table 1.1 "Hidden" Costs of Roadway Transport[7]
(in billions of 1990 dollars, per year)

	NYC Alone		Non-NYC Metro	
	Public	Motorists	Public	Motorists
Air Pollution (illness, property damage)	$2.9	$0.1	$2.8	$0.1
Accidents (death, injury, suffering)	$2.5	$5.2	$3.2	$9.9
Land (in excess of "reasonable" road space)	$2.0	NA	$2.9	NA
Noise (illness, lost productivity/amenity)	$1.4	$0.1	$1.4	$0.1
Congestion (lost time)	$1.1	$4.5	$1.1	$8.1
Military (to guarantee foreign oil)	$0.3	NA	$1.6	NA
Climate Change	$0.3	NA	$1.1	NA
Vibration (damage to buildings, infrastructure)	$0.2	NA	$0.6	NA
Pavement Damage to Vehicles	NA	$0.3	NA	$1.0
Total Hidden Costs ($ billions)	**$11**	**$10**	**$15**	**$19**

Motorists costs are those absorbed by those in their capacity as drivers (and passengers). Public costs are those borne by the public at large, including car owners when they are not driving. Columns are mutually exclusive. Public costs for congestion reflect transit buses, government vehicles, cyclists and walkers caught in gridlock. Public accident costs are net of motorist insurance premiums. Land costs are estimated as taxable value of 1/2 of road space (the area not needed for circulation of public vehicles and bicycles).

The table excludes numerous harms including junked cars and tires; environmental damage from manufacturing, transporting, and storing vehicles and fuel; runoff from salts applied to de-ice highways, lead and toxic organic compounds from vehicle emissions, brake lining wear, etc.; damage to park land, sidewalks, and other public property through crashes and parking; isolation of the non-driving poor, old, young, disabled, and defiantly auto-free.

A 1994 report by the Conservation Law Foundation reached similar conclusions when comparing the fully allocated costs of solo driving, car pooling, bicycling, walking, commuter rail, subways and streetcars, and buses.[8] They tallied "...personal expenses, government costs, and environmental and other impacts on the public as a whole, and calculated the total dollar cost for each mile a person travels..." as well as estimating travelers' user fees and taxes as a share of the costs they impose on government, the environment, and the economy. Their findings are summarized in Table 1.2.

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[6]Komanoff and Ketcham (1992)
[7]Komanoff and Ketcham (1992)
[8]*Roadkill*, (1994)

Table 1.2 Costs and Subsidies of Travel in Central Boston[9]

Travel Mode	Peak Period Cost Per Mile	Share Paid in User Fees and Taxes
Bike	$0.13	100%
Walk	$0.14	100%
Commuter Rail	$0.29	21 - 88%
Car Pool	$0.42	5 - 9%
MBTA Bus	$0.58	9 - 26%
Subway or Streetcar	$0.64	33 - 58%
Single Occupant Car	$0.81 - 0.94	9 - 18%

User fees paid by solo drivers and car poolers include gas taxes; tolls; registration, inspection, title and driver license fees; and motor vehicle taxes.

User fees paid by transit riders include fares.

Costs such as water pollution from oil spills, leaking underground storage tanks, and roadway runoff; wetland loss; creation of solid and hazardous wastes such as tires and auto bodies; and emissions of air toxins and substances that deplete the ozone layer could not be quantified.

Although the figures in Table 2 are specific to Boston, several notable conclusions from the CLF study are relevant to transportation in general across the United States:

- Transit is often less expensive than driving when costs are measured fully.
- Costs of transportation like air and noise pollution and trade effects of importing foreign oil are hidden from individuals—especially motorists.
- Most of what motorists do pay is a "sunk cost" of car ownership, and is not affected by the amount they drive.
- One of the highest hidden costs of driving is the true cost of parking spaces.
- Transit costs will drop if ridership goes up, while driving costs increase if traffic grows.
- Centralized metropolitan development results in low transportation costs, while sprawl poses high transportation costs (not to mention excessive infrastructure and maintenance costs for sewer, water, and other public services)
- Since every form of motorized transportation is very expensive, eliminating the need for long trips is an important way to cut transportation costs.

In conclusion, increased transit usage and compact, centralized urban form are desirable, but current transportation subsidization policies greatly favor auto usage and sprawl. The goal of transit investment should be to alter fundamentally the nature of the urban habitat to make it more hospitable, habitable, equitable, and sustainable in the long term.

[9] *Roadkill*, (1994)

1.4 The potential of transit

A transit system could improve the quality of life for all citizens by facilitating a transformation of the nature of the urban environment. Effective transit service may afford the opportunity to reduce auto-dependence and encourage less auto use by allowing realistic implementation of reduced parking requirements, decreased vehicular capacity on surrounding streets, and functional pedestrian and bicycle facilities and amenities. If successful at reducing auto use, these techniques have the ancillary benefits of not just improving the physical character of the city, but addressing broader environmental problems such as clean air and energy consumption. Additional social goals such as the provision of transit accessible affordable housing, open space preservation through enhanced "infill" development opportunities, and transportation equity for people who are unable or unwilling to drive also support transit investment. Increased responsiveness to community desires through environmental impact review procedures represents yet another potential benefit of new public facility investment.

However, many of these benefits do not yet appear to have been realized in the communities where rail transit facilities have opened in the past twenty years. Specifically, the historical model of rapid pedestrian-oriented development along new transit facilities has not occurred as it did with the streetcars, elevateds, and subways of 100 years ago. In today's pro-automobile environment, development around new transit stations has been influenced by much different factors than those which had previously shaped their urban design and scale. Personal observations of development around recently constructed transit stations in Boston, Chicago, Washington, Atlanta, and San Francisco at first seem to indicate that new stations are equally likely to be flanked by immense parking lots or structures, no noticeable new development, or decaying neighborhoods as they are to be home to new higher density, mixed use development. Ironically, many (but thankfully not all) of the station sites which did experience significant development during the massive 1980's office and commercial building boom were not of a design nature that promoted convenient transit use, and often included abundant free or low cost parking.

Several factors may be at work in these instances. First, many of the new stations have been built in previously developed areas. As such, the existing land uses and development patterns have a much stronger influence on the site than if it were a "green field" (as much land was around original transit and highway facilities). Second, all of the new transit facilities have been built during a period in which auto use and sprawl are encouraged explicitly and implicitly by government policy, transit is stigmatized as a mode of last resort, and developers are less than enthusiastic about voluntarily limiting auto accessibility to their developments. Third, planners and other community leaders have

taken a wide range of approaches to addressing the potential impacts of new transit stations, and have had varying degrees of success. An analysis of development around suburban BART and Washington Metrorail stations concluded that station area development "...seem[s] to be dictated by local conditions—markets, land use restrictions, accessibility, population, physical geography, etc."[10]

Understanding the relationship between transit capital investment, transit use, and urban form has been a topic of much academic attention over the last twenty years.[11] Specifically, it is believed by many researchers and advocates that one of the most important influences a rail transit system can have on a metropolitan area is to re-orient its land use patterns towards more intensive development in the vicinity of transit stations both within and, more importantly, beyond the traditional central business district. In 1977, when many new and expansion transit projects were underway or being planned, the USDOT recognized the importance of the transit station area development issue and released a study which examined the extent and kinds of land use changes which had actually occurred due to major rapid transit improvements.[12] Through their examination of new systems in Toronto, Montreal, and San Francisco, and major system expansions in Philadelphia, Boston, Chicago, Cleveland, New York, and Washington, the authors determined several critical issues related to transit induced development. These issues included downtown development, growth concentration, transit "induced" regional growth, and the role of land use policy. The study concluded that rail rapid transit improvements can influence downtown *and* outlying land use significantly when supported by other essential factors including land use controls, availability of land, attractiveness of surroundings, and regional demand for development, but are unlikely to lead to net new regional economic or population growth. It stressed that locations likely to offer challenges to land use intensification should be avoided as transit station sites wherever possible if station area development is a central objective. Unfortunately, transit facility alignment is often influenced heavily by both political and fiscal constraints.[13] As a result, many station sites and transit facilities have ended up in expressway medians or substantially built up areas where land assembly is difficult if not impossible, and opposition to development intensification is strong. This seminal study also recommended that:

- Local land use and other related policies should be identified more precisely, and transit-related land use change should support these explicitly.

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[10]Moon (1990)
[11]See TCRP Project H-1 (1995)
[12]See Knight and Trygg (1977)
[13]See Chang (1992)

- The many factors which influence land use should be acknowledged in policy and their coordination encouraged in general urban development as well as in transit planning.
- Commitment to local land use policies supporting desired land use impacts should be demonstrated before the transit improvement is begun.
- Because of the likely slow pace of land use impacts, subsequent phases of transit expansion should not rely on early public revenues "captured" from developments.
- Rapid transit improvements might be used as one element of a coordinated package of efforts to revitalize a declining metropolitan area, but should not be relied on solely or even primarily for such purposes.

Local economic growth potential is often cited as a major benefit of transit investment. Following elementary principles of land rent theory, the increased accessibility which a transit station brings to a site should boost property values and rents for landowners, enhance the marketability and raise the marketable density of new developments, and increase the local property tax base. Upon review of several comprehensive studies of land use impacts of North American rail systems, Robert Cervero concluded that "...urban rail transit will significantly benefit land use and site rents only if a region's economy is growing and a number of supportive programs are in place, for example permissive zoning to allow higher densities, and infrastructure such as pedestrian plazas and street improvements. Transit guides rather than creates growth, and by itself rarely effects significant land use changes."[14]

For the transit operator, there is potential for station area joint development and value capture—a legal and financial "...mechanism by which the agency responsible for the development of the urban transport infrastructure *captures* part of the financial benefit typically gained by land developers or the community at large."[15] Although the joint development concept has yet to contribute significantly to revenues of any transit operator, Cervero also found that "...where regional market conditions are favorable, rail transit appears capable of positive impacts on station area office markets. Combining transit investments with private real estate projects appears to strengthen these effects. [This] ...suggests that the rationale behind value recapture and other benefit sharing programs is economically sound..." for conditions similar to those which were studied.[16] Landis, et. al. examined 114 projects in over 20 US cities and found four conditions to be necessary for successful joint development ventures:[17]

- The local real estate market must be active and healthy.

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[14]Cervero (1994, *JAPA*)
[15]Tsukada and Kuranami, 1990
[16]Cervero (1994, *JAPA*)
[17]Landis, Cervero, and Hall (1991)

- The agency with the lead responsibility for pursuing joint development must have an entrepreneurial bent.
- Coordination is essential when joint development projects involve more than one public agency.
- Sponsoring agencies need to understand that there are benefits to joint development that go beyond generating revenues. The best joint development projects are those that encourage greater transit usage, create more interesting station environments, and reinforce other planning and development goals.

In addition, transit oriented land usage should have pro-transit impacts on travel behavior. Another 1994 study by Robert Cervero addressed the question of whether or not transit oriented development could draw Californians out of their cars.[18] He found that the propensity for transit station area workers to commute by rail decreased with the number of personal vehicles available and the availability of free parking, and increased with trip length and proximity of the household to the rail system. Significantly, he also concluded that rail oriented office development requires rail oriented housing development (although not necessarily at the same station) and higher charges for parking at the workplace if transit is to compete effectively with the automobile.

Transit accessible affordable housing initiatives have met many of the same challenges as other types of station area developments. Typically, the developers of affordable housing are nonprofit corporations, often acting in concert with state and local agencies. The expense involved in acquiring and assembling land in proximity to a transit station often strains the ability of these developers to provide housing economically. In addition, residential property values have been shown to increase within a mile radius of transit stations in desirable neighborhoods.[19] These factors indicate economically viable conditions for higher end or luxury apartments and townhouses, and indeed this is the type of housing most often found proximate to new rail transit stations.[20] Compounding the difficulties facing residential development is the phenomenon of "fiscalized" land use controls—often practiced in regions with property tax caps (like California's Proposition 13).[21] In a restrained property tax environment, municipalities have a great disincentive to encouraging residential land development (especially lower income residential development), because the people who will inhabit such dwellings consume public services such as schools, libraries, parks, safety services and utilities, but the ability of the municipality to tax for these services has been limited. Encouraging commercial

[18]Cervero (1994, TQ)
[19]Anas and Armstrong (1993)
[20]ibid.
[21]Sriver (1994)

developments—especially mass retailers which can generate unconstrained sales taxes—makes much better sense to a city or town in such a fiscal environment. Finally, urban rail transit systems are well suited to promoting auto-free reverse commuting options.[22] If suburban employment activity is concentrated at a transit station site, the jobs are instantly accessible to the urban residents who may also live along connecting transit corridors. This circumstance may also compliment social objectives if residential stations are located in lower income neighborhoods. Promoting reverse commute options serves the additional function of balancing the loads on transit vehicles, as the reverse commute direction generally features the same level of service as the peak direction—only serving many fewer passengers.

In spite of the encouraging potential of transit related land development, actually developing station areas to promote desirable ridership and urban form characteristics remains difficult. Commonly, the bottom line on transit facility investment evaluation still comes down to performance criteria based on ridership and system construction and operation costs.[23] Although important analytical tools, these measures are too simplistic to address comprehensively the complex nature of the potential effects of transit investment. Cost and ridership based evaluation techniques tend to ignore the temporal and political nature of the land use decision making process and never even address the effects of heavily subsidized auto transport. When land use issues are considered under this type of analysis, the discussion tends to degenerate into a chicken and egg argument: there will be no change in urban form without transit capital investment, and there will not be enough ridership to "warrant" transit capital investment until there is a change in urban form. (It is telling that "ridership" was not the criteria used to "warrant" the construction of the Interstate Highway System).

It would be better for the debate to focus on issues such as "What do we want our community to look like?", "How do we want it to function?", and "How might we achieve these goals effectively?" It is apparent how the land use in our urban areas has been affected directly by design standards and indirectly by economic policies which favor auto use exclusively. This presents an interesting challenge for the future of urban transportation policy—similar to the chicken and egg problem just described. On one hand, the economic and policy incentives for driving must be removed. But even if this were done, our urban and suburban environment often precludes the use of any other mode, so we must also "retrofit" our metropolitan areas by making them more pedestrian, bicycle, and transit "friendly." Rail transit station areas provide ideal environments in

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[22]Moon (1990)
[23]See Pickrell (1990)

which to encourage development (or redevelopment) of a pedestrian, bicycle, and transit "friendly" nature, which must necessarily exist in order to establish an environment in which proper allocation of automobile costs is politically and logistically possible. None of these conditions—properly pricing transportation, investing in transit, and creating a transit friendly urban form—is individually sufficient to reverse the decline of our urban environment, though (which may explain lackluster transit mode share at most of the "good" examples of transit station area developments which presently exist in the US.) However, these are collectively all *necessary* conditions to bring about desired changes to the urban environment. As such they are each worthy of study, and must not be summarily rejected just because they have not individually resulted in clear transit mode share gains.

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) and the Clean Air Act Amendments of 1990 signaled a new era in the development of transportation plans and programs in the US by strengthening the role of the public, conforming transportation plans with air quality plans, constraining the programming of projects to available funding, and analyzing transportation alternatives within corridors slated for major investment.[24] These laws represented a new direction and philosophy for federal transportation investment in the post Interstate highway program era, and the Federal Transit Administration (FTA, formerly UMTA) has been mandated with formalizing the consideration of economic development impacts and transit-supportive land use policies in the evaluation of competing fixed guideway projects.[25] Although the current legislative environment does provide greater opportunities for promoting transit-supportive urban design, ISTEA's widely acclaimed shift of decision making power from the national to the state level should be viewed with caution. Although this philosophy might be an effective method for reducing auto-dependence in places with strong local support for progressive transportation policy (like Portland, Oregon), many other states and communities are still heavily under the political influence of traditional pro-highway interests. Allowing communities to do their own thing in this environment is certainly not likely to reverse the prevalent transportation trends. Without the massive and deliberate federal policy interventions described previously, it is unlikely that the condition of our cities and transit systems would be as desperate as it is today. The much more livable cities and effective transit of Canada provide an opportunity to visualize what the US may have been like with different postwar federal housing and highway building policies.[26] It took these federal interventions to get us in our present state, and now that the "playing field" between transit

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[24]*ISTEA Planner's Workbook*, STPP (1994)
[25]Chang (1992)
[26]See Pucher (1994)

and autos is so unbalanced it is unlikely that conditions can be rebalanced without similar (but more enlightened) federal intervention.

In this context, it is tempting to wonder if such changes in the nature of American urban environments and the corresponding changes in travel behavior are even possible. This very question was addressed in a 1993 study refuting a proposition by Charles Lave that auto dependence was an "irresistible force", and transit has lost the battle in the US and is losing it in Europe. Through examinations of transport policies and characteristics in thirty-two North American, European, Asian, and Australian cities, the authors concluded that:

> "...although automobile dependence is a powerful force, it is not 'irresistible' or 'unstoppable' and it is certainly not an inevitable outcome of growing wealth. Differences in car travel and transit use, and particularly how each is changing, can at least partially be explained in terms of different policies and priorities in each city towards transport and land use—in short whether public planning is prepared to tackle the problem of automobile dependence with a coordinated suite of transport, land use, and economic instruments. Automobile dependence would appear only to be as irresistible as its proponents would allow it to be."[27]

Stockholm, Sweden has been cited as a counter-example to all the common "excuses" for America's auto dependency—enormous wealth, high auto ownership, abundant developable land surrounding the city, and explosive postwar growth. In spite of these similarities with the US, there has been careful coordination of regional transit and land use planning resulting in the construction of several pedestrian-oriented new towns surrounded by greenbelts and connected to Stockholm proper by rail transit. Industry and offices are distributed in proportion to a mix of residential housing types in the satellite communities to avoid excessive commuting in general, and Stockholm County enjoys a 40-50% rail transit share for commute trips.[28]

Further new trends in urban planning and design here in the United States also bode well for the prospects of re-orienting our communities away from cars. "Neotraditional" and "pedestrian-oriented" neighborhood design principals advanced by architects and planners such as Andres Duaney, Elizabeth Plater-Zyberk, and Peter Calthorpe have stirred the imagination of the planning and development communities. These principles are based upon using walkable neighborhoods as the fundamental building blocks of a community and include design features such as narrow streets with no cul-de-sacs, wide sidewalks, street trees, compact lots, alleys and rear garages, and neighborhood "centers" with

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[27]Kenworthy and Newman (1993)
[28]Cervero (1993)

apartments, public institutions, commercial establishments, formal open spaces, and public transit connections. These development concepts also promote affordable housing challenges by allowing and promoting apartments above commercial storefronts and garages. The early success of several new developments of this nature may make more developers comfortable with the idea of not acquiescing to the needs of the automobile at every stage of the design process. In addition, last year the Federal Transit Administration embarked on a new grants program called the Livable Communities Initiative in order to "...encourage local and state governments to adopt the principles of livable communities in their transit planning and land use decisions."[29] This program supports pedestrian and transit oriented urban design concepts and is already assisting with transit station area development and redevelopment efforts in several cities. The initiative provides funding for program guidance, technical assistance, capital project demonstrations, and program evaluation to community based organizations and other traditional FTA grant receiving government agencies as long as their development plans and programs incorporate livable community characteristics including: well planned and designed transit service; effective transit, bicycle, and pedestrian access; mixed-use neighborhoods; safe and secure streets; environmentally conscious planning; and full community participation in the decision making process. Although the funding available through this program is nearly insignificant compared to that for auto-oriented infrastructure, it does represent a positive shift in the federal approach to promoting transit use and an improved urban environment. These developments suggest that the time is now ripe to investigate further factors which influence transit related development. A clearer understanding of typical transit station area development processes should assist the effort to alter the auto-dominated urban landscape and facilitate the evolution of an auto *in*dependent environment.

1.5 Goals of this thesis

In spite of the transportation environment of the past thirty years, land development around several of the stations in recently constructed transit systems provides many lessons for future station area development efforts. The nature of most transit station environs has been dictated largely by local and regional political and institutional factors—zoning, economic incentives, community participation—and there are many diverse examples of development patterns to be analyzed. Although it is unreasonable to expect that a transit station and "desirable" land use and urban design in its area will solve the greater problems of our urban environments, it may be useful to examine several existing stations in light of the primary factors that influenced their development and see what conclusions can be

[29] *Livable Communities Initiative, Program Description*, FTA, USDOT, (1994)

drawn. These conclusions could serve as a guide for encouraging similar outcomes at other stations.

This thesis will address such issues as: Do these institutional and political factors fall into easily identifiable categories, and if so, what are they? What role does organized planning and land use policy-making play? What role does "institutional learning" play—does a community have to experience several failures in planning before it achieves success? What role does politics play? How does community participation affect development? Who decides what the desirable features of development around transit stations are? How might these decisions relate to the perceptions of the "success" of station area development, and the neighborhood "quality of life"? What planning *processes* are most effective as judged by various stakeholders? As old transit lines are rehabilitated and new systems continue to be built, what lessons may be of use to planners and citizens in their respective communities?

In Chapter 2, a land use typology is constructed within which station areas may be classified by the intensity of surrounding development and access characteristics. The analysis includes development efforts around transit stations in Boston, Toronto, Washington, Montreal, Atlanta, and Miami in particular, but also draws from relevant cases elsewhere. Station selection was based on obtaining a varied sample of many different combinations of station functions, as well as pre- and post-station development patterns over time at the respective sites. Over 60 transit stations which have opened in the past 30 years are analyzed in 32 case studies (see Appendix A). The 32 case station areas are assigned places in a matrix of pre-station neighborhood characteristics and actual post-station neighborhood characteristics. Analysis of these attributes uncovers a number of tools and techniques which have been used effectively to influence development at these transit stations, and draws out similarities in strategies and results between stations of the same land use types. In addition to the general attributes of station areas detailed above, several special attributes are examined for additional station area cases. These characteristics include stations located near hospitals, universities, or other institutions, as well as stations serving "new town" developments or urban renewal areas.

Lessons and implications of this analysis are detailed in Chapter 3. Various North American transit agencies, planning boards, and community groups have taken many approaches to encourage certain patterns of development around rail transit stations. By analyzing their goals, actions, and results, a useful guide to the relative effectiveness of alternate development plans, and the public and private actions that were needed to see these plans through to completion has been developed. Factors such as intergovernmental coordination, the political and economic environments at various levels, laws and other

institutional issues, governmental agency intentions and results, community desires and participation, impacts of project funding requirements, development incentives and disincentives, and idiosyncrasies of particular localities and types of land uses have been considered. A particular focus of the research is models of development that may be applicable to various proposed station sites for San Juan, Puerto Rico's Tren Urbano—although the results should also be applicable to similar transit projects in other environments.

The research implications are presented in Chapter 4 in a manner which should be useful for the citizens of the San Juan area and other "key players" in the Tren Urbano context. To this end, the transportation and land use/land development decision making environment in the San Juan region is analyzed and the results are designed to be easily accessible to all relevant parties. Presently most of the technical design of the Tren Urbano system has been based on the beliefs, intuition, and experience of the decision makers.[30] Ideas about how stations will work with existing neighborhoods or create new ones, and how the auto, pedestrian, and transit access modes will interact at particular station sites are still developing. San Juan appears to be at a critical point, headed either to auto-dominance—or a major shift towards a better balance between modes. Which way it will go is a question that depends on the decisions of public officials, actions of citizens, and the success of the design and operation of the future transit system. More information on how the transit system and the community might interface is an important part of the project's ability to change the (anti-) transit mindset of the San Juan public.

Conclusions and contributions of this research are discussed in Chapter 5, and directions for future research and action are suggested.

[30]Ken Kruckemeyer, personal communication

Chapter 2

A Methodology for Station Area Evaluation

The relationship between transit and land usage has been researched extensively from two perspectives: the impact of transit on urban form, and the impact of urban form on transit demand and travel behavior.[31] The analysis presented here corresponds most closely to the first research perspective by considering a broad range of institutional, political, economic, and regulatory factors which have influenced land development around new rapid transit stations in North America in the postwar era. Examination of existing transit station areas and the primary factors that have influenced their development should provide insight for developing techniques to encourage or discourage similar outcomes at other stations with similar attributes. To perform this analysis effectively, this chapter will construct a typology of station area characteristics, analyze these neighborhood attributes both before and after station construction, and examine the initiatives it took to achieve them for 32 cases in five North American metropolitan areas. Reasonable and effective strategies for accomplishing each station area land use "goal" in the typology may then be generalized from this analysis.

2.1 Construction of typology

Many features of existing and past land development are relevant in characterizing the nature of station neighborhoods. Common land use classifications such as residential, commercial, industrial, recreational, institutional, etc. provide a clear idea of the generalized activities associated with the dominant land uses in a particular area, and are the standard monikers used in zoning plans. However, these classifications are not so useful for describing the relationship of built structures to the land they occupy, their geographical surroundings, and the people who use them—important attributes which influence the method of access to particular land uses within and between neighborhoods. Indicators of development density, physical design, and degree of mixing among dissimilar (although potentially complementary) land uses would be useful for this type of analysis. An

[31] See TCRP Project H-1 (1995)

indication of dominant and possible access modes such as walk, bike, paratransit, jitney, taxi, bus, train, or auto may facilitate evaluation of the potential and realized impacts of transit investment. A demographic profile of the neighborhood denizens can help explain social and behavioral influences on station area development and the political and economic strength of stakeholders and participants in public and private decision making processes.

These features must be distilled into a useful and relevant format for analyzing the factors which influence alternate types of station area development both prior to station construction and as the stations actually exist at present. The approach attempted herein identifies a limited number of neighborhood "types" in terms of the above attributes, and matches station sites to the most appropriate "type." The following typology consists of "general" neighborhood attributes and "special" neighborhood attributes. General attributes should represent most urban forms, and are based on the idea of "intensity" or density of development and the degree of heterogeneity of land uses. Other features which influence the nature of a station area are described as special attributes, and may apply to any urban form or general attribute.

2.1.1 General Neighborhood Attributes (Pre-Station):

Rural, Undeveloped, Low Intensity Residential: This classification represents areas which had low overall levels of development prior to station construction. It may include stations surrounded by primarily agricultural, rural, or conventional low density single family home neighborhoods. Residential densities of less than three dwelling units per acre may be classified in this category, and the urban form features auto-oriented design techniques such as wide streets, cul-de-sacs, no sidewalks, and houses set back a great distance from the street. Commercial and other non-residential land uses are uncommon in such an area. For this analysis, abandoned railroad yards and other large tracts of vacant land are also included in this classification.

Low Intensity Mixed Use: Parking lot oriented land uses typify this category. Shopping centers, shopping malls, stand-alone restaurants, cinemas and retailers, and supermarkets are corresponding commercial uses, while auto-oriented multifamily residential developments and light industry also fit this classification. Examples of these types of development include highway commercial and lodging "strips," suburban apartment complexes (especially those which are spread out and have limited points of access and ornamental "lakes" and common areas), and light industrial "parks" or districts. Access to establishments in this type of area prior to station construction would be almost exclusively by automobile, as the nature of the roads, abundance of parking, and absence of pedestrian, bicycle, and transit amenities all but preclude using alternate modes.

Medium Intensity Residential: A good example of this type of development would be nearly any residential neighborhood built before 1940. Characteristics include densities of five to ten dwelling units per acre (or more), a connected "gridiron" network of fairly narrow streets with sidewalks, modest front yards, possibly rear alleyways for garage, utility and public service access, public parks, and on-street parking. Many of these features also give these areas a pedestrian and transit friendly nature. Courtyard style apartment buildings, other multifamily housing, and small commercial establishments (often with apartments above) are incorporated in these neighborhoods alongside single family homes, but usually on arterial streets.

Medium Intensity Mixed Use: This classification is also typified by prewar districts—in this case commercial centers. Suburban "downtowns," neighborhood centers, and old manufacturing districts are included in this category. Such areas are notable for storefronts and shopfronts which press right up to the sidewalk, and many of the same urban design features as in the "Medium Intensity Residential" station area type described previously. As these districts were often developed along streetcar lines, their physical nature is also well suited to transit access. Unless they are at the center of a stable and populous neighborhood, though, the older commercial areas which fit in this class have often been marginalized economically by the shift towards an auto-oriented society. As a result, prior to construction of a transit station these commercial areas tend to be either filling "niche" roles in regional commerce (such as antique store or entertainment districts), or are generally rather run down with higher vacancy rates and lower rents than in the community as a whole. Advancements in manufacturing processes have rendered many of the old industrial facilities included in this category obsolete. Although these types of buildings are often vacant, many are capable of being rehabilitated for light industry, warehousing, and storage activities and sometimes even for multifamily housing.

Suburban High Intensity Mixed-Use: The stereotypical "edge city" fits this category—millions of square feet of high-rise office, retail, and often residential space on large well-landscaped plots of generally contiguous land with abundant surface parking. This is the dominant conventional pattern for intensive suburban commercial development, and many such districts have taken shape along the perimeter highways of most major North American cities over the last fifteen years. Frequently centered around a regional shopping mall, such areas behave economically much like a traditional downtown. However, their physical nature and the spatial relationships between buildings makes non-automobile access burdensome at best and impossible at worst. Because these developments are generally designed and built by one or a few owners, they have little of the complexity or "life" of traditional cities.

Urban High Intensity Mixed-Use: This category describes development which conforms to more traditional notions of a downtown. These districts are often historic centers of transit access and are characterized by high density and high-rise office and residential space, limited parking (primarily in structures), relatively small blocks, wide sidewalks, streetfront retail, public institutions, and formal public spaces.

2.1.2 General Neighborhood Attributes (Post-Station):

The same (pre-station) general neighborhood categories still apply, except that *Rural, Undeveloped, Low Intensity Residential* is no longer relevant.

2.1.3 Special Neighborhood Attributes (Post-Station):

"New Town": This category is reserved for large scale station area developments on large parcels of commonly owned land which are developed under a "master plan" with the intent of the development functioning as an entire neighborhood once completed.

University Area: Stations within walking distance to a major university (which has the potential to generate a significant share of traffic at the station) may be classified as such.

Medical Center: Stations within walking distance to a major medical center (which has the potential to generate a significant share of traffic at the station) may be classified as such.

Urban Renewal Area: Any area which was suffering from pronounced economic instability and population decline prior to station construction may receive this designation.

Park-n-Ride / Transit Transfer Center: A station which serves as a connection with several bus routes or other transit lines, and/or incorporates extensive commuter parking facilities would have this attribute.

This particular typology categorizes all potential past and present land uses exhaustively and addresses several specific factors which may influence the nature of development at a station area. The categories are general enough that station areas in many different localities will still be able to be classified usefully, but specific enough so that the critical attributes of each land use are easily identifiable. Analysis based on this classification scheme should bring forth common themes regarding the factors influencing the spectrum of development patterns described above. Among the themes which may be made more apparent by this method of analysis is an indication of local political, economic, institutional, and regulatory conditions which have influenced station area land development. These factors will be examined in depth in Chapter 3.

2.2 Examination of relevant metropolitan areas

Development at over 55 stations has been detailed in 34 case studies for this analysis (see Appendix A). These stations are located in five North American metropolitan areas of 3 to 4 million people: Atlanta, Boston, Miami, Toronto, and Washington. Although similar in size, these cities represent a broad range of urban development patterns, economic growth conditions, and regional transit and transportation policies. Table 2.1 summarizes relevant statistical characteristics for each metropolitan area and transit system.

2.2.1 Atlanta

Founded as a railroad town named Terminus, Georgia in 1837, Atlanta owed much of its early development to transportation access. Like many southern cities, its growth and industrialization was stunted as capital fled north after the Civil War, but it became a boom-town in the second half of the 20th century. Presently the largest city and financial and industrial capital of the southeastern United States, Atlanta has experienced tremendous growth in the Interstate Highway era, and this is reflected in the region's land use and urban design. The city's Perimeter Highway was one of the first Interstate highways to spawn a ring of new automobile-oriented commercial and industrial development around the city—a model which has now been followed in every major metropolitan area across the United States. Much of the area within this highway (including most of the City of Atlanta proper) features low density single family housing, parking lot dominated retail centers, and wide streets without sidewalks. The region outside Perimeter Highway, especially to the north, extends for nearly 30 miles, and has been designed to accommodate automobile transportation exclusively.

Metropolitan Atlanta's rapid growth has been strong enough to support a booming downtown office market as well as the sprawling suburban development. This has been a stroke of good fortune for a region that features a downtown-focused rapid transit system in an otherwise highway oriented environment. In 1965 the Metropolitan Atlanta Rapid Transit Authority (MARTA) was created by the Georgia General Assembly to integrate and operate transit in Fulton and DeKalb Counties. In 1971 the citizens of the two counties approved plans for a $1.4 billion rapid transit system consisting of two main lines which intersect downtown, and several branch lines to surrounding neighborhoods (see Figure 2.1). Concurrent with MARTA rail system planning, the City of Atlanta implemented a new Urban Framework Plan (1973) which encouraged high density development in future transit station areas, and a new zoning ordinance (effective 1982) which brought zoning regulations into conformance with the urban plan. Atlanta has achieved considerable success in focusing development around MARTA stations—especially in locations where

Table 2.1 Metropolitan Area Characteristics

Metro Area (Transit Agency) Relevant Municipality	Population in 1990	Population Density (/sq mi)	Population Growth Since 1980	Transit Service Population	One-way Rail Route Miles	Average Weekday Unlkd Trips	One-way Peak Fare	Farebox Recovery (bus & rail)	Modal Split: Car & Carpool / Transit / Other		
Atlanta, Georgia (MARTA)	*2,834,000*	*1,544*	*32.54%*	*1,241,000*	*41*	*209,000*	*$1.25*	*40%*	*93%*	*5%*	*2%*
City of Atlanta	393,929	3,007	-7.32%								
City of Decatur	17,304	4,326	-5.98%								
Boston, Massachusetts (MBTA)	*4,172,000*	*2,086*	*5.04%*	*2,602,000*	*66*	*650,000*	*$0.85*	*22%*	*78%*	*15%*	*8%*
City of Boston	547,283	11,897	-2.79%								
City of Cambridge	95,802	13,686	0.50%								
City of Malden	53,884	10,777	0.93%								
Town of Medford	57,407	6,984	-1.15%								
Town of Quincy	84,985	5,107	0.29%								
Miami, Florida (M-DTA)	*3,193,000*	*1,009*	*20.77%*	*1,735,000*	*21*	*50,000*	*$1.25*	*28%*	*90%*	*6%*	*4%*
City of Miami	358,648	10,548	3.45%								
Dade County (outside Miami)	1,578,546	822	23.44%								
Toronto, Ontario (TTC)	*4,236,000*	*1,554*	*23.94%*	*2,276,000*	*47*	*775,000*	*Can$1.50*	*68%*	*63%*	*31%*	*6%*
City of Toronto	635,395	16,944	6.04%								
City of North York	563,270	8,105	0.66%								
City of Scarborough	524,598	7,286	18.33%								
Washington, D.C. (WMATA)	*3,924,000*	*2,023*	*20.70%*	*3,006,000*	*81*	*661,000*	*$1.00 - $3.50*	*45%*	*81%*	*14%*	*5%*
District of Columbia	606,900	9,949	-4.94%								
Arlington County, Virginia	170,897	6,573	11.99%								
Fairfax County, Virginia	818,623	2,052	37.15%								
Alexandria, Virginia	111,183	6,949	7.72%								
Montgomery County, Maryland	757,027	1,529	30.74%								
Prince George's County, MD	728,553	1,496	9.55%								

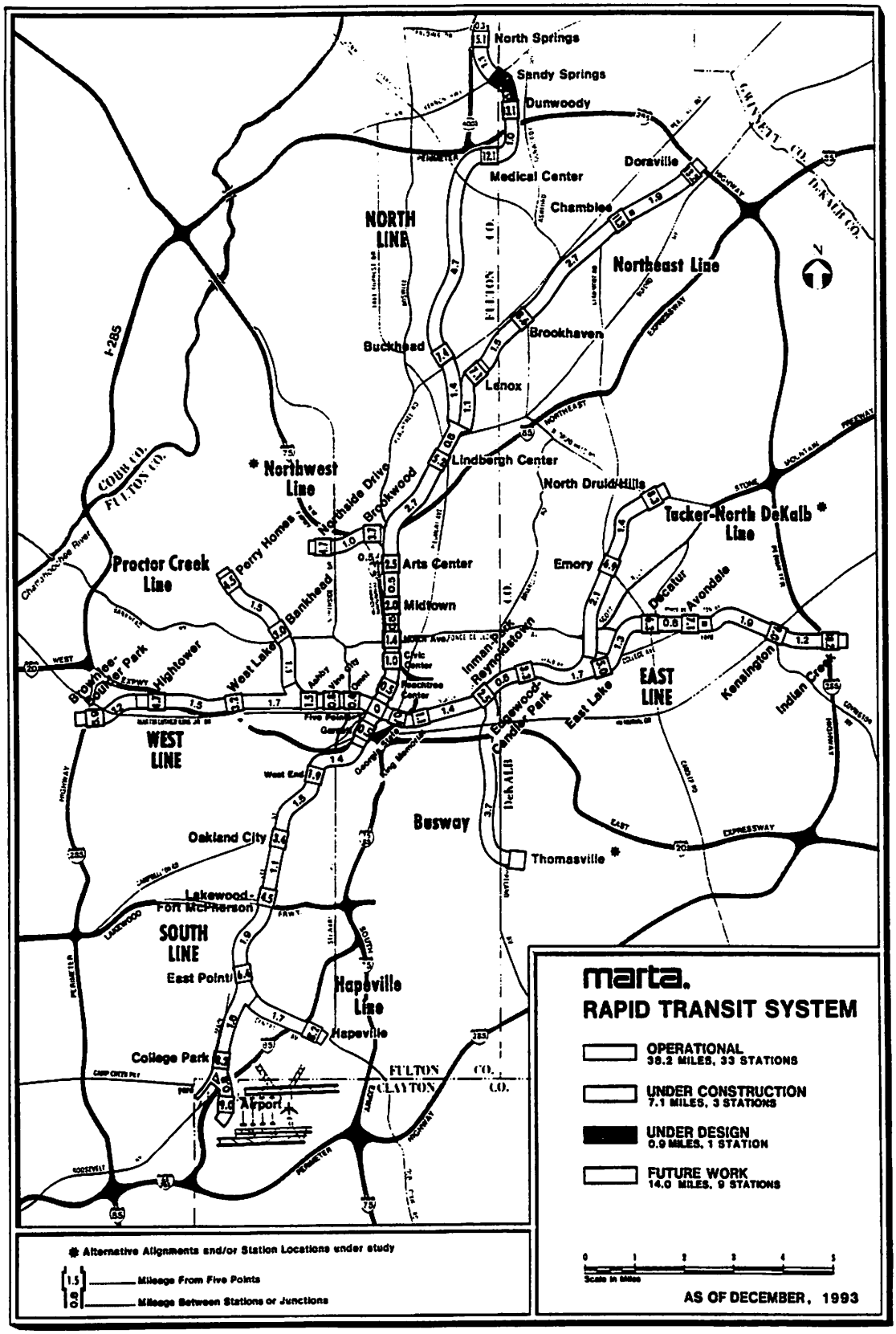

Figure 2.1 Metropolitan Atlanta Rapid Transit Authority System Map

the real estate market was strong to begin with. Unfortunately, since MARTA only has jurisdiction in the two urban counties, it is unable to influence the sprawling suburban development in the surrounding counties.

2.2.2 Boston

Settled over 350 years ago, Boston is the oldest major city in the United States. By the time the municipality incorporated in 1822, the area was already home to over 100,000 people—a number that would mushroom to over one million as the city industrialized at the turn of the century. As the country grew westward, Boston's remote northeast location soon placed it at a competitive disadvantage to New York as a port and to growing inland cities like Pittsburgh, Detroit, and Chicago as a manufacturing center. However, the region was able to take advantage of the fact that it is home to the world's largest concentration of academic and research institutions, and it became an international center for the growing technology and medical industries which have been driving its economy for over 40 years.

Indicative of its historical development, the major streets in the metropolitan area are descendants of trails and cowpaths that date back more than 100 years. As the town grew in a haphazard fashion along this complex web of narrow roads it took on many of the spatial characteristics of an old European city, making it unique in a nation full of towns and cities with wide boulevards that have been surveyed and platted on a rigid grid. Boston's street pattern has had the complimentary effects of making it a terrible city to navigate by automobile, but a fascinating and easy city to navigate by foot. Early subways and elevated railroads were developed in Boston around the turn of the century, and connected the "squares" or concentrations of businesses and residences that had developed at the intersections of the major roads in the growing city. As with most large industrial cities in the northeast, these initial rapid transit systems were financed and operated privately, and expansion stopped in the 1920's.

While many cities in the US spent the decade of the 1960's building expressways through old urban neighborhoods, Bostonians organized to stop the construction of an intracity freeway network once they witnessed the destruction that the first two highways wrought. These activists and community leaders were also successful at redirecting the highway money to much needed improvements in the rapid transit system of the newly created Massachusetts Bay Transportation Authority (MBTA or T). Over the last 30 years, Boston's rapid transit system has been substantially rebuilt and expanded extensively (see Figure 2.2). The MBTA has exclusive control over all public transit service in the entire metropolitan area, and the Commonwealth's Executive Office of Transportation and Construction makes major highway investment decisions. However, regional governments such as counties have very limited powers in New England, while small cities and towns

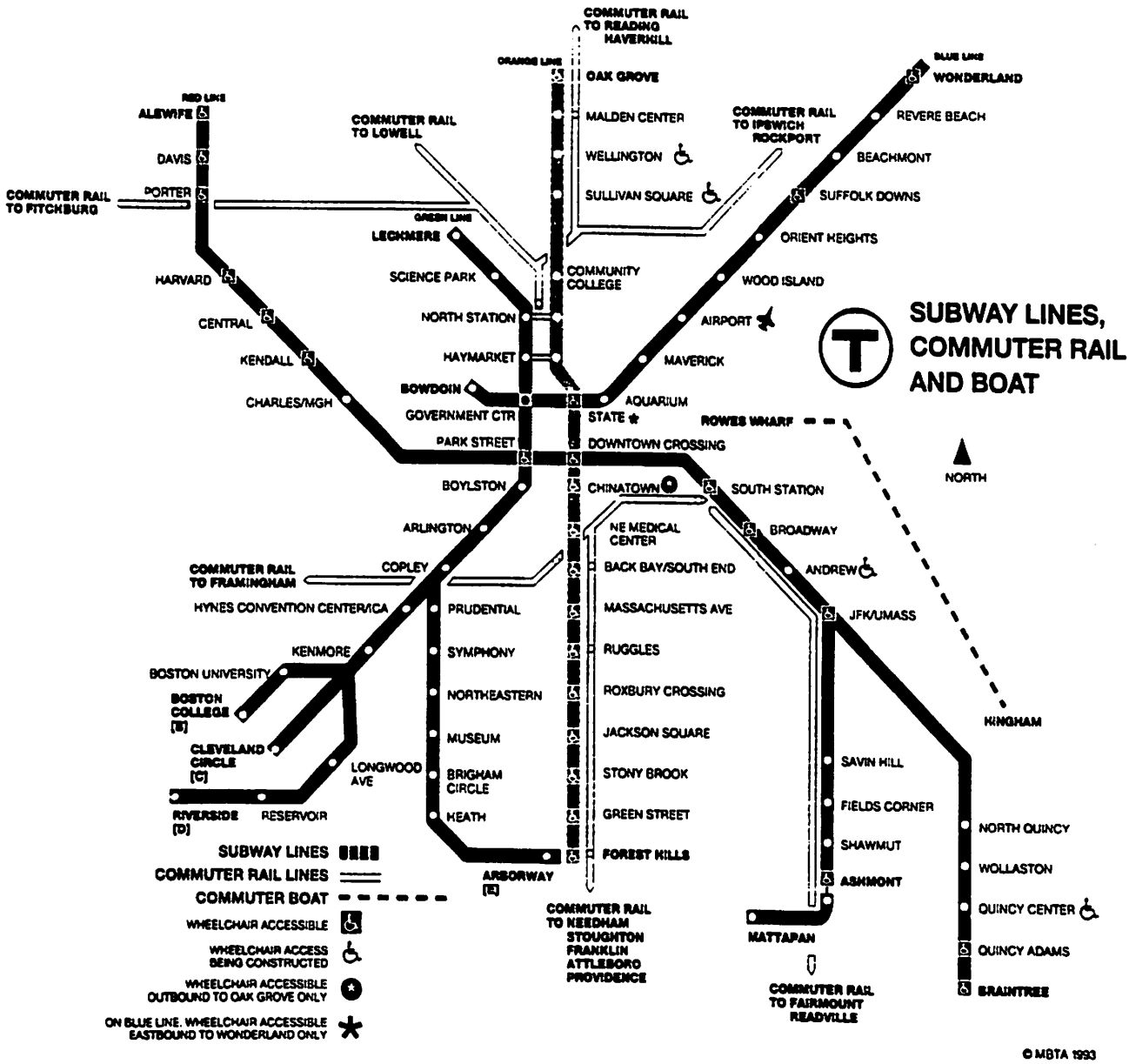

Figure 2.2 Massachusetts Bay Transportation Authority System Map

are plentiful and make all land use decisions. Consequently, while the MBTA was able to expand and rehabilitate its system, development around its stations is dependent upon the efforts of the local cities and towns in which they are located.

2.2.3 Miami

In 1896 railroad tracks were extended along the southeast coast of Florida to the Miami River where a settlement of less than 2,000 people stood. For the next fifty years, this semi-tropical region of the United States was promoted in the larger northern cities as the ideal vacation or retirement destination, and it grew to 250,000 residents—swelling by tens of thousands more during peak tourist seasons. Initially, access to the area was only by rail, and the early parts of the city assumed the traditional grid street network, with convenient streetcar service along arterial streets. As highways were built, relatively affluent retirees began to bring cars to their new residences on large lots in contrast with the cold, crowded conditions of their former northern homes. In the late 1950's and early 1960's, many wealthy Cuban property owners emigrated to Miami and established themselves in the business and political leadership structure of the community when their island land became public property after the Cuban revolution. As the economies of the Caribbean islands and Latin American nations developed over the last 30 years, Miami has become an international center of trade and finance as well as tourism. Immigration of poorer people from many Latin American nations has also fueled further population growth in south Florida, and the region's population now exceeds three million.

After several decades of predominantly auto-oriented metropolitan development, the oil crises of the 1970's and tremendous growth in downtown employment and regional population led many planners to believe that congestion would become intolerable and the cost of automobile travel excessive by the 1980's. They were convinced that Miami's only hope for sustaining continued future growth under these conditions would be by developing a rapid transit system. Local and federal funding for the first phase of the system was secured in 1978, and the Metro-Dade Transit Agency (M-DTA) began operation of a single 21 mile long line in December, 1984. Divisive political battles were fought to secure funding for this initial line, and once completed ridership fell woefully below most expectations. Consequently, only recently have local leaders begun planning for system expansions which are desperately needed if the rail network is to function effectively (see Figure 2.3). Land use planning in the Miami area takes place on a county-wide level and is coordinated by the Metro-Dade County MPO. This agency has a joint board including County Commissioners, a city representative, and a member of the school board. The Metro-Dade Transit Agency, Public Works, Planning, Aviation, and Environmental Resources Departments, and the Tri-County Commuter Rail Authority all

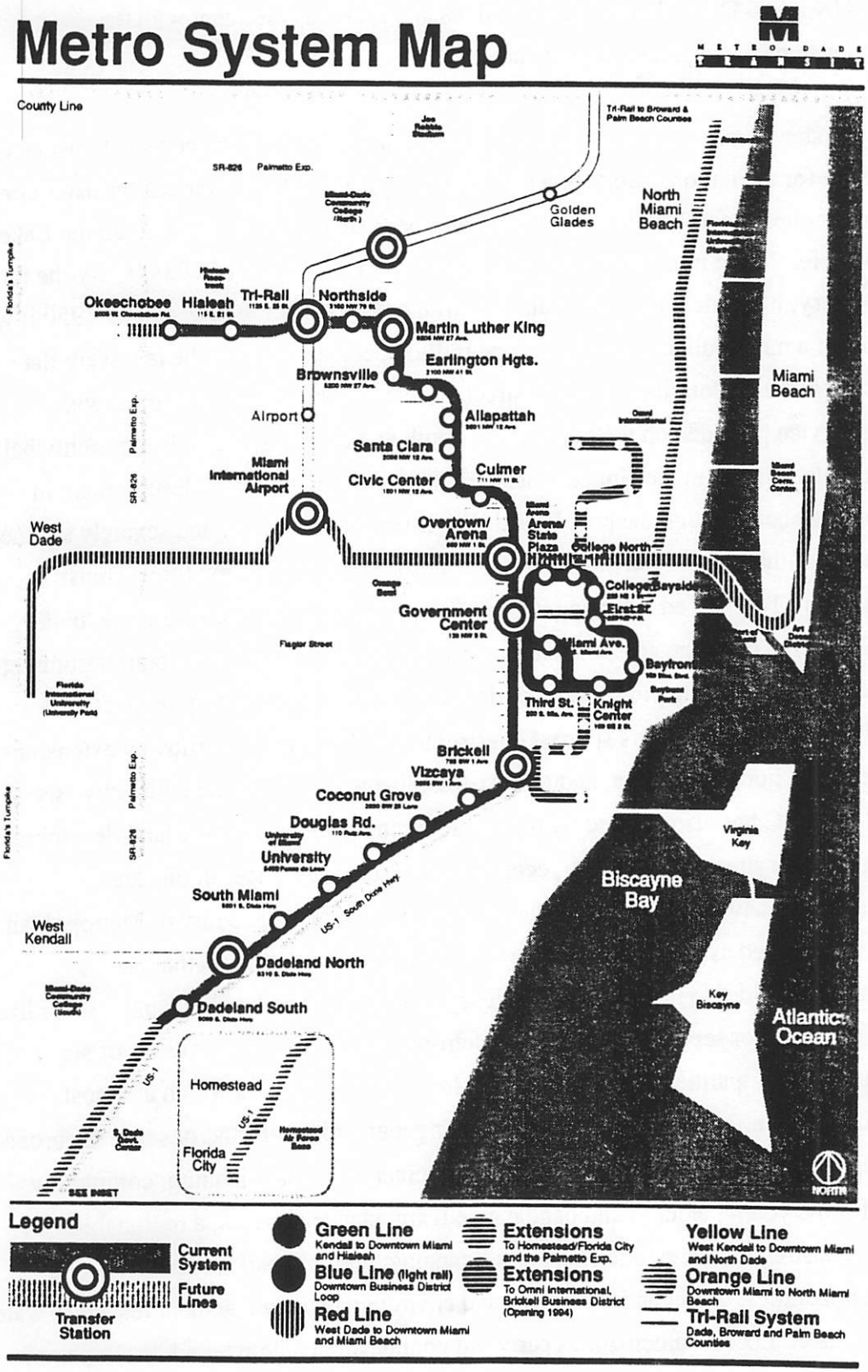

Figure 2.3 Metro-Dade Transit Agency System Map

contribute to the development of the region's long range transportation plans, which are reviewed by all 26 Dade County municipalities and must be consistent with the county Comprehensive Development Master Plan

2.2.4 Toronto

Greater Toronto is Canada's largest metropolitan area and the center of business and finance for the nation. Much like Chicago, Cleveland, and Milwaukee on sister Great Lakes, its economy and land use has historically been shaped by its location on the Lake Ontario shore. In the mid 1800's, Toronto was a frontier outpost of 20,000. By the turn of the century, it had developed into an industrial city of over 300,000, and by 1950 it was the center of a metropolitan area of over one million people. Built on the relatively flat prairies of southern Ontario, Toronto's street system followed a uniform grid, with streetcar service provided on the major north-south and east-west arterials at roughly half-mile intervals. Unlike in the United States, the streetcar-oriented land development in Toronto continued through the post World War II population boom, and severely strained the capacity of the transit system. In 1946 the Toronto Transportation (now Transit) Commission (TTC) passed a public referendum approving subway construction under Yonge Street, the city's busiest streetcar route. The success of this line upon its completion in 1954 and the increasing prominence of downtown Toronto as an employment center during the subsequent 25 years spurred construction of Yonge Street subway extensions, another parallel north-south line, and an east-west line which spans the entire city (see Figure 2.4). TTC has also worked with local governments to encourage land development around its station sites, and has been recognized widely as a pioneer in this area.

In 1953 a new governmental organization called the Municipality of Metropolitan Toronto was created as a federation of the City of Toronto and twelve smaller municipalities in order to improve the efficiency of municipal government and standardize the delivery of major services. Today, the Metropolitan Corporation consists of six consolidated municipalities and is responsible for "...those services which are most economically and efficiently provided on a larger geographic scale and/or serve the broader Metropolitan population."[32] Its responsibilities include: regional planning; community services for the young, elderly, and handicapped; ambulance services; a regional library; business licensing; police; public education financing; regional parks, recreation, and convention facilities; transit and highways; and environmental management related to water and solid waste. Local municipalities carry out zoning, site planning, and development control functions—all of which must conform to Metro's Official Plan. The regional nature

[32] *The Official Plan for the Municipality of Metropolitan Toronto* (1994)

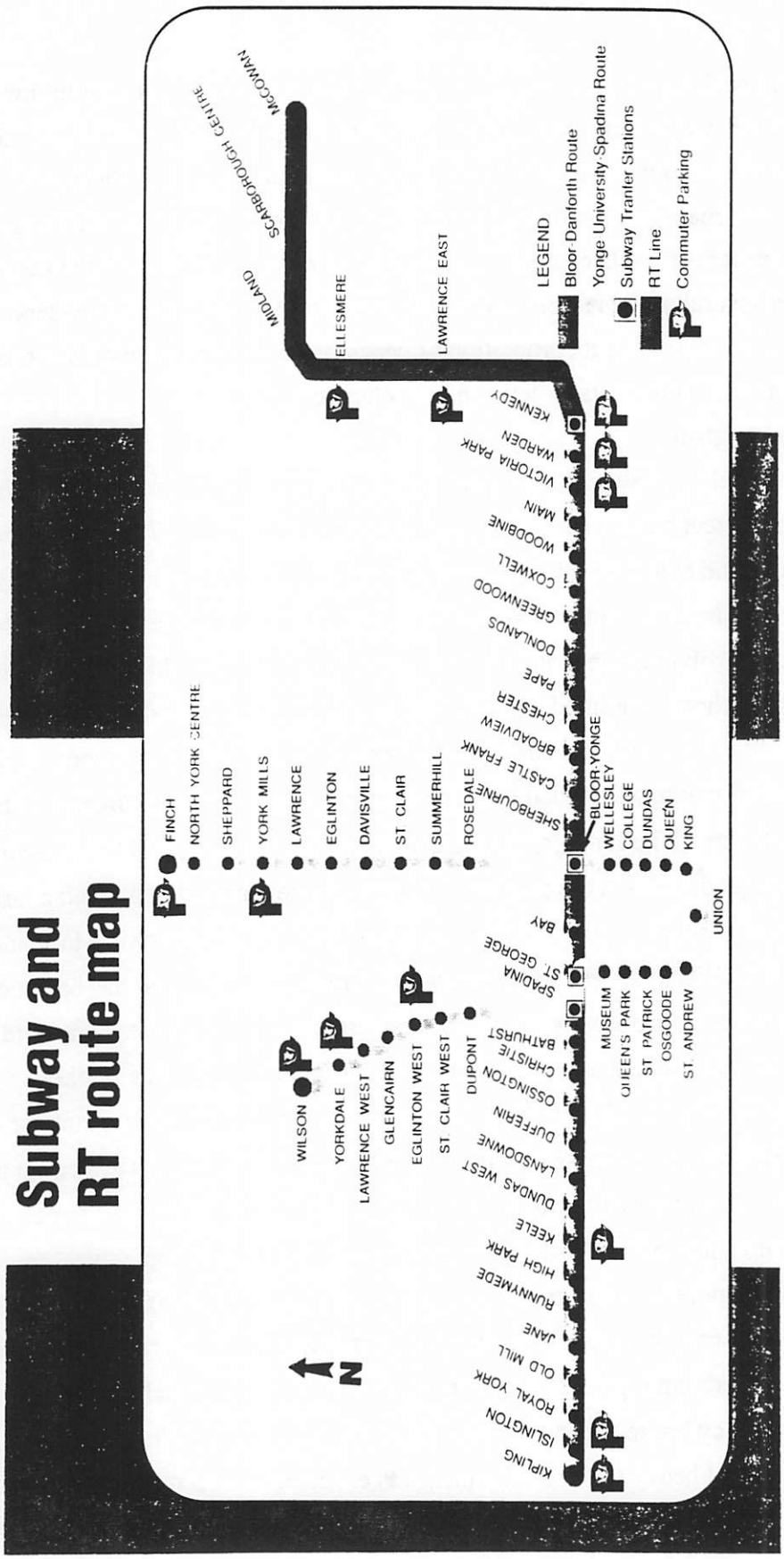

Figure 2.4 Toronto Transit Commission System Map

of planning in the Toronto area, as well as the absence of the large sums of highway construction money that were available in the States, has helped this area to continue developing in a more transit friendly nature than similar cities south of the border. Although its suburban jurisdictions do generally feature more auto-oriented design, overall development patterns have been relatively compact (there are no "exurbs" in Greater Toronto), and several of the regions outside Metro Toronto are becoming leaders in promoting and codifying the incorporation of pedestrian-oriented and neotraditional neighborhood design elements in new land development plans.

2.2.5 Washington

Sited largely in a swamp, the nation's capital grew slowly for most of its first 100 years. The grid street pattern and wide diagonal boulevards of the 1791 planned city were gradually paved and extended into the remainder of the 67 square mile District throughout the 19th and into the 20th century. With the exception of a few close-in neighborhoods around Bethesda, Silver Spring, and College Park, Maryland, and Alexandria, Virginia, pre-auto era growth was confined to the 100 square mile diamond at the center of the region which contained the District and Arlington County, Virginia. By 1940, though, the region's one million inhabitants had filled most of this area and development was beginning to spread into the much larger neighboring counties. The population of the Washington area has nearly quadrupled in the post-auto era, and the new growth has filled a large part of the 2,500 square miles of Montgomery and Prince George's County in Maryland and Fairfax County in Virginia. The region's postwar employment growth has been nearly exclusively in white collar sectors—primarily government-related professional and support services—which has made this region the nation's second largest office market.

During the late 1950's and early 1960's, extensive transportation plans for metropolitan Washington proposed building an 83 mile rail rapid transit system in addition to hundreds of miles of new freeways. All of the city's formerly extensive streetcar system had been torn up and replaced with much less popular busses by 1966, when the Washington Metropolitan Area Transit Authority (WMATA or Metro) was created by compact of the District of Columbia, Maryland, and Virginia and charged with planning, designing, and operating regional transit facilities. In 1968, with much federal and local bombast, this agency broke ground on the first segments of the five line, 98 mile "Metrorail" regional heavy rail system which was expected to be a model for new subways the world over (see Figure 2.5). The decade of the 1970's saw the completion of much of the highway system and a public backlash against the construction of several urban Interstates in the plan. Although the central subways were built rapidly, less than 40% of the entire Metrorail system was completed by 1980. However, funding was obtained

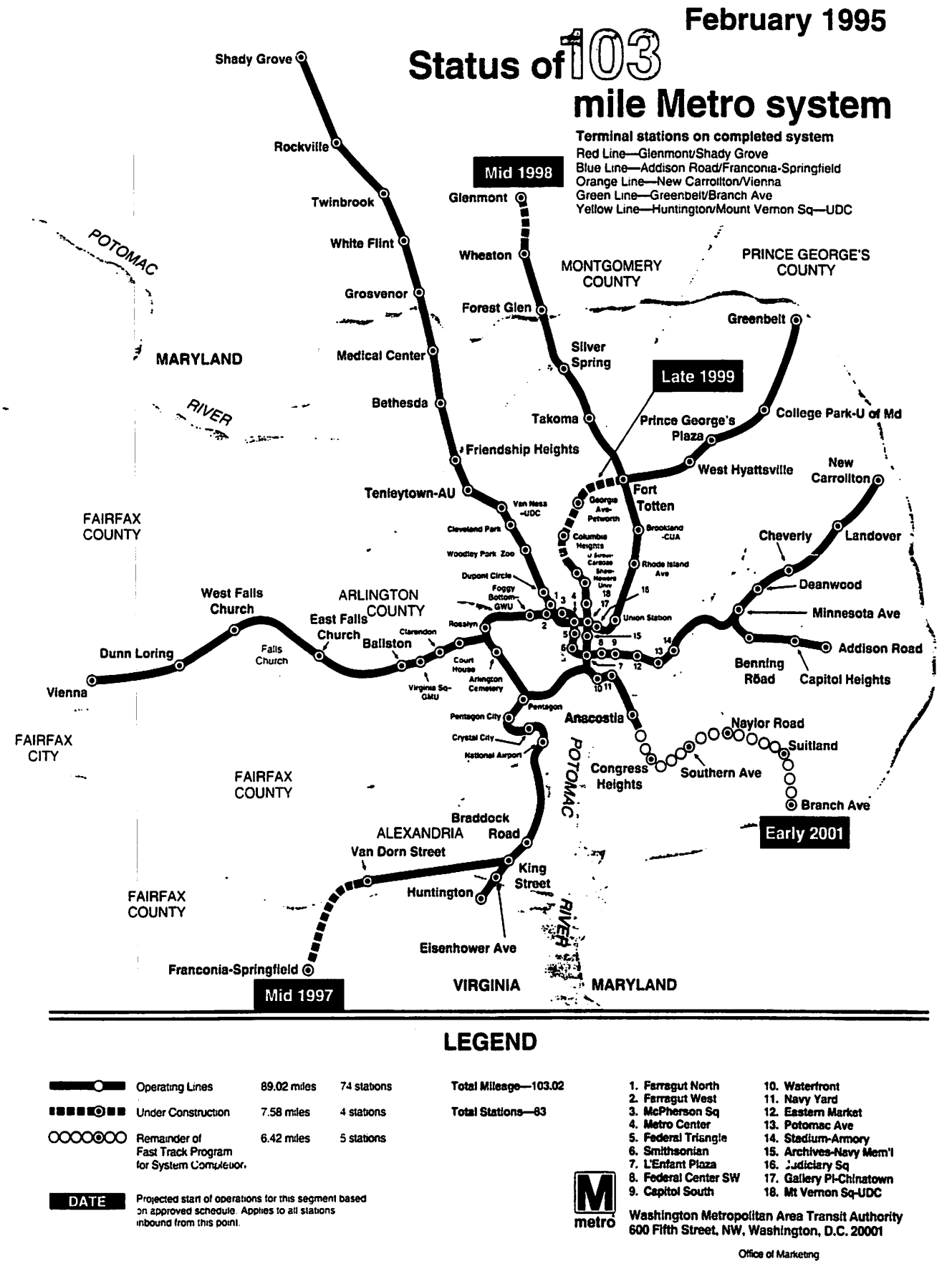

Figure 2.5 Washington Metropolitan Area Transit Authority System Map

consistently and construction stayed close to schedule throughout the 1980's. and at this time the system is over 90% complete and almost certain to reach its final 103 mile extent by 2000.

As the region's MPO, the Metropolitan Washington Council of Governments (WashCOG) is responsible for preparing all long range transportation plans and meets with local transportation providers regularly. Beyond approving the federally mandated regional Transportation Improvement Plan, though, it has no legal authority or funding control over transit. The states of Maryland and Virginia are relatively unique in terms of the regional nature of land use and zoning decisions within their borders. Unlike most states where land use and planning decisions are the domain of individual municipalities, this power rests at the county level in Washington's suburbs. With the exception of about six independent cities in both states, all zoning and planning boards are accountable to the county commissioners—the same people who serve as (or appoint) regional representatives to local transit funding boards. This structure is thought to be a primary reason why there has been a great deal of cooperation between local communities and WMATA since the transit agency started its highly successful Metro Station Area Development Program in 1981. Through their Office of Planning and Development, WMATA has succeeded in using local zoning and incentives to spur hundreds of millions of dollars of office, commercial, and residential real estate development around many of its train stations—providing economic growth for station area communities, station property lease revenues exceeding $4 million per year for WMATA, and a growing Metro transit market.

2.3 Classification of station area cases and analysis of development goals

Thirty-two station areas (some including multiple stations) have been identified and assigned appropriate places in the classification matrix (Table 2.2). Detailed case studies for each station area may be found in Appendix A. Features of interest in this analysis include land use characteristics at the station site prior to station construction, land use characteristics at the station site as it presently exists, and the land use *intentions* of relevant planners since the time the site was selected for a transit station. Past and present *actual* station area land uses are easily identifiable. Public records, photographs, site visits, and accounts from knowledgeable local people may all be used to construct an accurate characterization of the actual physical station surroundings.[33] Whether by accident or design, or a combination of both, these present and historical site conditions represent

[33]See Appendix B for information on the methods used to gather information on each station area.

Table 2.2 Matrix for Classifying Station Areas and Evaluating Development Potential/Goals

Pre-Station Neighborhood Characteristics — *General Attributes*	Actual Post-Station Neighborhood Characteristics — *General Attributes*: Low Intensity Mixed-Use	Medium Intensity Residential	Medium Intensity Mixed-Use	Suburban High Intensity Mixed-Use	Urban High Intensity Mixed-Use
Rural, Undeveloped, Low Intensity Residential (postwar conventional suburban)	• - Fairfax Cnty, WMATA			? Scarborough Center, TTC	
Low Intensity Mixed-Use (parking lot oriented shopping, multi-family residential, & light industrial)				+ Dadeland N&S, M-DTA ? R'ville Pk. Corr., WMATA ? New Carrollton, WMATA - Wellington, MBTA	+ Jeff. Davis Corr., WMATA + North York, TTC + King/Eisenhower, WMATA
Medium Intensity Residential (prewar neighborhood)		• * Inman Park, MARTA • * Tenleytown, WMATA • Anacostia, WMATA	+ Braddock Rd, WMATA	• * Quincy Adams, MBTA	
Medium Intensity Mixed-Use (town center, prewar commercial, vacant industrial)			• * Pape, TTC + Decatur, MARTA + Malden Center, MBTA + Davis Square, MBTA + Quincy Center, MBTA • - AUC Stations, MARTA • * Rhode Island Av., WMATA + Vn Ns & Fshp Hgt, WMATA + Virginia Sq-GMU, WMATA	- Alewife, MBTA + North Quincy, MBTA	+ Bethesda, WMATA + Blstn-Rslyn Corr., WMATA + Peachtree Corr., MARTA + Yonge Street Corr., TTC
Suburban High Intensity Mixed-Use (highrise, abundant parking, "edge city")				? Lenox/Buckhead, MARTA	
Urban High Intensity Mixed-Use (highrise, limited parking)					+ Downtown Miami, M-DTA + Downtown Atlanta, MARTA

• Indicates that there has been no significant new station area development since the station was constructed.

+ Indicates that the actual post-station neighborhood conditions are consistent with relevant formal station area land use plans.

- Indicates that the actual post-station neighborhood conditions are not consistent with relevant formal station area land use plans.

? Indicates uncertainty about whether the actual post-station neighborhood conditions are consistent with relevant formal station area land use plans.

* Indicates that relevant formal station area land use plans were never prepared for this case.

development outcomes which have actually occurred. Because these former and existing development patterns have been achieved, they should make robust and relevant models when considering how to influence development at new station areas. Therefore actual station area characteristics are used as the basis for this analysis and are the major categorization groups on the axes of Table 2.2. The rows of this matrix represent station area land uses prior to station construction, following the typology described in Section 2.1. The columns indicate land uses which actually occupy the station area at the present time.

It is also informative and useful to examine the station area *plans* that have been advanced since station construction, and to consider how and why actual development has followed and diverged from these plans. Relationships between the actual conditions and the land uses which have been encouraged by station area plans are indicated in the table by notations beside each case name. These symbols denote whether there has been any significant new development at the station site since construction, whether relevant formal station area plans have been prepared, and if the actual post station neighborhood conditions are consistent or inconsistent with these plans. Station sites were chosen for analysis based upon availability of information from local planning agencies, municipal governments and relevant individuals while attempting to locate enough appropriate stations to fill all relevant cells in the classification matrix.

2.3.1 Pre-station neighborhood characteristics

The only station areas which conformed to the Rural, Undeveloped, Low Intensity Residential category were the suburban Fairfax County Metrorail stations and Scarborough Center. The Fairfax County stations were all sited along or near expressways in otherwise primarily residential neighborhoods, while the City of Scarborough, Ontario planned and built its new town center on primarily agricultural land at what was the edge of suburban development twenty years ago. Seven station sites in this analysis were located in previously Low Intensity Mixed-Use areas. Dadeland, the Rockville Pike Corridor, and North York were characterized by their highway-oriented commercial development at the time of station construction. Wellington, New Carrollton, the Jefferson Davis Highway Corridor, and the King Street/Eisenhower Avenue area all featured scattered light industrial uses and vacant land, some parking lot retail, and low density housing at the fringes of the station areas. Medium Intensity Residential development, primarily in the form of pre-1940 vintage houses with minimal neighborhood retail, could be found at the Inman Park, Tenleytown, Anacostia, Braddock Road, and Quincy Adams stations.

The most common classification for pre-station areas chosen in this analysis was Medium Intensity Mixed-Use districts. Nearly all of these areas were existing

neighborhood retail centers or commercial corridors which dated from the beginning of this century. The Yonge Street Corridor, Pape, Van Ness, Friendship Heights, and Bethesda station areas were among the more economically healthy districts at the time of station construction, while transit access was looked upon to revive diminishing commercial activity at Decatur, Malden Center, Davis Square, Quincy Center, North Quincy, the Atlanta University Center stations, and along the Peachtree and Ballston-Rosslyn Corridors. At Rhode Island Avenue and Alewife the environs of the future stations were dominated by old and mostly vacant industrial and railroad facilities. Only a few pre-station districts conformed to the Suburban and Urban High Intensity Mixed-Use classifications. The Lenox/Buckhead area was developing into a suburban "edge city" with office towers, shopping malls, and abundant parking well before MARTA reached the site in 1985, and the downtown areas of Atlanta and Miami are the only two districts examined which had urban densities and land uses prior to rapid transit construction.

2.3.2 Actual post-station neighborhood characteristics

The incidental development which has occurred around the ten year old WMATA stations in Fairfax County has been primarily of the Low Intensity Mixed-Use type. Aside from a couple of office buildings at the Dunn Loring Station, and a few apartment complexes and small retail centers at the others, the Fairfax County station areas have not changed significantly from their pre-station Low Intensity Residential classification. Inman Park, Tenleytown, and Anacostia have also not experienced new development since their stations were opened sixteen, eleven, and four years ago, respectively. At Inman Park and Tenleytown neighbors have opposed development, whereas Anacostia is presently an economically depressed urban neighborhood with very little demand for development. A Metrorail station helped Braddock Road change from a residential area to a mixed use district while remaining Medium Intensity. Over half of the neighborhoods which were Medium Intensity Mixed-Use prior to station construction remained so afterwards—with many showing improved commercial viability over the same period. Decatur and Quincy Center shifted from traditional retail-based town centers to a higher proportion of office space, while Malden Center received several apartment buildings and government facilities, Davis Square's residential community and convenience and service retail businesses were strengthened, and Virginia Square has developed into a cultural and educational district with several new schools, parks, and arts facilities. The area around Pape and Danforth Avenues in Toronto is a vibrant restaurant and retail district, but has not seen much new development in the 29 years since the Pape station opened. The increasingly derelict industrial district at Rhode Island Avenue has seen no new development, and in spite of the presence of six colleges and universities, the three Atlanta University Center MARTA

stations have seen little in the way of nearby neighborhood development in the past fifteen years (although significant public improvements are being made presently in preparation for the 1996 Atlanta Olympic Games).

Eight of the nine areas in this study which are presently developing in a Suburban High Intensity Mixed-Use nature were not that way when their stations were planned. Scarborough Center grew from farmland into a major shopping mall and office center, although the first ten years of development anticipated the actual 1985 completion of its rapid transit station. The booming suburban retail centers of Dadeland and the Rockville Pike Corridor have added office and hotel space to what were primarily retail districts before Metrorail access, but remain highly auto-oriented in design. In Atlanta, the maturing Lenox area still boasts a strong office and retail market, but is becoming built out. Alewife, North Quincy, and Wellington have all seen more modest, primarily office development than the three previous areas, and suburban office development at Quincy Adams is only marginally within the station area. Naturally, the most concentrated and arguably "best" examples of station area development fall under the Urban High Intensity Mixed-Use classification. The downtown districts of both Miami and Atlanta have see a large amount of new office, retail, and some residential construction, and have remained very solidly urban in nature. Along the Jefferson Davis Highway, Ballston-Rosslyn, Peachtree, and Yonge Street Corridors and at the King Street, North York, and Bethesda stations, millions of square feet of highly concentrated mixed-use development has resulted in the creation of small urban centers where low and medium intensity districts stood before.

2.3.3 Post-station neighborhood plans and goals

Exactly half of the station areas examined in this study, including all of the stations which have seen the most intensive development, have developed in a manner which has been highly consistent with relevant formal station area land use plans. At Bethesda, Friendship Heights, North York, King Street, Braddock Road, and along the Ballston-Rosslyn, Peachtree, and Yonge Street Corridors, the station area plans were formal documents prepared by the local municipalities in direct response to the construction of the rapid transit system and have been updated since the stations opened and development has occurred. The Pentagon City and Crystal City developments along the Jefferson Davis Highway Corridor in Arlington County were conceived during and before the planning stages for Metrorail respectively, but have also followed formal land use plans prepared by their developers with the approval of the County. Smaller "town center" station areas such as Decatur, Malden, Quincy, and Davis Square have acknowledged the impacts of transit access in their city's comprehensive plans, and have addressed many station area issues on an individual basis and with community groups as development issues have arisen.

In four cases, the actual development around transit stations has not occurred as anticipated by the original station area plans. In Fairfax County, development plans called for small "transit-friendly" mixed-use nodes around each of the transit stations. Although proper zoning is in place, this type of development has yet to materialize at any of these sites. Aside from the universities, the AUC neighborhood has been an economically depressed section of Atlanta for several decades. Initial plans for its MARTA stations called for major reinvestments in nearby commercial districts which were never able to be financed, and consequently did not get built. At the Alewife and Wellington MBTA stations, the respective communities of Cambridge and Medford had prepared plans which called for large mixed-use mega-project developments at both stations. Real estate conditions precluded financing for either of these large scale projects, and in the absence of a viable alternate plan developers were permitted to build spread out suburban-style office buildings with ample parking.

It is questionable whether the actual station area development is consistent with plans at several sites primarily because the types of auto-oriented developments which have been permitted in these station areas is allowed by zoning but discouraged by the "intent" of formal community plans which stress the importance of transit access. This dichotomy is most apparent in the Lenox/Buckhead and Rockville Pike areas, each of which are home to millions of square feet of new office and retail space and thousands of apartment units, but all built in such a spread out manner that it is nearly impossible to walk to most of these developments from their respective transit stations. The New Carrollton station is developing with a "split personality" as the area southeast of the station is occupied by large parking lots and ten to twenty year old isolated office buildings, while the area to the northwest is located in a newly created district which mandates transit-oriented mixed use development. Scarborough Center appears to have had a change of heart towards urban design when rapid transit access arrived about midway through its development. Unfortunately, by the time that local planners realized that the district should be more transit and pedestrian-friendly, all of the automobile-oriented infrastructure and a huge shopping mall had already been built, leaving the city with the challenge of "retrofitting" the existing development as well as they are able. At sites where little or nothing has effectively been done regarding planning for station area development, such as Inman Park, Tenleytown, Pape, Rhode Island Avenue, North Quincy, and Quincy Adams, station area land use has not changed significantly.

2.4 Tools and techniques for influencing development at transit stations

A number of zoning techniques and other policy tools have been utilized in many of the station areas to influence the nature of, and promote, new development. Some stations have incorporated a broad spectrum of coordinated policies into their development strategy while others have stuck with just a few. A summary of local efforts is presented in Table 2.3, and the remainder of this section explains these strategies and factors which have been used to influence development.

2.4.1 Comprehensive plan for station area development

As described in the previous section, nearly all of the station areas under analysis have been the subject of land use plans. By addressing the nature of development with an intent to influence not only the nature of a particular section of town, but also how it functions economically and socially with respect to the other parts of the community, these land use plans go one step beyond typical zoning regulations which just stipulate permissible land uses throughout each municipality. In the Decatur, Malden, Quincy, and Davis Square areas, access to transit has been viewed as one element of broader district or community plans. More common, though, is the case for all of the other station areas with comprehensive plans. At these stations, intensive new development is desired or the municipality is home to several transit stations, and as a result the plans are frequently tailored to individual stations, and special attention is paid to particular idiosyncrasies of the site and surrounding neighborhoods.

2.4.2 Increased densities required / permitted (by "bonus") / permitted (by "right")

A primary tenant of suburbanization in the Interstate Highway era has been to promote lower development densities—single family homes on large lots, wide roads, single story shopping centers with enormous parking lots. Recognizing that this type of urban form makes transit service difficult to provide and inconvenient to use, a common technique for influencing development at station areas has been through regulating allowable densities of development. The strongest form of this type of regulation is to require all development to fall within a predetermined range of densities (such as a certain floor-area ratio for commercial buildings, or dwelling units per acre for residential property). Minimum density requirements have been used in the Ballston-Rosslyn, Peachtree, and Yonge Street Corridors, as well as in the North York, King Street, Alewife, and New Carrollton station areas in order to ensure development which will concentrate destinations for potential transit patrons close to the station. Ideally, in a downtown district or other area of concentrated activity density standards become self-enforcing as land values escalate to the point where intense development is all that is economically feasible.

Table 2.3 Strategies for and Factors Influencing Station Area Development

Post-Station General Attribute Station Area Station	Comprehensive Plan for Station Area Development	Increased Densities Required	Increased Densities Permitted (by "bonus")	Increased Densities Permitted (by "right")	Mixed-Use Development Required	Mixed-Use Development Encouraged	Pedestrian and Transit Amenities Required	Reduced Parking Required	Reduced Parking Permitted	Air Rights Development Permitted Over Station	Public Assembledge of Land for Development	Active Public Strategy to Market/ Encourage Particular Land Uses	"Adequate Public Facilities" Required (exacted)	Tax Incentives	Federal Programs/Grants	Travel Demand Management Programs Required	Neighborhood Development Org./ Business District Association	"Pro-Development" Local Environment	"Anti-Development" Local Environment
Low Intensity Mixed-Use																			
Fairfax County																			
West Falls Church	●			●		●	●		●										
Dunn Loring	●			●		●	●		●										
Vienna	●			●		●	●		●										
Huntington	●			●		●	●		●										
Medium Intensity Residential																			
Inman Park-Reynoldstown											●						●		●
Tenleytown																	●		●
Anacostia	●			●		●											●		
Medium Intensity Mixed-Use																			
Braddock Road	●	●			●		●	●			●	●				●		●	
Pape									●										
Decatur	●			●	●		●		●		●	●					●	●	
Malden Center	●			●		●			●								●		
Davis Square	●					●			●										●
Quincy Center	●			●		●	●		●	●									
AUC Stations																			
Ashby	●			●		●			●						●		●		
Vine City	●			●		●			●						●		●		
West End	●			●		●			●						●		●		
Rhode Island Avenue											●								
Van Ness-UDC	●			●	●				●	●				●					
Friendship Heights	●		●		●		●	●		●			●	●			●	●	
Virginia Square-GMU	●			●	●		●	●		●									
Sub'n High Int. Mixed-Use																			
Scarborough Center	●	●			●		●	●			●								
Dadeland																			
Dadeland North	●			●	●		●		●	●	●	●		●				●	
Dadeland South	●			●	●		●		●	●	●	●		●				●	
Rockville Pike Corridor																			
Grosvenor	●		●			●			●	●			●						
White Flint	●		●			●			●	●			●	●					
New Carrollton	●	●			●		●		●	●									
Wellington	●					●				●		●							
Quincy Adams																	●		●
Alewife	●				●		●	●		●		●							
North Quincy										●									
Lenox	●			●		●			●	●				●				●	

Table 2.3 Strategies for and Factors Influencing Station Area Development

Post-Station General Attribute Station Area Station	Comprehensive Plan for Station Area Development	Increased Densities Required	Increased Densities Permitted (by "bonus")	Increased Densities Permitted (by "right")	Mixed-Use Development Required	Mixed-Use Development Encouraged	Pedestrian and Transit Amenities Required	Reduced Parking Required	Reduced Parking Permitted	Air Rights Development Permitted Over Station	Public Assembledge of Land for Development	Active Public Strategy to Market/ Encourage Particular Land Uses	"Adequate Public Facilities" Required (exacted)	Tax Incentives	Federal Programs/Grants	Travel Demand Management Programs Required	Neighborhood Development Org./ Business District Association	"Pro-Development" Local Environment	"Anti-Development" Local Environment
Urban High Int. Mixed-Use																			
Jefferson Davis Corridor																			
Pentagon City	●	●			●			●		●								●	
Crystal City	●	●			●			●		●								●	
North York																			
Sheppard	●	●			●		●	●		●				●				●	
North York Center	●	●			●		●	●		●		●		●				●	
Finch	●	●			●		●	●		●								●	
King Street	●	●			●		●	●		●		●				●	●	●	
Eisenhower Avenue				●		●			●	●									
Bethesda	●		●		●		●	●		●			●	●		●	●	●	●
Ballston-Rosslyn Corridor																			
Rosslyn	●	●			●		●	●		●								●	
Court House	●	●			●		●	●		●				●				●	
Ballston	●	●			●		●	●		●		●		●				●	
Peachtree Corridor																			
North Avenue	●	●			●		●	●		●							●	●	
Midtown	●	●			●		●	●		●							●	●	
Arts Center	●	●			●		●	●		●							●	●	
Yonge Street Corridor																			
St. Clair	●	●			●		●	●		●				●				●	
Davisville	●	●			●		●	●		●				●				●	
Eglinton	●	●			●		●	●		●				●				●	
Downtown Miami																			
Brickell	●	●			●		●	●										●	
Government Center	●	●			●		●	●										●	
Overtown/Arena	●	●			●		●	●										●	
Downtown Atlanta																			
Five Points	●	●			●		●	●			●	●					●	●	
Peachtree Center	●	●			●		●	●		●							●	●	
Georgia State	●	●			●		●	●		●							●	●	
Omni	●	●			●		●	●		●							●	●	
Garnett	●	●			●		●	●		●							●	●	

This is the case in downtown Miami and Atlanta, as well as in more established commercial centers like Bethesda and Friendship Heights. When real estate markets encourage high density development, municipalities have used the opposite strategy, and only permit high density as a zoning "bonus" if other public amenities (as described in subsequent paragraphs) are provided. A few stations like Inman Park, Tenleytown, and Davis Square have density limits imposed in order to prevent high intensity development from occurring around these stations. The remaining station areas generally address development density by allowing high density as matter of zoning "right," but not necessarily requiring or encouraging it.

2.4.3 Mixed-use development required / encouraged

Many communities have also understood that density alone is not sufficient to encourage a vibrant station area environment, and have implemented zoning policies respecting mixed-use development. Both regulations which require and simply encourage a combination of office, residential, and retail land uses in pre-specified proportions near transit stations have been enacted at several of the case areas. Mixed-use requirements have generally been implemented in the more economically active development districts, while being encouraged nearly everywhere else.

2.4.4 Pedestrian and transit amenities required

Although it may seem like common sense for a developer to provide pedestrian and transit amenities around their station area projects, many communities have found it necessary to codify such requirements to make sure they actually occur. Typically these amenities include street furnishings such as park benches, trees, brick or paving block sidewalk treatment, special lights to illuminate the sidewalk, and coordinated signage.

2.4.5 Reduced parking required / permitted

An effective tool for promoting transit usage is regulating on and off-street automobile parking provision. Most station area plans address parking issues by either allowing developers to provide less parking in transit station areas than would otherwise be permissible under local policies, or by placing limits on the amount of parking which is allowed. More stringent parking restrictions can generally be found around the densely developed station areas where land values make off-street parking more expensive. In these cases, parking is often provided in garages, and developers are willing to accommodate fewer cars because it allows them to build more profitable commercial and residential space.

2.4.6 Air rights development permitted over station

Often the space above a transit facility located at or below grade represents a prime development site. Many transit authorities and local municipalities have recognized this and

designed transit stations to accommodate "air rights" development. Since the land is owned by the transit authority, this agency is typically able to negotiate receipt of a proportion of the development's rent in exchange for use of this station's air rights. Several stations allow this type of arrangement, but have not yet experienced such development. However, good examples of air rights projects may be found at Van Ness-UDC, Friendship Heights, Dadeland North and South, Pentagon City, Crystal City, Sheppard, North York Center, St. Clair, Davisville, Eglinton, Peachtree Center, Georgia State, and Omni stations.

2.4.7 Public assemblage of land for development

In addition to the public land including and surrounding the transit station itself, several municipalities have made efforts to clear and assemble tracts of land to improve its development potential. The respective municipalities have used this technique at the Braddock Road, Decatur, Dadeland, and Five Points stations, while Scarborough Center is built entirely on former farmland which was assembled by the city. Interestingly, a large amount of land around both the Inman Park and Rhode Island Avenue stations was cleared and assembled for highway projects which were canceled, but in both of these cases the land still lies vacant.

2.4.8 Active public strategy to market / encourage particular land uses

In several instances, transit station area communities have made concerted efforts to encourage particular land uses. In the late 1980's Alexandria, Virginia sold industrial revenue bonds to finance an effort to entice national associations to relocate their headquarters to the city, and used transit access as a key selling point. Having achieved success at encouraging increased office development near the Decatur MARTA station, city officials there are now focusing their efforts almost exclusively on securing residential development for the area. Dade County, Florida worked with several developers to build an office-hotel complex at the Dadeland South station, and are presently arranging a similar development at Dadeland North. Public efforts to revive Underground Atlanta at the Five Points station and build Ballston Common Shopping Mall on the site of an old shopping center met with success, while similar endeavors to encourage large scale development at the Alewife and Wellington MBTA stations did not fare so well.

2.4.9 "Adequate public facilities" required (exacted)

Only Montgomery County, Maryland has an "Adequate Public Facilities Ordinance" which stipulates how much burden new developments may place on local infrastructure (including transportation) before the county is authorized to require developers to pay for additional public improvements.

2.4.10 Tax incentives

Techniques such as local property tax abatements are fairly common methods for encouraging private investment in station areas but usually pertain only to individual developments. These types of incentives are also generally not applied in a uniform fashion so it is difficult to determine their exact nature and their impacts on station area development, and they have not been noted explicitly in this research. Another common tax incentive occurs when developments are built on land owned by the public transit agency. In these cases, which are noted in Table 2.3, developers need not pay property tax on the land upon which the building stands, as it is public property under lease. In some blighted urban areas, stations may also be located in local or national "Enterprise Zones" which provide tax incentives to employers who locate in and/or hire employees who reside in these areas.

2.4.11 Federal programs / grants

The primary and most immediate impact of federal money on transit station areas is usually the station itself, which in the United States have been built primarily with money from the Urban Mass Transit Administration (now Federal Transit Administration). The new FTA "Livable Communities Initiative" also makes federal funds available specifically for transit station area improvement projects, and has provided funding for efforts around the AUC stations as well as two stations which will be discussed in Section 2.5.

2.4.12 Travel demand management programs required

The Bethesda station and the Alexandria stations fall under local "travel demand management" (TDM) districts. The purpose of TDM programs is to reduce the demand for single occupant vehicle trips by promoting ride sharing, public transit, and work-at-home options. The key features of the Maryland and Virginia programs are parking incentives for car- and vanpoolers, discounted transit passes, and business outreach and information dissemination programs regarding employee travel options.

2.4.13 Neighborhood development organization / business district association

Often development goals for a station area can be best ascertained and implemented through the involvement of a local civic improvement organization, and nearly all of the station areas have seen participation by some type of neighborhood group in the transit planning process. Notable leaders in this realm include Central Atlanta Progress for their work on the downtown and Peachtree Corridor stations, AUC Inc. in the Atlanta University Center, the Anacostia Coordinating Council, and a joint city-property owner task force in Alexandria.

2.4.14 "Pro-development" / "anti-development" local environment

An important factor which influences the nature and extent of station area development efforts is the attitude of neighborhood residents. In the case of Inman Park and Tenleytown, local resistance forced downzoning in the station areas in an attempt to preclude any station area development. In addition, neighbors near several unstudied stations between downtown Miami and Dadeland forced downzoning to prevent construction of high density housing while residents of Miami's Northwest side had what one observer called a "visceral" reaction to Metrorail in their community.[34] At Quincy Adams, nearby residents succeeded in effectively isolating their station from the community by gating the neighborhood entrance. Now the station serves only park and ride traffic from the adjoining expressway. Residents and business around Davis Square became active in the station planning process from an early date to ensure that their new station did not have adverse effects on the business district and surrounding neighborhoods. Arlington County, Alexandria, Bethesda, Friendship Heights, Decatur, Downtown Miami and much of Atlanta and Toronto have been notable for their enthusiastic support and encouragement of any and all transit related development.

2.5 Examples and characteristics of station areas with "Special Attributes"

The typology outlined in Section 2.1 also recognizes that station areas may exhibit other attributes relevant to development which do not necessarily conform to the intensity based characteristics used as the previously specified "general" attributes. These special conditions, which may apply to station areas of any development intensity, include such features as development of a "new town" around a transit station, proximity to a major university, a major medical center, or in an urban renewal area, or a station which serves a dual or primary role as a transfer point between the rail system and buses or cars. The influence and relationship between these attributes and nearby stations is examined for several relevant cases in this section (see Table 2.4).

2.5.1 "New Town"

The two major new towns examined earlier are Scarborough Center in Ontario, and the Pentagon City and Crystal City developments along Jefferson Davis Highway in Arlington County, Virginia. These projects represent two different approaches to transit-orientation in a major planned center. A healthy mix of retail, office, residential, and entertainment uses were included in the initial plans for Scarborough Center, but the spatial

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[34]Jack Luft, City of Miami, phone interview. See Section 2.5 for his commentary on the transit planning environment in Miami.

Table 2.4 Matrix for Evaluating Station Area Special Attributes

Pre-Station Neighborhood Characteristics — *General Attributes*	Actual Post-Station Neighborhood Characteristics — *Special Attributes*				
	"New Town"	University Area	Medical Center	Urban Renewal Area	Park-n-Ride/ Transit Transfer Center
Rural, Undeveloped, Low Intensity Residential (postwar conventional suburban)	Scarborough Center, TTC				Fairfax Cnty, WMATA MARTA end of line stations TTC end of line stations
Low Intensity Mixed-Use (parking lot oriented shopping, multi-family residential, & light industrial)	Jeff. Davis Corr., WMATA				Dadeland N&S, M-DTA Rockville Pk. Corr., WMATA New Carrollton, WMATA Wellington, MBTA
Medium Intensity Residential (prewar neighborhood)				Anacostia, WMATA	Anacostia, WMATA Quincy Adams, MBTA
Medium Intensity Mixed-Use (town center, prewar commercial, vacant industrial)		Van Ness-UDC, WMATA Virginia Sq-GMU, WMATA AUC Stations, MARTA Shaw-Howard U, WMATA Ruggles, MBTA	LMA, MBTA	Rhode Island Av., WMATA Shaw/U Street, WMATA Peachtree Corr., MARTA Ruggles, MBTA Northwest Miami Fruitvale, BART Green Line, CTA	Decatur, MARTA Quincy Center, MBTA Rhode Island Av., WMATA Vn Ns & Fshp Hgt, WMATA Alewife, MBTA North Quincy, MBTA Bethesda, WMATA Ballston, WMATA North Avenue, MARTA Eglinton, TTC
Suburban High Intensity Mixed-Use (highrise, abundant parking, "edge city")			Med. Cntr, WMATA Med. Cntr, MARTA		
Urban High Intensity Mixed-Use (highrise, limited parking)				Downtown Miami, M-DTA Downtown Atlanta, MARTA Back Bay/South End, MBTA	

relationships between the structures housing these functions was oriented around parking lots. Now the town is struggling to create a more pedestrian friendly environment and attractive and functional public spaces under these existing conditions. Crystal City was also initially designed for auto access, although at much higher densities. Consequently, the buildings were placed close together and parking was provided in structures. This allowed effective pedestrian access between buildings through the underground system of walkways and lent itself to convenient Metro access once the station was completed. Later stages of this development have paid more attention to streetscape and outdoor public space details. Development at Crystal City and Pentagon City has occurred in large, discrete segments. This characteristic of planned communities results in a rather inflexible existing infrastructure when modifications such as the Metro station at Crystal City are made. In this case, a series of new underground passageways had to be built, and the station was not able to be a visible focal point of the development. Another feature of these mega-projects could be characterized as "all-or-nothing" development. At Pentagon City, there was no commercial or lodging space at all until several years of office construction had been completed and the developers perceived a need for an enormous shopping mall and a 345 room luxury hotel.

These examples of new town development also do not tend to integrate well with their surroundings. Both Scarborough Center and the large developments in Arlington are isolated from nearby neighborhoods by busy highways, feature no transitional land uses near the bordering single family home areas, and use street networks which are completely disconnected from those of the surrounding districts. Three nascent new town style developments will attempt to address some of these design issues by creating new districts on a smaller scale—more closely resembling that of a traditional neighborhood. The previously mentioned Carlisle development near the King Street station in Alexandria, Virginia has incorporated a grid street pattern similar to that of Old Town to enforce pedestrian-oriented building design, while an enormous new development on the Potomac Yard site in North Alexandria is intended to behave like an urban village with narrow streets, wide sidewalks, and streetfront retail. Development plans for this project call for 5,500 housing units and over six million square feet of commercial space in mid-rise mixed-use buildings all centered around a new Metrorail station. In the Portland, Oregon area, local officials have adopted pedestrian oriented land use plans for all of their new light rail transit station areas. These plans call for developing several existing large parcels of undeveloped land near stations as small scale town centers with mixed land uses and standard pedestrian and transit oriented urban design techniques.[35]

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[35]For example, see the *Gresham Civic Neighborhood Plan* (1995)

2.5.2 University areas

Urban universities and transit stations have had differing relationships in several metropolitan areas. In the case of UDC at WMATA's Van Ness station and GMU at WMATA's Virginia Square station, subway construction preceded or was coincident with the campus location decision. As described earlier, access to WMATA was crucial for locating UDC's Connecticut Avenue campus. However, even though GMU is also primarily a commuter school, the university did not use mass transit access as a determining factor when the decision was made to locate the Law School in Arlington. According to school administrators, the strongest site location factor was that the school got a good deal on an old department store building and adjoining land for a five acre campus. Transit access played only a small role. Nevertheless, the Virginia Square Metro station is close to the school and is heavily used by students, faculty and staff out of convenience.

Much like the Atlanta University Center schools examined earlier, which are all located several blocks from MARTA stations, WMATA's Shaw-Howard University station is about four blocks southwest of the campus, while the U Street-Cardozo station is six blocks west. These stations were completed in 1991 but sited over twenty years ago without input from the university, and the impact that four years of Metro access has had on the 128 year old campus thus far has been negligible.[36] Parking around campus is inadequate, though, so many commuters do take Metro. As the campus is surrounded by medium to high density residential neighborhoods on all sides, it is likely that land used for parking will become even more scarce as the school continues to grow, and Metro will be looked upon to play an increased role in providing access to the university.

When the MBTA's Orange Line subway was rerouted in 1987, Ruggles station was built along the south edge of Northeastern University. The nearly 100 year old campus is located between Boston's established and densely populated Roxbury and Fenway neighborhoods and was already served by a branch of the Green Line trolley to the north. The Orange Line had previously served neighborhoods associated with street crime, and that image lingered through the planning stages for the new line. Consequently, a T stop at the campus was not desired by administrators at this otherwise heavily commuter and transit-oriented campus. The transit authority prevailed, though, and built a grand station at Ruggles which features a subway station, commuter rail station, a large bus transfer facility, and a pedestrian concourse underneath a dramatic vaulted glass ceiling. The bus transfer facility primarily serves the surrounding community, while much of the commuter rail and subway traffic is generated by the university.

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[36]Adolf Hight, Howard University, phone interview

The impressive design of the station and efforts by the T to soundproof nearby buildings has changed the attitude of the Northeastern community towards the new facility since it opened. Former Green Line riders have even found the new line more convenient for trips to and from downtown Boston. Several fortunate byproducts came from station construction including closure of a number of formerly through streets, and corresponding pedestrian improvements on the existing right of way. The landlocked school has used Ruggles station—and the relative abundance of vacant land around it—as a focal point for new classroom, office, and laboratory construction. Three new facilities are presently under construction, and two have been completed recently. Now the university has become a major supporter of the proposed cross-town transit line in Boston, and has a heightened awareness of the benefits of being well connected to the transit system.[37]

2.5.3 Medical centers

Medical centers share many of the same characteristics as university campuses. As concentrations of employment on large pieces of land under common ownership, these facilities can exert a strong influence on the nature of employee access through facilities planning and parking policy decisions. Medical centers have been recognized as prime locations for rapid transit stations in several cities with newer systems like Washington and Atlanta, as well as historically in cities like Boston, New York, and Chicago. MARTA's Medical Center station is presently under construction on the North Line along the Perimeter Highway in unincorporated Fulton County. The surrounding area is not yet fully developed but is home to Children's, St. Joseph's and Northside Hospitals, and several office buildings for other medical professionals. The medical institutions have been moderately cooperative with MARTA as station development has progressed. Their main fear is that commuter parking at the station will exacerbate existing automobile congestion problems in the area. The transit authority has scaled back parking plans in response, and would like to design pedestrian improvements for the area if the hospitals would pay for construction.[38]

WMATA's ten year old Medical Center station on the Red Line between Friendship Heights and Bethesda is felt to be an asset to the adjacent National Institutes of Health (NIH) for transportation demand management purposes, but its effectiveness is limited due to the design of the entire Metrorail system.[39] All of the Metrorail lines radiate out from the center of DC, and there are no circumferential connections. Consequently, for destinations like Medical Center which are located further out on a spoke, only those people who live

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[37]June Hatfield, Northeastern University, phone interview
[38]Joe McCannon, MARTA, phone interview
[39]Stella Fiotes, National Institutes of Health, phone interview

along the line itself or on connecting lines in the District find Metro a convenient travel option. This is the case for a number of people who work at NIH, as about eleven percent of commuters to this facility take Metro.

An NIH master plan from 1972 anticipated the Metro station, but in a slightly different location than was actually built. At that time, the primary impact of the transit station was expected to be a substantial reduction in future parking requirements for the Institute. However these initial studies overestimated the use of Metro, and its impact on parking has not been as great as anticipated. When the NIH 20 year master plan was updated in 1993, administrators had several years of experience with an operational Metro station and employee travel surveys to draw upon. The physical location and layout of the station was incorporated into plans for expansion of the medical campus, and attention was paid to concentrating buildings and pedestrian improvements within an eight to ten minute walk from the station. A covered walkway is in the works for the main pedestrian corridor from the station to the center of the NIH campus and the plan calls for a pedestrian and bicycle connection to the south part of the campus. More proposed new buildings have also been sited close to the Metro station in the long range plan, but the availability of this land is contingent upon replacing the buildings that currently exist on these sites.

NIH has an extensive travel demand management program. The Institute encourages transit use by providing a $42 per month subsidy for transit passes, leases 400 park and ride spaces at remote Metrorail stations for the free use of its employees, and provides free shuttle buses which run every eight to twenty minutes and connect the station with the further reaches of the campus. The NIH also feels that it is important to encourage visitors not to drive to the campus if possible. In accordance with the philosophy of their plan, a new conference center was constructed close to the Metro station and features convenient pedestrian access. NIH is not bound by zoning or other regulations on land use, but it still works closely with local planning agencies—especially with respect to traffic and parking issues. Traffic mitigation efforts are coordinated closely with the local and regional planning agencies. NIH performs biennial traffic counts at critical intersections near its campus and takes mitigating steps if congestion levels are exceeded.

Unlike the areas around newer transit stations—the primary overall focus of this research—Boston's Longwood Medical Area (LMA) has been developing around transit for over 100 years. Green Line branches run along both sides of the area without penetrating it and radial and circumferential bus and streetcar routes have served the site along Longwood and Brookline Avenues since the late 1800's. It is likely that the decision for the initial LMA institutions (Harvard Medical School and Children's Hospital) to locate

here was influenced by this transit access.[40] Although its age and development history set this area apart from the others in this analysis, the efforts of the Medical, Academic, and Scientific Community Organization[41] (MASCO) to provide a highly coordinated transportation policy in the LMA provide an abundance of good examples which are worthy of examination.

To make transit a better commuting option, MASCO has advocated improved MBTA connections between LMA and nearby transit stations like Ruggles. At this station, only a limited number of commuter trains can stop due to platform length constraints, and MASCO has offered to pay for engineering work to make the necessary capital improvements. The organization has also been an advocate for the proposed circumferential transit line. It has organized the Circumferential Transit Employer Coalition which consists of the LMA institutions, University of Massachusetts at Boston, Boston City Hospital, Boston University and BU Medical Center, and several Cambridge and Somerville employers. This group supports continued funding through the state's transportation bond authorization to complete the studies that will make the line eligible for federal funding in the next transportation bill.

MASCO undertook an extensive signage program in conjunction with the MBTA where they provided directional and informational signs for nearby T stations and station areas. At the Longwood and Brigham Circle stops on the Green Line D and E branches, MASCO installed maps of the LMA as well as blue and white directional signs. At more distant stations like Fenway, Kenmore, and Ruggles, MASCO signage has included directions for using the bus to get to LMA. MASCO has also installed route descriptions and schedules at all LMA bus stops. The LMA institutions have been active in selling over 7,000 monthly T passes at discounts of 10 to 40 % which provide an estimated $700,000 annual benefit to employees who use transit. MASCO also coordinates the local transportation management program, Commuteworks. This program promotes commuting options through educational and informational outreach. MASCO supplies each of the member institutions with MBTA and other commuting information, and runs a ticket office in the Longwood Galleria food court where employees, patients, visitors, and students can purchase tokens and passes and obtain schedules and travel information.

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[40]Robert Tassinari, MASCO, phone interview

[41]MASCO is a nonprofit organization which coordinates policy and planning issues of joint concern to its member institutions, all located in the LMA. These member institutions presently include: Beth Israel Hospital, Brigham & Women's Hospital, Children's Hospital, Dana-Farber Cancer Institute, Emmanuel College, Harvard Medical School, Harvard School of Dental Medicine, Harvard School of Public Health, Joslin Diabetes Center, Massachusetts College of Pharmacy and Allied Health Sciences, New England Deaconess Hospital, Simmons College, Temple Israel, Wheelock College, and The Winsor School.

The MASCO area planning and development group serves a function similar to the planning department in a city government. The staff salary and overhead expenses are paid for by assessments to the member institutions, while capital improvements are financed using revenues from a restricted fund. MASCO was formed in 1972, and the planning division was created in 1978 to implement the programs recommended in a transportation plan produced by a consultant. Most of the employees in this section are trained as transportation and urban planners. The LMA transportation plan was updated in 1991 and the MASCO planning division is currently implementing the recommendations of this plan and coordinating their own shuttle bus service which connects LMA to remote parking sites and Harvard Square in Cambridge.

As with the city and town planning agencies in the region, transit service decisions are not directly under the control of MASCO planners. However the organization does benefit somewhat by representing major employers—a position which gives them political clout when they deal with the T or the Secretary of Transportation. Their capital improvements trust fund also helps MASCO to implement a wide variety of projects. They would also like to embark on transit marketing efforts, budget permitting. This work would include building kiosks to direct people from *and* to transit and parking facilities and the LMA institutions. Long range plans also include establishing transit "nodes" within LMA. Providing just a few centralized locations for T buses and MASCO shuttles to pick up and drop off passengers is expected to reduce travel times and make transit service in the area more coherent. Eventually these bus stops may include enclosed station-like facilities with stores and services.

2.5.4 Urban renewal areas

New transit stations in blighted urban areas are often looked upon to catalyze redevelopment. Anacostia and Rhode Island Avenue stations in Washington and the Peachtree Corridor in Atlanta are cases referred to in previous sections which have taken dramatically different paths towards redevelopment. The Washington stations have seen very little new development in spite of several proposals, while the district immediately north of downtown Atlanta has seen explosive growth ever since MARTA service commenced. MBTA's Ruggles station has made a great contribution to the Northeastern University campus which has surrounded it, but has done relatively little yet for the surrounding impoverished Roxbury neighborhood. The new WMATA Green Line station at Shaw was sited in a severely blighted part of the District, while the nearby U Street-Cardozo station is on the border between the gentrifying North 16th Street neighborhood and Shaw. A significant amount of housing rehabilitation and small commercial

construction has occurred along U Street since this station opened, but it is hard to tell how much of an influence the station has had.

The Northwest leg of Miami's Metrorail line was expected by some to restore economic vitality to several of the impoverished and riot-scarred neighborhoods through which it runs. There was some early interest in building station area housing, but federal housing assistance programs were slashed by the Reagan administration at the same time as the Metrorail system started service, and there has been little market or developer demand for constructing affordable housing without government assistance. Another aspect of Miami's Metrorail problems has been a deep and visceral reaction to building Metrorail lines through immigrant and poor communities.[42] These neighbors have been outspoken in their opposition; there is a fear of uncertainty and many people do not see the relevance of Metrorail. Conventional wisdom would suggest support for transit initiatives from lower income people, but Jack Luft, a planner with the City of Miami Department of Development and Housing observes,

> "Miami residents have reacted differently for several possible reasons. First, many immigrants here are from Central and South American cities like Havana, Lima, and Bogota with extensive bus transit but no rail. Miami's buses are a more convenient and familiar mode for these people, and they may fear that Metrorail investment will come at the expense of the bus system. Many people use the buses for short haul trips, and value the street corner access. The bus-to-rail idea is not a part of their travel patterns or habits. It appears to be largely a matter of 'cultural conditioning.'
>
> "Even in the city, it is not apparent to a large part of the population that Metrorail may have benefits to low income residents. All that many people see is the potential for ripping up neighborhoods and dividing communities like the expressways of the 1970's did. Right now there is a major push on in some of Miami's west side Latino neighborhoods to route a proposed east-west Metrorail extension away from the neighborhoods and through an industrial area. This way it would make only one stop (at the medical center) en route from the airport to downtown. The goal of the activists is to "protect" their neighborhoods from the physical impact of the elevated train by removing it entirely and hiding it. The communities feel no relationship with Metrorail and they believe it is only for downtown. Of course, this will be a self fulfilling prophesy if there are no neighborhood stations."

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[42]Jack Luft, City of Miami, phone interview

By focusing access on the central business districts of their metropolitan areas, the new transit systems in Miami and Atlanta (as well as Washington, Toronto, Montreal, San Francisco, and many more cities) have assisted the revitalization and growth of their downtowns, as described in the cases in Appendix A. Even in older cities such as Boston, new stations in existing transit-served areas have seen tremendous growth in their midst. Since it opened in 1987, the Back Bay T station rose quickly to be among the busiest single line transit stations in the MBTA's rapid rail system with over 15,000 boardings per day in 1993. Sharing its site with a commuter rail and Amtrak station near Copley Square, the station's stature as a transportation center in-between a high density urban residential neighborhood and major retail, cultural, and office centers is reflected well in its grand architecture. An enormous vaulted ceiling covers the entire station, providing a visual landmark for the neighborhood and a dramatic setting for travelers. Outside, millions of dollars of residential and commercial space has sprouted since the station construction started—much of it on formerly vacant lots and in the air space above Conrail tracks and the Massachusetts Turnpike. The transit and commuter rail lines both run underground, and on top a beautifully landscaped linear park leads west from the station. Pedestrian travel is the dominant mode on the surface and the stores, apartment houses, and abundance of other people make the station area a lively district.

Two recent projects at existing but neglected station areas in Oakland, California and Chicago, Illinois are taking novel approaches towards incorporating community involvement in the redevelopment process. In spite of being the site of a station on the Bay Area's twenty year old BART rapid transit system, the Oakland, California neighborhood of Fruitvale has experienced a "...steady flight of residents, businesses, and employment opportunities from a previously active economic center."[43] When the Bay Area Rapid Transit District proposed constructing an enormous parking garage for suburban commuters at the station in 1991, the community galvanized around the issue and began discussions in earnest about the future of the neighborhood. The outcome of these meetings was a "community design symposium" and the preparation of a plan, endorsed by the City of Oakland, BART, and the FTA, to redevelop the Fruitvale BART station area into a pedestrian and transit-oriented community center. Local monies and an FTA Livable Cities grant have been obtained to fund project conceptualization and to develop a plan to implement the vision. Presently a coalition of community organizations led by Oakland's Spanish Speaking Unity Council are securing funding for construction of streetscape and façade improvements as well as building renovations.

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[43]Olson (1995)

The two elevated railroads that form the Chicago Transit Authority's Green Line were each built over 100 years ago to carry steam locomotives and wooden passenger cars to and from Chicago's downtown. After years of deferred maintenance and dramatic losses in neighborhood population and employment, ridership on the now electrified but not-so-rapid transit line plummeted by over 30% from 1985 to 1990. By 1993 the antique structures were in danger of collapsing and a coalition of neighborhood groups led by the Center for Neighborhood Technology[44] (CNT) was instrumental in convincing CTA to rebuild the line instead of closing it permanently. This group also advanced the idea of using a rebuilt Green Line as a catalyst for rebuilding Chicago's impoverished and largely abandoned West Side. They demonstrated their commitment by preparing a prototype plan for a transit oriented community to be built around a new "super station" at Pulaski and Lake Street.

As reconstruction of the line has progressed, the local organizations have continued to advance the plan. At this point, the land for the station has been acquired by CTA, and preliminary design has been completed for a three story commercial building with retail on the ground floor, community group offices on the second floor, and the transit station on the top. A private developer will be chosen to lease and manage the building. There have been a lot of suggestions for tenants including a high quality convenience store, a medical center, a retail bank, and a temporary employment service office, and many potential tenants have expressed interest in locating in the new Lake/Pulaski "super station." The organizers realize that the development plan for this area is ambitious as they foresee an urban scale supermarket and pharmacy south of the station, historically preserved and rehabilitated buildings with retail uses and housing across the street, and an entertainment center including a sit down restaurant, full service video store, and a movie theater on nearby vacant land. CNT has teamed with other local organizations, the City, and CTA to apply for federal CMAQ and Livable Cities grants to pursue similar efforts at stations along the south branch of the Green Line.

2.5.5 Transit transfer/park and ride stations

Many of the transit stations under analysis have been designed to accommodate access by automobile, bus, foot, and/or alternate forms of transit. Upon examining station characteristics in relation to the intensity of surrounding land uses, a strong tendency can be seen for the less densely developed station sites to emphasize auto-oriented access in their design, while the most intensely developed stations serve pedestrian and on-street bus

[44]CNT is a 16 year old Chicago-based nonprofit organization which attempts to influence public policy and market practice to benefit low income neighborhoods. It pursues projects and policies that simultaneously bring about environmental and economic improvements and considers transportation-related initiatives to be a primary way to accomplish these goals.

traffic only. Table 2.5 summarizes station access characteristics including average weekday boardings, commuter parking spaces available, bus access characteristics, and an estimate of the pedestrian access[45] mode split for each of the station areas examined and provides "aggregate" measures of these characteristics for each post-station general attribute classification.

Station boardings averaged around 6,000 passengers per weekday for every general attribute category except Urban High Intensity Mixed-Use stations which typically saw over 10,000 boardings on the average weekday. Commuter parking spaces were most plentiful at the suburban stations, as Fairfax County's Low Intensity Mixed-Use stations averaged 6,425 spaces per station, while the eleven Suburban High Intensity Mixed-Use stations averaged nearly 2,000 spaces each. Only seven of the twenty-five densely developed Urban stations provided any commuter parking at all. Indicative of a concerted effort to accommodate transit interchange traffic at new stations, off-street bus access using bus bays and waiting areas adjoining the transit facility was common to every non-Urban station and over half of the Urban stations. At the remaining twelve facilities, bus passengers board and alight their buses along the street at curbside. Urban sites typically imposed spatial constraints or high construction costs on these stations, precluding off-street bus access. Nearly all of the Medium Intensity Residential and Mixed-Use stations and the Urban High Intensity Mixed-Use stations experience significant pedestrian access, while just the opposite is true at the Suburban and Low Intensity Mixed-Use stations which feature relatively few destinations within walking distance.

2.6 Critique of station area development typology

The analysis model used in this chapter built a framework within which 60 transit stations were classified and examined in over 30 case studies. Overall it appears that the typology is capable of effectively classifying a wide variety of station neighborhoods based on a small number of essential characteristics. However, by reducing the sensitivity of this model to a small number of neighborhood features it is possible that its value as an analytic tool has been compromised. The goals of this research should help indicate how sensitive this model ought to be. The primary intent is to be able to draw *generalized* conclusions about how political, institutional, and economic factors influence the nature of the change in land usage around recently constructed transit stations. Every individual case of a station area has so many particular idiosyncrasies that it would be impossible to deduce any

[45]Pedestrian access is defined as any trip to or from the transit station which was accomplished entirely by walking. An arbitrary value of 20% was chosen to determine which stations had "significant" pedestrian access. This statistic was not determined scientifically for every station and serves only to give a general indication of the nature of access to the station.

Table 2.5 Station Access Characteristics

Post-Station General Attribute Station Area Station	Transit System	Average Weekday Boardings	Commuter Parking Spaces	Bus Access Off Street	Bus Access On Street	Over 20 percent Pedestrian Access Yes	Over 20 percent Pedestrian Access No
Low Intensity Mixed-Use		*6,425*	*2,763*	*100%*	*0%*	*0%*	*100%*
Fairfax County							
West Falls Church	WMATA	5,400	3,150	●			●
Dunn Loring	WMATA	4,100	1,200	●			●
Vienna	WMATA	9,100	3,600	●			●
Huntington	WMATA	7,100	3,100	●			●
Medium Intensity Residential		*5,767*	*523*	*100%*	*0%*	*67%*	*33%*
Inman Park-Reynoldstown	MARTA	3,600	268	●		●	
Tenleytown	WMATA	5,200	0	●		●	
Anacostia	WMATA	8,500	1,300	●			●
Medium Intensity Mixed-Use		*6,323*	*149*	*100%*	*0%*	*92%*	*8%*
Braddock Road	WMATA	3,300	20	●		●	
Pape	TTC	14,500	0	●		●	
Decatur	MARTA	4,700	0	●		●	
Malden Center	MBTA	8,400	165	●		●	
Davis Square	MBTA	5,900	46	●		●	
Quincy Center	MBTA	7,100	872	●		●	
AUC Stations							
Ashby	MARTA	2,700	154	●		●	
Vine City	MARTA	2,800	50	●		●	
West End	MARTA	10,700	285	●		●	
Rhode Island Avenue	WMATA	4,800	350	●			●
Van Ness-UDC	WMATA	6,400	0	●		●	
Friendship Heights	WMATA	8,500	0	●		●	
Virginia Square-GMU	WMATA	2,400	0	●		●	
Suburban High Intensity Mixed-Use		*6,391*	*1,611*	*100%*	*0%*	*27%*	*73%*
Scarborough Center	TTC	11,000	0	●		●	
Dadeland							
Dadeland North	M-DTA	4,900	1,280	●			●
Dadeland South	M-DTA	4,800	2,953	●			●
Rockville Pike Corridor							
Grosvenor	WMATA	3,700	1,750	●			●
White Flint	WMATA	3,700	1,700	●			●
New Carrollton	WMATA	5,600	2,350	●			●
Wellington	MBTA	5,700	1,253	●			●
Quincy Adams	MBTA	5,300	2,227	●			●
Alewife	MBTA	10,000	2,209	●		●	
North Quincy	MBTA	5,100	1,205	●			●
Lenox	MARTA	10,500	796	●		●	

Table 2.5 Station Access Characteristics

Post-Station General Attribute Station Area Station	Transit System	Average Weekday Boardings	Commuter Parking Spaces	Bus Access Off Street	Bus Access On Street	Over 20 percent Pedestrian Access Yes	Over 20 percent Pedestrian Access No
Urban High Intensity Mixed-Use		*10,480*	*135*	*56%*	*44%*	*96%*	*4%*
Jefferson Davis Corridor							
Pentagon City	WMATA	8,500	0		●	●	
Crystal City	WMATA	11,700	0		●	●	
North York							
Sheppard	TTC	19,000	0		●	●	
North York Center	TTC	5,500	0		●	●	
Finch	TTC	35,500	2,682 †	●		●	
King Street	WMATA	4,100	50	●		●	
Eisenhower Avenue	WMATA	1,200	15	●			●
Bethesda	WMATA	7,600	550	●		●	
Ballston-Rosslyn Corridor							
Rosslyn	WMATA	12,800	0		●	●	
Court House	WMATA	6,200	0		●	●	
Ballston	WMATA	10,700	0	●		●	
Peachtree Corridor							
North Avenue	MARTA	6,800	0	●		●	
Midtown	MARTA	2,600	10	●		●	
Arts Center	MARTA	7,200	26	●		●	
Yonge Street Corridor							
St. Clair	TTC	16,600	0	●		●	
Davisville	TTC	10,000	0	●		●	
Eglinton	TTC	31,700	0	●		●	
Downtown Miami							
Brickell	M-DTA	2,000	0	●		●	
Government Center	M-DTA	10,000	0	●		●	
Overtown/Arena	M-DTA	1,500	34	●		●	
Downtown Atlanta							
Five Points	MARTA	28,300	0		●	●	
Peachtree Center	MARTA	9,600	0		●	●	
Georgia State	MARTA	6,000	0		●	●	
Omni	MARTA	5,100	0		●	●	
Garnett	MARTA	1,800	0		●	●	

† Finch has an unusually large number of parking spaces because it also serves as the terminal station on TTC's Yonge Subway Line. TTC has a policy of concentrating all park and ride access at end-of-line stations

broadly applicable conclusions about similar stations, because none would exist under such a finely grained analysis. An effective typology would allow just enough detail to draw relevant conclusions without being encumbered by irrelevant nuances of each station area, but not so simplistic that the conclusions are meaningless or not applicable. The model used for this analysis is neat, concise, and easy to use and understand. By permitting the comparison of a large number of station areas, and dividing them into a manageable number of unique and relevant characteristics, this model will also allow useful conclusions to be formulated and applied effectively to proposed station areas which exhibit similar attributes in Chapters 3 and 4.

It may be worthwhile, though, to point out a few of the more notable shortcomings of this typology. As anticipated, most of these problems stem from the simplifications that are inherent in fitting a diverse set of neighborhoods and land use relationships into a small number of categories. Some station areas seem forced into their classifications—especially when compared to other stations in the same category. For others, it seems as if there are only subtle differences separating the developments around one station with those around another, in spite of being classified differently. As detailed in section 2.3, the procedure used to classify stations was first to identify accurately which pre-station category the area fell into, and then determine the actual post-station condition—noting its relationship to relevant formal station area plans. In order for a station to change classifications, there needed to have been a significant actual change in land usage and/or the role of the station area in the community. This is a qualitative judgment by nature, which may explain some close calls.

A brief justification for the more debatable station classifications should help clarify the analysis. For Pre-Station Attributes, the stations that presented difficulty in categorizing were North York, Quincy Adams, and Bethesda. North York could have been classified as Medium Intensity Mixed-Use, as it was much like a small town center. However, in this area Yonge Street is a fairly wide thoroughfare, and its proximity to the Highway 401 perimeter expressway was putting pressure on this area to develop in a highway and parking lot oriented fashion. The subway construction and deliberate planning efforts on the part of the city and Metro government prevented this area from a likely future of low intensity mixed-use development. The change in land use at Quincy Adams station from Medium Intensity Residential to Suburban High Intensity Mixed-Use is only superficial, as the actual purpose of the station is to serve park-n-ride patrons from the expressway. The station has little interaction with either the nearby established residential neighborhood or the newer nearby office parks. The Bethesda station area was nearly developed to Urban High Intensity Mixed-Use standards prior to subway

construction, but compared to the other pre-station urban districts (downtown Atlanta and Miami), it was still more like a traditional town center.

There seem to be two types of *Post*-Station Suburban High Intensity Mixed-Use areas. One type features districts such as Dadeland, Rockville Pike, and Lenox. These areas are home to major suburban shopping malls which have been followed by large scale office and some residential construction—the typical "edge city." The remainder of the stations which have been classified as such are more like pale versions of the edge city model, featuring a limited number of parking-lot oriented office buildings and sparse retail and housing development. The King Street station area was the only questionable Urban High Intensity Mixed-Use area, primarily due to the height and size restrictions placed on the buildings there. Upon examination, though, it is apparent that the development in this area has been much more intense than that around Medium Intensity stations, and the recent southward shift of development towards the Carlisle area strengthens this assertion. Another method for characterizing station areas could be by their stature within the regional office, residential, or retail markets. Some stations may represent neighborhood centers, while others may have an economic influence throughout a local community or even the entire metropolitan area. In as much as the regional role of the station areas is correlated with increasing intensity of land development, the model presented in this chapter also captures the effects of this station area land use relationship.

Chapter 3

Lessons and Implications

The previous chapter formulated a model typology of land uses to examine station area development before and after station construction. Through analysis of the 32 case studies in Appendix A, many generalized conclusions may be drawn regarding the local political, economic, institutional, and regulatory conditions which have influenced station area land development. This chapter develops some lessons from the case study analysis and examines their implications. These lessons and implications have three main themes: determination of system-wide and station area goals for a rail transit system, development of effective implementation strategies through promoting development and influencing behavior to realize these goals, and other more general lessons about station area development.

3.1 Forming system-wide and station area development goals

Implicit in the idea that factors influencing transit station area development are worthy of analysis is the assumption that some potential development outcomes may be more desirable than others. The community in which a new transit system does or will operate must first determine what "successful" development means in their case, before addressing the mundane particulars of every potential transit related development issue. This is the key normative question that should be addressed continually by all parties involved in the transportation decision making process, as its answers are central to building a rationale for making any public investment in transportation infrastructure. Land uses which generate large volumes of commuting or shopping travelers are most likely to have a positive impact on transit ridership when located in station areas. Consequently, the nature of station area development should have a strong influence on system patronage, and should be a fundamental factor influencing the agency's ability to maximize the return on their capital investment and provide cost-effective rail service. However, the intensive development which would best serve transit interests is often not amenable to the needs of the immediate station area communities. The nature and attributes of successful urban development and its relationship to transit must therefore be approached from two complimentary perspectives. On a system-wide level rail transit will have an impact on the

nature of the metropolitan area. Characteristics of system design, line routing, service provision, station siting, and overall station area development patterns are basic elements which will control the effect that rail transit service can have on a region. At individual station areas, detailed development, station layout, and general urban design issues contribute significantly to the effect of transit access on travel behavior and quality of life in the surrounding districts, and must be the result of local consensus between neighbors and the transit operator.

3.1.1 System-wide considerations

Prospects for ensuring effective utilization of regional transportation infrastructure, such as a rail transit system, are predicated upon public attention to several fundamental issues regarding the nature of metropolitan land development. This attention requires the formulation of a holistic and comprehensive vision for the community which addresses every aspect of how the region functions—especially with regard to travel demand. Transportation planners are responsible for considering a large number of issues that affect fundamentally the quality of life in a community. Spatial relationships between jobs, housing, recreation, retail services, and civic, educational, and medical institutions have a direct bearing on the quality of the urban environment, and influence greatly the nature of accessibility to the locations of the principal activities in most people's lives. These relationships may be publicly regulated and ought to conform to a regional vision for the role that each potential travel mode is expected to play in the ideally developed metropolitan area. Planners, citizens, and community leaders must determine which types of trips are expected to take place by which travelers using which modes, and plan the transportation system and future development in a manner that will permit these objectives to be met.

The ability of community leaders to make desirable transportation decisions is affected by several common impediments to the effective implementation of transit-sensitive regional transportation plans. Often local transportation regulations which encourage transit use run counter to national transportation incentives (see Chapter 1) and prior local policies which have encouraged automobile use. This severely compromises the short term effectiveness of new transit policies and projects, and undercuts the political viability of future transit initiatives. A dramatic example of this phenomenon occurred in Miami, where extremely low initial ridership on Metrorail made the system vulnerable to being characterized as a model of "wasteful" public spending by anti-transit Congressmen who dubbed it "Metrofail." Coming on the heels of bitter local political battles to secure funding for the project, this inaugural drubbing on the national stage effectively eliminated any chance for rapid implementation of future phases of the system.

Auto-centered transportation policies have also made the nature of existing development in many communities a significant challenge to transit-based transportation planning. The transit infrastructure that has been put in place in each of these cities represents the first element towards changing the regional travel behavior and urban environment. At the time of rapid transit construction Miami and Atlanta were strongly automobile-oriented urban areas, and they largely remain so today with over 90% of work trips being served by private automobiles (see modal split data in Table 2.1). In these cities driving is still a convenient and relatively inexpensive travel option—even for trips to the central business district, where transit has the greatest competitive edge. By contrast, transit-supportive public policies in Toronto have helped this metropolitan area maintain over 30% of its work trips on transit, while the development pattern of Boston and the addition of Metrorail to the Washington area have kept transit mode shares for these two regions near 15%. A significant amount of urban development in Toronto and Washington has also become more transit-oriented since construction began on their extensive subway systems, and having started earlier they are further along in the process of making a significant change in metropolitan area travel behavior than Atlanta and Miami.

Pursuing transit-oriented development policies in an environment where direct and hidden auto subsidies are plentiful may also appear to add unnecessary infrastructure costs and regulatory burdens to development. As such, these policies may reduce the short term "economic competitiveness" of areas which implement them and shift development to those which do not. This is a particularly powerful impediment to transit sensitive development in areas which do not have effectively coordinated regional land use policies. Without such controls, it is nearly impossible to enforce development standards across a metropolitan area, as remote districts which are under-served by regionally funded transit (but generally well enough served by state and county funded highways) will encourage auto-oriented development. This compromises the effectiveness of all transit based land use initiatives by creating activity centers that people will want to access, but which are not able to be reached by the transit system. These effects are widely evident around Toronto, Boston, and Washington—even though they are the most transit-oriented metropolitan areas in this analysis. In these regions, most of the substantial new development is continuing to occur beyond transit station areas. In Washington alone, only about one third of new regional commercial space (in size and value) has been built within Metrorail station areas since 1986.[46] This example is particularly ironic since land use decision-making is largely consolidated at the county level in metropolitan Washington. Some DC area municipalities like Arlington and Alexandria have relegated all intensive commercial development to Metro

[46] *Commercial Construction Indicators Annual Summaries from 1980-1994*, WashCOG (1994)

station areas, but in the much larger Counties of Fairfax, Montgomery, and Prince George's, development is not so restricted. In Toronto, local land use plans are subject to the approval of Metropolitan Government, but development is increasingly spreading into the less regulated suburban districts beyond the Metro Toronto border. The other metropolitan areas have no effective regional land use regulation and follow the typical model of auto-oriented development being welcomed by communities which do not have transit service at the expense of those which do. Consequently, the successes of a few development efforts around transit stations have very little impact on the nature of the entire metropolitan area, and seem to be the equivalent of winning a few battles while losing the overall effort to make the community less auto-dependent.

These factors also illustrate the influence of network design, system operation, and station siting on the overall ability of the transit network to function effectively, and their importance as components of transit planning. The "purpose" of the rapid transit system should be manifest by where it goes, who it serves, and when it runs. Route planners must be careful not to compromise the ability of the system to meet service goals and influence long term ridership behavior negatively by basing the right of way alignment decision on short term political expediency. The nature of transit ridership—and future political support for network expansions and improvements—often depends on the alignment, construction phasing, and operating plan of the system. It is unlikely that the initial bond to finance Miami's Metrorail would have been ratified if the poorly performing northwest route was not chosen, but now that it has been built and its low ridership has tarnished the reputation of the system, it appears that waiting for support of an alignment with stronger ridership potential may have been a wiser option. In contrast, the initial subways along Yonge Street in Toronto, the East Line in Atlanta, and Washington's Red Line were all built in high traffic corridors following established high volume transit routes. Their success facilitated subsequent system expansions to connect other principal transit corridors and urban activity centers into the transit networks.

Route alignment and station location influence which communities will be served and the nature of the trips that will be made. An interesting lesson in route planning may be learned from Washington, where political battles over alignment of the Green Line delayed its construction through primarily lower income neighborhoods in the city. Although this construction phasing had negative social equity implications, a beneficial side effect was that by serving Washington's higher income neighborhoods first, the Metrorail system has had a positive public image as a travel mode of choice since its first day of service, and political support for completion of the entire system has not waned over its twenty year construction period. Another common impediment to effective rapid transit service in many

North American environments (including all five systems in this analysis), is their radial route structure. This type of network precludes convenient circumferential transit trips, and makes highway access necessary to provide comprehensive accessibility to these station sites. Plans for circumferential transit lines connecting intensely developed radial station areas have been advanced in Boston, Toronto, and Washington to address this issue, but none have yet been built.

Operational considerations such as transit service hours, frequency, and train routing on multiple line networks also have a significant impact on system effectiveness. Trains should follow routes which minimize the number of transfers necessary to get between any two points in the system. Ideally every line will have at least one connecting station with every other line, so that a single transfer is the most that will ever be necessary. Train schedules should be coordinated to minimize waiting time at transfer stations—especially when infrequent service is provided. Service frequency can be varied widely on a rapid transit system since trains allow the ability to stretch off peak headways by adding cars to accommodate the extra passengers. However, this type of operating plan saves costs at the expense of forcing passengers to wait longer and will ultimately affect ridership. Effective system service standards and performance measures will help ensure that operational aspects of the system do not deter ridership even when stations are sited and developed in a transit supportive manner.

Ideally, the transit network and ancillary station area development should form a self-contained system, capable of supporting a "client" population—one which is transit dependent by choice, not by necessity. In such a system each station would relate to the other stations through complimentary travel behavior between their surrounding land uses. A primary travel relationship that transit systems satisfy is that of bringing workers from suburban dwellings to downtown places of employment. All five transit networks examined in this study fulfill this role. However, for a system to be most effective, it must service more trip types than just the downtown commute. Stations should be sited near a variety of trip generators and a wide range of development should be encouraged nearby so that the transit system may provide comprehensive transportation service. It is important that the system connects a variety of land uses with its stations so that many trip purposes may be satisfied by the transit system. A combination of high and medium intensity development around stations may be employed to best exploit transit access and promote usage of the system, while a proper balance of trip attractors and generators will maintain demand for transit service throughout the day and evening. Many of the station area types outlined in Section 2.1 may play such roles. Recreational destinations and districts that are home to varying types of housing, retail, and office space may all be serviced by the same

system at different stations, encouraging transit use by weekday and weekend shoppers, commuters, after hours socialites, and tourists exploring the city's attractions. Mixed-use districts incorporating several types of development in one area allow stations to behave as both origin and destination locations, which also promotes off-peak transit travel. When located at stations, major business employment centers, universities, and medical centers may attract transit-using employees who reside along the branches of the system. Ultimately a "critical mass" of station types and "client" patrons is needed for the network to function effectively as a system and make transit-related development opportunities readily apparent and self-sustaining.

There are many examples of station areas with characteristics that compliment the land uses at other stations. Park and ride orientation at suburban terminals acknowledges the demand for primarily downtown-focused transit service from low density residential areas located beyond convenient walking distance or lacking effective bus service to the station. Nearly every end-of-the-line station in the case cities is oriented towards park and ride commuters. These stations seem to just make the best of a bad situation, however, as they are generally ineffective at serving non park and ride transit traffic. Indicative of the radial-route problem described earlier, experience at Dadeland, New Carrollton, Alewife, and Scarborough Center suggests that office and other employment-based land uses at terminal stations also do not generate much transit traffic because they can only effectively draw a limited number of "reverse" commuters from one line of the system. Stations which service a larger proportion of bus transfer traffic from surrounding neighborhoods than park and ride travelers seem to be more likely to serve also as a focal point for development. This pattern is evident at Decatur, Davis Square, Quincy Center, Van Ness-UDC, Friendship Heights, King Street, Bethesda, Ballston, Eglinton, Davisville, and North Avenue. The office complexes at most of these stations feature low rents without compromising significantly the access to large concentrations of workers which is provided at higher rent downtown office locations. Significant retail development takes a long time to nurture and is generally the most difficult land use to sustain at transit stations since conventional shopping districts often need abundant parking to garner financing and meet zoning restrictions. Consequently, areas with both highway and transit access such as Scarborough Center, Dadeland, the Rockville Pike Corridor, Lenox, Pentagon City, North York, and Ballston have been most successful as retail centers. Districts like Decatur, Malden Center, Quincy Center, Bethesda, and King Street are still struggling to build a strong retail core in spite of successful office development.

Some station areas may be more appropriate for certain kinds of development than others, and it is important that the intended function of a new station compliments the

existing land uses at its proposed site. In many cases, significant station area development can be attributed in part to trends which were already occurring at the time of station planning and construction. Station access and favorable local development policies have helped to make many such new projects highly transit accessible, unlike similar concurrent regional developments which were not located in station areas. However, rail transit service has been more effective at catalyzing new development and permitting greater development densities at stations which have been sited in growing districts than it has been at attracting development to stable and declining neighborhoods. In Toronto, the Yonge line replaced the city's busiest streetcars—a built-in feature for success. This line was also more of a reaction to contemporary patterns of growth than an attempt to "lead" development. In contrast, TTC's Spadina Line has been a bust for development. This reflects its alignment in a proposed (but unbuilt) expressway corridor which was sited to avoid centers of population or commercial activity. Station areas which had strong development potential in Atlanta's growing office market prior to MARTA were enhanced by transit access, while those which did not remained unchanged. The Peachtree Corridor, Lenox, Buckhead, and the north side in general has been home to most major development in the metropolitan area for several decades, and MARTA's North and Northeast Lines have benefited from and contributed to this growth. Recent development in Atlanta's south and west sides has been much more modest both in and out of the station areas. Similarly, the Montgomery and Arlington County areas were burgeoning growth centers prior to Metrorail service and continued their dramatic development in the ensuing years, while many economically depressed Northeast D.C. station areas have continued to deteriorate. Boston has traditionally had a strong downtown development market. The difficult nature of driving and parking in this city and good transit service to the central business district have maintained MBTA use a habit for much of the urban population, with corresponding beneficial implications for development around newer stations. Aside from downtown Miami and the relatively auto-oriented Dadeland area, Miami's Metrorail system does not serve any of the other growth districts in Dade County. Future service is now proposed for the West Dade employment center, Miami International Airport, Miami Beach, the Convention Center, the Medical Center, and several universities.

System planning and route alignment decisions must recognize the dynamics of urban growth and decay which occur independently of transit access when anticipating the nature of station area development that may occur. It is apparent from the circumstances cited above and the cases analyzed in Appendix A that the provision of rail transit service is unlikely to reverse prior development trends on its own. Rail transit has generally been singularly ineffective as a tool for inducing development in economically depressed areas,

as pre-station market trends tend to limit the growth that may be expected in the station area. When conditions prior to transit construction are not amenable to development or redevelopment, the provision of rail access alone is not likely to be enough to change these real estate market dynamics. A comprehensive set of supporting regulatory policies and incentives (see Section 3.2) are essential to reviving idle development markets, but even then the likelihood of their success is uncertain. Conversely, when transit access is introduced to a district which is otherwise part of a high growth area, much less needs to be done to entice development. In this environment, regulation becomes an important tool for encouraging transit sensitivity in project designs.

3.1.2 Station area considerations

At the level of individual stations, micro-level goals must be established which compliment the macro-level or system-wide goals discussed in the previous section and ensure their successful realization. The transit station may serve many purposes simultaneously. It may act as a tool for reducing parking requirements for neighborhood development or it may become a physical focal point to give the neighborhood an "identity". There is the potential for stations to *reinforce* existing land uses and strengthen local and neighborhood level economies, or a station may usher in "wholesale change" to a district. Alternate strategies for station area development goals may be based on what types of transit patrons and residents the station area neighborhood is intended to serve. Issues relating to multimodal station area access strategies and traffic congestion need to be addressed effectively from an early stage. Details of station location and design can influence all of these factors as well as having a dramatic impact on area development and transit use.

In the cases examined, transit stations seem to be most effective at reducing parking requirements around large institutions and office centers, but less effective with retail developments. The Atlanta University Center schools, Howard University, Northeastern University, and UDC all indicated that the ability to reduce parking on their urban campuses was one of the most significant impacts of proximity to a transit station. Similarly, transit access has given employees and visitors to the National Institutes of Health and the Longwood Medical Area institutions a great deal of travel flexibility in addition to making nearby land available for uses more productive than parking. Office oriented and mixed-use areas such as Friendship Heights, Scarborough Center, Alewife, and all of the Urban High Intensity Mixed-Use stations have implemented reduced parking regulations successfully while retail districts around Dadeland, Lenox, and the Rockville Pike Corridor have had less success. In Miami reduced station area parking for retail is not encouraged like it is for office because local officials feel that retail parking turnover is

higher, meaning that less spaces are needed anyway, whereas office spaces are full for most of the day, so entire parking spaces may be removed for individuals who use transit to commute.

Transit stations at Davis Square and Braddock Road have effectively assumed the role of defining the center of their respective neighborhoods. In both cases, modest commercial and residential development and redevelopment has occurred in the area, bringing a healthy infusion of new capital and residents, and bolstering formerly sagging neighborhood economies. Several historic town centers have also been resuscitated since transit stations opened at Malden Center, Quincy Center, and Decatur. In many of these cases, though, the commercial mix has shifted from retail to office due to present trends in retailing, nonetheless the local economies have been improved. In several instances, neighborhoods have experienced radical change since the arrival of transit. The Ballston, North York, and Peachtree Corridor areas were all low key residential and minor commercial districts, while King Street and the Jefferson Davis Corridor were dilapidated commercial and industrial areas prior to station-related redevelopment into high intensity mixed-use districts. The tax revenues and increased commercial activity brought about by these developments have given a major boost to the economic strength of their municipalities and possibly to the greater region as well.

The neighborhood residential and employee population in station areas may be addressed in several different manners. Potential goals include leaving existing land uses for existing residents, using existing land uses for new residents, or creating new land uses for new residents, at varying scales of development. Communities near Inman Park, Tenleytown, and Davis Square stations insisted that there be very little change in their neighborhood's character and residential composition, and restricted the amount or scale of new development that could occur. Other areas like Ballston, King Street, Virginia Square, North York, and the Peachtree Corridor desired a dramatic change in the nature of the neighborhood's day and evening denizens, and made successful efforts to encourage well defined but intensive commercial and residential developments. A third group of neighborhoods including most of the remaining stations did not take any specific actions to direct the nature of the area's residents and workers but rather let development continue under the primary influence of existing external market forces.

The manner in which a station relates physically to its environment will have a strong impact on the way it is perceived and used by the community. Elevated stations are highly visible and make obvious landmarks in any community, but can also be noisy eyesores if not designed and integrated into the community well. Subways, though far more expensive, may fit discreetly into nearly any environment and allow much greater

opportunities for surface treatment of station entrances. The location and design of entrances and exits determines how the station will "fit in" with existing and proposed nearby developments and how it will influence the relationships between the individual developments and the overall character of the neighborhood. At Bethesda, Davis Square, and North York, the subway stations were successfully incorporated into the designs of public plazas which were built concurrently, while the Decatur station completely disrupted the historic main street which it replaced and the Anacostia station entrances were located in federal park land five blocks away from the business district where they belong. Underground transit alignment also facilitates providing direct connections from the station to surrounding structures. These connections to potential future development must be conceived and "roughed-in" early in the design process or else it may be prohibitively expensive to retrofit the station to accommodate these connections after construction. Good examples of this approach include the Friendship Heights Metro station which features direct underground station access to four nearby retail and office developments—two of which were built several years after the station but anticipated in its design, and downtown Toronto where nearly every office building and subway station is connected by an extraordinarily extensive all-weather underground pedestrian system.

The nature of station access for all modes influences the physical operation of the station as well as the willingness of potential patrons to use various modes to get to it. Just as parking spaces and direct links to highways are necessary for effective park and ride operations, frequent and direct bus service to safe and clean interchange areas is crucial for encouraging bus access. Pedestrians and bicyclists need special facilities and amenities of their own including walkways and bikeways separated from vehicular traffic, and secure bicycle racks and lockers. Taxis should also be provided their own area for queuing so they do not interfere with other traffic around the station. Station placement in expressway medians and park land isolates it from nearby development, discouraging pedestrian access and lowering passengers perception of security, while promoting commercial uses such as convenience stores with extended hours near station entrances increases ambient pedestrian activity and improves security. Bright lighting and clear vistas also provide a sense of security and characterize the design of all of the case stations.

3.2 Methods for achieving development goals effectively

The influence of the system-wide considerations detailed in the last section can not be understated. Local decisions and efforts of any magnitude to affect development at particular stations will be ineffective if the area has been handicapped by system-wide factors such as poor siting, design, market conditions, or regional development and land

use coordination policies. Given that these considerations have not precluded all development opportunities, though, several strategies have been employed with varying degrees of effectiveness to influence development at the case stations. Development should be both encouraged and regulated in order to ensure that the most appropriate type occurs, and a desirable station area environment which yields the greatest transit patronage results. Many philosophies may guide the method that is taken to address these issues. The fundamental strategies fall into two primary categories: promoting development near transit or advocating land conservation away from transit, and encouraging behavior of developers, residents, workers, or the general public with respect to transit. In the cases examined, tactics for promoting development at transit stations dominate those which encourage preserving land on the urban periphery, while a carrot and stick combination of development incentives and disincentives appears to be the best way to regulate development in environments where there are typically no effective regional plans. The tools used to achieve land use and transportation objectives depend upon these strategies.

3.2.1 Promoting development

Several trends are apparent upon examination of the comprehensive planning methods employed at the various case station areas. It appears that the lack of comprehensive planning results in the de facto maintenance of status quo conditions at the station site while unclear planning directives end up perpetuating conventional auto-oriented development. The station areas which did have definitive comprehensive plans—especially those which were flexible—had the most success in realizing these visions. Although there were no comprehensive plans prepared for stations like Tenleytown, Inman Park, Quincy Adams, and several stations on Miami's southwest side, ordinances or other public actions which effectively forbade new or intensive development resulted in a low-growth environment. The same effect has occurred at Pape and Rhode Island Avenue where development was hindered by economic conditions as well as a lack of planning. Braddock Road and Davis Square used comprehensive plans to ensure that development which did occur still preserved much of the existing character of the neighborhood. In these cases, the planning process created benefits for the municipality in terms of development revenue while also strengthening the neighborhood. For larger scale initiatives, comprehensive planning seems to be necessary but not sufficient. The older, spread out development to the south of New Carrollton station does not address transit access at all, and is an example of the worst that might happen when no planning efforts are made. A completely different strategy is presently being employed by Prince George's County for the land north of the station, and initial development on this site is much more sensitive to the nearby station. Conflicting (pro-transit) regional planning principles and

actual (pro-auto) zoning and development approval behavior has resulted in a large amount of automobile-oriented development around Dadeland, Scarborough Center, the Rockville Pike Corridor, and Lenox in spite of transit access. The ill-fated comprehensive plans for mega-project development at Alewife and Wellington indicate a danger in making inflexible plans. The successful approaches employed in the case of the Ballston-Rosslyn, Jefferson Davis, and Peachtree Corridors, as well as at King Street, Bethesda, and North York were all able to capitalize on supportive regional market trends, stressed general features of development rather than mandating a rigid strategy, and were monitored and updated as development progressed.

Air rights development has been an effective way to "mend" the urban fabric after disruption by transit construction. It also represents a potential revenue source for the transit agency which owns the land. Typically, air rights projects require close interaction between developers and the transit agency to prevent developments from interfering with transit operations while encouraging mutually supportive interaction between the two. WMATA has the most ambitious air rights development program with over twenty completed projects at sixteen stations, generating over $4 million in annual revenues for the agency. Their strategy involves producing a station area development "prospectus" for WMATA owned parcels when the agency is approached by a developer, or when it feels that the area may be ripe for developer interest. Each prospectus details the extent of WMATA land holdings and nature of suitable development as agreed to by Metro and local planners. This document is released publicly and the rights to Metro's land are offered to the highest bidder. If no satisfactory bids are received, WMATA is free to negotiate with developers individually. The other agencies and municipalities which allow air rights projects do not have coordinated strategies for the development of their properties, and generally wait for developers to express interest.

Local municipalities have often used urban renewal powers to assemble large parcels of land from smaller lots which are individually unsuitable for development. In primarily residential areas, it is often difficult for private developers to assemble land for more intensive uses because there are typically many small parcels under separate ownership. On Miami's southwest side, for instance, this circumstance has precluded any significant new residential development. At Braddock Road, however, the City of Alexandria negotiated a land swap and consolidation agreement with a school district and public housing authority in order to assemble prime development parcels adjacent to the station. Most communities have tended to shun the large scale "remove and replace" initiatives that characterized redevelopment efforts of the 1950's and 1960's in favor of incremental and incentive-based approaches to encourage a more gradual change in

of support is the standard by which the success of all public initiatives are judged. The experiences in the case cities underscore this point. In Toronto and Boston, transit rider and citizen led initiatives were behind the respective movements to build and rebuild each city's subway system. The Washington and Atlanta subway promoters also relied on extensive public support for subway authorization in the wake of dramatic growth in population and traffic congestion, and cultivated public approval for continued construction funding in response to the energy crises of the 1970's. Ongoing public relations efforts in each of these cities including a pro-transit/pro-urban attitude on the part of relevant public officials has been crucial to maintaining popular support for all new transit initiatives. As detailed in previous sections, Miami provides abundant examples of public relations disasters. It is likely that Metrorail will prove to have been a desirable investment, but it will take time for its full impacts to be felt. All of the bad publicity that the system has generated thus far has made it difficult to convince the public of this.

Active participation of the station area community in every aspect of the station area development decision-making process is also crucial to the effective realization of the transit system's potential as a positive influence on the urban environment. Lack of participation in the transit planning process is a key factor that distinguishes neighborhoods that have and have not received transit stations warmly. The manner in which neighbors relate to their stations is also influenced by how well organized they are and by their demographic composition. Many station area neighborhoods that have successfully implemented development plans have been well organized and lower to middle income in nature. These residents have worked with their local officials and acquired an understanding of how to control development, rather than letting it occur in a manner which alters the neighborhood in an undesirable fashion or implementing measures which prohibit development altogether. North York and the Yonge Street, Ballston-Rosslyn, and Peachtree Corridors are all good examples of areas where high intensity mixed-use development has been concentrated around transit stations without degrading existing nearby lower density residential neighborhoods. The station area communities in these cases all played a role in the process and emphasized development control and containment rather than prohibition. In station areas where development of lower intensity has occurred, the process of relating it to the existing community has been simpler.

When the community truly believes in the benefits of transit access, employer-led initiatives also become useful ways for influencing travel behavior and urban form. These efforts often take the form of TDM programs, but may even include working directly with the transit agency or lobbying appropriate legislative bodies to secure funding for relevant transit projects. A good example of this type of action is the efforts of Boston's MASCO

which represents institutions in the Longwood Medical Area. The attitudes of relevant decision makers are particularly important for influencing institutional development at transit stations. The universities and hospitals examined each related to their transit station in a different manner, although the access provided was fairly similar for all. Factors such as the historical development, spatial constraints, and existing orientation (pedestrian vs. automobile) of campus facilities and their relation to the station itself, the nature and public perception of the transit system, and traditional commuting behavior of its employees, students, and visitors influence the perspective of institutional administrators towards the transit facility and related parking policies.

3.3 The land developer's perspective

Whether or not commercial development actually occurs is ultimately the decision of land developers themselves. As a consequence, it is important to consider what influences their decisions, what factors are important to them, and how they view the station area attributes and development strategies examined in Chapter 2. The primary objective of the land developer is to maintain the profitability of their investment over a ten to twenty year financing period. The lending institution which finances the project normally must be satisfied that it will produce enough lease or rental revenue to meet its loan payments. Typically these institutions are highly risk-averse and tend to be conservative in their judgment of a commercial real estate project's prospects for financial solvency. These factors tend to make developers stick to "proven" development techniques which include favoring projects in higher income neighborhoods and on the urban periphery while shunning investment in older, lower income areas and economically depressed communities. In terms of access, the proven methods generally mean paying close attention to automobiles and ignoring transit—techniques which have provided short term success to real estate ventures across North America, and have been powerful influences on design. However, these strategies provide no incentive for developers to consider the long term implications of automobile dependence and urban sprawl or the overall economic vitality of the communities in which they build. Nor do they encourage most developers to build structures of lasting significance or architectural value. When lenders misread the market or simply act in a careless and illegal manner, as happened during the late 1980's U.S. building boom and Savings & Loan scandal, then real estate markets become grossly over-built. Ironically, this over-building typically takes place in the same "proven" high growth locations and using the same "proven" design techniques as before, leaving communities in a weak position to regulate further development. Developers also generally consider several roughly equivalent potential project sites. When land use regulations are

not coordinated and enforced on a regional level, they tend to influence project location as developers will prefer building where restrictions are the most lax. To overcome these aversions, the public sector must often provide financial or other incentives to lessen perceived or actual financial risks and soften the impacts of public-interest regulations.

Throughout the analysis it is apparent that mixed-use development combining office, residential, and retail space has been a goal of most station area development plans. The classification scheme in Section 2.1 employed a rather loose definition of mixed-use to mean any district that was not entirely residential. However a truly mixed use neighborhood—one where a large proportion of the residents might be able to work, play, and do most of their shopping within walking distance of their home—is much rarer than the matrix would indicate. In fact, this is possible in only ten of the cases: Lenox (which is only marginally pedestrian accessible) and all of the Urban High Intensity Mixed-Use station areas. Although convenience retail establishments may be found near many transit stations, the land use most often missing from the other station areas is large scale retail. Office buildings typically attract the same types of trips by the same people each day. When their work locations are accessible by rail transit, office employees may choose to incorporate transit use in their commuting behavior. Residential developments which are located near a station may also exploit the commuting advantages of transit by attracting residents whose places of employment are also located at a station.

Large scale retail developers, however, tend to be the most strongly auto-oriented and the hardest to convince about the merits of rail station area sites. They are also categorically less receptive to each of the tools and techniques for influencing development which were outlined in Section 2.4. A major influence on the design and location of retail development—as typified by the shopping mall—is the developer's desire to control every facet of the retail environment including all design details, the hours of operation of all establishments, the maintenance and use of all shared (but not "public") spaces, who may enter and use the facility (i.e. no homeless people, street performers, protesters, or public speakers), and the mix and arrangement of stores. The last feature is perhaps the most important because it allows a large developer essentially to monopolize the retail market in a region by leasing space to several large department stores, or retail "anchors". Since the developer controls all the surrounding retail space, it has a great deal of power in negotiating leases with whichever other tenants it desires. In this manner, an "optimal" mix of stores may be carefully constructed. The magnitude of this type of development endeavor also means that the geographical market for shoppers will be fairly large, typically of a regional nature rather than a local one. The large floor area and abundant parking for the regional shoppers required for this type of retail mall makes single-story suburban

construction on inexpensive land attractive. Auto-oriented satellite shopping centers compound the difficulties of transit service in this environment since the groups of retail establishments are typically an inconvenient if not impossible walk from one another. Consequently, most large scale retail districts share Suburban High Intensity Mixed-Use attributes. While increasing the accessibility to affluent auto-owning suburban consumers, the auto-orientation of these districts does impair their accessibility to the often less affluent people who must commute by automobile to their retail jobs daily. Large scale retail developments in urban settings often feature relatively convenient transit access, but also rely upon a large, affluent shopping clientele with limited access or desire to use cars. Even then, such districts are still typically also served by large parking structures.

3.4 General lessons about station area development

Upon examination of the station area classification matrix (Table 2.2), the Medium Intensity Mixed-Use neighborhood characteristic stands out as the primary attribute for fifteen (or 47%) of the districts before station construction and ten (or 31%) as they are actually developed today. The case station areas were not chosen randomly, but rather to fill the matrix and permit the formulation of significant or illustrative conclusions. It was not the intent to emphasize the Medium Intensity Mixed-Use cases, but rather examples of this type of development near individual transit stations were just more common than any other type. It is also worth noting that many of the Suburban High Intensity Mixed-Use and Urban High Intensity Mixed-Use cases represent several proximate stations, and if taken individually the Urban High Intensity Mixed-Use classification would have the greatest representation among post-station cases. The abundance of medium to high intensity mixed use stations available for analysis suggests that transit planners in the respective metropolitan areas did frequently site stations in areas which were most suitable for development. That examples of station areas which are less well suited to development exist indicates that these siting decisions were made without regard to development potential, made in error, or most likely were motivated by factors other than development potential. Anecdotal evidence suggests that these other factors were often political expedience and construction cost savings.

Rapid transit construction itself can be highly disruptive to a community, leaving a lingering imprint on the minds of neighbors and prospective developers and affecting their attitudes towards future transit-related decisions. Excavation of several blocks in downtown Atlanta for the Five Points MARTA station unearthed a large number of rats, further compromising the suffering image of this distressed retail area. Fortunately the pests were abated by the time the station and ancillary street improvements were completed,

and a public relations campaign helped to bring a better reputation to the ailing district. MARTA station construction in downtown Decatur also caused severe disruption as it closed off a major commercial street in the heart of town and nearly drove many local merchants out of business. When the MBTA Red Line subway was extended through North Cambridge in the late 1980's, expensive tunneling was necessary due to the tremendous impact that cut and cover construction would have had. The highly populated and congested Massachusetts Avenue above this subway passes through two commercial districts and features a trolley bus line. The City of Alexandria had to decide whether their segment of Metrorail would serve the center of Old Town along Route 1, or follow a much less disruptive alignment along the existing RF&P railroad, a mile west. The latter route was chosen because it was favored politically even though it would have a more limited natural influence on development and because the city committed itself to the revitalization of the derelict district around the new station site at King Street.

Institutional relationships between local jurisdictions and the transit authority may also affect land development. In the case of suburban Washington, county-wide land use decisions are often made by the board members who serve as or appoint representatives to the WMATA board, increasing the likelihood of shared priorities when it comes to decisions affecting land use and transportation interactions. Land use recommendations are prepared by the Atlanta Regional Commission and several different Boston area governmental organizations but all actual land use decisions in these metropolitan areas are ultimately made at the local level, with or without the input of MARTA or the MBTA. Metropolitan governments in Miami and Toronto are responsible for both the operation of their respective regional transit systems and preparation and administration of long range transportation and land use plans which must be adhered to by the local municipalities. Washington's Metro is the "nation's subway," the pride of many congresspeople, and has enjoyed capital financing from a line item on the federal transportation budget for over twenty years. Atlanta is also a capital city with good connections to funding and a strong capital base. Consequently, it was able to secure sufficient matching funds for the federal contribution to complete Phases II and III of its rail system and enjoy steady, uninterrupted development of its rail and bus networks over the past fifteen years. Miami, on the other hand, just barely passed a bond to cover its match for the federal contribution for Phase I of Metrorail. The struggle was so painful and problematic that politicians have not followed up on the effort to secure dedicated funding sources until just recently, after twelve years of soul searching and wondering if Metrorail construction was a wise idea.[47]

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[47]Jack Luft, City of Miami, telephone interview

Several factors influence the applicability of the experiences detailed for the case station areas to station sites in other metropolitan regions. As noted earlier, local market trends have a tremendous impact on station area development. In every case examined, transit access has been noted to assist or catalyze a real estate market, but not create it. Market trends prior to subway construction indicated that Arlington County and Atlanta's Peachtree Corridor were ripe for major commercial investment, while transit construction in Toronto occurred in response to the onset of development intensification along the Yonge Street Corridor. Meanwhile, very little development has been seen in Atlanta's economically depressed west side or along the South Line which parallels a railroad right of way through old industrial districts, nor has transit access brought new investment to the blighted communities of northwest Miami and northeast Washington. The national trend towards the large scale suburbanization of retail during the 1970's and 1980's was felt in every case of a neighborhood or town center that is now home to a transit station. In as much as land development is driven by regional and national economic conditions, it may be that any negative effects of increased land use regulation are heightened during national recessions and in localities with depressed economies, while lessened under healthy economic conditions and in regions which are developing rapidly. Over the past thirty years, a dramatic increase in the size of the federal government and regulatory agencies has been accompanied by new policies permitting leasing federal office space rather than owning it. As a result of this and a growing number of federal contractors, the market for privately developed office space in the Washington area is now second only to New York City in North America. With its unusually large and growing market for office space, it is not surprising that there are a large number of transit station areas with significant commercial development in the Washington metropolitan area. The unique nature of Washington's continually robust office market suggests that caution be employed when drawing conclusions about station area development from these cases. The continuing demand for office space in Washington would have to be met whether there was a transit system or not. Fortunately, the construction of Metrorail has allowed a significant portion of this office development to occur near transit stations.

3.5 Prospects for success of various land use transformations

A final analysis of the land use transformations which have taken place at the case station areas (see Table 2.2) should give a general indication of the likelihood of a successful transformation from one land use category to another (see Table 3.1). In no case was there an example of a station area *de*-intensifying. This type of transformation would indeed be difficult to accomplish and unlikely in any environment—let alone that of

Table 3.1 Likelihood of Successful Land Use Transformations

Pre-Station Neighborhood Characteristics — *General Attributes*	Actual Post-Station Neighborhood Characteristics — *General Attributes*: Low Intensity Mixed-Use	Low Intensity Mixed-Use	Medium Intensity Residential	Medium Intensity Mixed-Use	Suburban High Intensity Mixed-Use	Urban High Intensity Mixed-Use
Rural, Undeveloped, Low Intensity Residential	▲	▲	●	●	●	●
Low Intensity Mixed-Use	▽	▲	●	●	▲	▲
Medium Intensity Residential	▽	▽	▲	●	●	●
Medium Intensity Mixed-Use	▽	▽	▽	▲	▲	▲
Suburban High Intensity Mixed-Use	▽	▽	▽	▽	▲	▲
Urban High Intensity Mixed-Use	▽	▽	▽	▽	▽	▲

Legend: ▽ Unlikely ▲ Likely ● Possible

a transit station—as it would involve massive removal of existing infrastructure. It also appears that Low and Medium Intensity Residential station areas are not likely to experience a dramatic shift towards high intensity land use. In the case of the Fairfax County, Inman Park, and Tenleytown stations, the adjoining stable neighborhoods provided both physical and political constraints on intensified development. The Scarborough Center area has gone from an Undeveloped state to Suburban High Intensity Mixed Use, but its rapid ascent may be attributed more to twenty years of excellent automobile access than to its ten year old transit station. However, the access to transit is being relied upon to make possible the leap from Suburban to Urban High Intensity.

The two land use classifications which showed the greatest propensity for changing land use attributes were Low and Medium Intensity Mixed-Use. Stations which were initially of these types frequently became either Suburban or Urban High Intensity Mixed-Use areas. Each of the newly Urban areas developed according to a comprehensive plan, and with the exception of the master planned communities in the Jefferson Davis Corridor, all developed in areas that featured a traditional street grid with fairly small blocks and sidewalks. The Suburban High Intensity districts did not have existing traditional street patterns and were not as likely to have followed a development plan, but they did correspond to development trends within their metropolitan areas. A plurality of station areas did not change land use categories subsequent to station construction, although many of them did experience economic stability and neighborhood growth conforming to the scale of the existing development.

Chapter 4

The Case of Tren Urbano

The Commonwealth of Puerto Rico is presently advancing plans to add a twelve mile long light rail line to the currently bus-only transit system in the San Juan metropolitan area. The $1 billion, double track, grade separated light rail system is called Tren Urbano and will feature sixteen stations and connect major employment and residential centers. Today the San Juan region is highly auto-oriented, and public transport accounts for less than ten percent of trips between home and the workplace.[48] Under pressure from severe peak period automobile congestion and in light of limits on possible increases in highway capacity due to political and environmental concerns, Tren Urbano is expected to improve the level of transportation mobility within the metropolitan area and reverse a several decades decline in transit mode share. Most of the proposed station sites along the line present significant land development opportunities and exhibit characteristics which parallel many of the cases examined in the previous chapters. Appropriate development in these areas may help to create an urban environment which is much less auto-dependent than the one that presently exists—an important factor influencing the success of the overall Tren Urbano initiative and contributing to an improved quality of life in urban San Juan.

4.1 Physical and demographic characteristics of the metropolitan area

San Juan Bay forms a natural harbor from the Atlantic Ocean on the north coast of the island of Puerto Rico (see Figure 4.1). Nearly 500 years ago Europeans began to settle in the area, building a fort on the end of a small elongated island now known as Old San Juan at the mouth of the bay (see Figure 4.2). Over the next 400 years, the settlement grew slowly inland and eastward along the ocean, and by the early part of this century urban growth was concentrated in a district called Santurce. An early center for banking and trade on the island, the area was also home to many government offices (although not the capital, which has remained in Old San Juan) and came to be the central business district of San Juan by the 1920's. A streetcar system developed concurrently to serve Santurce and the densely populated surrounding neighborhoods. For several decades this early rail service

[48] *Regional Transportation Plan, San Juan, Puerto Rico* (1993)

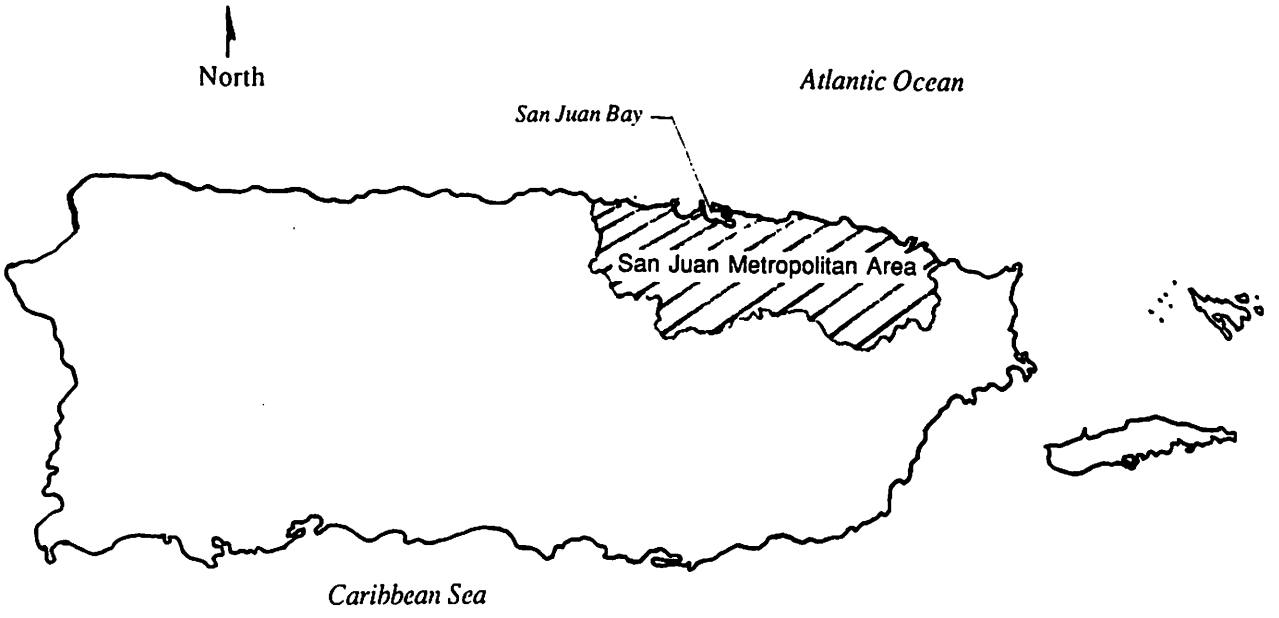

Figure 4.1 Puerto Rico

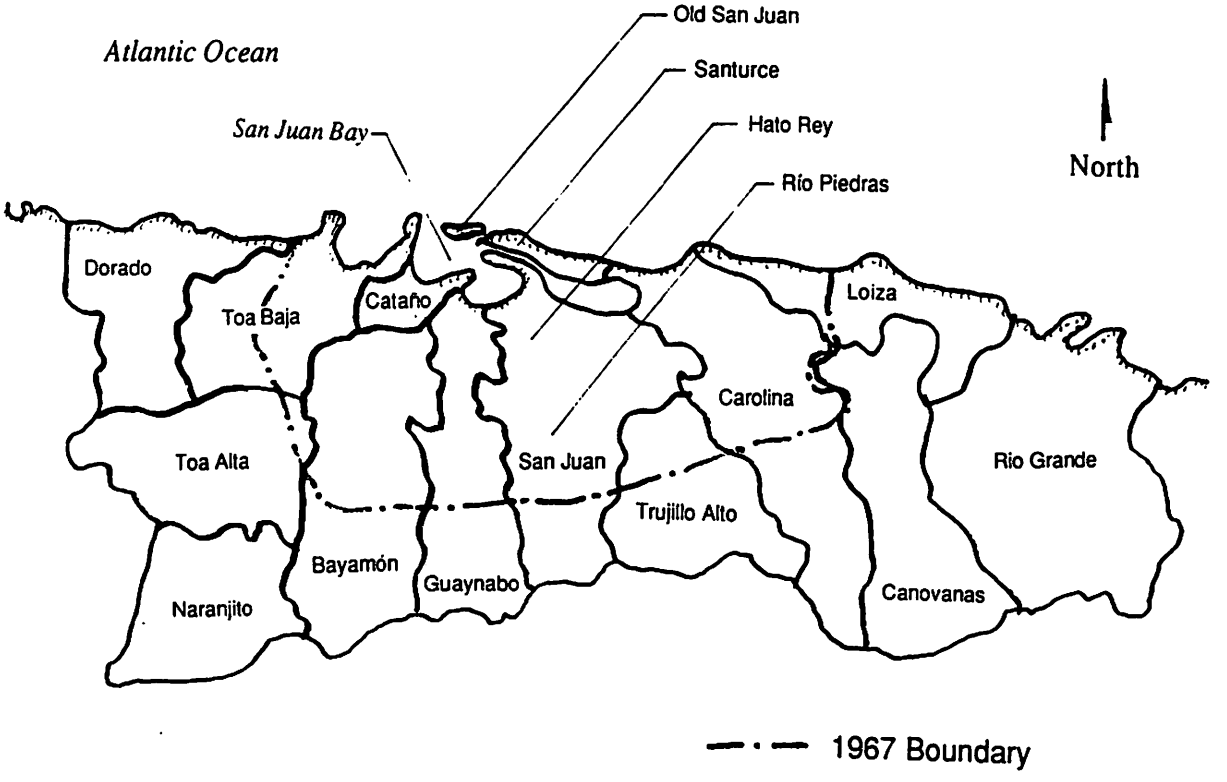

Figure 4.2 San Juan Metropolitan Area

stretched three miles south to the neighboring town of Río Piedras, home of the main campus of the University of Puerto Rico, defining a transportation corridor which has served as the backbone of regional development to this day. The mountainous forested regions in the interior have forced all urban development into the narrow band of the coastal plain that rings the island, and dirt roads were used to reach the other neighboring inland towns of Bayamón and Carolina, eight miles southwest and southeast of Santurce respectively.

The years following World War II saw both the island become a self governing commonwealth of the United States and its sugar cane-based agricultural economy collapse. Special tax exemptions, low interest loans, and other incentives introduced in the late 1940's as part of the "Operation Bootstrap" program helped nurture growing pharmaceutical, machinery, food products, textile, and tourism industries on the island and especially in the capital city. This industrial growth turned what was once the "Poorhouse of the Caribbean" into an area which now has the highest per capita income in Latin America. However at $6,360, the island's per capita income is still well below the corresponding figure of $20,000 on the mainland, while retail prices are nearly the same.[49] As a result of the shift from an agricultural to a manufacturing economy, a large number of former farm laborers relocated to both the mainland United States and San Juan—more than doubling the metropolitan area population from 450,000 to 1,000,000 people between 1950 and 1970, and surpassing 1.3 million today. This urban population growth has been accommodated by the development of immense auto-oriented single family residential neighborhoods which have filled the open spaces between (and beyond) the old towns of Santurce, Río Piedras, Bayamón, and Carolina.

The transportation demands of the evolving city have been addressed by an aggressive expansion of the region's road network, including the construction of an extensive system of expressways and wide principal arterial streets. Personal vehicles, public buses, and privately operated jitneys called "públicos" accounted for 63%, 20%, and 9% of regional travel respectively in 1964 and 92%, 2.4%, and 3.7% in 1990, while the urbanized area of the San Juan metropolitan region grew from 140 square miles to over 400 square miles during the same period.[50] The regional population density is now just over 3,200 people per square mile, which rises to 5,100 people per square mile for the five central municipalities and over 8,500 people per square mile for San Juan proper. Although these densities are still high relative to mainland standards, auto-oriented land use

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[49]Puerto Rico per capita income is from the Tren Urbano DEIS, 1995; US mainland per capita income is from statistics in the 1995 *World Almanac and Book of Facts*; retail price levels are based on personal observations in several communities within the San Juan metropolitan area.

[50]*Regional Transportation Plan, San Juan, Puerto Rico* (1993)

patterns and street networks, poor bus service, and successful automobile marketing have combined to make the region highly auto-dependent. Auto ownership rates have increased from 0.141 to 0.405 cars per person over the last 30 years, and it is estimated that "...a typical family in Puerto Rico spends about 40 percent of its income in the acquisition, operation, and upkeep of its family car."[51]

Since the 1960's, San Juan's center of business and finance has gradually shifted south from Santurce into a district called Hato Rey, further strengthening the Santurce-Río Piedras corridor as the region's center of intensive development and public transit usage. The retail hub of the region also moved during this period with the construction of the largest shopping mall in the Caribbean, "Plaza Las Americas," a half mile west of Hato Rey. Identical to large suburban malls on the mainland, this development is surrounded by an enormous parking lot and has generated additional construction of smaller shopping centers, stores, and restaurants on its periphery. The highways that connect the historic town centers of the metropolitan area have also become lined with auto-oriented retail establishments, serving residents of the sprawling residential neighborhoods. The traditional retail districts in central Río Piedras, Bayamón, and Carolina are still active and remain hubs of público activity, but generally serve an older and poorer clientele than their newer suburban counterparts. Regional employment is fairly concentrated in the municipality of San Juan, home to over 60 percent of the area's 410,000 jobs but only a third of its population. Although some office development has occurred along the radial expressways, the familiar US trend towards large scale suburbanization of office space has not taken root yet in the San Juan metropolitan area. Heavy industrial and manufacturing activity in the region is largely on the south and west sides of the San Juan Bay and along the Río Bayamón Canal. The popular tourist districts of San Juan are located along the wide beaches of the Atlantic coast between Old San Juan and the Luis Muñoz Marin International Airport. This six mile long strip contains nearly all of the attractions that most tourists ever see in San Juan and is separated from the rest of the city by central Santurce and the San José Lagoon.

4.2 Transit in San Juan today

Several public agencies oversee the provision of transportation services in metropolitan San Juan. Overall direction for all highways and public transportation within the Commonwealth of Puerto Rico is the responsibility of the Department of Transportation and Public Works (DTOP), a cabinet level department under the Governor. The Metropolitan Bus Authority (AMA), one division of DTOP, operates public buses on fixed

[51] *Tren Urbano Project DEIS* (1995)

routes and schedules throughout San Juan and seven surrounding municipalities. Highway funding, planning, construction, and maintenance is performed by the Highway and Transportation Authority (ACT), another division of DTOP. This Authority is also responsible for oversight of one privately contracted bus service called Metrobus, and direction of the Tren Urbano project. Two separate entities, the Public Service Commission and the Ports Authority, regulate the públicos and operate the Acuaexpreso passenger ferry service respectively.

4.2.1 Bus transit

AMA provides regularly scheduled service on over 40 fixed routes in and between San Juan, Carolina, Guaynabo, Bayamón, and four smaller municipalities with a fleet of about 150 buses. Fares are 25 cents a ride, which cover approximately 13 percent of operating costs. By 1990, AMA buses had become notoriously unreliable, dirty, and inconvenient. Service frequencies were typically less than two per hour, missed runs were commonplace, maintenance was terrible, and most routes were highly circuitous. System ridership fell from 230,000 average weekday passengers in 1964 to 155,000 in 1976, and just 80,000 in 1990. Late in 1991, the first of several key changes to improve public transit service in San Juan was implemented. Operation of AMA's most heavily used Route #1, which served the intensely developed corridor including Old San Juan, Santurce, Hato Rey, and Río Piedras was contracted to a private operator with oversight by the ACT. The route was renamed Metrobus, new buses were purchased, headways were improved to 4-5 minutes, and fares which were initially 25 cents have since been increased to 50 cents. The new, reliable service was an overnight ridership success, boosting patronage from 10,000 average weekday Route #1 passengers[52] to over 23,000 Metrobus riders.[53] The ensuing years have seen dramatic management and labor reforms at AMA which have improved service reliability and cut operating costs. Presently, a Comprehensive Bus and Público Planning Study is being undertaken by DTOP in order to create an effective multi-modal transit network into which Tren Urbano can be integrated successfully in the future. The first phase of the plan will restructure all AMA service by creating a new bus network linking 13 "transit centers" in major commercial, residential, and employment districts with higher frequency trunk bus routes and providing less intensive bus service from these centers to other parts of the region. The centers would also serve as nodes for público activity, permitting transfer traffic between buses and públicos.

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[52]as reported in *Integration of San Juan Metropolitan Region Público and Private Bus Routes into the Metrobus System* (1992)

[53]from 1993 USDOT FTA Section 15 report data for ACT

4.2.2 Público service

The island of Puerto Rico, and particularly the San Juan area, also features a jitney-type transit service known as "públicos" which operate under license from the Public Service Commission (PSC). A fleet of over 3,000 privately owned vehicles (mostly fifteen passenger vans) provide morning, afternoon, and early evening service on 120 routes within the metropolitan area. Routes and service frequencies are approved by the PSC but determined by drivers who are often organized into associations or cooperatives. The highly market responsive service carries an estimated 143,000 passengers each day principally to and from major terminals in Bayamón and Río Piedras. The 35 most heavily traveled routes provide service every ten minutes or less between popular destinations within the urban area, while the other routes connect more remote locations to urban destinations less frequently. Público fares vary by route but average about 75 cents. The only public subsidy received by público operators is indirect in the form of the cost of construction and maintenance of terminal structures and areas, which are borne by the local municipalities.

4.2.3 Other transit services

Passenger ferry service has operated across the mouth of the San Juan Bay between Old San Juan and Cataño for nearly 100 years. In 1991 the Ports Authority completed an $81 million project to dredge the Martín Peña Channel between San Juan Bay and Hato Rey, open a new ferry terminal in Hato Rey, and begin additional service between this facility, Cataño, and Old San Juan with high speed catamaran vessels. Unfortunately, the channel re-silted a short time later, and service to the new terminal was suspended indefinitely. AMA also provides a limited dial-a-ride paratransit program for the elderly and handicapped in San Juan and Carolina. This service is being expanded and new accessible buses are being ordered for fixed route operations in compliance with Americans with Disabilities Act requirements. Finally, a small number of PSC regulated private bus companies provide essentially público-style service between público and AMA terminals on seven routes within the metropolitan area.

4.3 The Tren Urbano system

Rail transit is not a new idea to Puerto Rico. At the turn of the last century, the territory supported both a streetcar system in San Juan, and short time later an ambitious project to build a railroad which encircled the island was also completed. Like many of their North American counterparts, economic depression and the advent of the automobile brought both of these services to an end. However, by the 1960's the problems of traffic congestion renewed public interest in rail transit as a desirable transportation mode for the

San Juan area. The region's first long term transportation plan was developed from 1964 to 1967 and recommended the development of a "Nuevo Centro" district, or "new center" for the metropolitan area in Hato Rey, which is more accessible than Old San Juan and Santurce. To compliment this new area of intense development it was also recommended that a subway system be constructed which featured a north-south route connecting Old San Juan and Río Piedras via Hato Rey and an east-west route connecting Bayamón Centro with Carolina Centro also via Hato Rey. The Hato Rey/Nuevo Centro station would serve as the central transfer point on the system—much like Five Points station in Atlanta.

The following decade saw regional plans begin to promote a multi-centered metropolitan area where all the centers would still be connected by two transit lines crossing at Hato Rey. In the late 1970's, the alignment of the proposed transit system was altered to take advantage of an abandoned expressway corridor between Bayamón and Río Piedras, about 1-2 miles south of the original east-west alignment. A lack of political consensus, negative public impressions of transit, car-oriented transportation philosophies in relevant legislative bodies, and an inability to secure federal transit matching funds are credited for the demise of subway plans in the early 1980's. By the end of the 1980's, though, the extreme traffic congestion which plagues the metropolitan area today again brought attention to transit initiatives. The Metrobus and Acuaexpreso services were proposed, and a new regional transportation plan was commissioned which again recommended construction of an urban rail system, only this time using light rail technology. The new rail proposal gained support of all three Puerto Rico political parties, was dubbed "Tren Urbano," and a new office under ACT was established to carry out planning and design for the system.

As presently envisioned, Tren Urbano will be built in several phases ultimately to connect Old San Juan and the International Airport via Santurce, Santurce and Caguas via Hato Rey and Río Piedras, and Bayamón and Carolina via Centro Médico and Río Piedras (see Figure 4.3). The first phase will follow closely the alignment of the last version of subway plans advanced in the 1970's and utilize a twelve mile long double tracked fully grade separated right of way (see Figure 4.4). Starting in the west with a station adjacent to downtown Bayamón (Bayamón Centro), the trains will travel eastward on an elevated structure stopping at the Bayamón Sports Complex (Complejo Deportivo) before crossing Río Bayamón and entering the vacant 65th Infantry Highway corridor at grade level. This highway right of way has been owned by the state for several decades, and much of the surrounding relatively low density residential development along it has been sited to keep the path unobstructed. There will be five stations along this stretch of Tren Urbano (Jardines de Caparra/Río Bayamón, Torrimar, Las Lomas, San Alfonso, and De Diego)

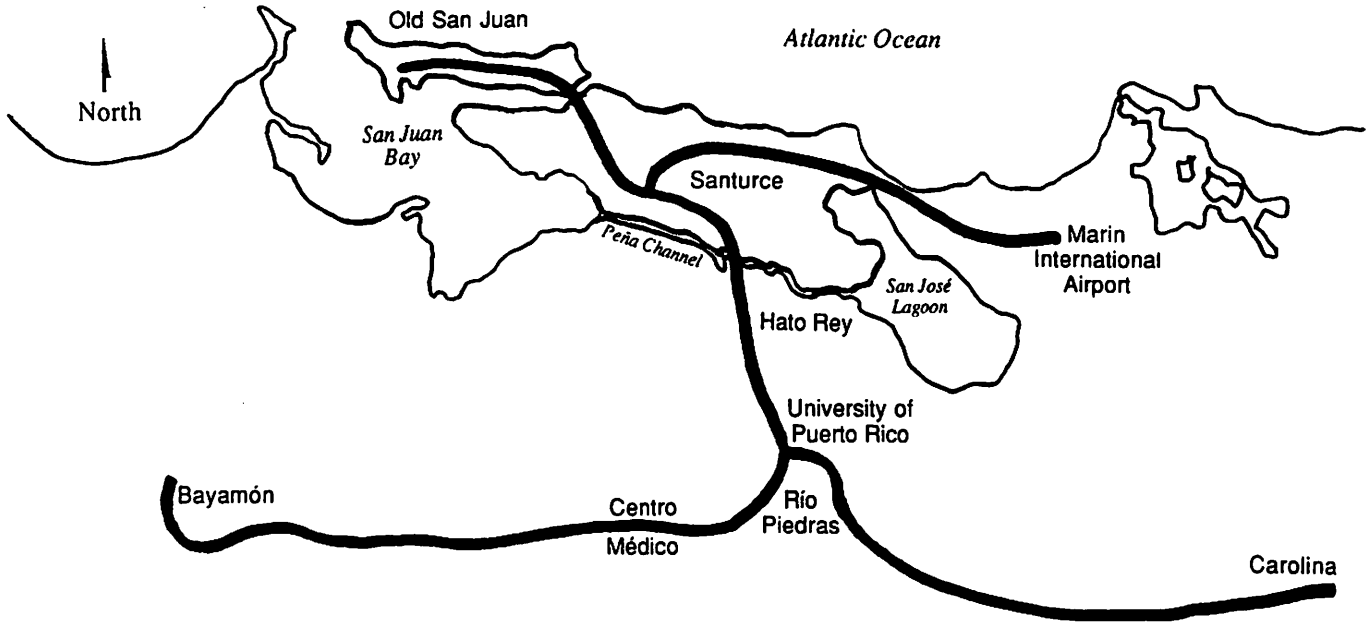

Figure 4.3 Proposed Tren Urbano System

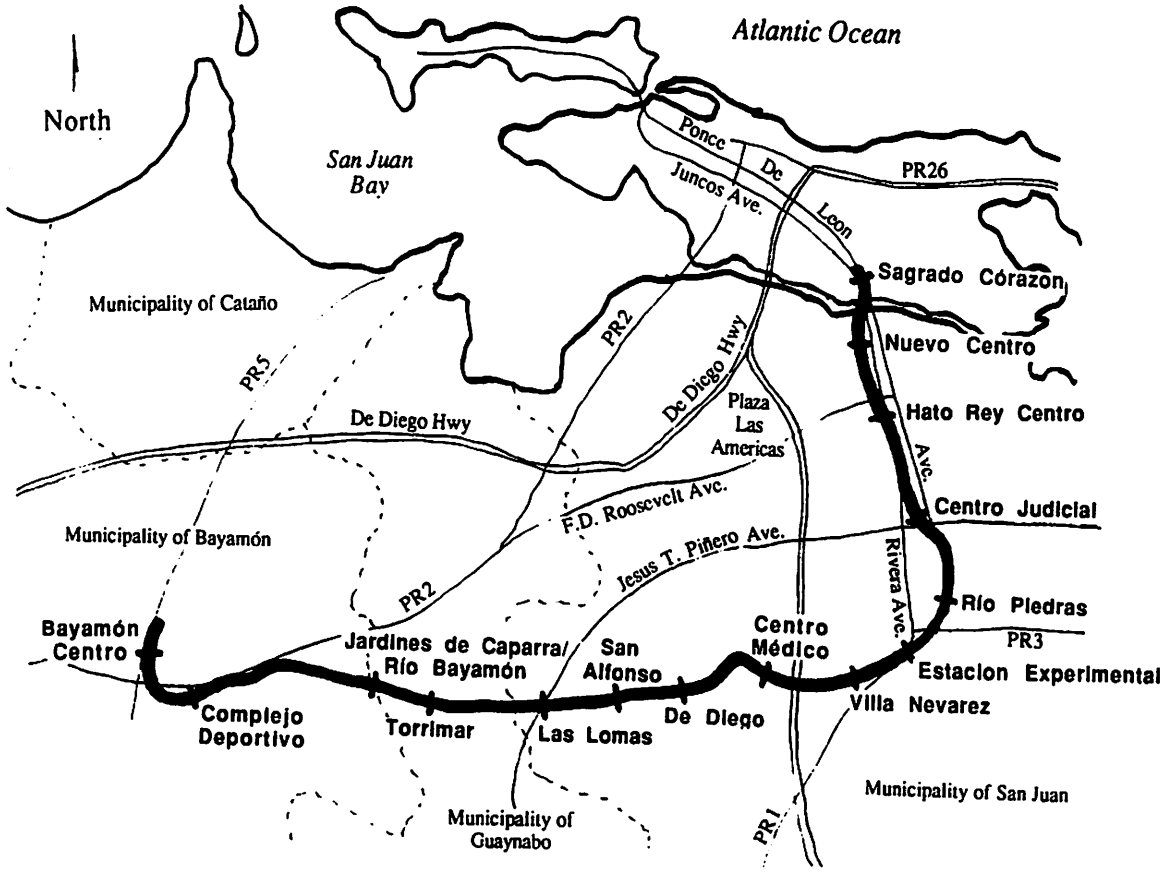

Figure 4.4 Tren Urbano, Phase One

which all serve primarily low density middle to upper income residential neighborhoods. The proposed rail alignment leaves the former highway right-of-way after the De Diego station to serve a station in San Juan's extensive Medical Center (Centro Médico) district where públicos stop presently. From there it will continue eastward on elevated structure to the Villa Nevarez station in a residential area and another station at the Estación Experimental Agrícola, home of the Botanical Gardens of the University of Puerto Rico.

At this point, the proposed alignment turns northward and serves the intensely developed Río Piedras-Santurce corridor. Plans call for Tren Urbano to run in a subway alignment skirting the west edge of central Río Piedras and the neighboring main campus of the University of Puerto Rico. Possible station arrangements include one station each for the commercial center and the campus six blocks to the north, or a combined station between the two destinations. Ascending from the tunnel to elevated structure and crossing the Jesus T. Piñero Expressway, the train will proceed to a station between San Juan's Judicial Center (Centro Judicial) and the El Monte Shopping Mall. From this point north the Tren Urbano will run on elevated structure between, over, and along side Luis Muñoz Rivera Avenue and Ponce de Leon Avenue, the two principal arterial streets which define this urban corridor. Three more stations will be located on the line. One will be in Central Hato Rey at Franklin D. Roosevelt Avenue (which leads to Plaza Las Americas, one mile west), another named Nuevo Centro station will serve the Hato Rey Acuaexpreso and AMA bus terminal, and the final station in Phase 1 of Tren Urbano is named Sagrado Corazón and will be located on the south edge of Santurce.

Tentative operating plans call for Tren Urbano service seven days a week between 6:00am and 10:00pm. Headways are expected to be every five minutes during peak periods, ten minutes during the day, and fifteen minutes late in the evening. Ridership forecasts estimate that the five busiest stations, Bayamón Centro, Centro Médico, Río Piedras, Nuevo Centro, and Sagrado Corazón, will account for nearly 70 percent of the estimated 114,000 average weekday boardings system wide. Access to transit stations is expected to come primarily from buses and públicos—especially at the five busiest stations, which are all transit transfer facilities. Non-transfer stations will be served mostly by pedestrian access, as park and ride patronage is not expected to be significant.

4.4 Tren Urbano station area development

System planning for Tren Urbano has addressed several of the factors which have influenced previous transit plans for the San Juan metropolitan area. Station location, system alignment, the broader institutional environment within San Juan, individual station design and area development efforts, and the Tren Urbano operating strategy will all have a

strong influence on system patronage. Each proposed station presents design and area development opportunities and challenges which will need to be addressed by local officials, planners, and transit operators. As with the transit systems examined in the previous chapters, the presence of transit stations in the neighborhoods through which Tren Urbano runs will provide an opportunity to examine and improve the nature of urban design in the transit station areas. This section will classify the proposed station areas in the Tren Urbano system using the typology developed in section 2.1 (see Table 4.1), and draw from the lessons of Chapter 3 to consider the nature of the factors and strategies which might or should influence development at each of these sites (see Table 4.2).

4.4.1 System-wide factors

From the earliest plans for rail transit in San Juan to today's Tren Urbano, the corridor connecting Old San Juan, Santurce, Hato Rey, and Río Piedras has formed the backbone of all proposed systems, while access to regional centers such as Bayamón, Centro Médico, Carolina, and the airport have also been addressed. In the case of the present Tren Urbano proposal, the dual primary concerns of route location and station siting have been influenced both by travel demand criteria and by logistical and political concerns. It is likely that the "ideal" route for rail transit in San Juan would still follow the "cross" alignment of the 1960s and feature north-south and east-west lines connecting near Nuevo Centro in Hato Rey. These corridors have experienced the most intensive development in the metropolitan area during recent decades, and are expected to continue to be strong markets for commercial and residential construction. However, the availability of the 65th infantry right of way between Bayamón and Río Piedras has provided a major practical incentive to locate an east-west leg of the system in this corridor, even though it would not serve the more densely developed Bayamón to Hato Rey corridor which includes the developing San Patricio office center and the Plaza Las Americas mall. As noted in Chapter 3, alignment and station location decisions are crucial to the realization of system goals, which in this case include improving regional mobility and public transit service and supporting regional economic growth. The alignment selected should provide considerable travel time savings for trips within its corridor, and does serve most of the primary activity centers within the central San Juan/Bayamón area. Utilizing the 65th infantry right of way should also improve the economic viability of the overall project without significantly hindering its effectiveness.

As the cases in the previous chapters indicated, a comprehensive plan or vision for each of the station areas is necessary for successful post-station era development to be realized. By considering in advance and preparing for the desired development at each station, an effective mix of land uses can be encouraged. In this manner, complimentary

Table 4.1 Matrix for Classifying Tren Urbano Station Areas and Development Potential/Goals

Pre-Station Neighborhood Characteristics — *General Attributes*	Actual Post-Station Neighborhood Characteristics — *General Attributes*: Low Intensity Mixed-Use	Medium Intensity Residential	Medium Intensity Mixed-Use	Suburban High Intensity Mixed-Use	Urban High Intensity Mixed-Use
Rural, Undeveloped, Low Intensity Residential (postwar conventional suburban)	Torrimar		Jardones de Caparra/ Río Bayamón		
Low Intensity Mixed-Use (parking lot oriented shopping, multi-family residential, & light industrial)	Las Lomas San Alfonso De Diego Villa Nevarez				
Medium Intensity Residential (prewar neighborhood)					
Medium Intensity Mixed-Use (town center, prewar commercial, vacant industrial)			Río Piedras Bayamón Centro		
Suburban High Intensity Mixed-Use (highrise, abundant parking, "edge city")					Hato Rey Corridor Centro Médico
Urban High Intensity Mixed-Use (highrise, limited parking)					Santurce

Table 4.2 Recommended Strategies for Influencing Tren Urbano Station Area Development

Post-Station General Attribute Station Area Station	Comprehensive Plan for Station Area Development	Increased Densities Required	Increased Densities Permitted (by "bonus")	Increased Densities Permitted (by "right")	Mixed-Use Development Required	Mixed-Use Development Encouraged	Pedestrian and Transit Amenities Required	Reduced Parking Required	Reduced Parking Permitted	Air Rights Development Permitted Over Station	Public Assembledge of Land for Development	Active Public Strategy to Market/ Encourage Particular Land Uses
Low Intensity Mixed-Use												
65th Infantry Corridor												
Torrimar	●			●		●	●		●			
Las Lomas	●			●		●	●		●	●	●	
San Alfonso	●			●		●	●		●	●		
De Diego	●			●		●	●		●			
Villa Nevarez	●			●		●	●		●			
Medium Intensity Mixed-Use												
Jardones de Caparra/ Río Bayamón	●				●		●		●	●	●	●
Río Piedras	●				●		●	●		●		
Bayamón Centro	●				●		●	●			●	
Urban High Intensity Mixed-Use												
Hato Rey Corridor												
Nuevo Centro	●		●		●		●		●	●	●	●
Hato Rey Centro	●		●		●		●		●	●	●	
Centro Judicial	●		●		●		●		●	●	●	●
Centro Médico	●		●				●		●	●	●	
Urban High Intensity Mixed-Use												
Santurce												
Sagrado Corazón	●			●	●		●		●		●	

station areas will develop and Tren Urbano will serve travel destinations including office, retail, residential, and institutional districts, in addition to providing pedestrian, bus, público, and auto access from areas outside the transit corridor. The multiple land uses around the proposed stations should serve a wide variety of trip purposes and contribute to forming a "critical mass" of system-wide transit area development. As described in section 3.1.1, this complimentary development will influence travel behavior by increasing the desirability of making discretionary transit trips. Future system additions linking government and tourist districts including Old San Juan, the oceanfront, and the airport should increase the mix of travel that may be accommodated by the system significantly and induce greater patronage. Effective initial planning will help ensure community support for proper station area development while avoiding preventable negative effects such as land speculation, neighborhood disruption, compromised personal safety, and poor pedestrian and vehicular access. Overlay zoning districts may also be used as tools for enacting these planning principals, and may conform to the particular needs of each station area.

Following the lessons of the previous cases, the design of each station must anticipate the future development of the area, and compliment both the existing and proposed surrounding conditions. Ideally, the station design will be effective both the day it opens *and* twenty years later. Land and air rights owned by Tren Urbano for the station and track itself, or excess land which will be acquired for construction or specifically for joint development purposes, may be improved strategically under the direction of Tren Urbano to influence subsequent area development and capture lease revenues from the publicly owned land. Station and track structure design issues will be particularly important as a large proportion of the system will be elevated and highly visible. The operational implications of overall system and station design issues must also be addressed. For example, the initial phase of the system is expected to accommodate six car trains at all stations, in preparation for anticipated future peak passenger loads. The temptation to run long trains at infrequent intervals must be overcome in the short term if the system is to develop a reputation for a high level of (frequent) service.

Several other transportation-related metropolitan area issues will also likely affect the success of Tren Urbano. Primary among these is comprehensive improvement of the Metropolitan Bus Authority. Efforts over the past few years indicate that a credible strategy is being pursued with regard to this goal, and many appropriate changes are being made to the existing public transit to allow it to complement and augment the success of Tren Urbano rather than detract from and hinder it. Unfortunately, local and Commonwealth strategies regarding highway investment and land use planning appear to be less sympathetic to advancing the cause of transit within the metropolitan area. There is no

comprehensive land use plan which guides development in the parts of the San Juan Metropolitan Area that are not presently urbanized, nor are there effective regulations which promote the incorporation of transit-sensitive design principles in new developments or improvements to existing areas. Several major urban road improvement projects are currently being planned which will increase highway capacity at the same time that the Tren Urbano will be attempting to lure people from their cars. A major investment in a new suburban expressway, PR 66, is also being planned for the Centro Médico-Carolina corridor—a prime candidate for a future extension of the Tren Urbano system. The fact that such high-level transportation investment decisions do not reflect a complimentary overall plan for regional transport, but rather seem to pit modes against one another is cause for concern regarding the success of Tren Urbano. If the San Juan metropolitan area is to avoid the growth of auto-oriented edge cities on its urban periphery, ACT needs to re-assess its suburban highway plans at this early stage. The effectiveness of Tren Urbano at concentrating metropolitan development within the existing core areas will be compromised severely by increasing auto access to remote districts where land is plentiful and regulations are lax. The long term regional development issues associated with highway construction need to be given serious thought and reconciled with transit initiatives or else the Commonwealth risks spending its own money to hinder the performance of Tren Urbano.

4.4.2 65th Infantry Highway right-of-way residential corridor

Much of the land along the 65th Infantry Highway right of way is presently developed in a low density fashion, and consists primarily of single family homes, a small amount of automobile-oriented convenience retail, and a few institutions and light industry. The proposed Villa Nevarez, Torrimar, and Jardines de Caparra/Río Bayamón station areas can be best characterized by the "Rural, Undeveloped, Low Intensity Residential" pre-station land use classification. The Villa Nevarez station will be located adjacent to a middle income residential neighborhood at the intersection of several major highways. Although the community lies between the major commercial and employment activity centers of Centro Medico and Río Piedras, access to them is limited due to an expressway on the west edge of the neighborhood and the Río Piedras (river) and undeveloped University of Puerto Rico land to the east. Like most of the postwar housing developments (or "urbanizations," as they are called in Puerto Rico), Villa Nevarez features single family homes on individual lots, an elementary school, wide streets, no significant multifamily housing or commercial space, and very few pedestrian amenities. Although the individual lots are typically smaller that those generally found in similar residential developments on the mainland and the population densities are a little higher as a result, the auto oriented nature of the streetscape and separation of land uses does not lend itself to effective transit

use. The residents of this neighborhood have also expressed interest in "closing" their urbanization and making it a "gated community"—a trend which has become popular in Puerto Rico in recent years as perceptions of street crime have worsened. The state penitentiary, a small office building, and a few commercial buildings are located along the highways to the south of the Villa Nevarez neighborhood, but the combination of roads that intersect at this location is confusing for motorists and daunting for pedestrians.

Torrimar station will be located in the municipality of Guaynabo between several affluent gated communities including Garden Hills and Torrimar. This area is even more solidly residential in nature than Villa Nevarez, although there are a few smaller retail establishments along the periphery. Immediately west of Torrimar is the site of the Jardines de Caparra/Río Bayamón station which will straddle the Guaynabo/Bayamón municipal border. Existing development to the north and west of this station is much like the conventional auto-oriented urbanizations surrounding Torrimar. However, to the south of the station site lies the largest undeveloped tract of land in the entire Tren Urbano corridor. This 400 acre parcel which extends south to the busy Lomas Verdes Highway and west to the Río Bayamón was acquired by the Commonwealth in 1963 to be held in reserve and developed intensively at a later date, and has since been the subject of intensive planning attention. Two competing development plans have been advanced by the Housing Department which owns the land, and the Tren Urbano Office of ACT which will have made over $65 million in transportation infrastructure improvements adjacent to the site when Tren Urbano is operational. The Housing Department plan calls for construction of a conventional shopping center with abundant parking facing the highway, and clustered housing set back from a ring road around the site. The station entrance would be peripheral to the housing and retail development. The Tren Urbano Office recommendation incorporates many neotraditional neighborhood design elements and features two central boulevards leading to the transit station which will serve as a focal point for neighborhood development. In this plan development would occur on rectangular blocks formed by narrow streets with sidewalks, and storefronts would line the boulevards. Development density would be highest near the train station. At present, the Housing Department has not decided which plan will be pursued.

The remaining stations in the corridor, Las Lomas, San Alfonso, and De Diego are primarily residential in nature, but are also near light industrial, commercial, and institutional uses. The Low Intensity Mixed-Use classification would best describe their present state of development. Las Lomas station will occupy a mostly vacant site along the newly built R. Martinez Nadal Expressway. Nearby land uses include relatively dense high-rise and low-rise housing to the northeast, the Metropolitan Hospital to the southeast,

and scattered low density light industrial and commercial buildings along the expressway to the north and south. Presently, it is difficult to access any of these destinations by foot. San Alfonso and De Diego stations also feature similar conditions to Las Lomas, with limited commercial and vacant land near the proposed station site and predominately single family residential development beyond. AMA's headquarters and central bus maintenance facility are located a short distance southeast of the De Diego Station.

With the exception of the Río Bayamón new town development, the character of much of the existing residential development along the 65th Infantry right-of-way is unlikely to be affected significantly by access to Tren Urbano. These neighborhoods are well established, stable and desirable places to live, and existing zoning regulations and fragmented land ownership in station areas will make it difficult to develop any new large projects. However, in the immediate vicinity of each of the transit stations, concerted planning efforts may be directed towards streetscape improvements to make better pedestrian connections between the stations and the surrounding land uses, and encouragement of small retail and service establishments such as convenience stores, garment cleaning, shoe repair, and day care. This type of development may be particularly appropriate at San Alfonso and De Diego stations where there are smaller parcels of vacant or developable land close to the station. Increased development densities should not be outlawed, rather new projects should be scrutinized carefully in order to make sure that they are not disruptive to the character of the neighborhood. San Alfonso and Las Lomas stations may also support additional development in the air rights above the Tren Urbano tracks. Such projects will require major capital investment, and should be anticipated in the station design and improvements to the local street network so that they will integrate with the neighborhood if built. A larger amount of developable land adjoins the Las Lomas station, particularly to the west across the Nadal Expressway. This land may be consolidated by the government for private or public development, and all new projects should feature direct pedestrian access to the station. Pedestrian access between Las Lomas and San Alfonso stations and the nearby Metropolitan Hospital should also be upgraded, potentially easing parking constraints at this facility.

The primary concern at Villa Nevarez should be the nature of the PR 21 highway in the station area. This road is presently not amenable to pedestrian activity, although the future station would otherwise be within walking distance of the large adjoining residential area, small offices, and the state penitentiary, a large employer. The neighborhood initiative in this area to gate their community would also likely have negative implications for Tren Urbano. Although providing increased security for the residents, a gated community precludes opportunities for effective mixed-use development and transit service

by limiting the access points to the neighborhood and restricting the number and type of people who may enter it. The existing gated communities at Torrimar station already pose this challenge to transit use. These neighborhood issues underscore the importance of incorporating nearby residents in the planning process for station area initiatives and developing a positive local attitude towards the neighborhood station. The cases of Braddock Road and Davis Square may serve as models for effective residential station areas, and both involved significant community participation. Inman Park and Tenleytown present an alternate scenario of transit having an unnecessarily limited impact on similar communities. All of these recommended improvements for the 65th Infantry Highway right-of-way stations are likely to be enacted effectively based upon the experiences at the case stations (see Table 3.1), while the success of development at Jardines de Caparra/Río Bayamón will likely depend upon whether the transit- or highway-oriented master plan is followed. The transit-oriented plan that has been advanced for the site features a large number of standard design techniques for encouraging transit use by the neighborhood's future denizens, and represents a tremendous opportunity to create a neighborhood which may serve as an example to guide future development in the region—just as the first auto-oriented developments did nearly fifty years ago.

4.4.3 Bayamón and Río Piedras town centers

Bayamón Centro and Río Piedras stations are located in traditional town centers which fit the "Medium Intensity Mixed-Use" neighborhood type well. Primarily a suburban municipality, Bayamón is home to over 220,000 residents, and its present borders extend for many miles beyond the historic town center. The elevated Bayamón Centro station is to be constructed on a narrow strip of land bordering the east edge of this central district. A pedestrian "paseo" connects the station site with the traditional town square, three blocks west. The congested square area is surrounded by crowded old and somewhat run down shops, produce markets, and offices, and still serves as a terminal for 31 público routes. Most of the públicos that service downtown Bayamón utilize one of two large terminal buildings located two blocks west and three blocks south of the square. The small central area shops press up to crowded narrow sidewalks, while the newer office and government facilities located in the south edge of the district along Highway 2 are hulking concrete structures with no commercial storefronts and wide desolate sidewalks.

Once the center of a thriving independent town but now a part of the municipality of San Juan, Río Piedras has lost much of its population and former economic vitality over the past 40 years. Central Río Piedras is larger in area and its denizens tend to be poorer and younger than their Bayamón counterparts. A large plaza also marks the center of this district, and is a potential site for a Tren Urbano station. An alternate station site is located

just three blocks north at the southwest corner of the University of Puerto Rico campus. The business district is home to a large number of retail stores, a street market, a fresh produce market, public and private institutions, churches, schools, and many old low rent apartments above the street level shops. The stores and tenements that characterize this area are generally old and crowded, while the urban grid features many small blocks and narrow streets which are congested during the day but deserted at night. Público routes converge upon the plaza as well as on a large terminal building two blocks east. About a quarter mile northeast of the plaza is the Capetillo bus terminal, the largest such facility in AMA's system, serving 22 routes and the Metrobus.

The aging commercial centers of Bayamón and Río Piedras owe their historical development to their location at the confluence of public transit routes. Just as their continuing decline in regional economic significance has paralleled the advent of auto-oriented shopping, the arrival of Tren Urbano could help reverse their sagging fortunes by reinforcing the transit travel behavior that these neighborhoods historically evolved to serve. A pedestrian and transit oriented urban fabric already exists in both of these business districts, although it has been disrupted severely by adjacent highways—PR 2 and 5 in Bayamón and PR 3 in Río Piedras. Station design should compliment the fine texture of small apartment and retail buildings and public spaces that has developed in these districts rather than obliterate it as was done when the new government facilities, public housing, and sports complexes were built surrounding Bayamón Centro during the last 30 years. Special attention must also be paid to the physical relationship between the train station and the active público terminals in both areas, making sure that pedestrian connections between the two modes follow routes that concentrate foot traffic on commercial streets in order to strengthen local commerce and security. Downtown area public improvements such as signs, lighting, and street furniture should accompany the construction of both stations.

Both districts presently accommodate very little vehicular access through a few public garages and on street parking spaces, and parking facilities should continue to be limited. Bayamón Centro tends to attract an older clientele from surrounding neighborhoods and the former countryside who arrive via público to work, shop, socialize, and receive professional and government services. The increased accessibility from Tren Urbano may help to infuse new life into the district from transit riders who did not previously have access to the community or who found access difficult with a car. The station site itself is presently a run down parking lot wedged between the back sides of a row of old commercial buildings and PR 5. This area should undergo major redesign and landscaping when the station is built in order to provide more convenient access to the

surrounding areas as well as AMA bus and público boarding space. The old densely developed streets around the central plaza will not likely change much in character as a result of the train, and any new development in this area should conform to the size and scale of the commercial buildings which are there presently.

Transit access may however be an incentive to spur intensified, pedestrian oriented development at the periphery of the business district. To the south, along PR 2, the large concrete government buildings which dominate the area skyline are entirely out of proportion with the traditional surrounding development. One of Bayamón's público terminals is in the government complex, while the other is an enormous freestanding structure located one block closer to the plaza. The government buildings turn their backs on the town center, and offer an austere face to passing pedestrians, while providing convenient access to motorists on PR 2. The addition of commercial storefronts and improved landscaping is highly recommended the next time these buildings are renovated. The Virgilio Davila public housing project lies to the east, immediately across PR 5 (Columbia Street) from the station site, but is presently separated from it by the busy highway and a chain link fence. The portion of Columbia Street between the station and Virgilio Davila may be rebuilt with improved sidewalks and signalized pedestrian crosswalks at the time of station construction. To the north is a small aging shopping center and vacant land owned by the municipal government which represents an opportunity to create a detailed master plan for the development of this district with the input of its present denizens, representatives from Bayamón Centro, and prospective Tren Urbano patrons. Each of the Bayamón Centro station sub-districts will accommodate additional development easily—especially the land to the north—but they will all require improved pedestrian access to the station in order to take advantage of the Tren Urbano service.

If the Tren Urbano subway station at Río Piedras is located in the plaza, access to the hundreds of públicos that congregate there will be straightforward, and service to público passengers using the large public terminal three blocks away will also be relatively convenient. The alternate station location across from the University of Puerto Rico campus will provide better access to this institution but will be more difficult to reach from the públicos. The ideal design solution would be to provide independent stations for both the university and plaza areas. In either case, the Río Piedras station will be located six or seven blocks west of the heavily used Capetillo AMA bus terminal. To facilitate AMA-Tren Urbano transfers by eliminating the need for walking between the station and bus terminal, bus routes may be altered so that they make a stop at the station just prior to laying over at the terminal, or a shuttle service may be provided between the two facilities.

The central Río Piedras area will also likely accommodate little intensification of development, but like Bayamón would benefit from a more diversified clientele and residential population. Presently, this district caters to a generally lower income segment of the population, and while extremely busy during the day, is nearly void of street life at night and perceived as an unsafe place to be. Housing construction and rehabilitation initiatives in the Central Río Piedras area may be an effective way to bring new residents into this district. The areas to the west and north of the station, especially along Luis Muñoz Rivera and Ponce de Leon Avenues, are suitable for more intensive commercial and residential development. The heavily traveled Rivera Avenue is a southerly extension of the Hato Rey Corridor and is presently home to several hotels, office buildings, and merchants. Improved pedestrian connections between the station area and Rivera Avenue should promote Tren Urbano use to access this corridor, while minimizing disruption to the densely populated residential district that lies in-between. Much of the land to the north is undeveloped property of the university, and will be examined in Section 4.4.6. The "stabilization" of Río Piedras and Bayamón Centro will not involve a major transformation of land use and is akin to many of the town center stations and some of the urban renewal areas studied previously. It is likely that the goal of not changing the land use attributes of these Medium Intensity Mixed-Use neighborhoods will be easy to accomplish, while reviving their slowly declining economies will depend greatly on the nature of Tren Urbano patrons and their relationship with the businesses and residences in Río Piedras and Bayamón Centro.

4.4.4 The Hato Rey Corridor

Although the street grid and high-rise development along the Hato Rey Corridor give it a relatively urban nature, this district which includes Centro Judicial, Hato Rey Centro, and Nuevo Centro stations also has many of the attributes of the "Suburban High Intensity Mixed-Use" category. In particular, the neighborhood features abundant surface parking which prevents it from developing even more intensely and precludes a continuous and cohesive pedestrian oriented streetscape—hallmarks of a truly urban area. The district follows the parallel Ponce de Leon and Louis Muñoz Rivera Avenues for over two miles between the Martin Peña Channel and the Jesus T. Piñero Expressway, and features over twenty major office buildings containing more than 4 million square feet of space as well as major government facilities, hospitals, schools churches, professional organizations, and several shopping centers. The Judicial Center, El Monte shopping mall, and a large high-rise luxury apartment complex dominate the south end of the district which is also characterized by large parking lots and limited pedestrian amenities. Most of the land to the northwest of the Rivera and Roosevelt Avenue intersection is government-owned property,

set aside for the long planned Nuevo Centro de San Juan high intensity mixed use district. A few components of this development including the Hato Rey Acuaexpreso and AMA Bus Terminal, two large multifamily housing complexes, a light industrial park, and an aquatic recreation park have already been realized, but a large portion of the land close to the center of Hato Rey remains vacant. With the exception of the Nuevo Centro area, which extends west to the Plaza Las Americas shopping mall, the entire Hato Rey corridor is never more than three or four blocks wide, and is flanked on the east and west by densely populated low rise single family residential neighborhoods. Over fifteen AMA bus and several público routes serve this urban spine in addition to the Metrobus. Special contraflow bus lanes in this corridor allow public transit vehicles to operate unencumbered by the traffic congestion which plagues the rest of San Juan's street network.

Hato Rey's status as the center of business and finance for the island is not expected to change. Land ownership is largely consolidated in the hands of several developers and large institutions who intend to build more large commercial and office structures along Rivera and Ponce De Leon Avenues, and large parcels of government owned land remain in the Nuevo Centro development area to the northwest. As the largest concentration of development along the Tren Urbano route and the area suffering the most from the effects of congestion, the district could also be the greatest beneficiary of access to high capacity transit service. Development along this corridor must presently rely upon enormous parking garages or surface lots in order to accommodate the large number of cars that bring workers in and out of the area every weekday. Garages add considerable expense to the cost of constructing new office buildings, while the omnipresent parking lots disrupt the character of this urban corridor by creating a discontinuous street face. Excessive land and garage space devoted to parking also diminishes the lease and tax revenue that the developer and municipality are respectively able to realize on developments.

The Hato Rey Corridor has many features similar to the Yonge Street, Ballston-Rosslyn, and Peachtree Corridors examined in the previous chapters. Like Yonge Street, it is presently the principal transit corridor in the region, a feature which has been highlighted by the success of the reliable and convenient Metrobus service. It also continues to evolve from a medium density commercial and residential area into a high intensity district similar to both the Ballston-Rosslyn and Peachtree Corridors. Unlike these other corridors, though, Hato Rey's intense development has occurred prior to the provision of rail transit service and is still highly auto-oriented. These characteristics indicate that Tren Urbano era strategies for influencing development in the Hato Rey corridor will require both encouraging transit sensitivity in new developments as well as "retrofitting" the existing

environment to relate to the new stations. The experiences of these similar cases also suggests that a successful transformation of this district into a transit-centered Urban High Intensity Mixed-Use corridor is extremely likely with conscious effort on the part of San Juan planners to promote proper development.

The strong development climate and parking problems in the district would suggest that zoning regulations and parking restrictions might be effective tools for influencing development and commuting behavior in this area. Care should be taken when crafting these types of regulations though, so as not to make conditions so restrictive that lenders will be driven to support development in areas which are not served by transit. Ingrained driving habits and the auto-oriented nature of the metropolitan area will not change overnight, and stringent parking restrictions will initially be more likely to raise the ire of developers and lenders than to alter driving habits significantly. "Bonus" zoning provisions which *permit* but do not mandate transit sensitive development techniques in exchange for increased allowable building space may be most effective in this area. Some of these techniques may include decreased (or no) parking requirements for the "bonus" office space, compelling developers to devise ways to decrease parking demand on their own (perhaps by implementing TDM programs, with public agency assistance), so that they may provide more office space without increasing parking. Street level pedestrian amenities are important provisions for any transit-oriented zoning regulations, and as experience near Metro and MARTA stations indicates, developer compliance is common when these requirements are attached to zoning bonuses. The environment of the Hato Rey Corridor would also be improved dramatically if these amenities included requirements to devote street level space to commercial activities, disallow excessive building setbacks from the sidewalk, and restrict parking garage and service access to side streets and alleyways. Another technique that has been applied successfully in the Ballston station area which may be desirable in this corridor are requirements to construct residential space in addition to commercial space. Such incentives help create a natural demand for mixed land uses and services, as the neighborhood will be populated by both workers in the day and residents at night. The elevated stations in this area should not preclude either air rights development or pedestrian connections to the stations but will make them a more sensitive design issue than if an underground alignment were followed. Each of the stations should be designed to accommodate effective elevated pedestrian connections to existing and potential surrounding structures.

The publicly owned land in the Nuevo Centro area and the municipal institutions around the Centro Judicial station provide excellent opportunities for the public sector to be a role model in designing new edifices and spaces in a transit sensitive manner. The

physical arrangement of streets and parks and placement of buildings of various uses in the Nuevo Centro district will also determine how development in this area relates to the new transit station and the AMA and Acuaexpreso terminal. The abundance of surface parking and spread out nature of development in the Centro Judicial area provides a great opportunity for public investment in this area to set the tone for future adjacent private development, and may make excellent examples of how to "retrofit" an auto-oriented group of structures surrounded by parking lots into a transit oriented area through the strategic placement and design of new buildings and public spaces. The Hato Rey Centro station will be the closest Tren Urbano station to the Plaza Las Americas shopping district and adjacent municipal stadium and coliseum. A frequent shuttle service between the station and this district would not only encourage Tren Urbano use to access the mall and sports venues, but also permit Hato Rey workers and residents to visit Plaza Las Americas without driving—eliminating another reason to bring a car to this district to begin with.

4.4.5 Santurce

Sagrado Corazón station is located on the southern edge of the truly "Urban High Intensity Mixed-Use" Santurce area. This district is the most densely developed section of San Juan, home to both rich and poor, and the center of municipal government. The proposed station area is close to the YMCA, the lower income Barrio Obrero neighborhood, the more affluent Monte Flores area and newer San Juan Park development, and the Sagrado Corazón University. These neighborhoods date back to the turn of the century and feature well connected narrow streets, sidewalks, and storefront retail on the principal thoroughfares. However, as development has shifted southward towards Hato Rey and into the suburbs, much of this urban infrastructure has not been well maintained. In addition, the primary streets in the immediate vicinity of the station presently function like expressway ramps, making the area a challenge to navigate on foot. Due to the confluence of bus and público routes in this area, the Sagrado Corazón station is also expected to serve as a major transfer point for over fifteen routes. Much of the Santurce district lies to the north of this station which will function as the terminus of Phase 1 of the Tren Urbano system, and it is envisioned that Phase 2 will include extensions to serve the remainder of this area including the Minillas Government Center and the Condado hotel district.

Although the commercial and institutional economies of the central Santurce neighborhoods should be bolstered if Tren Urbano is extended northward, the south edge of the district around the Sagrado Corazón station does not presently afford many development opportunities due to the nature of the street network in the immediate vicinity of the station, and the small lots under fragmented ownership which characterize the older

development in adjacent neighborhoods. A reconfigured street network could create several tracts of ACT-owned land adjacent to the station which would be well suited to intensive joint development. Otherwise, small scale initiatives to encourage infill development, convenience retail, and housing rehabilitation, as well as public works projects to improve the existing sidewalks and streets in this area would help make this a more vital community. Redesigning the street network in the immediate vicinity of the station would also help to promote pedestrian access to the nearby YMCA and San Juan Park developments. The spatially constrained Sagrado Corazón University may realize benefits from the nearby station in terms of reduced parking demands at their campus, but pedestrian access between the station and their campus will also need to be improved.

4.4.6 Station areas with special attributes

Several of the proposed Tren Urbano station areas may also be characterized by their "special attributes" (see Table 4.3). Estación Experimental and Complejo Deportivo stations will serve special event-oriented patronage. The large parking lots surrounding the Complejo Deportivo station in Bayamón also provide the opportunity to allow Tren Urbano commuters from the Bayamón area to use this station as a park and ride facility when the sports venues are not hosting games. An advertising campaign and enhanced parking lot security should encourage such commuting behavior and help to utilize this publicly owned land most effectively. Jardines de Caparra/Río Bayamón station could be home to the Río Bayamón new town development discussed previously. The nature and scale of development proposed for this site is much less intensive than the Scarborough Center, Crystal City, and Pentagon City new towns examined in the case studies. In addition, key design issues including pedestrian-orientation, residential/commercial land use mix, and integration with the surrounding neighborhoods have already been addressed in the development strategy endorsed by the Tren Urbano Office, unlike the Scarborough and Arlington examples. The incremental, block-by-block development approach envisioned by the proponents of this project should also help it avoid the "all-or-nothing" nature of development experienced at Pentagon City (which limited any retail development until an enormous shopping mall was built).

The University of Puerto Rico and Centro Médico are the two special land uses most likely to have significant impacts on the Tren Urbano system. The University of Puerto Rico's Río Piedras campus is the oldest and largest state school in the Commonwealth, and with over 22,500 students, faculty, and staff, it is also the largest single traffic generator on the Tren Urbano system. Much like the university cases examined in Chapter 2, the student population is highly commuter-oriented, although most access to the UPR campus presently occurs by car. In addition to making the campus

Table 4.3 Matrix for Evaluating Tren Urbano Station Area Development Special Attributes

Pre-Station Neighborhood Characteristics — *General Attributes*	Actual Post-Station Neighborhood Characteristics — *Special Attributes*				
	"New Town"	University Area	Medical Center	Urban Renewal Area	Park-n-Ride/ Transit Transfer Center
Rural, Undeveloped, Low Intensity Residential (postwar conventional suburban)	Río Bayamón				
Low Intensity Mixed-Use (parking lot oriented shopping, multi-family residential, & light industrial)					Complejo Deportivo
Medium Intensity Residential (prewar neighborhood)					
Medium Intensity Mixed-Use (town center, prewar commercial, vacant industrial)		Río Piedras		Río Piedras Bayamón Centro	Río Piedras Bayamón Centro
Suburban High Intensity Mixed-Use (highrise, abundant parking, "edge city")			Centro Médico		Centro Medico Nuevo Centro
Urban High Intensity Mixed-Use (highrise, limited parking)				Santurce	

facilities and services more accessible to the members of the San Juan community who do not own autos, an improved transit system and Tren Urbano may be used to change the commuting behavior of the people who presently drive there daily. The Río Piedras campus itself is oriented to pedestrians, but many acres of land along its periphery are devoted to parking lots. Increasingly inadequate parking and a desire to place permanent university facilities on some of the present parking lots has encouraged the institution to support Tren Urbano construction actively. Improved transit access would also make increased parking charges and more restrictive parking policies more feasible, as an affordable and convenient option would now be a viable alternative to driving for many students. Special student-rate passes and other incentives could also be employed to make transit a more attractive option for this large group of potential patrons. Following the lead of stations like Ruggles at Northeastern University in Boston, and Van Ness-UDC in Washington, a distinct Tren Urbano station serving exclusively the UPR district can act as a focal point for new student housing and student oriented commercial activity at the main entrance to the campus. Similar activity takes place presently on University Avenue to the west of campus, and a station immediately at the main entrance would afford the institution the opportunity to develop a large amount of vacant land in this area. A "shared" station at the edge of the campus in the Río Piedras business district would likely be less effective at influencing university development and at associating Tren Urbano with access to UPR. The university would also be wise to re-orient its master campus plan to acknowledge transit access and improve pedestrian connections between the station and major destinations on campus.

Centro Médico is the largest concentration of medical facilities on the island and home to Puerto Rico's premier hospitals including the University of Puerto Rico Medical School and a Veterans' Administration Hospital. At present the Centro Medico campus is oriented heavily towards automobiles. With 28 institutions on a constrained site of less than 300 acres, land is at a premium in this district. Transit access is expected to help reduce the space presently devoted to parking at this facility and make it available for more productive medical facilities. The Tren Urbano station site itself is also suitable for air rights development of additional transportation and/or medical facilities. In addition to straddling the Tren Urbano alignment, Centro Médico is located at the confluence of several principal highways which lead from many suburban points to Río Piedras, Hato Rey, and Santurce. On account of this highway access, the Centro Médico station will also serve as a major bus and público transfer center and feature direct bus ramps from proposed HOV lanes on the adjoining Las Americas Expressway.

The Centro Médico area shares many characteristics with the National Institutes of Health campus in suburban Washington and the Longwood Medical Area in Boston. Both of these medical centers have prepared extensive comprehensive plans for their respective environs which have addressed future utilization of land and buildings as well as transportation issues. As one large agency, the NIH has been able to direct the nature of its growth within its own organizational structure, but the multiple institutions in the LMA have had to rely upon the jointly operated MASCO organization to coordinate shared objectives between the member institutions. Centro Médico institutions will likely need a similar organization to most effectively address common issues such as transportation and facility planning. Beyond developing a comprehensive plan for the area, a planning oversight agency like MASCO could also be used as a tool for implementing a wide variety of travel demand management programs for the Centro Médico area just as MASCO has for LMA. Transit incentives including fare discounts, exclusive remote park and ride lot use, increased parking restrictions and/or fees, improved signage, travel information and pedestrian facilities, and ridesharing programs have all worked for the NIH and in the LMA and could be implemented effectively in San Juan's Medical Center. In addition, the major AMA bus and público transfer facility which will adjoin this Tren Urbano station will provide unparalleled transit access to this major employment center, and present unique opportunities for a Centro Médico planning oversight agency to establish innovative commuting programs incorporating públicos for regional access as well as circulation within the medical campus.

Chapter 5

Conclusions

Many of the factors which have influenced development around transit stations over the past thirty years differ from those that shaped the nature of transit oriented development at the turn of the century. Rapid transit systems which have been built in this era represent investments in a mode of transport that nearly all other political, economic, institutional, and regulatory factors have been aligned to defeat. Nevertheless, these systems have been built with the expectation that they will help to alleviate many of the problems that auto-dependency has created. The issues of transit travel behavior and quality of the urban environment converge in the subject of transit station area development. Construction of a rapid transit network provides the opportunity to orient metropolitan area development in a manner which will take advantage of the travel efficiencies afforded by rapid transit and affect regional travel behavior and quality of life. However, the influence of auto-oriented design standards is strong enough that simply providing transit access will not ensure transit-oriented design around stations and complimentary land uses among station areas. The factors which influence transit station area development are largely the result of policy decisions on the local, regional, state, and national levels that determine the nature, type, extent of, and demand for development.

5.1 Transportation and development

Historically, transportation and land development have been related intricately. Most major cities began as outposts along natural or human-made transportation corridors such as natural harbors, rivers, canals, railroads, and highways—often at the point where two or more transportation corridors intersected. Other cities have been sited based upon topographical or climate conditions, but did not experience rapid development and growth until transportation access permitted it. The advent of mass transit made this transportation-development relationship evident within the urban landscape. At the turn of the twentieth century, neighborhoods and suburban town centers grew around stations of early suburban railroads and rapid transit lines, and commercial development lined the streetcar-served thoroughfares of every major city. Massive public investment in highways and a dramatic increase in personal automobile use following World War II led to a similar phenomenon

only on a much larger scale. Highways made vast expanses of countryside accessible to the car owning public, and soon the concept of development "concentrating" at points of transportation was replaced by sprawling development over the ubiquitous transportation infrastructure. Auto ownership, highway access, and communication technology is presently so widespread in this country that traditional notions of the influence of transportation accessibility limiting the location of land development have become nearly obsolete—increasingly, there is no such thing as a "remote" location.

At present, auto-orientation is the norm for all development—residential, commercial, industrial, institutional and recreational. The postwar suburbs in the United States have been designed nearly universally in a manner which precludes all non-automobile forms of access, and the traditionally pedestrian and transit-oriented older cities have been largely rebuilt to accommodate auto travel primarily if not exclusively. This auto-centered landscape is not necessarily a desirable one. The costs of auto-dependency are high, both to society as a whole and to the natural environment in which we live. These costs are also borne disproportionately by people who are unable or unwilling to drive—often the poor, disabled, old, and young—further marginalizing these people in our society. There are other less tangible, but possibly more important costs of auto-oriented development. A public sense of "place," or a physical "community" worth caring for and being proud of is lost amid the parking lots, tract houses, and cheap, generic shopping center architecture that are duplicated on every highway in every suburb *and* city coast-to-coast.

However, an automobile-dependent landscape is neither the "natural" course of human progress, nor our "destiny" and beyond our ability to control it. A number of deliberate public policies acted in concert to make the present state of urban development feasible, and it is within our power to reverse these policies and create an environment which is more desirable to inhabit. As Juri Pill stated:[54]

> "...in essence the decision boils down to two options: a city based on automobiles and expressways where transit is essentially a charity service for those who have no choice, or a city where transit is given prominence and used by everyone, and the automobile is a convenience rather than a measure of survival. The course of least resistance is to let the car take over, and the transit-oriented option can be pursued only through a deliberate direction set by political will and community leadership."

As so much automobile infrastructure is already in place, it will take a concerted and sustained effort on the part of public officials and citizens to re-orient the nature of our cities. Several initiatives are presently addressing these issues with some success. The

[54]Pill (1988)

ISTEA legislation of 1991 has given more discretion over the use of federal transportation funds to states and localities, permitting formerly highway-dedicated funds to be used for transit initiatives if the recipient government desires, while the FTA's new Livable Cities Initiative provides funding for projects which strengthen the relationship between transit and land use in existing neighborhoods. Architects and planners in both academic and practicing circles are advancing the cause of incorporating "traditional" neighborhood design techniques in new developments, and stressing the pedestrian oriented nature of older urban residential and commercial districts. Finally, the new rail transit system construction that has taken place in many North American cities over the past thirty years has provided many examples of transit station area development possibilities and strategies in otherwise auto-dominated urban environments.

5.2 Analyzing modern station area development

The construction of a new rail transit system represents a fixed infrastructure investment and a political commitment to the future role of transit in a region. Toronto, Washington, Atlanta and Miami have all made this commitment over the past forty years, while Boston embarked upon an aggressive system expansion and rehabilitation program during the same period. The constituent municipalities and planning institutions of these metropolitan areas have paid varying degrees of attention to station area development as the principal way that their transit system interacts with land use and ultimately affects regional travel behavior and permits the provision of cost-effective transit service. Many of the neighborhoods in which the stations of these systems are located share similar attributes based upon the "intensity" and auto- or pedestrian-orientation of their development. These characteristics allow a fairly accurate categorization of transit stations which highlights common factors that have influenced land development in their vicinity. Beginning with rural or undeveloped land and continuing to low, medium, and high intensity auto- and pedestrian-oriented neighborhoods, like station areas may be examined in terms of their development state both prior to station construction and at present. Station areas may also exhibit "special" characteristics including "new town" development, urban renewal status, or proximity to a major institution. Such analysis brings to light both the goals and anticipation of relevant planners since the stations have been proposed and built, as well as the key political, institutional, economic, and regulatory factors which have actually influenced station area development. In addition, a host of zoning techniques and policy tools for promoting and influencing development have been used with varying degrees of success in station areas with different attributes.

The analysis in the preceding chapters provides several significant implications for planning and developing new rail transit facilities. On a system-wide level, transit network design and station siting must consider the relationship between land uses which generate and attract potential transit patrons over the course of a day or a week, and optimize their access to the rail network. A balance must be struck which incorporates a variety of the station types categorized previously, and operating strategies for the network should be designed to provide effective high quality transport between these complementary land uses. Regional intermodal transportation strategies and policies must be coordinated on an institutional level so that highway, transit, and land use plans may also complement one another, and not undercut each other's effectiveness or implementability. The desires of citizens who live near or will use the transit facilities must be ascertained and addressed, and their input incorporated in system planning. The physical design of individual stations plays a critical role in facilitating or precluding potential area development and transit access options. While transit access may catalyze land development in a growing district, a new rail station alone is not enough to reverse poor station area economic and land development trends. A coordinated suite of supporting incentives and regulations must be employed to increase development opportunities in this case.

Development goals may be achieved effectively by both utilizing techniques which promote development or strategies which influence the behavior and attitudes of citizens and developers. Comprehensive planning efforts for station sites appears to be a prerequisite for desirable station area development as it forms the basis through which other strategies and tools may be implemented. Other methods for encouraging appropriate development include permitting construction on transit facility air rights, utilizing urban renewal and public land assemblage powers, and directing investment in properly designed public facilities towards station areas. Travel behavior and patterns and attitudes towards transit may be affected by zoning provisions which require or encourage pedestrian and transit-friendly design techniques. Parking restrictions, tax incentives, and travel demand management programs can also help make transit a more favored travel option. Experiences in the five case cities indicate that low and medium intensity mixed-use station areas are most likely to be able to be transformed into high intensity districts, while residential neighborhoods are least likely to foster intensification.

5.3 Implications for San Juan

The construction of the Tren Urbano system provides an opportunity to influence the urban form and travel behavior of the San Juan metropolitan area significantly. Explosive auto-oriented urban growth in the postwar era has proceeded hand-in-hand with

public transit system decline making this one of the most auto-dependent cities in the continent—in spite of high population densities and low incomes. Tren Urbano could be the catalyst for a major shift in travel behavior to and from the high intensity corridors which it serves as well as allowing further concentration of development along its alignment. Many of the lessons distilled from analysis of the case studies in this research seem to be particularly appropriate for various proposed station areas in the San Juan region. The primarily residential stations along the 65th Infantry Highway right-of-way should accommodate little to moderate increased development, but would be well served by local pedestrian infrastructure improvements and active neighborhood participation in the station area planning process. The declining Bayamón and Río Piedras town centers stand to regain a significant portion of their former economic significance with a well-used Tren Urbano, as these stations will serve as major transfer points in the system and bring a large number of transit patrons to the respective station areas. Significant real estate development can be expected to continue in the Hato Rey corridor, only of a more pedestrian- and transit-friendly nature now that non-automobile based options for access to the area will be improved significantly. In addition, several special areas including Centro Médico, the University of Puerto Rico, and a new town development at Río Bayamón should provide additional opportunities to capitalize on the improved accessibility made possible by the new transit system.

However this new less auto-dependent environment will not develop overnight, nor will the construction of the transit system alone be sufficient to bring all these positive side effects to metropolitan area travel behavior and land use. Presently most factors, including the attitudes of many San Juan area residents and developers, and indeed the proposed highway initiatives of the Highway and Transportation Authority do not support increased transit use or a transit-oriented urban environment. It will take a comprehensive, coordinated effort to challenge and change the present nature of the urban landscape and a significant public education initiative to develop a civic understanding for the ill effects of auto-dependency and widespread public support for a change.

5.4 Contributions of this research

The primary contributions of this research include the development of an effective typology for classifying transit station areas by land use and access characteristics, the application of the implications of this analysis to the proposed Tren Urbano system in San Juan, Puerto Rico, and the examination of over thirty transit station areas which fit the most relevant categories of the typology. As discussed in Section 2.6, the analysis model was capable of distilling over sixty individual existing transit stations into one of six general

attribute categories and five potential special attribute categories. This model proved useful for structuring the analysis of development strategies and tools used in these station areas. Trends in access behavior, development incentives and regulations, and the effects of planning efforts were made apparent through analysis of stations as categorized by their present day development state. It should be useful to utilize this same typology, or one similar to it, to analyze design and development characteristics of districts in any metropolitan area for other transportation-related studies.

Transportation decision makers in the San Juan metropolitan area are fortunate to be able to learn from the experiences of several other North American efforts to introduce rail transit in what were increasingly auto-dependent environments. The lessons and implications of this research have been structured to be particularly pertinent to the Tren Urbano case, and should help development efforts around its stations gain from similar experiences in the other urban environments examined. The collective experience detailed in the case studies is also a significant contribution of the thesis. The stations examined for this research represent a wide range of possible development scenarios and various techniques, strategies, and extenuating circumstances that led up to the present conditions in each station area. It is likely that many more conclusions may be drawn from these analyses, taken as a whole, in groups, or individually.

5.5 Directions for further research and action

This research has exposed several related issues that warrant further study. The methodology used in this study may be developed further to suggest additional trends and properties which are correlated with various neighborhood development attributes. To perform such analyses, the factors which define the typology developed in Chapter 2 may be subjected to more rigorous statistical analysis. By comparing travel behavior, development trends, and demographic characteristics on a microscopic level using local and census data, this classification system may make clear useful factors and trends for more advanced model building.

On a system level it was noted that relationships exist between individual stations, and that principal land uses and traffic generated by some stations complement the land uses and traffic attracted at others. The obvious example was the trip-making behavior between suburban park and ride stations and central business district stations, but many more subtle relationships also exist. It was stated that a "critical mass" of station area development and many such complementary relationships are necessary for achieving a "client" population of transit users—a group which relies on transit service by choice, not by necessity. These notions of complementary land uses, critical masses, and client

populations are all vague, and ought to be analyzed further. It would be useful to gain a better understanding of exactly which transit-oriented land uses complement which others and how this happens in order to determine more accurately the relationships between stations and travel behavior of transit users. The concept of a critical mass of system-wide and station area development might be quantifiable for different types of land uses, station environments, and transit networks.

The complex relationships that exist between each of the institutions responsible for formulating and implementing regional transportation policy in the San Juan area epitomizes the lack of coordination in most metropolitan areas. Highway and transit investment need to be coordinated with an enforceable land use strategy in order to maximize the effectiveness of public sector transportation infrastructure investments, but this is rarely the case in reality. Typically, sprawling development on inexpensive under-regulated suburban land strains the capacity of existing local roads and utilities, and massive public investment must follow to ameliorate these conditions. By this time, the "solution" has been determined in advanced, as the development has been designed in an inexpensive, automobile-oriented fashion which features none of the public amenities necessary to encourage public transit use. To compound matters, land use regulations which do exist often mandate auto-oriented design standards including strict segregation of land uses, wide streets, large lot sizes, and excessive parking requirements. There seems to be a strong need for developing new institutional frameworks which effectively assess and address regional transportation and urban quality of life issues in a comprehensive manner. Many communities have a regional transportation plan, but are not able to reconcile this with regional growth patterns. Concepts such as urban growth boundaries have been utilized in cities such as Portland, Oregon, while more stringent land use controls have been enacted in other metropolitan areas internationally and may offer insights for policy researchers. Ultimately transit station area development and transit oriented design in general can be only one component of an effective strategic effort to lessen urban auto dependence and improve the urban environment.

At the level of the individual station or neighborhood, redevelopment policies and urban initiatives in general have been able to achieve varying degrees of success. The relationships between improved transit access and urban renewal efforts may be explored more thoroughly. Programs which combine "enterprise zone" tax incentives with transit station area zoning and design regulations may hold promise for rebuilding neighborhood economies in urban areas without destroying the pedestrian oriented nature of the community or requiring its residents to own automobiles. The success of endeavors such as these is also tied closely to our national urban policy, and how we as a society and our

legislators view the role of cities. For all of the potential promise that Tren Urbano may bring to San Juan, its gated communities may also serve as a warning for cities in the mainland. The link between the welfare of transit and the welfare of cities is clear. If we want effective transit, we need to believe that urban, pedestrian oriented, mixed land use environments can be desirable places to live. Transit for the sake of transit will not win support—either public or private. It must be billed as a tool to achieve economic development, improved quality of life, cleaner air, and other desirable objectives. It is incumbent upon all transit-related agencies to play the role of the advocate and forge alliances with as many kindred community-based interest groups as possible. Changing the course of transit and urban policy necessitates broad public support, which in turn involves sustained public education. Maintaining a prime position for transit issues in the larger realm of political decision making mandates keeping the link between transit and urban quality of life firmly in the forefront of public discussion.

Appendices

Appendix A

"General" Attributes for Pre- and Post-Station Conditions: 32 Case Studies

The following station area development case studies are organized according to pre-station and actual post-station general attributes, following the main headings on Table 2.2.

Pre-Station Neighborhood Characteristics:

Rural, Undeveloped, Low Intensity Residential

Post-Station Neighborhood Characteristics: Low Intensity Mixed-Use

Station Sites: Fairfax County, Washington Metropolitan Area Transit Authority

Station Ridership (Average Daily Boardings, 1994)		Commuter Parking
West Falls Church	5,400	3,150
Dunn Loring	4,100	1,200
Vienna	9,100	3,600
Huntington	7,100	3,100

In many respects, Fairfax County Virginia epitomizes the sprawling postwar American suburban environment. Lying to the west and southwest of Washington, DC, the county has seen its population mushroom from 165,000 in 1955 to over 800,000 in 1995. As with many suburban areas of large North American cities, much of the initial growth was primarily single family homes on half acre and larger lots, and aside from a few small historic town centers, all of the growth of the past 40 years has been of an auto-oriented nature. As increasing numbers of people were attracted to Fairfax County in the 1970's and 1980's, single family homes were supplemented by duplexes, townhouses, high-rise apartments, and shopping centers. Commercial development in Fairfax County has turned the once "bedroom" jurisdiction into a major white collar employment center and home to "edge cities" such as the Route 50 / Interstate 66 area, the Dulles Airport access road corridor, and Tyson's Corner—each containing tens of millions of square feet of office and retail space.[55] In spite of these emerging and growing concentrations of commercial development, the Fairfax County Metrorail transit lines were sited to relate to the expressway system, not necessarily nodes of traffic generating activity.

The land use patterns around these four stations are all nearly identical. At the time the rail lines opened in the mid 1980's, all of the station environs had been developed in a low density, primarily residential fashion. None of the station sites was an existing center

[55]Garreau (1991)

or concentration of commercial or residential activity. West Falls Church, Dunn Loring, and Vienna are all located in the median of Interstate 66, which was designed to accommodate the transit facility, while Huntington was built near a busy highway and the Beltway. This station siting and the provision of large park and ride lots has made it convenient for people to drive their cars to rail, although feeder bus service has also been provided from surrounding neighborhoods and institutions. At the time of station construction, the Fairfax County Board of Supervisors commissioned a Metro Station Area Study to recommend development guidelines for the areas around each station in order to "...ensure that Fairfax County's interests are best served by development at these station areas."[56] Each station area development plan calls for encouraging mixed use and pedestrian-oriented development at increased densities close to the station. The guidelines identify definite boundaries of the station development areas, and recommend parcels for particular types of development or redevelopment in order to "...capitalize on the opportunity to provide transit-focused housing and employment locations, while still maintaining the existing [non transit focused] nearby land uses."[57] Unfortunately, these plans have not been realized in the eight years since their inception. Only the Dunn Loring station area, which is at the intersection of Interstate 66 and the Beltway, has seen even modest office construction (400,000 square feet since 1984[58]), while the remaining stations have the same low density residential character as in the pre-Metro days. County administrators cite market factors as the reason why so little transit related development has taken place in Fairfax County—in spite of supportive zoning.[59]

Post-Station Neighborhood Characteristics: Suburban High Intensity Mixed-Use

Station Site: Scarborough Center, Toronto Transit Commission (TTC)

Station Ridership (Average Daily Boardings, 1994): 11,000

Commuter Parking Spaces Available: 0

Scarborough is a suburban municipality in the east part of Metro Toronto which has been developing since the 1950's. It has grown in a northeasterly direction, spreading out from the neighboring City of Toronto's border on the southwest. The municipal offices were located originally in the southwest quarter of the city, but in the 1960's a decision was made to relocate them to a new "city center" closer to the geographic center of the future built out municipality. A large tract of land near Highway 401 (Toronto's perimeter road) and McCowan Road was selected for the site and an official plan for development was

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[56]*The Comprehensive Plan for Fairfax County, Virginia* (1991)

[57]ibid.

[58]*Fiscal Impact of Metrorail on the Commonwealth of Virginia* (1994)

[59]Tom Rishani, Fairfax County, phone interview

approved in 1968. In 1972, the Scarborough municipal offices and a major regional shopping mall were the first developments to open at Scarborough Center (except for a few older light industrial buildings along the expressway), and were joined in 1979 by a large Bell Canada office building. Initially, transit access to the site was poor while highway access was outstanding, so the development was designed in an automobile-oriented fashion. Through the 1970's, though, regional plans called for a light rail line to serve the site on its own right of way, and connect with Toronto's existing Danforth Avenue Subway. In 1980 the decision was made to build an intermediate capacity fully automated Scarborough Rapid Transit (RT) line; construction was started in 1982 and operation commenced on March 23, 1985.

Scarborough Center was promoted as a regional employment center by local planners, but office developers did not respond enthusiastically to the site until ground was broken for the RT line. Several major office buildings, including Scarborough's first speculative building, were started at this time. It is thought that the investment in transit gave the developers more confidence in the future significance of Scarborough Town Center, as four more office buildings and a major Government of Canada facility have been built since.[60] During the recent recession office construction has stopped, but residential construction has increased.

Although the development was at first exclusively auto-oriented, the arrival of the RT has fostered a change in philosophy among Scarborough officials regarding the urban design of the area. Planners and other city leaders would like to see Scarborough Center become more pedestrian-oriented, but the existing landscape has been difficult to change. The station area is presently a hybrid environment where automobile access still dominates, but transit has an increasing role. The auto-oriented shopping mall has been expanded from 800,000 to 1.4 million square feet in the last twenty years. However, it now features the Scarborough Center RT station at its south end. New policies to promote a pedestrian friendly environment are in place, but the goal has not yet been achieved as there are still many vacant parcels of land, and private investment is needed to fill in these "holes" in the center's master plan. Currently the district employs 18,000 people, and at build-out could accommodate over 50,000. The long term objective of the city is to create a high density center with a pedestrian and transit focus. In 1987, 25% of work trips to the center were by transit while the goal is to serve 55% of work trips on transit when the site is built out.

[60]Ed Watkins, City of Scarborough, phone interview

Pre-Station Neighborhood Characteristics: Low Intensity Mixed-Use

Post-Station Neighborhood Characteristics: Suburban High Intensity Mixed-Use

Station Site: Dadeland North and South, Metro-Dade Transit (M-DTA)

Station Ridership (Average Daily Boardings, 1995)		Commuter Parking
Dadeland North	4,900	1,280
Dadeland South	4,800	2,953

The Dadeland stations are the last two on the south end of Miami's single Metrorail line, which began service in 1981. Subsurface conditions precluded effective tunneling, so this rapid transit system was constructed entirely on elevated structure. From downtown Miami, the line runs south above an abandoned freight rail right of way (which has since been landscaped and made into a pedestrian and bicycle trail) parallel to a busy arterial road, South Dixie Highway. The south end of the line serves the middle and upper income communities of Vizcaya, Coconut Grove, and Coral Gables, including the University of Miami. The alignment of the north half of the line was more influenced by political considerations than by ridership generation potential[61], and runs through several lower income neighborhoods which are neither generators nor attractors of many Metrorail trips. The northern half has not performed as well as the southern half in terms of ridership (its twelve stations attract less than 90% of the riders of the south eight stations) or transit related land development.

Dade County did several things to encourage development around its transit stations. It created a 21 mile long "transit zone" along the entire system which gives the county jurisdiction over all zoning in the transit district. Station area design and development studies were performed to encourage development both in response to M-DTA efforts as well as on its own by providing infrastructure, amenities, and zoning for higher densities at stations. The land along South Dixie Highway had been developing in an auto-oriented "strip" retail fashion prior to the commencement of Metrorail service. The area around and within walking distance to the two Dadeland stations was a rapidly growing commercial district and home to the Dadeland Mall. In 1982, the county initiated a joint development project at the Dadeland South station. Completed in phases from 1986 to 1989, the project involved building a 275 room Marriott hotel, two 200,000 square foot office buildings, a 1000 space M-DTA parking garage, and an entrance to Dadeland Mall. This joint development project was built primarily above the garage, with the public (M-DTA) providing the land and the parking structure and a private developer building the offices, hotel, and more parking. As the land owner, the county shares part of the rent from all developments built adjacent to the transit facility. One benefit of the transit access

[61] Jack Luft, City of Miami, phone interview

to the developer is reduced parking requirements close to the station—up to 25% less than normal. This is believed to be a greater incentive for office development than retail, as there is low turnover in office-related parking spaces throughout the day, requiring more parking overall. Another joint development incentive is that there is no property tax on the county owned land, only on the buildings.

Overall, the station area development which has occurred since Metrorail service started has not been of a particularly transit-oriented nature, and there has been very little residential development of any kind. Station area urban design can be characterized by large amounts of parking and wide streets—in short, easy and convenient automobile access. Pedestrian concerns have not been entirely ignored as there are paths and connections from the stations to major developments, but there are really no disincentives for driving to any of the station area destinations. Consequently, the stations are used primarily by suburban commuters who park and ride to work downtown. The Dadeland area is still growing, but it is running out of open space. Local officials believe that most of the recent development in this district would have occurred without Metrorail, although probably not as quickly or densely. They feel that the transit access has assisted by acting as a catalyst for the market, but not created it. The market has been soft lately, but last year another agreement was reached to build a similar joint development facility adjacent to the Dadeland North station. This development will include 320,000 square feet of retail space, and eventually another 300 room hotel and 200,000 square feet of office space. Other developments have occurred around the transit stations without direct M-DTA assistance, but again mostly on the southern portion of the line.

Station Site: Rockville Pike Corridor, WMATA

	Station Ridership (Average Daily Boardings, 1994)	Commuter Parking
Grosvenor	3,700	1,750
White Flint	3,700	1,700

The Rockville Pike commercial and employment corridor extends for several miles immediately north of the Capital Beltway and east of I-270 in suburban Montgomery County, Maryland. The corridor bisects a region of upscale housing and is a well established commercial and residential area. A large amount of upscale single family housing was built in the area during the 1960's and 1970's. This development continued and was accompanied by a wave of commercial, office, and multifamily residential projects along major arterial roads like Rockville Pike in the 1980's and 1990's. Like many other suburban development corridors with ample highway infrastructure and an affluent surrounding population, development along Rockville Pike has proceeded in an almost

exclusively auto oriented fashion for several decades. Only recently, with the 1984 opening of the Metrorail Red Line which runs in tunnel and open cut parallel to Rockville Pike, and the mid 1980's passage of an adequate public facilities ordinance (APFO) by the Montgomery County Board, have transit and pedestrian supportive design techniques been encouraged and implemented in this area.

Grosvenor and White Flint are the two primary Metro stations serving the Rockville Pike corridor. Grosvenor anchors the south end of the district and is home to over 4,000 units of mid-rise and high-rise multifamily residential developments. The relatively high density of development in this area would ostensibly be conducive to transit use, but the physical relationship between much of the nearby development and the station is less than ideal. Most of the high-rise housing is located across the busy, six lane Pike, and is designed in the "towers in a park" fashion—surrounded by extensive parking lots and garages. The mid and low rise housing is laid out around parking lots and winding access roads which are also not very conducive to pedestrian activity. There is little storefront convenience retail, and that which does exist is located behind parking lots, not next to the sidewalk. Future plans call for continued high density residential development in the area, and county planners intend to try to make the nature of the district more pedestrian friendly to encourage walking to the Metro station.

White Flint station is located near the heart of the Rockville Pike commercial district—White Flint Mall. Much of the development in this vicinity preceded Metro, or did not respond to its presence, and as a result is difficult to reach without a car. Most of the development in the area is of the conventional shopping center nature with storefronts set back from the road by hundreds of feet of parking, and a few stand alone restaurants and banks in the middle of the parking lots. Until recently, there were not even any sidewalks along the Pike leading to the Metro station. Since the station opened, there has been a general increase in the scale of development, with larger office buildings and shopping centers replacing the existing smaller ones, and several new multifamily residential developments. A few notable exceptions to the general trend in development have been spurred by the APFO legislation. Prominent among them was the development of the site immediately south of the entrance to the White Flint station and bus transfer center. White Flint North, as the office project is known, was completed in 1988 and houses the offices of the Nuclear Regulatory Commission. The site provides convenient pedestrian access to the station and is laid out and landscaped to encourage on site walking. Further office and residential development of the same character is planned for the remainder of the site. A short distance further south is the White Flint Mall. This fifteen year old facility is surrounded by parking lots and structures, but has just recently built and landscaped a

special pedestrian entrance from a bus unloading area along Rockville Pike which is now used by transit riders and pedestrians from nearby office developments.

Station Site: New Carrollton, WMATA
Station Ridership (Average Daily Boardings, 1994): 5,600
Commuter Parking Spaces Available: 2,350

The New Carrollton station area seems to be blessed with as much major transportation infrastructure as a suburban site could possibly accommodate. It features stations on Metrorail's Orange Line, Amtrak's Northeast Corridor (Metroliner), and the MARC commuter service's (Baltimore to Washington) Pennsylvania Line, as well as access from the Capital Beltway and the expressway that connects Washington and Annapolis (US 50). The railroad corridor, US 50, and the Beltway form a triangle of nearly 200 acres known as Ardmore Triangle. Until the mid 1970's this area was mostly vacant and zoned for industrial use, but no development took place due to lack of utilities and access roads from the expressways. By 1976, 80 acres of land along the railroad tracks were being used by Metro to construct the Orange Line's terminal station, park and ride lots to accommodate 1,500 cars, and train yards and shops—all of which opened in 1978. In addition, the Pennsylvania Railroad (now Amtrak Northeast Corridor) tracks were the site of a temporary station for intercity and commuter trains. At this time, the owner of the remaining land in the triangle proceeded to provide utilities and roads and sell off parcels of this land for low density office park development which was permitted under the area's industrial zoning. In spite of their proximity to the train station, the office developments all featured surface parking and no pedestrian amenities.

Prince George's County imposed no transit-oriented regulations on the newly transit accessible site and the developer made no provisions for residential land uses or even the slightest retail development to serve commuters, and none were built. At present the Metro Park East employment area, as it is now known, is nearly built out with low density single-use office buildings, and it appears that the nature of the area will not change dramatically in the upcoming years. There may be more hope for transit sensitive development on about 40 acres of WMATA owned parking lots along the railroad tracks which are suitable for air rights development, and another 70 acres of mostly vacant land under mixed ownership immediately to the north of the station, beyond the Triangle. In 1989, Prince George's County approved a Transit District Development Plan for the area to the north of the station, with the intent of ensuring a functional and pedestrian-friendly station area environment. Using a zoning device known as a Transit District Overlay Zone, the county has stipulated acceptable land uses and urban design standards for the highly

transit accessible site. In 1994, the Internal Revenue Service broke ground on a new 1.2 million square feet office complex on a large portion of this land which dwarfs the development in the Triangle and will serve as a strong anchor for the station area.

Station Site: Wellington, MBTA
System Ridership (Average Daily Boardings, 1994):
Station Ridership (Average Daily Boardings, 1994):
Commuter Parking Spaces Available:

In 1975 several new stations along a relocated and extended Orange Line north of Boston were opened to the public. Chief among them in terms of development potential was Wellington in Medford. The Wellington site was long a forlorn corner of Medford, bordered by the Mystic River, and home to an old drive-in theater, a landfill, and scattered industrial and undeveloped Metropolitan District Commission park property. However, bisected by the new transit line and by the busy Revere Beach Parkway, the accessibility of this vacant land has made it attractive to developers in recent years. The City of Medford has pursued development aggressively, and has prepared several comprehensive plans for the area. Presently, only a tiny fraction of the area has been residential development, and this has occurred on the edge of the closest existing residential neighborhood just northwest of the station. Due to the relatively remote location of the station site and its former unsightly land uses, all new development has had few negative impacts on the community and has been received favorably overall.

Medford also allows development in the air rights over the station, and a grand proposal by the city in 1976 featured extensive use of this concept at the Wellington site. The city's actual efforts have centered on parceling land and working with the development firm Cabot Cabot and Forbes to create a rather ordinary, but commercially successful spread out "suburban-style" office park that capitalized on the escalating cost of downtown Boston real estate in the 1980's. Presently, the development is mostly in the northeast quadrant of the station area, across the heavily traveled high speed parkway from the station itself. Due to limited sidewalks, relatively long distances to walk, and the challenge of crossing the parkway, many of these employers operate shuttle vans between the office park and the station and park and ride lot. The city would like to address this situation by adding pedestrian facilities along the parkway, but blame jurisdictional red tape for preventing such actions on the state right of way. Medford is also pushing for a hotel-conference center development in the southeast quadrant of the station area on the bank of the Mystic River, and intends it to be more accessible to pedestrians. The remaining section of the station area is occupied by an MBTA train yard and shops.

Post-Station Neighborhood Characteristics: Urban High Intensity Mixed Use

Station Site: Jefferson Davis Corridor, Arlington County, WMATA

Station	Ridership (Average Daily Boardings, 1995)	Commuter Parking
Pentagon City	8,500	0
Crystal City	11,700	0

In the early 1960's, the far southeast corner of Arlington County, Virginia had several dominant features. It was separated from the rest of the municipality by Shirley Highway (Interstate 395) on the north and west, and it featured a large single family residential neighborhood to the southwest, Washington National Airport to the east, and was bisected by Jefferson Davis Highway and the Richmond Fredericksburg & Potomac Railroad. The entire northern portion of this district, a 3,000 feet by 4,000 feet tract immediately across Shirley Highway from the Pentagon, was vacant while the 7,000 feet stretch of land along Jefferson Davis Highway and the railroad tracks was devoted to low intensity industrial use including a drive in movie theater, junkyards, and some motels.

In 1963, developer Robert H. Smith recognized that the corridor's location between downtown, the Pentagon, and National Airport made it an ideal site for mixed use office, retail, residential and hotel development. Although not the original intent, his initial developments laid the groundwork for what became Crystal City, which today is home to over 50 buildings housing approximately 6,000 upscale apartment and condominium residents and 60,000 office workers.[62] In 1979, completion of the Metrorail Blue and Yellow Lines from the District to Washington National Airport enhanced the accessibility of the site with an underground station in the center of the development, and weatherproof connections to most of its buildings. Across Jefferson Davis Highway, the Pentagon City Metro Station also opened in the center of the 116 acre tract of vacant land south of the Pentagon. Three years earlier, the Arlington County Board had approved a phased development site plan for the landowners of this site which called for 1.25 million square feet of office space, 1 million square feet of retail space, 1,630 hotel rooms, and 6,500 residential units. Although the office component of the Pentagon City development and some residential space was built rapidly, the major residential and hotel developments did not move forward until a centerpiece one million square foot shopping mall called Fashion Centre at Pentagon City was completed in 1989. With four floors and two department store anchors, Fashion Centre is the only major regional shopping center in the Washington area with direct Metro access.

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[62]Wheeler (1995)

Taken together, the developments around these two stations have created a self contained city. Transit access is an integral component of the projects, but this is not readily apparent from ground level. The initial Crystal City residential and office towers preceded Metrorail by fifteen years, and were designed to take advantage of the auto access provided by Davis Highway. The site plans for both Crystal City and Pentagon City reveal very large blocks suitable for several sizable buildings each. The streets are wide and designed to accommodate automobiles easily. Although there are sidewalks and street trees and it is possible to walk about, there is relatively little storefront retail and limited public spaces (especially around the older developments); the street level is still effectively the domain of cars. This characteristic is somewhat compensated for by an extensive underground network of pedestrian passages, many of which are lined by retail establishments. In 1993 an urban station of the Virginia Railway Express commuter rail service from suburban Virginia to Washington Union Station was added to the east edge of Crystal City on re-routed CSX (formerly RF&P) tracks. Although the developments are not connected underground, physical proximity and a few key pedestrian and bike paths also allow non-motorized access between Crystal City, Pentagon City, the Pentagon itself, and National Airport—each of which also has its own Metro station.

Station Site: North York (Sheppard, North York Center, Finch), TTC

Station Ridership (Average Daily Boardings, 1994)		Commuter Parking
Sheppard	19,000	0
North York Center	5,500	0
Finch	35,500	2,682

North York is a large suburban jurisdiction in the Municipality of Metropolitan Toronto. It is bisected by Yonge Street about eight miles north of downtown Toronto, immediately north of Highway 401. By the early 1970's, city leaders felt that the traditional downtown district of North York located along Yonge Street near Sheppard Avenue was in need of revitalization. In 1974, the Yonge subway line was extended to Finch Avenue, just north of downtown North York, and its Sheppard Avenue station was seen as a way to catalyze new development in this district. The combination of a rapidly growing local economy, subway access, and proximity to the Highway 401 ring road have helped the North Yonge Corridor change from a flagging minor commercial district into a major metropolitan retail, commercial, and residential district. Over 22,000 people are employed in this area (a figure projected to grow to 65,000 by 2011), making North York second only to downtown Toronto itself in terms of concentrated employment.[63]

[63] *The Official Plan for the Municipality of Metropolitan Toronto* (1994)

Shortly after the subway extension was opened, work began on the district's first major multi-use development, Sheppard Center. This complex consists of over 500,000 square feet of office space in twin buildings, three apartment towers, and a large shopping concourse connected directly to the subway station. Since this development was completed, it has been joined by nearly a dozen neighboring high-rises including additional office and residential space, as well as a federal building, hotels, and educational institutions. North York's role as a center of regional economic importance was recognized officially in the mid 1980's when it was designated as one of two "Major Metropolitan Centers" (the other is Scarborough City Center) in the Metro Toronto Official Plan. The Official Plan stresses the importance of ensuring that there will be sufficient land to accommodate expected metropolitan growth, and "...that the locations of places of employment are related to the transportation system for the efficient movement of people and goods."[64] The Metropolitan Centers are intended to serve as focal points for business, government, and community activity, while also serving as transportation hubs for local surface transit. These districts are accompanied by four additional "Intermediate Centers" at subway stations which will receive slightly less concentrated development.

In a dramatic demonstration of their commitment to concentrating development around transit in North York, the city, TTC, and private developers joined forces in 1987 to complete development of the $250 million City Center at North York Civic Center. This 2.2 million square foot mixed use complex contains a new North York City Hall, a new Central Library, a 250 room hotel, a connection to the existing Board of Education building, and 2 million square feet of office space all surrounding a large public plaza with direct underground connections to the new North York Center subway station. Subsequent to this development, two more large scale mixed use centers have been constructed adjacent to the station on the east and south. Development has also been occurring further north along Yonge Street into the district the city calls Uptown. The city is encouraging this activity due to the relative abundance of developable land in this area, as well as its proximity to the Finch Avenue subway station.

The city has influenced development in the North Yonge Corridor by using zoning to encourage density and mixed land uses near the subway stations, and relegating vehicular access to the rear portions of structures. The development which has occurred thus far has frequently been of the mega-project variety, and the urban space between the buildings and the streetscape as a whole has not taken on a unified appearance. Current plans attempt to address some of these issues by recommending an improved and unified pedestrian network including wide sidewalks, street trees, active building façades

[64] *Metropolitian Toronto: The Transit/Development Connection* (1987)

(storefronts and windows instead of blank walls and ventilation grates), courtyards, and an integrated underground pedestrian system. The intensive development district extends for only one block on either side of Yonge Street—a strict zone which has left the surrounding existing single family residential neighborhoods intact and stable. Future regional plans call for a new subway to be constructed eastward under Sheppard Avenue towards Scarborough Center. Cognizant of the factors which have influenced development along Yonge Street, the North York government is presently preparing extensive plans to promote continued intensive and transit sensitive commercial development along the new Sheppard subway corridor.

Station Site: King Street / Eisenhower Avenue, WMATA

	Station Ridership (Average Daily Boardings, 1994)	Commuter Parking
King Street	4,100	50
Eisenhower Avenue	1,200	15

Alexandria, Virginia is one of two historic towns along the Potomac River in the Washington metropolitan area which preceded the creation of the District of Columbia. The other town, Georgetown, was incorporated into the District while Alexandria remains an independent municipality. Due to its age and the attractive appearance of its residential "Old Town" district, which features a dense grid of cobblestone streets and orderly antebellum row houses on every block, the town has become a popular tourist attraction and residential address. The city limits extend to the west of the original town by several miles and include a large amount of auto-oriented residential and commercial development. Most of the newer parts of the city are separated from Old Town by the CSX (formerly RF&P) railroad. The 20 to 30 block area between Old Town and the railroad tracks used to flood and in the 1950's much of the land was developed into parking lot oriented shopping centers. There was only one historical building in the district—most of the remaining structures were "disposable."[65] By the early 1970's, the area had become a rather tawdry looking collection of vacant land, auto dealerships and repair shops, parking lot oriented retail, and generally run down commercial buildings.

In 1974 a Metrorail alignment along the RF&P right of way was chosen, and King Street station was sited adjacent to this decrepit commercial area and alongside Alexandria's historic but rarely used Union Station—about one mile west of the heart of Old Town. All the station area properties were held by several different private owners, and the existing street system was irregular—unlike the orderly Old Town grid a few blocks to the east. A case could be made for the city to take an "urban renewal" approach to assembling and

[65]Larry Grossman, City of Alexandria, phone interview

consolidating the land for private development, but it did not due to bad previous experiences. Instead, the city relied on zoning incentives to achieve its development and urban design objectives. A task force of property owners and city representatives agreed on a site improvement plan prior to the commencement of any station-related construction. The idea was to integrate the new development with the character of the nearby Old Town district by emphasizing features such as brick sidewalks, ornamental street lights, and street trees. The city relied on a partnership whereby they would make road and park improvements while the developers would make the proper streetscape improvements. Developers and tenants formed a capital improvement association for the district to coordinate finances for these improvements. City planners felt that it was also important to respect the fifty foot building height restrictions of the nearby historic and residential areas, and actually reduced the heights and building densities from what was allowed previously—choosing to emphasize compact, high quality office, retail, residential, and hotel development over massive high-rise mega-projects. To encourage transit use, new parking regulations reduced greatly the amount of off street parking that developers were required to provide (especially for convenience retail which caters to walk in traffic from office workers), and mandated that all parking structures be placed under or behind buildings—away from view.

Although there was some initial apprehension that all these land use restrictions would hinder development, over 1.3 million square feet of office space, 70,000 square feet of primarily storefront retail space, and a 267 room all-suites hotel have been built in the redevelopment district since the King Street station was completed in 1984.[66] The change in appearance of the neighborhood could not be more dramatic. The formerly derelict district is now a very charming pedestrian oriented group of office buildings with well landscaped brick sidewalks and plazas and ornamental street furnishings. The development is entirely compatible with the scale and feel of the Old Town neighborhood, and the physical transition between districts is nearly seamless to the pedestrian. City administrators note that several former Old Town office tenants have actually moved closer to the King Street station.[67] The most dramatic indication of the change in character of the station area is that now the elevated Metro station seems too auto-oriented—its bus bays, an ample kiss and ride lot, and 50 park and ride spaces look out of place in its "new" surroundings. It is likely that this WMATA owned land around the station will be a prime parcel for more intensive development in the near future.

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[66]*Fiscal Impact of Metrorail on the Commonwealth of Virginia* (1994)
[67]Larry Grossman, City of Alexandria, phone interview

To the west of the station is the historic George Washington Masonic Temple and a large park, and to the north are a few potential development sites and stable residential areas. The greatest remaining development opportunity lies on the southern fringe of the station area, where a large master planned mixed-use community called Carlisle is taking shape on the site of a former Norfolk Southern railroad yard. The first phase of this development includes several million square feet of space on 80 acres. A new US courthouse is the centerpiece of the project which will additionally feature 680 residential condominium units in three high-rises. The streetscape will also take after Old Town, with a dense grid street pattern emphasizing pedestrian access. A mile further south, the Eisenhower Avenue station is surrounded by land under the ownership of one person who has not done much to develop it in a manner that takes advantage of its proximity to the transit station. There are a few buildings with Department of Defense tenants and acres of surface parking. City administrators were not able to get the property owner to develop his land in a more transit sensitive manner and feel this station area has been a big disappointment. They hope that the success of the developments around King Street and Carlisle will have a positive impact on the urban design of future developments near the Eisenhower Avenue station.

Pre-Station Neighborhood Characteristics: Medium Intensity Residential

Post-Station Neighborhood Characteristics: Medium Intensity Residential

Station Site: Inman Park, Metropolitan Atlanta Rapid Transit Authority

Station Ridership (Average Daily Boardings, 1995): 3,600

Commuter Parking Spaces Available: 268

The Inman Park/Reynoldstown station is located three miles east of downtown Atlanta on MARTA's East Line. To the south of the station lies an industrial district and a lower income neighborhood of single family homes called Reynoldstown. To the north is a middle to upper income neighborhood of restored turn-of-the-century single family homes known as Inman Park. Within Inman Park is a traditional neighborhood commercial district known as "Little Five Points." Long-standing neighborhood development plans have emphasized the residents' desires to keep Inman Park relatively isolated from the rest of the city—free from commercial and industrial encroachment, and lower income housing. The low intensity commercial uses in the Little Five Points district have been buoyed by city efforts to provide street, intersection, water, sewer, park, and plaza improvements in this area. Industrial development has been promoted for the land along the parallel MARTA and Seaboard Coastline railroad tracks, and in 1987 the freight railroad opened a $15 million transfer facility for containerized freight at this site. The Reynoldstown community has been in a stagnant to declining state, and has not experienced much new development of any kind in many years.

Ever since the elevated station opened in 1979, the Inman Park neighborhood has turned its back on MARTA.[68] It did not want any transit induced development or any relation to the system at all. A large amount of land was cleared for a freeway through the community in the 1960's. When the freeway was canceled shortly thereafter a neighborhood group and the city reached an agreement to use the vacant land for a park, new housing, and parkway. The Jimmy Carter Presidential Museum was constructed in Freedom Park ten years ago and the parkway was recently opened to traffic, but no new housing has been built on any of the land yet. The park reaches into several different parts of the community and is ideal for bike and pedestrian trails to connect them together. However, Inman Park neighbors have opposed any such connections fearing increased crime. Although most of the station patrons live in the neighborhood, the community in general has not viewed the transit station as a positive influence on Inman Park and, again fearing crime and change, has not wanted to encourage stronger links between their neighborhood and MARTA. Aside from the continuing restoration of homes and the

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[68]Laurie Lelend-Kirk, City of Atlanta, phone interview

stabilization of the Little Five Points district (several blocks north of the station), there has been very little change in this historic neighborhood since MARTA arrived.

Station Site: Tenleytown, WMATA
Station Ridership (Average Daily Boardings, 1994): 5,200
Commuter Parking Spaces Available: 0

The stable and affluent northwest Washington DC neighborhood of Tenleytown is home to American University, limited storefront commercial development along Wisconsin Avenue, a few small office buildings, private schools and apartments, a large number of well maintained single family homes, and since 1984 a Metrorail station. A district which grew up around the Wisconsin Avenue streetcar lines both before and after World War II, it remains a highly pedestrian oriented environment in spite of its relatively low density of development. The neighborhood features an interconnected street network with sidewalks, street trees, and convenience retail along arterial streets. When the Tenleytown station on WMATA's Red Line subway was being planned in the late 1970's, local citizens were not incorporated in the decision making process from the beginning, and consequently did not buy in to the city's plans.[69] Many residents considered station area development to be just another way for developers to put offices in established residential areas, and the debate became polarized. Many Red Line station areas like Tenleytown—desirable residential neighborhoods which could have attracted new development—have restricted the intensity of permitted development with the intent of preserving their communities. Washington city planners point to examples of "neighborhood sensitive" development at station areas in Toronto and Virginia and lament their inability to have instilled in DC residents an understanding of how to control and contain development around the transit stations.[70] The result of these attitudes has been zoning policies which effectively prohibit most new development. The neighborhoods have remained stable, but the city has been prevented from even encouraging the most benign (but still fiscally beneficial) intensification of land usage near many stations.

The factors which influenced development at Tenleytown have also been present in the Northwest DC neighborhoods near the Cleveland Park and Woodley Park-Zoo Metro stations. There was one attempt at a Washington comprehensive plan in the 1980's which could have gotten all relevant parties to address station area planning as a result of the nascent DC self government. However, the relevant leaders did not utilize citizen participation as a tool for charting a course for community development. According to one

[69]William Washburn, District of Columbia, phone interview
[70]ibid.

DC planning official the decision makers at that time were driven more by politics than by problem solving, and problems were addressed like oiling squeaky wheels. The better organized neighborhoods and those with the greatest resources were most successful at directing policy to suit their interests. A broad consensus for development over the entire city was not reached, and Metrorail's effectiveness as a development tool was hindered. In short, most of DC was already built up and new development was generally only occurring downtown. Many of the city's neighborhoods were undesirable places to develop, and those which were not, were the most resistant to it.

Station Site: Anacostia, WMATA
Station Ridership (Average Daily Boardings, 1994): 8,500
Commuter Parking Spaces Available: 1,300

Anacostia is an economically depressed neighborhood in the southeast part of Washington DC. Its Metrorail station occupies a site at the intersection of the Anacostia Freeway, South Capitol Street, and Martin Luther King Jr. Avenue. It is about one half mile west of the area's commercial center at Martin Luther King Jr. Avenue and Good Hope Road. The actual station site was selected because of an early 1970's neighborhood initiative to re-think the wisdom of the initial station site in the deteriorating commercial district. This counterintuitive position was taken by the citizens because they felt that there was little room for the station as planned originally so the business district would have to be disrupted. An equally important concern was that the original station site would also not serve the people who need it most—those dependent on buses for access from the surrounding neighborhoods which are beyond walking distance and separated by hills from either site. A WMATA study took ten years to reach the same conclusions as the neighbors and student researchers had, and the site was finalized in 1981. The station opened in 1991 and is now an interim terminus on the Green Line which is being extended through relatively open land through Southeast DC and into Prince George's county.

As built, the station features two entrances. One entrance serves the expressway traffic and park and ride garage, while the other serves the neighborhood and bus transfer facilities. Prior to station construction, the site featured a church, a Moose Lodge, and several run down frame houses. The Lodge and residents were relocated, but the church used political connections to remain at the site, although their structure is now surrounded by Metrorail facilities. Metro did secure the right of first refusal if the church property is ever sold. Across the street from the station is an elementary school, a play lot, and a historic school building presently used as a job training center for ex-offenders. Other nearby land uses include a relatively stable residential neighborhood, a large mental

hospital, a large amount of National Park Service property, and some vacant land which is often used for illicit activities.[71]

Due to the highways, topography, and park property, over half of the land in the vicinity of the station is not developable. However, some low-lying land immediately west of the station's "highway" entrance would be suitable for development if filled. This land has recently been rezoned to encourage office or possibly light manufacturing development. Industrial development is preferred by local leaders since it would provide more employment opportunities for area residents, but the market for office space is stronger, so that option was also reserved. Air rights development over the station is also possible, but market conditions preclude any such projects at this time. Due to the traffic noise at this site, residential uses have been discouraged.

Post-Station Neighborhood Characteristics: Medium Intensity Mixed-Use

Station Site: Braddock Road, WMATA

Station Ridership (Average Daily Boardings, 1994): 3,300

Commuter Parking Spaces Available: 20

In 1984 an elevated Metrorail station opened in a primarily residential area along Braddock Road on the north side of Alexandria, Virginia. Local planners intended for the station and ancillary development to stabilize the neighborhood and a small adjacent industrial district which were beginning to show some signs of urban decay, and moved aggressively to secure key parcels of developable land around the station. The strategy was to purchase and redevelop two 7.5 acre tracts—a former school site and a 90 unit public housing project. The housing authority sold the project to get assets and the redevelopment authority helped find a suitable site for relocation of the housing units. The land was rezoned for high density mixed use—not just office. As the formerly industrial district was not established as either office or residential, it was felt that the first new project would set the tone for future development in the neighborhood.[72] In the late 1980's, the city sold this land to a pension fund which constructed 323,000 square feet of office space, over 200 residential units, and convenience retail space in several mid-rise buildings on the site. After the initial development on the publicly assembled land, private investment followed with a mid-rise apartment building on an adjacent parcel in 1990. The recent economic slowdown has prevented further development at this site, but the market for existing multifamily units and the surrounding single family homes has remained strong.

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[71]Dorn McGrath, George Washington University, phone interview

[72]Larry Grossman, City of Alexandria, phone interview

The surrounding residential densities are conducive to Metro usage, and there is a relatively large walk-in ridership at Braddock Road. Prior to the initial station area development, the neighborhood featured a grid street pattern and sidewalks, but no focal point or small retail district. The station and surrounding medium intensity development has helped to define the neighborhood in this fashion. Initially the neighbors perceived that there might be a massive dislocation of the present residents due to station area development. They did not know what was going to happen and feared the worst. However, the City of Alexandria was able to build trust and convince the community that a new station does not have to bring only negative externalities to its environs. At Braddock Road most of the new development took place in the industrial district, so there was very little change in the residential area. Local officials acknowledge that some gentrification may have occurred, but it has happened slowly. The neighborhood has become richer, but a wholesale displacement of the poorer residents has not taken place.

Post-Station Neighborhood Characteristics: Suburban High Intensity Mixed-Use

Station Site: Quincy Adams, Massachusetts Bay Transportation Authority

Station Ridership (Average Daily Boardings, 1993): 5,300

Commuter Parking Spaces Available: 2,227

In 1980, the MBTA's Red Line was extended south along the former Old Colony Railroad corridor and two primarily park-and-ride stations were opened. One of these stations, Quincy Adams, was constructed where the rail corridor intersects Route 3 in South Quincy. Designed to serve primarily automobile traffic, it includes dedicated access ramps to and from the expressway and the largest parking garage in the MBTA system. There has been a continuing highly unfavorable neighborhood reaction to the Quincy Adams station which mostly serves far south suburban commuters. Although the station features a pedestrian entrance from the adjacent single family residential neighborhood, it has been gated and locked since the station opened due to neighborhood concerns about crime and commuter parking on their streets. There is no potential for station-induced development at this site, as it is physically removed from the adjacent neighborhood by an embankment and fences, and surrounded by busy highways on all other sides. A new office park is taking shape along the Route 3 expressway about one half mile from the station. A shuttle bus provides service between the office park and the station, but otherwise this development is isolated from the station by fences, fields, and a busy highway and its design is entirely oriented towards the freeway and automobiles.

Pre-Station Neighborhood Characteristics: Medium Intensity Mixed-Use

Post-Station Neighborhood Characteristics: Medium Intensity Mixed-Use

Station Site: Pape, TTC

Station Ridership (Average Daily Boardings, 1994): 14,500

Commuter Parking Spaces Available: 0

The neighborhood around Danforth and Pape Avenues three miles east of downtown Toronto is known locally as Greektown due to the concentration of Greek restaurants and merchants located in the area. This active restaurant, entertainment, and local shopping district was built up over fifty years ago along the Danforth streetcar lines. The pedestrian friendly neighborhood consists primarily of two and three story commercial buildings along Danforth with mostly single family residences along the surrounding side streets. Overall development densities are relatively low given the proximity to TTC stations. Subway construction in the mid 1960's had a major impact on the neighborhood, as it was built in a cut and cover fashion just behind the buildings on the north side of Danforth. The subway replaced the Danforth streetcars, and since it was below ground and made fewer stops than the trolleys it diminished pedestrian traffic and reduced the visibility of the storefront retailers and restaurants. The land cleared for the subway in the Pape area was covered with parking lots and ironically increased the auto accessibility of this commercial district. Consequently, this area is still rather active but much of the rest of Danforth Street—especially the other commercial districts—are not as stable. Comprehensive plans which address the potential for transit oriented development along Danforth Street were neither prepared at the time of station completion in 1966, nor do they exist today.

Station Site: Decatur, MARTA

Station Ridership (Average Daily Boardings, 1995): 4,700

Commuter Parking Spaces Available: 0

Decatur, Georgia is the seat of DeKalb County, six miles east of downtown Atlanta. As an independent municipality of 17,000 which has been surrounded by the growth of the much larger neighboring city, Decatur has characteristics of both a small town and a suburban community. The central business district was laid out in a traditional grid street pattern centered around Courthouse Square. It was settled in 1823, 25 years before Atlanta, and represents about ten percent of the land area of present Decatur. The downtown is surrounded by single family residential neighborhoods which have been built out since the 1950's. Decatur has three stations on MARTA's East Line—two at the city limits and one downtown, under Courthouse Square. Prior to MARTA construction in

1979, downtown Decatur was a retail, professional services, and government center. However the timing of MARTA's construction coincided with large scale suburbanization of metropolitan retailing. Downtown Decatur lost a large number of retailers to shopping centers, but many elected officials and community leaders thought a centrally located transit station could encourage revitalization. As early MARTA planning progressed, Decatur was intended to be a "destination" station within the system, and a significant amount of redevelopment was expected to occur. However, only the locally owned shops stayed downtown through the period of retail suburbanization, and these suffered during subway construction when there was a 40 foot ditch cut through the central business district. Subway construction permanently closed a major retail street to vehicular traffic, and replaced it with a pedestrian mall that is not very well integrated with the station or the rest of downtown. The station roof is raised several feet from the ground and forms a clear divider between the retail establishments and the rest of downtown by forcing these shops to look out onto what seems to be an alley.

The first major redevelopment effort commenced as the station was completed. The city teamed up with a large developer and planned to tear down several historic commercial buildings and replace them with ten to twelve floor office buildings and a hotel. This proposal provoked a major uprising from downtown merchants and neighbors. Another loud protest came from a large number of young "preservationists" who had moved into the neighborhood in the preceding years and were not a part of the local leadership structure that encouraged this development. Ultimately the development plan was dropped, and this event precipitated a two year planning process with citizens and businesses to formalize a vision for downtown Decatur. This process culminated in the Decatur Town Center plan of 1982 which identified Decatur's assets and needs and promoted increased office and residential development. A downtown development authority was created in 1983 to nurture the vision and develop strategies to implement the plan. Through the 1980's downtown retail continued to diminish, but major office construction picked up. City administrators feel that the ongoing office development is likely related to the existence of MARTA, which increased accessibility between Decatur and Atlanta, and gave a more urban feel to the small town. Mid-rise office space in Decatur has nearly tripled in the last decade. Banks have expanded and preferred to locate service and support staff offices here because of lower rent, easy access, and its reputation as a pleasant and safe place to work.[73] Today's retail environment consists primarily of more professionally oriented services such as restaurants and specialty stores. In 1988 the first major project of the Town Center plan was completed—a Holiday Inn/conference center with a parking deck.

[73]Evelyn Menne, City of Decatur, phone interview

MARTA is only now being seen as an asset by much of the community. Previously, some residents had seen it as a detriment and a cause of the decline in downtown retail, but city planners feel that many of these changes would likely have occurred anyway. Now people and businesses are moving to Decatur because of the combination of a small town atmosphere with convenient MARTA access to downtown Atlanta. Emory University is located on the west edge of the town, and is outgrowing its space and moving non-academic functions off campus. As the closest office center, downtown Decatur is getting more and more Emory related facilities including their Pathology Department, public relations division, and medical clinic. On campus parking is also limited so the university encourages employees to use MARTA and operates a shuttle service between campus and the Decatur station.

Zoning policies and parking restrictions have not been used to influence development. Downtown is a commercial district and that is the type of development that has been encouraged. Present development efforts are mostly focused on stimulating residential development which they hope will bring ancillary retail development.[74] City administrators do not want downtown Decatur to become an office park which closes at 5 PM, and have directed their marketing efforts away from offices and towards housing and retail. However, the downtown is still suffering from a poorly designed subway station. At the time of subway construction, it was thought that much of the old downtown would be razed and replaced, and the station was designed with no regard to the existing downtown. The city is presently in the midst of working with MARTA to improve this and other aspects of the station including maintenance problems and bus to rail transfer issues. There has been a great increase in the number of bus transfers through Decatur in the last 15 years, and a new feeder bus transfer facility which would allow buses to access the underground station from an arterial street is needed. ISTEA monies are being targeted to make these improvements and enhance the pedestrian streetscape around the station with new sidewalks and street trees.

Station Site: Malden Center, MBTA
Station Ridership (Average Daily Boardings, 1993): 8,400
Commuter Parking Spaces Available: 165

At the west edge of the central business district in Malden, Massachusetts is a joint rapid and commuter rail facility. The Orange Line was brought here in 1975 primarily due to the efforts of then Mayor Walter Kelleher, in keeping with his vision for the urban redevelopment of the downtown area. His early 1970's achievements also included

[74]Hugh Saxon, City of Decatur, phone interview

rerouting Pleasant Street, Malden's main street, and creating a pedestrian mall in its place. Presently, as at the time of station construction, this area is built up intensively, and is diverse in terms of land usage. The station itself fits into Malden's urban fabric well, and did not require extensive additional pedestrian amenities. However, handicap accessibility and a direct pedestrian walkway to City Hall have not been completed 20 years after promised by the MBTA.[75] A new government center has been built opposite the station, and forms a gateway to what has become a somewhat run-down shopping district. The city has not pursued a structured plan for downtown development or specific urban design goals since the urban redevelopment days, but has encouraged construction of higher density residential and commercial development through zoning. In this regard, the station has fostered considerable downtown development—an estimated 1000+ mostly mid-rise dwelling units, and several thousand square feet of new office space. Although the city has also constructed four municipal public parking garages in recent years, many city administrators agree that the T station is the most influential single factor in the development of downtown Malden in the past 50 years. In spite of relatively robust housing and office markets, many vacant storefronts indicate that retail uses have been slow to follow. The city expects this picture to turn around with an upturn in the overall economy and the completion of a new mega-supermarket complex on the south edge of downtown, although the design of the completed portions of this complex is oriented towards auto users.

Station Site: Davis Square, MBTA
Station Ridership (Average Daily Boardings, 1993): 5,900
Commuter Parking Spaces Available: 46

The long planned but often delayed extension of the MBTA Red Line north from its original terminus at Harvard Square became reality on March 30, 1985. The new transit line was constructed entirely in tunnel to minimize the disruptive effects on the communities through which it passes both during and after construction. The Davis Square neighborhood is an old, established, densely populated section of Somerville, Massachusetts near Tufts University. Developed originally around streetcars, the district is ideal for pedestrian activity but more difficult to access by car. Narrow streets around the subway entrances are lined with small retail establishments in two and three story commercial buildings dating to the early 1900's which cater to the numerous and diverse neighborhood residents. Community members were vocal and organized effectively when subway plans were announced in the mid 1970's. As a result, they were able to ensure

[75]Fred Thurlow, City of Malden, phone interview

station design that provided superb pedestrian access to all nearby establishments and a station entrance plaza which fits the character of the neighborhood.

The station planning activists were adamant that no major roadway or parking garage facilities should be connected to the station, instituted a three story height limit for all buildings in the area, and insisted that improvements be made to the public spaces in and around the square in conjunction with station construction.[76] As a result of their demands that the station *enhance* the neighborhood, not recreate (or destroy) it, the changes brought about by the stop are difficult to observe, but the city administrators believe that the value and marketability of residential and commercial property in the neighborhood has been bolstered by the increased accessibility. The commercial uses are mostly related to human and health services, but most evident is the residential character of the neighborhood. Nearly all of the buildings around the square have dwelling units in them—even the buildings with retail storefronts. The demand for residential space has risen dramatically due to the subway, especially among students studying at nearby institutions along the Red Line and young professionals employed in central Boston. In spite of the lively, active nature of the square today, some Somerville city planners are not sure that the city would not be better off by allowing more intensive development, such as a hotel to serve Tufts guests, and higher rent paying (hence tax revenue generating) commercial enterprises. These planners feel that Davis Square is at a developmental disadvantage to more open and auto accessible transit stations such as Malden and Quincy Center. Regardless, the station has no park and ride facilities and still attracts ridership on par with any of the more auto accessible MBTA stations.

Station Site: Quincy Center, MBTA
Station Ridership (Average Daily Boardings, 1993): 7,100
Commuter Parking Spaces Available: 872

The Quincy Center station is at the site of a former railroad station, and serves the Quincy central business and historic districts. The site includes a large city bus terminal, small retail space, and a parking garage built over the station and railroad tracks, and the existing grid street system provides adequate pedestrian access to the station and surrounding neighborhoods. Several new developments have occurred recently in Quincy Center, each involving participation of the town's Planning and Community Development Office, but none seem to be particularly influenced by their access to the transit station. The President's Place office, retail, and residential complex is half completed one block from the station, and several smaller commercial and residential developments have been

[76]Patrick Russett, City of Somerville, phone interview

built in the area. An addition to the City Hall has also been completed recently next to the station, and there are long range plans for a hotel nearby. Quincy laws permit private construction *over* the tracks by leasing air rights, although only one development other than the Quincy Center station itself has taken this approach—for another parking garage!

The concrete station/parking garage/bus terminal structure was completed in 1970 and does not relate well to the surrounding development in terms of appearance, scale, and siting. The neighboring structures on the east are mostly brick "Colonial" style buildings with façades that press up to the sidewalk. The station is set back about 250 feet from the street behind a plaza and access road. To the west of the station is a residential neighborhood which had several dozen houses along the railroad tracks removed in order to accommodate the station and a widened arterial street. The remaining homes on the opposite side of the street have been converted into commercial and office uses. The main actions of the city with respect to transit station area development are planning and zoning board approval of private proposals and strict regulation of the downtown historic district. There are no "comprehensive plans" for any station areas, nor does the city specifically or actively encourage transit or pedestrian sensitive urban design for the development which does occur.

Station Site: AUC Stations (Ashby, Vine City, West End), MARTA

	Station Ridership (Average Daily Boardings, 1995)	Commuter Parking
Ashby	2,700	154
Vine City	2,800	50
West End	10,700	285

The Atlanta University Center (AUC) is a consortium of six independent institutions which constitutes the largest predominantly African American educational complex in the nation. Over 12,000 total students are enrolled in Clark Atlanta University, The Interdenominational Theological Center, Morehouse College, The Morehouse School of Medicine, Morris Brown College, and Spellman College. AUC Inc. is a nonprofit organization which coordinates services for students of all the schools and promotes cooperative decision making between the institutions. The neighborhoods around the AUC campuses lie approximately one mile west of downtown Atlanta and are served by three MARTA rail stations. The Vine City and Ashby stations on the West Line provide access to the northeast and northwest sides of the AUC respectively, while the West End station on the South Line serves the area to the south of the schools. In spite of the growth of the educational institutions, the surrounding neighborhoods have been in a state of economic decline for the past 30 to 40 years, and it was hoped that the introduction of MARTA

service would bring new vitality to these areas. Several redevelopment initiatives have been taken at each of the station sites, but each with limited success.

The most promising station area development effort yet is now underway as part of preparations for the 1996 Atlanta Olympic Games. The AUC/West Side Pedestrian Corridor System project will improve the design and physical appearance of three street corridors connecting the AUC campuses with each other, the Olympic venues, and the three area MARTA stations. As part of this initiative, there have been meetings with neighbors, merchants, schools, and associations and workshops with students. In Atlanta planning is done at the level of "Neighborhood Planning Units." This group was involved very early on to pick the major pedestrian corridors for analysis and improvement. It is felt that there is great potential for redevelopment in the area and that these improvements will catalyze social and economic development well after the Games are over.[77] They are being paid for with part of a $3 million FTA Livable Communities grant.

The business district along Martin Luther King Jr. Drive, immediately south of the Ashby station has historically been the focal point of Black commerce, education, culture, and politics in Atlanta. By the early 1970's though, community growth was lagging, and the city teamed with a local developer to guide development in the area around the transit station. The development plan put forward just prior to station completion in 1979 emphasized community participation in a three phase project called University West. The mixed-use development was to include a central outdoor marketplace, museum, library, theater, conference center, and parking garage, with office, residential, and hotel space to follow in later phases. A federal grant was obtained to leverage private financing, but the arrangements fell through in 1981, and none of University West was ever built. Since this time, the city's efforts have concentrated on promoting reinvestment in neighborhood housing and existing retail establishments through the provision of low interest economic development loans. A large parcel of land south of the station is now to be developed by the city with a large grocery store, movie theater, and smaller retail. More federal funding has been secured to finance this project, and AUC is putting in the pedestrian infrastructure to provide safe access from the surrounding neighborhoods to the station area and the university campuses.

Similar low intensity redevelopment efforts have been directed towards the Vine City station area over the past fifteen years, resulting in the rehabilitation of several homes and the city-financed construction of multi family townhomes and housing for the elderly. This neighborhood wants to develop a daycare facility at the station in cooperation with the city, state, and MARTA. The Vine City station and neighborhood is also right across from

[77]Danita Brown, AUC, phone interview

the 70,000 seat Georgia Dome. The station was designed only to serve neighborhood passengers, but it experiences overflow crowds on game days when people cross the highway to get from the Dome to the station.

The West End station area has also received much public attention from the city's economic development department, but aside from being a more stable neighborhood to begin with, the area has not had much more new development than Ashby or Vine City. West End's main attributes include a residential section with a large number of historic Victorian homes to the west, a shopping district called Mall West End near the station, and a light industrial and warehousing area on the east side of the station near railroad tracks and an expressway. Recent efforts to encourage more preservation and development in the respective districts have been marginally successful. West End is the most viable commercial district in the AUC, but I-20 separates it from AUC. The planned pedestrian connections are expected to facilitate walking to visit these commercial establishments and reduce automobile congestion. A MARTA survey of transit use in this corridor indicated that West End is already the station most heavily used by AUC students and that many students take the north-south line from homes in southwest Atlanta, alight at West End, and walk to campus.

The AUC campuses are all spatially constrained so the schools attempt to acquire neighboring properties when they become available. They are all private institutions with limited financial resources and are all under the zoning controls of the city. The schools do not want to build parking because it is expensive and takes up valuable space, but city zoning often requires it. The FTA and the city are working to create special permit parking zones around AUC so that money does not have to be used to build parking simply to satisfy zoning standards. During construction on a former parking lot, Spellman College started an initiative not to issue parking permits in order to get the student population acclimated to using transit. Spellman administrators promoted parking at outlying MARTA stations and using the existing pedestrian links from the AUC stations. Parking and congestion are among the largest common problems faced by the AUC institutions. Each of the six schools has its own parking policies even though AUC Inc. pulls together all of the presidents to try to coordinate their efforts. A joint parking management system task force has been funded as part of the FTA Livable Communities grant to address these issues.

Station Site: Rhode Island Avenue, WMATA

Station Ridership (Average Daily Boardings, 1994): 4,800

Commuter Parking Spaces Available: 350

Rhode Island Avenue was among the very first Metrorail stations to open in 1976. It occupies a site south of the Avenue, and east of the CSX (formerly Baltimore & Ohio) Railroad right of way along which this branch of the Red Line runs for several miles in Northeast DC. This location is immediately north of the WMATA Brentwood yards and shops and Washington Union Station. The station is surrounded by hundreds of acres of derelict and some functional industrial property and hundreds more acres of vacant land, including the 18 acre Harmony Cemetery which was cleared for the canceled North Central Freeway. Beyond the immediate station area lie several medium to high density old lower income urban neighborhoods. The physical layout of the station and its relationship to the heavily traveled Rhode Island Avenue make pedestrian access nearly impossible. Consequently, nearly all of the station's traffic comes from feeder buses and park and ride patrons. The abundant developable land around the site would seem to make this station a prime target for transit-oriented development, but in the last twenty years nothing has yet materialized. The Government Printing Office and US Postal Service have alternately expressed interest in constructing huge facilities near the station which could serve to anchor the site and induce further development, but ground has yet to be broken by either agency. Both a 1976 and a 1983 study of the issues affecting station area development at this site drew the same conclusions, which are still true today:[78]

- Developer indecision has suspended strong momentum to redevelop key station area parcels;
- Poor pedestrian access to the station has limited the transit system's utility to nearby residential neighborhoods; and
- Poor retail services and inefficient industrial sprawl have created an undesirable environment for private investment in the station area.

Station Site: Van Ness-UDC and Friendship Heights, WMATA

	Station Ridership (Average Daily Boardings, 1994)	Commuter Parking
Van Ness-UDC	6,400	0
Friendship Heights	8,500	0

There are two primary exceptions to the tendency for DC station neighborhoods to have restricted development along the northwest branch of the Red Line: the Van Ness-UDC station area along Connecticut Avenue and Friendship Heights on Wisconsin Avenue

[78] *Metrorail Station Area Planning* (1983)

at the DC-Maryland border. These districts were home to a few large commercial and institutional land uses prior to station completion in 1984 so developers had a relatively easy time gaining public approval, assembling land, and building office and retail space. The strip of new office development at Van Ness-UDC runs for several blocks on either side of the station immediately along Connecticut Avenue, keeping everything within an easy walk of Metro. The centerpiece development at this station is a seven story 200,000 square feet mixed-use office and retail complex built on land owned by the University of the District of Columbia (UDC) which opened in 1983. The facility incorporates five off-street bus bays and 24 kiss and ride spaces next to a station entrance. According to a UDC administrator, easy access to public transit is important to the university since it is a commuter school and its students come from all over the city. As the state university of DC, the school provides many public services in addition to its classes, and public transit accessibility is another useful link into the community. The Van Ness campus was built a few years before the station opened but not prior to Metro planning, and the main reason for the station's siting is that UDC would be locating there.[79] UDC also incorporated commercial space into the ground floor of its Van Ness campus which provides an outside source of revenue (or "value capture") for the university.

Friendship Heights has been a commercial center serving the far northwest edge of the district and nearby Maryland suburbs for over 40 years. Beginning in the 1950's several major upscale department stores located near the busy intersection of Wisconsin and Western Avenues to serve the nearby affluent neighborhoods of single family homes. Although most of the area was built up at that time, several hundred acres of undeveloped land remained immediately west and northwest of this intersection. During the 1960's, low and mid rise commercial uses continued to concentrate around Wisconsin Avenue, while high-rise office and residential properties were developed on the vacant land to the west. Although even more intensive development was planned for this area, residents and local officials became worried about the automobile traffic that was being generated, and reconsidered the area's zoning in the early 1970's. The initial developments anticipated the future construction of several radial expressways near the area as well as Metrorail to provide improved access, and relieve traffic congestion. When the highways were canceled and Metrorail was delayed, the development plan for Friendship Heights was reduced in intensity—especially on the Maryland side—and the site of the future Metro station became the focus for most new projects.

Since the station opened in 1984, there has been considerable new development along Wisconsin Avenue, but only a limited amount in the high-rise district to the west.

[79]John Ross, UDC, phone interview

The older development is also still served by large parking lots and wide roads—vestiges of the pre-Metro days—while the newer development has occurred under the present more restrictive station area parking requirements. The south entrance to the subway is at street level, between several storefronts along Wisconsin Avenue. The north entrance is from a concourse located under the intersection of Wisconsin and Western. This concourse is fed by pedestrian passageways to each of the four buildings located at the intersection. Two entrances lead to department stores on the west side of the street, and another leads to a 230,000 square feet office and retail Chevy Chase Metro Center building which was completed at the same time as the subway and includes a bus transfer station and kiss and ride spaces. The fourth entrance is from the Chevy Chase Pavilion, a new shopping mall located at the southeast corner of the intersection in the District of Columbia. The direct connections between Metro and these developments make the Friendship Heights station area a model of incorporating transit accessibility into an established commercial district.

Station Site: Virginia Square-GMU, WMATA
Station Ridership (Average Daily Boardings, 1994): 2,400
Commuter Parking Spaces Available: 0

The Virginia Square area in central Arlington County, Virginia is located along Wilson Blvd. and Fairfax Street at N. Monroe Street. A primarily single family residential neighborhood with a traditional grid street network, the area saw increasing low density commercial development along Wilson and Fairfax as the neighboring Ballston and Clarendon commercial districts grew in the 1950's. By the early 1970's commercial growth in the county was waning, and Arlington embarked on an ambitious comprehensive planning effort which culminated in the policy decision to promote extensive commercial and residential growth along the corridor of the proposed Metrorail Orange Line through the center of the county. At four of the five stations in what became known as the Ballston-Rosslyn Corridor, varying degrees of intensive commercial and development was planned. The remaining station area, Virginia Square was set aside primarily for residential, cultural, educational, and recreational uses, with limited office and commercial development.

The planning efforts of Arlington County have been highly effective. Since the station opened in 1979, over 600,000 square feet of office space, 50,000 square feet of retail, and 1,000 new residential units have been added to the area. In 1991, the Federal Deposit Insurance Corporation completed construction of a 700,000 square feet training center which includes offices, residential units, and the replacement of the neighborhood's major grocery store. In addition, George Mason University purchased a nearby former department store building in the early 1980's and has made it home to their Law School,

International Institute, and Small Business Development Center. The university has recently embarked upon a multi-year effort to triple the size of its Arlington campus. An expanded main branch of the Arlington County Public Library opened near the station in 1992, and the Arlington Arts Center occupies a former elementary school building just one block from the station. The area is home to one large and four small public parks. Arlington County's efforts have also included improving the streetscape around the station with new sidewalks and street trees, and encouraging affordable housing by requiring the replacement of units lost through private redevelopment efforts.

Post-Station Neighborhood Characteristics: Suburban High Intensity Mixed-Use

Station Site: Alewife, MBTA

Station Ridership (Average Daily Boardings, 1993): 10,000

Commuter Parking Spaces Available: 2,209

The Alewife area is unlike the rest of Cambridge, Massachusetts in its relatively open, spread out, suburban nature. The 370 acre district includes the Alewife T station (the northern terminus of the MBTA Red Line), several highways and major arterial roads, many acres of wetlands and MDC park land, and a large amount of former railroad and industrial property bordering one active and one former trunk line. In 1979, prior to the completion of the Red Line extension, the Community Development Department of Cambridge published the *Alewife Revitalization Plan.* This plan promoted sweeping changes to the land use in this area through planned use developments and mega-projects. The MBTA's second largest parking facility is adjacent to the station, as is retail space—much of which is unoccupied today. As the 1980's progressed, a significant level of commercial and office development did occur in the Alewife area, but very little in the form of PUD's, as envisioned by the 1979 plan. Without guidance from a relevant development plan, many of the projects in the area "seemed isolated from abutting neighborhoods, and did not reflect the traditional [urban] fabric of Cambridge."[80] To address this situation, a neighborhood study committee was commissioned in 1990 to develop new goals for the area.

The new plan, published in 1994, addresses nearly every conceivable issue regarding development standards for the area. The ultimate goal is to make the presently disjointed parcels of land into a cohesive "neighborhood" and promote development that is consistent with the city's growth policy document entitled *Towards a Sustainable Future.* Connected street networks and pedestrian access from the T station to all points in the district are planned, as are landscaping and parking stipulations, and a new commuter rail

[80]*Alewife: A Plan for Sustainable Development*, (1993)

station in the center of the area. Residential, commercial, industrial, and recreational land uses have been provided for, and the relationship between this area and the established neighborhoods at its edges has been addressed.

Station Site: North Quincy, MBTA

Station Ridership (Average Daily Boardings, 1993): 5,100

Commuter Parking Spaces Available: 1205

On September 1, 1971 the MBTA inaugurated service on an extension of the Red Line to Quincy, Massachusetts, immediately southeast of Boston proper. This rapid rail line was constructed on the right of way of the former Old Colony Railroad, and its first station is at North Quincy. This station occupies a site at the northern edge of an old residential area, immediately east of a large high school and the commercial Hancock Street. There were several hundred vacant acres of land to the west of the station in 1971, and much of it is still vacant today. The major developments in this area include a large back office operation of Boston's State Street Bank which has occupied the site since the early 1970's. Former Quincy Mayor John Macintyre was influential in locating a station at the site and extending Newport Avenue along the west side of the station and the State Street Bank site, and was also the first to promote increased development in the area. The North Quincy station area, while containing a large amount of vacant land, is not developing in a pedestrian sensitive manner to take advantage of the transit access. The State Street Bank site has a direct but unsightly entrance to the station, and to get anywhere else from the station the traveler must cross parking lots or busy arterial streets. The Town of Quincy has not prepared any sort of comprehensive plans for this station area, so it is unlikely that future developments will relate to the station or the other developments in a coherent and pedestrian oriented fashion.

Post-Station Neighborhood Characteristics: Urban High Intensity Mixed-Use

Station Site: Bethesda, WMATA

Station Ridership (Average Daily Boardings, 1994): 7,600

Commuter Parking Spaces Available: 550

By the 1970's the Bethesda area along Wisconsin Avenue at East West Highway in Montogomery County was already established as a regional commercial center. The initial growth of this area followed the extension of trolley lines from DC into suburban Maryland during the first half of this century. As long as forty years ago (preceding Metrorail planning), this district began to receive high density office type development and began emerging as a suburban commercial center serving southern Montgomery County. About

four high-rise apartment buildings, six office buildings, and some mid-rise townhouses and apartments had been built in this affluent mostly single family residential neighborhood before Metrorail arrived in 1984. The general plan for the entire county in the 1960's and 1970's was known as "Wedges and Corridors," and development of downtown Bethesda fit this plan perfectly. The concept was to promote wedges of green space, open areas, and low density development in-between corridors of higher density commercial, residential, and institutional development. Concentrating development in this pattern both followed established development trends and lent itself to transit serviceable districts and efficient use of metropolitan land. Bethesda's nature as an evolving commercial hub made it an obvious choice for a station on the northwest branch of the Red Line. Subsequent to the arrival of Metrorail, this district has witnessed even more intensive office and retail construction in the core area around the station, and high-rise residential development on the periphery. The Metro station itself opens into a large public plaza which forms the center of Bethesda Metro Center, an enormous four building complex that was built concurrently with the train station, and features over 260,000 square feet of office space, 355 hotel rooms, a 33,000 square feet retail concourse, and sits atop a Metrobus terminal and Kiss and Ride facilities. Another newer office tower across Wisconsin Avenue is also connected to the station by an underground walkway.

A 1976 land use plan allowed transit supportive densities in the station area while controlling the quality of the pedestrian environment at street level. Prior to this plan, local zoning permitted large buildings with no public amenities. These regulations were replaced by a new "CBD" zone which reduced the zoning potential of the "base" zone (minimum standards with no amenities), but allowed a doubling of building density for a project and site which met municipal guidelines and demonstrated public benefits in terms of streetscape design. This has been a strong enough incentive to entice every major development since the ordinance was passed to opt for the density bonuses and comply with the urban design standards.[81] There was an extensive public participation process when Montgomery County's zoning plans were developed. It included the normal formal public hearings, two to three years of staff involvement, formal advisory committee and informal group recommendations, and individual sessions with commercial associations and large and small developers. Zoning controls have been one major tool for guiding the development and scope of Bethesda station area projects. The other major tool has been controlling project "staging." Under Montgomery County's "Adequate Public Facilities Ordinance," there must be capacity in the transportation system before a project can be built. This allows the municipality to exact payments for infrastructure improvements

[81]Don Downing, M-NCPPC, phone interview

(which meet the county's standards) from the developer, or require the developer to wait until the county makes the improvements on its own. Either way the county gets the public amenities that it desires.

Bethesda's parking policies allow adequate parking for retail and some customer business through short term parking (two to three hour) areas. All day (eight to nine hour) parking is provided for no more than fifty percent of the number of employees in the business area to encourage transit and carpool use. There is some public parking so that employers who don't have 100% of their required parking may pay a public fee or opt to provide partially less and pay a pro-rated amount. Since 1982 there has also been a "Bethesda Urban Partnership District." This organization consists of a public/private board which controls revenue generated from a special CBD tax to maintain sidewalks and public landscaping, conduct promotional activities, sponsor parades, and print a newsletter. Currently, this group is looking into providing positive security in the form of "friendly" guides in uniform which can provide additional street presence beyond the police. Ultimately they would like downtown Bethesda to function like a well run shopping mall.

Station Sites: Ballston-Rosslyn Corridor, WMATA

Station	Ridership (Average Daily Boardings, 1994)	Commuter Parking
Rosslyn	12,800	0
Court House	6,200	0
Ballston	10,700	0

The Washington Metro Orange Line corridor through central Arlington County, Virginia easily qualifies as the best example of extensive transit oriented development in the United States. The three most intensely developed stations in this five station corridor are Rosslyn, Court House, and Ballston. Since Metro service commenced in 1979, these stations have seen combined new construction of over 8.3 million square feet of office space, 1.0 million square feet of retail space, 1,500 hotel rooms, and 11,500 residential units.[82] The county has been fully developed since the 1970's and all of this new growth has taken the form of "infill" development in existing neighborhoods without generating urban sprawl over previously undeveloped countryside. The development efforts around each of these three stations has been highly successful, but each plan has had notable differences. Rosslyn was transformed from a derelict industrial and warehouse district into a densely populated high-rise office and residential area. Originally home to county offices and a small amount of run down housing and retail buildings, Court House has been strengthened as the center of the county's government and legal activity and has become an

[82] *Fiscal Impact of Metrorail on the Commonwealth of Virginia* (1994)

extensive high-rise residential district. Ballston has changed from a flagging, auto-oriented retail center to the dramatic home to dozens of high-rise office buildings, hotels, residences, and a major regional shopping mall—all within a short walk of the transit station.

In spite of the unsightly land uses which dominated the Rosslyn landscape in the 1960's, this area was blessed with an outstanding location immediately across the Potomac River from Georgetown and the Federal Triangle office district of downtown Washington, and it enjoyed suburb highway access from the entire region. Arlington County planners were hesitant to use the conventional urban redevelopment techniques of the day to clear and assemble land in this area for fear that too much public housing would be required by accepting federal grants and their corresponding urban renewal powers.[83] Instead, they chose an incentive-based development approach whereby developers received huge density bonuses in return for complying with the county's redevelopment plans and providing pre specified infrastructure improvements to the area. This plan was implemented at the same time that the federal government was changing its real estate practices from owning office space in the District to leasing less expensive private space in the Washington suburbs—especially the most convenient one, Arlington. Not surprisingly, office and residential construction boomed in the Rosslyn redevelopment district throughout the 1960's and 1970's. Although it was known that a Metrorail station would be located in Rosslyn well before it actually opened, the county's plans assumed that everyone would drive to work and allowed for ample parking and wide streets to funnel large numbers of cars in and out of the area every day. Unfortunately, the great success of Rosslyn in terms of redevelopment has been tempered by the recognition that the district has been an urban design failure. A system of above grade walkways was intended to serve pedestrian and mid-day travel needs, but it ended up being poorly integrated between developments and generally ineffective. Consequently, most foot traffic still occurs at street level where pedestrians must navigate narrow sidewalks, heavy vehicular traffic, ubiquitous parking garage entrances, and a dearth of storefront retail establishments and pedestrian oriented public spaces like parks or plazas. Since the Metro station opened and introduced a large number of additional pedestrians in to the neighborhood, these issues have attained a prominent place on the agenda of Arlington's planning department. Present plans for the area's next generation of development and redevelopment call for more pedestrian-sensitive design features, lower parking requirements, and a better integration of the pedway system into existing and future development.

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[83]Ward (1991)

The Court House area is located less than a mile west of Rosslyn, on top of a bluff along the Potomac River. The goal for redevelopment of this district was to create a "...model urban governmental center featuring a cohesive mix of high density residential and office uses, while preserving established [residential] uses on the periphery."[84] The plan for the area was prepared throughout the 1970's as part of a comprehensive effort for the entire corridor stretching west from Rosslyn to Ballston. The county chose this alignment for their segment of the Orange Line, and decided that all future growth would take place in Metro station areas. At Court House, a series of public plazas and institutions surround the station. Nearby development includes a series of county office buildings, courthouses, and jails to the south, and several new mid-rise office buildings to the north. A small network of underground walkways connects many of these buildings to the subway station, but above ground access is also easy as many pedestrian improvements including widened sidewalks and specially paved crosswalks have been added. The center of development in the area is the twin white marble towers of Courthouse Plaza, a joint effort between the county and a private developer which houses municipal administrative offices, an attractive retail courtyard between the buildings, and an eight-screen movie theater. On the southern periphery of the station area nearly 4,000 units of high-rise apartments, condominiums and townhouses have been built, while on the northern periphery an existing single family home neighborhood has been maintained.

Ballston has been a major retail center in Arlington since the 1950's when the Parkington Shopping Center was built on a site just two blocks south of the present day Metro station. Arlington County's pre-Metro planning studies of the 1970's reinforced the prominence of this area as a regional commercial center, and a 1978 rezoning of an eight block area around the future transit station permitted the highest density development in the county on this site. In 1980, the Arlington County Board made official their intent to create a "new downtown" in central Arlington around the Ballston station, and adopted a new "Commercial, Office, Apartment" (C-O-A) zoning classification designed specifically for this district. County officials worked earnestly to ensure that this station area would develop successfully to serve as an anchor for redevelopment of the entire Rosslyn-Ballston Corridor. They were cognizant of the shortcomings of the developments in Rosslyn and paid special attention to streetscape design considerations in the C-O-A zoning regulations. The provisions of the aptly named C-O-A zone also mandated a balance between office, residential, and retail land uses by requiring office developers also to construct residences. The intent of the county was to create a "...street oriented urban

[84]Parris (1989)

living/working environment..."[85] using the existing grid street pattern around the subway station.

In 1983 Interstate 66 was completed along the west edge of the area and provided expressway access to the site. Shortly thereafter, the two centerpiece developments of the Ballston station area opened. The 26-story Ballston Metro Center stands atop the station itself, and features 712,000 square feet of office, hotel, residential, and retail space. It provides bus and rail transfer facilities on its lower level, and a direct connection from the station to a retail concourse which leads to the Ballston Common Shopping Mall. This regional mall was built on the site of the former Parkington Shopping Center, and represents a cooperative venture between the county and a private developer. Since these two projects have been completed, the area has seen consistent high density growth with over one million square feet of office space, and over 1,500 additional residential units built in the last eight years alone. The change in appearance of the neighborhood could not be more dramatic. Photos taken at the time of station construction just fifteen years ago reveal a landscape of old single family homes and large parking lots surrounding several commercial establishments. Today the primary vestige of the former Ballston, a solitary IHOP in its parking lot, looks woefully out of place in the midst of dozens of mid-rise and high-rise apartments and office towers with retail establishments lining the sidewalks. The county has addressed the relationship between the new development and the surrounding lower density residential neighborhoods by zoning for decreasing density and more residential uses at the periphery of the station area, as well as by extending streetscape improvements into the surrounding neighborhoods.

Station Sites: Peachtree Corridor, MARTA

	Station Ridership (Average Daily Boardings, 1995)	Commuter Parking
North Avenue	6,800	0
Midtown	2,600	10
Arts Center	7,200	26

The Peachtree Corridor follows Peachtree Street north from downtown Atlanta for one and a half miles. Once a populous residential and retail district, the area began to deteriorate in the 1960's. In the mid 1970's, a coalition of civic groups was able to enact nuisance ordinances to rid the area of illicit business establishments, and promote it as a cultural center. Today the area is home to Atlanta's art and theater communities, a growing number of affluent residents, and a booming high-rise office market. The corridor's three

[85]Miller (1993)

MARTA subway stations, North Avenue, Midtown, and Arts Center were all completed in the early 1980's and helped to spur the hundreds of millions of dollars in redevelopment which this area has seen in the subsequent years.

MARTA had to expedite construction of the initial segment of North Line in order to serve a new regional headquarters for Southern Bell at the North Avenue station. This 47-story, 1.9 million square foot office complex houses over 3,500 employees and represents one of Atlanta's first station area developments, and to this date remains one of the largest single projects of its kind. Ensuing years have seen the city formulate and implement a comprehensive redevelopment plan for this station area in close cooperation with Central Atlanta Progress, a nonprofit civic and development organization which had earlier worked to clean up the declining district. The new plans called for encouraging high intensity development along Peachtree street, but confining it between the neighboring Georgia Institute of Technology campus on the west and stable residential neighborhoods a few blocks to the east. One block east of the station, the historic Fox Theater has been renovated, and the Ponce de Leon Apartments and Hotel Georgian Terrace, two structures on the National Register of Historic Places, have been converted into luxury apartments. Crowning a decade of redevelopment, in 1992 the land immediately across the street from the station became home to the tallest building in the Southeast United States—the 1,050 feet, 57-story Nation's Bank Tower. Modest storefront retail serving daytime office workers has also been incorporated in the new developments and renovated buildings.

At the time the MARTA station opened, the Midtown area was characterized by an abundance of nearby developable land. Prior to station construction, developers had assembled and cleared large tracts, and for the first few years of MARTA operation they appeared to be sitting on the land while it appreciated in value.[86] By the end of the decade, though, the entire area was flourishing with new construction activity. Two historic buildings have been renovated for apartment and condominium use, while several million square feet of new high-rise office space, two large retail developments, and hundreds of new hotel rooms have been added. A half mile further north on Peachtree Street is the Arts Center station. Home to the High Museum, Academy Theater, a public Library branch, as well as the Atlanta Memorial Arts Center, this station has seen the corridor's most extensive development. With access to MARTA and both Interstates 75 and 85, developers have found this station area an attractive place to construct over two million square feet of office space, 500 hotel rooms, and 1,000 new residential units in the last ten years.

All three stations are connected by the Peachtree Walk Park which runs above the subway tunnel. A $500,000 joint venture between the City of Atlanta, Central Atlanta

[86]Davis, Brown, and Holmes (1985)

Progress, and the Midtown Business Association, the new public park serves to tie together all of the new development and is a focal point of outdoor recreation and lunch time activity for those who live and work in the corridor. The city has also used a zoning device called a "Special Public Interest District" to impose parking restrictions and parking deck size limitations on the new developments around these three stations. The idea has been to limit the amount of parking available to encourage transit use and development other than parking within the district. Additional regulations govern sidewalk width and subject every development to a design review process which is oriented towards creating a better pedestrian environment.

Station Site: Yonge Street Corridor, TTC

Station	Ridership (Average Daily Boardings, 1994)	Commuter Parking
St. Clair	16,600	0
Davisville	10,000	0
Eglinton	31,700	0

Canada's first subway began service under Toronto's principal arterial thoroughfare, Yonge Street, in 1954. Although construction disrupted traffic and local businesses for several years, the line from Union Station at the southern edge of downtown to Eglinton Avenue nearly five miles north was an overnight success. Yonge Street was home to Toronto's busiest streetcar lines, which were running at capacity almost continuously before the subway was built.[87] The single family home neighborhoods which bordered both sides of this major street were home to many downtown workers, and the street itself was lined with retail establishments and very little parking along the entire length of the subway route. Principal intersections outside the downtown, such as St. Clair, Davisville, and Eglinton, were already developing into concentrated nodes of commercial activity, further exacerbating the transit capacity problems in this corridor. These existing trends, coupled with a rapidly growing economy in Toronto during the decades following construction of the initial subway, made conditions ripe for an explosion of commercial and residential development around the Yonge Street stations during this period.

The city of Toronto Planning Department and city council agreed to allow the most dense commercial development at station areas, and land use and planning controls were developed to encourage this growth. The initial impact of these policies was to focus the region's commercial growth of the 1960's on the downtown and major intersection station areas. Between 1952 and 1962, tax assessments in districts paralleling the Yonge Subway

[87]Greg Stewart, City of Toronto, phone interview

line increased by 45 percent in the downtown core and 107 percent towards the Eglinton Avenue end of the line.[88] The city averaged an increase of 25 percent over the same period. The development around the St. Clair, Davisville, and Eglinton stations was initially of the slab apartment type, and was followed by a great deal of office and retail space in later years. The numbers of residences and employment around these stations are about equal, making them an outstanding example of people living and working in the same district. To this day, these three stations remain among the busiest outside downtown Toronto. At St. Clair and Davisville most of the transit patrons walk to the station, while Eglinton also sees a large number of bus transfer passengers.

[88]Davis, Brown, and Holmes (1985)

Pre-Station Neighborhood Characteristics:

Suburban High Intensity Mixed-Use

Post-Station Neighborhood Characteristics: Suburban High Intensity Mixed-Use

Station Site: Lenox (and Buckhead), MARTA

Station Ridership (Average Daily Boardings, 1995): 10,500

Commuter Parking Spaces Available: 796

The Lenox/Buckhead section of Atlanta is an urban planning paradox. It is a typical auto-oriented "edge city" with millions of square feet of office, retail, hotel, and residential space surrounded by large well landscaped parking lots. However, this north side district is also home to a dozen major MARTA bus lines, the eleven year old Lenox station of the Northeast rapid transit line, and the Buckhead station on the North Line which is scheduled to open later this year. The construction boom in this affluent suburban-style Atlanta neighborhood began when the Lenox Square Shopping Center opened over thirty years ago, and has yet to subside. Most of the local street network was designed and built to suit automobiles well before the transit stations were even planned, and the urban design and transit accessibility of the area still suffers tremendously as a result.

Lenox station was built in a corner of the immense Lenox Square Shopping Center parking lot. Station construction coincided with a major transit area joint development project called Resurgens Plaza. This one million square feet mixed-use complex over the MARTA station itself consists of a 34-story office and residential condominium tower with retail space on the lower floors. A 900 space parking garage for tenants, a 630 space garage for MARTA commuters, and bus transfer facilities were also included in the development. Neighborhood concerns about accessibility to the station and the development itself were addressed by providing entrances to the project from both the single family residential area to the south and the enormous commercial district to the north. All automobile access is from the highways to the north. Beyond the Resurgens Plaza development and the mall itself, the remainder of the Lenox area remains difficult to access without a car. The main problem for pedestrians is the sheer distances between the developments which are all separated by parking lots and busy multi-lane suburban highways. At present, this area is close to being "built out" at its present auto-oriented densities. Although the city has not encouraged increased density or pedestrian amenities in the area, the land owners and developers may soon realize on their own that such techniques can be an effective way to allow more development in this district.

The neighboring Buckhead district, located less than a mile west of Lenox, is currently the hotbed of development in this area. Long a fashionable business and retail address, the location of its soon-to-open transit station has been known for many years,

and several large office and commercial developments have been built around the Buckhead station entrance in anticipation of its completion. Much more developable land remains around this station than around Lenox, and developers have announced plans for over a million square feet more office space accompanied by nearly as much retail space. Atlanta city planners are trying to make sure that the new developments are designed in a more transit and pedestrian sensitive manner than their predecessors, but are struggling.[89] There is work being done to apply parking and urban design restrictions to the Buckhead Station area by designating it a "Special Public Interest District" like the Midtown area. Unfortunately, developers and lenders are apprehensive of any moves to limit parking in this traditionally auto dominated area, so all the new developments still have abundant parking, although mostly in garages. Given the seemingly limitless potential for growth in the area, the city hopes it will have some success in getting developers to be willing to cooperate with their transportation visions to address the new Buckhead station effectively.

[89]Laurie Lelend-Kirk, City of Atlanta, phone interview

Pre-Station Neighborhood Characteristics:

Urban High Intensity Mixed-Use

Post-Station Neighborhood Characteristics: Urban High Intensity Mixed-Use

Station Sites: Downtown Miami, M-DTA

System Ridership (Average Daily Boardings, 1994): 50,000

Station	Ridership (Average Daily Boardings, 1994)	Commuter Parking
Brickell	2,000	0
Government Center	10,000	0
Overtown/Arena	1,500	34

Most rapid transit systems follow underground alignments through their region's central business district in order to minimize disruption in these densely built up areas.[90] In the case of Miami, poor soils prevented the construction of a subway, so an alignment which just skirts the west edge of the downtown district was chosen. Consequently, the three downtown stations are beyond walking distance to most downtown development. To address this problem, the "Metromover" people mover system has been built in stages subsequent to Metrorail construction. The 4.2 mile elevated guideway connects Brickell and Government Center Metrorail stations with the four main parts of downtown Miami—Brickell, the Central Business District, Park West, and the Omni area. Metromover provides frequent service along three routes in small unattended vehicles for a fare of 25 cents. Completion of two extensions to the system in 1994 has put Metromover stations within walking distance to all major downtown destinations.

This 99 year old city was laid out with a traditional grid street pattern along the shores of the Biscayne Bay at the Miami River. The mild climate made the city a popular resort and retirement destination during the first half of this century, while more recently it's strategic location near the Caribbean Islands and Latin America has made the city an international center of trade and finance as well as tourism. This shift in the region's economy brought about a great demand for office and hotel space, much of which was accommodated in the Central Business District and Brickell area immediately to the south (which has become known as the "Wall Street of the South" due to the concentration of financial institutions in this district). Much of this development has occurred in the presence of the Metrorail and Metromover systems. Since 1983 the four downtown districts have seen a combined total of $2.3 billion in new construction and renovation of existing structures. This investment has resulted in over seven million square feet of office

[90]The notable exception is Chicago, where an extensive elevated system was built above downtown streets almost 100 years ago as a temporary measure. The replacement subway system was never completed, and the physical constraints of the elevated trackage still limit car length and train scheduling for the Chicago Transit Authority.

space (more than doubling that which had been built in the previous 90 years), 650,000 square feet of retail space, 2,600 new housing units, and 2,000 hotel rooms. The building boom has been accompanied by over $500 million in public investments including the transit improvements, museums, a sports arena, a library, a convention center, and several public park and street improvements. Downtown employment now stands at just over 100,000 and is expected to grow by 20,000 in the next twenty years.[91] Presently, office construction has slowed down but residential demand has picked up. Over $125 million in new residential projects are underway or planned for the downtown districts—mostly along the shore east of Brickell and the Omni area. Most recent developments have been sensitive to pedestrian access, as the climate is conducive to outdoor activity and there are several boulevards and park-like promenades in the downtown area. A number of large office, retail, and residential developments feature direct access to and from Metromover stations—including two stations which have been built inside buildings. The city also allows a 30% parking reduction for buildings built in Metromover station areas.

Station Site: Downtown Atlanta, MARTA

System Ridership (Average Daily Boardings, 1994): 194,000

Station Ridership (Average Daily Boardings, 1994)		Commuter Parking
Five Points	28,300	0
Peachtree Center	9,600	0
Georgia State	6,000	0
Omni	5,100	0
Garnett	1,800	0

Downtown Atlanta grew up around the junction of several railroads in the late 1800's. During the first half of this century, a series of viaducts were constructed to eliminate at-grade street crossings downtown, all of the streets were paved, and sidewalks were constructed to facilitate pedestrian movement. Most of these early streetscape improvements still exist today and shape the character of the downtown area. Office and retail activities concentrated to the north of the tracks, while manufacturing and trade uses dominated the south side. A major street intersection just to the north called "Five Points" developed into the commercial heart of the city and became home to the city's largest department stores. By the time MARTA began central area subway service in 1979, the downtown railroad industries had all but vanished and the Five Points commercial district was struggling to compete with suburban shopping centers. The hub of the MARTA system and the only transfer station between the East-West and North-South Lines was

[91] All development statistics are from Miami Downtown Development Authority reports

located at Five Points and was expected to reinvigorate retail development downtown. Unfortunately, construction of the subway itself caused great disruption to this area and forced several more retailers to close.[92] Shortly after the station opened, though, the City of Atlanta, Fulton County, MARTA, the State of Georgia, a community group, and Rouse Corporation funded the preparation of a revitalization plan for the district around Five Points, known as "Heart of Atlanta." The plan called for a significant tourist-oriented "festival marketplace" similar to Faneuil Hall in Boston and Harbor Place in Baltimore and has been substantially completed in the past ten years. Today the station area features a refurbished Underground Atlanta shopping and dining complex, several interconnected public plazas, a hotel, the World of Coca-Cola, a theater, and a direct connection to the Five Points station. Although the recent closing of the venerable Rich's Department Store, which also featured direct access to MARTA, has left a giant hole in the retail mix of the project, it is hoped that increasing convention activity and Olympic Games tourists will keep these transit-oriented developments busy. The brightest sign for the future of this district is the Atlanta Federal Center, which is currently under construction. This new complex covers three city blocks and will consolidate nearly all federal offices in the Atlanta region. Although moving to this facility will vacate other buildings in the region, the 8,000 new employees should mean a tremendous boost for Five Points retailers and MARTA ridership.

Four other central area stations also serve distinct portions of the downtown area. Garnett station is located in the former industrial and retail district south of Five Points, and has yet to see much redevelopment. The major venues for the 1996 Atlanta Olympic Games are located immediately to the south of this station, and the area is presently being cleaned up and landscaped in preparation. The Omni station lies just west of Five Points adjacent to a large number of recently built office and entertainment developments. This area includes a large mixed use building which houses a hotel and CNN's studios, the 1.5 million square feet Georgia World Exposition Center, and the newly opened Georgia Dome professional football stadium. All of these large scale developments have been built above freight railroad tracks and are linked by an incomplete network of new streets and pedestrian plazas above the ground level. This upper level of streets and plazas is being completed as the surrounding land is developed, so the pedestrian orientation of this district is presently chaotic—great in some places and terrible in others. To the east of Five Points is the Georgia State Capital, Georgia State University, and the Georgia State subway station. Development in this area has been almost exclusively state government or university related, and the station itself is located inside a one million square feet state office

[92]Davis, Brown, and Holmes (1985)

building. Most of the state government and university buildings are an easy walk from MARTA. The center of downtown Atlanta's booming office district is the first station on the North Line, Peachtree Center. Located 110 feet beneath Peachtree Center, a downtown development of over ten buildings including four convention hotels and three million square feet of office space, this station serves even more nearby offices, residences, and retail establishments. This district is the most densely built up part of the city, and a strong generator of MARTA traffic.

Appendix B

Sources of Information for Case Station Areas

Post-Station General Attribute Station Area Station	Phone Interviews	Municipal Planning Documents	Personal Site Visits	Other Research Reports	Newspaper & Journal Articles
Low Intensity Mixed-Use					
Fairfax County					
West Falls Church	●	●	●	●	
Dunn Loring	●	●		●	
Vienna	●	●	●	●	
Huntington	●	●		●	
Medium Intensity Residential					
Inman Park-Reynoldstown	●	●	●	●	
Tenleytown	●		●		
Anacostia	●		●	●	
Medium Intensity Mixed-Use					
Braddock Road	●		●		
Pape	●		●		
Decatur	●	●		●	
Malden Center	●		●	●	
Davis Square	●		●		
Quincy Center	●		●	●	
AUC Stations					
Ashby	●	●	●	●	
Vine City	●	●	●	●	
West End	●	●	●	●	
Rhode Island Avenue	●		●	●	
Van Ness-UDC	●		●		
Friendship Heights	●		●	●	
Virginia Square-GMU		●	●	●	
Suburban High Intensity Mixed-Use					
Scarborough Center	●	●			
Dadeland					
Dadeland North	●			●	
Dadeland South	●			●	
Rockville Pike Corridor					
Grosvenor	●	●	●		
White Flint	●		●	●	
New Carrollton	●	●	●	●	
Wellington	●		●	●	
Quincy Adams	●		●		
Alewife	●	●	●		
North Quincy	●		●	●	
Lenox	●	●	●	●	●

Post-Station General Attribute Station Area Station	Phone Interviews	Municipal Planning Documents	Personal Site Visits	Other Research Reports	Newspaper & Journal Articles
Urban High Intensity Mixed-Use					
Jefferson Davis Corridor					
Pentagon City		●	●	●	●
Crystal City		●	●	●	●
North York					
Sheppard	●	●		●	
North York Center	●	●		●	
Finch	●	●		●	
King Street	●		●	●	
Eisenhower Avenue	●		●		
Bethesda	●		●	●	●
Ballston-Rosslyn Corridor					
Rosslyn		●	●	●	●
Court House		●	●	●	●
Ballston		●	●	●	●
Peachtree Corridor					
North Avenue	●	●	●	●	●
Midtown	●	●	●	●	●
Arts Center	●	●	●	●	●
Yonge Street Corridor					
St. Clair	●	●	●	●	●
Davisville	●	●	●	●	●
Eglinton	●	●	●	●	●
Downtown Miami					
Brickell	●	●		●	
Government Center	●	●		●	
Overtown/Arena	●	●		●	
Downtown Atlanta					
Five Points	●	●	●	●	
Peachtree Center	●	●	●	●	
Georgia State	●	●	●	●	
Omni	●	●	●	●	
Garnett	●	●	●	●	

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